SCENE User Manual

October 2024

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Chapter 1: Introduction

SCENE is a comprehensive 3D point cloud processing and managing software tool for the professional user. It is specially designed for viewing, administration, and working with extensive 3D scan data obtained from high resolution 3D laser scanners such as the FARO Focus Laser Scanner.

SCENE processes and manages scanned data highly efficiently and easily by offering a wide range of functions and tools, such as filtering, automatic object recognition, scan registration, as well as automatic scan colorization.

After SCENE has prepared the scan data, you can begin evaluation and further processing right away. For this, it offers functions from simple measuring to 3D visualization through to meshing and exporting your scan data into various point cloud and CAD formats.

Starting from version 2024.0, you can upload projects to the new cloud solution Sphere XG as well as download and synchronize existing projects. With Sphere XG, your scan projects can be published on the Internet and viewed with a standard Internet browser.

If you have any questions or need further instructions for any procedure, contact your **Customer Service** representative by phone, fax or email. You can also reach the Customer Service Applications and Training group through email at the following addresses:

- support@faro.com
- applications@faro.com
- training@faro.com

Visit the **FARO Customer Service area** on the Web at www.faro.com to search our technical support database, which is available 24 hours a day, 7 days a week.

You may also find various **online tutorials** on the Internet at learn.faro.com.

System Requirements

To use SCENE seamlessly, your computer should have the following specifications.

NOTE: The Minimal Specifications are sufficient for scan resolutions up to 1/4, a project of less than 10 scans, and when stereo rendering is not required.

	Minimal Specifications	Recommended Specifications
Processor	• Quad-core, with at least 2-GHz (for example, Intel Core i7)	• 8 physical cores (for example, Intel Core i7, Core i9 or Xeon)
Graphics Card	• OpenGL 4.3, or higher • At least 4 GB Memory. **For VR Rendering:** • NVIDIA 1060GTX or similar • Oculus Rift S • Oculus with Oculus Touch Controllers or HTC VIVE • SteamVR **For Processing of Focus Scan using the PanoCam :** • DirectX 11 Feature Level 11.0	• OpenGL 4.3, or higher • At least 8 GB Memory • Dedicated graphics card **For VR Rendering:** • NVIDIA 1080GTX or similar • Oculus with Oculus Touch Controllers or HTC VIVE • SteamVR **For Stereo Rendering:** • NVIDIA Quadro **For Processing of Focus Scan using the PanoCam:** • DirectX 11 Feature Level 11.0
Main Memory	At least 32 GB	64 GB
Hard Disk	512 GB Solid State Drive	1 TB Solid State Drive + Regular HDD
Display	1366 x 768	1920 x 1080
Operating System	Microsoft Windows 10 (64-bit) Microsoft Windows 11 (64-bit)	Microsoft Windows 10 (64-bit) Microsoft Windows 11 (64-bit)
Accessories	Mouse with 2 buttons and a scroll wheel Network connectivity is required for licensing	

Chapter 2: Installation and Licensing

This chapter describes the installation and licensing procedures.

Licensing SCENE Versions 2022.2 and Later

Starting from SCENE 2022.2, the software is licensed via the FARO Licensing Manager. The SCENE installation contains FARO InTouch as well as the FARO Licensing Manager. You can access the FARO Licensing Manager via FARO InTouch.

You can find further information on licensing SCENE with the FARO Licensing Manager starting from section *Licensing SCENE Versions 2022.2 and Later* on page 5.

Licensing SCENE Versions 2022.1. and Earlier

For SCENE 2022.1. and earlier your licensing option is determined when you purchase SCENE. The following licensing options are available:

a. Licensing with a port lock: the license number is recorded into the port lock (USB dongle). Attach the port lock to a USB port on your computer.

b. Licensing with a product key: enter a string of characters that you received from FARO.

- The product code must be validated using an Internet connection. After completion, this validation is permanently stored on your computer.
- If you do not have an available Internet connection, contact FARO's customer service team to receive a validation file.
- Each key code can only be activated one time. If you install the software on a new computer, use the license transfer options or contact FARO's customer service team for support.

You can find further information on these licensing options starting from chapter Licensing SCENE Versions 2022.1. and Earlier.

Contact FARO's customer service team if you need to switch your licensing option, or have other issues with licensing. Additional information is available on the FARO Knowledge Base.

Installing the Software

NOTE: You must belong to the group of administrators to install the software.

NOTICE: Uninstall any third-party software that interacts with SCENE and OpenGL software. This includes but is not limited to GPU performance and over-clocking tools, gaming overlays, FPS counters and various streaming and recording tools. These tools are known to cause random SCENE crashes when working with 3D views.

The following third-party software products are not compatible with SCENE:

• Nahimic
• MSI Afterburner
• Lavasoft Web Companion
• Trimble Connected Community Explorer

1. Insert the installation USB flash drive supplied with the scanner.
2. Select the language that the installation should use.
3. Select the product and follow the installation instructions on the screen. An installation wizard will guide you during installation.
4. Read the license agreement and accept it to proceed.

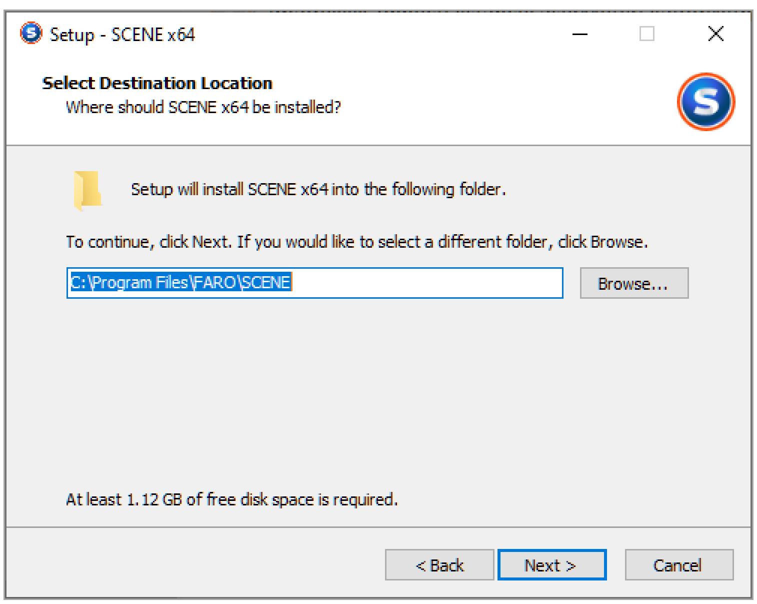


Figure 2-1 SCENE installation startup

5. Accept the default components for installation, or change the selection according to your needs.

6. If desired, create a new default folder.

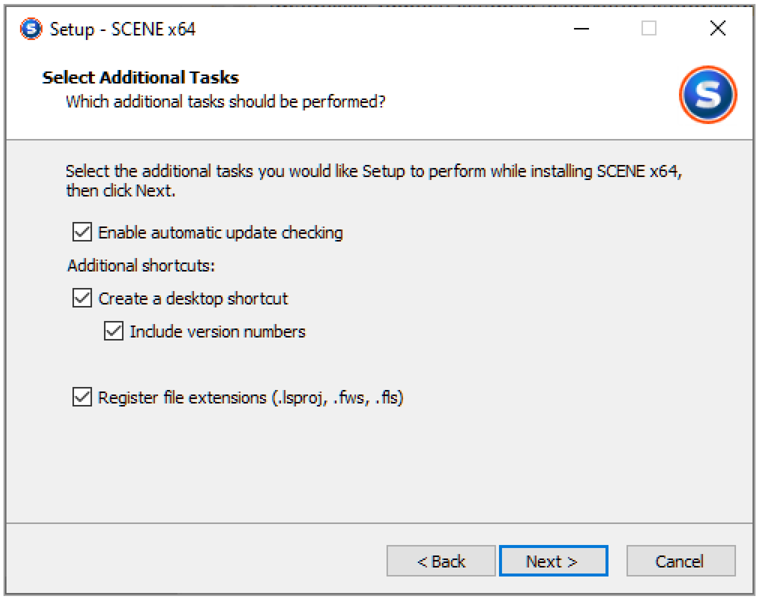


Figure 2-2 Select Additional Tasks

7. Decide if you want to be informed about updates. You will then be notified if a newer version is available than you are using. A dialog appears that shows the used version, the new version and a link to download the .exe file for the new version. After downloading, you must install the software manually.

8. If the new version is a major release (first or second number has been incremented) you may need another license to use the new version. Select the "Don't ask me again" checkbox if you don't want to be informed again about this new version, for example, if you want to download later.

9. **Create a desktop icon**: Select, if you would like to have the SCENE button shown on your computer's desktop.

10. **Register file extensions (.lsproj, .fws, .fls)**: Decide if you want to open scan projects by clicking the file name in Windows Explorer.

11. Review the setting and install the software.

When installing SCENE version 2022.2 and later, FARO InTouch and the FARO Licensing Manager are installed as well. Starting from SCENE 2022.2, you need the FARO Licensing Manager to request, update and manage your license.

Licensing SCENE Versions 2022.2 and Later

Starting from SCENE 2022.2, the software is licensed via the FARO Licensing Manager. The SCENE installation contains FARO InTouch as well as the FARO Licensing Manager. You can access the FARO

Licensing Manager via FARO InTouch.

1. To access the FARO Licensing Manager, open InTouch, and click **Run** on the Licensing Manager tile.

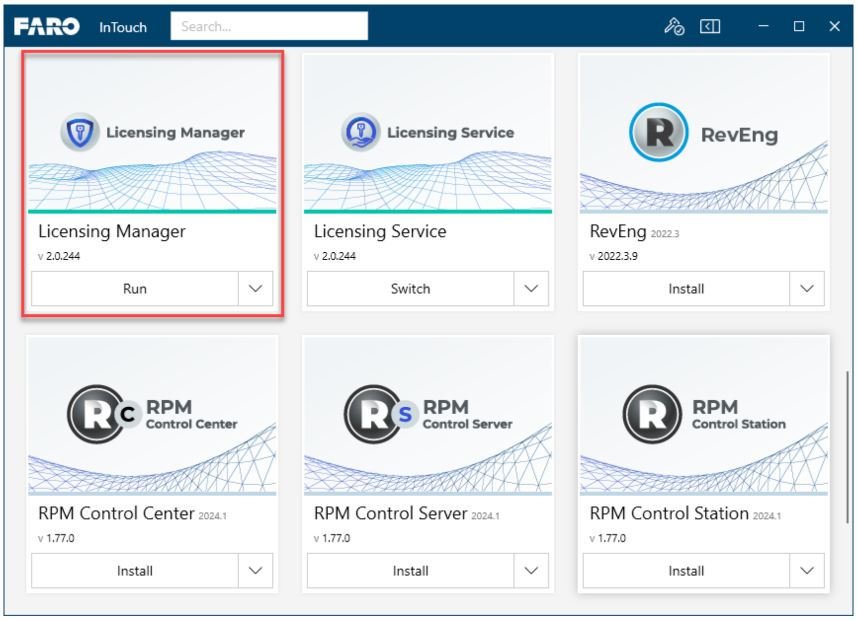


Figure 2-3 FARO InTouch

The FARO Licensing Manager opens.

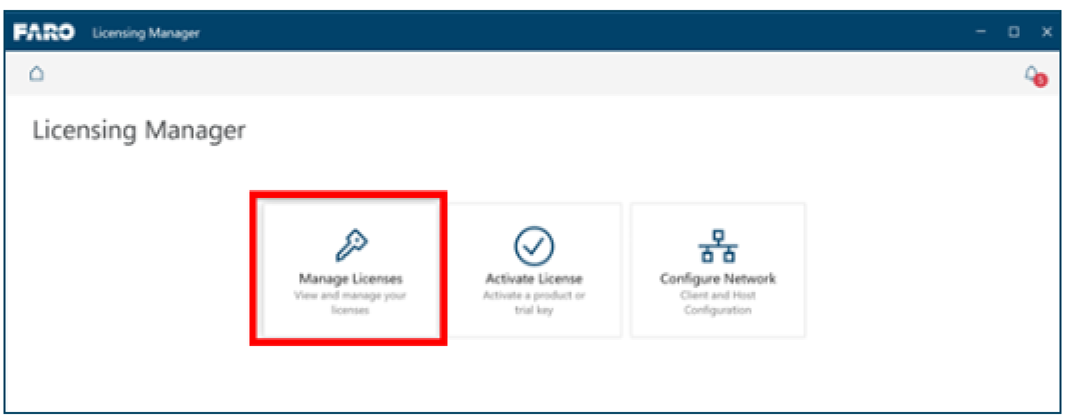


Figure 2-4 FARO Licensing Manager

2. Click **Manage Licenses**.
3. Then, click **Activate New**.
4. Enter your product key in field **Product key** and click button **Activate**.

The license will be added and activated. Note that this may take some time.

Updating Your License Automatically

1. To access the Licensing Manager, open InTouch, and click **Run** on the Licensing Manager tile.
   The FARO Licensing Manager opens.

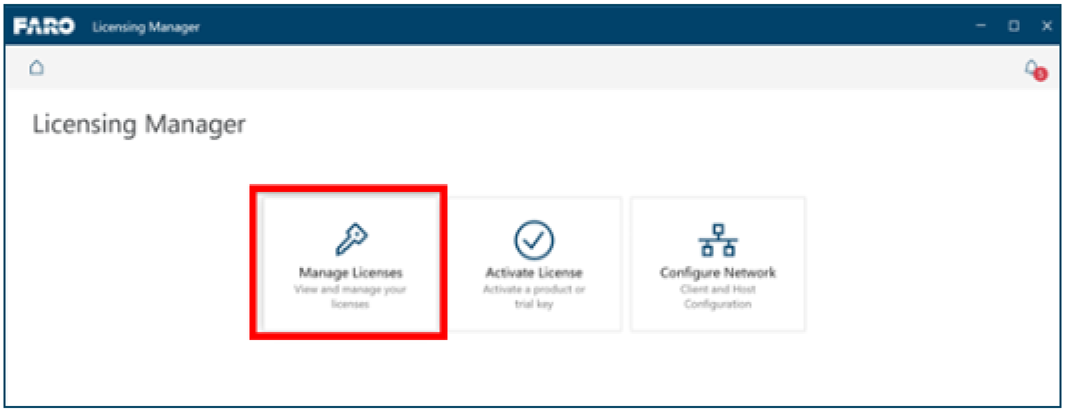


Figure 2-5 FARO Licensing Manager

2. In the FARO Licensing Manager, click **Manage Licenses**.
   The licenses which need updating are displayed.

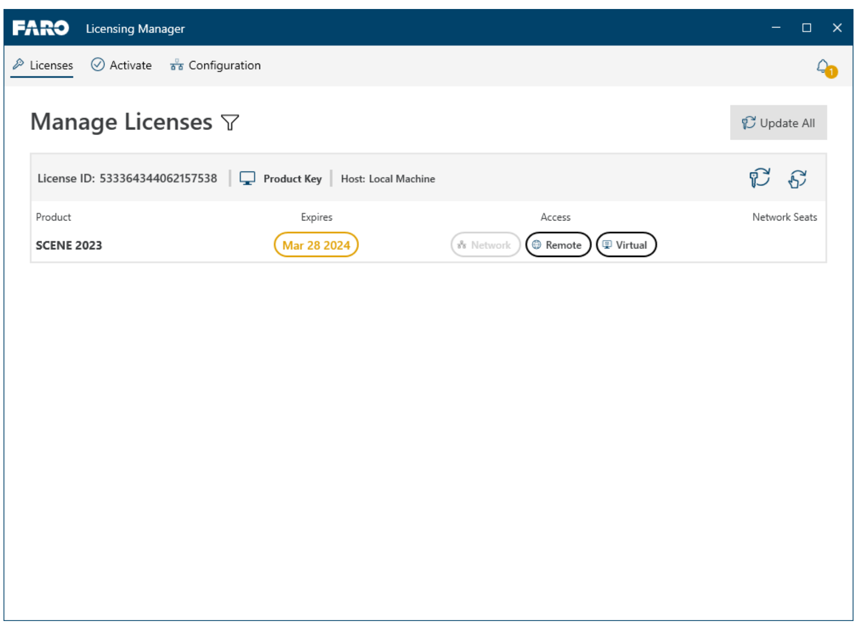


Figure 2-6 Update license view

3. Click icon .
   The update may take some time. If the update does not work even after several attempts, you can also update your license manually.

If you want to update all available licenses, click button Update All. To filter licenses, click icon and select the filter criterion you want from the context menu.

Once the license is updated successfully, it will be shown in the list and a green notification symbol will be appear next to the icon at the top right side of the FARO Licensing Manager.

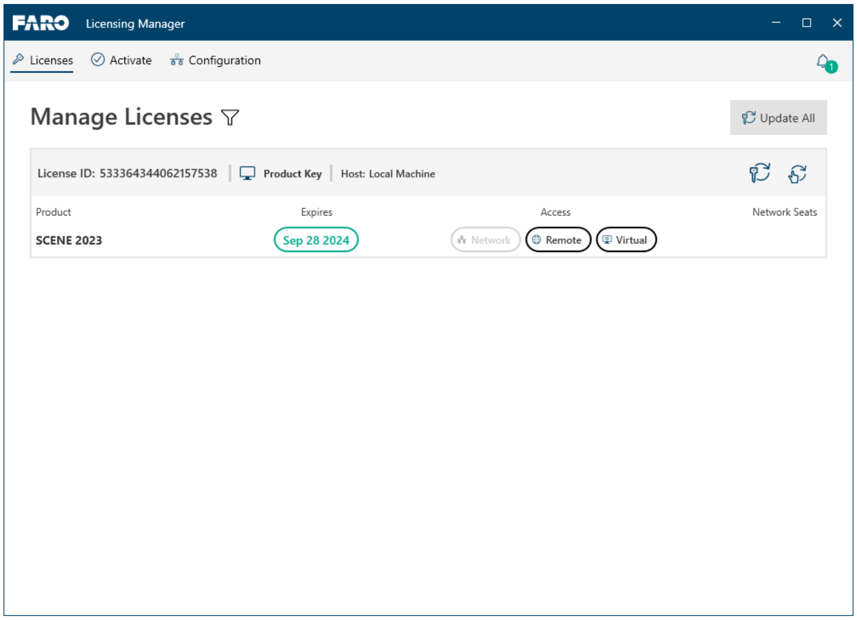


Figure 2-7 License updated successfully

Updating Your License Manually

1. To access the Licensing Manager, open InTouch, and click **Run** on the Licensing Manager tile.
   The FARO Licensing Manager opens.

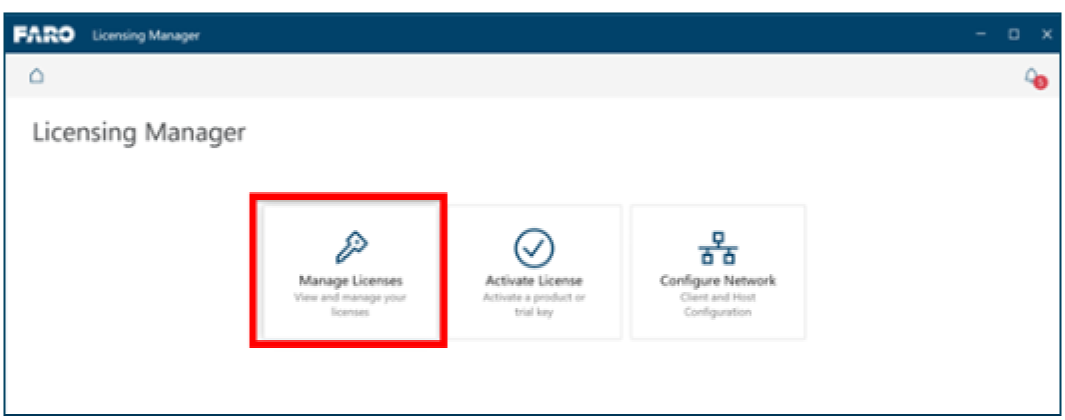


Figure 2-8 FARO Licensing Manager

2. In the FARO Licensing Manager, click **Manage Licenses**.
   The licenses which need updating are displayed.

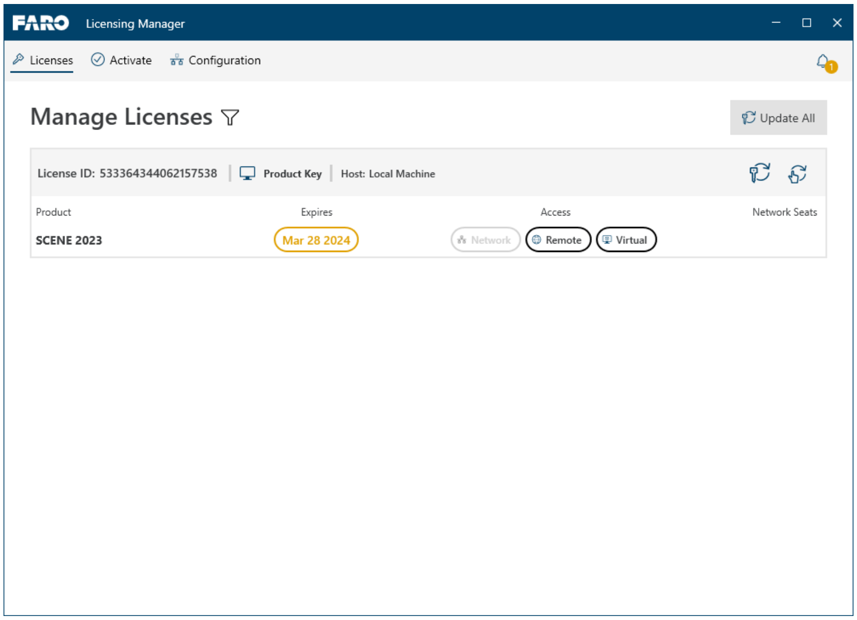


Figure 2-9 Update license view

3. Click icon .

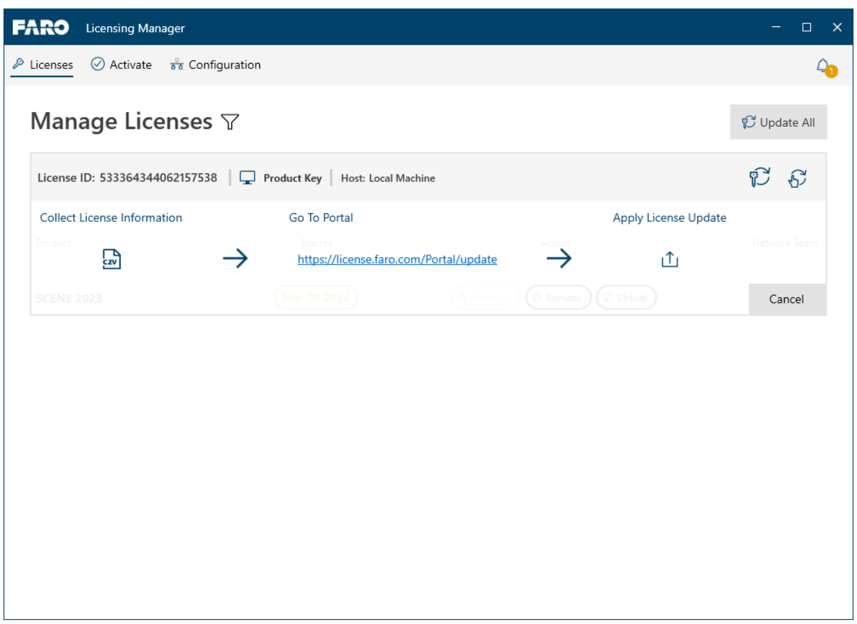


Figure 2-10 Update license manually

4. Click icon and save the .c2v file to your computer.

5. Then, click the **Go to Portal** link.
   The FARO Licensing Portal is opened in a browser.

6. In the FARO **Licensing Portal**, click button **Browse**, then select the .c2v button from your computer.

7. Click button **Update**.
   (You may need to try more than once.)

8. Click **Download zip file**.

9. Go the zip file location and unzip the .v2c file contained in the downloaded zip file.

10. Go back to the FARO Licensing Manager.

11. Click the **Apply License Update** icon and select the .v2c file that you have downloaded and unzipped in steps 8 and 9.

Once the license is updated successfully, it will be shown in the list and a green notification symbol will be appear next to the icon at the top right side of the FARO Licensing Manager.

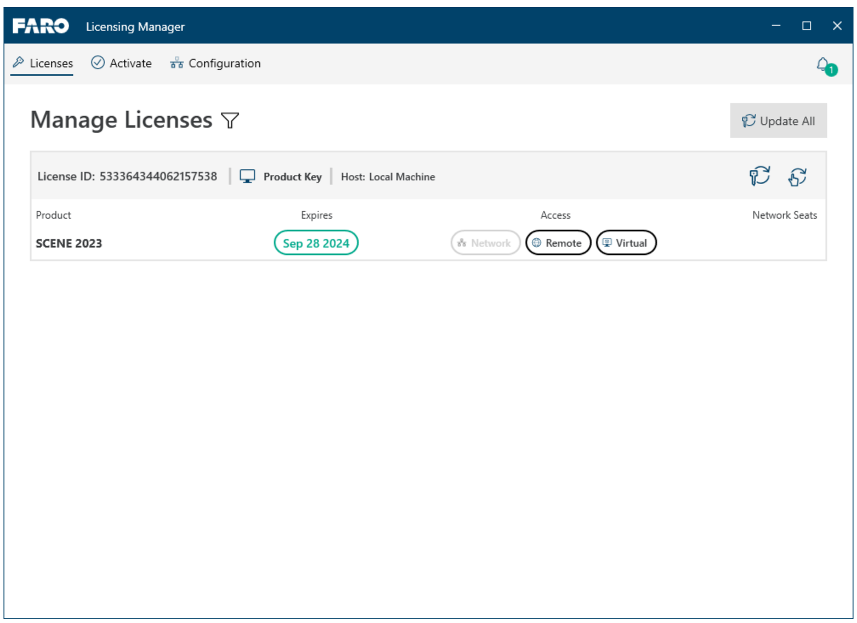


Figure 2-11 License updated successfully

Licensing SCENE Versions 2022.1. and Earlier

When you start an unlicensed version of SCENE, the following dialog is shown:

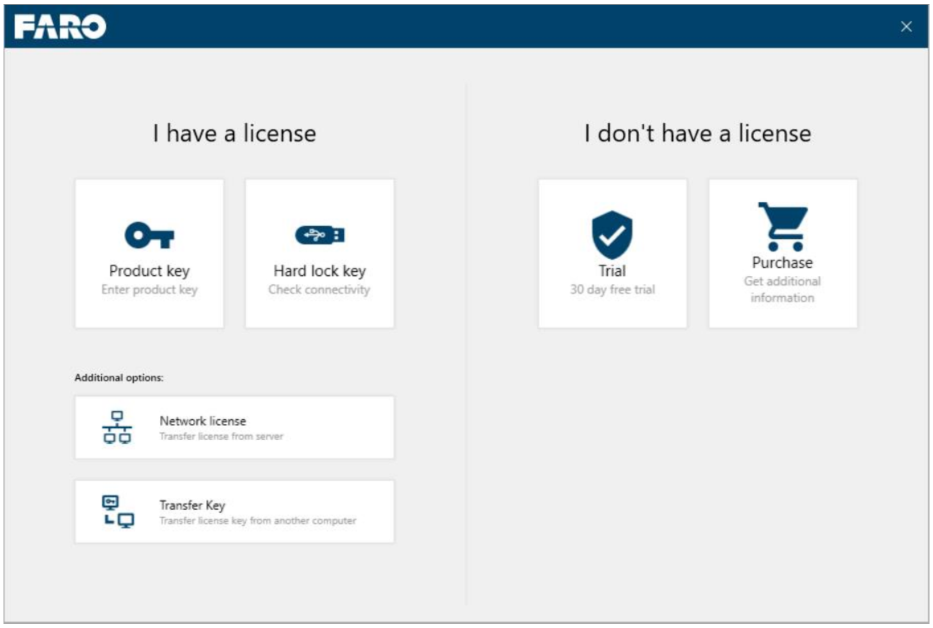


Figure 2-12 Activation Wizard

If you don't yet have a license, you can activate the 30 day trial license, or you can purchase a license.

To request a trial license, click the **Trial** button to be directed to the SCENE product page. On this page, you can submit the required information, after which you will receive a trial license via email.

To purchase a license, click the **Purchase** button to be directed to a FARO website where you make your purchase. You can buy a license either as a product key (a series of numbers or letters) or as port lock that contains a USB dongle. If you plan to use SCENE on more than one computer, especially computers on different networks, a port lock allows you to move the license quickly between computers. A product key is usually more convenient if you will only use SCENE on one computer.

If you already have a license, use this dialog to select a licensing option:
Product Key: If you have your license as a string of characters, select this option and follow the instructions in the wizard.

Hard Lock Key: If you have your license as a port lock, select this option and follow the instructions in the wizard.

Network License: If network licensing is available for SCENE on your network, select this option and follow the instructions in the wizard. You will need to know the host name or IP address of the network server. If network licensing is not available, and you want to set it up, contact FARO's customer service team to update your license. See Collect license information.

Transfer Key: If another computer on your network has a SCENE license that you want to transfer to your computer, select this option and follow the instructions in the wizard. After transfer, the license will no longer be available on the original computer.

Managing your Licenses

The License Manager is available from within the SCENE GUI. Access the manager from the **Settings** tab by clicking button .

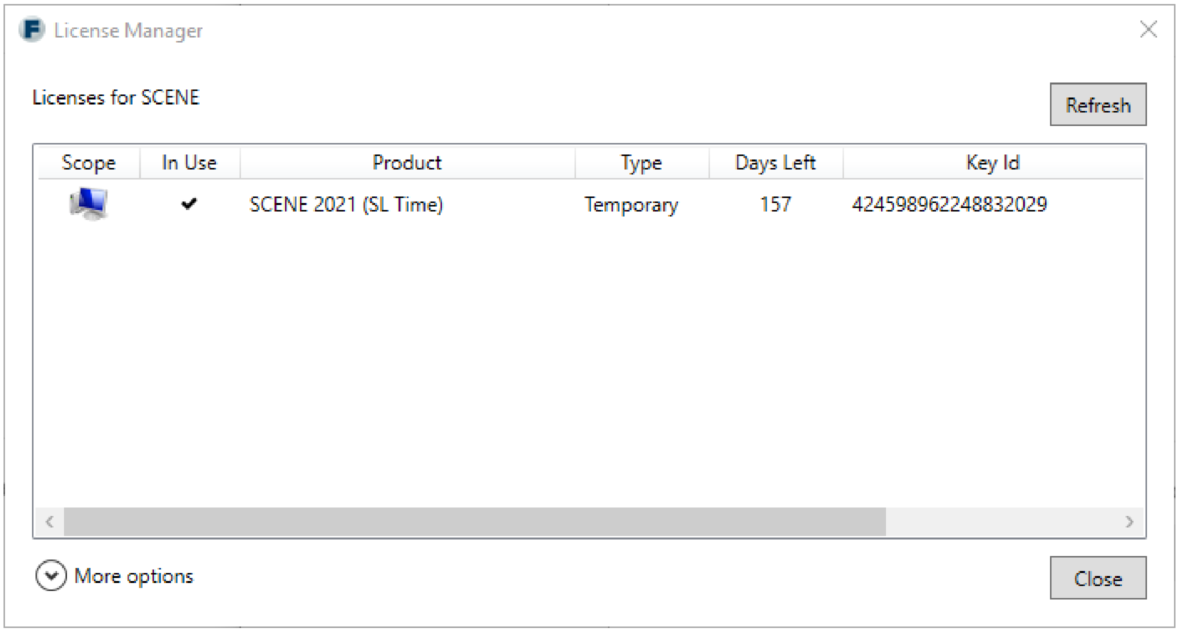


Figure 2-13 License Manager

- **Scope**: The icon indicates whether the license is a local, network or dongle license. Hover over the icon to get additional information.
- **In Use**: A check mark is present if the license is currently used by an instance of SCENE.
- **Product**: The product for which the license is valid.
- **Type**: This indicates whether the licenses is a trial, temporary (time-limited), or perpetual license.
- **Days left**: If the license is not perpetual, this column indicates the number of days remaining before the license expires.
- **Key ID**: The Key ID of the licenses. Note that this is not the same as the Product Key.
- **Hostname**: Name of the computer on which the license resides.

Start trial

Use to request a trial license.

Add license

Use to enter a product key. This operation requires an Internet connection.

Update licenses

To update existing licenses stored on your computer or the attached USB dongle to a new version of SCENE, ensure that you are connected to the Internet and click the **Update Licenses** button.

Transfer key

To transfer a single-user license from one computer system to another, click the **Transfer Licenses** button. This opens a PDF document with details about how to transfer a SCENE, SCENE Process, or SCENE app license. The FaroRUS tool, that is required to perform the transfer, is also opened. Follow the process specified in the document to transfer the license.

Collect license information

If you do not have an available Internet connection, contact FARO’s customer service team to update your license. You will need to create a C2V license file for FARO customer service if you are deleting a license, modifying a license, or activating the software for the first time on a computer that does not have Internet access (also known as an offline activation). Make sure you apply the license you are given before you generate a C2V using this link. Send the exported file to support@faro.com.

Update from file

If you do not have an available Internet connection, contact FARO’s customer service team to update your license.

Network Licensing

SCENE allows management of multiple licenses over a network. This option is available for users who want to use a separate computer to host a network license without having to install SCENE on that computer.

Network licenses are hosted on a license server computer and shared to client computers over the network. They can be locked to a USB dongle (port lock) or to the licensing server computer.

When you start SCENE on any computer in your network, it will search the network for available licenses. If one is found, it will use this license for the time it is executed. When you close SCENE, the license will be released and will be available to other SCENE installations in the network.

Installing the Sentinel HASP Licensing Software on the License Server

SCENE licenses are managed with Sentinel HASP from SafeNet. To setup a computer as a license server, you must install the Sentinel licensing software on that computer. Sentinel is automatically installed with SCENE; however, if you do not want to install SCENE on the computer that hosts the network licenses, you must install Sentinel manually. Do one of the following to install the Sentinel licensing software on the server computer:

- Click **HASP Network License Manager** on the USB menu and follow the prompts.

  OR

- Execute `haspdinst.exe -install` from a command shell. You can obtain this file from the FARO Technical Support Center site.

To verify the proper installation of the Sentinel licensing software, open an Internet browser on the license server and enter the address http://localhost:1947/ to open the Sentinel Admin Control Center. If the Sentinel Admin Control Center appears, installation was successful.

Enabling Remote Access on the Server

Before users can access the network licenses, remote access must be enabled on the server computer:

1. Open an Internet browser on the license server and enter the address http://localhost:1947/ to open the Sentinel Admin Control Center.
2. In the **Options** window, select **Configuration** to display the configuration tab set.
3. Click the **Access from Remote Clients** tab.
4. Select the **Allow Access from Remote Clients** checkbox.
5. Click **Submit**.

Network Licenses Attached to a USB Dongle (Port Lock)

You can obtain a special network port lock from FARO Customer Service. This port lock may be plugged into any computer that has the Sentinel HASP drivers installed. This computer will act as the license server and share the licenses over the network (after you enable remote access from clients). Activation of these licenses is not necessary.

If you want to add network licenses to a port lock, you can purchase network licenses linked to a product key. To transfer them to the port lock, attach it to any computer with SCENE installed and follow the steps to validate the product key and activate the licenses. When validating the key and activating the licenses, you will be asked whether you want to lock the licenses to the computer or to the attached port lock. Select the second option. After completion, you can remove the port lock from the computer and attach it to the license server again (if you used another computer to activate the licenses).

Network Licenses Attached to a Key Code

You can also lock network licenses to the license server computer using a product key. To do so, install and start SCENE on the server, then follow the steps to validate the product key and activate the licenses. If you do not want to install SCENE on the license server, you can use the FARO Remote Update System tool to activate the licenses on the server instead.

To activate licenses with the FARO Remote Update System:

1. Start the FARO Remote Update System (**Start** > **All Programs** > **FARO** > **SCENE** > **FARO Remote Update System**).
2. On the **Collect Key Status Information** tab, click the **Collect Information** button. The System will generate a C2V file.
3. Save the C2V file to your local hard disk.
4. Send the C2V file and your product key to support@faro.com.
5. After a short processing time, you will receive an email with an activation file (V2C). Save this file to your local hard disk.
6. Start the FARO Remote Update System again and click the **Apply License File** tab.
7. Select the V2C file you received from FARO Customer Service and click **Apply Update**. The license will activate and be bound to the computer.
8. Open http://localhost:1947/ with an Internet browser on the server to verify the proper activation of the SCENE license. In the **Options** window, select **Products** to display the available SCENE licenses.

Detaching Network Licenses

If your license server hosts network licenses that are attached to the computer with a key code (not to a port lock), you can detach a network license and temporarily bind it to a client computer. The license can then be used locally on that computer without being connected to the network. When the detached license expires, it is automatically unbound from the client computer and restored to the server.

The license server and the client computer must be configured to allow detaching of network licenses.

To enable license detachment on a server or client computer:

1. Open http://localhost:1947/ with an Internet browser on the server or client computer.
2. In the **Options** window, select **Configuration** to display the configuration tab set.

3. Click the **Detachable Licenses** tab.
4. Enable **Detaching of Licenses**.

NOTE: On a server, you may also specify the number of reserved non-detachable licenses and the maximum detach duration.

5. Click **Submit**.

To detach a license and bind it to your client computer:

1. Open http://localhost:1947/ with an Internet browser on the client computer.
2. In the **Options** window, select **Products** for an overview of all available local and network licenses. Detachable network licenses are identified by a red arrow.
3. Click the **Detach** button to access the **Detach License** dialog.
4. Select the expiration date to specify the day the license will be restored to the pool.
5. Click **Detach & Attach** to temporarily bind the license to your client computer. It will return to the network license pool when it has expired.

To return a detached license before it expires:

1. Open http://localhost:1947/ with an Internet browser on the client computer.
2. In the **Options** window, select **Products** for an overview of all available local and network licenses. Detached network licenses are identified by a green arrow.
3. Click the **Cancel License** button and confirm your selection on the following dialog to return the license to the network license pool.

Transferring Network Licenses

1. To transfer (rehost) a valid SCENE license from one computer to another:
2. On both computers, start the FARO Remote Update System (**Start** > **All Programs** > **FARO** > **SCENE** > **FARO Remote Update System**).
3. On both computers, click the **Transfer License** tab.
4. On the recipient computer (the computer that will receive the license), select a location to save an information file (ID) and click **Collect and Save Information**.
5. Transfer the ID file to the source computer (the computer which currently contains the license).
6. On the source computer, highlight the license to transfer.

7. Browse to the ID file created in Step 3.
8. Select a location to save a license transfer file (H2H) and click **Generate License Transfer File**.
9. Transfer the H2H file to the recipient computer.
10. On the recipient computer, click the **Apply License File** tab.
11. Select the H2H file created in Step 7 and click **Apply Update**.

License Server Administration

The Sentinel Admin Control Center provides various functions to manage and monitor the usage of network licenses and to diagnose problems. For more information, refer to the Sentinel Admin Control Center help.

Updating Your License

Use the FARO Remote Update System, found in the program group, to check for any pending license updates. When you run this program, SCENE will download any pending updates or orders and automatically update your port lock. For example, if you order a translator from FARO customer service, you can use the License Update tool to download the translator and automatically apply it to your license.

If you do not have an available Internet connection, contact FARO’s customer service team to update your license. You will need to create a C2V license file for FARO customer service if you are deleting a license, modifying a license, or activating the software for the first time on a computer that does not have Internet access (also known as an offline activation). Make sure you apply the license you are given before you generate a C2V.

To create a C2V file:

1. Start the FARO Remote Update System (**Start** > **All Programs** > **FARO** > **SCENE** > **FARO Remote Update System**).
2. Click **Collect Information**.
3. Save the C2V file.
4. Send the file to support@faro.com.
5. After a short processing time, you will receive an email with an activation file (V2C). Save this file to your local hard disk.
6. Start the FARO Remote Update System again and click the **Apply License File** tab.
7. Select the V2C file you received from FARO Customer Service and click **Apply Update**. The license will activate and be bound to the computer.

8. Open http://localhost:1947/ with an Internet browser on the server to verify the proper activation of the SCENE license.

Chapter 3: SCENE Projects Overview and Projects Details Pages

SCENE always starts with the **Projects Overview** window. This chapter describes this window and its contents and functions.

Updates and News

When SCENE starts for the first time, the **Updates and News** window is displayed. This window provides you with the latest information from FARO about SCENE, including information about software updates, training, apps and so on. If you want to see the information again next time you start SCENE, click **CLOSE**. If you *don't* want to see the information again click **DISMISS** and then **CLOSE**. The information is always available from the Help page.

Projects Overview

The **Projects Overview** presents all scan projects which are saved in your default project folder. The path of this project folder is displayed at the top of the screen. Clicking on this path will open a Windows dialog, where you can select the folder you want.

SCENE will verify all known projects at start-up that are available locally or in the cloud, i.e. in Sphere XG. The cloud option is available starting from SCENE version 2024.0.

SCENE LT will verify all known projects at start-up.

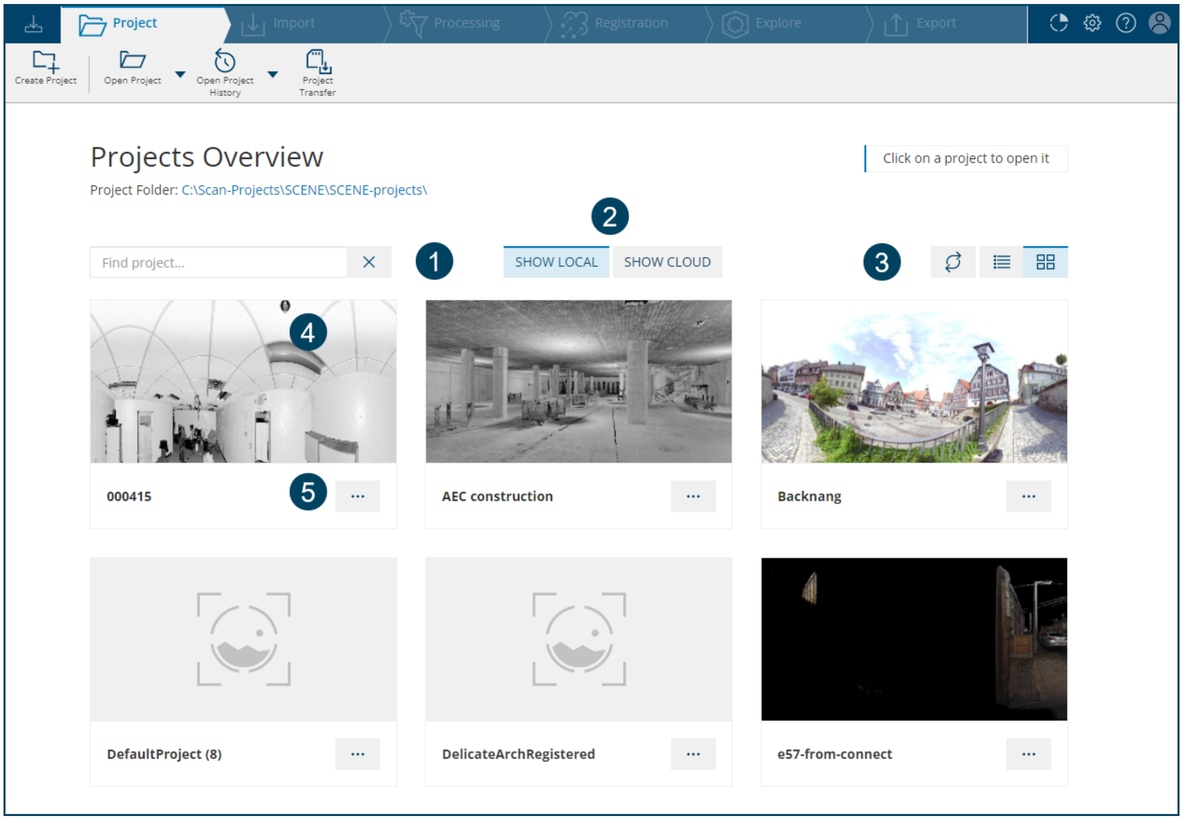


Figure 3-1 Projects Overview window

1 Search field. Start typing, and SCENE LT will automatically show scan projects with names that match what you type.

2 Click to show either local projects on your computer or projects in the cloud. For this purpose, you must be signed in to Sphere XG, see *Sign into Sphere XG* on page 64.

3 Refresh project view, show the scan projects either as a list view, or as a tile view.

4 Scan projects shown with preview image. Hover with the mouse to see a short description of the scan project. This short description corresponds to what you see in the list view.

5 Click the three-dots menu to open the Project History or Project Folder.

Opening scan projects

Use one of the following options to open a scan project.

- In the tile view, click the project's preview image.
- In the list view, click the line of the scan project.

- Drag and drop a scan project file (ending: .lsproj) from a file system into the Project Preview.
- Drag and drop a scan file (ending: .fls) from a file system into the Project Preview. A new scan project will be created and opened.

NOTE: Starting with SCENE version 2019.2, projects can be opened by versions of SCENE that are older than the version used to save the project. For example, version 2019.2 will be able to open projects saved by future versions of SCENE. (For SCENE versions 2019.1 and older, the older versions of SCENE cannot open projects saved by younger versions.)

Project Details

After the scan project is opened, the **Project Details** will be shown.

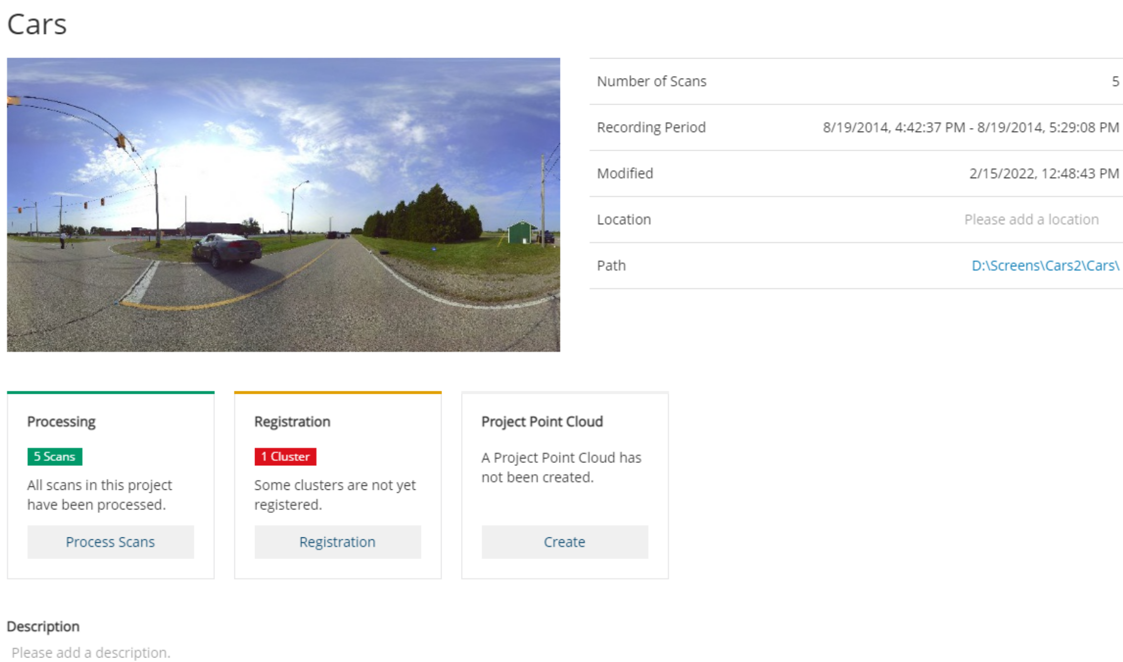


Figure 3-2 Project preview

If the preview image is not the one you want to see at this place, you can replace it by another one. Only images in .jpg or .jpeg format are allowed.

1. Hover over the preview image. The **Change Image** button appears.
2. Click the **Change Image** button.
3. Browse to a folder, and select the image.
4. Click the **Open** button to replace the image.

Number of scans

The number of scans belonging to the scan project.

Recording period

Date and time when scanning was started, and date and time when scanning was finished. Times shown here are in local time.

Modified

Date and time when the scan project was modified for the last time.

Location

Add a position to your project to make the Google Maps View feature available.

The coordinates must be entered in decimal notation, first the latitude, then the longitude.

Here are some example coordinates:

Moscow:	55.758032	37.617188
Sydney:	-33.870416	151.204834
Rio de Janeiro:	-22.902743	-43.214722
Seattle:	47.606163	-122.332764

Google Maps

If positional information is provided for a project, the **Google Maps View** button  becomes available in the project's preview. Clicking this button will open a Google Maps view of the project's location in your default web browser.

Path

The path of the folder in which the scan project is saved.

Description

You can enter a description of your scan project.

Read-only projects

Projects that cannot be opened with write access are read-only. This happens for example if the project is opened by another SCENE instance. In this case, SCENE will show a message box while loading the project.

After the loading is finished, the project will be shown as read-only with a warning message at the top of the project dashboard. The **Save** button is disabled. As an additional hint for the user, the SCENE title bar contains a read-only hint.

Status tiles

Depending on your scan project, different status tiles may be shown. The order of the status tiles corresponds to the workflow steps in the Workflow bar.

Each status tile shows the status regarding one specific step of processing a scan project.

A status tile usually consists of color coded badges, a description text, and an action button.

Depending on the status of the tile, the action button is disabled or enabled.

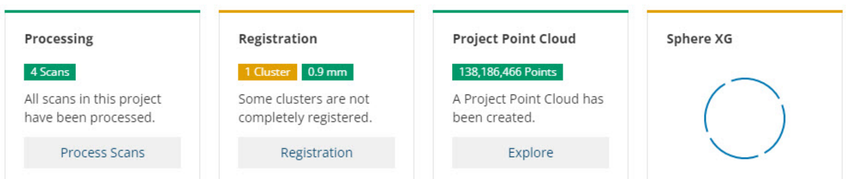


Figure 3-3 Color coding with running upload to Sphere XG

NOTE: The status tiles and their buttons are meant as information, and offer a short way to access a specific function. It is not mandatory to click the buttons, you can also click the appropriate Workflow bar buttons.

Status Tile "Processing"

NOTE: From the processing status tile, you can click the processing button to select scans and configure processing. If your project is a mix of hand-held and Focus scans, clicking this button will only allow you to select Focus scans. To process hand-held scans, click the Processing tab and select Process hand-held Scans.

The Processing status tile shows the current processing status of the scans inside the project.

The colored badges in the Processing Tile categorize the scans of the project into three categories:

Green: The Scan has been processed and has an up-to-date Scan Point Cloud.

Yellow: The Scan has been processed but does not have an up-to-date Scan Point Cloud.

NOTE: Scans that have been processed with SCENE 6.0 or lower must be processed again to have an up-to-date Scan Point Cloud, and to utilize the full functionality of SCENE 7.1.

Red: The Scan has not been processed yet.

Processing Status

The processing status of scans is displayed as follows:

- The status color of the tile is gray if there are no scans in the project.
- Tile and badge are green if all scans are processed and have the updated Scan Point Clouds.
- The status color of the tile is yellow if the yellow badge is visible and the red badge is not visible. This means that all scans in the project were processed, but for some scans, Scan Point Clouds must be regenerated.
- The status color of the tile is red if the red badge is visible, when there is at least one scan that was not processed at all.

Click the **Process Scans** button to start processing.

The task will open. For more details, see *Processing Settings* on page 46.

Status Tile "Registration"

The Registration status tile shows the current registration status of the scan project. For more details, see *Registration* on page 115.

The tile will show different badges which show the number of clusters for each registration state.

An additional badge showing the mean point error is displayed if all clusters were successfully registered.

All information corresponds directly to the information shown in the registration dashboard and the registration report.

Each badge type has a tool tip with additional information.

The tile can have three different states which correspond directly with the current state of the project in the Registration dashboard. These states are symbolized by colors:

Grey

- The currently open project does not contain any clusters or scans.
- The **Registration** button is disabled.

Orange

There are still clusters which need some user interaction to be successfully registered.

- Red badge: the number of unregistered clusters.
- Orange badge: the number of incomplete clusters.

- Green badge: the number of finished clusters.

Click the **Registration** button to switch to the registration dashboard.

Green

All clusters are successfully registered.

- Green badge: the number of finished clusters.
- Red, orange, or green badge will show the overall mean point error. This number is also shown in header of the registration report with the same color coding, which depends on how high the error is.

Click the **Show Report** button to switch to the registration report.

Status Tile "Project Point Cloud"

The Project Point Cloud status tile shows the current processing status of Project Point Cloud (PPC).

Status colors

Tile and badge are gray if no Project Point Cloud exists for this project.

Click the **Create** button to create the Project Point Cloud.

The Point Cloud Creation dialog will open.

NOTE: If the registration is not yet complete, i.e., the registration tile is not green, a warning message is displayed which recommends finishing the registration before creating the Project Point Cloud.

Orange: A Project Point Cloud in a legacy format exists.

Click the **Update** button to update the Project Point Cloud.

First, the legacy Project Point cloud will be deleted, and the new Project Point Cloud is created afterwards.

Green: A Project Point Cloud in the current format exists.

A green badge will show the total number of scan points within the Project Point Cloud.

Click the **Explore** button to switch to the Explore category where the Project Point Cloud is shown in a 3D view.

Status Tile "Sphere XG"

This status tile shows whether or not the project has been uploaded to Sphere XG.

The following status are possible:

- **Blue**: You are not signed into Sphere XG, see *Sign into Sphere XG* on page 64 for more information.
- **Grey**: You are signed into Sphere XG, but the project has not yet been uploaded.

- **Yellow**: The upload is running.
- **Green**: The project was uploaded successfully.
- **Red**: The upload has failed.

Status tile buttons:

- **Upload**: Uploads the project to Sphere XG, see *Upload a Project* on page 66.
- **Sync**: Synchronizes changes between SCENE and Sphere XG.
- **Resume**: Resumes an upload that was aborted for any reason, for example by the user, Internet connection lost, etc.

Chapter 4: Navigation

This chapter introduces to the toolbars and buttons which help you to navigate through a scan or a point cloud.

NOTE: SCENE provides all the features needed to finish typical scan projects. For some advanced features, however, you must switch to the classic style user interface by clicking **Switch UI in the Settings toolbar**.

After you have opened a scan project, the SCENE window appears. This window is made up of the following areas:

Figure 4-1 Composition of the SCENE window

① Workflow Bar

The workflow bar guides you through a series of steps to process a scan project. All steps are structured in a similar way which will help you to get familiar with all the functions.

② Toolbar

The toolbar provides a quick and easy way to access features.

③ Structure View

The structure view displays the project structure, including all folders and objects. If you click the name of those folders and objects with the right mouse key, a so-called context menu will open which offers specific functions.

By default, the structure view is visible. If you want to fold it away, click the thumbtack button. To make the structure view permanently visible again, click the **Structure** button, then click the thumbtack button.

④ Scan and Object Views

Shows the visual presentation of the scan data and other objects. Scans and objects can either be displayed in a quick view , a detailed planar view, or in 3D view.

If you click the scan data and objects with the right mouse key, a context menu will open which offers specific functions.

⑤ Navigation Toolbar (3D View Only)

Offers a quick and easy way to a number of navigation modes. In addition, it allows opening various views, for example gap filling or point sizes.

⑥ Coordinate Axes

Shows the viewing direction by means of x, y, and z coordinate axes

⑦ Status Bar

Displays command and scan point data details

Workflow Bar

The workflow bar and its buttons provide easy functions to work on scans and scan projects. Working through the steps from the left to the right should lead to a satisfactory result.

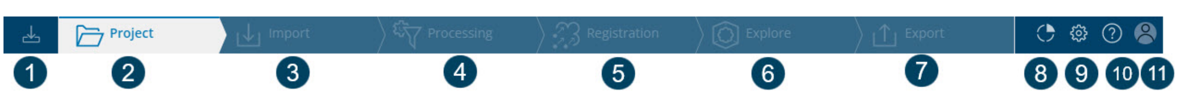


Figure 4-2 workflow bar

① Select the **Save** icon to save the currently open scan project.

② Select the Project category to find the features for your entire scan project.
There are two sets of toolbars, one that shows up when no scan project is opened, and one that shows up when a scan project is opened.

③ Select the Import category to import scans, projects, images, or WebShare data.

④ After importing, select the Processing category to determine how the raw scan data will filtered, colorized, and otherwise modified to make it more useful.

⑤ Select the Registration category to open the Registration features.

⑥ Select the Explore category to add annotations, measurements, viewpoints, or clipping boxes.

⑦ Select the Export category to export scan points, the point cloud, or the scan project.

⑧ This icon opens the Apps feature.

⑨ This icon opens the Settings for the categories.

⑩ This icon opens the Help page.

⑪ This icon opens the sign-in dialog to Sphere XG. For more information, see *Upload and Download SCENE Projects to/from Sphere XG* on page 64.

Help Page

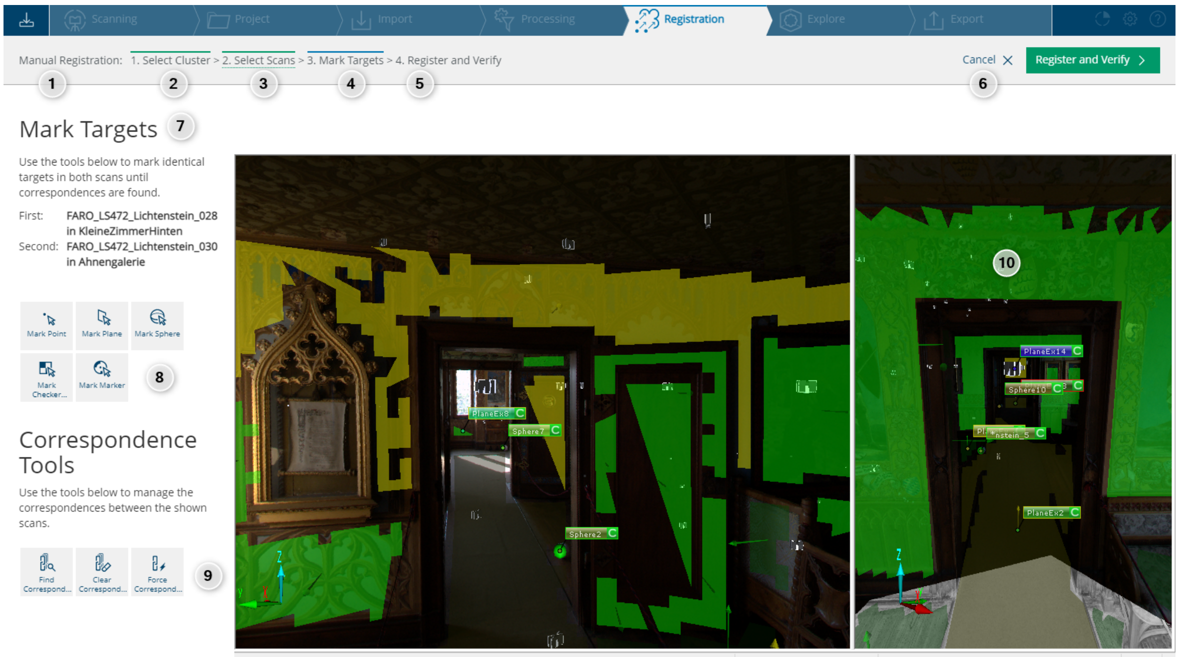
Icons and search options in the ribbon (from left to right):

- Button **English Manual** opens the English User Manual
- Button **Online Manuals** opens the FARO Knowledge Base.
  Here, the user manual is available in further languages.
- Button **Online Tutorials** opens the FARO YouTube Channel, where you can find training videos.
- Click button FARO Knowledge Base to create and monitor support cases, access asset information, update contact information, submit product ideas, and more.
- Click button **Contact Technical Support** to create a technical support request.
  Clicking on this button opens the website Request Support.
- Search the FARO Knowledge Base directly.

The following options are available in the section on the left side.

- About: View version and build numbers for this version of the software.
- News: Get the latest news about this software.
- 3rd-Party Licenses: View the licenses for 3rd-party products included in this version of the software.

Tasks and Task Steps



Task steps

① The task that is currently being executed, and the several steps of that task that are performed sequentially.

② Completed Step

③ Completed Step you can go back to. You can go back only one step at a time. Changes will not be reversed (for example, the result of a registration).

④ Active Step

⑤ Upcoming Step

⑥ Navigation Buttons:
The **Cancel** button exits the current task. It does not undo changes.
The **Continue** button is only active (green) if all necessary prerequisites of the current step are fulfilled. It either goes to the next step, or finishes the task.

⑦ Name of currently active task step.

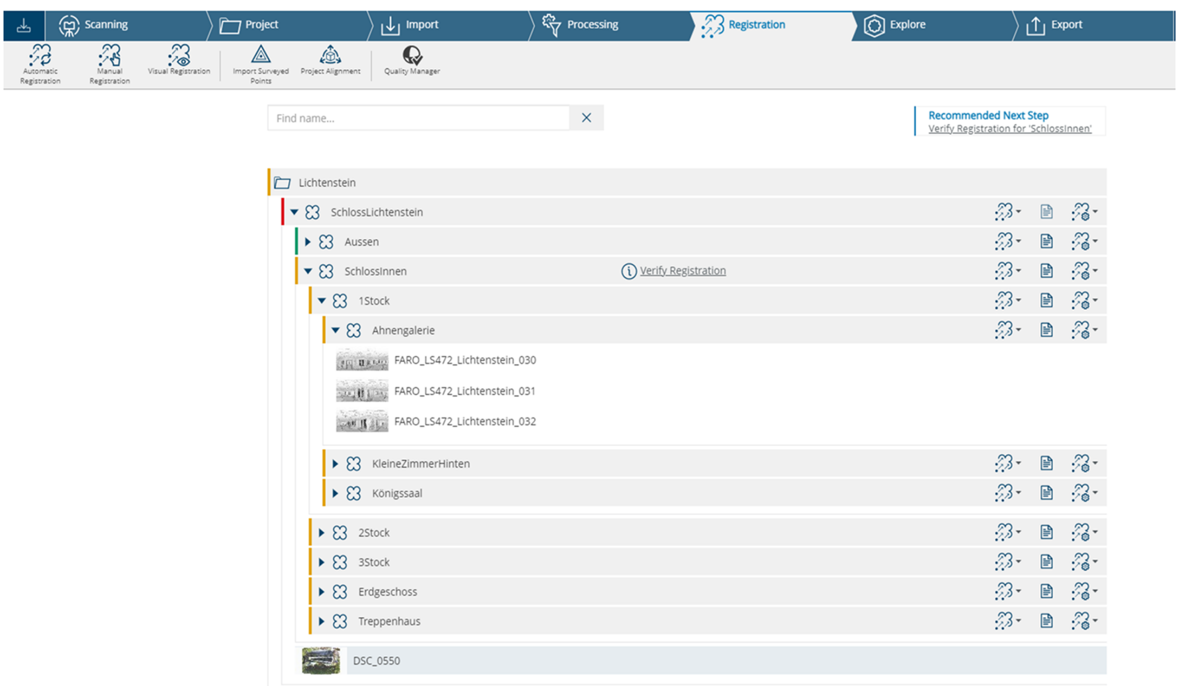
⑧ Optional description and tools of currently active task step.

⑨ Correspondence tools that assist you in finding or dismissing correspondences between the selected scans.

⑩ Work area, for example 3D views and additional information …

Color Coding

While you are working with SCENE, you will notice different colors, for example header lines, buttons, traffic light symbols, or messages. Those colors are meant to be an additional information.



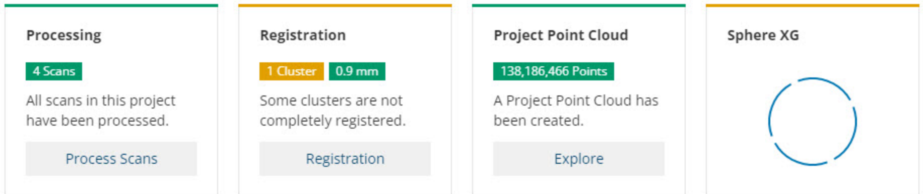


Figure 4-3 Color coding

Blue: Stands for an information, or shows an active step

Green: Everything is working properly or previous step has been completed successfully. For buttons: you can now click to continue.

Yellow: Something is not working properly, or there is legacy data. Check and fix.

Red: Something went wrong, or some step has not yet been processed. Check and fix.

Navigation Toolbar (3D View only)

A navigation toolbar is displayed only with the 3D scan view.

Figure 4-4 3D Navigation toolbar

The following options are available in the 3D navigation toolbar. For details, click the links:

View Modes

Note that the appearance of this button depends on your Views default settings.

Camera Modes

View All

Predefined Views

Center of Rotation

Last Camera Position

Align Camera on Point

Toggle Clipping Boxes

Point Cloud Visibility

Supersampling

Gap Filling

Clear View

Adaptive

Point Sizes

Coordinate Coloring

Shading

View Modes

Examine Mode

Click **Examine Mode** to start the object-based navigation. The objects will appear to move while you stand still.

Smart Mode

The **Smart Mode** combines different navigation modes.

A ring is used to divide the view into different zones. When starting the actual navigation by clicking the mouse button, different navigation modes will be used depending on the zone.

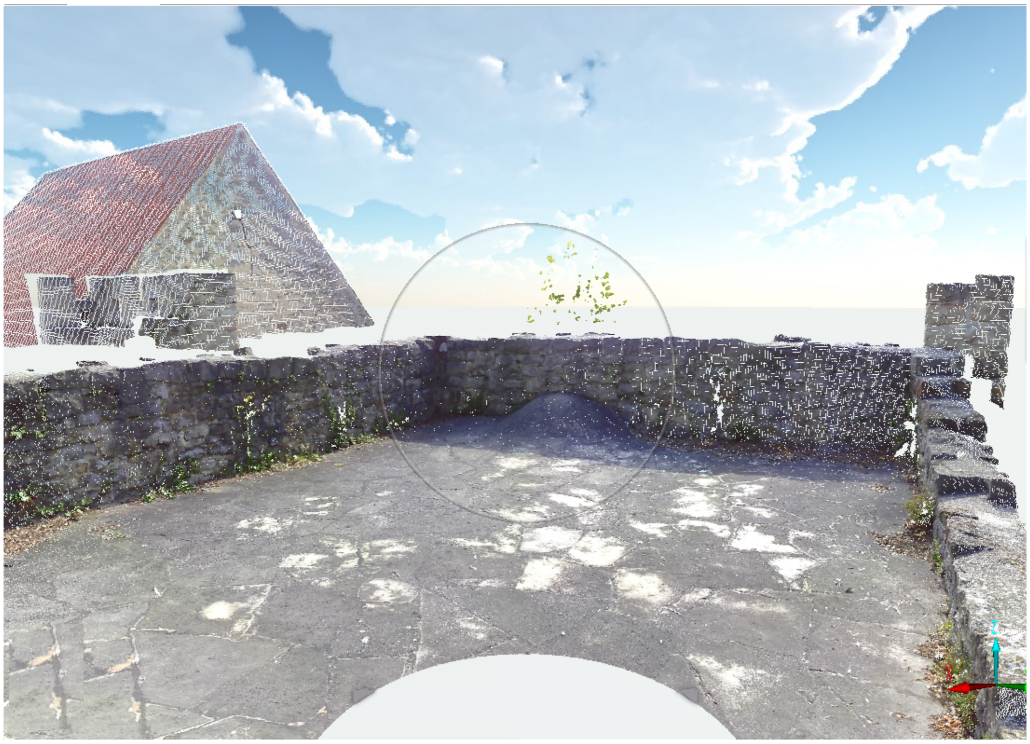


Figure 4-5 SCENE with activated Smart Mode

The navigation ring disappears when the mouse is not moved anymore, or while you are clicking and moving the view. It appears again as soon as you hover with the mouse.

2 Zone navigation (default)

A thin ring visualizes the two zones. The cursor updated depending on its position.

Figure 4-6 2 Zone navigation

① Fly Mode: activated if the cursor is in the inner of the ring.

② Examine mode: Activated if the cursor is in the outer area of the ring.

3 Zone navigation

A thick ring visualizes the three zones. The cursor is updated depending on its position.

NOTE: To set the 3 Zone navigation, you must switch to the SCENE classic style user interface by clicking **Settings > Switch UI**. In the old UI, select **Tools > Options**, then click the **Navigation** tab. On the navigation tab, activate radio button **Fly, Examine, Roll**.

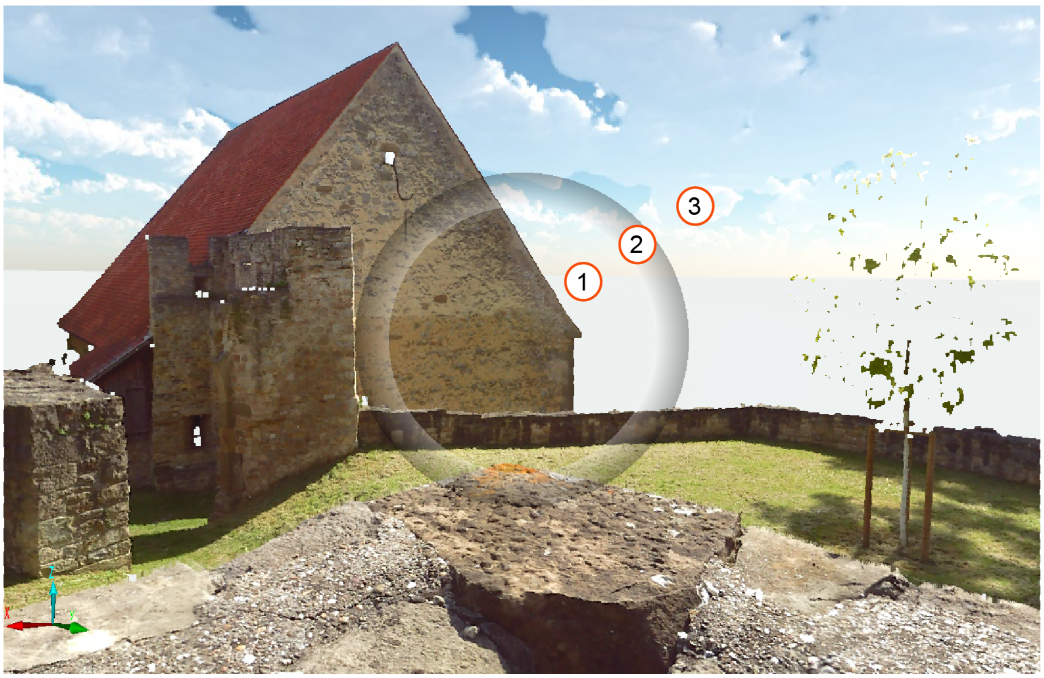


Figure 4-7 3 Zone navigation

① Fly Mode: Activated when the cursor is in the inner of the ring.

② Roll Mode: Activated when the cursor is on the ring.

③ Examine Mode: Activated when the cursor is in the outer area of the ring.

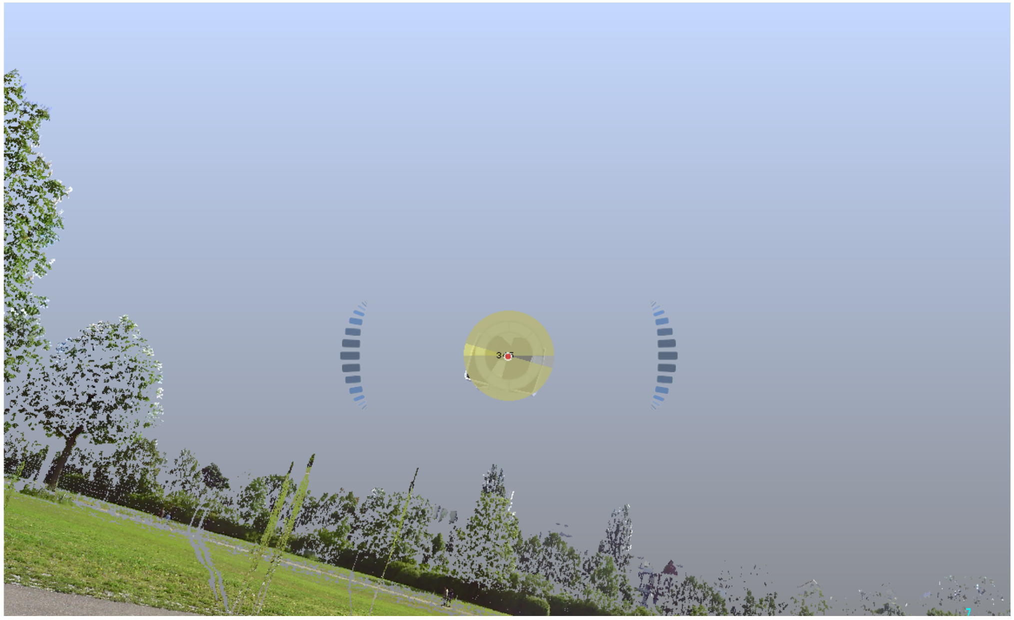


Figure 4-8 Scenery with Roll mode

To do this, click the ring and drag in any direction. A circle will appear in the middle of the view, indicating the rotation angle.

Fly Mode

The **Fly Mode** of the observer-based navigation simulates flying through the 3D world.

- Click and drag the 3D view with the mouse to simulate a flight around the scanner's position.
- The cursor keys left, right, up, and down turn your head to the left, the right, forward, and backwards.
- The keys page-up and page-down move you up and down.
- In addition, you can press the shift key to accelerate these movements.

Pan Mode

There is no turning available in this navigation mode. Mouse movements are interpreted as observer movements.

Walk Mode

The **Walk Mode** of the observer-based navigation is similar to the fly mode but you can only travel along the XY plane. This is useful if you want to stay at the same height while navigating.

Camera Modes

Click the camera modes button to change from Orthographic to Perspective mode and vice versa.

Perspective

The 3D view displays the scan points and objects with the correct perspective - objects of the same size appear smaller with increasing distance.

Orthographic

The 3D view displays objects of the same size identically, regardless of how far away they are. This type of representation is common in a CAD systems.

View All

Not available in the quick view.

Changes the position of the observer in such a way that a view on all the objects is achieved.

Predefined Views

Changes the position and viewing direction to view the complete scene from top, bottom, right, front, back, or in an isometric view.

NOTE: Double-click a scan point to fly to a location. SCENE will then zoom into the scene, close to the selected scan point. Cancel the movement by clicking and moving the view with the mouse, or with the respective keys.

Center of Rotation

The **center of rotation** (the rotation point) is somewhere in the 3D world. It is set automatically by some functions, for example, when using the object-based navigation.

In the Fly mode, the center of rotation is set to the position of the observer.

To set it manually, click the **Set rotation point** button, then click the scan point or object.

Last Camera Position

The **Last Camera Position** button moves camera to the last camera position.

Align Camera on Point

Click the **Align Camera on Point** button, then pick a point in the 3D view to align the camera position to an estimated surface. The center of rotation will be set to the picked point.

Supersampling

Switches supersampling on or off.

Supersampling renders the point cloud with a resolution higher than the resolution of your screen, and then shrinks the point cloud to fit the screen resolution.

This reduces anti-aliasing effects and gives the point cloud a smoother visual appearance. Fine and filigree structures look sharper, and stray points will appear less annoying. Set the resolution of the initially rendered point cloud compared to the screen resolution by selecting one of the options 2x2, 3x3, or 4x4.

For example, selecting 2x2 means that the point cloud will be rendered with a resolution that is 4 times the resolution of your screen.

NOTE:

- Objects like walls might appear transparent when using small point sizes in combination with supersampling.
- High supersampling resolutions like 4x4 require large amounts of graphics card memory.

Gap Filling

Switches gap filling on or off.

If switched on, it will fill gaps between scan points that are physically close to one another. Gap filling can be defined as a predefined setting.

Clear View

Switches Clear View on or off. Clear View can be defined as a predefined setting.

Toggle Clipping Boxes

If there are Clipping Boxes (3D view) placed in the 3D view, you can switch these on or off with the Toggle Clipping Boxes button.

Point cloud visibility

Switches the Point cloud visibility on or off. If switched off, other settings, e.g., clipping boxes, remain active.

Point Sizes

Toggles adaptive point size mode, and switches through three different point size settings.

Adaptive

When **Adaptive** point size is active, the displayed size of each point adapts to its distance to the observer. The closer a point is to the observer, the larger it gets.

If adaptive point size is deactivated, points always are drawn with the same size in pixels. They get displayed with the same size on screen, no matter how distant from the observer they are located.

The three point size buttons scale the size of the points on the screen and can be used to influence the density of point visualization.

The 3D view is used just like the other views. In addition, in the 3D view you can position yourself at arbitrary positions in space and look at the scan points and CAD models. The mouse is used to define the turning movements you want to perform, and with the keyboard you define the actual movement in space.

Coordinate Coloring

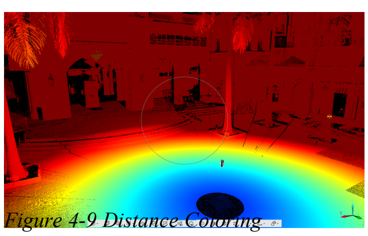


Figure 4-9 Distance Coloring

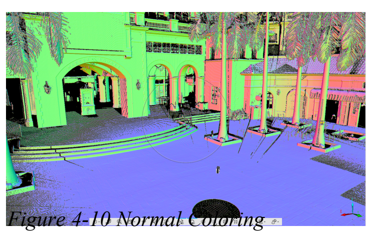


Figure 4-10 Normal Coloring

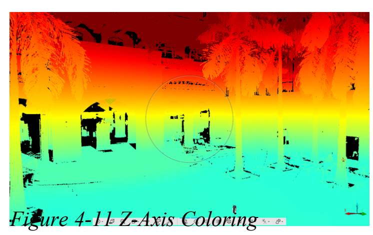


Figure 4-11 Z-Axis Coloring

This feature temporarily changes the color of the points in the point cloud according to their coordinates in the scan. This can highlight features that are difficult to see in the point cloud, such as showing whether a surface is perfectly flat, or showing if objects that are far from each other have similar or different elevations. Use the coloring modes shown below with the settings found in *Coloring* on page 245 and *Shading* on page 245 where you can adjust color palettes, coloring ranges, shading strength and other parameters used in coordinate coloring.

Normal Coloring: A geometric *normal* is a vector that is perpendicular to an object. *Normal* coloring changes the color of the points depending on the direction of the point's normal. This means that mostly flat, uncurved surfaces will be one color, while surfaces that are curved will have more colors.

XYZ Axis Coloring Mixes all R, G, B (X,Y,Z) color channels.

X Axis Coloring: changes the color of the points based on their position in the X axis.

Y Axis Coloring: changes the color of the points based on their position in the Y axis.

Z Axis Coloring: changes the color of the points based on their position in the Z axis.

Distance Coloring: changes the color of the points based on their distance from the *reference object*.

Original Colors: Removes the coordinate coloring and shows the points with the colors they originally had after the scan was processed and colorized.

Point Shading

Shading makes some points darker in an attempt to simulate shadows to increase the sense of depth and make subtle features more visible. You can select strong, light, or no shading.

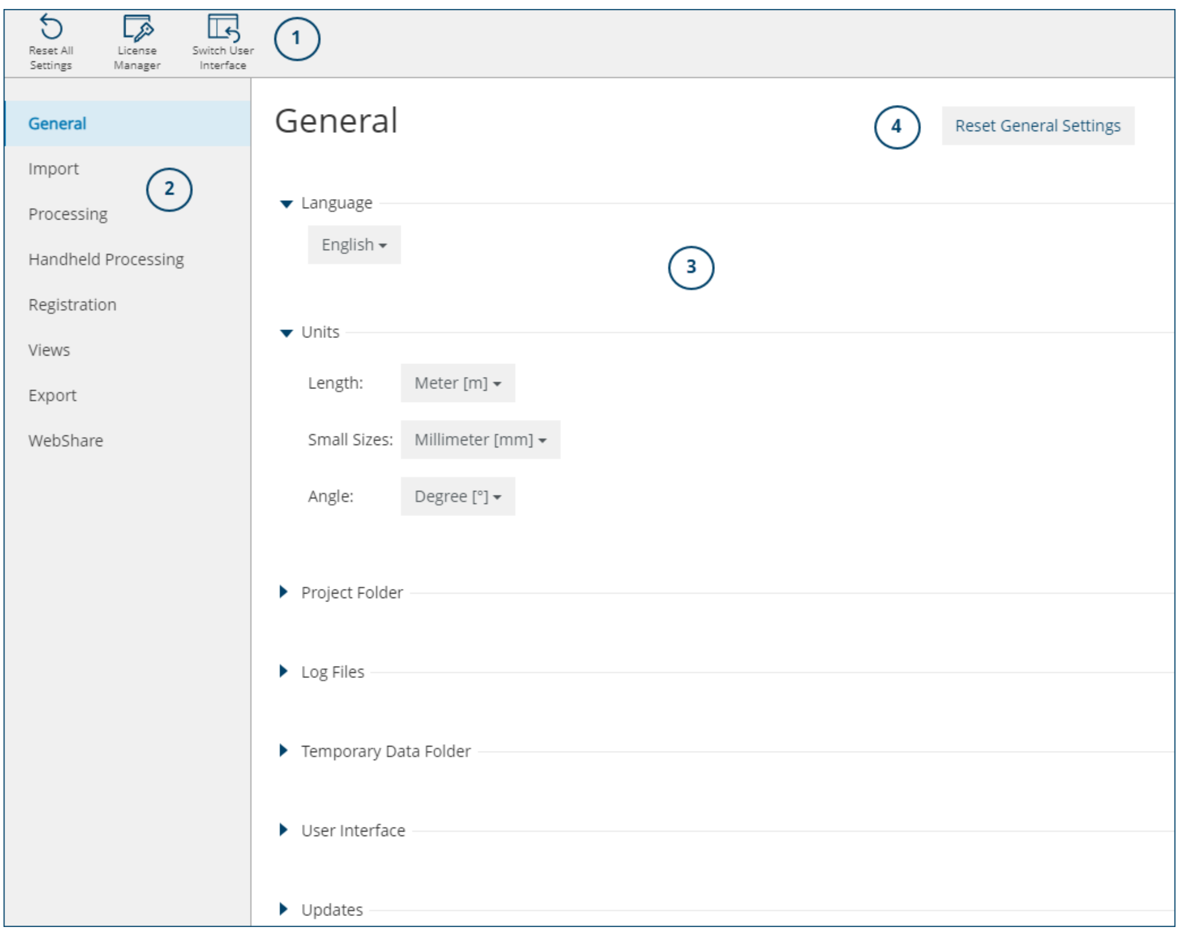
Chapter 5: Settings

The **Settings page** provides options to specify or edit all SCENE settings in one place. All changes (except language changes) are immediately visible and applied after returning to a scan project.

NOTE: Settings are valid for all scan projects. As soon as you start working on a new scan project, it might be necessary to adjust some settings.

1. *Figure 5-1 Open Settings*

2. Click the **Settings** icon on the right side of the workflow bar to open the Settings.
   By default, page General is opened.



① Settings toolbar with more functions

② Available **Settings** pages. Click the page that you want to check or modify.

③ Check and modify the settings as required. If one of the settings is shown collapsed, click the header line to open it. If you change a parameter, the changes are immediately applied.

④ Each Settings page has a **Reset** button. Click this button to reset all parameters to their predefined values.

Settings Toolbar

The **Settings toolbar** offers some more functions:

Figure 5-2 Settings features

Reset All Settings button

Resets all SCENE settings to the predefined values.

A confirmation box similar to the reset of the individual categories will be shown.

NOTE: Reset All Settings does not only reset the settings visible and accessible in the new UI, but also all settings only accessible in the SCENE classic style user interface. Hidden and undocumented registry settings are also removed/set back to their predefined status.

License Manager

The License Manager provides an overview of all licenses available for the currently running SCENE version and helps manage them.

