

# **EVIXSCAN 3D SUITE 2.8 USER MANUAL**

**Version 1.0**

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# 1 Introduction

*eviXscan 3D Suite 2.8* is the newest version of the software that made the debut in version 2.0 in 2018. The software is rapidly developing from version to version giving users new functionalities to facilitate the process of scanning and processing of digital 3D models. It is supported by an intuitive and easy-to-use interface that assists the work of both experienced and novice users. This user manual provides a guidance and additional sources of practical information for the user of this software version.

## 2 Installation

### 2.1 System Requirements

OS	<ul style="list-style-type: none"> <li>- Windows 8</li> <li>- Windows 10</li> <li>- <b>Recommended:</b> Windows 10 (64 bit)</li> </ul>
CPU	<ul style="list-style-type: none"> <li>- Intel® and AMD® processor with a minimum clock speed of 2.5 GHz</li> <li>- <b>Recommended:</b> Multithreaded processor, Hyperthreading, CPU clock greater than 3 GHz</li> </ul>
RAM	<ul style="list-style-type: none"> <li>- Minimum: 8 GB</li> <li>- <b>Recommended:</b> 32+ GB (depending on the system)</li> </ul>
Hard Disk	<ul style="list-style-type: none"> <li>- 30 GB or more</li> <li>- <b>Recommended:</b> SSD 256GB or more</li> </ul>
Display	<ul style="list-style-type: none"> <li>- DirectX 11</li> <li>- Minimum resolution: 1280 x 960</li> <li>- <b>Recommended resolution:</b> 1920 x 1080</li> </ul>
GPU	<ul style="list-style-type: none"> <li>- nVidia® GTX 970 or higher</li> <li>- <b>Recommended:</b> nVidia® Quadro P1000 or GTX 1060Ti</li> </ul>



## 2.2 Installation Process

To install the *eviXscan 3D Suite* software, run the installation file you received (eviXscan\_3D\_Suite\_2.8.x.x.msi). An installation wizard will be displayed, which will guide you through the installation process. Click on the *Next* button to proceed to the next step.

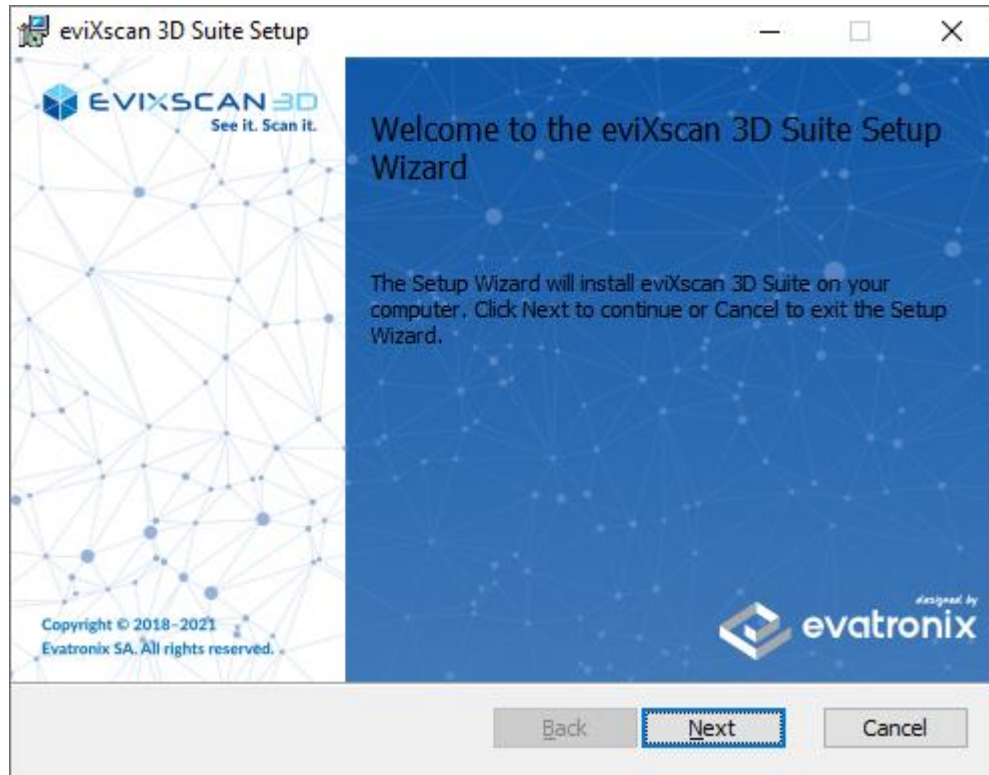


Figure 1. Installation wizard – welcome window

Moving on to the next step requires acceptance of the software license agreement. Once this is done, you can proceed to the next step by clicking *Next*.

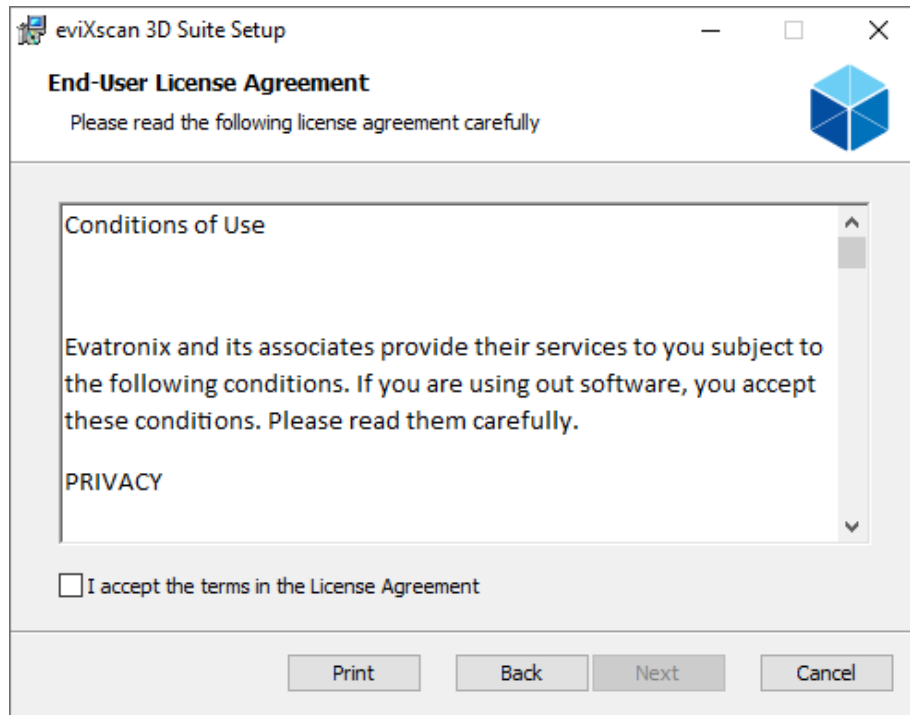


Figure 2. Installation wizard – license agreement

At this stage, you need to indicate the location where the software will be installed. You can also leave the default path suggested by the software.

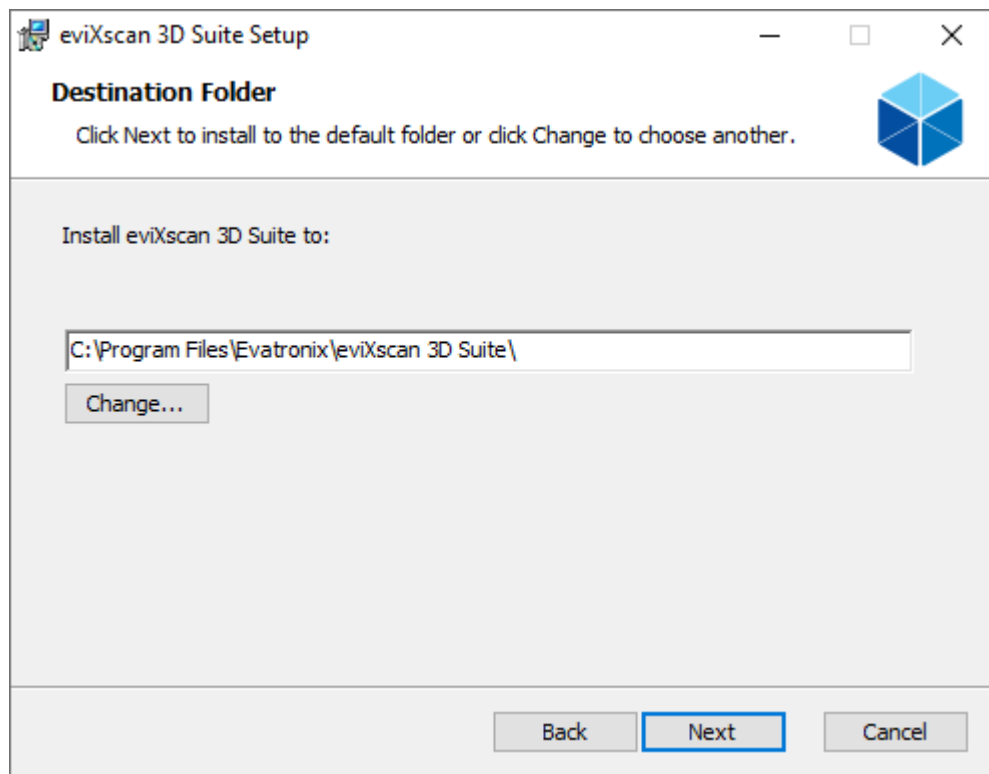


Figure 3. Installation wizard – destination folder

After clicking on the *Install* button, the software installation will begin.

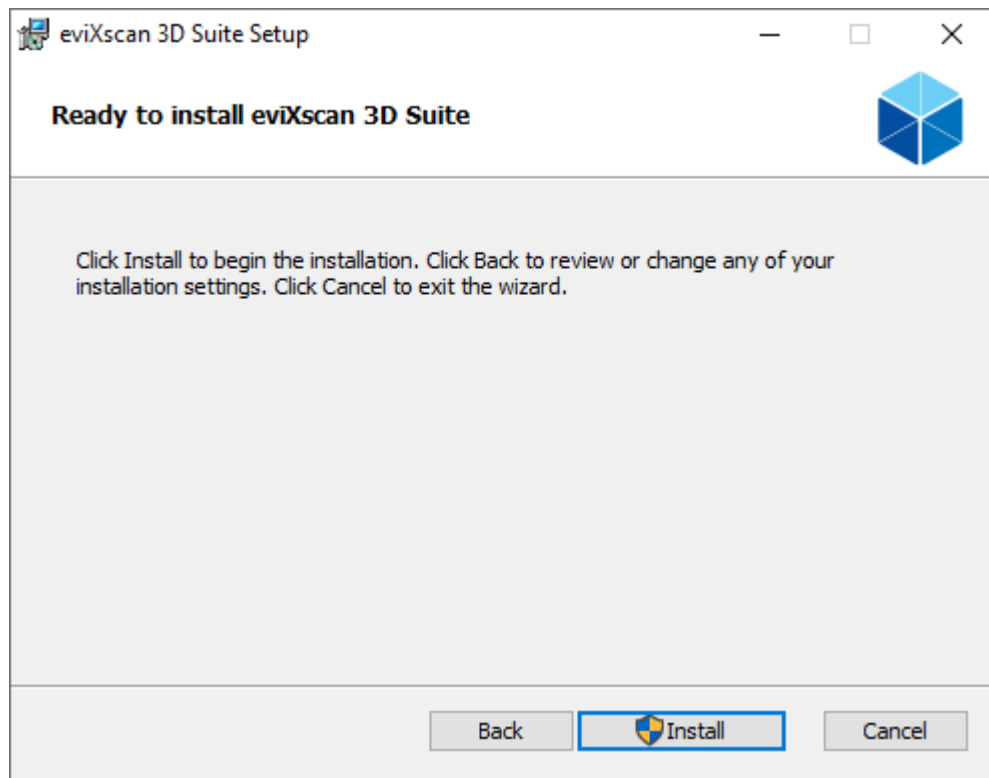


Figure 4. Installation wizard – product installation

When the installation process is complete, the last window will be displayed, informing you about the progress of the installation (its successful completion or failure). The *Finish* button ends the installation wizard.

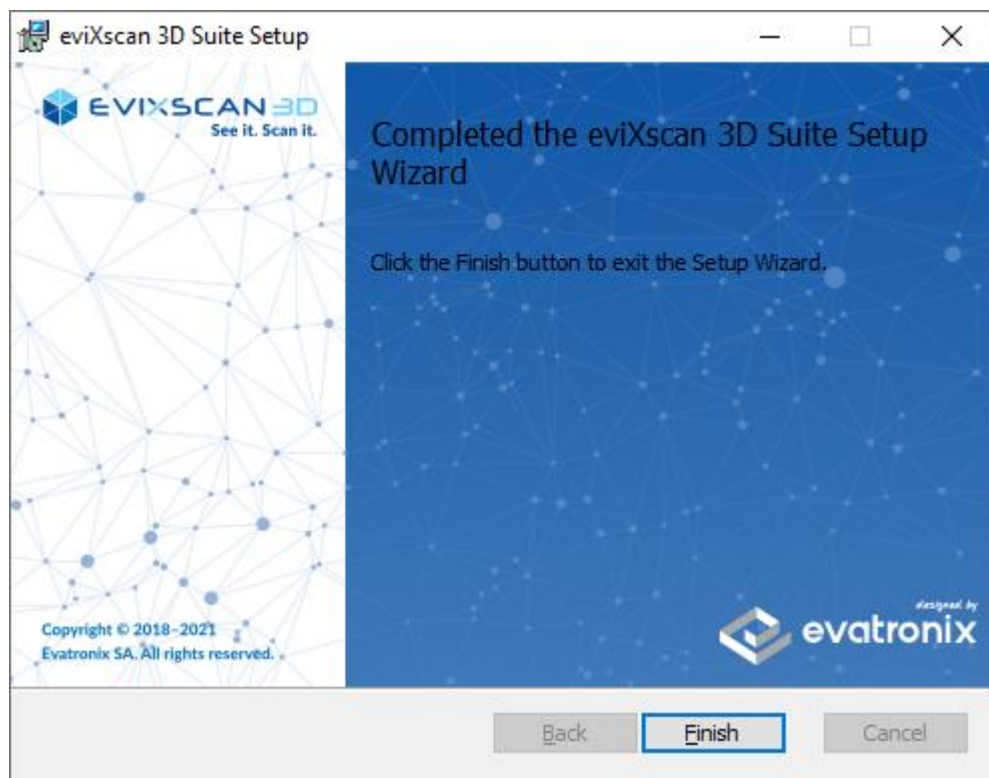



Figure 5. Installation wizard – farewell window

## 2.3 Notifications about the Availability of a New Software Version

If the server has a newer version comparing to the one currently installed locally, a window informing about an available update will appear at the start of the software. The window contains information about solved problems and introduced improvements (1), information about the current and the latest version (2) and the option to download the latest version from the website by clicking the *Download* button (3) or closing the window with the *Close* button (4). If you check the option *Don't show this window again for this version* (5), messages about the new version will not appear until the next version is available – in the case displayed on the Figure 6 it will be the version 2.8.12.1 or higher.

### **i** NOTE

The *Download* button (3) redirects you to the website to log into your own account and download the new version.

 More information about version download can be found in Subsection 3.2.2.

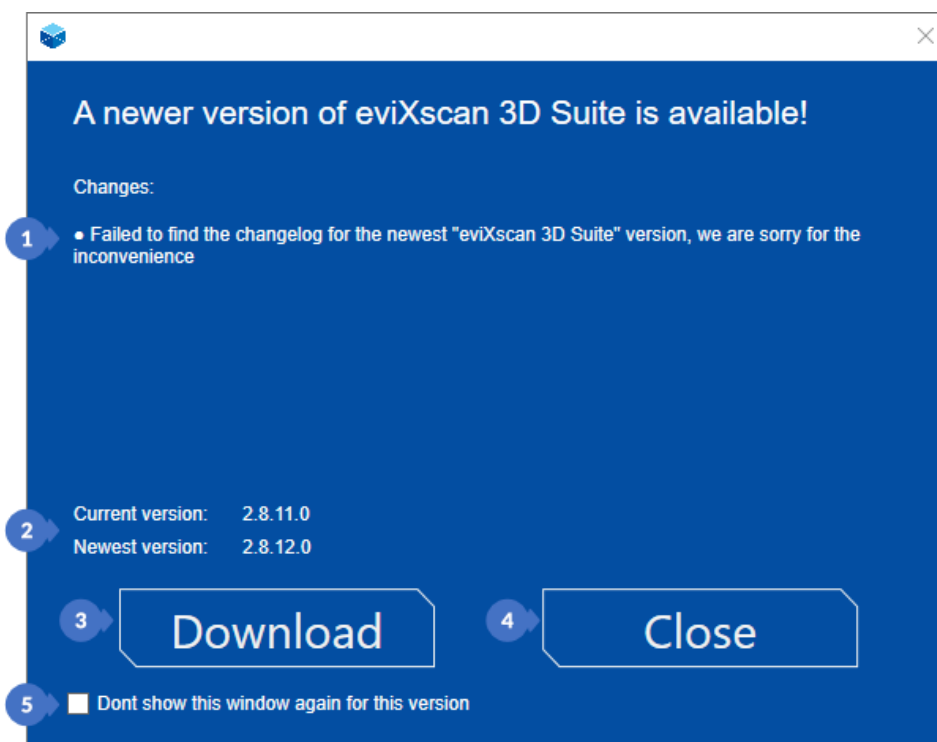
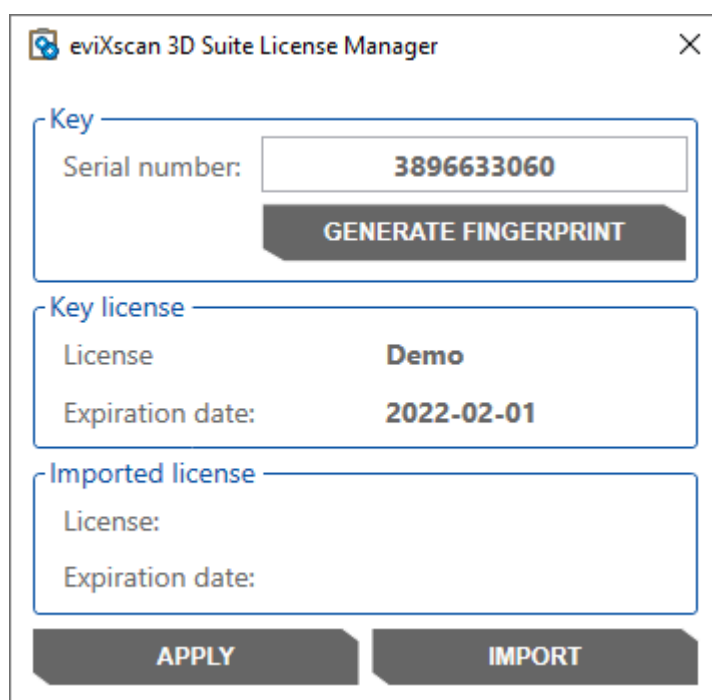


Figure 6. A window informing about a new version available for download.

## 3 LICENSE ACTIVATION

### 3.1 License Activation to Full Version

For the proper operation of the *eviXscan 3D Suite* software, the license activation is required using the dongle provided with the scanning system. Before starting the activation, place the dongle in the USB port of your computer. Then start the *eviXscan 3D Suite* software and select the *License Manager* button from the *Start* menu. You can also start the *License Manager* from the Windows start bar by searching for the *eviXscan 3D Suite* folder (in addition to the *eviXscan 3D Suite software* shortcut there are shortcuts to *License Manager* and *Quick Support*). The *License Manager* window will be displayed on the screen.



Key	
Serial number:	3896633060
<b>GENERATE FINGERPRINT</b>	

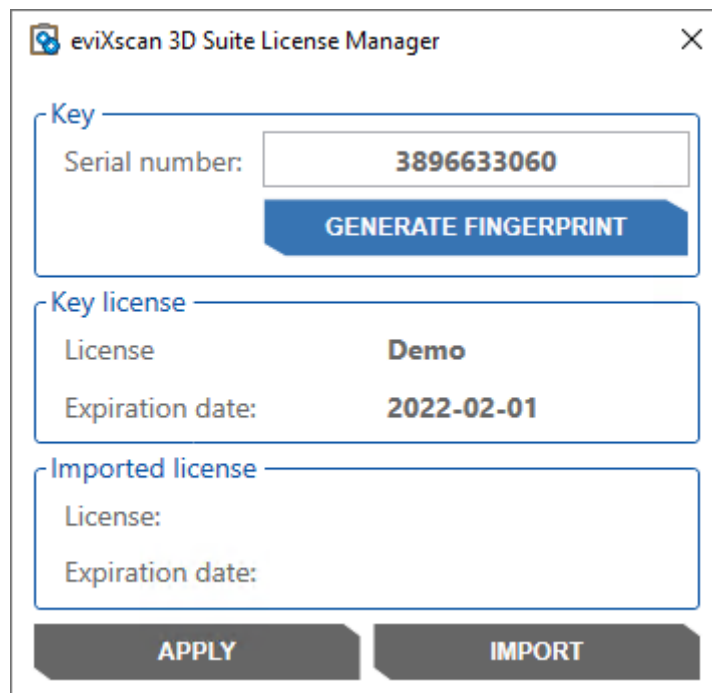
Key license	
License	Demo
Expiration date:	2022-02-01

Imported license	
License:	
Expiration date:	

**APPLY** **IMPORT**

Figure 7. *eviXscan 3D Suite License Manager*

Use the running program to generate a file with the .efp extension by clicking the *GENERATE FINGERPRINT* button.

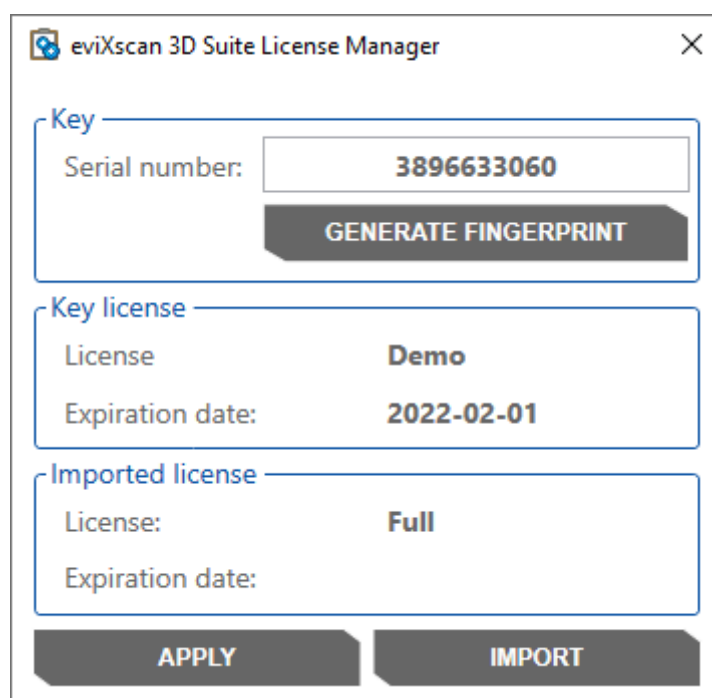


The screenshot shows the 'eviXscan 3D Suite License Manager' window. It has three main sections: 'Key', 'Key license', and 'Imported license'. The 'Key' section contains a 'Serial number' field with the value '3896633060' and a blue 'GENERATE FINGERPRINT' button. The 'Key license' section shows 'License' as 'Demo' and 'Expiration date' as '2022-02-01'. The 'Imported license' section has empty fields for 'License' and 'Expiration date'. At the bottom are 'APPLY' and 'IMPORT' buttons.

Section	Field	Value
Key	Serial number	3896633060
	GENERATE FINGERPRINT	Button
Key license	License	Demo
	Expiration date	2022-02-01
Imported license	License	
	Expiration date	
APPLY		Button
IMPORT		Button

Figure 8. eviXscan 3D Suite License Manager – GENERATE FINGERPRINT

The file generated in this way should be sent to [support@evatronix.com](mailto:support@evatronix.com). A return email will be sent to you containing the file with the .lic extension. Import it into the software by clicking on the *IMPORT* button in the *License Manager*. The *Imported license* field contains information about the imported license.



This screenshot is similar to Figure 8, but the 'Imported license' section now shows 'License' as 'Full'. The 'Key' and 'Key license' sections remain the same. The 'APPLY' and 'IMPORT' buttons are still at the bottom.

Section	Field	Value
Key	Serial number	3896633060
	GENERATE FINGERPRINT	Button
Key license	License	Demo
	Expiration date	2022-02-01
Imported license	License	Full
	Expiration date	
APPLY		Button
IMPORT		Button

Figure 9. eviXscan 3D Suite License Manager – type of imported license

After the license file is correctly imported, confirm the license upload using the *APPLY* button. A message indicating that the license has been uploaded correctly will be displayed.

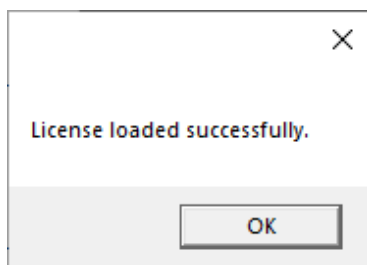


Figure 10. eviXscan 3D Suite License Manager – message indicating that the license is loaded correctly

Finally, the previous license status in the *Key license* field should have the same information as the *Imported license* field (Figure 11).

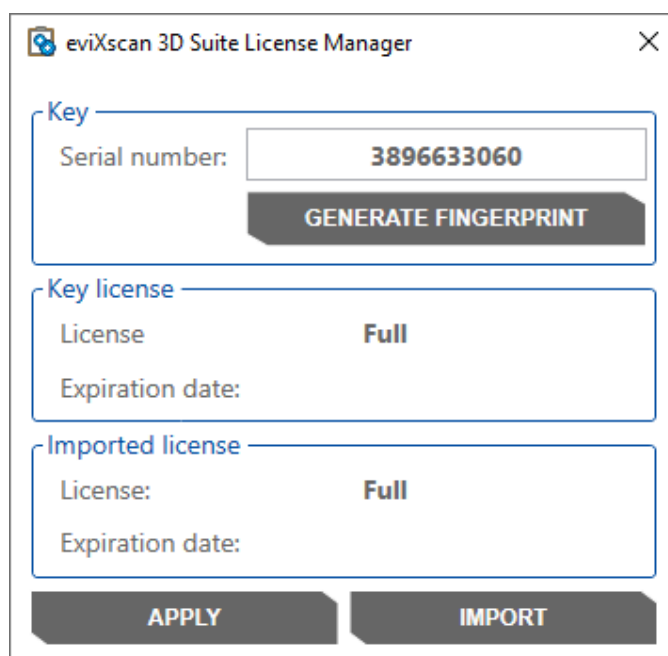


Figure 11. eviXscan 3D Suite License Manager – window view after the correct license upload

After completing the steps described above, you can close the *License Manager* window.

## 3.2 On-line License Activation for Trial Version

To get access to the 30-day trial version, enter [website](https://evixscan3d-support.azurewebsites.net/userregistration)<sup>1</sup> and make a registration (*Registration*) (1). If you already have an account, you can go to *Login* (2).



Figure 12. Navigation buttons page (registration and login)

<sup>1</sup> <https://evixscan3d-support.azurewebsites.net/userregistration>

## 3.2.1 Registration

On the registration page (1) the following data must be entered in the registration form:

### Register

Please enter your details

First name

3 William

Surname

4 Deleon

Reseller name

5 eviXscan 3D

Phone number +1

6 4107756132

Email address

7 williamdeleon@armyspy.com

Company

8 The Royal Canadian Pancake Houses

Country

9 United States

Password

10 .....

Repeat password

10 .....

11 ☒ I agree to Evatronix storage and processing of my personal data ([link to the regulations](#)). ([link to the regulations EN](#)).

12 Register

Figure 13. Account registration form

- (3) – name,
- (4) – surname,
- (5) – the name of the distributor or, alternatively, the name of the source from which you obtained the information about the to install the software trial version,
- (6) – phone number,
- (7) – email address,



- (8) – company,
- (9) – country,
- (10) – password and password repetition,
- (11) – accept the terms and conditions.

After filling in the above data and checking its correctness, use the *Register* button (12) (Figure 12) to complete the registration. If everything goes correctly, the system will send you an e-mail (13) (Figure 13) informing you that your registration is completed. It also informs you that you should wait for the verification by the technical support. Accounts with false data will not be approved.

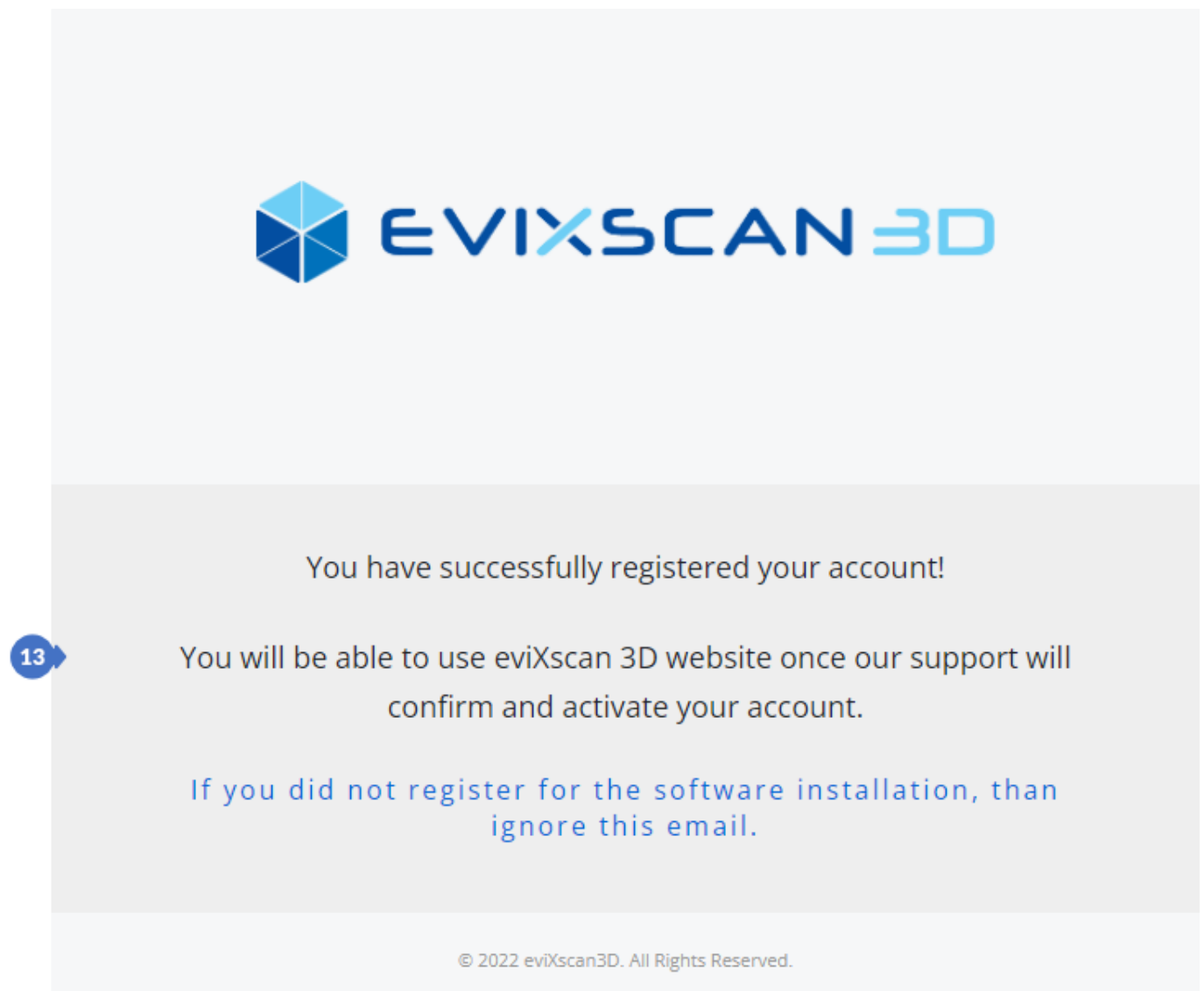


Figure 14. Confirmation of registration

## 3.2.2 Logging in

To go to the login panel, open [the page](#)<sup>2</sup> or, if you have registered, switch to the *Login* tab (2) (Figure 12). In the login window (Figure 15) you should enter the data used in the registration. If your account has been activated, login to your account by entering the e-mail address (14) and the password (15).

### Login

Figure 15. Account sign-in window

The *My Account* tab (17) is used to manage the account of the currently logged user.



Figure 16. Tabs in the logged-in panel



Figure 17. Welcome bar and the account logout button

In this tab you will find a *Download Trial eviXscan 3D* category containing a *Download eviXscan 3D* button (21) to download the trial license.

You can find there the *Download eviXscan 3D Suite* category (Figure 18) with the *Download demo version* button (21) to download the test license and the *Download full version* button (22) visible only if you have an active software subscription – this is indicated by the status (*Maintenance*) (24) in Figure 19.

<sup>2</sup> <https://evixscan3d-support.azurewebsites.net/userlogin>

## Download eviXscan 3D Suite

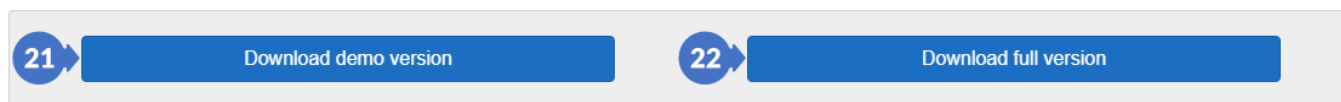


Figure 18. Download eviXscan 3D Suite category with button to download the trial or the full version

The *My account category* includes the data provided during registration (3-9). An additional parameter is the information about the enabled/disabled *e-mail notifications* (23) option, the status of subscription of the software (*Maintenance*) (24) and a button that opens the page with the information about the *privacy policy* (25).

## My account

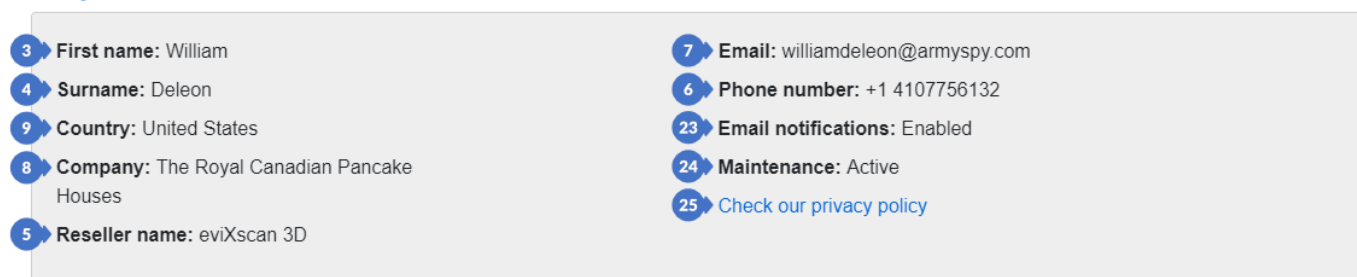


Figure 19. My account category with account details provided during the registration

The entered data can be edited in the *Settings category*. The personal data, i.e. *First name* (3), *Surname* (4), *Company* (8) can be changed by making changes to *Edit personal data* and sending a request to the technical support using the *Send request* button (26). Change of user data such as *e-mail* (7), telephone number (*Phone number*) (6), *Reseller name* (5), *Country* (9) and enable/disable e-mail notifications (*Receive email*) notifications (23) can be done in *Edit user data* by changing the corresponding fields and by confirming the changes with the *Change* button (27).

## Settings

The screenshot displays two side-by-side form panels under the 'Settings' category.

**Edit personal data:**

- First name:** Field with value 'William' (callout 3).
- Surname:** Field with value 'Deleon' (callout 4).
- Company:** Field with value 'The Royal Canadian Pancake Houses' (callout 8).
- Action:** A blue button labeled 'Send request' (callout 26).

**Edit user data:**

- Email:** Field with value 'williamdeleon@armyspy.com' (callout 7).
- Phone number: +1** Field with value '4107756132' (callout 6).
- Reseller name:** Field with value 'eviXscan 3D' (callout 5).
- Country:** Dropdown menu showing 'United States' (callout 9).
- Notifications:** A toggle switch labeled 'Receive email notifications' which is currently turned on (callout 23).
- Action:** A blue button labeled 'Change' (callout 27).

Figure 20. Settings category to change account data

Further in the *Settings category* there are fields for changing the password (*Change password*), which can be changed by entering the current password in the *Password* field (28) and then the new password in the *New password* and *Repeat new password* fields (29) and clicking on the *Change password* button (30). The *Delete Account* part is used to delete the account. Before deleting it, you must enter the current password in the *Password* field (31) and then the *Delete account* button (32).

The screenshot displays two side-by-side form panels under the 'Settings' category.

**Change password:**

- Password:** Field (callout 28).
- New password:** Field (callout 29).
- Repeat new password:** Field (callout 29).
- Action:** A blue button labeled 'Change password' (callout 30).

**Delete account:**

- Password:** Field (callout 31).
- Action:** A blue button labeled 'Delete account' (callout 32).

Figure 21. Settings category to change password and delete account.

The tab for managing your licenses (Figure 16) (18) contains all the information about your licenses (Figure 23).

## My licences

Deactivate

Key	Bought Date	Expiration Date	Licence Type	Is Active	Is Suspended
-----	-------------	-----------------	--------------	-----------	--------------

1/00FirstPreviousNextLast

Figure 22. Information about your licenses

To log out of your account, use the Logout button (20) (Figure 17) located in the upper right corner next to the welcome text (19).

### 3.2.3 Installation the Trial Version

Installation of the software downloaded from the website using the *Download demo* (21) or *Download full* version (22) (Figure 18) is described in the earlier section.

More information about downloading the trial version can be found in Subsection 3.2.2.

More information about installing the download version can be found in Subsection 2.2.

### 3.2.4 Trial Version Activation

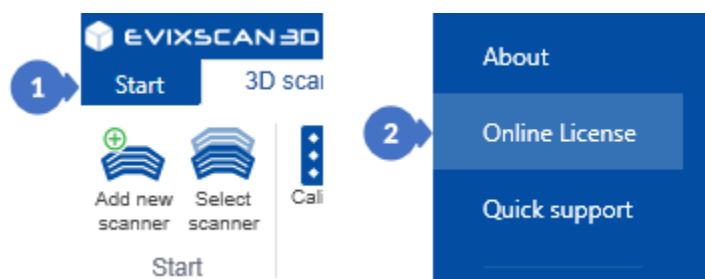


Figure 23. Open a tab to activate an online license

To activate an online license, open the *Start* menu (1) and select the *Online License* tab (2).

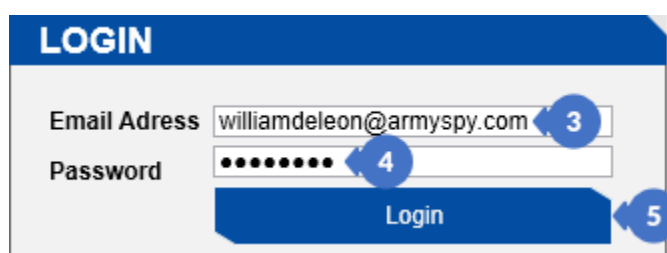


Figure 24. Sign into account

In the *LOGIN* group, to login to the account, enter the email address (*Email Address*) (3) with which you registered and the password (*Password*) (4) and then click on *Login* (5).

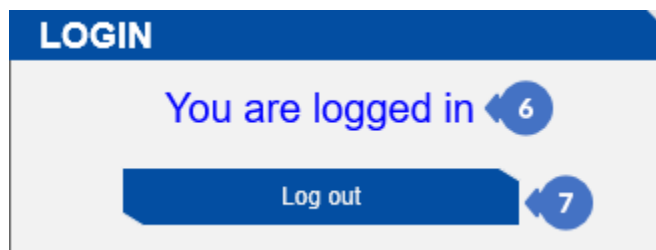


Figure 25. Sign-in message

If you have logged in correctly, the login message *You are logged in* (6) will appear. To log out, simply click on *Log out* (7).

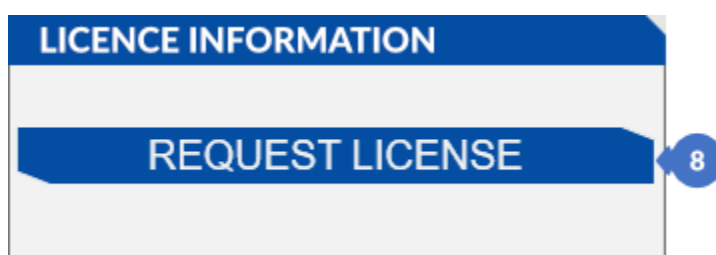


Figure 26. Information about the license

License information appears in the *LICENSE INFORMATION* group. It is only displayed if you are logged in to your account. If your license is a trial license and has not been activated yet, you can activate it with the *REQUEST LICENSE* button (8). More detailed information about the license will appear in this group.

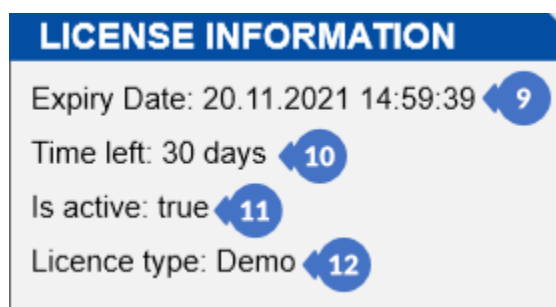


Figure 27. Information about the license

In the information field you will see the license *Expiry date* (9), *Time left* (10), the information whether the license is active or has been suspended by the publisher for some reasons – for example due to violation of the license rights (*Is active*) (11) and the type of license you have (*License type*) (12).

## 4 USER INTERFACE

### 4.1 Verification of the Requirements

If the computer on which the software is installed does not meet the minimum hardware requirements, an information window will be displayed indicating which parameters do not meet the minimum requirements (1). This window should be considered as only informative and can be hidden by checking the *Don't show this window again* (2) box.

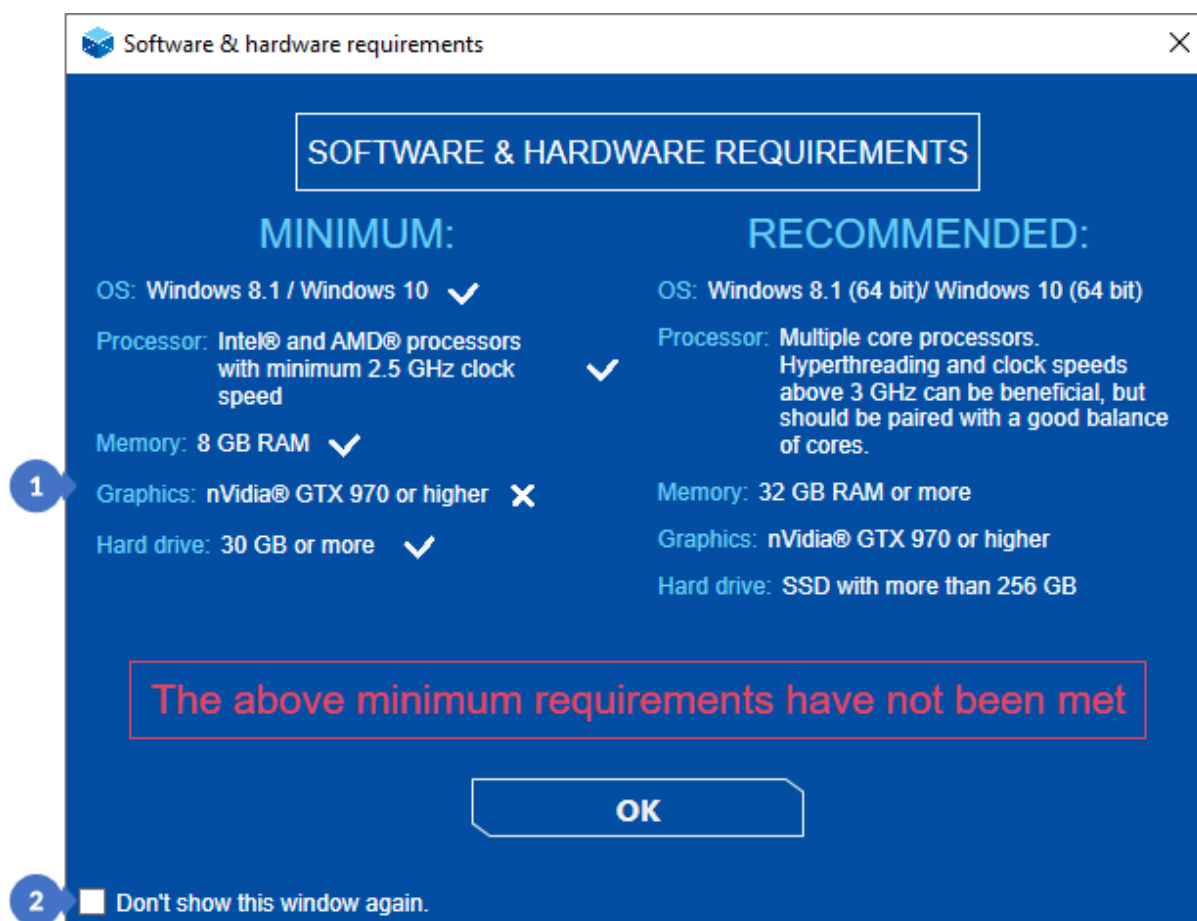


Figure 28. Window informing about the unfulfilled software and hardware requirements

**i** NOTE

Sometimes the message may appear even on newer cards when the model is not recognized by the software. In this case, just ignore the message by checking *Don't show this window again* (2).

## 4.2 Changing of Software Version

While installing the software for the first time or updating it, a message window will appear to inform you that the software has been reset to the default settings. This procedure is aimed at eliminating potential errors that may result from changes introduced between the software versions.

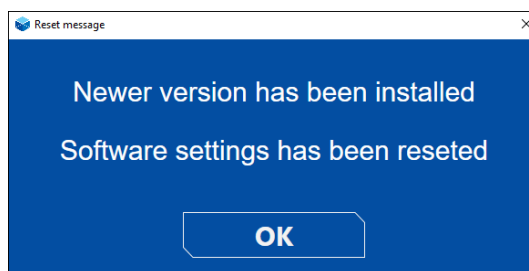


Figure 29. Message window informing about the reset to default settings

## 4.3 The Startup Window

The startup window of the *eviXscan 3D Suite* (Figure 30) software has the following elements:

- (1) – list of recently opened models,
- (2) – model search engine (from the list of recently opened models)
- (3) – information about the location of the project on which the cursor is currently located,
- (4) – information about the installed software version,
- (5) – *Create new* button that opens the tab for creating a new project,
- (6) – the *Open* button that opens a window to select the project to be opened.

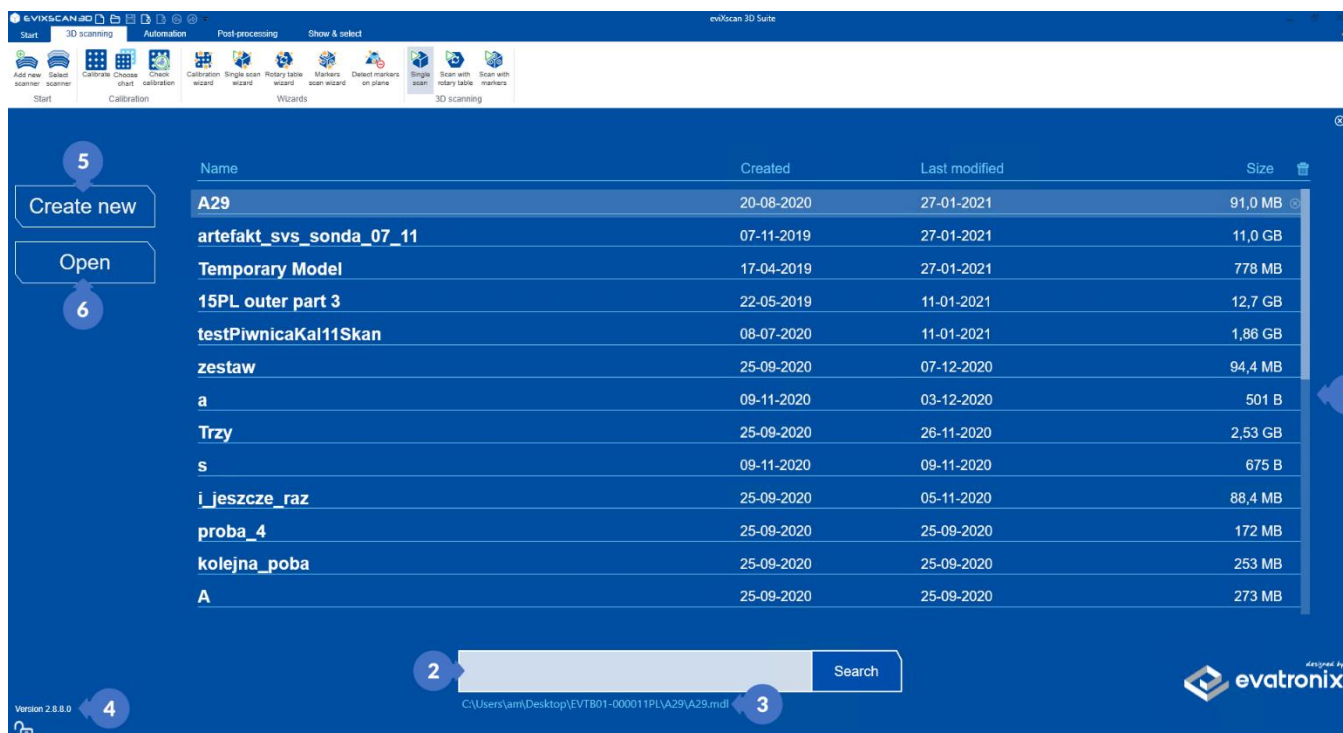


Figure 30. The startup window



### 4.3.1 Startup Window Context Menu

By right-clicking on the selected element from the list, you can choose one of the available actions:

- (1) – *Show in file explorer* – opens the folder with the location of the project, if an existing project is selected, in the case of a non-existent project, the option will be unavailable,
- (2) – *Clear recent list* – clears the entire list of recently opened projects,
- (3) – *Clear all not exist paths* – clears the list of non-existent projects (names of non-existent projects are crossed out).

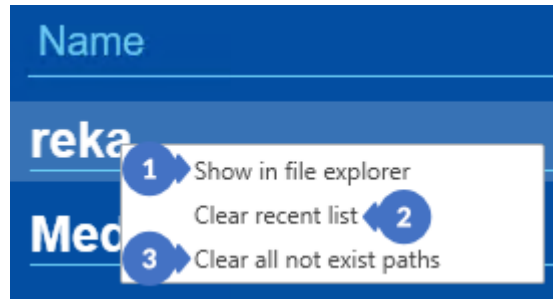


Figure 31. Context menu for the list of recently opened models

## 4.4 Description of the Contents of the Start Menu

The *eviXscan 3D Suite* software menu consists of the following options:



Figure 32. Menu Start

- (1) – *New* – opens the view for creating a new project,  
 ■ More information about creating a new project can be found in Subsection 12.1.
- (2) – *Open* – opens a view for opening existing projects from disk,  
 ■ More information about opening projects can be found in Subsection 12.2.
- (3) – *Import* – is used to import files with specific extensions into an open project,  
 ■ More information about import can be found in Subsection 12.3.
- (4) – *Export* – is used to export selected elements to the indicated location with selected extensions,  
 ■ More information about exporting files can be found in Subsection 12.5.
- (5) – *Export all* – serves the same purpose as *Export*, but does not require prior selection of elements, as it exports all the project files,
- (6) – *Save* – is used to save changes made to the project,  
 ■ More information about saving can be found in Subsection 12.6.
- (7) – *Options* – contains the program settings, both those concerning the settings of individual parameters and the settings of viewed elements,  
 ■ More information about the options can be found in Subsection 5.1.
- (8) – *Configuration* – contains settings for the scanner, the calibration files and the artefacts,  
 ■ More information about configuration can be found in Subsection 5.2.
- (9) – *Save log* – saving a file useful for programmers in the case of reporting software bugs,  
 ■ More information about saving logs can be found in Subsection 19.2.
- (10) – *About* – displays the software information window,
- (11) – *License manager* – application for the license activation,  
 ■ More information about the license activation application can be found in Subsection 3.1.
- (12) – *Quick support* – application for the technical support,  
 ■ More information about the support application can be found in Subsection 19.3.
- (13) – *Close project* – closes the currently opened project.

## 4.5 Quick Access Bar

The user interface consists of several basic parts. At the top there is a *Quick Access Bar* with the following elements:

- (1) – quick creation of a new project – *New*,
- (2) – opening an existing project – *Open*,
- (3) – saving files in an open project or saving a new project – *Save*,
- (4) – file import (e.g., previously scanned model) – *Import*,
- (5) – file export – *Export*,
- (6) – methods to Undo and Redo the last operation,
- (7) – allows you to customize the toolbar – *Customize the toolbar*.

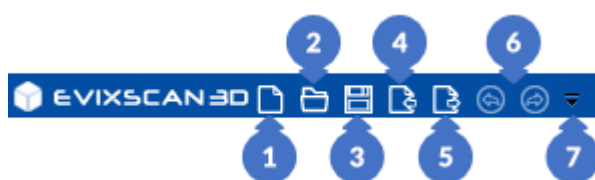


Figure 33. Quick Access Toolbar

In the middle of the quick access bar there is the name of the software along with the title of the currently opened project (if there is one that has been opened).

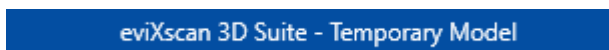


Figure 34. Quick access bar – name of the project

## 4.6 Main Tools Ribbon

Under the quick access bar there are tabs with appropriately categorized tools that are part of a given tab – the *Main Tools Ribbon*. The division into tabs and groups has been thought out in such a way as to show the user the various stages of work in the software in the logical order. The user should start the work from the left-most *Start* side menu, in which the scanning device will be configured, successively going to the next stages towards the right side, i.e. the calibration of the scanner and its verification, the scanning of the object (*3D scanning* tab), the processing of acquired scans (*Post-processing*) and eventually the completion of the process with the saving of the project and data export.



Figure 35. Tool ribbon – the main toolbar

## 4.7 The Model Tree

On the left side there is a panel with a tree containing all scans or groups of scans acquired during scanning (A) or imported from outside (B). Scans in the category (A) can be regenerated, but only in the situation in which all the data needed for such a regeneration has been saved on the disk. Scans from the second category (B) cannot be regenerated because they do not have the appropriate data (including photos) needed to reprocess them. The tree has two ways of displaying information: a standard mode – *STANDARD* (1) (Figure 36) where all the data is visible, and a compact mode – *COMPACT* (2) (Figure 37) where some additional information is not displayed to save the space on the screen.

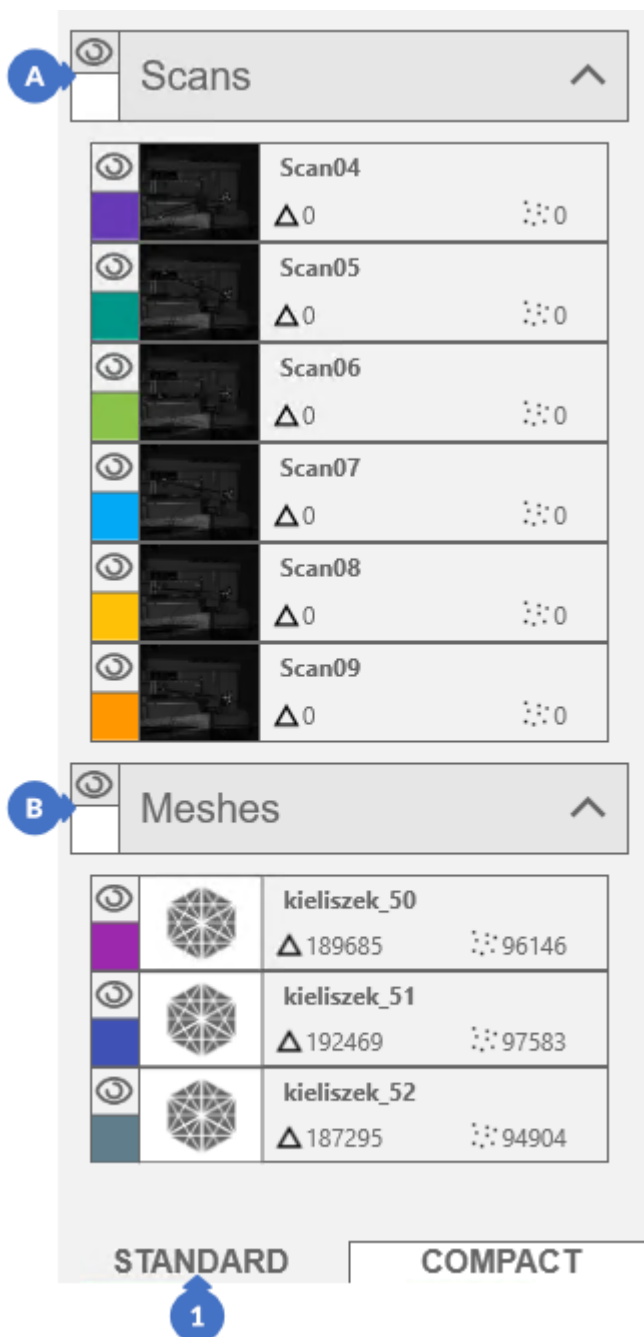


Figure 36. The Model Tree – standard view

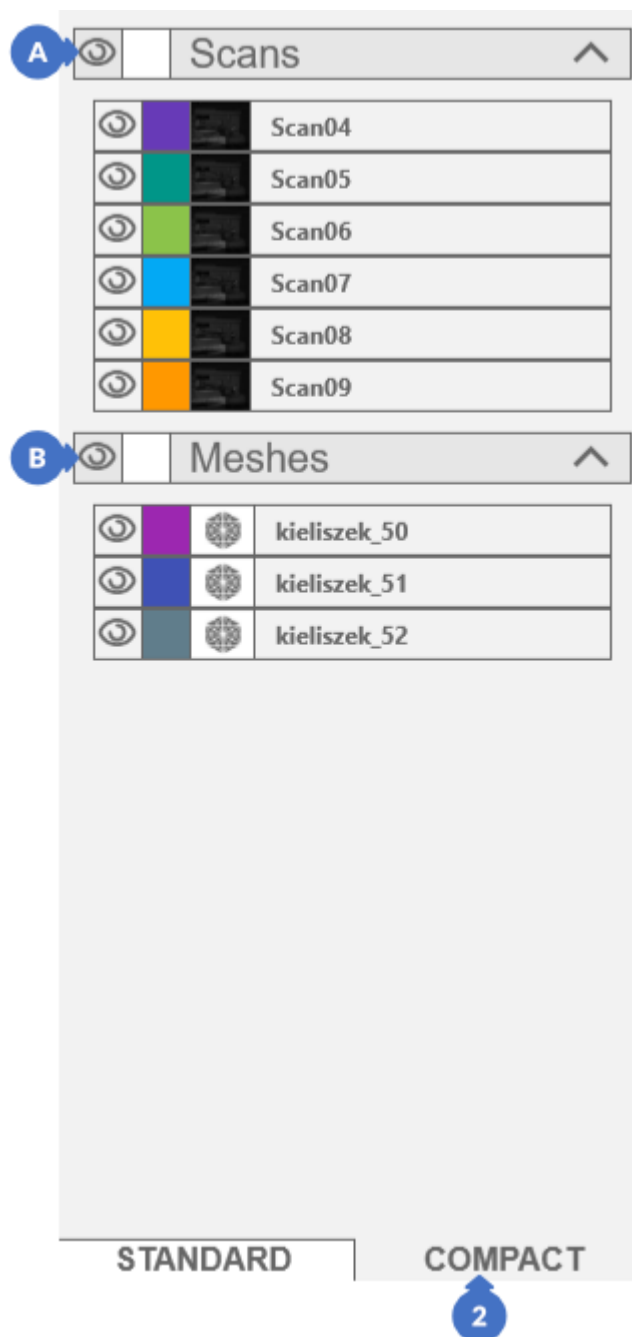


Figure 37. The Model Tree – compact view

A particular scan/mesh in *STANDARD* mode has the following information:

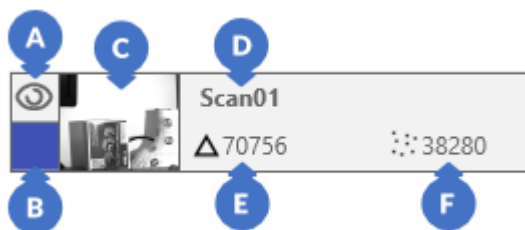


Figure 38. Components of the scan

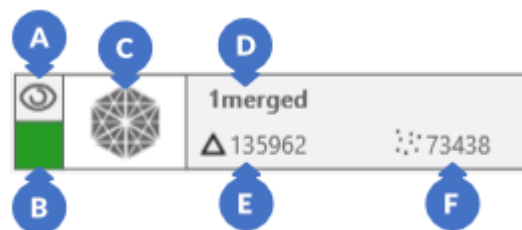


Figure 39. Components of the mesh

- (A) – button to show/hide scan in the 3D view,
- (B) – button to change the color of the scan,
- (C) – thumbnail on the left camera – in the case of a scan, the mesh has a default graphic,
- (D) – name of the scan/mesh,
- (E) – the number of triangles in the scan/mesh,
- (F) – number of points in the scan/mesh.

In the *COMPACT* mode, each scan/mesh contains only the information (A), (B), (C), (D).

## 4.8 Right Side (dynamic) Action Panel

On the right side of the window (depending on the selected tool from individual tabs and categories) a dynamic panel will appear for executing and changing the algorithm settings (1). A separate section in this manual is devoted to the settings of individual algorithms. Additionally, in the *Post-processing* tab, in the right part of the main window, there is the *Properties* button (2) used to view information about the selected scan in the tree.