Switch User Interface

To access some SCENE functions, you must switch to the Classic user interface.

Back button 

Click the **Back** button to exit the **Settings** page, and to return to the workflow bar.

General Settings

The **General Settings** page offers settings which are typically made only once and which are valid for all scan projects, for example country-specific settings, or the folder in which scan projects are to be saved.

Check the **Show Scanning Category** option to activate **Scanning**.

Language Settings

Select the language of the user interface.

NOTE: The new language will be applied after restarting SCENE.

Unit Settings

Select the units in which length and angle values are displayed.

The following options are available:

Length

- Metric: Millimeter [mm], Centimeter [cm], Meter [m]
- Imperial: Inch [in], Feet [ft], Yard [yd]
- US surveyor: Inch [in US], Feet [ft US], Yard [yd US]

The predefined setting is Meter [m].

Small sizes

Select one of the units for defining sizes. The options available are same as those for the **Length** option.

The predefined setting is Millimeter [mm].

The small sizes setting is used when presenting dimensions that are very small, such as the tensions in the registration reports.

Angle

Select one of the units of angle: Degree [°], Radian [rad], or Gon [gon].

The predefined setting is Degree [°].

Project Folder Settings

The project folder is in the predefined folder where scan projects will be saved. All projects listed in this folder will be displayed in the Project Selector. When you first open SCENE, the predefined project location will be a folder in C:\Users\<YourName>\Documents\FARO\Projects. All projects listed in this folder will be displayed in the Project Selector. .

1. Click the **Browse** button ... to open the file system browser.
   You cannot enter a project folder path directly into the field.

2. Browse to the folder, or create a new folder.

NOTE: Only one folder can be defined as project location. If you need to have additional project locations, you can use symbolic links to refer to those locations.

The symbolic links must be placed on your project folder and can point to an arbitrary folder (for example, on another drive).

Log File Settings

In case of technical problems with SCENE, FARO customer service may ask you for log files.

Enable logging if you experience problems during operating. Specify a folder to save the log files. When you first open SCENE, the predefined log file location will be a folder in C:\Users\<YourName>\temp\SCENELogs.

1. Select the **Enable Logging** checkbox.

2. Click the **Browse** button ... to open the file system browser. You cannot enter a log file path directly into the field.

3. Browse to the folder, or create a new folder.

SCENE will then create log files which will be placed in the selected folder.

There will be one SCENE log file which contains all logged information.

Temporary Data Folder Settings

This folder is used to buffer data during complex processes, for example the creation of point clouds. Ensure that sufficient disk space should be available.

When you first open SCENE, the predefined project location will be a folder in C:\Users\<your name>\AppData\Local\Temp\SCENETemp.

1. Click the **Browse** button ... to open the file system browser.
   You cannot enter a temporary data folder path directly into the field.

2. Browse to the folder, or create a new folder.

User Interface Settings

This section provides the option to activate or deactivate the **Scanning** category or Tab in the user interface.

Updates Settings

SCENE version update checking can be enabled or disabled in the SCENE settings.

Check the **Enable Automatic Update Checking** option to activate update checking.

When enabled, the update checker checks directly at startup, if there is a new SCENE version available. You must have an active Internet connection on your system for this option to function.

Customer Experience Improvement Program Settings

When you install SCENE, you are asked if you want to participate in the Customer Experience Improvement Program. If you click yes, anonymous usage statistics are sent to FARO. We collect the following information:

- The version number of the SCENE instance.
- The date and time that SCENE started and stopped. This allows us to detect crashes.
- The execution of some specific commands where we want to get more information about how they are used. This helps us to improve the software in the future and helps us understand what may have caused a crash.
- Tracing information that we have added to the software to help us investigate defects that have been reported, but which we cannot reproduce.

We use this information to help us understand how customers use SCENE so we can continue to make the software better. On the settings page, you can change your decision at any time.

Import settings

When importing scan data, it's often necessary to define the unit of length. In the **Import settings** page, you can set a default unit of length. Other determining parameters are set in the respective **Import** dialogs.

Units

- Metric: Millimeter [mm], Centimeter [cm], Meter [m]
- Imperial: Inch [in], Feet [ft], Yard [yd]
- US surveyor: Inch [in US], Feet [ft US], Yard [yd US]

The default setting is Meter [m].

Processing Settings

The processing settings are applied when a processing operation is started through the **Process Scans** button , or the **Process Scans** command in the context menu of a scan or cluster.

General Processing Settings

On this page you can define general processing settings.

Create Scan Point Clouds

If enabled, a scan point cloud for each scan will be created as last part of the processing.

This setting is enabled per default.

Automatic Registration

Indicate that the project should be registered with an automatic registration after the processing of scans finishes successfully.

The method used for the automatic registration is the method selected on the page.

Colorization Settings

On this page, you can define various colorization settings.

No colorization

If you mark this checkbox, no color will be added to the scan points during processing.

Colorize Scans

If you have a scan taken by a laser scanner with the color option, this scan will also contain the digital pictures which the scanner took automatically during the scanning. These pictures will be applied to color the scan if this option is selected.

NOTE: Starting from version 2022.1, SCENE supports coloring Focus Premium scans with high-resolution images (13MP) made by the scanner's internal camera.

Laser Illuminated HDR

With LI-HDR, a photograph of a scanned area is combined with information about the amount of laser light that was reflected by surfaces during scanning. Because the laser provides the illumination, details in areas that are completely over- or underexposed in the photograph can nevertheless be added to the LI-HDR image, as shown in this example:

Figure 5-3 Laser Illuminated HDR

The laser light does not provide color information, so areas illuminated only by the laser are shown as grayscale.

Create PanoCam Scans

If you mark this checkbox, PanoCam scans will be created for every stationary scan whose color was captured with the PanoCam. As a result, after processing, only the PanoCam scans will remain in the project.

Filter Settings

To identify an inaccurate scan point, the filters compare the scan point with the scan points in the surrounding area. Some of the filtering is performed based on information from the point.

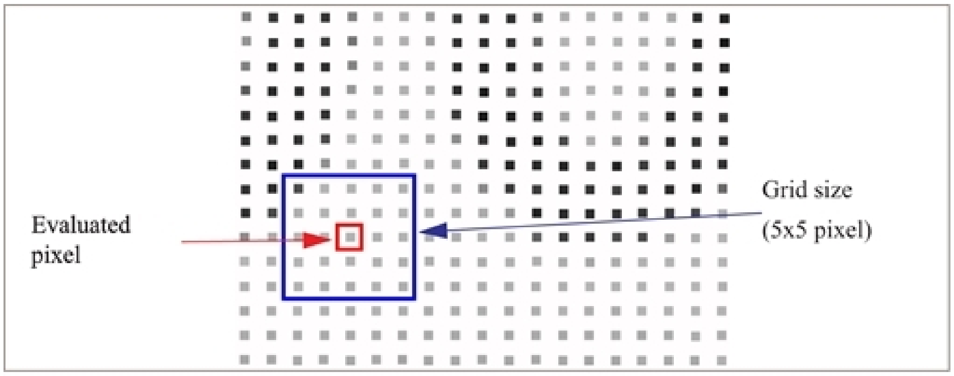


Figure 5-4 The area surrounding a scan point, in a 2D grid

In the figure above the surrounding area oriented toward the recording point is shown. With filters, you can set what should be regarded as the surrounding area. In this example, the value 5 was set, which means the edge length of the surrounding square is 5.

Dark Scan Point Filter

This filter removes points based on a reflectance value. **Reflectance Threshold** indicates the minimum reflectance value a scan point must have. The Reflectance Threshold range is: 0 to 2048.

This criterion is useful because with a dark scan point, only a very small amount of light entered the scanner and therefore the measurement will have an increase in noise.

NOTE: This filter is not applicable for colorized scan points.

Distance Filter

This filter removes all scan points which are outside of the defined distance range. All points with a distance less than the **Minimum Distance** and all points with a distance larger than the **Maximum Distance** will be deleted.

Stray Point Filter

This filter checks if the 2D grid cell of a scan point contains a sufficient percentage of points with a distance similar to the scan point itself.

- **Grid Size**: The size of the surrounding area used for comparison. For each scan point of the scan or selection, the filter takes the valid scan points of this surrounding area and counts how many of them are at a distance to the scanner which is approximately the same as the distance of the scan point currently being viewed.

- **Distance Threshold**: A scan point is counted if the difference in distance is smaller than the value of Distance Threshold.
- **Allocation Threshold**: If at least the percentage of scan points indicated by the Allocation Threshold in the surrounding area is within this distance threshold, the scan point remains in the scan. Otherwise, it is removed.

NOTE: The Stray Point Filter is very well suited to correct incorrect scan data. It also works well if the **Allocation Threshold** is below 50%. However, the filter must not be applied on surfaces that were strongly inclined versus the scanner’s laser. The filter is always applied to the whole scan. It is not possible to apply it only in selected areas.

Edge Artifact Filter

This filter is enabled by default. The filter is especially useful to remove artifacts at the edges of objects.

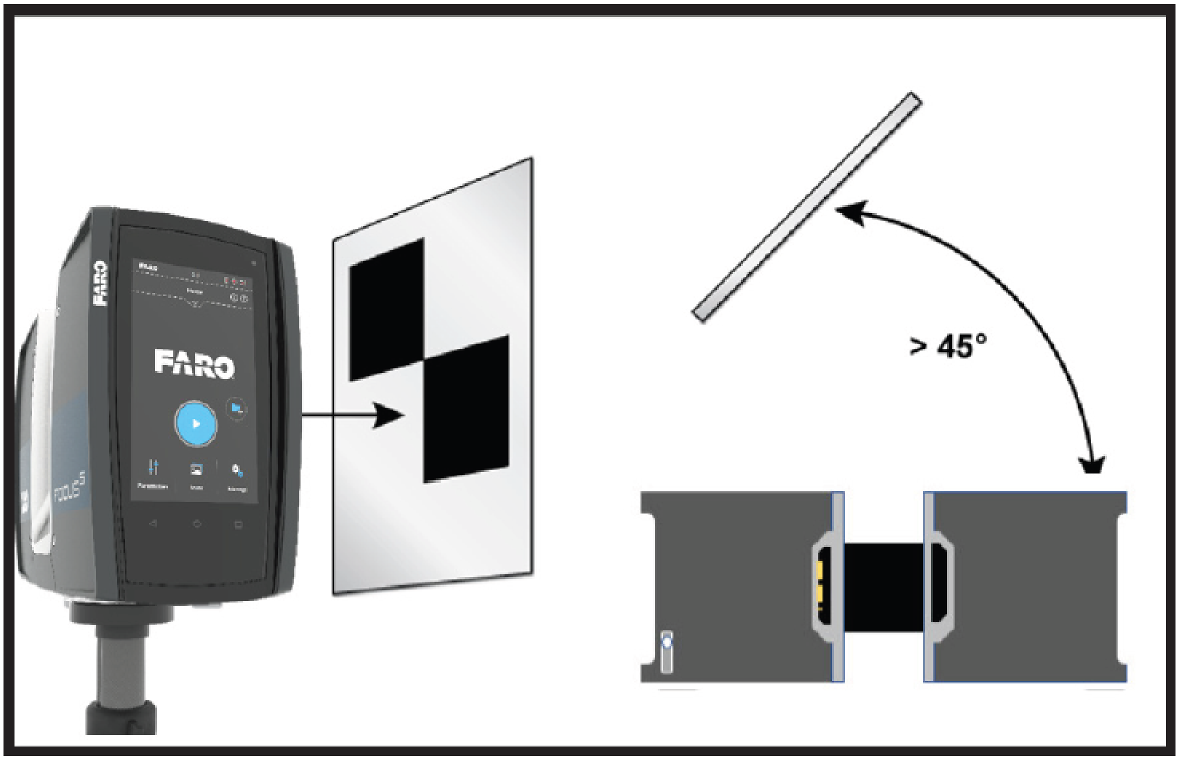
Target Settings

The **Find Targets** section allows you to select targets such as checkerboards, planes, and spheres. These will then be searched in each scan during processing.

NOTE: Finding targets is time-consuming and should be enabled only when scans are registered with the target-based registration.

Find Checkerboards

A frequently used paper target is the *checkerboard* target. A checkerboard target fit determines the center point of the target’s four quadrants. Select this option to find checkerboards and use them for scan registration. note that the angle between the laser beam and the checkerboard should be higher than 45 degrees. Otherwise, the accuracy of checkerboard may be compromised.



Find Markers

Select this option to find markers. Markers are printed targets with a unique ID.

Find Planes

Select this option to find planes and use them for scan registration.

Find Spheres

This refers to three-dimensional, white, reference spheres that come in various sizes. The advantage of spheres is that they can be placed at any angle to the scanner. Select this option to find spheres and use them for scan registration.

NOTE: Sphere search works with spheres meant for registration. Forensic spheres (used for determining shot trajectories) may not be found by this target search.

The global list of sphere sizes set in the **Settings** > **Processing** page are displayed in the active and inactive sphere radii list.

Active Sphere Radii

Click **Add New** and specify new sphere radii. These sphere sizes will be used for target detection.

This list of user-defined sphere sizes will be used for processing the scans in the current processing task run.

Inactive Sphere Radii

Click **Add New** and specify additional sphere radii for sphere detection.

Drag the sphere radii that are not required for the current project, from the Active Sphere Radii to the inactive Sphere Radii list.

You can easily move items between the two lists and manage the sphere radii for processing the scans in the current project.

Hand-held Processing Settings

These processing settings are only used for hand-held scans.

Plane Detection

Switches plane detection on or off for all processing. **Auto** switches on plane detection only if it was switched on when the scan was created.

Replay

If scans already passed some processing steps, Replay restarts the processing from the beginning. Processing is then executed with higher precision than it was done during capturing.

Scan Optimization

Adjusts all frames of a scan to minimize the overall displacements errors. The function searches for loops in the scan and tries to close those loops. Loop closing is necessary because small errors from frame to frame may accumulate over time, resulting in gaps if you return to the same position again. The **Extended** setting may give better results, but will take longer.

Stray Point Filtering

Removes stray points, creating a cleaner overall look. Select **Standard** to remove stray points without additional 3D smoothing. This setting tends to make edges and corners look better. Select **Smooth** to add additional 3D smoothing. This setting tends to make planes look better.

Color Optimization

Averages the color of scan points in overlapping areas within the selected scan, and adjusts color effects caused by different lighting situations.

Registration Settings

Adjustments made in the **Registration** settings page will affect the quality of the registration result.

You can define settings for the registration methods:

- Automatic registration
- Manual registration

You can also define settings for the registration options:

- Target-based
- Top-view-based
- Cloud-to-Cloud

You can also define settings for the Registration Report.

General Registration Settings

The scanner's sensor data that will be used during registration:

- The inclinometer data will be used for all registration methods.
- The compass data will be used for top-view-based and target-based registration.

NOTE: Sensor data can only be used if the sensors were enabled during scanning.

Use Inclinometer

Normally, inclinometer data is available and used by default to level the scans during registration.

Leveling ensures that the z-axis of the registered scan corresponds to the z-axis defined by the inclinometer. By this technique one reference can be replaced during registration. When registering with inclinometer data, this will be used as fully-trusted information and all other registration objects will be used with lower priority.

Use Compass

If the scans were recorded with a FARO Focus Laser Scanner equipped with a built-in compass, orientation information is available for the single scans. Enable this option to use this information as auxiliary information for the correspondence search. If the correspondence search cannot find any correspondences that are consistent with the compass data, this may be an indicator that the compass was influenced by environmental interference and the compass data will be ignored. If you disable this option, no compass data will be used for correspondence search.

Expert Settings

Move cluster to the center of its scans

When you create a new cluster in the correspondence view, it is shown at the center of the scans displayed on the screen. However, if you add some of the displayed scans to the cluster, it may happen that the cluster is not shown at the center of these scans. If this option is activated, the cluster is automatically moved to the center of its scans. If it is deactivated, a message is shown in which you can confirm that the cluster should be moved to the center of its scans.

Note that this does not change the global position of the clusters or scans but only the representation on the screen.

Auto Clustering

SCENE may not be able to find a spatial relationship between all scans in your scan project and only groups of scans can be registered to each other. The registration internally recognizes which scans can be registered correctly and which can not. All groups of correctly registered scans are automatically arranged in appropriate sub-clusters (named Cluster1, Cluster2 etc.).

Automatic Registration Settings

Registration method that will be used when performing the automatic registration task.

Select among the following 4 options:

- Target-based
  Use this option if you have well measured targets, like spheres or checkerboards. Target-based registration doesn't need scan positions.

- Top-view-based
  Used for a fast indoor or rough outdoor placement. If inclinometer data is available, this registration method is independent of the initial scan position. We recommend refining a top-view-based registration with a cloud-to-cloud registration.

- Cloud-to-Cloud
  Used for refining roughly positioned scans, for example by sensors, manual positioning, or a top-view-based registration. Different initial positions may lead to different results.

- Top-view-based and Cloud-to-Cloud
  Performs a top-view-based registration first and then a cloud-to-cloud registration.

Manual Registration Settings

Select if you want to optimize each registered pair of scans with cloud-to-cloud registration. This optimization is always done before you are asked to select another pair of scans.

Target-based Registration Settings

Find correspondences for scan positions

Mark this checkbox if the position of a scan is known, for example, by a surveyed reference point or by a reference sphere representing the position of the scanner in other scans.

Force correspondences by target names

Mark this checkbox, if you want to force correspondences by target names. The targets in each scan must be named according to their counterparts in the other scans. This feature requires that targets are already detected by SCENE. In **Settings** > **Process**, select a target search, then run **Process**. After that, open the cluster or the scans in **Explore**. You can then click the target’s names the in structure view and rename them.

Use Checkerboard Normals

If this setting is active, the normals of checkerboards are used for the correspondence search. Uncheck if the direction of checkerboards has changed from one scan to another. For example, if you use checkerboard targets that can be tilted and turned for a precise orientation to the scanner.

Target Distribution Threshold

Sets the limit for registration. If targets are too near to one another, registration will be refused. In this case, lowering the limits gives you a result.

Top-view-based Registration Settings

Subsampling

The result of the registration can be adjusted through the subsampling rate. The value defines the size of the grid in which scan point homogenization is performed. The resulting grid of points will be used to perform the registration. When you move the slider, the set value will be shown. Five centimeters (0.05m) usually work for all environments. If you are indoors, in an industrial environment, you can reduce the subsampling to 0.35m or even 0.25m.

Reliability

The reliability value determines the amount of additional checks on a registration. It filters out results that could be contested. Higher values allow for more certainty, but could affect the needed time by algorithm to provide a solution. Set the slider to the value which you expect to bring the result you want. As soon as you move the button, the set value will be shown.

Cloud-to-Cloud Registration Settings

Subsampling

The result of the registration can be adjusted through the subsampling rate. The value defines the size of the grid in which scan point homogenization is performed.

Set the slider to the value which should bring the result you want. As soon as you move the handle, the set value will be shown.

Maximum number of iterations

You can define the maximum number of iterations for the algorithm to find the best solution. By default this parameter is set to 30 iterations. Click this number to open the input field. Enter the number of iterations.

Maximum search distance

The maximum distance in which the registration searches for corresponding points. The maximum search distance must be larger than the initial misplacement. By default the distance is set to 10 meters. Click this number to open the input field. Enter the distance you want.

Registration Report Settings

On this page, you can define settings for the Registration Report. You can define settings for the following:

Scan Point Statistics, i.e., the references between scan points which are calculated by a top-view-based or a cloud-to-cloud registration

Target Statistics, i.e., references between targets returned by a target-based registration

Thresholds

You can define thresholds as follows:

Values below the first threshold are shown in green, and values above the second threshold are shown in red. Values in-between are shown in yellow. The color codes are used in the Registration Report, the Project Dashboard, and the Scan Managers.

Set specific thresholds by clicking in the field and entering a new value.

NOTE:
For the interactive registration, it is recommended to use the following threshold values:

- **Thresholds for overlap color coding**: Set to 5% for **Red below** and to 20% for **Green above**. With the default settings a lot of connections between scans would be displayed yellow if the overlap is very low. (If you have previously used the default settings, you must set Red below first, because otherwise, you can't set the Green above value).
- **Thresholds for point error color coding**: Use default values of 20 mm for **Red above** and 8 mm for **Green below**.

Views settings

The **Views** settings page provide settings for:

- 3D View
- Quick View
- Planar View

General Views Settings

Explore

Check the **Automatically Open 3D View** option under the Explore category. When you switch to explore category, a new 3D view is opened. You can uncheck this option if the 3D view takes a lot of time to load.

Measurement Properties

The **Measurement Properties** provides settings to set the displayed measurement distances for all views.

The following options are available:

- **Overall Distance:** This is the default setting. The overall distance measured between two points is displayed.
- **Horizontal Distance:** The horizontal measurement of the point-to-point distance is displayed.
- **Vertical Distance:** The vertical measurement of the point-to-point distance is displayed.

The selected distance measurements will be shown in 3D view, quick view, and planar view.

The chosen distance value will be displayed in all new measurement objects.

However, to change the displayed measurement distance for each individual measurement, use the **Measurement Object Properties** dialog.

3D Views Settings

The settings for the 3D view are separated into Display and Navigation settings. All these settings will be applied when a new 3D view is opened. These settings will not be applied to views which are already opened.

Navigation

Default Mode: Select the navigation mode to be activated when you open a new 3D view. You can select among Fly, Examine, or Smart mode as default navigation modes. Depending on your selection, the 3D toolbar button changes its appearance.

Invert Mouse Wheel: Changes the forward and backward movement by the mouse wheel. The default behavior of the mouse wheel is: spinning it forward will move the view backwards in space and vice versa.

Use Positional Zoom (instead of Optical Zoom): Sets the zoom mode for the 3D view. The default zoom is a *positional* zoom, meaning that it zooms by behaving as if the position of the camera (that is, the position from which you observe the scan) is moving toward the position of the cursor on the screen. This allows zoom, meaning that it zooms by behaving as if the position of the camera (that is, the position from which you observe the scan) is moving toward the position of the cursor on the screen. This allows you to do things like zoom past or through objects. Prior to SCENE 2019.1, the default zoom was an *optical* zoom, meaning that it zoomed by increasing the magnification of the scan (as if you were standing in one position and using a zoom lens to magnify the scan). Note that you can toggle between these two modes on-the-fly by pressing and holding the SHIFT key**Default Movement Speed**: Change the speed of the left, right, forward and backward movement triggered by pressing the cursor keys.

Acceleration Factor: This is the factor which is used to determine the accelerated speed. The accelerated speed is the factor multiplied with the default speed. The accelerated speed is used by pressing the cursor keys in combination with the SHIFT key.

The settings **invert Mouse Wheel**, **Default speed** and **Accelerated Factor** will be applied to the opened view.

Display - Effects

Supersampling: renders the point cloud with a resolution higher than the resolution of your screen and then shrinks the point cloud to fit the screen resolution. This reduces anti-aliasing effects and gives the point cloud a smoother visual appearance. Fine and filigree structures look sharper and stray points will appear less annoying. Set the resolution of the initially rendered point cloud compared to the screen resolution by selecting one of the options 2x2, 3x3, or 4x4. For example, choosing 2x2 means that the point cloud will be rendered with a resolution that is 4 times the resolution of your screen.

Figure 5-5 Supersampling turned off (left) and turned on (right)

NOTE: Objects like walls might appear transparent when using small point sizes in combination with supersampling.

High supersampling resolutions such as 4x4 require large amounts of graphics card memory.

Gap Filling: The gap filler fills gaps between scan points that are physically close to each other.

Clear View: In the clear view mode, points in areas with low point density will be displayed more transparently and points in areas with a high point density will be displayed more brightly. It adds transparency to the otherwise completely opaque point cloud rendering. This allows for viewing through walls or ceilings and may give a much better impression of the spatial structure of the underlying point

In the clear view mode, points in areas with low point density will be displayed more transparently and points in areas with a high point density will be displayed more brightly. It adds transparency to the otherwise completely opaque point cloud rendering. This allows for viewing through walls or ceilings and may give a much better impression of the spatial structure of the underlying point cloud. Points in areas with low point density will be displayed more transparently and points in areas with a high point density will be displayed more brightly.

NOTE: Changing the effects will be applied if a new 3D view is opened. The effects which can be changed directly in the 3D view are only applied to the 3D view which is opened.

Gap filler or clear view can only be activated if supported by hardware.

Display - Background

Select either **Environment Map** or **Color Gradient**.

Environment Map

See Environment Map as Background Image for a 3D View

Color Gradient

The gradient background color starts with the selected top color and transitions linearly to the selected bottom color.

1. Click the **Top Color** button to open the color selector dialog.
2. Select the color that you want the background to start at the top of the display.
3. Click the **Bottom Color** button to open the color selector dialog.
4. Select the color that you want the background to start at the bottom of the display.

Display - Scans

Loaded scan replaces scan point cloud in 3D view

Two representations of a scan exist in your project, the original scan points and the optimized scan point cloud. If this option is selected and the scan is loaded, the original scan points are used for visualization instead of the scan point cloud.

The scan point cloud representation is optimized for visualization performance of a scan. Any combination of original scan points and scan point clouds in a single view will disable tools such selections and the visualization performance may degrade. Deactivate this setting to avoid these issues.

Environment Map as Background Image for a 3D View

SCENE offers solid or gradient color backgrounds in a 3D view. These are suitable for editing of point clouds, but when a realistic visualization is needed (like for capturing a video of an outdoor scene in the Video App), the result would look somewhat boring.

To make such scenes or videos look more realistic, you can add a so-called **Environment Map** as a background image.

The background image selected last will be used as a default setting for a new 3D view.

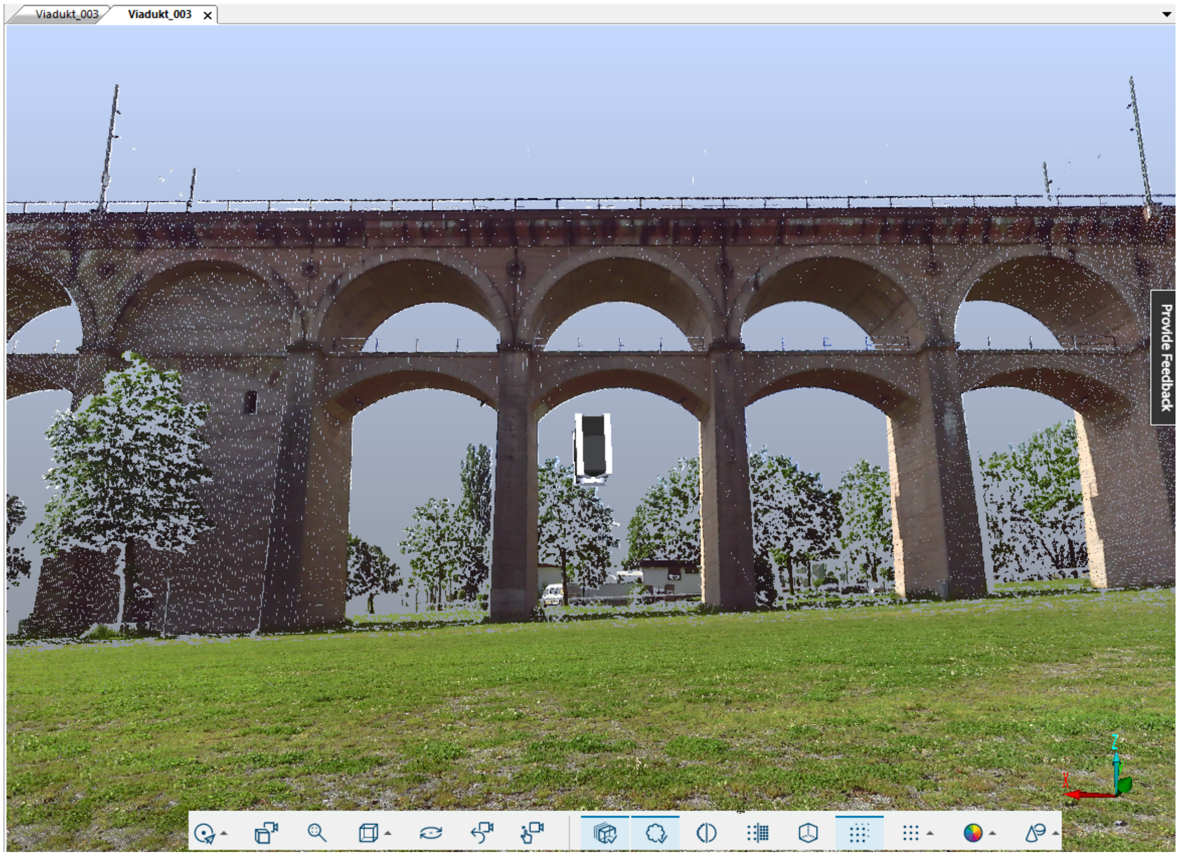


Figure 5-6 3D view with a solid gray background

Figure 5-7 Environment Map showing a cloudy sky

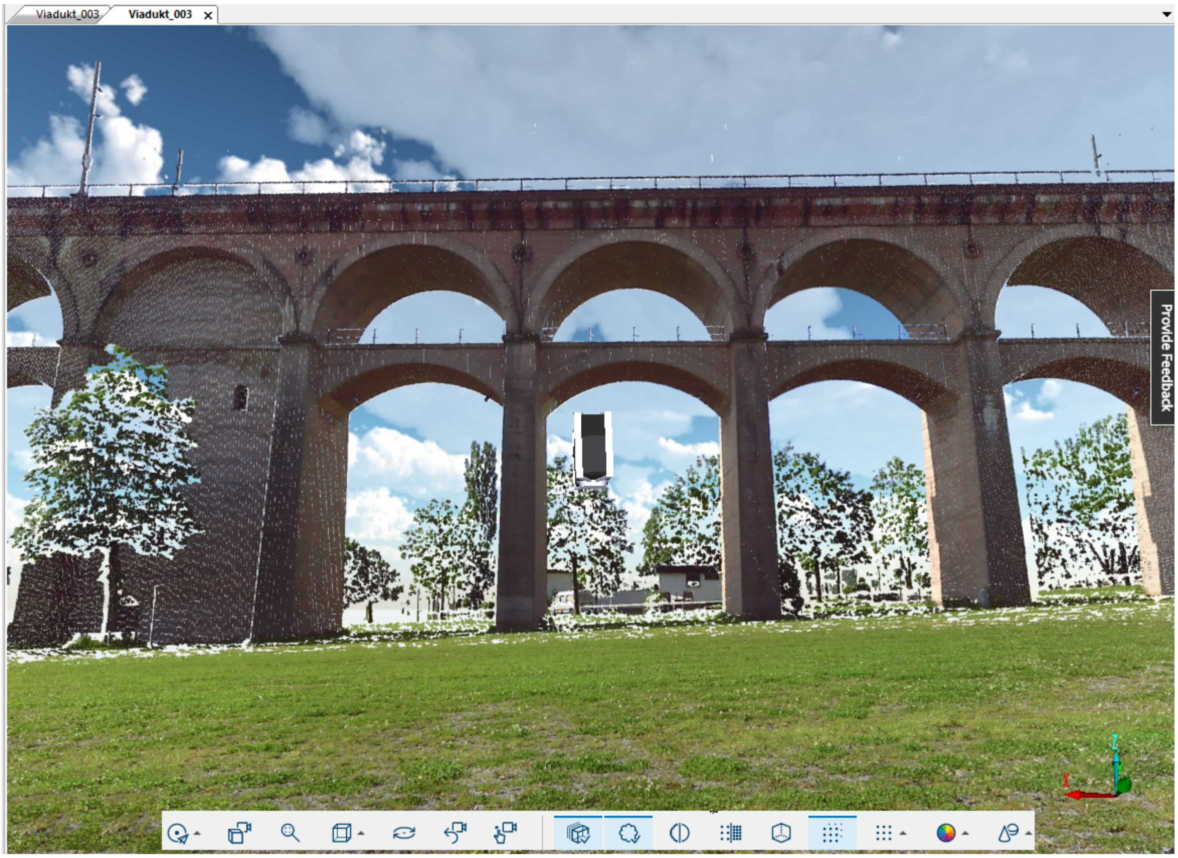


Figure 5-8 3D view with Environment Map

How to add an Environment Map

The usage of Environment Maps can be enabled in the Visibility Settings dialog of a 3D view.

1. Click the **Settings** button on the right side of the workflow bar, then select the **View** page.
2. To select a new Environment Map, click the **Browse** button in section **Background > Environment Map**.
   A dialog opens with the folder Environment Maps.
3. Select your new background image and click **Open**. The file name is now shown in the View tab.

The selected Environment Map will be saved with the project. So, when another person on another machine opens the project, the Environment Map will again be shown as background image.

Limitations

At the moment, the Environment Map is only available for 3D views with a perspective camera setting. For views with orthographic cameras, it is disabled.

Creating individual Environment Maps

If you need a special background image for your scan project, you can create it yourself.

It must fit the following conditions:

- Aspect ratio 2:1, which means that it is twice as wide as it is high.
- The lower half of the image shall show “ground” and should not show too much structure.
- The image is later mapped to an imaginary spherical firmament.
- should look distorted because it is meant to texture a sphere. Professional graphics editors offer a feature called “Spherics” which may help in creating suitable images.
- The left and the right end of the image must fit.

You can save the newly created Environment Map into the folder SCENE\EnvironmentMaps, but you can save it to any other folder as well.

Planar and Quick View Settings

Scan Data Load Behavior

Select the default scan load behavior to be used to load a scan for planar view or quick view. By default, the scan is loaded in color mode.

Overview Map Settings

Foreground Color

Defines the color of the overview map itself

Background Color

Defines the color around the overview map

Highlight Scan Color

In the overview map, the scanner positions are displayed as dots. When you hover the mouse pointer over such a dot, all scan points related to this scans are highlighted in the defined color.

Highlight the scan points when selecting the scan position

When is option is active and you click a scanner position in the overview map, the color of the scanner position changes, too.

Export Settings

The **Export** settings page provides **Units** settings for exporting SCENE data.

Units

Set the default unit of length used to export data.

Select one of the units of length:

- Millimeter [mm], Centimeter [cm], Meter [m]
- Inch [in], Feet [ft], Yard [yd]
- Inch [in US], Feet [ft US], Yard [yd US]

The default setting is Meter [m].

NOTE: Some export formats like PTX do not support user-defined **Unit** settings. They support only the metric system

WebShare Settings

The WebShare settings page provides settings to login to WebShare.

NOTE: WebShare is being replaced by the new cloud solution Sphere XG. Contact the FARO support or find information in the Sphere XG user manual.

Login

The login credentials will be used to automatically log in every time a connection to WebShare is required for **Import** or **Export** process.
Domain: Enter your organization’s subdomain name on WebShare.

User Name (email) : Enter the user name to log in to WebShare.

Password : Enter the password with which to log in to WebShare.

Login and Save Credentials : Click to save the login credentials to WebShare button. If the login is not successful, an error message is displayed and the credentials are not saved.

Upload and Download SCENE Projects to/from Sphere XG

Starting from SCENE 2024.0 you can upload SCENE projects to the cloud solution Sphere XG. It is also possible do download projects from Sphere XG and to make incremental uploads from SCENE to Sphere XG.

The cloud solution Sphere XG replaces Sphere Legacy and WebShare Cloud. For more information on Sphere XG, see the Sphere XG user manual.

This feature is in continuous development. You may find more recent information on the FARO Knowledge Base.

NOTE:

- You can only upload FARO Focus scans. The upload will fail if your project contains other scan file types, for example created by the Orbis scanner, the legacy Freestyle or imported .e57 files.
- The upload will fail if the SCENE project folder contains files that were added manually, for example .csv files, .docx files, .e57 files.
- You need a Sphere XG account to use this upload feature.

Sign into Sphere XG

1. In SCENE, click the Sphere XG profile icon in the top right corner.
   You are redirected to the Sphere XG sign-in page. If you are signed in, the icon picture changes to your initials.

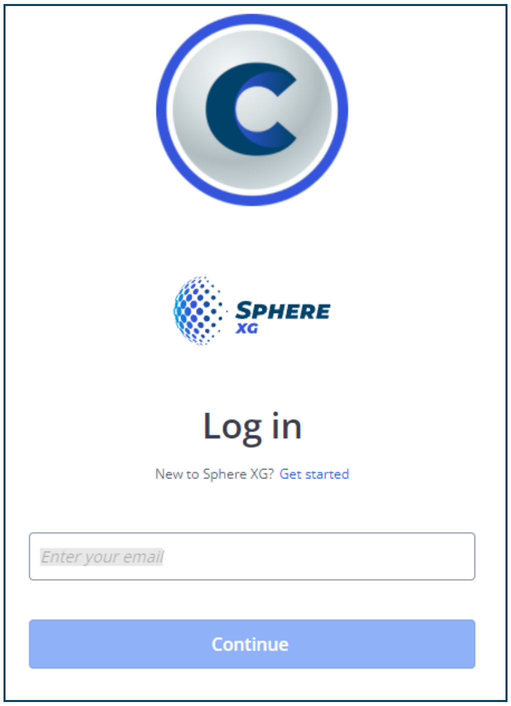


Figure 5-9 Sphere XG log-in form

The connection to Sphere XG is established in the browser. If the sign-in is successful, the message **Login successful - Switch to SCENE** is displayed.

2. Go back to SCENE.

You may need to wait a few seconds until the workspace selector is displayed.

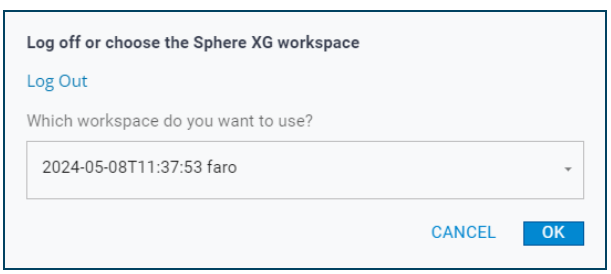


Figure 5-10 Select a workspace

3. Select the Sphere XG workspace to which you want to upload the project.

Upload a Project

NOTE:

- You can only upload one project at a time.
- If you want to upload more than one SCENE project at a time, you can open multiple SCENE instances.
- You must have sufficient permissions to upload a SCENE project, i.e. the permission to create a project.
  You can find an overview of roles and permissions in Overview of Roles and Permissions on the Workspace and Project Level in the Sphere XG user manual.
- A project point cloud must be available in the SCENE project if you want to see the 3D point cloud in the Sphere XG Viewer.

1. Open the SCENE project you want to upload.
2. On the **Project** tab, click the **Upload** button on the Sphere XG tile.

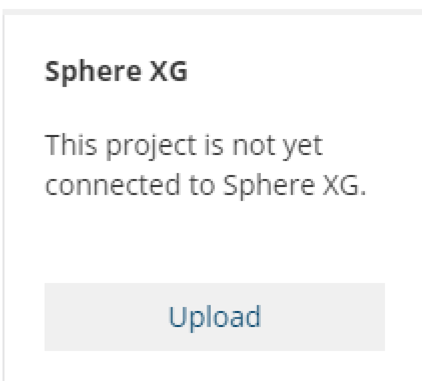


Figure 5-11 Upload to Sphere XG tile

The **Upload to Sphere XG** dialog is displayed.

Figure 5-12 Upload to Sphere XG dialog

3. Enter the Sphere XG project name you want.
   This name can be different from the name in SCENE.

4. Select the workplace to which you want to upload the project.

5. Select the group to which the project will be assigned in Sphere XG.

6. Click OK.

The upload will be started.

When the upload is finished, the Sphere XG tile in tab **Project** will turn green.

To open your project, open Sphere XG and go to the previously selected workspace. For more information, see Open an existing project in the Sphere XG user manual.

Download a Project from Sphere XG

1. Open SCENE, sign into Sphere XG and select the workspace as described above, then follow the steps below:

2. On the **Projects Overview** page select **Show Cloud**.

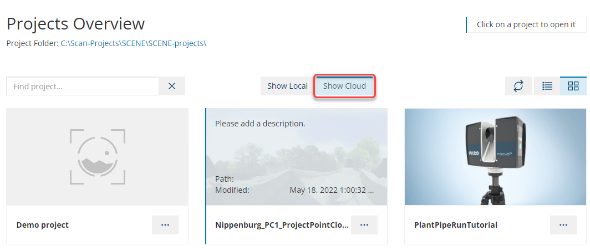


Figure 5-13 Show Cloud tab

3. Click the three-dots icon on the tile of the project that you want to download.

4. Select **Light Download** or **Full Download**, see further explanations below.

If you click the project tile when **Show Cloud** is selected, SCENE will automatically start a light download of the project.

When a project is downloaded, you will notice that the scan point clouds and the project point cloud are not present in the project. This is to minimize the amount of data that is uploaded/downloaded. You should recreate them if they are needed.

- Full download: Downloads the entire SCENE project as described above.

- Light Download: Downloads only the project structure and metadata. The scans are only downloaded when they are loaded in SCENE. The light download allows you to easily and efficiently add or remove scans in existing large projects without the need to download the entire project.

You can find more detailed information and tutorials on the FARO Knowledge Base.

Synchronize Changes with Sphere XG from within SCENE

Once you have uploaded a project to Sphere XG, it is possible to make changes in your SCENE project and to synchronize those changes with Sphere XG. Once the changes are synchronized, they will be visible in the Sphere XG Viewer.

The following changes can be synchronized:

- Added and removed scans.
- Modified registration of the existing scans.
- Modified scans, e.g. reprocessed, points cleaned.
- Modified project point cloud.

This is a major improvement compared to the existing WebShare Cloud workflow where a new WebShare Cloud project had to be created for every project update. With Sphere XG it is easy and efficient to perform incremental updates on uploaded projects.

To synchronize the changes:

1. Save the project.

The Sphere XG tile is highlighted yellow and the **Sync** button is enabled to indicate that the project is no longer in sync with Sphere XG.

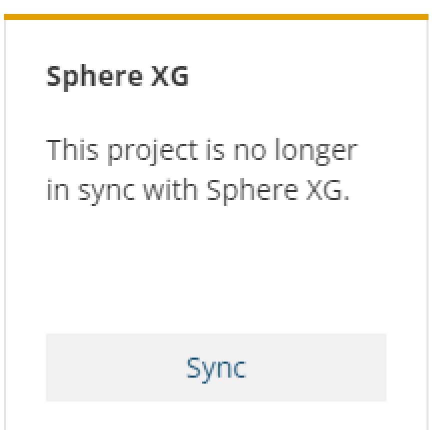


Figure 5-14 Sphere XG tile

2. Click button **Sync**.

You can find more detailed information and tutorials on the synchronize functionality on the FARO Knowledge Base.

Change the Workspace

1. Click the Sphere XG icon in the top right corner.
   The **Log off or choose the** Sphere XG workspace dialog is displayed.

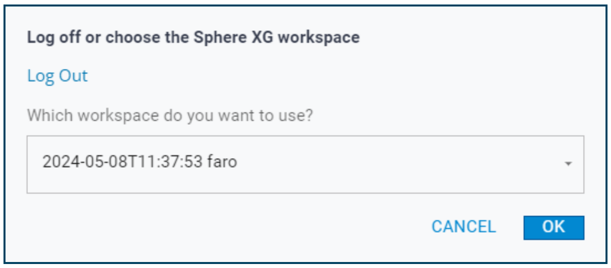


Figure 5-15 Change workspace or sign out of Sphere XG

2. Open the dropdown list and select the workspace you want.

3. Click **OK**.

Sign out of Sphere XG

1. Click the Sphere XG icon in the top right corner.
   The **Log off or choose the Sphere XG workspace** dialog is displayed, see above.

2. Click **Log Out**, then click **OK**.

Troubleshooting

How to resume an aborted upload?

1. Go to the **Project** tab.
   The Sphere XG tile will show a **Resume** upload button.

2. Click this button to resume the upload.

How to re-upload a SCENE project that has been previously uploaded?

Open the project

From the project tab you can remove the existing connection between your SCENE project and the Sphere XG project by clicking the icon next to the Sphere XG link (see figure below). Note that the connection between the project in SCENE and the project in Sphere XG cannot be re-established once it is deleted.

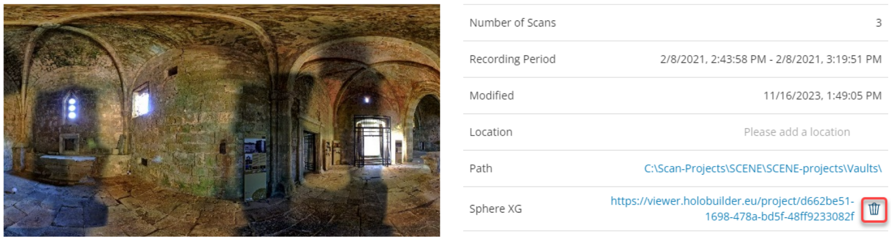


Figure 5-16 Remove connection between SCENE and Sphere XG project

Note that this may also work when uploading a project fails. You can find more troubleshooting information on the FARO Knowledge Base.

Chapter 6: Project

The Project toolbar provides the features for your entire scan project.

There are two sets of toolbars, one that shows up when no scan project is opened, and one that shows up when a scan project is opened.

Project Features when no Scan Project is Opened

Figure 6-1 Project toolbar when no scan project is opened

- Create Project: Create a new scan project from scratch.
- Open Project: Open an existing scan project. Clicking the little arrow opens a dropdown menu with the recently loaded scan projects.
- Open Project History: Open a specific revision of a scan project. Clicking the little arrow opens a dropdown menu with the recently loaded scan projects. When you have selected a project, another dialog opens in which you must select a project revision.
- Project Transfer: Transfer scan data from an SD Card, or from any other place.

Create Project

Create a new scan project. The new scan project is initially empty and you must fill it.

There are different ways to create new scan projects:

1. Click the **Create Project** button  in the toolbar. The **Create New Scan Project** dialog appears:

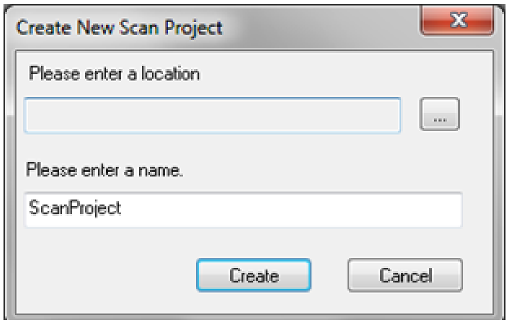


Figure 6-2 Create a new project

2. Enter a location, or click the **Browse** button to open the file manager.

3. Enter a **project name**.

4. Click **Create**. All necessary files and structures will automatically be created at the selected location.

When creating a new scan project from scratch, you must fill it with the appropriate scan files. SCENE offers several Import features.

The scan project can be identified by the `.lsproj` file which is accessible in the folder of the scan project. It is usually named like the scan project itself.

You may also create a new project by transferring scan data from an SD Card, exporting an existing scan project, a cluster, or a single scan to a different location. For this, use the Export features.

You can also create a new project based on a project revision of another project.

Open an Existing Project

There are different ways to open scan projects:

1. Click the little arrow besides the **Open Project** button in the toolbar.
   A dropdown menu with the recently loaded scan projects opens.

2. Select a project from the dropdown menu.

or

1. Click the **Open Project** button in the toolbar.
   The **Open Existing Project** file manager is opened.

2. Enter a path, or browse to find the folder containing the project that you want to open.

3. Select the project and click **Open**.

or

Click one of the project tiles in the **Projects Overview**.

NOTE: The scan project can be identified by the `.lsproj` file which is accessible in the folder of the scan project. It is usually named like the scan project itself.

Open Projects in Read-Only Mode

When a user has opened a project, other users can open this project in read-only mode.

When users try to access the scan project while a write lock already exists, the scan project will only be opened in read-only mode.

- The SCENE title bar contains a new additional read-only warning string between the project name and the SCENE version.
- When trying to save a project opened in read-only mode, the message box informs that you must open the project with write access to be able to persist modifications.

Transfer a Project

The Project Transfer task can be used to transfer scan projects from a source folder to a target folder.

A typical example for a project transfer is the SD card import. If an SD card is inserted, the **SD Card Transfer** task will open automatically, and the SD card will be used as predefined source folder.

Transfer scan projects from a storage medium

1. Click button in the toolbar.
2. Select the source folder.
   If you wish to change the predefined folder, carry out the following steps:
   a. Click the **Browse** button to open the file system browser. You cannot enter a project folder path directly into the field.
   b. Browse to the folder.
3. Select the target folder.
4. Select the **Transfer** checkbox of all scan projects that you want to transfer.
5. Select the **Process** checkbox if you want the imported project to be processed automatically after the import is finished.

You can select and deselect all checkboxes in columns **Transfer** and **Process** at once by selecting or deselecting the corresponding checkboxes in the header line.

NOTE: If you do not only wish to process the scan project but even to register its scans afterwards, go to Settings > **Processing**. Activate **Perform Automatic Registration**. In addition, you can change the registration method on page Registration.

6. Click the **Start Transfer** button to start the transfer.

Transfer scan projects from SD card

If you insert an SD card and SCENE is already running, the **SD Card Transfer** dialog will be shown after some seconds.

If a scan project is already opened, this scan project must be closed before the SD Card transfer can start. In this case, the **SD Card Transfer** dialog will show a warning.

1. Click the **Yes** button to start the **SD Card Transfer** task.
2. Select the scan projects to be transferred by checking the **Transfer** checkbox of the project.
   If there is more than one scan project, you can select/deselect all checkboxes by clicking the checkbox in the header line.
3. Select the **Process** checkbox if you want the imported project to be processed automatically after the import is finished.
   If there is more than one scan project, you can select/deselect all checkboxes by clicking the checkbox in the header line.
4. Select the target folder. If you wish to change the predefined folder, carry out the following steps:
   a. Click the **Browse** button to open the file manager. You cannot enter a project folder path directly into the field.
   b. Browse to the folder.
   c. In the folder, select the scan project file, which is a file with the file ending .fws or .lsproj.

      For every project to be transferred, SCENE will search for a matching project name in the predefined project folder.
   d. If a matching project is found, the target folder will point to the folder of the project and an **Import project** icon is shown. The transferred project will be merged into the existing project.
   e. If no matching project is found, the target folder will be a new folder in the project folder based on the name of the project. In this case, an **Add project** icon is shown.
5. Click the **Start Transfer** button to start the transfer and finish the task.

After the transfer was performed, the task is closed and a message is shown in which all projects are listed.

Project Features for an Opened Scan Project

Figure 6-3 Project toolbar for an opened scan project

Close Project: Closes the currently opened scan project. Before, you will be asked if you want to save the scan project. If you click **Yes**, you can enter a comment, and the author's name. You can also select if the project point cloud shall be updated before closing the scan project.

Project History : Shows all revisions of a scan project and allows to load a specific version or revert to a specific version.

Wipe Project History : Deletes the project history, which means, that all revisions will be lost.

Work with the Project History

All revisions of a scan project are available in the Project History. Note that you can also open a specific project revision when no project is opened.

Click the **Project History** button to open the history of a scan project.

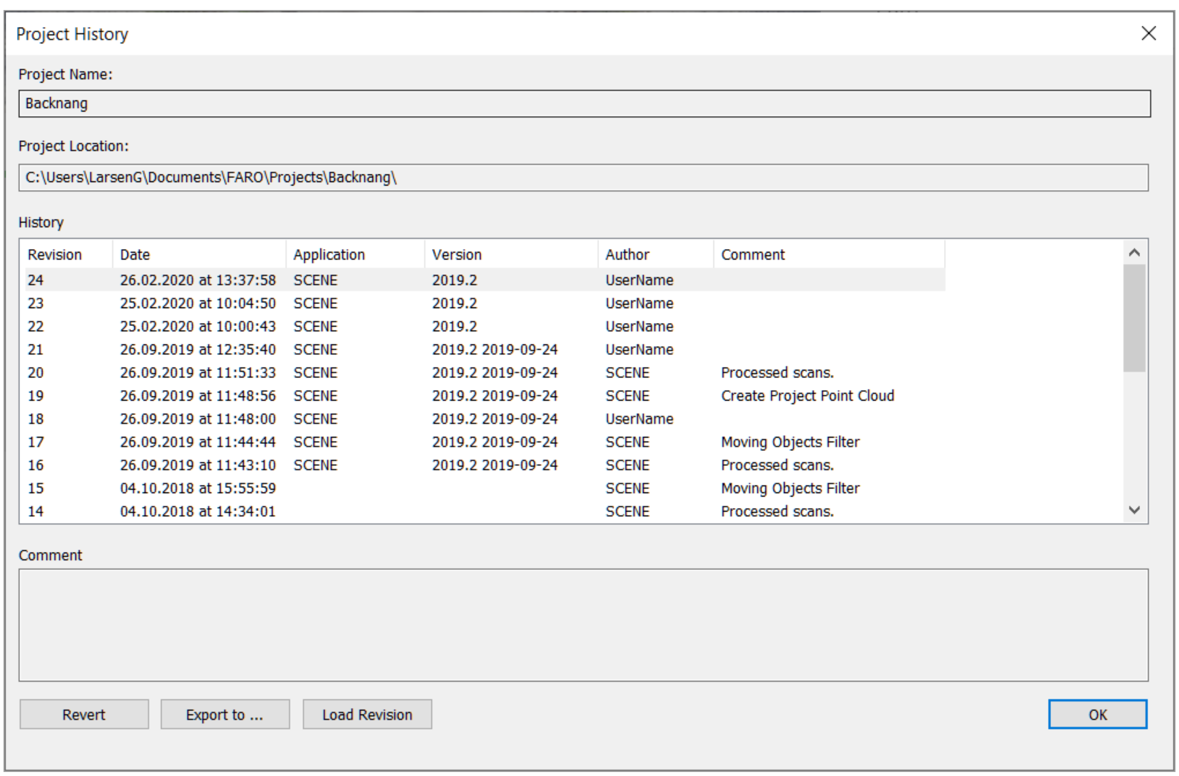


Figure 6-4 Project History

The project history shows the following information:

- all revisions of a scan project numbered from 1 to x
- the date the revision was saved
- the name and version number of the FARO application that was used to save the project
- the author (either the application or the user) that saved the revision
- any comment added when saving

Revert to a Project Revision

This feature is useful, for example, when you made changes that you want to undo.

NOTE: After you revert to a specific revision, all revisions that were created after the revision you are reverting to will be deleted and are no longer available.

1. Click the revision that you want to revert to.
2. Click button **Revert**.
   Dialog Revert to revision <revision number> is opened.
3. In the dialog, type the word *revert* and click OK.
   A message is displayed confirming the reversion.
4. Confirm message.

Export a Revision to Another Project

Exporting a project revision to another location creates a new project based on this revision.

1. Click the revision that you want export.
2. Click button **Export to ...**.
3. In the dialog that opens, select a file location for the new project and enter a project name.
4. Click OK.
   A message is displayed confirming the creation of the new project.
5. Confirm message.

Load Revision

When you want to look at a project at a given date or in a given state, you can load a specific project revision.

NOTE: Note that you can load previous project revisions in read-only mode only. When you have loaded a revision, all later revisions are no longer visible. When you close and reopen the project, all revisions are visible and accessible again.

If you want to continue working with a given project revision, use function Export to ... (see above) to create a new project based on a selected project revision.

1. Click the revision that you want to load.
2. Click button **Load Revision**.

The selected project revision is loaded in read-only mode.

Wipe Project History

As a project grows over time, numerous revisions may accumulate in the scan project history. Thus it may become necessary to reduce the number of revisions and the amount of stored data, for instance when an important milestone has been reached and the individual steps are no longer needed. At this point you may delete all revisions, and save a new revision.

NOTICE: The scan project history is deleted.

All information about the history of a project will be lost. You will no longer be able to revert the project to a previous revision afterwards.

1. Click the **Wipe Project History** button. After confirming a warning message, the Share Changes dialog opens.
2. If required, modify the entry.
3. Click the **OK** button.
SCENE will then start to create a new revision.

NOTE: If revision history is critical, you should Export the scan project. Exporting the scan project will perform a cleanup and compact function but stores the results in a new scan project. The revisions of the original project will be kept.

Basic Concepts

The following basic concepts are important for understanding SCENE.

Scans

Scans are the scan files as they are recorded by the scanner with their millions of data records that include position, reflectance, and color for single scan points. Scans consist of scan points that were recorded from a single scanner location. They are organized in a row column order.

Scan Point Clouds

Scan point clouds are an alternative representation of the scans and must be created from the single scans. Scan point clouds are organized in a spatial data structure that facilitates fast visualization of scan points and automated point loading based on point visibility. They may facilitate and accelerate the processing of the scan points.

Project Point Cloud

The result of a scan project in SCENE typically is a comprehensive project point cloud of the scanned object.

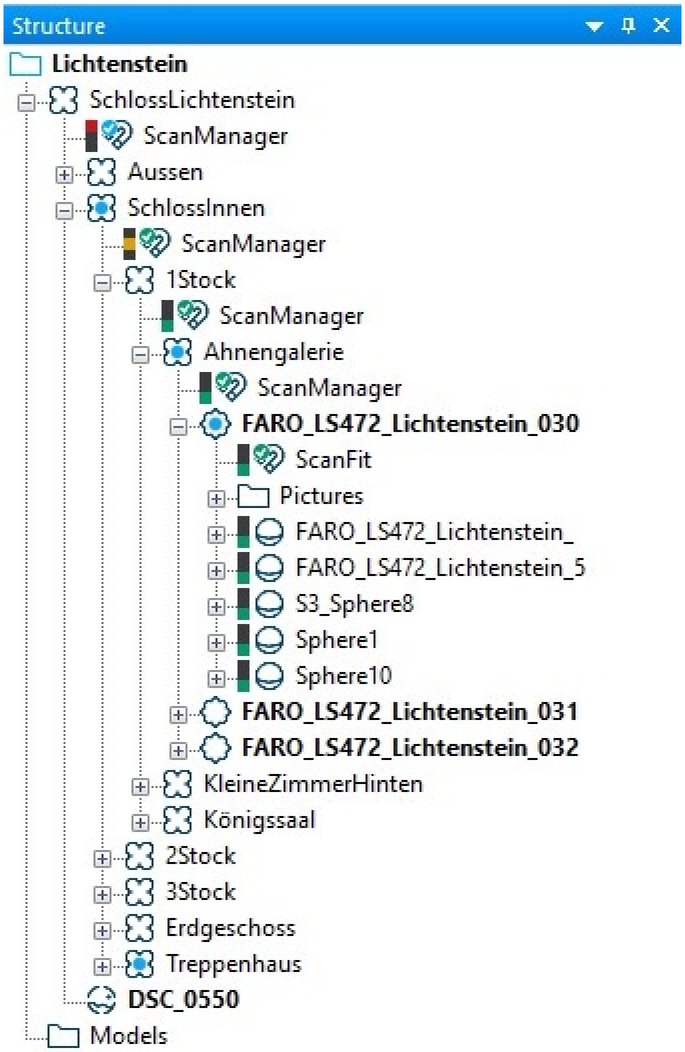
Unlike scans and scan point clouds, the project point cloud consists of the points of all the scans within your scan project and can be seen as a comprehensive point cloud of the complete scan project. This means that a project point cloud can be very large. It is typically created from all the single scans in your project after they have been processed, colorized and registered.

The project point cloud is optimized for fast visualization of large amounts of scan points in the 3D view and is organized in a spatial data structure that facilitates fast visualization of the scan points. However, such large amounts of points cannot be loaded into a physical memory at once. Therefore, the points of the project point cloud are automatically loaded and visualized on demand based on the camera position and point visibility. The automated point loading of the project point cloud can visualize hundreds of scans at once. This empowers you to actually see all scans of a scan project at once regardless of whether they fit into your computer’s physical memory. Manual scan file loading is not necessary.

As the point cloud visualization technique is constantly loading scan points from the hard disk drive based on point visibility, the overall performance strongly depends on the speed of your hard disk drive. While project point clouds outperform all other visualization methods (including scan point clouds) on regular hard disk drives, we recommend using a solid state drive for maximum performance. Using a solid state drive will also speed up the process of creating the project point cloud.

Structure View

In the **structure view**, you can see the hierarchy of the objects.



There are various views to display and explore scans and scan point clouds:

- **Quick View**: The standard scan view to examine single scans. For this, the scan doesn't have to be loaded. The quick view is available within a few seconds. In the meantime, the scan data will be loaded in the background. You can manipulate the scan points as soon as background loading is finished. Until then you are only able to view and navigate. You can find further information in topic Quick View.

- **Planar View**: Used to examine single scans. The scan must be loaded. At first glance, the planar view may appear very strange because the scanned area seems to be distorted. Connections between objects in the picture do not run in a straight line but are curved. For the planar view, uses the same technique as it is used for depicting the earth's surface on a map where the area around the poles appears to be magnified, and the flight route between two distant cities is not straight but bent. You can find further information in topic planar view.

- **3D View**: With the 3D view, you can achieve the most easily comprehensible view of the scan points and CAD models. The 3D view is normally set up with the field of view corrected, so that you get an impression close to reality. Unlike the quick view and the planar view, scan points manipulation and analysis is limited in the 3D view. You can find further information in topic 3D view.
- **Overview Map:** The overview map provides a top view overview to the whole scan project. The map is by default, a gray scale image. It is recommended to create the map after the registration and cleanup of scan points is completed. (Note that the map is created from the points in the individual scans—not from the project point cloud.) You can find further information in topic Overview Map.

Chapter 7: Import

This chapter gives an overview of the formats that are supported by SCENE to import scans, projects, objects, or images.

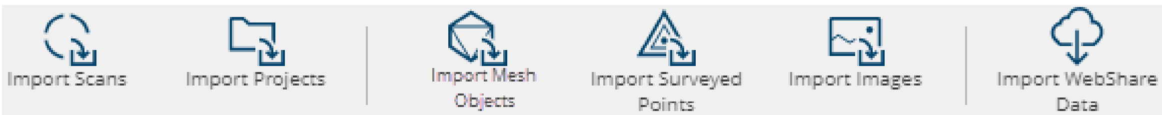


Figure 7-1 Import features

Import Scans: Imports scans and point clouds. This includes FARO Focus Laser Scanner files (FLS), E57 files, PTZ files, PTX files, and unstructured point data in ASCII XYZ, LAS, and LAZ. With PTX and ASCII XYZ files, you must make sure that the scan points in the scan file are arranged in a way that they correspond to the row or column-oriented recording process of the scanner. You also must make sure that the scan was not registered.

Import Projects: Will SCENE Projects into existing projects. Note that this is different from simply opening a project.

Import Mesh Objects: Will import VRML files, i.e. WRL and WRLGZ, as well as OBJ (Wavefront) files.

Import Surveyed Points: Will import surveyed points files, i.e. CSV or COR files.

Import Images: Will import images as a layout plan, virtual scan, or simple image.

Import WebShare: Will start the WebShare Import assistant.

Import by Drag & Drop

The easiest way to import scan projects, scans, images, or objects is by drag & drop.

NOTE: Drag & drop is not only available in the **Import** window. You can also use it in all other steps in which the structure view is available.

1. Open a file system browser, for example, MS Explorer.
2. Click the **Import** button in the Workflow bar.
3. In your file system browser, select the file to be imported.
4. Drag & drop the file to SCENE in the Drag & Drop field. The Drag & Drop field will change its size and its color as soon as the file is accepted.

Depending on the type of the file, the following would happen:

Importing a scan project

The scans and objects of the newly imported scan project will be added to the currently opened scan project.

CAUTION! Scan names must be unique. If a scan in your project has the same name as a scan in the project you are importing into, the existing scan will be replaced with the imported scan.

Importing a scan

The newly imported scan can be found in the structure view, in the cluster the mouse pointer was when dropping the file. You can move it to another cluster, again using drag & drop.

NOTE: Newer versions of the FARO Focus Laser Scanner allow the creation of scan groups, which are several scans created without moving the scanner.

One use for scan groups is to make a complete 360° scan, and then to make several higher-resolution partial scans of the targets that are visible in the first scan. This reduces the total time needed to scan the area, while still getting high-quality scans of the targets to ensure that registration is accurate.

Importing an image

After dropping the image file, the **Import Pictures** dialog will open.

The newly imported images can be found in the **Pictures** folder.

Importing objects

After dropping the object file, a dialog will open in which you can adjust some settings. Those settings depend on the file format of the object.

The newly imported object can be found at the following positions in the structure view: objects in VRML format in the **Models** folder, objects in CSV format in the **References** folder, and so on. You can find further information in Import Mesh Objects and Import Surveyed Points.

Import Scans

The **Import Scans** feature allows to import scans and point clouds. This includes FARO Focus Laser Scanner files (FLS), E57 files, PTZ files, PTX files, and unstructured point data in LAS, LAZ, and ASCII XYZ format.

1. Click the **Import Scans** button in the **Import** toolbar.
2. Browse to select the files which you want to import.
3. Click the **Open** button.

After closing the file manager, SCENE will start to import the selected files and show the progress.

The newly imported scans can be found in the structure view. You can move them to a cluster by drag & drop.

When importing files with a space in the file name, this space will be automatically replaced by an underscore.

Cancel Import

You can cancel this import process by clicking the **Cancel** button.

The **Cancel** button will not stop the import immediately, but after importing the current file. This is the reason why the **Cancel** button is not available if the import was started for only one file.

When the **Cancel** button was clicked, it will be grayed out and the status message is updated.

General Scan Data Format .xyz

XYZ files sometimes contain row and column information for each scan point:

- If the xyz file contains row and column information, the data is imported as an ordered scan that can also be displayed in the quick view and the planar view.
- If the xyz file does not contain row and column information, the data is imported as unordered scan point cloud. In this case, the quick view and the planar view are not available.

After the XYZ coordinates, either the intensity value or the RGB value may be supplied. When importing a xyz file that contains both types of values, only the RGB value is used.

Scan Data Format .ptx

PTX is an ASCII based interchange format for point cloud data, which is usually created with the scan software Leica Cyclone.

This format is especially suited for exchanging scan points and their corresponding coordinate transformation.

All values are given in ASCII and are metric. The first line states the number of columns, the second line the number of rows. In the next line, the translation part of the transformation is given (a 3D vector). After that, 3 lines with the rotation part follow (a 3x3 matrix). The next 4 lines contain the full transformation (a

4x4 matrix). Finally the scan points are written, one scan point per line: x, y, z, and a reflection value. In addition, the RGB value may follow. The reflection value is between 0 and 1.

When importing a PTX file, the following dialog opens:

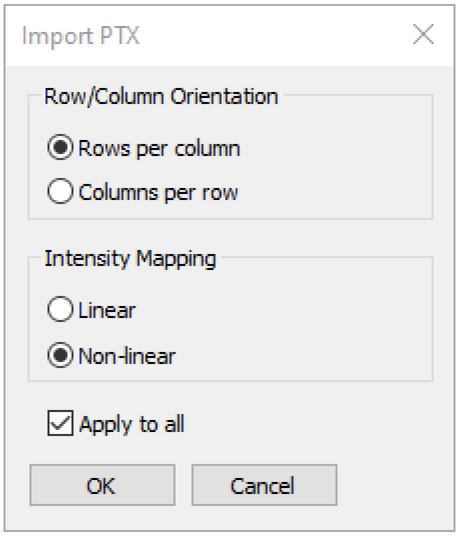


Figure 7-2 PTX import dialog

Rows per column: The input file contains the data column-wise, i.e. it starts with all the rows of the first column, then all rows of the second column, and so on. Good when importing FARO PTX files.

Columns per row: The input file contains the data row-wise, i.e. it starts with all columns of the first row, then the second row, and so on.

Linear: A linear mapping of intensity values to gray values.

Non-linear: A non-linear mapping of intensity values to gray values. Good when importing for example Leica PTX files. If the PTX file contains a RGB value, intensity mapping is not done. The RGB value is used instead. If the PTX file contains both, RGB and intensity values, the RGB value is used.

NOTE: If your input looks not right in the planar view, but seems to be OK in the 3D view, try to import again with a different row/column orientation.

If the **Apply to all** checkbox is selected and you click the **OK** button, it will apply the same settings for the following scans and will not ask again.

If you click the **Cancel** button, the import will abort for the current scan and all following scans. Scans that were already imported will remain.

Scan Data Format .ptz

PTZ is the binary data format of Leica HDS scan files, which are usually created with the scan software Leica Cyclone.

When importing a PTZ file, the following dialog opens:

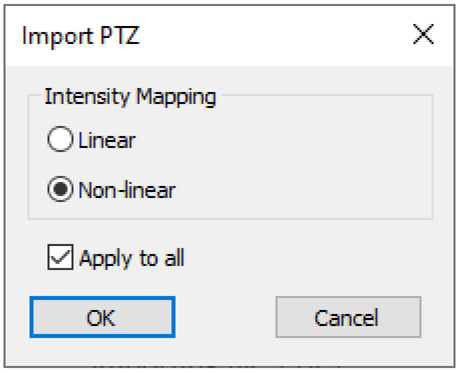


Figure 7-3 PTZ import dialog

Linear: A linear mapping of intensity values to gray values.

Non-linear: A non-linear mapping intensity values to gray values. Good when importing for example Leica PTZ files.

If the PTZ file contains colors, intensity mapping is not done. The colors are used instead.

If the **Apply to all** checkbox is selected and you click the **OK** button, it will apply the same settings for the following scans and will not ask again.

If you click the **Cancel** button, the import will abort for the current scan and all following scans. Scans that were already imported will remain.

Scan Data Format .e57

This scan data format is a vendor-neutral standard for storing point cloud data produced by 3D imaging systems. The "ASTM E57 3D file format" (officially ASTM E2807) is a format for three-dimensional imaging data such as laser scans. The E57 file is used as shorthand for "ASTM E57 3D file format" and is a combination of binary data and XML (eXtensible Markup Language).

An E57 file can store 3D point data, attributes associated with 3D point data such as RGB or intensity values, or both. (The specification of the format is available on www.astm.org/Standards/E2807.htm. SCENE uses the library libE57 V1.1.312 to write and read E57) files.

SCENE supports the import of several features of the E57 file, for example exported by FARO Connect. When importing, the E57 file must contain xyz or spherical coordinates as well as RGB or intensity values for each scan point. If the E57 file contains RGB and intensity values, the RGB value is used.

If the E57 file doesn't contain information about row/column ordering, the following dialog opens:

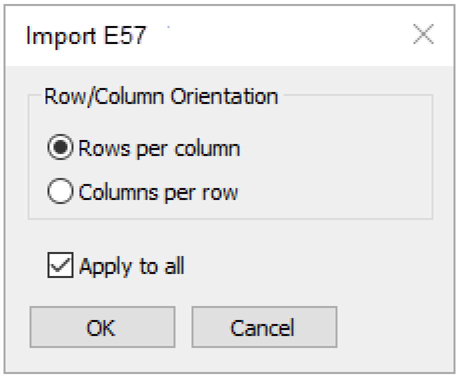


Figure 7-4 E57 import dialog

Select the correct ordering of the file, then click the **OK** button.
Rows per column: The input file contains the data column-wise, i.e., it starts with all the rows of the first column, then all rows of the second column, etc.

Columns per row: The input file contains the data row-wise, i.e., it starts with all columns of the first row, then the second row etc.

Currently, SCENE doesn't support the import or export of associated 2D images.

If the **Apply to all** checkbox is selected and you click the **OK** button, it will apply the same settings for the following scans and will not ask again.

If you click the **Cancel** button, the import will abort for the current scan and all following scans. Scans that were already imported will remain.

Import Projects

The **Import Projects** feature allows to import SCENE scan projects.

NOTE: The **Import Projects** feature will only work if a valid SCENE project is already open.

1. Click the **Import Projects** button in the **Import** toolbar.
   The file system browser will open.
2. Browse to select the files which you want to import.
3. Click the **Open** button.

The scans and objects of the newly imported scan project will be added to the currently opened scan project.

Import Images

The **Import Images** feature will import images as virtual scans, layout plans, or simple images.

There are three ways to use images in SCENE:

- Images with their original resolution which provide additional information about the scan environment
- Images with their original resolution which provide additional information about the scan environment. These images are imported into the 3D world as virtual scans with their full resolution. Such images will be interpreted like a high resolution scan of a plane surface and can be placed on arbitrary positions in the 3D world.
- Images which add color information to already existing scan points

1. Click the **Import Images** button in the **Import** toolbar.
   The file system browser will open.
2. Select the file format *Image Files (*.bmp, *.jpg, *.png)*.
3. Browse to select the files which you want to import.

File names of imported images cannot be renamed in SCENE. Ensure that the image file has the name you want before importing it.

4. Click the **Open** button.
   The following dialog appears:

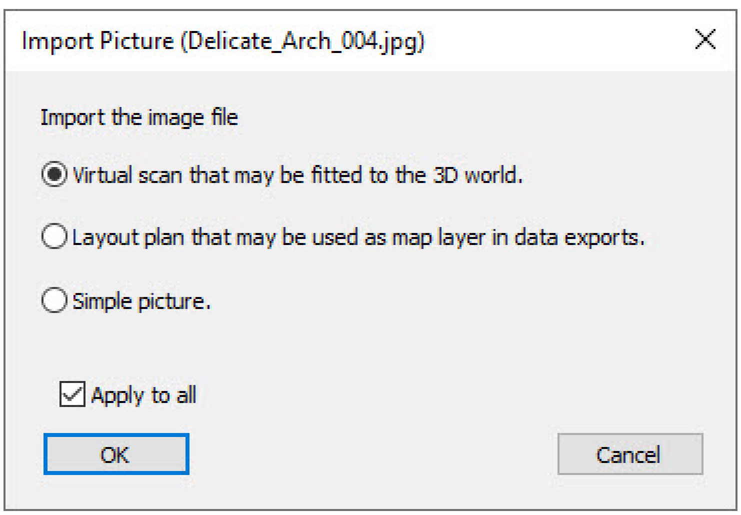


Figure 7-5 Import image dialog

5. Select how you want to use the image.
   If there are several images for one application, select **Apply to all**, or select the appropriate ones.

Import High-Resolution Image as Virtual Scan

This method allows you to include high resolution pictures (for example, digital photos of important details in the scan environment) into the 3D world by importing them with their full resolution as *virtual scans*.

Such pictures will then be interpreted as a high-resolution scan of a plane surface and can be placed in an arbitrary position in the 3D world.

For this, import a picture into SCENE as virtual scan (see above).

If you choose to create a virtual scan, the picture will be placed in the scan folder of the structure view and be marked with a special icon, signifying that it is a picture with 3D information.

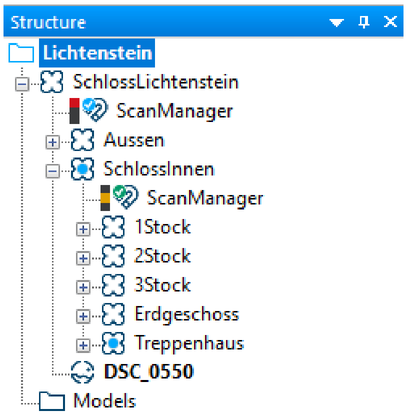


Figure 7-6 Virtual scan in the structure view

Initially, the virtual scan is scaled in such a way that the longest side of the picture is equal to 1 meter. The initial position in the 3D world is in the origin of the coordinate system.

Figure 7-7 Virtual scan in 3D view

The main application for virtual scans is to complement existing 3D scans with detailed information from high resolution photos of flat surfaces.

In this case, size and location of the virtual scan are fixed and can be determined by using the **Place on Surface** command under **Operations** > **Registration** in the virtual scan's context menu.

The command **Place on Surfaces** scales and places the virtual scan in the 3D world using a plane and corresponding points in the virtual scan and a scan in the 3D world. The command **Place in 3D** places the virtual scan upright in the 3D world.

The technique to place and scale virtual scans is similar to the one used to colorize existing scan points. This time, however, new points are created from the pixels of the picture and added at the proper position in the 3D world.

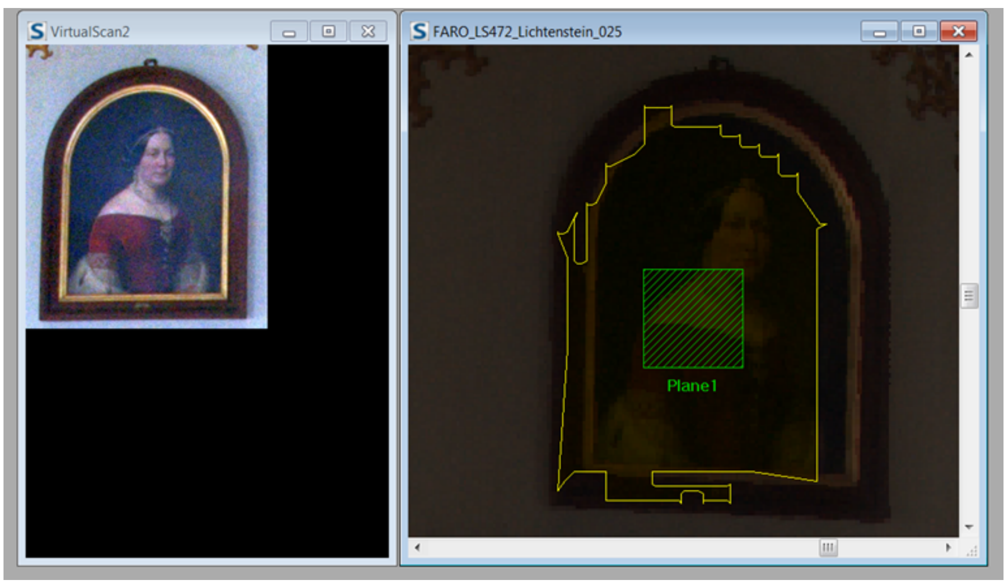
Place on Surface

The position of the virtual scan is defined by a plane that must be created in one of the scans at the approximate position where the virtual scan should be placed. The exact position and size on this plane are then determined by selecting matching points in the virtual scan and in a real scan.

1. In the structure view, right-click the virtual scan, then select **View** > **Planar View**.
   A new tab opens which shows the virtual scan.

2. In the structure view, right-click the scan in which the virtual scan shall be placed, then select **View** > **Planar View** or **Quick View**.

3. Use the **Mark Plane** function to mark the area where the virtual scan shall be placed.



Mark Plane to place virtual scan

4. In the structure view, right-click the virtual scan and select **Registration** > **Place on Surface**.

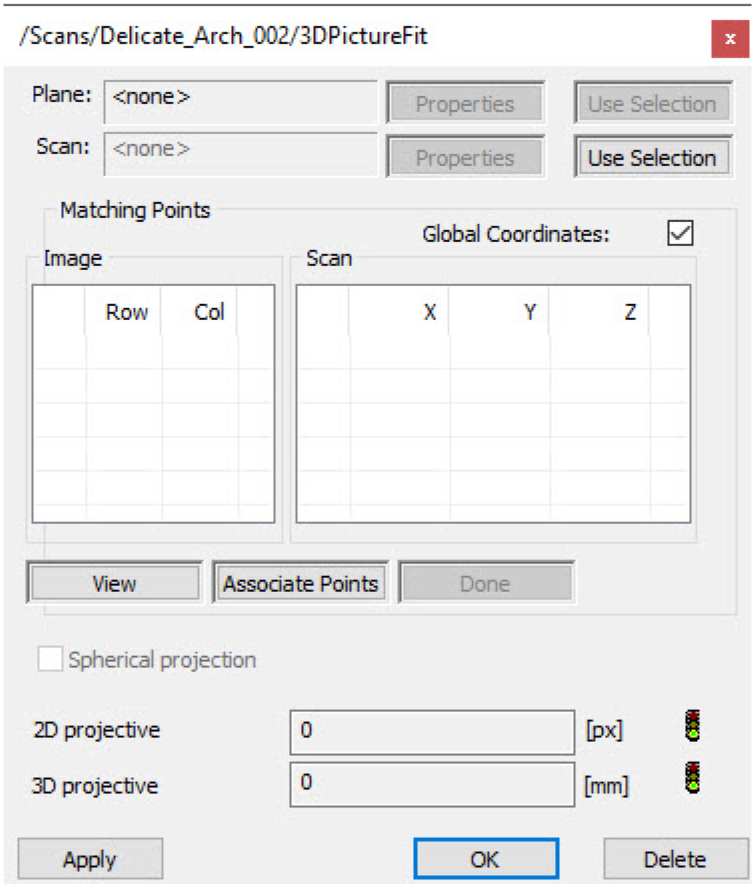


Figure 7-8 Place and scale dialog

5. In the structure view, click the scan, then click **Use Selection** in the dialog.

6. In the structure view, click the plane, then click **Use Selection** in the dialog.

7. Click **Associate Points**.
   The mouse pointer changes and is displayed cross-shaped.

8. Mark at least 4 suitable scan points in the virtual scan.
   Each scan point position is listed in the **Image** column in the dialog.

9. Mark the corresponding scan points in the scan.
   Take care to keep the same order. Each scan point position is listed in the **Scan** column in the dialog.

10. When you are done selecting points, click **Done** to place and scale the virtual scan.

Figure 7-9 Placed and scaled virtual scan in 3D view

11. Open the scan folder or cluster in 3D view.

12. In the structure view, right-click the virtual scan and select **Locate**.

The virtual scan is now displayed at its new place.

Place in 3D

1. In the structure view, right-click the virtual scan, then select **View** > **Planar View**. A new tab opens which shows the virtual scan.

2. In the structure view, right-click the scan in which the virtual scan shall be placed, then select **View** > **Planar View** or **Quick View**.

3. Use the **Mark Plane** function to mark the area where the virtual scan shall be placed.

4. In the structure view, right-click the virtual scan and select **Registration** > **Place in 3D**.

5. In the structure view, click the plane, then click **Use Selection** in the dialog.

6. In the structure view, click the scan, then click **Use Selection** in the dialog.

7. Click **Associate Points**. The mouse pointer changes and is displayed cross-shaped.

8. Mark at least four suitable scan points in the virtual scan. Try to find scan points in all three dimensions. Each scan point position is listed in the **Image** column in the dialog.
9. Mark the corresponding scan points in the scan. Take care to keep the same order. Each scan point position is listed in the **Scan** column in the dialog.
10. In the dialog, click the **Set** button beneath **Foot Point**.
11. In the virtual scan, click a scan point that is suitable as placing point. These coordinates are now displayed as Foot Point.
12. When you are done with selecting points, click **Done** to place and scale the virtual scan.

Measure

1. Select the virtual scan.
2. Select **Measure points**.
3. Measure an object.

Show positions in 3D View

Open the scan folder or cluster in 3D view.

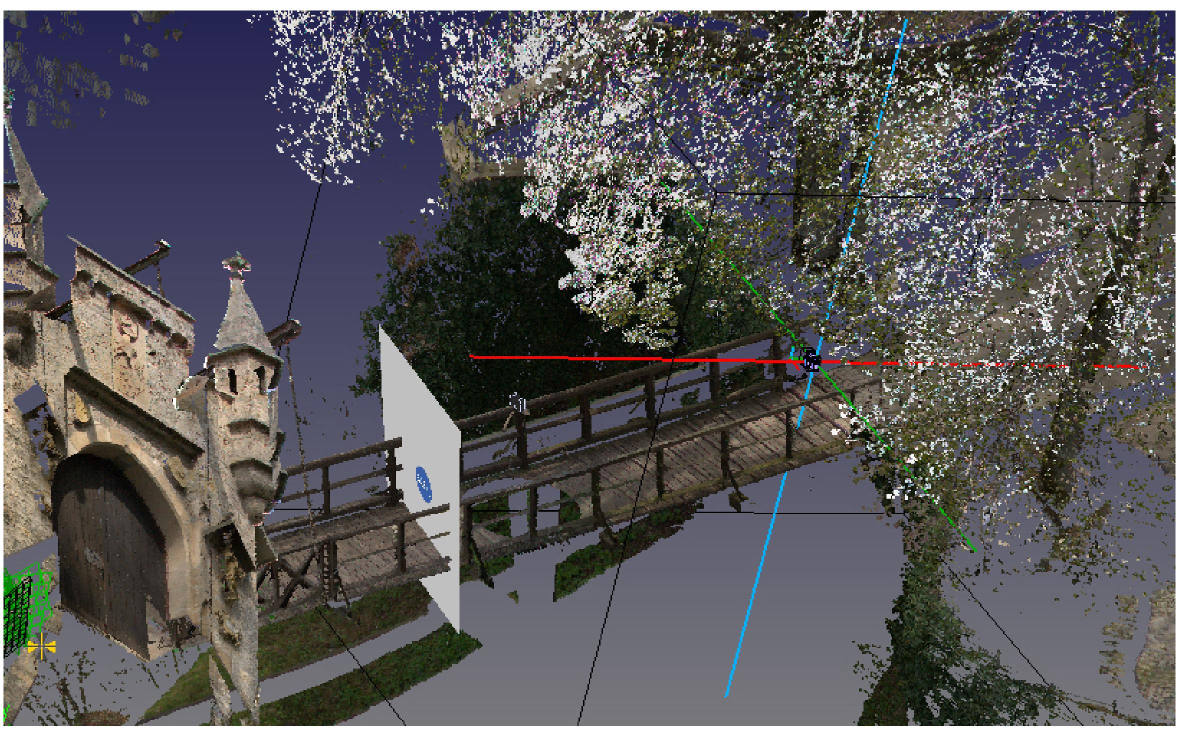


Figure 7-10 Laced virtual scan and camera position in 3D view

The virtual scan is now shown at its new place, not in original but plane-shaped. To find the camera position, search the 3D view for a suitable small camera symbol. If you click the camera symbol, the orientation of the camera is displayed.