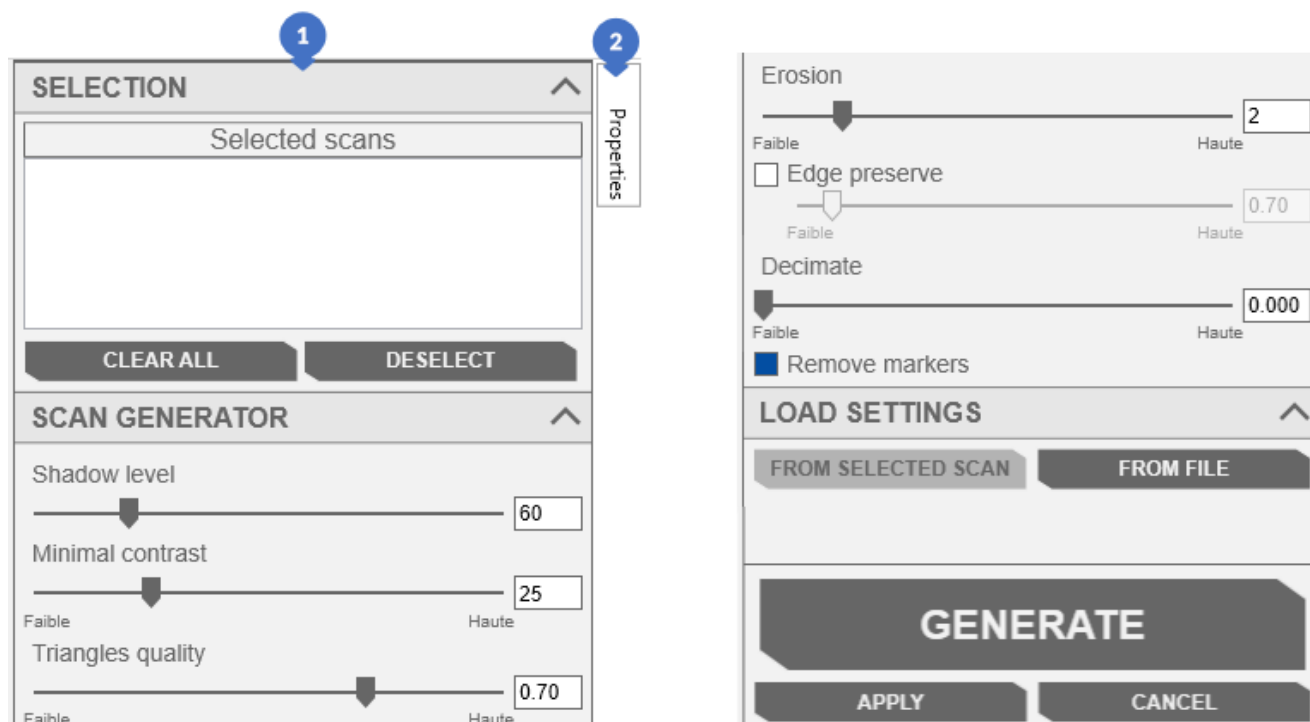


Figure 40. Panel for changing parameters and properties

The information displayed in the *Properties* tab depends on the type of scan and is divided into the following categories:

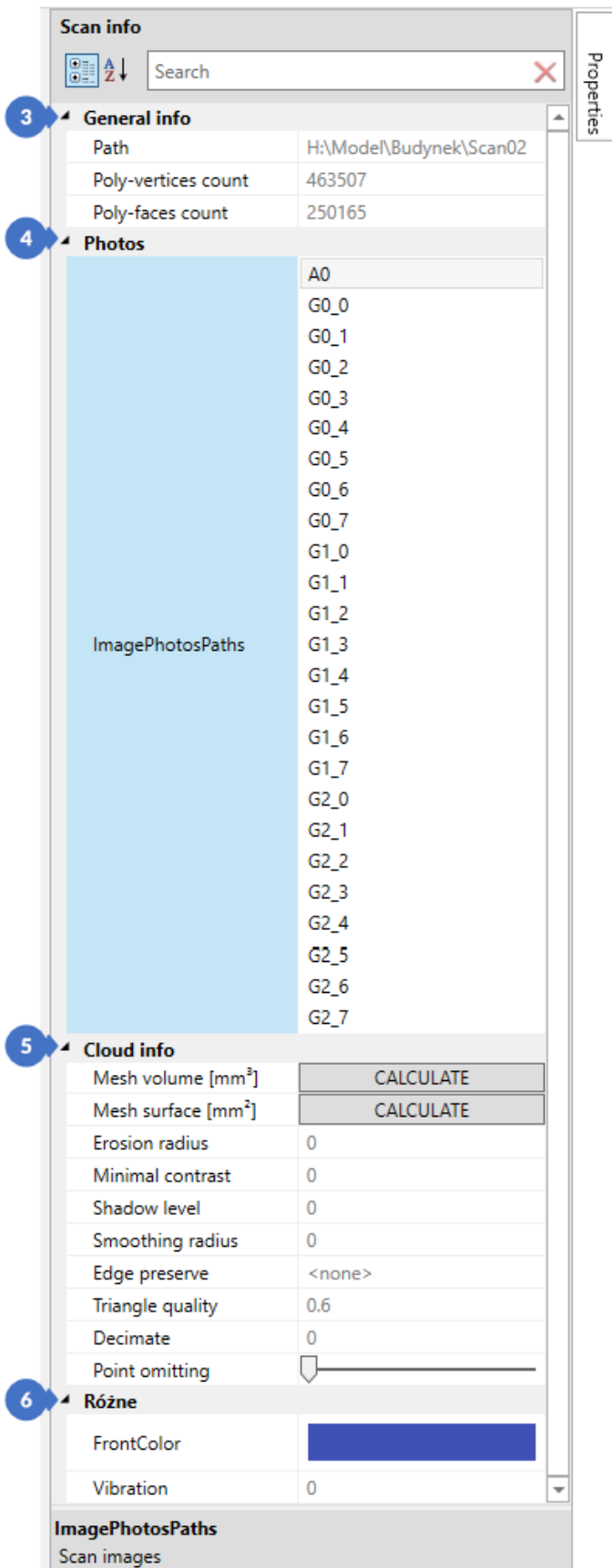


Figure 41. Properties of the scan

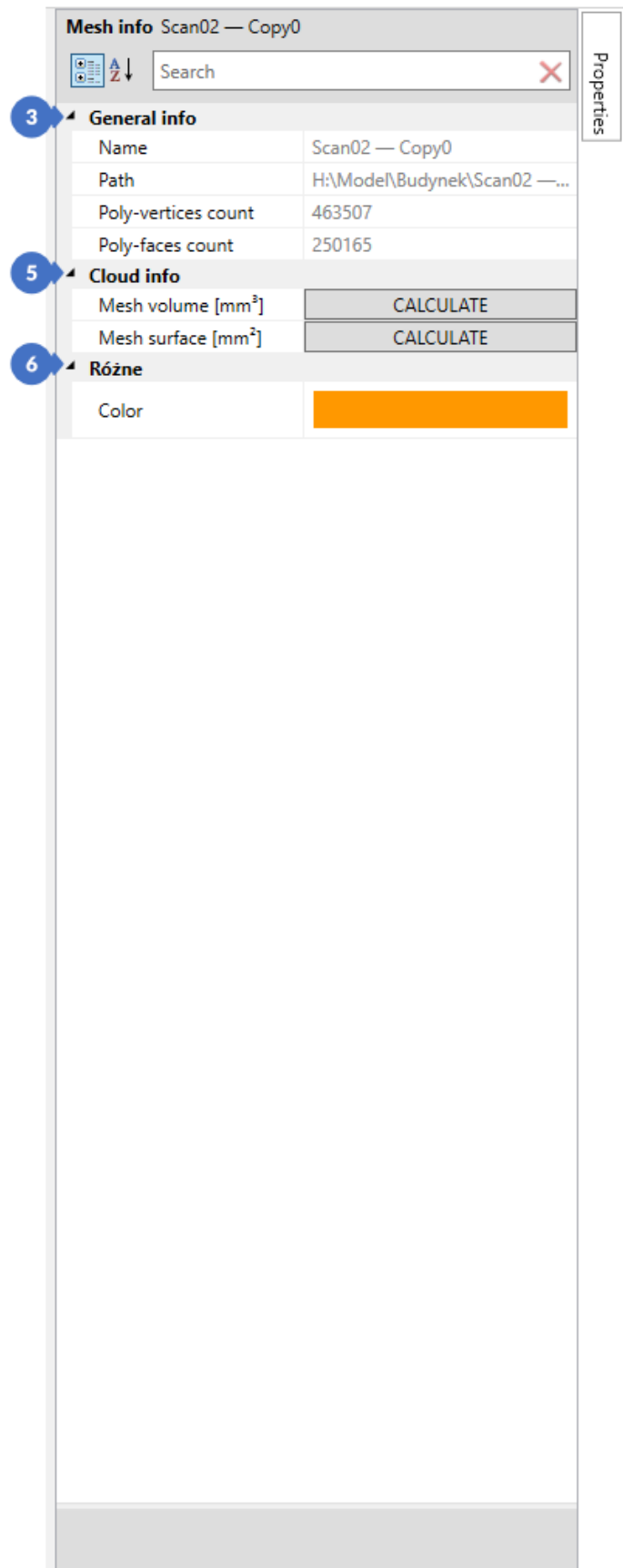


Figure 42. Mesh properties

- (3) The category *General info* includes:
  - (A) – *Name* – only in the mesh properties,
  - (B) – file path information (*Path*),
  - (C) – information about the number of vertices (*Poly-vertices count*),
  - (D) – information about the number of triangles (*Poly-faces count*).
- (4) – The photo list (*Photos*) contains the names of the photos taken. This category only appears in scans with information generated by *eviXscan 3D*.
- (5) – *Cloud info* contains information about the estimated volume and size of the scan area – the value appears after the conversion:
  - (A) – information about the presumed mesh volume (*Mesh volume*),
  - (B) – information about the expected mesh surface (*Mesh surface*).
 Information about the parameter settings used to generate the cloud – only in the scan:
  - (C) – *Erosion radius*,
  - (D) – *Minimal contrast*,
  - (E) – *Shadow level*,
  - (F) – *Smoothing radius*,
  - (G) – *Edge preserve*,
  - (H) – *Triangle quality*,
  - (I) – intelligent erosion (*Decimate*),
  - (J) – simple erosion (*Point omitting*).
- (6) – *Other* contains information about:
  - (A) – scan color (*FrontColor/Color*),
  - (B) – *Vibration* for scans.

### 4.8.1 Side (dynamic) Action Panel Modes

In some cases, the panel has two tabs at the bottom:

- (1) the *SIMPLE* mode has fewer complex options and some options are simplified comparing to the advanced mode to enable quicker start for non-experienced users,
- (2) the *ADVANCED* mode contains full set of options and settings as opposed to the *SIMPLE* mode.



Figure 43. Panel modes

## 4.8.2 The Wizard Mode

The wizard mode consists of several elements that are constant for each tutorial panel. Standard elements include:



Figure 44. Buttons for starting/ending work with the wizard

- (1) – the wizard start button that begins with the word *START* (in this case depicted on the Figure 44 the button *START CALIBRATION* starts the calibration process),
- (2) – the wizard finish button that closes the panel,

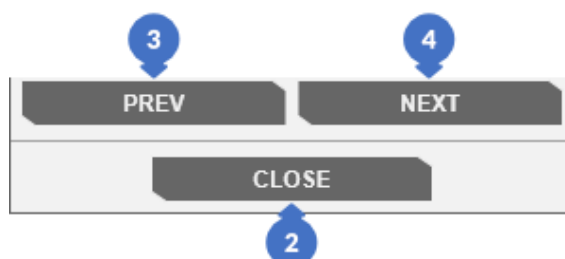


Figure 45. Wizard navigation buttons

- (3) – the previous step of the wizard (*PREV*), available only if it is possible to go back in the wizard,
- (4) – the next step of the wizard (*NEXT*), it is available only if it is possible to proceed to the next step of the wizard.



### NOTE

The *PREV* (3) and the *NEXT* (4) navigation buttons are visible throughout the wizard except for the wizard start view. Sometimes these buttons are also not visible in the view ending work with the wizard. The *CLOSE* button (2) is always visible.

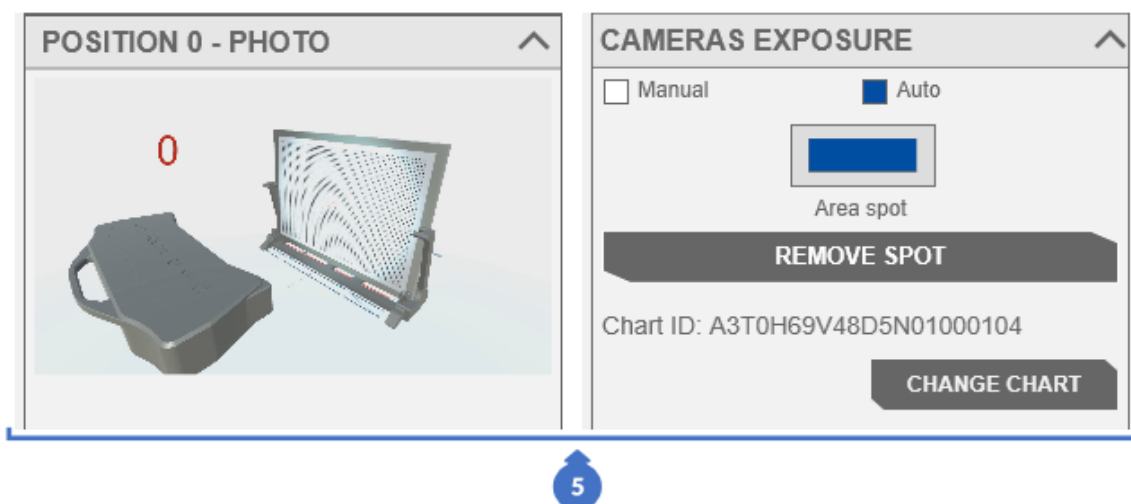


Figure 46. Step content

Above the navigation buttons there is the area displaying the content of a given step (5). It contains parameters and options that can be modified within the step. It often happens that at the top there is a looped animation showing in a simplified way how to use the parameters below or what steps should be taken to proceed to the next part of the wizard.



## 4.9 Main Window

In the middle there is a window with several modes depending on the selected tab or option (in a given tab).

### 4.9.1 Preview from Cameras

The preview mode from cameras is available in the *3D scanning* tab. It allows to check what the scanner "sees" in the real time. This feature facilitates the choice of correct scanning parameters for the environment in which the scanned object is located.

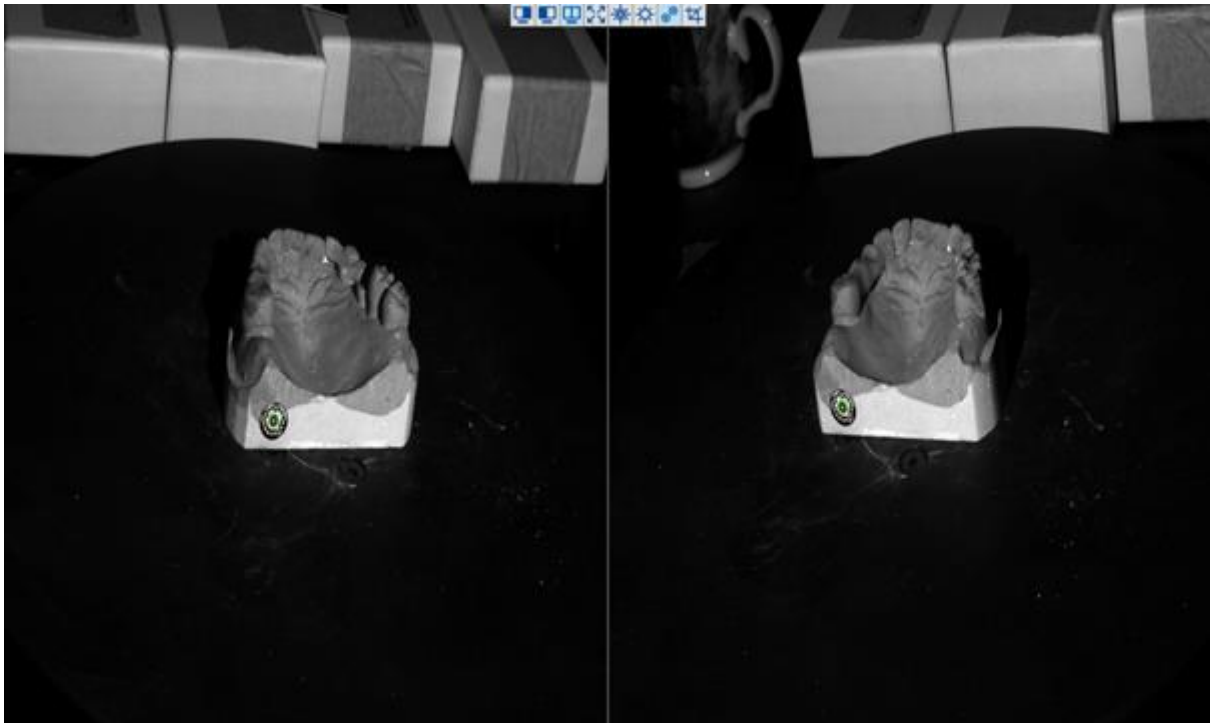


Figure 47. Preview from cameras

In the camera preview mode, there is a toolbar in the upper part of the window with the following options:

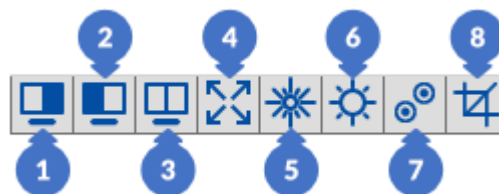


Figure 48. The toolbar is visible in the camera preview mode

- (1) – *Left camera* enables preview only from the left camera,
- (2) – *Right camera* enables preview only from the right camera,
- (3) – *Multi cameras* enables preview from both cameras (this is the default mode),
- (4) – *Zoom* enables/disables the possibility of enlarging/reducing the displayed image,
- (5) – *Overexposed pixels* enables/disables the detection and display of overexposed areas (marked in red),
- (6) – *Underexposed pixels* enables/disables the detection of underexposed areas (the underexposed area in the preview becomes transparent),

- (7) – *Show markers* enables/disables the algorithm for detecting and selecting markers in the preview from cameras,
- (8) – *Select scanning area* enables/disables the possibility of selecting the scanning area (*ROI - Region of Interest*).

Enabling options (5) and (6) makes it easier to adjust the exposure and brightness parameters of the projector.

## 4.9.2 3D View (Viewer)

3D view mode – *Viewer* is visible mainly after selecting the *Post-processing* tab. This mode enables the preview of all existing scans (meshes) and perform basic operations, e.g., removing fragments of scanned or imported models.

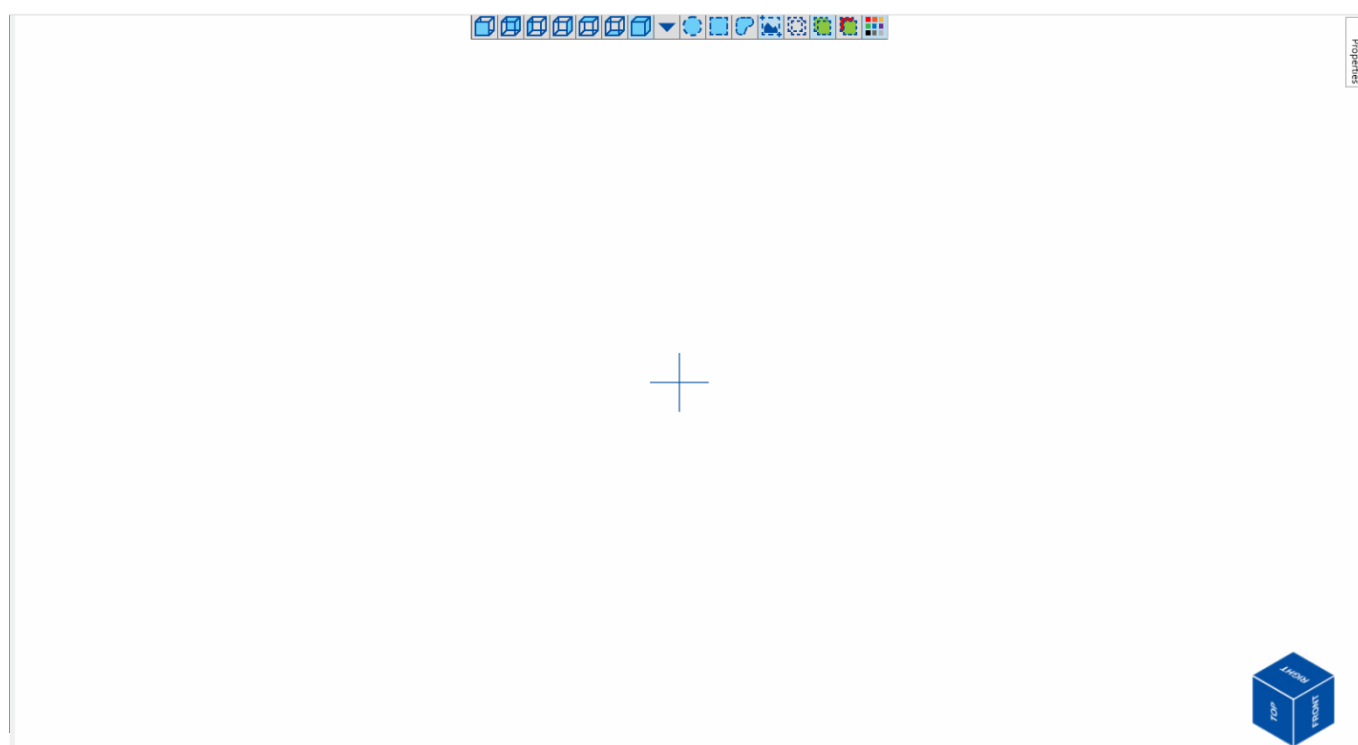


Figure 49. Viewer – the middle window of the application

The virtual cube in the lower right corner informs about the representation of the object in the 3D coordinate system.



Figure 50. Virtual cube representing a position in a 3D coordinate system

The scans rotate around the crosshair that represents the center of the view.



Figure 51. Crosshair – the center of rotation of the scans

🚩 Moving in 3D space is described can be found in Subsection 6.1.

The middle view window has a separate toolbar.

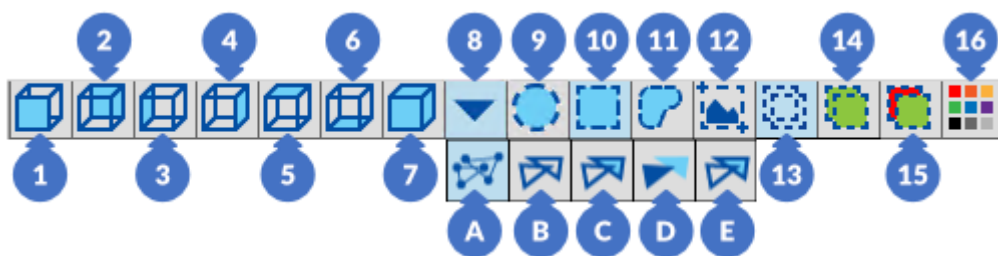


Figure 52. Toolbar of the middle scan preview window

This bar is used to change the model view according to defined projections:

- (1) – *Front*,
- (2) – *Back*,
- (3) – *Left*,
- (4) – *Right*,
- (5) – *Top*,
- (6) – *Bottom*,
- (7) – *Isometric*,

and the ways to present the mesh (8):

- (A) – a view represented by pixels (*Show pixels*),
- (B) – a view represented by thick mesh without filling (*Show thick wires*),
- (C) – a view represented by the surface (mesh filled) (*Show surfaces*),
- (D) – a view represented by smooth surface (*Triangles smooth*),
- (E) – a view representing a surface with bold edges - mesh with filled (*Show surface with edges*),

and selection methods:

(9) – *Circle selection mode,*

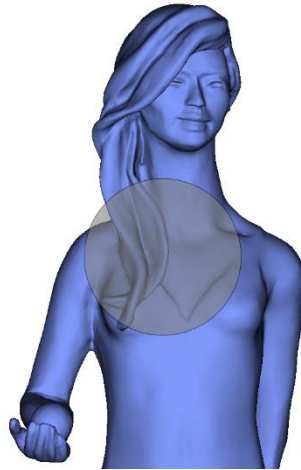


Figure 53. Selecting with a circle

(10) – *Rectangle selection mode,*

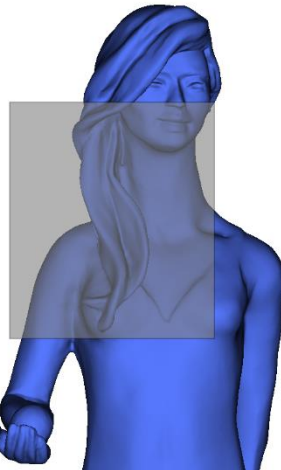


Figure 54. Select with rectangle/square

(11) – *Lasso selection mode,*

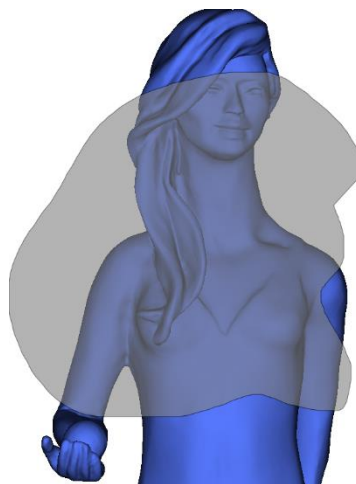


Figure 55. Marking with a lasso - a hand-drawn curve

(12) – all adjacent surfaces forming a whole from small clusters (*Cluster selection*),

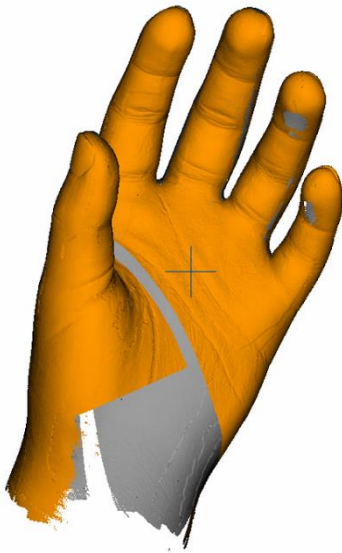


Figure 56. Before selecting the clusters

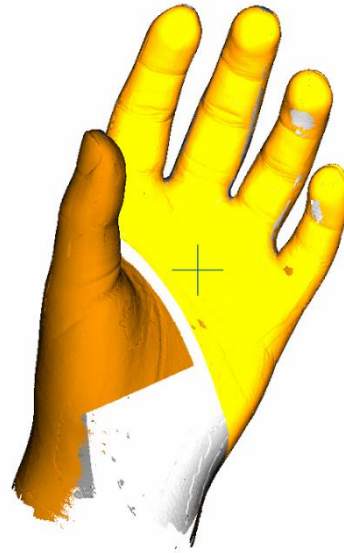


Figure 57. After selecting the clusters

selection mode:

- (13) – *Select through* visible and invisible parts of the scans - the option is selected by default,
- (14) – *Select only visible* part of the scans omitting invisible parts based on scanner coordinates,
- (15) – only the inside – back part (*Select backfaces*),

and others:

- (16) – *Multicolor mode* / color mixing (both in the tree and in the view) to increase the visibility of individual scans. Automatically changes colors throughout the design to random colors from the available color palette.



Figure 58. Multicolor/color blend mode disabled



Figure 59. Multicolor/color blending mode enabled

### 4.9.3 Photo Preview

Photo preview is used to preview the image captured by cameras – from the right and left cameras. To visualize the photos of the scan, select one of the scans in the tree (in the panel on the left) by clicking on it with the left mouse button. The scan field should be highlighted in a bluish color.

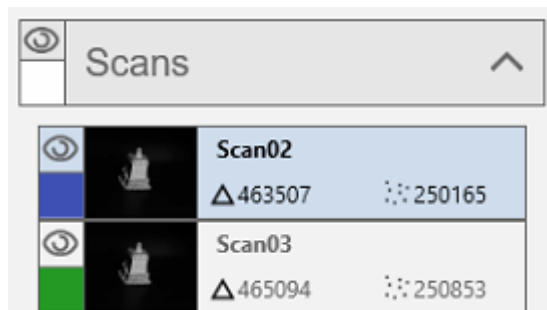


Figure 60. The selected scan

#### **i** NOTE

*Photo preview only works for scans (which have photos) in the Scans group. The scans (meshes) in the Meshes group do not have the corresponding photos, therefore it is not possible to bring up the preview window. The photo preview is also visible for the calibration photos (cf. the calibration section in this manual (Figure 64 and Figure 65)).*

Then, in the *Post-processing* tab on the right side of the main eviXscan 3D Suite window, the *Properties* tab should be opened with basic information about scans/meshes.



Figure 61. Button that opens the tab with properties

If the selected scan has the corresponding photos, the *Photos* list will appear in the *Properties* window.

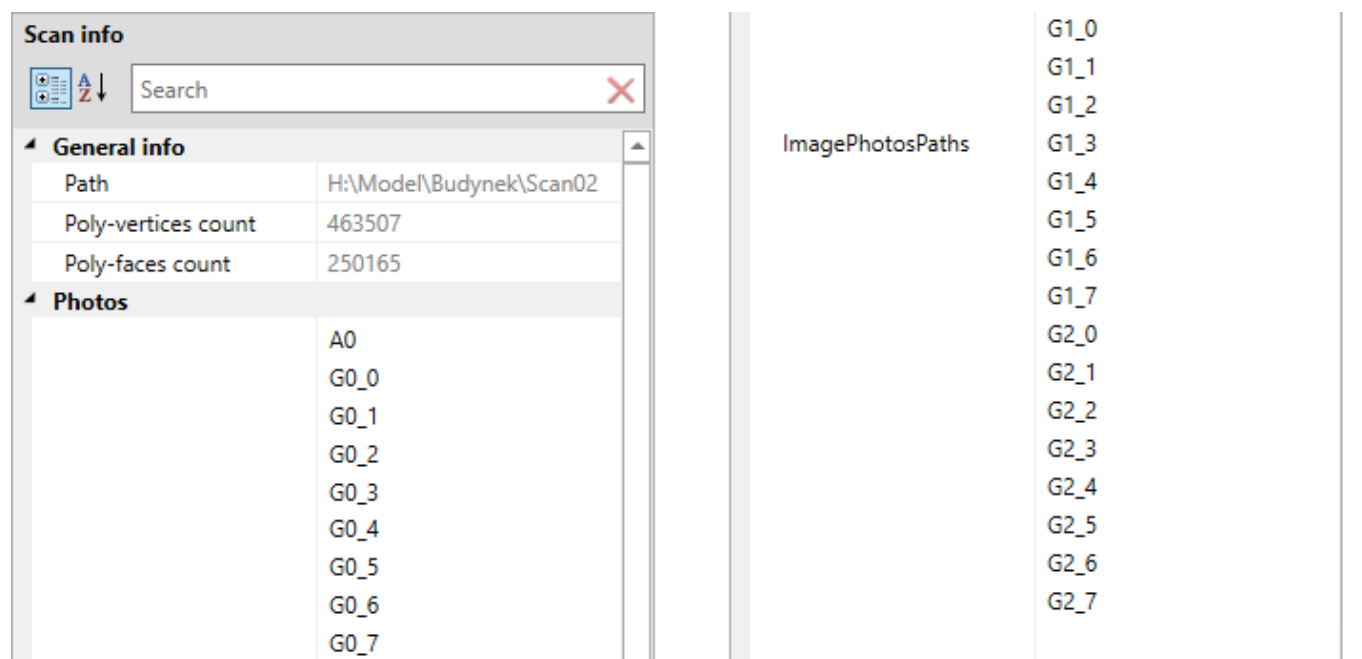


Figure 62. Scan Properties – Photos list

The election of any of the available items in the panel can be done by clicking on a given name. The selected name will become highlighted.

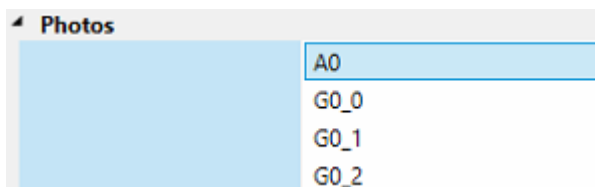


Figure 63. The selected photo in the property panel



The photo preview for the right and left cameras will be displayed simultaneously in the middle window.

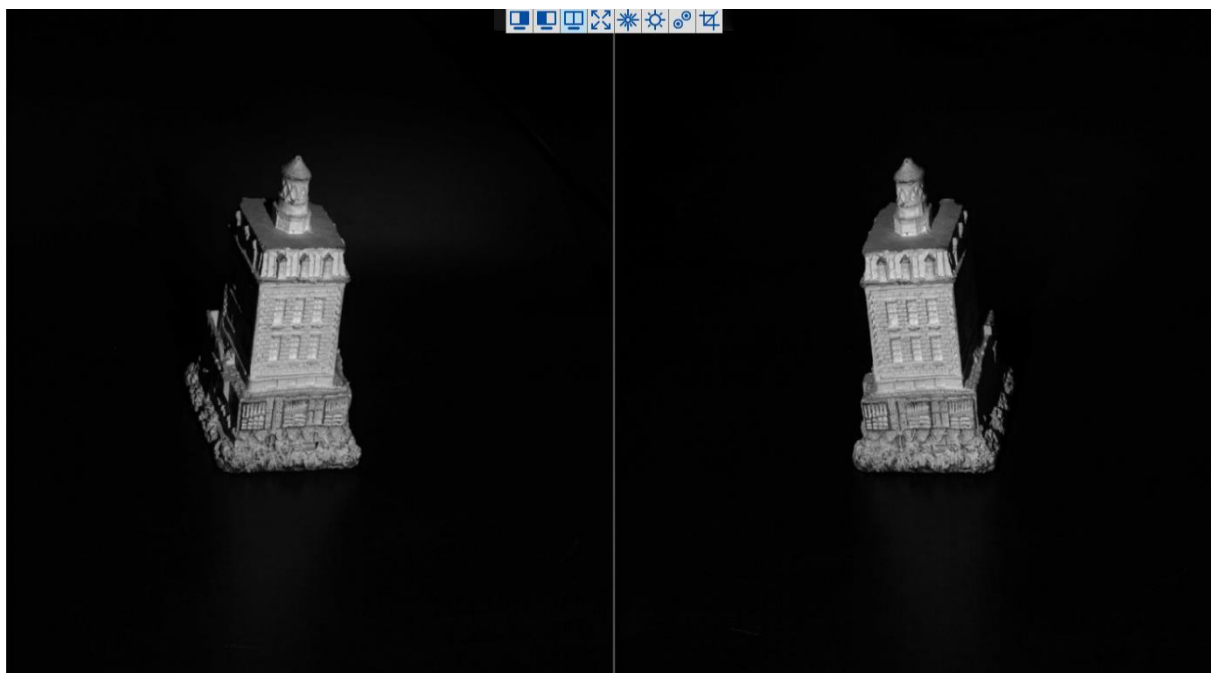


Figure 64. Preview of scan photos

With the properties tab open, you can navigate through the names of the photos using the arrows on the keyboard (up and down). The same options work on the preview from the photos as on the preview from the cameras, even in the middle window you can see the same toolbar as described in Section above.

More information about the toolbar can be found in Subsection 4.9.1.

The photo preview window is also visible when selecting the calibration photo preview from the *Scanning*, *Calibrate* tab in the *Calibration* category by selecting a photo from the tree (cf. the tree containing calibration photos in the manual (Figure 112)).

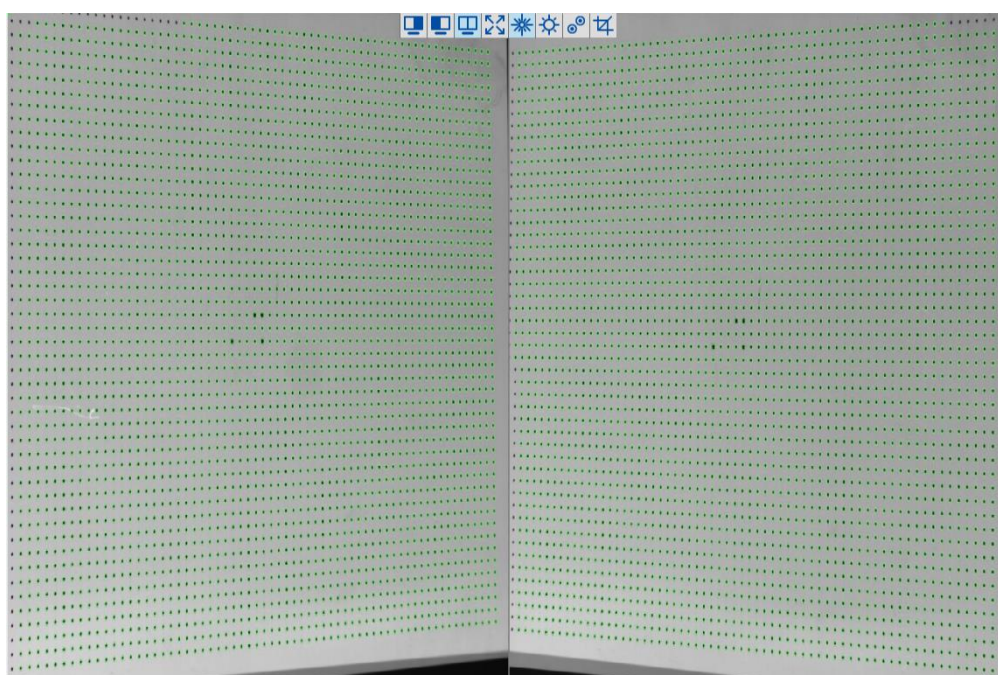


Figure 65. Calibration photo preview



## 4.10 Information Bar

At the very bottom of the eviXscan 3D Suite main window, there is an information bar that informs you about the plugged-in dongle with an active license (1).



Figure 66. Information bar – hardware key status

In addition, the information on ongoing operations or errors is displayed on that bar. The default color is blue. Besides blue, there are other colors in use, with the following meaning: yellow (neutral) – informing e.g., about the process being currently performed (2), green (positive) – informing about the successful completion of the process (3) and red (negative) – informing about an error (4).



Figure 67. Information bar – types of information

## 5 GLOBAL SETTINGS

### 5.1 Options

The Options in the *Start* menu have tabs that divide each option into categories.

#### 5.1.1 General Options



Figure 68. General settings tab

There are four groups in these *General options* tab (1).

##### 5.1.1.1 Cameras

The first is the *CAMERAS* group (2) and, as the name suggests, it relates to the camera settings.

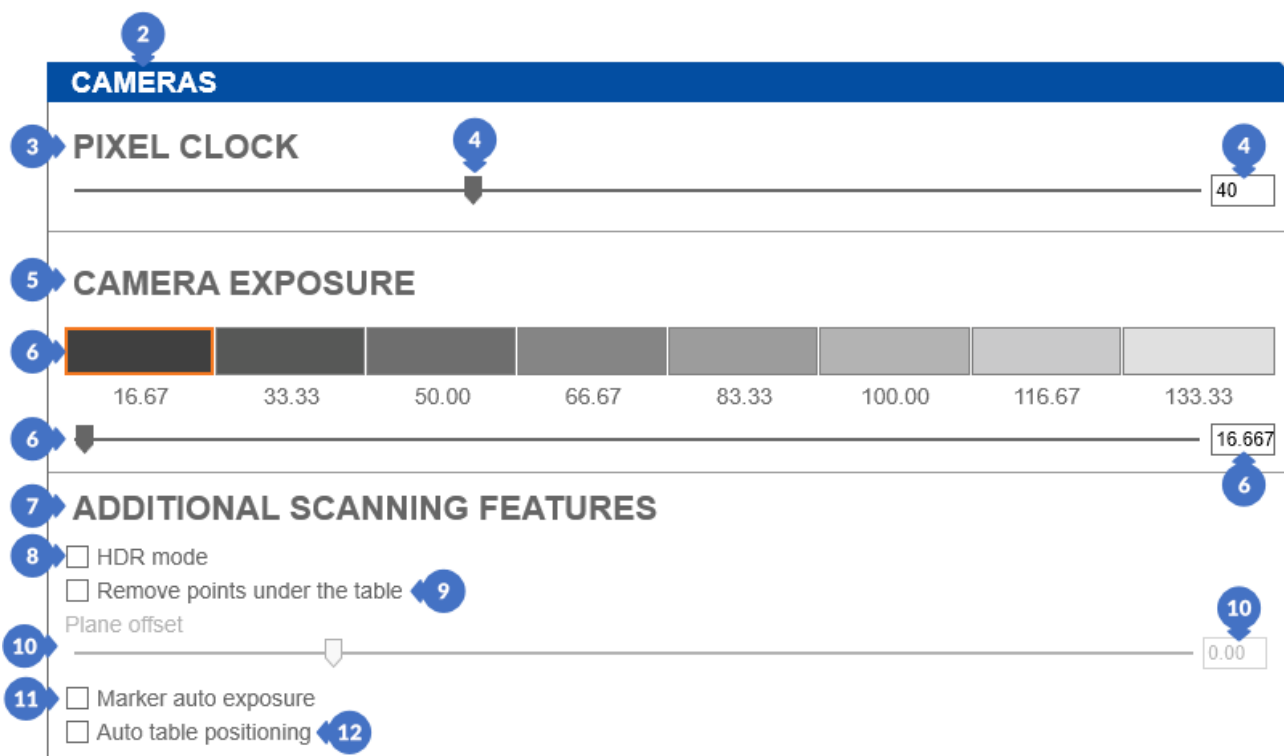


Figure 69. Camera settings

Groups have their headings informing about the category, we distinguish the following categories:

- (3) – *PIXEL CLOCK* category is used to set the parameter (4) responsible for the maximum speed of reading data from the camera sensor. The higher the parameter value, the faster the image capture but bigger communication load between the camera ports and the computer ports.

**i NOTE**

Higher pixel clock values (4) require a stable and faster connection between the cameras and the computer's USB ports.

- (5) – *CAMERA EXPOSURE* contains tiles (6) for selecting the defined exposure values (more information about exposure can be found in Section 9),
- (7) – *ADDITIONAL SCANNING FEATURES* has *HDR mode* (8) for introducing several exposures to obtain the highest possible level of details from the scanned object. Another available mode is *Remove points under the table* (9). This mode is intended for scanning with a rotary table and (as the name suggests) it defines the position below which the points are deleted from the scan. After selecting this option, the *Plane offset* slider (10) is activated for setting the cutting position. The default value is 0, the minimum value is -3 and the maximum value is 10. The slider can be set with an accuracy of 0.01. The second last option is *Marker auto exposure* (11) – an option for automatic selection of exposure for marker photos. Selecting this option automatically hides and deactivates *Marker photo enabled* - the option described in subchapter 5.1.1.2 point (16). The *Auto table positioning* field (12) is used to start the automatic positioning of the rotary table in panels with the *START POSITIONING* option – clicking on this button will trigger the automatic positioning process.

More information about HDR mode can be found in Subsection 15.1.7.

More information about positioning mode can be found in Subsection 14.2.

### 5.1.1.2 Acquisition Parameters

The next group in this tab is *ACQUISITION PARAMETERS* (13).

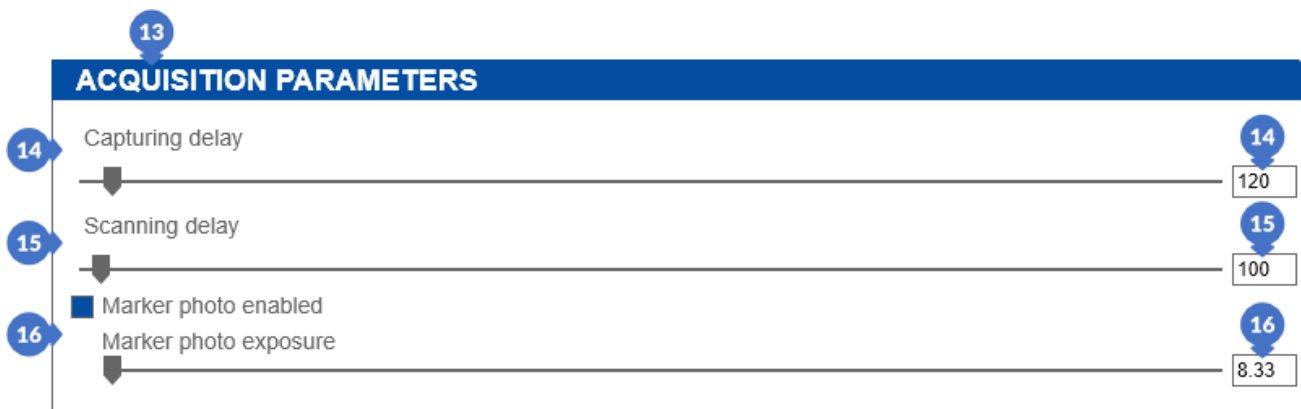


Figure 70. Acquisition parameters settings

Slider *Capturing delay* (14) responsible for delaying capturing (taking) photos. The value of this parameter is given in milliseconds and has values from 60 to 2000 ms. This delay is necessary for the projector to display a new pattern. If the delay time is set too low, it may happen that some of the photos will have the same pattern as the previous photo, which is obviously not correct.

**i NOTE**


Assuming that 25 photos are taken per scan with a delay of 120 ms, it must be assumed that the scanning time will not be shorter than 3 seconds.

*Scanning delay* (15) is a parameter necessary when using a rotary table. Thanks to it, it is possible to wait (for a defined time) for the scanned object (and the rotary table) to stabilize after the rotation of the table. It is necessary to perform a more stable, thus more accurate scan. This parameter can have values ranging from 0 to 5000ms.

**i NOTE**

*The smaller the scanning delay, the greater the probability that the performed scan will be less accurate because of the potential object movement.*

The *Marker photo enabled* checkbox (16) (Figure 70) is used to save an additional photo of markers with the shutter speed value set with the slider (cf. more on exposure in the Section 9). The *Marker photo enabled* slider can have values ranging from 1 to 300 ms. This option is invisible when *Marker auto exposure* from the camera parameter settings (*CAMERAS*) is active. Thus, the option of saving additional photos will be active and the exposure of marker photos will be adjusted automatically.

 More information about cameras parameters can be found in Subsection 5.1.1.1.

### 5.1.1.3 Scan Generator

The third group in *General options* tab is *SCAN GENERATOR* (17) (Figure 71) which contains the following parameters:

- (18) – *Shadow level* is responsible for skipping all pixels (found in A0 photo) below the indicated value while generating a point cloud. Its minimum value on the slider depends on the set value of the minimum contrast (20). The maximum value of the slider is 200,
- (19) – *Minimal contrast* defines the minimum difference between the smallest and the largest pixel value in the phase images<sup>3</sup> (all images in the scan except the A0 mark). All pixels below the value defined by this parameter will be omitted when generating the point cloud. The slider of this parameter takes values from 0 to 100,
- (20) – *Triangle quality* – parameter responsible for the type of generated triangles. The higher the parameter value, the more equilateral and less irregular triangles will be generated. The range of this slider is from 0.00 to 0.99,
- (21) – *Erosion* is a parameter responsible for the elimination of noise, jagged narrow edges ("branches") and, consequently, reduces the object and widens "holes" in the incoherent areas. The higher the parameter value, the more mesh edges are removed. The parameter slider takes values from 1 to 7,
- (22) – *Edge preserve* – this parameter prevents the destruction of edges by removing incorrectly generated points on the edges. Increasing this parameter will increase the number of generated points, including incorrect points. When the points on the edges are not generated correctly, the value of this parameter should be decreased. However, it is too low value will cause the removal of correctly generated points. When the parameter is active, its value on the slider may range from 0.5 to 3.0,
- (23) – *Decimate* is a parameter responsible for smart reduction of the number of mesh points. On flat surfaces, it causes the formation of large triangles,
- (24) – *Remove markers* – selecting this parameter will automatically remove markers after generating the cloud.

---

<sup>3</sup> Phase photos are the patterns displayed by the projector before the scan, which are strips of different spacing and thickness.

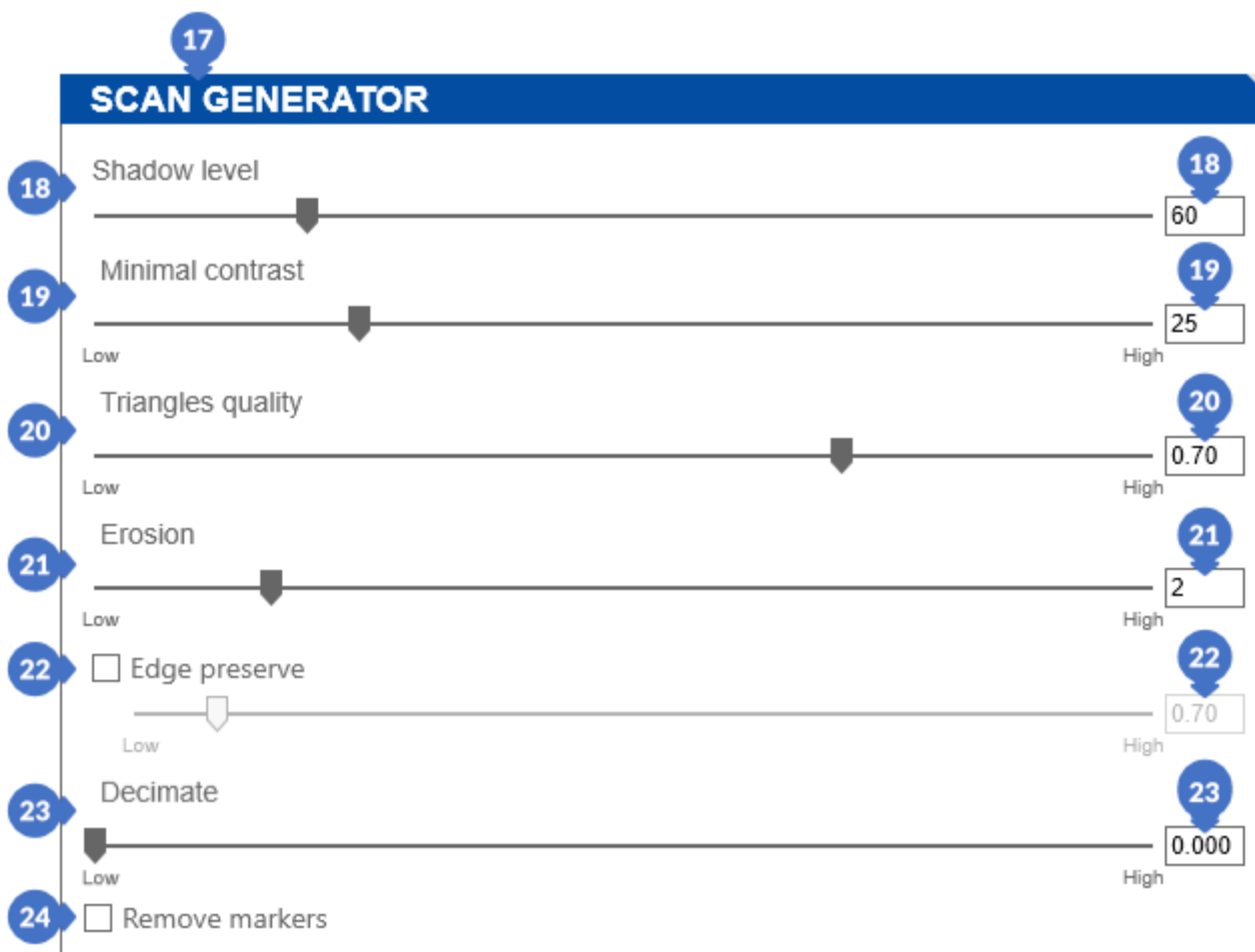


Figure 71. Scan generator settings

Any changes to the scan generator settings are recommended for experienced users, as improper selection of parameters will cause problems in generating the scan meshes.

#### 5.1.1.4 Data

The last group of parameters in the *General options* tab is *DATA* (25), which is responsible for the data recording method. The *File type* parameter (26) is responsible for the extension of the saved scan file (it can be a lightweight .ply file, or a former format of the eviXscan .evx file – not recommended).

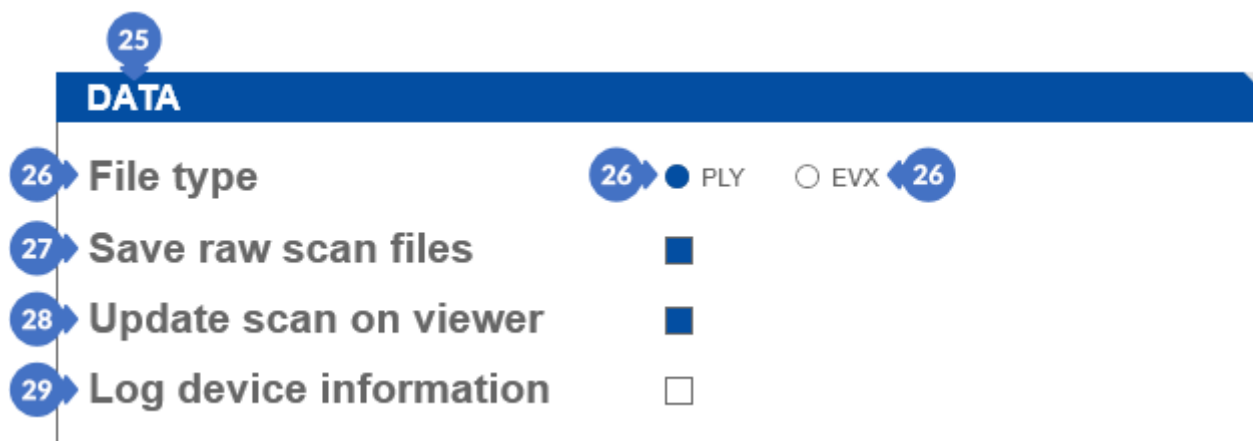


Figure 72. Data management settings

The *Save raw scan files* (27) parameter is used to save scan photos, it is recommended to leave the save option turned on.

**i NOTE**

*This parameter can be unchecked to reduce the weight of scans but turning it off will disable the possibility of regenerating the scan later.*

*Log device information* (29) is an optional parameter that is important in case there are any problems on your computer. Selecting this option and then saving the log file (more about saving log files can be found in Section 19.2) will allow programmers to solve the problem faster, because it will allow technicians to receive the full specification of the device on which the software is installed.

### 5.1.1.5 Description Panel

In addition to the groups described above, there is the *DESCRIPTION* panel (30) on the right side of the tab with parameter descriptions after hovering over a given group.

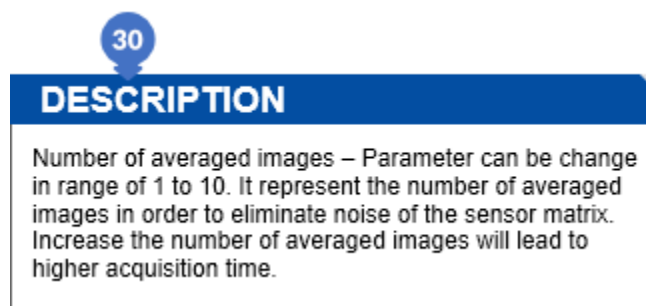


Figure 73. Description panel of individual parameters (example)

Below the description panel there is a *RESET OPTIONS* (31) button used to reset all changes made to default values.



Figure 74. Reset button for bringing back default values of all parameters

### 5.1.2 View Tab



Figure 75. View settings tab

### 5.1.2.1 Mesh Display Method

There are three groups in the *View settings* tab (1) (Figure 75). The first is the *MESH DISPLAY METHOD* (2) (Figure 76) group which is used, among others, to change the representation of the scan view to:

- (3) – *Pixels*  
☒ The equivalent of this option is *Show pixels* (A) from Subsection 4.9.2.
- (4) – *Thick wires*  
☒ The equivalent of this option is *Show thick wires* sub-item (B) from Subsection 4.9.2.
- (5) – *Surface*  
☒ The equivalent of this option is *Show points* sub-item (C) from Subsection 4.9.2.
- (6) – *Triangles smooth*  
☒ The equivalent of this option is *Show points* sub-item (D) from Subsection 4.9.2.
- (7) – *Surface with edges*  
☒ The equivalent of this option is *Show points* sub-item (E) from Subsection 4.9.2.

Clicking on one of the five buttons described above will highlight it in a navy blue color.

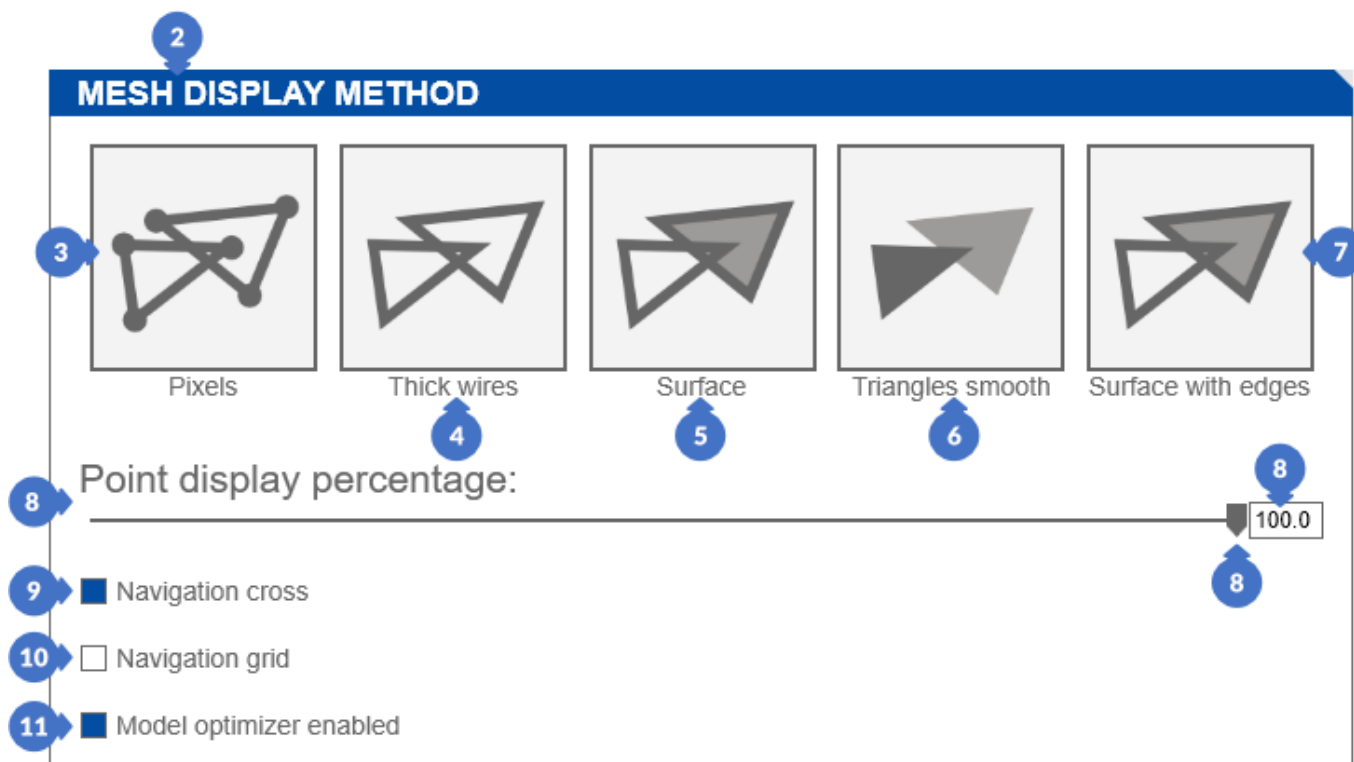


Figure 76. Grids display method settings



Below is the view of the selected option representing the grid in the view.

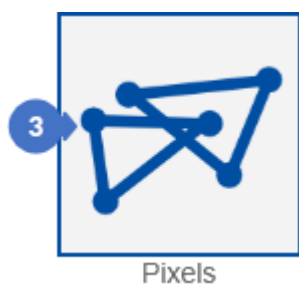


Figure 77. Selected view represented by pixels

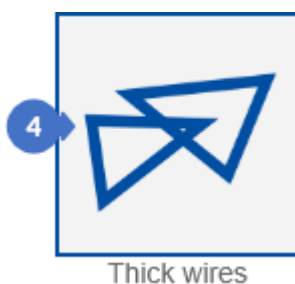


Figure 78. Selected view represented by thick wires

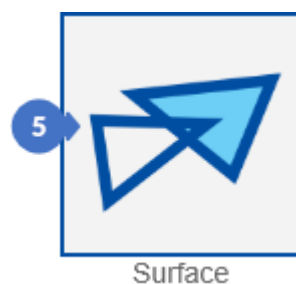


Figure 79. Selected view represented by surfaces

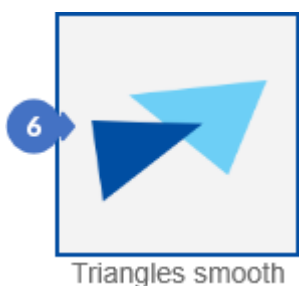


Figure 80. Selected view represented by triangles smooth



Figure 81. Selected view represented by surface with edges

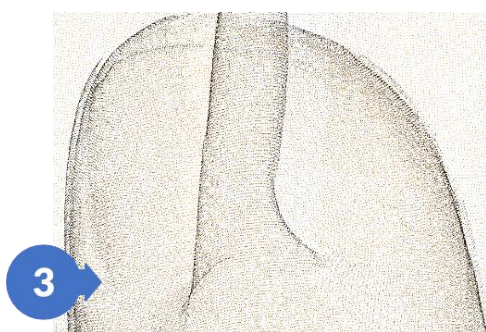


Figure 82. View represented by pixels



Figure 83. View represented by thick wires

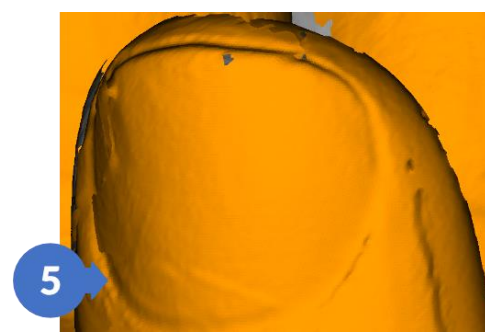


Figure 84. View represented by surfaces

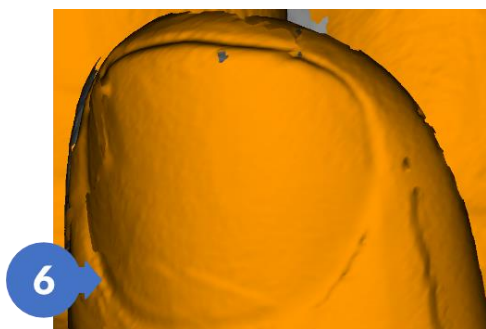


Figure 85. View represented by triangles smooth

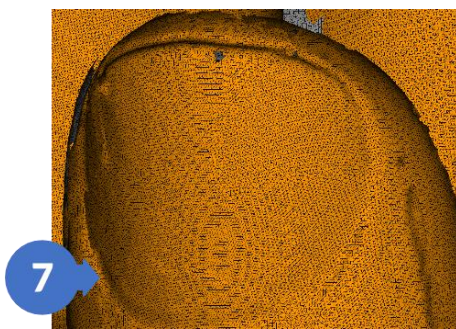


Figure 86. View represented by surface with edges



The *Point display percentage* (8) is used to change the number of displayed points. This option is useful for projects with many scans, where the parameters of the subassemblies are no longer sufficient to smoothly move around the view. The slider for this parameter ranges from 1 to 100%. The change in the value of this parameter is best seen in the scatter representation of the scan.

The principle of the *Point display percentage* (8) slider can be seen in the pictures below.

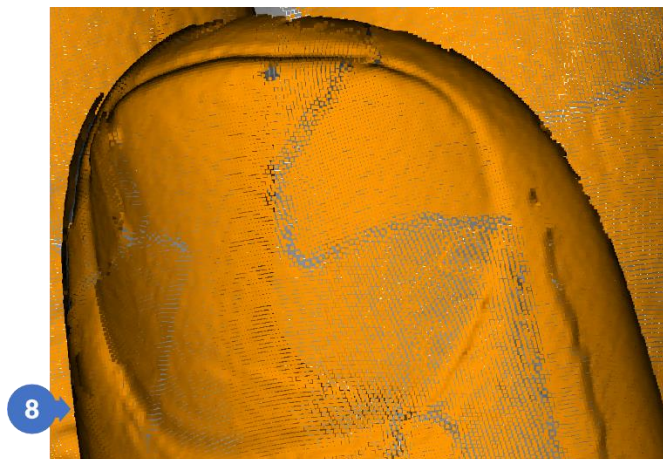


Figure 87. 100%-point view

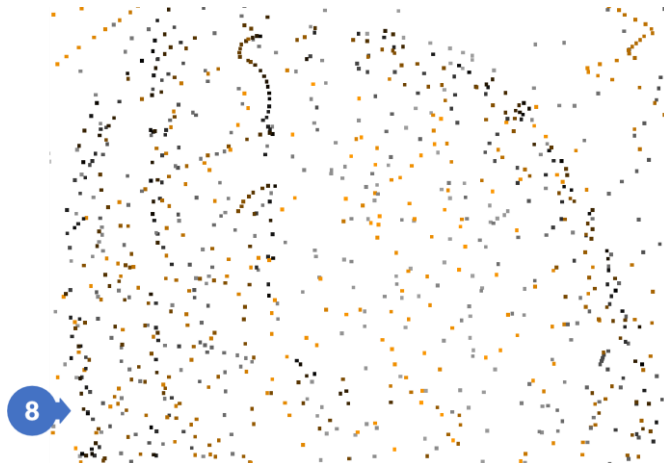


Figure 88. 1%-point view

The *Navigation cross* (9) option is used to display a graphical representation of the pivot point around which the scan will be rotated. If this option is selected, the graphical representation of the pivot point is visible. If it is disabled – the pivot point is not visible, but the principle of handling the scan does not change. A graphic plus-shaped representation is shown in the pictures below.

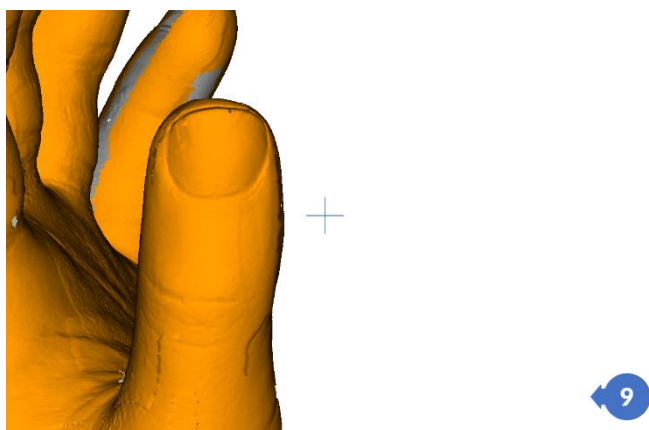


Figure 89. Navigation cross option turned on

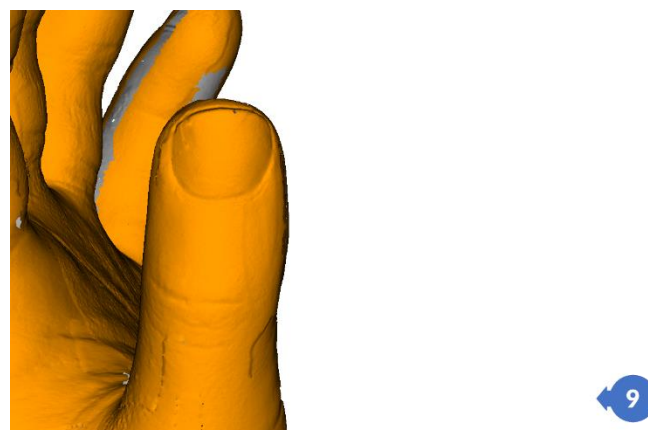


Figure 90. Navigation cross option turned off

The option *Navigation grid* (10) works similarly to *Navigation cross*. When this option is selected, a grid is displayed in the view. If it is off, the mesh is hidden.

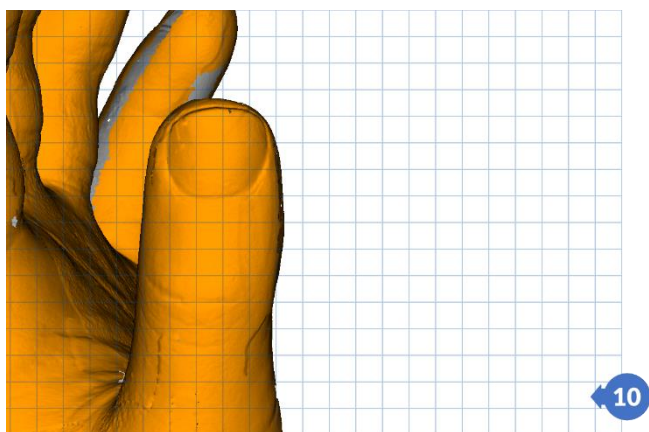


Figure 91. Navigation grid option turned on

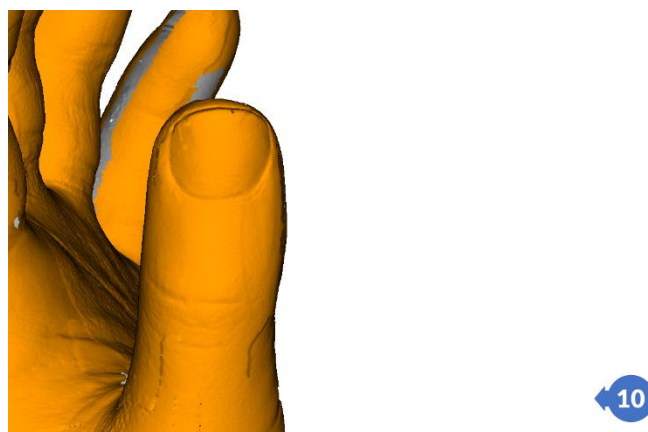


Figure 92. Navigation grid option turned off

The last option in this group is *Model Optimizer Enabled* (11) (Figure 76), when the zooming in, zooming out or rotating the scan is selected, it causes a short-term change of the display to a reduced number of points, which speeds up the performed action. After the transition is finished the view of scan display comes back to the normal operation. By disabling this option, the above visualization effect is invisible, but the specific actions on the display require more computer resources to be executed.

### 5.1.2.2 Model Tree

The next group is the *MODEL TREE* (11) that allows you to change the way the information is represented in the tree between *Standard* and *Compact* views (12).

More information about the representation of information in the tree can be found in Subsection 4.7.



Figure 93. Setting the method of information representation in the tree

### 5.1.2.3 Language

In the group *LANGUAGE* (13) you can select the language of the software (14). Currently, it is possible to select either English (default) or French.



Figure 94. Software language selection

### 5.1.2.4 Colors

The last group is the *COLORS* group (15) enabling the modification of the representation of the default scan grids and the background view.

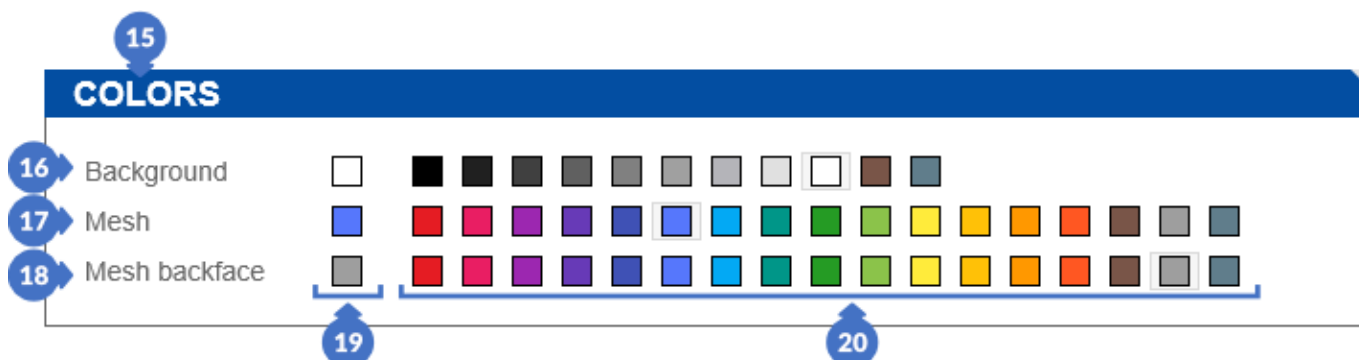


Figure 95. View color settings

*Background* (16) parameter allow to change the color of the display (screen background). *Mesh* (17) is the default color of the scan front (in case the group does not have a different color). The *Mesh backface* (18) is the color of the back of the scan. The colors in position (19) show the current selection of colors for the background, the mesh and the mesh backface. The available color palette is in position (20). Clicking on a color in each row assigns it to a specific parameter.

In addition to the above groups, the tab has a description of individual parameters *DESCRIPTION* and a *RESET OPTIONS* button to restore default settings.

More information about the description of individual parameters *DESCRIPTION* can be found in Subsection 5.1.1.

### 5.1.3 Hardware Tab



Figure 96. Hardware settings tab

### 5.1.3.1 Camera and Projector Drivers

In the hardware settings tab (*Hardware*) (1) (Figure 96) there is a group with the option of enabling / disabling support for *CAMERA DRIVERS* (2).



Figure 97. Camera drivers support settings

**i** **NOTE**  
Any change to the above settings may disturb the proper operation of the scanner. It is necessary to restart the software after changing the state (switching on / switching off) of available controllers in the group.

## 5.2 Configuration

The *Configuration* tab can be accessed by the *Start* menu and has various options in the respective categories.

### 5.2.1 Scanner Tab



Figure 98. Scanner settings tab

### 5.2.1.1 3D Scanner Configuration

The *Scanner* tab (1) (Figure 98) contains the scanner settings. The *3D SCANNER* group (2) (Figure 99) located in the *Scanner* tab has the following elements:

The screenshot shows the '3D SCANNER' configuration window. It includes a 'LIGHT SOURCE' dropdown menu (3) with a 'CONFIGURE ETHERNET' button (4). Below is a table of '3D SCANNERS' (5) with columns for Name (A), Created (C), Last scanner calibration (D), and Camera resolution (E). To the right of the table are four action buttons: 'USE SELECTED' (6), 'REMOVE' (7), 'RE-CALIBRATE' (8), and 'ADD NEW' (9).

Name	Created	Last scanner calibration	Camera resolution
<input checked="" type="checkbox"/> Optima+ 21112020 - 1030	23-11-2020	03-12-2020	4112×2176
<input type="checkbox"/> Basic 10-26 12.30	26-10-2020	02-11-2020	1280×1024
<input type="checkbox"/> Optima 12-22 08.53	22-12-2020	none	none
<input type="checkbox"/> Basic 09-21 10.10	21-09-2020	none	none
<input type="checkbox"/> Optima_1 07-02 15.29	02-07-2020	02-07-2020	2560×1920
<input type="checkbox"/> Optima_2 07-02 15.29	02-07-2020	03-02-2021	2560×1920

Figure 99. Scanner selection

- (3) – *LIGHT SOURCE* provides the list of available projectors (it may include also computer/laptop screen(s) of the computer to which the scanner is connected),
- (4) – *CONFIGURATION ETHERNET* is a toolset used in previous scanner models using Ethernet connectivity. By clicking on the button, the *ETH Projectors manager* program is launched, which can be used for configuring the Ethernet connection between the computer and the scanner, and precisely to operate the projector.

The 'ETH Projectors Manager' window is shown. It has a 'Projectors' list at the top. Below are two sections: 'Projector Info' and 'Adapter settings'. The 'Projector Info' section includes fields for Projector, IP Address, and IP Mask. The 'Adapter settings' section includes fields for IP Address and IP Mask, along with 'Hint' and 'Set' buttons. A 'Close' button is at the bottom right.

Figure 100. Ethernet configuration window

(5) – A list of available scanner configurations with the following items (Figure 99):

(A) – *Name* of the scanner,

(B) – Active scanner configuration (marked with a blue square),

**i** **NOTE**

*There can be only one active scanner configuration, in case of choosing another one, the previous selection will be unchecked.*

(C) – *Created* – configuration creation date,

(D) – *Last scanner calibration* – the date of the last scanner calibration, if the scanner has not been calibrated, the text *none* is displayed,

(E) – *Camera resolution* located in the scanner. In case the scanner has not been calibrated, the text *none* is displayed,

▀ *More information about the scanner configuration can be found in Section 8.*

(6) – *USE SELECTED active calibration selection*. The desired calibration should be selected in the list so that it gets a bluish glow and then it should be confirmed by a click on the *USE SELECTED* button,

▀ *More information about selecting an existing scanner configuration can be found in Subsection 8.5.*

(7) – *REMOVE* is a button for removing the selected configuration of scanner,

▀ *More information about removing a scanner configuration can be found in Subsection 8.6.*

(8) – *CALIBRATE/RE-CALIBRATE* opens the scanner calibration panel,

▀ *More information about re-calibrating an existing scanner configuration can be found in Subsection 8.7.*

(9) – *ADD NEW* initiates the creation of a new configuration

▀ *More information about creating a new configuration can be found in Subsection 8.2.*

### 5.2.1.2 Description

On the right side there is a *DESCRIPTION* (10) panel which shows the functionality of a selected group.

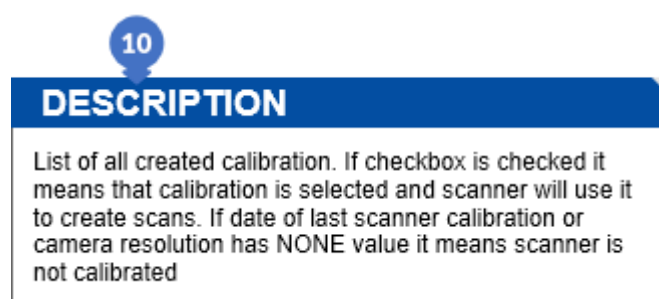


Figure 101. A panel containing descriptions of individual functionalities

## 5.2.2 Equipment Tab

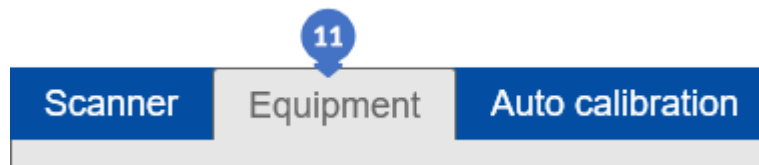


Figure 102. Equipment settings tab

There are two groups in the *Equipment* (11) tab: *CALIBRATION CHART* and *ARTEFACT SETS*.

### 5.2.2.1 Calibration Chart

*CALIBRATION CHART* (12) has the following elements:

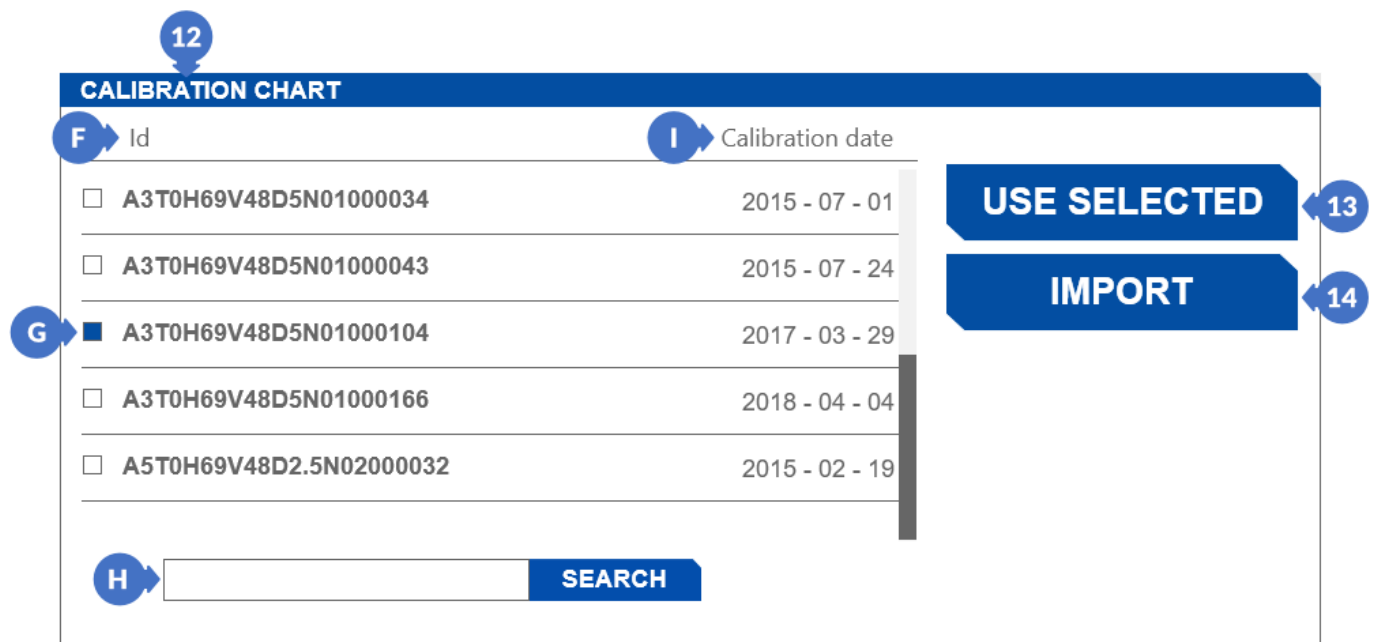


Figure 103. Selection of the calibration chart

(F) – the serial number of the calibration file for the calibration plate (Id)

(G) – the active calibration file of the calibration chart (marked with a blue square),

**i** *NOTE*

*Only one active calibration chart file is allowed at a time, in case of choosing another calibration file, the previous one will be unselected.*

(H) – field for searching for the calibration file by name,

(I) – *Calibration date* is a date when the calibration file was created

(13) – calibration chart selection button (*USE SELECTED*). The calibration file should be selected in the list so that it gets a bluish glow and then it should be confirmed by a click on the *USE SELECTED* button

More information about selecting the calibration file can be found in Subsection 8.3.4.



(14) – **IMPORT** button opens a window which allows to choose new array calibration file with extension .md (15). To add a file to the list click on the **Open** (16) button.

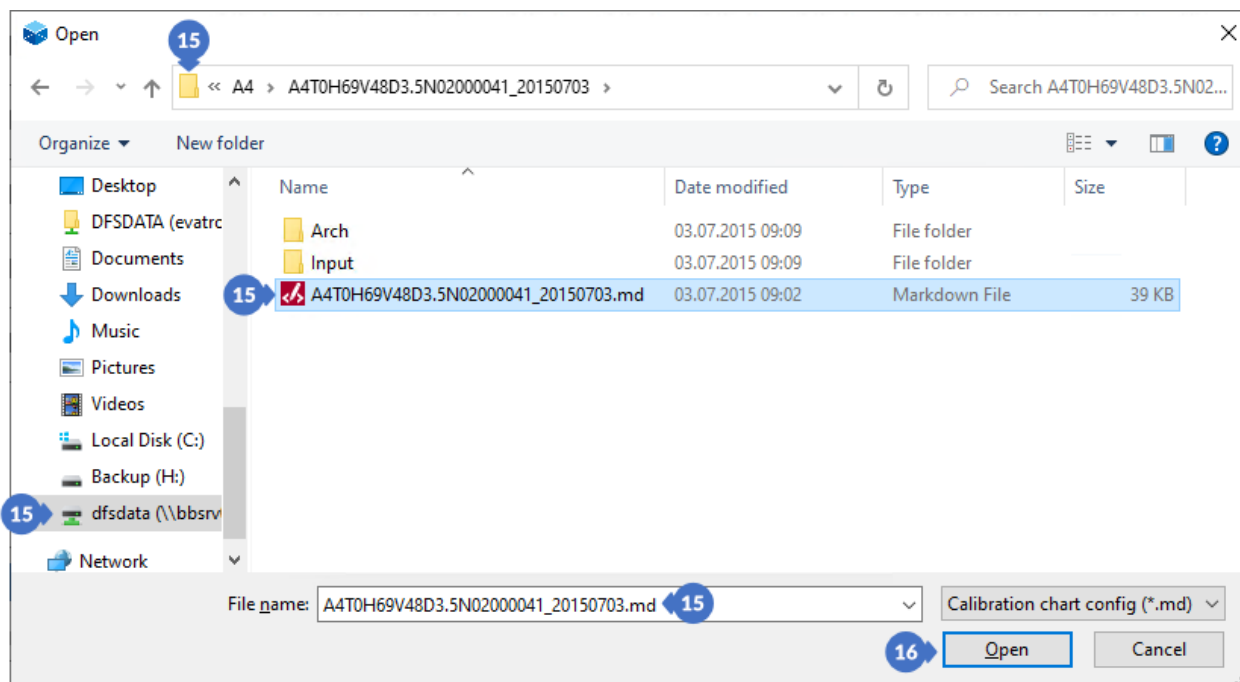


Figure 104. Import of the calibration file for the calibration chart

### 5.2.2.2 Artefacts Set

The second group in the *Equipment* tab is used for handling the artefact<sup>4</sup> files (**ARTEFACTS SET**) (17) and it has the following elements:

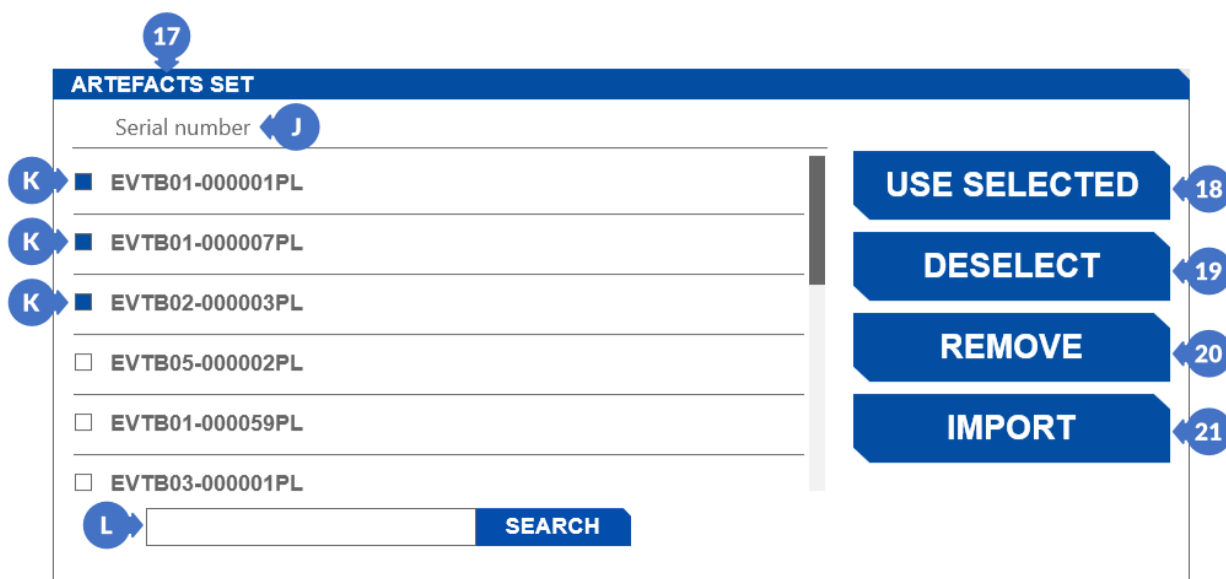


Figure 105. Selecting files with artefacts

(J) – *Serial number* shows serial number of artefacts,

<sup>4</sup> Artefacts are called a minimum of one black object (as there may be several) with markers on their walls.



(K) – active artefact files (marked with a blue square),

**i** *NOTE*

*There can be many active artefact files.*

(L) – field for searching artefact files by their serial numbers,

(18) – *USE SELECTED* button for activating the file with artefacts selected in the list,

(19) – *DESELECT* button for deactivating a file with artefacts selected in the list,

(20) – *REMOVE* button for removing a file with artefacts selected from the list,

(21) – *IMPORT* button that opens a window for importing artefact files. The artefact files have the extension .xml. To import, select a file (22) in the window and click on *Open* (23) to add the artefact file to the list (Figure 106).

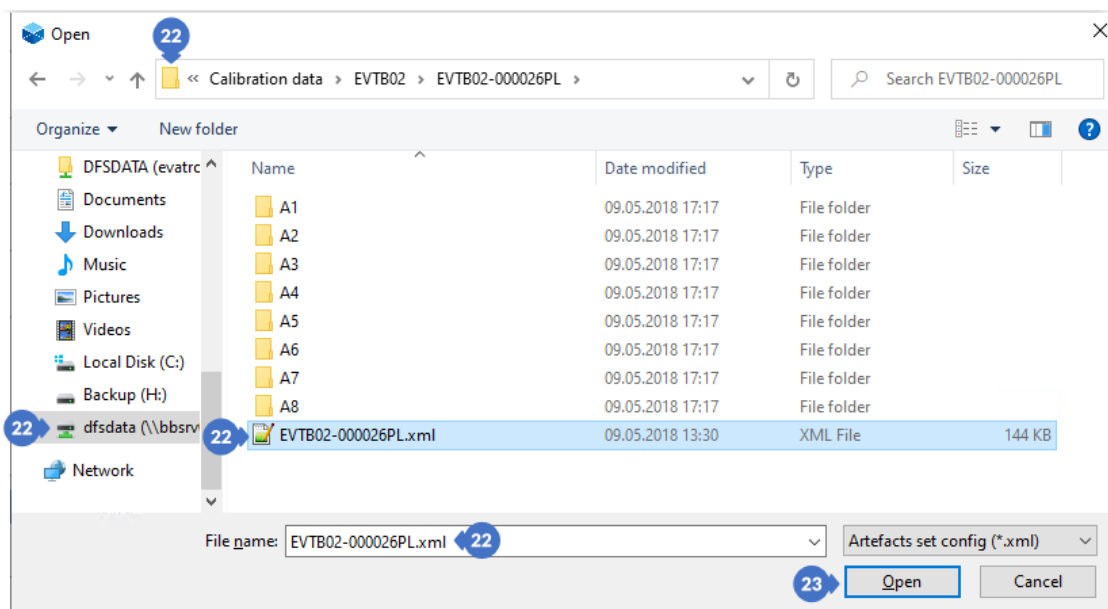


Figure 106. Import artefact file

**i** *NOTE*

*It may happen that a red exclamation mark (24) appears after importing or activating an artefact file. When you hover over such an item, a list of all artefacts that are repeated in other files of the imported sets will appear.*

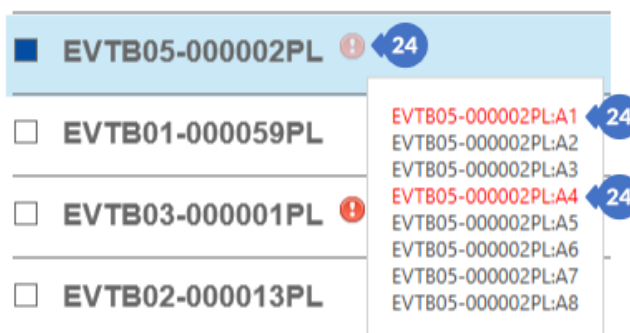


Figure 107. An exclamation point and a red marking indicate duplicate artefacts in the files

As in the *Scanner* tab, also in the *Equipment* tab (Figure 102) there is a panel on the right side which briefly describes the functionality of a given group.

## 5.2.3 Autocalibration Settings



Figure 108. Autocalibration tab

In the autocalibration tab there is a group *CALIBRATION PATH* (26) with a list of calibration files for the eviXmatic device. In the list, the *Name* column (A) contains the names of the imported files. Next to the name of the imported file (C) there is a square (B) informing about the currently selected calibration path (the selected path is marked dark blue). To select or change the calibration path, use the *USE SELECTED* button (27) – select the path in the list and press the button. Each imported track can be deleted by selecting it in the list and clicking on the *REMOVE* button (28). Use the *IMPORT* button (29) to import paths.

More information about eviXmatic in Section 16.

**NOTE**  
In the first launch of the software, the list is empty – it is necessary to import the delivered calibration files to eviXscan 3D Suite using the *IMPORT* button (29).

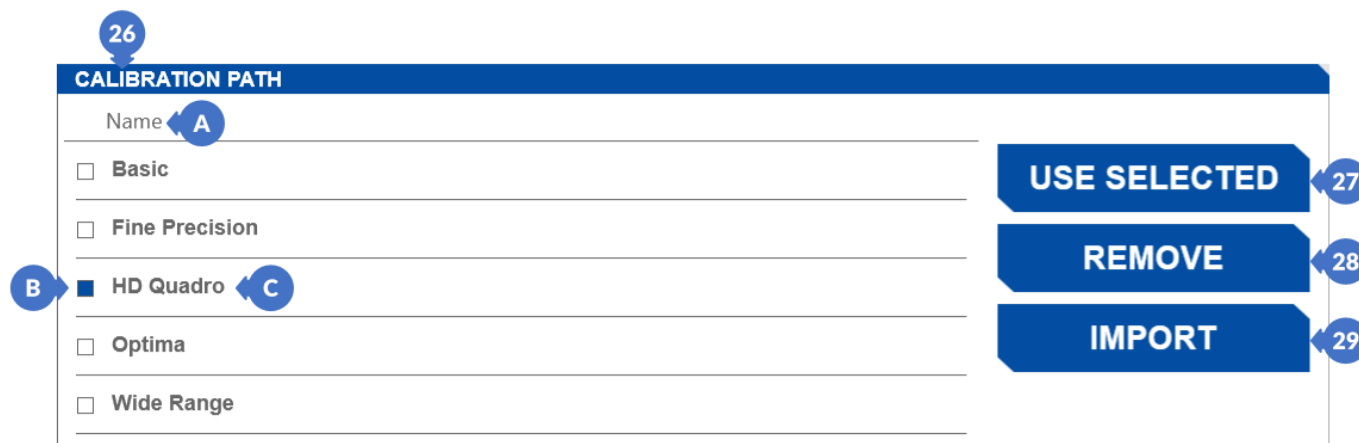


Figure 109. Selection of calibration files for autocalibration with eviXmatic

**NOTE**  
Only one calibration file can be selected at a time. Selecting a different calibration path in the list will automatically deselect the previous active path.

After clicking on the *IMPORT* (29) button, a window will appear that allows you to indicate the location of the file with the extension *.xml* to be imported (30). After selecting the file, click on *Open* (31) to import (Figure 110).

**NOTE**  
It is possible to import only one file with the calibration path at a time – it is impossible to select more than one file in the import window.

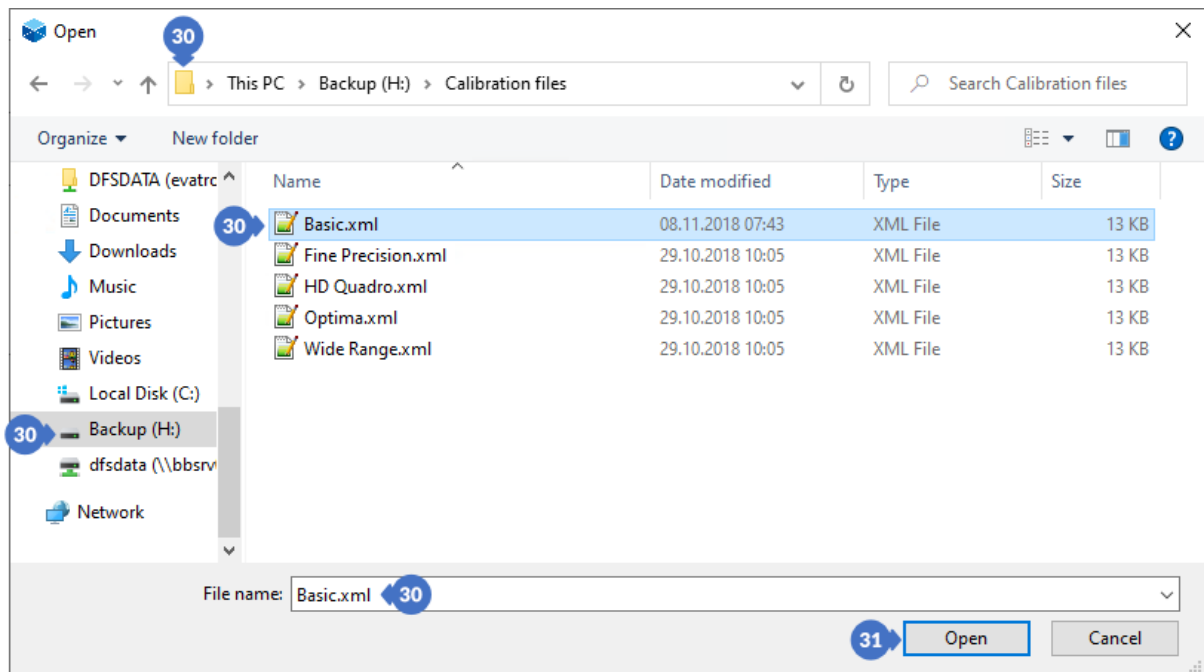


Figure 110. Import file with the calibration path

If there is a file on the list with the same name as the name of the newly imported file, a message will appear prompting the user to overwrite the existing file.

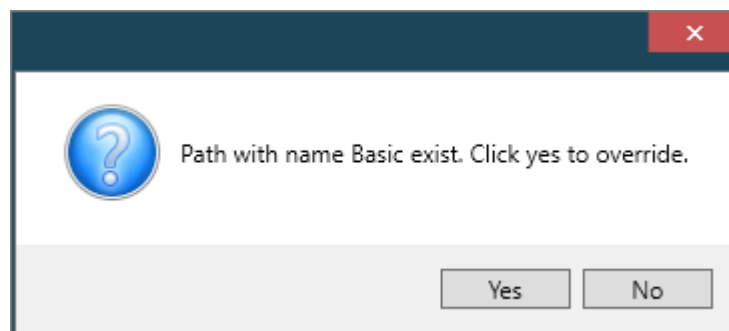


Figure 111. Window with a request to overwrite an existing file

## 6 INTERACTION WITH SOFTWARE

### 6.1 3D View Control

Using the mouse, you can change the position of the scans in the 3D space. The graphics engine allows for the following activities:

Mouse Button	ACTION	USAGE
Left	Click and hold and move the mouse	Selecting mesh fragments with the selection tool (selection tools are described in Section 4.9.2)
	Double Click	Zoom out and center the view
Right	Click and hold and move the mouse	Rotating the scan
Scroll wheel	Click and hold and move the mouse	Moving in 3D space
	Scroll	Zoom in/out on the subject

### 6.2 Controlling the Model Tree

You can perform operations in the *Model Tree* panel using the action keys below:

Button	ACTION	USAGE
Left mouse button	Clicking on the scan	Selects an element, activates the ability to move through elements using the up/down arrows
	Double Click	Setting the isometric view to the indicated scan
	Click and hold and move the mouse	Allows to transfer the selected item to an existing group
	SHIFT + Left-click	Selects scans in the <i>Model Tree</i> from the first selected element to the element selected by pressing the SHIFT key
	CTRL + Left-click	Selects the selected scan (allows to select multiple scans in a random order)
Right mouse button	Right-click	Opens a context menu
SHIFT	Holding and pressing the up / down arrow	Allows to select/deselect several elements (one by one)
CTRL	Holding and pressing the up / down arrow	Launches keyboard selection mode
SPACE	Pressing	Allows to select/deselect items in keyboard selection mode (requires holding down the CTRL key while moving with the up/down keys otherwise the last item will be deselected)

## 6.3 Shortcut Keys

SHORTCUT KEY		DESCRIPTION
CTRL	S	saves the project
	N	opens the window for creating and saving a new project
	O	opens a window to open an existing project
	I	opens the scan import window (mesh)
	E	opens the scan export window
	A	selects all elements of the <i>Model Tree</i>
	G	groups selected elements in the <i>Model Tree</i>
	U	ungroups selected scans, ignores the selection of the group itself
	F	opens the directory of the first selected item (scan)
	H	hides selected scans/groups
	W	shows selected scans/groups
	Z	undo an action (e.g., removing points in a view)
	M	enables/disables the multicolor (color blending) mode
	D	duplicates the selected scan
	SHIFT I	inverts the selection in the view
~		switches between the <i>SCANNING</i> and <i>POST-PROCESSING</i> tabs
F2		changing the name of a group in the <i>Model Tree</i>
F5		brings up the window for creating a new scanner
F6		brings up the scanner calibration status window
F7		brings up the scanner configuration window
F8		starts scanning (1 scan) from the <i>Single scan</i> window
F9		starts series by table from the <i>Scan with rotary table</i> window
ESC		deselects all items
DEL		deletes part of the selected scan

## 7 THE MODEL TREE

The *Model Tree* can take one of two representations:



Figure 112. Calibration images Model Tree

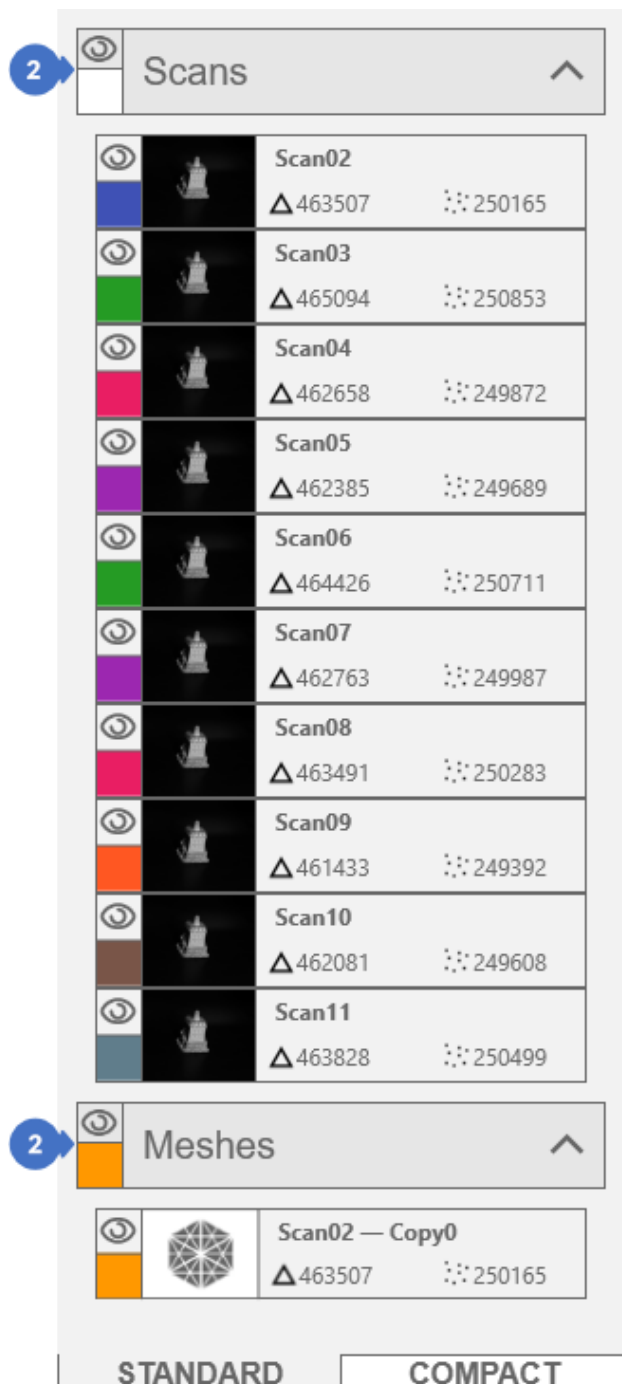


Figure 113. Scans and meshes Model Tree

(1) – *Calibration images* – contain photos acquired during the scanner calibration process. To view the calibration photos, go to the *Scanning* tab and select the *Calibrate* option from the *Calibration* category. Clicking on the photo will display a preview of the calibration photo.

More information about the photo preview can be found in Subsection 4.9.1.

(2) – *Scans, meshes* for the scans, you can also preview the photos from which the scan was generated.

More information about the photo preview can be found in Subsection 4.9.1.

## 7.1 Context Menu

The context menu is a panel that opens when you use the right mouse button. With it, you can perform additional actions not available elsewhere in the software.

### 7.1.1 Context Menu of Scans and Meshes in the Model Tree

The context menu of both scans and meshes consists of the following options:

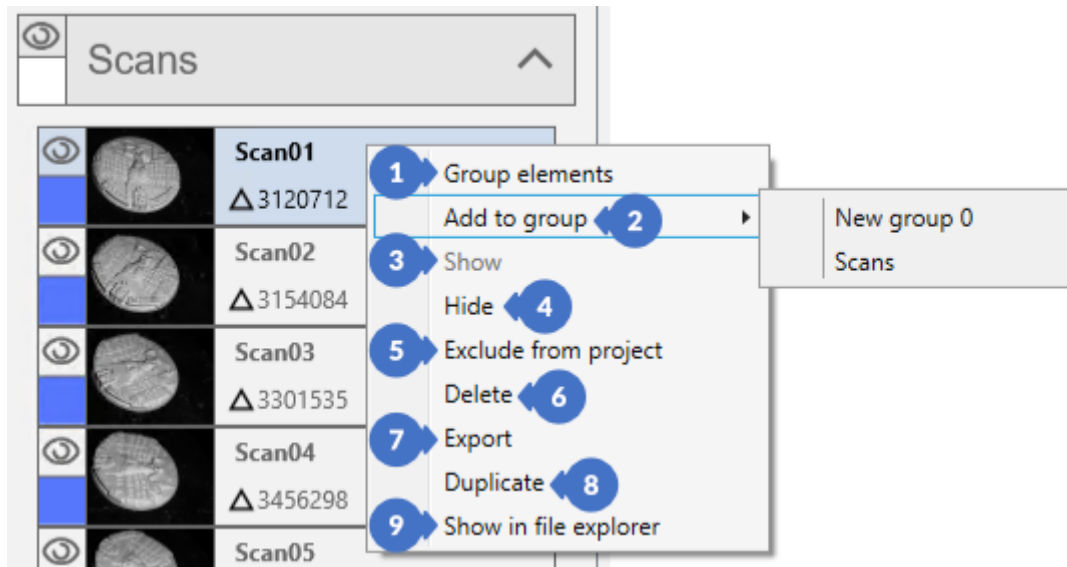






Figure 114. Context menu of scans/meshes

- (1) – *Group element* – groups all elements within a given default group,  
 More information about grouping can be found in Subsection 7.2.2.
- (2) – *Add to group* – moves the selected elements to the selected group,  
 More information about grouping can be found in Subsection 7.2.2.
- (3) – *Show* – shows the scan in a view and the eye icon left to the scan element in the tree. Not available if the scan is already visible,
- (4) – *Hide* – hides the scan in a view and the eye icon left to the scan element in the tree. This option is unavailable if the scan is already hidden,
- (5) – *Exclude from project* – removes the scan reference from the project. Excluding from the project does not delete the scan files from the disk,  
 More information about removing scan references can be found in Subsection 7.2.5.
- (6) – *Delete* – deletes the scan from the project and from the disk,  
 More information about removing scans can be found in Subsection 7.2.6.
- (7) – *Export* – opens the window for exporting selected scans to the files with the selected extension,
- (8) – *Duplicate* – duplicates an element, turns it into a mesh (both scans and meshes) and adds to the *Meshes* default group,
- (9) – *Show in file explorer* – opens the folder with the content of the scan.

## 7.1.2 Context Menu of the Default Group

You can read about what is the default group in Subsection 7.2.1.

By right-clicking on the default group, you can choose between the following options:

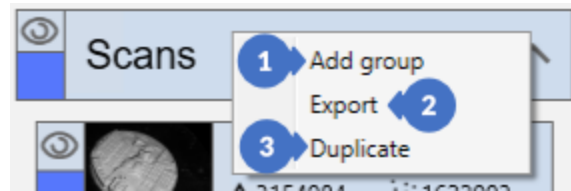


Figure 115. Context menu of the default group

- (1) – *Add group* – creates a new group,  
 ■ More information about creating groups can be found in Subsection 7.2.2.
- (2) – *Export* – exports all group elements to the specified location with the extension selected by the user,
- (3) – *Duplicate* – duplicates all group elements and includes them in the default *Meshes* group (if the groups exist, they also will be duplicated).

## 7.1.3 Context Menu of Groups

After right-clicking on a group, the user will be able to choose one of the following options:

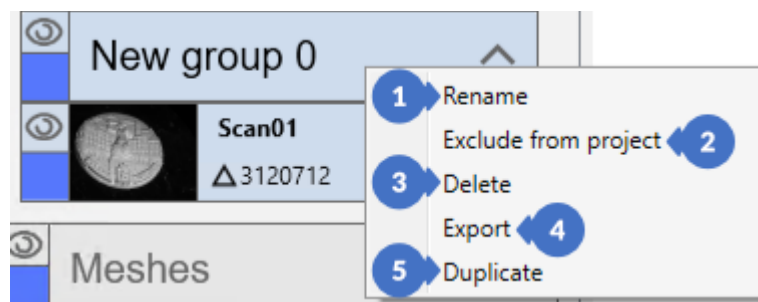


Figure 116. Context menu of the group

- (1) – *Rename* – rename a group,  
 ■ More information about renaming groups can be found in Subsection 7.2.3.
- (2) – *Exclude from project* – removes references of all scans/meshes from the project (does not delete files from the disk) and removes the group,  
 ■ More information about removing groups can be found in Subsection 7.2.8.
- (3) – *Delete* – deletes the entire content of the group (including the group itself) from both the project and the disk,  
 ■ More information about removing groups can be found in Subsection 7.2.8.
- (4) – *Export* – exports the entire content of the group to the specified location with the defined extension,
- (5) – *Duplicate* – duplicates the group (including its content) and includes it in the default group *Meshes*.



## 7.2 The Model Tree management

### 7.2.1 Default Groups of Scans

There are two default groups for scans in *eviXscan 3D Suite*. These groups cannot be removed – they are always visible in the project. All scans made by the *eviXscan 3D Suite* software are placed in the *Scans* group (1), while in the *Meshes* group (2) the scans without photos (which are a single file) are placed.

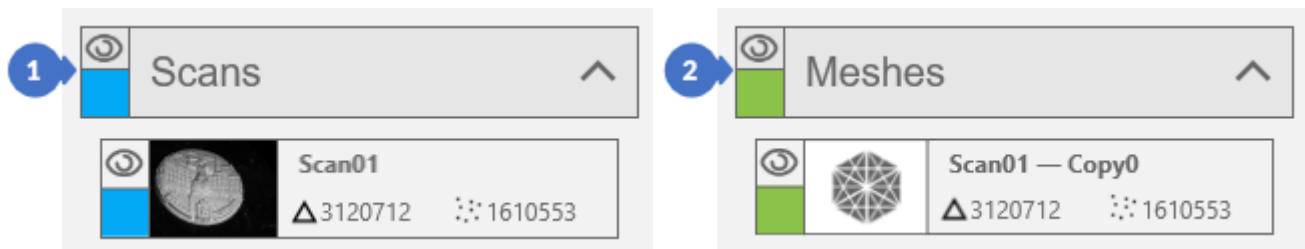


Figure 117. Default scan groups

### 7.2.2 Creating Groups

To organize the scans, it is possible to place them inside groups – both in the *Scans* and *Meshes* groups. There are two ways to create groups. They can be created from the context menu by right-clicking on the default group and selecting *Add group*.

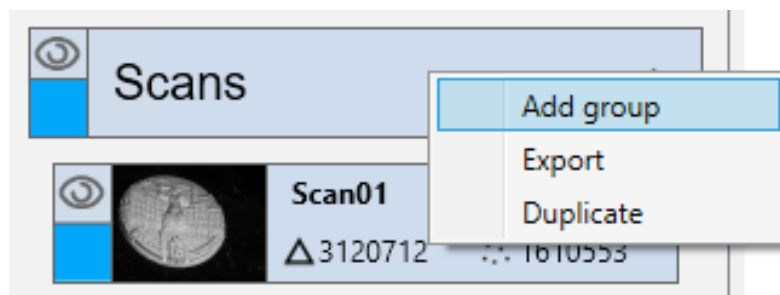


Figure 118. Create a group

The second way is to right-click on the scan and select the *Group elements* option from the context menu (Figure 119). This method combines all selected items, but only within its default group. It is not possible to group scans from the default *Scans* group with scans from the default *Meshes* group. The same grouping action can be performed with a keyboard shortcut by selecting the items to be grouped and pressing *CTRL + G*.

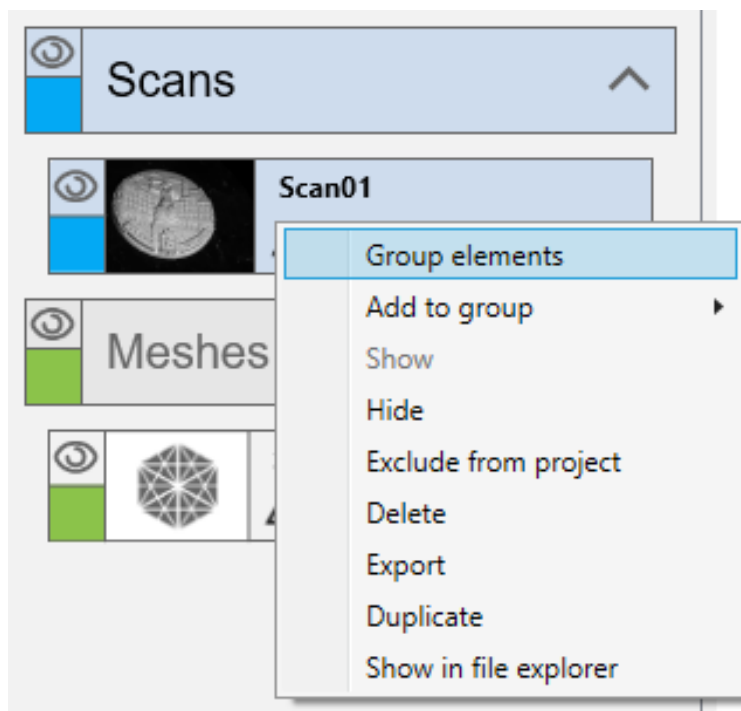


Figure 119. Creating a group – grouping elements

### 7.2.3 Rename a Group

The group name can be changed by right-clicking on the group from the context menu and selecting *Rename*. The default group name is "*New group*" with the next highest ordinal digit (starting from 0) not present in the tree.

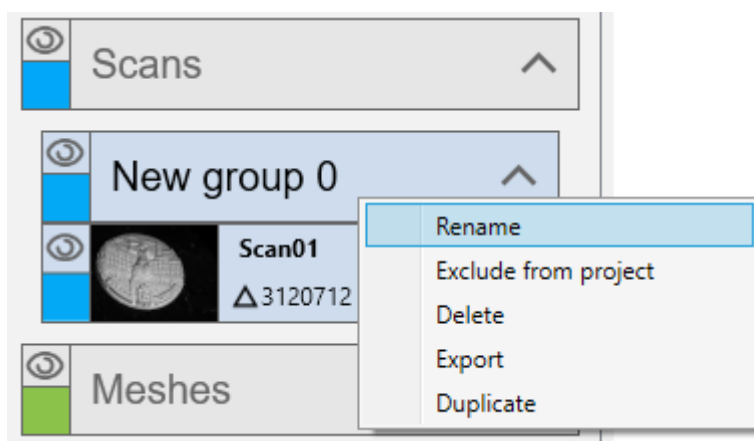


Figure 120. Rename the group

After entering the group name editing mode, the name color will change to blue, and the cursor will start pulsating in the field. Then the name is editable.

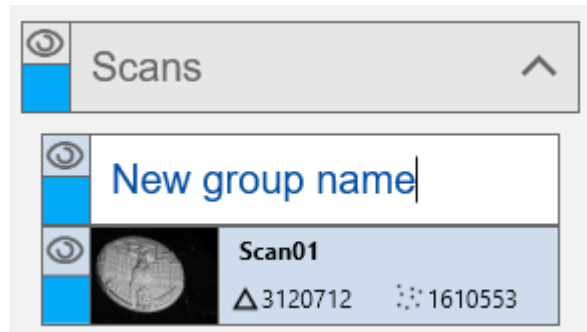


Figure 121. Rename the group – edit mode

After entering the name, the edit mode can be closed by confirming the new name by pressing *ENTER* or by pressing *ESC* to cancel the change. The color of the group name changes to black.

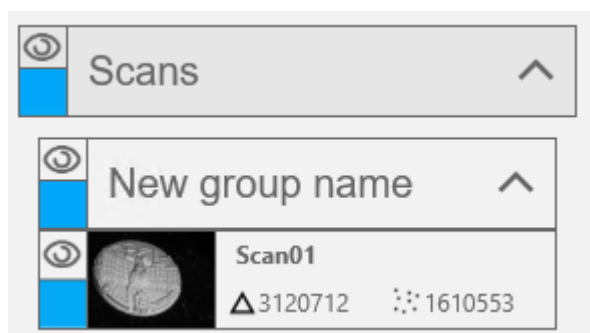


Figure 122. New group name approved

The *Rename* action can also be displayed by selecting the group and pressing the *F2* key.

## 7.2.4 Transferring Scans between Groups

The scans in the *eviXscan 3D Suite* software can be transferred between groups using the "Drag and drop" action by selecting the scans to be transferred and then, with the left mouse button pressed, moving to a new group. Then the mouse cursor will change to the one shown in the screenshot below and after releasing the mouse button the scan or group of scans will be moved to the indicated group. Again, scans cannot be moved between the default groups.

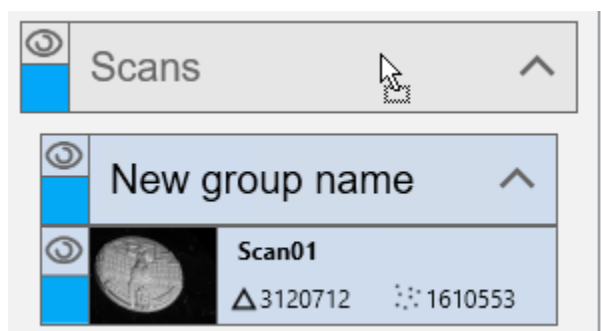


Figure 123. Transferring the scan between groups

Scans can also be transferred by right-clicking on the scans and selecting *Add to group* from the context menu and then selecting the target group to which the selected scan should be moved.

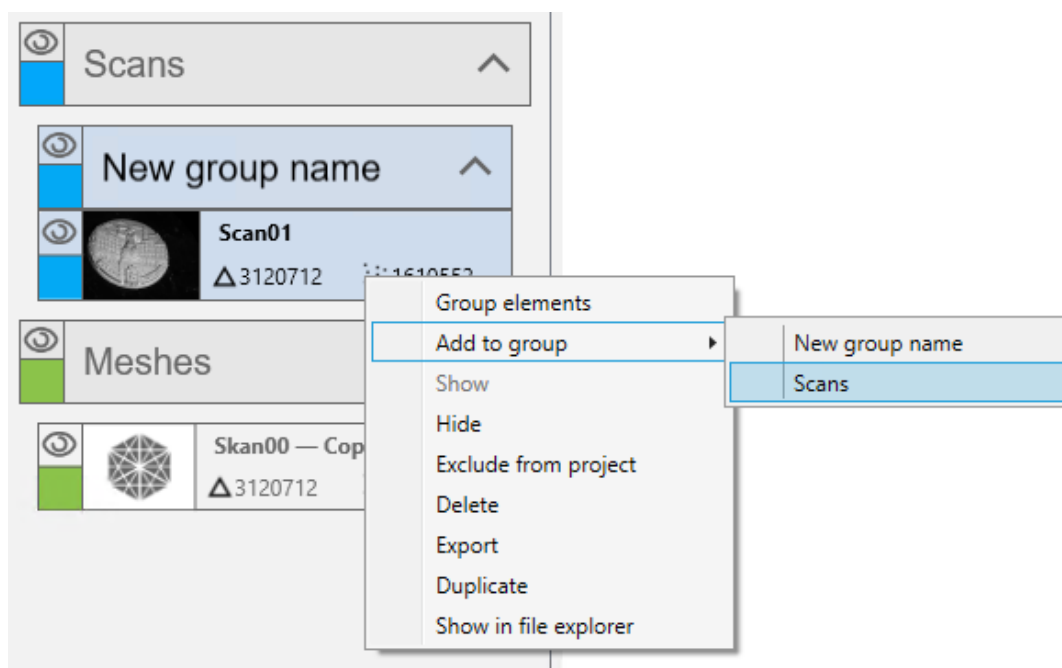


Figure 124. Transferring the scan between groups using the context menu

## 7.2.5 Detach Scans from the Project

In the *eviXscan 3D Suite* software it is possible to detach scans/meshes from the project. The *Exclude from project* option is used for this purpose. It does not delete the physical files from the disk, but the link information is removed in the project.

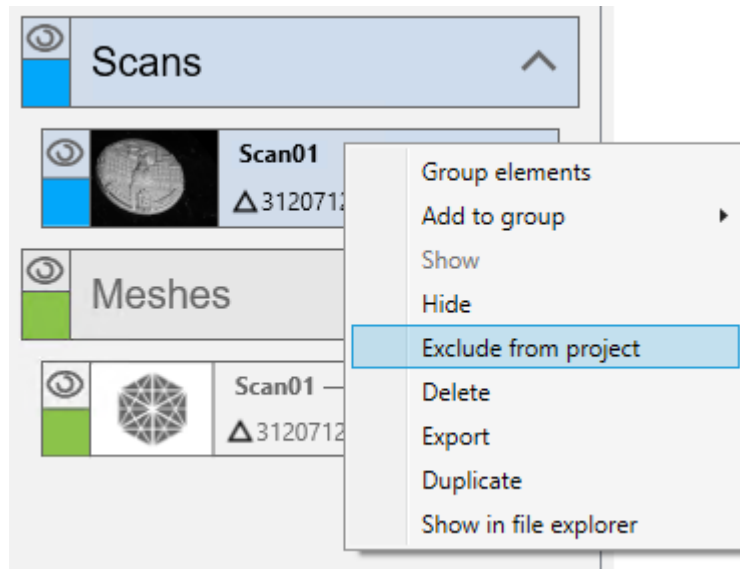


Figure 125. Removal of scan references/meshes

## 7.2.6 Delete Scans

Use the *Delete* option to completely remove the scan/mesh from the project and from the disk.

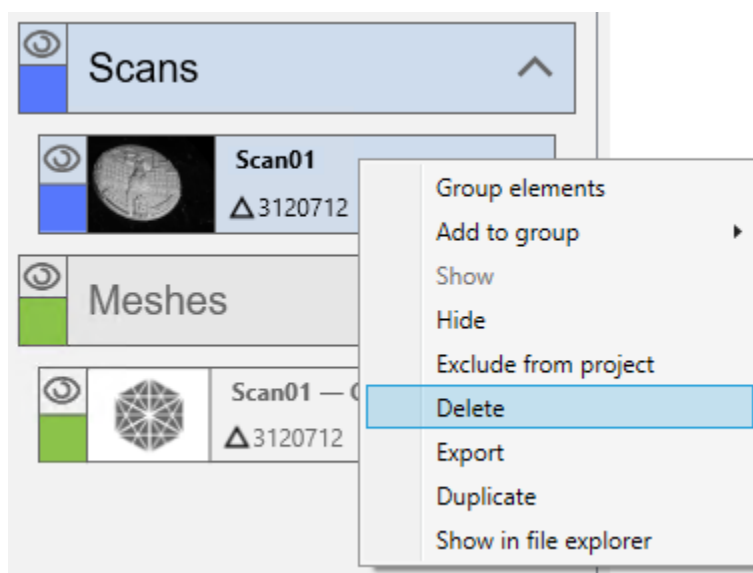


Figure 126. Complete removal of scans/meshes

After selecting the *Delete* option, a message will appear requesting confirmation of the delete action.

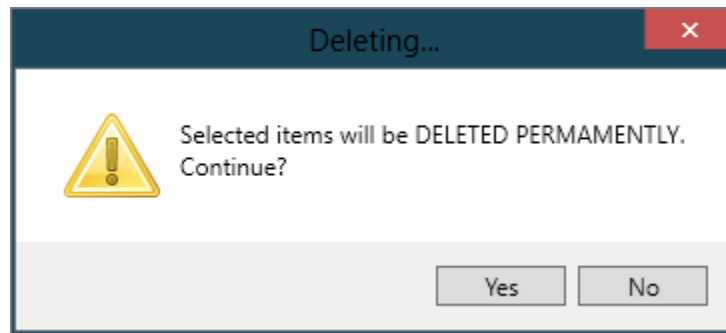


Figure 127. Request for confirmation of removing scans/meshes from the disk

**i** **NOTE**  
Scans deleted in this way cannot be recovered.

## 7.2.7 Detach a Group of Scans from the Project

In *eviXscan 3D Suite* it is also possible to remove group references along with the scans/meshes. To do this, select the *Exclude from project* option from the context menu. When you execute this action, the scans and groups will be removed only from the project – all the data will remain on the hard drive in the initial project location.

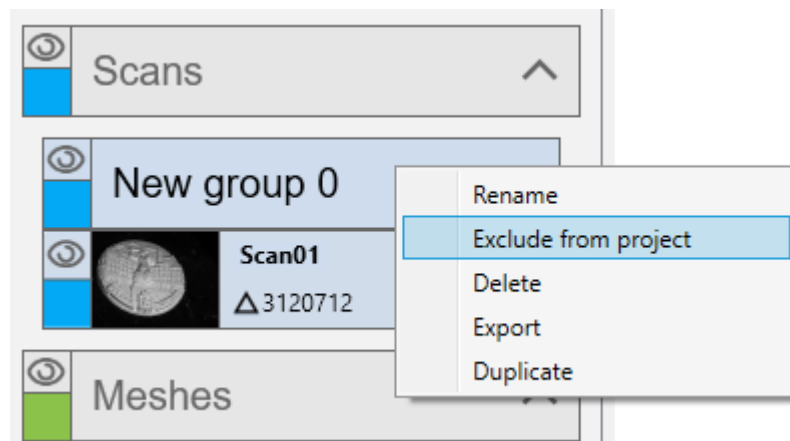


Figure 128. Removing references of the whole group (including scans/meshes contained in it)

## 7.2.8 Deleting a Group

To delete a group with its entire content, use the *Delete* option (as in the case of deleting scans). If the group contains scans, the same message will appear (as during the removal of scans in Subsection 7.2.6) requiring confirmation of the removal of the group with its entire content.