Import Mesh Objects

The **Import Mesh Objects** feature allows you to import VRML files and OBJ files.

To compare the scanned reality with models from the CAD system, you can import the model into SCENE. For this, the model must be in multi-vendor-capable VRML (Virtual Reality Modeling Language) or OBJ data format. Many CAD systems provide the option of exporting models in these formats. For further information, read the instructions of your CAD system.

VRML

Although the VRML standard recommends a specific coordinate system and a specific unit of length, not all VRML files are modeled that way. The standard defines the unit of measure of the world coordinate system to be meters, and a coordinate system in which the y-axis points upwards.

When importing a VRML model, you can have SCENE combine any meshes in the model into a single mesh.

SCENE does not support all objects or object properties that are available in the VRML format. The following parameters are not transferred:

- Light sources
- Textures with 8 or 16 bit per pixel (use 24 bit per pixel instead)
- The in-line node

OBJ

When imported, the OBJ model is split into one separate mesh object for each material. If some parts of the model are not assigned to any material, they are grouped into another separate mesh object.

SCENE does not support all objects or object properties that are available in the OBJ format. The following parameters are not transferred:

- Vertex colors
- Material illumination models: the illumination model _2: Highlight on_ is always used
- Advanced texture maps: only the diffuse texture map is used
- Texture options, such as offset and scale

How to Import the Mesh Objects

1. Click the **Import Mesh Objects** button in the **Import** toolbar.
   The file manager will open.

2. Select the file format

   - OBJ (*.obj)

   - VRML 2.0 (*.wrl, *.wrl.gz)

1. Browse to select the files which you want to import.

2. Click the **Open** button.

3. Select the units, coordinate system, and optimizations, then click **OK**.

Import Reference Points

Usually, external reference points are measured with survey equipment such as a total station. For **spheres**, the survey point lies the center point of the sphere. For **circular flat targets,** the survey point lies the middle of the light circle, which stands out clearly from the surrounding darker border. Finally, for **checkerboards**, the survey point lies the center point of the four quadrants.

Survey data can be imported, for example, from a .csv file into SCENE. You can import the survey data into a specific folder or cluster. Survey data is displayed in a **References** folder in the structure view.

In the selected location, a folder called **References** contains a separate object for each survey point with the name and coordinates from the survey file.

External references are used for target-based registration.

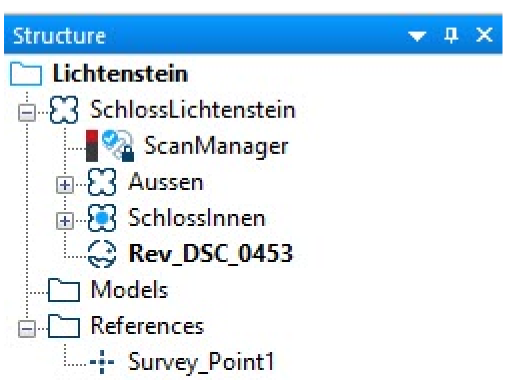


Figure 7-11 External References Folder

When registering scans within a cluster, external references are not mandatory. Nevertheless, existent external references will be used and will have a higher weighting in the registration algorithm than scan references.

If external references are available, the Reference folder of the cluster is used first. If not, the Reference folder of the next available higher leveled cluster is used.

NOTE: When importing survey data, SCENE uses a right-handed coordinate system.

In some applications, scans shall be registered without referring to higher-leveled references. In this case, create an empty Reference folder on the same level as the cluster with these scans, or create it somewhere between the cluster and the Reference folder which would be used.

Each row of the file contains one single reference point with the following specifications: name, x coordinate, y coordinate, z coordinate, and measurement quality. All four specifications must be given and must be separated by the same separator, which can be a blank space, a colon, a semicolon, or a tab. The coordinates are specified in the unit that has been defined in **Settings** > **General**.

NOTE: SCENE uses a right-handed coordinate system.

1. Click the **Import Surveyed Points** button in the **Import** toolbar.
   The file system browser will open.
2. Select the file format *Surveyed points (*.cor, *.csv)*.
3. Browse to select the files which you want to import.
4. Click the **Open** button.
   The file will be imported.

Import WebShare Project Modifications back to SCENE

If you have scan projects uploaded to WebShare, these scan projects might be modified by adding measurements, annotations, etc. You can import those modifications back to SCENE. Follow the steps below to do this:

NOTE: WebShare is being replaced by the new cloud solution Sphere XG. Contact the FARO support or find information in the Sphere XG user manual.

Login

The legacy method is as follows:

In the **Import** tab, click the button in the scan project toolbar and log in to WebShare.
Domain: Enter your organization’s subdomain on WebShare.

User Name (email): Enter the user name with which you log in to WebShare
Password:

Enter the password with which you log in to WebShare

Save Credentials: Click to save your login credentials so that you do not have to enter them again in the future

Cancel Import: Click to stop importing, and return to the scan project

Select project

The software will guide you through the import process with the help of following dialogs, see example below.

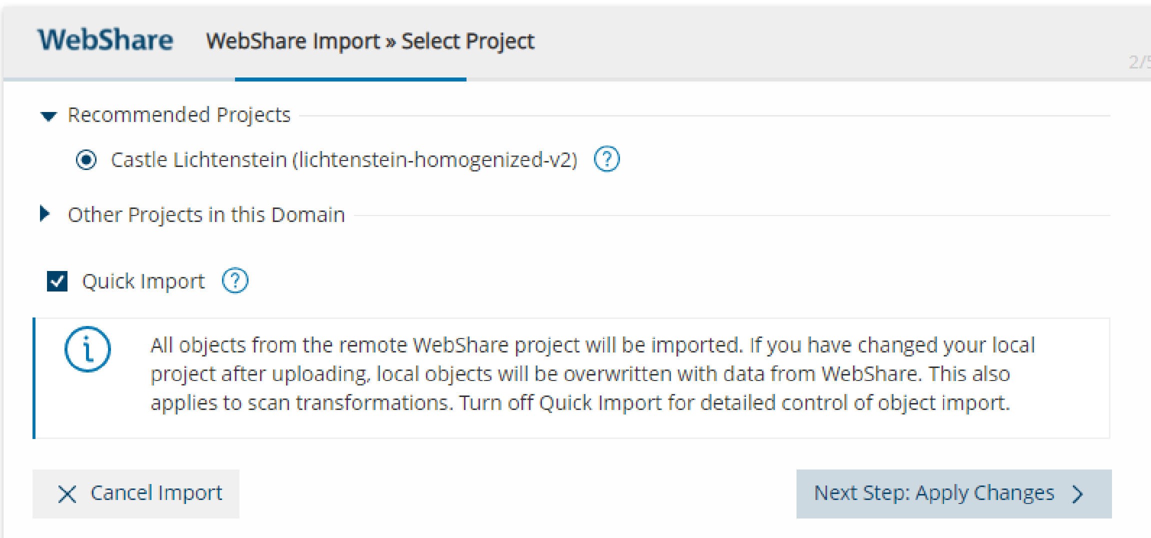


Figure 7-12 WebShare import dialog – Select project

Recommended Projects: The WebShare project which is most similar to the one opened in SCENE will be displayed.

Other Projects in this Domain: Click the little arrow to see all the scan projects saved in this domain. If you want to import the contents of one of these projects, select it by clicking its checkbox.

Quick Import: The contents of the scan project are imported with default settings.

Click the **Next Step: Apply Changes** button to import the scan project.

If you want to modify those settings, clear the Quick Import checkbox. Two additional dialogs are then shown in which you can specify the import process.

Select Object Filters

User filter

Select whether you want to import the modifications you made yourself, or if you want to import the modifications of other users as well.

If your WebShare role is Project Manager, you will be able to import all the modifications, even those which were set to “private” by one of the other users.

Object type filter

Select which type of objects you want to import. Click the **Select** button to select all object types, or none of them. If you select “none”, you must re-select at least one of the checkboxes below.

Category filter
Objects without a category: Select, if you want to import objects although they have no category.

Category name: Select, if you want to import all objects which are linked to this category.

Tag filter
Objects without tags: Select, if you want to import objects although they have no tags.

Tag names: Select, if you want to import all objects which are tagged with this tag name.

Select Objects

Select at least one of the objects in the list.

- **Objects to be Updated** -Click the objects you want to update. Click the **Select** button to select all objects of one type, or none of them. If you select “none”, you must re-select at least one of the object checkboxes in the list.

- **Objects to be Created** -Click the objects you want to create. Again, click the **Select** button to select all object types, or none of them. If you select “none”, you must re-select at least one of the object checkboxes in the list.

Click the **Apply Changes** button to start the import. Final report

The Final Report shows a list of what has been imported.

- **Save Report** – Click this button to receive a machine readable report. A dialog will open in which you can browse for a saving location.

- **Close report** – Click this button to close the report. This will not save the imported changes. To save the changes, use the regular SCENE saving function.

The Final Report also shows errors which may occur while importing, for example:

- The scan project in SCENE includes an object with the same name as one in the WebShare project, but it is not the same object. Such an object will be given a default name.

- A parent object is missing. It may happen that you uploaded a scan project to WebShare, and, in the meantime, deleted one of the scans in your scan project in SCENE. If you or someone else created objects in that scan in WebShare, these objects cannot be imported back anymore.

Check import in SCENE

You can now open one of the scans to see the imported objects. These objects are also listed in the structure view.

- Modifications made in the Panorama View of a scan are listed in the folder of that scan.
- Modifications made in the Overview Map are listed in the folder of the Overview Map.

Chapter 8: Processing

In the **Processing** toolbar you can work on the entire scan project, a cluster or a single scan.

If at least one of the selected scans already has a scan point cloud, the creation of scan point clouds is enforced for all selected scans to ensure data consistency.

Start Processing

Click the **Process Scans** button to start processing scans (laser scanner or hand-held scans, and mixed projects).

You can also start processing in the **Explore** toolbar if you right-click the scan project, cluster, or scan in the structure view and then click **Operations > Process Scan(s)**.

Processing a FARO Swift Scan Project

FARO Swift is a collection of features that makes it possible for a FARO Focus Laser Scanner and a FARO ScanPlan to work together to complete scanning projects much faster than with the laser scanner alone. The software uses a simultaneous localization and mapping (SLAM) algorithm that enables one to scan while the scanner is in motion. This can significantly reduce the scanning time and the cost of large scanning projects. A Swift scan project contains two types of scans: mobile scans, that are created while the scanner is in motion, and conventional scans, that are used to provide context for the mobile scan or to provide better resolution in areas where more detail is required. For more information about FARO Swift, refer to the *FARO* Swift *User Manual*.

Swift scans require special preprocessing, but this is done automatically when you process the scan.

However, you can also process Swift scans manually:

1. Go to tab **Processing**.
2. Right-click the Swift scan sequence and select menu entry **Operations > Swift > Preprocess**.
   The following dialog opens.

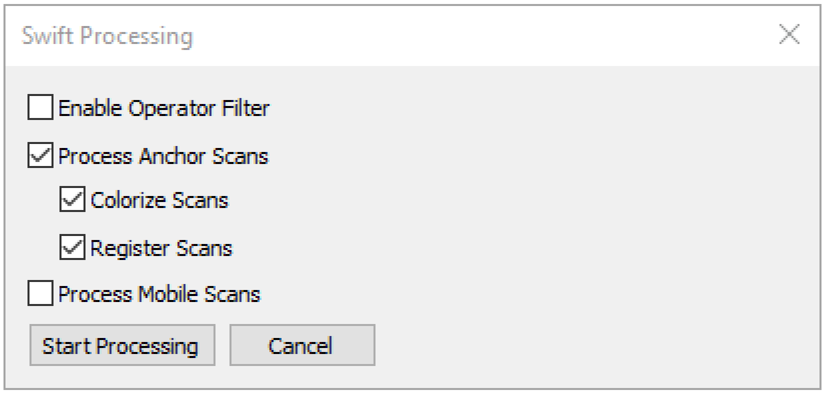


Figure 8-1 Swift Processing Dialog

3. Select the option you want, see below.

4. Click button **Start Processing**.

Enable Operator Filter

This option removes objects that are too close to the scanner or that are moved along with the scanner.

Process Anchor Scans

A FARO Swift scan project begins by making an anchor scan. This is a fast, low resolution scan which aligns the Focus and the ScanPlan and creates a known set of scan data that the mobile scan will use as its base. You can also make subsequent anchor scans.

- Mark checkbox **Colorize Scans** if you want to color Swift anchor scans with PanoCam data.

- Mark checkbox **Register Scans** if you want to register Swift anchor scans. Note that this registration does not start the SCENE registration but an internal cloud-to-cloud registration of the anchor scans to ensure correct positioning.

Process Mobile Scans

Runs the standard Swift preprocessing sequence.

Processing Focus Scans Using the PanoCam

FARO Focus Laser Scanners can be used in combination with a Ricoh Theta Z1 360° camera to reduce the time needed to take the pictures that colorize the points of a scan. Such projects receive special preprocessing which is done automatically when you process the scan.

To improve the scan visualization, you can use functionality Create PanoCam Scan on the Explore tab.

Requirements

- The scans must be taken with a Focus scanner that is outfitted with a Ricoh Theta Z1 camera and a mounting adapter. Contact your FARO sales representative to purchase the equipment necessary to colorize scans with your Ricoh Theta Z1 camera. Refer to the FARO Focus Laser Scanner Accessories Manual, available at knowledge.faro.com for information about how to make Focus Scan using the PanoCam.

- DirectX drivers must be installed and active to process these scan projects. An error message will appear if you select *Colorize Scans* for a project without active DirectX drivers.

- Each computer and user needs one calibration scan made with the same Ricoh Theta Z1 camera that was used when the scan data was captured.

About Calibration Scans

A calibration scan is a scan that is used by SCENE to align the colors of the Ricoh Theta Z1 picture with the points of the Focus scan. It is saved as a normal fls folder on the scanner SD card and can be used in SCENE like other scans. To successfully colorize a Focus Scan whose color was captured with the PanoCam, you must have at least one calibration scan made with the same Ricoh Theta Z1 camera that was used for the scan project you are processing. The computed calibrations are shared across all projects for one user.

If the colorization quality deteriorates, or if you see the error message, *Calibration failed. Failed to match scan data to color data*, it may help to capture a new PanoCam calibration scan.

Limitations

If you want to export panoramic pictures via the context menu entry **Export Panoramic Images**, you must create the PanoCam scans first. You can then use the PanoCam scans to export the panoramic pictures.

Processing Flash Scans

When importing and processing Flash scans, SCENE automatically creates PanoCam scans. Metadata is included in these PanoCam scans. The registration is done based on the PanoCam scans.

Process Scans

Use the **Process Scans** button to start processing scans (laser scanner or hand-held scans, and mixed projects).

NOTE: There is a second possibility to start Processing during executing **Explore** features: in the structure view, right-click the scan project, cluster, or scan, then click **Process Scan**.

Configure Processing – General

Skip Fully Processed Scans

This option is selected by default if one or more scans have already been fully processed. Deselect if you want to reprocess these scans.

Configure Processing – Scan Point Clouds

Create Scan Point Clouds

If you mark this option, scan point clouds will be generated. These scan point clouds ensure data consistency.

This option is grayed out if there are already scan point clouds.

Configure Processing – Colorization

No colorization

If you mark this checkbox, no color will be added to the scan points during processing.

Colorize Scans

If you have a scan taken by a laser scanner with the color option, this scan will also contain the digital pictures which the scanner took automatically during the scanning. These pictures will be applied to color the scan if this option is selected.

NOTE: Starting from version 2022.1, SCENE supports coloring Focus Premium scans with high-resolution images (13MP) made by the scanner's internal camera.

Laser Illuminated HDR

With LI-HDR, a photograph of a scanned area is combined with information about the amount of laser light that was reflected by surfaces during scanning. Because the laser provides the illumination, details in areas that are completely over- or underexposed in the photograph can nevertheless be added to the LI-HDR image, as shown in this example:

Figure 8-2 Laser Illuminated HDR

The laser light does not provide color information, so areas illuminated only by the laser are shown as grayscale.

NOTE: If you always want to use LI-HDR when processing scans, you can set this in Settings, Processing, Colorization.

Configure Processing - Filters

To identify an inaccurate scan point, the filters compare the scan point with the scan points in the surrounding area. Some of the filtering is performed based on information from the point.

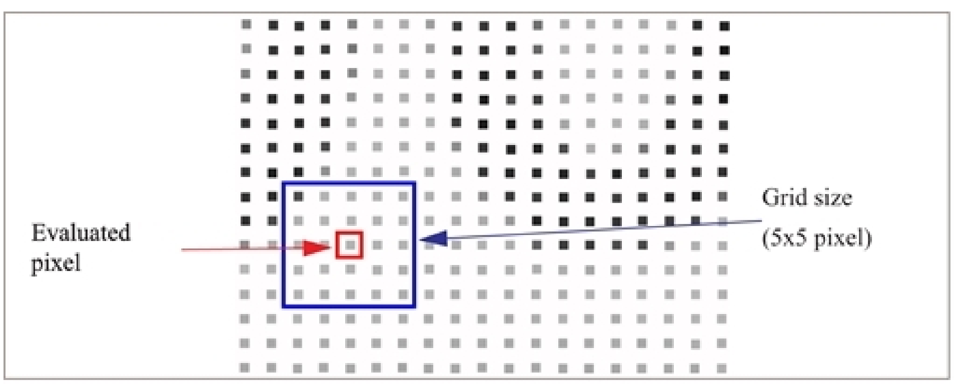


Figure 8-3 The area surrounding a scan point, in a 2D grid

In the figure above the surrounding area oriented toward the recording point is shown. With filters, you can set what should be regarded as the surrounding area. In this example, the value 5 was set, which means the edge length of the surrounding square is 5.

Dark Scan Point Filter

This filter removes points based on a reflectance value. **Reflectance Threshold** indicates the minimum reflectance value a scan point must have. The Reflectance Threshold range is: 0 to 2048.

This criterion is useful because with a dark scan point, only a very small amount of light entered the scanner and therefore the measurement will have an increase in noise.

NOTE: This filter is not applicable for colorized scan points.

Distance Filter

This filter removes all scan points which are outside of the defined distance range. All points with a distance less than the **Minimum Distance** and all points with a distance larger than the **Maximum Distance** will be deleted.

Stray Point Filter

This filter checks if the 2D grid cell of a scan point contains a sufficient percentage of points with a distance similar to the scan point itself.

- **Grid Size**: The size of the surrounding area used for comparison. For each scan point of the scan or selection, the filter takes the valid scan points of this surrounding area and counts how many of them are at a distance to the scanner which is approximately the same as the distance of the scan point currently being viewed.
- **Distance Threshold**: A scan point is counted if the difference in distance is smaller than the value of Distance Threshold.
- **Allocation Threshold**: If at least the percentage of scan points indicated by the Allocation Threshold in the surrounding area is within this distance threshold, the scan point remains in the scan. Otherwise, it is removed.

NOTE: The Stray Point Filter is very well suited to correct incorrect scan data. It also works well if the **Allocation Threshold** is below 50%. However, the filter must not be applied on surfaces that were strongly inclined versus the scanner's laser. The filter is always applied to the whole scan. It is not possible to apply it only in selected areas.

Edge Artifact Filter

This filter is enabled by default. The filter is especially useful to remove artifacts at the edges of objects.

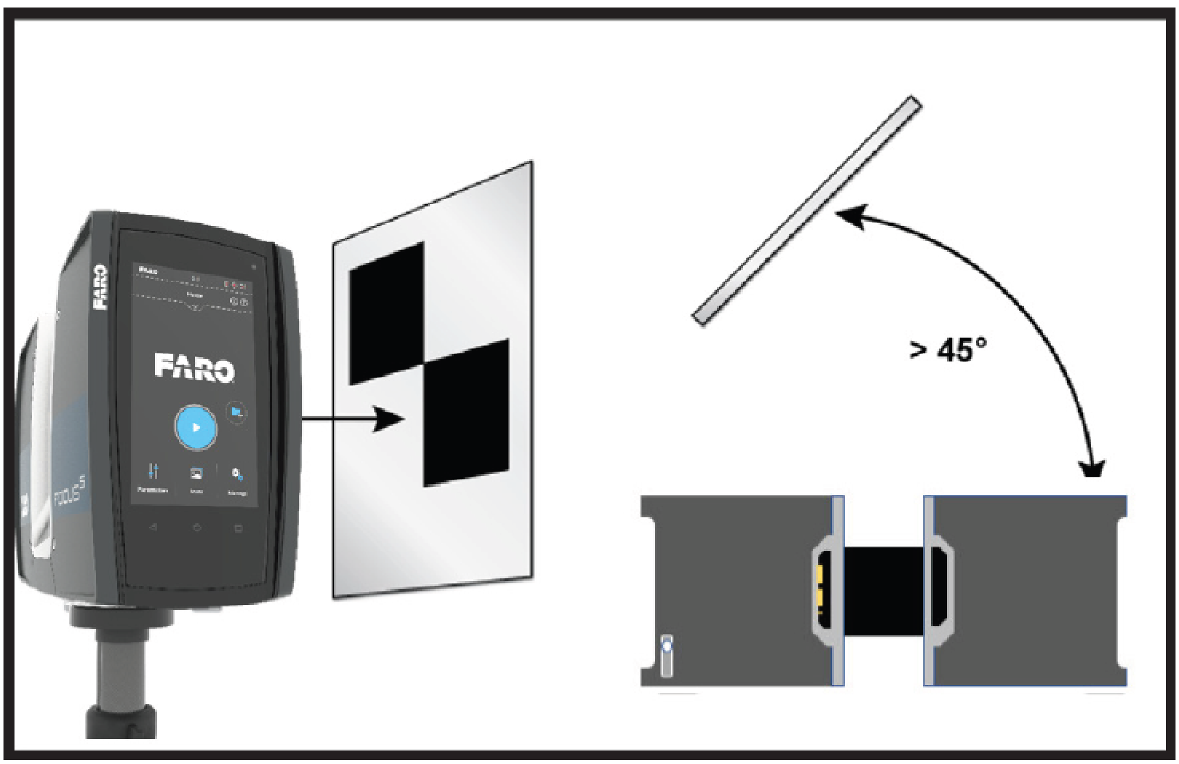
Configure Processing – Find Targets

The **Find Targets** section allows you to select targets such as checkerboards, planes, and spheres. These will then be searched in each scan during processing.

NOTE: Finding targets is time-consuming and should be enabled only when scans are registered with the target-based registration.

Find Checkerboards

A frequently used paper target is the *checkerboard* target. A checkerboard target fit determines the center point of the target's four quadrants. Select this option to find checkerboards and use them for scan registration. note that the angle between the laser beam and the checkerboard should be higher than 45 degrees. Otherwise, the accuracy of checkerboard may be compromised.



Find Markers

Select this option to find markers. Markers are printed targets with a unique ID.

Find Planes

Select this option to find planes and use them for scan registration.

Find Spheres

This refers to three-dimensional, white, reference spheres that come in various sizes. The advantage of spheres is that they can be placed at any angle to the scanner. Select this option to find spheres and use them for scan registration.

NOTE: Sphere search works with spheres meant for registration. Forensic spheres (used for determining shot trajectories) may not be found by this target search.

The global list of sphere sizes set in the **Settings** > **Processing** page are displayed in the active and inactive sphere radii list.

Active Sphere Radii

Click **Add New** and specify new sphere radii. These sphere sizes will be used for target detection.

This list of user-defined sphere sizes will be used for processing the scans in the current processing task run.

Inactive Sphere Radii

Click **Add New** and specify additional sphere radii for sphere detection.

Drag the sphere radii that are not required for the current project, from the Active Sphere Radii to the inactive Sphere Radii list.

You can easily move items between the two lists and manage the sphere radii for processing the scans in the current project.

Configure Processing – Hand-Held Scans

This section is only visible when you process hand-held scans.

Load Presets

Two presets are available: **Fast** or **Accurate**.
Fast is the default setting and will produce satisfactory results from good scans. If you experienced tracking errors when scanning, or see doubled images in the scan before processing, you may find that setting **Accurate** produces better results.

Plane Detection

Switches plane detection on or off for all processing. **Auto** switches on plane detection only if it was switched on when the scan was created.

Replay

If scans already passed some processing steps, Replay restarts the processing from the beginning. Processing is then executed with higher precision than it was done during capturing.

Scan Optimization

Adjusts all frames of a scan to minimize the overall displacements errors. The function searches for loops in the scan and tries to close those loops. Loop closing is necessary because small errors from frame to frame may accumulate over time, resulting in gaps if you return to the same position again. The **Extended** setting may give better results, but will take longer.

Stray Point Filtering

Removes stray points, creating a cleaner overall look. Select **Standard** to remove stray points without additional 3D smoothing. This setting tends to make edges and corners look better. Select **Smooth** to add additional 3D smoothing. This setting tends to make planes look better.

Color Optimization

Averages the color of scan points in overlapping areas within the selected scan, and adjusts color effects caused by different lighting situations.

Delete Raw Data

Deletes the raw scan data and the project history after processing is complete. Select this option only if you are sure that you never want to process the scan again.

Configure Processing – Automatic Registration

Perform Automatic Registration

Select this option to enable automatic registration after the processing. If the automatic registration is enabled, more registration settings will appear. These settings vary depending on the selected Registration Method.

General

The scanner’s sensor data that will be used during registration:

- The inclinometer data will be used for all registration methods.
- The compass data will be used for top-view-based and target-based registration.

NOTE: Sensor data can only be used if the sensors were enabled during scanning.

Use Inclinometer

Normally, inclinometer data is available and used by default to level the scans during registration.

Leveling ensures that the z-axis of the registered scan corresponds to the z-axis defined by the inclinometer. By this technique one reference can be replaced during registration. When registering with inclinometer data, this will be used as fully-trusted information and all other registration objects will be used with lower priority.

Use Compass

If the scans were recorded with a FARO Focus Laser Scanner equipped with a built-in compass, orientation information is available for the single scans. Enable this option to use this information as auxiliary information for the correspondence search. If the correspondence search cannot find any correspondences that are consistent with the compass data, this may be an indicator that the compass was influenced by environmental interference and the compass data will be ignored. If you disable this option, no compass data will be used for correspondence search.

Expert Settings

Move cluster to the center of its scans

When you create a new cluster in the correspondence view, it is shown at the center of the scans displayed on the screen. However, if you add some of the displayed scans to the cluster, it may happen that the cluster is not shown at the center of these scans. If this option is activated, the cluster is automatically moved to the center of its scans. If it is deactivated, a message is shown in which you can confirm that the cluster should be moved to the center of its scans.

Note that this does not change the global position of the clusters or scans but only the representation on the screen.

Auto Clustering

SCENE may not be able to find a spatial relationship between all scans in your scan project and only groups of scans can be registered to each other. The registration internally recognizes which scans can be registered correctly and which can not. All groups of correctly registered scans are automatically arranged in appropriate sub-clusters (named Cluster1, Cluster2 etc.).

Target-based

Find correspondences for scan positions

Mark this checkbox if the position of a scan is known, for example, by a surveyed reference point or by a reference sphere representing the position of the scanner in other scans.

Force correspondences by target names

Mark this checkbox, if you want to force correspondences by target names. The targets in each scan must be named according to their counterparts in the other scans. This feature requires that targets are already detected by SCENE. In **Settings** > **Process**, select a target search, then run **Process**. After that, open the cluster or the scans in **Explore**. You can then click the target's names the in structure view and rename them.

Use Checkerboard Normals

If this setting is active, the normals of checkerboards are used for the correspondence search. Uncheck if the direction of checkerboards has changed from one scan to another. For example, if you use checkerboard targets that can be tilted and turned for a precise orientation to the scanner.

Target Distribution Threshold

Sets the limit for registration. If targets are too near to one another, registration will be refused. In this case, lowering the limits gives you a result.

Top-view-based

Subsampling

The result of the registration can be adjusted through the subsampling rate. The value defines the size of the grid in which scan point homogenization is performed. The resulting grid of points will be used to perform the registration. When you move the slider, the set value will be shown. Five centimeters (0.05m) usually work for all environments. If you are indoors, in an industrial environment, you can reduce the subsampling to 0.35m or even 0.25m.

Reliability

The reliability value determines the amount of additional checks on a registration. It filters out results that could be contested. Higher values allow for more certainty, but could affect the needed time by algorithm to provide a solution. Set the slider to the value which you expect to bring the result you want. As soon as you move the button, the set value will be shown.

Cloud-to-Cloud

Subsampling

The result of the registration can be adjusted through the subsampling rate. The value defines the size of the grid in which scan point homogenization is performed.

Set the slider to the value which should bring the result you want. As soon as you move the handle, the set value will be shown.

Calculate Target-based Statistics

If this setting is active and the scan contains targets, the target-based statistics are calculated in addition to the scan point statistics. In other words, the registration will also return the target errors. You can use the result as a double-check of the registration result. Note however, that only the scan points are used for the registration.

Maximum number of iterations

You can define the maximum number of iterations for the algorithm to find the best solution. By default, this parameter is set to 30 iterations.

Maximum search distance

The maximum distance in which the registration searches for corresponding points. The maximum search distance must be larger than the initial misplacement. By default, the distance is set to 10 meters.

Top View and Cloud-to-Cloud

Shows settings for both, top-view-based and cloud-to-cloud registration, see above.

Start Processing and Check Processing Results

1. Start Processing by clicking the **Process Scans** button.

2. Select a scan, a cluster, or the entire project. Then, click the **Configure Processing** button.

3. The **Configure Processing** dialog provides the same settings as the Processing Settings, and also some options for automatic registration. However, here, the settings are only valid for this task.

Results

When processing is finished, a dialog is shown in which shows the results.

The dialog is color coded:

- green: all scans were successfully processed. Clicking the result line will show the list of scans.
- yellow: some scans were successfully processed, but there are scans which need special treatment. This dialog would consist of two parts: a list of scans which were processed successfully, and a list with scans which could not be processed. Clicking the result lines will show the list of scans.
- red: no scan could be processed.

Moving Objects Filter

The *moving objects filter* (valid only for laser scanner scans) provides a method for removing scan points created from objects that are present in one scan, but which are not present in the same area in another scan. An example of this is a car which was parked in one scan, but drove away before the next scan was made, or a person who walks through the area during scanning. The moving objects filter compares areas that were recorded in two or more scans, finds objects that are present in one scan, but not in others, then removes the points created by that object.

NOTE: The results of the filter are only visible in the 3D view. The planar and quick views are not changed because the filter only removes scan points. Because the filter does not modify color values, it will not correct the color values of scan points that were incorrectly colorized due to moving objects.

- Before you begin, ensure that the scans in the cluster you want to process are registered.
- Scans of areas containing mirrors, highly reflective objects, or windows, may contain stray scan points that are incorrect. You should delete those scan points before running the filter otherwise valid points of other scans might be filtered accidentally.
- To see the results, first locate the moving objects in the 3D view and create a viewpoint. After running the filter, return to the viewpoint and verify that the scan points that you expected were removed.

Apply the moving objects filter

Use the procedure below to apply the moving objects filter.

1. Save the project so that if the results of the moving objects filter are not what you expect, you can revert to the last saved version and try with different settings.
2. Select the **Processing** tab.
3. Select a cluster of registered scans. If the scans in the cluster you want to process are not registered, click **Cancel**, register the cluster and return to the moving objects filter. (If you are working with a FARO Swift scan, note that stationary scans use the moving objects filter, but mobile scans cannot.)
4. Click **Configure Filter.** Adjust the sensitivity, overlap threshold and maximum scan comparisons as needed. We suggest that you use the defaults first, and adjust if the results are not what you expect.
5. Click **Start Filter** to begin running the filter. Depending on your processing speed and the number of scans in the cluster, this can take a long time.
6. When the filter completes, check the 3D view to ensure that the scan points created by moving objects were removed. If the results are not what you expected, revert to the last saved version of the project and try again with different settings.

Hand-held Scan Repair

Unlike stationary scanners, which record objects only once per scan, hand-held scanners record pictures of the objects they are scanning multiple times each second. Each of these pictures is called a *frame*. The scanner keeps track of where it is in space by comparing one frame to another, and builds a single, coherent scan out of all the frames. This process is called *tracking.*

It’s normal for very small measurement errors to occur during tracking. In most cases, these errors are normalized by processing software, and are not visible in the final scan. But if a scan is long, and especially if it records the same objects at the beginning and end of the scan, it can happen that the cumulative tracking errors prevent the processing software from correctly merging objects that were recorded at different times in the scan. This can result in a scan where some objects are duplicated, or appear thicker than they actually are. See figure below for an example.

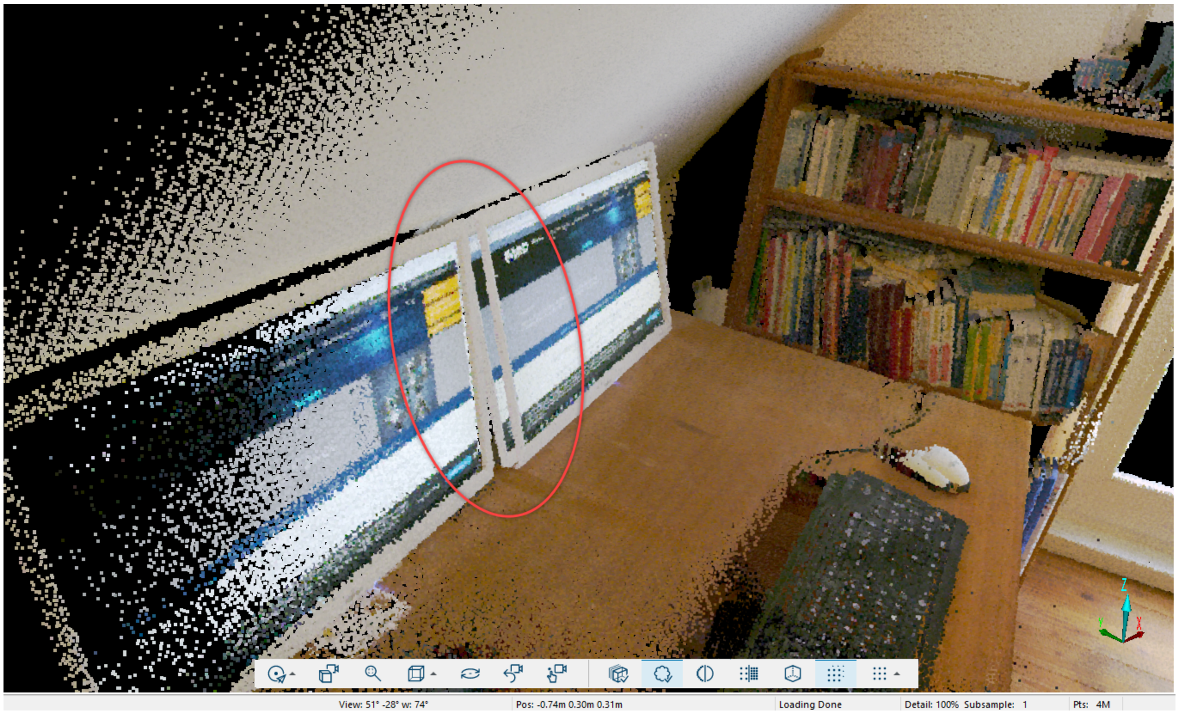


Figure 8-4 Duplicate object

The hand-held Scan Repair tool provides an option for an automatic scan repair as well as another option for a manual scan repair.

Automatic Scan Repair

1. In the Processing tab, open the scan that you want to repair in a 3D view.
2. Click the **Handheld Scan Repair** icon.
3. Click button **Automatic Scan Repair**.

SCENE now starts the repair process. When the repair process is finished, the repaired scan ins shown in a 3D view.

4. When it is finished, check whether the result is satisfactory.

If you are not satisfied with the result, you can repeat the automatic scan repair or start a manual scan repair, see below.

Manual Scan Repair

1. In the Processing tab, open the scan that you want to repair in a 3D view.
2. Click the **Handheld Scan Repair** icon.

3. Arrange the scan so that you can see the area that you want to repair.

4. Click the **Selection** button.
   The selection tools appear.

5. Use the selection tools to select the area that you want to repair.
   Note that the repair tool requires planes to function correctly. Ensure that the area you select contains one or more planes.

If there are no planes in the selected area, you can also run the repair with irregular planes. For this purpose, select **Scan Repair > Cloud2Cloud > Run and Add** after you have created the repair area in step 6.

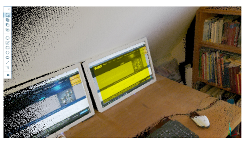


Figure 8-5 Surface selected

6. Select **Scan Repair** > **Create Repair Area**
   If the area you selected was recorded at two different times during the scan, you will see some scan points turn green and other scan points turn red. The two colors show the two sets of consecutive frames in which the objects were recorded. (If the area was recorded more than twice, additional colors will be visible, one for each set of consecutive frames.)
   Where the red and green points overlap, you will see them mix. This shows how the repair tool will merge the objects.

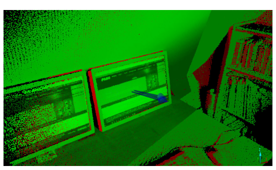


Figure 8-6 Repair area created

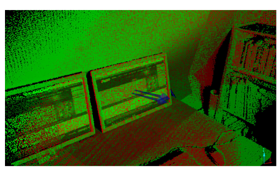


Figure 8-7 Scan repair preview

7. Select **Scan Repair** > **Apply** to make the changes permanent.
   See figures below to compare the original and the repaired scan.

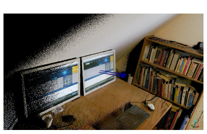


Figure 8-8 After repair

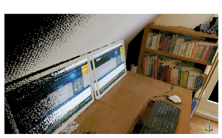


Figure 8-9 Before repair

Chapter 9: Registration

Scan points are recorded and saved in a coordinate system which is relative to the scanner. The point of origin for this scan coordinate system is the position where the laser meets the mirror. The coordinates of this point are x = 0, y = 0, z = 0. If you have two or more scans taken at different locations in a room, each scan will only know its own scan coordinate systems right after scanning.

In reality however, the origins of these scan coordinate systems are at different positions in the room. Therefore, it is necessary to determine the spatial relationship between them. This is called *registration*, and the step from the scan coordinate system into the overall coordinate system is called *transformation*.

The scans of your scan project might have a rough initial placement derived from the sensors of the laser scanner (GPS, Altimeter, Inclinometer or Compass), but, in general, it is still necessary to perform a registration to get a more precise spatial relationship between the scans.

Registration Dashboard

The Registration Dashboard will guide you through the registration process. It informs you of the status, and it helps you to perform the necessary steps to get the desired results.

The Registration Dashboard shows a hierarchical view of the registration relevant objects: clusters and scans.

For clusters, it includes their current registration status and it allows registration relevant actions on the cluster.

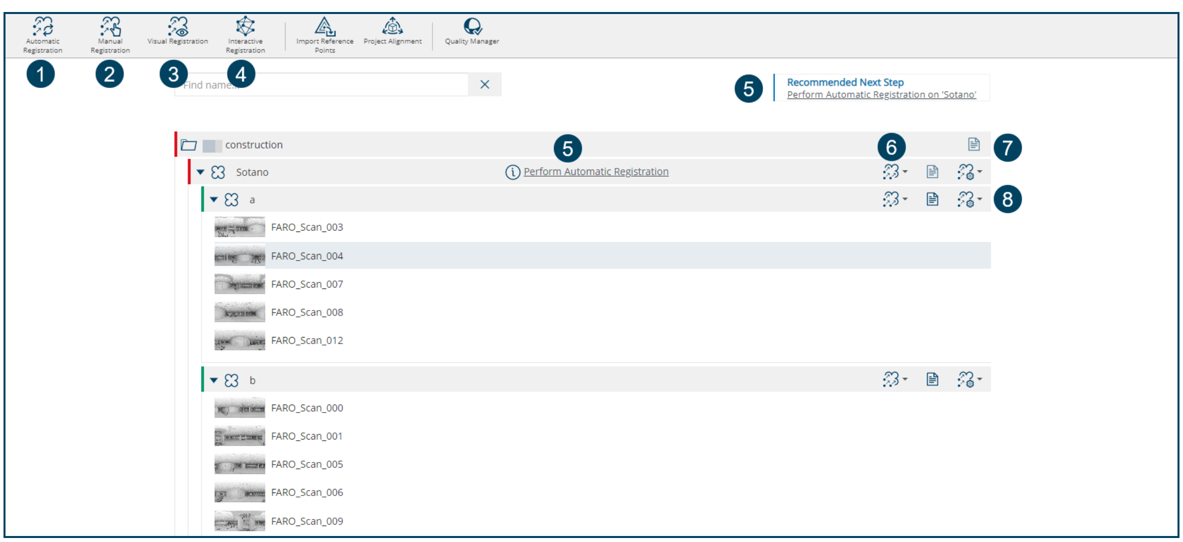


Figure 9-1 Registration Dashboard

① Automatic registration: select the cluster and an automatic registration will be executed afterwards.

② Manual registration: select the cluster and a manual registration will be executed after you have marked some scan points which the scans in this cluster have in common.

③ Visual registration: select the cluster and then drag scans and clusters to the right position by view. It is recommended to use the interactive registration instead.

④ Interactive Registration: opens the Interactive Registration page (available since version 2023.1). Note that this type of registration does not follow the workflow outlined on this page.

⑤ **Recommendation button:** click to execute the recommended type of action.

⑥ **Cluster registration options:** select automatic, manual or visual registration of the cluster.

⑦ Registration Report: shows the Registration Report.

⑧ **More** button: provides additional cluster handling functions.

To view a specific scan or cluster, collapse or expand a cluster by clicking on it.

If you click the preview image, it will be shown enlarged.

Registration Status

Colors

For each cluster, the current registration status is shown with a colored line in front of the cluster's name. The registration status describes how well the subordinate clusters or scans are registered against each other.

The following colors are possible:

- Green: A registration was performed and successful and you verified the result.
- Yellow
  - A registration was performed and successful, but you did not verify it yet.
  - A registration was successfully performed and verified by the user, but an optimization is recommended through the used registration method.
- Red
  - This cluster is not registered at all.
  - A registration was performed but failed.

Hints

The Registration Dashboard shows a hint, if available, for a cluster. The hint can help you with what is the best to do next with that cluster. The following hints are possible:

- Perform *Manual Registration* on page 126: Perform a Manual Registration on this cluster.
- Perform *Automatic Registration* on page 123 Perform an Automatic Registration on this cluster.
- Optimize Registration: Optimize the registration result by performing a cloud-to-cloud registration or target-based registration if targets exist.
- Verify registration: A registration on a cluster was performed, but you have not verified the result yet.

Registration Dashboard – Filter functions

The elements shown in the **Registration Dashboard** can be filtered by name.

Filter by name

Use the text field to filter by names. As soon as you start typing a search string, the filter is automatically applied. Clear the search field by clicking the **Clear Entry** button.

Clusters

A cluster usually collects scans which somehow belong together, for example scans which were recorded on the same floor of a building, or scans which were taken in the same room. Scan groups, created during the scanning process, are also automatically put into clusters when they are imported into SCENE.

Clusters are marked with an icon.

The Registration Dashboard allows modifying clusters in a fast and comfortable way. You can either use the buttons on the right side or click the links provided by the Registration Dashboard.

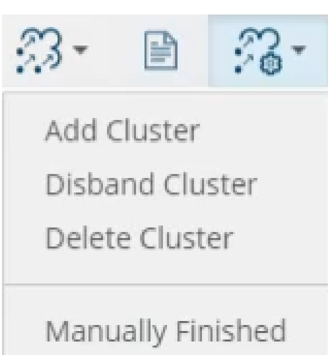


Figure 9-2 Finished cluster

You can define standard settings for clusters in the General Registration Settings.

Add Cluster

1. In the Registration Dashboard, open the **Cluster Management** dropdown list, then click **Add Cluster**. A new cluster will be inserted below the one in which you clicked the button.
2. If required, name the new cluster, and click the ✓ button.

Drag and Drop Cluster

If you want the cluster at another place, drag and drop it to its new place. SCENE checks if it is allowed to drop the cluster at the new place.

Disband Cluster

In the Registration Dashboard, open the **Cluster Management** dropdown list, then click **Disband Cluster**. The cluster and its scans will be added to the superordinate cluster. Note that clusters which are scan groups cannot be disbanded.

Delete Cluster

1. In the Registration Dashboard, open the **Cluster Management** dropdown list, then click **Delete Cluster**.
   A warning message will be shown.
2. Click the **OK** button to delete the cluster and its content.

Manually Finish Cluster

Sometimes clusters are already registered correctly, but SCENE keeps suggesting additional steps because it assumes the cluster is not yet finished. This can happen, for example, when a project was registered with an older version of SCENE, or if you decline to optimize the registration.

In such cases the **Manually Finished** feature can be used to force a clusters status to finished (green).

In the Registration Dashboard, open the **Cluster Management** dropdown list, then click **Manually Finished**.

If this feature is enabled for a cluster, the cluster is displayed as finished (green) and contains a hint that explains the status (to not confuse it with the finished status computed by SCENE). When you click the hint, a popup is displayed.

To undo the **Manually Finished** status you can:

- Click **Remove Manually Finished** at the bottom of the popup.
- Open the **Cluster Management** and click **Manually Finished** again.

  - **NOTE:** The activation works recursively. That means if you enable **Manually Finished** for a cluster, all subordinate clusters will be also marked. The same applies for removing the **Manually Finished** status. All subordinated clusters will get their “real” registration status back.

    The **Manually Finished** feature locks the cluster and all its subordinate clusters. The flag tells SCENE that the cluster should always be displayed as finished. Any registration task can be started as usual on the cluster, but you will not be able to see the resulting registration status until you remove the Manually Finished flag.

Lock and Unlock Clusters for Registration

You can lock and unlock clusters with the Scan Manager of the corresponding cluster.

Lock a Cluster

1. Right-click the cluster Scan Manager.
2. Select **Lock all** from the context menu.
   The cluster and all its child clusters will be locked.

Unlock a Cluster

1. Right-click the cluster Scan Manager.
2. Select **Unlock** from the context menu.
   The cluster and all its parent clusters will be unlocked

Locked cluster Behavior

The relative position of scans within a locked cluster won’t change. However, the entire cluster will be moved to be registered against external scans or clusters.

A locked cluster is not flexible, i.e., you can translate and rotate the entire cluster, but you cannot change its shape or internal geometry.

You should lock clusters after you have finished the registration. Otherwise, SCENE will consider the registration as not verified. If this happens, you can, of course, simply run the verification procedure. When this procedure is finished successfully, all clusters will be locked.

Unlocked Cluster Behavior

The relative positions of scans within an unlocked cluster as well as the cluster position will be modified to be registered against external scans or clusters.

An unlocked cluster is flexible, i.e., you can translate and rotate the entire cluster, and you can also change its shape and internal geometry.

Targets

Targets are physical objects in the area to be scanned that SCENE can detect and use to register the scans. A target can be a naturally occurring plane such as a wall or desk, or you can use extra objects made specifically to function as targets. These artificial targets are spheres, checkerboards, and markers.

There are several things to consider when deciding which type of targets to use.

- Since planes probably exist in the environment you are scanning, you don’t have to do anything extra to use them. But you can’t be sure that your environment will have enough planes, and you can’t document the location of the target by other means, i.e., via GPS coordinates.
- Spheres are highly accurate at any angle to the scanner and are often used in conjunction with GPS coordinates, but they are more expensive than printed targets, and can be bulky to transport.
- Both checkerboards and markers can be printed with your laser printer. They are easy to transport and replace, but they do not work if they are placed at an oblique angle to the scanner.
- Checkerboards, when scanned at right angles, can be detected at greater distances than other types of targets.
- Markers and planes can be automatically detected in scans made by both the FARO Focus Laser Scanners and FARO Hand-held Scanners, so you can use one set of targets for both types of scanner.

Spheres

Three-dimensional, white surveying spheres can be used as targets. A sphere is determined by its position and its radius, and its central point is used for the registration. Hence, you can add global position information to the sphere’s property.

NOTE: Sphere search works best with surveying spheres that are meant for registration. Forensic spheres (used for determining shot trajectories) may not be found by this target search.

Spheres with Preset Radius

This type of sphere is particularly well-suited to fitting survey spheres, because their radius is known in advance. Use one of the following options to create spheres with a preset radius:

- During the Manual Registration, select the **Mark Sphere** button.
- Right-click a scan or a scan point selection, then click **Find Objects**. In the menu, select **Spheres**.

  You can predefine one or more sphere radii under **Settings** > **Processing**.

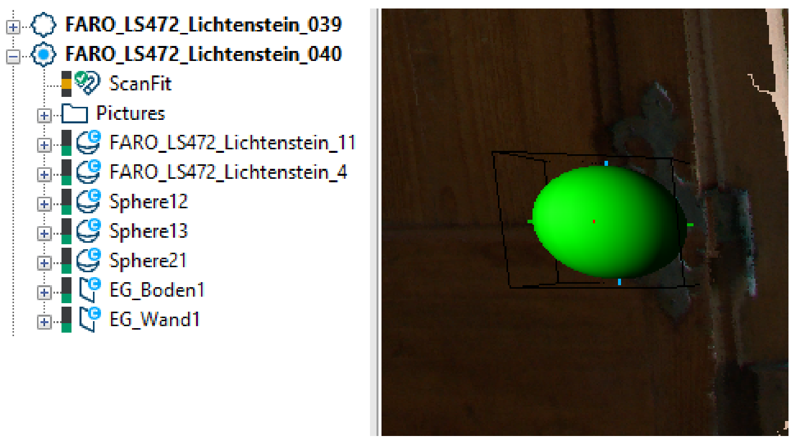


Figure 9-3 Fitted survey sphere

Checkerboards

A frequently used type of paper target is the checkerboard target. A checkerboard target fit determines the center point of the target's four quadrants. This point is used for scan registration.

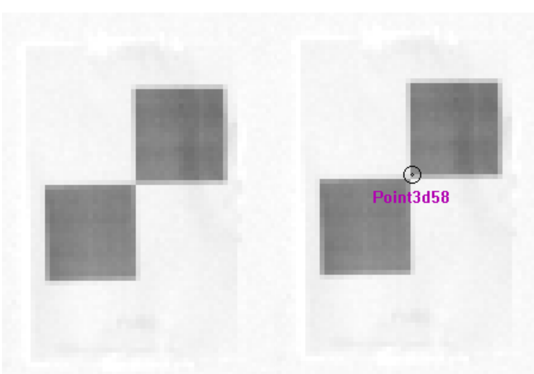


Figure 9-4 Checkerboard target and fitted checkerboard point

Creating checkerboard points

1. During the Manual Registration, select the **Mark Checker Board** button .
2. Right-click a scan or a scan point selection, then click **Find Objects**.
3. In the menu, select **Checkerboards**.

Markers

Markers are printed and used like checkerboards, but unlike checkerboards, markers are unique. This means that correspondences between scans are only possible for markers with the same ID. After installing SCENE, a PDF file containing 200, A4-size pages each with one marker and one unique ID can be found at:

```
<Installation Path>\
RegistrationMarkers\RegistrationMarkersA4.pdf
```

You can print the markers at a reduced size to cover up less of the area that you are scanning but this will change the maximum distance at which the markers can be detected. The table below shows the distances at which markers can be detected depending on scan resolution and marker size. Note that the markers must be placed orthogonally (at right angles) to the scanning direction to reach these limits. The values shown in the table can be increased by 20% when fully processing scans that have color images.

Scan Resolution	Marker size 100% 15.5cm (6 in)	Marker size 75% 11.7cm (4.5 in)	Marker size 50% 8 cm (3 in)
1/16	4 m (13 ft, 1 in)	3 m (9 ft, 10 in)	2 m (6 ft, 7 in)
1/8	7 m (22 ft, 12 in)	5 m (16 ft, 5 in)	4 m (13 ft, 1 in)
1/4	13 m (42 ft, 8 in)	9 m (29 ft, 6 in)	7 m (22 ft, 12 in)
1/2	23 m (75 ft, 6 in)	17 m (55 ft, 9 in)	13 m (42 ft, 8 in)

NOTE: To print the markers at 100% on US letter size paper, select *Actual Size*, instead of Fit or Shrink. The A4 pages will be trimmed slightly but the markers and IDs are not affected.

Marker IDs *must* be unique within a project. Ensure that you do not include two markers with the same ID in the scan area.

Circular flat target

The circular flat target (referred to as “a Circular Flat Point” in the SCENE interface) is one type of target which may be used for scan registration. The circular flat target usually consists of a white circle on a dark background. The mean point of the circle is used for the scan registration.

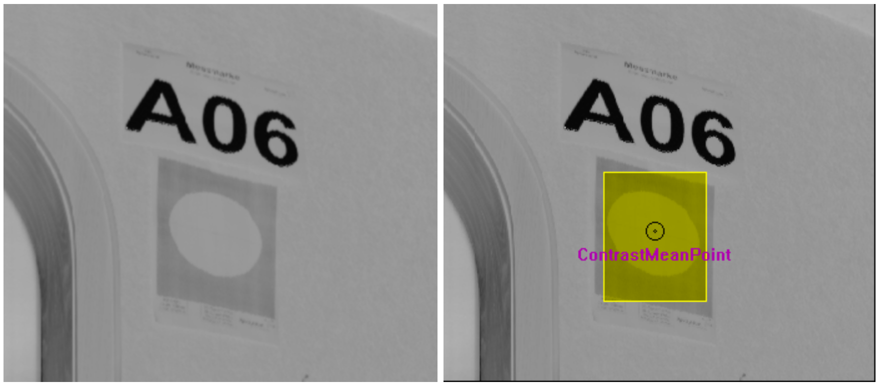


Figure 9-5 Circular flat target

To determine this mean point, select the target in the scan and use the object marker tool or the command **Create Objects > Contrast Mean Point** in the context menu of the selection. The selection should contain the complete circle and the selection should be made on the dark background. The shape of the selection is not important; only that it contains the complete circle.

NOTE: In general, it is recommended to use checkerboard targets instead of circular flat targets. The recognition of checkerboard targets is usually more precise and SCENE is able to automatically identify those targets in the scans. This makes reference creation and registration less time-consuming.

Automatic Registration

The Automatic Registration looks for similar geometric constellations in the scans. The result can then be viewed and evaluated in the correspondence view.

Automatic Registration uses inclinometer data, if activated in **Settings** > **Registration**.

Check the Registration Settings for the type of Registration to be executed. You can select among 4 options: target-based, top-view-based, cloud-to-cloud, Top View first and cloud-to-cloud registration afterwards.

If you want to run an automatic cloud-to-cloud registration, you should pre-align the scans. You can do this as follows:

- automatically with a top-view-based registration
- manually with a manual registration
- manually in the correspondence view

You can start the automatic registration as follows:

- Click the **Automatic Registration** button in the toolbar. You will then be asked to select a cluster.
- Open the **Registration** dropdown list in a cluster line, then click **Automatic Registration**. Select the settings to start registration.

- Click the recommendation to perform an Automatic Registration in a cluster line. Select the settings to start registration.

Automatic Registration from the Toolbar

1. Click the **Automatic Registration** button in the toolbar.

2. Select a cluster, then click the **Select Method** button on the upper right side.
   The **Select Method** page is shown. Available registration methods are: top-view-based, cloud-to-cloud, target-based, and a combination of top-view-based and cloud-to-cloud registration.

On the right side, the available settings for this registration method are shown. These settings correspond with those in the Registration Settings page. If necessary, modify the settings. Your modifications will now be valid for the current registration. It will not change the settings made in the Registration Settings.

3. Click the **Register and Verify** button on the upper right side.
   The registration is executed. Depending on the number of scans in this cluster, this may take some time.

4. Verify the registration.

Automatic Registration from the Cluster Line

1. Open the **Registration** dropdown list in the cluster line, then select **Start Automatic Registration**.

2. Proceed as described in the section above.

Register and Verify

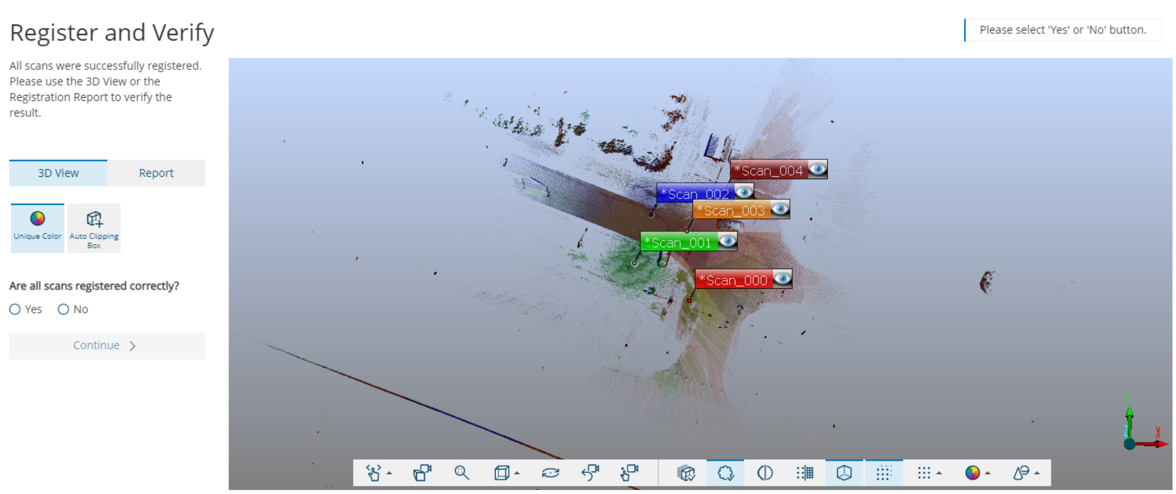


Figure 9-6 Registration task, verification: 3D view

A 3D view is displayed with which you can check if the registration was successful.

Use the following options to check:

- **Camera Mode** buttons and **View** buttons in the task panel to change the observer's view
- **View All** button to get a view on all the objects
- **Coordinate Coloring** button in the task panel to switch between scan colorization modes

Registration was successful

In the verification step, you are asked if the registration was successful.

- Yes: the cluster is marked as registered and you are returned to the dashboard.
- No: marks the registration of the cluster as failed and continues to the dashboard which will suggest a manual registration for the cluster. You can also visually verify the registration result in the correspondence view, improve the scan alignment there and then retry running an automatic registration.

Registration failed but Auto Clusters are found

If the automatic registration failed but could create one or more Auto Clusters with some partial results, the verification step for partial results will be displayed.

1. Decide which of the Auto Clusters you want to keep.
   When the task step opens, a 3D view showing all generated Auto Clusters is opened first.
2. Select a view to check the Auto Cluster. For this, use the 3D view or **Registration Report** button for each of the generated Auto Clusters.
   Additionally, there are also some tools shown in the task step that are useful for this verification step.

Every Auto Cluster that is not selected will be disbanded and its scans will be moved back to the parent cluster. The selected auto clusters will become normal clusters and are marked as registered.

The **Finished** button is colored green and clickable when this step is shown. Clicking this button finishes the task and returns you to the dashboard. The selected clusters from the verify step are shown yellow with the hint that the registration should be optimized.

Optimize Registration

Optimize Registration executes a cloud-to-cloud registration or target-based registration if targets exit with the settings you have made in the *Registration Settings* on page 52.

NOTE: If there is an **Optimize Registration** step at all depends on the settings you have made in the *Registration Settings* on page 52. **Optimize Registration** is only available if you select **Top View based registration** for the Automatic Registration or Manual Registration.

The result is Not Satisfactory?

Select the **No** checkbox and click the **Other Pair** button. You are returned to the **Select Scans** step, and you are asked to select the next scan pair.

Manual Registration

NOTE: The manual registration and the visual registration are troubleshooting options that you can use when the automatic registration does not work.

The **Manual Registration** can be executed for a cluster.

It offers the possibility to identify corresponding scan points of two scans by picking such scan points. As soon as there are sufficient corresponding scan points, SCENE will register the two scans. The result can then be viewed and evaluated in the correspondence view.

Manual Registration uses inclinometer data, if set in the *Registration Settings* on page 52.

There are three ways to start a manual registration:

- Click the **Manual Registration** button in the toolbar.
- Open the **Registration** dropdown list in the Cluster Management, then click **Manual Registration**.

Figure 9-7 Select Registration option in the Cluster Management

- Click the recommendation to perform a Manual Registration in a cluster line.

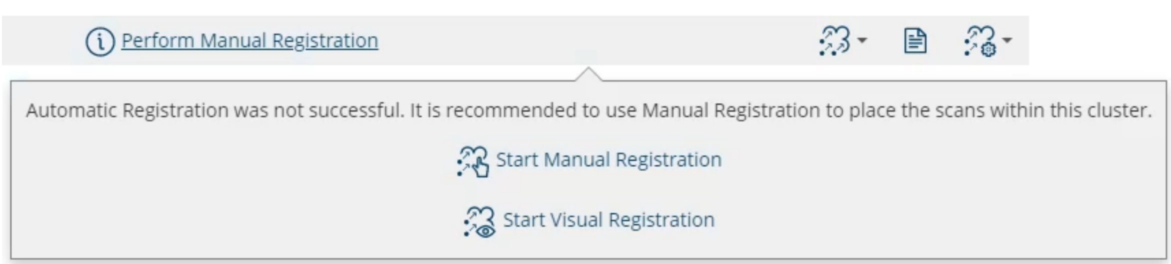


Figure 9-8 Recommendation to perform a Manual or Visual Registration

Manual Registration from the Toolbar

1. Click the **Manual Registration** button in the toolbar.

2. Select a cluster.

Manual Registration from the Cluster Line

Open the **Registration** dropdown list in the cluster’s line, then select **Manual Registration**.

Select Scans

When a cluster is selected, **Select Scans** is shown. In this step, scans or clusters that must be registered with each other, can be selected.

1. Click **Select Scans** on the upper right of the header line.
   Now, the display is divided into two columns, and each column shows previews of the scans in the selected cluster.

- You can filter the lists by name. Enter the string in the **Find name...** field above each column.

- It is also possible to sort the scans by Recording Time and Name. Click the text to open the selection, then select the type of sorting. Click the small field with the triangle to sort upwards or downwards.

- For the right column, it is possible to sort by the Best Match. Best Match means that scans with a similar recording date as the selected scan on the left side are shown first. For every sort method except for the Best Match, it is possible to reverse the sort order by clicking on the triangle next to the dropdown.

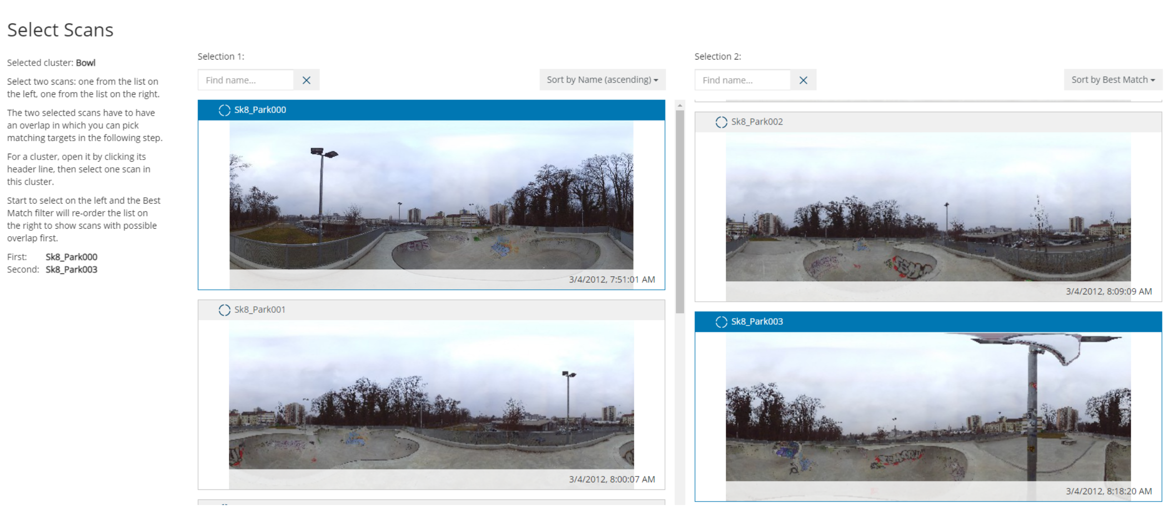


Figure 9-9 Manual Registration task, first step: select scans

2. Select a scan by clicking its preview. The header of the scan preview is marked blue. The preview of this scan in the other column will be grayed and is no longer accessible.
   - If by accident the wrong scan was clicked, simply click another one.
   - If a cluster contains a subordinate cluster, the scans in these clusters are displayed as a single group of scans. To register such a subordinate cluster, pick one representative scan. Selected subordinate clusters are also framed in color, they can be expanded or collapsed.
3. Change to the other column and select a second scan by clicking its preview. Again, the scan preview is marked with a blue triangle in its upper left corner. The preview of the same scan in the other column will be grayed and is no longer accessible.

Mark Targets

1. Click the **Mark Targets** button on the upper right side of the header. Now, the display changes to the **Split View**.
   - In the column on the left side, SCENE will show buttons, notes, and advice which guide you through the registration.
   - The two windows show each the two selected scans in a quick view.

   NOTE: Some types of scans will be shown in a 3D view, for example hand-held scans.

   Rotate, move, zoom the two scans until you have them in a useful position, i.e., they show the same part of the scenery.
2. Check for natural targets like points or planes, or artificial targets like spheres, markers or checkerboards which could be useful and which are not marked yet. Usually planes work better than points.
   - Select the **Mark Point** button to mark a point.
   - Select the **Mark Plane** button to mark a plane.
   - Select the **Mark Sphere** button to mark a sphere target.
   - Select the **Mark Checkerboard** button to mark a checkerboard target.
   - Select the Mark Marker button to mark a marker

NOTE: When marking a point in SCENE it’s possible for you to click a position where no point actually exists. SCENE always selects a group of points around the place you clicked, calculates the median point, and marks that point. (This can have unexpected consequences if the points in the group appear close in your view, but are actually far apart in the 3D view. Because of this, we suggest that, whenever possible, you mark planes instead of points.)

Plane Normals

A plane is identified by the fact that it is level, i.e., there is precisely one direction that the plane stands perpendicular to (actually, there are two such directions; however, they are exactly opposite to one another). This direction is called the Normal of the plane.

Some types of scans will be shown in a 3D view, for example Freestyle3D scans.

In this case, an additional **Invert Plane Normal** button is displayed on the image, This button can be selected to invert the Normal. This avoids that the scan is placed with a flipped orientation. Mark the targets by hopping and clicking between the windows.

Correspondence Tools

There are three tools that can help you locate and work with correspondences: Find Correspondences, Clear Correspondences and Force Correspondence

Find Correspondence

When you click this icon, SCENE will attempt to automatically locate correspondences in the scans. If SCENE detects that there are correspondences among the newly marked objects, or one of the newly marked target corresponds to an earlier marked target, it will mark them with a label.

NOTE: A label shows a name with a maximum of 9 characters. If the name has more characters, only the last 8 will be displayed and an asterisk (*) will replace the missing characters. As soon as you click a label, the name is shown completely.

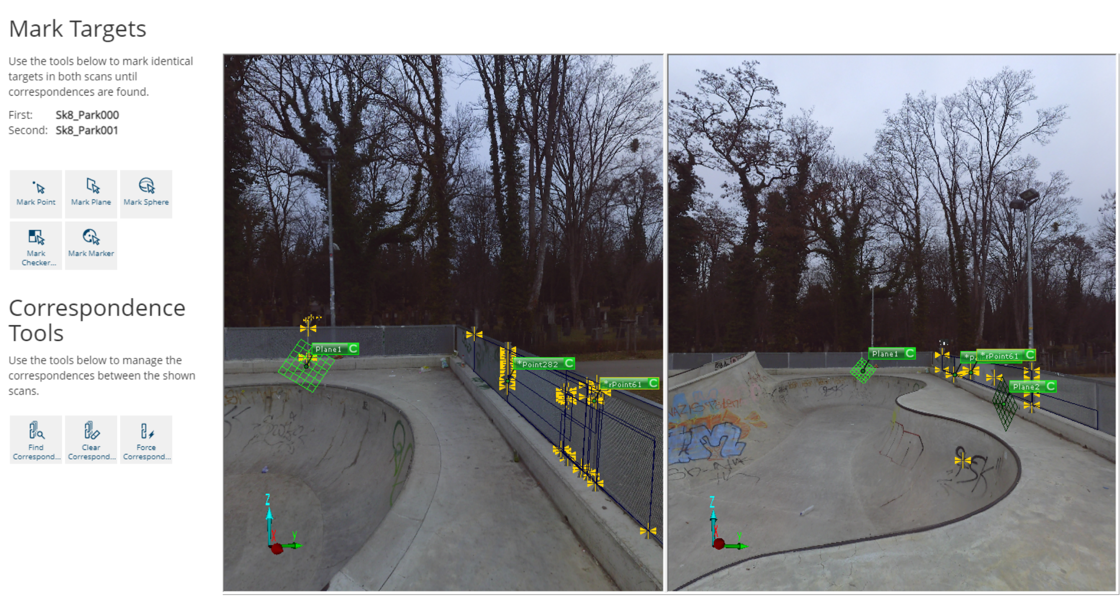


Figure 9-10 Split View with detected correspondences

The label then has a small green field with a "C" which indicates that those correspondences were found automatically.

The frame around the label symbolizes the quality of the correspondence:

- Green: good quality
- Yellow: compromised quality
- Red: seriously compromised quality

Continue with marking correspondences until the button on the upper right side changes from **Mark Targets** to **Register and Verify**, and gets a green color. This means that there is a sufficient number of correspondences to perform the registration.

Clear Correspondence

If you want to start over, you can click the clear correspondences button to remove all correspondences.

Force Correspondence

You can force a correspondence between two points. Click the **Force Correspondence** button; the cursor changes to show cross-hairs: . Click the two points where you want to force the correspondence. Use it only if you are very sure that your targets are placed correctly. For this purpose, you can also select unique locations in the scan, for example, a unique wall in the scan or a corner of a door or window.

Delete specific targets or correspondences

It may happen that, at the end, your scans show marked targets which were not needed for a correspondence, or you want to delete a correspondence because it is wrong.

Right-click the correspondence, then click **Delete 'name'**.

If two or more correspondences are very close to one another, a list will be shown. Select one of the correspondences by clicking on it, then click **Delete 'name'**.

Register and Verify

1. Click the **Register and Verify** button on the upper right side.
   The registration is executed.
2. Verify the registration.
3. Click either the **Finish** button, if there are no more scans in this cluster, or click the **Next Pair** button to register the next scan pair.

Auto Cluster

To save registered pairs during registration, they are moved into a so-called AutoCluster. It is created below the previously selected cluster, which is the cluster in which scans pairs are to be registered. If SCENE needs more than one AutoCluster, these AutoClusters are numbered.

After all scans and clusters were registered, these automatically created clusters are removed.

NOTE: If you cancel a registration for some reason, you will see such an Auto Cluster in the Registration Dashboard.

Optimize Registration

Optimize Registration always offers a Cloud-to-Cloud registration. To do this, click the **Start Optimization: Cloud-to-Cloud** button.

After a manual registration, the cluster contains scans with user-defined targets. A target-based registration can be performed using **Start Optimization: Target Based step** button.

Visual Registration

NOTE: The manual registration and the visual registration are troubleshooting options that you can use when the automatic registration does not work.

Visual Registration provides an option to place scans and clusters view by moving them with drag and drop. In other words, the visual registration is like a puzzle where you have to fit the pieces, i.e., the scans, together. The result can then be viewed and evaluated in the correspondence view. After a placing, an Automatic Registration can be started to refine the registration.

There are three ways to start a **Visual Registration**:

- Click the **Visual Registration** button in the **Registration** toolbar.
  You will then be asked to select a cluster.
- Click the **Visual Registration** button in a cluster line. Select the settings to start registration.

Figure 9-11 Select Registration option in the Cluster Management

- Click the recommendation to perform a **Visual Registration** in a cluster line. Select the settings to start registration.

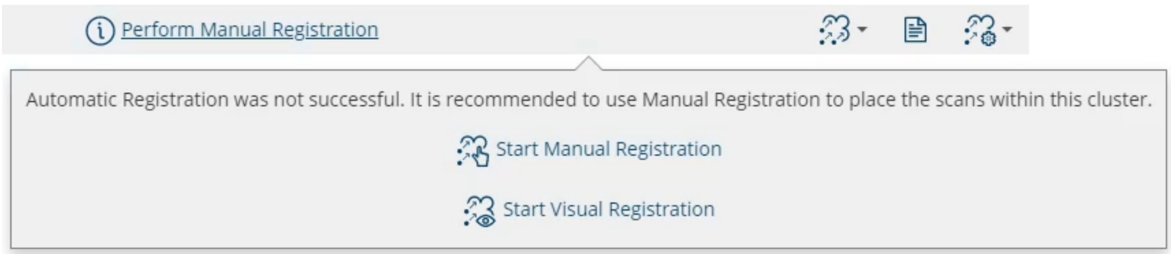


Figure 9-12 Recommendation to perform a Manual or Visual Registration

Select Cluster

In the first step, select a cluster that must be used for registration.

Select Method

In the second step, select a method that must be used for registration:

1. Click the **Select Method** button on the upper right side. The **Select Method** dialog is shown.
2. Visual Registration provides only two methods:
   - Cloud-to-Cloud
   - Target-based

Place and Register

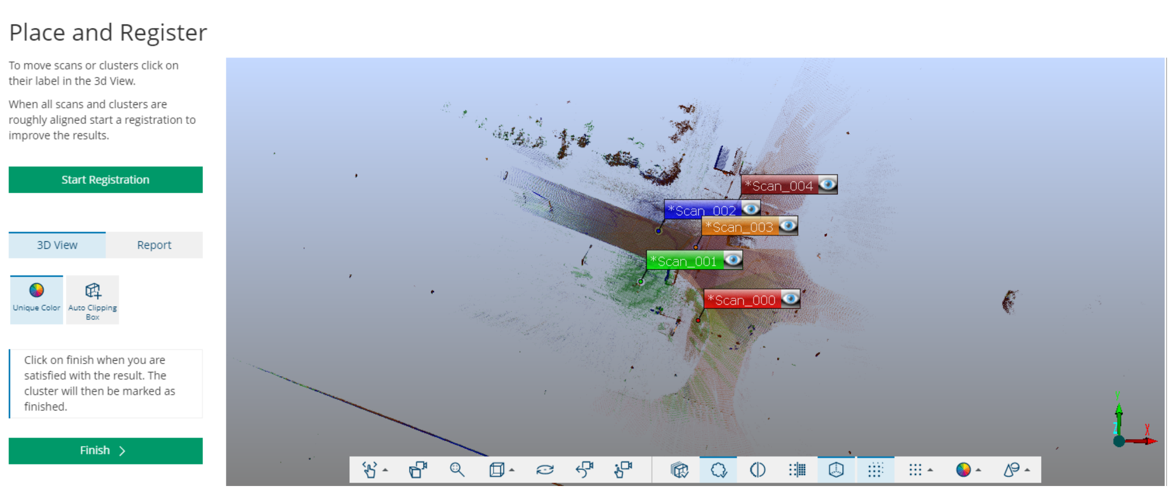


Figure 9-13 Visual Registration: Place and Register Scan

In the third step, place and register the scans. For this purpose, think of the scans as pieces of a puzzle that you must assemble.

A correspondence view is opened on the selected cluster.

1. Click the scan tag.
   Rotation and movement manipulators are shown on the scan.

2. Drag and drop the scans.
   Look for unique points in the scans, e.g., trees or buildings and align them. To adjust the height, select the side view (front, back, left or right).

3. Place all scans and clusters correctly in the correspondence view. Click the button **Start Registration**.

If the registration is successful, the result is displayed in the 3D view or through the Registration Report. If the registration is not successful, a dialog is shown to inform the user.

NOTE: To better be able to place the scans/clusters and verify the result, select **Unique Color** or **Scan Color** or create an **Auto Clipping Box**.

Interactive Registration

The interactive registration, developed in cooperation with FARO key customers, allows registering large and complex projects. While you can still use the automatic, manual and visual registration options, the interactive registration now provides intuitive, graphical workflows to register scans.

1. To start the interactive registration, click tab **Registration** in the workflow bar.

2. Then click icon  to access the interactive registration.

The interactive registration contains the following tool groups.

Figure 9-14 Interactive registration tools

① Registration views

② Automatic registration tools

③ Interactive registration tools

④ Georeferencing tools

⑤ Registration toolbar

The order of views and tools in the toolbar reflects the order of steps of the registration workflow. The registration toolbar helps you to visualize registration objects and their properties.

Workflow Descriptions and Tutorials

The interactive registration is highly workflow-driven and allows using different registration options at the same time. While you can find step-by-step descriptions of standard workflows in chapter *Interactive Registration Workflow Examples* on page 150 to get you started, we strongly recommend to watch the **Interactive Registration Tutorials** in the FARO Academy.

1. Log in to the learn.faro.com.
   If you do not have an account yet, you must create a new account.
2. Go to tab **On Demand**, search for SCENE and launch course **FARO** SCENE **Interactive Registration**.

Interactive Registration Views

This chapter provides an overview of the interactive registration views.

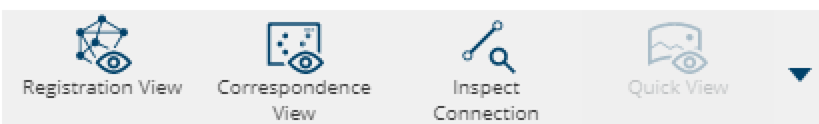


Figure 9-15 Interactive registration views

- *Registration View* on page 134
- *Correspondence View* on page 169 (link outside registration chapter)
- *Inspect Connection* on page 138
- *Quick View* on page 167 (link outside registration chapter)
- *Correspondence Split View* on page 170 (link outside registration chapter)

Registration View

Click the registration view icon .

The registration view is opened. This is the main view of the interactive registration.

If you do not select an object in the structure view, there are two options:

- There is only one cluster under the root element. In this case, the registration view of the cluster is opened.
- There is more than one cluster under the root element. In this case, the registration view of the root element is opened.

To show the registration view of a particular cluster, click the cluster you want in the structure view.

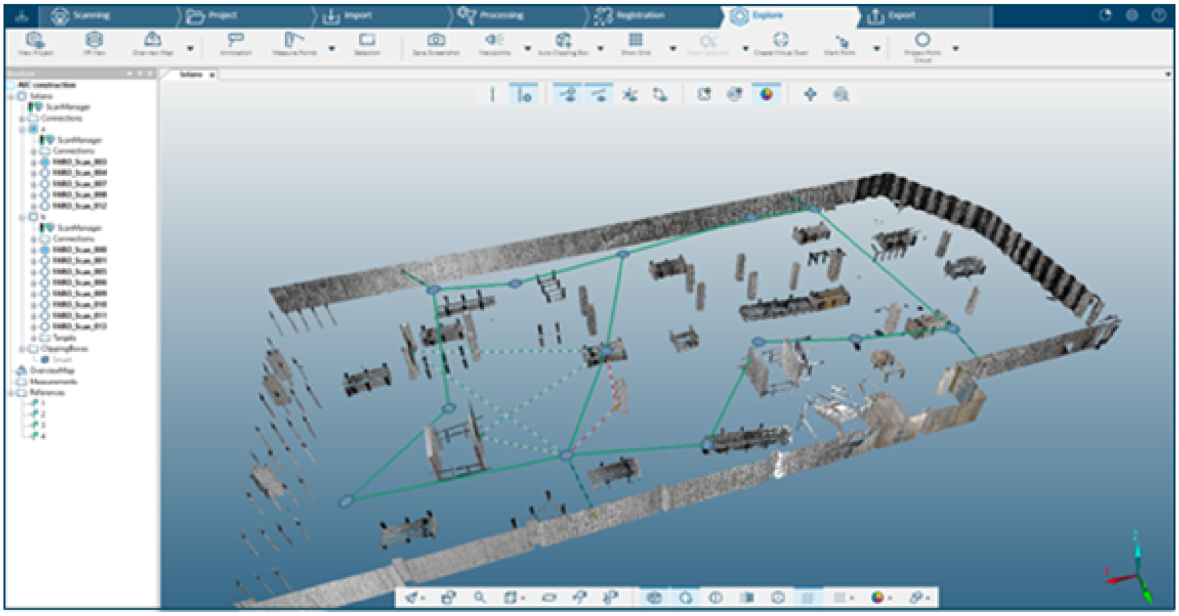


Figure 9-16 Cluster in registration view

The registration view displays the registration results in an intuitive, visual way. Connections between scans, targets and reference points are colorized based on the registration results (see below). With the interactive registration tools and the registration toolbar you can interact with the registration:

- Add, delete, edit and compute connections
- Search correspondences
- Quickly optimize scan positions
- Update the registration statistics, etc.

For further information on the interactive registration tools, see *Interactive Registration Toolbars and Tools* on page 140.

Scan Symbols

The following scan symbols may be displayed in the registration view:

Scans captured by the FARO Focus scanner

FARO Flash scans

PanoCam scans

Scans taken by another scanner

Connections

Connections are only displayed, if a pre-alignment in Stream or a previous registration in SCENE was done.

The interactive registration shows connections between scans, between scans and targets and between scans and reference points.

Connections may have different colors depending on their state:

- Blue: New connections that have not yet been refined are displayed in blue.
- Green: Connections are green if the scan point error is below the green value specified in the registration settings.
- Yellow: Connections are yellow if the scan point error is between the green and the red value specified in the registration settings.
- Red: Connections are red if the scan point error is above the red value specified in the registration settings.
- Purple: Connections are purple if they were rejected by the scan position optimization due to a big scan point error.

This color coding applies to connections between scans, between scans and targets and between scans and reference points.

① Connections between targets are solid.

② Connections between scans and targets are thin dash lines.

③ Connections between scans and reference points are thick dash lines.