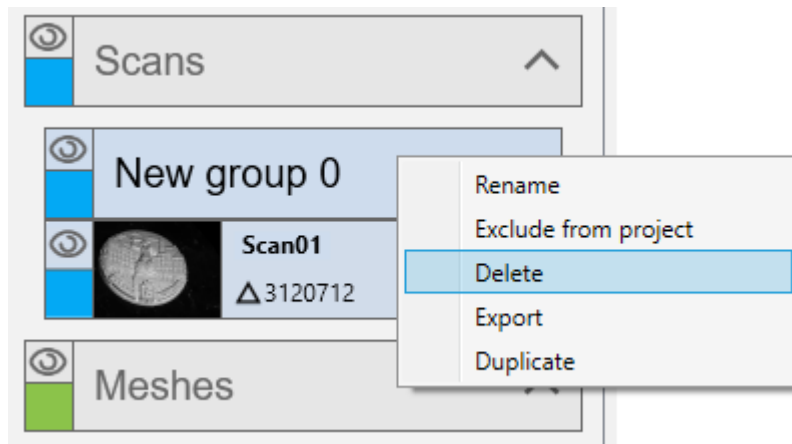


Figure 129. Complete removal of the group with scans/meshes

**i** NOTE

*Scans deleted in this way cannot be recovered.*

## 8 CONFIGURATION PROCESS

Before starting to work with the 3D scanner, it is necessary to configure the scanner so that the scanning results are accurate and consistent. Due to the high sensitivity of the optical systems to vibrations – that may occur especially during transportation or device dislocation - the calibration process cannot be avoided. For this reason, it is recommended to calibrate the device regularly – especially, if the scanner is moved frequently.

### 8.1 Projector Selection

When connecting the scanner, the *eviXscan 3D Suite* software will automatically detect the projector physically installed in the scanning device, but also other types of displays connected to the PC. In some cases, the algorithm responsible for automatic selection of the projector will select another display device connected to the PC instead of the scanner projector. In such situation you will have to manually replace the projector selected by default. To select the projector, open the *Start menu* (1), go to *Configuration* (2), *Scanner* (3) and then select the correct projector from the *LIGHT SOURCE* (4) drop-down list.

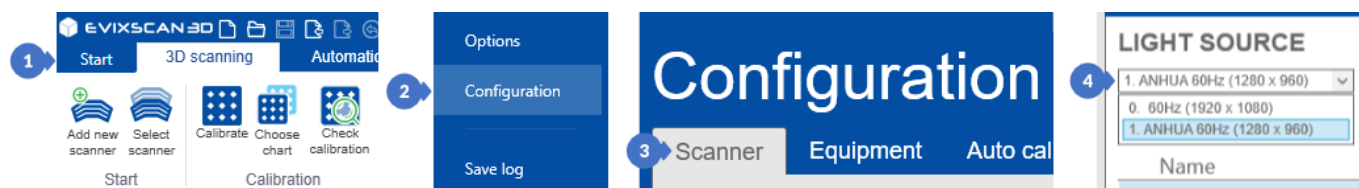


Figure 130. Projector selection

A correctly selected projector, after switching to any panel that has the option to select the *PROJECTOR PATTERN* as well as the *PROJECTOR BRIGHTNESS* slider will react to changes made in the panel.

### 8.2 Creating a New Scanner Configuration

Each scanner can have multiple user configurations (calibrations) but can only use one at a time. To calibrate the scanner, go to the new scanner creation window. There are two ways to do this. The first is to open the *Start* side menu (1), select the *Configuration* tab (2), the *Scanner* tab (3) and then click the *ADD NEW* button (4). You can call the same window by going to the *3D scanning* tab and then clicking on the *Add new scanner* (5) option from the *Start* category.

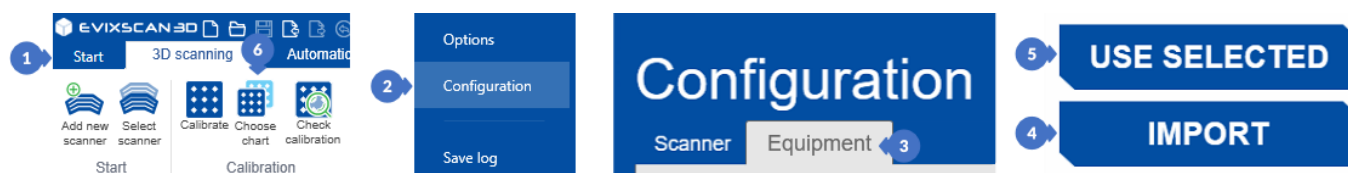


Figure 131. Create a new configuration (new scanner)

When the window is displayed, select the *SELECT SCANNER TYPE* (6) (Figure 132) type of scanner from the drop-down list. Next, make sure that the *SELECT CAMERAS* list (7) shows all cameras built into the device (there should be at least two) and that the image displayed on the left side of the window belongs to the left camera (A), and respectively from the right window to the right camera (B). A connection check can be done using the straightforward method of covering one of the cameras with the hand and observing the view. If the device has made the wrong selection of cameras, click on the field with the opposite camera in order to make



manual corrections. The preview image of the cameras should change. Then enter the name of the configuration being created in the *NAME* field (8) or leave the default one introduced as a result of changing the scanner type. When everything is set up, you can click on the *CREATE AND CALIBRATE* button (9) to go to the device calibration.

**i NOTE**

The *CREATE AND CALIBRATE* button automatically sets the configuration of the newly created scanner as active, although it can be used for scanning only after calibration.

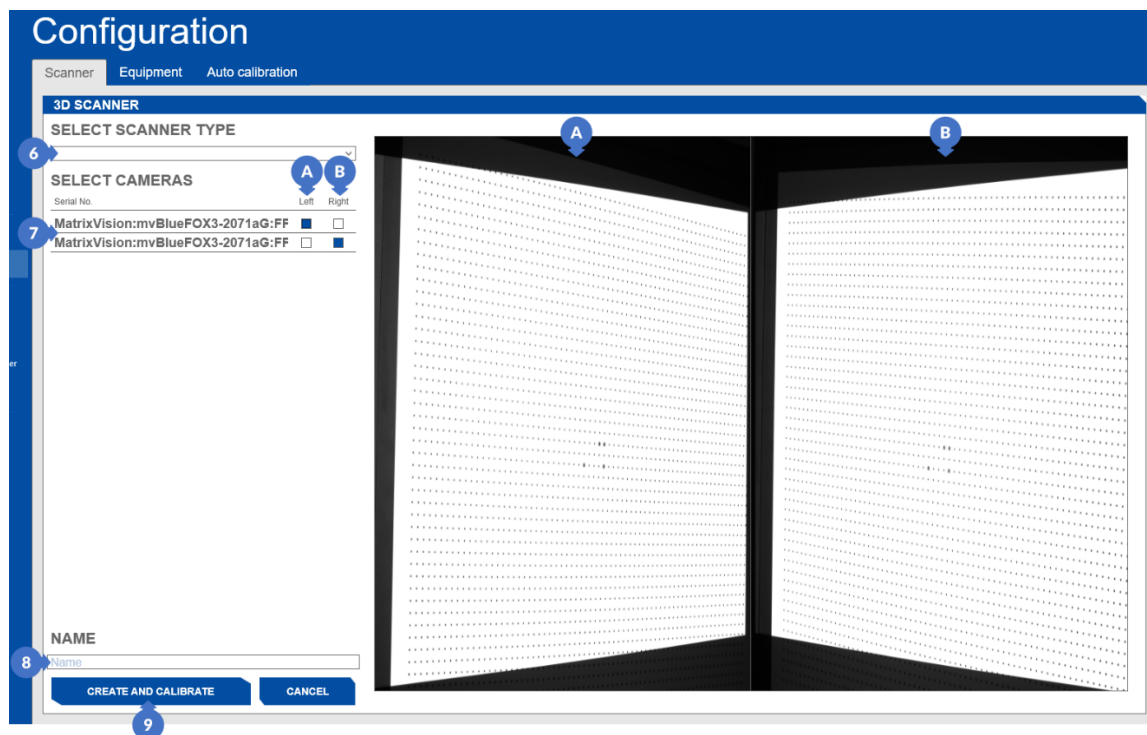


Figure 132. New scanner creation window

The list of available types of *SELECTED SCANNER TYPE* (5) scanners includes four main predefined types: *HD Optima*, *HD Basic*, *HD Quadro Inner* and *HD Quadro Outer*. In addition, the list has been expanded with three new types of scanners: *FinePrecision* – which allows you to scan small objects, *Optima+ M*, and *WideRange* which are based on the most recent image and projection technology that speeds up the scanning process. It is possible that the number of types will increase with the development of new scanner models, the advance of technology and new software versions.

## SELECT SCANNER TYPE

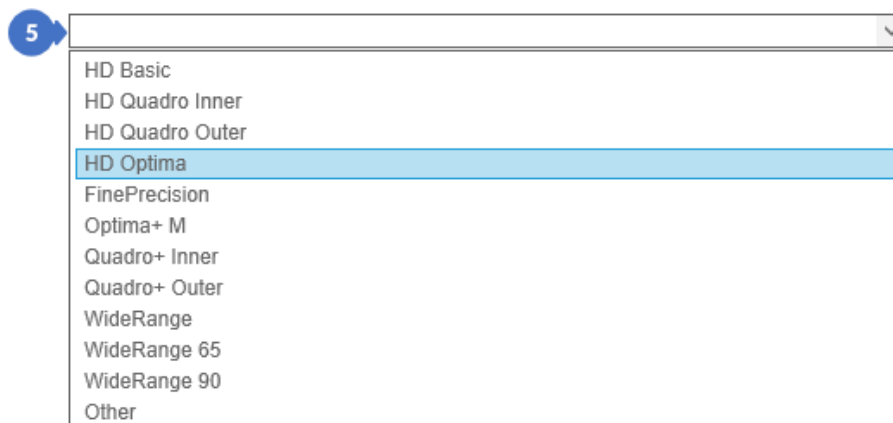


Figure 133. Types of available scanners

## 8.3 Scanner Calibration

Creating a new scanner (precisely: creating its configuration) using the *CREATE AND CALIBRATE* button will close the scanner creation window and switch the software into the calibration mode. The calibration opened in this way from the *3D scanning* tab, the *Calibrate* (1) option in the *Calibration* category is intended for users who already have had contact with the device calibration. Beginners are advised to use the simplified *Calibration wizard* mode (2) with animations showing step-by-step how to set up the calibration charts in the process of taking photos.

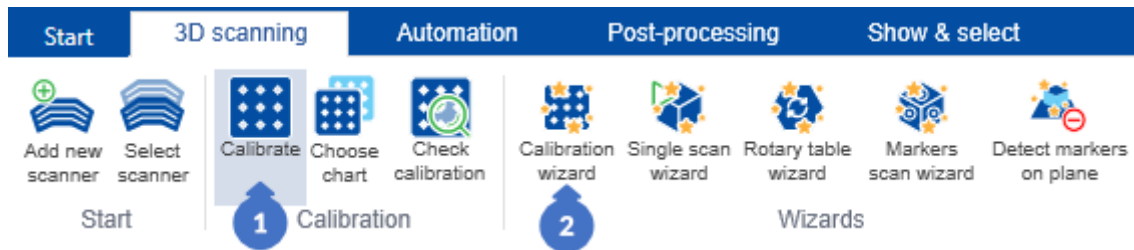


Figure 134. Calibration modes

### 8.3.1 Regular Calibration

In the regular calibration process, the dynamic panel on the right side of the software window has the following options (in the *SIMPLE* (A) mode):

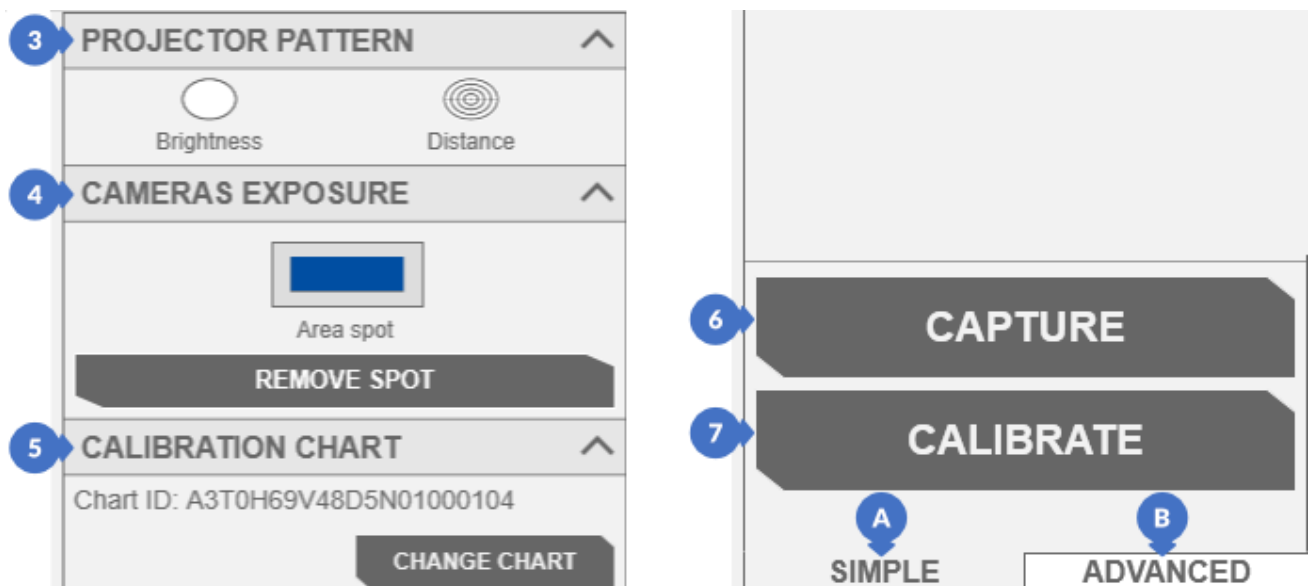


Figure 135. Calibration panel – before performing the calibration

- (3) patterns projected by the *PROJECTOR PATTERN* – an important step when calibrating the scanner is the correct positioning of the scanner in relation to the calibration chart. Using the *Distance* pattern, the appropriate height and distance of the scanner from the chart should be adjusted,
- (4) *CAMERAS EXPOSURE* – used to select exposure on the scanner cameras,  
 ■ More information about exposure can be found in Section 9.

**i NOTE**

To make things easier, the *SIMPLE* panel has a semi-automatic exposure selection – the user only needs to select the place where the exposure will be automatically detected.

- (5) **CALIBRATION CHART** – to perform the calibration, select the factory calibration file received with the calibration chart using the **CHANGE CHART** button. Each table has its own individual calibration file generated during its manufacturing,

More information about selecting the calibration chart can be found in Subsection 8.3.4.

- (6) the **CAPTURE** button is used to collect pictures in the individual chart positions in relation to the scanner. All steps of setting up the chart have been drawn on a specially prepared calibration pad included in the scanner box. Correctly taken photos of the calibration chart have a green symbol, incorrectly taken photos of the chart have a red symbol,
- (7) the **CALIBRATE** button is used to run the algorithm responsible for calibrating the device based on the collected calibration photos.

**NOTE**

The calibration process may take a while depending on the computing power of your PC. This process, once initiated, cannot be stopped.

Before starting to collect the calibration photos, place the scanner at the appropriate height and distance from the calibration chart, select the appropriate exposure and brightness of the projector, and then take photos of the calibration chart at all positions marked on the supplied calibration pad. The order of taking the calibration photos does not matter, it is only important that their number is not less than the number of items marked on the calibration pad.

After the calibration is performed, the **CHANGE CHART** button located in the **CALIBRATION CHART** (5) (Figure 136), as well as the **CAPTURE** button (6), will become inactive, and the **CALIBRATE** button itself will change its name to **DECALIBRATE** (7). By clicking **DECALIBRATE**, the calibration for a given scanner is deleted, but it will not delete the previously taken photos, so it is possible to add the missing ones and re-calibrate by pressing the **CALIBRATE** button (7).

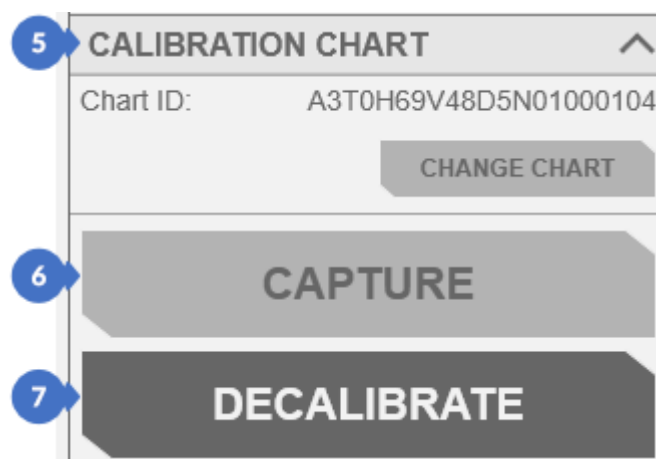


Figure 136. Calibration panel – after calibration

The **ADVANCED** (B) tab compared to the **SIMPLE** (A) tab contains a list of all projector patterns (8) in the **PROJECTOR** category (Figure 137).

More information about projector patterns can be found in Subsection 10.2.

The **CAMERAS** tab (9) has a *Pixel clock* slider and a manual slider for changing *Cameras exposure*.

More information about *Pixel clock* can be found in Subsection 5.1.1.1, point (3).

More information about adjusting exposure can be found in Section 9, Subsection 9.1.1.

The *ADVANCED* tab also has a slider *PROJECTOR BRIGHTNESS* (10), it is visible only in the manual exposure mode.

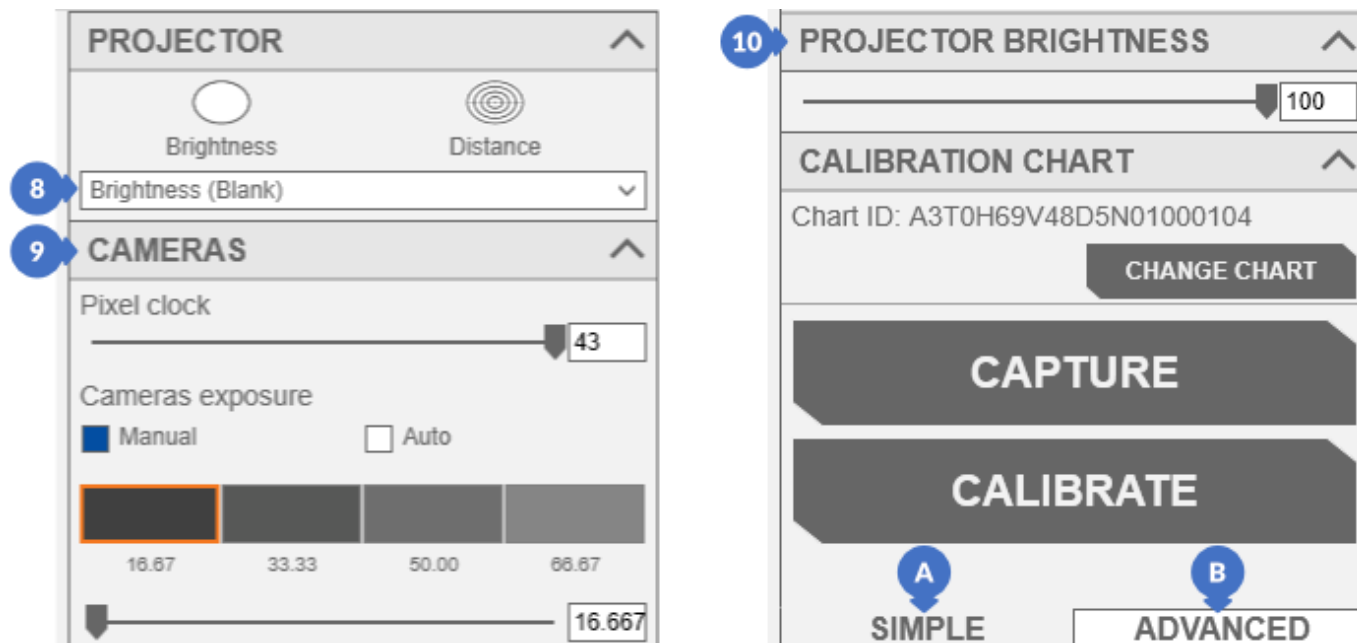


Figure 137. Calibration panel – advanced settings

**i NOTE**

If you choose to manually set the exposure in the *ADVANCED* (B) *CAMERAS* (10) manual tab, for the newer types of scanners, the selection of exposures from the predefined "tiles" will not be visible. In this case, use the slider.

## 8.3.2 Calibration Using the Wizard

Calibration with the *Wizard* should be started by selecting the *3D scanning* tab and then the *Calibration Wizard* option from the *Wizards* category.

A panel appears on the right side to guide the user through the entire calibration process. Starting work with the wizard is triggered by pressing the *START CALIBRATION* button.

More information about building the *Wizard* can be found in Subsection 4.8.2.



Figure 138. Start the calibration process

### 8.3.2.1 Projector Selection

**i** NOTE

For scanners with a built-in trigger, this step is invisible. In its place, you will see the step described below.

In the first step of *SELECTED PROJECTOR STEP*, select the appropriate projector (1) (if the one selected by default is wrong) and proceed to the next step using the *NEXT* button.

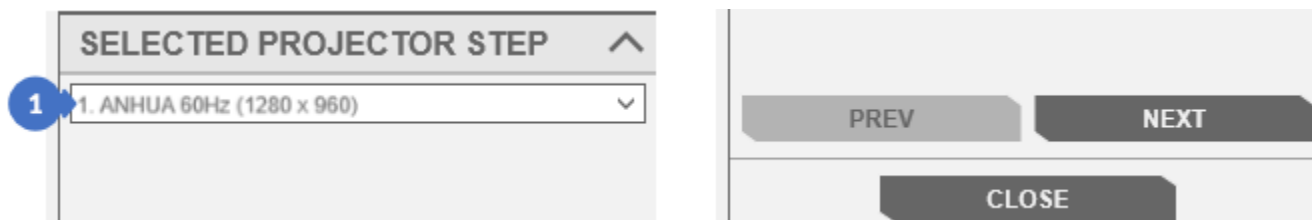


Figure 139. Projector selection

### 8.3.2.2 Setting the Distance of the Scanner from the Calibration Chart

In the second step, *SET DISTANCE*, an animation appears (2) showing how to set the distance between the scanner and the calibration chart. After completing this step, proceed with the *NEXT* button.

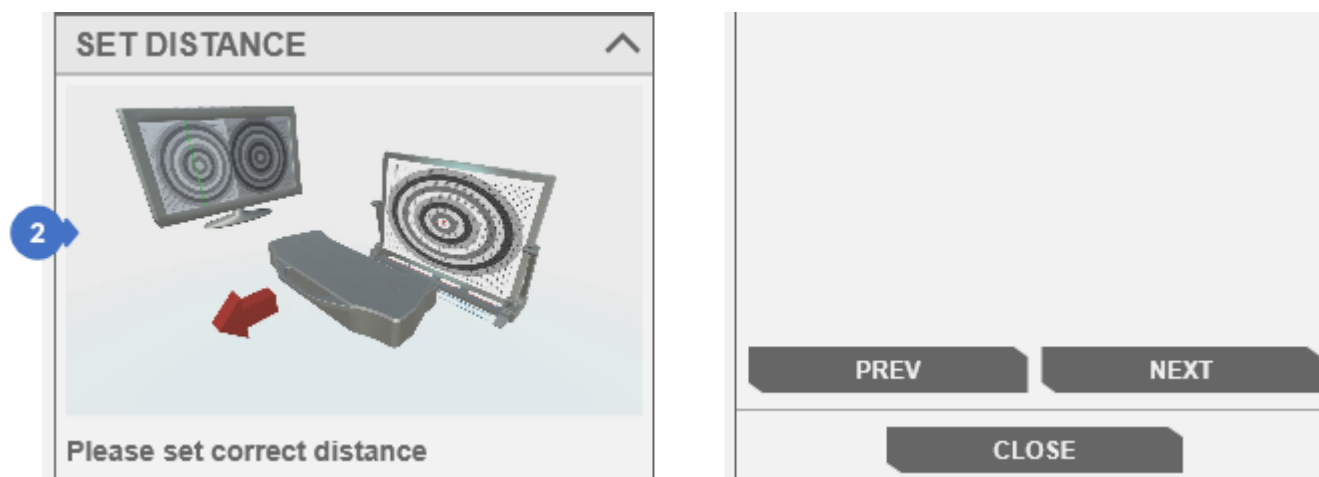


Figure 140. Setting the distance between the scanner and the chart

### 8.3.2.3 Setting the Height of the Scanner Relative to the Calibration Chart

In the third step, *SET HEIGHT*, the animation (3) shows the corrected scanner height setting. After completing the recommendations shown in the animation, you can proceed with the *NEXT* button.

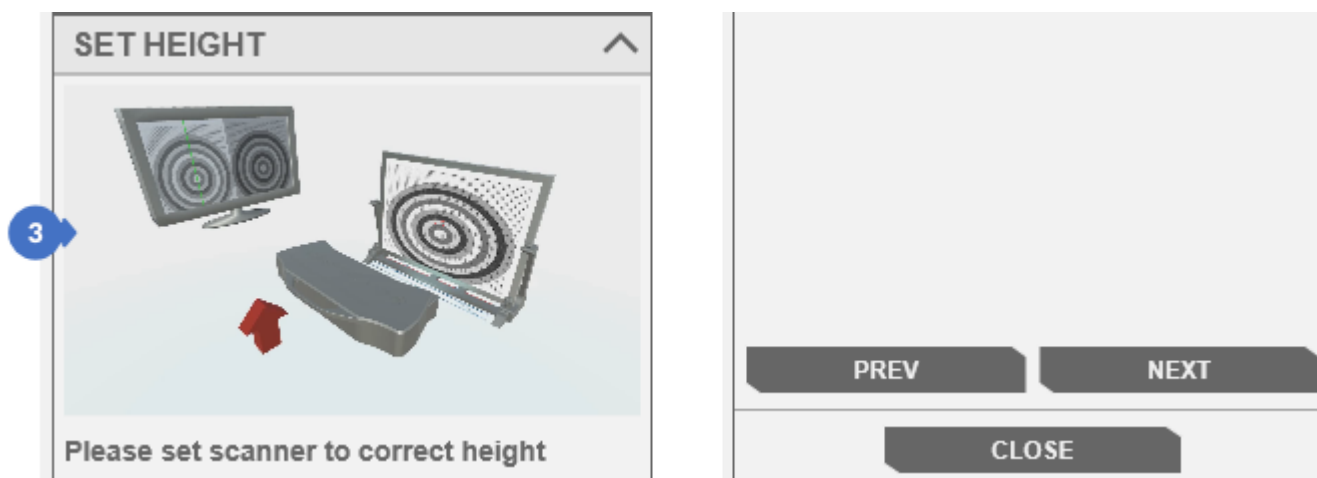


Figure 141. Setting the height of the scanner

### 8.3.2.4 Taking Pictures of the Calibration Chart

In the fourth step of *POSITION 0 – PHOTO*, set the calibration chart to position 0 (4) and indicate the place where the exposure is to be detected (for the calibration chart, the white area with black dots visible on the camera preview) using the *Area spot* button in *CAMERAS EXPOSURE* (5) in the automatic mode (Figure 143) or select the appropriate camera exposure settings in the manual mode (Figure 142) – *CAMERAS EXPOSURE* (5) and the *PROJECTOR BRIGHTNESS* (6). (For more on exposure settings, see Section 9). Additionally, select the received calibration file intended for your calibration chart using the *CHANGE CHART* button in *CALIBRATION CHART* (7). The *NEXT* button will trigger the first calibration photo.



#### NOTE

The *PROJECTOR BRIGHTNESS* group containing the slider to change the brightness of the projector is visible only in Manual mode. The default mode of the wizards is automatic.



More information about selecting the calibration chart file can be found in Subsection 8.3.4.

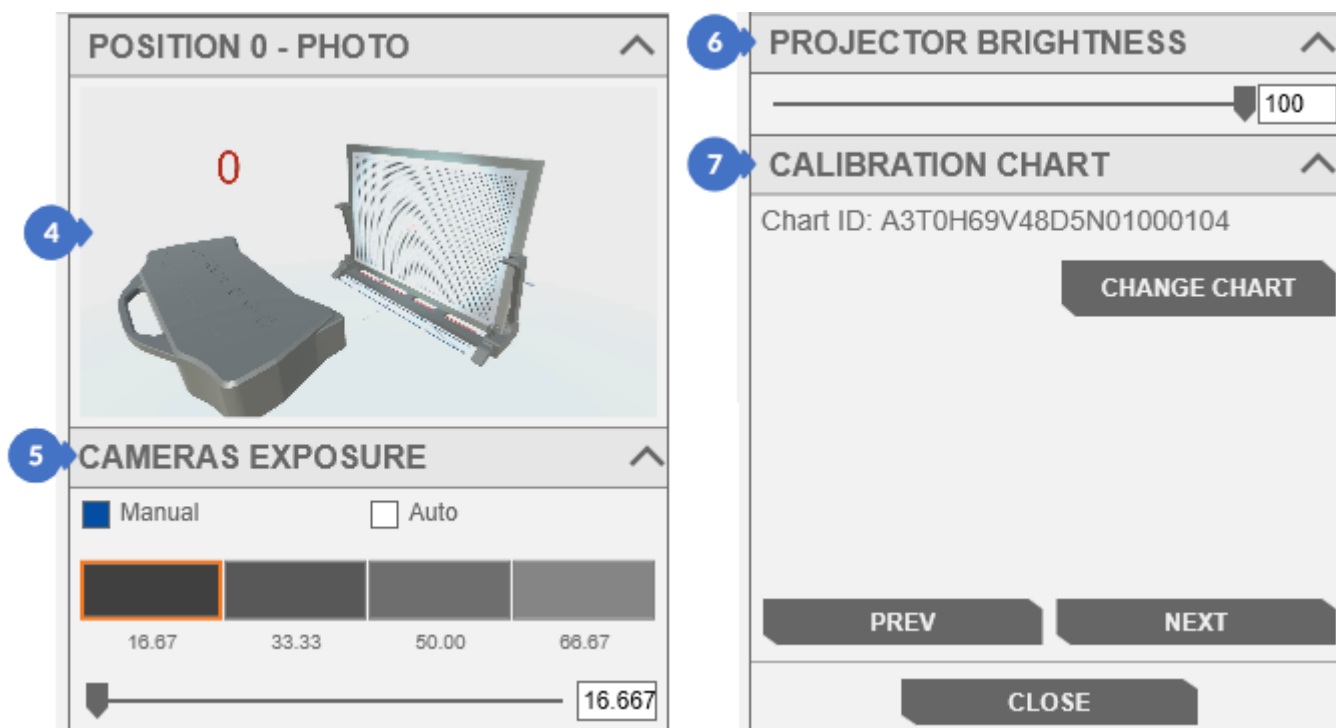


Figure 142. Taking the first calibration photo in manual mode

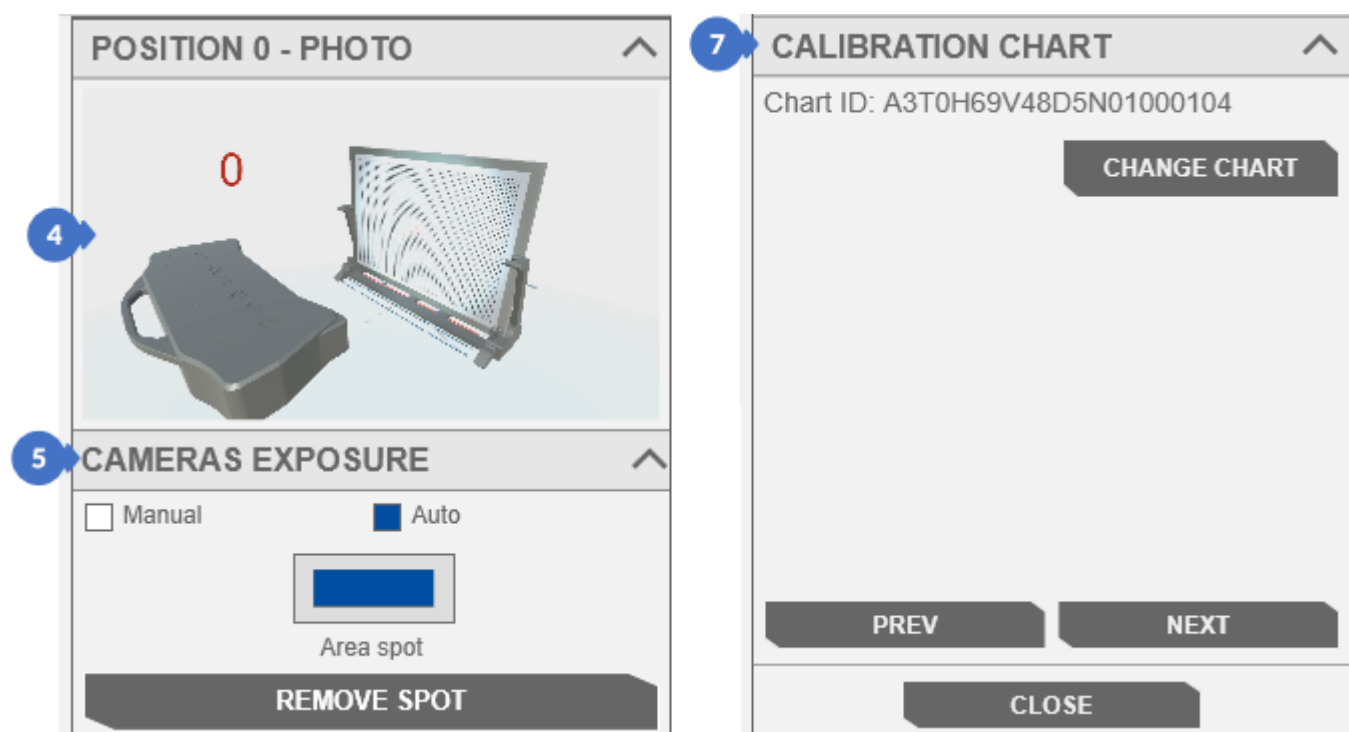


Figure 143. Taking the first calibration photo in automatic mode



The next steps are used to collect photos from the items presented in the animations – they can be, for example, photos of the vertically positioned chart moved forward in three steps: F1, F2, F3:



Figure 144. The position of the chart: F1, F2, F3

the vertically positioned chart moved backwards: B1, B2, B3, B4, B5, B6:



Figure 145. The position of the chart: B1, B2, B3, B4, B5, B6

a calibration chart set vertically on slants: D1, D2, D3, D4:



Figure 146. The position of the chart: D1, D2, D3, D4



the forward leaning chart: 0 (LEAN FORWARD), B6 (LEAN FORWARD):



Figure 147. The position of the chart: 0 (LEAN FORWARD), B6 (LEAN FORWARD)

the backwards tilted board: 0 (LEAN BACK), F3 (LEAN BACK):



Figure 148. The position of the chart: 0 (LEAN BACK), F3 (LEAN BACK)

The visible *NEXT* button always leads to the next step. In case of steps in which it is required to set the calibration chart according to the animation, pressing the *NEXT* button also triggers the calibration photo to be taken. If the photo taken is not approved during the verification process, it will not be possible to proceed to the next step, until the current step is not accomplished.

**i** NOTE

*The animations of the calibration chart layouts for individual photos may differ from those presented above – it all depends on the calibrated scanner.*

### 8.3.2.5 Calibration

The last step of the calibration wizard is to generate calibration files based on the calibration photos taken – the *CALIBRATE* button (8) is used to launch the generation process. After the scanner calibration file is correctly created, the name of the *CALIBRATE* button (8) will change to *DECALIBRATE* and there will be only one button *CLOSE* at the bottom to leave the wizard panel.

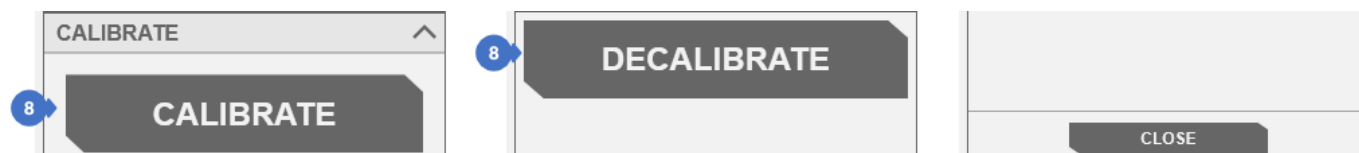


Figure 149. Calibrate/decilibrate the scanner in the Wizard

**i** NOTE

The calibration process may take a while depending on the computing power of your computer. This process cannot be stopped.

**i** NOTE

Pressing the *DECALIBRATE* button (8) in the wizard (after the calibration has been performed) will restart the wizard and you will have to go through all the steps again to recalibrate. To avoid this, you can close the wizard and go to the normal calibration mode in the 3D scanning tab, calibrate option (Calibration category) and then click the *CALIBRATE* button.

## 8.3.3 Deleting Calibration Photos

### 8.3.3.1 Decalibration

After clicking on the *DECALIBRATE* button in the calibration panel, after the scanner has been calibrated, a question box will be displayed whether the calibration photos in the tree are to be deleted or should be left.

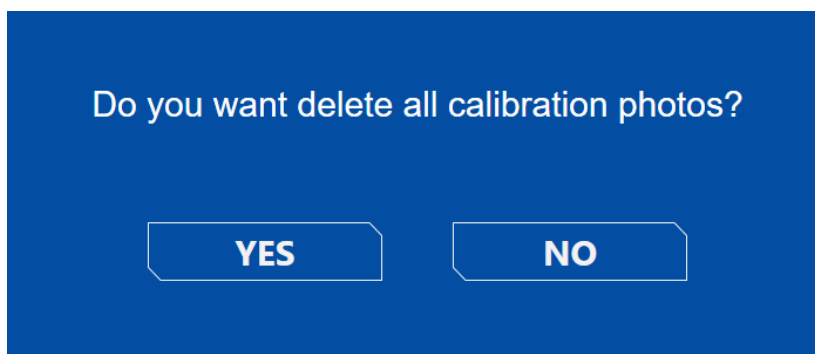


Figure 150. A window with a question about deleting all calibration photos.

### 8.3.3.2 Deleting Photos from the Tree

Incorrectly taken calibration photos or repeatedly taken in the same position of the calibration chart can be removed from the tree only when the calibration process has not been completed or when the calibration has been deleted (the *DECALIBRATE* button was used). To do this click the left mouse button and select the only available *Delete* option.

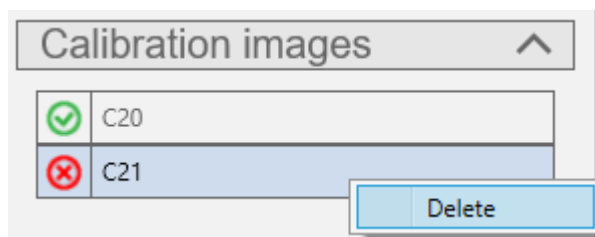


Figure 151. Delete the calibration photo

#### **i** NOTE

*Incorrect calibration photos (with the red "x" symbol) are not taken into account in the calibration process, so it is not necessary to delete them.*

### 8.3.4 Selection of the Calibration File of the Calibration Chart

The calibration chart file can be selected by opening the *Start* menu (1) then selecting the *Configuration* (2), and the *Equipment* (3) tab. If the list of chart files is empty or there is no calibration chart file required for the scanner calibration, import it by pressing the *IMPORT* button (4) indicating the location of the file with the .md extension. The *USE SELECTED* button (5) is used to select the chart calibration file. The panel for selecting the chart calibration file can also be opened by means of the *Choose chart* option (6) in the *3D scanning* tab in the *Calibration* category.

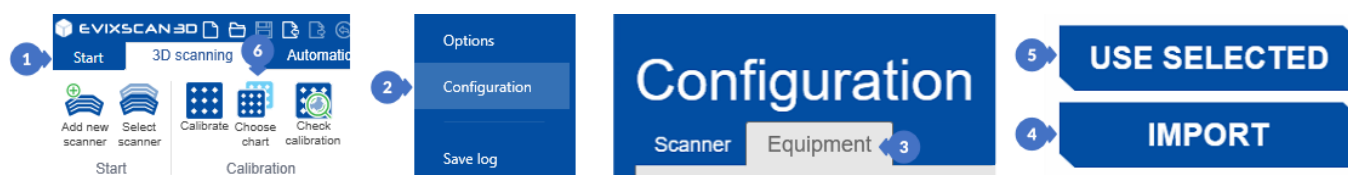


Figure 152. Opening the window for selecting the calibration chart

The selected calibration chart file has a marked field (blue square to the left of the name) (7) (Figure 153).

Each calibration file has:

- (9) – identifier (Id), it can also be found on a sticker on the back of the calibration chart,
- (10) – date of generating the calibration file (*Calibration date*).

The process of searching a long list of charts is facilitated by the search engine at the bottom of the *CALIBRATION CHART* window.

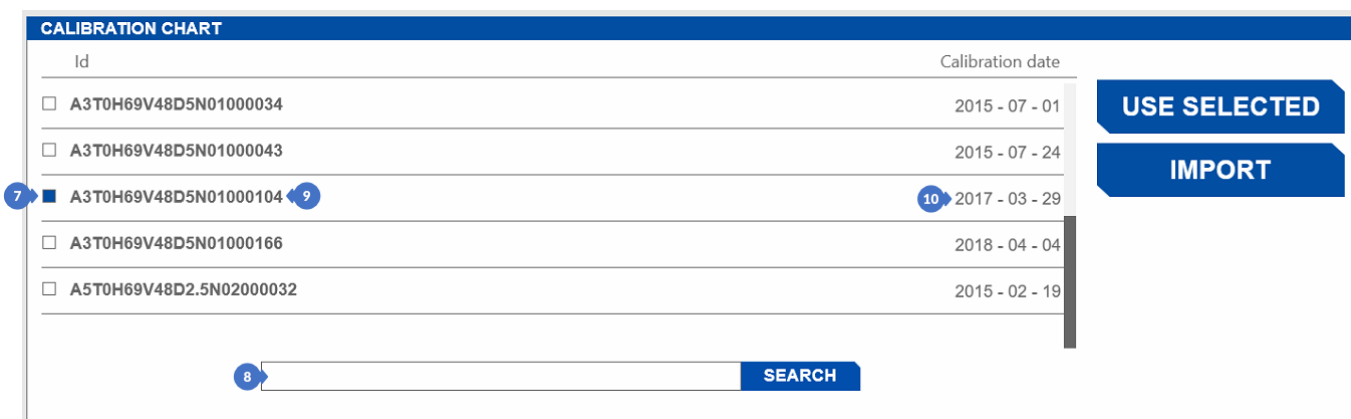


Figure 153. Calibration chart selection windows

## 8.4 Verification of the Correctness of Calibration

Before starting the calibration verification, you need to have the selected scanner configuration appropriate for the connected scanner. The *Check calibration* option (1) that opens the verification panel (on the left) is located in the *3D scanning* tab in the *Calibration* category.

More information about selecting a calibration can be found in Subsection 8.5.

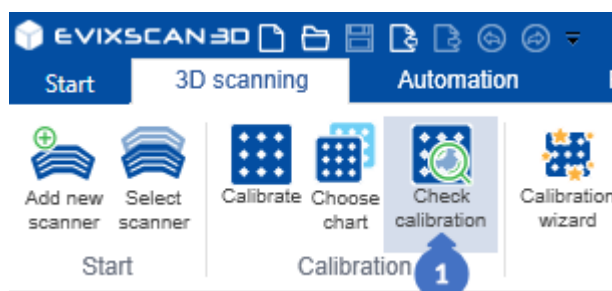


Figure 154. Opening the Check calibration panel

The panel of the SIMPLE (A) tab contains the following settings:

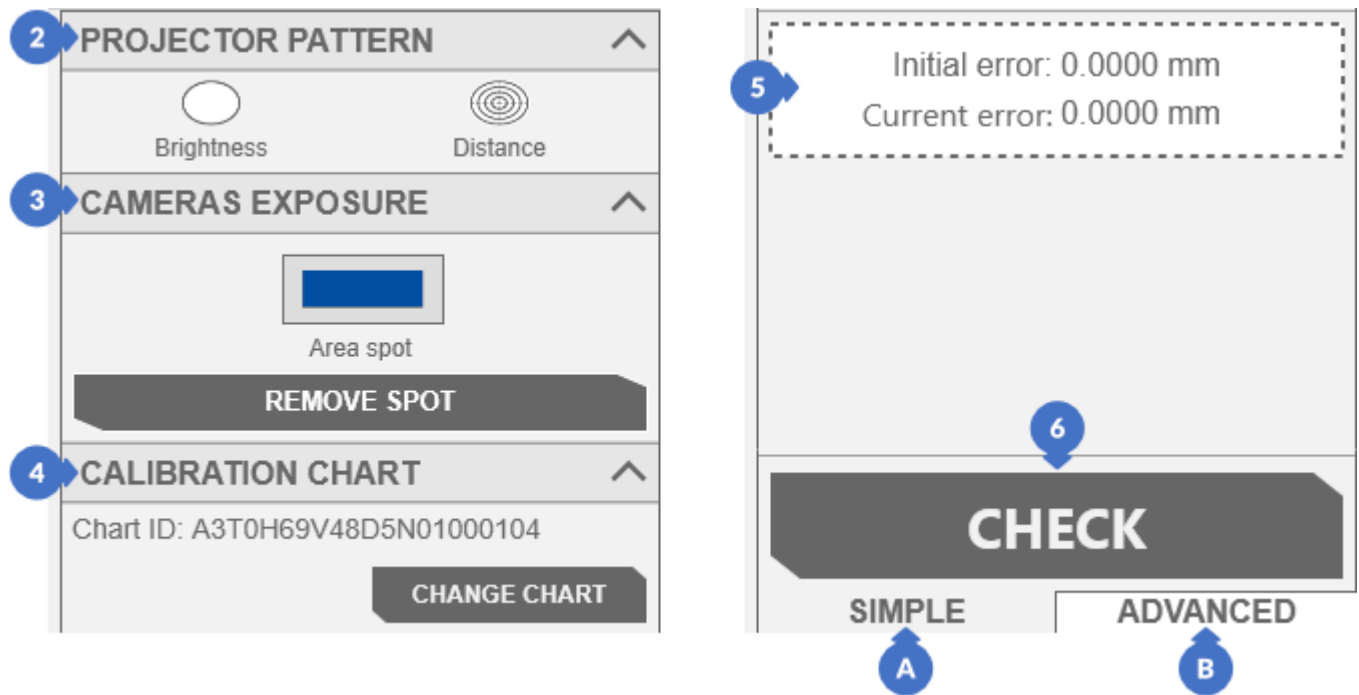






Figure 155. Calibration verification panel – SIMPLE tab

- (2) – changing the pattern projected by the projector (*PROJECTOR PATTERN*), the *Distance* sight pattern allows to set the appropriate distance and height of the scanner from the calibration chart,
- (3) – *CAMERAS EXPOSURE* will allow to select the appropriate exposure time,  
 ■ More information about the selection of exposure can be found in Subsection 9.2.
- (4) – *PROJECTOR BRIGHTNESS* will allow to adjust the brightness of the projector,  
 ■ More information about selecting projector brightness can be found in Subsection 10.1.1.
- (5) – *CALIBRATION CHART* selects the correct calibration file that matches your calibration chart,  
 ■ More information about choosing the calibration chart can be found in Subsection 8.3.4.
- (6) – results obtained from the calibration checking process. *Initial error* is the base error while *Current error* is the error received as a result of verification.

The panel of the ADVANCED (B) tab expanded by:

- (7) – projector pattern selection (PROJECTOR)  
 More information about the projector patterns can be found in Subsection 10.2.
- (8) – slider responsible for Pixel clock on cameras (CAMERAS)  
 More information about Pixel clock can be found in Subsection 5.1.1.1, point (3)
- (9) – cameras exposition selection (CAMERAS),  
 More information about selecting cameras exposure can be found in Subsection 9.
- (10) – slider for adjusting the brightness of the projector,  
 More information about projector brightness can be found in Subsection 10.1.

Before starting the verification, set the calibration chart to the position 0 according to the calibration pad.

**i NOTE**

The verification process of the performed calibration is best carried out immediately after performing the calibration, because then the most reliable result will be obtained, resulting from the fact that the only element moved in space will be the calibration chart.

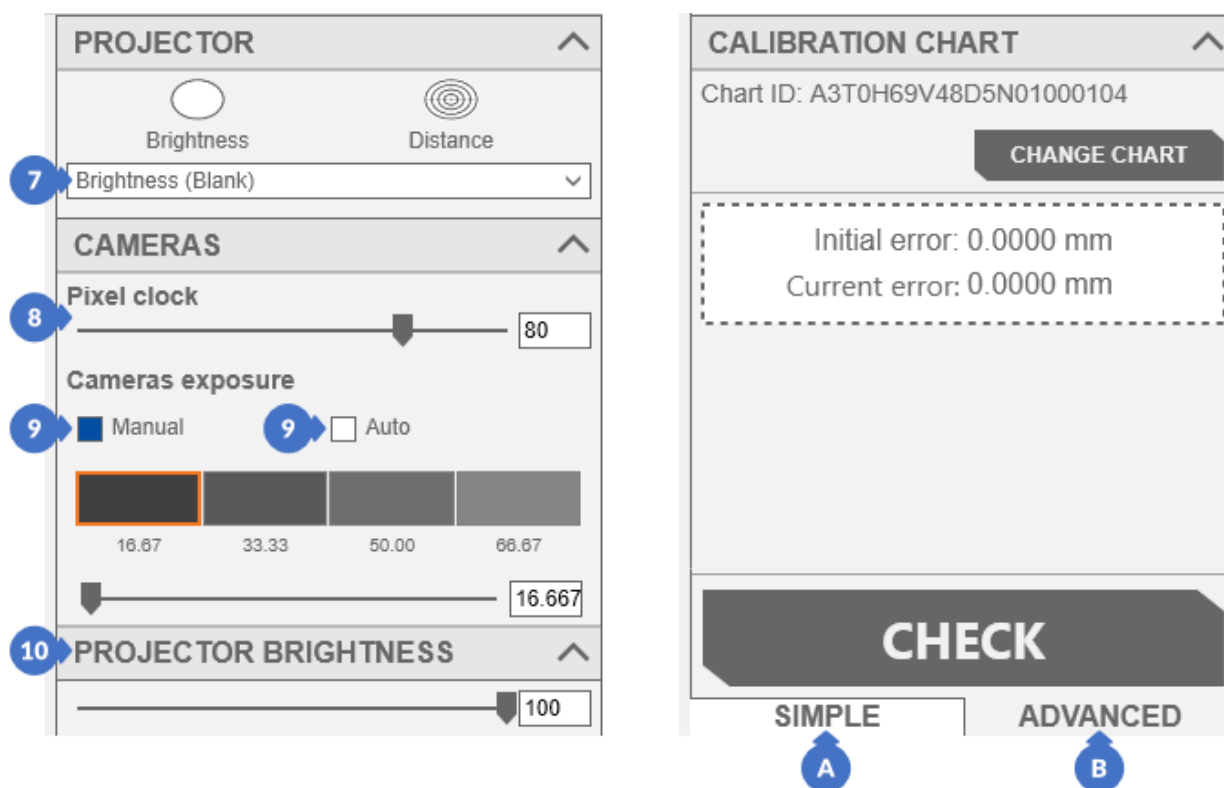


Figure 156. Calibration verification panel – ADVANCED tab

## 8.4.1 Types of Messages after Verification

If the calibration is acceptable, but the scans made with it may have deviations from the reality, the *Current error* value will change to yellow (A), displaying the appropriate message in red (A). If correctly calibrated, both *Current error* and the displayed message will be green (B).

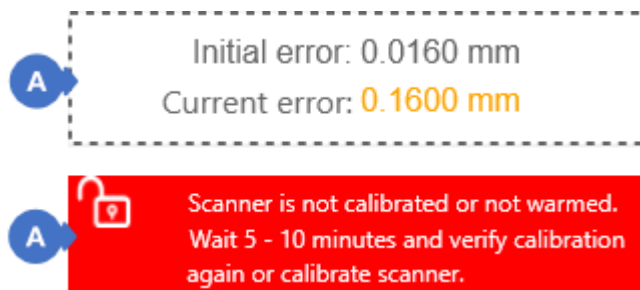


Figure 157. Calibration acceptable but not suitable for making accurate scans

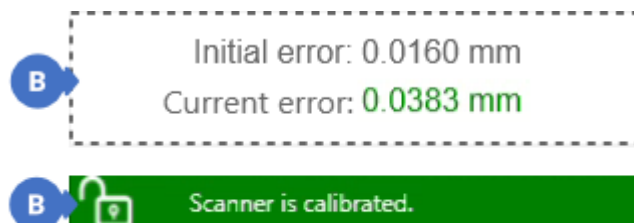


Figure 158. Calibration corrects and scannable

Failure to detect the calibration chart in front of the scanner (C) or the lack of a calibrated scanner configuration will change the color of *Current error* and the message to red,

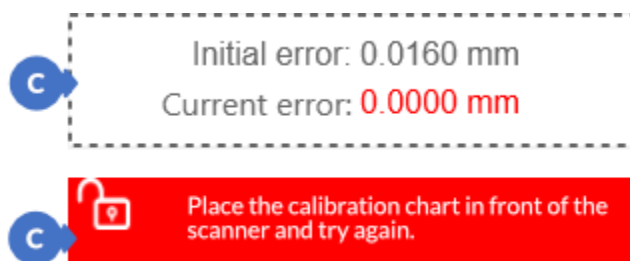


Figure 159. Calibration verification error – undetected calibration chart

## 8.5 Selecting Another Existing Scanner Configuration (Select Scanner)

The choice of a previously created scanner configuration can be made in two ways. The standard way is to open the *Start menu* (1), then the *Configuration* (2), and the *Scanner* (3) tabs. The *USE SELECTED* button (4) is used to set the selected scanner configuration as active. The second way to open this window is the *Select scanner* option (5) in the *3D scanning* tab in the *Start* category.

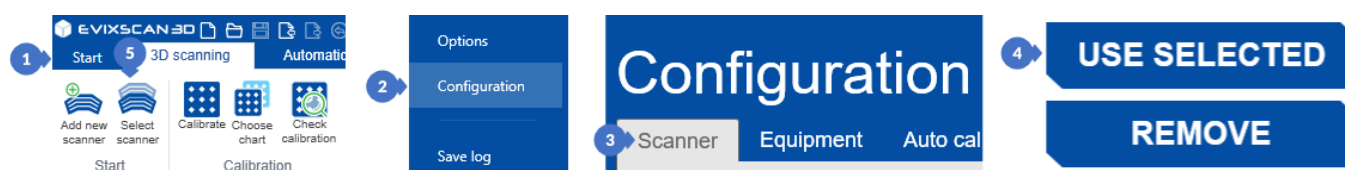


Figure 160. Open the scanner configuration selection window

All available device configurations are listed below the *3D SCANNERS* heading (6). The active configuration has a selected box (the blue square to the left of the name) (7). Only one configuration can be selected at a time. Each scanner configuration includes:

- (8) – *Name* – usually with the date, unless the user modifies the default name,
- (9) – *Created* – configuration creation date,
- (10) – *Last scanner calibration* – date of the last calibration with the given configuration,
- (11) – *Camera resolution* – camera resolution of the device to which the configuration applies.

3D SCANNER

LIGHT SOURCE

1. ANHUA 60Hz (1280 x 960) CONFIGURE ETHERNET

6 3D SCANNERS

Name	Created	Last scanner calibration	Camera resolution
<input checked="" type="checkbox"/> Basic 02-05 08.26 8	9 05-02-2018	10 04-02-2021	11 1280×1024
<input type="checkbox"/> Optima 12-22 08.53	22-12-2020	none	none
<input type="checkbox"/> Optima+ 21112020 - 1030	23-11-2020	03-12-2020	4112×2176
<input type="checkbox"/> Basic 10-26 12.30	26-10-2020	02-11-2020	1280×1024
<input type="checkbox"/> Basic 09-21 10.10 tttt	21-09-2020	none	none
<input type="checkbox"/> Optima_2 07-02 15.29	02-07-2020	03-02-2021	2560×1920

4

USE SELECTED

REMOVE

RE-CALIBRATE

ADD NEW

Figure 161. Scanner configuration selection window

## 8.6 Deleting a Scanner Configuration

Any scanner configuration you create can be deleted. The button for deleting a configuration is in the window for selecting and creating a new configuration (in the *Configuration, Scanner* tab in the *Start* menu). To delete a configuration, simply select it in the list and then select the *REMOVE* button (1).

Name	Created	Last scanner calibration	Camera resolution
<input checked="" type="checkbox"/> Optima 12-22 08.53	22-12-2020	none	none
<input type="checkbox"/> Basic 02-05 08.26	05-02-2018	05-02-2021	1280×1024
<input type="checkbox"/> Optima+ 21112020 - 1030	23-11-2020	03-12-2020	4112×2176
<input type="checkbox"/> Basic 10-26 12.30	26-10-2020	02-11-2020	1280×1024
<input type="checkbox"/> Basic 09-21 10.10 tttt	21-09-2020	none	none
<input type="checkbox"/> Optima_2 07-02 15.29	02-07-2020	03-02-2021	2560×1920

USE SELECTED

REMOVE 1

CALIBRATE

ADD NEW

Figure 162. Scanner configuration selection window – the REMOVE button



## 8.7 Re-calibrating the Existing Scanner Configuration

Re-calibration is nothing but a decalibration and a subsequent calibration. The equivalent of the *RE-CALIBRATE* button is the *DECALIBRATE* button. The re-calibration process does not delete the calibration photos, but the file created during the calibration process. It allows to manually delete unnecessary calibration photos or take new ones and then recalibrate the device. The list of device configurations (located in the *Configuration, Scanner* tab in the *Start* menu), if a configuration is selected, without calibration (or decalibrated), it will display the *CALIBRATE* button (1) (Figure 163), which clicking automatically sets the configuration to active and transfers to the normal calibration panel.

More information about calibration can be found in Subsection 8.3.1.

Name	Created	Last scanner calibration	Camera resolution	
<input checked="" type="checkbox"/> Optima 12-22 08.53	22-12-2020	none	none	USE SELECTED
<input type="checkbox"/> Basic 02-05 08.26	05-02-2018	05-02-2021	1280×1024	REMOVE
<input type="checkbox"/> Optima+ 21112020 - 1030	23-11-2020	03-12-2020	4112×2176	CALIBRATE 1
<input type="checkbox"/> Basic 10-26 12.30	26-10-2020	02-11-2020	1280×1024	
<input type="checkbox"/> Basic 09-21 10.10 tttt	21-09-2020	none	none	
<input type="checkbox"/> Optima_2 07-02 15.29	02-07-2020	03-02-2021	2560×1920	ADD NEW

Figure 163. Scanner configuration selection window – the *CALIBRATE* button

The *RE-CALIBRATE* button (1) (Figure 164) works in a similar way. It appears only for the calibrated configurations and when you click it, it sets the selected configuration (to active) and decalibrates it, and then transfers it to the normal calibration panel.

Name	Created	Last scanner calibration	Camera resolution	
<input checked="" type="checkbox"/> Optima 12-22 08.53	22-12-2020	none	none	USE SELECTED
<input type="checkbox"/> Basic 02-05 08.26	05-02-2018	05-02-2021	1280×1024	REMOVE
<input type="checkbox"/> Optima+ 21112020 - 1030	23-11-2020	03-12-2020	4112×2176	RE-CALIBRATE 1
<input type="checkbox"/> Basic 10-26 12.30	26-10-2020	02-11-2020	1280×1024	
<input type="checkbox"/> Basic 09-21 10.10 tttt	21-09-2020	none	none	
<input type="checkbox"/> Optima_2 07-02 15.29	02-07-2020	03-02-2021	2560×1920	ADD NEW

Figure 164. Scanner configuration selection window – *RE-CALIBRATE* button

A similar effect can be obtained by going to the calibration panel and after the calibration is done, initiate the action with the *DECALIBRATE* button.

## 9 EXPOSURE

Exposure is a term used in the photography and film industry. Determines the amount of light that is captured by the image sensor. Exposure is obtained by setting the appropriate aperture values and shutter speed. In our case, the shutter speed can be set, and the aperture value is fixed permanently at the factory.

### 9.1 Exposure Modes

There are two exposure setting modes in the *eviXscan 3D Suite* software. The default mode is *Manual*.

**NOTE**  
The exposure of cameras can be adjusted manually using the slider / defined buttons with exposure (if they are supported for a given scanner) or automatically after indicating the place where it is to be detected. The exposure mode depends on the last setting of the panel tab - each time the *SIMPLE* tab is selected, the exposure mode is automatically set to *Auto*. In the *ADVANCED* tab, you can manually change the method of selecting the exposure to *Manual*.

#### 9.1.1 Manual Exposure

The controls for managing the exposure in manual mode can be found in most dynamic panels. Additionally, the manual exposure control can be found in the program settings. To go to the settings, open the *Start* menu (1), go to the *Options* tab (2) and then select *General options* (3).

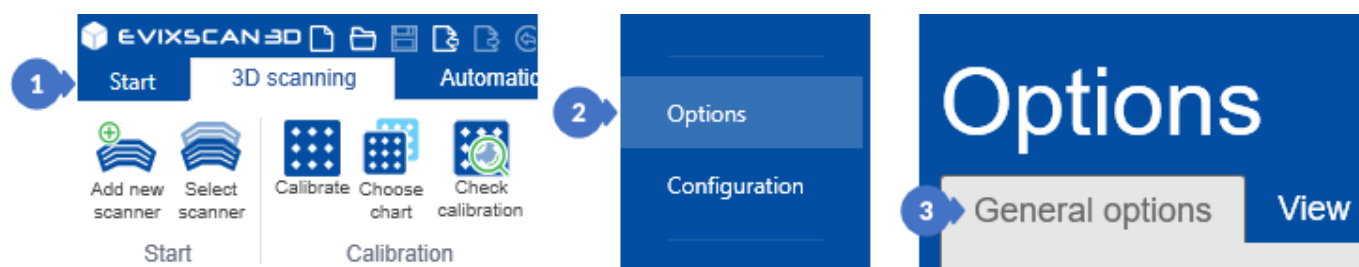


Figure 165. General settings

There is a *CAMERAS* (4) section devoted to camera settings.

(5) – the tiles represent the most used exposure values. An orange wrapper around the tile indicates that the exposure is currently active. All numerical values under the tiles are in milliseconds,

(6) – the slider with the text field on the right represents the value of the selected exposure (corresponding to the value of the tile or other)

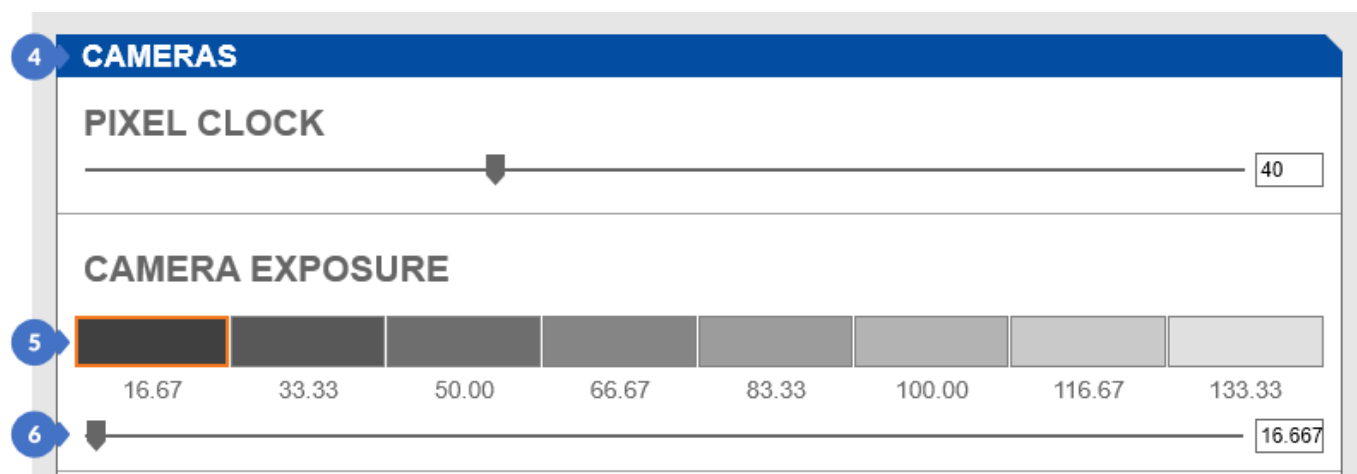


Figure 166. Manual exposure control in general options

The control in the panels contains the same elements as the settings control. All settings made on any control are global settings - this means that changes are made within the entire software, and thus a change in one control makes changes to all controls representing the same functionality. In the case of exposure tiles (5) in the panels, their displayed quantity depends on the width of the panel. An additional element is the Gain slider (7) for digital amplification of the signal from the camera sensor to add an additional brightness to the photos.

More information about the Gain option can be found in [Section 11](#).

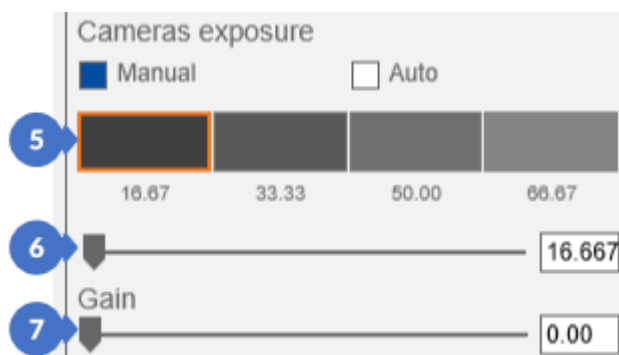


Figure 167. Manual exposure control in panels

## 9.1.2 Automatic Exposure (semi-automatic)

Automatic exposure automatically adjusts the exposure to suit the surrounding light conditions with a little help from the user. There are three methods of automatic exposure selection, but they do not always occur simultaneously.

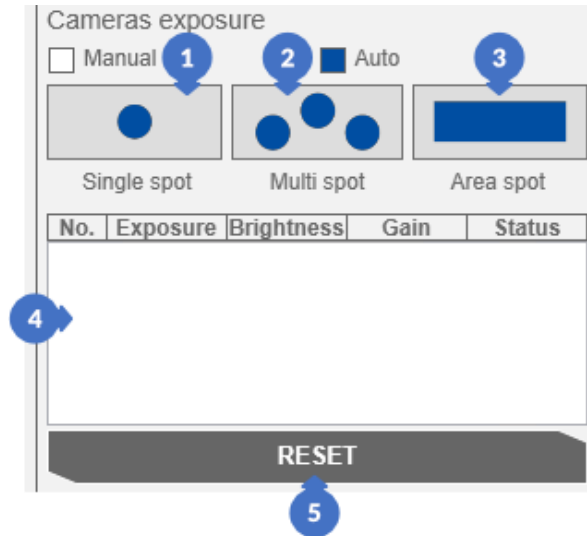


Figure 168. Autoexposure indicator in the panels

- (1) – *Single spot* is a mode in which the selection of the exposure is made by selecting a single point (marker) (A) in the preview window from the left camera. The preview window of the right camera (B) will show how the object will be scanned after the selected exposure based on the selected point (Figure 169),

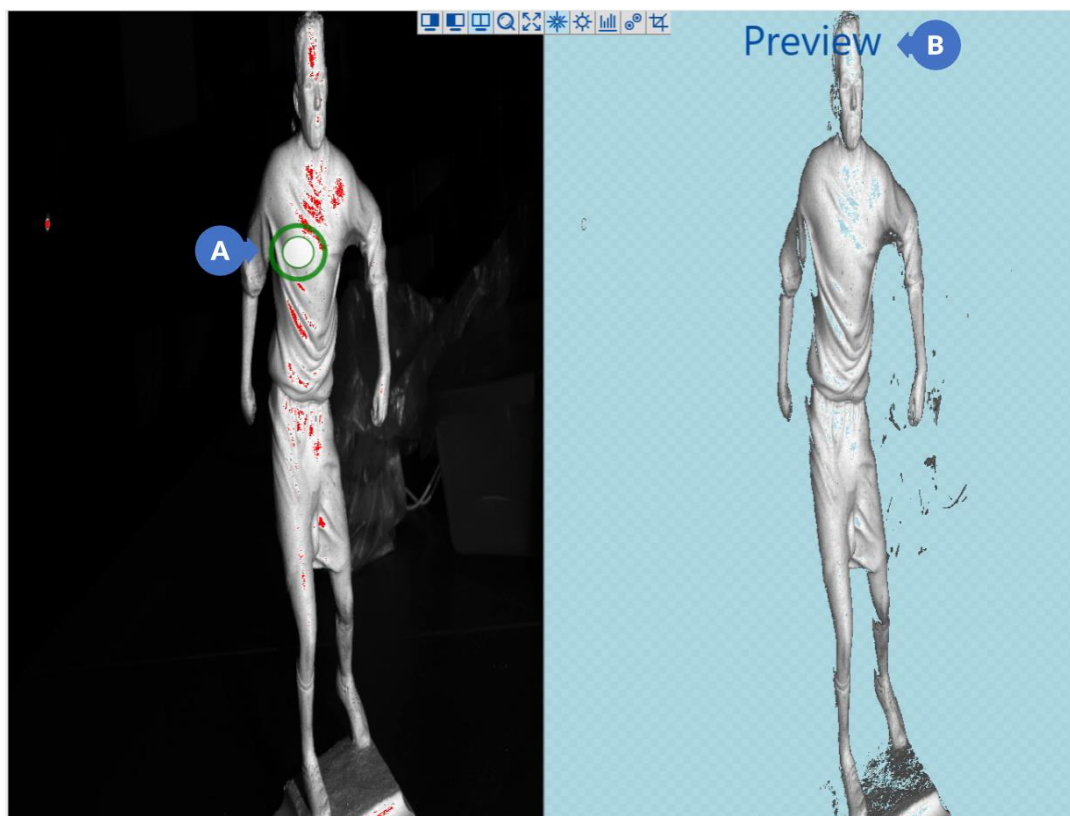


Figure 169. Automatic exposure using the single spot method

- (2) – *Multi spot* is a mode in which the selection of the exposure is made by selecting a few points (C) (maximum 5) in the preview window of the left camera. In the preview window of the right camera, as in the case of the single spot, there will be a preview of the automatically selected exposure (D) for the scanned object based on the marked points,

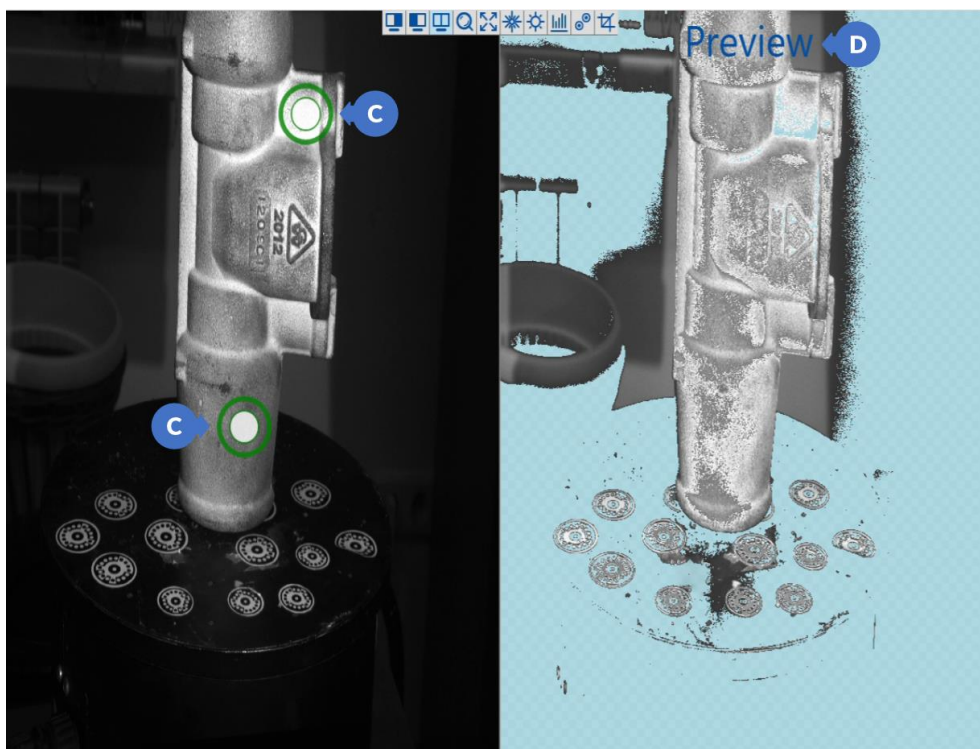


Figure 170. Automatic exposure using the multi spot method

- (3) – *Area spot* is a mode in which the exposure selection points are selected based on the rectangle marked in the preview from the left camera (E). The preview window the right camera will show a preview of the scanned object (F) for the selected rectangle,

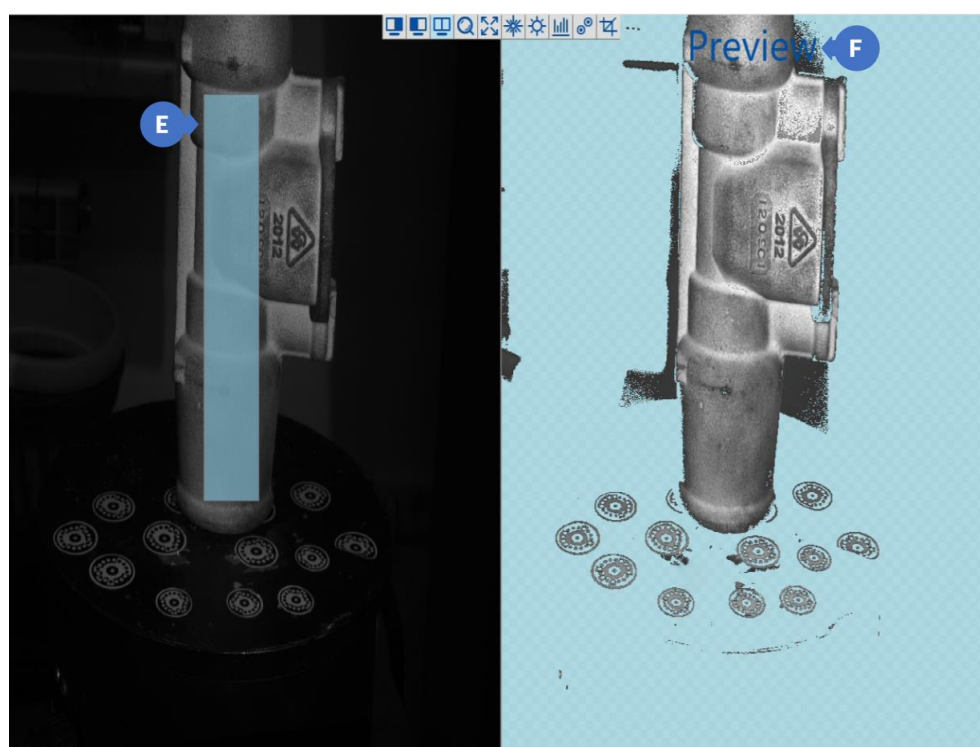


Figure 171. Automatic exposure using the Area spot method

- (4) – list of marked points in the left camera preview window. It has the following information:
- (G) – *No.* – order number,
  - (H) – *Exposure time* – set exposure,
  - (I) – *Brightness* – projector brightness,
  - (J) – *Gain* – digital image amplification,
  - (K) – *Status* – informing about the processing status or its completion,

G	H	I	J	K
No.	Exposure	Brightness	Gain	Status

Figure 172. Autoexposure point list

- (5) – *RESET* – deletes the settings made in the auto exposure.

Selecting a point on the list (M) will highlight it (L) (change its color to blue) in the left camera preview window.

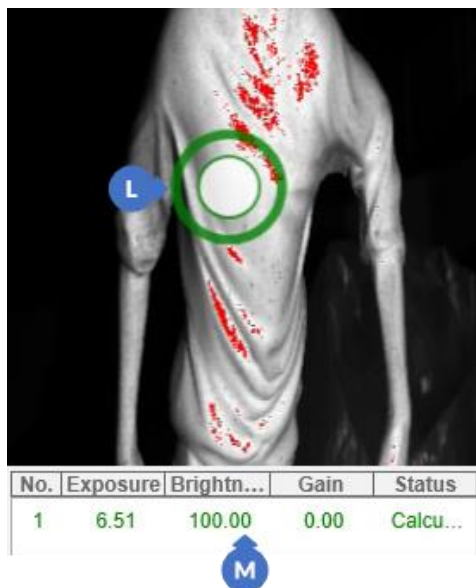


Figure 173. Point not marked in the automatic exposure list



Figure 174. Point selected in the automatic exposure list

Clicking on a point and holding down the left mouse button will change the position of the point. After this operation, it is required to recalculate the point using the *RECALCULATE SPOT* button (6) (Figure 168) (before clicking the button, select the point in the list).

In the calibration panel, there is an automatic selection of the exposure in a simplified form. There is only one option available of selecting the *Area spot* with the rectangle (3) and the button for deselecting the *REMOVE SPOT* (5).

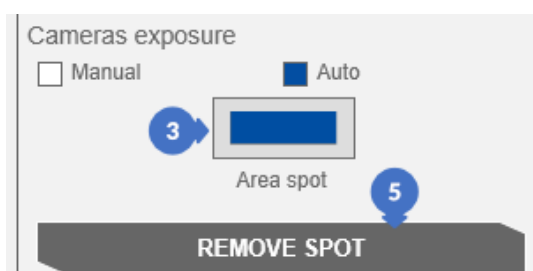


Figure 175. Autoexposure on the normal calibration panel



## 9.2 Correct Selection of Exposure

The correct selection of the exposure is based on the appropriate selection of the exposure time, leading to a compromise between overexposure and underexposure of the photo. An important element is the selection of the exposure in such a way that the picture taken contains as few overexposed pixels as possible. If the overexposure can no longer be avoided by changing the exposure settings, the projector brightness variable can be used, but only when there is no other way to reduce the overexposure.

More information about changing projector brightness can be found in Subsection 10.1.1.

### 9.2.1 Overexposure

Overexposure (also known as burnout in photography) is the loss of bright parts of an image as a result of the too long exposure of the image sensor. The photo obtained in this way has too much accumulation of bright pixels (marked as 255 in the graphics). In the *eviXscan 3D Suite* software, overexposed parts of the image in the camera preview window are marked in red when the *Overexposed pixels (1)* option is enabled.



Figure 176. Overexposed pixels option enabled

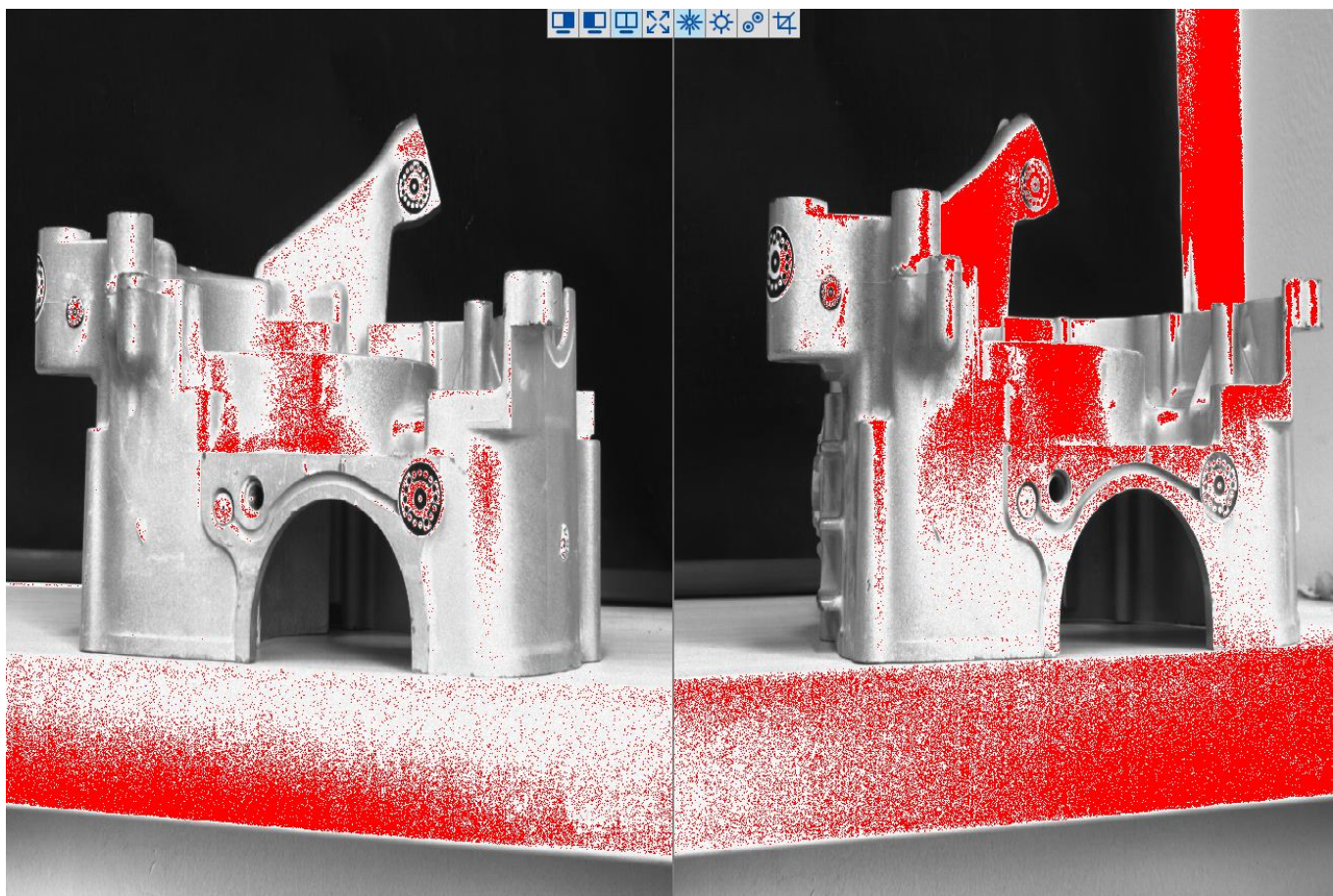


Figure 177. Overexposed pixel view in left and right camera preview

## 9.2.2 Underexposure

Underexposure is, like overexposure, the data loss, but in this case, it is due to a lack of light caused by a too short exposure time. Pictures obtained in this way have too much accumulation of dark pixels (marked as 0 in the graphics). In the *eviXscan 3D Suite* software, the *Underexposed pixels* (1) option is responsible for displaying underexposed pixels in the camera preview.



Figure 178. Underexposed pixels option enabled

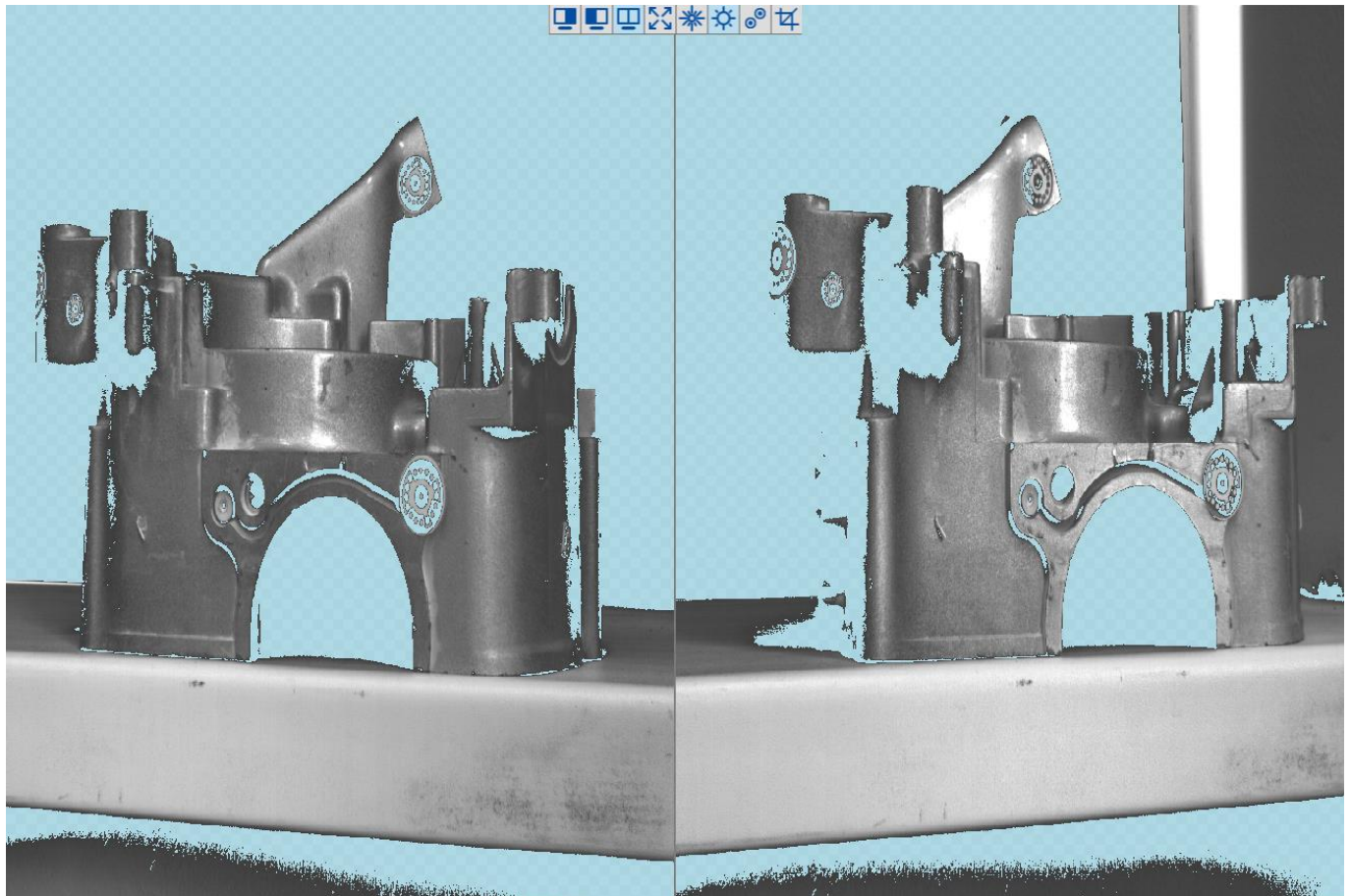


Figure 179. Overexposed pixel view in left and right camera preview



# 10 PROJECTOR

The projector is responsible for projecting the light beam and is an essential part of every scanner.

## 10.1 Projector Brightness

The projector brightness parameter is a global parameter for all software (changing it in one control updates the values in the others). It can be found in most of the panels on the right side of the software window, but only and exclusively in the manual exposure mode (*Manual*). In the *Auto* mode the brightness is selected automatically. The *PROJECTOR BRIGHTNESS* slider ranges from 0% to 100% and sets the intensity of the light emitted by the projector.

More information about exposition can be found in Section 9.



Figure 180. Projector brightness slider

### 10.1.1 Correct Selection of Projector Brightness

The brightness values of the projector slider should not be changed to the point where overexposed pixels can be reduced using exposure parameters. If, for technical reasons, it is no longer possible – because, for example, the camera frames are too high – the projector's brightness slider can help. As a general rule, it can be assumed that the value of the projector brightness slider should be in the range from 70% to 100% and should not go below the lower limit (i.e. < 70%). As in any general rule, also here deviations from it may occur, however, they should be controlled so that changes in the brightness introduced below the lower limit do not affect the quality of the acquired scans.

## 10.2 Projector Patterns

There are two basic patterns displayed by the projector in the software. The first is *Brightness* (1) and the second is *Distance* (2).

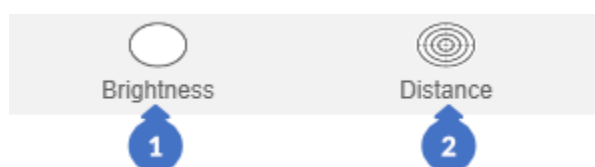


Figure 181. Projector pattern selection

The *Brightness* button displays a bright light, while the *Distance* button (*Viewfinder*) helps to select the appropriate distance between the scanner and the object. The operation of both patterns is presented below.

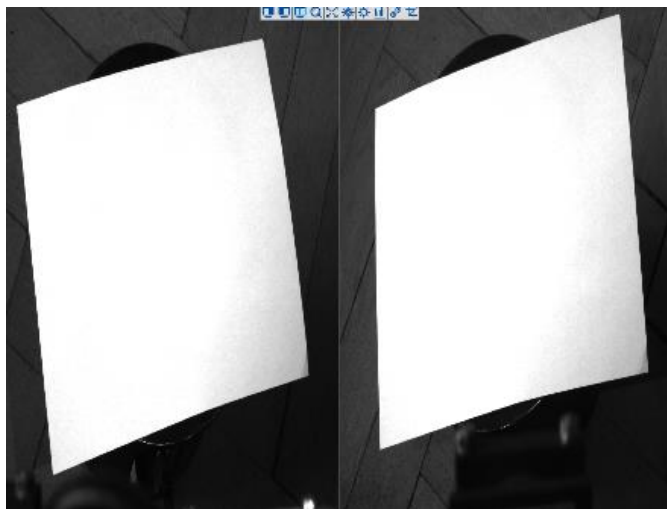


Figure 182. Preview of the *Brightness* pattern on the cameras

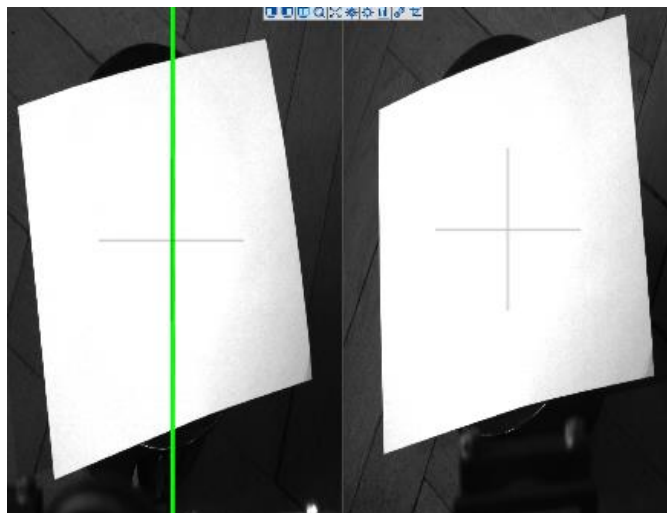


Figure 183. View the *Distance* pattern on cameras

Besides the two main patterns (1) (2), you can use additional patterns from the list below.

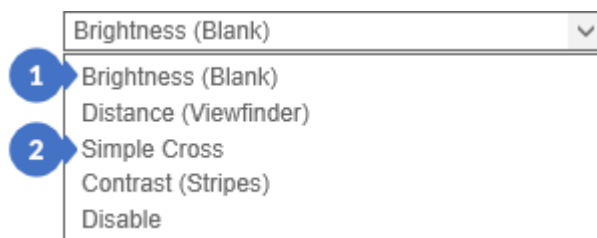


Figure 184. List of additional patterns

The *Distance Pattern (Viewfinder)* is a different (more advanced) version of the *Distance* Pattern. *Contrast (Stripes)* is a pattern that displays stripes vertically until the entire display area is filled-in. *Disable* stops displaying the pattern – stops the light projection.

## 11 GAIN

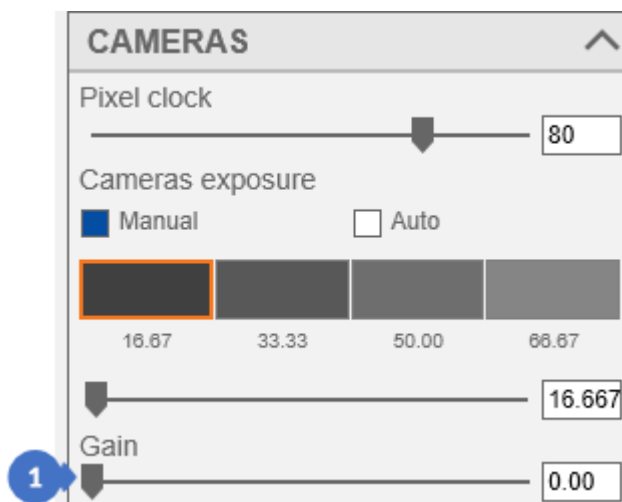


Figure 185. Gain parameter on the panel

The *Gain* (1) parameter, found in most of the *Manual Exposure Settings* panels, is used to digitally amplify the signal from the camera sensor to brighten the photos. This parameter takes values from 0 (where there is no signal amplification) up to the maximum value of 15. This value can be changed with an accuracy of 0.01.

**i** NOTE

*It should be remembered that the amplification of the camera sensor signal also increases the image noise.*

### 11.1 Correct Selection of Digital Image Amplification

In the case of very dark objects, when it is not possible to increase exposure on cameras and the projector's brightness is 100%, the last parameter with which the sensitivity of the sensor in the camera can be increased to "artificially" brighten the photo. This parameter is called *Gain*. With the increase of its value, the preview from the cameras should brighten, but at the same time, there will be an additional noise introduced to the pictures caused by a higher sensitivity set on the matrix sensor.

## 12 SCANNING PROJECT

A project in *eviXscan 3D Suite* is a set of scans (made with the software and those imported from the outside – meshes) located in one location together with a file having the .mdl extension.

### 12.1 Creating a New Project

A new project can be created by opening the *Start* menu (1) and pressing the *New* button (2).

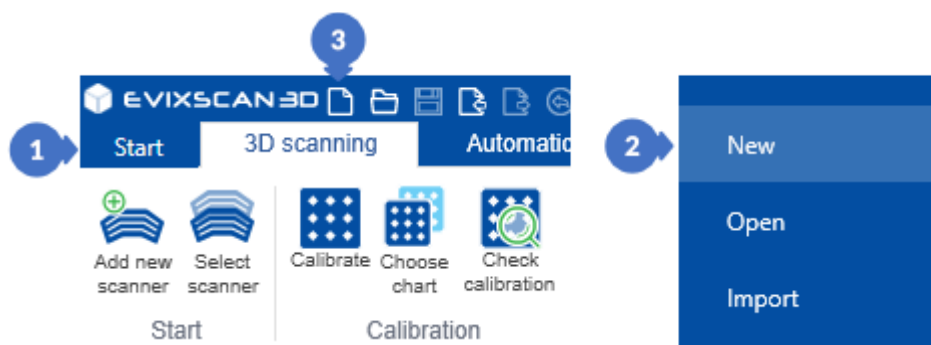


Figure 186. Create a new project

In the *New* tab, select the *Directory* (4) using the *Browse* button (6) or enter it manually. Additionally, enter the name of the project in the *Name* field (5) and then click on the *OK* button (7). If the entered path and name of the project are correct, the project will be created in the indicated location.

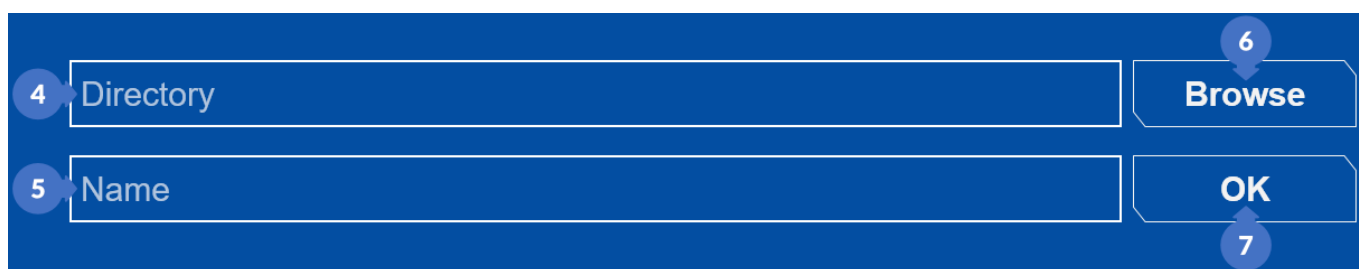


Figure 187. Creating new project – the New tab

The second way to create the project is the *New* button (3) (Figure 186) with a card icon from the quick access bar. This button opens a window in which you can select the path of the newly created project (8) (Figure 188), enter the name of the project (9) and then click the *Save* button (10) to create the new project. The project extension is a .mdl file.

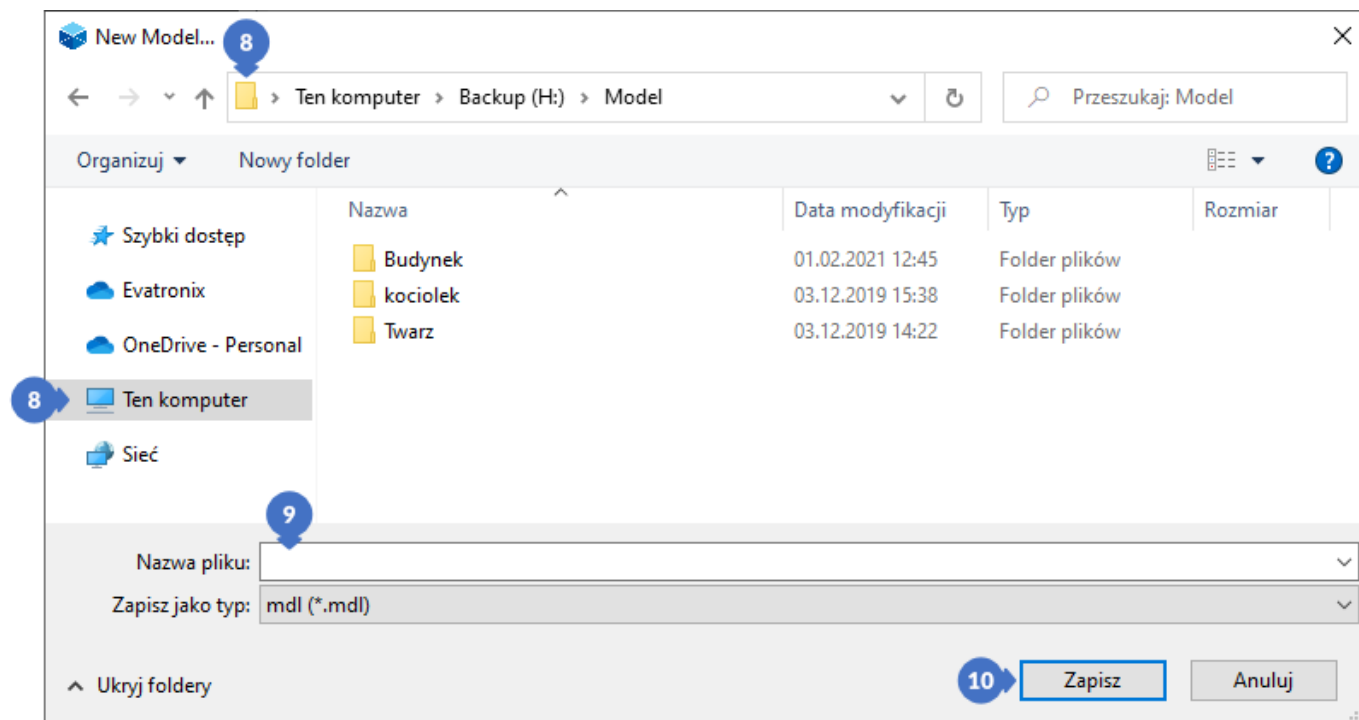


Figure 188. Creating new project – quick access *New*

### 12.1.1 eviXscan 3D Suite Requested New Project

There is also a different type of window in *eviXscan 3D Suite* that allows you to quickly create a project. This window appears when the user loads a file with the file extension other than .mdl, e.g. .evx, .ply, .glb, .stl, or starts scanning without having a project opened.

More information about opening a project can be found in Subsection 12.2.

In this window, there is a field where you can enter the name of the project (1), the location where the project will be created (2) by entering it manually or selecting the *BROWSE* button (2).



Figure 189. Creating new project requested by *eviXscan 3D Suite*

In the window that will be opened (with the use of the *BROWSE* button (2), select the folder (5) in which the project will be created and then click on *Select folder* (6) (Figure 190). The location of the selected folder appears in the field (2) (Figure 189).

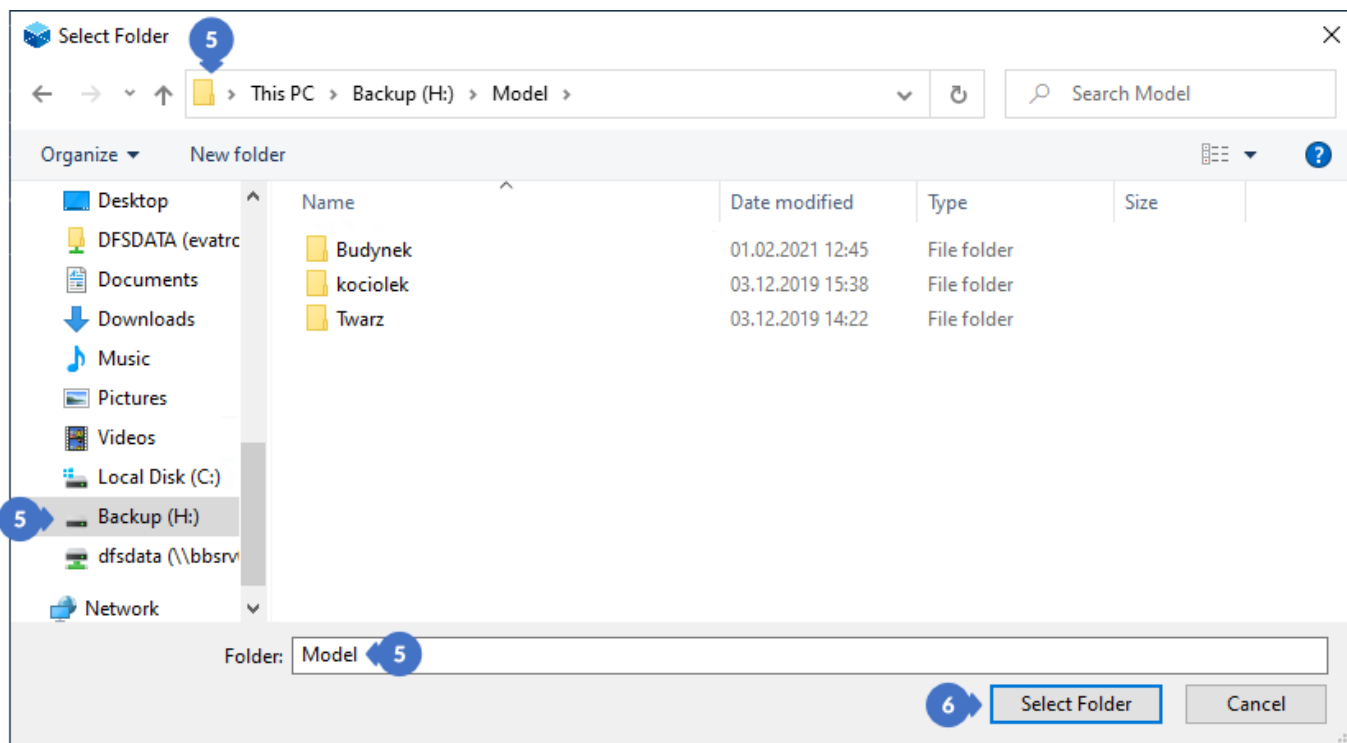


Figure 190. Creating new project requested by eviXscan 3D Suite – path selection

After filling in all the required fields, you can create a project using the *CREATE* button (3). The *CANCEL* (4) is used to close the window and results in creating a temporary project with the name containing the date and time at which it is created in the indicated path (if the default path has not been changed) (2) (Figure 189).

## 12.2 Open an Existing Project

You can open a previously created project in three different ways. The first is to open the *Start* menu (1) and select the *Open* tab (2) and then use the *Open* button (3)



Figure 191. Opening an existing project

In the window, find the path to the project (6) and select the file with the *.mdl* extension (7) and then click on the *Open* button (8) (Figure 192). Selecting a file with the *.evx*, *.ply*, *.glb*, *.stl* extension will bring up a window for creating a new project.

More information about creating a new project can be found in Subsection 12.1.1.

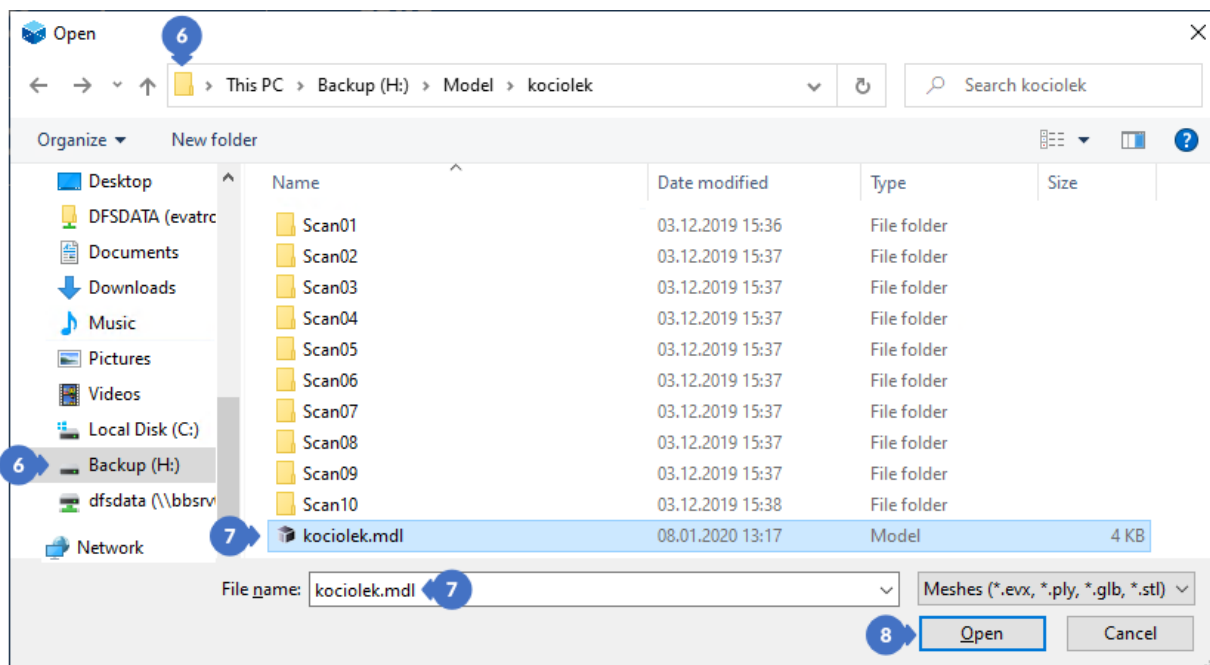


Figure 192. Opening an existing project – select project window

The second way to open the project is throughout the *Open* button (4) with the folder icon from the quick access bar. It brings up the same project selection window as the *Open* button (3) described above (Figure 191).

The third way to open a project is to select it from the list of recently opened projects (9) (Figure 193) in the *Open* tab (3) (Figure 191), the view of this tab is exactly the same as the view of the start window described earlier.

✚ The start window view is described in Subsection 4.3.

The *Create new* button (5) brings up the new project creation window (the *New* button with the card icon from the quick access bar).

✚ The view of the new project creation window is described in Subsection 12.1.

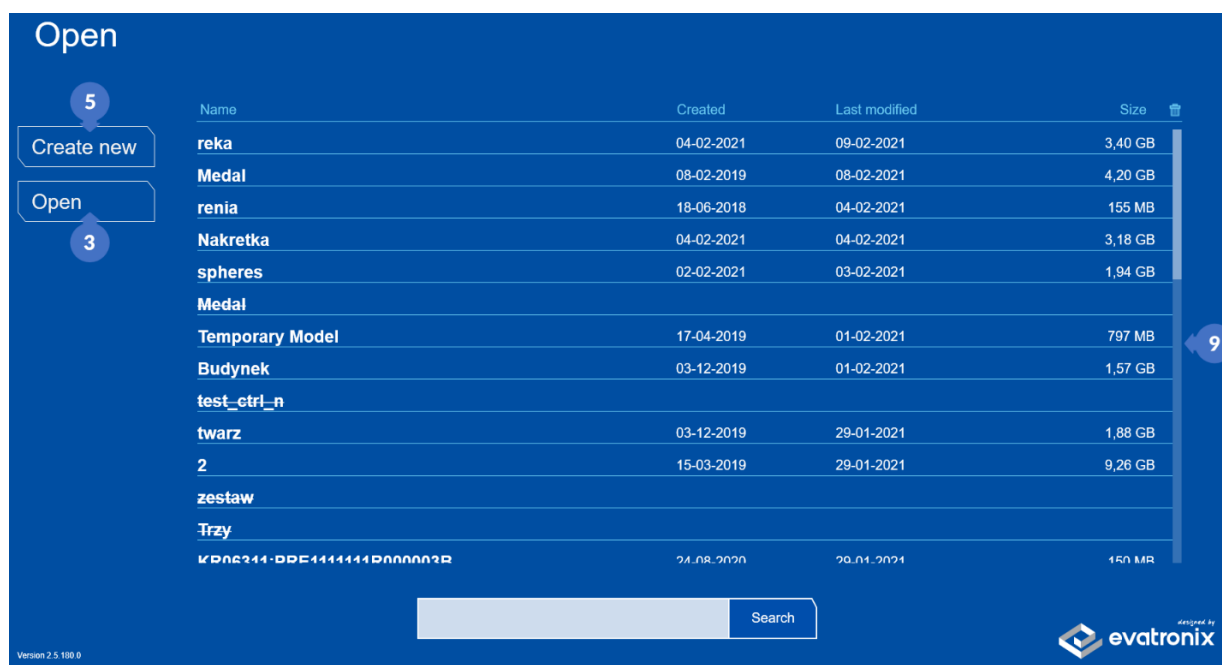


Figure 193. Opening an existing project – recent project list

## 12.3 File Import

The file import supports the following formats: *.evx*, *.glb*, *.stl*, *.ply*, *.wrl*. There are two ways to import scans. The first way is to open the *Start* menu (1) and then click on the *Import* button (2).

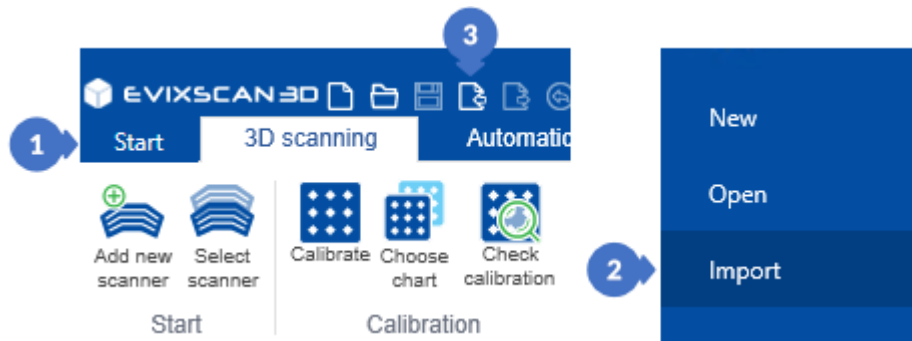


Figure 194. Importing files

In the window that opens, select the folder (4) in which the scans are located and then select all files that are to be imported into the project. You can change the filter (6) to display a specific format. After selecting the files, click on the *Open* button (7). This way, the imported files will appear in the tree in the default *Meshes* group.

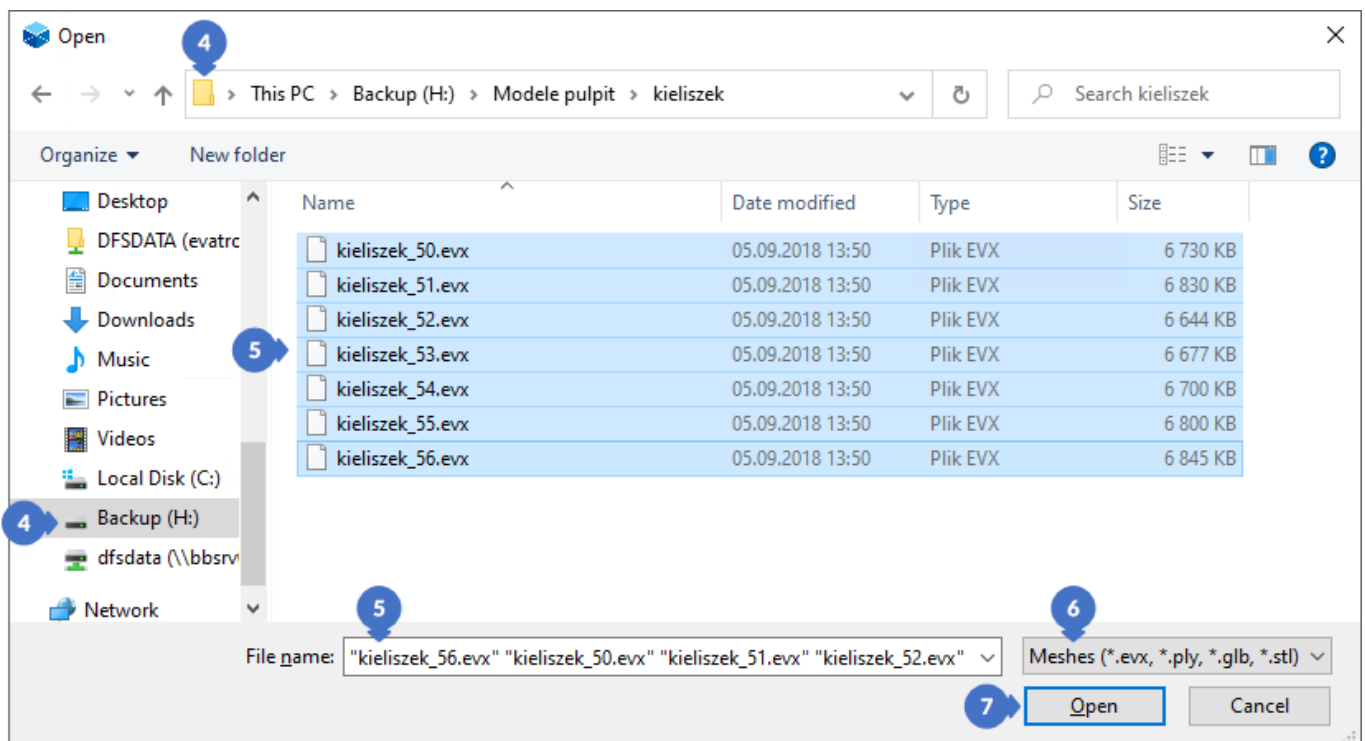


Figure 195. Importing files – selection window



### NOTE

Due to the fact that single files (without photos) are always imported, after import they will always appear in the *Meshes* default group, provided that they are imported correctly. As a result of the import, the file is added to the project and is located in its folder.

The second way to import files is the *Import* button (3) (Figure 194) with a paper sheet icon with an arrow pointing towards the sheet. Clicking this button opens the same window as in the case of the *Import* button (2) from the *Start* menu.



## 12.4 Open or Import by Drag-and-Drop

eviXscan 3D Suite supports opening and importing files using the Drag-and-Drop method. To use this method, it is enough to drag a file with the supported format onto the program window. Supported mesh formats are: *evx*, *glb*, *stl*, *ply*, *wrl* and the project file itself with the *.mdl* extension. If the project is already open, dragging the mesh files will import the files to the project. Dragging a different project file (*.mdl*) into the window when another project is already open will close the previously opened project and open a new project. Dragging the mesh, when there is no open project, will display a window to create a project as in the case of normal file import.

### **i** NOTE

*It is not possible to import a mesh and a project at the same time, just as it is not possible to open two projects with the .mdl extension in this way (simultaneously).*

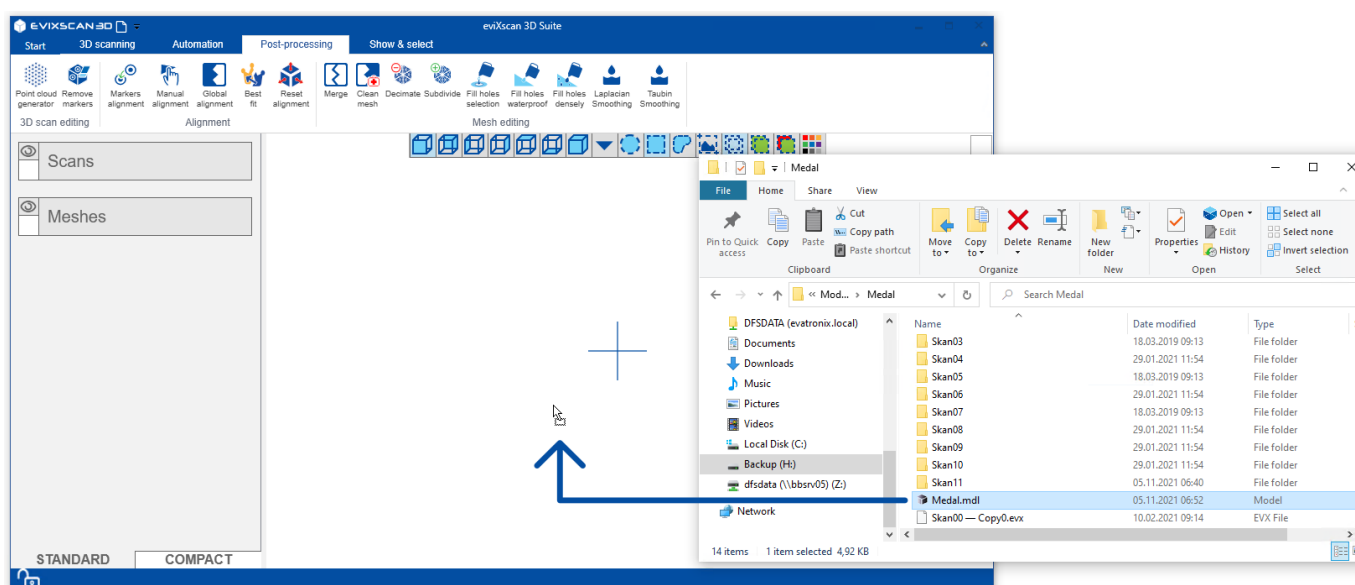


Figure 196. Importing files – drag-and-drop method

## 12.5 Export Files

The export of scans (including scans and meshes) can be done in several ways. The first is to select the *Start* menu and click on the *Export* button (2), this option will only work for selected scans.

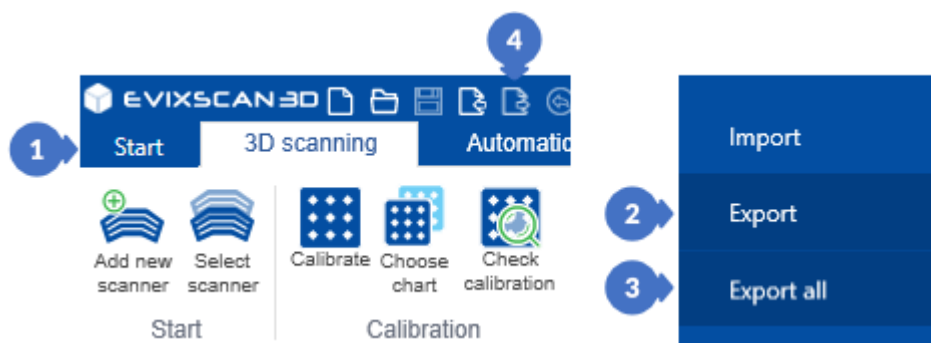


Figure 197. Export files

The *Export* window will open, in which you have three possibilities to enter the name for the files to be exported. The first option is to enter the name (5) (Figure 198) without selecting *Use scan name* (6) and *Use model name* (7) then the files will start from the given name taking into account the subsequent ordinal

numbers starting with 1 (e.g., for the entered name "model" will be exported files "model\_1", "model\_2" and so on for all scans). Another option is to select *Use scan name* (6), then the names appearing in the project are taken into account, ignoring the previously entered name in the field (5).

**i** NOTE

*The Use scan name (6) and Use model name (7) check boxes are mutually exclusive – only one of the options can be selected at the same time (the other will be automatically deselected).*

The third option is to select *Use model name* (7) then all exported files begin with the project name considering the consecutive ordinal numbers starting from 1 (e.g., for a project named "New" the files "New\_1", "New\_2" will be exported and so on for all scans).

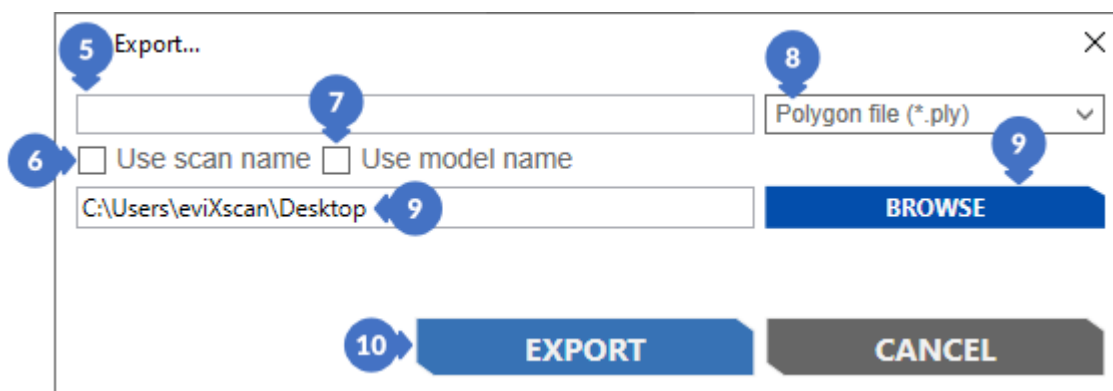


Figure 198. Export settings window

When exporting, the following extensions can be selected (8): *.asc, .bin, .evx, .glb, .obj, .ply, .stl, .wrl*. The *BROWSE* button (9) is used to select the path to be exported (it can also be entered manually into the text field (9)). After clicking on *BROWSE* (9), a window will appear in which you can select a folder (11) (Figure 199) and click on *Select folder* (12).

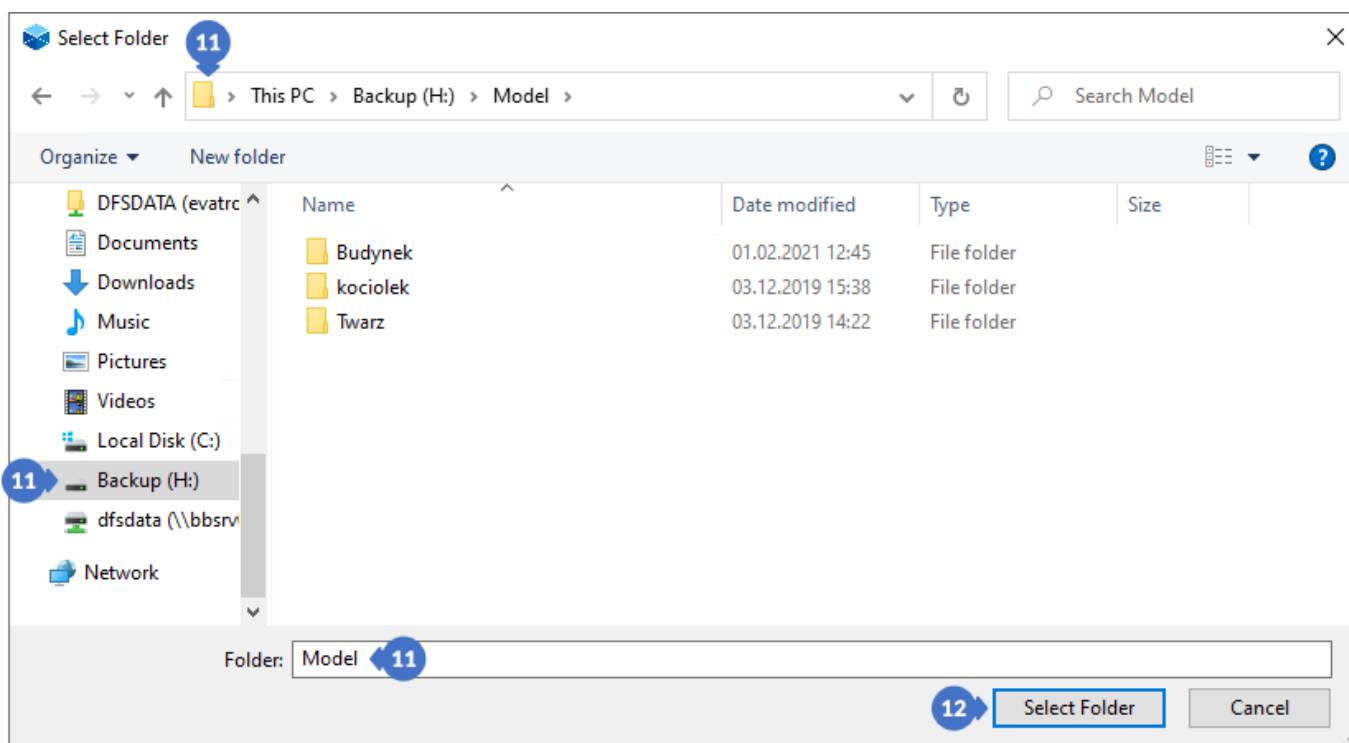


Figure 199. Export files – select destination

The second method of exporting scans is to use the *Export all* (3) (Figure 197) option which does not require selecting the scans as it exports the entire content of the project to the selected location. Clicking on *Export all* (3) opens the same window as in the case of the *Export* button (2).