See examples in the figure below:

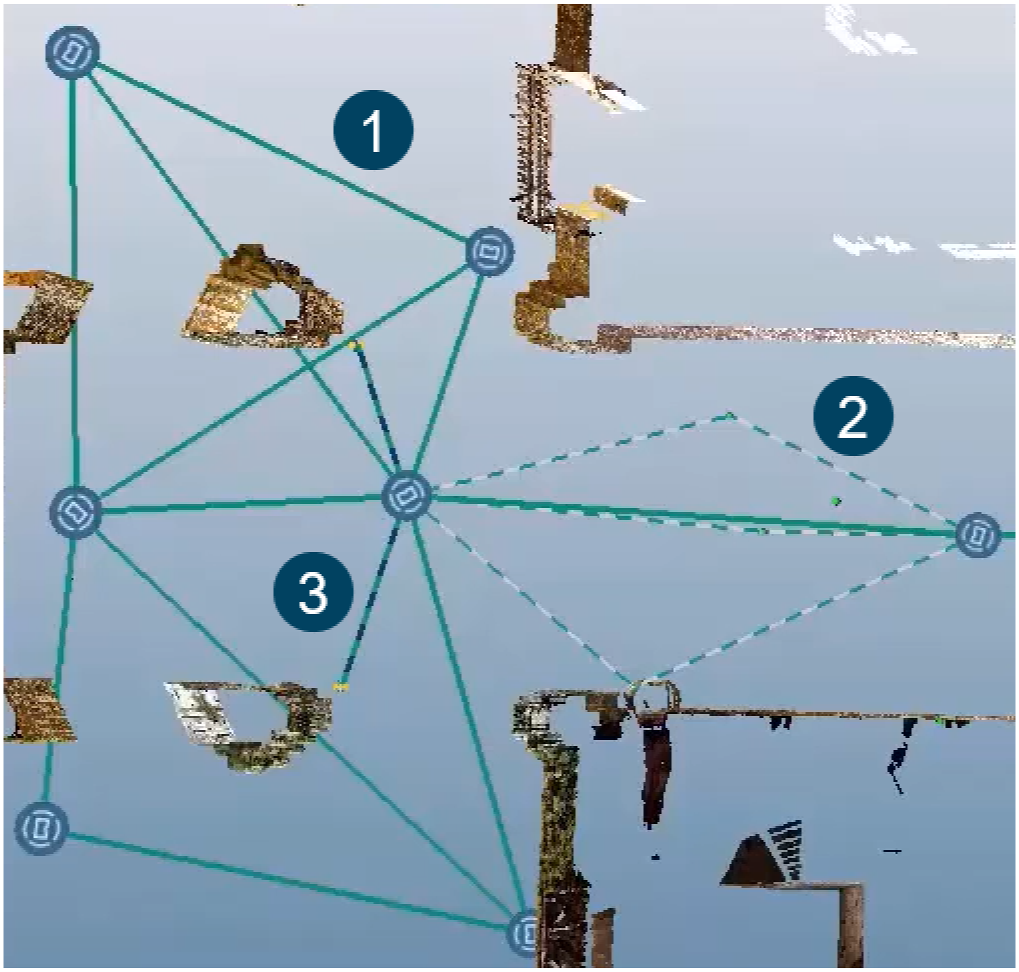


Figure 9-17 Interactive registration connections

If connections overlap, do a right-click and select the connection you want. The connection is then highlighted in the registration view and in the structure view.

Correspondence View

Click button to open the correspondence view.

You can use the correspondence view or the coarse registration to pre-align scans. For further information, refer to *Correspondence View* on page 169.

Inspect Connection

You can retrieve information about a connection and make changes as follows:

1. Click the connection you want to investigate in the registration view or in the structure view.
   The connection is highlighted. The connection object in the structure view is also highlighted.

2. Click in the toolbar.
   The **Manual Alignment** dialog opens. At the same time, the two scans connected by the connection are opened in the correspondence view.

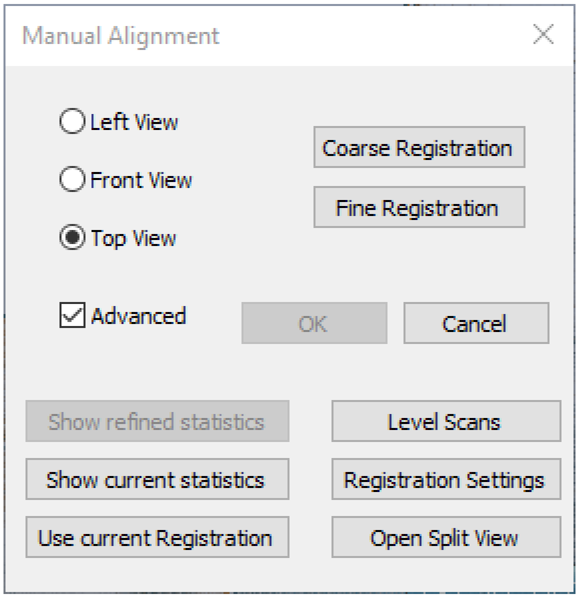


Figure 9-18 Manual Alignment dialog

Left View/Front View/Top View: Changes the orientation of the scans in the correspondence view.

Coarse Registration: Runs a coarse registration (top-view).

Fine Registration: Runs a fine registration (cloud-to-cloud).

Advanced: Marking this checkbox extends the dialog and shows the following options:

Show Refined Statistics: Shows the connection statistics after you have run a fine registration of the connection.

Show Current Statistics: Shows the current connection statistics.

Use Current Registration: Uses the current registration settings.

Level Scans: Uses the tilt sensor of the Focus data to level the scans if they were not leveled.

Registration Settings:

Open Split View: Opens the correspondence split view.
If you have worked on correspondences in the correspondence split view, make sure to close the correspondence split view and the Inspect Connection View and then run Optimize Scan Positions.

The **OK** button is only available after you have run a **Fine Registration** or clicked option **Use Current Registration**.

Quick View

- Click the scan that you want to open in the quick view.
(For this purpose, you can click the scan in the registration view or in the structure view.)

- Click in the toolbar.

Correspondence Split View

Open the dropdown behind the icon and select Correspondence Split View.

Interactive Registration Toolbars and Tools

This chapter provides an overview of the interactive registration tools. For a description of the interactive registration workflow, refer to chapter *Interactive Registration Workflow Examples* on page 150.

The interactive registration provides the following tools:

- Registration toolbar
- Automatic registration tools
- Interactive registration tools
- Georeferencing tools

In addition to these tools, you can also find the following tools that you know from the Explore toolbar, see chapter *Explore Toolbar* on page 173.

Interactive Registration Toolbar

The tools in the toolbar help you to visualize objects in the project.

Figure 9-19 Interactive registration toolbar

Connection Tools

For further information about connections, refer to *Interactive Registration Views* on page 134.

Color connections by pairwise error

- Cloud-to-Cloud connection: Shows the connections of a scan by pairwise (or local) error. The pairwise error is the error of the registration of a pair of scans. All other scans are not taken into consideration for the error calculation.
- Targets connections: Shows the fit quality of the target for spheres, planes, markers and checkerboards in each scan. Errors after registration are not taken into consideration.

To check the pairwise error:

With a target connection or a cloud-to-cloud connection selected, click icon

You can open the connection properties and check the calculated error values by right-clicking the connection in the registration view or the structure view and selecting **Properties** from the context menu. For cloud-to-cloud connections, you can also open the properties by double-clicking them in the structure view.

Color connections by global error

Shows the connections of a scan by global error. The global error is the error after the bundle adjustment. This means that all other scans and connections are taken into account.

To check the global error:

With a target connection or a cloud-to-cloud connection selected, click icon .

You can open the connection properties and check the calculated error values by right-clicking the connection in the registration view or the structure view and selecting **Properties** from the context menu. For cloud-to-cloud connections, you can also open the properties by double-clicking them in the structure view.

Reference points connections

Shows or hides connections to reference points. See also *Import Reference Points* on page 94.

Target connections

Shows or hides the connections between scans and targets. For further explanations on connections, see *Connections* on page 136.

Cloud-to-Cloud connections

Shows or hides the cloud-to-cloud connections.

All direct connections

Shows direct connections of a scan to other scans, targets, or reference points.

1. Select the scan for which you want to display all connections.
2. Click icon .

If you want to see also connections to another scan:

3. Click the next scan.
4. Click icon again.
5. Repeat for more scans if required.

Reset shown scan connections

Click icon to reset all connections that you have displayed with icon **All direct connections**.

If a scan is still selected, the connections will still be shown after you have clicked. To deselect the scan, click anywhere in the registration view.

Cluster and Scan Tools

Color points by cluster

Colors scan points by cluster.

Color points by scan

Colors scan points by scan.

Default points color

Uses the default scan point color.

Smart Clipping Box

Creates a smart clipping box around the scan positions to make them visible and hides the exterior.

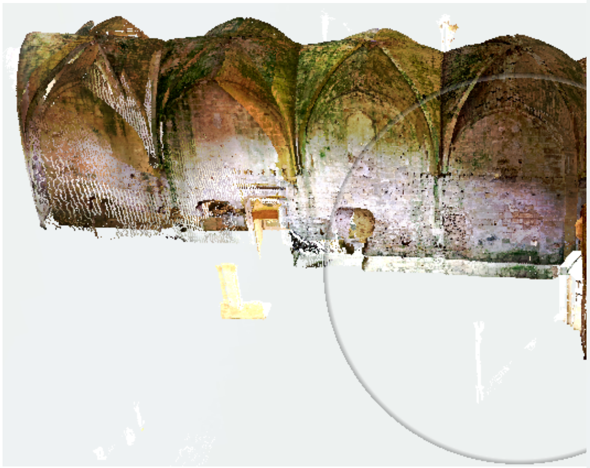


Figure 9-20 Before creating clipping box

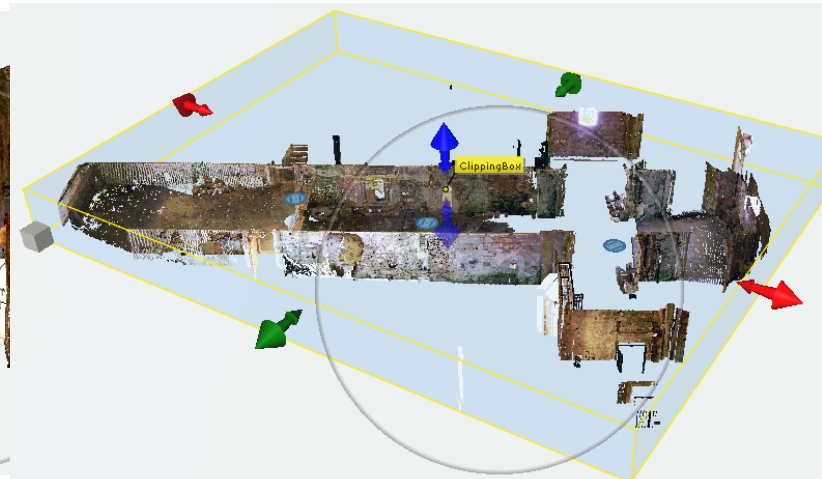


Figure 9-21 After creating clipping box

You can now manipulate the clipping box by grabbing and dragging the handles. The clipping box is stored and is available in the structure view either on project level or in the cluster in which it was created.

If you resize the clipping box to a subset of the project and you are hiding the interior or exterior, you can toggle between clipping only points and clipping everything by clicking button .

This is especially useful when you want to register a project with multiple floors.

NOTE: You must click icon in the clipping (or use the context menu) to make the clipping box invisible. Otherwise, you can't select objects in the registration view.

For further information on clipping boxes, refer to section *Clipping Boxes (3D View)* on page 194.

Identify scan

Allows you to identify to which scan a scan point belongs.

1. Click any scan point or scan point group in the registration view.
2. Click .

The scan to which the selected scan points belong is highlighted in the structure view and in the registration view.

Automatic Registration Tools

Using the tools in the order in which they are shown in the toolbar runs a complete registration.

NOTE: The following registration options will work in the selected cluster and its subclusters. If you have not selected a cluster, the registration will be run for the cluster that is displayed in the registration view and its subclusters.

Coarse Registration

NOTE: If you run a coarse registration any previous registration information will be overwritten.

After the coarse registration is finished, the Scan Manager will be displayed. This is a pre-registration method to position the scans in a way that is good enough to run a fine registration. After running a coarse registration, there might still be scan point errors with a significant value. You need to run a fine registration.

If some scans are not in a roughly right position after the coarse registration is finished, you can go to the correspondence view and change the positioning manually.

Fine Registration

Runs a fine (cloud-to-cloud) registration. Note that the scans must be pre-registered before running a fine registration.

Depending on your environment and the scan pre-alignment, you can change the **Average subsampling point distance** and the **Maximum search distance** as described below in section *Registration Settings Dialog*.

For optimum results, you should leave all clusters unlocked. The only exception to this recommendation occurs if you are registering to reference points. You can find a detailed tutorial in the FARO Academy.

When the registration is finished, the **Scan Manager** is displayed. If you go to tab **Scan Point Errors**, you can sort for the highest error value and double-click it. The connection in question is then highlighted in the registration view and in the structure view.

If you are satisfied with the registration results, you should lock the cluster that you have registered. Otherwise, the registration will be displayed as not verified. If the cluster has subordinate clusters, locking the topmost cluster will also lock all subordinate clusters.

Note that if a fine registration is run after a coarse registration or on a project that has been pre-registered in Stream, the connections between scans created by the coarse registration or Stream are refined and new connections are searched by the fine registration.

Target-based Registration

Deletes all non-forced correspondences and runs a target-based registration.

You can check the registration results in the Scan Manager of the cluster or root object that you have registered.

Registration Settings Dialog

Clicking the three-dots icon behind **Target-based Registration** opens the **Registration Settings** dialog. In this dialog, you can override settings that you have made on the registration settings page.

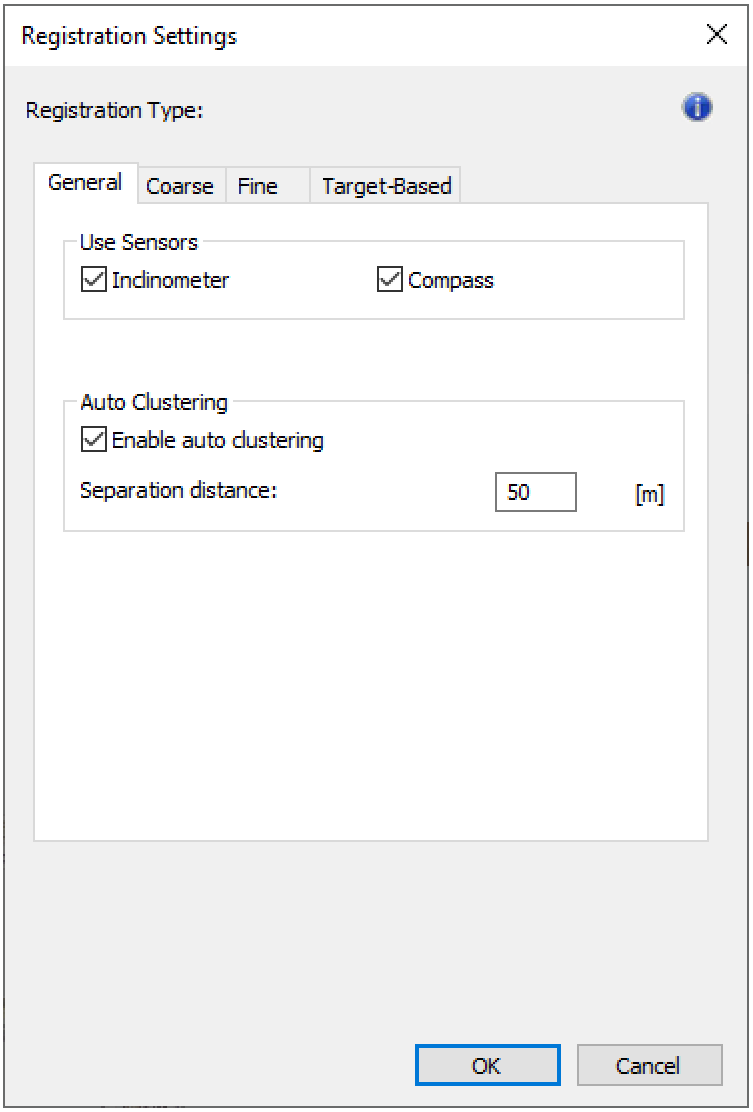


Figure 9-22 Registration Settings dialog

Tab General

Inclinometer: Leveling ensures that the z-axis of the registered scan corresponds to the z-axis defined by the inclinometer. If you select this option, the inclinometer measurement is used by the registration bundle adjustment. The inclinometer weight in the bundle adjustment is properly set by default, but you can change it from the registration weights menu, see also *Expert Settings: Adapt Bundling Weights* on page 162.

Compass: If the scans were recorded with a FARO Focus Laser Scanner equipped with a built-in compass, orientation information is available for the single scans. Enable this option to use this information as auxiliary information for the correspondence search. If the correspondence search cannot find any correspondences that are consistent with the compass data, this may be an indicator that the compass was influenced by environmental interference and the compass data will be ignored. If you disable this option, no compass data will be used for correspondence search.

Enable auto clustering: SCENE may not be able to find a spatial relationship between all scans in your scan project and only groups of scans can be registered to each other. The registration internally recognizes which scans can be registered correctly and which can not. All groups of correctly registered scans are automatically arranged in appropriate sub-clusters (named Cluster1, Cluster2 etc.).

Separation distance: Separation distance for auto clusters.

Tab Coarse

Subsampling: The result of the registration can be adjusted through the subsampling rate. The value defines the size of the grid in which scan point homogenization is performed. The resulting grid of points will be used to perform the registration. When you move the slider, the set value will be shown. Five centimeters (0.05m) usually work for all environments. If you are indoors, in an industrial environment, you can reduce the subsampling to 0.35m or even 0.25m.

Average subsampling point distance: Displays the average subsampling point distance in the current project.

Reliability: The reliability value determines the amount of additional checks on a registration. It filters out results that could be contested. Higher values allow for more certainty, but could affect the needed time by algorithm to provide a solution. Set the slider to the value which you expect to bring the result you want. As soon as you move the button, the set value will be shown.

Tab Fine

Subsampling: see above under *Tab Coarse.*

Average subsampling point distance: see above under *Tab Coarse.* Five centimeters (0.05m) usually work for all environments. If you are indoors, in an industrial environment, you can reduce the subsampling to 0.3m or 0.35m.

Maximum number of iterations: You can define the maximum number of iterations for the algorithm to find the best solution. By default, this parameter is set to 30 iterations.

Maximum search distance: The maximum distance in which the registration searches for corresponding points. The maximum search distance must be larger than the initial misplacement. By default, the distance is set to 10 meters. If the scan pre-alignment is satisfactory, you can set this parameter to 1, 3 or 5 m.

Tab Target-Based

Enable correspondence search: Enables the search for correspondences.

Find correspondences for scan positions: Mark this checkbox if the position of a scan is known, for example, by a surveyed reference point or by a reference sphere representing the position of the scanner in other scans.

Force correspondences by manual target names: Mark this checkbox, if you want to force correspondences by target names. The targets in each scan must be named according to their counterparts in the other scans. This feature requires that targets are already detected by SCENE.

Find correspondences to References: Enables the correspondence search between targets in the scans (points, spheres, markers and checkerboards) and the reference points.

Target distribution threshold: Sets the limit for registration. If targets are too near to one another, registration will be refused. In this case, lowering the limits gives you a result.

Use checkerboard normals: If this setting is active, the normals of checkerboards are used for the correspondence search. Uncheck if the direction of checkerboards has changed from one scan to another. For example, if you use checkerboard targets that can be tilted and turned for a precise orientation to the scanner.

Calculate scan point based statistics: If this setting is active, the scan point statistics are calculated in addition to the target statistics. In other words, the registration will also return the scan point errors. You can use the result as a double-check of the target-based registration. Note however, that only the targets are used for the registration.

Use principal directions of scans: Uses planes in scans to determine a principal direction for each scan. These principal directions are used to avoid wrong registration results. This setting may be useful for scanned buildings with mainly perpendicular walls. The setting is ignored for scans without planes and should be turned off in scan projects with mainly non-perpendicular planes.

Use points for validation: Enables an enhanced validation of registered scans by comparing the scan points of the scans. This additional check may help to avoid wrong registrations.

Interactive Registration Tools

Chapter *Automatic Registration Tools* on page 143 describes how you can run a coarse[1], a fine[2] and a target-based registration automatically. The interactive registration tools will help you to quickly edit and fix the results from the automatic registrations. See below some registration workflows combining these tools.

- Run a coarse and then a fine registration and then use the interactive registration tools to remove wrong connections and then use **Update Statistics**.
- Run a coarse registration and then use the interactive registration tools to add connections (to close the loop, make the registration more robust). Then, use **Refine New Connections** and **Update Statistics**.
- Import a Stream project with pre-registered scans, process the scans, and then use the interactive registration tools to add connections (to close the loop, make the registration more robust). Then, use **Refine New Connections** and **Update Statistics**.

---

[1]top-view based
[2]cloud-to-cloud

- Import a Stream project with pre-registered scans, process the scans, and then use the interactive registration tools to run a correspondence search, which uses the current scan positions. Then, use **Update Statistics**.

Figure 9-23 Interactive registration tools

Add Connections

1. Click .

2. Then, connect the scans with the mouse.

A new connection is established. In most cases, the new connection will be blue because it has not yet been computed. For example, you can add connections to close the loop in the scan capture. If a new connection automatically turns green after creating it, it had already been computed by a fine registration, but was discarded.

If there are connections with a high error in the Scan Manager, you can also delete them if they are not needed:

3. Optional: click the connection in the structure view or in the registration view, then press the DEL key to delete a connection.

For further information on connections, refer to *Connections* on page 136.

Add Correspondence

1. Open the dropdown behind **Add Connections**.

2. Select **Add Correspondence**.

Run Correspondence Search

1. Open the dropdown behind **Add Connections**.

2. Select **Run Correspondence Search** to run an automatic search for correspondences between scans.

Refine New Connections

Click this button to compute new connections, i.e. run a cloud-to-cloud on new connections that have not yet been refined. If the registration is successful, the connections' color changes to green.

Color Coding of Connections

- Blue: New connections that have not yet been refined are displayed in blue.
- Green: Connections are green if the scan point error is below the green value specified in the registration settings.
- Yellow: Connections are yellow if the scan point error is between the green and the red value specified in the registration settings.
- Red: Connections are red if the scan point error is above the red value specified in the registration settings.
- Purple: Connections are purple if they were rejected by the scan position optimization due to a big scan point error.

Optimize Scan Positions

This computes the optimization of scan positions after you have added and refined or deleted connections. It does not yet change the statistics and takes only a few seconds.

You can undo the last optimization by opening the dropdown list and selecting **Undo Last Optimization**.

Update Statistics

If you are satisfied with the scan optimization and positioning, click **Update Statistics**. This will update the Scan Manager statistics. This process may take seconds or minutes depending on the number of affected scans.

NOTE: Update Statistics also optimizes the scan positions. The reason for providing an extra button for the **Optimize Scan Positions** feature is that you may want to optimize the scan positions, change the positions and then optimize the scan positions again before you update the statistics.

Georeferencing Tools

It is recommended to lock clusters before you start a registration to reference points. This allows an initial fit of the scans to the reference points.

Import Reference Points

Opens a dialog in which you can browse the file system.

Select the reference points file you want and click open.

Register to Reference Points

After you have imported the reference points file, run **Register to Reference Points**. This registration type only finds correspondences between targets and scans to reference points. It does not find target connections between scans.

Interactive Registration Workflow Examples

In this chapter, you will find step-by-step descriptions of two standard workflows, using the automatic registration tools and the interactive registration tools. Note that the interactive registration allows you to use automatic and manual steps in one registration procedure. Therefore, we strongly recommend to watch the detailed tutorials in the FARO Academy. These tutorials include, for example, the following workflow approaches:

- Hybrid registration where you can add targets.
  Hybrid registration which allows you to use cloud-to-cloud and target connections in the same registration.
- Register to reference points using the georeferencing tools.

To open the FARO Academy:

1. Log in to the learn.faro.com.
   If you do not have an account yet, you must create a new account.
2. Go to tab **On Demand**, search for SCENE and launch course **FARO** SCENE **Interactive Registration**.

Optional Registration Settings Before you Start the Interactive Registration

Go to the Registration Report settings and change the settings as explained in the **NOTE** section.

Open the Interactive Registration

1. To start the interactive registration, click tab **Registration** in the workflow bar.

2. Then click icon to access the interactive registration.

If required, select the cluster that you want to register.

3. Click icon to open the interactive registration view.

Registration works for the selected cluster. If no cluster is selected, it works for the cluster that is displayed in the registration view as well as its subclusters.

Make Registration Objects more Visible with a Clipping Box

As a first step, you should make the objects in the registration view, scans and connections, as well as targets and reference points, more visible by setting a smart clipping box. See explanations in *Smart Clipping Box* on page 142.

Workflow: Coarse and Fine Registration with the Automatic Registration Tools

1. Make sure that the clusters you want to register are unlocked.

If the scans have not been pre-aligned with Stream or if the pre-aligning is not satisfactory, run a coarse (top-view-based) registration.

2. For this purpose, click icon **Coarse Registration**.
   Note that the coarse registration will remove any prior registration.

If required, you can inspect connections as well as add or delete connections. If the scans are not in a good position, you can go to the *Correspondence View* on page 169 and correct the scan positioning manually. At this point, the connections are still blue because they have not yet been refined.

3. Optional: Adjust the fine registration settings.

4. When the scans are positioned correctly, refine the registration with a fine registration by clicking icon .

5. Check the scan point errors in the Scan Manager.

6. Lock the cluster(s) that you have registered.
   Otherwise, the registration will be displayed as not verified.

Workflow: Fine Registration with the Interactive Registration Tools

1. Make sure that the scans are pre-aligned, either in Stream, with a coarse registration or manually in the correspondence view.
2. If required, add or delete connections.
3. Click **Refine New Connections** to run a fine registration on the new connections.
4. Click **Optimize Scan Positions**.
   This procedure takes just a few seconds and allows you to view the final positions of the scans. The scan statistics are not yet updated.
5. If you are satisfied with the scan positions, click **Update Statistics**.
   This will update the Scan Manager.
6. Lock the cluster(s) that you have registered.
   Otherwise, the registration will be displayed as not verified.

Optimize Scans after a Registration

You can only run this compensation after registering clusters with cloud-to-cloud connections between scans. You cannot run this compensation if you have used only a target-based registration.

What is Compensated by this Process?

The process analyzes the geometry within the overlap areas of multiple scans to compensate deviations in the scans. Such deviations may have different root causes including a not properly warmed up scanner, or dirty optics. See the user manual of the laser scanner for more details.

What is not Compensated by this Process?

This process does not compensate the angular errors in the scanner. If you detect a gap, for example double walls in the overlap area between the beginning and the end of the scan, you must run an on-site compensation on your scanner.

For more information, see your scanner user manual.

How to Identify Scans that are Affected by Distance Errors

After you have run a registration, you may notice some gaps, for example double walls, during the visual verification that you cannot fix as usual by changing the registration parameters or by adding or removing connections between the scans.

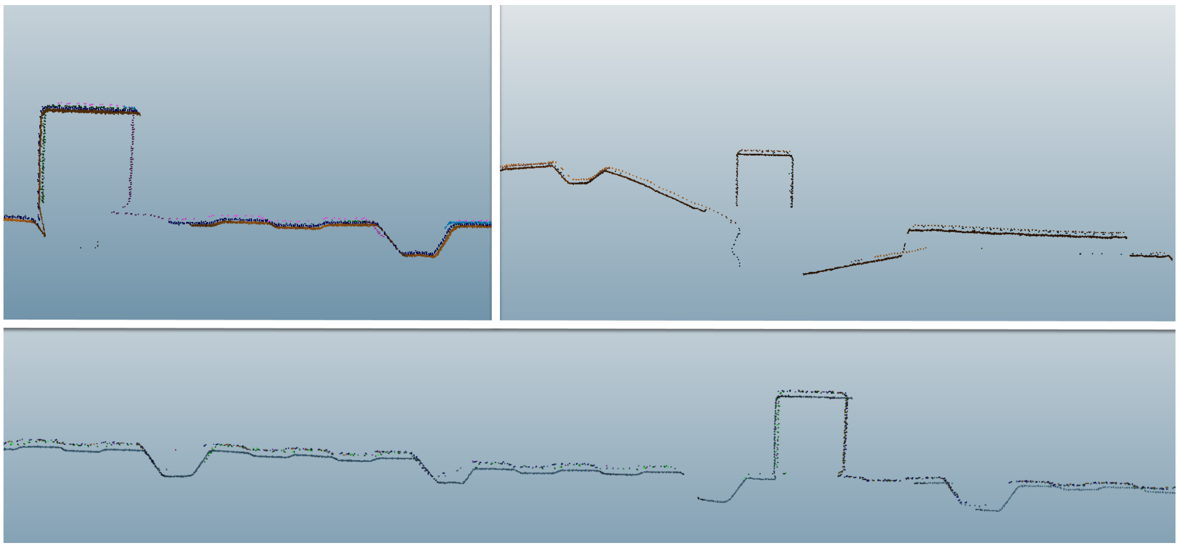


Figure 9-24 Registered scans with gaps in overlap areas

Run the Scan Optimization

Before you start the procedure, make sure that the scans are not affected by the angular error described above.

1. Go to the interactive registration.
2. Open the registration view of the cluster.
3. Unlock the Scan Manager of the cluster for which you want to run the post-registration optimization, including the subordinate clusters.
4. Right-click the cluster in the structure view and select **Operations > Registration > Post Registration Scans Optimization**.

The compensation process will start. When the process is finished, a message will be displayed telling you how much the registration mean error has been improved.

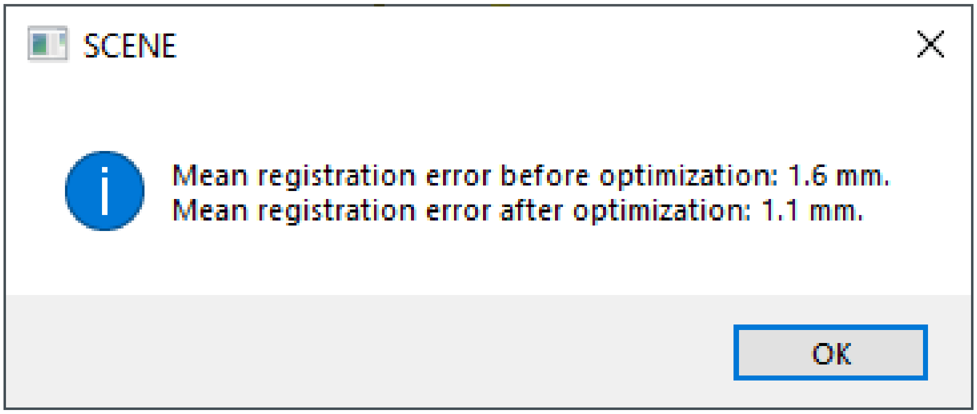


Figure 9-25 Example of an optimization message

If no scans were found for optimization, the message will be *No scans found that can be optimized*.

If serious errors were found, the algorithm will be able to improve the scans. Despite these improvements, the scans' accuracy will still be compromised. Such errors occur, for example, when a scanner mirror is extremely dirty. In such a case, the following error message will be displayed:

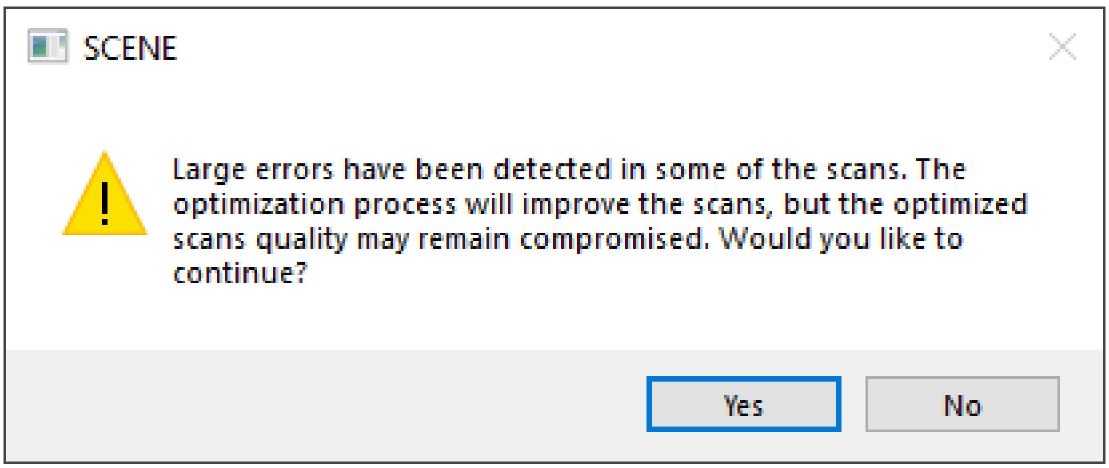


Figure 9-26 Optimization error message

If the scans in the cluster need to be compensated, the process will take the equivalent time to process and register (refine connections and update statistics) the scans from the beginning.

The results of the compensation process are:

- Compensated scans.
- The registration is updated using the new compensation scans.

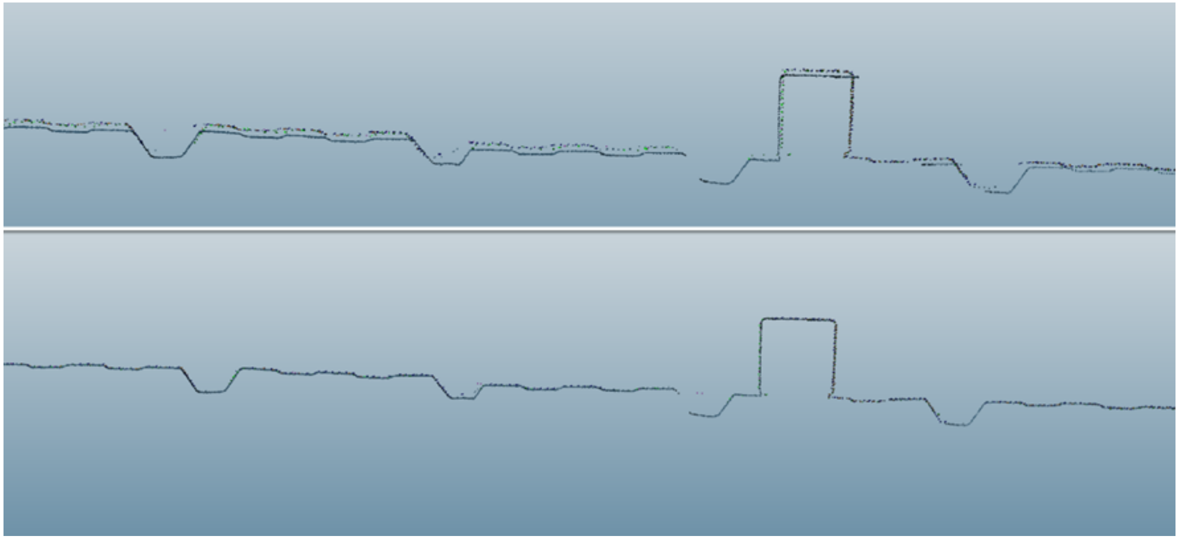


Figure 9-27 Section of a wall with column before (top) and after (bottom) optimization

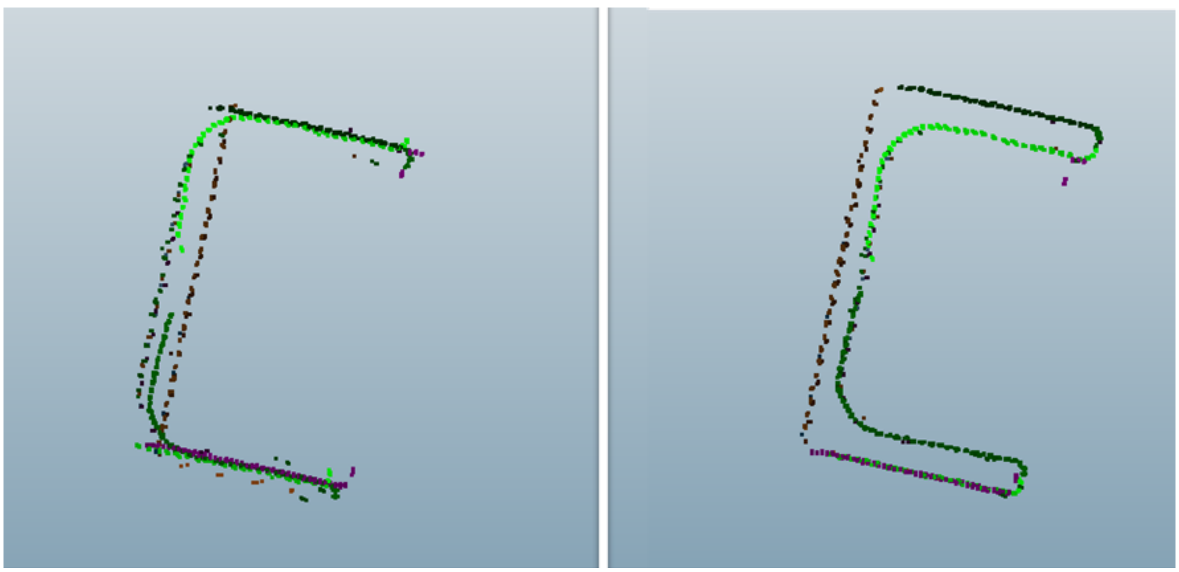


Figure 9-28 Small steel profile section before and after optimization

Registration Report

After you have gone through all registration steps, the Registration Report will give you an overview of the results.

In the Registration Dashboard, click the **Registration Report** button. This button is also displayed on the final page of the registration task.

NOTE: For the report, all values with a length unit (point error, subsampling settings, and others) will be shown in the smallest unit of the selected set (metric = mm, imperial = inch, imperial US = inch US).

Target Statistics

Target Statistics shows all reference pairs and target pairs used for the scan registration. Values close to zero indicate a good registration result. Here you can easily identify reference pairs which are causing problems in the registration.

As you can see in the figure below, all values are color coded with a bar on the left side, same as the table cells.

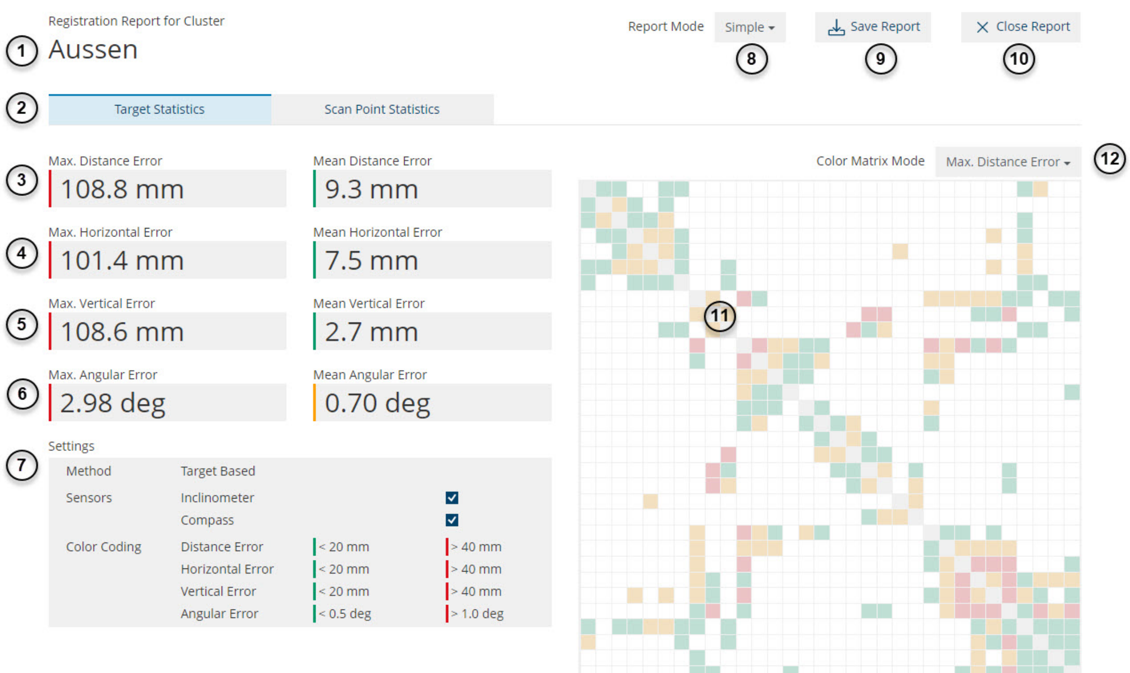


Figure 9-29 Target-based registration report

① Name of the cluster
The name of the registered cluster the report is opened on.

② Switch between *Target Statistics* on page 156 and *Scan Point Statistics* on page 158.

③ Maximum Distance Error
This setting as well as the following statistics display the averaged Maximum and Mean error between all targets in this cluster: Maximum Distance Error / Mean Distance Error

④ Maximum Horizontal Error / Mean Horizontal Error

⑤ Maximum Vertical Error / Mean Vertical Error

⑥ Maximum Angular Error / Mean Angular Error
Shows the averaged maximum or minimum angular error between all plane targets in this cluster. Angular errors can only be calculated for plane targets, which are planes, checkerboards, and slabs.

⑦ Settings
Shows the settings used for placing the scans as well as a legend for the color coding of errors.

⑧ Report Mode
The report has three modes:
Simple: Displays all statistics between the first-level scans of the cluster.
Full: Displays all statistics between all scans inside the cluster (recursive).
Color Matrix Mode

⑨ If you require the Registration Report Table for usage outside SCENE, you can either save the report as PDF or copy the report directly into Microsoft Excel. Mark the table, or parts of it, and copy it to Microsoft Excel. Save the Registration Report as PDF.

⑩ Click the **Close** button to close the Scan Report and to return to the Registration Dashboard.

⑪ Matrix
Gives a colored overview for the registration quality of the scans. Displays the error between a pair of scans or cluster. The type of error shown (e.g., Max Distance Error) can be changed in the Error Type Selection List.

⑫ Error Type Selection List
Open the dropdown menu to select the type of error you want to see in the corresponding mode.

The view of the matrix depends on the content of the selected cluster. If this cluster contains subordinate clusters, the matrix displays the registration quality for those clusters. If the selected cluster contains scans, the matrix displays the registration quality for those scans.
If there is a square in yellow, red, or green color and you want to know which pair of scans or clusters they represent, use the mouse to hover over the square. The names of the two scans or clusters are displayed, with the error value.

The **Detailed Errors** table shows errors between corresponding targets in a structured way:

- In the first level, the registered scans or clusters are listed. The maximum and mean errors for all the connections of the scans or clusters in the first level are displayed.
- In the second level, the scans or clusters with which the scan or cluster of the first level has targets in common, are listed. The maximum and mean errors for each connected scan pair are displayed.
- In the third level, individual targets and the errors in the registration of corresponding targets between the scans of the first and second level are listed. The point errors are displayed for each connected target pair.

Inclinometer Mismatches

The Inclinometer mismatches list is shown as part of the scan point statistics. This list displays the angular offsets between a scan's up direction after registration and the scan's up direction according to the scanner's inclinometer.

For scans without an inclinometer, a dash '-' is shown instead of a value.

Scan names are specified as follows:

- Scan Name: For direct Scans of the main report cluster.
- Cluster Name: For sub-clusters.
- Cluster Name_Scan Name: For scans in the sub-clusters of the report cluster.

Scan Point Statistics

A similar report is available for the scan point statistics. However, this report shows the scan point references rather than the target pair references.

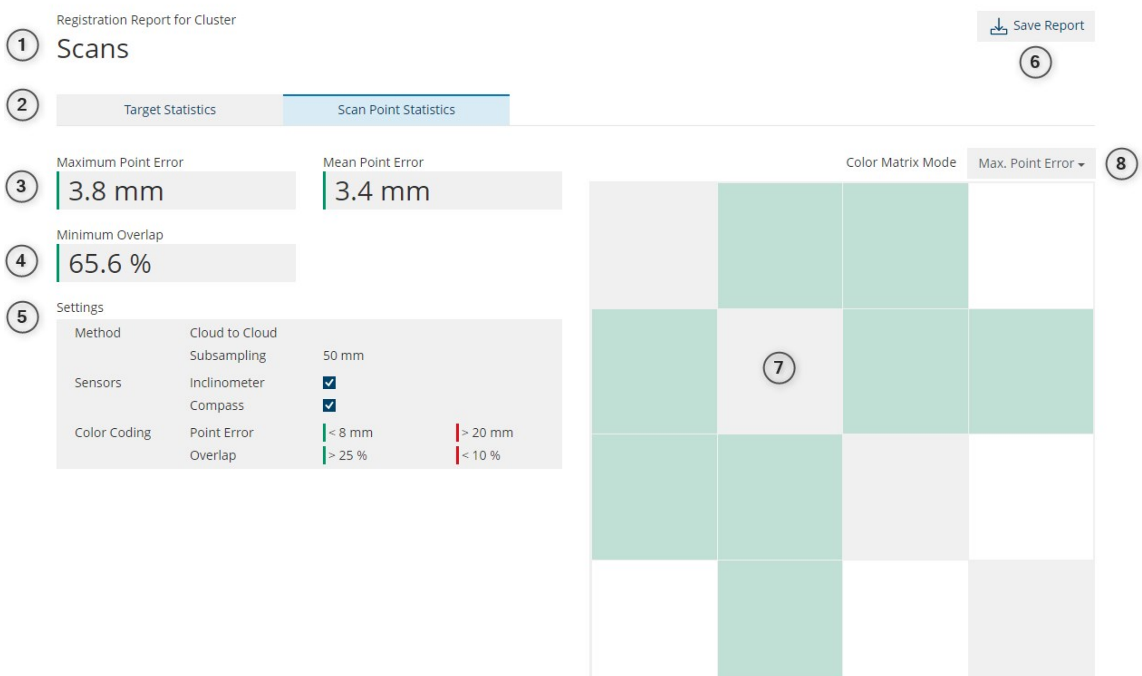


Figure 9-30 Scan point based registration report

① Name of the cluster
The name of the registered cluster the report is opened on.

② Switch between *Target Statistics* on page 156 and *Scan Point Statistics* on page 158.

③ Maximum Point Error
Maximum point error of all shown scan pairs.
Mean Point Error: Mean point error of all shown scan pairs.

④ Minimum Overlap
Minimum percentage overlap of all shown scan pairs. All values are color coded with a bar on the left side, same as the table cells.

⑤ Settings
Displays the settings used to register the selected cluster.

⑥ If you require the Registration Report Table for usage outside SCENE, you can either save the report as PDF or copy the report directly into Microsoft Excel. Mark the table, or parts of it, and copy it to Microsoft Excel as PDF.

⑦ Color Matrix Mode

⑧ Error Type Selection List

Detailed Errors, Scan Point Statistics

The **Detailed Errors** table (in Simple Mode) shows detailed error values for every registered scan pair or cluster pair:

- Depending on the selected report mode, in the first hierarchy, all scans inside the cluster are shown. The errors that are displayed are applicable to all connections of the Scan or Cluster.
- The first hierarchy will show the name of the scan or cluster, the number of connections it has, the mean point error, maximum point error and minimum overlap.
- By clicking on the first hierarchy row, the connections show the individual scan or cluster Name, point error, and overlap.
- The three right columns are color coded with red, orange and green according to specific thresholds that can be adjusted using the registration settings.

The table can be sorted by clicking on the table header of every column.

Saving or Exporting the Registration Report

If you want to use the Registration Report Table outside SCENE, you can either save the report as PDF or copy the report directly into Microsoft Excel. Mark the table, or parts of it, and copy it to Microsoft Excel.

NOTE: When importing the table to Excel, the decimal separator must correspond to the decimal separator used in SCENE. Otherwise, the numbers will be automatically converted into another format, e.g., a date.

Clicking the **Save Report** button opens a File Open dialog where a location and a file name can be chosen.

In the PDF report, the same data is displayed as in the SCENE report. Additionally, some information about the project are listed like project name and recording period.

Import Surveyed Points

In the **Registration** toolbar, you have an option to import surveyed points. You can use this option when you need to include external references. For further information, see Import surveyed reference points.

Project Alignment Dashboard

The Project Alignment Dashboard provides you with tools that enable you to change global coordinates in your project. Use these tools after you have processed and registered all your project scans. Project alignment tasks are often helpful when you want to export your project for use with other data, and you want to ensure that the exported data matches the coordinate system of the data you want to use with it.

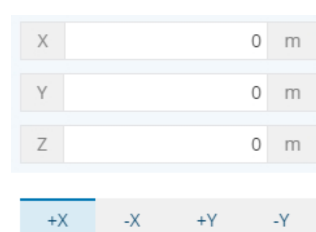
All changes that you make are immediately applied to the project. As long as you have the dashboard open, you can undo the changes that you make during that dashboard session. After leaving the dashboard, the changes can only be undone by rolling back to a previously saved version of the project.

Dashboard Tools

Two point alignment

Use the two-point alignment tool to change the origin position and orientation of your project's coordinate system while keeping the "up" direction (Z-axis) unchanged. To use the two point alignment tool:

1. Select a point that should serve as the rotation point.



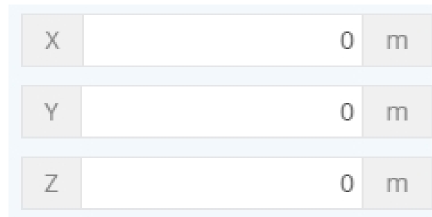
2. Select a point to define the first axis. This axis will go through this point and the origin point you selected.
3. Select another point for the z-axis rotation. The axis will be constructed orthogonal to the z-axis.

Three point alignment

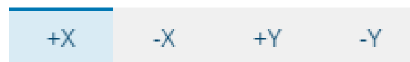
Use the three point alignment tool to change the origin position or the orientation of your project's coordinate system. You can select an existing scan point to serve as the origin, or you can set an offset to a selected point to move the origin to a place where no scan points exist. To use the three point alignment tool:

1. Select a point that should serve as the new origin, or a point that is close to where the new origin will be.

2. If the point is not exactly the point that should serve as the new origin, enter an X, Y, and Z offset, as needed, to define the position of the origin.



3. Select a point to define the first axis. This axis will go through this point and the origin point you selected.



4. Select another point. This point defines the direction of the second axis, which will pass through the origin point at a right angle to the first axis.

Quality Manager

Quality Manager is a program used to verify and report the quality of FARO SCENE registrations. It also helps make the registration process for target-based registrations more efficient and improves delivered results.

The quality of a registration is checked by launching Quality Manager from the toolbar icon. A graphical interface shows all important data and highlights possible quality problems.

Refer to the Quality Manager User Manual for more information.

Fix the Position and Orientation of Scans

This feature allows you fix the position and orientation of one or multiple scans. This means that the scans will be used during the registration, but their positions and orientation will not be changed.

You can select a cluster, multiple scans or only one scan. The fixed scans are displayed with an orange circle in the structure view:

This feature is especially useful if you add new scans to an existing project where you do not want to change the position of the existing scans while registering the new scans to them.

1. Select the scan(s) you want in the structure view, then right-click to open the context menu.
2. In the context menu, select **Operations** > **Registration** > **Fix Scan**.

Expert Settings: Adapt Bundling Weights

The default weights have been set using many projects from different applications and are valid for most cases.

NOTICE: We do not recommend changing the default weights unless you have considerable experience in surveying networks adjustments, in least squares or you have been told by a FARO employee to modify the bundling weights. For example, you should be aware that the inclinometer is an angular value (weight 8) while the target point is a position (weight 1). This does not mean that the the inclinometer has 8 times more weight than the target point.

If you need to change the bundling weights, proceed as follows:

You can select any item in the structure view and modify the default weight of that object. If you click a cluster, you will modify the weight of all elements in that cluster.

1. Right-click the object you want, either in the structure view or in the registration view.
2. In the context menu, select **Operations** > **Registration** > **Bundling Weights**.
   The following dialog is displayed.

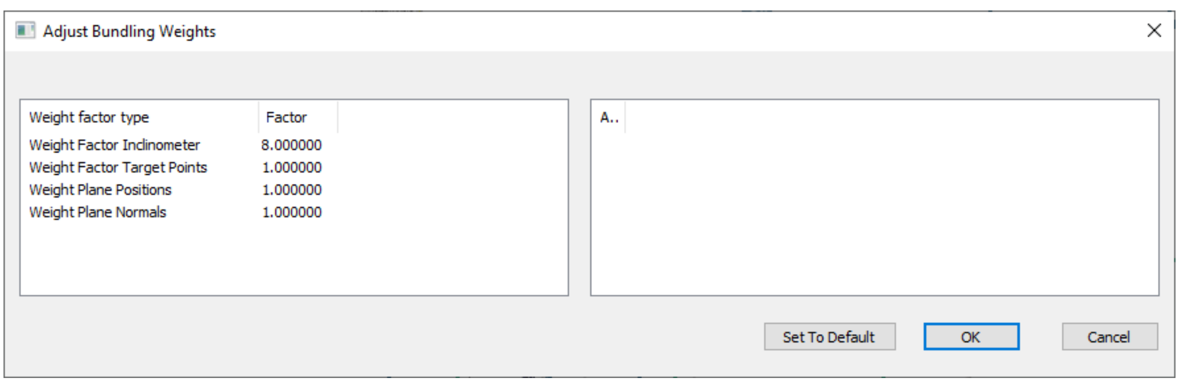


Figure 9-31 Adjust bundling weights - example

3. Click into the line you want in column Factor and change the value.
4. Click OK.

You can reset any changes to the default value by clicking button **Set To Default**.

Chapter 10: Explore

There are various views to display and explore scans and point clouds. In the views, you take a position as an observer and look in a certain direction to observe the scanned area with a freely selectable scale. Depending on the type of view, your selection of position can be limited. In the quick view and the planar view, you can only assume the position of the scanner, i.e., you cannot move freely in the room as an observer. This is only possible in the 3D view. The line of sight and the scale are freely adjustable in all types of view.

When you open the view of a single scan, at first you are in the position of the scanner when it recorded the scan. You will see the scan points of the scanned area all around you. To change the scale, use the scroll wheel of your mouse. If you turn the wheel toward you, you increase the scale; the displayed area becomes smaller. This is similar to using a telephoto lens on a camera. If you turn the wheel away from you, you decrease the scale. The displayed area becomes larger, similar to using a wide-angle lens.

NOTE: When a project is opened, the scans are not automatically loaded. To load all scans, select **Load all Scans** option in the context menu of the project in the structure view. To unload all scans, select **Unload all Scans and Pictures** option in the context menu of the Project. However, to unload the scans, de-select the **Loaded** option in the context menu of the Scan or Cluster. After a Scan is unloaded, it can be reloaded by selecting the **Loaded** option.

View Project

Click the **View Project** button. The scan project is shown in a 3D view.

There are various views to display and explore scans and point clouds. For further information, refer to section Basic Concepts.

VR View

With the virtual reality equipment, you can experience your scans as if you were on location, take measurements, make screen captures, and read annotations. For further information, refer to section Virtual Reality.

Clusters

To create a new cluster:

1. In the structure view, right-click the project name, then click **New> Cluster**.
   A cluster will be created.

2. Give the cluster a name.

3. Create more clusters, for example *FirstFloor*, *SecondFloor*, *ThirdFloor*.

4. If required, create subordinate clusters, for example, clusters that contain the scans for special rooms.

5. Arrange those clusters by dragging and dropping them into the respective superordinate cluster in the structure view.

6. Drag and drop the scans into the clusters in which they belong.
   You can also drag and drop subordinate clusters into a cluster folder.

NOTE: You can combine laser scanner scans and hand-held scans in one scan project.

3D View

With the 3D view, you can achieve the most easily comprehensible view of the scan points and CAD models. The 3D view is normally set up with the field of view corrected, so that you get an impression close to reality. Unlike the quick view and the planar view, scan points manipulation and analysis is limited in the 3D view.

NOTE: On systems with NVIDIA Quadro graphics processors, rendering performance in the 3D view might be slow or intermittent. To improve rendering performance, start the **NVIDIA Control Panel** application (available in the **Windows Control Panel**) and select **3D Settings > Manage 3D Settings >** tab **Global Settings > 3D App – Game Development** .

The 3D view will show scan point clouds, or the project point cloud. Such a point cloud must be generated by SCENE 6.1 or greater.

If there are no such point clouds, these will be generated automatically. During generation, no scan points are displayed. This is not the case for hand-held scans during capturing, because those scans have a different format and will be converted later on during processing.

If your scan project contains point clouds of new and old format (including scans for which no point cloud has been created), the following will happen:

- Automatic conversion of legacy point clouds in the background.

- A warning message is displayed.

It is not possible to edit the legacy point clouds until they are converted.

Point Clouds of Earlier SCENE Versions Available

If your scan project contains point clouds of an old format, editing of the point clouds is possible.

You will be informed that these point clouds should be updated.

3D View of a Single Scan

Right-click the scan’s name in the structure view, then click **View > 3D View** in the context menu.

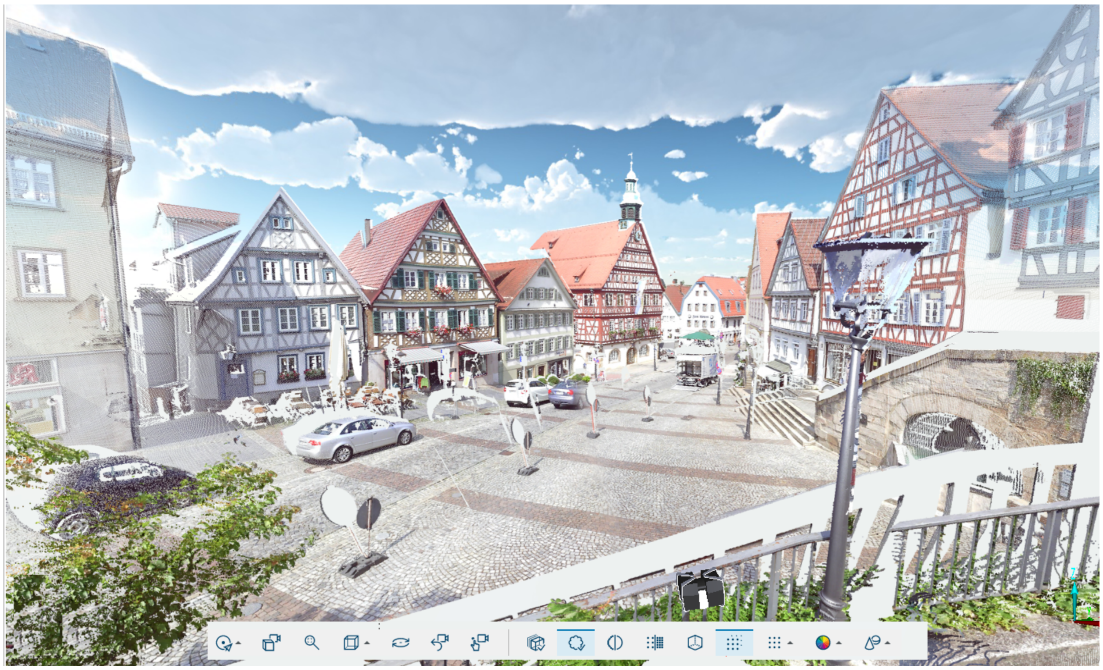


Figure 10-1 3D view of a single scan

3D View of a Cluster

You can also open the 3D view for all the scans within a cluster.

Right-click the cluster’s name in the structure view, then click **View > 3D View** in the context menu.

In the 3D view, the points of scans have priority over the points of scan point clouds, which means that the points of loaded scans will be displayed instead of the points of the related scan point clouds.

3D View of the Project Point Cloud

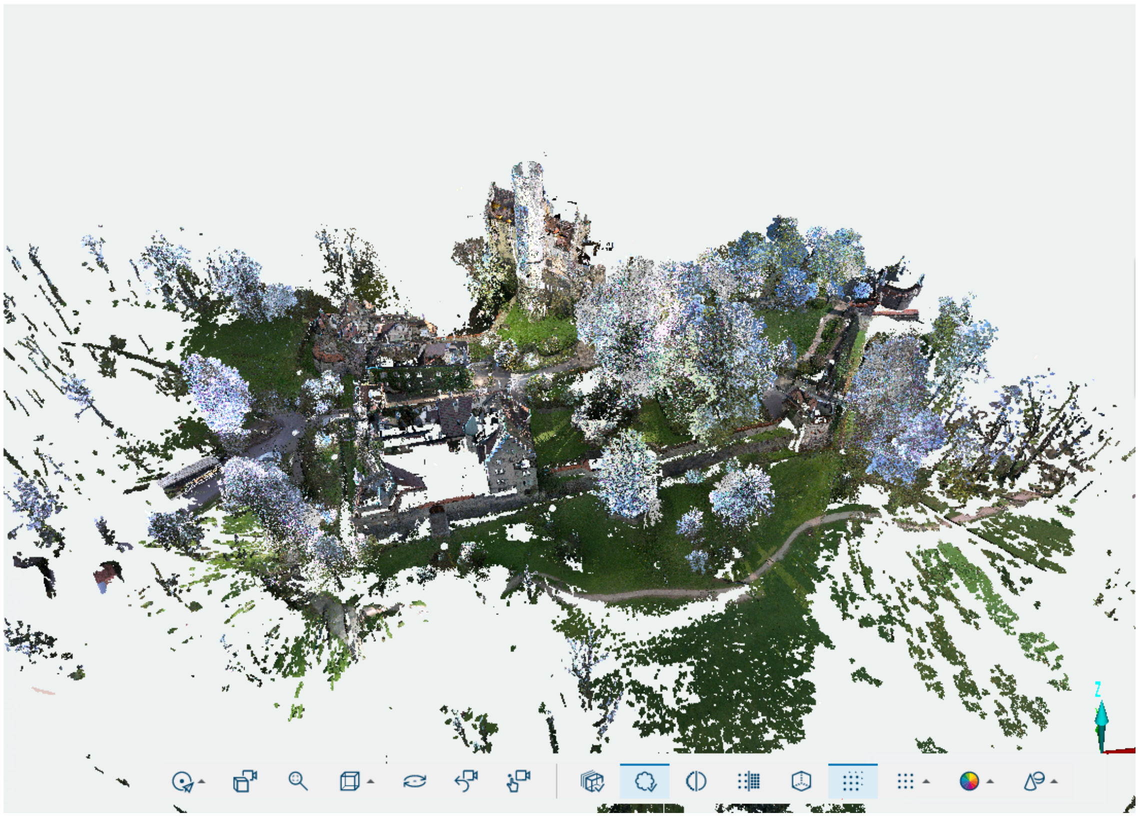


Figure 10-2 3D view of a project point cloud

Right-click the superordinate cluster in the structure view. Typically, it is simply called *scans*. Then, click **View** > **3D View** in the context menu.

NOTE: If no project point cloud is available, this button or command will open the 3D view of all scans of the project. Displaying the scans of a project behaves like displaying the 3D view of a cluster.

Normally, the 3D view displays the scan points and objects with the correct field of view. In other words, objects of the same size appear smaller with increasing distance (**Perspective View**). You can also change the view to an **Orthographic View**. Then, objects of the same size always appear the same size, regardless of how far away they are. This type of representation is common in a lot of CAD systems. You can switch between these two representations in the *Navigation Toolbar (3D View only)* on page 32.

Quick View

Figure 10-3 Quick view

The quick view is the standard view and displays the content of a single scan.

To start the quick view ,

- double-click the scan’s name in the structure view.
- right-click the scan’s name in the structure view, then click **View > Quick View** in the context menu.

You can also open the quick view in the interactive registration.

After the quick view has been opened and is displayed, the scan point data will be loaded in the background. Until the data is loaded, you can view the scan and navigate but you cannot manipulate the scan points. As soon as the scan data has been fully loaded, all the scan point manipulation functionality is available.

The following restrictions apply in the quick view:

- You always see the scanned area from the scanner position, which means you cannot leave this position until you change your line of sight and scale.
- The field of view cannot exceed 180°.

You can adjust the line of sight by holding the left mouse button down and moving the scan points in the direction required. In quick view, the Examine Mode is the standard viewing mode.

Planar View

Figure 10-4 Planar view

Like the quick view , the planar view displays the content of a single scan only.

To start the planar view right-click the scan’s name in the structure view, then click **View > Planar View** in the context menu.

At first glance, the planar view may appear very strange because the scanned area seems to be distorted. Connections between objects in the picture do not run in a straight line but are curved. For the planar view, uses the same technique as it is used for depicting the earth's surface on a map where the area around the poles appears to be magnified, and the flight route between two distant cities is not straight but bent.

The consequence of the distortion is that it only succeeds approximately in displaying other objects congruent with the scan points. If a scanned reference sphere already appears in the view more like an ellipsoid than a sphere, do not be surprised that the added reference object does not cover the reference sphere completely. For this reason no CAD models are displayed in the planar view; use the 3D view for this instead.

The planar view is useful because of the fact that with some scanners, it is the most natural display format of the scan points. A lot of scanners process the horizontal and vertical angles step by step; it is therefore practical to display the scan points in a column and row oriented manner accordingly.

The view starts at the left margin with the first column the scanner recorded. In the local coordinate system of the scanner, this column normally has the horizontal angle of 0°. The subsequent columns then come to the right, with an increasing horizontal angle until 360° is reached with a circumferential scan. In the top row, the scan points with the greatest vertical angle reached are displayed, for example, the zenith with +90°, which is directly over the scanner. From top to bottom, the vertical angle decreases, reaching 0° at the horizontal line and then becoming a negative value. The smallest possible vertical angle is –90°.

As in the quick view, you always view the scanned area from the scanner position – you cannot leave this position. However, you can of course change your line of sight and scale.

As in all views, you can set the scale using the scroll wheel of your mouse. There are also further buttons in the toolbar for the planar view which you can use to change the scale.

Correspondence View

In the correspondence view, you can change the position of scans. This can be helpful to pre-align scans before running a cloud-to-cloud registration or to verify registration results.

1. To open the correspondence view, right-click the **Cluster** node in the **structure view**.

2. From the context menu select **View > Correspondence View**.

You can also open the correspondence view in the interactive registration.

If there are clusters that are not located in the center of their scans, a message is shown asking you whether you want to move the clusters to the center of their scans. You can also make this a default in the registration settings.

Now you can start placing the scans.

3. Click the scan tag.
   Rotation and movement manipulators are shown on the scan.

4. Drag and drop the scans or use the keys described below to move the scans.
   Look for unique points in the scans, e.g., trees or buildings and align them. To adjust the height, select the side view (front, back, left or right).

Keyboard Options for Positioning Scans

The following options are available on a keyboard with a number pad:

- Change the size of the manipulators with the number pad + key (increase size) and **-** key (decrease size).
- Use keys 8 and 2 to move the selected scan up and down.
- Use keys 4 and 6 to move the selected scan to the left and to the right.
- Use keys 9 and 7 to move the selected scan clockwise and counterclockwise.

NOTE: Only a certain amount of pixels is moved when you use these keys. If you have zoomed in, the scan representation on the screen will move very slowly. If you want to go faster, zoom out before moving the scan representation.

Undo and Redo Changes

1. You may undo and redo your changes with the following buttons:

   Undo the last transformation change with .

2. Redo the last transformation change with .

3. Restore the initial transformation with .

Note that this is only possible as long as the current scan is selected. When you select another scan, you can no longer undo and redo the changes of the previous scan.

Correspondence Split View

The correspondence split view shows two scans side by side in either 3D view or quick view. In the correspondence split view, you can find and force correspondences between two scans to prepare registration. You can also use the correspondence split view to check and compare registration results.

1. To open the correspondence split view, right-click the **Cluster** node in the **structure view**.

2. From the context menu select **View > Correspondence Split View**.

You can also open the correspondence split view in the Scan Manager Properties or in the interactive registration.

The screen splits into two windows. In addition, a toolbar is displayed that provides options for marking targets as well as finding, forcing and clearing correspondences.

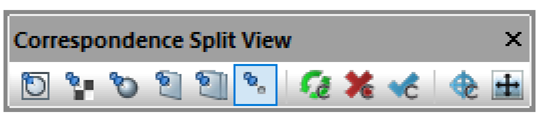


Figure 10-5 Correspondence split view toolbar

3. Drag one scan into the left window and another into the right window.

NOTE: If you want to find correspondences between the scans, both scans must either already have target references or you must mark targets, like planes or points. The procedure of marking targets is similar to the procedure described in chapter Manual Registration.

Find Correspondences

1. Rotate, move, or zoom the two scans until you have them in a useful position, i.e., they show the same part of the scenery.

2. Click the **Find Correspondences** button .
   SCENE starts to search for corresponding objects and will mark them with a label.

NOTE: A label shows a name with a maximum of 9 characters. If the name has more characters, only the last 8 will be displayed and an asterisk (*) will replace the missing characters. When you click a label, the name is shown completely.

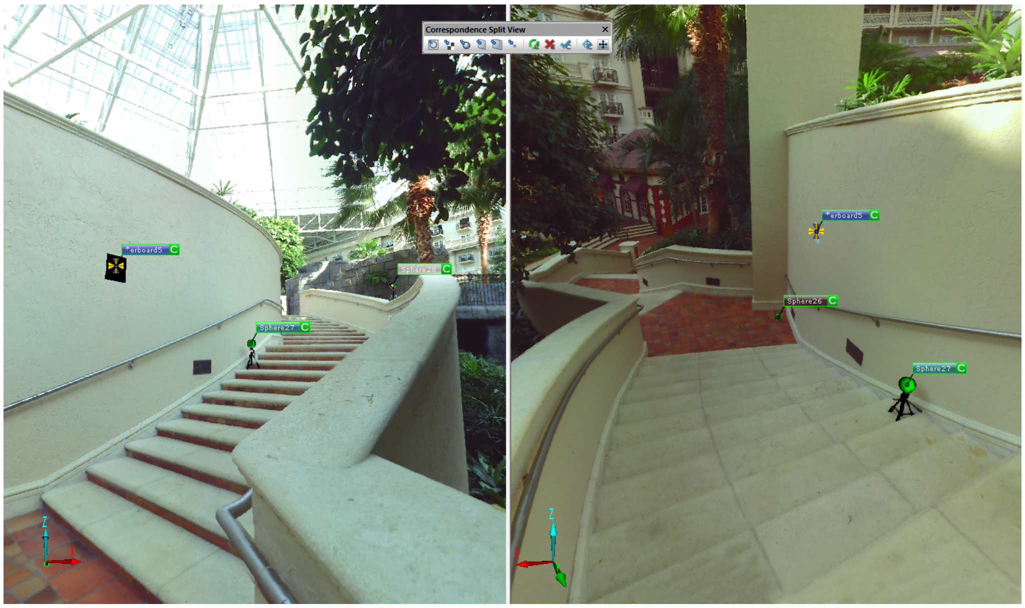


Figure 10-6 Correspondence split view with automatically detected targets

When a correspondence has been found, the label gets a small green field with a *C* which indicates that these correspondences were found automatically.

The frame around the label shows the quality of the correspondence:

- Green: good quality
- Yellow: compromised quality
- Red: seriously compromised quality

Mark Targets to Find Correspondences

1. Check if there are corners, angles, planes, etc. which could be useful and which are not yet marked.
2. Click one of the following buttons and mark the same target in both scans.

: marks a point

: marks a plane

: marks a circular flat target

: marks a checkerboard target

: marks a sphere

: marks a slab

If SCENE detects that the marked objects are correspondences, it will mark them with a label.

Force correspondences

1. Check if there are more objects which could be useful and which are not yet marked.
2. Click the **Force Correspondences** button .
3. Select the first object in the left window.
4. Select the corresponding object in the right window.
5. Repeat the above steps until you have marked all objects for which you want to force a correspondence.
   If SCENE detects that the newly marked objects are correspondences, it will mark them with a label.
6. If no correspondences are found automatically, you can force them by clicking the **Force current correspondences between shown scans** button .

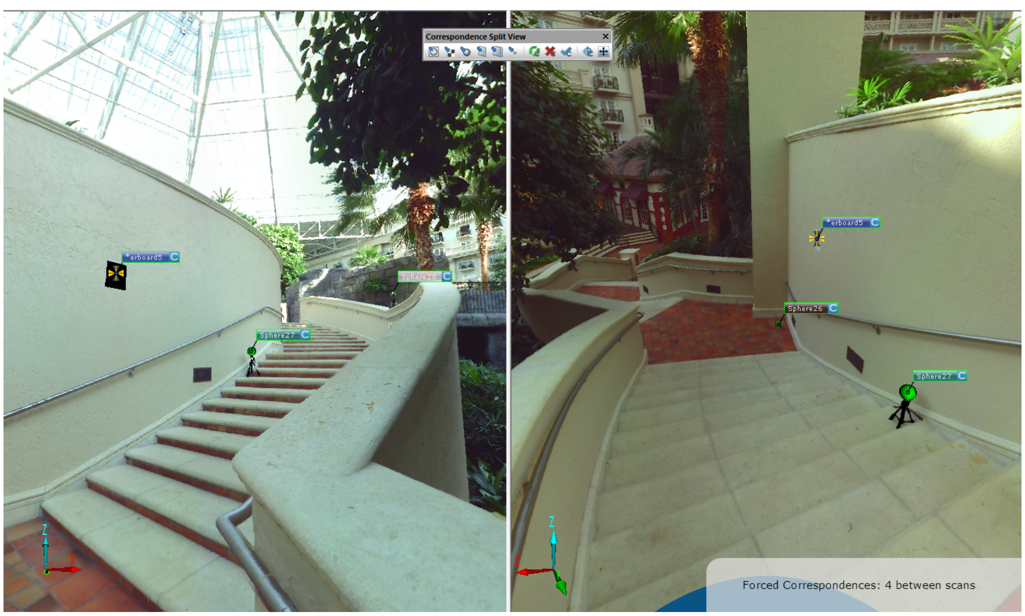


Figure 10-7 Correspondence Split View with corresponding and forced targets

SCENE will now force correspondences between these objects. Their labels will then show a small blue field with a *C* which indicates that these correspondences are forced.

Explore Toolbar

The Explore features allow analyzing a scan in different views. The buttons you see in the **Explore** toolbar depend on the kind of view that is currently selected, i.e. quick view, planar view or 3D view. Several buttons include more than one function and are marked with a little arrow beneath the icon. To check those functions, click the triangle icon and a dropdown menu will open. Some of these functions might be grayed because they do not work with a certain view. As soon as you select a function out of a dropdown menu, its icon will be shown in the toolbar.

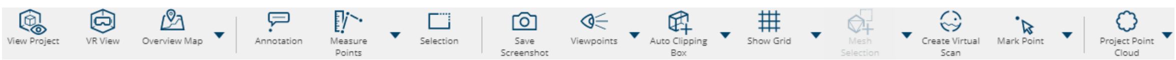


Figure 10-8 Example: Explore toolbar for a 3D view

Buttons for Quick View, Planar View and 3D View

- View Project
- VR View
- Overview Map
- Annotation
- Measure Points
- Selection
  When you click this button, a toolbar with various selection buttons is shown in the work area. If you click the Expand button, menu entries are displayed next to the selection buttons.
- Mark
  The **Mark** menu provides different options to mark points, planes spheres, checkerboards or markers.
- Project Point Cloud

Buttons for 3D View

- Viewpoints
- Show Grid
- Mesh Selection
- Create Virtual Scan
- Auto Clipping Box

Button for Planar View

Zoom 100%
Adjusts the zoom of the displayed part of the planar view to 100%

Button for Quick View and 3D View

Save Screenshot

Buttons for Quick View and Planar View

- **Color Mode** (only quick view and planar view)
  This button provides an option to easily switch between color and gray (intensity) mode of a scan. Click **Color Mode** to reload the scan in the color mode or gray (intensity) mode. If more than one view of this scan is opened, all views are updated and the scan data is visualized in the selected mode. If the color mode is selected and the scan contains only color or gray mode views, a warning is displayed. This button is now also available in the interactive registration quick view because detecting spheres is more accurate in color mode.

- Mark Distance Range (only quick view and planar view)

Navigating with the Mouse in 3D View

Left mouse button click and drag: Move the image area.

Left mouse button double click: When you double-click a scan point the 3D view, the camera flies toward that scan point. Each time you double-click again on the same scan point, the camera flies even closer to that scan point. To stop this **Fly to point** feature, move the view with the mouse or with the respective keys.

Mouse wheel scroll: Zoom in or out.

Middle mouse button or mouse wheel click: Shift the image.

Right mouse button click: Open the context menu.

Navigating with the mouse in Quick View

Left mouse button click and drag: Move the image area.

Left mouse button double click: When you double-click a scan point the 3D view, the camera flies toward that scan point. Each time you double-click again on the same scan point, the camera flies even closer to that scan point. To stop this **Fly to point** feature, move the view with the mouse or with the respective keys.

Mouse wheel scroll: Zoom in or out.

Middle mouse button or mouse wheel click: Shift the image.

Right mouse button click: Open the context menu.

Navigating with the mouse in Planar View

Left mouse button click and drag: Move the image area.

Mouse wheel scroll: Zoom in or out.

Right mouse button click: Open the context menu.

Overview Map

The overview map provides a top view overview to the whole scan project. The map is by default, a gray scale image. It is recommended to create the map after the registration and cleanup of scan points is completed. (Note that the map is created from the points in the individual scans—not from the project point cloud.)

Scans in the Overview Map

In the overview map, the scanner positions are displayed as colored dots. If you click a dot, the scanned area is highlighted and a menu opens that allows opening the scan in the 3D view, the quick view or the planar view.

The  icon with the dropdown button provides a menu with the following options:
If no overview map is available, clicking on this icon will create an overview map.

NOTE: An overview map can also be opened on a single scan or a cluster. Right-click the desired object to open the context menu and select **View > Overview Map**. This overview map displays only the scan or the scans that are part of the cluster.

Create

Select this option to create a new overview map for a scan project.

Update

If you change the transformation of scans or clusters, or if scan points are deleted after the map has been created, the map becomes invalid. Update the map in such instances.

Delete

Select this option to delete the overview map.

NOTE: Even though an overview map is deleted, it may be available in older revisions of your project. Perform the **Wipe Project History** operation to free the space allocated for the overview map files in old revisions, if required.

The toolbar contains a view all button, zoom in/zoom out buttons, and a button that opens the Overview Map settings, see below.

The lower left corner also contains a scale bar that shows the metric and imperial scale. The default scale is meter or feet.

Each scan is marked with an icon. Hover on a scan marker icon to view the name of the scan. Click the icon, to open a popup. The popup contains the name of the scan and buttons to open quick and 3D views of the scan.

Overview Map Settings

You can adjust the visible objects and the color of the overview map. Click the **Settings** button in the toolbar and go to **Views Settings**. In section **Overview Map**, you can set the foreground, background and scan highlight color, show or hide the scanner positions and scan highlight points. Refer to chapter Overview Map Settings for more information.

You can also change the overview map settings directly in the **Explore** category. If you open the overview map several times in different tabs, you can have different settings in each tab.

Click icon in the small toolbar at the bottom of the screen to open the settings for the current overview map.

If you want the settings to be identical in all open tabs, click in the tab that has the settings you want and switch on **Apply To All Maps**. When you open an overview map in any project, default values are always used. You can use the settings in any map to set new default values by clicking in the map and then switching on **Save to Default Settings.**

Export the Overview Map

The overview map for a scan project can be exported as a high resolution TIF image or as a DXF file that can be opened in any CAD system for further modeling.

In the **Export** toolbar, click **Export Overview Map**.

A file dialog opens where you can enter a name of the exported file.

An additional text file is also created that contains information about the resolution, the image size in pixels and in meter, and the corner points of the image and the associated TIF file.

In the Export tab, you can not only export the complete scan project, but also scan clusters and single scans.

Annotations (3D View, Quick View, Planar View)

To attach an annotation to a certain scan point:

1. Open a view of a scan, a cluster, or a scan project.
2. Select the annotation tool from the toolbar, then click the point of interest in the view.
3. The new annotation and its **Documentation Properties** dialog are displayed.

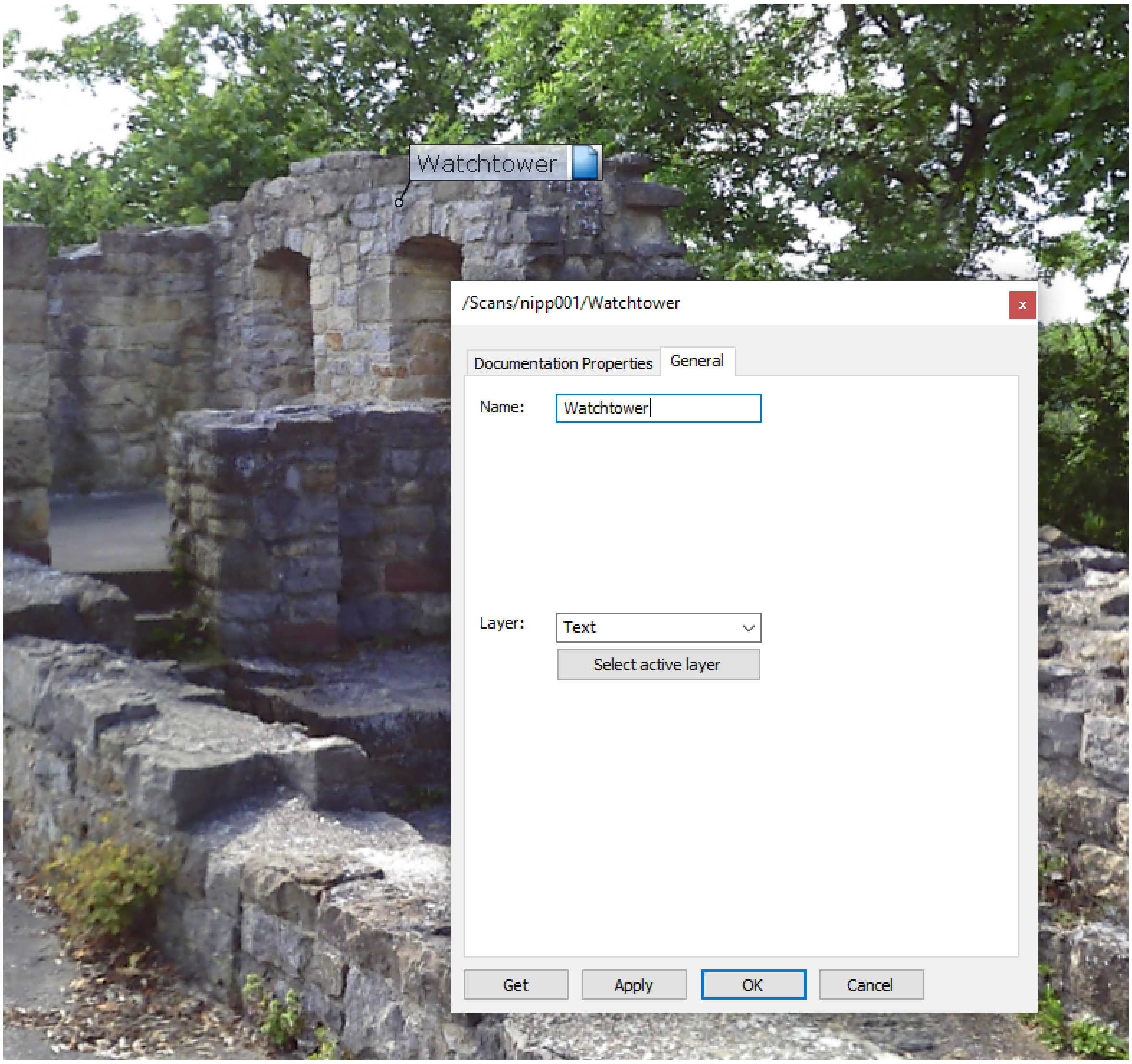


Figure 10-9 Documentation object in 3D view

Documentation Properties

You can enter detailed information in the **Documentation Properties** dialog.

Position – determines the position of the documentation object in the working area.

Description – detailed information about the documentation object.

Hyperlinks – hyperlinks to files or websites.

- Add a new hyperlink by entering its address into the lower text field, then press **Add**.
- Change the order of the hyperlinks with the **Up** and **Down** buttons.

- Delete them with the **Remove** button.
- Open them by double-clicking the list item or by pressing the **Open** button.

General Tab

You can enter the name of the documentation object in the **General** tab. Since a documentation object usually consists of a text string, its **Layer** should be defined as **Text**.

Create Annotations at the Scanner Position

To create a documentation object at the scanner position:

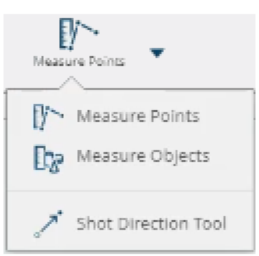
1. Right-click the scan in the structure view.
2. Select **New** > **Documentation**.
   The Documentation Properties dialog is displayed.
3. Proceed as described above.

Measuring (3D View, Quick View, Planar View)

With renovations, you are often confronted with the question of whether there is still enough space in the building for the intended machinery. Since you can only rely on the CAD model of the building to a certain extent, you will probably have to examine and take measurements of the site.

There are two different approaches for measuring distances:

- Between scan points
- Between objects such as spheres or planes



Shot Direction Tool

The Shot Direction Tool can only be used with the Forensic Wizard app. On a crime scene, investigators can mark bullet holes with rods and spheres and then scan the crime scene. With the Shot Direction Tool , you can connect these spheres. In the Forensic Wizard app, these connections are evaluated to determine the bullet trajectory and the position of the shooter.

You can find detailed information on the FARO Knowledge Base.

Measure Points

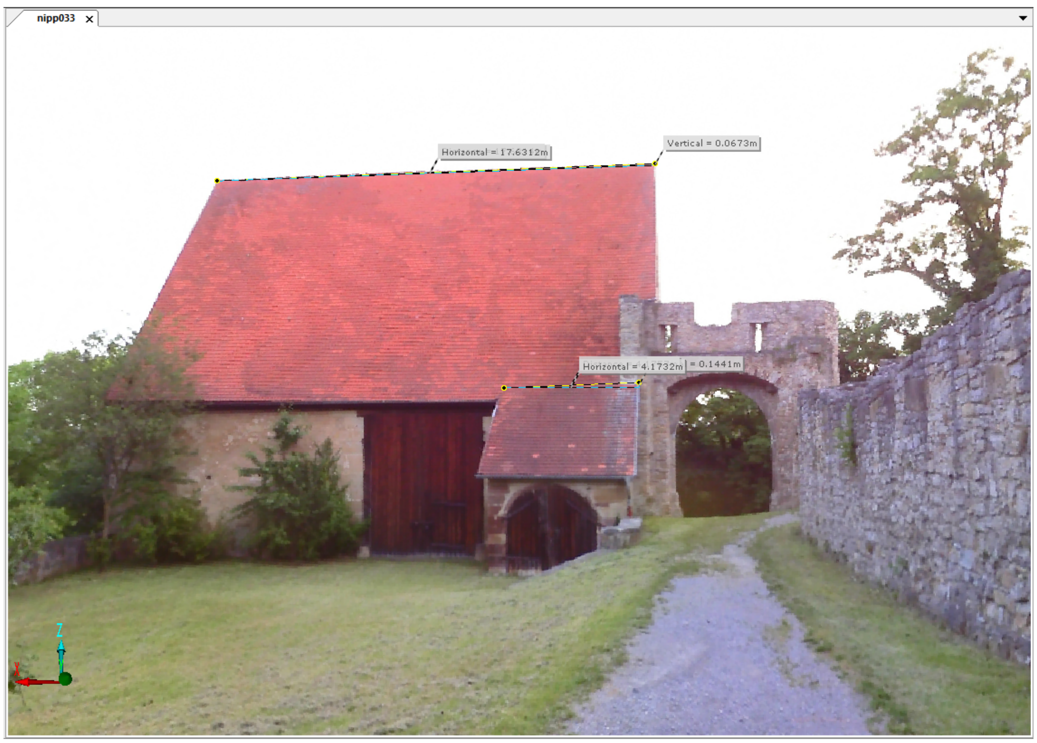


Figure 10-10 Point-to-point measurement

1. Open the **Measure** dropdown list in the toolbar and click **Measure Points**.
   The appearance of the dropdown list depends on your previously selected measuring mode.
2. Select valid scan points in the respective view with the **left mouse button**.
3. Select the last measure point and finalize the measurement by a **double-click** with the left mouse button.
4. To leave the measurement process, click the **right mouse button** or press the **Esc** key.

Several keyboard commands are available in the quick view and the 3D view:
ENTER : Finalize the measurement without adding a last measure point.

Backspace : Remove the last measure point.

Home : Add a last measure point at the start position and finalize the measurement.

A new point-to-point measurement gets added as a child object in the **Measurements** folder of the structure view.

A point-to-point measurement made in the 3D view is only visible in the 3D view. It is not linked to any individual scan. If the involved scans are changed later or transformed, the measurement stays in the same place. In this case you could delete the measurement and create a new one.

In the quick view and the 3D view, a yellow dashed line is drawn between the measure points. Labels show the overall distance and the length of each measure segment. In the planar view, only the overall distance is shown.

Invalid measure points of point-to-point measurements are indicated by a red outline. An invalid measure segment is indicated by a red dashed line.

Two additional lines show the vertical and horizontal distance between the first and last measure point.

Measure Objects

Probably you frequently have to measure distances to level surfaces, for example to the wall, the floor or the ceiling. In this case you should fit a plane through the wall and measure from the plane to the point you are interested in. When using a plane, the measurement is automatically taken perpendicular to this plane.

NOTE: Object measurements are also available in the structure view.

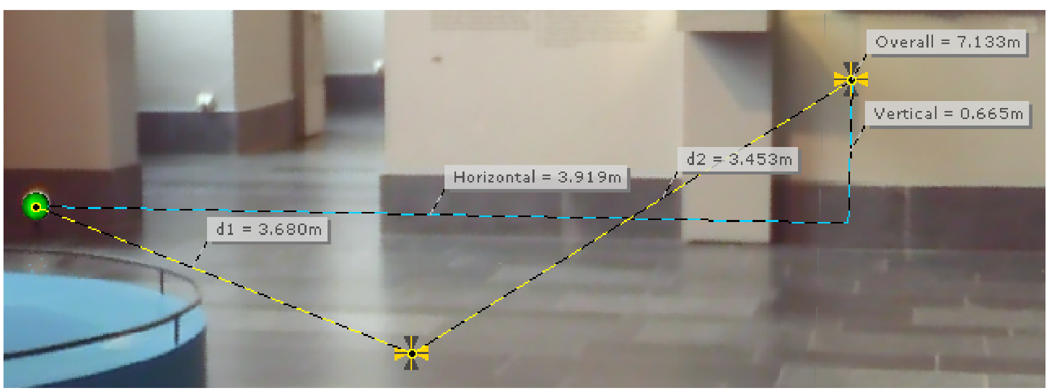


Figure 10-11 Object measurement

You can measure between objects of the following types:

Point objects

- Sphere (A sphere is a point object because its central point is used for measurement)
- Checkerboard
- Point Object, Corner Point
- Scan, i.e. the scanner icon which stands for a scanner position

Figural objects

- Plane, including Expanded Plane, Rectangle, Slab
- Pipe

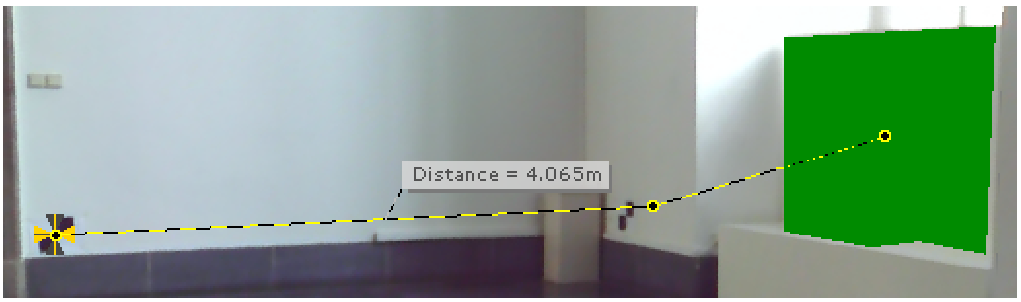


Figure 10-12 Checkerboard point – plane measurement

1. Open the **Measure** dropdown list in the toolbar and click **Measure Objects**.
   The appearance of the dropdown list depends on your previously selected measuring mode.

2. To select objects for your measurement, select them with the **left mouse button**.
   You can also select objects in the structure view this way.

It may happen that objects superpose. In this case, a small dialog opens which lists these objects.

3. Double-click the one you want to use, and continue measuring.

You can measure the distance between more than two objects if you hold down the **Shift** key when clicking on the next object. However, an object measurement can only contain one figural object.

A new object measurement gets added to the **Measurements** folder of the structure view.

If the position or location of the objects used for the measurement change, for example, by a new fit or by updating the registration, the measurement is automatically updated.

Measure Object

The representation of a measurement is called a measure object. To open the **Properties** dialog of a measure object, double-click it in the structure view, on its label, or near a measure line.

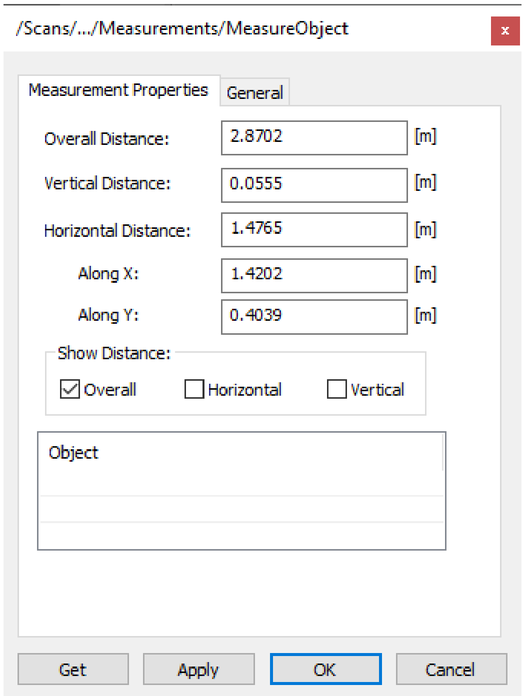


Figure 10-13 Properties of measurement object

The Properties dialog provides distance information and a list of the involved objects of an object measurement.

You can hide the lines for the vertical and horizontal distances and the label for the overall distance by selecting the **Show Distance** checkboxes.

Selecting Scan Points (3D View, Planar View, Quick View)

Depending on the view, it is possible to select scan points and then apply commands to this group of points:

- Selecting Scan Points in the Planar View or the Quick View
- Selecting Scan Points in 3D View
- Inverting a selection of scan points

You can also delete scan points.

Selection Combinations

There are different types of selection combinations which determine what effect the next selection to be executed has on the selection that already exists.

1. If there is no selection: select scan points with one of the scan point selection tools.
2. Select the required combination type from the toolbar:

New selection button : The next selection replaces the existing selection.

Add selection button : Combination mode whereby the next selection is added to the existing selection.

Subtract selection button : Combination mode, whereby the next selection is removed from the existing selection.

Intersect selection button : Combination mode whereby the difference of the two selections is retained.

Selecting Scan Points in the Planar View or the Quick View

In the planar view and in the quick view, it is possible to select scan points and then apply a variety of commands to this group of points.

- Apply filters on the selected scan points
- Delete scan points
- Push or pull
  Push: All scan points of a selection which are situated between **Minimal Distance** and **Maximal Distance**, are moved away from the scanner position (being the origin of the local coordinate system of the scan) by the value that is specified in **Scan** > **Properties** > **Scanner Info** > **Range**.
  Pull: All scan points of a selection which are situated between **Minimal Distance** and **Maximal Distance**, are moved toward the scanner position (being the origin of the local coordinate system of the scan) by the value that is specified in **Scan** > **Properties** > **Scanner Info** > **Range**
- Apply a white-balance
- Colorize scan points using scanner based pictures
- Export scan points into a CAD system
- Create a new scan from the selected scan points.

Selected scan points are colored yellow. There can only be one selection simultaneously in all views, in other words, if you make a selection in one view, the selection disappears from the view worked on before.

NOTE: If you wish to select an area that you cannot see with the set line of sight, you can also switch into navigation mode during the selection process. Simply press the control (Ctrl) key.

Available Selection Tools in Quick View and Planar View

Click **Selection** in the Explore toolbar. The tools options toolbar is opened.

Select Polygon Button

1. Click the polygon tool in the toolbar.
2. Click the left mouse button to define the starting point of the selection.
3. Release the mouse button, move the mouse to the next point and click to fix the point.
   A straight connection is drawn automatically between these two points.
   You can also hold the mouse button down and drag the mouse over the area you want to select. Then all the scan points that you move over with the mouse are selected.
4. Lock the selection by double-clicking with the left mouse button.

When completing the selection, the line will be closed; in other words, the last fixed point is connected to the starting point. The selection comprises all the scan points that are enclosed within the outline.

Select Rectangle Button

1. Click the rectangle tool in the toolbar.
2. Select a rectangular area by first defining a corner of the rectangle by clicking and holding the left mouse
3. Drag the mouse over the area that you want to enclose in the rectangle and then release the mouse button.

Select Circle Button

1. Click the circle tool in the toolbar.
2. Click the left mouse button to define the starting point of the selection.
   A circle with the radius just set is displayed.
3. Change the radius by turning the mouse wheel.
4. Click and hold with the left mouse button and drag the circle to the position you want.

Select Ellipse Button

1. Click the ellipse tool in the toolbar.

1. Click the left mouse button to define the starting point of the selection.
   An ellipse with the starting point of the major axis just set is displayed.

2. Change length of the minor axis (i.e., the width) by turning the mouse wheel.

3. Click and hold with the left mouse button and drag the circle to the position you want.

Select Line Button

A linear selection has a thickness of one point.

1. Click the ellipse tool in the toolbar.

2. Click the left mouse button to define the starting point of the line.

3. Release the mouse button, move the mouse to the next point of the line and click to fix the point.
   A straight connection is drawn automatically between these two points.

4. Lock the selection by double-clicking with the left mouse button.

Planar View only: Select Poly Edge Button

Select an arbitrarily shaped area of scan points, with the polygon following the visible edge in the scan points.

1. Click the ellipse tool in the toolbar.

1. Click the left mouse button to define the starting point of the selection.

2. Release the mouse button and move the mouse to the next point.
   If you reach an edge, i.e., an area in which there is a noticeable difference in the reflection value, the selection will automatically follow this edge. If there is no such edge, a straight connection is drawn.

3. Click to fix the point.

If you are not confident with the polygon, you can undo the last part of the polygon by backtracking it in the opposite direction. You can always backtrack to the last fixed point.

With a right click, you switch edge detection on or off, and you can cancel the selection.

Selecting Scan Points in the 3D View

In the 3D view, it is possible to select scan points and then apply a variety of commands to this group of points.

- Delete a scan point selection
- Invert a scan point selection
- Export scan points into a CAD system
- Create meshes
- Send selected scan points to WebShare

Available Selection Tools in the 3D View

Click **Selection** in the Explore toolbar. The tools options toolbar is opened.

Select Polygon Button

The polygon selection applies to point clouds.

1. Click the polygon tool.

1. Click the left mouse button to define the starting point of the selection.
2. Release the mouse button, move the mouse to the next point and click to fix the point.
A straight connection is drawn automatically between these two points.
You can also hold the mouse button down and drag the mouse over the area you want to select. Then all the scan points that you move over with the mouse are selected.
3. Lock the selection by double-clicking with the left mouse button.

When completing the selection, the line will be closed; in other words, the last fixed point is connected to the starting point. The selection comprises all the scan points that are enclosed within the outline.

Select Brush Button

The brush selection can be used similar to brush tools known from 2D image processing programs. It works with scan point clouds or project point clouds.

The brush works in three-dimensional spaces, meaning that you can use the mouse to literally paint points which are going to be selected.

The brush has the shape of a sphere. A transparent red circle will highlight the area where the selection sphere is currently located.

1. Click the left mouse button to define the starting point of the selection, hold the button down to paint the points.
2. Moving the cursor around while having the brush selector tool activated will highlight the scan points that are currently within the selection sphere.
3. Use the mouse wheel to modify the radius of the sphere.
4. Hold the shift key to modify the sphere radius more quickly.

Inverting a Selection of Scan Points

There may be applications in which the marking of scan points is difficult or time-consuming, and it would be much easier if you could mark those scan points you do not need.

1. Open a 3D view of a point cloud.
2. Click **Selection**, and choose the **Select Polygon** or the **Select Brush** selection tool.
3. Create a selection in the 3D view.

4. Scan points of a house, marked with the Polygon selection

5. Right-click the selection, then click **Selection > Invert Selection**.

   Your selection will be cleared and all other scan points will be selected.

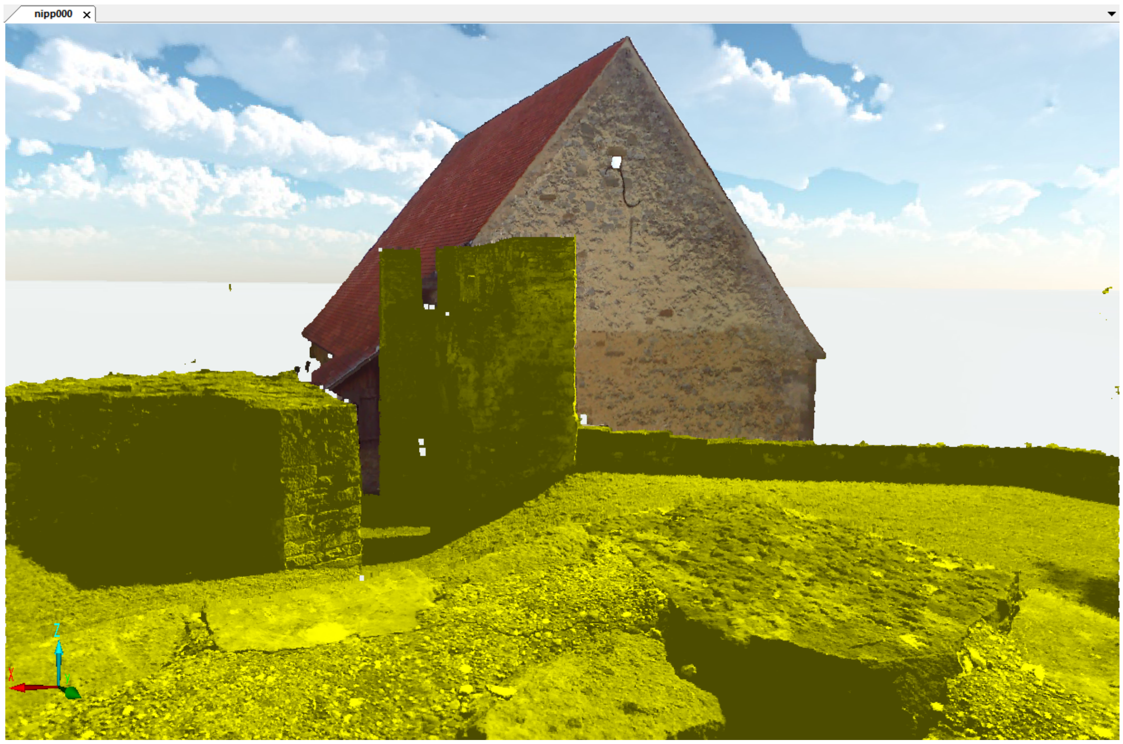


Figure 10-14 Scan after using the invert function

Delete Scan Points

You can delete scan points from scans, scan point clouds, or project point clouds in the 3D view, the quick view and the planar view.

In scan point clouds or project point clouds in the 3D view, you can also undo and redo deletions, see below.

Option 1: Delete Scan Points from a Selection

1. Click the **Selection** button in the toolbar.
   The Selection toolbar is shown.

2. Select a selection tool from the toolbar, e.g., **Polygon** or **Brush** .

3. Create the selection at the position you want.

4. Right-click anywhere in the work area to open the context menu.

5. Select **Current Selection > Delete Points**.
   The points inside the selection will be deleted.

If you select **Current Selection > Invert** and then select **Current Selection > Delete Points**, the points outside your selection will be deleted.

Option 2: Delete Scan Points from a Clipping Box

1. Open the **Clipping Box** dropdown menu in the toolbar and select the clipping box option you want.

2. Create the clipping box.
   While creating the clipping box, you can also decide whether you want to hide the interior or the exterior of the clipping box.

3. Right-click into the clipping box to open the context menu.

4. Select **Active Clipping Boxes** and then either **Delete visible points** or **Delete invisible points**.

- **Delete visible points of all active clipping boxes**: All visible points of all active clipping boxes will be deleted, regardless of whether they are inside or outside the clipping boxes.

- **Delete invisible points of all active clipping boxes**: All invisible points of all active clipping boxes will be deleted, regardless of whether they are inside or outside the clipping boxes.

Undo and Redo Scan Point Deletions

You can undo and redo scan point deletions in the 3D view of a scan point cloud or a project point cloud.

NOTE: Undoing and redoing scan point deletions is not possible in the quick view, the planar view or in the 3D view of raw scans.

You can delete scan points of more than one selection or clipping box and then undo and redo these deletions. This also means that you can make deletions in several scan point clouds. When you go back to an individual scan point cloud, you can still undo and redo the deletions you have made there.

For Deletions Based on Selections

Undo scan point deletions:

1. Right-click anywhere in the work area to open the context menu.

2. Select **Current Selection > Undo Delete Points**.
   The last deletion is undone.

3. Repeat for further deletions if necessary.

Redo the last scan point deletion after an undo procedure:

1. Right-click anywhere in the work area to open the context menu.
2. Select **Current Selection > Redo Delete Points**.
   The last undone deletion is redone.
3. Repeat for further deletions if necessary.

For Deletions Based on Clipping Boxes

Undo scan point deletions:

1. Right-click anywhere in the work area **outside** the clipping box to open the context menu.
2. Select **Current Selection > Undo Delete Points**.
   The last deletion is undone.

Redo the deletion after an undo procedure:

1. Right-click anywhere in the work area **outside** the clipping box to open the context menu.
2. Select **Current Selection > Redo Delete Points**.
   The last undone deletion is redone.

Creating Scans from Selected Scan Points

If you would like to reduce scans to their important sections without losing the original data, you may select the relevant scan points of these scans and create new scans from the selections.

1. Open the planar view or the quick view of the scan.
2. Select the scan points for which you would like to create a new scan.
3. In the context menu of the selected area, click **Scan Points > Create Scan**.
   The following dialog opens:

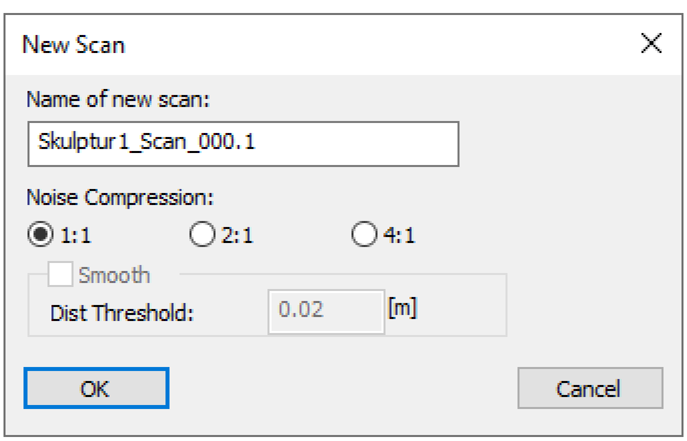


Figure 10-15 New scan

4. Assign a **name**.
   Make sure that there is no other scan in the project that has the same name.

With a **noise compression** rate of 2:1 or 4:1, the number of rows and columns will be reduced accordingly. So with a rate of 4:1, the resulting scan will only have 1/16 as many scan points as the original selection.

5. Optional but recommended: Mark checkbox **Smooth** to activate the smoothing filter if you reduce the noise in a ratio of 2:1 or 4:1.

Dist. Threshold is the threshold for calculating the mean value. If the distance between the center scan point and a scan point of the surrounding area is beyond the threshold, this scan point will not be used when calculating the mean value. The smoothing filter never removes scan points but rather alters their respective position.

A new independent scan is created.

Save Screenshot (3D View)

You can save the view currently being displayed, for example, to share the view or to use it as a preview for your scan project.

1. Open a 3D view of a scan.
2. Move the 3D view until it shows the view you want to see in the screenshot.
3. Click the **Save Screenshot** button in the toolbar.

An information box opens, saying: "The screenshot will be saved in the structure view in the folder named Screenshot." (The name will be different if you renamed the folder. If the screenshots folder doesn't exist, it will be created.)

The screenshot's name is generated automatically as **Screenshot**. Subsequent screenshots have a number appended. When the screenshot is created, a child object called a **Viewpoints** is also created.

The screenshot image will show exactly what you have seen in the 3D view, including annotations or measurements, scan point selections, etc.

If you want to export the screenshot to a file, right-click the screenshot and select **Import/Export** > **Export Picture**.

Viewpoints (3D View)

Save the current camera position and line of sight as a viewpoint, so that you can return to it later. In the dropdown menu of the **Viewpoints** button, you can activate the previous or next viewpoint.

Create Viewpoint

1. Move the camera to a position that you would like to keep for later use.
2. Click the **Viewpoints** button . The dropdown menu opens.
3. Click **Create**. A little dialog opens in which you can enter a name for that viewpoint.
4. Click **OK** to save the viewpoint.

NOTE: You can also create a viewpoint with the by pressing hot-keys **Ctrl + F2.**

Viewpoints are added to a folder called Viewpoints in the structure view. Viewpoints are part of the project and will be saved when saving.

In the structure view, you can organize the viewpoints into folders. Create new folders, and drag and drop the Viewpoints into them.

Go to a viewpoint

In the structure view, right-click the Viewpoint, then select **Activate** in its context menu.

Activate viewpoints

1. Click into the 3D view.
2. Click the **Viewpoints** button . The dropdown menu opens.
3. Click either **Locate Previous**, or **Locate Next**.
   The view will move to that position.

NOTE: All viewpoints can also be successively activated in the order of their creation by using the hot-key **F2** or in reverse order by using **Shift+F2.**

Mark Distance Range (Quick View and Planar View)

The scan points in the quick view and the planar view are normally displayed so that the reflection value of a scan point determines the brightness of the pixel. You can also display the scan points so that the pixel assumes a different color depending on the distance of the scan point from the scanner. You can also then choose to either have all scan points in a range assume the same color or have the color reflect the actual distance.

This type of visualization is appropriate, for example, when analyzing a scan, if it must not fall below a certain level of precision. Generally, the quality of a scanner's distance measurement is not constant across the entire range but decreases as the distance increases. You can then highlight in color the range in which the distance measurement is no longer satisfactory.

You can switch the highlighting on or off using the **Mark Range on/off** button in the toolbar.

The colors are displayed corresponding to your entries:

- Scan points that lie close to the lower limit is colored red.
- Scan points that lie in between are colored yellow to green.
- Scan points that lie close to the upper limit is colored blue.
- Scan points lying outside this range are not colored.

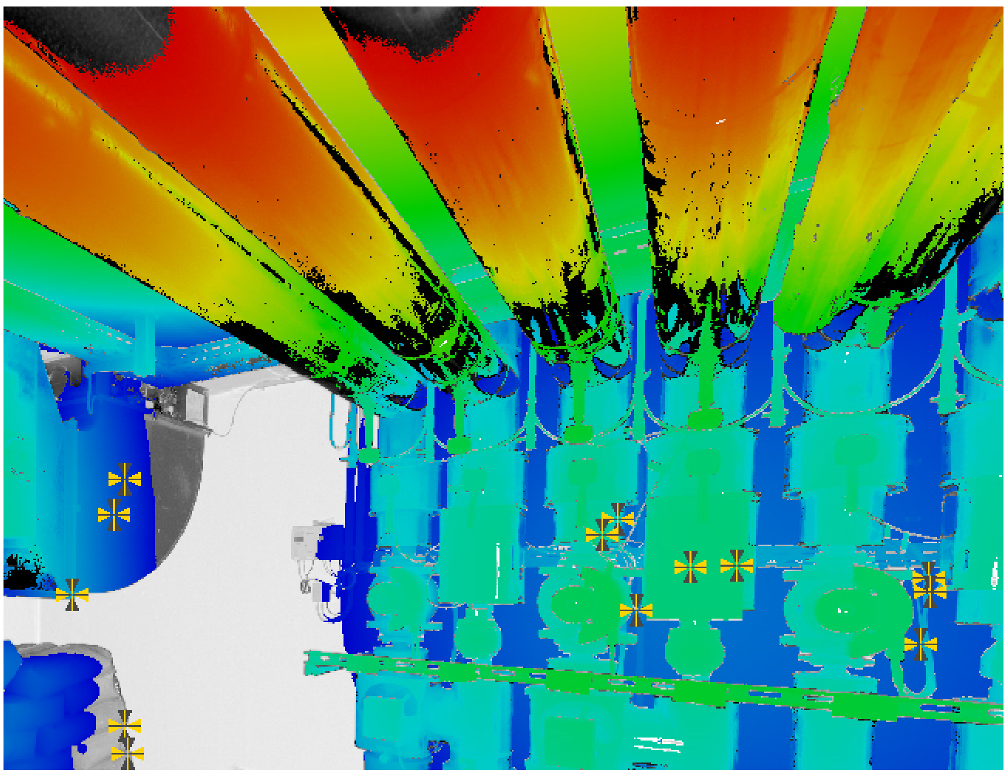


Figure 10-16 Scan points colored depending on distance

You can edit layers, objects and ranges in the **Visibility Settings** dialog. To open this dialog,

1. right-click in the planar view.
2. Select Visibility Settings from the context menu.

Clipping Boxes (3D View)

Clipping boxes provide an easy access to areas of interest of a 3D point cloud. They allow slicing the point cloud and clipping away specific areas which enables you to display or hide certain points of the 3D point cloud.

There are two types of clipping boxes:

- Clipping boxes with the points outside of the box hidden. Only the points inside the box are displayed.
- Clipping boxes with the points outside the box displayed. Points inside the box are hidden.

If you resize the clipping box to a subset of the project and you are hiding the interior or exterior, you can toggle between clipping only points and clipping everything by clicking button .

Clipping boxes may also be used to select scan points in the 3D view to perform certain operations on these points.

NOTE: Clipping boxes can be applied to the points of point clouds, not to the points of scans. If your scan project contains more than one scan, register those scans first, then use the clipping boxes for the entire scan project.

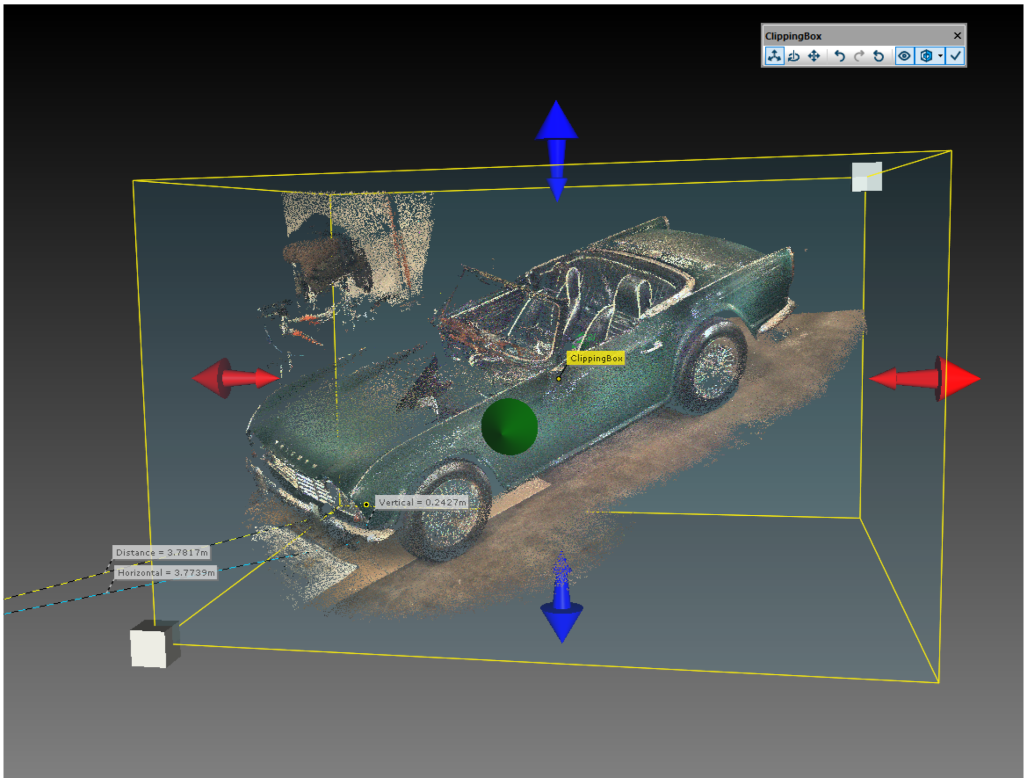


Figure 10-17 3D view without clipping box (upper picture) and with clipping box (lower picture)

Creating a Clipping Box

1. Open a 3D view and navigate to the area of interest.

There are various ways to create a clipping box:

2. Click **Auto Clipping Box** to get the following options:

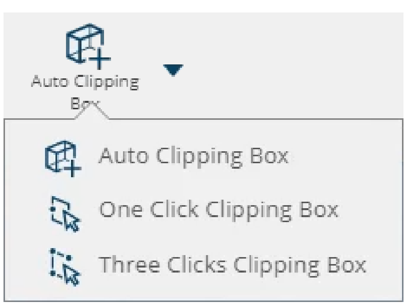


Figure 10-18 Clipping Box dropdown menu

Auto Clipping Box

Click the **Auto Clipping Box** button in the toolbar.

The clipping box toolbar opens. For details about how to use the toolbar, refer to the section Manipulating a Clipping Box.

A clipping box will be created close to the center of the current 3D view. The created clipping box will be scaled so that it covers roughly two thirds of the screen.

One Click Clipping Box

1. Open the dropdown menu of the **Clipping Box** button and select entry **One Click Clipping Box**.
2. Select a point in the 3D view to determine the surface.
   The clipping box will then be created with one of its faces being coplanar to the defined surface, and with the selected point in the center. The created clipping box will be scaled so that it covers roughly two thirds of the screen.

Three Clicks Clipping Box

1. Open the dropdown menu of the **Clipping Box** button and select entry **Three Clicks Clipping Box**.
2. Select three points in the 3D view to determine the surface.
   The clipping box will then be created with one of its faces being coplanar to the surface defined by the three picked points. The clipping box will be scaled in such a way as it exactly encloses the picked points.

Aligned to a Limited or Unlimited Plane Object

Select **New > Aligned Clipping Box** in the context menu of a plane object to align a clipping box to the object. You can mark a plane by opening the context menu of button Mark Object in the toolbar and selecting **Mark Plane** .

- Unlimited plane: The new clipping box will be created as a unit cube centered on the reference point of the plane. Its faces will be parallel to the selected plane.
- Limited plane: The new clipping box will tightly enclose the boundary polygon of the limited plane.

The created clipping boxes are saved for later use and will be added to a folder **ClippingBoxes** in the **structure view**. Those folders are added as follows:

- New clipping boxes are local, which means, they will be placed below the object the 3D view is opened on.
- If the overall project 3D view gets opened, created clipping boxes will be global.
- In scan projects imported from earlier SCENE versions, clipping boxes will stay global.
- Operations started from a 3D view which operates with clipping boxes will use only the clipping boxes visible in that 3D view.

After you have created the clipping box, you can reposition and resize it.

NOTE: After it has been created, the rotation point of the view will be set to the center of the clipping box.

Creating clipping boxes does not delete any points from the point cloud. The points outside or within the clipping box are simply hidden and may be displayed again at any time.

Deleting a Clipping Box

If you would like to have one or more of the available clipping boxes not being regarded, you can enable or disable them or delete them from the project.

1. To delete a clipping box, right-click the clipping box either in the work area or in the structure view to open the context menu.

2. Select menu entry **Delete Clipping Box**.

Visualizing Scales and Distances

SCENE allows visualizing dimensions and distances in the 3D view by displaying a customizable two-dimensional grid.

This tool is only available in the 3D view.

The grid is a set of visible lines that serve as a visual distance reference and can be seen as a two-dimensional ruler. The grid can be positioned anywhere in SCENE and gives a good impression of distances and scales in the point cloud. You can attach the grid to a scan point, or with one or three clicks.

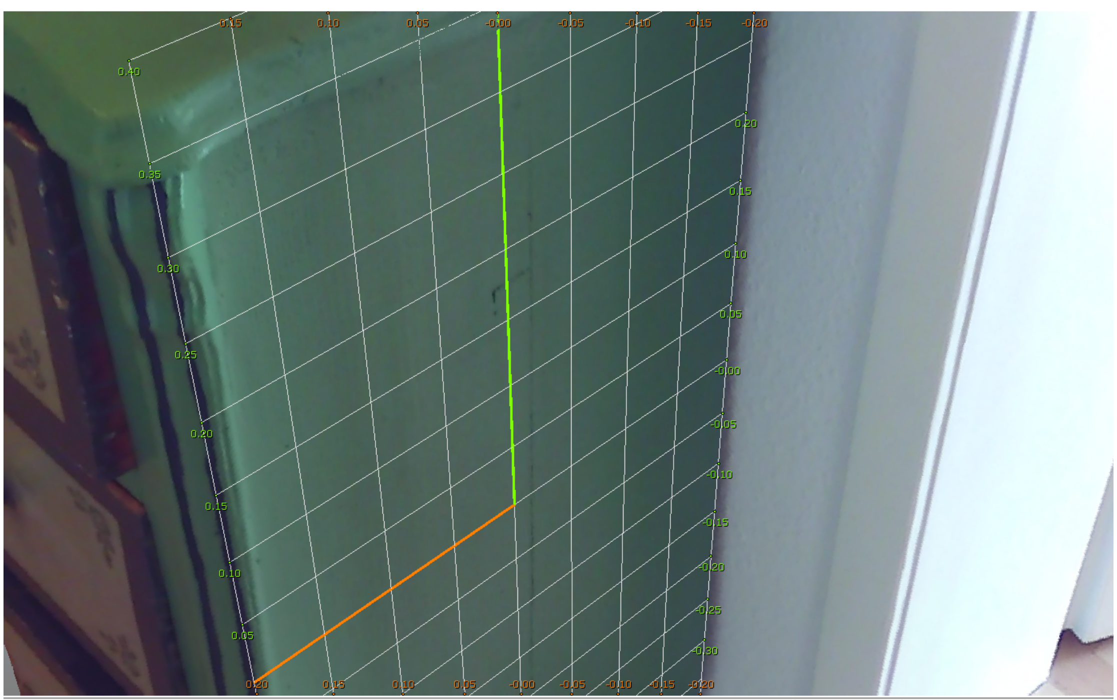


Figure 10-19 Regular grid in 3D view

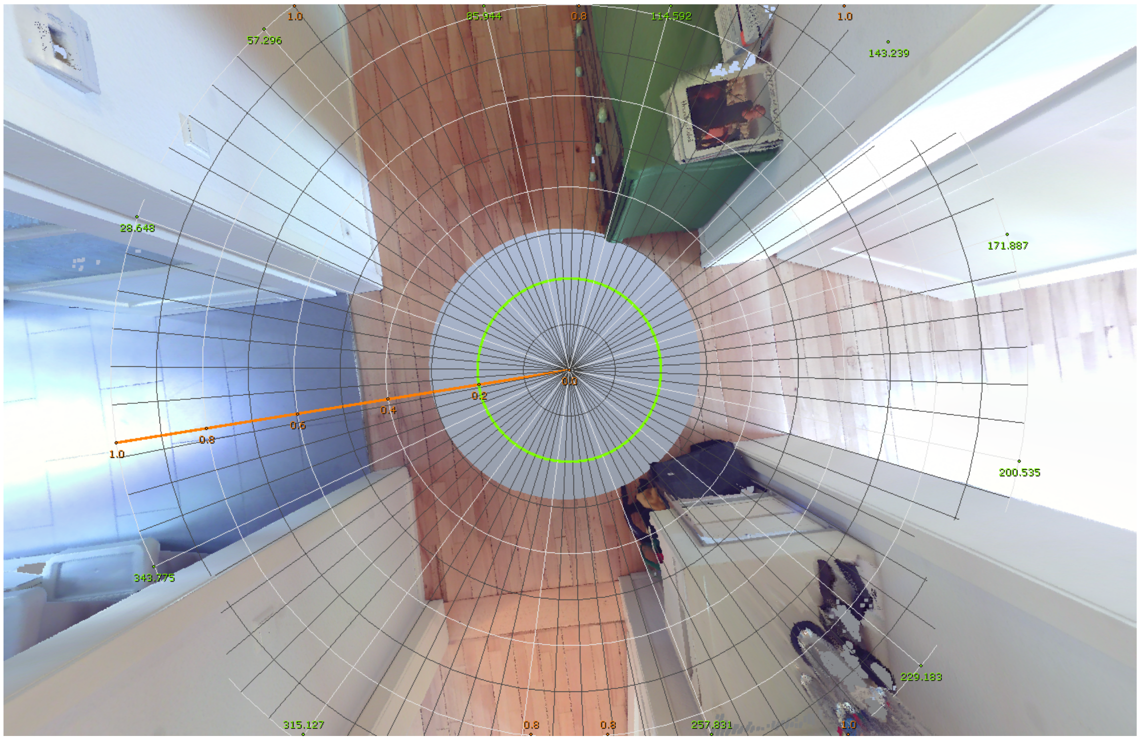


Figure 10-20 Polar grid in 3D view

Displaying and customizing the grid

1. Open the Grid dropdown menu and select **Show Grid**.
   By default, the grid is located in the coordinate origin and lies in the XY plane.

2. Then, use the dropdown menu options to make your adjustments.

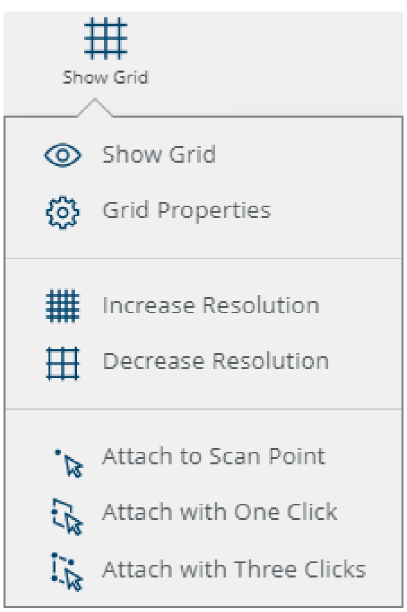


Figure 10-21 Grid dropdown menu

Grid Properties

Open the **Grid Properties** dialog from the **Show Grid** dropdown menu. The dialog has different options to set the grid properties.

Style

- The **regular grid** divides the space in axially parallel and evenly spaced rectangular areas. Both scales in X and Y direction show the distance in relation to the grid's origin.

- The **polar grid** consists of concentric rings and radial dividers. The concentric rings show the distance to the grid's origin. With the radial dividers one can estimate the angles between two points of interest.

Start/End – Define the dimensions of the displayed grid in both directions by entering a **Start** and an **End** value.

Colors – Change the color of the lines for the two directions.

Resolution – Define the **resolution** of the grid by changing the distance between the displayed grid lines for both directions.

Resolution

Increase the resolution of the grid by decreasing the distance between the displayed lines by a factor of 2.

Decrease the resolution of the grid by increasing the distance of the displayed lines by a factor of 2.

Tab Display Options

On this tab you can toggle the visibility of certain visible grid elements:

Direction X – x-axis (colored line)

Direction Y – y-axis (colored line)

Labels X – labeling of lines parallel to the x-axis

Labels Y – labeling of lines parallel to the y-axis

Primary Scale X – labeled lines of the grid in x direction

Primary Scale Y – labeled lines of the grid in y direction

Secondary Scale X – non-labeled lines visible at certain zoom levels in x direction

Secondary Scale Y – non-labeled lines visible at certain zoom levels in y direction.

Attach to Scan Point

Change the position of the grid's origin. Pick a point in the SCENE and the grid's origin will be moved to that point.

Attach with One Click

Align the grid by picking one click, if the plane has an even surface.

Attach with Three Clicks

Align the grid by picking three points, if the plane is uneven, or if you need a high accuracy. Picking three points for planes makes sense for outdoor scans, or for a scans of an old building in which floors or ceilings often are more or less curved.

Manipulating a Clipping Box

You can change the transformation of a clipping box by rotating, moving, or changing its size.

For this, click the clipping box in the 3D view, or click its name in the structure view. A floating tool bar will appear which provides the manipulation functionality.

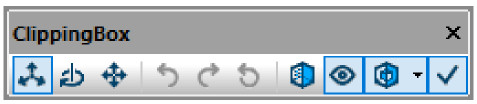


Figure 10-22 Clipping Box toolbar

Scale button 

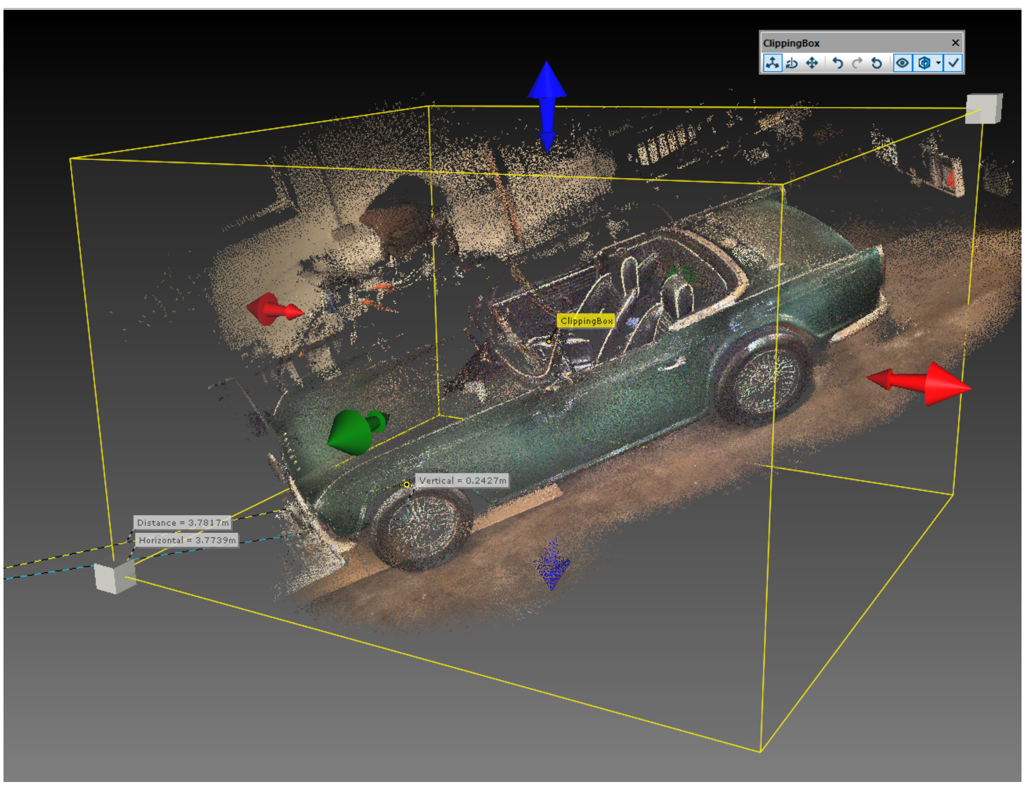
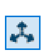


Figure 10-23 Resizing a Clipping Box

1. Select the **Scale** button  from the clipping box toolbar to **resize** the clipping box. Handlers will appear on the clipping box allowing you to resize it.

2. Drag one of the red, blue or green handlers to resize the clipping box.
   The corresponding face of the box will move.

3. Drag the gray cubes at the corners to resize the clipping box proportionally.

When dragging one of the handlers, the length of the movement will be indicated in the view as shown in the picture below.

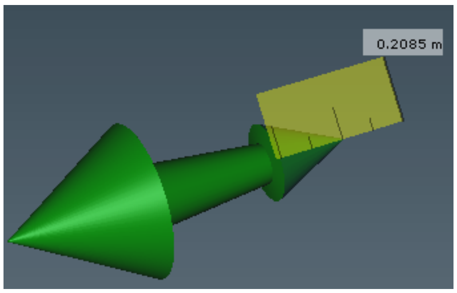


Figure 10-24 Length of movement

Rotate button

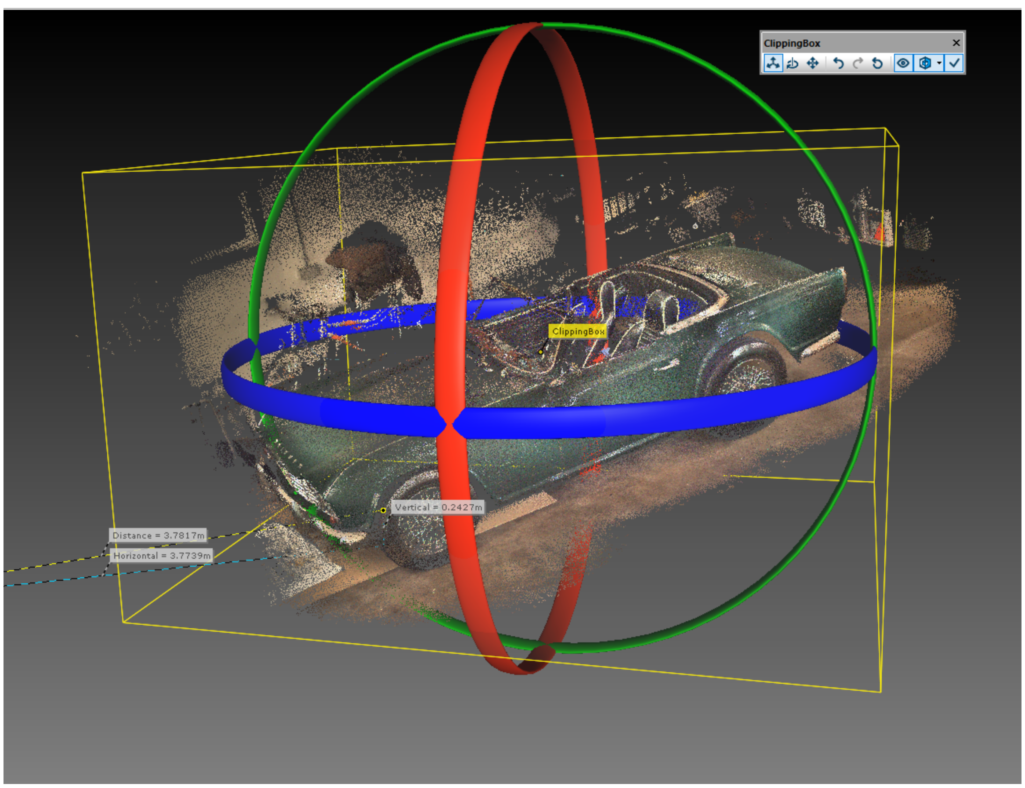


Figure 10-25 Rotating a Clipping Box

1. Select the **Rotate** button from the clipping box toolbar to **rotate** the clipping box.
   Handlers will appear on the clipping box allowing you to rotate it around different axes.

2. Drag one of the red, blue or green handlers and rotate the clipping box along the corresponding axis.

Move button 

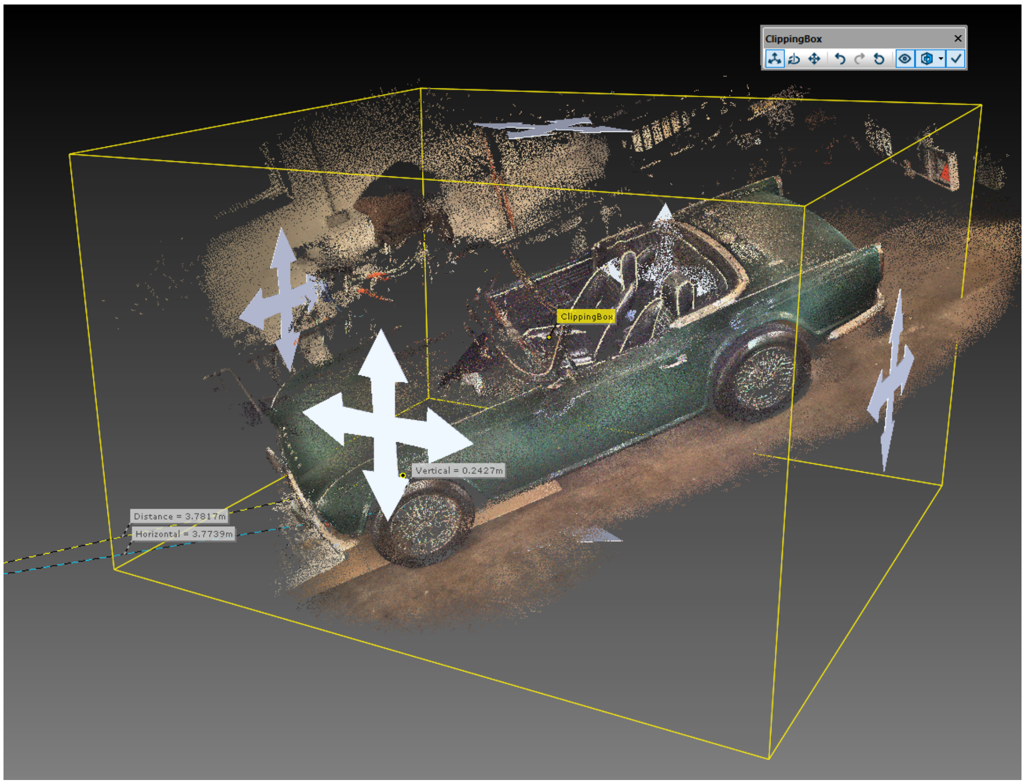


Figure 10-26 Moving a Clipping Box

1. Select the **Move** button  from the clipping box toolbar to **move** the clipping box.
   Handlers will appear on the clipping box allowing you to change the position of the box.

2. Drag one of the handlers (white arrows) and move the clipping box within two dimensions.
   The dimensions depend on the used handler. You may also use the keys 2, 4, 6 or 8 on the number pad instead.

You can change the size of the handlers with the number pad + key (increase size) and **-** key (decrease size).

You may undo (and reapply) your transformation changes with the following buttons of the clipping box toolbar:

- Undo the last transformation change with 
- Redo the last transformation change with 
- Restore the initial transformation of the clipping box with 

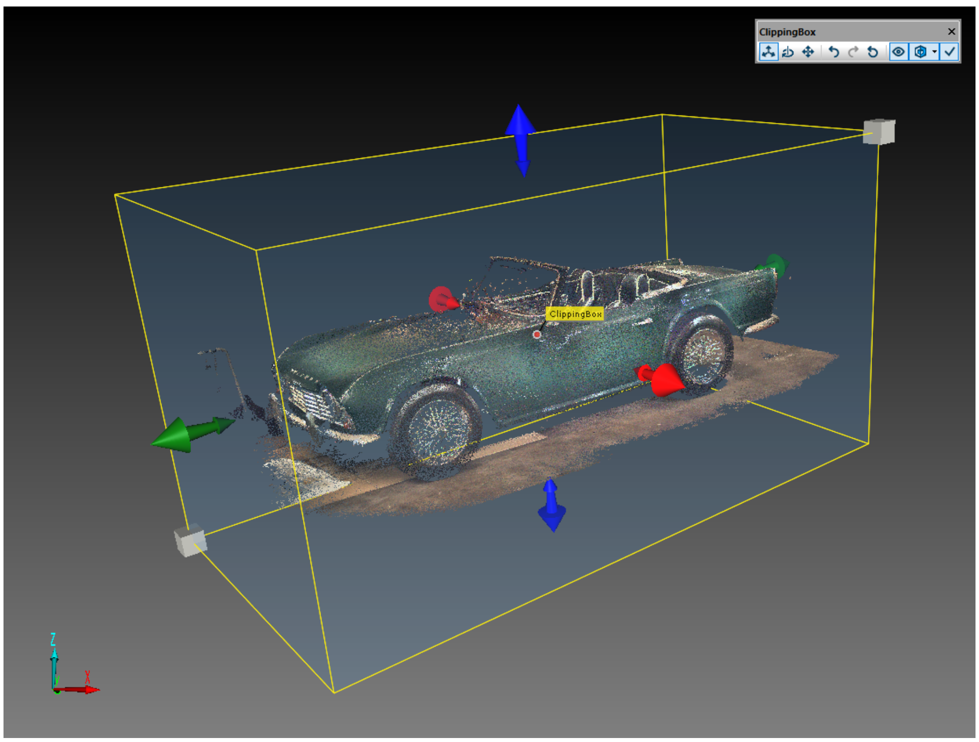
Hiding and Displaying Points by Means of Clipping Boxes

Click button **Hide** in the clipping box toolbar to select which points should be displayed.

- **Hide exterior**: Hide the points outside the selected clipping box. This is the default setting.
- **Hide interior**: Hide the points inside the selected clipping box.

This does not have an effect on the visible objects in the 3D view.

If you resize the clipping box to a subset of the project and you are hiding the interior or exterior, you can toggle between clipping only points and clipping everything by clicking button .



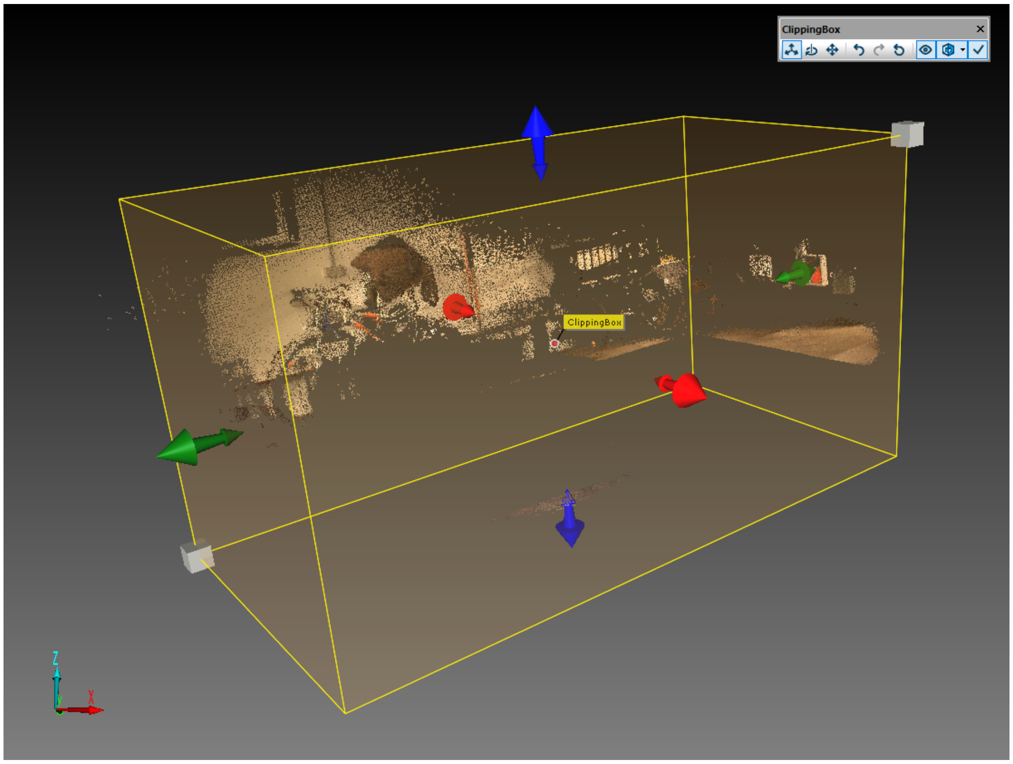


Figure 10-27 Exterior hidden (upper picture) and interior hidden (lower picture)

Depending on this setting, the boundaries of the clipping box as well as the icon in the **structure view** will be displayed in different colors:

- transparent blue when the exterior is hidden.
- transparent orange when the interior is hidden,

This setting will be saved in the clipping box properties for later use and may also be changed in the Properties dialog.

Working with Multiple Clipping Boxes

You can combine the point visibility settings of several clipping boxes. For this, the following rules apply.

Adding a clipping box with **Hide Exterior** enabled to already available and active clipping boxes:

- The points inside this box will always be added to the currently visible points, even if this box intersects with boxes that have the interior hidden.
- The points outside this box will not be hidden. In that case the clipping settings of the already available clipping boxes have the precedence.

Adding a clipping box with **Hide Interior** enabled to already available clipping boxes:

- This will cut out the points that are inside this box from the points that are visible at that time, even if this box intersects with boxes that have their exterior hidden (and the interior displayed).
- The points outside this box will not be displayed. In that case the clipping settings of the already available clipping boxes have the precedence.

The order of creation of the clipping boxes thus matters and has an effect on which points are displayed.

Example: You want to show the motor of the car. For this, you use a scan in which the hood is opened:

Figure 10-28 Example: Complete point cloud

Now you add the first clipping box around the car that has its exterior hidden (clipping box 1).

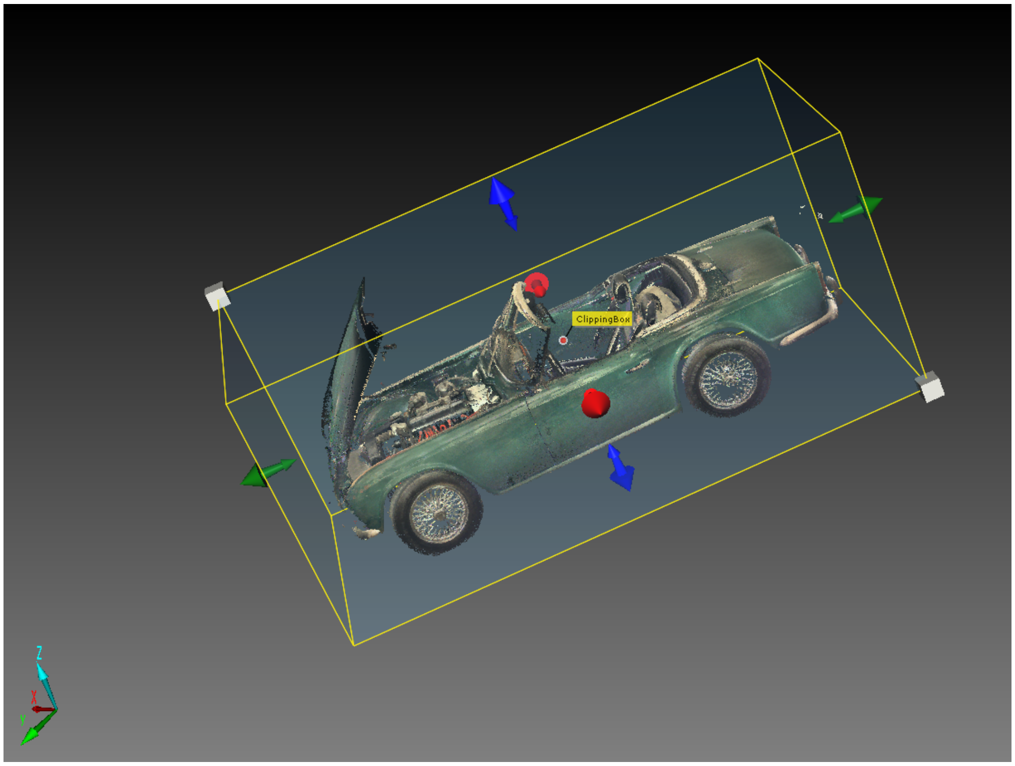


Figure 10-29 Example: First Clipping Box with hide exterior added

All the points outside the clipping box are now hidden, only its interior is displayed. Now you would like to remove the hood because it disturbs the view. So you add a new clipping box with hide interior enabled (clipping box 2).

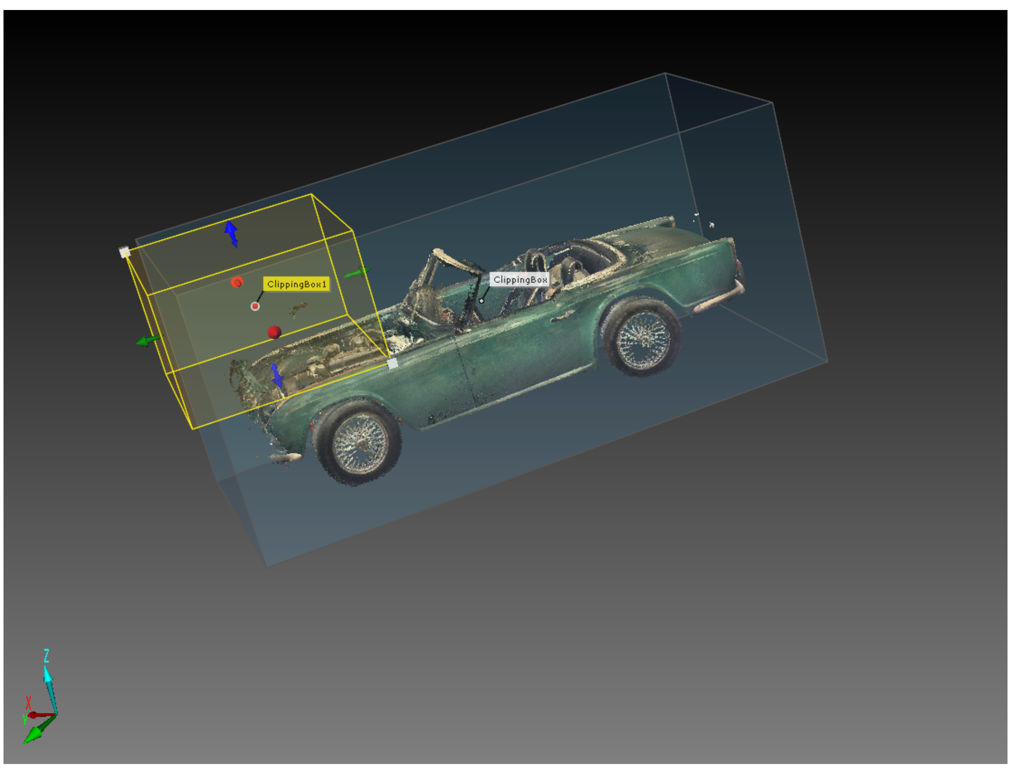


Figure 10-30 Example: Second Clipping Box with hide interior added

The points within clipping box 2 are now hidden. But now you would like to hide the points of the two front fenders. So you add two new clipping boxes but this time with hide interior enabled (clipping boxes 3 and 4).

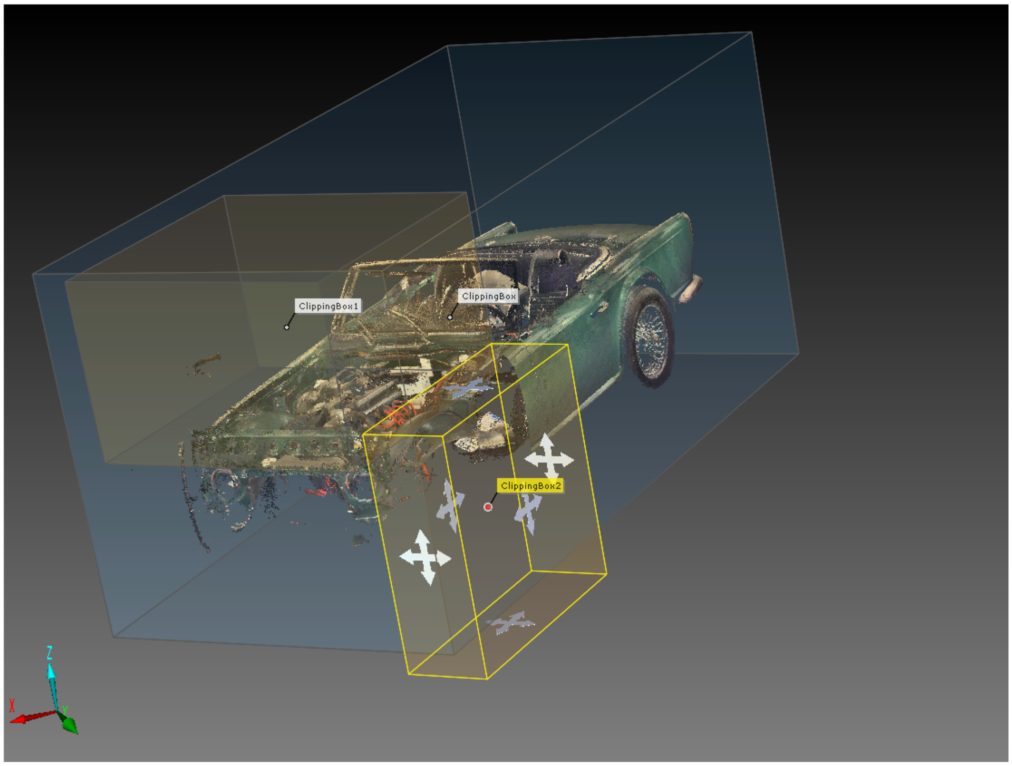


Figure 10-31 Example: clipping box 3 with hide interior added

The points in the overlapping areas between clipping boxes 1 and clipping boxes 3 and 4 are now removed.

Figure 10-32 Example: Result with hidden clipping boxes

Deleting Points by Means of Clipping Boxes

You may delete points of all active clipping boxes. For further information, see Delete Scan Points.

Enabling and Disabling Clipping

Click button **Enable/Disable Clipping** in the clipping box toolbar to enable or disable the clipping of the selected clipping box.

When disabled, the points hidden by this box will be displayed again. The color of the clipping box boundaries and its icon in the **structure view** change to gray.

This option is also available in the context menu of the clipping box in the structure view.

Figure 10-33 Disabled Clipping Box

This setting will be saved in the clipping box properties for later use and may also be changed in the Properties dialog.

Toggle Application of Clipping Boxes Button

Click button **Toggle Clipping Boxes** in the 3D toolbar at the bottom of the screen to enable or disable clipping of all available clipping boxes globally.

This setting will not be saved in the properties of the individual clipping boxes.

Toggling the Visibility of Clipping Boxes

Toggle the visibility of a clipping box as follows:

- With the **Clipping box visibility** button in the clipping box toolbar
- In its context menu
- In its properties dialog

Disabling the visibility of a clipping box will only hide its boundaries. The clipping box is still active (if clipping is enabled) and it still has effect on the visibility of the points in the 3D view.

Creating Multiple Clipping Boxes Along an Axis of an Existing Clipping Box

You can create multiple clipping boxes along one of the three axes of an already available clipping box which also serves as a template for the new clipping boxes. This allows slicing the point cloud into specific areas of interest and can be a useful feature, for example to divide a building into its several floors.

Do the following to create multiple clipping boxes along an axis of an already existing clipping box:

1. Open the 3D view.
2. Navigate to the clipping box which should serve as the template.
3. Check if this clipping box has the clipping mode **Hide Exterior**.
   If not, select **Hide Exterior**, see Hiding and Displaying Points by Means of Clipping Boxes.

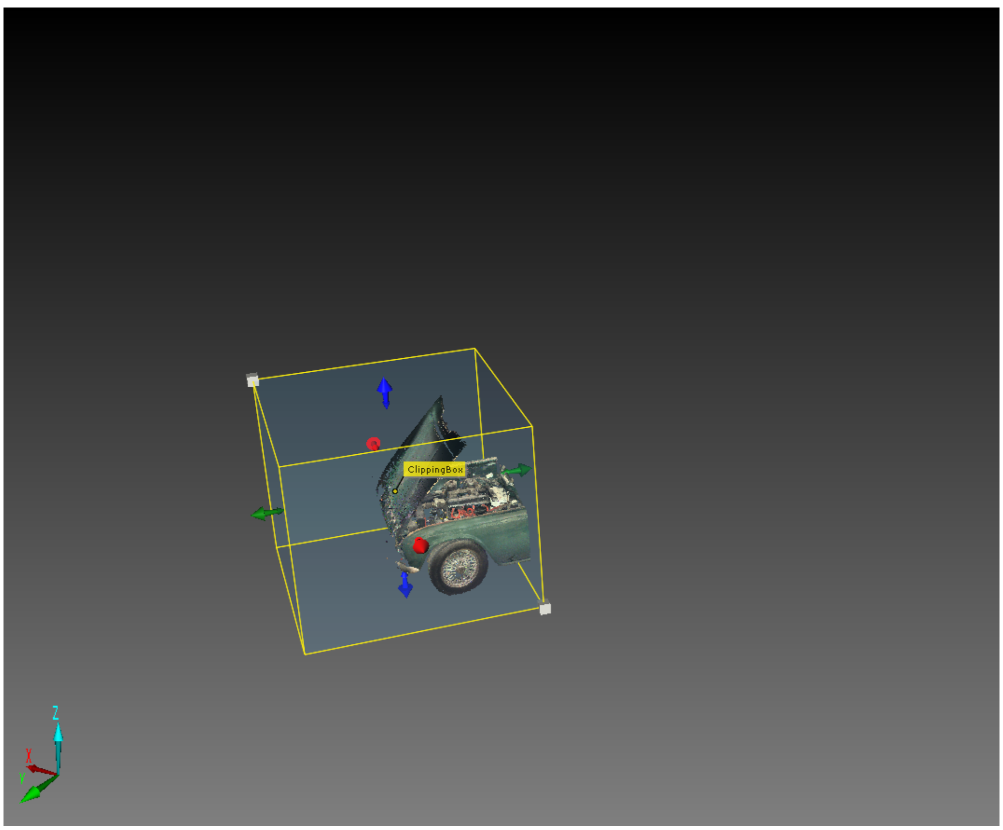


Figure 10-34 Clipping boxes along an axis – Hide Exterior

4. Right-click this clipping box to open the context menu and select **Create Clipping Boxes along an axis**.
   Two new clipping boxes will be displayed according to the default settings.

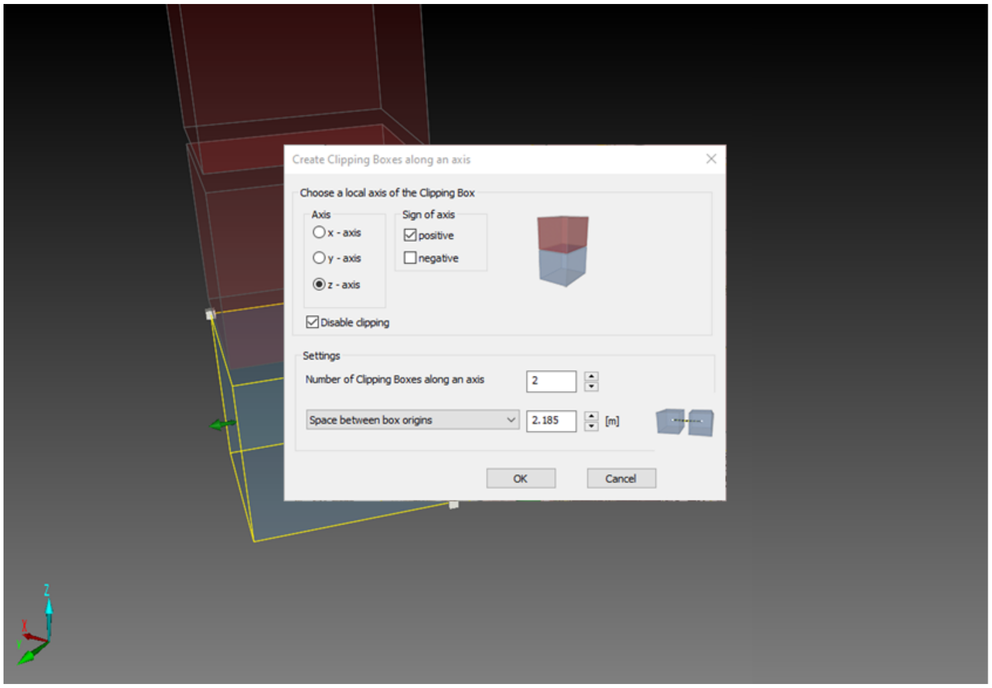


Figure 10-35 Clipping boxes along an axis – Preview

5. Enter your settings in the dialog.
   In our example, there should be a clipping box for the front part, for the middle part, and for the rear part of the car.

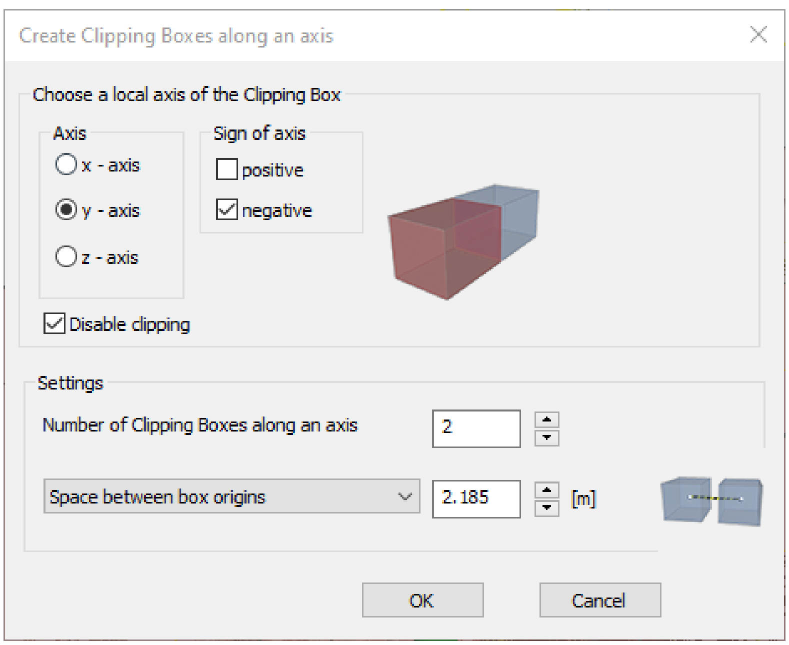


Figure 10-36 Clipping boxes along an axis – Settings dialog

Axis

Select the axis of the existing clipping box along which the new clipping boxes will be generated. A preview of the new clipping boxes will be available in the current 3D view.

Disable Clipping

Disable clipping in the preview.

Sign of Axis

Select the direction of the axis in which the clipping boxes will be created.

Number of Clipping Boxes along axis

Define the number of clipping boxes to be created.

Space between boxes / Space between box origins

The distance between the clipping boxes. There are two ways to define the distance, either between the origins of the clipping boxes or between the adjacent faces of the clipping boxes.

6. Click **OK** to create the clipping boxes with the selected settings.

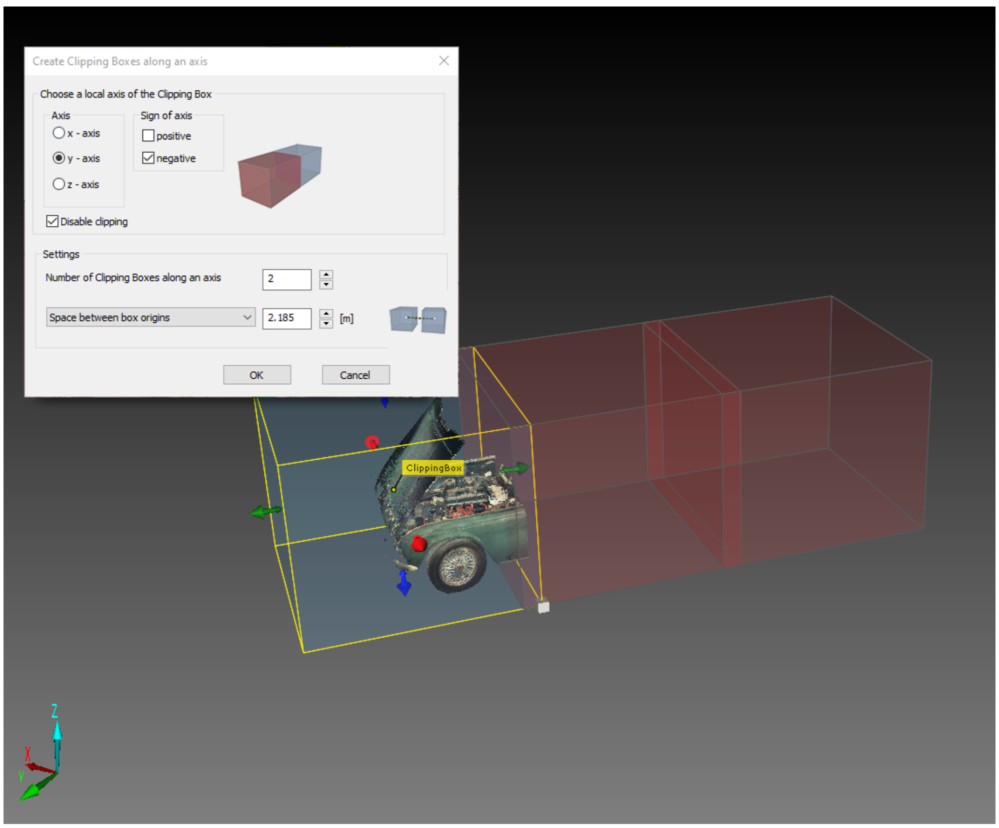


Figure 10-37 Clipping boxes along an axis – preview

The initial clipping box will be moved to the new clipping box folder and will be renamed according to the folder's name. The other clipping boxes will get the name of the folder and a number. The clipping boxes will be surrounded by the so-called **Clipping Box container**.

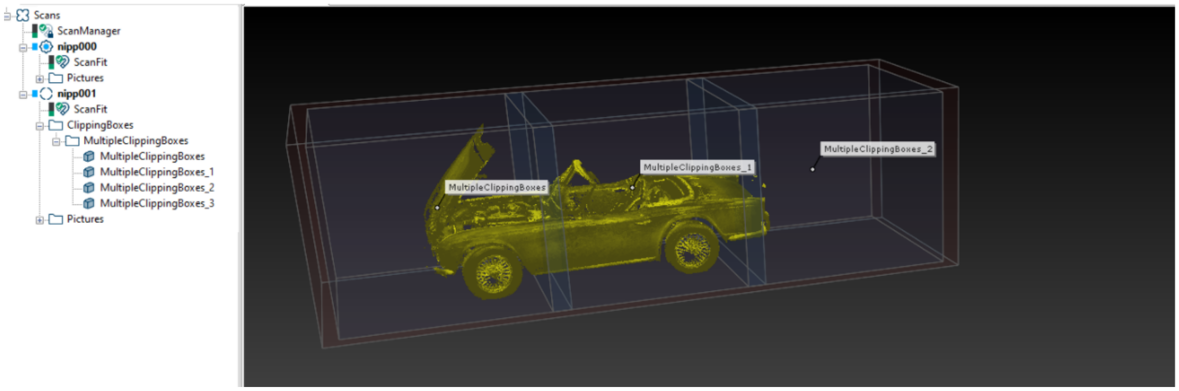


Figure 10-38 Clipping boxes along an axis, with Clipping Box container

Working with Clipping Box Containers

A clipping box container contains all the clipping boxes which were created along an axis of an existing clipping box. It has a transformation which consists of scale, rotation and translation.

You can rotate, move, or resize a clipping box container similar to a clipping box.

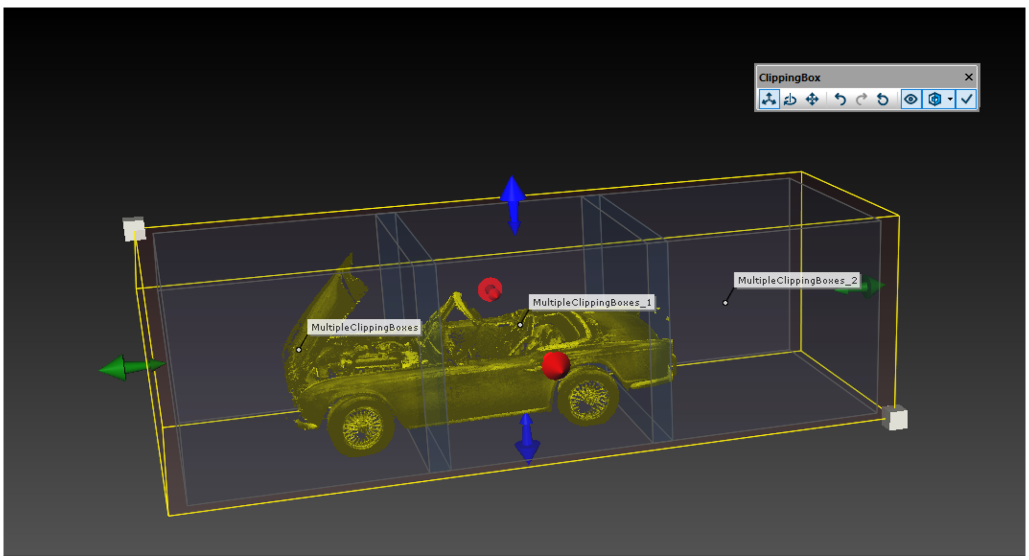


Figure 10-39 Clipping box container with resize handlers

These transformation changes will be proportionally applied to the clipping boxes within the container.