The third way is to click on the *Export button* (4) (Figure 197) with the card icon with an arrow pointing outwards from the quick access bar. This button works exactly like the *Export* button (2) from the *Start* menu.

The fourth way to export is to export using the context menu.

For more information about exporting scans via the context menu can be found in Subsections [7.1.1](#), [7.1.2](#) and [7.1.3](#).

## 12.6 Saving Changes for the Project

To save changes to the project, go to the *Start* menu (1) and click the *Save* button (2). It will call up the project save after which the option becomes inactive. The same will happen after pressing the *Save* button (3) with the floppy disk icon in the quick access bar.

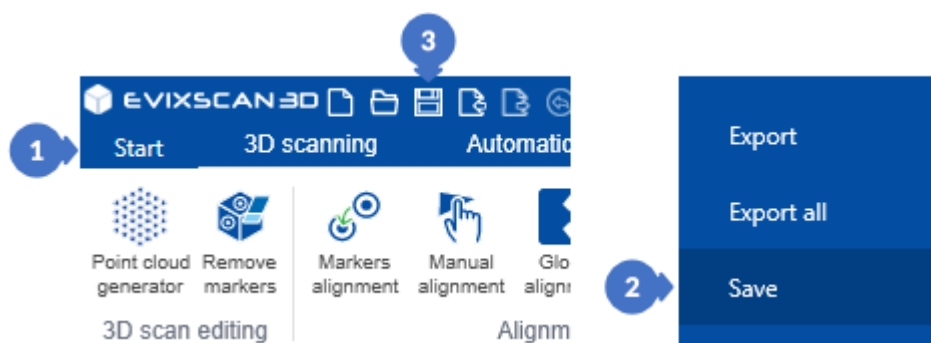


Figure 200. Save changes in the project

Most of the changes made while working with the project are saved automatically. However, there are options that do not perform auto-saves. A good example is selecting a scan piece on the view (1) and pressing the **DELETE** key on the keyboard (2). This will delete the selected part.

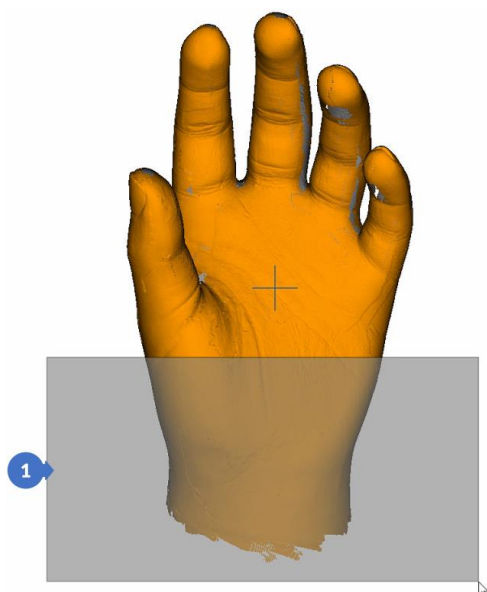


Figure 201. Selecting mesh fragment

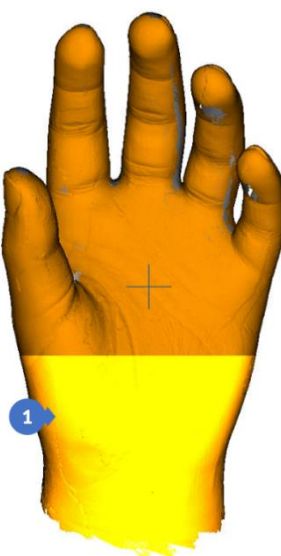


Figure 202. Selected mesh fragment

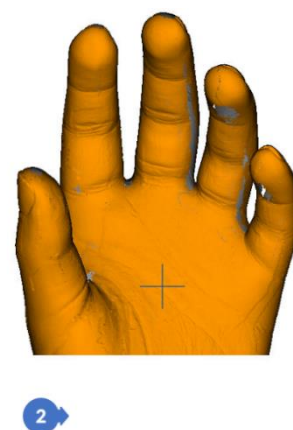


Figure 203. Deleted mesh fragment

You can notice the difference in the tree between the scan marked (1) and the scan with the fragment removed (2). After deleting the fragment, a red dot (3) appears next to the name of the scan (in the example mesh), indicating unsaved changes. After saving, the dot will disappear. The pre-save file will differ in the changed number of triangles (4) and points (5), but this is normal for deleting scan fragments.



Figure 204. Mesh state in project tree after selection

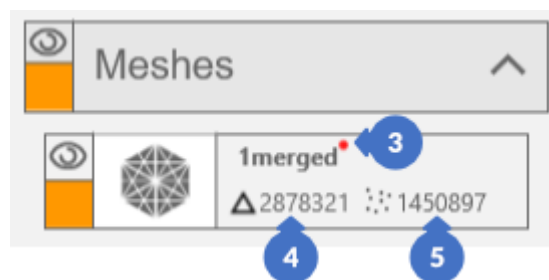


Figure 205. Mesh state in project tree after deleting 3D points

## 13 MARKERS & ARTEFACTS

Markers are specially prepared symbols thanks to which it is possible to adjust the performed scans in one frame of reference in the three-dimensional space. A group of markers attached to an object (e.g., a cube) permanently creates an artefact.



Figure 206. Artefact with markers

### 13.1 Marker Types

There are two types of markers: non-unique (1) and unique (2).



Figure 207. Markers

Non-unique markers (1) are used, for example, in the standard positioning of a rotary table. It is possible to use them only when we want to determine the axis of rotation in the three-dimensional space. In this case, changing the position of the positioning pattern (some kind of artefact) should be performed in a fully controlled and repeatable manner – as it is the case with the rotary table. Based on a single non-unique marker it is not possible to determine the exact angle of rotation of an object, as the marker only conveys the information about its center. For this reason, unique markers (2) with coded identification numbers were designed by eviXscan 3D, thanks to which the algorithm can easily recognize the angle by which the rotation was made. Nevertheless, for greater accuracy, it is recommended to use more than one marker.

#### **i** NOTE

*The table positioning plate may also have unique markers. In this case, the type of markers used does not matter.*

## 13.2 Marker Detection Mode

Marker detection mode can be turned on/off in the camera preview window (2) (Figure 209) and in the scan photo preview window by selecting the *Show markers* option (1) (Figure 208).

More information about the camera view window can be found in Subsection 4.9.1.



Figure 208. Option to enable/disable the marker detection algorithm

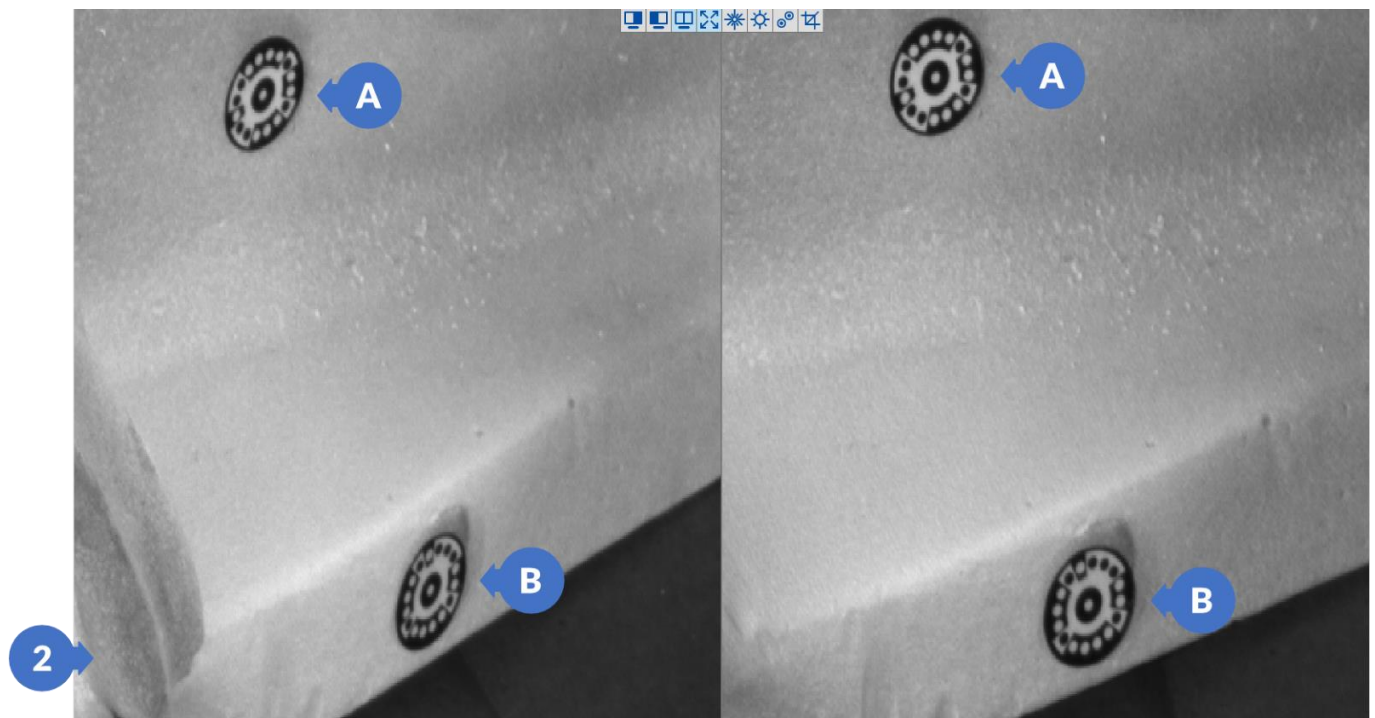


Figure 209. Preview of markers for the right and left cameras

After selecting the *Show markers* option, the algorithm will mark in the real time the detected markers (3) (Figure 210).

**i** NOTE

The number in parentheses next to the marker number indicates the number of markers detected in the entire project on all scans.

A correctly detected marker has the center marked with a green plus sign and the individual circles around the center of the dot (green for black circles and red for white).

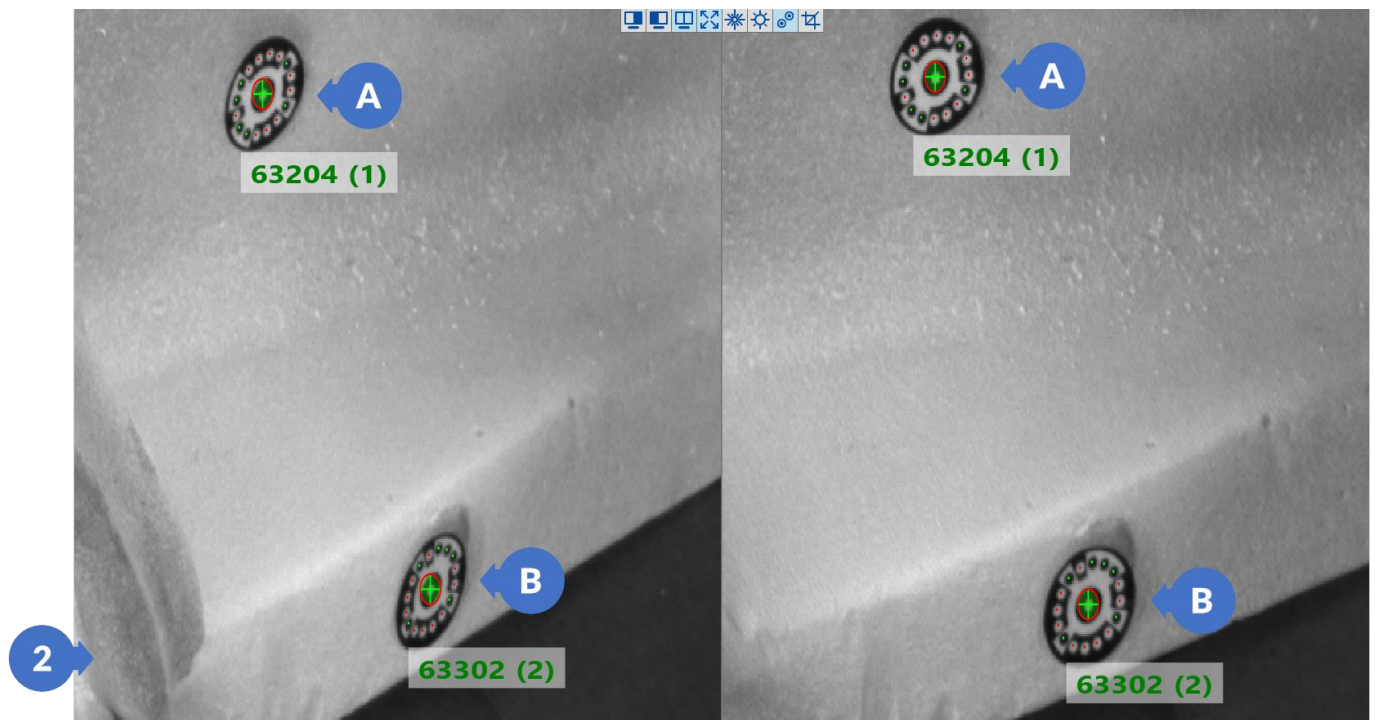


Figure 210. Preview of detected markers for the right and left cameras



## 13.2.1 Representation of Detected Markers in eviXscan 3D Suite

There are two ways of representing markers in the software. Each marker detected in the photo (for the left and right camera) obtained at the time of scan has its position in the 2D space. If such a 2D marker is visible in the photo from both the right and left camera, it can be converted into a 3D marker and placed in the three-dimensional space.

Below is an example of a preview of the detected 2D marker only on the left photo from the camera.

**i NOTE**

*It is not possible to calculate a 3D marker from a single marker, detected by one camera only.*

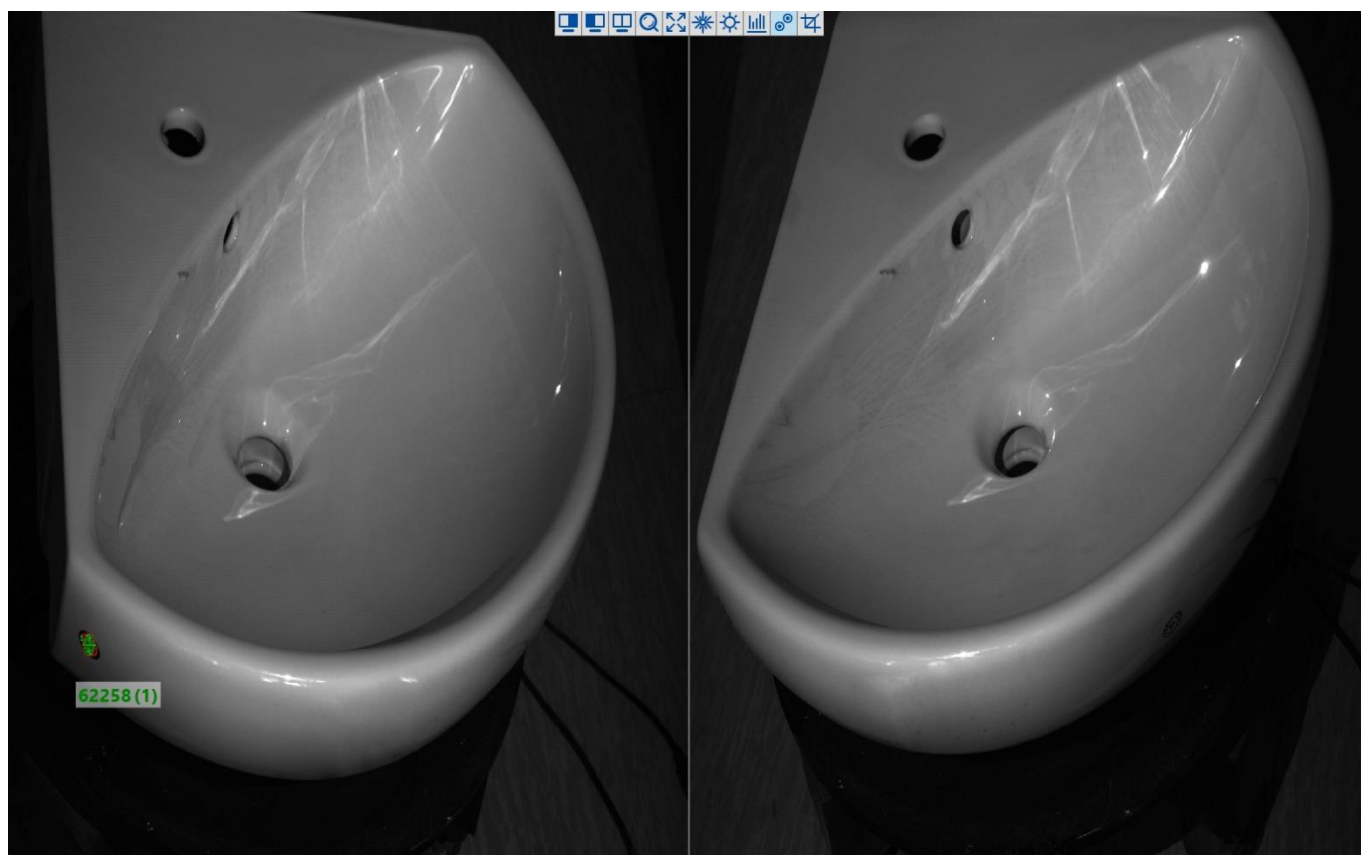


Figure 211. Preview of the detected 2D marker

An example of two markers detected in the photo of the left and right camera can be seen in the preview from the photos below.

**i NOTE**

*From such 2D markers, the software can calculate 3D markers because both markers are detected on both cameras.*





Figure 212. Preview of the detected 2D marker that can be converted to 3D marker

## 13.3 Align Using Markers & Artefacts

### 13.3.1 Markers Alignment

The *Markers alignment* option in the *Post-processing* tab opens a panel for matching scans or groups of scans using the detected markers.

🚩 The alignment process using the *Markers alignment* panel is described in Section 17.3.1.

### 13.3.2 Automatic Group Joining after a Series of Scans

The *Include markers/artefacts* option in the panel for scanning on the rotary table is used to automatically adjust a group of scans after a series of runs.

**i NOTE**  
The way of matching the two groups only works for common markers between the surfaces of one and the other group.

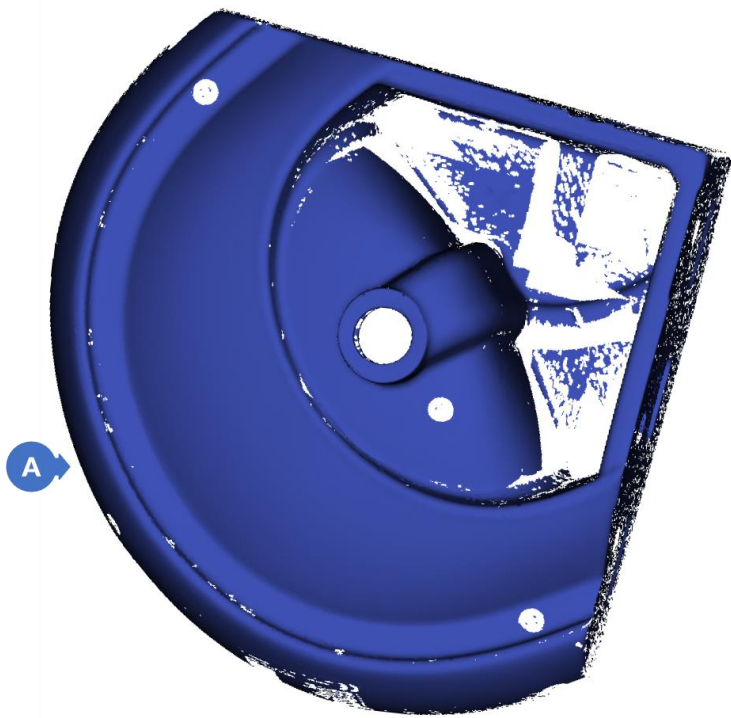


Figure 213. A series of scans of the bottom of the sink

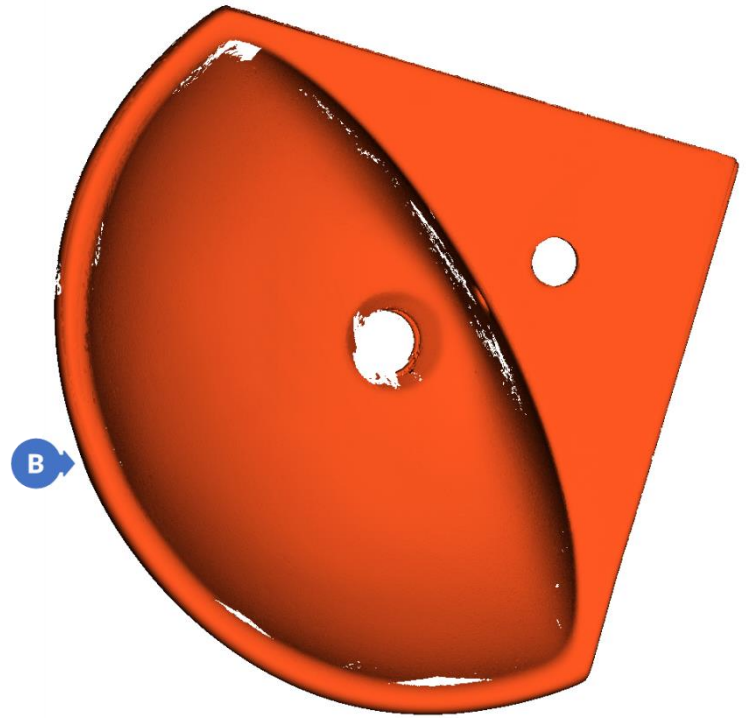


Figure 214. A series of scans of the top of the sink

If a series (A) is run over a rotary table and the object is flipped and a series (B) is made, both groups will be combined into one object (C) (Figure 215) based on detection of common markers visible for both series.

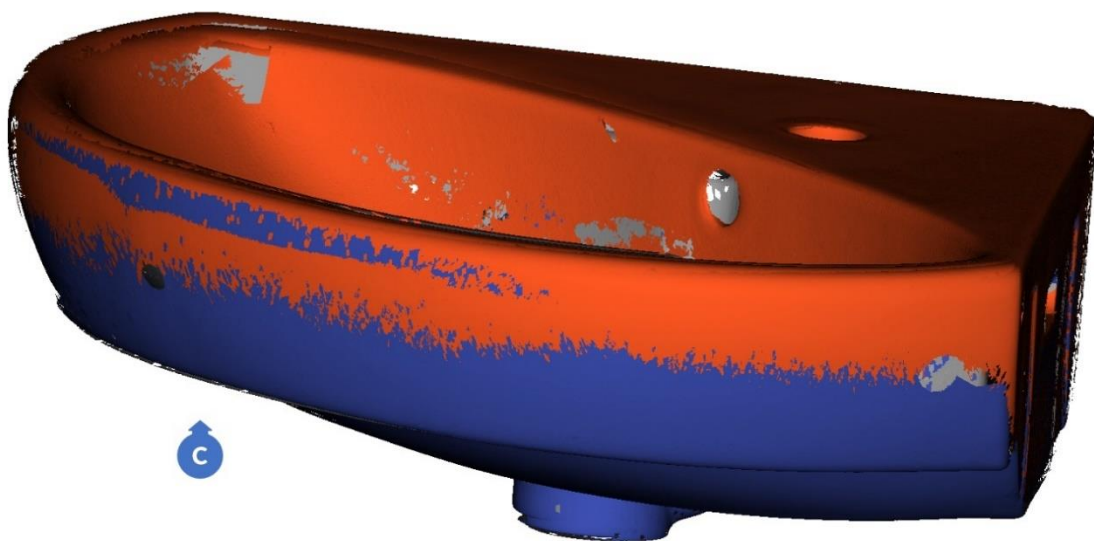


Figure 215. Matched series that form an object

## 14 ROTARY TABLE

The rotary table is a device that facilitates the process of scanning objects. It allows to accurately scan the object, without the need to stick markers on it and/or move the scanner.

### 14.1 Selection of a Rotary Table

The rotary table can be selected from the drop-down list of available devices in the table's control panel. When there is more than one table in the list, the first one from the list will be automatically selected.

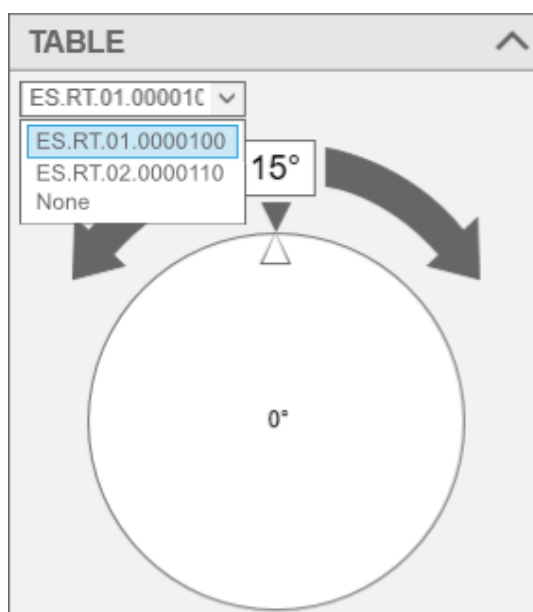


Figure 216. Selection of a rotary table

### 14.2 Positioning the Rotary Table



Figure 217. Positioning pattern

The rotary table positioning process consists in taking a series of three photos with a positioning pattern at different angles to determine the axis of the center of the table. This can be done from the rotary table wizard or the scan with rotary table panel.

- More information about rotary table wizard can be found in [Section 15.1.3](#).
- Scan with rotary table panel is described in [Section 15.1.4](#).

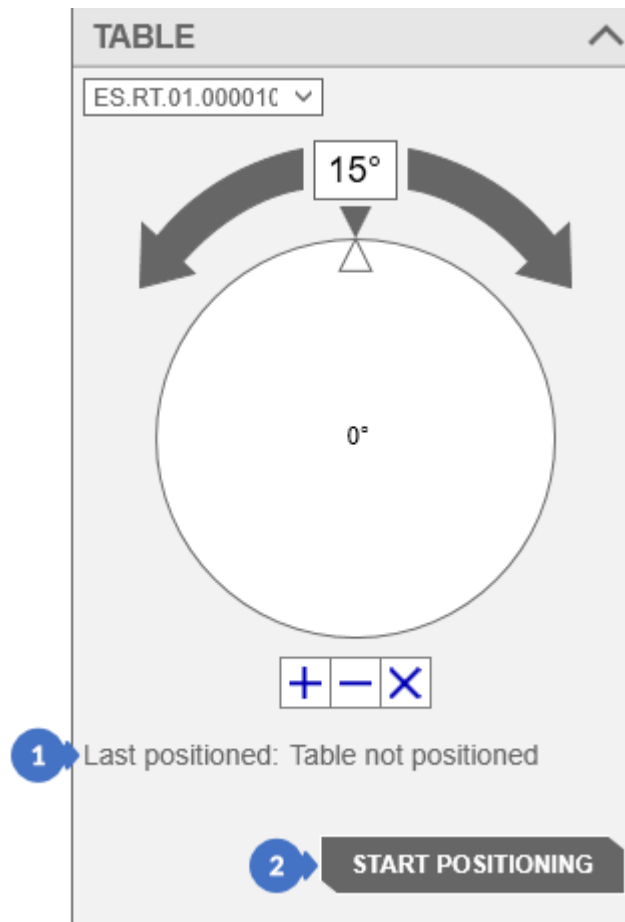


Figure 218. Rotary table positioning process

Uncalibrated rotary table in the *TABLE* panel in the *Last positioned* (1) has the text: *Table not positioned*.

**i** NOTE

*It may also happen that this item will be empty. It also means that the table is not positioned yet.*

## 14.2.1 Positioning in Manual Mode

In order to perform positioning, put the positioning pattern on the table, select the appropriate exposure and brightness parameters of the projector, and then click the *START POSITIONING* button (2).

More information about choosing exposures, overexposures, and underexposures can be found in Section 9.

More information about selecting projector brightness can be found in Section 10.1.

To take a photo, click on the *TAKE PHOTO* button (4). The first photo can be taken at 0° (or any other position). After the picture is taken, you will notice that the number of captured photos (3) will increase from 0 to 1.

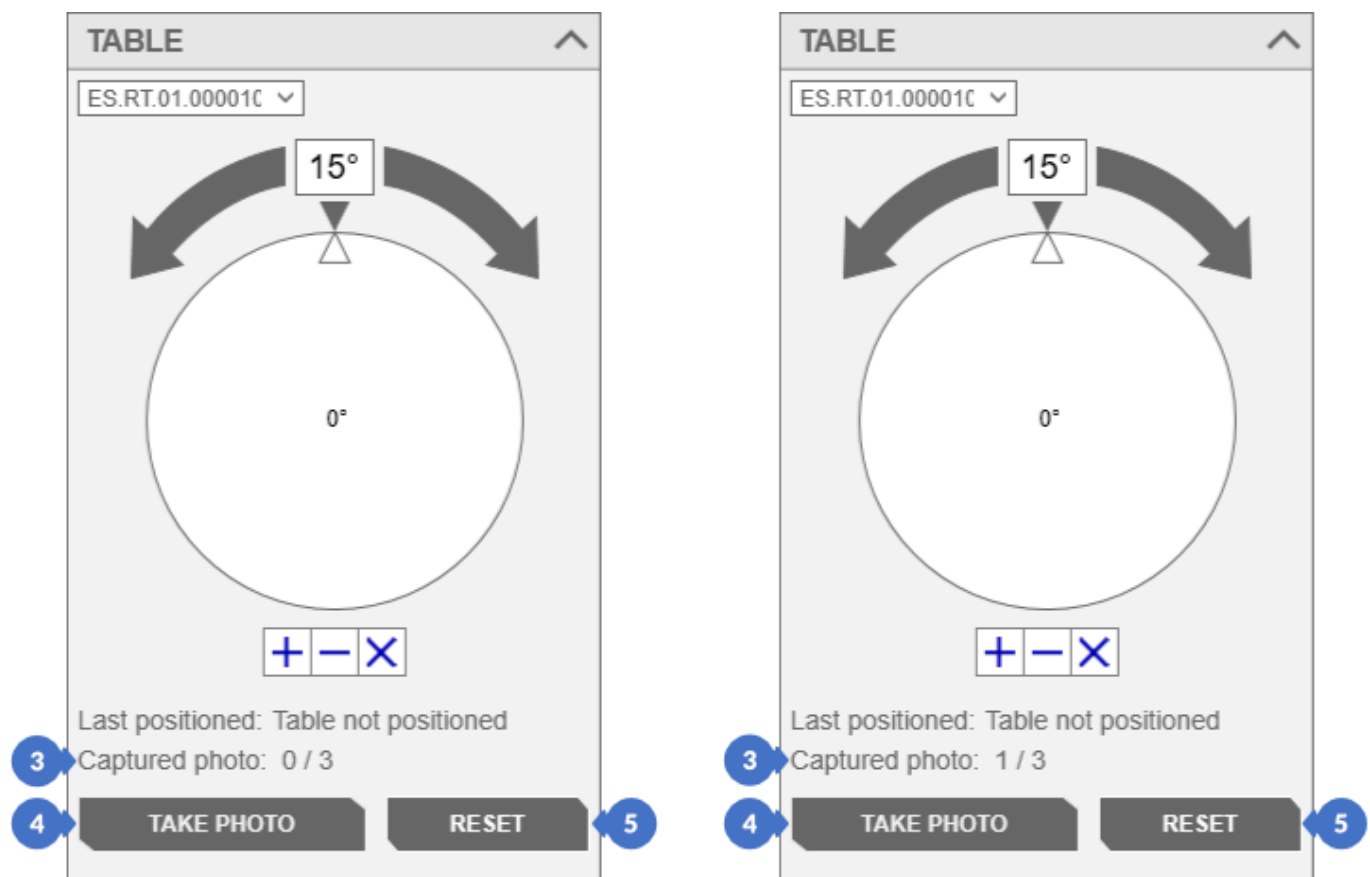


Figure 219. Rotary table positioning process – first photo

The second and third photos should be taken after the table is rotated min. 15° to the right (15° angle on the table) and left (345° angle on the table) from the position of the first photo. Moving the table by 15° and click *TAKE PHOTO* (4) will change the number of captured photos (3).

### **i** NOTE

*The order in which the positioning photos are taken does not matter. An important element is to take 3 photos at an interval of at least 15°. Thus, for example a photo can be taken initially at 345°, then at 0° and finally at 15°.*

After correctly taking the three photos, the stage axis will be calculated, and the *TAKE PHOTO* button (4) will change into *RESET & TAKE PHOTO* (6) removing the stage positioning files and automatically taking a photo in the position set on the stage interface rotary table. At each stage of taking positioning pictures, you can delete the pictures taken with the *RESET* button (5) and start the positioning from the beginning.

**i NOTE**

Clicking the *RESET* button (5) deletes only the pictures taken but does not change the position of the table to the starting position. The position of the table must be changed manually. This button is quite important when, for some reason, it is not possible to move to the next photo – this problem may arise e.g., in the event of a power loss on the table. Disconnecting the table from the power source resets its information about the current position (angle).

The properly positioned rotary table has information (month, day and time) in the *Last positioned* field (1) about the last table positioning operation. The *CLOSE* button (7) (Figure 220) hides the positioning buttons, leaving only one initial *START POSITIONING* (2) (Figure 218).

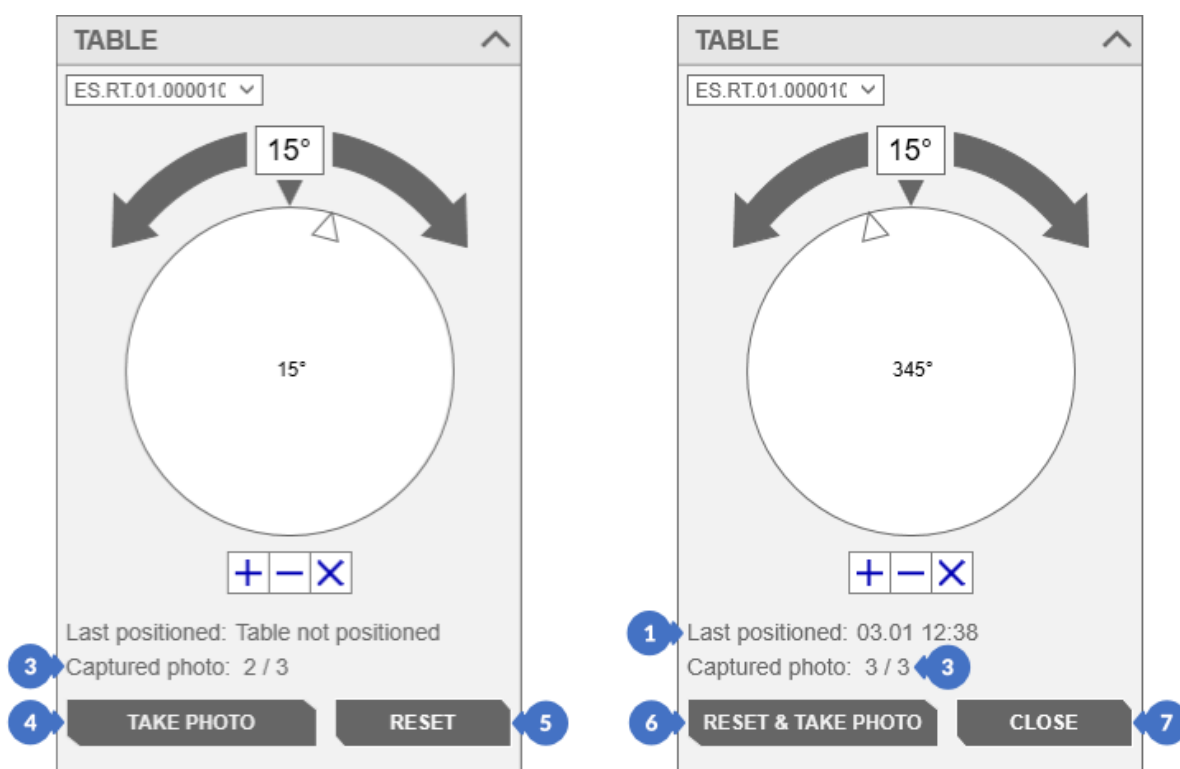


Figure 220. Rotary table positioning process – second and third photo

**i NOTE**

Scanning without a positioned rotary table will result in the scans that have the wrong position in the three-dimensional space (they will not create a complex object).

## 14.2.2 Positioning in an Automatic Mode

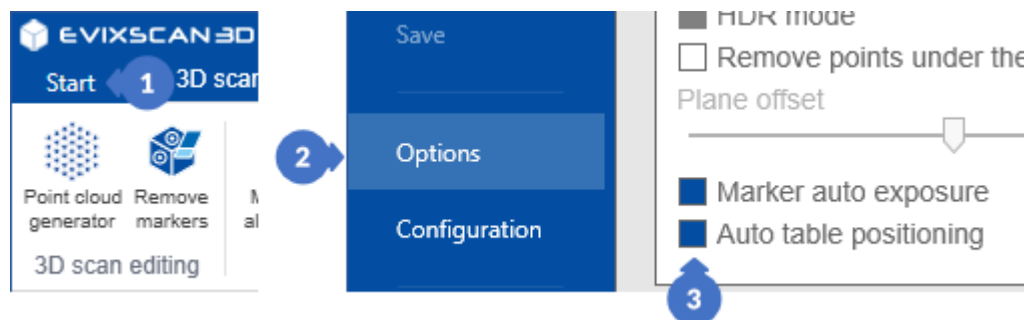


Figure 221. Auto table positioning option



### NOTE

Automatic table positioning is available only when the Auto table positioning (3) option is selected in Start menu (1), Options (2) tab, CAMERAS category.

Positioning the table in an automatic mode does not require setting the appropriate exposure parameters and projector brightness, because the auto exposure algorithm for the markers will select the correct values before performing the positioning process. In the automatic mode, just press the START POSITIONING button (5) and wait until all positioning photos are taken.

After taking the photos, a message will appear in the bottom bar about the successful or unsuccessful positioning of the table in the automatic mode. If the positioning was unsuccessful, set the positioning pattern again with the front facing the scanner and repeat the process using the START POSITIONING button (5). In case the positioning is successful, then the positioned rotary table in the field *Last positioned* (4) has the information about the last positioning operation (i.e., month, day and time). Use the START POSITIONING button (5) to recalibrate the axis of the rotary table.

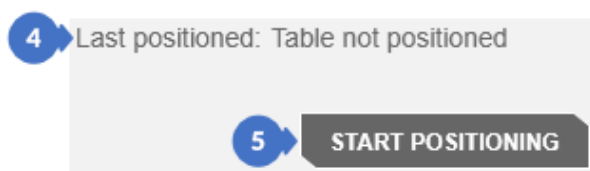


Figure 222. View of the rotary table panel before positioning

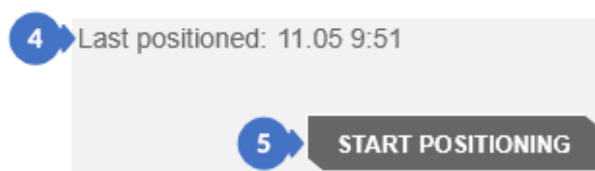


Figure 223. View of the rotary table panel after positioning

## 14.3 Rotary Table Operation

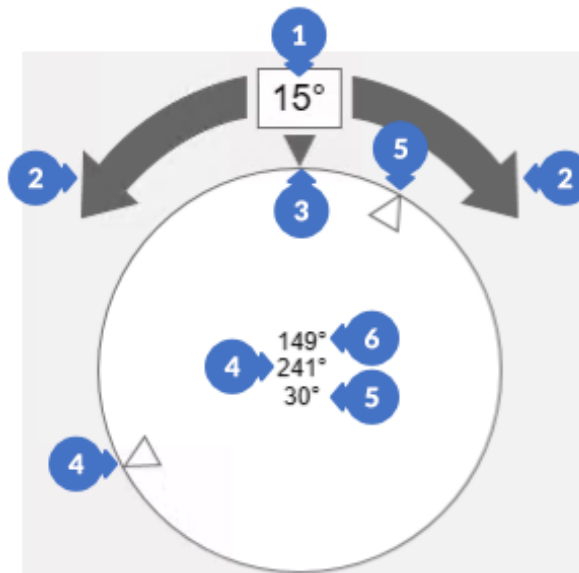


Figure 224. Rotary table indicator (table dial with arrows)

The indicator of the rotary table has a field (1) for setting the number of degrees for the table rotation. The default value is 15°. You can rotate the rotary table by this angle by clicking the arrows (2) to the right or left. Additionally, it is possible to rotate the table to the right by the angle entered in the field (1) by right-clicking on the table's surface (in the user interface). Clicking the left mouse button on the table's dial will rotate the table to the indicated position on the table. The gray triangle (3) at the top of the dial symbolizes the 0° position.

The current position of the table is indicated by the arrow (4) and the angle information (4) in the center of the control. The angle on the table indicated by the mouse cursor is presented by the arrow (5) and the angle at the current angle (5). The angle (6) shows the shortest distance (in degrees) between the current stage position (4) and the displayed position (5).

### 14.3.1 The Ways of Setting Angles

In addition to being able to set the angles with the arrows (left/right) and the mouse, there are two ways to define the rotation angles when running a series of scans on a rotary table. The first way is to change the *Number of scans* in a series (1) parameter available both in the SIMPLE (A) and ADVANCED (B) tabs in the panel with a rotary table. Based on the *Number of scans* in a series, the angle of rotation is Angle increment (2).

**i NOTE**

*The default Angle increment is the ratio of 360° divided by the set number of scans (Number of scans in series). For example, for 8 scans, the Angle increment will be 45°.*

The angle increment (2) can be selected as needed between 1° and 180°.

**i NOTE**

*Please note that each time you change the number of scans, the software automatically sets the default Angle increment.*



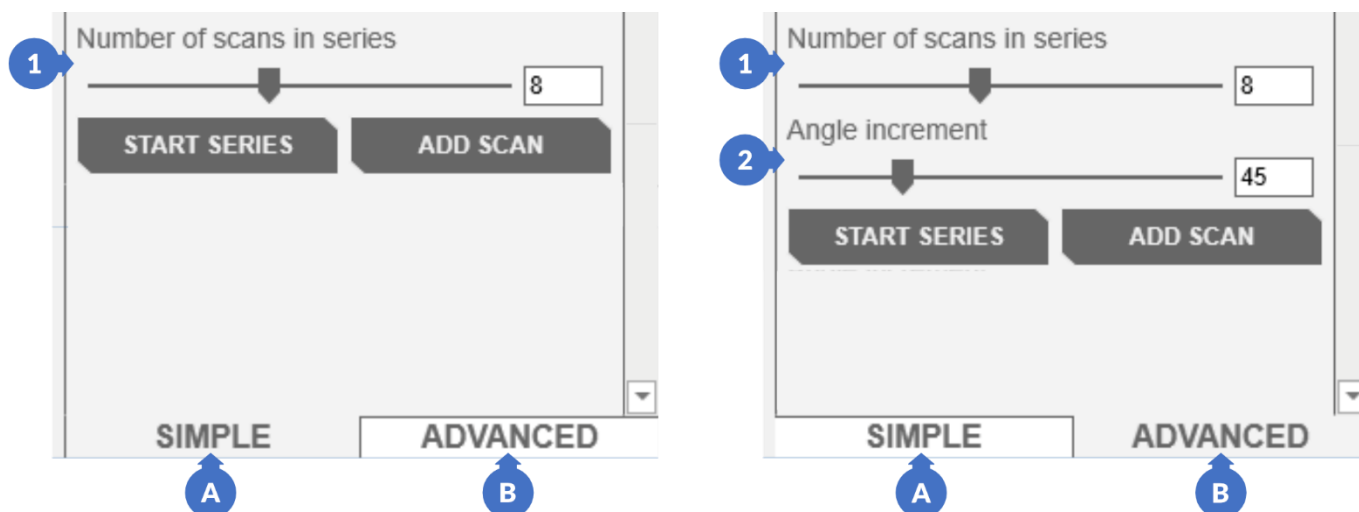


Figure 225. Angle selection for all scans.

More information about the Rotary Table Scanning Panel can be found in Subsection 15.1.4.

The above-described method of setting the angle forces the interval between scans to be the same. In this case, it is not possible to set several angular values.

The second method of defining lines in the stage interface is used to set individual angles (Figure 226). There are buttons under the stage dial in the settings control. The plus button Add line (3) is used to add the current position of the table to the virtual dial (4). If there is at least one line on the dial representing the position of the table, the sliders with the number of scans and the angle definition (7) become inactive until all lines are deleted.

**NOTE**  
To add another line around the current line (4), change the table position and click the Add line button (3). The minimum distance between the current line (4) and the new line is 6°.

The minus button Remove line (5) removes a line from the position in the table.

**NOTE**  
It is impossible to remove the line (4) from a position other than 84-85°. To delete a line, the same angle or an angle 1° smaller is required.

The X button Clear all lines (6) is used to delete all defined table positions.

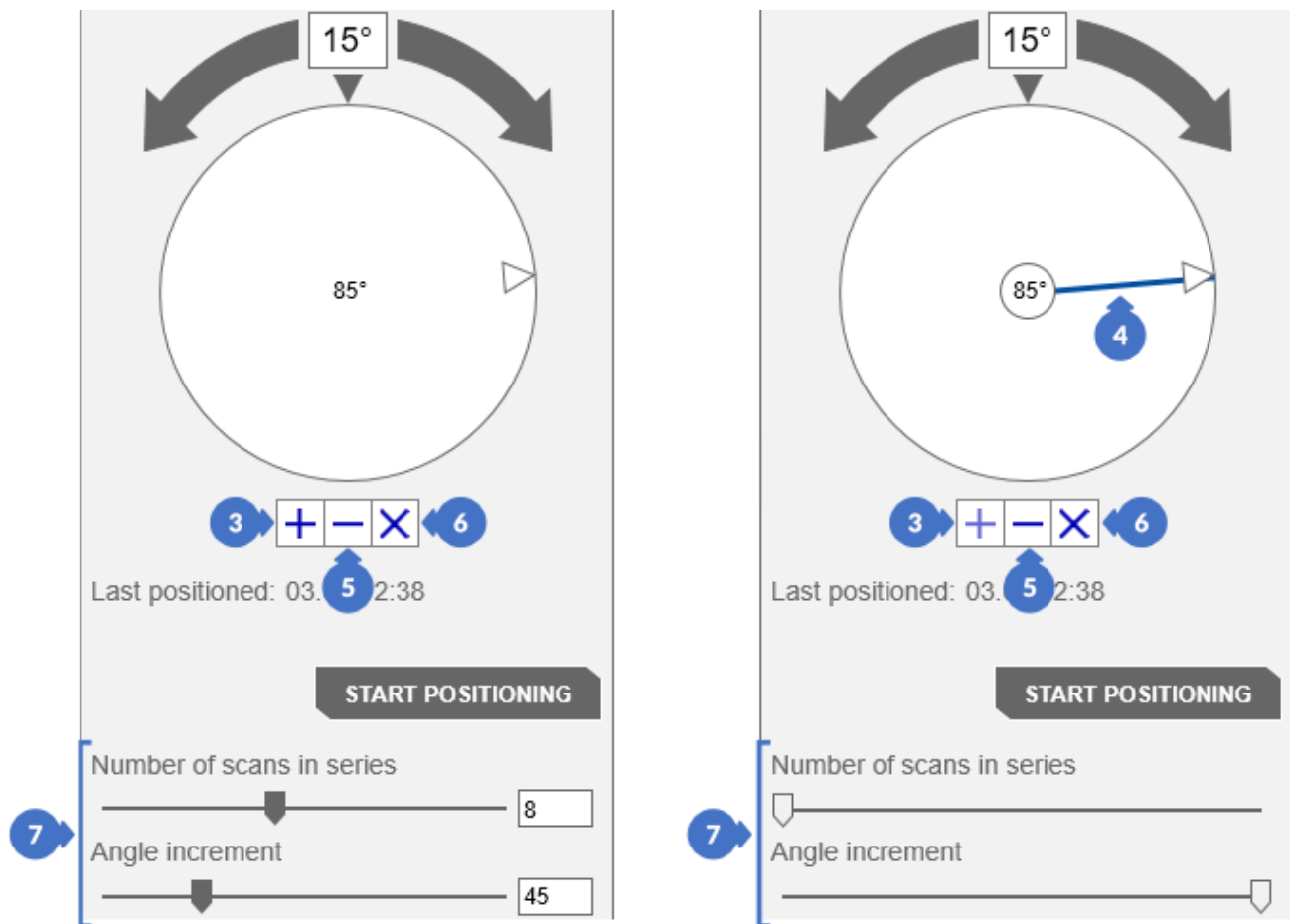


Figure 226. Setting individual table angles for a series

The order in which you add the lines with the angles of the stage is not important. Starting the scan always sets the table from the smallest to the largest angle. The picture below shows the described situation – the stage will move to position 1 and start scanning up to position 3.

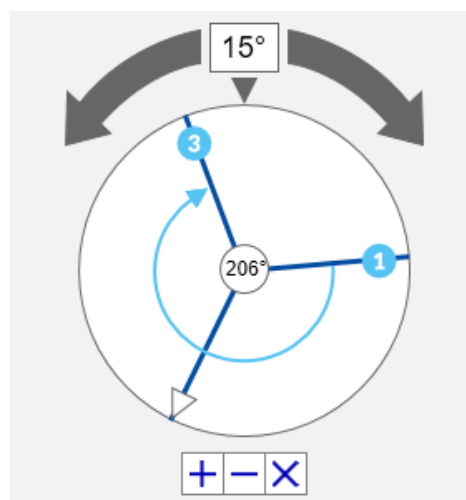


Figure 227. Sequence scanning direction across the stage with manually defined rotary table angles

**i NOTE**

During the scanning, the lines defining the table angles do not change their position.

## 15 SCANNING

Scanning is the process of collecting photos of the scanned object along with patterns displayed by the projector using cameras.

**i NOTE**  
The scanning process should be performed in a place where the lighting conditions do not change drastically all the time.

### 15.1 Scanning Modes

The following modes are available in *eviXscan 3D Suite* for scanning objects:



Figure 228. Modes used for scanning

- (1) – opens a panel with a wizard for performing a single scan (*Single scan wizard*),
- (2) – opens a wizard panel for making scans using rotary table (*Rotary table wizard*),
- (3) – opens a panel with a wizard for making scans using markers (*Markers scan wizard*),
- (4) – opens the panel with the *Detect markers on plane* wizard (this option is useful when scanning on the table – it allows you to cut off all the necessary parts of the scans below the stage),
- (5) – opens the scan panel (*Single scan*),
- (6) – opens a panel for making scans using rotary table (*Scan with rotary table*),
- (7) – opens a panel for making a scan with the use of markers (*Scan with markers*).

#### 15.1.1 Performing Single Scans – the Wizard Mode

To enter the single scan wizard mode, go to the *3D scanning tab* (1) and select *Single scan wizard* (2).

**📖** More information about building wizards can be found in Subsection 4.8.2.

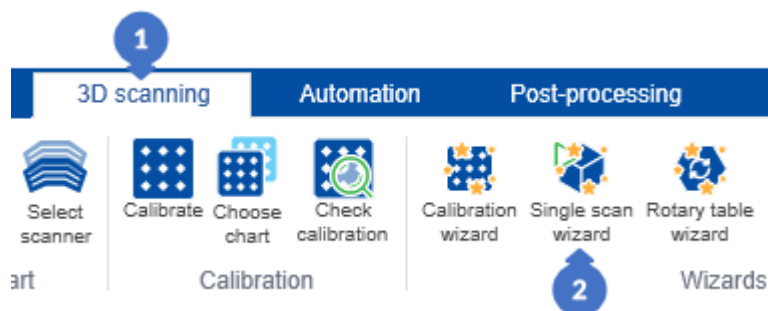


Figure 229. Open the Scan wizard panel

The wizard panel will open on the right of the software window. To start scanning, click on the *START WIZARD* button.



Figure 230. Button to start the scan wizard

### 15.1.1.1 Choosing a Projector

**i** NOTE

*For scanners with a built-in trigger, this step is invisible. In its place, you will see the step described below.*

The first step is to select the projector (3) from the *SELECTED PROJECTOR STEP*. The projector selected from the list should be changed if the one automatically selected is not correct. Checking if the selected projector is correct, will be described in the description of the next step. To go to the next step, click on the *NEXT* button.

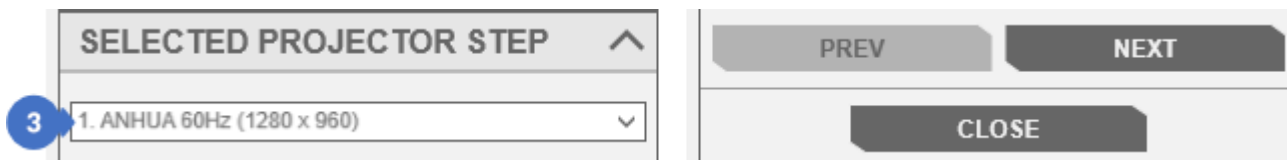


Figure 231. Choosing a projector

### 15.1.1.2 Choosing a Projector Pattern

The step *SET PATTERN STEP* is used to change the *Brightness* pattern (5) to the *Distance* pattern (6) (Figure 232).

**i** NOTE

*To check if the projector selected in the previous step is working correctly, you should switch between the *Brightness* pattern and the *Distance* pattern several times. If the selected projector is correct, you will notice the changing patterns displayed by the projector. If not, go back to the previous step using the *PREV* button, change the selected projector and try again until the projector is set up correctly.*

Before proceeding to the next step, using the *NEXT* button, select the *Distance* pattern from the *PROJECTOR PATTERN* category, which is suggested by the animation (4) in *SET PATTERN STEP* in the wizard panel.

**i** NOTE

*If the user does not choose the *Distance* pattern (6), it will be selected automatically, however, the software in the wizard mode is designed to develop good user's habits to help him in further independent work.*

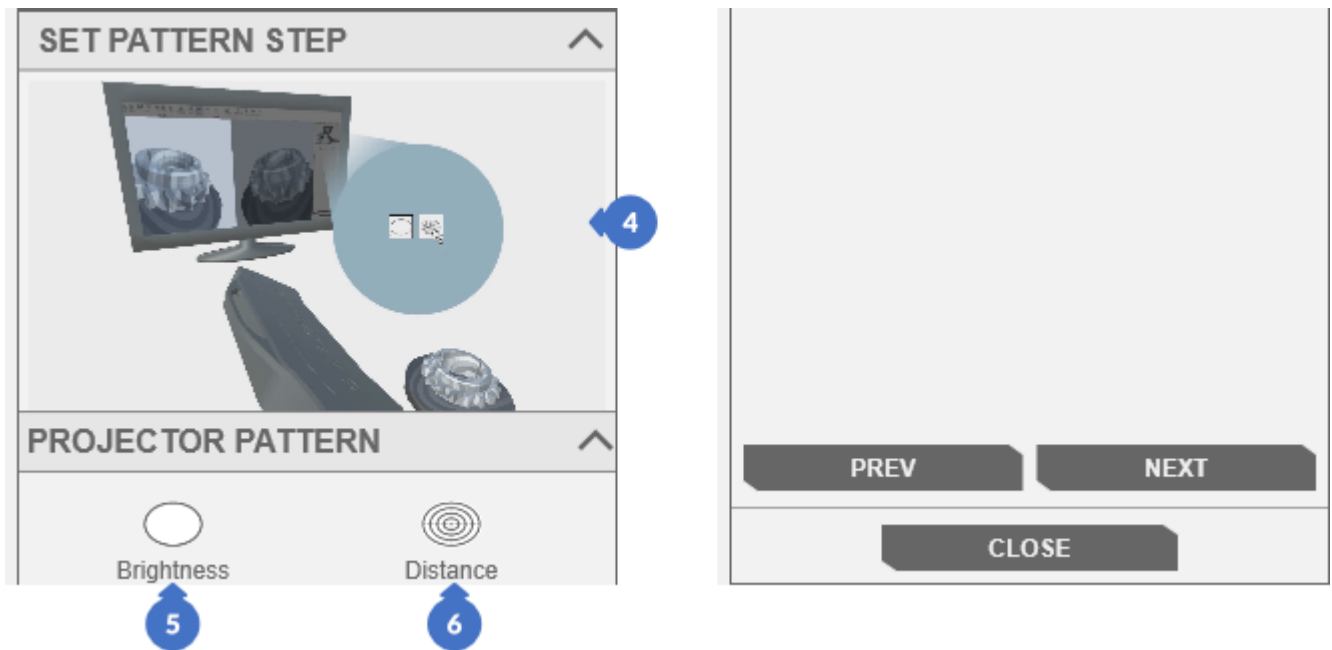


Figure 232. Choosing a projector pattern

### 15.1.1.3 Rotate the Scanner to the Object

The next step is to change the scanner's angle of inclination so that the light coming from the projector is directed at the scanned object. To change the angle, see the animation in the *ROTATE SCANNER STEP* (7). After executing the instructions from the animation, you can proceed to the next step with the *NEXT* button.

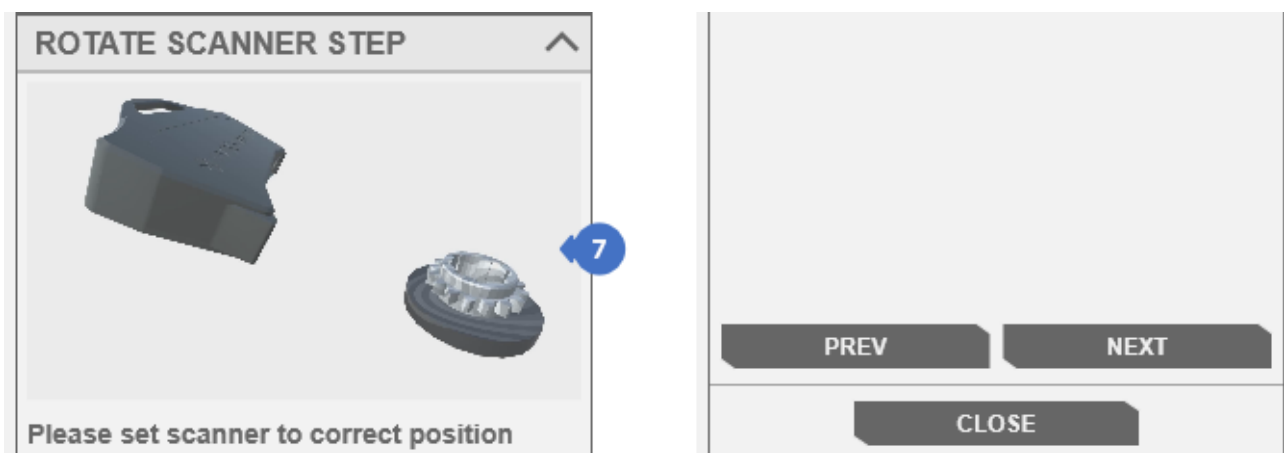


Figure 233. Setting the scanner in the correct position – directing the scanner to the object

#### 15.1.1.4 Setting the Distance between the Scanner and the Object

When the projector's light is directed at an object, set the appropriate distance between the scanner and the object. This process is shown in the animation in *DISTANCE TO OBJECT STEP* (8) (Figure 235). You can notice that from the moment you turn on the target (*Distance*) pattern (6) (Figure 232) a green line appears in the preview of the left camera. It is used to set the appropriate distance. The correct distance between the scanner and the object is when the green line on the left camera aligns with the center of the cross pattern displayed by the projector.

The illustration below shows the position of the green line relative to the displayed cross pattern.

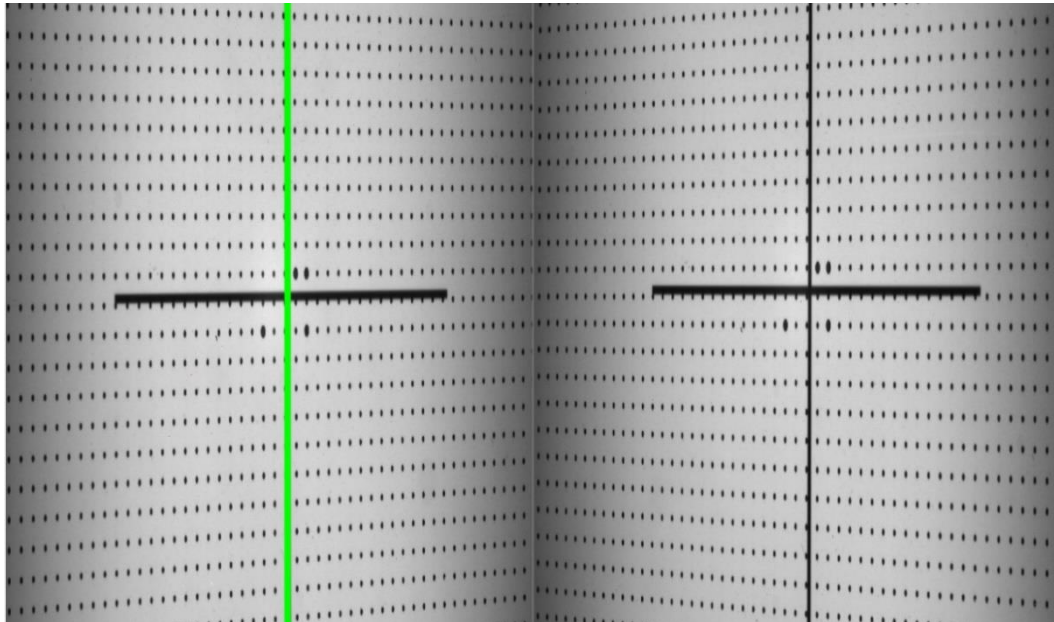


Figure 234. Correctly set distance of the scanner to the object (crosshair and green line coincide)



Figure 235. Setting the distance between the scanner and the object

### 15.1.1.5 Setting the Height of the Scanner Relative to the Object

After moving to the next step, use the *NEXT* button to set the appropriate scanner height – this process is shown in the animation (9) in *HEIGHT TO OBJECT STEP*.

**i NOTE**  
The actions in the previous two steps and the in the current one are wizard-independent and can be performed until the scanner is in the best positioning toward the object.

After obtaining the appropriate height of the scanner relative to the object, continue working with the wizard by pressing the *NEXT* button.



Figure 236. Setting the height of the scanner relative to the object

### 15.1.1.6 Setting Cameras Exposure and Projector brightness

The next step is the selection of the exposure on cameras (*CAMERAS EXPOSURE*) (11). The default mode is *Auto* (B) (Figure 233). The user can also change the mode to *Manual* (A) (Figure 234) to manually adjust the exposure and the projector brightness (*PROJECTOR BRIGHTNESS*) (12). The entire process of using the controls is presented in the animation (10) in *BRIGHTNESS AND EXPOSURE* depending on the selected mode.