If required, you can change the size of the clipping boxes inside the clipping box container. It is no longer possible to rotate one of the clipping boxes, nor is it possible to move one of the clipping boxes to the outside of the clipping box container.

NOTE:

All clipping boxes within a clipping box container have constrained functionality:

- The single clipping boxes cannot be rotated individually.

  Their clipping mode cannot be changed.

- The single clipping boxes cannot leave the volume of the clipping box container.
- You can change the visibility of the clipping box container and the clipping boxes in the container with the **Clipping box visibility** button in the clipping box toolbar or in its context menu.
- Any transformation of the clipping box container will transform the single clipping boxes.
- The visibility state of the clipping box container is a global state and not view-specific.

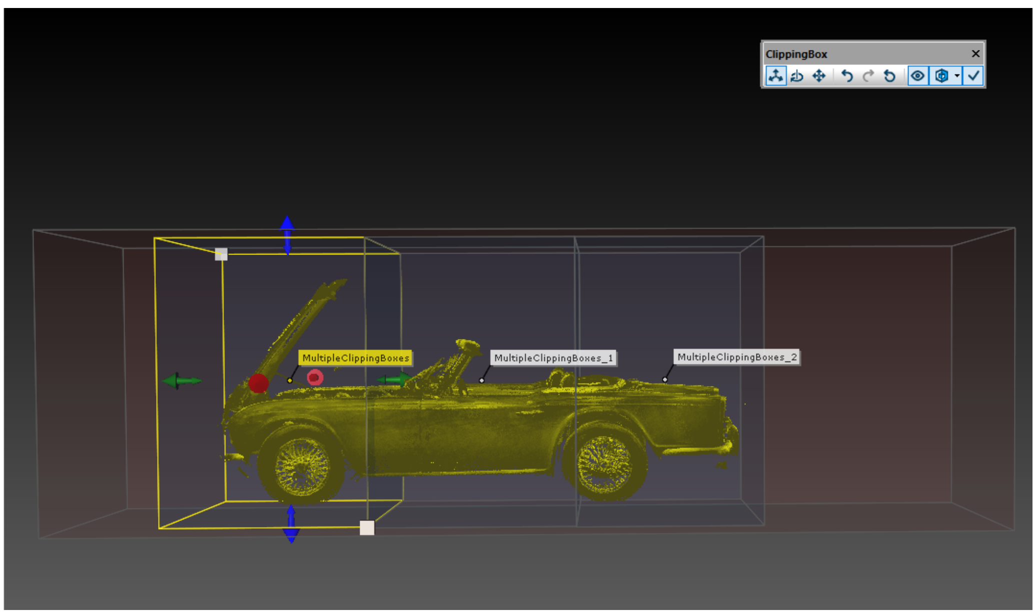


Figure 10-40 Resizing the Clipping Boxes inside the Clipping box container

Exporting Scan Points by Means of Clipping Boxes

You may also export 3D points into different file formats using the active clipping boxes.

1. Right-click the 3D view, or,
2. Right-click a clipping box to open the context menu and select entry **Active Clipping Boxes > Export 3D Selection**.

SCENE will then create a 3D selection and export the selected points afterwards.

Additionally, you may export the points in a local coordinate system defined by one of the available clipping boxes. For this, select **Use Local Coordinates** in the export dialog and select the clipping box from the list.

NOTE: Only the points of point clouds will be exported. The **Export** menu shows the **Color/Gray** option as well as the **Full scan** option grayed out, because they don't make sense for a point cloud.

Meshing (Planar View and 3D View)

This section describes how to use the meshing feature in SCENE.

What is a Mesh?

When an object is scanned, the scan points represent individual spots on the surface of the object. If you want to reconstruct the surface itself, you can create a mesh which takes the scan points as a basis and approximates the surfaces within certain limits.

NOTE: Creating a mesh for a very large object (for example, a building) may not produce satisfactory results. Create several smaller meshes of the various parts of the large object, instead.

The approximation of the scanned surfaces is done with a set of triangles.

Depending on the curvature of the real surface and the required approximation quality, the number of triangles can vary between a few and a huge number.

Making Your Mesh Watertight

To print a 3D model with a 3D printer, the 3D model must not have any gaps. The 3D model must have a solid volume, it must have a solid surface without gaps. A commonly used term for this is *watertight*.

Creating a Mesh in Planar View

NOTE: Meshes created in the planar view do not have the same quality as meshes created in the 3D view.

1. Create a 2D selection as described in Selecting Scan Points in the Planar View or the Quick View.

2. Right-click the selection, then click **Current Selection > Mesh**. Doesn't exist --> Context menu Create objects > Mesh, node is created but can't be opened.
The Mesh Generation Parameters dialog is shown.

To create a mesh in planar view, select the Mesh Generation Parameters in the following dialog:

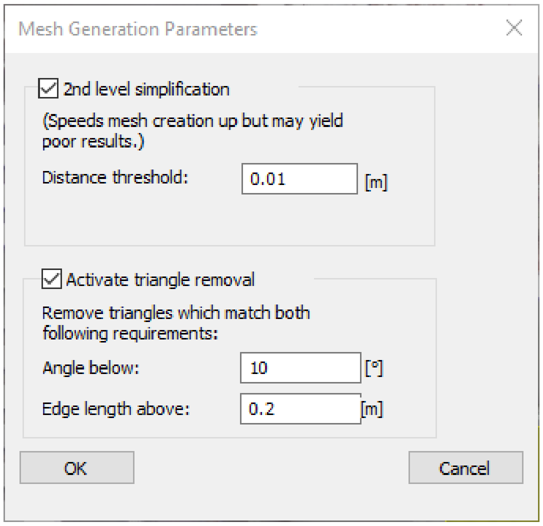


Figure 10-41 Mesh generation parameters

2nd level simplification: Activate 2nd level simplification based on the distance between scan point and nearest triangle.

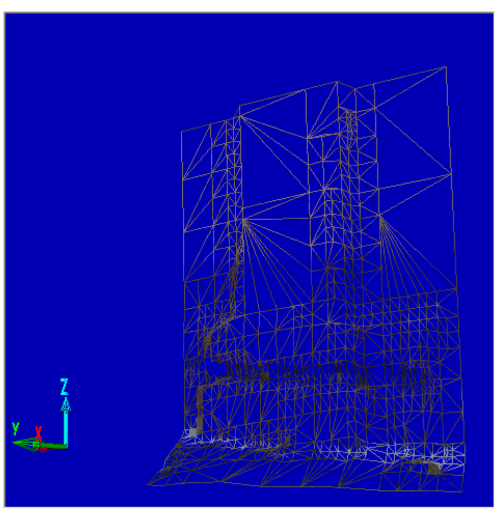
Distance threshold: A triangle approximates all scan points within this distance threshold. The smaller the value, the more triangles you'll get.

Activate triangle removal: If an object is in front of a different object, neighboring scan points shouldn't be connected by triangles. Here you can activate the removal of triangles which match both of the following requirements.

Angle below: The angle between the scanner and the surface of the triangle. The larger the value, the more triangles will be removed.

Edge length above: The edge length of the triangle. The smaller the value, the more triangles will be removed.

Although the resulting mesh may be a relatively small collection of triangles, its appearance can show more details. This is done by a texture, which is similar to a photo glued onto the triangles. By default the display contains textures.



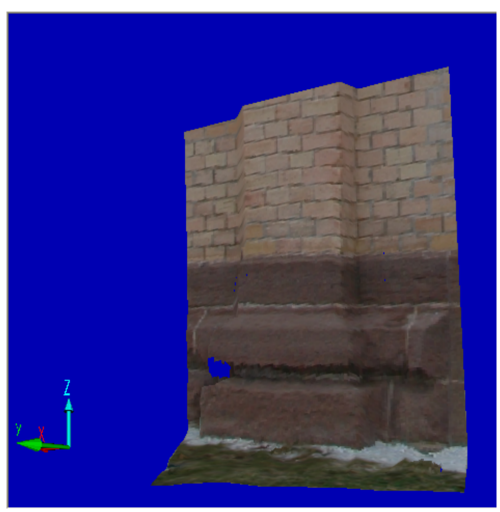


Figure 10-42 Mesh without and with texture

Creating a Mesh in the 3D View

Figure 10-43 Meshing Object

NOTE: Meshing in the 3D view is only available for point clouds. For information about creating point clouds refer to topic *Processing* on page 99.

There are two methods to create a mesh:
Mesh Selection: You can make a freehand selection of scan points.

Mesh Clipping Boxes: You can use one or more clipping boxes to select what you want to be meshed.

Meshing a Selection

1. Create a 3D selection as described in *Selecting Scan Points (3D View, Planar View, Quick View)* on page 183
2. Click the Mesh dropdown menu and select **Mesh Selection**.
   The **Create Mesh** – **Settings** dialog is shown. You can also right-click the selection, then click **Selection – Mesh Selection**.

Mesh Clipping Boxes

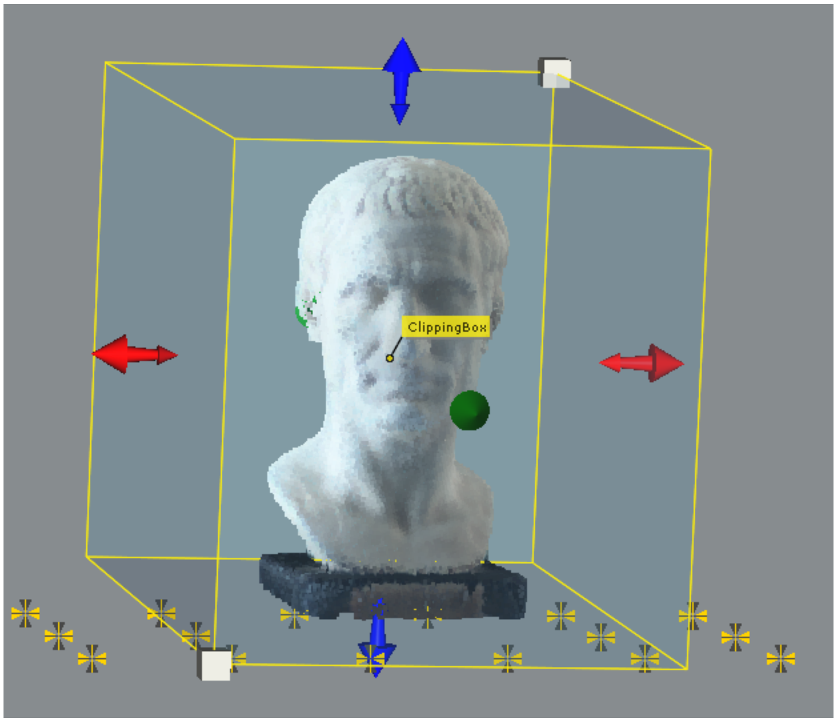


Figure 10-44 Object selected with a Clipping Box

1. Create and adapt one or more clipping boxes around the object as specified in Creating a Clipping Box.
2. Click the Mesh dropdown menu and select **Mesh Clipping Boxes**.
   The **Create Mesh Settings** dialog is shown. You can also right-click the clipping box, then click **Active Clipping Boxes > Create Mesh**.

Settings

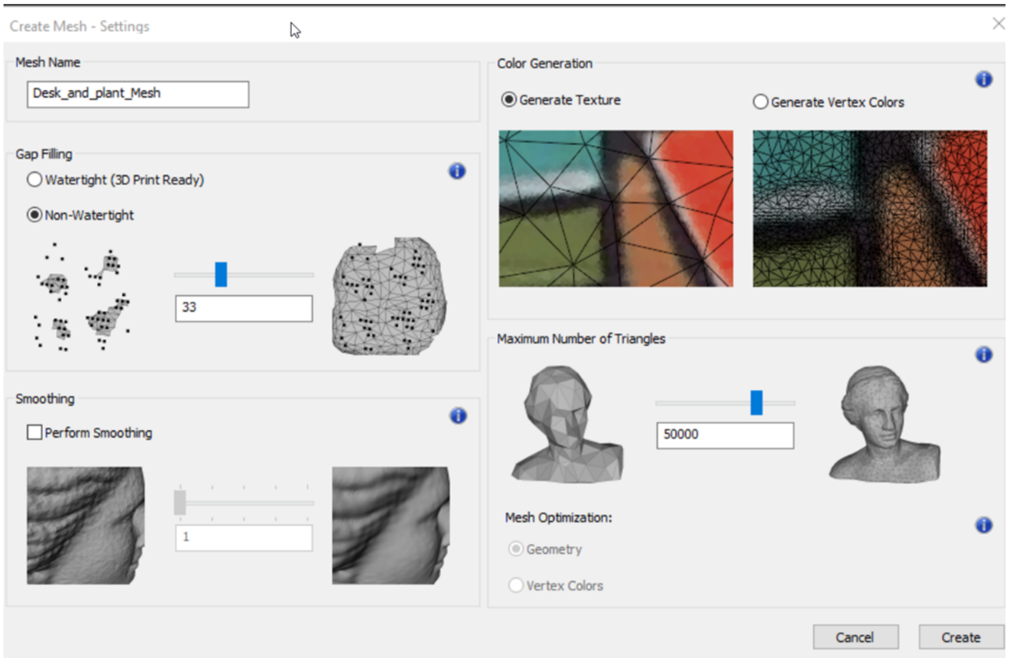


Figure 10-45 Create Mesh Settings

Mesh Name

Specify a name for the mesh.

Gap Filling

Watertight (3D Print Ready)

Select this option if the mesh will be used for 3D printing. The mesh will then be generated “watertight”, which means, it has a solid surface.

Non-Watertight Mode

Select this option if the mesh will not be used for 3D printing.

Slider - Meshing Mode

The slider in the **Meshing Mode** box, allows closing holes and expanding the mesh beyond the points. This option is available when **Non-Watertight mode** is selected.

Smoothing

Perform Smoothing

Select this checkbox to apply a post-processing operation to make the mesh smoother.

Slider – Smoothing

The slider in the **Smoothing** box allows making mesh smoother.

The higher the slider value, the smoother the mesh will be.

Color Generation

You can color the mesh as follows:

Generate Texture

This creates color in the texture by applying a graphic file to each triangle. It is the method supported by most 3rd-party software products and will likely have the best results.

Generate Vertex Colors

This method creates color in the texture by applying color information to the vertices in the mesh.

Maximum Number of Triangles

Slider – Maximum Number of Triangles

The slider under this category allows you to control how many triangles will be created in the mesh, if non-watertight mode is active.

If you know the maximum number of triangles which your software is able to process, enter this number. Otherwise, the default value is recommended.

Mesh Optimization

Geometry vs. Vertex Colors

Geometry is selected by default if you have selected **Generate Texture**. If you have selected **Generate Vertex Colors**, choose **Geometry** if you want the mesh to have the most accurate shape even at the expense of color. Choose **Vertex Colors** if accurate color is more important.

Create

Click the **Create** button to start the mesh creation. The created mesh will be added to the structure view and displayed in the opened 3D view. It is also possible to open a 3D view on the mesh, through the context menu.

Mesh Properties

You can review the mesh properties by right-clicking the name of the mesh in the structure view and selecting **Properties**. The surface area of the mesh is calculated by taking the sum of the surface area of all the triangles in the mesh.

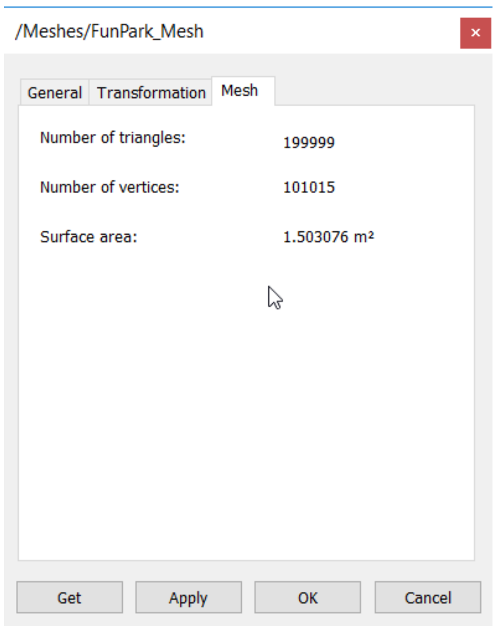


Figure 10-46 Mesh Properties Dialog

Manipulating a Mesh

A mesh can be moved to a different orientation or placement within the 3D view.

Select a mesh (or a folder containing only a mesh) while a 3D view is open, and a 3D manipulator appears at the center of the selected object in that 3D view. This manipulator lets you modify the local transformation of that object by rotating or moving it. Click and drag on the colored circles to rotate the mesh, or the arrows to move it. Immediately after modifying the position of the mesh, a small toolbar appears near the mouse: . With this toolbar you can step forwards and backwards through the recent orientations, or undo them all.

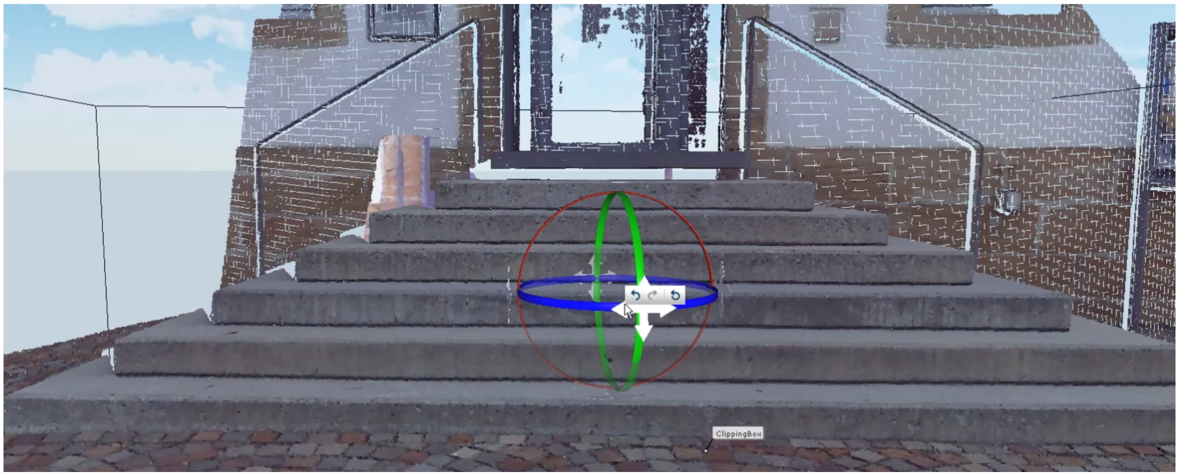


Figure 10-47 Meshed Clipping box with Handle and toolbar

NOTE: Because legacy meshes imported from VRML files don't have transformation attributes of their own, you may only move them by selecting their containing folder and using its manipulator.

Colorizing Scan Points

Besides the distance information, a scan may also contain information about the reflectance or even the color of the individual scan points.

By default, SCENE loads the color information whenever it is available. But sometimes it is useful to load the scan with its original gray value. You can achieve this when you change the corresponding setting under **Settings** > **Views** > **Planar/Quick View** > **Scan Data Load Behavior** and then either **Color** or **Grey (Intensity)**.

Color information can be added to a scan after the scan has been taken.

If you have a scan taken by a scanner with the color option, this scan will also contain the digital pictures which the scanner took automatically during the scanning, see Colorizing Using Scanner Based Pictures.

If you don't have such a scan, you can still add color information if you have taken digital pictures of the scanned environment, see Colorizing Using Additional Pictures.

To add the color information of digital pictures to the scan, some prerequisites must be matched:

- The digital picture must be free of any distortions caused by the lens. Especially wide-angle lenses tend to cause so-called barrel or pin-cushion distortions. In a picture with such distortions, a straight line doesn't appear straight but bent.
- Position, orientation, and zoom factor of the camera must be known or must be computable.

In addition, you can enhance the color overlay and enhance the white balance of pictures.

Colorizing Using Scanner Based Pictures

The scanner based pictures are stored within the scan and are visible in the **structure view**.

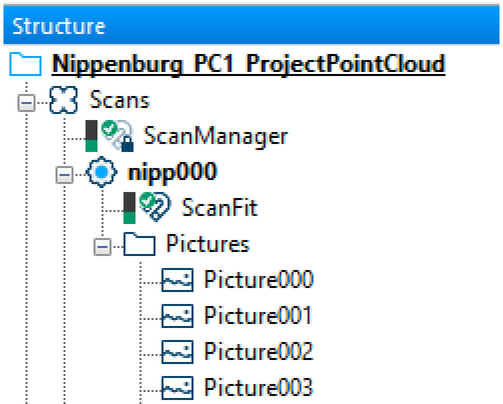


Figure 10-48 Scan with pictures

Colorize One Scan

1. In the Structure view, right-click the scan and select **Operations** > **Color/Pictures** > **Apply Pictures**.

This will open the scan and all its pictures.

Then, it will remove any distortions from the pictures. Finally, it will add the color information to the scan points.

2. Save the scan afterwards by clicking the icon in the Workflow bar.
   This is not done automatically.

Colorize All Scans in a Scan Folder

In the Structure view, right-click the scan folder and select **Operations** > **Color/Pictures** > **Apply Pictures**.

In this case, the scans are saved automatically afterwards if you have the correct setting of **Save modified scan points**.

NOTE: If you get an out of memory error during applying the pictures, you should check the **Colorize all scan points** option under **Tools** > **Options** > **Scan Data**. If it is switched off, switch it on and try again. If you want to colorize raw scan data (raw scans that have not yet been loaded in SCENE, manipulated and saved again), the original gray values of these scans will be overwritten by the color information. The gray values get lost. SCENE will inform you before that happens. It is recommended to load the raw scans at least once and save them afterwards. For example, this will be done if you apply the recommended standard filters to the scans while preprocessing the scan data with the preprocess option.

Export pictures

If you want to manipulate the taken pictures with a professional graphics editing program before applying them to the scan, you can export them to your hard drive.

In the structure view, right-click the scan and select **Operations** > **Color/Pictures** > **Export all Pictures**.

This will open a dialog to select the storage location and to select the export format of the pictures.

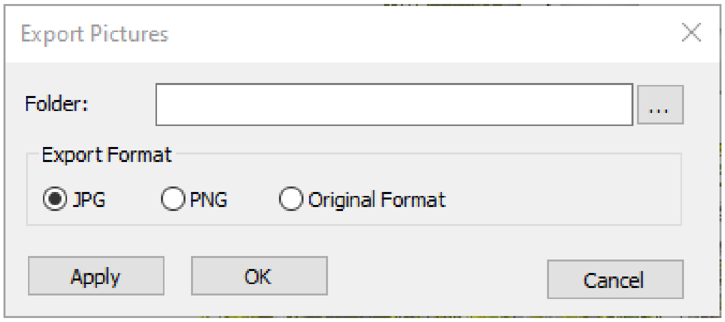


Figure 10-49 Export all pictures

Original format will export the pictures without changing their format. **JPG** will export them in JPEG-format, **PNG** in Portable Network Graphics format.

Colorizing Using Additional Pictures

As mentioned above, you can also use your own additional pictures, but then you must perform additional tasks to meet the prerequisites.

The most important requirement is that the picture is free of distortions. It is not recommended to use pictures with visible distortions, as these will be mapped onto the scan and will result in a confusing visual impression. You can avoid these distortions if you use high quality lenses.

The position, orientation, and zoom factor of the camera can be calculated by the software. All it needs are at least 6 pairs of matching points in the scan and in the picture.

1. In the structure view, right-click the scan or a picture within a scan, and select **Operations** > **Color/Pictures** > **Colorize Scan**.
   The Colorize Scan dialog is shown.

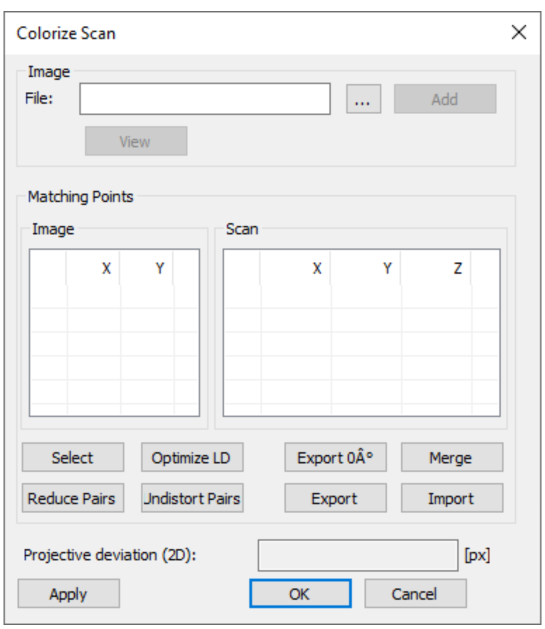


Figure 10-50 Colorize scan

Colorize Scan

2. Select the picture to be used.
   Use the **Browse** button to look for the picture in the file system.

3. Press **Add** to add it to the scan.

Alternative Picture Selection

When you start **Colorize Scan** on a picture within a scan, you don't have to browse for the picture and add it to the scan.

1. Open a planar view of the scan.

2. Press **View** in the **Colorize Scan** dialog to open a view of the picture.

3. Press **Select** to find the pairs of matching points in both, the picture and the scan.

Select Matching Scan Points

4. Select at least 6 pairs of matching points.
   The selected points are displayed in the Colorize Scan dialog.

Figure 10-51 Selecting pairs of matching points

You can select the points in any order you want. You can first select all points in the planar view of the scan, then in the picture view, or vice versa. Or select the points pair by pair, changing back and forth between the planar view and the picture view.

If you want to modify the selection, you can change the sequence of the points, re-assign it, or delete a pair. Simply right-click the point in the corresponding table of the **Colorize Scan** dialog, and select the appropriate command.

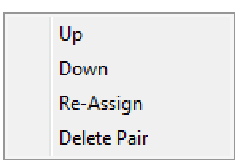


Figure 10-52 Context menu: Matching points

NOTE: Make sure to cover all 3 dimensions! The points should not lay more or less on a plane, but should span a box with reasonable length, width, and depth.

It’s always good to have some redundancy and to select more than 6 pairs.

5. When you're done with the selection, press **Apply** or **OK**.

Now the software will calculate the position, orientation, and zoom factor and will then add the color information to each scan point.

You must open a new view to see the scan in color. The already open planar view of the scan will not change.

The **Colorize Scan** dialog will display information about the quality of the projection by calculating the mean distance between the 2D projection of the selected 3D points and the corresponding points that have been selected in the picture. This distance is called projective deviation (2D) and is measured in pixels.

If you are not satisfied with the results, you can adjust some of the selected points and try again. You can also export the list of selected points to a file and continue the work the next day.

6. Save the scan.

Enhancing the Color Overlay

As soon as the scans have been colorized, you may want to enhance the color overlay of the scans. You can do this automatically with the built-in color contrast filter or manually by manipulating the color overlay with a professional graphics editing program.

Color Contrast Filter

The color contrast filter automatically enhances the dynamic range of the scan's color overlay. To apply the color contrast filter to a single scan or to all scans within a scan folder, execute the command **Operations > Color/Pictures > Color Contrast Filter** in the appropriate context menu.

Figure 10-53 Colored scan points without color contrast filter

Figure 10-54 Colored scan points with color contrast filter

Manually edit the color overlay

To manually edit the color overlay of a scan, you may export its color overlay as a picture to your local hard drive, manipulate this picture in any way with a professional graphics editing software and then replace the initial color overlay of the scan with the manipulated picture.

Export color overlay

To export the color overlay of an already colorized scan as a picture:

1. Select **Operations > Color/Pictures > Export Color Overlay** in the context menu of the scan.
2. Save the color overlay to your local hard drive.
3. Manipulate the exported color overlay.
4. Select **Operations > Color/Pictures > Replace Color Overlay** to replace the initial color overlay of the scan with the manipulated picture.

The color overlay can be replaced with a picture in JPEG (.jpg), Bitmap (.bmp) or Portable Network Graphics (.png) format. Makes sure that the manipulated picture has the same pixel resolution as the initial one.

White Balance

Scans may appear with biased colors when they were recorded under certain lighting conditions.

The White Balance function offers the possibility to select a scan point of which you know that, in reality, it has a white color.

SCENE will then adjust all colors of the scan according to this setting.

NOTE: White balance is available in planar view, quick view and 3D view. For 3D view, a scan point cloud is required.

1. In the structure view, right-click the scan, then click **Operations > Color/Pictures > White balancing**.
2. Click a scan point which should be displayed in white color. If the currently shown view is not suitable, you can rotate the scan by pressing the **Ctrl** key and clicking the scan.

SCENE will now use a sphere-shaped selection around the selected scan point to adjust the colors.

Figure 10-55 Scan before using white balance

Figure 10-56 Scan after using white balance

SCENE will ask you whether you are satisfied with the result. If you do not like the result, click the **No** button, and the settings will be undone.

Virtual Scans (3D View)

For technical reasons, hand-held scans cannot be displayed as a Panorama View in WebShare. They must be converted to so-called virtual scans first and can then be uploaded.

Virtual scans are created from the point cloud data of already existing scans. After the virtual scans were created, they behave like scans which were recorded with a laser scanner.

You can open a virtual scan in

- quick view,
- planar view, and
- 3D view.

You can export a virtual scan as

- an image,
- as an object,
- as scan points, and
- as a new scan project.

1. Click the **Create Virtual Scan** button in the toolbar. The Create Virtual Scan dialog is shown:

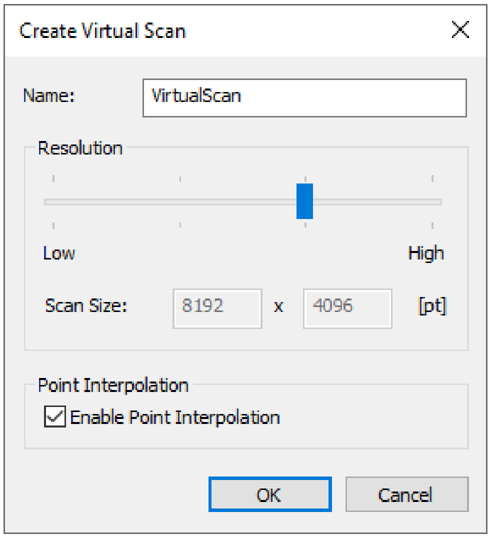


Figure 10-57 Create virtual scan dialog

Name

Enter a name for the virtual scan.

Resolution

Set the resolution with the slider. The first number corresponds to the number of columns, the second number for the number of rows.

Point interpolation

Select, if the virtual scan shall include interpolated points.

2. Click the **OK** button to start the creation of the virtual scans. A folder named VirtualScans will be created which contains the virtual scans.

Create PanoCam Scans

When you use a PanoCam with the FARO Focus Laser Scanner, SCENE provides an option to create a photo-realistic spherical visualization of the scans by creating so-called PanoCam scans. You can use them in SCENE, WebShare Cloud, SCENE 2go and ReCap. PanoCam scans enable creating virtual tours where you can measure objects and scan points as well as add annotations. They are independent of the scan resolution.

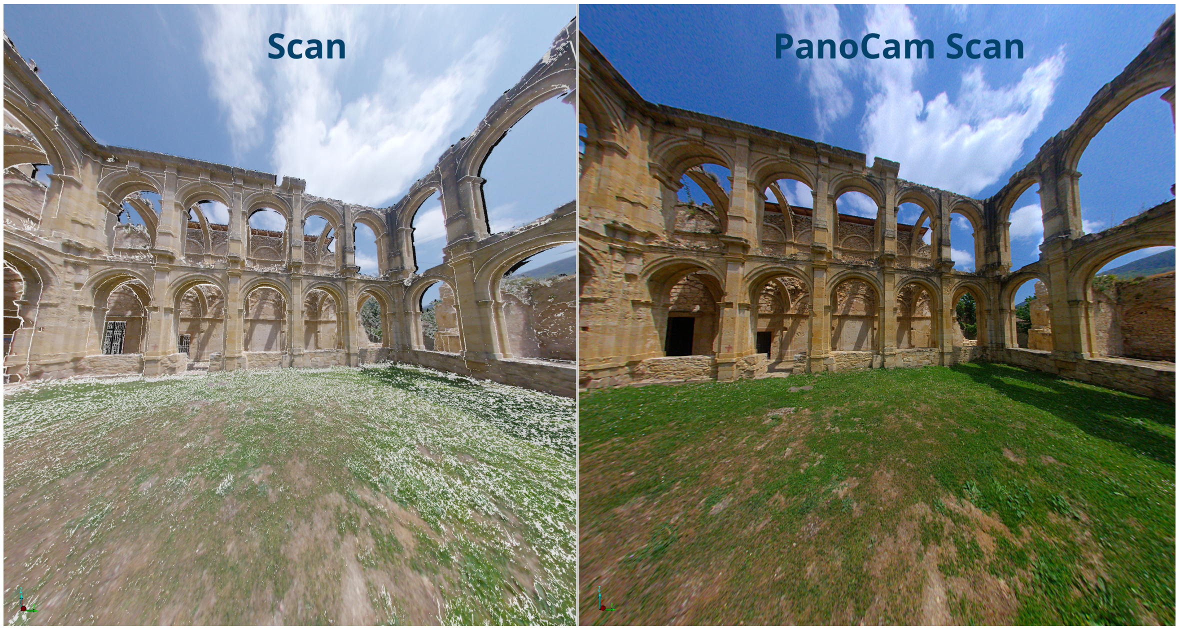


Figure 10-58 Before and after creating a PanoCam Scan

General Information on PanoCam Scans

- The First PanoCam Picture is used to create the PanoCam scan.
  Note that points hidden by the scanner cover are not included in the PanoCam scan.
- The minimum resolution is the PanoCam resolution (8000x4000) not the original scan's resolution.
  If the original scan resolution is higher, the PanoCam resolution will also be increased.
  If the original scan resolution is lower, some points will be interpolated.
- The original scan metadata is transferred to the PanoCam scan.
- PanoCam scans contain intensity and color.

NOTE: Some hidden areas may not be colorized correctly. Created PanoCam scans cannot be read by SCENE versions older than 2023.0.

Create PanoCam Scans at Processing

If you want to create PanoCam scans at processing, go to the Processing Settings and activate checkbox **Create PanoCam Scans**.

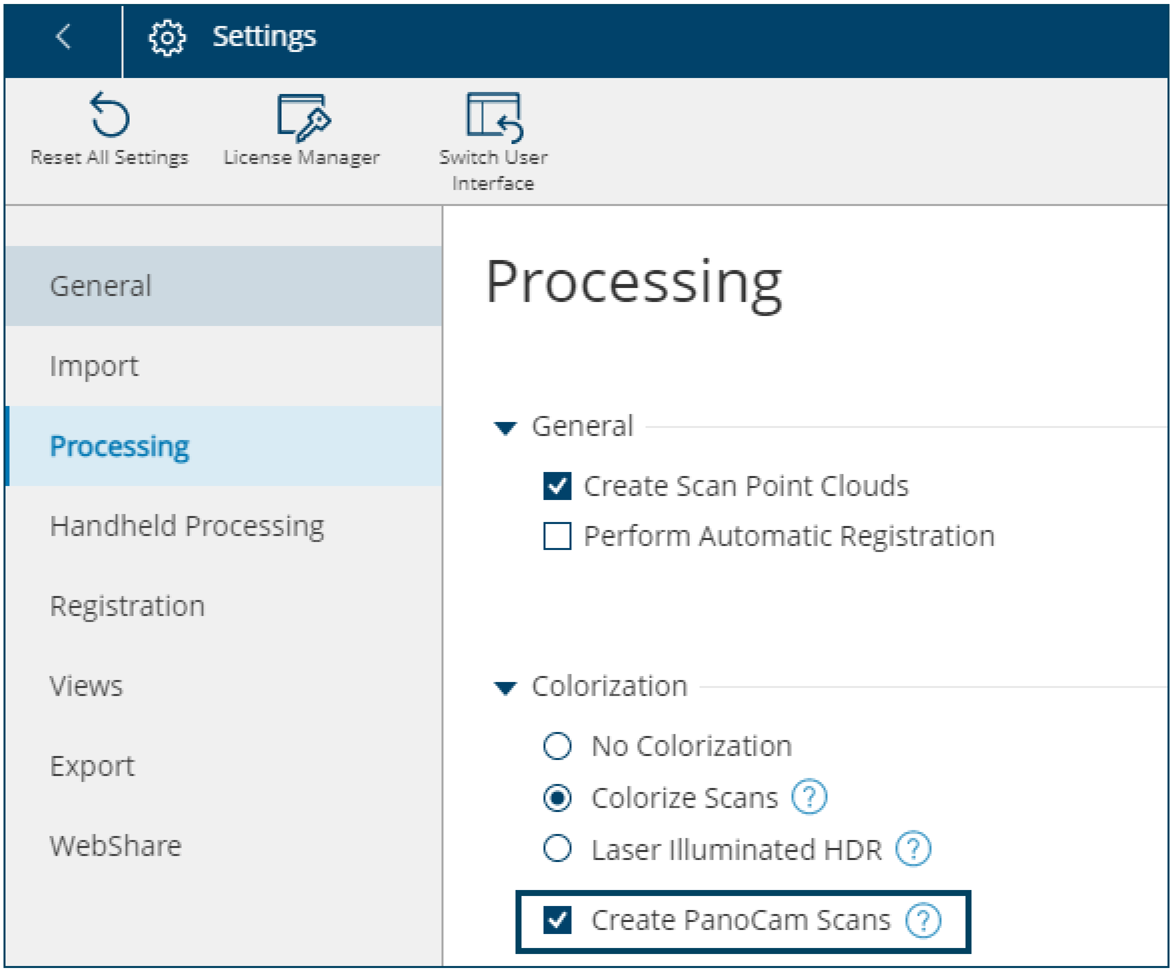
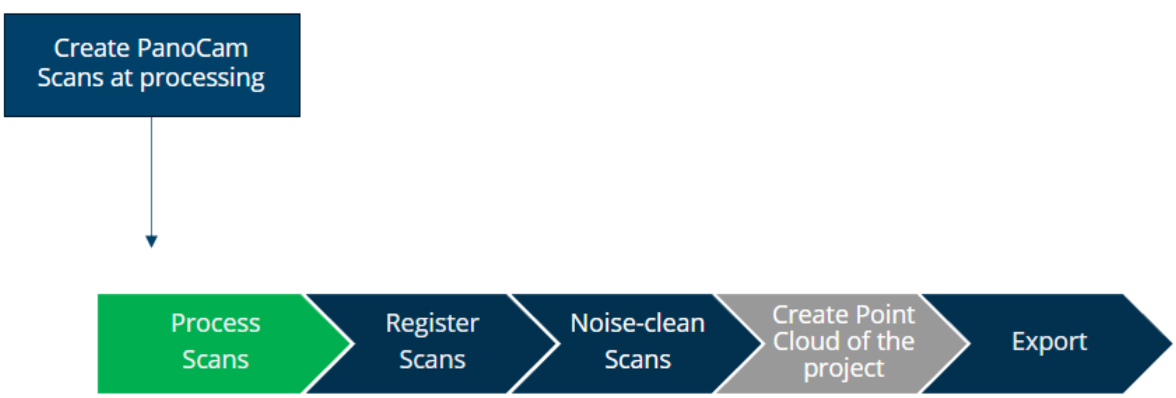


Figure 10-59 Processing Settings

If you mark this checkbox, PanoCam scans will be created for every stationary scan whose color was captured with the PanoCam. As a result, after processing, only the PanoCam scans will remain in the project.

Recommended Workflow 1



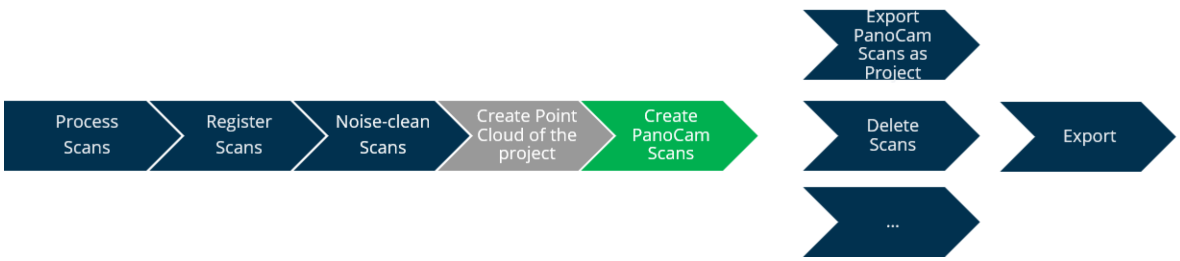
Create PanoCam Scans after Registering and Cleaning Scans

1. Right-click a scan or a cluster containing scans that were taken with the PanoCam.
2. In the context menu, select entry **Operations > Create PanoCam Scan**.
   The PanoCam scan is created in the project. In the structure view, they are at the same level as the previously selected scan or cluster.

This procedure also works in calibration scans.

Note that the original scans and the PanoCam scans exist in the project. Consider deleting the original scans.

Recommended Workflow 2



Working with the Project Point Cloud

Like the scan point clouds, the project point cloud is optimized for fast visualization of large amounts of scan points in the 3D view. It is organized in a spatial data structure that facilitates fast visualization of the scan points. The project point cloud consists of the points of all the scans within your scan project.

For this reason, the amount of points in a project point cloud can be enormous. Unlike scan files, such large amounts of points cannot be loaded into a physical memory at once. Therefore, the points of the project point cloud are automatically loaded and visualized on demand based on the camera position and point visibility. This allows you to actually see all scans of a scan project at once, regardless of whether or not they fit into your computer's physical memory. Manual scan file loading is not necessary.

The project point cloud is the best way to visualize and manipulate enormous amounts of scan data interactively. here can only be one project point cloud per project.

You can:

- Create a project point cloud
- Update a project point cloud
- Delete a project point cloud

If your project has a project point cloud:

1. Open a 3D view with the **View Project** button from the toolbar, or
2. use **View** > **3D** from the context menu of the project folder.
3. Start exploring.

As the point cloud visualization technique is constantly loading scan points from the hard disk drive based on point visibility, the overall performance strongly depends on the speed of your hard disk drive. While project point clouds outperform all other visualization methods (including scan point clouds) on regular hard disk drives, we recommend using a solid state drive for maximum performance. Using a solid state drive will also speed up the process of creating the project point cloud.

Creating the Project Point Cloud

The project point cloud is typically created from all the single scans in your project after they have been processed and registered.

1. Open the scan project from the Project Overview, or by clicking the **Open Project** button in the **Project** toolbar.
2. Click the **Explore** button in the workflow bar.
3. Click the **Project Point Cloud** button in the toolbar. A dropdown menu opens.
4. Select **Create** .

Preparing your Scan Project

The resulting point cloud is about two to four times the size of your scan files. SCENE will create large amounts of temporary data during point cloud creation, which will be deleted after the point cloud was successfully built. The amount of space needed for the temporary data during the point cloud creation process can be up to seven times the size of the original scan data. The actual amount of temporary data and the size of the project point cloud strongly depend on the point data itself and cannot be safely predicted beforehand. Make sure to have enough free space on your target hard disk drive (the location of your scan project) and in the location of the temporary data folder when creating project point clouds. The temporary data folder can be changed in the Settings.

NOTE: Project point cloud creation will only consider the global position of the scan points at the time of the creation. All changes to scans, clusters, or folders that are performed after the project point cloud has been created will not alter the project point cloud. This will lead to an inconsistency between the point cloud and the traditional scan-based data of the scan project. For this reason, we recommend creating the project point cloud after you have completed the registration.

You can, of course, change your registration at any time, even if a project point cloud already exists, but be aware that the project point cloud will not have these changes applied until it is updated or recreated.

Project Point Cloud Creation Settings

After you have initiated the project point cloud creation, the point cloud settings dialog shows up:

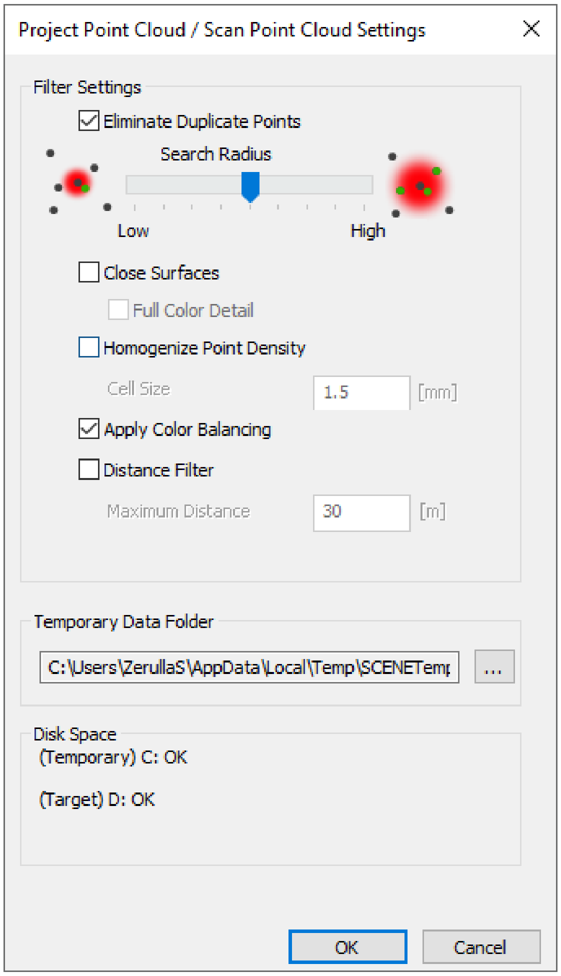


Figure 10-60 Create project point cloud settings

Filter

For the creation of the project point cloud, the following point filters are available. Each of these filters will reduce the overall point count by eliminating different types of (unwanted) points.

Eliminate Duplicate Points

The filter removes duplicate points that always exist when points are recorded from several different scanner positions. Overlapping areas can be optimized by removing some of the duplicate points. This filter can improve the visual quality of your project point cloud significantly while reducing overall point count and therefore improving interactivity and loading times of the point cloud.

Points are considered duplicates of others when they were recorded from different scanner positions and their 3D positions are similar. The actual distance threshold for duplicate points depends on point-to-scanner distances. The farther from the scanner a point is recorded, the “larger” we consider this point to be, because the farther a point is recorded, the greater the spatial distance to its neighbors.

The filter is configured to always keep the highest quality point. Higher quality means smaller distance to the scanner position. If two points are considered duplicates of each other, the point with the greater distance – and therefore lower quality – is dismissed. Only the higher quality point is added to the project point cloud.

When creating a project point cloud from a project that contains both, laser scanner scans and hand-held scans, all points are considered. Usually, hand-held scanner points are used only where no laser scanner points are available.

With the **Search Radius** slider you can adjust the distance threshold for point elimination. The default setting should be sufficient for almost all scenarios.

Adjust the **Search Radius** slider to the right to enlarge the search radius and increase the number of eliminated points. This may help to reduce point count when your registration is not very accurate (for example when using natural targets only).

Adjust the **Search Radius** slider to the left to reduce the number of eliminated points. This can be useful if too many points have been deleted by this filter in previous point cloud iterations.

Close Surfaces

Select this checkbox if you want to have additional points interpolated between original scan points, to create a denser impression of the surfaces. The color or gray value of these additional points will also be interpolated.

NOTE: Scans captured using FARO hand-held scanners are interpolated immediately after they are captured (if the appropriate option was enabled during capture). No additional interpolation is performed for these data sets during project point cloud creation. Nevertheless, you need to select this option to get a closed surface representation of your data. If you don’t, points of hand-held scans are stored with smaller sizes.

Full Color Detail

Select this option if the color of the points shall be retrieved from the laser scanner's high resolution camera images. Moreover, additional even smaller points are interpolated to transfer the color information from the camera images into the point cloud. By using the images from the camera images, smearing effects are reduced and more color details are visible in the project point cloud.

NOTE: The time needed for the interpolation and the creation of the point cloud will greatly increase. The files will need much more disk space.

Homogenize Point Density

This filter balances the density of points within the point cloud by reducing the number of points in areas where the average target density is exceeded. This is especially the case close to scanner positions, where the point density is particularly high or in areas where two or more scans overlap. By reducing the total number of points in the point cloud, less hard disk space is required and the performance of the point cloud visualization is increased, while preserving the overall visualization quality.

The achievable rate of data reduction is highly dependent on the input data. Outdoor projects with little overlap between scans will benefit less than densely scanned indoor projects where a data reduction of 25% and more can be achieved with hardly any perceivable loss of visualization quality.

Cell size

You can adjust the cell size of the existent homogenization feature. The standard value of 1.5 mm was empirically chosen so that no band artifacts emerge. The unit of the maximum distance is adapted according to the setting of the small standard units. The homogenization and **Close Surfaces** are mutually exclusive, which means that setting the **Close Surfaces** will unset the homogenization checkbox and vice versa.

Apply Color Balancing

A typical effect seen in real world laser scanning projects is that the overall perception of color may not always be consistent across colored scans. This effect can have two different reasons:

- The internal camera of the FARO Focus Laser Scanner performs white balancing on a per-scan basis. As a result, the internal camera may choose to apply a different white balancing at different scan positions, given that the lighting conditions vary. For example, the scanner is set up in a room illuminated by neon lights as opposed to natural light when scanning outdoors.
- While carrying out a scanning project, lighting conditions may vary over time. For example, when the project starts in the morning and is completed in the evening (or even on another day).

This effect may especially become apparent when such differently colored scans are combined into a project point cloud and visualized together as shown in the following figure:

Figure 10-61 Inconsistent color of a floor due to scans taken under varying lighting conditions.

When enabled, the color balancing filter minimizes the color contrast between scans in the project point cloud and results in a more homogeneous overall perception of color as shown in the following figure:

Figure 10-62 Significant reduction of color inconsistencies by applying color balancing

Distance Filter

If this checkbox is set, all points which are more than **Maximum Distance** units away from the associated scanner position will not be used to create the project point cloud. This filter can be used to restrict the point cloud to the more precise near the area of the scanner. For example, if you scan a windowed room, you can now ignore most outside stray points, which are probably bad, because they were scanned through the window glass. The unit of the maximum distance is adapted according to the setting of the standard units.

Temporary Data Folder

During the project point cloud creation process all scans in the project will be loaded successively; their point data will be processed and saved as temporary data. This temporary data will be stored inside the temporary data folder. Do not delete, move or copy any of these files during the point cloud creation process or the process might fail. The temporary data will be deleted automatically after the process is complete.

Section **Disk Space** shows if there is enough free space on the hard disk used for the temporary data and the (target) hard disk used for saving the final point cloud data. The target hard disk is the disk on which the scan project data is stored.

Updating the Project Point Cloud

The project point cloud can be updated to make changes such as deleted points or scans persistent. When points are deleted or scans have been removed from the scan project, they are not deleted from the point cloud but rather marked as removed. The point cloud will no longer visualize these points; they are filtered out during the point loading process. Unfortunately these filter operations will slow down the process of point loading. This may not be noticeable for only a few delete operations but as you work with your point cloud, deleting more and more points over time, you might notice a decrease in performance. When this happens, the project point cloud should be updated.

1. Click the **Project Point Cloud** button in the toolbar.
   A dropdown menu opens.
2. Select **Update**.
3. In the dialog that appears, confirm that you want to update the project point cloud.

Update When Saving the Project

In the **Share Changes** dialog, mark the **Update Point Cloud** checkbox.

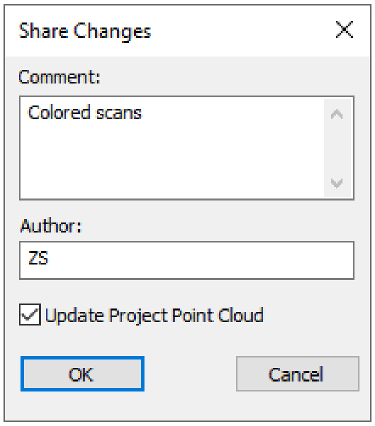


Figure 10-63 Share changes

This way the project point cloud will be updated automatically after the sharing and saving operation is complete.

After the update has been initiated, you are asked to specify the same parameters as for the initial creation of the point cloud. If point filters where enabled during its creation, it is not necessary to apply them during updating again since the resulting points will just be the same (and the updating will also take longer without any visual benefit).

Deleting the Project Point Cloud

1. Click the **Project Point Cloud** button in the toolbar. A dropdown menu opens.
2. Select **Delete** .

Visibility Settings

The views can also show objects other than the scan points, such as:

- The positions of the other scans in the project.
- The simple objects assigned to a scan that were created by a fit, for example spheres, and 3D points.
- CAD models.

Not all views can display all these objects. For further information, see the more detailed description of views.

You can decide whether to display the objects using the visibility settings, which are arranged in three levels:

- The visibility of the layer to which the object is assigned.
- The visibility according to the prominence of the object.

- The distance of the object from the observer.

An object is only visible if the visibility on the first two levels is set accordingly and it is located in the set range.

The visibility settings are maintained separately for each view. It is therefore possible that an object is visible in one view and not in another. When you open a new view, this view initially takes over the default values of the visibility settings. You can also change these default values.

Right-click in a view in the work area, then select **Visibility Settings.** The Visibility Settings dialog is displayed.

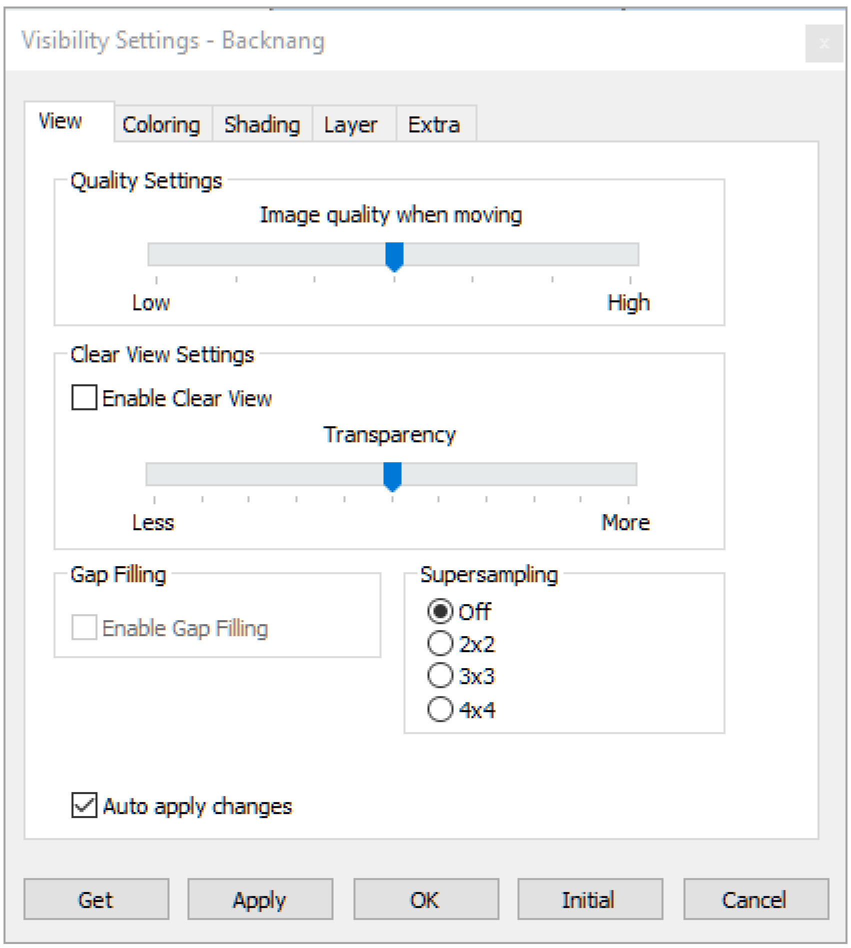


Figure 10-64 Visibility settings –view

View (3D View only)

NOTE: If **Auto apply changes** is selected, new settings are visible immediately; you do not need to click the **Apply** button.

Quality Settings – Determines the image quality while moving.

If the handle of the slider is moved to the left, the quality of the rendering is reduced during movement in favor of performance.

If the handle of the slider is moved to the right, the quality increases and the performance decreases. If the handle of the slider is moved completely to the right, there will be no quality penalty during movement.

Clear View Settings – In the clear view mode, points in areas with low point density will be displayed more transparently and points in areas with a high point density will be displayed more brightly.

Enable Clear View – check if you want to use Clear View. By changing the settings with the slider you can intensify or weaken this effect.

Gap Filling – The gap filler fills gaps between scan points that are physically close to each other.

Figure 10-65 Gap filling turned off (left) and turned on (right)

NOTE: If clear view and gap filling are grayed out, **Offscreen Rendering** under **Tools > Options > View** might be disabled. Offscreen Rendering must be enabled for Gap Filling and Clear View.

Supersampling – renders the point cloud with a resolution higher than the resolution of your screen and then shrinks the point cloud to fit the screen resolution. This reduces anti-aliasing effects and gives the point cloud a smoother visual appearance. Fine and filigree structures look sharper and stray points will appear less annoying. Set the resolution of the initially rendered point cloud compared to the screen resolution by selecting one of the options 2x2, 3x3, or 4x4. For example, choosing 2x2 means that the point cloud will be rendered with a resolution that is 4 times the resolution of your screen.

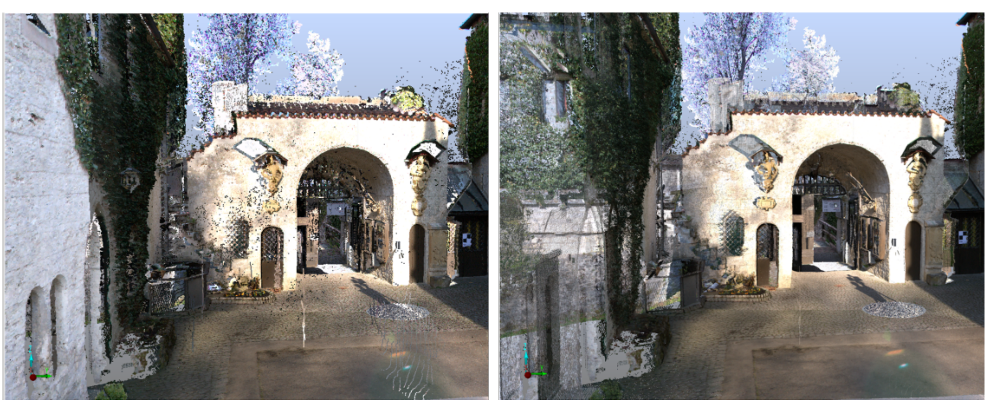


Figure 10-66 Supersampling turned off (left) and turned on (right)

NOTE: Objects like walls might appear transparent when using small point sizes in combination with supersampling. High supersampling resolutions like 4x4 require large amounts of graphics card memory.

Coloring

The coloring tab lets you set values that are used in coordinate coloring. For more information, see *Coordinate Coloring*.

Reference Object: Reference is the object used as a reference for coloring x, y, z, xyz, and distance. The reference object can be scan origin, clipping box, or marked point. If you choose custom, you can define the reference origin to be anywhere, even where no point exists. Default is currently (0 ,0, 0) for x, y, z, xyz, and camera position for distance coloring.

Reference Origin: Only active if you selected *custom* as your reference origin.

Coloring Ranges: Minimum and maximum values are required in order map the data to colors. A larger gap between the minimum and maximum value makes the bands of color larger. Points outside the minimum and maximum are colored the same as minimum and maximum.

Use active clipping boxes: Creates a temporary clipping box that is large enough to contain all the clipping boxes that are active in the project, then sets the origin and ranges to apply coloring within the confines of the new clipping box.

Blend point color with coloring: The original colors of the scan points can be blended with the colors produced by coordinate coloring to give a shading. This helps to retain the original features of the scan, while still getting the additional information provided by coordinate coloring.

Colormap. Choose the colormap for coloring. Choices are:

- Rainbow
- Cold-Hot, which is blue, white and red values
- Linear, which is black increasing to red (x), green (y), blue (z) and white (distance)

Select **Discrete** if you want to have solid colors instead of continuous colors. Use **Increments** to set the number of discrete colors.

Shading

For more information, see *Coordinate Coloring*.

Shading Strength: Increases or decreases the strength of shading.

Apply to meshes: Applies shading to the meshes. Initially off.

Layer

Toggle the visibility of the available layers and their related objects and the object names in the view. See chapter *Layer* on page 245 for more information.

Extra

Objects – Display or hide certain types of objects:

Models Folder – Display CAD models.

References Folder – Display reference objects.

Scan positions – Display the scanner positions in the view. If enabled, the positions will be visualized by this symbol:

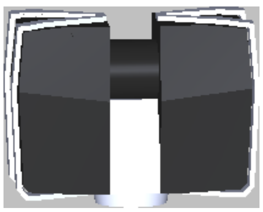


Figure 10-67 Scanner position

Cameras – Display the camera positions of other views.

Scan objects – Display or hide the objects that are assigned to the scans in the view. You may display these objects only if the scan is loaded.

Visibility – Set the minimum and maximum distance at which objects are shown.

Documentation Objects – Set the maximum distance at which documentation objects are shown.

Import CAD layout plans or aerial photographs as Image Files in SCENE

This method allows importing image files into a scan project to be used as a floor plan or background image for the scan.

- In 3D view, this image can be aligned and modified
- with the manipulators known from the clipping box.
- by entering dimension and aligning values in the Properties menu of the image.

This is done as follows

1. Go to the **Import** .
2. Click Import Images.

3. Select the image and click **Open**.

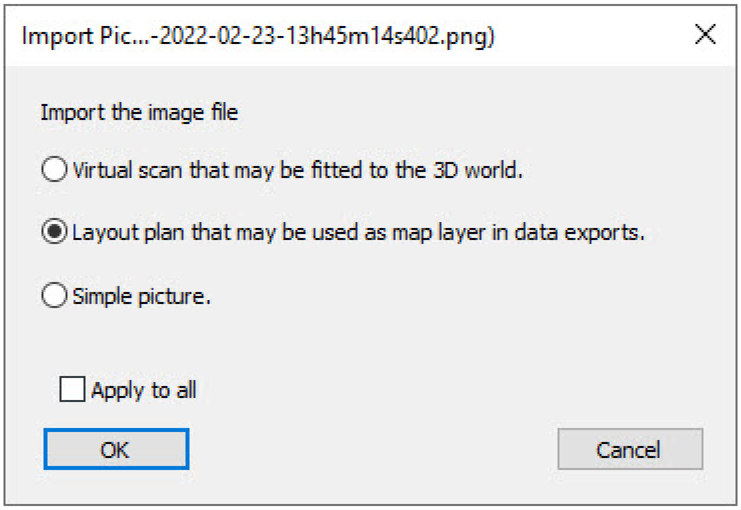


Figure 10-68 Import picture dialog

4. Select **Layout plan that may be used as map layer in**, for example in Sphere XG.

5. If there are several pictures, you can select **Apply to all**.

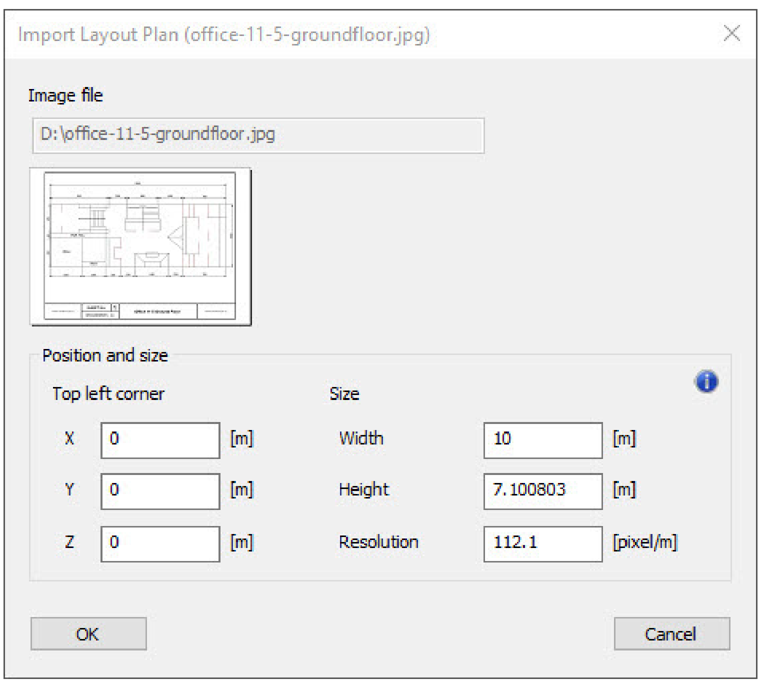
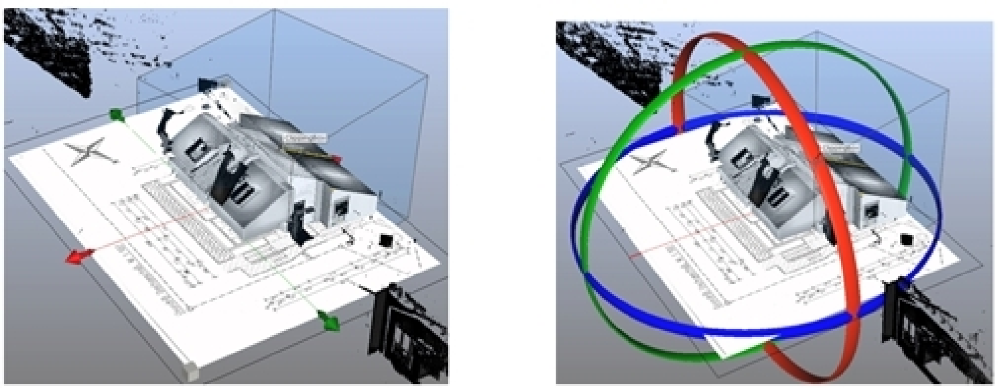


Figure 10-69 Predefine alignment dialog

6. Predefine the position, the size (width and height) and the resolution in which the picture shall be imported. If a TIFF image with valid GeoTIFF coordinates (http://trac.osgeo.org/geotiff/) is imported, the position and size will be preset automatically.
7. Click **OK** to import the picture.

Manual alignment

1. In the 3D view, use the manipulators to move, rotate and scale the picture in an easy way.



An imported layout plan with scale manipulators (left picture) and rotation manipulators (right picture)

2. Choose an appropriate button from the toolbar to align the layout plan to the point cloud.

Scale Manipulator : Select to resize the picture. Handlers will appear on the picture allowing you to resize it.

Rotate Manipulator : Select to rotate the picture. Handlers will appear on the picture allowing you to rotate it around different axes.

Translation Manipulator : Select to move the picture. Handlers will appear on the picture allowing you to change the position.

Restore previous transformation : Undo the last transformation change.

Reapply transformation change : Reapply a transformation change.

Restore initial transformation : Restore the initial transformation of the picture.

3. To align the picture in a precise manner, use the properties dialog of the picture.

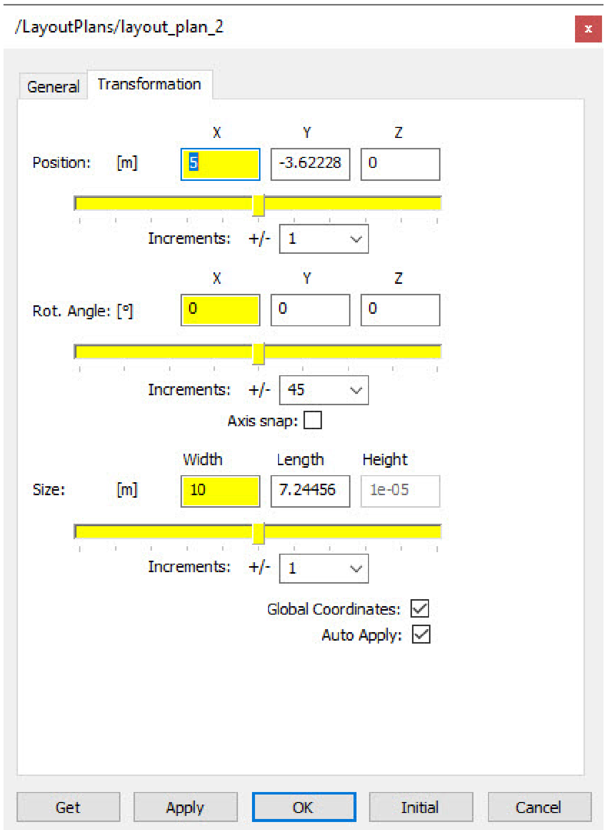


Figure 10-70 Properties dialog with transformation settings

4. Set or modify

Position: The translation portion of the transformation.

X: To key in a transformation in the x direction.

Y: To key in a transformation in the y direction.

Z: To key in a transformation in the z direction.

Scroll bar: Set the transformation using the mouse. The direction of the transformation will be the x, y or z coordinate that is highlighted in yellow.

Each tick increments by: Set the increment for the scroll bar.

Rotation Angle: The angle of rotation if the rotation axis is split along the coordinate axes.

X: The angle of rotation around the x-axis.

Y: The angle of rotation around the y-axis.

Z: The angle of rotation around the z-axis.

Scroll bar: Set a new angle of rotation.

To change a value, you can either enter the required value directly into the appropriate field, or you first select the field and then use the corresponding slider to change the value step by step. You can set the increment using the dropdown box. If you hit the edge with the slider, simply reselect the field and the slider will return to the center without you losing your previous changes.

Axis snap: If checked, you can change the rotation for the current axis independently from the others. This is achieved by changing the order in which the rotations are applied.

Size: Enter length, width and height, if you know the data.

Scroll bar: Set the transformation using the mouse. The direction of the transformation will be the x, y or z coordinate that is highlighted in yellow.

Each tick increments by: Set the increment for the scroll bar.

Global Coordinates: If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner (see chapter *Global Coordinates* on page 308).

Auto Apply: If selected, new settings are applied and visible immediately; you do not need to click the **Apply** button after changing the settings.

Click **Apply** to use the changed values and **OK** to use them and close the dialog.

Chapter 11: Export

To use scan points from the scans in other applications such as CAD systems, SCENE provides the possibility to export scan points in various data formats and write them to a file. You can then import this file into the application you want.

You may change certain settings in the Export dialog before you export the scan points.

NOTE:

Due to the nature of the underlying data, the export of points from 3D selections provides only a reduced set of export settings. The mismatching will be grayed in the export dialog when exporting points of a 3D Selection.

Not all export formats are available when exporting points from a 3D selection. The supported formats are **CPE**, **E57,VRML**, **DXF**, **XYZ Text**, **XYZ Binary**, **IGES, FLS, PTS**, **RCS, LAS,** and **POD**.

The export of multiple scan point clouds of a scan folder does not support exporting all points into a single file.

The export of scan point clouds and of the project point cloud will consider activated Clipping Boxes in the same way as they are applied in the 3D views (what you see is what you get).

If Clipping Boxes exist in the project, but should temporarily not be considered during the export, deactivate the Clipping Boxes individually or with the global Clipping Box setting.

Exporting the Scan Project

Figure 11-1 Export toolbar

1. Click the **Export** button in the **Workflow** bar.
   The toolbar will now show the available Export functions.

2. Click the button of the **Export** function you want to execute for the entire scan project.

You can:

- Export scans
- Export the project point cloud
- Export the project
- Export the overview map
- Export and upload data to WebShare

  It is recommended to use the new cloud solution Sphere XG instead of WebShare.

Export Scans

In the **Export** toolbar, click **Export Scans**, then click one of the following options:
Export Scans – ordered: Export all scans of this scan project

Export Scan Point Clouds – unordered: Export all point clouds of this scan project. Exporting scan point clouds on a scan or cluster will only apply the Clipping Boxes below the scan or cluster, instead of all available Clipping Boxes.

The **Export Scan Points** dialog opens, and you can specify the export format, and the required settings.

Export Project Point Cloud

In the **Export** toolbar, click **Export Project Point Cloud**.

The **Export Scan Points** dialog opens, and you can specify the export format, and the required settings.

All clipping boxes will be applied.

Export Project

In the **Export** toolbar, click **Export Project**.

The dialog opens. Set the following three options:
Format: select one of the following: SCENE Project (*.lsproj) or ReCap Project (*.rcp)

Project Name: Enter a project name for the new project.

Location: Select the target folder to save the new project.

Note that a project export requires a large amount of disk space.

Export Overview Map

Export Overview Map of the Scan Project

The overview map for a scan project can be exported as a high resolution TIF image or as a DXF file that can be opened in any CAD system for further modeling.

In the **Export** toolbar, click **Export Overview Map**.

A file dialog opens where you can enter a name of the exported file.

An additional text file is also created that contains information about the resolution, the image size in pixels and in meter, and the corner points of the image and the associated TIF file.

Export Overview Map of the Scan Cluster

To export the overview map of a single scan or a cluster:

Right-click the cluster and select **Export> Overview Map**.

Export Overview Maps of the Single Scans

To export each overview map of a scan into a single file:

Right-click the cluster and select **Export > Scans > Overview Map**.

A file dialog opens where you can enter a base name of the exported file. For each overview map exported, the corresponding scan name is added to the base name.

Export and Upload Project Data to WebShare

NOTE: WebShare is being replaced by the new cloud solution Sphere XG. Contact the FARO support or find information in the Sphere XG user manual.

In the toolbar, click WebShare.

A dropdown menu opens in which you can select one of the following options:
Export WebShare Project: Export the project for WebShare

Upload WebShare Project: Upload an existing export to WebShare

Upload Project Point Cloud Data: Upload the project point cloud to WebShare as a CPE file. This CPE file can be used as source data for the 3D view in WebShare.

Export Objects

In the structure view, right-click the scan, then click **Export > Objects.**

The **Export Objects** dialog opens, and you can specify the export format, and the required settings.

Export Meshes

1. Right-click the mesh, then click **Export**.
   The **Export** dialog is shown.

2. Select the file format in which you want the meshed object to be exported.
   Available file formats are: .stl, .ply, .obj, and .wrl. Note that with .obj files, the material and texture files are also saved.

3. Click **OK** to start the export.

Exporting Scan Points of an Entire Scan

1. Open the scan in planar view or the quick view .

2. Right-click into the view, then select the command **Export > Direct Export** or **Export > Export Scan Points**.

- Select **Direct Export** to export the scan points without opening the Settings dialog. The prior settings will be used and the data will be saved directly to a file.

- Select **Export Scan Points** to open the Settings dialog to make certain settings prior to exporting the points.

Exporting scans

To export scans:

1. In the structure view, right-click the cluster.

2. Select **Export > Scan Points**.
   This command will be grayed out if a scan point cloud of the respective scan does not exist.

There are the following scan export options:

- Exporting the scans of a cluster

- Exporting the scans bundled as a new project

- Exporting panoramic images of scans or the scan project

Exporting the Scans of a Cluster

In the structure view, right-click the scan, then select **Export** > **Scan Points.**

The **Export Scan Points** dialog opens, and you can specify the export format, and the required settings.

Exporting the Scans Bundled as a New Project

In the structure view, right-click the cluster, then select **Export > As Project**. The **Export as Project** dialog opens.

Format: select one of the following:

- SCENE Project (*.lsproj)
  Recap Project (*.rcp)
- **Project Name**: Enter a project name for the new project.
- **Location**: Select the target folder where you want to save the new project.

Note that a project export requires a large amount of disk space.

Exporting Panoramic Images of Scans or the Scan Project

Single Scans

1. In the structure view, right-click the scan, then select **Import/Export> Panoramic Images**.
2. Select **Scan Resolution** to create images that have the same color resolution as the scan, or select **Full Color Resolution** if you want to create panoramic images with the highest color quality possible, and which are compensated to remove the offset between the two halves of the scan, as well as any distortion cause by the scanner's rotation.
   Full color resolution panoramas have a white stripe at the bottom of the picture because the proportions of the scan and the picture are different. (Scans made with FARO scanners versions M70, S70, S350 and later create 160 megapixel images. Scans from older scanners only output panoramic images with 40 megapixel images.)
   The **Select a folder for images export** dialog opens,
3. Browse to the target folder where you want to save the images.

Scan Project

If you want to export the panoramic images of all scans and import them in your own app or web viewer, it is not enough to simply export the single images. You also need the position and orientation of each image.

1. In the structure view, right-click the scan project (topmost folder) and select **Import/Export>Export Positions**.
2. In the dialog, enter a file name and select a target folder.

3. Click **Export**.
   A .txt file with specifications of all scans and reference objects is created and saved. The format of scan positions is: Scan Name, X, Y, Z, 4 values for the rotation in axis-angle representation[1] (i.e., 3 vector components and rotation around the vector), date, time. Be aware that the Z component of the vector can be negative and the rotation direction is defined by the right-hand rule

4. In the structure view, right-click the scan project again and select **Import/Export> Panoramic Images** and either **Scan Resolution** or **Full Color Resolution** (see above).

5. Browse to the target folder where you want to save the images and click **Select Folder**.

The export is started.

Export Formats

SCENE supports the following scan export formats. Click a link below to learn more about the export options for each format:

- *CPE Export Settings* on page 257
- *DXF Export Settings* on page 259
- *E57 Export Settings* on page 261
- *SCENE Scan File Export Settings* on page 273
- *IGES Export Settings* on page 263
- *LAS Export Settings* on page 266
- *PointoolsTM POD Export Settings* on page 267
- *PTS Export Settings* on page 270
- *PTX Export Settings* on page 271
- *SPW Export Settings* on page 274
- *VRML Export Settings* on page 275
- *XYZ ASCII Export Settings* on page 278

[1] If you are not sure about the meaning of axis-angle representation you can, for example, browse www.wikipedia.org for further reference.

- *XYZ Binary Export Settings* on page 279
- *Exporting Slices* on page 281

CPE Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

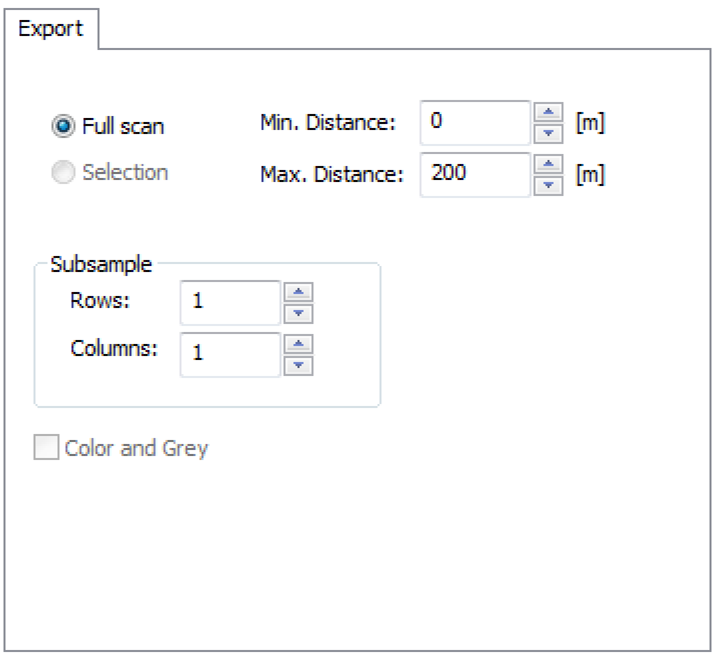


Figure 11-2 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

CPE Tab

CPE is a file format for point data developed by FARO that combines minimal file size with flexible quality settings.

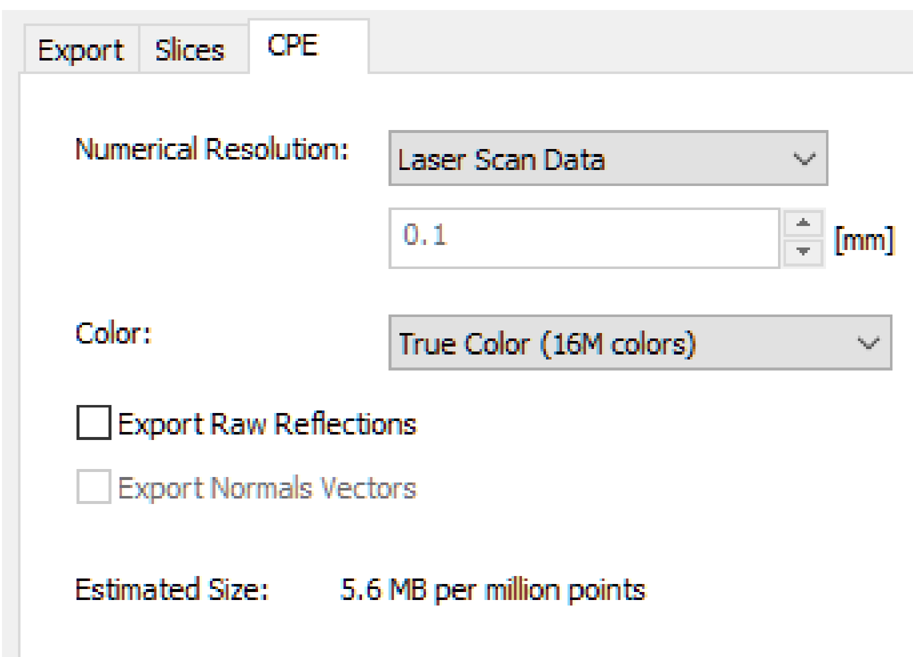


Figure 11-3 CPE Export

When exporting scans to the CPE file format, the following information must be provided:
File name: Name and location of the file to be created.

Export each scan in a separate file: If not selected, all scans will be saved in one file.

> **Numerical Resolution**: Set the numerical resolution (quantization) for the exported scan points to one of

Set the numerical resolution (quantization) for the exported scan points to one of the recommended values or your own desired value.**Color**: Set the number of colors used for the exported scan points to “True Color” or use “High Color” for a smaller file size, but with a reduced visual quality of color gradients.

Export Reflection Values : Export with raw reflections, that can be between 0 and 2047 for the FARO Focus Laser Scanner. Otherwise, the monitor brightness will be exported (values between 0 and 255). Export the original reflection values of the scan points if they're available.

Export Normal Vectors: Export the normal vectors of the scan points.

Estimated size: The estimated file size in MB per million exported scan points.

Color and Grey

Export RGB and grayscale (intensity) values of each scan point if available. This function is enabled for the formats E57, XYZ text, POD, PTX and PTS. To export both values, the scan will be unloaded first and re-loaded with both values. After the export, the scan will be unloaded again and the initial scan status will be restored.

DXF Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

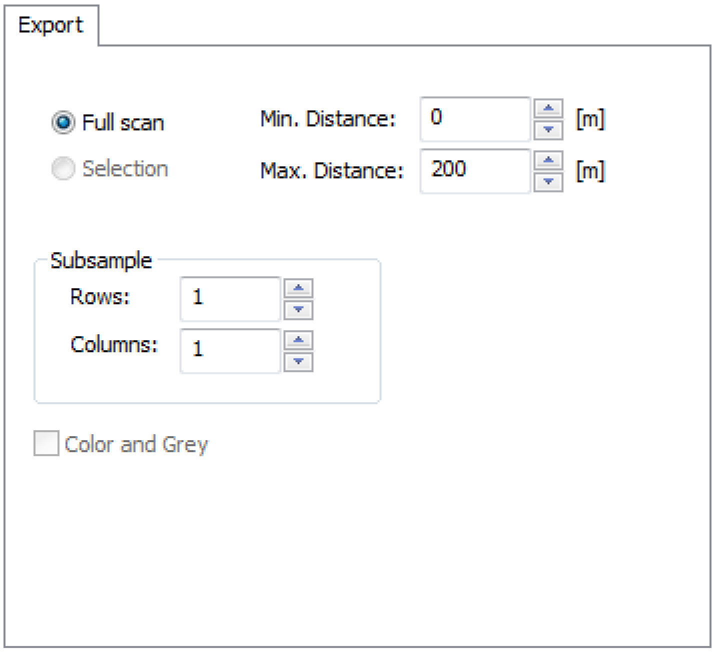


Figure 11-4 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

DXF Tab

DXF is a data format developed by AutoDesk for the exchange of CAD drawings. SCENE uses DXF version 12.