**🚩** The exposure selection process is described in Section 9, and the projector brightness selection process is described in Section 10.

**i NOTE**  
In manual mode, do not change the projector's brightness level unless it is necessary.

In the automatic exposure mode (B), the contents of the panel are as follows:

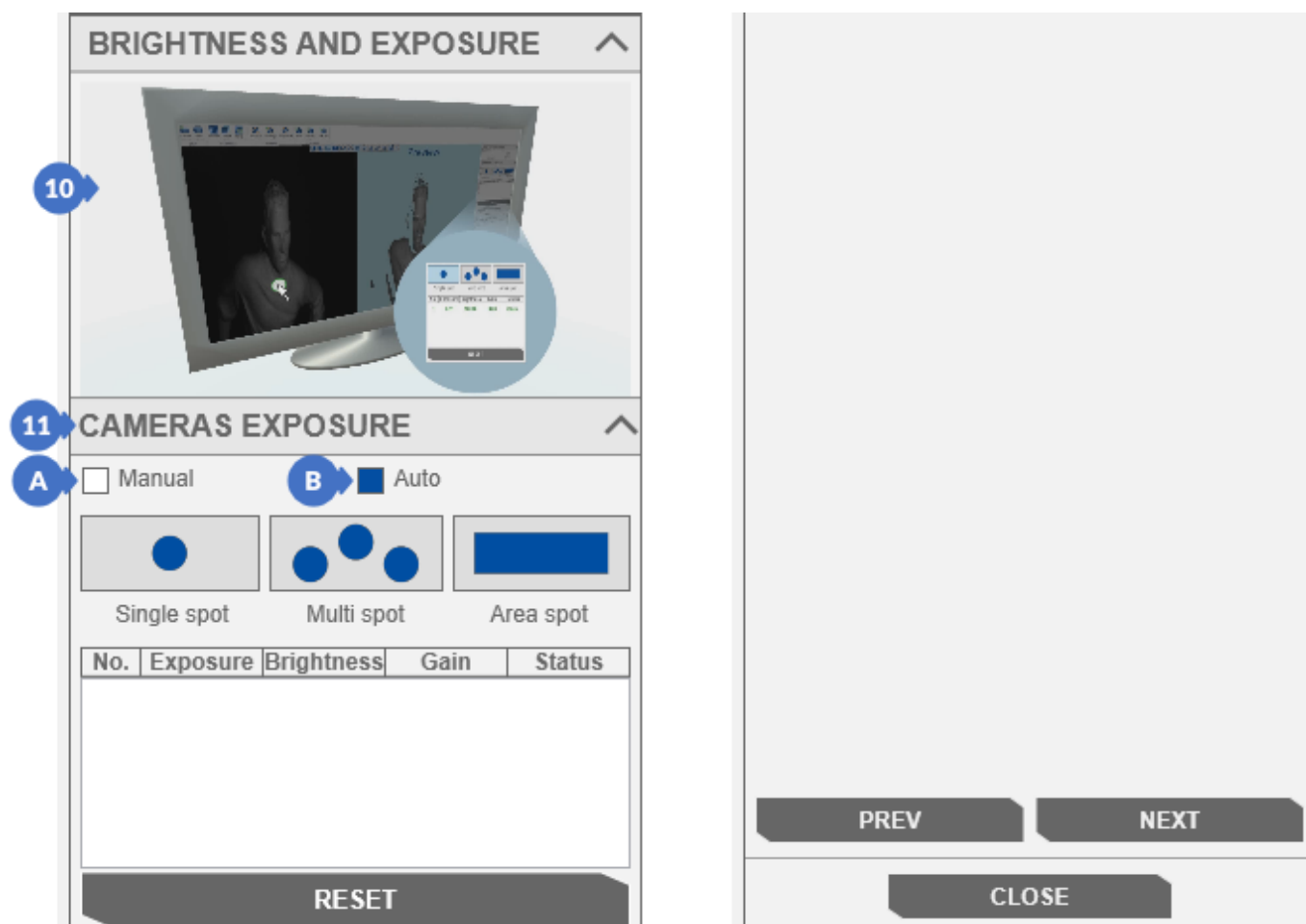


Figure 237. Semi-automatic selection of exposure and projector brightness

In the case of the manual mode (A), the indicators on the panel are presented in the following way:

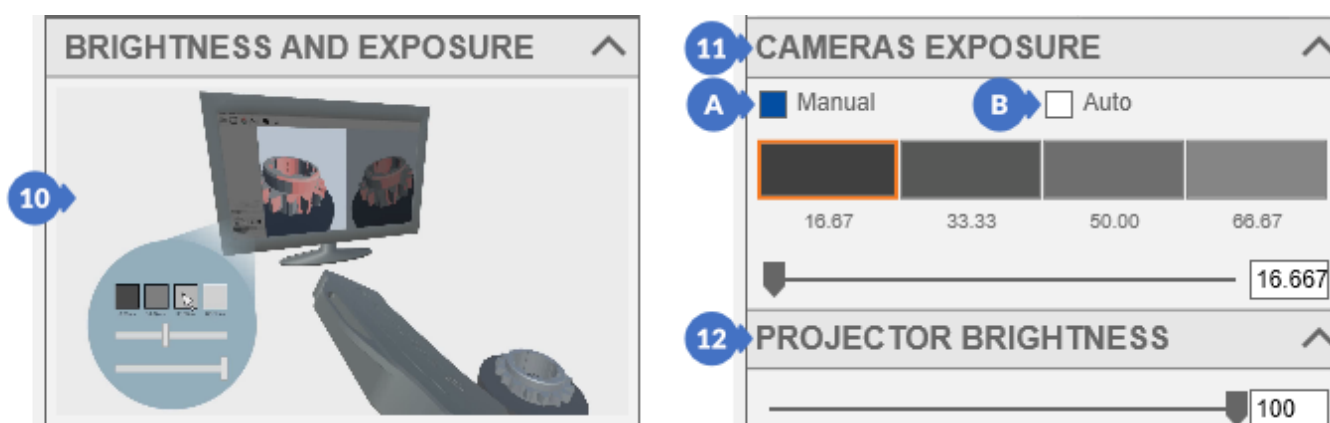


Figure 238. Selecting the correct exposure and projector brightness in the manual mode

After selecting the appropriate exposure and brightness of the projector, press the *NEXT* button to proceed.



### 15.1.1.7 Changing the Settings of the Point Cloud Generator

The next step includes two simple point cloud parameter settings (*CLOUD PARAMETERS STEP*) (13) for scanning bright objects – *Bright object* (A) and dark objects – *Dark object* (B) (Figure 235). By default, the option *White object* is always selected.

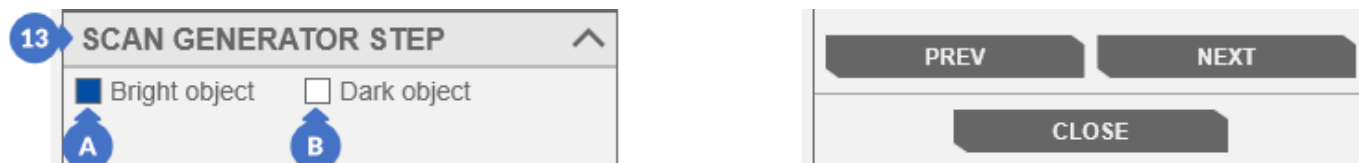


Figure 239. Point cloud generator settings

After pressing the *NEXT* button, the last step of the wizard will be displayed.

### 15.1.1.8 Trigger a Scan

In this step the *SCAN* button (14) is used to start the scanning process.

**i NOTE**  
After the scan, if the user wants to scan another object, he should use the *CLOSE* button to finish the wizard and start the whole process again. However, to prevent going through all the steps again, you can return the wizard to the setting of the scanner position and perform the entire process from that point on or use the regular scanning panel.



Figure 240. Triggering the scanning process

## 15.1.2 Performing Single Scans – the Normal Mode

The scanning mode can be enabled by going to the *3D scanning* tab (1) and selecting *Single scan* (2).

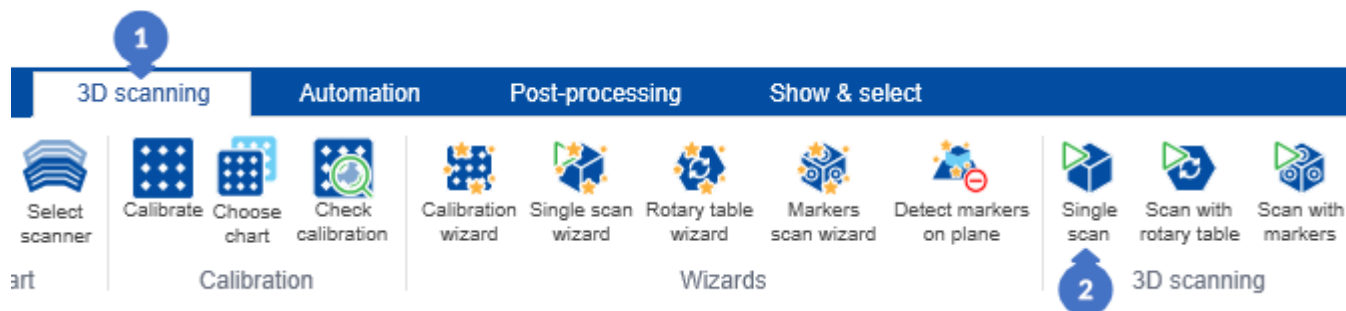


Figure 241. Open the regular scan panel

A panel will be displayed on the right of the software window with the following settings in *SIMPLE* mode (A) for less advanced users:

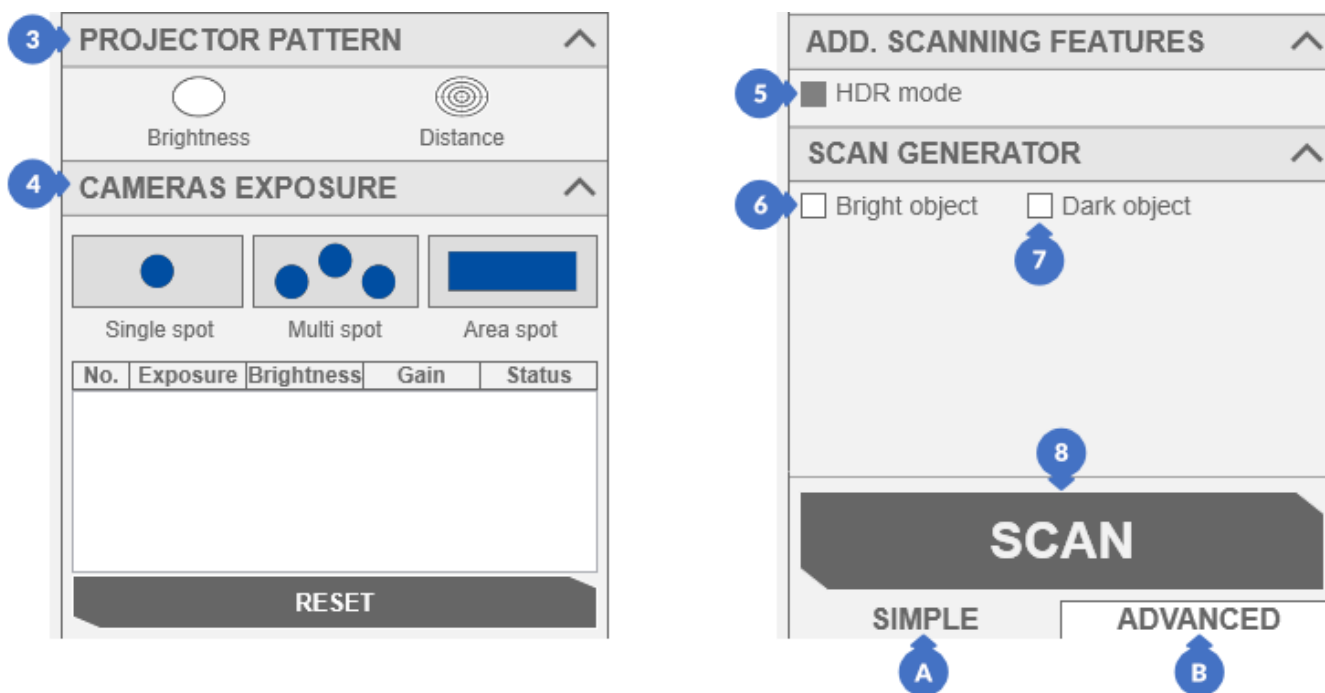


Figure 242. Scanning panel (the SIMPLE view)

- (3) – *PROJECTOR PATTERN*,  
 ■ More information about projector pattern can be found in Subsection 10.2.
- (4) – *CAMERAS EXPOSURE* – automatic mode,  
 ■ More information about exposures can be found in Section 9.
- (5) – *HDR mode* – unactive in *SIMPLE* tab because of the automatic exposure,  
 ■ More information about HDR mode can be found in Subsection 15.1.7.
- (6) – selecting the option for scanning bright objects (*Bright object*) changes the current settings to the default settings of the cloud generator,
- (7) – selecting the option for scanning dark objects (*Dark object*) changes the current settings of the point cloud generator to the settings defined inside the software for scanning dark objects,  
 ■ More information about settings point cloud generator can be found in Subsection 5.1.1.3.

(8) – SCAN button starting the scanning process.

**i** NOTE

*If the White object (6) and Black object (7) boxes are not checked, the settings from the Start menu (SCAN GENERATOR) are taken directly for generating the point cloud.*

More information about settings point cloud generator can be found in Subsection [5.1.1.3](#).

To scan an object, place it in front of the scanner and choose the appropriate distance between the scanner and the object. In addition, taking into account the prevailing lighting conditions, you should set the exposure and brightness of the projector and then click the *SCAN* button (8) to scan the object.

For more advanced users, there is the *ADVANCED* (B) (Figure 243) tab which combines the functionality of the *SIMPLE* tab and additionally has the following options:

(9) – extensive selection of projector patterns (*PROJECTOR*),

More information about projector patterns can be found in Subsection [10.2](#).

(10) – Pixel clock settings on cameras (*CAMERAS*),

More information about Pixel clock can be found in Subsection [5.1.1.1](#), point (3).

(11) – selecting the mode for setting the exposure on cameras (*CAMERAS*) between the default automatic (*Auto*) and the manual (*Manual*),

More information about exposition can be found in Subsection [9.1.1](#).

(12) – settings of the *Gain* parameter on cameras (*CAMERAS*) – available in the *Manual* mode – used to digitally amplify the signal from the camera sensor to brighten the photos,

More information about Gain can be found in Section [11](#).

(13) – *PROJECTOR BRIGHTNESS* – available in the *Manual* mode,

More information about Projector Brightness can be found in Subsection [10.1](#).

(14) – enable / disable *HDR mode* (the same option as in *SIMPLE*) – available in the manual exposure mode,

More information about this parameter can be found in Subsection [15.1.7](#).

(15) – *ADDITIONAL SCANNING FEATURES* contains a plan shift parameter - *Remove points under the table*,

More information about this parameter can be found in Subsection [5.1.1.1](#), point 9.

(16) – *SCAN GENERATOR* settings – extended version,

More information about this parameter can be found in Subsection [5.1.1.3](#).

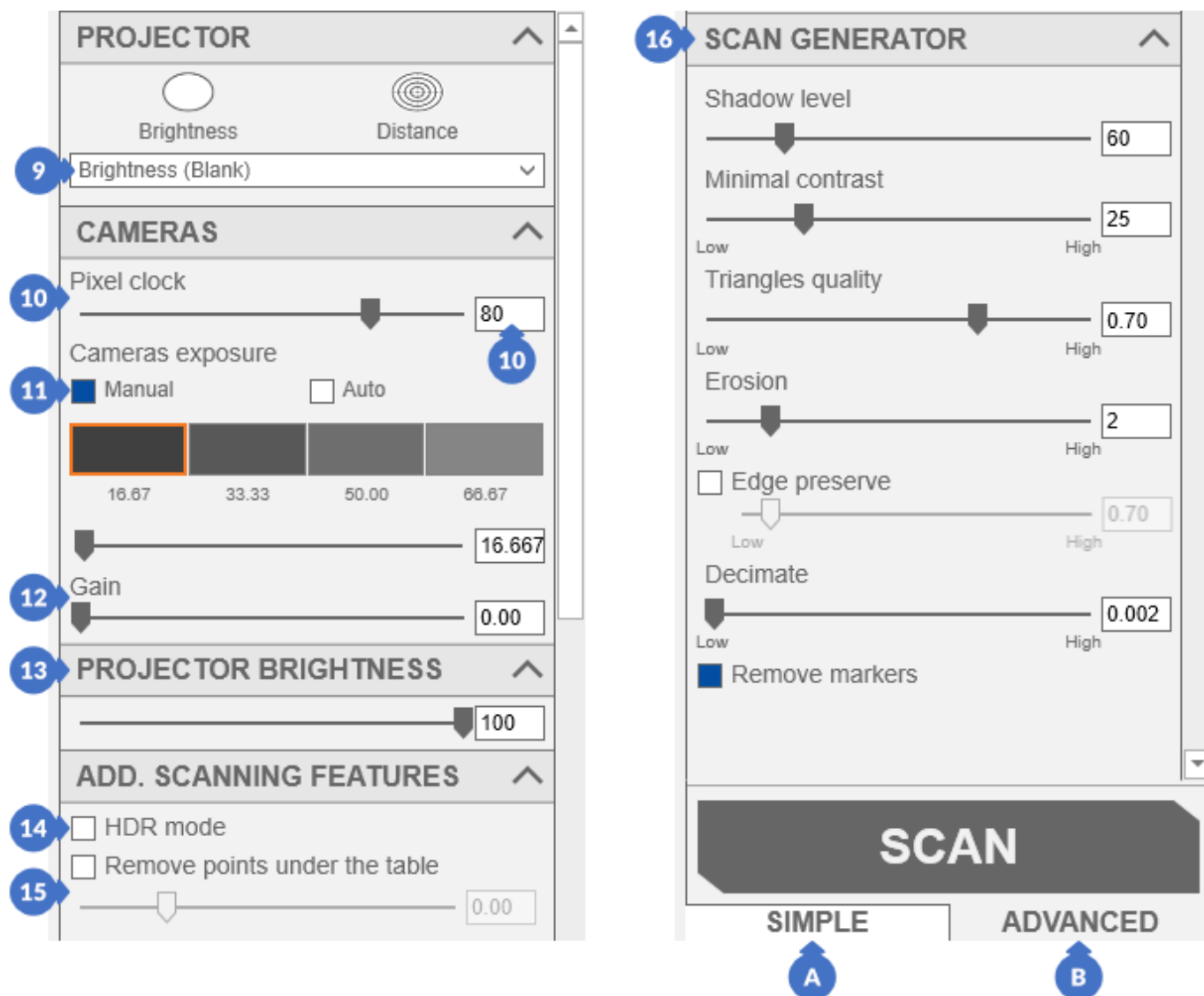


Figure 243. Scanning panel (the ADVANCED view)

### 15.1.3 Table Scan – the Wizard Mode



Figure 244. Opening the Rotary table wizard panel

The scanning wizard mode with the use of a rotary table can be started by going to the *3D scanning* tab (1) and then clicking the *Rotary table wizard* button (2). It will open the *Table Scanning Wizard* panel.

More information about building wizards can be found in Subsection 4.8.2.

The *Table Scanning Wizard* is launched by pressing the *START WIZARD* button.

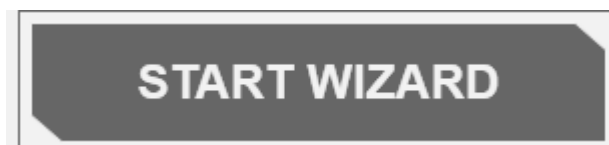


Figure 245. Button to start the Rotary table wizard

**NOTE**

Many wizard steps in the *Marker Scan Wizard* will be repeated from the *Scan Wizard*, so they will be presented in abbreviated form here below with links to a more complete description.

#### 15.1.3.1 Selecting the Projector, Setting the Scanner Position

Step description:

(3) – projector selection,

More information can be found Subsection 15.1.1.1.

**NOTE**

For scanners with a built-in trigger, this step is invisible. In its place you will see the step described below.

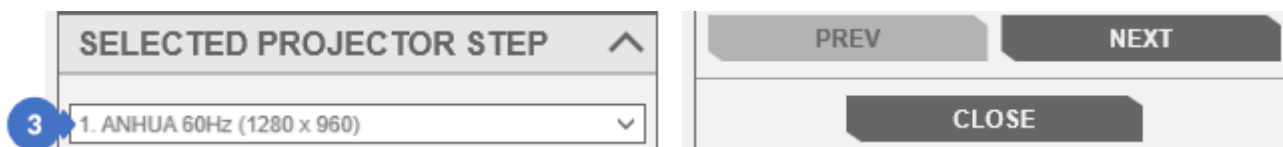


Figure 246. Projector selection

- (4) – rotation of the scanner with respect to the object,

More information can be found in Subsection 15.1.1.3.

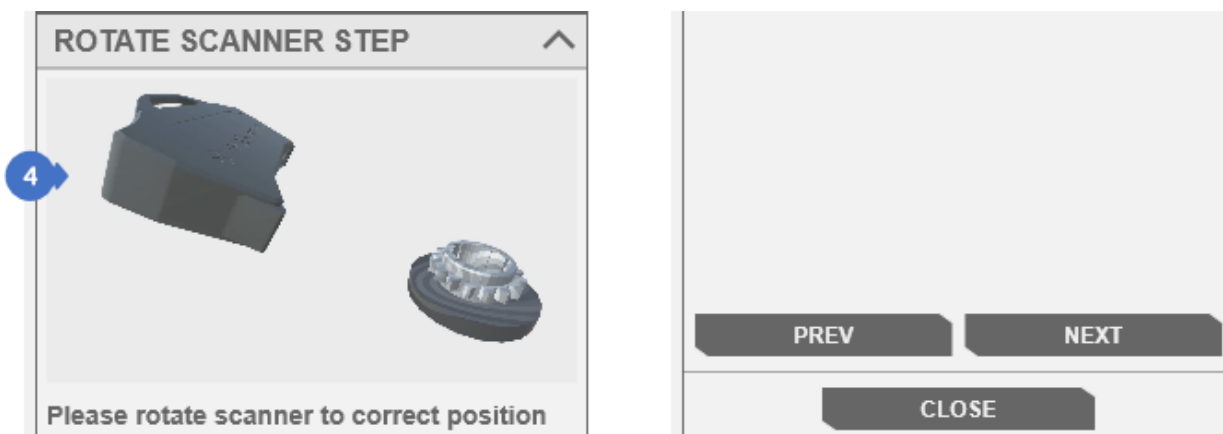


Figure 247. Setting the scanner in the correct position – directing the scanner with respect to the object

- (5) – setting the distance between the scanner and the object,

More information can be found in Subsection 15.1.1.4.



Figure 248. Setting suitable distance between the scanner and the object

- (6) – setting the height of the scanner in relation to the object,

More information can be found in Subsection 15.1.1.5.



Figure 249. Setting suitable height of the scanner in relation to the object

After selecting the appropriate height and distance between the scanner and the object, proceed to the rest of the wizard with the *NEXT* button.

### 15.1.3.2 Setting the Positioning Pattern

The next step prepares you for the rotary stage positioning process in order to correctly combine the scans in relation to the stage axis. This process will be presented in the next steps of the wizard. In this step, remove the object on the table and place a pattern with markers (non-unique or unique - both types are supported) in its place, as presented in the animation (7) in *SET PATTERN STEP* (Figure 232). The entire process of selecting exposure and projector brightness is performed automatically.

More information about markers can be found in Section 13.

At the very end, make sure that the markers are detected correctly, and then go to the next step of the wizard with the *NEXT* button

More information about the marker detection process can be found in Subsection 13.2.



Figure 250. Table positioning (positioning pattern)

Clicking the *NEXT* button will automatically set the table to the 0° position.

**i** NOTE

*If in the previous step the pattern was in a position other than 0°, after turning the table, set the pattern in the same position as it was set in the previous step.*

### 15.1.3.3 Rotary Table Positioning – the First Photo

In this step, make sure that the positioning pattern is in the position shown by the animation (8). The *TABLE* tab (9) visible in the panel is used to change the angle settings of the rotary table and indicates the currently selected angle.

More information about rotary table and positioning can be found in Section 14.

Proceeding to the next step with the *NEXT* button will trigger the first position photo by setting the rotary table to the 15° position.

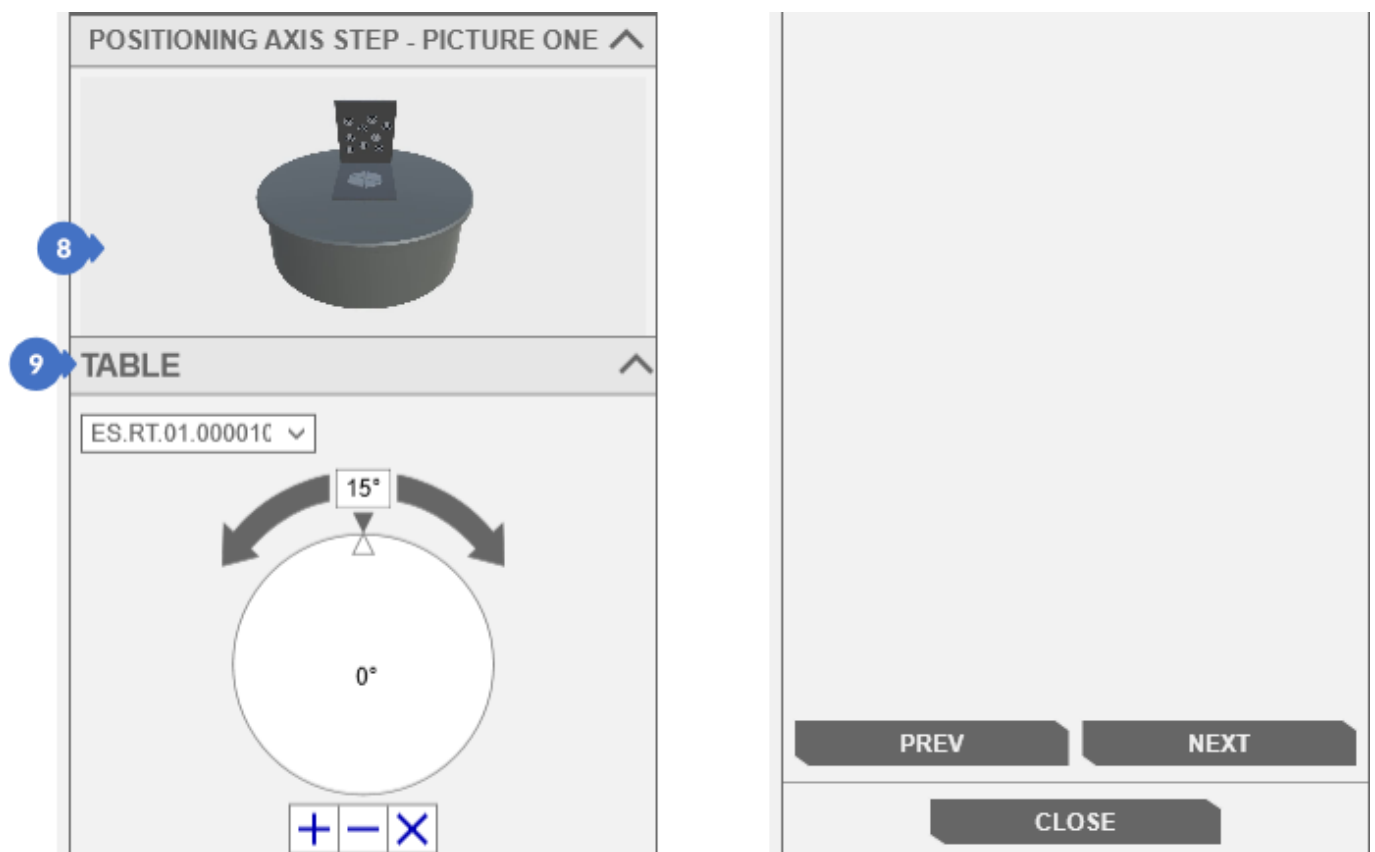


Figure 251. Positioning the rotary table (the first photo)

### 15.1.3.4 Rotary Table Positioning – the Second Photo

This step is identical to the previous one with a small exception – the position of the table (11) in the *TABLE* tab has changed, and thus the position of the pattern should look like in the animation (10). If the pattern has a position consistent with the position of the animation, you can proceed to the next step of the wizard with the *NEXT* button. The second position shot is taken and the table moves to 345 ° (rotates 30 ° to the left).



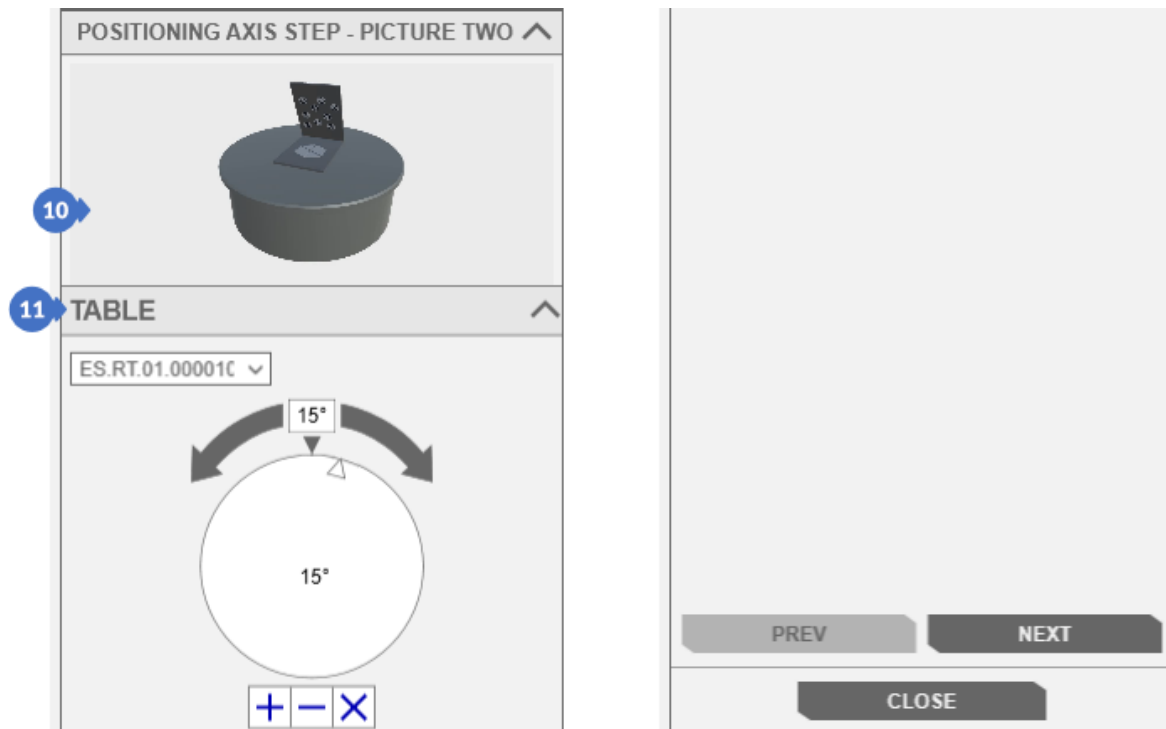


Figure 252. Positioning the rotary table (the second photo)

### 15.1.3.5 Rotary Table Positioning – the Third Photo

As in the case of the second photo, in this step of the wizard only the angle of the table (17) in the *TABLE* tab is changed. The pattern for positioning should be in the position shown by the animation (16). Clicking on the *NEXT* button will invoke the table positioning algorithm. If the photos have been taken correctly, the table will turn to the initial position (i.e. 0°) and the wizard will display the next step.

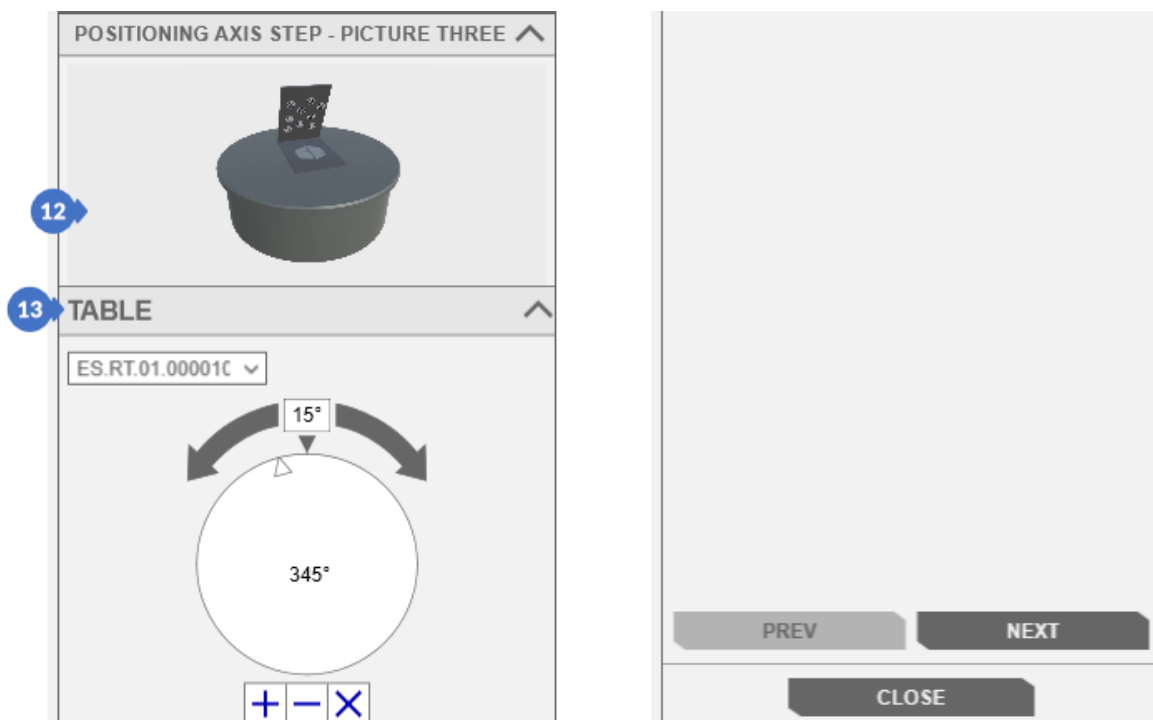


Figure 253. Positioning the rotary table (the third photo)

### 15.1.3.6 Setting Cameras Exposure and Projector Brightness

The **BRIGHTNESS AND EXPOSURE** step (Figure 250) requires you to replace the positional pattern with the object to be scanned. After placing the object on the table, select the area as shown in the animation (14), on the basis of which the exposure and projector brightness are to be automatically selected - default mode is *Auto* (B) in the category **CAMERAS EXPOSURE** (15) or after changing to *Manual* mode (A), adjust the exposure parameters, the **CAMERAS EXPOSURE** category (17) and the projector brightness in the **PROJECTOR BRIGHTNESS** category (18) which is visible only in *Manual* mode – so as to reduce the overexposure and underexposure of the object. This process is shown in a simplified way in the animation (16).

More information about choosing exposures, overexposures and underexposures can be found in Section 9.

More information about selecting projector brightness can be found in Section 10.1.

When all parameters are selected correctly, you can continue working with the wizard by clicking on the **NEXT** button.

The autoexposure panel is presented as below:

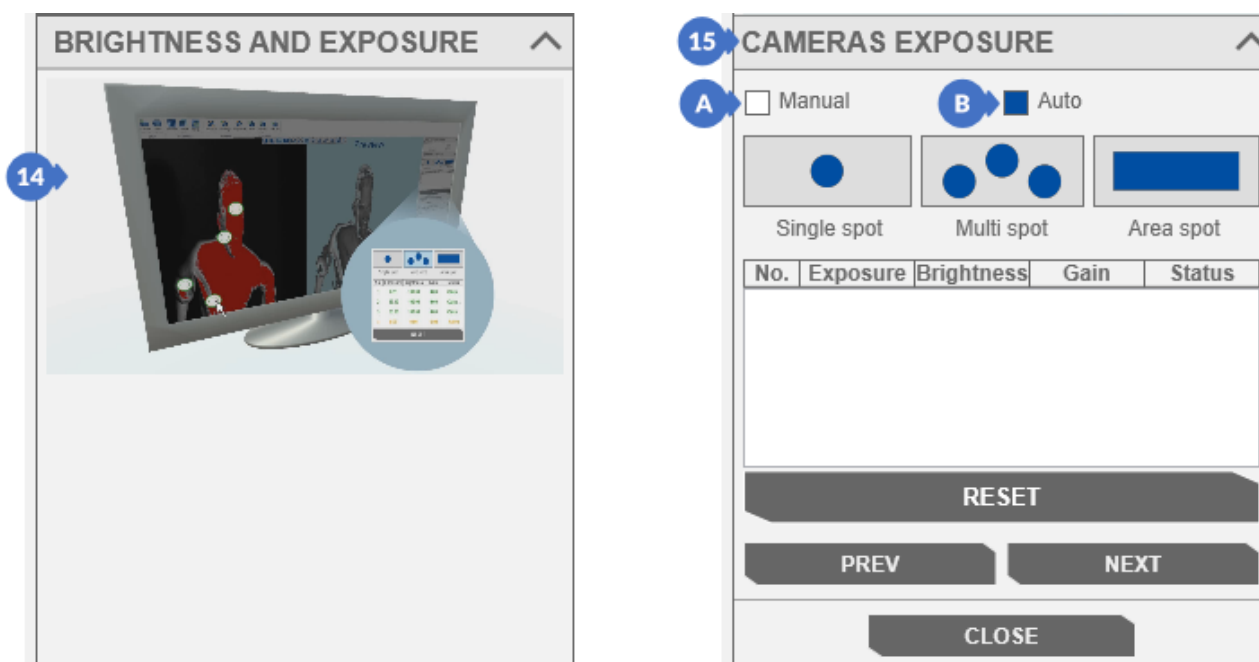


Figure 254. Selection of the correct exposure parameters and projector brightness for the automatic mode

The manual exposure mode is as follows:

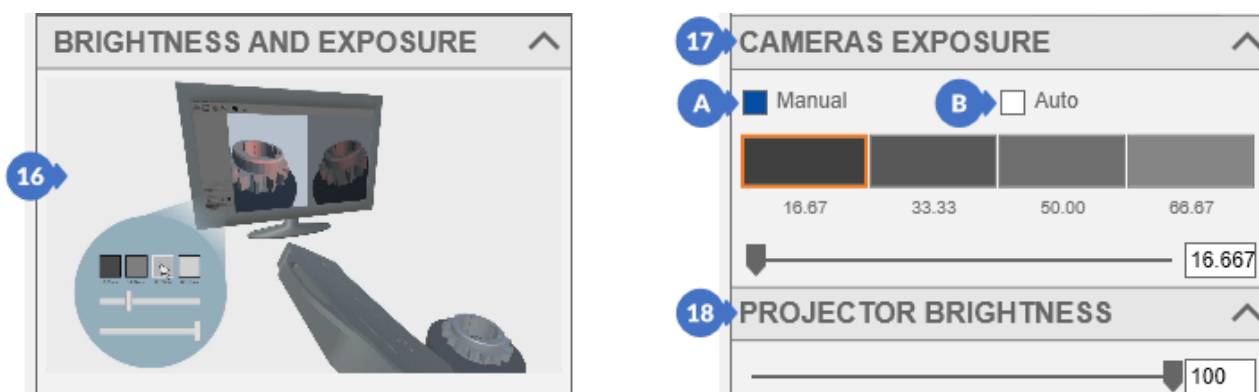


Figure 255. Selection of the correct exposure parameters and projector brightness for the Manual mode

### 15.1.3.7 Launching the Scanning Process

The last step of the wizard is to select the number of scans with the slider (19). It gives you a choice from 2 to 16 scans. The scanning process is started with the *SCAN* button (20).

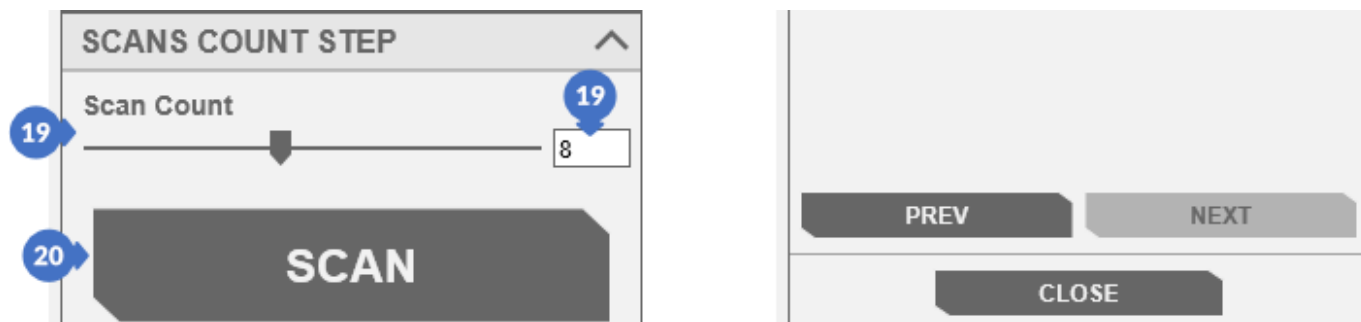


Figure 256. Selecting the number of scans and starting the scanning process

#### **i** NOTE

Scanning on the table without restarting the wizard is possible until neither the rotary table nor the scanner change their position. The slightest shift or change in the angle of inclination (in the scanner) requires a new process of setting the distance between the scanner and the object and positioning the table.

### 15.1.4 Table Scan – the Normal Mode

To open the panel with rotary table scanning, go to the *3D scanning* tab (1) and then select *Scan with rotary table* (2) from the *3D scanning* category.

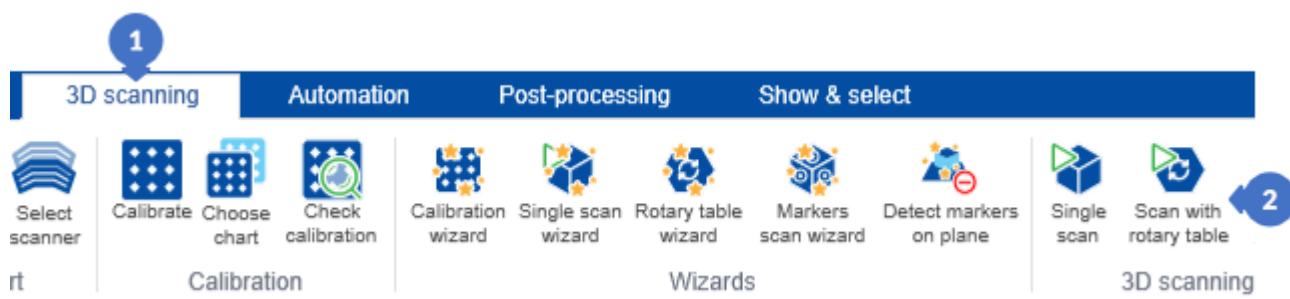


Figure 257. Opening the scanning panel on the rotary table

The rotary table scan panel in the *SIMPLE* (A) mode has the following options:

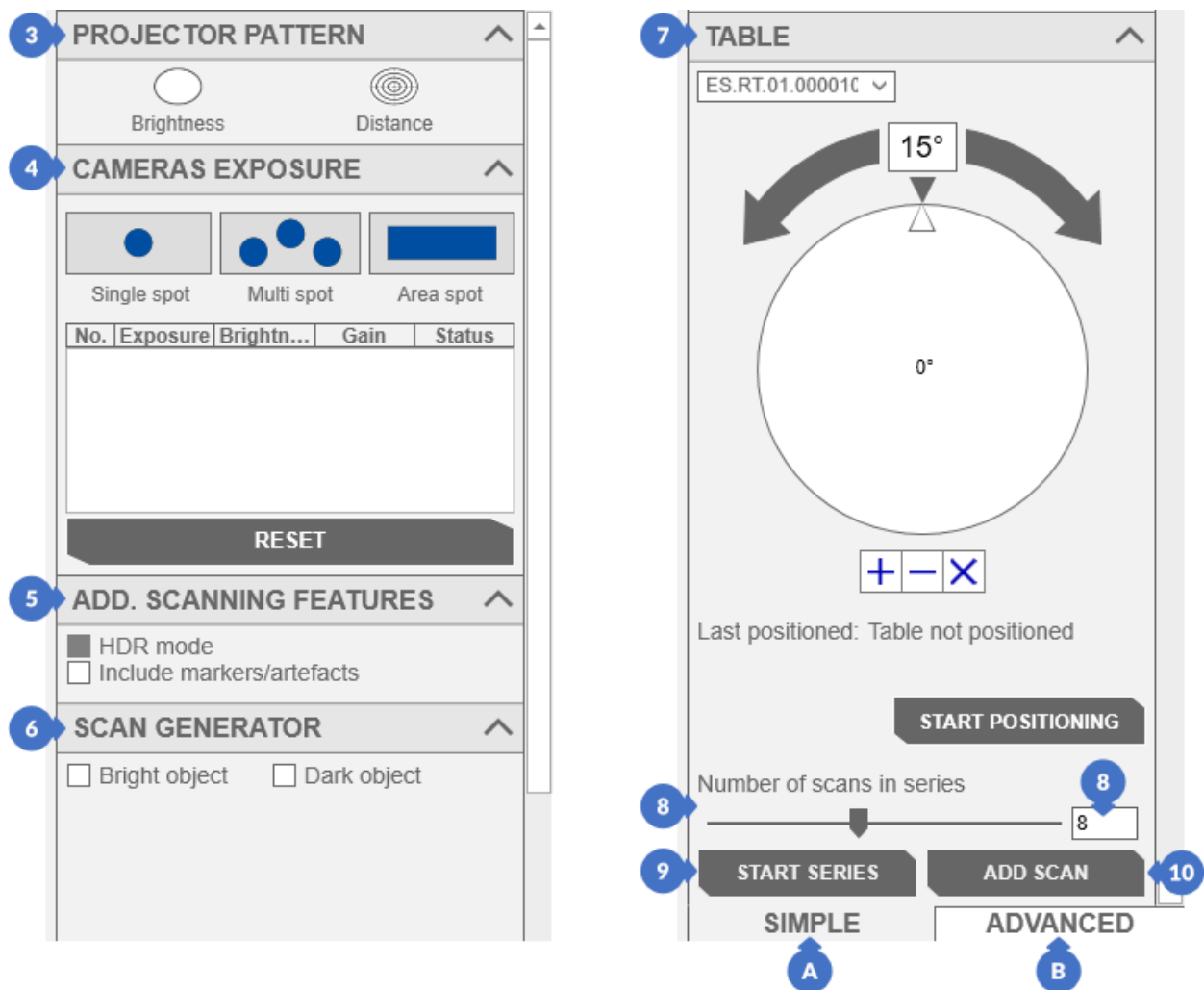


Figure 258. *SIMPLE* mode with the rotary table scanning

- (3) – *PROJECTOR PATTERN*,  
  - More information about projector pattern can be found in Subsection 10.2.
- (4) – *CAMERAS EXPOSURE* – default mode is the *Auto* mode,  
  - More information about exposures can be found in Section 9, Subsection 9.1.2.
- (5) – additional scan settings (*ADD. SCANNING FEATURES*) have HDR scanning mode (*HDR mode*) applied to objects with hard-to-scan surfaces and the option of combining markers and artefacts (*Include markers/artefacts*). Selecting the (*Include markers/artefacts*) option will combine two scanned groups (obtained after completing the series) based on common markers/artefacts placed on the object,  
  - More information about HDR mode can be found in Subsection 15.1.7.
  - A more detailed description of the *Include markers artefacts* option can be found in Subsection 13.3.2.
- (6) – scan generator settings (*SCAN GENERATOR*) allow you to enter predefined default settings for scanning dark objects (*Dark object*) or restore the point cloud generator settings to the default settings (*Bright object*),  
  - Black object and White object options has already been covered can be found in Scan mode in Subsection 15.1.2, point (6) – White object and point (7) – Black object.*
- (7) – rotary table settings, including the positioning process, can be found in the *TABLE* tab,  
  - More information about the rotary table settings, include positioning can be found in Section 14.

- (8) – the *Number of scans in series* slider is used to set the number of scans to be performed. The slider range is from 2 to 16 scans,
- (9) – the button that starts the scan series (*START SERIES*) performs the number of scans set on the *Number of scans in series* slider,
- (10) – the (*ADD SCAN*) button takes one scan and adds it to the last scanned group

**i NOTE**

*In case the series scanning was not performed, the scan will be added to the main group.*

To perform a scan on the table, set the object (or pattern for positioning the table) and then set the appropriate distance of the scanner from the object using the target (*Distance*) pattern. Once the scanner has been set up, adjust the exposure and brightness of the projector to the current lighting conditions and check whether the markers on the positioning pattern are detected. Then you need to position the table. After positioning the table, replace positioning pattern with the object to be scanned, adjust the exposure and brightness of the projector, set the number of scans on the table *Number of scans in series* (9) or define individual angles of the table rotation and click on *START SERIES* (10) to execute the series on the table (Figure 258).

Information about positioning the rotary table can be found in Subsection 14.2.

More information about adjusting individual rotary table angles can be found in Subsection 14.3.1.

In addition to the basic settings in the *SIMPLE* (A) mode, you can go to the *ADVANCED* (B) tab for more advanced options in the rotary table scanning panel. In this tab you can find the following additional options:

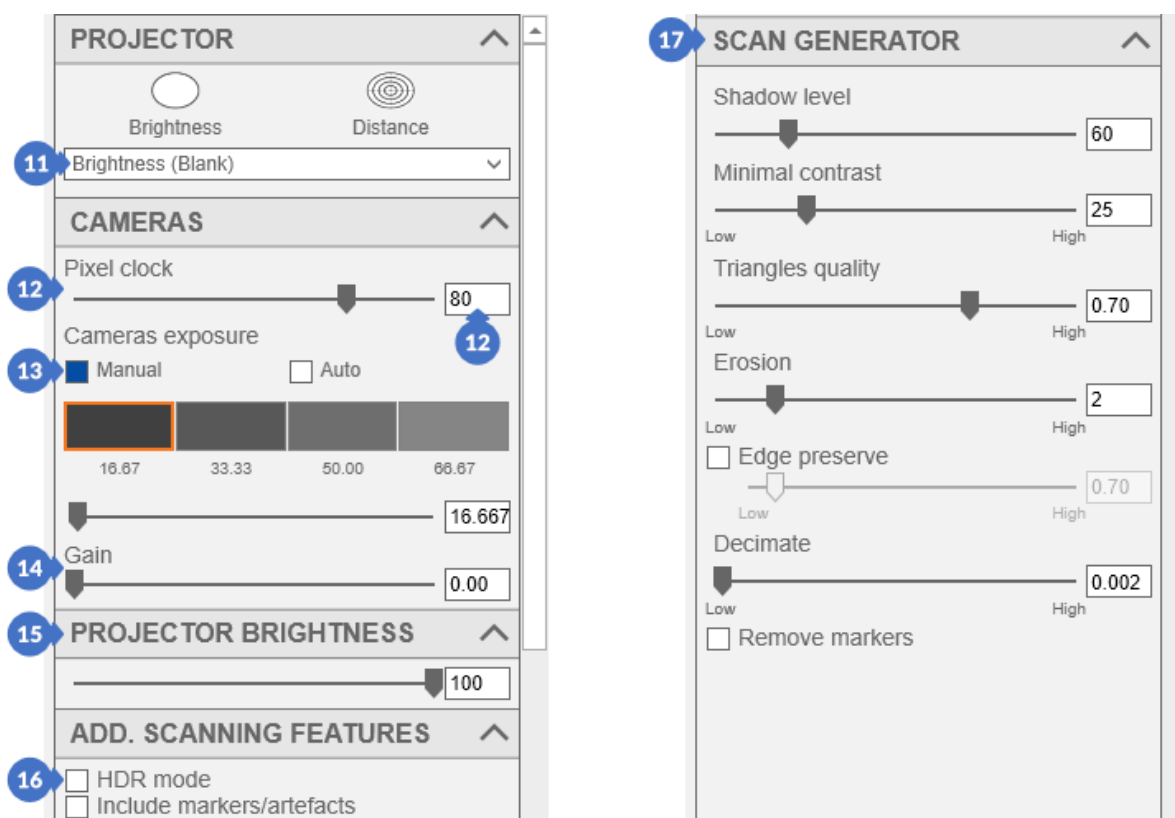


Figure 259. *ADVANCED* mode with scanning on the table

- (11) – extensive selection of projector patterns (*PROJECTOR*),  
 More information about projector patterns can be found in Subsection 10.2.
- (12) – *Pixel clock* settings on cameras,  
 More information about *Pixel clock* can be found in Subsection 5.1.1.1, point (3).

- (13) - *CAMERAS EXPOSURE* settings in the *Manual* mode,  
 More information about exposure on cameras can be found in Subsection 9.1.1.
- (14) - *GAIN* parameter – is used for digital amplification of the signal from the camera sensor to brighten the photos  
 More information about Gain can be found in Section 11.
- (15) - *PROJECTOR BRIGHTNESS* – available only in the *Manual* mode  
 More information about projector brightness can be found in Subsection 10.1.
- (16) – the ability to enable/disable *HDR mode* – available only in the *Manual* mode – used for objects with surfaces that are difficult to scan,  
 More information about HDR mode can be found in Subsection 15.1.7.
- (17) – settings point cloud generator (*SCAN GENERATOR*),  
 More information about point cloud generator parameters can be found in Subsection 5.1.1.3.
- (18) – table settings (*TABLE OPTIONS*), such as a slider with Scanning delay, enable/disable removing points under the table and enable/disable the *Use only markers* option for aligning the scans only on markers (then it ignores the table axis),  
 More information about Scanning delay can be found in Subsection 5.1.1.2.  
 More information about removing points under the rotary table plane (*Remove points under the table*) in Subsection 5.1.1.1 in the part with additional scanning parameters (7).
- (19) – settings of the rotary table (*TABLE*), in addition to the slider of the number of scans in the series (*Number of scans in series*), also have the *Angle increment* slider to set the angle of rotation after the scan. With the *Number of scans in series* setting, the angle is determined automatically. The *Angle increment* slider allows you to enter your own angle settings.

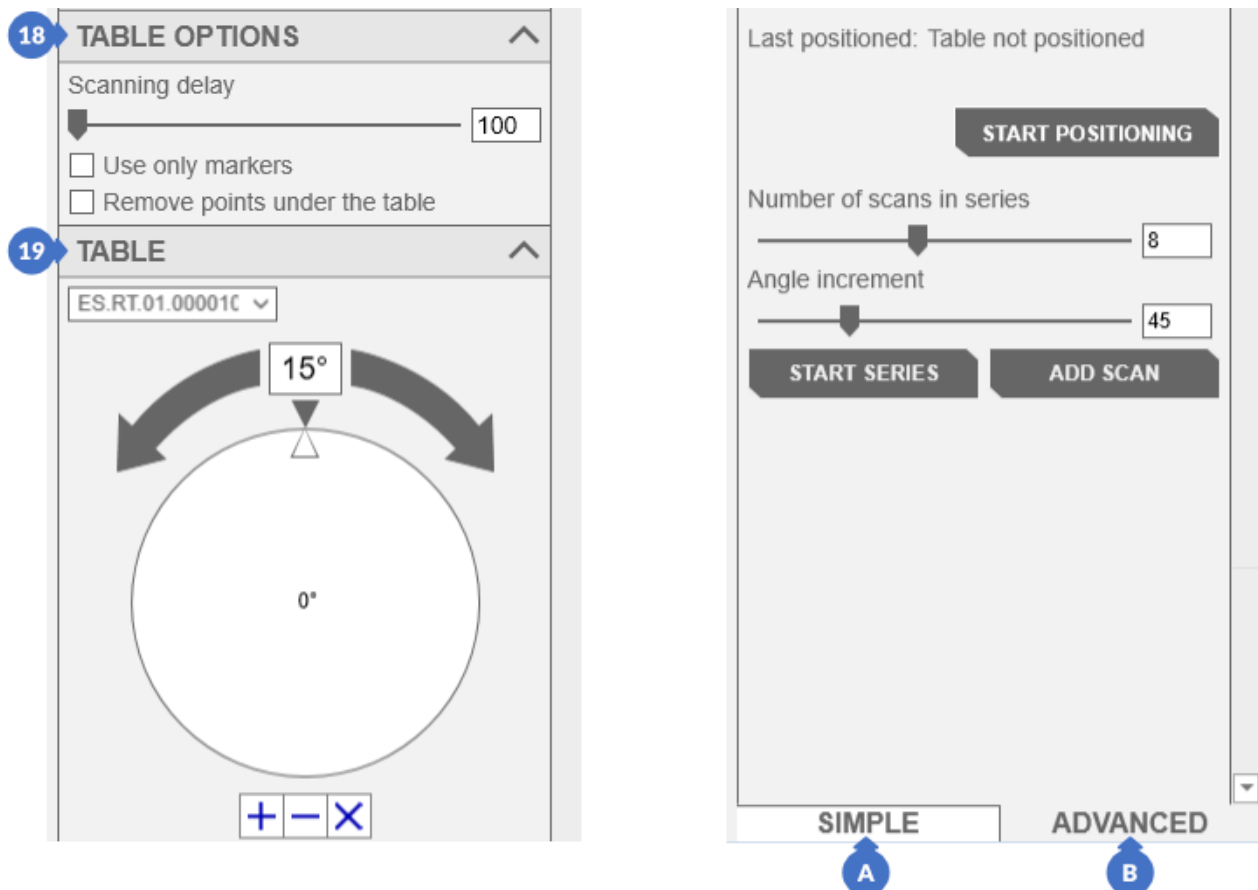


Figure 260. ADVANCED mode with the rotary table scanning

## 15.1.5 Scanning with Markers – the Wizard Mode



Figure 261. Open the Scan wizard panel with the use of markers

To open the table scan wizard panel, go to the *3D scanning* tab (1) and then select *Markers scan wizard* (2) from the *Wizards* category.

More information about wizards can be found in Subsection 4.8.2.

In the panel on the right, click on the *START WIZARD* button to start working with the wizard.

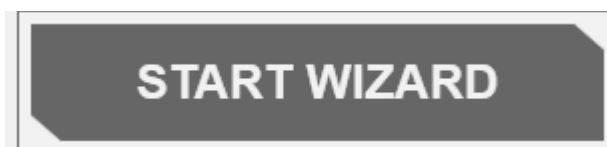


Figure 262. Button to start the Marker Scan Wizard

### NOTE

Many wizard steps in the Marker Scan Wizard will be repeated from the Scan Wizard, so they will be presented in the abbreviated form with links to a more complete description.

### 15.1.5.1 Selecting the Projector, Projector Pattern, Setting the Correct Position of the Scanner

(3) – selecting the projector,

More information can be found in Subsection 15.1.1.1.

### NOTE

For scanners with a built-in trigger, this step is invisible. In its place you will see the step described below.



Figure 263. Selecting the projector

- (4) – selecting projector pattern,  
 ■ More information can be found in Subsection 15.1.1.2.



Figure 264. Selecting the projector pattern

- (5) – rotation of the scanner to an object,  
 ■ More information can be found in Subsection 15.1.1.3.

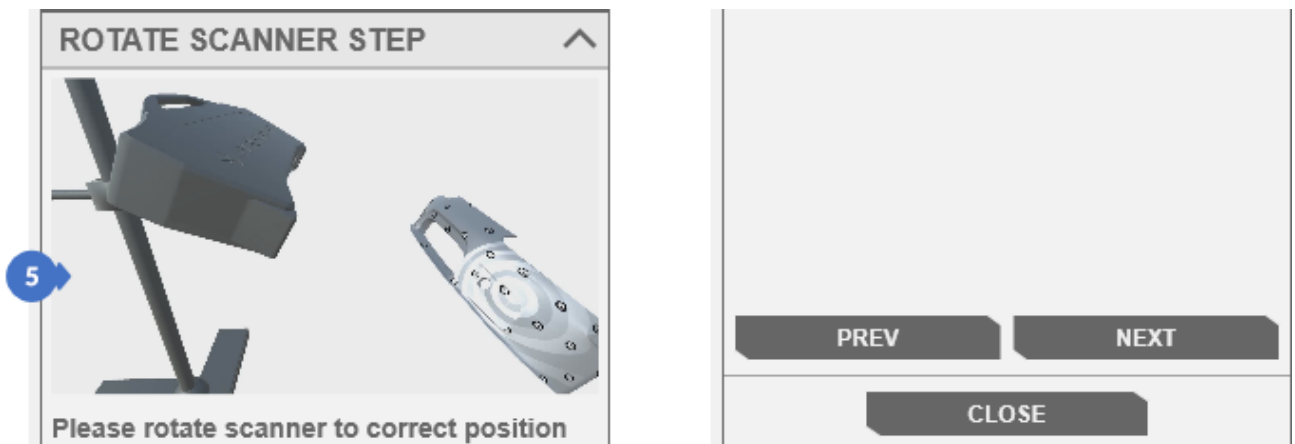


Figure 265. Setting the correct position of the scanner – rotation of the scanner towards an object

- (6) – setting the correct distance of the scanner to an object,  
 ■ More information can be found in Subsection 15.1.1.4.

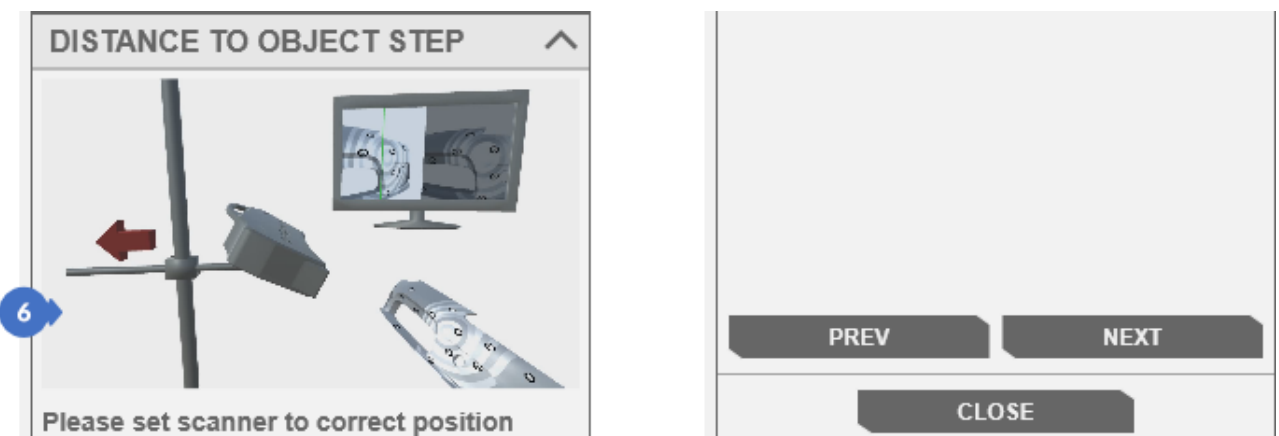


Figure 266. Setting the correct distance of the scanner to an object



(7) – setting the correct height of the scanner to an object,

More information can be found in Subsection 15.1.1.5.