The scan points in DXF are always displayed as points. Since DXF has very few gray scales at its disposal, the visual appearance is not as good as in SCENE.

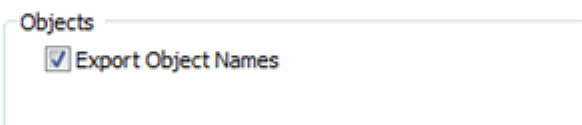


Figure 11-5 Setting for DXF export

Export Object Names

Select this checkbox if you want the names of the selected objects to be exported.

E57 Export Settings

When exporting scans to the E57 file format, the following information will be stored in the exported file:

- For each scan point in a scan, the xyz-coordinate, RGB or intensity values, and the corresponding index of row and column. This information is part of the binary section of the E57 file. It is possible to store several scans in one E57 file.
- Additional meta information such as the scan name, the unique ID (UUID) of a scan and the software version that is used for the export[1]. This information is stored in the XML-part of the E57 file.

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

[1]For more detailed information refer to www.libe57.org or www.astm.org/Standards/E2807.htm

Export Tab

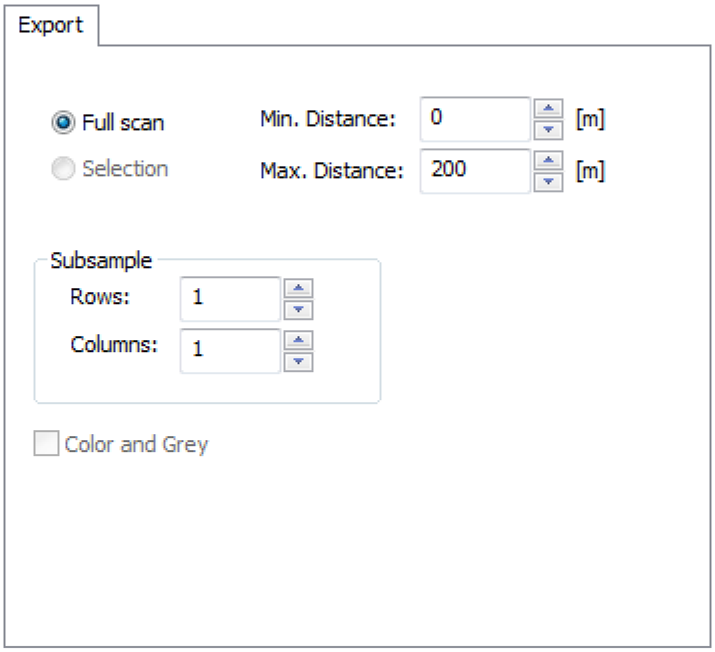


Figure 11-6 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Color and Grey

Export RGB and grayscale (intensity) values of each scan point if available. This function is enabled for the formats E57, XYZ text, POD, PTX and PTS. To export both values, the scan will be unloaded first and re-loaded with both values. After the export, the scan will be unloaded again and the initial scan status will be restored.

Export Scan Pictures

Exports pictures taken by the scanner.

Full Color Resolution Panorama Image

Exports a full color resolution panorama image taken by the scanner.

IGES Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

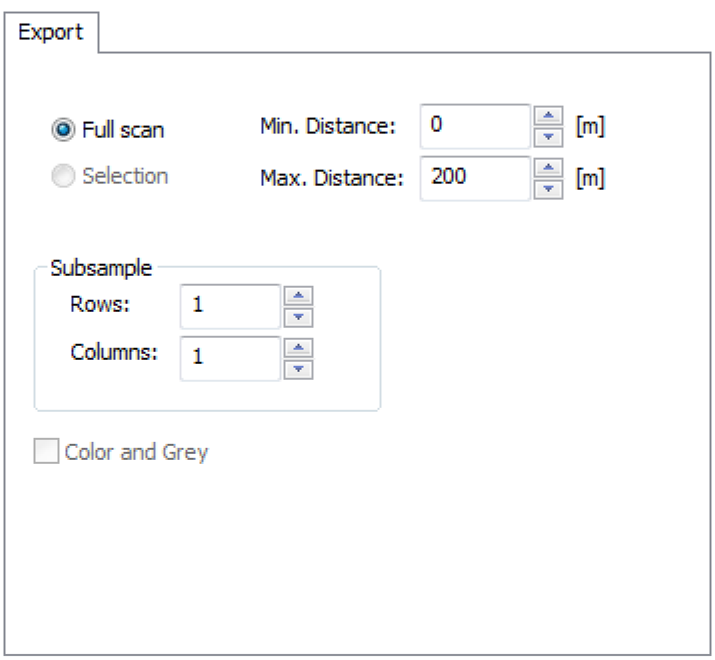


Figure 11-7 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

Min. Distance – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.

Max. Distance – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

IGES Tab

IGES is a multi-vendor-capable standard for the exchange of CAD drawings. SCENE uses IGES version 5.3.

The scan points are exported as gray points or color points, if color information is available. When you import the IGES file into your CAD system, it decides how it will represent these points in its own gray or color space.

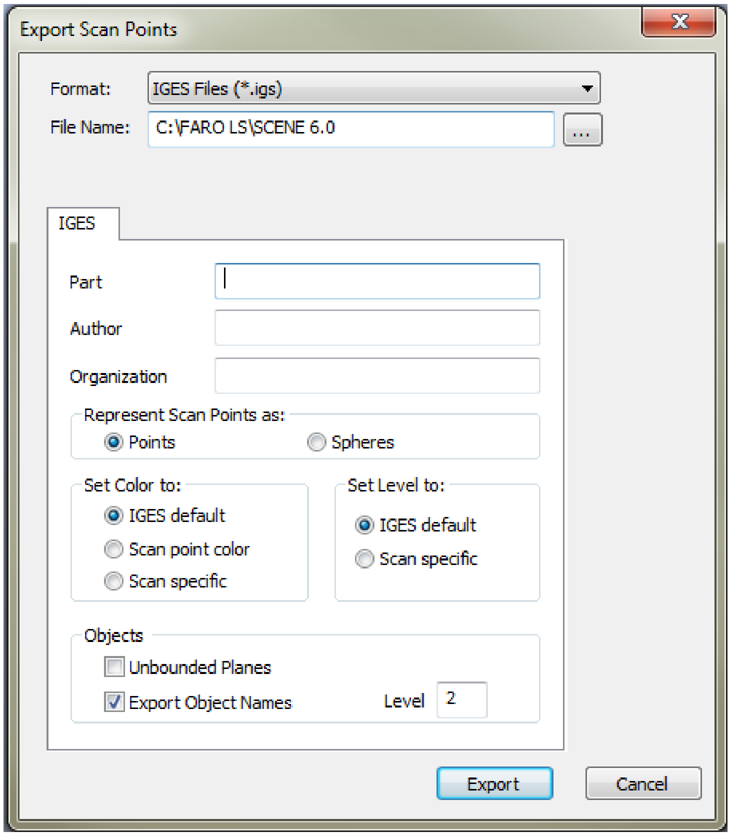


Figure 11-8 Settings for IGES export

Part

Naming the parts is a required component of an IGES file.

Author

Specifying the author is a required component of an IGES file.

Organization

Specifying the organization is a required component of an IGES file.

Represent Scan Points as

Points – Scan points are displayed in the CAD system as points.

Spheres – Scan points are displayed in the CAD system as small spheres.

Set Color to

Settings for the colors to be used.

IGES default – The export file does not contain any color specifications so the CAD system will use the default color.

Scan point color – Use the gray value or color value of the scan point.

Scan specific – If the export consists of several scans, the scan points from the different scans will have different colors.

Set Level to

Settings for the level to be used.

IGES default – The export file does not contain any level specifications so the CAD system will use the default level.

Scan specific – If the export consists of several scans, the scan points from the different scans will have different levels.

Objects

Unbounded Planes – The idealized planes without border are also exported as idealized and without border. Otherwise, a square is exported.

Export Object Names – Object names are exported.

Level – The level allocation for object names.

LAS Export Settings

File name

Name and location of the file to be created.

Export Tab

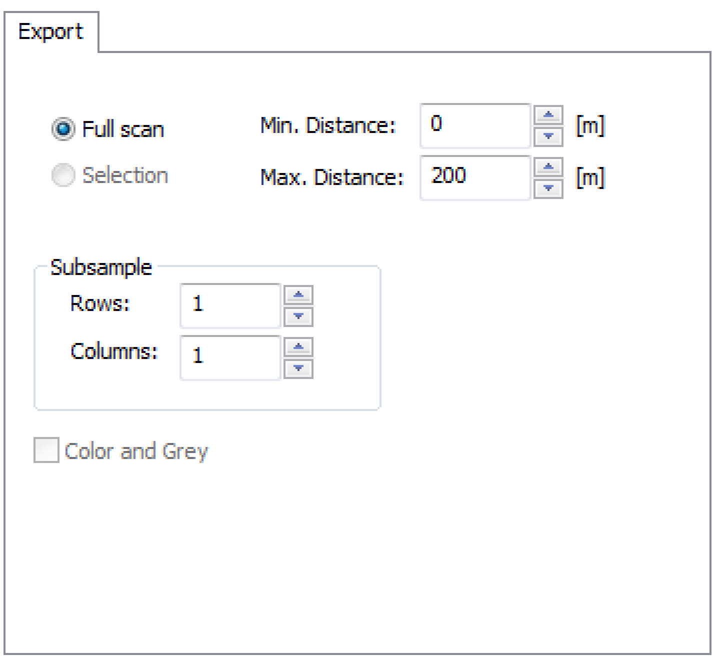


Figure 11-9 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

Min. Distance – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.

Max. Distance – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Pointools™ POD Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

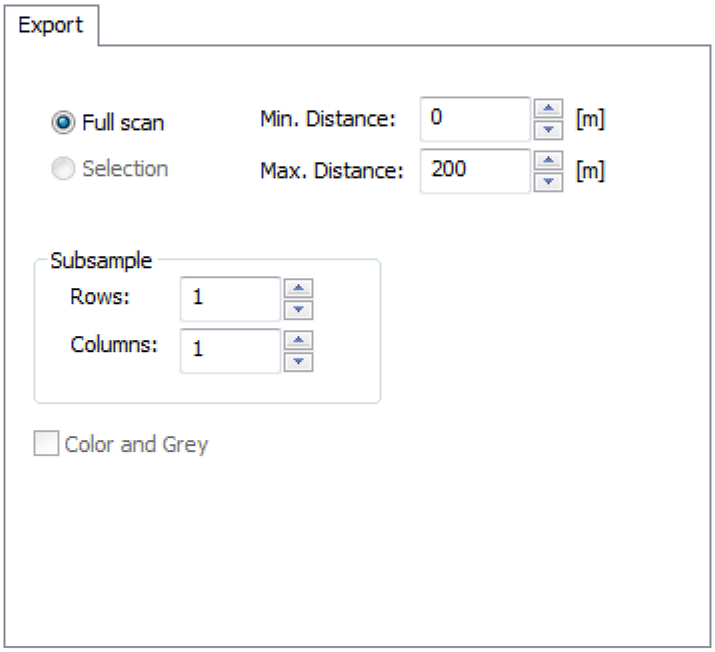


Figure 11-10 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

Color and Grey

Export RGB and grayscale (intensity) values of each scan point if available. This function is enabled for the formats E57, XYZ text, POD, PTX and PTS. To export both values, the scan will be unloaded first and re-loaded with both values. After the export, the scan will be unloaded again and the initial scan status will be restored.

POD Tab

Pointools is a third-party application that provides an environment for viewing, analyzing, editing, and producing visual content from a range of 3D data types.

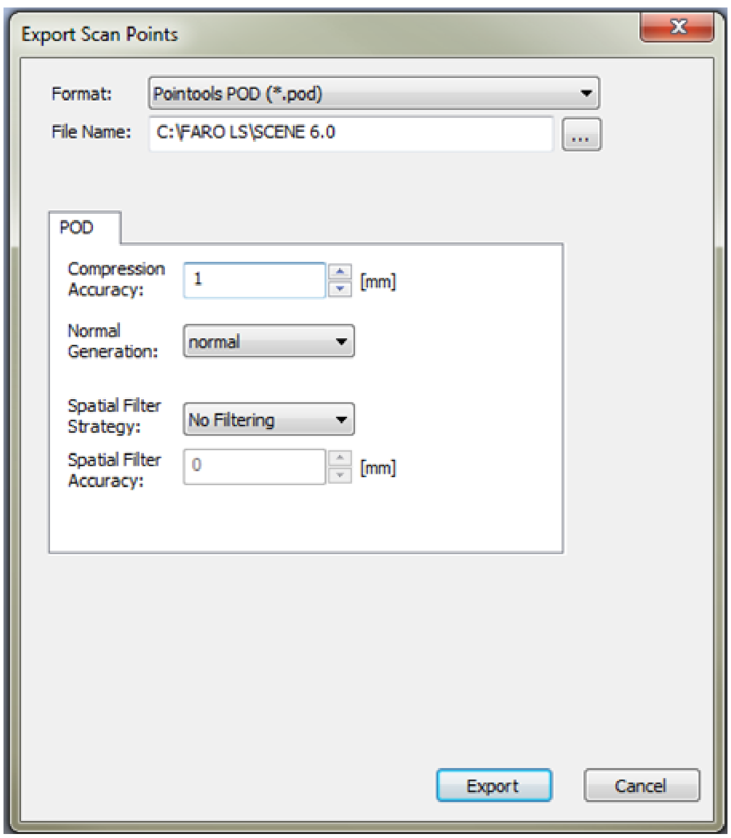


Figure 11-11 Settings for Pointools export

Compression Accuracy

POD files compress cloud data for efficient storage and faster retrieval from disk. You can set the level of accuracy you want to maintain. It is important to consider the accuracy of the instrument used to acquire the data and to not set the compression accuracy too high.

Normal Generation

Normals are required for point lighting. This data is either imported from the source file or generated upon import.

Normal – no altering.

Sharpest, Sharper, Sharp – Quality of normals, degree of faceting on object's surface.

Smoothest, Smoother, Smooth – Quality of normals, degree of curvature on object's surface.

Spatial Filter Strategy

For advanced users. Default setting is usually sufficient.

Spatial Filter Accuracy: Much like the compression accuracy, setting this too high may result errors.

NOTE: For details about the export, refer to the Pointools™ manual.

PTS Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

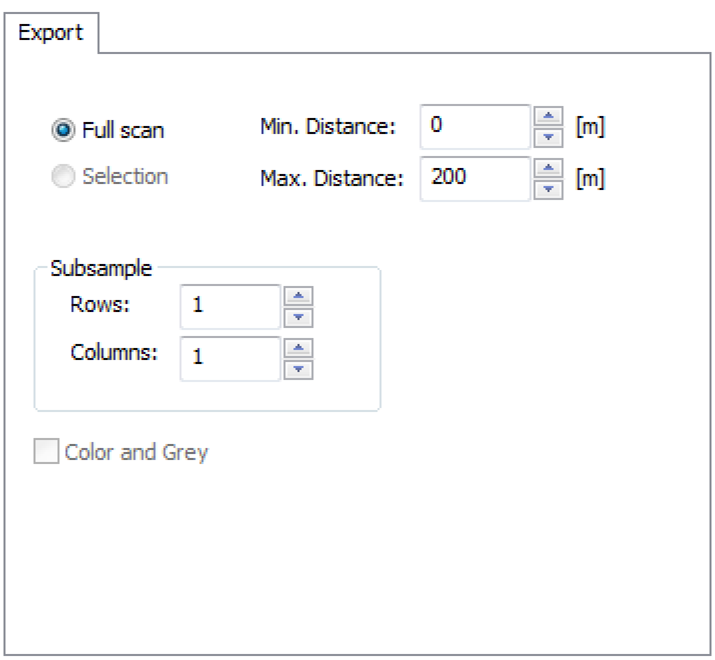


Figure 11-12 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

Color and Grey

Export RGB and grayscale (intensity) values of each scan point if available. This function is enabled for the formats E57, XYZ text, POD, PTX and PTS. To export both values, the scan will be unloaded first and re-loaded with both values. After the export, the scan will be unloaded again and the initial scan status will be restored.

PTX Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

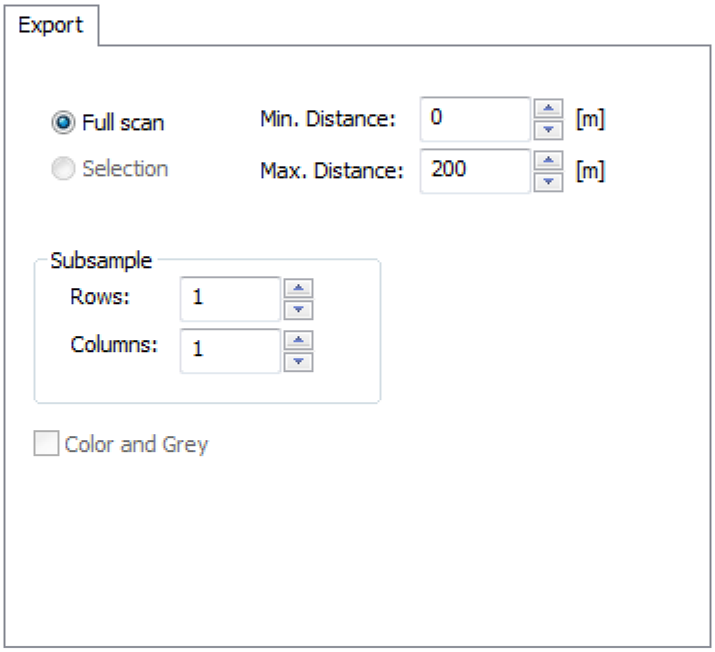


Figure 11-13 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Color and Grey

Export RGB and grayscale (intensity) values of each scan point if available. This function is enabled for the formats E57, XYZ text, POD, PTX and PTS. To export both values, the scan will be unloaded first and re-loaded with both values. After the export, the scan will be unloaded again and the initial scan status will be restored.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

SCENE Scan File Export Settings

File name

Name and location of the file to be created.

Export Tab

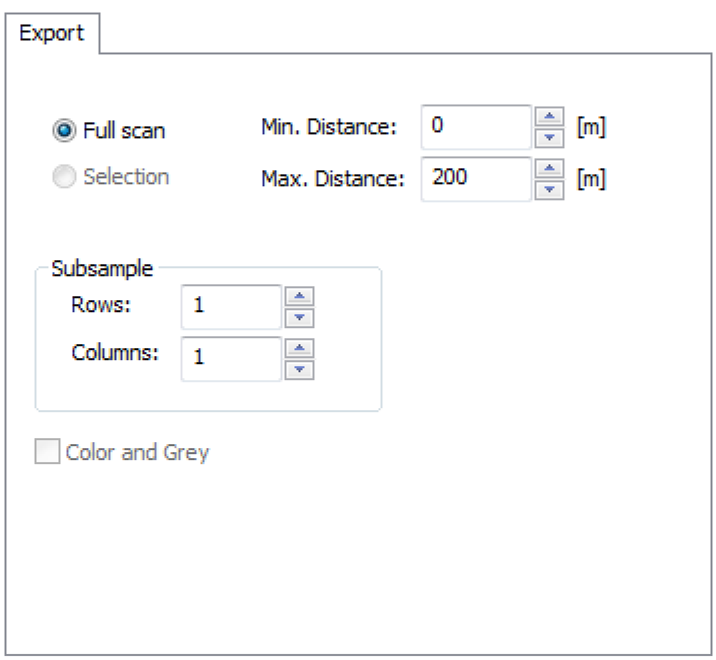


Figure 11-14 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.

Max. Distance – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

SPW Export Settings

File name

Name and location of the file to be created.

Export Tab

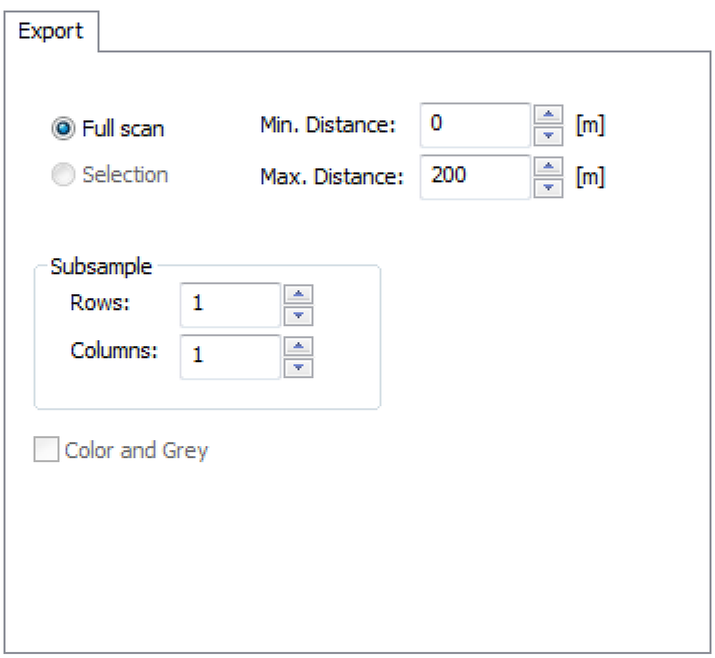


Figure 11-15 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

Min. Distance – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.

Max. Distance – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Color and Grey

Export RGB and grayscale (intensity) values of each scan point if available. This function is enabled for the formats E57, XYZ text, POD, PTX and PTS. To export both values, the scan will be unloaded first and re-loaded with both values. After the export, the scan will be unloaded again and the initial scan status will be restored.

VRML Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

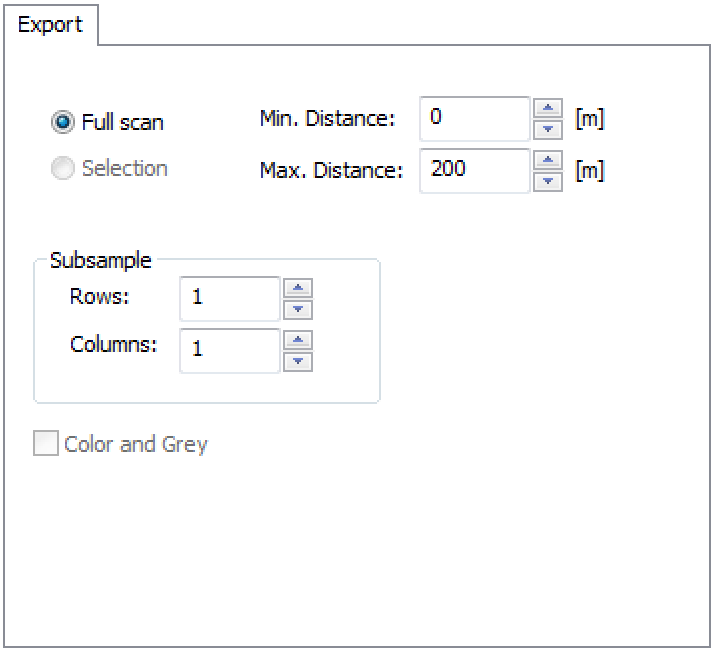


Figure 11-16 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

VRML Tab

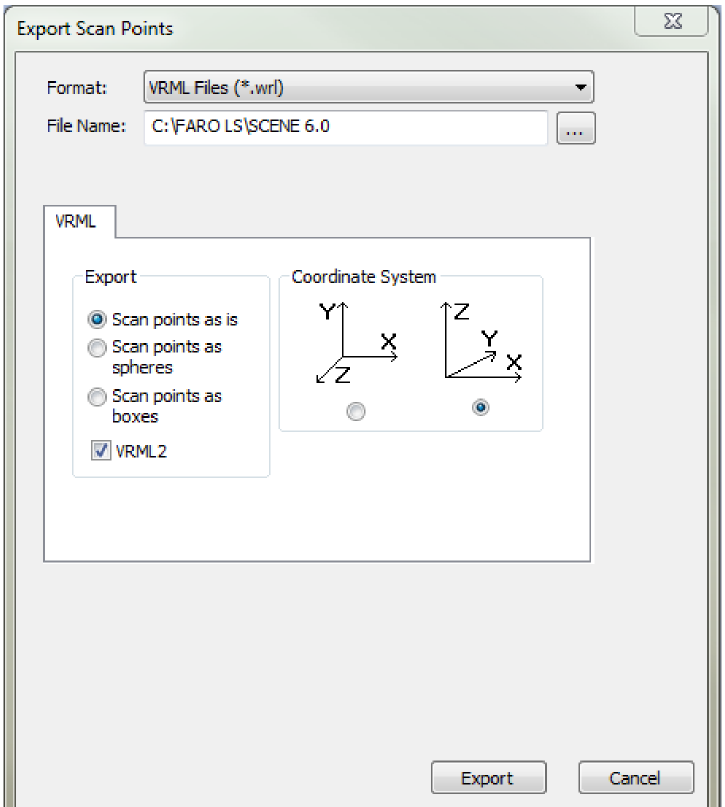


Figure 11-17 Settings for VRML export

Export

Scan points as is – Scan points are exported as points.

NOTE: Many VRML viewer programs do not support points.

Scan points as sphere – Scan points are exported as small spheres.

Scan points as boxes – Scan points are exported as small boxes.

VRML2 – Export in VRML2 format. Otherwise, VRML1 is used.

Coordinate System

Select the target coordinate system.

XYZ ASCII Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

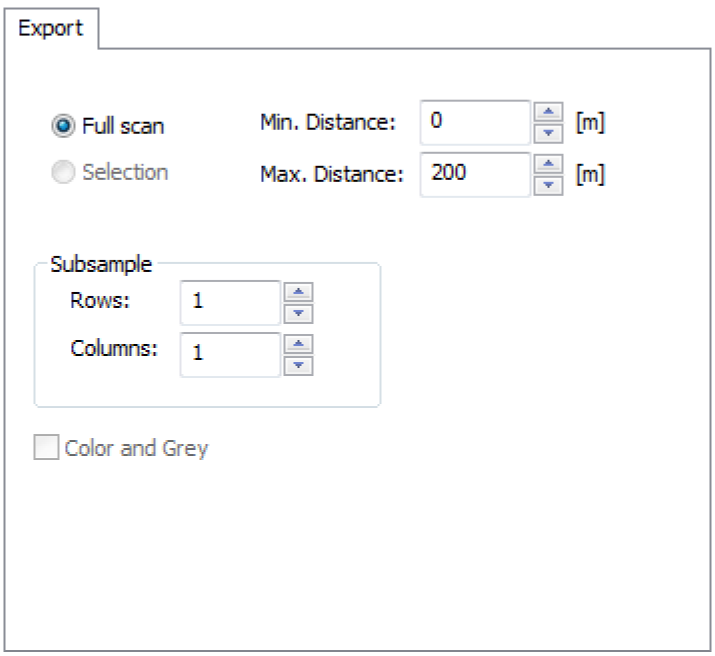


Figure 11-18 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Color and Grey

Export RGB and grayscale (intensity) values of each scan point if available. This function is enabled for the formats E57, XYZ text, POD, PTX and PTS. To export both values, the scan will be unloaded first and re-loaded with both values. After the export, the scan will be unloaded again and the initial scan status will be restored.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

XYZ Tab

With XYZ text format, the export file contains one scan point per row. Each scan point is identified by its 3 Cartesian coordinates X, Y, and Z and the reflection value. You can also specify the row and column number of the scan point. Both these numbers will then be next to the current scan point in the export file.

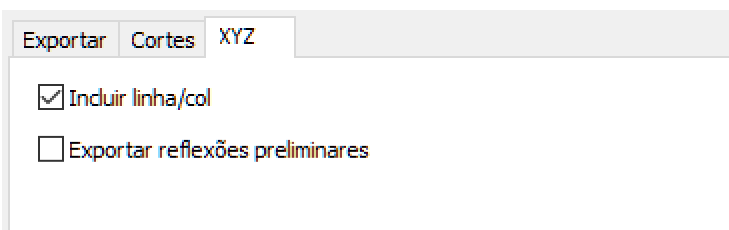


Figure 11-19 Settings for XYZ ASCII

XYZ Binary Export Settings

File name

Name and location of the file to be created.

Export each scan in a separate file

If not selected, all scans will be saved in one file.

Export Tab

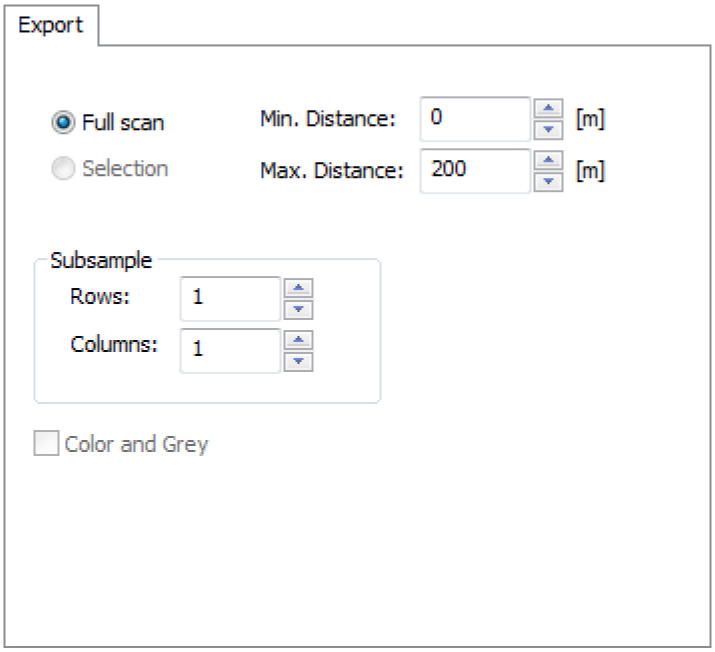


Figure 11-20 Export tab

Full Scan and **Selection** – These selections become available only when exporting from a single scan within the tree or from a point selection.

Distance – To reduce the number of points you export, you can indicate a threshold for the distance that a scan point may be from the scanner to be exported:

> **Min. Distance** – The minimum distance the exported scan points may be from the scanner. Scan points that are closer are not exported.
>
> **Max. Distance** – The maximum distance at which the exported scan points may be from the scanner. Scan points that are farther are not exported.

Subsample – Because even small selections of a scan can contain a great number of scan points, it may be necessary to reduce or thin out the exported scan points. Thinning out is achieved by only exporting every second, or third scan point of a row or column. Scan points are thinned according to their arrangement in the planar view or quick view .

Rows – Reduction by thinning out the rows

Columns – Reduction by thinning out the columns

With the value 1, every column/row is exported, with 2 every second, and so on. For example, if you enter the value 10 in both fields, you export 1 in 10 columns and 1 in 10 rows, so in total you will export one hundredth of the scan points.

Slices Tab

In the slices tab you can configure the export so that only slices of the scan are exported. You might use this to create a floor plan of a building, see Exporting Slices for more information.

Exporting Slices

If you want to very quickly create the floor plan of a building from the scan points, it is practical to use the slice export. When exporting slices, only those scan points are exported, which are between the top and the bottom limit you have specified. If you select a slice where there is little furniture or machines blocking the view, you obtain the floor plan of the building very easily.

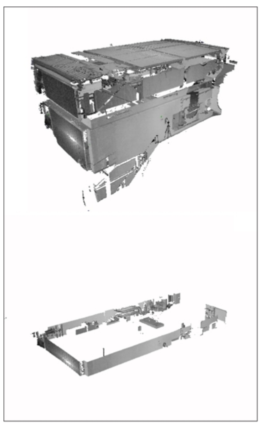


Figure 11-21 Slice of scan points

When exporting slices, only those scan points are exported which are between the top and the bottom limit you have specified. You can also apply the threshold outlined above for reducing and thinning out when exporting slices.

Slices Tab

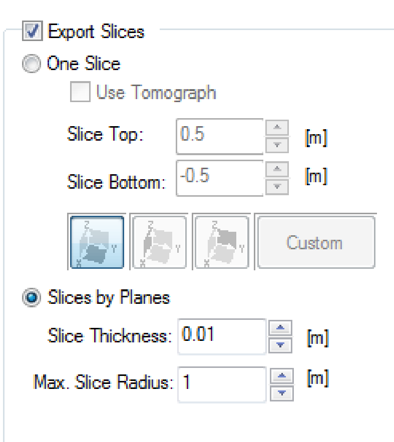


Figure 11-22 Export of a single slice

One Slice

The orientation and position of the slice are defined by the reference plane. The default setting of the reference plane is the ground floor, so top and bottom limits refer to the z coordinate and are limits in height.

If you want to create vertical slices, you can select the corresponding predefined plane with the normal pointing along the x-axis or y-axis.

The reference plane will be added to the project after the export. It will be called **ExportRefPlane** and will be available in the folder named References.

However, the export of slices is not limited to planes with normals pointing along the axes. With the **Custom** button you can use arbitrary planes as reference planes. Custom reference planes make it very easy to export scan points of objects that are located above a flat surface, like objects on the floor or on a table, by fitting a plane to the surface and using this plane as a reference.

Use Tomograph

When exporting slices, scan points from horizontal surfaces in the slice are also exported. This can make it difficult to define the floor plan. The Tomograph resolves this: it brings out vertical surfaces and hides horizontal surfaces, thereby allowing walls and supports to stand out.

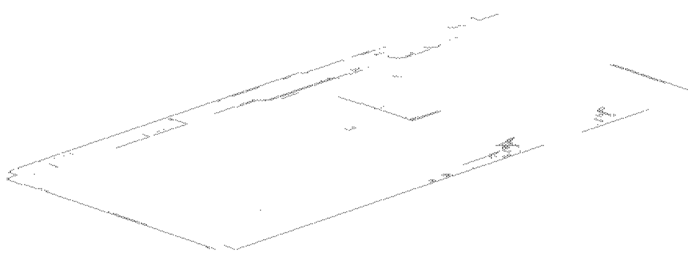


Figure 11-23 Tomograph

The Tomograph works like an X-ray apparatus – the X-ray goes through the slice from above and comes out on a photo plate below. The photo plate is covered with a fine raster and a raster field now either turns black or it remains white. If the X-ray hits sufficient scan points on its way through the slice, the raster field turns black. This occurs predominantly with vertical surfaces. If the X-ray hits only very few scan points, as is the case with horizontal surfaces, the raster field remains white.

The Tomograph brings out vertical surfaces and hides horizontal surfaces, thereby allowing walls and supports to stand out. The Tomograph can be used with any reference plane.

Slice by plane

If you want to export several slices at the same time, you can define the slices with a set of planes. In contrast to the export of a single slice, here each plane directly defines the location of the slice. Instead of having a plane and a top and a bottom distance, each plane defines the center of the slice. All slices have the same thickness which you can input into the dialog.

Also in contrast to the export of a single plane, here only those points of a slice are exported which are located within a given radius around the center point of the slice.

The center point of each slice is defined by the position of the corresponding plane.

You can create planes either by fitting or manually. Notice that all planes of the project will be used as reference planes – even if they are defined in other scans or in completely different folders of the project.

In the figure below you can see an example of an export with a set of equidistant planes that were defined manually. This figure shows the exported scan points after they have been imported back into SCENE.

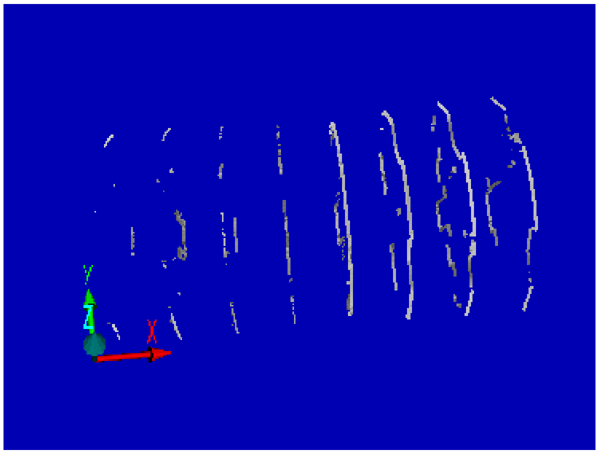


Figure 11-24 Slices defined by a set of equidistant planes

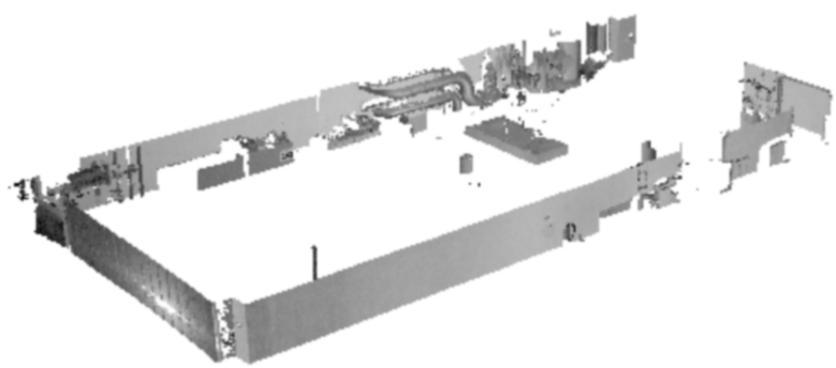


Figure 11-25 Export of several slices

You can create planes either by fitting, or manually. Observe that all planes of the project will be used as reference planes – even if they are defined in other scans or in completely different folders of the project.

Exporting Scan Point Clouds

Export the scan points of one scan point cloud:

In the structure view, right-click the scan, then select **Export > Scan Points**. This command will be grayed out if a scan point cloud of the respective scan does not yet exist.

Export the scan points of several scan point clouds of a scan folder:

In the structure view, right-click the scan, then select **Export > Scan Points**. This command will be grayed out if the respective scan folder does not contain any scan point clouds.

Exporting the project point cloud

To export the project point cloud of a scan project:

1. Click the **Project Point Cloud** button in the **Export** toolbar. It does not matter what you clicked in the structure view before.

   The **Export Scan Points** dialog is shown.

2. Select the file format in which you want the project point cloud to be exported.

3. Click **OK** to start the export.

Legacy: Export and Upload a WebShare Project from within SCENE

NOTE: WebShare and Sphere are migrated to the new cloud solution Sphere XG. Please see *Upload and Download SCENE Projects to/from Sphere XG* on page 64for information how to upload a project to Sphere XG.

With WebShare, panoramic scan images can be put on the Internet, thus enabling anyone to share scan information of scan projects with other parties, like far-off company sites, customers, suppliers or partners without the need of additional software.

WebShare is a web service hosted by FARO Technologies inc. which enables you to share your scan projects without setting up a web server on your own. The project data can be accessed with a standard web browser, no additional software or plug-ins are needed. Connect to faro.websharecloud.com to view the publicly available projects.

See the WebShare online help for more information.

NOTE: WebShare is being replaced by the new cloud solution Sphere XG. Contact the FARO support or find information in the Sphere XG user manual.

You can also upload a SCENE project to Sphere using the Sync Agent. From Sphere Legacy, you can upload the SCENE project to WebShare. For further information refer to the Sphere Legacy User and Administrator Documentation, chapter Sync Agent.

Export WebShare Project

Before publishing a scan project in WebShare, special WebShare data must be created from the project. Follow these steps to create such data:

1. Open your scan project. Make sure that the scan project is processed and registered.

   NOTE: Hand-held scans are visible in overview maps, but if you want to view your hand-held scans as panoramas in WebShare, you must first create virtual scans.

   See *Upload Project Point Cloud* on page 290 to learn how to create 3D views from hand-held scan data in WebShare.

2. In the **Export** tab, click the WebShare button in the tool bar. A small menu opens.
3. Click the **Export** WebShare **Project** button in that menu.
4. You will be asked to save the scan project first.
5. The WebShare export dialog appears. This dialog has three tabs:
   - **Export Settings** – allows configuring the data export of the WebShare **Overview Map** and the Panorama Views.
   - **Project Settings** – allows providing the name of the project and its URL identifier plus additional project information to be published in WebShare.
   - **Upload Settings** – allows entering the user login data, and starting the project upload to WebShare immediately.

6. Configure the data export on tab **Export Settings** of the WebShare export dialog.

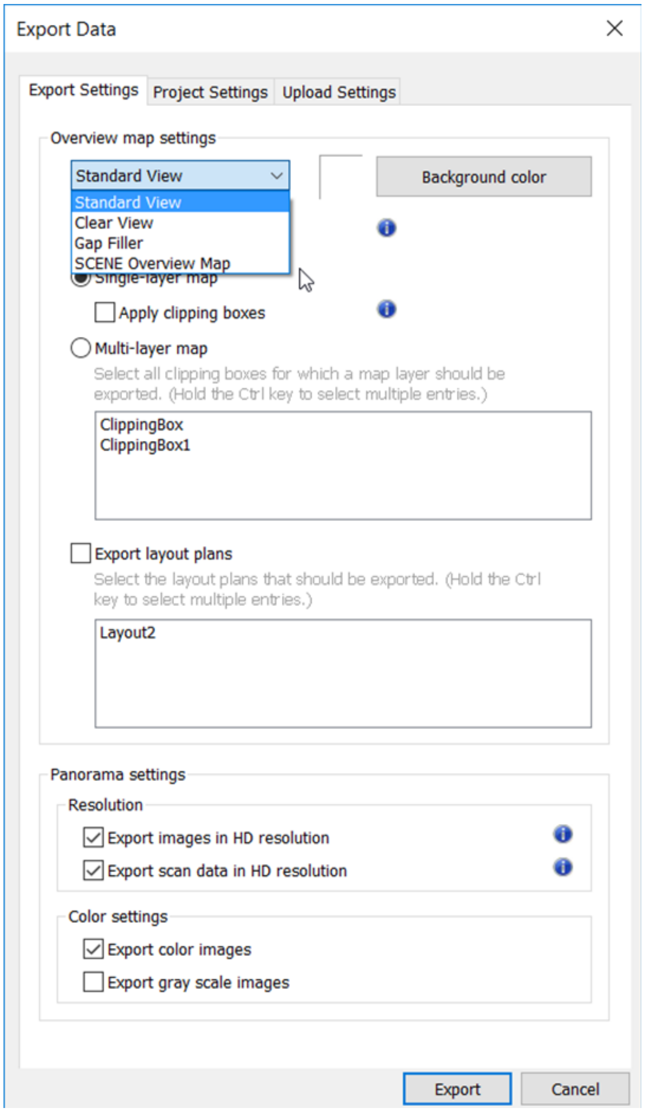


Figure 11-26 WebShare export dialog – Export Settings

Export Settings

Overview Map settings

Settings for the **Overview Map**, which is a top view of your entire scan project.

Standard View – Select an option in this dropdown list to export the Overview Map with the following options:

- Standard View
- Clear View
- Gap Filler
- SCENE Overview Map

Background color – Select the background color of the **Overview Map**. Selecting a color other than white might be useful when the scan project contains crucial structures which are white themselves. You can test this by selecting a white background in the 3D view and looking at the project from above.

Create Scan Overlays – If this checkbox is selected, the coverage of each scan can be shown in the overview map.

If this checkbox is activated, the coverage of each scan can be shown in WebShare's overview map. Since the creation of the scan overlays increases the export and upload time significantly, the option is deactivated by default.

Single-layer map

Apply Clipping Boxes – Sometimes, it might be useful to hide points (for example, the roof of a building) with the help of Clipping Boxes to improve readability of the map.

Select this option to create the **Overview Map** from the visible scan points, defined by the available and active Clipping Boxes.

Multi-layer map – These map layers can be toggled on and off separately in WebShare. Clipping boxes are used as the basis for the map layers. Select one or more clipping boxes from the given list.

The Clipping Boxes must show their inside. They do not need to be active.

Export layout plans – If the project contains layout plans, select here if you want them to be exported and if yes, if you want all layout plans or only some of them.

Panorama settings

Settings for the panoramic scan images.

Resolution

- **Export images in HD resolution** – Select whether to export the panorama images in the standard resolutions only (width of the standard panorama images is up to 4096 pixels) or, to export the panorama images in the standard resolutions and additionally in a higher resolution (HD resolution, width of images is 8192 pixel or 16384 pixels). Such HD images can only be displayed on desktop PCs or Notebooks. On mobile devices like tablet computers, the panorama images will be displayed in the standard resolutions.

- **Export scan data in HD resolution** – The scan data which is necessary for measurements and annotations in the panorama images can be exported in two sizes, in the standard size and, additionally, in the maximal size. Exporting scan data in the maximal sizes needs additional storage space of 128 MB per scan on the server, but facilitates the exact positioning of measurements and annotations in HD panorama images.

Color Settings

Panorama images can be exported in color or as gray scaled images, or both. If there are scans in the scan project that are not colorized, gray scaled images will be exported from these scans, even if **Export gray scale images** is not selected. And vice versa, if there are scans in the project that do not have their original reflection values anymore, only colored images will be exported from these scans, even if **Export color images** is not selected.

Project Settings

1. Set up project information on tab **Project Settings**:

   Name – Enter the name of the scan project.

   URL identifier – Enter a unique identifier for the project in the WebShare. Every project in the WebShare must have a unique URL identifier. The following characters are allowed: **a-z**, **0-9**, and **-**.

   Preview image – Select a preview image for the project. This image will be displayed in the WebShare project selection. Supported picture formats are BMP, JPEG, and PNG.

   Access control

   - **Make public** – If you set this option, everybody will be able to see and access the project in WebShare. If you do not set this option, the project will not be visible to the WebShare users. After project has been uploaded, the appropriate project access rights must be defined in the Administration area of WebShare to make the project visible to certain users or user groups. See the WebShare online help for more information.

   - **Feature project** – If you set this option, the project will be shown in the slide show on the WebShare Project Overview page.

     Description – Enter a description text for the project.

     Keywords – Enter keywords associated with the project, separated by commas.

     Project coordinates – Enter the project’s world coordinates. The project location will be displayed on a map in the WebShare. The latitude must be a decimal number between -90 and 90, the longitude between -180 and 180.

2. Click **Show the project location in Google Maps** button  to test the entered coordinates in Google Maps.

3. If you want to upload the data to the WebShare immediately, switch to tab **Upload Settings.**

Upload Settings

Immediately start upload – Starts to upload all files created during the WebShare export immediately. If you do not want to upload the WebShare data immediately, you can do this at any time later.

NOTE: We recommend exporting and uploading the data in parallel.

Upload options – enter your Sphere login credentials to access WebShare:

Save Credentials – Select to save your login credentials so that you do not must enter them again in the future.

Point Cloud Options

If a project point cloud exists in the SCENE project, both boxes are checked by default.

- **Upload Project Point Cloud** – Check this box to upload the SCENE project point cloud as a CPE file after the WebShare Cloud project is successfully uploaded. If no point cloud exists, you are prompted to create it.
- **Create data for** WebShare **3D View** – After the CPE file is successfully uploaded, data creation for the WebShare 3D view begins. Note that this can take some time. The 3D view will be available in the WSC project after it is created.

After you are finished, click **Export** to start the creation of the WebShare data that will be saved to the project folder. The data is uploaded to the WebShare Cloud.

Uploading WebShare Project

If WebShare data is already available for your scan project, you can upload it to the WebShare at any time. Follow the steps below to do this:

1. Click the WebShare button in the toolbar. A small menu opens.
2. Click **Upload Data in** that menu. The WebShare upload dialog will show up. This dialog has two tabs, **Upload Settings** and **Project Settings.**

Upload options – enter your Sphere login credentials to access WebShare:

Save Credentials – Select to save your login credentials so that you do not must enter them again in the future.

Point Cloud Options

If a project point cloud exists in the SCENE project, both boxes are checked by default.

- **Upload Project Point Cloud** – Check this box to upload the SCENE project point cloud as a CPE file after the WebShare Cloud project is successfully uploaded. If no point cloud exists, you are prompted to create it.
- **Create data for** WebShare **3D View** – After the CPE file is successfully uploaded, data creation for the WebShare 3D view begins. Note that this can take some time. The 3D view will be available in the WSC project after it is created.

After you are finished, click **Export** to start the creation of the WebShare data that will be saved to the project folder. The data is uploaded to the WebShare Cloud.

1. Specify project relevant information on tab **Project Settings.**

2. After you are finished, click **Upload** to start uploading the data to WebShare.

You must have a Sphere account with project role Uploader to upload scan projects. Ask your Administrator for more information.
You can **resume interrupted uploads**: To resume an interrupted upload, make sure to enter the same URL identifier in the **Project Settings** as used in the previous upload attempt.

Upload Project Point Cloud

NOTE: This upload functionality is now only useful if you have an existing WebShare Cloud project. For new projects you upload the point cloud automatically.

It is now possible to upload point clouds to WebShare or export the point clouds generated in SCENE to a particular project in the WebShare domain. Select the **Upload Project Point Cloud** option in the WebShare dropdown menu to open the **Send to** WebShare tab.

This functionality can also be accessed from the:

- context menus of scans or clusters, select **Point Cloud > Send to** WebShare

- context menus of clipping boxes, select **Active Clipping Boxes > Send to** WebShare

- context menus of selections, select **Selection > Send to** WebShare

NOTE: It is recommended to upload the project point cloud, or selections based on it. Due to filtering and color balancing, a better visualization quality can be achieved than with scan point clouds.

Login

The **Login** page is displayed. Login with your Sphere login credentials.

You must have a Sphere account with project role Manager to upload project point clouds. Ask your Administrator for more information.

If the login credentials are already saved, you are automatically logged in with the saved credentials.

Select Project Settings

The **Select Project Settings** page opens.

Based on the project properties of the current SCENE project, matching WebShare projects are recommended.

Other projects can be selected by expanding the section **Other Projects in this Domain**.

If you want to upload the CPE file into a new empty WebShare project, create the project in WebShare first.

NOTE: When uploading to an existing WebShare project, make sure that you did not modify the scan positions in SCENE after the WebShare export. Otherwise, the uploaded point cloud will not be aligned to the scan positions in the WebShare project.

Point Cloud Settings

The **Point Cloud Settings** page opens.

The project point cloud is generated in CPE format. Enter the name of the file, and file format properties.

Start Upload

Click **Start Upload** to upload the project point cloud. After the upload has successfully completed, you can use the **Create 3D Data** task in WebShare to create the data for the 3D view. Select the uploaded CPE file in the **Select Sources** option. You can additionally select other CPE files or scans to get a combined 3D view. After the 3D data creation has finished, you can view the uploaded point cloud in WebShare.

Chapter 12: Virtual Reality

SCENE gives you the ability to step into your point cloud with virtual reality (VR). You can now experience your scans as if you were on location, take measurements, make screen captures, and read annotations.

Virtual Reality

Introduction

SCENE gives you the ability to step into your point cloud with virtual reality (VR). You can now experience your scans as if you were on location, take measurements, make screen captures, and read annotations.

VR System requirements

See *System Requirements* on page 1 for all VR system requirements.

SCENE Project Requirements

- Your project requires a point cloud.
- Closed surfaces are strongly recommended.

SCENE Virtual Reality Features

When you view your project using VR goggles, the following features are available:

- View a project point cloud
- View imported meshes
- Choose among different movement modes:
  - Teleporting
  - Flying
  - Flying with fixed vertical position (walk mode)
  - Jump directly to measurements, annotations, and scans
- A virtual tablet that serves as your user interface while using the VR goggles. It can be minimized when you don’t need it.
- Keep track of your location with a 2D overview map (if present in your project)
- Take and delete measurements
- View and delete annotations and attached image files
- Take and delete screen captures. The images are stored in the structure view under the **Screenshots** folder. To export the screen captures, select the images in the structure view, right-click and choose export images.
- View the help page for Oculus and HTC VIVE that explains how to use the controllers to explore the virtual world
- VR Settings (Within VR only)

Starting the Virtual Reality in SCENE

1. Ensure that the VR hardware is correctly connected to the computer.
2. Open the **Explore** toolbar and click the VR icon.

Chapter 13: Scanning

The Scanning category available in SCENE and FARO Laser Scanner provides the options for Scanner Control, On-Site Registration, and On-Site Compensation.

Typically, you will not see the **Scanning** feature in SCENE since it is hidden. If you need it, activate it in **Settings** > **General** > **User Interface** > **Show Scanning Category** under the **User Interface** option. The Scanning feature will then appear in the workflow bar.

Scanning

Figure 13-1 Scanning toolbar

The Scanning toolbar provides the following options:

- Scanner Control
- On-Site Registration
- On-Site Compensation
- Open Target PDF

Scanner Control

The **Scanning** category has the **Scanner Control** option**.** It can be used to start a remote connection to control the laser scanner. The scanner can be controlled by using the scanner user interface that is displayed in SCENE.

To connect to the scanner:

1. Click button in the toolbar.

2. Enter the IP address of the scanner. Note that after connecting to a scanner, its IP address is stored in the computer's registry. It will appear by default the next time you try to connect to the scanner. You can change it on the Connect page, if necessary.

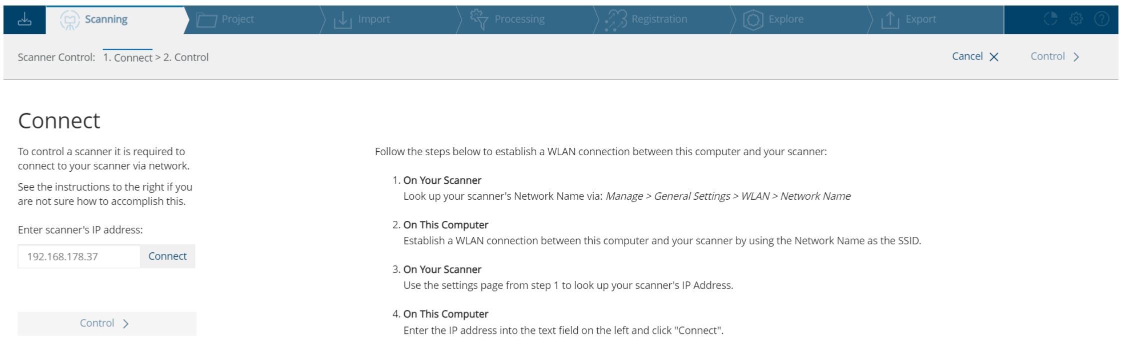


Figure 13-2 Connect page: Enter the IP address

3. Click **Connect** to retrieve the details of the scanner. The page will be updated.

4. If the IP address is not associated to an active laser scanner, an error message is displayed.

5. If a connection is successful to a supported FARO Focus Laser Scanner, the **Control** button becomes active and green.

6. Click this button to control the scanner through the HTML user interface.

NOTE: After connecting, SCENE checks the version of the firmware that is installed on the scanner. If a newer version of the firmware will work better with the current version of SCENE, you are encouraged to update your scanner.

7. SCENE starts the **Scanner Control** task and displays the scanner user interface. You can control the scanner remotely through this HTML interface.

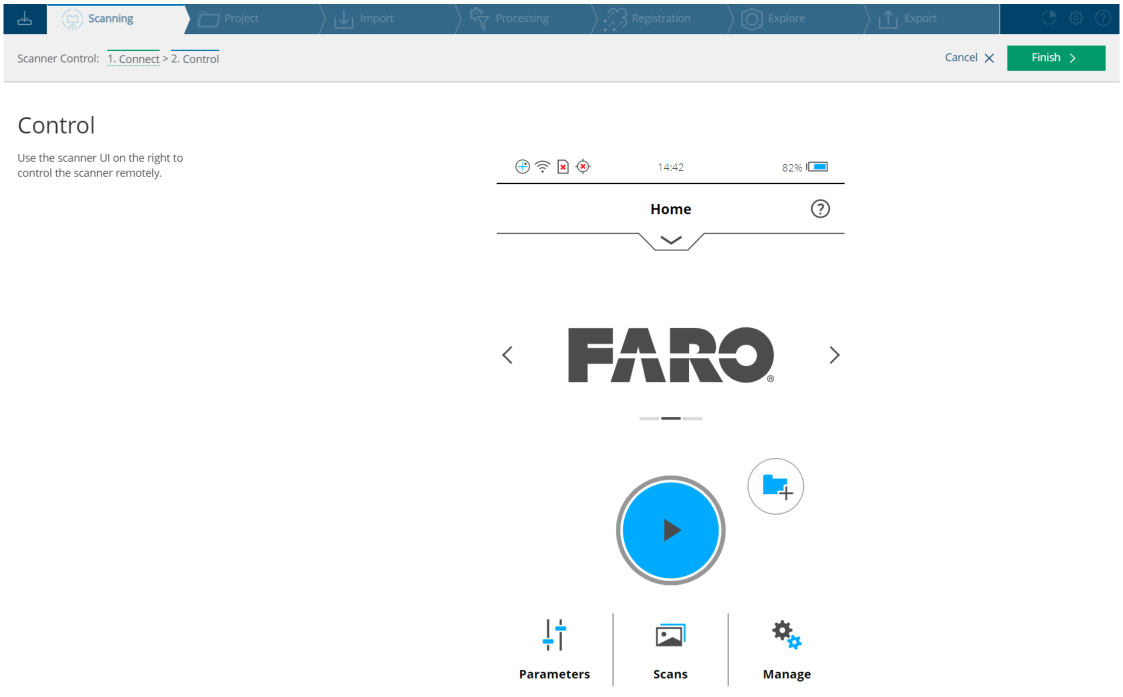


Figure 13-3 Finish or Cancel task

8. Click the **Finish** or **Cancel** button to close the scanner user interface, scanner control task and disconnect from the scanner.

On-Site Registration

NOTE: We recommend using the FARO Stream app for on-site registration.

The On-Site Registration feature enables the user to process and register scans on-site remotely through the computer running SCENE software. The scanner must be connected to SCENE and can be controlled by using the scanner user interface displayed in SCENE. The processing and registration of the scans are performed in SCENE

The user can operate on-site registration functionality as follows:

- directly on the scanner
  Or
- through a connected device like a phone or tablet, showing the scanner user interface
  Or

- within SCENE. The scanner can be remotely accessed through WLAN or Ethernet through a computer running SCENE.

On-Site Registration Setup

To enable on-site registration, see *On-Site Compensation* on page 298.

The procedure to setup on-site registration is as follows.

On the Scanner

Configure the scanner

1. Configure the WLAN connection on the laser scanner. See Connecting the Scanner to WLAN.
2. Configure scan project/cluster, scan name, scan parameters.

NOTE: Refer to the *Operating Software* chapter in *FARO Focus Laser Scanner User Manual* for more information about on-site registration settings and related user interface pages.

Enable On-Site Registration

1. Go to **Home** > **Manage** > **On-Site Registration Settings**.
2. Turn **On-site Registration** ON or OFF by sliding the button. The scanner now connects to a remote system in the network, running SCENE.
3. The IP address and port will be automatically set on the scanner.
4. The **Start Scan** button leads to the new map page. When **Start Scan** is selected, the map page will be displayed.

On your Computer

Configure SCENE

1. Configure the WLAN network of the computer.

NOTE: The scanner and computer must be continuously connected to the same WLAN network.

2. Start SCENE on the computer.

3. Start **On-Site Registration** task in the **Scanning** category of SCENE.

4. Enter the IP address of the laser scanner. You can find the IP address of the laser scanner by tapping **Manage** > **General Settings** > **WLAN** > **IP Address** on the scanner user interface. Enter the IP address as it is, following exactly the given scheme of digits.

5. Connect to the FARO Focus Laser Scanner after entering the IP address in the **On-Site Registration** task. The scanner **Home** page is displayed.

6. On the scanner home page click the **Map** button. A map is displayed with the available scans in a project.

Figure 13-4 On-Site Registration overview map with list and status of scans

7. Now click **Start Scan** button to start a new scan on your scanner, or remotely in SCENE. All recorded scans on the current cluster or project opened on the scanner will be uploaded to SCENE. The scans will be automatically processed by SCENE.

NOTE: If one scan fails to register, run a connection scan with the scanner placed in between the area of the two different scans. To validate the registration of scans, highlight their points in the map.

On-Site Compensation

On-Site Compensation process is a procedure to test and improve the angular accuracy of the scanner using SCENE software.

NOTE: On-Site Compensation feature is not available for Focus M 70.

Preparing the Compensation Station

Site Setup

Before you begin the On-Site Compensation process, ensure that the scan site has the following facilities:

- Target sheets must be setup at the scan site at regular distance to the laser scanners between 1.5 m to 3 m.
- No windows or other reflective planes: The markers on the target sheets would be reflected if the scan site has any windows or reflective surfaces. This can cause incorrect measurements.
- Lighting conditions are less important because On-Site Compensation is done with the laser, video images are not used.

Connect Laser Scanner to Computer through Wireless LAN

To be able to transfer the scanned data directly to your computer, you must connect the computer with the laser scanner and through WLAN to remotely access and control the scanner.

Using the scanner as a WLAN access point

NOTE: Disable the proxy server to make the connection work. If this is not possible for some reason, enter the addresses of both devices in the Exceptions field.
We recommend using a WLAN card that supports IEEE 802.11n.

On your scanner

1. Enable WLAN on your scanner (see *Connect Laser Scanner to Computer through Wireless LAN* on page 299).
2. Look up your scanner’s network name by tapping **Manage > General > WLAN > Network Name** on the scanner’s user interface.

On your Computer

Establish a WLAN connection between the computer or tablet and the scanner by using the network name as the SSID.

NOTE: The following ports must be open to establish a LAN/WLAN connection between the Laser Scanner and SCENE:

8765	SOCKS Channel communication between Scanner and SCENE/SDK/Scanner API
8775	Broadcasts - discover Scanner in the current network
8888	Scanner WebAPI, e.g., for On-Site Registration
80	Port for the HTML GUI: HTTP
443	Port for a secure HTML GUI: HTTPS
15975, 16824, 17673, 18522, 19371, 20220	Ports used in SCENE for the WebAPI, e.g., for On-Site Registration (15975 + x * 849)

On-Site Compensation steps

On your computer

Select Output folder

1. Click **Start On-Site Compensation** button in the Scanning toolbar by selecting the Scanning toolbar.

All data captured during On-Site Compensation, including the **Compensation Report** will be stored in the output folder**.**

2. Click the **Browse** button to open the file system browser.

3. Browse to the folder. Click the **OK** button.

Setup

Enter Scanner IP Address

1. Enter the IP address of the laser scanner. You can find the IP address of the laser scanner by tapping **Manage > General Settings > WLAN > IP Address** on the scanner user interface. Enter the IP address as it is, following exactly the given scheme of digits and dots.

2. Click the **Connect** button.

3. In the dialog, click the **Place Targets** button to continue with the next step.

Place target

On your Computer

1. In the **Place Targets** page, a picture is shown that describes how to place the targets and the scanner for the compensation.
2. If the 6 Target Sheets are not available In SCENE, click the **Open Target PDF** button.
3. Select among the DIN/ISO A4 format, or US letter format. Your standard PDF viewer will open, showing the target PDF sheet.
4. Print at least 6 marker sheets.

NOTE: We recommend gluing the target sheets on suitable rigid plates, especially if On-Site Compensation is done at an outdoor location.

On Site

Place at least 6 Target sheets on site as follows:

1. Place the target sheets in a vertical range of -50° to 50° from the scanner device.
2. Distribute the target sheets uniformly over the specified range. At least one board must be close to the horizon (0°).
3. Make sure that the distance between the target sheets and the scanner is between 1.5 m to 3 m.
4. Make sure that all target sheets are vertically aligned.

Laser Scanner Placement

1. Mount the laser scanner on a tripod.
2. Place tripod and scanner on a stable and plane ground. The tripod must not move during scanning.

Horizontal Alignment

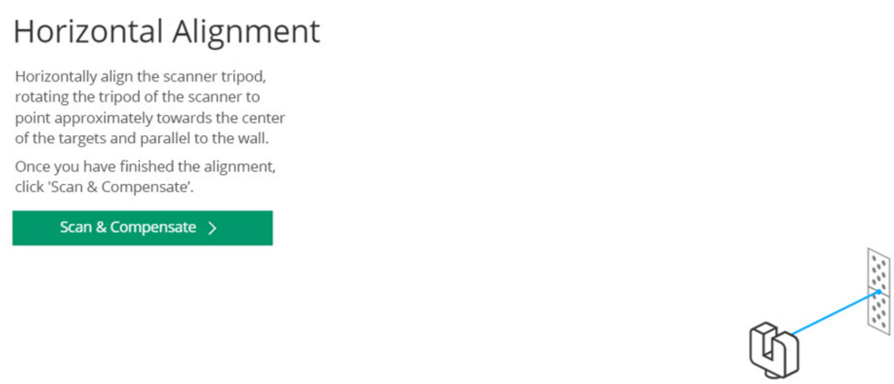


Figure 13-5 Horizontal Alignment

Horizontally align the scanner tripod as follows:

1. Rotate the tripod of the scanner to point approximately toward the center of the targets.
2. Start scanning and compensation by clicking the button **Scan & Compensate**.

During the compensation process, the status of progress is displayed. You can cancel the process if required.

Scan & Compensate

1. Select whether you want to apply the compensation data to the scanner.
2. Click disconnect to disconnect from scanner and finish the On-Site compensation.
3. To apply this compensation to the scanner choose “yes” and click the **Finish** button. Choose “no“ if you do not want to apply this compensation.

When the compensation is finished, the Compensation Report is displayed with the results of the compensation. Open the compensation report as PDF by clicking the button **Open Report**. The **Compensation Report** is saved as PDF to the location specified in the left side of the page.

Troubleshooting

Error

Reading and writing to the selected data output folder failed.

Solution

Make sure that you have sufficient rights to read and write in the selected output folder. Ensure that you have sufficient disk space. Approximately 330MB are necessary to perform an On-Site compensation.

Error

The process did not identify enough targets for compensation.

Solution

In the output folder a targetImage.png file is stored. This image shows the identified markers as blue circles. Areas with a sufficient amount of detected targets have a green background color. Areas with an insufficient amount of detected targets the background color is red.

Error

No consistent solution could be determined.

Solution

Make sure that the tripod and the targets did not moving during the procedure.

Error

The SD card of the scanner could not be accessed.

Solution

Make sure that the SD card is inserted and that it is not write-protected and has sufficient free space left (approximately 330MB).

Error

Communication with the scanner failed.

Solution

Make sure that the WLAN connection to the scanner is stable.

If this error appears when connecting to the scanner or applying the compensation parameters, try to repeat the corresponding step.

Chapter 14: Apps

For developers SCENE offers an application programming interface (API) which gives the opportunity to integrate own functionality into SCENE. This API allows anyone to create custom applications (Apps) which integrate seamlessly into the SCENE user interface to extend the functionality. Developers are free to share their Apps with others (for free or for sale), so that everybody can benefit from them.

Publicly available apps may be downloaded from the FARO 3D App Center.

Installing and Managing Apps

You can install and manage apps with the SCENE App Manager.

Click the **Apps** button on the right side of the workflow bar.

Figure 14-1 Apps toolbar

The Apps toolbar shows the **Apps** button, and all the Apps that are available. Note that the number of apps displayed in your toolbar may differ from the apps shown in the figure above.

App Manager

The SCENE App Manager provides the following functionality:

- It allows installing new apps. For more information, see chapter *Installing and Managing Apps* on page 304.
- It gives an overview of the already installed Apps with additional information, like the version number.
- You can activate or deactivate already installed apps or remove them from the system. For more information, see chapters *Activating / Deactivating Apps* on page 306 or *Updating Apps* on page 306.
- Developers can create an app package file (app in installation file) from their app files (with the **Pack App…** button that will be displayed when checkbox **Developer Options** is enabled).

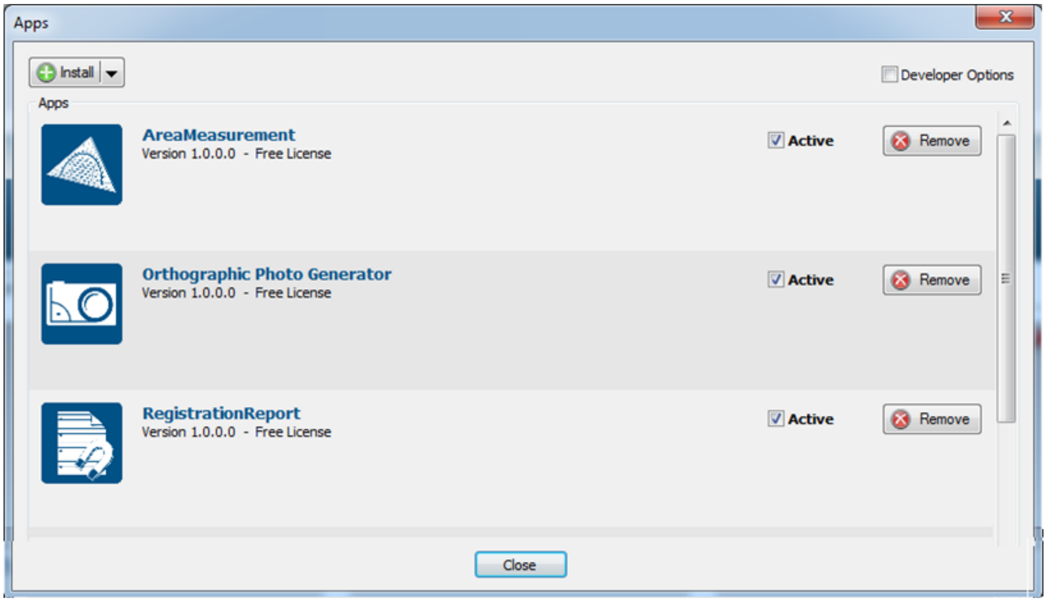


Figure 14-2 App Manager

Use the  button to uninstall an app from your system.

Installing Apps

To install a SCENE App, do one of the following:

1. Click the  button and select an App package file (with the extension .fpp) from your hard disk. In the dropdown menu of the button you will find:
   - the possibility to install an App that is not packed to an App package but whose individual program files are available within a folder on the hard disk.
   - a link to the FARO 3D App Center to download new apps.
2. Drag & drop a downloaded App package file into SCENE.
3. Double-click an App package file in Windows Explorer.

If the App is already installed you will get an error message and the installation will be canceled.

SCENE also checks whether the App is compatible to the current version of SCENE. If the App and SCENE are not compatible, the installation will be canceled.

After installation is complete, the App will be activated by default.

Updating Apps

If you would like to install a new version of an already installed App, remove the former version of the app from your system first, and then install the new version as described above.

Activating / Deactivating Apps

Use the **Activate** checkbox in the App Manager to enable or disable certain Apps at runtime.

Uninstalling Apps

Use the  button to uninstall an App from your system.

Chapter 15: Advanced Functions

This chapter explains the use of local and global coordinates. The chapter also lists options that enhance the software's speed and ease of use.

Coordinates

The coordinates of a point describe its exact location in relation to an agreed reference point. This reference point is referred to as the origin of the coordinate system. With a scan, you receive points in the three-dimensional space. Therefore, for a precise description of a measured point, you need the definition of the origin and three other values which then indicate the relative location to this origin.

Depending on the choice of origin, you can decide between local coordinates or global coordinates. The three other values can be set to different degrees, for example polar coordinates or Cartesian coordinates.

Local Coordinates

When scanning, the position of the scanner emerges as the natural origin of the coordinate system because when recording the scan, all position specifications of the points are initially recorded in relation to the scanner. This coordinate system is therefore described as the local coordinate system.

Due to the rotation of the scanner, its natural coordinate system is the polar coordinate system, with which two angles and a distance value are used to determine the position.

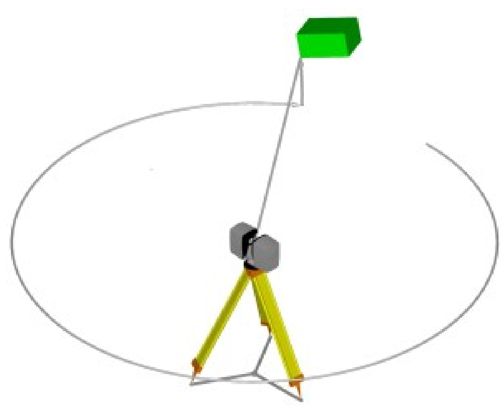


Figure 15-1 Polar coordinates

For the single scan points created by the scanner, you can find the polar coordinates in the bottom status bar:

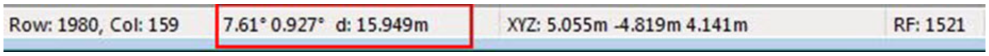


Figure 15-2 Display the polar coordinates of a scan point

Cartesian Coordinates

In day to day use, you would generally use Cartesian coordinates, which have a direct reference to concepts such as length, width and height, rather than polar coordinates.

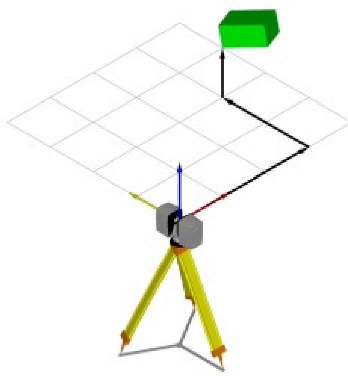


Figure 15-3 Cartesian coordinates

The conversion of polar coordinates into Cartesian coordinates occurs automatically in SCENE. It is completely independent from the location of the scanner or other influencing variables because it simply converts between two types of representation at the same level. The converted coordinates are displayed directly next to the polar coordinates in the bottom status bar:

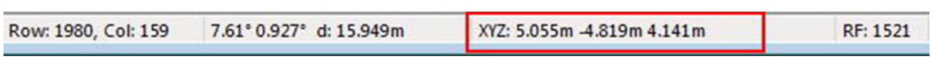


Figure 15-4 Display of the Cartesian coordinates of a scan point

Global Coordinates

If a scan is viewed in its 3D position against another scan, local coordinates are no longer practical. If, for example, two scans were recorded at different positions, the points within each one can have the same local coordinates; they match reality but not one another.

Therefore, you should relate the coordinates to one reference point which remains the same for all scans. This reference point is normally selected so that it is also possible to make a comparison using other systems, for example a CAD system.

By doing so, you can view polar coordinates and Cartesian coordinates again. However, since the polar coordinates do not produce a clearer representation than the Cartesian coordinates. They are therefore not explained in any more detail here.

You can calculate the global coordinates using the local coordinates of a point if you know the relationship between the local and the global coordinate system. To do this, you transfer the local coordinates into global coordinates by tracing the movement which would make both coordinate systems match. You can differentiate between two types of movement:

If the local origin does not match the global origin, all coordinate specifications must be moved by the difference between the local and global origin. This movement is also called Translation.

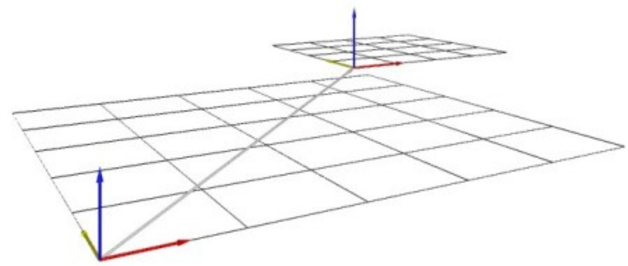


Figure 15-5 Translation

If the orientation of the coordinate axes is different, you must make them match with a Rotation**.**

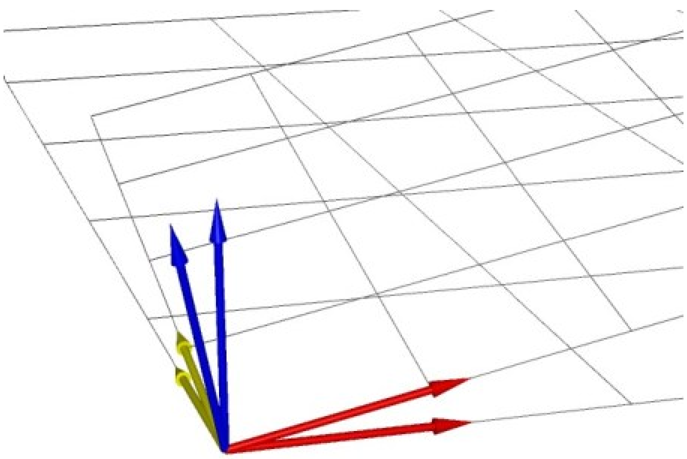


Figure 15-6 Rotation

The rotation is described by a rotation axis and the corresponding angle of rotation. Generally speaking, any rotation can be described with a single rotation axis. This rotation axis, however, does not necessarily match one of the coordinate axes. It is difficult to show this rotation graphically. However, you can also split the rotation up into three separate rotations around the coordinate axes. In this type of representation you can imagine the result of a rotation more easily. SCENE saves the rotation internally with a single rotation axis and a single angle of rotation. The user interface, however, displays the more comprehensible type of representation of the three rotations around the coordinate axes.

NOTE: When splitting the rotation into three separate rotations around the coordinate axes, it is important to have a defined sequence of the axes. If you first rotate around x, then around y, and finally around z with some specific angles of rotation, you get different results than you would get with the sequence x, z, y.

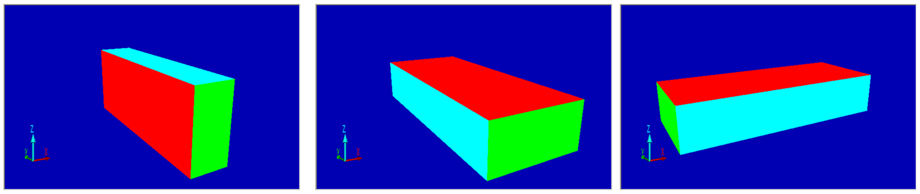


Figure 15-7 Rotation of 90° around y and then 90° around z

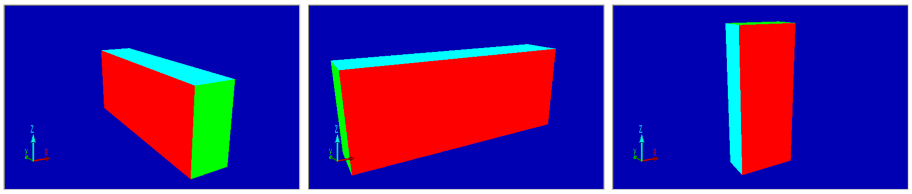


Figure 15-8 Rotation of 90° around z and then 90° around y

In the user interface, SCENE uses the sequence x-y-z.

If you want to fine-tune a rotation on a per-axis basis, this default sequence may lead to some unexpected behavior. For example, you want to place an object interactively and you are so far satisfied with the orientation around the x-axis and the z-axis. Now you want to adjust the orientation around the y-axis. But when you change the corresponding rotation angle, the object seems to move around a totally different axis. This is caused by the fact that the rotation around the y-axis is applied in the middle of the two other rotations. A more intuitive behavior is achieved when the rotation is last in the sequence. You can enforce this more appropriate sequence, when you select **Axis snap** in the dialog (see below).

Local coordinates can always be transferred into global coordinates with a simple combination of these two basic movements: translation and rotation. This transfer is also called Transformation. The sequence in which the basic movements are executed is important because it makes a big difference whether you first move and then rotate or first rotate and then move. In SCENE the rotation takes place first and then the translation.

Coordinate Transformation of a Scan

To know the coordinate transformation of a scan, you must know its position and orientation. You can see these values if you click the scan with the right mouse button in the **structure view** and select **Properties** in the context menu.

On the **Scan** tab, the position and orientation are displayed in compact notation with a single angle of rotation.

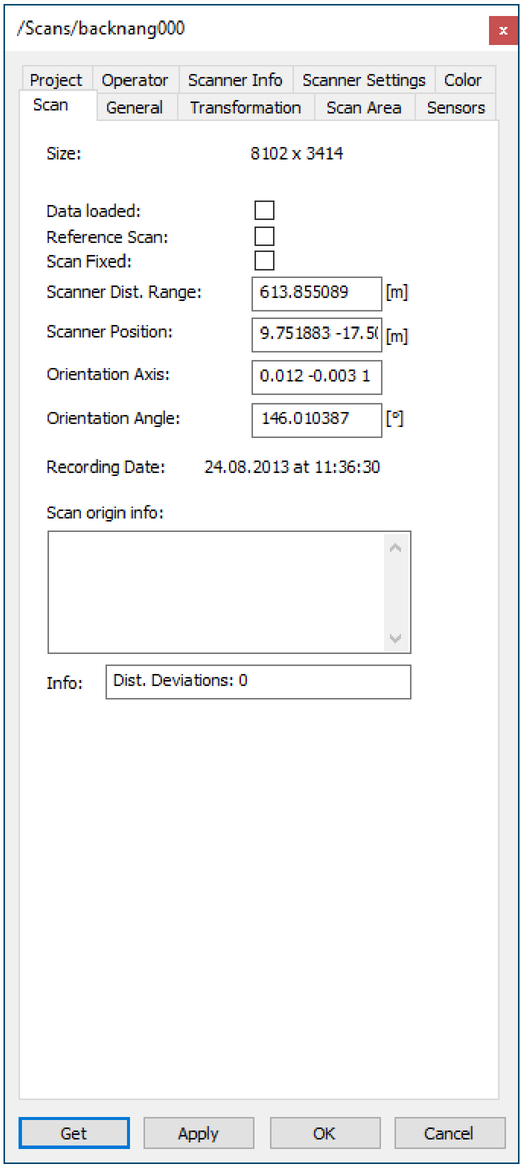


Figure 15-9 Orientation displayed compactly

On the **Transformation** tab, you will see the same information displayed in a more intuitive way.

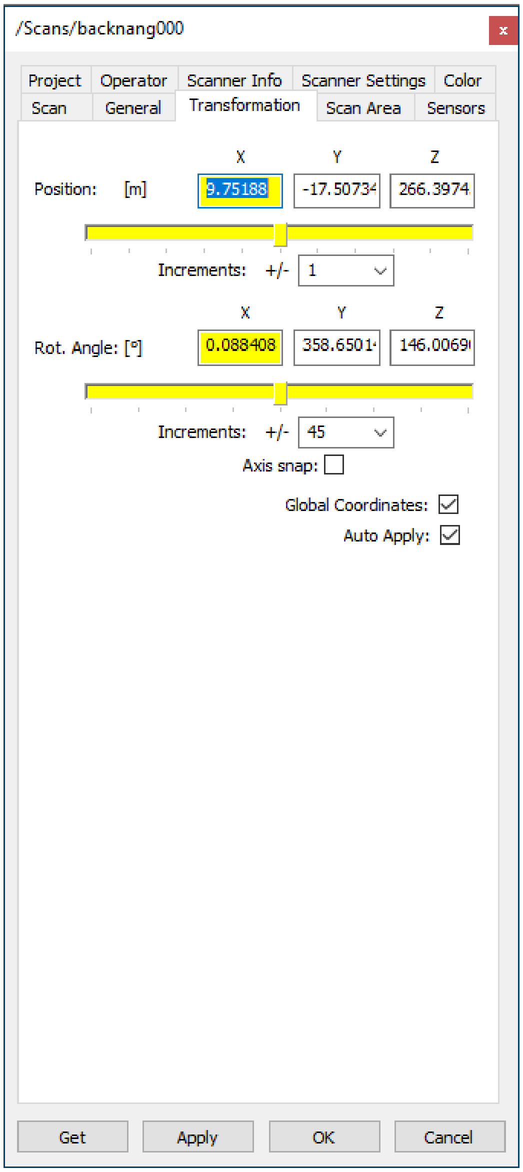


Figure 15-10 Orientation displayed more intuitively

Of course, coordinate transformations cannot only be applied to local coordinates but can also be used to convert from one global coordinate system to another. For example, you could use a hall coordinate system as the first coordinate system, which has the origin in the corner of a hall and whose axes run along the walls of the hall. On a greater scale, you could define a plant coordinate system whose origin lies in the south-west corner of the plant premises and whose axes match the four points of a compass.

Then you only have to describe the transformation between the hall and the plant premises to automatically obtain all the coordinate specifications within the hall in plant coordinates. SCENE proceeds from the inside to the outside: first, the local coordinates within the scan are transformed into hall coordinates and these are then converted into plant coordinates.

When using hierarchical transformations, you should note that the scan file only stores the local transformation and not the global transformation. In the example above, this means that the scan file only contains the relative position to the hall, not to the plant.

Transformation and Registration

Registration of scans is always performed in the global coordinate system. If you have added transformations in the scan folders, these transformations will of course also be used during the registration. The result might not be the one you expect: the scans will be positioned on the same global coordinates as they would have without the additional transformations. Only their local coordinates may differ.

If you want to add a transformation because you don’t want to use the coordinate system of the surveyor, you should input it into the **References** folder.

Quick Change of Global Origin

For some tasks it might be helpful to use a different coordinate system than it is currently defined globally. But as not all tasks need this specific coordinate system, it should be possible to switch between such coordinate systems easily. For example imagine the examination of a robot cell in a plant. The global coordinate system might be defined according to the plant, but now you would like to export scan points in the local coordinate system of the robot cell. In this case you would like to switch to the local coordinate system of the robot cell temporarily, and later switch back again. For this you need the position and orientation of the robot cell within the plant and you put this transformation in a folder, and the mark this folder to be used as definition for the global coordinate system.

When you want to work in the local coordinate system of a folder (or scans folder or scan), you activate its transformation by **Operations > Global System > Set as Global Origin** in its context menu. The folder is now marked with icon G to indicate that it is currently defining the global coordinate system.

If you want to switch back to the original global origin, you may select **Operations > Global System > Clear Global Origin** in the context menu of this folder.

Exemplary Driver Configuration for the Stereoscopic Mode

This chapter describes how to enable OpenGL Stereo for an exemplary hardware and driver configuration. Enabling OpenGL Stereo on comparable configurations should be similar. The stereoscopic mode will most likely run with other driver versions, too. However, the menu structure may look different than described here.

Exemplary hardware and driver configuration used for this description:

Hardware

- NVIDIA Quadro Graphic Card
- NVIDIA 3D Vision (Shutter Glasses)
- 120 Hz Monitor
- Compatible cable (HDMI 1.4 or Dual Link DVI)

Driver

NVIDIA Quadro/NVIDIA Tesla Driver (Release 295.73)

Enable OpenGL quad buffering:

1. Open the NVIDIA system control. Right-click the Desktop and choose **NVIDIA system control** in the context menu.

2. In the NVIDIA system control tool select **Manage 3D Settings** the structure tree on the left.

3. In the pane that is shown on the right set **3D OpenGL Stereo** as global preset under global settings.

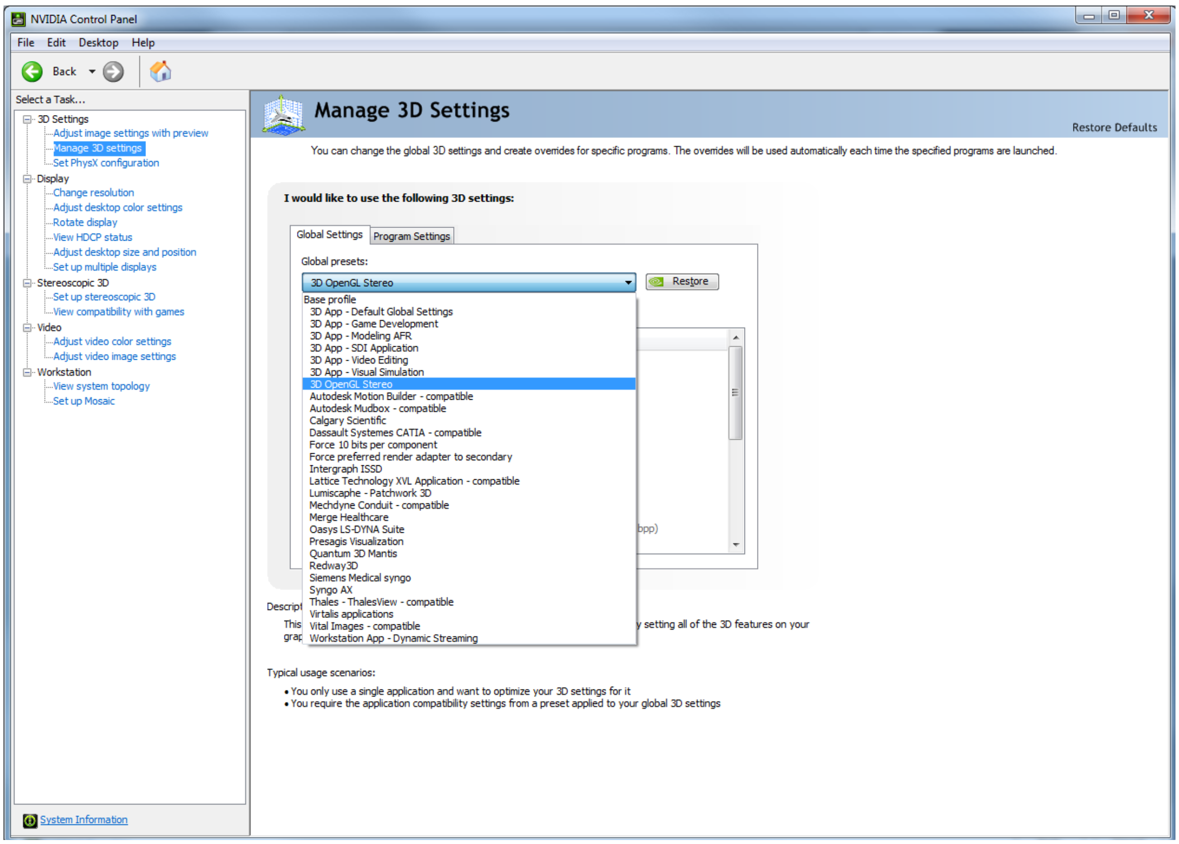


Figure 15-11 Enabling OpenGL quad buffering

Set the 120 Hz Monitor as the primary output device (only when using multiple displays):

4. Select **Set up multiple displays** in the structure tree on the left.

5. In the pane that is shown on the right, right-click the 3D monitor and select **Make this in the Windows main display**.

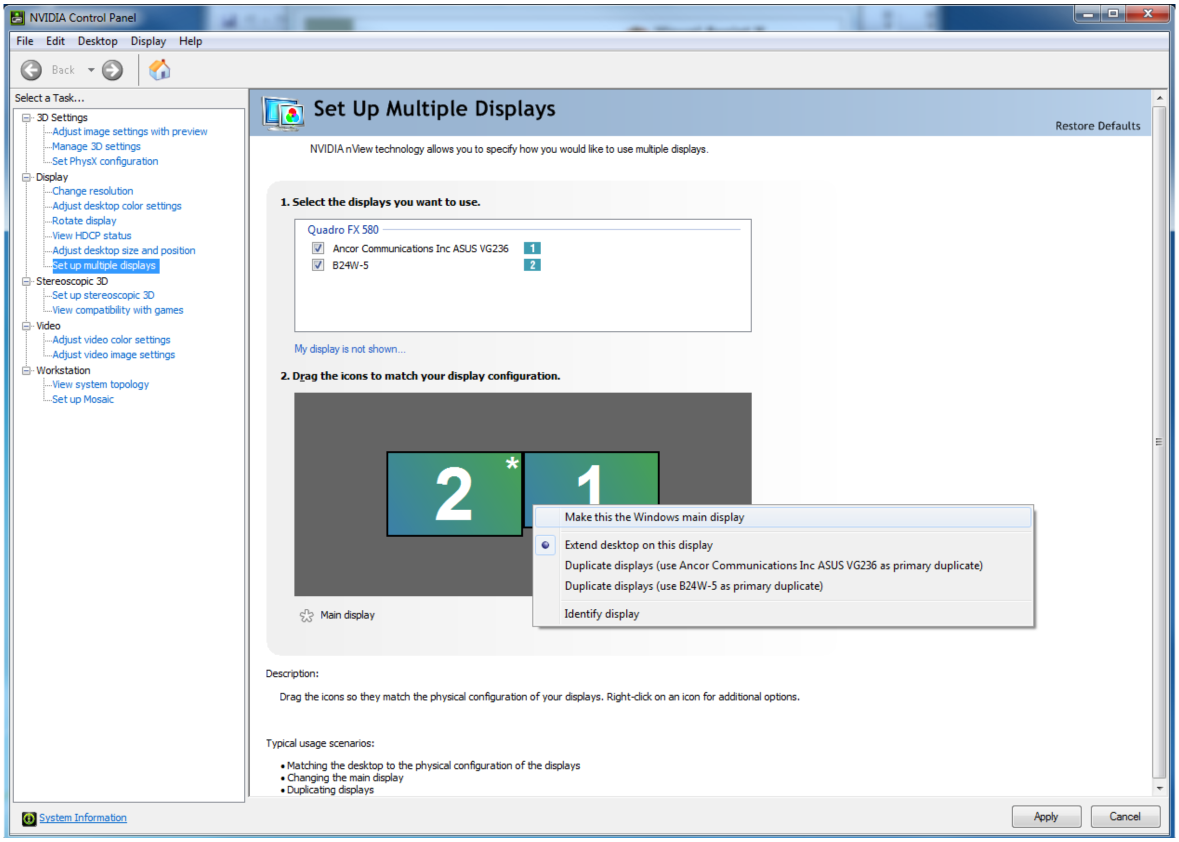


Figure 15-12 Select primary display

Ensure that the monitor refresh rate is set to 120 Hz:

6. Select **Change resolution** in the structure tree.
7. Select the 3D monitor and then choose 120 Hz in the refresh rate dropdown box.
   The refresh rate of 120 Hz is not available for some resolutions. If the refresh rate is not available for any resolution, the display was not recognized as a 3D display. In this case refer to the manual of the display.

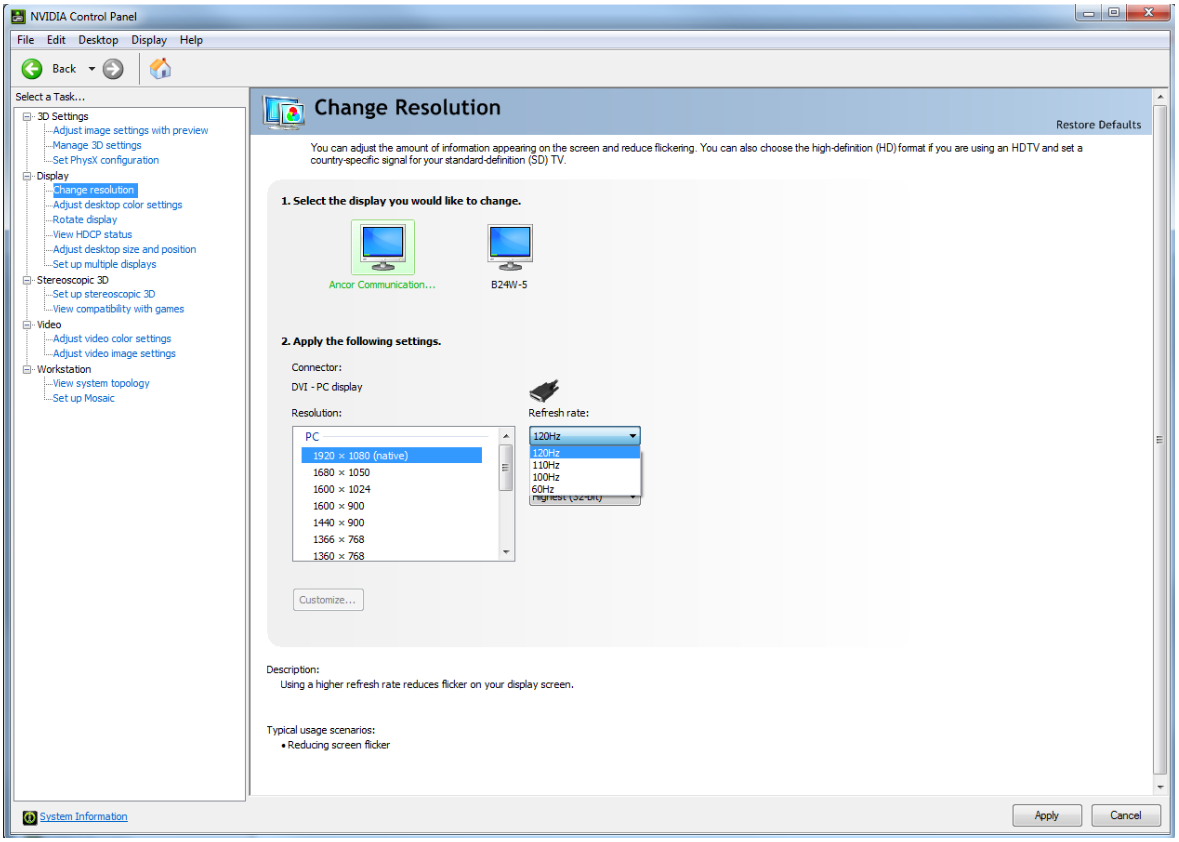


Figure 15-13 Select primary display

Activate NVIDIA vision:

8. Switch on the shutter glasses.

3DConnexion 3D Mouse Support

3DConnexion is a manufacturer of 3D mice for navigating and manipulating 3D content. The 3DConnexion 3D mice are supported by SCENE. Compared to the use of traditional mice and keyboards, such a 3D mouse may make navigation in your 3D data much more intuitive and controllable.

Gently push, pull, twist or tilt the Controller Cap of the 3D mouse to pan, zoom and rotate in your 3D data. Increase pressure to go faster or decrease pressure to make intricate adjustments.

When operating the Controller Cap, the 3D mouse acknowledges the selected camera mode. In fly mode, for example, you can rotate the camera by twisting the cap. In camera pan mode, twisting it has no effect since only left-right and up-down movements of the cap are recognized. When a 3D view tool such as the measurement tool is selected, the 3D mouse operates in the examine mode. You can also use the 3D mouse to rotate and zoom in the quick view and to pan and zoom in the planar view.

NOTE: When using a 3DConnexion Mouse, make sure to always use the latest drivers. You can download them from www.3dconnexion.com. Refer to the 3DConnexion documentation for more information on installing and setting up the 3D mouse.

Predefined Commands

If the 3DConnexion Add-in for SCENE has been installed with the driver of the 3D mouse, the following assignment of keys will be available (the number of available buttons varies with the available 3D mouse model):

- **Fit** – Move the camera to show the whole scene in the 3D view; return to the initial zoom level in the quick view and planar view.
- **Menu** – Open the settings menu of the 3D mouse
- **T** – Display the top view
- **B** – Display the bottom view
- **L** – Display the left view
- **R** – Display the right view
- **F** – Display the front view
- **Bk** – Display the back view
- **Rot** – Toggle rotation on/off
- **Pan Zoom** – Toggle pan and zoom on/off

Optionally, the following commands can be assigned to the function keys from 1 to 10 with the 3DConnexion settings tool. This tool is accessible from the Windows start menu or the task bar. See the manual of the 3DConnexion mouse for more information.

- Switch to fly mode
- Switch to examine mode
- Switch to walk mode
- Switch to camera pan mode
- Set the rotation point automatically during movement
- Set the rotation point automatically after movement
- Don’t set the rotation point automatically
- Show the rotation point always
- Show the rotation point during movement
- Hide the rotation point

Adjusting the 3D Mouse Behavior

To adjust the behavior of the 3D mouse and to access further functions, open the settings menu with the **Menu** button on the 3D mouse.

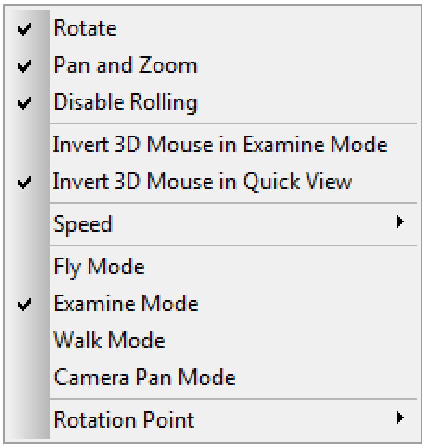


Figure 15-14 3DConnexion Mouse – Settings

Rotate – Switch the rotation capability on/off

Pan and Zoom –Switch the pan and zoom capability on/off

Disable Rolling – Switch the roll axis – on/off

Invert 3D Mouse in Examine Mode – Invert all axes in the examine mode

Invert 3D Mouse in Quick View – Invert all axes in the quick view

Speed – Set the speed of movement

Fly Mode – Switch to fly mode

Examine Mode – Switch to the examine mode

Walk Mode – Switch to walk mode

Camera Pan Mode – Switch to camera pan mode

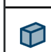
Rotation Point – Adjust the behavior of the rotation point. For more information, see *Navigation Toolbar (3D View only)* on page 32.

Chapter 16: Reference Handbook

This chapter explains the symbols and elements of SCENE.

Symbols in the Structure View

Note that this list is not exhaustive.

Symbol	Meaning
	Project Folder
	Cluster
	Scan
	Virtual scan
	Point
	Sphere
	Plane
	Slab
	Pipe
	Scan path
	Mesh, imported mesh object
	Documentation
	Region
	Clipping box
	View point
	Picture

Symbol	Meaning
	Overview map
	Fit
	Marker
Scans and Cluster	
	Fully loaded
	Reference scan or cluster
	Fixed scan or cluster
	Locked **Scan Manager**
	Global Origin
	Missing file
	Freestyle3D: Not processed completely
	Freestyle3D: Recoding finished. Some single frames unloaded because of low memory.
	Freestyle3D: Post processing done
	Freestyle3D: Reduced quality because of low machine performance
	Freestyle3D: Capture or Replay
	Freestyle3D: Next step is Replay
	Freestyle3D: Next step is Optimize Scans
	Freestyle3D: Next step is Color Smoothing
	Freestyle3D: Next step is Stray Point Filter
	Freestyle3D: Next step is Point Cloud Creation
Fitting	
	Active fit
	Outdated active fit

Symbol	Meaning
	Good quality
	Compromised quality
	Seriously compromised quality
Registration	
	Ignored for Place Scans
	Object with automatically found correspondence
	Object with user forced correspondences

Context Menu Entries for Objects in the Structure View

Plane

New

Reference on Folder Level – Place a copy of the selected object in the reference objects folder of the current scan. The copy does not have any link to a fit object that may exist.

Reference on Workspace Level (i.e. Project Level) – Place a copy of the selected object in the reference objects folder of the workspace. The copy does not have any link to a fit object that may exist.

Intersection Point – Creates an intersection point on the plane at the spot determined by the mouse pointer.

Plane with Border – Creates a new limited plane with border lines from the point selection that was used to create the selected plane.

Slab By Plane – Creates a slab from the plane.

Aligned Clipping Box – Creates a new Clipping Box aligned to the selected plane.

Documentation – Attach a documentation object to the selected object.

View > 3D View – View the selected object 3D view.

Visible – Make the selected object visible or invisible.

Operations > Correspondences > Delete Correspondences – Deletes the correspondences of the selected object. You can select to delete user forced, system found or anti-correspondences.

Alignment – modifies the overall orientation of the entire project according to the desired alignment of the plane to a cardinal direction (north, south, east, west, ceiling, ground or custom).

Flip – turns the plane's Normal for 180 degrees.

Export… – Exports the selected object.

Delete – Deletes the selected object.

Properties... – Opens the properties dialog.

Limited Plane

New

Reference on Folder Level – Place a copy of the selected object in the reference objects folder of the current scan. The copy does not have any link to a fit object that may exist.

Reference on Workspace Level (i.e. Project Level) – Place a copy of the selected object in the reference objects folder of the workspace. The copy does not have any link to a fit object that may exist.

Documentation – Attach a documentation object to the selected object.

View > **3D View** – View the selected object 3D view.

View Scan Point Distance – Deviations from a level surface relation to

a plane are highlighted color.

Operations > **Correspondences** > **Delete Correspondences** – Deletes the correspondences of the selected object. You can select to delete user forced, system found or anti-correspondences.

View Scan Point Distance – Analyze the evenness of the surface. Deviations of the scan points from the plane will be highlighted different colors.

Export… – Exports the selected object.

Set Border from Selection – The border line of the plane is replaced by the border line of the selection.

Delete – Deletes the selected object.

Rename – Renames the selected object.

Plane Fit

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Flip – turns the plane's Normal for 180 degrees.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Constrained Plane Fit

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Sphere

Locate – Displays the selected object in the center and enlarges the active view.

New

> **Reference on Folder Level** – Place a copy of the selected object in the reference objects folder of the current scan. The copy does not have any link to a fit object that may exist.
>
> **Reference on Workspace Level** (i.e. Project Level) – Place a copy of the selected object in the reference objects folder of the workspace. The copy does not have any link to a fit object that may exist.
>
> **Fit** – Only available if a selection of scan points exists. Creates a new fit from the selected scan points. Both the sphere position and the sphere radius are ascertained from the scan points.
>
> **Fit (fixed radius)** – Only available if a selection of scan points exists. Creates a new fit from the selected scan points with a fixed preset sphere radius. The sphere position is ascertained from the scan points.

View > **3D View** – View the selected object 3D view.

Operations > **Correspondences** > **Delete Correspondences** – Deletes the correspondences of the selected object. You can select to delete user forced, system found or anti-correspondences.

Update Fit – Recalculates the fit of the sphere.

Export... –

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Sphere Fit

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Region

New

> **Reference on Folder Level** – Place a copy of the selected object in the reference objects folder of the current scan. The copy does not have any link to a fit object that may exist.
>
> **Reference on Workspace Level** (i.e. Project Level) – Place a copy of the selected object in the reference objects folder of the workspace. The copy does not have any link to a fit object that may exist.
>
> **Documentation** – Attach a documentation object to the selected object.

Select – The selection that was used to create the region is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Import/Export – Export the region as object.

Delete – Delete the region object. The scan points are not deleted.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Point

Locate – Displays the selected object in the center and enlarges the active view.

New

> **Reference on Folder Level** – Place a copy of the selected object in the reference objects folder of the current scan. The copy does not have any link to a fit object that may exist.

Reference on Workspace Level (i.e. Project Level) – Place a copy of the selected object in the reference objects folder of the workspace. The copy does not have any link to a fit object that may exist.

Documentation – Attach a documentation object to the selected object.

View – Opens a new 3D view of the point.

Set Rotation Point – Sets the rotation point to the center of the scan point.

Visible – Make the selected object visible or invisible.

Operations > Correspondences > Delete Correspondences – Deletes the correspondences of the selected object. You can select to delete user forced, system found or anti-correspondences.

Export… – Exports the selected object.

Delete – Deletes the selected object.

Properties – Opens the properties dialog.

Point Fit

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Pipe

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Pipe Fit

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Line

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Line Fit

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Rectangle

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Rectangle Fit

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Scan

Visible – Make the selected object visible or invisible.

View

3D View – View the scan 3D view.

Planar – View the scan planar view.

Quick – View the scan quick view.

Locate – Resumes the initial perspective of the view. 3D view the rotation point will be set to the position of the scanner.

Loaded – Loads the scan points of the scan. Here a check mark shows whether the scan points of a scan are loaded.

Process Scan – Opens the **Configure Processing** page to configure the settings for processing and start processing.

Point Cloud – Create or delete a Scan Point Cloud from the scans within the scan folder or cluster.

Create Scan Point Cloud – Create a Scan Point Cloud from the scans within the scan folder or cluster.

Delete Scan Point Cloud – Delete a Scan Point Cloud from the scans within the scan folder or cluster.

Send to WebShare Cloud – Export the Point Cloud to WebShare. An account is required.

Export

Image – Obtains an overview image from the scan points and saves it the file system the same folder as the scans.

Objects – Export the objects of this scan.

Scan Points –

- **Export Scans** – **unordered** to export the scan points of the selected scan.
- **Export Scan Point Clouds** – **ordered** to export the point cloud of the selected scan.

As Project – Create a new SCENE project, or a new ReCap project. A dialog opens in which you can select the export format, a file name, and the location in which the new project shall be saved.

Delete – Deletes the scan from the workspace. The associated file is not deleted.

Properties – Opens the properties dialog.

For Unprocessed Hand-held Scans

Operations > Registration

Level

- by picking one point, if the plane has an even surface.
- by picking three points, if the plane is uneven, or if you need a high accuracy.

Process the scan – Processes the steps Replay, Optimize Scans, Color Adjustment, and Stray Point Filtering.

Global System > Set as Global Origin – Select to work the local coordinate system of the scan. The scan will be marked with a red G to indicate that it is currently defining the Global Coordinates system.

Create virtual scans – creates one or several virtual scans from a scan.

For Processed Hand-held Scans

Operations > Registration

Level

- by picking one point, if the plane has an even surface.
- by picking three points, if the plane is uneven, or if you need a high accuracy.

Fixed Scan – Mark the scan alignment as fixed and exclude it from further automatic registration attempts.

Reference Scan – Set the scan as reference scan.

Find Objects – Detect checkerboards, spheres, planes, corner points, rectangles or lines the scan.

Filter – Apply filters to the scan.

Preprocessing > Preprocess Scan – Opens the preprocess menu dialog. With the preprocess option you may apply a series of processing steps such as filters, automatic object detection or scan registration to the scan. The scan is automatically loaded, processed, saved and unloaded again.

Correspondences > Delete Correspondences – Deletes the correspondences of the scan and of its objects. You can select to delete user forced, system found or anti-correspondences.

Preprocessing > Preprocess Scan – Opens the preprocess menu dialog. With the preprocess option you may apply a series of processing steps such as filters, automatic object detection or scan registration to the scan. The scan is automatically loaded, processed, saved and unloaded again.

Correspondences > Delete Correspondences – Deletes the correspondences of the scan and of its objects. You can select to delete user forced, system found or anti-correspondences.

Delete inactive Fits – Deletes all inactive fit objects.

Color/Pictures

Apply Pictures – Apply the color information of the picture onto the scan. Position, orientation, and zoom factor of the camera are already known. This command is only available if the pictures reside inside a scan.

Adjust Picture Angles – Adjust the picture angles.

Export All Pictures – Exports all pictures of the scan (if the scan has been recorded color). Opens a dialog to select the storage location and the export format of the pictures. You can select between *Original format* and *jpg*. *Original Format* will export the pictures without changing their format; *jpg* will convert the pictures and save them as JPG.

Import All Pictures – Opens a dialog to select the storage location of the pictures you want to import. This option is only available for scans which already contain pictures.

Color Contrast Filter – Enhances the dynamic range of the color pictures.

Restore Grey Image – Remove the color information and restore the original reflectance values.

Replace Color Overlay – Import a manually edited picture to replace the scan’s initial color overlay with this picture. See chapter for more information.

Export Color Overlay – Export the scan's color overlay as a picture to your local hard drive.

Point Cloud Tools – Create a scan point cloud from the scan or delete an existing scan point cloud.

Global System > **Set as Global Origin** – Select to work the local coordinate system of the scan. The scan will be marked with a red G to indicate that it is currently defining the Global Coordinates system.

Create virtual scans – creates one or several virtual scans from a scan. Virtual scans are required if you want to export scan projects made by hand-held scanners to WebShare.

Import / Export

Export Objects – Export the objects of this scan.

Export Scan Points – Export the scan points of the selected scan. This applies to the points of the scan only and does not export the scan points of any possible scan point cloud.

Export Scan Point Cloud – Export the scan point cloud of the scan.

Export as Project – Create a new SCENE project, or a new ReCap project. A dialog opens in which you can select the export format, a file name, and the location in which the new project shall be saved.

Export Image – Obtains an overview image from the scan points and saves it the file system the same folder as the scans.

Export Compensation – Write compensation data to a file.

Export Scan Parameters – Export the parameters of the scan.

Import Compensation – Import compensation file and use immediately. You may not be able to import a compensation if the scan points were changed by a filter beforehand and have not been saved again.

Save Objects Scan – Save the objects of the scan the scan file.

Delete – Deletes the scan from the project

Scan Fit

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Scans Folder / Cluster

Visible – Make the selected object visible or invisible.

View – Open the scans and objects of the scan folder, the correspondence view, the 3D view or the structure view.

Locate – Resumes the initial perspective of the view. 3D view the rotation point will be set to the position of the scanner.

Loaded – Loads the scan points of the scan. Here a check mark shows whether the scan points of a scan are loaded.

Process Scan – Opens the **Configure Processing** page to configure the for processing and start processing.

Point Cloud – Create or delete a Scan Point Cloud from the scans within the scan folder or cluster.

Create Scan Point Cloud – Create a Scan Point Cloud from the scans within the scan folder or cluster.

Delete Scan Point Cloud – Delete a Scan Point Cloud from the scans within the scan folder or cluster.

New – Create a new Cluster within the scan folder.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Export

Scans –

- **Export Scans** – **ordered** to export the scan points of the selected scan.
- **Export Scan Point Clouds** – **unordered** to export the point cloud of the selected scan.

As Project – Create a new SCENE project, or a new ReCap project. A dialog opens in which you can select the export format, a file name, and the location where the new project shall be saved.

Images – Obtains panorama images of the planar view of each scan and saves these images the file system the same folder as the scans.

Delete – Deletes the scan folder and all the scans it from the project. The files belonging to the scans are not deleted.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Scan Manager

Lock all – locks the Scan Manager of the cluster and the Scan Managers of subordinated clusters.

Unlock – The cluster and all its superordinate and subordinate clusters will be unlocked.

Unlock All – unlocks the Scan Manager of the cluster and the Scan Managers of subordinated clusters.

Delete – Deletes the **Scan Manager**.

Rename – Renames the Scan Manager.

Properties – Opens the Scan Manager.

Virtual Scan (3D Picture)

The virtual scan is treated as a normal laser scan.

Visible – Make the selected object visible or invisible.

View > **3D View** – View the scan 3D view.

Locate – Resumes the initial perspective of the view. 3D view the rotation point will be set to the position of the scanner.

Export

> **Image** – Obtains an overview image from the scan points and saves it the file system the same folder as the scans.
>
> **Objects** – Export the objects of this scan.
>
> **Scan Points** – Export the scan points of the selected scan. This applies to the points of the scan only and does not export the scan points of any possible scan point cloud.
>
> **As Project** – Create a new SCENE project, or a new ReCap project. A dialog opens in which you can select the export format, a file name, and the location where the new project shall be saved.

Delete – Deletes the scan from the project. The associated file is not deleted.

Properties – Opens the properties dialog.

3D Picture Fit (Fit of a Virtual Scan)

Select – The selection that was used to create the fit object is reactivated. The selection combination mode determines how the new selection results from the existing selection and the reactivated selection.

Active – A black check mark indicates whether this fit object is the active fit object of the corresponding object, i.e., whether it is the one that determined the properties of the corresponding object. An object can have several fit objects, of which one at the most can be active.

Update – Recalculates the object parameters. The basis for this is again the selection that was also used to create the fit object.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Correspondences

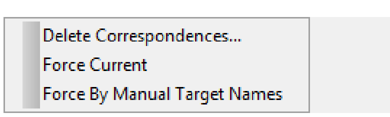


Figure 16-1 Context menu: Scan folder > Operations > Correspondences

Delete Correspondences – Deletes correspondences of the scan folder, its scans and of all objects that belong to its scans. You can select to delete user forced, system forced, system found or anti-correspondences.

Force Current – Force all already existing correspondences of the scan folder.

Force by Manual Target Names – Forces correspondences by manually created reference name.

Preprocessing > Preprocess Scans – Opens the preprocess menu dialog. With the preprocess option you may apply a series of processing steps such as filters, automatic object detection or scan registration to the scans of the scan folder. The scans are automatically processed and saved.

Color/Pictures – Apply the pictures to all the scans within the folder or apply the color contrast filter.

Delete inactive Fits – Deletes all the inactive >.

Global System > Set as Global Origin – Select to work the local coordinate system of the scan folder. The scan folder is now marked with a red G  to indicate that it is currently defining the global coordinate system.

Import/Export

Export Objects – Export objects. Note, scans need not to be loaded and are therefore not loaded automatically.

Export Project – Exports the entire scan project. Select, if the new scan project will be used in SCENE or ReCap. Then, select the target location and a project name.

Export Images – Obtains panorama images of the planar view from all the scans in the project. The scans are loaded one after the other, the panorama image is created, then saved and then unloaded again.

Export Positions –Saves the position specifications of all scans and reference objects.

Assemble Meshes –

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Visibility

3D Visibility – Opens the dialog with the default visibility for quick view and 3D views.

Planar View Visibility – Opens the dialog with the default visibility for the planar view.

Layer Manager – Opens the dialog box of the layer manager.

Viewpoint

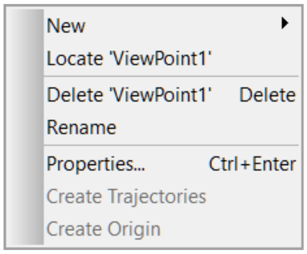


Figure 16-2 Context menu: Viewpoint

New – Create a new Point, Sphere, Checkerboard, Circular Flat Target, Corner Point, Plane, Slab, Documentation Object, Folder or Scan Folder in the project.

Activate – Go to the selected viewpoint the current 3D view.

Delete – Deletes the fit object.

Rename – Renames the fit object.

Properties – Opens the properties dialog.

Properties of Objects in the Structure View

If you right-click an object in the structure view, a context menu opens from which you can select entry **Properties**. This menu entry opens a dialog. In this chapter you can find an overview of the different objects in the structure view.

Scan Project

Name – The name of the object. The green symbol at the object name indicates that corresponding objects have been found. If corresponding references have not been found, no symbol will be displayed.

Layer – The representation layer on which the object is located.

Select active layer – Enters the currently active representation layer.

Assign layer to all contained objects – All the scans take on the representation layer of the scan project.

Transformation Tab

Position – The translation portion of the transformation.

- **X** – To key in a transformation in the x direction.
- **Y** – To key in a transformation in the y direction.
- **Z** – To key in a transformation in the z direction.

Scroll bar – Set the transformation using the mouse. The direction of the transformation will be the x, y, or z coordinate that is highlighted in yellow.

Increments – Set the increment for the scroll bar.

Rotation Angle – The angle of rotation if the rotation axis is split along the coordinate axes.

X – The angle of rotation around the x-axis.

Y – The angle of rotation around the y-axis.

Z – The angle of rotation around the z-axis.

Scroll bar – Set a new angle of rotation.

To change a value, you either enter the required value directly into the appropriate field, or you first select the field and then use the corresponding slider to change the value step by step. You can set the increment using the **Increments** dropdown box. If you hit the edge with the slider, simply reselect the field and the slider will return to the center without you losing your previous changes.

Increments – Set the increment for the scroll bar.

Axis snap – If checked, you can change the rotation for the current axis independently from the others. This is achieved by changing the order in which the rotations are applied.

Global Coordinates – If checked, coordinates are displayed in the global coordinate system. Otherwise, they are displayed in the coordinate system of the scanner.

GPS Reference Tab

Define the reference coordinate system by entering the GPS or UTM position.

Scan Folder

General Tab

Name – The name of the scan folder.

Layer – The representation layer in which the scan folder is located.

Select active layer – Enters the currently active representation layer.

Assign layer to all contained objects – All the scans of the scan folder take on the representation layer of the scan folder.

Transformation Tab

Position – The translation portion of the transformation.

X – To key in a transformation in the x direction.

Y – To key in a transformation in the y direction.

Z – To key in a transformation in the z direction.

Scroll bar – Set the transformation using the mouse. The direction of the transformation will be the x, y, or z coordinate that is highlighted in yellow.

Increments – Set the increment for the scroll bar.

Rotation Angle – The angle of rotation if the rotation axis is split along the coordinate axes.

X – The angle of rotation around the x-axis.

Y – The angle of rotation around the y-axis.

Z – The angle of rotation around the z-axis.

Scroll bar – Set a new angle of rotation.

To change a value, you either enter the required value directly into the appropriate field, or you first select the field and then use the corresponding slider to change the value step by step. You can set the increment using the **Increments** dropdown box. If you hit the edge with the slider, simply reselect the field and the slider will return to the center without you losing your previous changes.

Increments – Set the increment for the scroll bar.

Axis snap – If checked, you can change the rotation for the current axis independently from the others. This is achieved by changing the order in which the rotations are applied.

Global Coordinates – If checked, coordinates are displayed in the global coordinate system. Otherwise, they are displayed in the coordinate system of the scanner.

Folder Tab

Cluster – Determine the scan folder as a cluster.

Reference Cluster – Determine the cluster as the reference cluster

Fixed Cluster – Mark the cluster alignment as fixed and exclude it from further automatic registration attempts.

Scan Manager

NOTE: You can resize the Scan Manager dialog to display all columns.

Scan Manager Tab

Name – The name of the Scan Manager.

Managed by – Name of the superordinate Scan Manager.

Locked – as soon you finished your work with this cluster, you can lock its Scan Manager.

Sub Manager – List of the subordinate Scan Managers.

The Scan Manager also informs whether external references were used for the registration.

The traffic lights next to the Scan Managers indicate whether they contain good or failed Scan Fits. If a traffic light next to a Scan Manager is red, this means that this Scan Manager contains bad Scan Fits. Green means that all the quality criteria are met. Amber shows that at least one quality criterion is somewhat compromised. If there is a symbol next to a Scan Manager or a Scan Fit, this means that registration could not be executed, maybe because of missing references.

If you want to see the critical fits of a subordinate Scan Manager, double-click this Scan Manager to open it. Switch to the tab **Scan Results**.

Scan Results Tab

The tab **Scan Results** gives you a list of all Scan Fits managed by the Scan Manager and shows the overall quality of each registration. This is symbolized by a traffic light too. Double-clicking on a fit object in the list opens its properties dialog.

The average tension of each registration is calculated in the **Mean Target Tension** column of this table: the lower the value, the better the registration result. Here you can easily see which registrations failed or which registration results are bad (in this example the first two Scan Fits have an amber traffic light, so they seem not to be optimal). To identify the critical reference pairs which are responsible for the bad fit, you can switch to tab **Ref. Tensions**.

Correspondence View – opens the correspondence view with all the scans that are managed by the Scan Manager.

Correspondence Split View – opens the correspondence split view.

You can also open both views by right-clicking the cluster node in the structure view and selecting View > Correspondence View or View > Correspondence Split View.

Scan Point Errors

Tab **Scan Point Errors** shows all reference cluster pairs used for the scan registration.

Mean – describes the discrepancy between the two corresponding referenced clusters.

Full Hierarchy – When activated, the reference pairs of all >s will be displayed.

Overall Statistics

> **Error** – The resulting error between scans calculated by measuring the distances between scan points.
>
> **<4 mm** – Deviation smaller than 4 mm, displayed percent. This value gives a quick overview on the overall quality of the registration.

You can go directly to a scan point error by double-clicking it. The corresponding view is opened and the connection is highlighted.

Target Tensions Tab

Tab **Target Tensions** shows all reference pairs used for registration, sorted by their tension.

Tension – describes the discrepancy in the global coordinate system between the position and the orientation of the two corresponding reference objects Scan 1 and Scan 2. With reference points in the distance between the positions of the two reference points serves as input for the calculation of the tension. With planes, slabs or pipes the position and the direction of the objects serve as input for the calculation of this value.

Values close to zero indicate a good registration result. Here, you can easily identify reference pairs which are causing problems in the registration. Clicking on the scan name selects the corresponding reference in this scan, double-clicking opens the reference’s properties.

Full Hierarchy – When activated, the reference pairs of all > will be displayed.

Weighted Statistics

Error – The resulting error between scans calculated by measuring the distances between scan points.

Deviation – Deviation over all tensions.

Min. – Minimum tension

Max. – Maximum tension

You can go directly to a target tension error by double-clicking it. The corresponding view is opened and the selected object is highlighted. If you right-click a target tension in the Scan Manager and select Locate in <scan_name>, you can locate the target tension in the scan you want.

Scans

Depending on the used scanner type, the scan properties dialog might have different tabs. On the following pages the scan properties dialog will be described for scans recorded with the FARO Laser Scanner.

General Tab

Name – Name of the scan. Scans cannot be renamed.

Layer – The representation layer in which the scan is located.

Select active layer – Enters the currently active representation layer.

Assign layer to all contained objects – All the objects of the scan take on the representation layer of the scan.

Scan Tab

Size – The number of columns and rows. If a scan is loaded reduced in resolution, the reduced number of columns and rows is displayed and, light gray underneath, the complete number of columns and rows.

Data loaded –Indicates whether the scan is loaded.

Reference Scan –Indicates whether the scan is used as a reference scan for registration.

Scan Fixed – Mark the scan alignment as fixed and exclude it from further automatic registration attempts.

Scanner Dist. Range – Range of the scanner.

Scanner Position – The position of the scanner with the mirror being the point of origin.

Orientation Axis – Rotation axis of the scan.

Orientation Angle – The scan's angle of rotation.

Recording Date – The time the scan was recorded.

Scan Origin Info – Additional information on the origin of the scan, for example, where it was recorded and information about issues (scanner warnings or errors) that occurred during recording of the scan.

Info – Further details that were provided when recording.

Scan Area Tab

Selected Profile – The scan profile that was selected for the recording of the scan (only available for FARO Focus scanners).

Angular Area – The recorded angular area.

> **Vertical** – The vertical angular area.
>
> **Horizontal** – The horizontal angular area.

Resolution – The resolution of the scan, measured fractions of the maximum resolution.

Quality – The quality setting that was selected for the recording of the scan. This setting has influence on the quality respectively on the noise of the scan data. The corresponding measurement rate is displayed too (in 1000 points per second).

Filters

> **Clear Sky** – Checked if the Clear Sky Filter was applied during the recording of the scan.
>
> **Clear Contour** – Checked if Clear Contour Filter was applied during the recording of the scan.

Scan Size – Number of rows and columns.

Resolution – The resolution of the scan. You can select between:

pt/360°, pt/°, °/pt, '/pt, "/pt, mm/10m, in/30ft.

File Size – File size of the scan.

Distance Range – The distance range that was selected for the recording of the scan (only available for FARO Focus Laser Scanner V7 or greater).

Operation Tab

This tab is only available for scans taken with the FARO Laser Scanner LS, the FARO Laser Scanner Photon or the FARO Focus Laser Scanner.

Name – The name of the project or the order.

Company – The client's company name.

Division – The client’s or order’s division.

Subdivision – The client’s or order’s sub-division.

Area – The scanned area.

Info – Additional information.

Min. Reflection – The reflection value limit set when recording.

Project Tab

This tab is only available for scans taken with the FARO Focus Laser Scanner.

This tab shows information about the scan project. This information was given before the scan was recorded.

Project Name – The name of the project / or sub-project that was assigned to the scan.

Customer – information about the potential project customer.

Additional information – Additional information provided for the project.

Operator Tab

The FARO Focus Laser Scanner allows to create operator profiles with names, contact details and further information. While scanning, it also allows to specify the operator who is currently working with the scanner. This information will then be saved in the meta data of the recorded scans and is shown on this tab. It might be useful for the person who is post processing the scans; especially when there are several scanner operators working on the same scan project.

You can still add or change this information when processing the scans SCENE.

Scanner Info Tab

Scanner – The name of the scanner.

Revision – The revision number which is allocated during servicing.

Scanner Type – The type of scanner.

Serial Number – The serial number of the scanner.

Range – The range of the scanner.

Compensation – The name of the compensation file.

Scanner Settings Tab

This tab contains some compensation data of the scanner.

Sensors Tab

Inclinometer

Use – Enable or disable the use of the inclinometer data for registration.

Inclinometer Axis – Shows the up direction of the inclinometer in the scan system.

Inclinometer Angle – Shows the angle between the z-axis and the inclinometer axis in the scan system.

Ignore Measurement – Overwrites the inclinometer axis and the angle with values that level the scan.

Transformation mismatch – Shows the difference between the z-axis defined by the inclinometer and the z-axis defined by the scan's transformation.

Compass

Use – Enable or disable the use of the compass data for the correspondence search.

Compass Axis – Shows the orientation of the scan in the scan system.

Compass mismatch – Shows the difference between the orientation defined by the compass and the orientation defined by the scan's transformation.

Altimeter

Use – Enable or disable the use of the altimeter data for correspondence search.

Measured Height – The height measured by the altimeter of the scanner based on a given reference height.

Global Positioning System (GPS) – the values measured by the scanner's GPS sensor.

Position (lat./long.) – GPS position longitude and latitude.

Position (UTM) – GPS position UTM coordinates.

Measured Height – Height above sea level.

Transformation mismatch – Shows the difference between the position defined by the GPS data and the position defined by the scan's transformation.

Advanced – Shows the raw data from the GPS sensor.

Place using Sensors – Restores the initial placement of the scan according to the measurements of the various sensors.

Camera Tab

This tab is only available for scans taken with the FARO Laser Scanner LS or the FARO Laser Scanner Photon.

Camera Mount – Type of the camera bracket that has been used for taking a colored scan.

Non-winding – The old, fixed type for scans taken with FARO Photon and LS scanners and the type for all scans taken with FARO Focus Laser Scanner.

No parallax – The new mount with the sliding mechanism.

No parallax, with pins – The camera mount with the sliding mechanism and pins that fit into the bushings on the side of newer FARO Laser Scanners. Note that older models of the FARO Laser Scanner are not equipped with these bushings.

Camera Orientation – Camera orientation

Top – The camera was fixed at the top position of the mount bracket: Therefore the camera was pointing slightly upwards when taking pictures.

Horizontal – The camera was fixed at the lower position of the mount bracket and therefore oriented horizontally.

Exposure

Manual – Exposure time, exposure index, and f-number is set directly at the camera.

By Scanner – The scanner determined a balanced exposure setting.

Correction – Correction factor for the exposure that has been determined by the scanner.

Color Tab

This tab is only available for scans taken with the FARO Focus Laser Scanner.

Scan with Color – Checked if the scan was recorded colored.

Exposure Metering Mode – The exposure metering mode used to take the color pictures when colored scan recording was switched on:

Even Weighted Metering – The light information coming from the entire SCENE without giving special weighting to a particular area was used to determine the exposure of the camera.

Horizon Weighted Metering – The light information coming from the horizon was used to determine the exposure setting of the camera.

Zenith Weighted Metering – The light information coming from above the scanner was used to determine the exposure setting of the camera.

Scan Fit

Scan Fit Tab

Scan Name – Name of the scan. Scans cannot be renamed.

Name – The name of the fit object.

Transformation

Position – The calculated position of the scan.

Orientation Axis – The calculated rotation axis of the scan.

Angle – The calculated angle of rotation of the scan.

Click the **Used Settings** button to check which registration method was performed.

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Target Tensions Tab

This tab is displayed when you have run a target-based registration.

Normalized Tension – In most cases, this value is identical to the *Point Distance* (see below). It is only different if you have reference coordinates based on GPS measurements. For example if you use a GPS device to measure the position of a sphere, the position of the spheres is not very accurate. As a consequence, the > cannot be as good as it normally is, and would show very large deviations.

In such cases the indicator of the > quality should not base on this, therefore the *Normalized Tension* puts a lower weight on the GPS reference positions, leading to smaller numbers for the tension.

Point distance – The standard deviation of the distance between the local reference points and their corresponding references.

The traffic light indicates the quality of this individual criterion:

green: < 10 mm

orange: ≥ 10 mm and ≤ 20 mm

red: > 20 mm

Point drift – The mean value of the deviations between the local reference points and their corresponding references. In contrast to viewing purely the distance, the direction of the deviation is also taken into account here. Deviations can therefore cancel each other out.

The traffic light indicates the quality of this individual criterion:

green: < 1 mm

orange: ≥ 1 mm and ≤ 5 mm

red: > 5 mm

Long. mismatch – The standard deviation of the longitudinal distance between the local reference points and their corresponding references. The longitudinal distance is the difference between the distance values to the scanner.

The traffic light indicates the quality of this individual criterion:

green: < 10 mm

orange: ≥ 10 mm and ≤ 20 mm

red: > 20 mm

Angular mismatch – The standard deviation of the angular distance between the local reference points and the corresponding references. The angles are measured with reference to the local coordinate system of the scanner.

The traffic light indicates the quality of this individual criterion:

green: < 0.08°

orange: ≥ 0.08° and ≤ 0.17°

red: > 0.17°

Orthogonal mismatch – The standard deviation of the orthogonal distance between the local reference points and the corresponding references. This is a way to express the angular mismatch as distance mismatch.

Inclinometer mismatch – Angular difference between the calculated orientation axis and the axis defined by the inclinometer.

The traffic light indicates the quality of this individual criterion:

green: < 1°

orange: ≥ 1° and ≤ 5°

red: > 5°

List of targets used

Object – The name of the reference object. If reference object is a specific real reference, the full path of the corresponding object will be displayed; if referenced object is a virtual mean reference (mean reference from several scans) only its name will be displayed.

Distance – The distance between the local reference point and the corresponding global reference.

Long. – The longitudinal distance between local reference point and the corresponding global reference.

Angular – The angular distance between the local reference point and the corresponding global reference.

Orth. – The orthogonal distance between the local reference point and the corresponding global reference.

The traffic light here is green if a minimum of three references (including the inclinometer) are available; it’s red if there are less than three references.

When you press the **View** button, a 3D view will open which gives you an overview of the placement of the scanner and the local and global references.

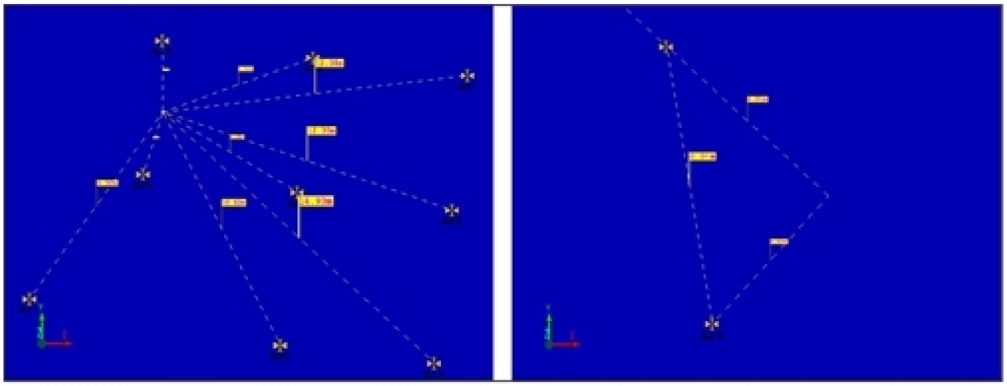


Figure 16-3 Overview of references

Scan Point Tensions

This tab is displayed when you have run a cloud-to-cloud or a top-view-based registration. It is also displayed when you have run a target-based registration and marked checkbox Calculate scan point statistics.

Cluster/Scan x– In these two columns the point errors of each cluster or scan compared to every other scan are displayed.

Mean [mm] – The mean point error between a pair of clusters or scans.

< 4mm [%] – The percentage of a pair of clusters or scans where the point error is more than 4 mm.

Overlap [%] – The percentage of a pair of clusters or scans where the overlap is higher than 90%.

Used Points – Number of scan points that were used to calculate the cloud-to-cloud registration.

Details – If you click this button a dialog opens that shows more details of the scan point tension.

Overall Statistics

> **Mean [mm]** – The overall mean point error between pairs of scans or clusters.
>
> **< 4 mm [%]** – The overall percentage of pairs of scans or clusters where the point error is more than 4 mm.

Constraints Object

Name – The name of the constraints object.

Scanpoint Distance – A quality parameter of a plane.

> **Max** – The scan point distance of the plane with the highest distance. The traffic light indicates the quality of this individual criterion. It is green at values <4 mm, red at values >20 mm and orange between them.
>
> **Mean** – The mean value of all managed planes. The traffic light indicates the quality of this individual criterion. It is green at values <4 mm, red at values >20 mm and orange between them.

Constraint Error – Constraints are implemented by functions that are zero if the constraint is met. Deviations from zero are called Constraint Error.

Max – Highest value of all constraint functions. The traffic light indicates the quality of this individual criterion. It is green at values <2.2e-013, red at values >1e-005 and orange between them.

Mean – Mean value of all constraint functions. The traffic light indicates the quality of this individual criterion. It is green at values <2.2e-013, red at values >1e-005 and orange between them.

Planes – Planes used to define constraints.

Plane – Name and path of the plane.

Fixed – Fixed planes are only used to define the constraint but will not be changed.

Constraints – List of pairs of planes and the constraint chosen for this pair.

Plane 1 – First plane.

Plane 2 – Second plane.

Description – The constraint chosen.

Constrained Plane Fit

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Plane Name – Name of the corresponding plane

Name – Name of the fit (by default named according to the constraints object that manages this fit)

Normal – The orientation determined by the fit. The orientation is given by the direction which stands perpendicular to the plane.

Position – The position determined by the fit.

Number of scan points – The number of scan points in the selection used for the fit. The traffic light indicates the quality of this individual criterion. It is green at values >80, red at values <20 and orange between them.

Scan point distance – The standard deviation of the distance of the scan points from the calculated plane. The traffic light indicates the quality of this individual criterion. It is green at values <4 mm, red at values >20 mm and orange between them.

Scan point drift – The average distance of the scan points from the calculated plane. With this, the scan points above the plane can be averaged out with the scan points below the plane. The traffic light indicates the quality of this individual criterion. It is green at values <1 mm, red at values >5 mm and orange between them.

Last Constraint – The name and path of the last constraints object that has been used to manage this fit.

Measurement

General Tab

Name – The name of the object.

Layer – The representation layer on which the object is located.

Measurement Properties Tab

Overall Distance – Measured distance. When measuring between two points, the result will be the point-to-point distance. When using a plane or rectangle, the measurement is automatically taken perpendicular to this plane or rectangle. Note that negative distances will occur if the normal of the plane or rectangle points opposite direction.

Vertical Distance – Vertical part of the point-to-point distance.

Horizontal Distance – Horizontal part of the point-to-point distance.

Along X – The distance along the x-axis of the point-to-point distance.

Along Y – The distance along the y-axis of the point-to-point distance.

Show Distance – Select which values shall be shown in the views.

Measure Objects –List of objects that were used for the measurement. List is empty for point-to-point measurements.

Picture

General Tab

Name – The name of the object. The green **traffic light** right to the object name indicates that corresponding objects have been found in other scans. If corresponding references have not been found, no traffic light will be displayed.

Layer – The representation layer on which the object is located.

Picture Properties Tab

Spherical – A check-mark to indicate spherical pictures.

Pipe

General Tab

Name: The name of the object. The green **traffic light** to the right of the object name indicates that corresponding objects have been found in other scans. If corresponding references have not been found, no traffic light will be displayed.

Use for Place Scans, Correspondence Search and Automatic Name: The object will be used for registration. Correspondence relationships to this object are enabled and its name will automatically be changed if corresponding objects have been found or the name of a corresponding object has been changed. Local reference objects will have this option activated by default if their name has not been manually changed by the user.

Use for Place Scans and Correspondence Search: The object will be used for registering scans. Correspondence relationships to this object are enabled but its name will not be changed automatically. This means that the name of this object is fixed and corresponding reference objects to other scans will be named accordingly. Global reference objects and local references which have been (re-)named manually will have this option activated by default.

Use for Place Scans: The object will only be used for registering scans but excluded from any correspondence search. Its name will not be changed automatically.

Ignore for Place Scans: The object will not be used for registering scans and is excluded from any correspondence search. Its name will not be changed automatically. These options are relevant for the automatic correspondence search and for the registration of scans which are only available in SCENE.

Layer: The representation layer on which the object is situated.

Pipe Properties Tab

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Pipe Name – The name of the pipe.

Axis – The axis of the pipe.

Position – The position of the pipe.

Diameter – The diameter of the pipe.

Length – The length of the pipe.

Pipe Fit

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Pipe Name – The name of the corresponding pipe.

Name – The name of the fit object.

Axis – The axis determined by the fit.

Position – The position determined by the fit.

Diameter – The diameter determined by the fit.

Length – The length determined by the fit.

Number of scan points – The number of scan points in the selection used for the fit.

The traffic light indicates the quality of this individual criterion:

green: >80 points

orange: ≥ 20 and ≤ 80 points

red: <20 points

Scan point distance – The standard deviation of the distance of the scan points from the calculated pipe.

The traffic light indicates the quality of this individual criterion:

orange: < 4 mm

orange: ≥ 4 mm and ≤ 20 mm

red: >20 mm

Scan point drift – The average distance of the scan points from the calculated pipe. With this, the scan points inside the pipe can be averaged out with the scan points outside the pipe.

The traffic light indicates the quality of this individual criterion:

green: < 1 mm

orange: ≥ 1 mm and ≤ 5 mm

red: >5 mm

Plane

General Tab

Name – The name of the object. The green **traffic light** right to the object name indicates that corresponding objects have been found in other scans. If corresponding references have not been found, no

traffic light will be displayed.
Name: The name of the object. The green **traffic light** to the right of the object name indicates that corresponding objects have been found in other scans. If corresponding references have not been found, no traffic light will be displayed.

Use for Place Scans, Correspondence Search and Automatic Name: The object will be used for registration. Correspondence relationships to this object are enabled and its name will automatically be changed if corresponding objects have been found or the name of a corresponding object has been changed. Local reference objects will have this option activated by default if their name has not been manually changed by the user.

Use for Place Scans and Correspondence Search: The object will be used for registering scans. Correspondence relationships to this object are enabled but its name will not be changed automatically. This means that the name of this object is fixed and corresponding reference objects to other scans will be named accordingly. Global reference objects and local references which have been (re-)named manually will have this option activated by default.

Use for Place Scans: The object will only be used for registering scans but excluded from any correspondence search. Its name will not be changed automatically.

Ignore for Place Scans: The object will not be used for registering scans and is excluded from any correspondence search. Its name will not be changed automatically. These options are relevant for the automatic correspondence search and for the registration of scans which are only available in SCENE.

Layer: The representation layer on which the object is situated.

Plane Properties Tab

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Normal – The orientation of the plane, given by the direction that stands perpendicular to the plane.

Position – A point of the plane.

Plane Fit

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Plane Name – The name of the corresponding plane. You can enter a name manually or choose one from the dropdown menu. This menu contains the names of the last 10 fitted planes other scans and helps choosing the right name for the registration and accelerates the manual naming process.

Name – The name of the fit object.

Normal – The orientation determined by the fit. The orientation is given by the direction which stands perpendicular to the plane.

Position – The position determined by the fit.

Number of scan points – The number of scan points in the selection used for the fit.

The traffic light indicates the quality of this individual criterion:

green: >80 points

orange: ≥ 20 and ≤ 80 points

red: <20 points

Transversal normal deviation – The standard deviation of the normal, which is determined using the interim results of the fit. A high standard deviation indicates that the selected area is not as flat as it should be. There could be a ripple or there might be other objects in the plane. The standard deviation is broken down a transversal and longitudinal deviation.

The traffic light indicates the quality of this individual criterion:

green: < 1°

orange: ≥ 1° and ≤ 2.29°

red: >2.29°

Longitudinal normal deviation – The standard deviation of the normal longitudinal direction.

The traffic light indicates the quality of this individual criterion:

green: < 1.15°

orange: ≥ 1.15° and ≤ 2.29°

red: >2.29°

Scan point distance – The standard deviation of the distance of the scan points from the plane that has been determined. This is a good measurement for noise.

The traffic light indicates the quality of this individual criterion:

green: < 4 mm

orange: ≥ 4 mm and ≤ 20 mm

red: >20 mm

Limited Plane Fit

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Border Points – A list of all the corner points of the plane.

Plane Name – The name of the corresponding plane. You can enter a name manually or choose one from the dropdown menu. This menu contains the names of the last 10 fitted planes other scans and helps choosing the right name for the registration and accelerates the manual naming process.

Name – The name of the fit object.

Normal – The orientation determined by the fit. The orientation is given by the direction which stands perpendicular to the plane.

Position – The position determined by the fit.

Number of scan points – The number of scan points in the selection used for the fit.

The traffic light indicates the quality of this individual criterion:

green: >80 points

orange: ≥ 20 and ≤ 80 points

red: <20 points

Transversal normal deviation – The standard deviation of the normal, which is determined using the interim results of the fit. A high standard deviation indicates that the selected area is not as flat as it should be. There could be a ripple or there might be other objects in the plane. The standard deviation is broken down a transversal and longitudinal deviation.

The traffic light indicates the quality of this individual criterion:

green: < 1°

orange: ≥ 1° and ≤ 2.29°

red: >2.29°

Longitudinal normal deviation – The standard deviation of the normal longitudinal direction.

The traffic light indicates the quality of this individual criterion:

green: < 1.15°

orange: ≥ 1.15° and ≤ 2.29°

red: >2.29°

Scan point distance – The standard deviation of the distance of the scan points from the plane that has been determined. This is a good measurement for noise.

The traffic light indicates the quality of this individual criterion:

green: < 4 mm

orange: ≥ 4 mm and ≤ 20 mm

red: >20 mm

Slab

General Tab

Name: The name of the object. The green **traffic light** to the right of the object name indicates that corresponding objects have been found in other scans. If corresponding references have not been found, no traffic light will be displayed.

Use for Place Scans, Correspondence Search and Automatic Name: The object will be used for registration. Correspondence relationships to this object are enabled and its name will automatically be changed if corresponding objects have been found or the name of a corresponding object has been changed. Local reference objects will have this option activated by default if their name has not been manually changed by the user.

Use for Place Scans and Correspondence Search: The object will be used for registering scans. Correspondence relationships to this object are enabled but its name will not be changed automatically. This means that the name of this object is fixed and corresponding reference objects to other scans will be named accordingly. Global reference objects and local references which have been (re-)named manually will have this option activated by default.

Use for Place Scans: The object will only be used for registering scans but excluded from any correspondence search. Its name will not be changed automatically.

Ignore for Place Scans: The object will not be used for registering scans and is excluded from any correspondence search. Its name will not be changed automatically. These options are relevant for the automatic correspondence search and for the registration of scans which are only available in SCENE.

Layer: The representation layer on which the object is situated.

Slab Properties Tab

Global Coordinates – If checked, coordinates are displayed in the global coordinate system. Otherwise, they are displayed in the coordinate system of the scanner.

Face – The visible face of the slab object.

Thickness – The thickness of the slab object.

Normal – The orientation of the slab, given by the direction that stands perpendicular to the slab.

Position – A point of the slab.

Slab Fit

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; otherwise, they are displayed in the coordinate system of the scanner.

Slab Name – The name of the corresponding slab. You can enter a name manually or choose one from the dropdown menu. This menu contains the names of the last 10 fitted slabs, helps you choose the right name for the registration, and accelerates the manual naming process.

Face – The visible face of the slab object.

Thickness – The thickness of the slab object.

Name – The name of the fit object.

Normal – The orientation determined by the fit. The orientation is given by the direction which stands perpendicular to the plane.

Position – The position determined by the fit.

Number of scan points – The number of scan points in the selection used for the fit. The traffic light indicates the quality of this individual criterion:

green: > 80 points

orange: ≥ 20 and ≤ 80 points

red: < 20 points

Transversal Normal deviation – The standard deviation of the Normal, which is determined using the interim results of the fit. A high standard deviation indicates that the selected area is not as flat as it should be. There could be a ripple or there might be other objects in the plane. The standard deviation is broken down a transversal and longitudinal deviation.

The traffic light indicates the quality of this individual criterion:

green: < 1°

orange: ≥ 1° and ≤ 2.29°

red: > 2.29°

Longitudinal Normal deviation – The standard deviation of the Normal longitudinal direction. The traffic light indicates the quality of this individual criterion:

green: < 1.15°

orange: ≥ 1.15° and ≤ 2.29°

red: > 2.29°

Scan point distance – The standard deviation of the distance of the scan points from the plane that has been determined. This is a good measurement for noise. The traffic light indicates the quality of this individual criterion:

green: < 4 mm

orange: ≥ 4 mm and ≤ 20 mm

red: > 20 mm

Point

General Tab

Name: The name of the object. The green **traffic light** to the right of the object name indicates that corresponding objects have been found in other scans. If corresponding references have not been found, no traffic light will be displayed.

Use for Place Scans, Correspondence Search and Automatic Name: The object will be used for registration. Correspondence relationships to this object are enabled and its name will automatically be changed if corresponding objects have been found or the name of a corresponding object has been changed. Local reference objects will have this option activated by default if their name has not been manually changed by the user.

Use for Place Scans and Correspondence Search: The object will be used for registering scans. Correspondence relationships to this object are enabled but its name will not be changed automatically. This means that the name of this object is fixed and corresponding reference objects to other scans will be named accordingly. Global reference objects and local references which have been (re-)named manually will have this option activated by default.

Use for Place Scans: The object will only be used for registering scans but excluded from any correspondence search. Its name will not be changed automatically.

Ignore for Place Scans: The object will not be used for registering scans and is excluded from any correspondence search. Its name will not be changed automatically. These options are relevant for the automatic correspondence search and for the registration of scans which are only available in SCENE.

Layer: The representation layer on which the object is situated.

Point Properties Tab

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Position – The position of the point.

Add GPS Position – Add GPS information to the point.

Point Fit

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Point Name – The name of the corresponding point.

Name – The name of the fit object.

Position – The position determined by the fit.

Number of scan points – The number of scan points in the selection used for the fit.

The traffic light indicates the quality of this individual criterion:

For (contrast) mean points:

green: > 80 points

orange: ≥ 20 and ≤ 80 points

red: < 20 points

For checkerboard points:

green: > 400 points

orange: ≥ 100 and ≤ 400 points

red: < 100 points

GPS Position – Enable to add a GPS position to the object.

Format – Select to enter the GPS position either as coordinates decimal degree notation or UTM format.

Position – the GPS position decimal degree notation or UTM format.

Altitude – The altitude above sea level of the position.

Accuracy – The accuracy of the position.

Only bright points – Is set for the contrast mean point of a selection.

Objects – When creating an intersection point, the fit is depending on the properties of the corresponding plane. This dependency is listed here.

Sphere

General Tab

Name: The name of the object. The green **traffic light** to the right of the object name indicates that corresponding objects have been found in other scans. If corresponding references have not been found, no traffic light will be displayed.

Use for Place Scans, Correspondence Search and Automatic Name: The object will be used for registration. Correspondence relationships to this object are enabled and its name will automatically be changed if corresponding objects have been found or the name of a corresponding object has been changed. Local reference objects will have this option activated by default if their name has not been manually changed by the user.

Use for Place Scans and Correspondence Search: The object will be used for registering scans. Correspondence relationships to this object are enabled but its name will not be changed automatically. This means that the name of this object is fixed and corresponding reference objects to other scans will be named

The object will be used for registering scans. Correspondence relationships to this object are enabled but its name will not be changed automatically. This means that the name of this object is fixed and corresponding reference objects to other scans will be named accordingly. Global reference objects and local references which have been (re-)named manually will have this option activated by default.**Use for Place Scans**: The object will only be used for registering scans but excluded from any correspondence search. Its name will not be changed automatically.

Ignore for Place Scans: The object will not be used for registering scans and is excluded from any correspondence search. Its name will not be changed automatically. These options are relevant for the automatic correspondence search and for the registration of scans which are only available in SCENE.

Layer: The representation layer on which the object is situated.

Sphere Tab

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; otherwise, they are displayed in the coordinate system of the scanner.

Radius – The radius of the sphere.

Position – The position of the sphere mean point.

Sphere Fit

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; otherwise, they are displayed in the coordinate system of the scanner.

Sphere Name – The name of the corresponding sphere.

Name – The name of the fit object.

Radius – The sphere radius determined by the fit.

Position – The position of the sphere mean point determined by the fit.

Number of scan points – The number of scan points in the selection used for the fit. The traffic light indicates the quality of this individual criterion:

green: > 80 points

orange: ≥ 20 and ≤ 80 points

red: < 20 points

Radius deviation – The standard deviation of the radius, which is determined using the interim results of the fit. The traffic light indicates the quality of this individual criterion:

green: < 1 mm

orange: ≥ 1 mm and ≤ 4 mm

red: > 4 mm

Position deviation – The standard deviation of the position of the sphere mean point, which is determined using the interim results of the fit. The traffic light indicates the quality of this individual criterion:

green: < 15 mm

orange: ≥ 15 mm and ≤ 80 mm

red: > 80 mm

Scan point distance – The standard deviation of the distance of the scan points from the calculated sphere surface. The traffic light indicates the quality of this individual criterion:

green: < 4 mm

orange: ≥ 4 mm and ≤ 20 mm

red: > 20 mm

Scan point drift – The average distance of the scan points from the calculated sphere surface. Scan points outside the sphere can be averaged out with scan point within the sphere. The traffic light indicates the quality of this individual criterion:

green: < 1 mm

orange: ≥ 1 mm and ≤ 5 mm

red: > 5 mm

GPS Position – see Point Fit

Clipping Box

General Tab

Clipping – Select between hiding the points outside the Clipping Box (**hide exterior)** or inside the Clipping Box (**hide interior**).

Clipping Box enabled – Enable or disable clipping of the Clipping Box. When disabled, the points hidden by this box will be displayed again; the color of the Clipping Box boundaries and its icon in the **red** change to gray.

Clipping Box visible – Toggle visibility of the Clipping Box. Disabling the visibility of a Clipping Box will only hide its boundaries; the Clipping Box is still active (if clipping is enabled) and it still has effect on the visibility of the points in the 3D view.

Transformation Tab

Position – The translation portion of the transformation.

X – To key in a transformation in the x direction.

Y – To key in a transformation in the y direction.

Z – To key in a transformation in the z direction.

Scroll bar – Set the transformation using the mouse. The direction of the transformation will be the x, y, or z coordinate that is highlighted in yellow.

Increments – Set the increment for the scroll bar.

Rotation Angle – The angle of rotation if the rotation axis is split along the coordinate axes.

X – The angle of rotation around the x-axis.

Y – The angle of rotation around the y-axis.

Z – The angle of rotation around the z-axis.

Scroll bar – Set a new angle of rotation.

To change a value, you either enter the required value directly into the appropriate field, or you first select the field and then use the corresponding slider to change the value step by step. You can set the increment using the **Increments** dropdown box. If you hit the edge with the slider, simply reselect the field and the slider will return to the center without you losing your previous changes.

Increments – Set the increment for the scroll bar.

Axis snap – If checked, you can change the rotation for the current axis independently from the others. This is achieved by changing the order in which the rotations are applied.

Global Coordinates – If checked, coordinates are displayed in the global coordinate system. Otherwise, they are displayed in the coordinate system of the scanner.

Documentation Object

You can add annotations at the scanner position or at any scan point, see Annotations (3D View, Quick View, Planar View).

Global Coordinates – If checked, coordinates are displayed in the global coordinate system; else they are displayed in the coordinate system of the scanner.

Position – the position of the documentation object in the project.

Description – detailed information about the documentation object.

Hyperlinks – hyperlinks to files or web sites. Add a new hyperlink by entering its address into the lower text field, then press **Add**. You can change the order of the hyperlinks with **Up / Down**, delete them with **Remove** or open them by double-clicking on the list item or by selecting the **Open** button.

Virtual Scan (3D Picture)

General Tab

Name: The name of the object. The green **traffic light** to the right of the object name indicates that corresponding objects have been found in other scans. If corresponding references have not been found, no traffic light will be displayed.

Use for Place Scans, Correspondence Search and Automatic Name: The object will be used for

The object will be used for registration. Correspondence relationships to this object are enabled and its name will automatically be changed if corresponding objects have been found or the name of a corresponding object has been changed. Local reference objects will have this option activated by default if their name has not been manually changed by the user. **Use for Place Scans and Correspondence Search**: The object will be used for registering scans. Correspondence relationships to this object are enabled but its name will not be changed automatically. This means that the name of this object is fixed and corresponding reference objects to other scans will be named accordingly. Global reference objects and local references which have been (re-)named manually will have this option activated by default.

Use for Place Scans: The object will only be used for registering scans but excluded from any correspondence search. Its name will not be changed automatically.

Ignore for Place Scans: The object will not be used for registering scans and is excluded from any correspondence search. Its name will not be changed automatically. These options are relevant for the automatic correspondence search and for the registration of scans which are only available in SCENE.

Layer: The representation layer on which the object is situated.

Scan Tab

Size – The number of columns and rows. If a scan is loaded reduced in resolution, the reduced number of columns and rows is displayed and, light gray underneath, the complete number of columns and rows.

Data loaded –Indicates whether the scan is loaded.

Reference Scan –Indicates whether the scan is used as a reference scan for registration.

Scan Fixed – Mark the scan alignment as fixed and exclude it from further automatic registration attempts.

Scanner Dist. Range – Range of the scanner.

Scanner Position – The position of the scanner with the mirror being the point of origin.

Orientation Axis – Rotation axis of the scan.

Orientation Angle – The scan’s angle of rotation.

Recording Date – The time the scan was recorded.

Scan Origin Info – Additional information on the origin of the scan, for example, where it was recorded and information about issues (scanner warnings or errors) that occurred during recording of the scan.

Info – Further details that were provided when recording.

Transformation

Position – The translation portion of the transformation.

- **X** – To key in a transformation in the x direction.
- **Y** – To key in a transformation in the y direction.
- **Z** – To key in a transformation in the z direction.

Scroll bar – Set the transformation using the mouse. The direction of the transformation will be the x, y, or z coordinate that is highlighted in yellow.

Increments – Set the increment for the scroll bar.

Rotation Angle – The angle of rotation if the rotation axis is split along the coordinate axes.

X – The angle of rotation around the x-axis.

Y – The angle of rotation around the y-axis.

Z – The angle of rotation around the z-axis.

Scroll bar – Set a new angle of rotation.

To change a value, you either enter the required value directly into the appropriate field, or you first select the field and then use the corresponding slider to change the value step by step. You can set the increment using the **Increments** dropdown box. If you hit the edge with the slider, simply reselect the field and the slider will return to the center without you losing your previous changes.

Increments – Set the increment for the scroll bar.

Axis snap – If checked, you can change the rotation for the current axis independently from the others. This is achieved by changing the order in which the rotations are applied.

Global Coordinates – If checked, coordinates are displayed in the global coordinate system. Otherwise, they are displayed in the coordinate system of the scanner.

Chapter 17: Error Messages

The application must be started once by someone with sufficient privilege to register controls. Otherwise, several modules won't work as expected. You should at least have Power User rights. This also ensures that all functions can be executed smoothly.

Version of model is not supported – The project was saved with a later version of SCENE and cannot be read by your version. Use a later version of SCENE.

Version of scan is not supported – The scan was saved with a later version of SCENE and cannot be read by your version. Use a later version of SCENE.

Failed to rename 'Scan'. Renaming scan files is not permitted! – You cannot rename scans.

One or several objects failed to read in successfully. Please check properties of marked objects. – The project contains scans that do not exist as a file.

Not all contents of 'Object' were copied successfully. One or several children are bound to their original location. – When copying objects that were created by a fit, it is not possible to also copy the fit object to the new location.

The move request was rejected, because either 'Object' or one of its children is bound to its current location. – Some objects cannot be moved or copied to different locations, for example fit objects, or unloaded pictures.

No valid point cloud to be exported. Hint: try processing scans – In the rcp export no scan was exported

The required software license was not found. – You tried to process a Swift sequence without a valid Swift license. Make sure that you have a valid Swift license.

Chapter 18: FAQ

Why can I not rename scans?

Scans in the project must have the same name as the corresponding scan file on your data medium. You cannot rename the scan file at the same time as the scan in the project because scans can be used in several projects simultaneously.

Why do I always get the message “Load data reduced size” when loading scans?

Check settings the under **Tools** > **Options** > **Scan Data**. The maximum scan size permitted is set there. You can lift the size restriction by setting the setting to **unlimited**.

Why does my license not work anymore?

The license is linked to the Ethernet address of your network card. When checking the license, SCENE compares the Ethernet address of the network card with the saved license. Unfortunately, a lot of network cards hide the Ethernet address if you are not physically connected to a network.

Why is the scan loaded even when starting a Quick View?

Usually, the quick view is saved in the scan. If this is not the case for a scan, SCENE must first load the scan before it can display the quick view . If the security settings permit it, SCENE then writes the quick view in the scan, so that next time you open the quick view , it is no longer necessary to load the scan.

When I open the context menu, why do I sometimes get the dialog to select the object?

If several objects are available next to one another or objects are available within the selection, SCENE must ask which object you want to select.

Why can I no longer load some scans?

Some virus scanners have problems with the extensive scan files. Disable the virus scanner when working with SCENE.

Why do I get a black window when opening the 3D View?

SCENE requires a graphics card that supports OpenGL 4.3 or higher. If your graphics card supports older versions only, the 3D view might not work. Switching off the advanced textures or off-screen rendering under **Tools** > **Options** > **View** might solve this. When switching off advanced textures, the stereoscopic view is not available anymore. When switching off onscreen rendering, the stereoscopic view, the clear view and gap filling are not available anymore.

Why is the rendering performance in the 3D View slow or intermittent?

On systems equipped with NVIDIA Quadro graphics processors, rendering performance in 3D view might be slow or intermittent. To improve rendering performance, start the **NVIDIA Control Panel** application (available in the **Windows Control Panel**) and select the global preset **3D App – Game Development** from the **Global Settings** tab.

Why don't I get the most current position and orientation when I open an .fls scan file in a third-party application?

Point data and transformation information for scans may be stored in separate revisions. If you want to make sure that an .fls scan file contains the most current transformation, you must use the command **Export as Project** in the context menu of the scans or scan folders.

You can contact the technical support in the Workflow bar in the Help section.

Glossary

A

artifact
A defect in a scan that occurs as a result of the methods used to capture or process the scan.

C

clipping box
A virtual box that allows defining places of interest in a 3D point cloud by hiding points within or without of the clipping box.

cloud-to-cloud registration
A registration method that serves as refinement of already roughly positioned scans (by sensors, manually or other algorithms). Different initial positions may lead to different results.

cluster
A collection of scans which belong together, for example, scans that were recorded on the same floor of a building, or scans which were taken in the same room. Scan groups, created by the FARO Focus scanner, are also automatically put into clusters when they are imported into SCENE.

D

DataHub
FARO’s centralized cloud storage for project data. In WebShare, you can use the DataHub to create WebShare projects from SCENE or Stream data.

F

FARO Stream
A FARO phone app from which you can control your FARO Focus Premium laser scanner, pre-register captured scans, collect complementary data, and upload captures directly into FARO Sphere.

folder
An object type which stores any objects other than scans. It is similar to the Windows file system folder. The complement to this is the Scan Folder, in which scans are contained.

I

inclinometer
An instrument, similar to a level, used to measure angles of slope.

L

layer
A logical grouping of objects in a scan project that can be used to switch the visibility of those objects on and off.

M

model
A node in the structure view that contains CAD objects.

O

Overview Map
A top view of the entire scan project showing the position of the scanner and the scanned areas. The scanner positions are shown as colored dots.

P

processing
A series of software manipulations to the scan data in a project that improve the quality of the scan.

project point cloud
A point cloud that consists of the points of all the scans within a scan project. It can be seen as a comprehensive point cloud of the complete scan project. It is typically created from all the single scans in the project after they have been preprocessed, colorized and registered.

R

references
A node in the Structure View that contains the reference objects for positioning scans (for example, survey coordinates). It should not be renamed.

registration
The process of aligning multiple scans in a parent coordinate system using reference positions common between scans. References are common points between scans that are used to create a “best-fit” alignment.

S

scan
A file recorded by scanner, containing millions of data points that include position, reflectance, and color for single scan points. A scan consists of scan points that were recorded from a single scanner location. Its points are organized in a row column order.

scan folder
An object type that contains scans. It is similar to the Windows file system folder. The complement to this is the folder, in which all other objects are contained.

scan point cloud
An alternative representation of a scan. It must be created from a single scan and is organized in a spatial data structure that facilitates fast visualization of scan points and automated point loading based on point visibility.

scan project
A collection of related scans and additional data needed to represent a scanned object or site, such as a building or a crime scene.

sphere
A sphere-shaped target used for target-based registration of scan projects.

structure view
Tree-structure on the left side of the screen in SCENE. It shows the project structure, including subfolders and objects.

Sync Agent
FARO Software that helps you keep project data synchronized between your PC and FARO Sphere. You can install the app on your PC by using FARO InTouch.

T

target
A physical object in the area to be scanned that can be detected by the software and used to register the scans. A target can be a naturally occurring plane such as a wall or desk, or an artificial marker.

target-based registration
A registration methods that uses targets (e.g., spheres, checkerboards, markers) to determine the alignment of the scans. This registration method does not use scan positions.

V

virtual reality
The integration of digital information to create a simulated experience of an entire scan project. You can view the project through a compatible VR headset.

W

white balance
The adjustment of the intensity of primary colors to produce images that match what the human eye sees under different lighting conditions.

Appendix A: Technical Support

FARO Technologies, Inc. is committed to providing the best technical support to our customers. If you have any problem using one of our products, follow these steps before contacting our Technical Support Team:

- Be sure to read the relevant sections of the documentation to find the help you need.
- Visit the FARO Customer Care area on the Web at www.faro.com to search our technical support database. This is available 24 hours a day 7 days a week.
- Document the problem you are experiencing. Be as specific as you can. The more information you have, the easier the issue will be to solve.
- Email or faxes sent outside regular working hours usually are answered before 12:00 pm in the next working day. Should our staff be on other calls, leave a voice mail message; calls are always returned within 24 hours. Remember to leave a detailed description of your question. Do not forget to include your name, email address, fax number, telephone number and extension so we can reach you promptly.

North America	Support Hours (Monday through Friday) 8:00 a.m. to 7:00 p.m. Eastern Standard Time (EST) email: support@faro.com Phone: +1 800 736 2771, +1 407 333 3182 (Worldwide) Mexico: 866-874-1154 Fax: +1 407-562-5294
Europe	Support Hours (Monday through Friday) 8:00 a.m. to 5:00 p.m. Central European Standard Time (CET) email: support.emea@faro.com Phone: +800 3276 7378, +49 7150 9797-400 (Worldwide) Fax: +800 3276 1737, +49 7150 9797-9400 (Worldwide)
Asia	Support Hours (Monday through Friday) 8:30 a.m. to 5:30 p.m. Singapore Standard Time (SST) email: supportap@faro.com Phone: +1 800 511 1360, +65 6511 1350 (Worldwide) Fax: +65 6543 0111
Japan	Support Hours (Monday through Friday) 9:00 a.m. to 5:00 p.m. Japan Standard Time (JST)

	email: supportjapan@faro.com
	Phone: +81 561 63 1411 (Worldwide)
	Fax: +81 561 63 1412 Support Hours (Monday through Friday)
	8:30 a.m. to 5:30 p.m. China Standard Time (CST)
China	email: supportchina@faro.com
	Phone: +400.677.6826
	Fax: +86 21 6494 8670 Support Hours (Monday through Friday)
	9:30 a.m. to 5:30 p.m. India Standard Time (IST)
India	email: supportindia@faro.com
	Phone: 1800.1028456
	Fax: +91 11.4646.5660

End User Documents

All documents related to the Software End User License Agreement, Purchase Conditions, and FARO Products Service Policy can be found on the FARO Knowledge Base at the following URL: knowledge.faro.com/Essentials/General/FARO_End_User_License_Agreement_Location.

Appendix B: Software License Agreement

This Software License Agreement is part of the Operating Manual for the product and software System which you have purchased from FARO TECHNOLOGIES, INC. (collectively, the “Licenser”) By your use of the software you are agreeing to the terms and conditions of this Software License Agreement. Throughout this Software License Agreement, the term “Licensee” means the owner of the System.

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VI. In the event of any breach by the Licensee of this Agreement, the license granted hereby shall immediately terminate and the Licensee shall return the software media and all written materials, together with any copy of such media or materials, and the Licensee shall keep no copies of such items.

VII. The interpretation of this Agreement shall be governed by the following provisions:

> **A.** This Agreement shall be construed pursuant to and governed by the substantive laws of the State of Florida (and any provision of Florida law shall not apply if the law of a state or jurisdiction other than Florida would otherwise apply).
>
> **B.** If any provision of this Agreement is determined by a court of competent jurisdiction to be void and non-enforceable, such determination shall not affect any other provision of this Agreement, and the

remaining provisions of this Agreement shall remain in full force and effect. If any provision or term of this Agreement is susceptible to two or more constructions or interpretations, one or more of which would render the provision or term void or non-enforceable, the parties agree that a construction or interpretation which renders the term of provision valid shall be favored.

C. This Agreement constitutes the entire Agreement, and supersedes all prior agreements and understandings, oral and written, among the parties to this Agreement with respect to the subject matter hereof.

VIII. If a party engages the services of an attorney or any other third party or in any way initiates legal action to enforce its rights under this Agreement, the prevailing party shall be entitled to recover all reasonable costs and expenses (including reasonable attorney's fees before trial and in appellate proceedings).

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