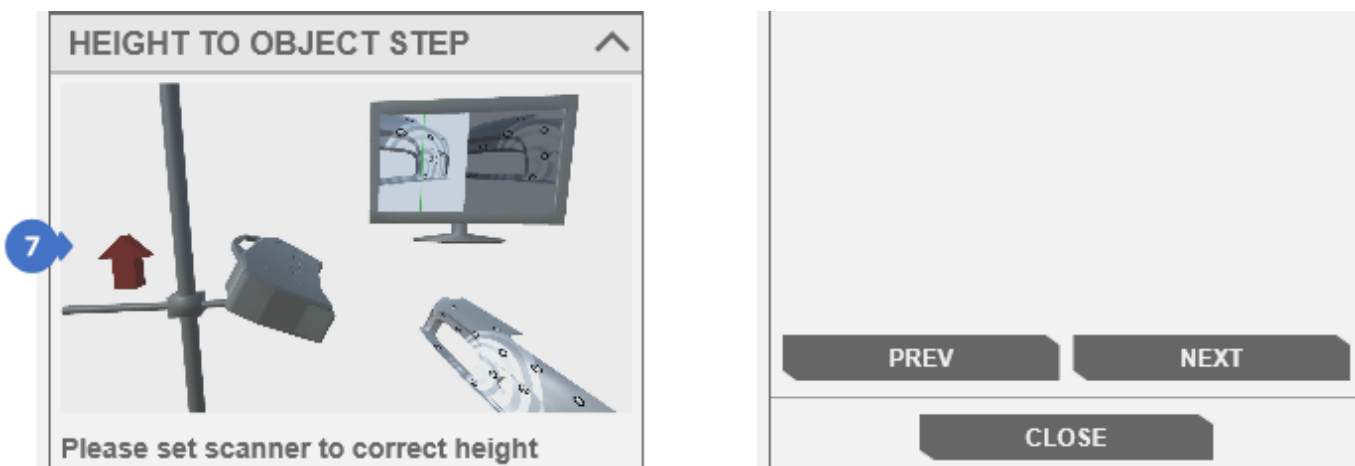


Figure 267. Setting the correct height of the scanner to an object

## 15.1.5.2 Marker Detection

In this step, the animation (8) informs the user about the necessity to turn on the marker detection option.

### **i** NOTE

The user does not need to turn on any marker detection options. This option is activated automatically. This step is only intended to inform the user about the need to check whether the markers are detected in the marker scanning process and to what extent the marker detection process is accurate. If a wrong calibration is selected, the markers may be incorrectly detected or not detected at all.

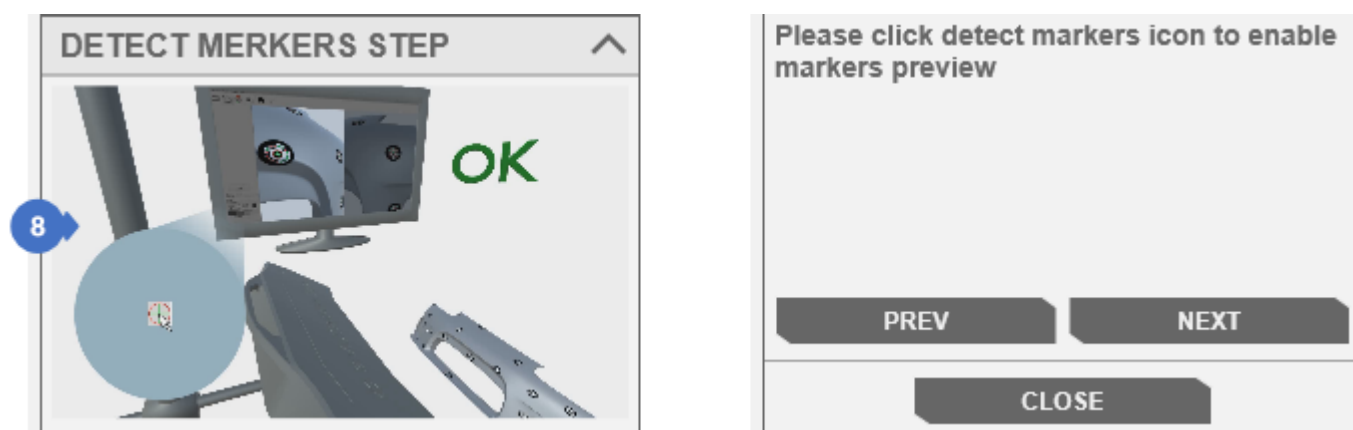


Figure 268. Marker detection

More information about enabling/disabling the marker detection algorithm can be found in Subsection 4.9.1, point (7) and Subsection 13.2.

### 15.1.5.3 Selection of the Exposure and the Projector Brightness Parameters

The next step is to select the area in which the automatic exposure will be searched for – the *Auto* (B) or *Manual* (A) mode that allows you to manually select the appropriate camera exposure parameters and (*PROJECTOR BRIGHTNESS*) (11) to the current lighting conditions so as to eliminate the overexposure and/or underexposure. This process is illustrated in the Animation (9) – the *Auto* mode and Animation (10) – the *Manual* mode.

More information about exposure can be found in Section 9.

More information about projector brightness can be found in Subsection 10.1.

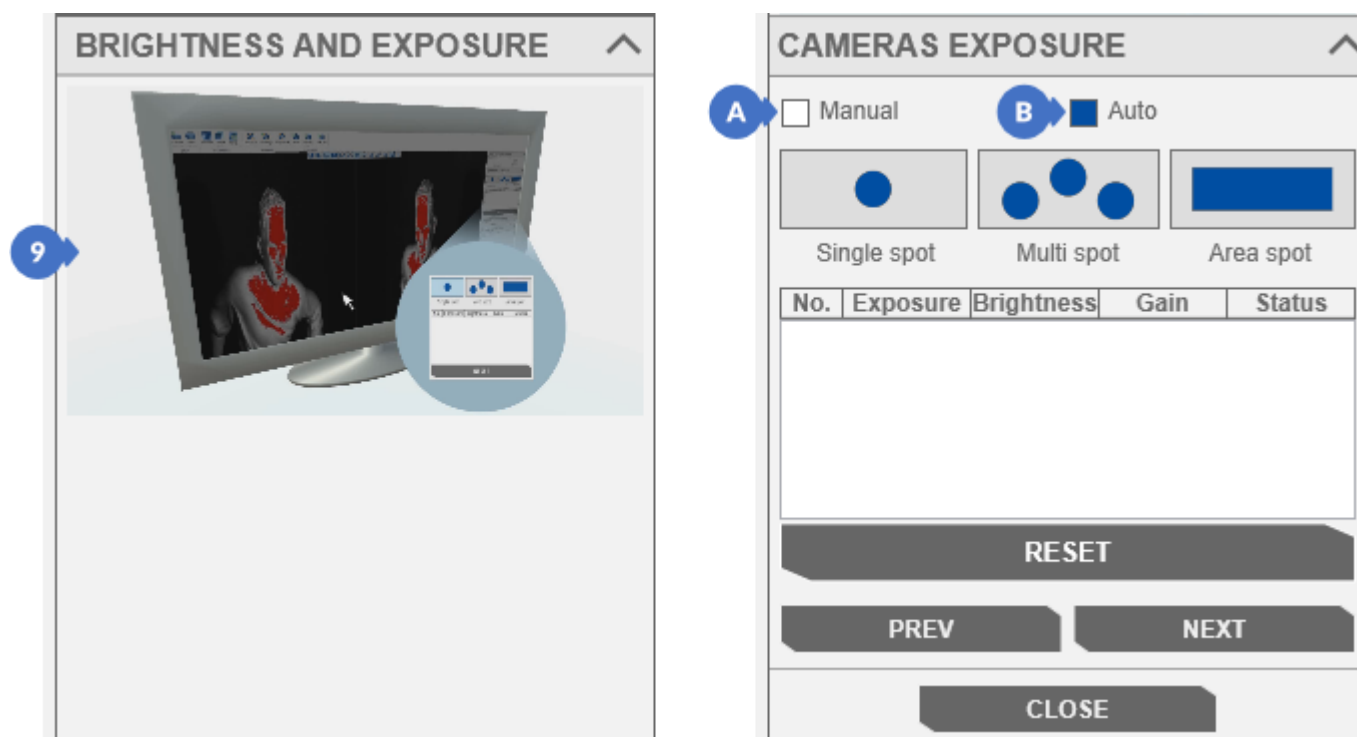


Figure 269. Selection of the exposure and the projector brightness – the Auto mode

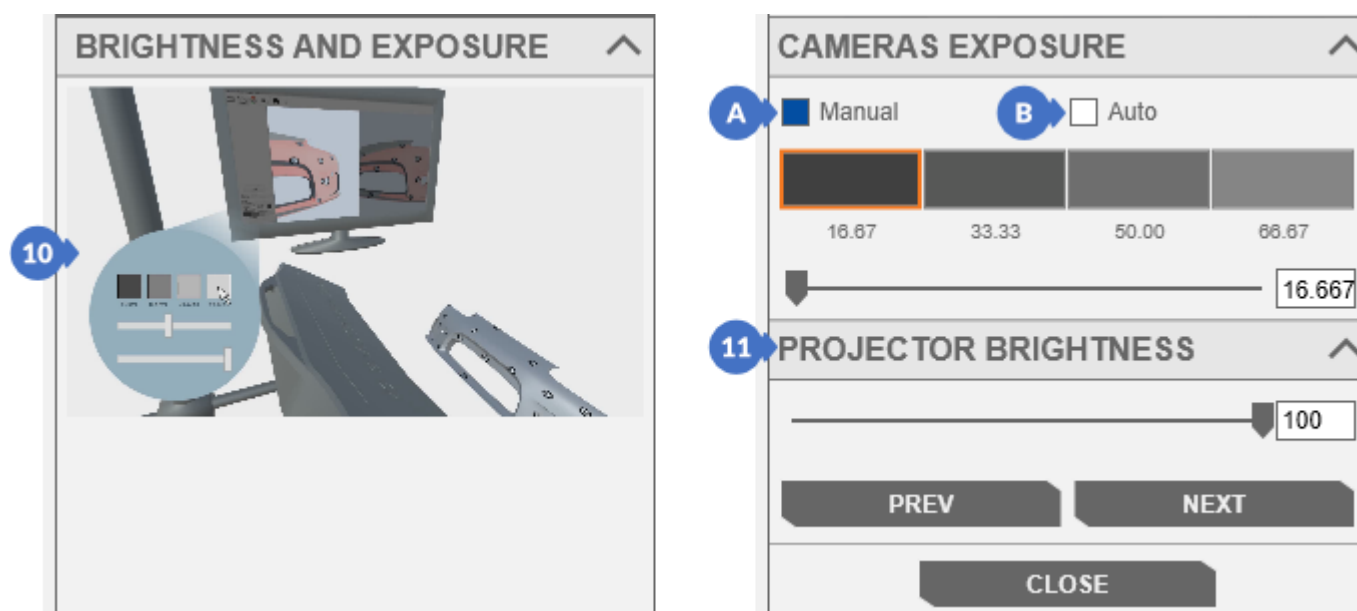


Figure 270. Selection of the exposure and the projector brightness – the Manual mode

#### 15.1.5.4 Scanning an Object

The last step of the *Marker Scan Wizard* has the *SCAN* button (13) (Figure 271) to execute the scanning process. After the scanning of one side of an object, you can move the object or the scanner to scan its another side, so that the end of the process the entire surface of the object will be scanned.

**i NOTE**

When scanning with markers, you can move the scanner or the object, but remember to keep the marker "overlap" between scans so that the algorithm can adjust the scans based on common markers discovered on consecutive scans. The aforementioned marker "tab" is presented in a simplified way in the animation (12).

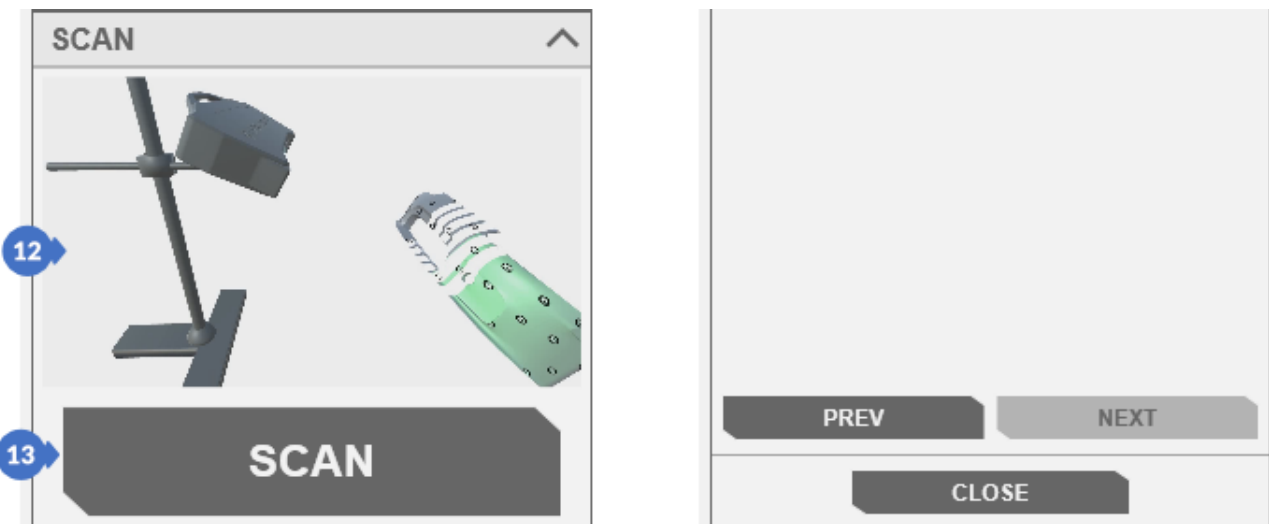


Figure 271. Scanning with markers

#### 15.1.6 Scanning with Markers – the Normal Mode

The scanning process with the use of markers is used to scan objects with a large surface, bigger than the single scan area. To open the panel for scanning with markers, go to the *3D scanning* tab (1) and select *Scan with markers* (2) from the *3D scanning* category.

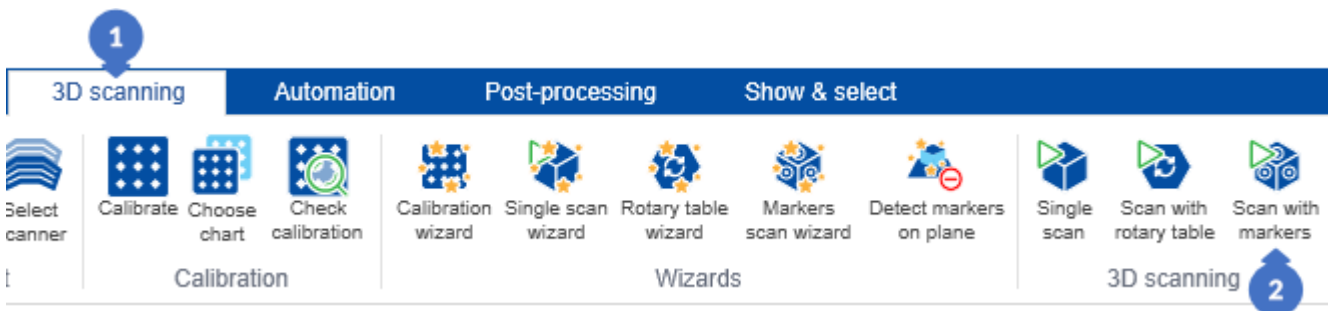


Figure 272. Open the scan panel with markers

The *SIMPLE* (A) tab in the right panel has the following options (Figure 273):

(3) – *PROJECTOR PATTERN*,

More information about patterns can be found in Subsection 10.2.

(4) – *CAMERAS EXPOSURE* – automatic mode (default in this tab),

More information about exposure can be found in Section 9, Subsection 9.1.2.

- (5) – **ADD. SCANNING FEATURES** includes the *HDR mode* – the option is inactive in the *SIMPLE* panel due to the automatic selection of exposure and brightness of the projector,  
 ■ *More information about HDR mode can be found in Subsection 15.1.7.*
- (6) – simplified settings of the point cloud generator (*SCAN GENERATOR*),  
 ■ *The subject of Black object and White object options has already been covered in Scan mode in Subsection 15.1.2, point (6) – White object and point (7) – Black object.*
- (7) – the (*SCAN*) button that starts the scanning process with the use of markers.

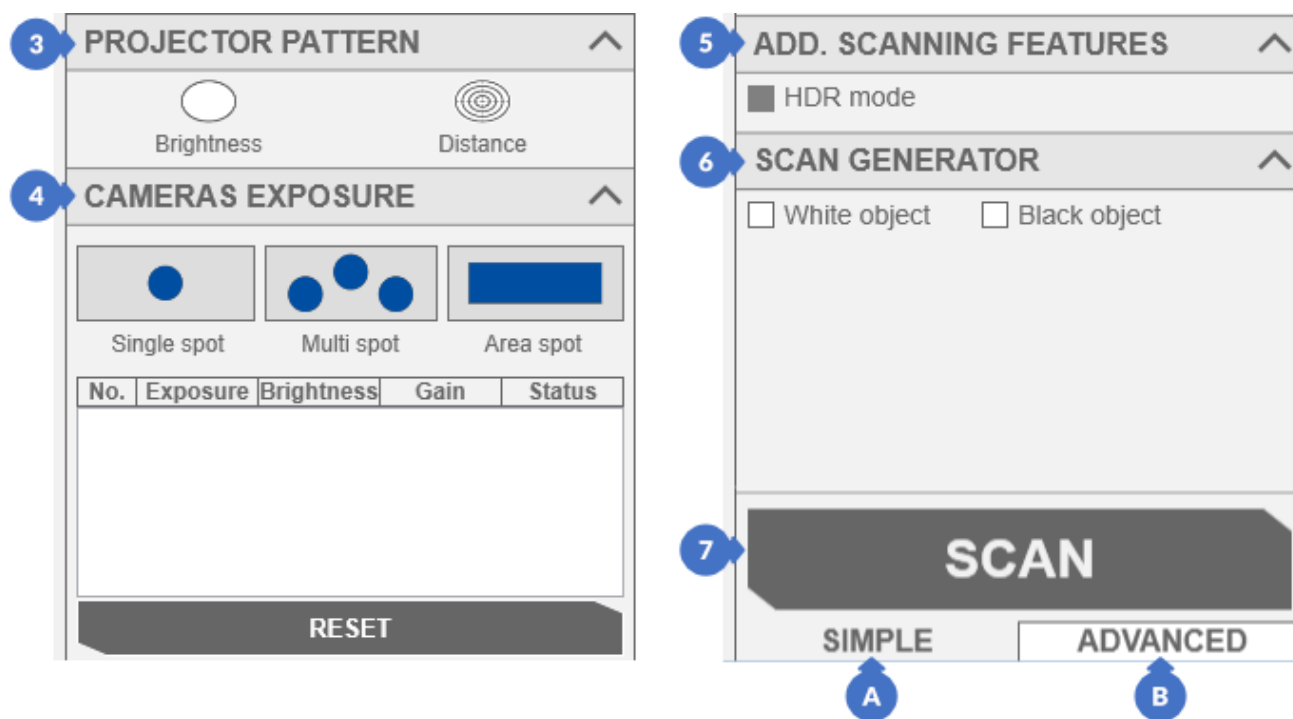


Figure 273. SIMPLE mode for scanning with markers

The process of scanning an object with markers does not differ much from a regular scanning, except for the need to stick markers or attach artefacts in the least significant places, which can later be easily removed in the post-processing process while processing the scanned surface. Performing a scan in this mode (after detecting common markers between the existing scans in the tree) will enable an automatic alignment of scans based on common markers.

■ *More information about regular scanning can be found in Subsection 15.1.2.*

*More information about post-processing can be found in Section 17.*

The following parameters can be found in *ADVANCED* (B) mode for advanced users (Figure 274):

- (8) – extensive selection of projector patterns (*PROJECTOR*),  
 ■ *More information about additional patterns can be found in Subsection 10.2.*
- (9) – *Pixel clock* settings on cameras (*CAMERAS*),  
 ■ *More information about Pixel clock can be found in Subsection 5.1.1.1 point (3).*
- (10) – selecting the mode for setting the exposure on cameras (*CAMERAS*) between the default automatic (*Auto*) and manual (*Manual*)  
 ■ *More information about exposition can be found in Section 9.*
- (11) – *GAIN* parameter – is used for digital amplification of the signal from the camera sensor to brighten the photos  
 ■ *More information about Gain can be found in Section 11.*

(12) – **PROJECTOR BRIGHTNESS** – available only in *Manual* mode

More information about projector brightness can be found in Subsection 10.1.

(13) – **ADDITIONAL SCANNING FEATURES** in addition to enabling / disabling the HDR mode (the same option as in the *SIMPLE* mode) - the option is available in the *manual* exposure mode - the scan settings contain the plane shift parameter to be deleted

More information about HDR mode can be found in Subsection 15.1.7.

More information about plane shift parameter can be found in Subsection 5.1.1.1, point (10).

(14) – **SCAN GENERATOR**

More information about the parameter can be found in Subsection 5.1.1.3.

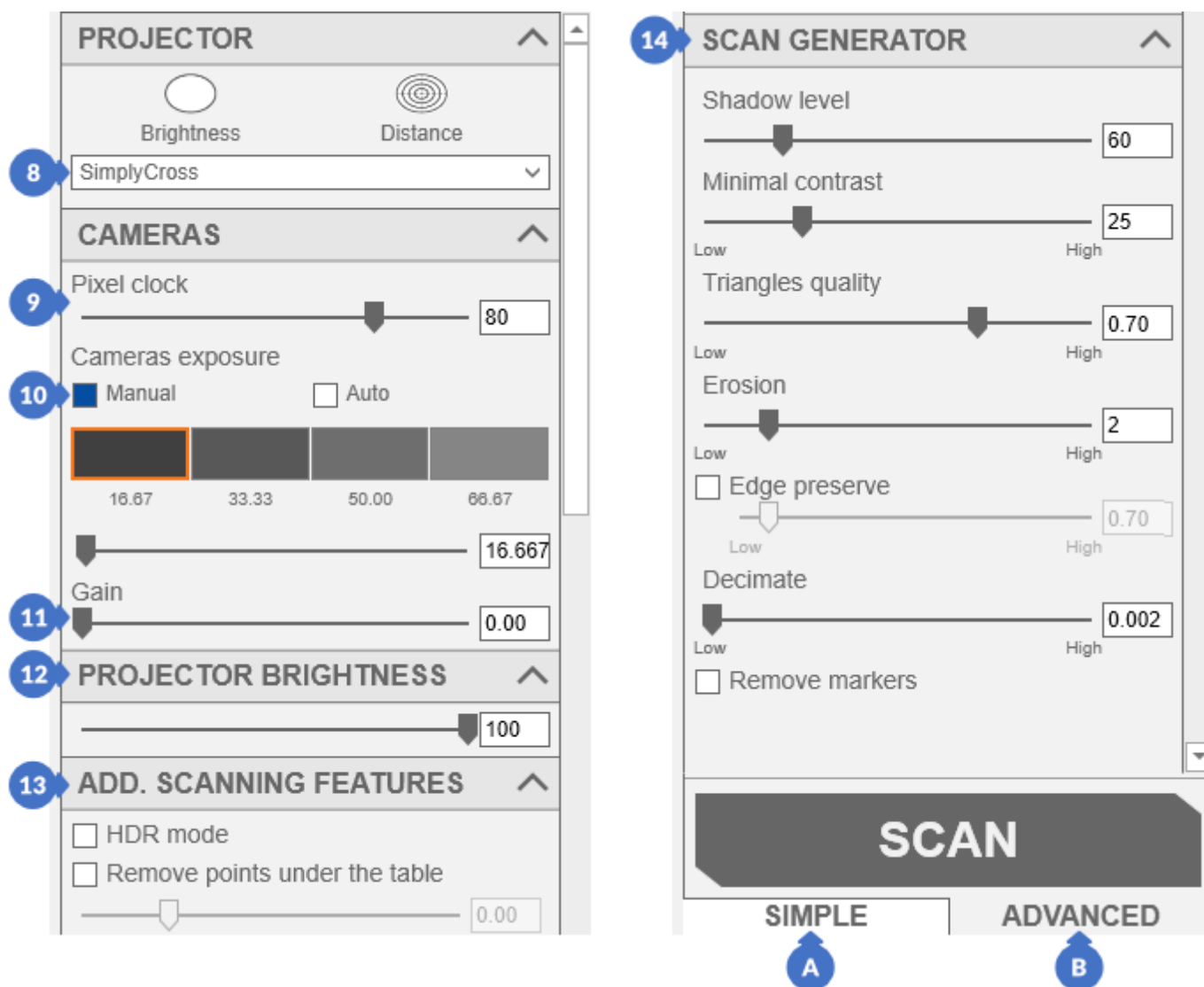


Figure 274. ADVANCED mode for scanning with markers

An additional difference between the normal scanning panel and the scanning with markers is the appearance of the middle window in the software. In the scan mode, only the camera preview is visible, while in the scan mode with markers, both the *Viewer* (15) with generated point clouds (scans) and the camera preview (16) are visible (Figure 275).

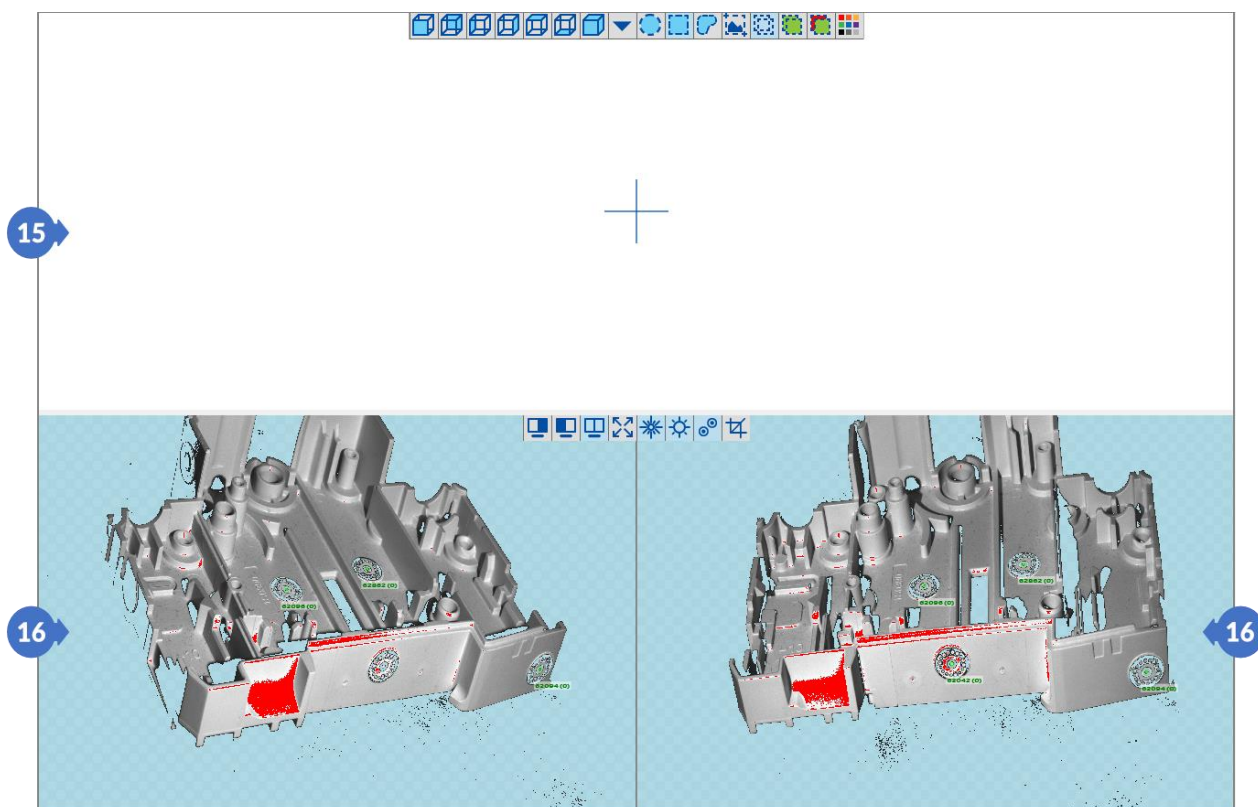


Figure 275. The appearance of the middle window when scanning with markers

## 15.1.7 HDR Mode

The HDR mode is used to perform scans of objects with a surface difficult to scan with a single camera exposure. This option extends the scanning time depending on the number of different exposures with which the entire scan is to be made, as it requires taking additional photos with these exposures. Next, the separate exposure photos from the list are processed – the algorithm selects the best pixels (the brightest, but not overexposed) to obtain the greatest amount of detail and largest coverage of the surface.



Figure 276. HDR mode control

After enabling the *HDR mode* (1), the list (2) appears, in which there are displayed the selected exposures for cameras (*Exposure*), the brightness of the projector (*Brightness*) and the *Gain* on the cameras. Any item in the list can be removed by selecting it in the list and clicking on the *REMOVE* button (4). Adding exposure with the projector brightness and the gain is to set the exposure in the control with the exposure, gain and brightness

of the projector in the control with brightness, and then click the *ADD* button (3). The *HDR mode* list, as well as the option to enable / disable the mode, is global, and thus the changes are common between the panels.



**NOTE**

*HDR mode is available only with the manual exposure. In the automatic exposure mode, it is unavailable and thus cannot be used in any panel in the SIMPLE tab, because the default exposure setting mode there is Auto.*

	More information about exposition can be found in <a href="#">Section 9</a> .
	More information about projector brightness can be found in <a href="#">Subsection 10.1</a> .
	More information about Gain can be found in <a href="#">Section 11</a> .

## 15.2 Plane Detection and Cutting

### 15.2.1 Detection of a Plane Covered with Markers – the Wizard Mode

In order to detect a plane with markers, open the *3D scanning* tab (1) and then click on *Detect markers on plane* (2).



Figure 277. Open the Plane Detection Wizard panel

After clicking on the *START WIZARD* button (3), the process of the wizard starts. The *CLOSE* button (4) closes the panel and stops the wizard.



Figure 278. Start the Wizard

The first step of *PREPARE PLANE STEP* is to prepare the plane for scanning. All the controls included in it depend on the selected mode of the marker exposure (the Markers auto exposure option is in the Start menu in the Options tab, General options - selecting this option activates the automatic mode). In this step, remove the objects from its surface - this process is presented in the animation (A) (Figure 279) – in the automatic mode or (Figure 281) in the step with the manual mode. When the surface does not have any markers, stick them on.



More information about selecting exposition for markers can be found in [Section 5](#), [Subsection 5.1.1.1](#).



### 15.2.1.1 Preparation of the Plane for Scanning – the Automatic Mode

In the automatic mode, you do not need to adjust the exposure and brightness parameters of the projector. All you need to do is to set the scanner in the right position to the plane with the markers. Then you can press the *NEXT* button (B).

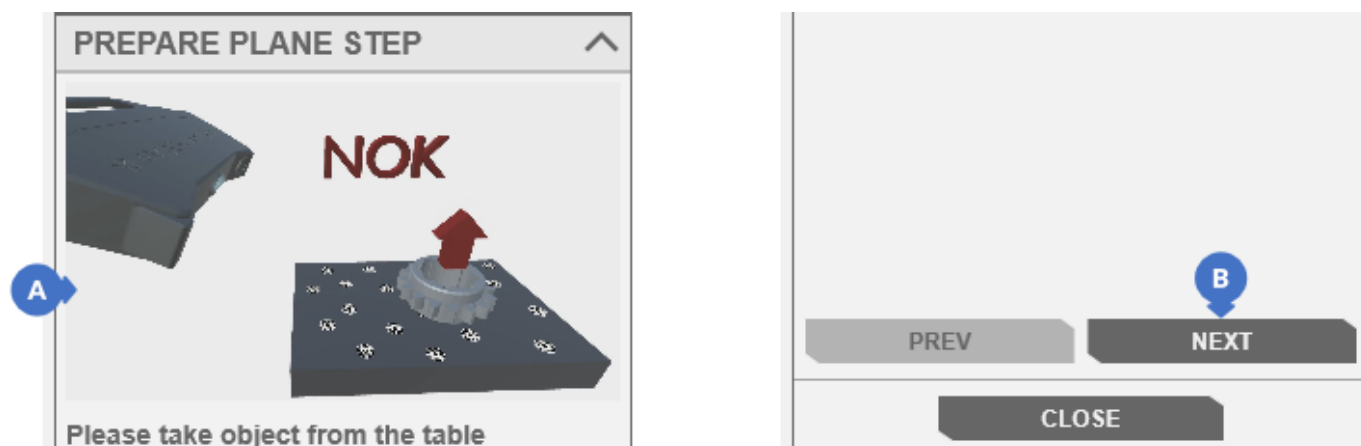


Figure 279. Preparing the plane for scanning – the automatic mode

### 15.2.1.2 Preparation of the Plane for Scanning – the Manual Mode

In the manual mode, you must manually set the scanner parameters. First, select the target pattern (5), aiming the scanner at the surface of the plane so that its position allows for the detection of as many markers as possible. Additionally, the exposure (6) and the projector's brightness (7) should be set. Then, when all the preparatory steps have been completed, you can proceed to the next step with the *NEXT* button (B).

More information about projector patterns can be found in Subsection 10.2.

More information about exposition can be found in Section 9.

More information about projector brightness can be found in Subsection 10.1.

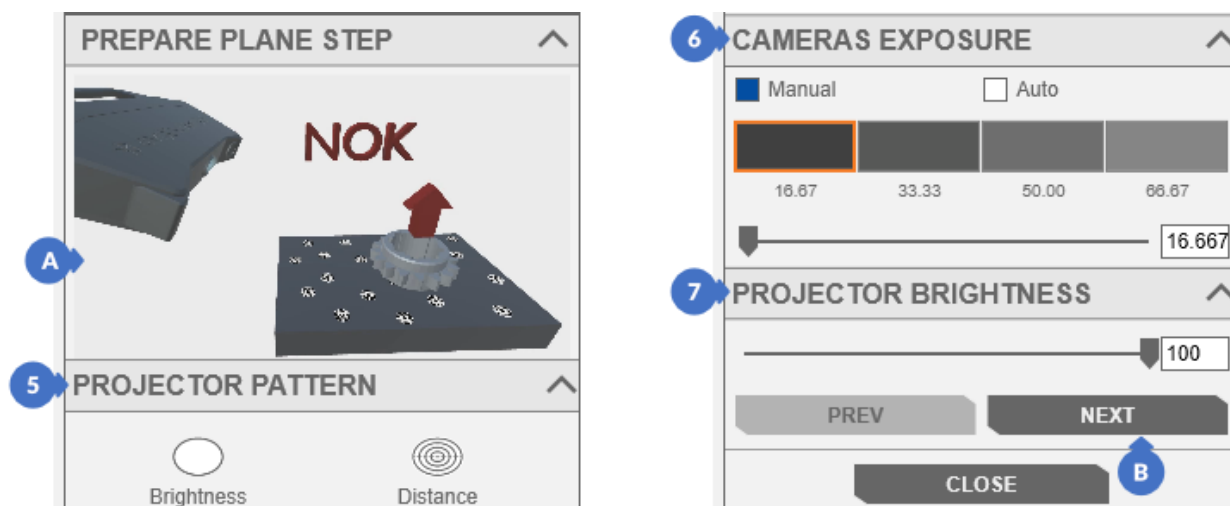


Figure 280. Preparing the plane for scanning – the manual mode



### 15.2.1.3 Markers Detection on the Plane

The next step is to set the *Plane offset* parameter (8). The *DETECT MARKERS ON PLANE* button (11) is used to start the process of detecting markers on a plane.

More information about the *Plane offset* parameter can be found in Subsection 5.1.1.1, point (7).

All changes in the exposure or brightness of the projector can be made in the previous step, if needed return to these settings using the *PREV* button (10), but only in the manual mode in which the selection of the exposure of markers is possible (see the above Section on how to turn on the manual mode). After detecting the markers on the plane, you can close the wizard window by pressing the *CLOSE* button (11).

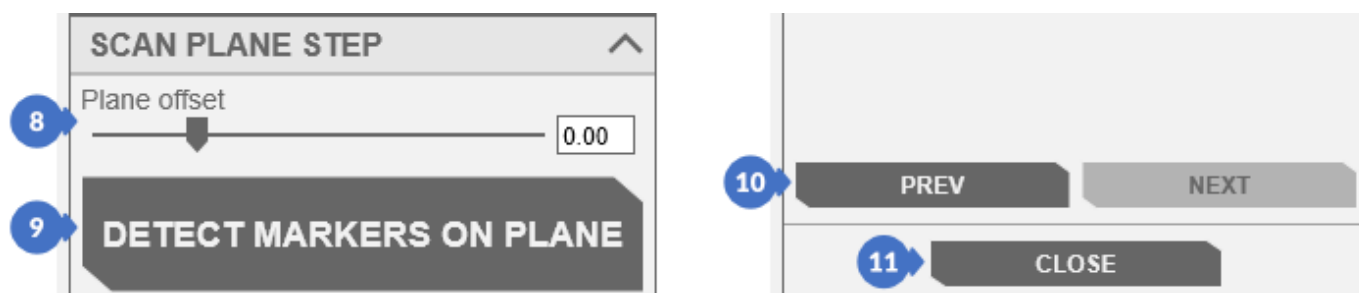


Figure 281. Detection of markers on a plane

## 15.2.2 Scanning with Plane Cut-off

Scanning with cutting off the plane requires detecting the markers on the plane and having the *Remove points under the table* option selected in the *Options* tab in the *Start menu* (*CAMERAS / ADDITIONAL SCANNING FEATURES*) or in the *Scan with rotary table* panel in the *ADVANCED (TABLE OPTIONS)* or *Single scan tab / Scan with markers* in the *ADVANCED (ADDITIONAL SCANNING FEATURES)* tab.

The plane detection process is described can be found in the previous Section 15.2.1.

More information about the *Remove points under the table* option can be found in Subsection 5.1.1.1, point (7), in Subsection 15.1.2, point (15) or in Subsection 15.1.4, point (18).



#### NOTE

The method of scanning with the plane cutting is intended for the stage scanning process, but it also works for regular scanning.

In this case, the scanning is performed in the same way as the regular scanning with the rotary table. The only difference in this process is that the plane needs to be detected and the option to delete points below the plane is checked.

More information about scanning with the rotary table (wizard mode) can be found in Section 15.1.3 or (normal mode) in Section 15.1.4.

The following illustrations show the difference between the scanning without plane cut-off option enabled (Figure 282) and scanning with the plane cut-off option enabled (Figure 283).



Figure 282. Scanning without the plane cut-off option enabled



Figure 283. Scanning with the plane cut-off option enabled

## 16 AUTOMATION

As the name suggests, the settings available in the tab are used to automate the scanning process (it is also associated with the automation of the calibration of the device itself). For this mode, devices such as the dedicated *eviXmatic* or *UR Robot* and *Han\*s Robot* co-operating with the software are recommended.



Figure 284. eviXmatic



Figure 285. UR robot



Figure 286. Han\*s robot

### 16.1 Device Configuration

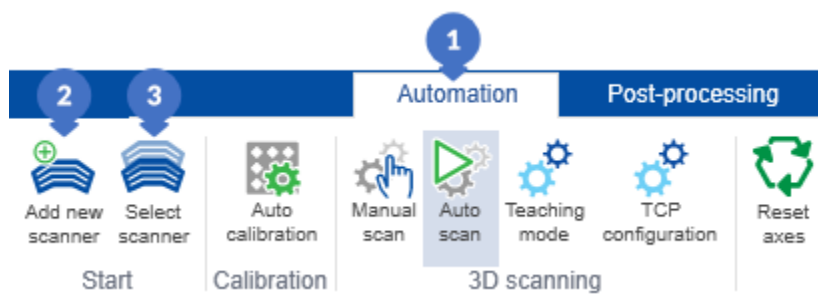


Figure 287. Automation tab

As in the *3D Scanning* tab, in *Automation* (1) there are options for creating a new configuration of the *Add new scanner* (2) and selecting the existing configuration *Select scanner* (3).

✚ Process of creating a new configuration can be found is described in Subsection 8.2.

✚ More information about selecting an existing configuration of scanner can be found in Subsection 8.5.

## 16.2 Calibration Panel

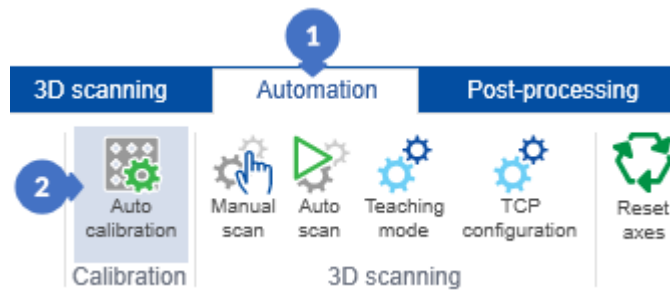


Figure 288. Opening the auto calibration tab

To calibrate a dedicated *eviXmatic* device, go to the *Automation* (1) tab and then click the *Auto calibration* (2) button. An automatic calibration panel will appear on the right side in the software window with the following options in the automatic exposure mode (B):

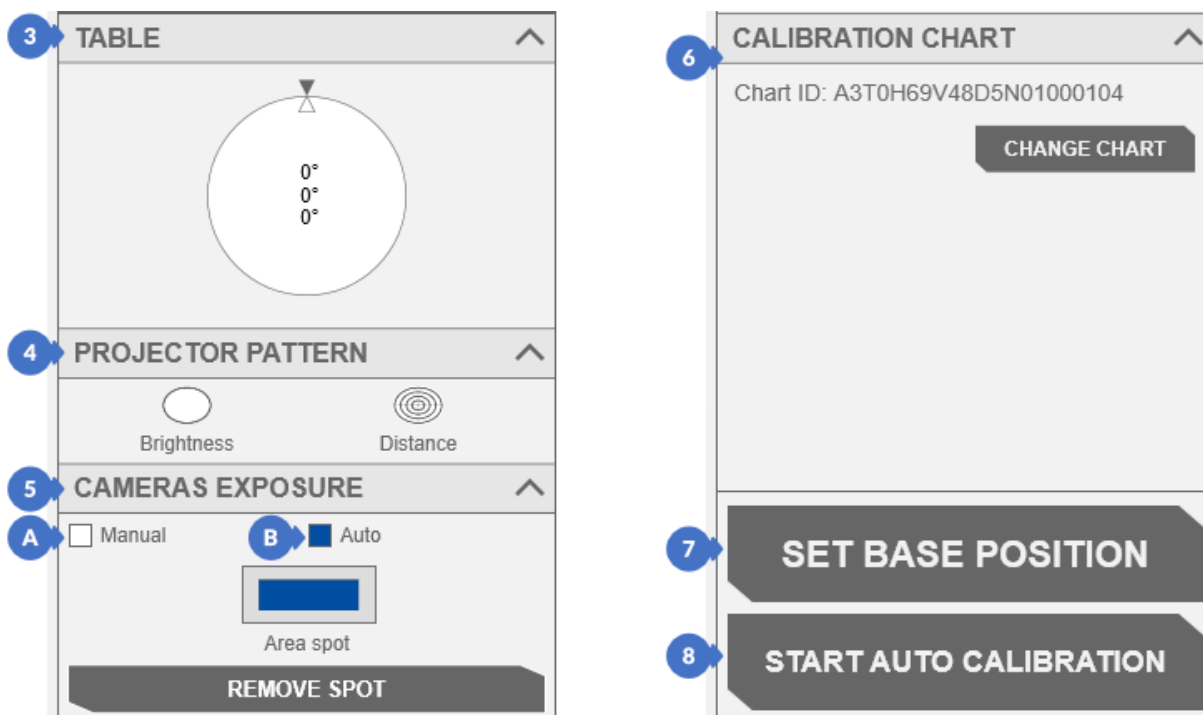


Figure 289. Calibration panel of device in Automation tab- automatic exposure mode

- (3) – control for setting the position of the rotary table built into the *eviXmatic* device (*TABLE*),  
 ■ More information about moving the rotary table can be found in Subsection 14.3.
- (4) – (*PROJECTOR PATTERN*),  
 ■ More information about projector patterns can be found in Subsection 10.2.
- (5) – (*CAMERAS EXPOSURE*),  
 ■ More information about cameras exposure can be found in Section 9.
- (6) – (*CALIBRATION CHART*) with button *CHANGE CHART* used to select or change the currently selected calibration chart file,  
 ■ More information about selecting calibration chart can be found in Subsection 8.3.4.

- (7) – *SET BASE POSITION* button used to set *eviXmatic* in the initial position located in the device calibration file (it is equivalent to the F3 position on the calibration pad),
- (8) – *START AUTO CALIBRATION* button initiating the automatic calibration process.

**i NOTE**  
Clicking on the *SET BASE POSITION* or *START AUTO CALIBRATION* button when the device calibration file has not been selected will end with the display of a message about an unselected calibration path.



Figure 290. A message informing about the lack of a file for device calibration

In the manual exposure mode (A), the following category also appears:

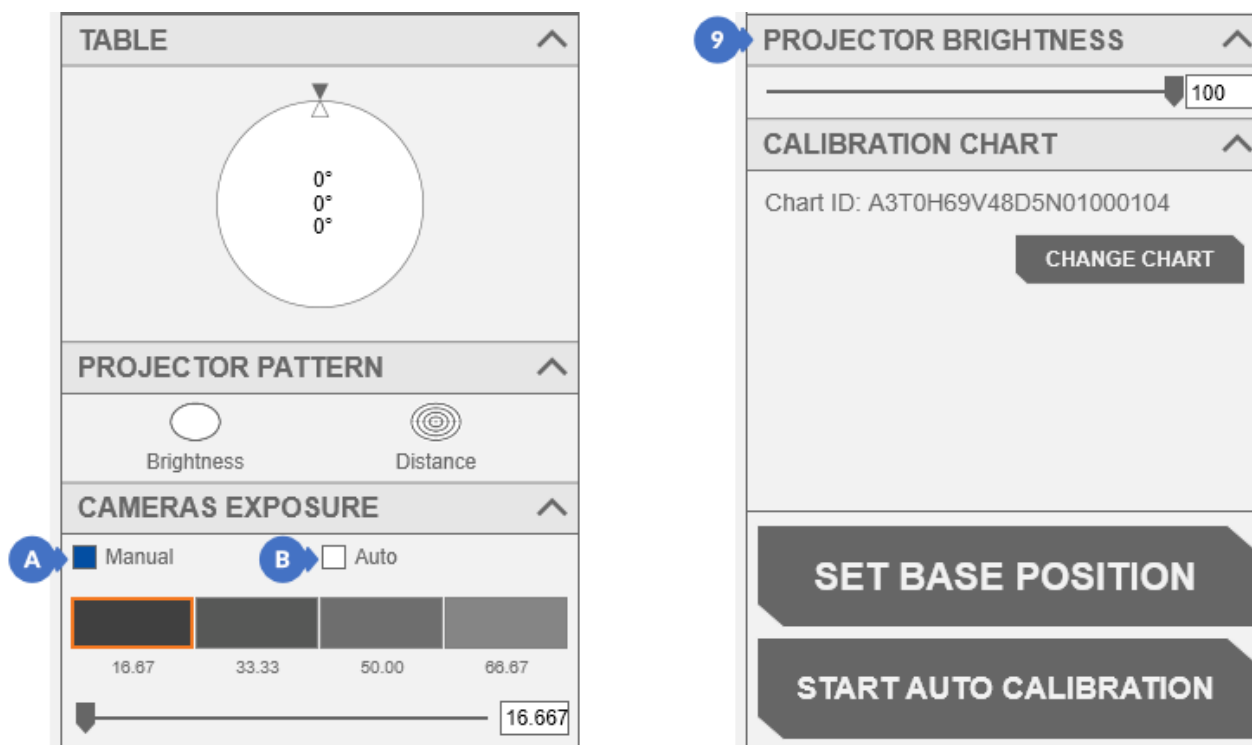


Figure 291. Device calibration panel in the Automation tab – the manual exposure selection mode

- (9) – (*PROJECTOR BRIGHTNESS*),

More information about *PROJECTOR BRIGHTNESS* can be found in Subsection 10.1.

## 16.2.1 Selecting a File for Device Calibration

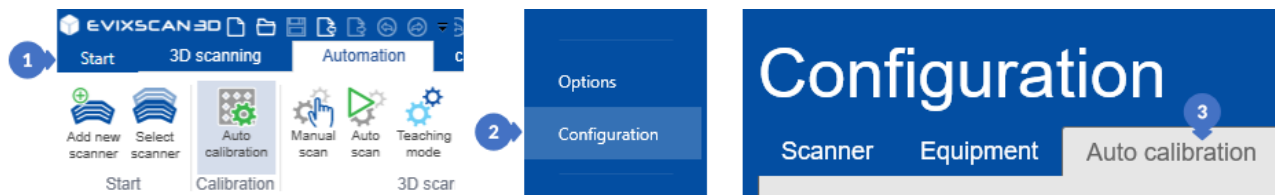


Figure 292. Selecting the calibration file

To select the calibration file, from the *Start* menu (1), go to the *Configuration* tab (2) and then *Auto calibration* (3). In the *CALIBRATION PATH* (4) group there is a list of imported calibration files with the extension .xml.

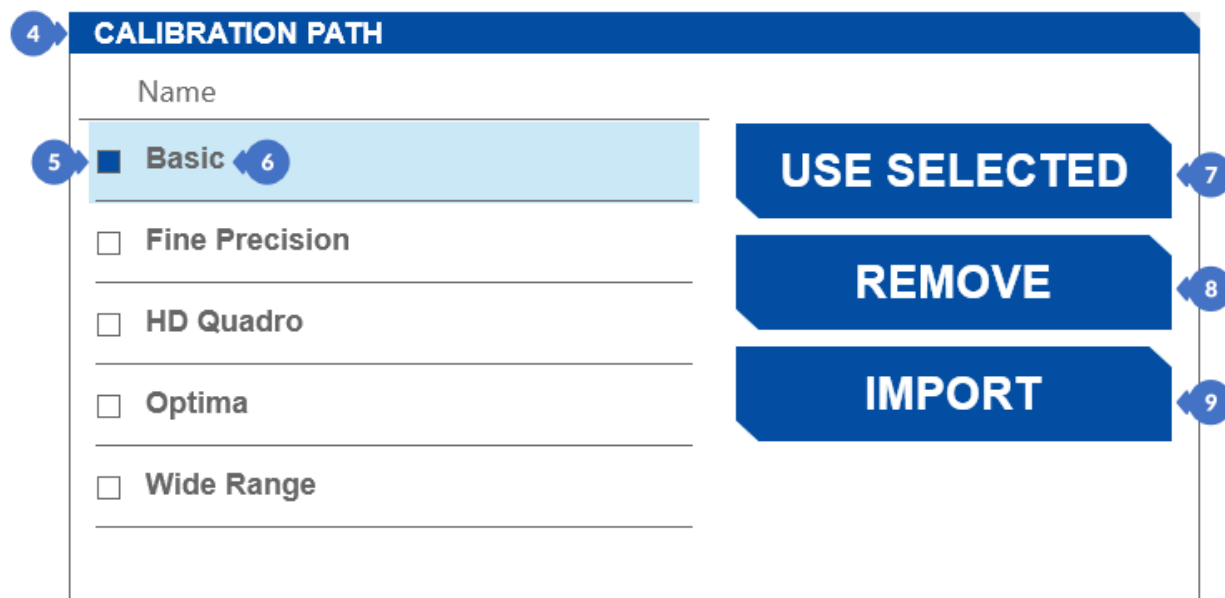


Figure 293. List of calibration files for the automatic device calibration

The items in the list have the name of the imported file (6). If the required calibration file is not available on the list, import it using the *IMPORT* button (9). Any file on the list can be removed with the *REMOVE* button (8). To activate the calibration file, select it in the list and then click the *USE SELECTED* button (7) – the active file will have a blue square marked next to its name (5).

## 16.3 Synchronization of Gantries and Management of USB Connection

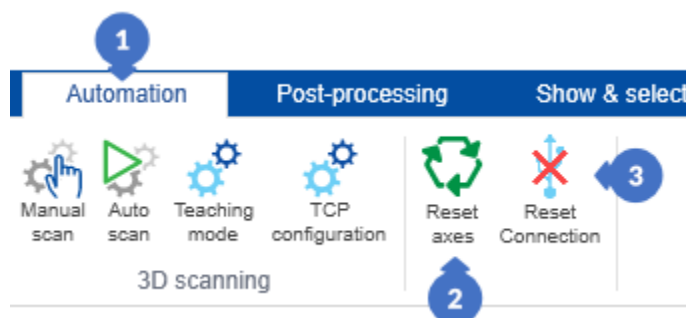


Figure 294. Buttons for resetting the eviXmatic axis position and connection with the device



## 16.3.1 Reset Axes

An important element before starting the calibration and each subsequent use of the device after restarting the *eviXscan 3D Suite* software or disconnecting the device from the computer during its operation is the process of resetting the position of the device's gantry cranes. This process allows to determine the current position of the scanner and the rotary table and to check the maximum overhang of the table's crane from the minimum position.

### **i** NOTE

*Failure to perform the process of resetting the gantry before starting work with the device may result in sudden stop of the gantry in its extreme positions. The brake mechanism is designed to prevent damage to the machine. Additionally, the range of sliders represented by the software's graphical interface may differ from the actual range of the device without a prior reset.*

*Reset axes* (2) button is in the *Automation* tab (1). After clicking it, the device will automatically start changing the position of the gantries to recognize their maximum range.

## 16.3.2 Reset Connection

If the device does not respond to the software commands, the connection between the device has probably been broken. To reconnect, just click the *Reset connection* button (3) located in the *Automation* tab (1).

## 16.4 Device Calibration



Figure 295. Preparation of the calibration chart for device calibration

The device is calibrated using the calibration panel, opened with the *Auto calibration* button.

More information about Auto calibration panel can be found in Subsection 16.2.

For the calibration to be successful, the axes of the device must be reset using the *Reset axes* button before starting it.

More information about Reset axes can be found in Subsection 16.3.1.

After completing this process, the included calibration chart should be placed on the rotary table, facing the scanner (1). If the calibration file has not been selected yet, it should be selected in the calibration panel window using the *CHANGE CHART* button.

More information about selecting calibration chart file in Subsection 16.2, point (6).

After performing all the above-mentioned steps, you can set the device to its initial position using the *SET BASE POSITION* button and then *START AUTO CALIBRATION*.

More information about setting base position and starting automatic calibration can be found in Subsection 16.2, point (7) and (8).

### NOTE

Before starting the calibration process, make sure that the plate is facing the front of the scanner.

## 16.5 Scanning Modes

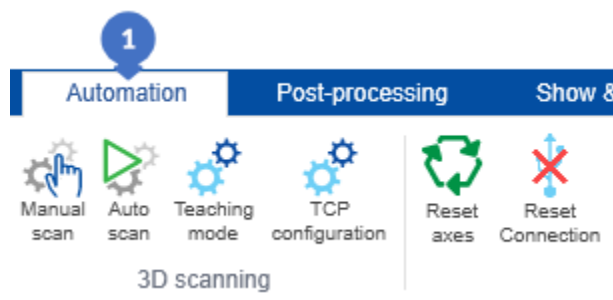


Figure 296. Automation tab – scanning modes

In the *Automation* panel (1) there are scanning modes with the use of full or partial automation. However, the preparation of appropriate templates that the software will use for its operation requires an additional preparation time. In addition to the automatic mode (3), there is also a manual mode (2).



## 16.5.1 Manual Mode

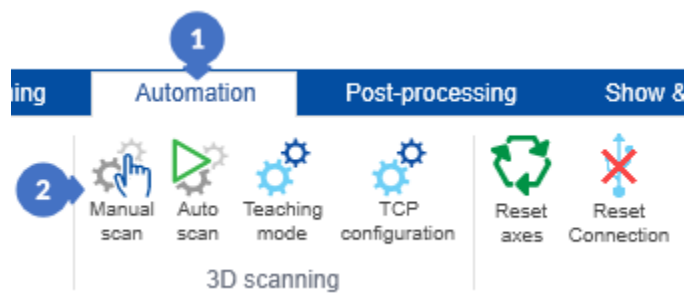


Figure 297. Opening manual mode window

To switch to the manual mode, from the *Automation* tab (1), click the *Manual scan* button (2). You will see a panel on the right with *SIMPLE* and *ADVANCED* modes.

The *SIMPLE* (A) mode has the following options:

- (3) – (*MOTION CONTROLLER*) contains options for moving the dedicated device and includes the following:
  - (C) – vertical slider – is used to move the scanner up and down,
  - (D) – horizontal slider – is used to move the table towards the scanner or in the opposite direction,
  - (E) – a slider for changing the angle of the scanner,
  - (F) – a disc used to change the angle of rotation to the sides,
  - (G) – table disk for its rotation by left-clicking on the indicated position,
  - (H) – a slider for setting the speed of the cranes – takes values from 0 to 4,
  - (I) – scanning delay slider with values from 1 to 5000ms. It is used to stabilize the position of an object placed on the table surface, which may vibrate due to the movement of the overhead crane or the table,
- (4) – (*PROJECTOR PATTERN*),
  - More information about projector patterns can be found in Subsection 10.2.
- (5) – (*CAMERAS EXPOSURE*),
  - More information about exposure can be found in Section 9.
- (6) – (*HDR mode*) – inactive in the *SIMPLE* panel due to automatic exposure,
  - More information about HDR mode in Subsection 15.1.7.
- (7) – *SCAN* button to start a single scan

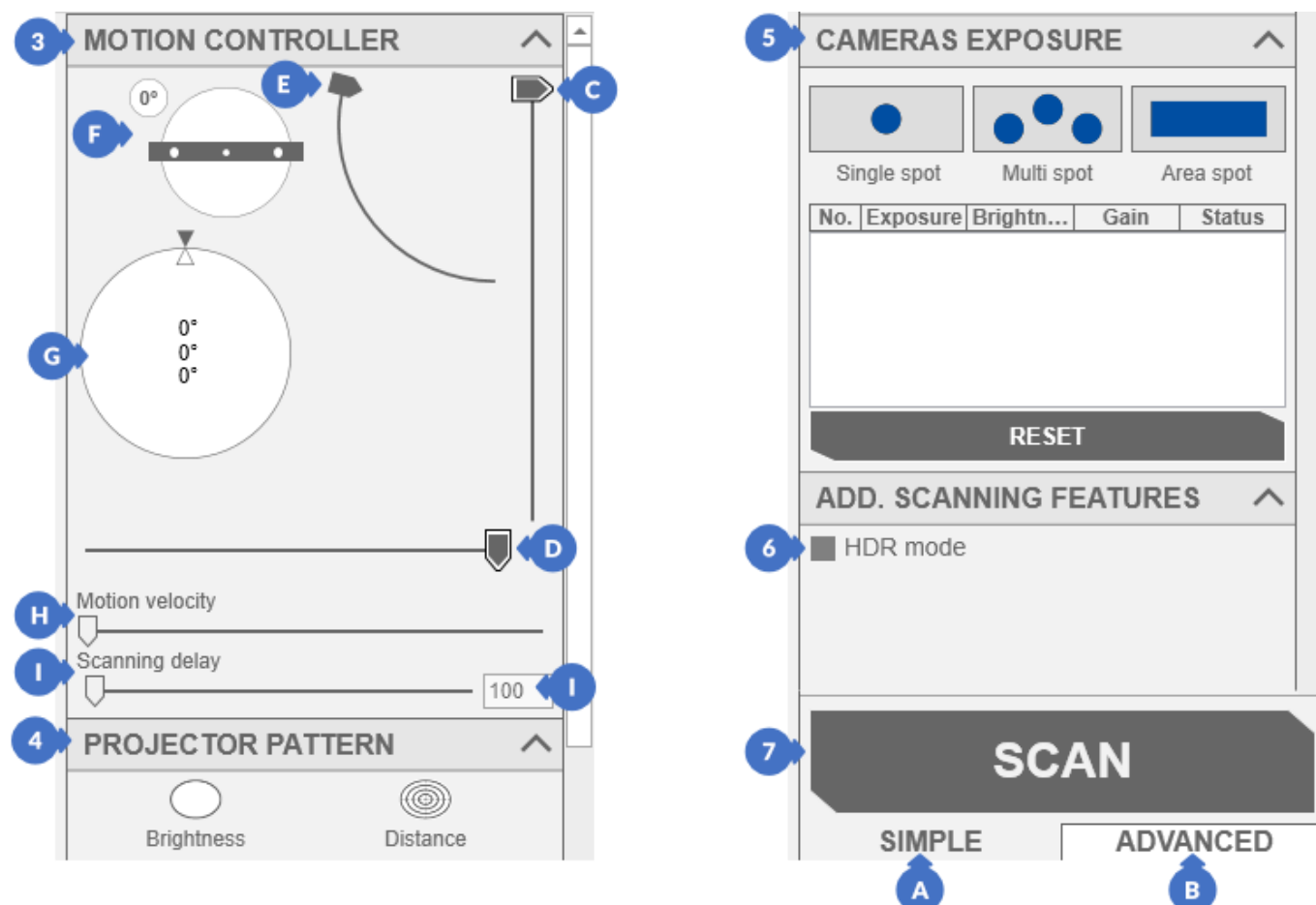


Figure 298. Scanning panel in manual mode (the SIMPLE view)

**ADVANCED** mode is extended compared to the **SIMPLE** mode with the following options:

- (8) – buttons for setting the angles of the table used for scanning,  
 More information about setting rotary table angles can be found in Subsection 14.3.1.
- (9) – extensive selection of projector patterns (**PROJECTOR**),  
 More information about projector patterns can be found in Subsection 10.2.
- (10) – selection of the exposure setting mode for cameras between the default automatic (**Auto**) and (**Manual**)  
 More information about exposition can be found in Section 9, Subsection 9.1.1.
- (11) – (**PROJECTOR BRIGHTNESS**) available only in **Manual** mode,  
 More information about projector brightness can be found in Subsection 10.1.
- (12) – enables / disables HDR mode (**HDR exposure**) –available only in the manual exposure mode for cameras,  
 More information about HDR mode can be found in Subsection 15.1.7.
- (13) – settings of the acquisition parameters (**ACQUISITION**),  
 More information about acquisition parameters can be found in Subsection 5.1.1.2.
- (14) – point cloud generator settings (**SCAN GENERATOR**),  
 More information about point cloud generator settings can be found in Subsection 5.1.1.3.

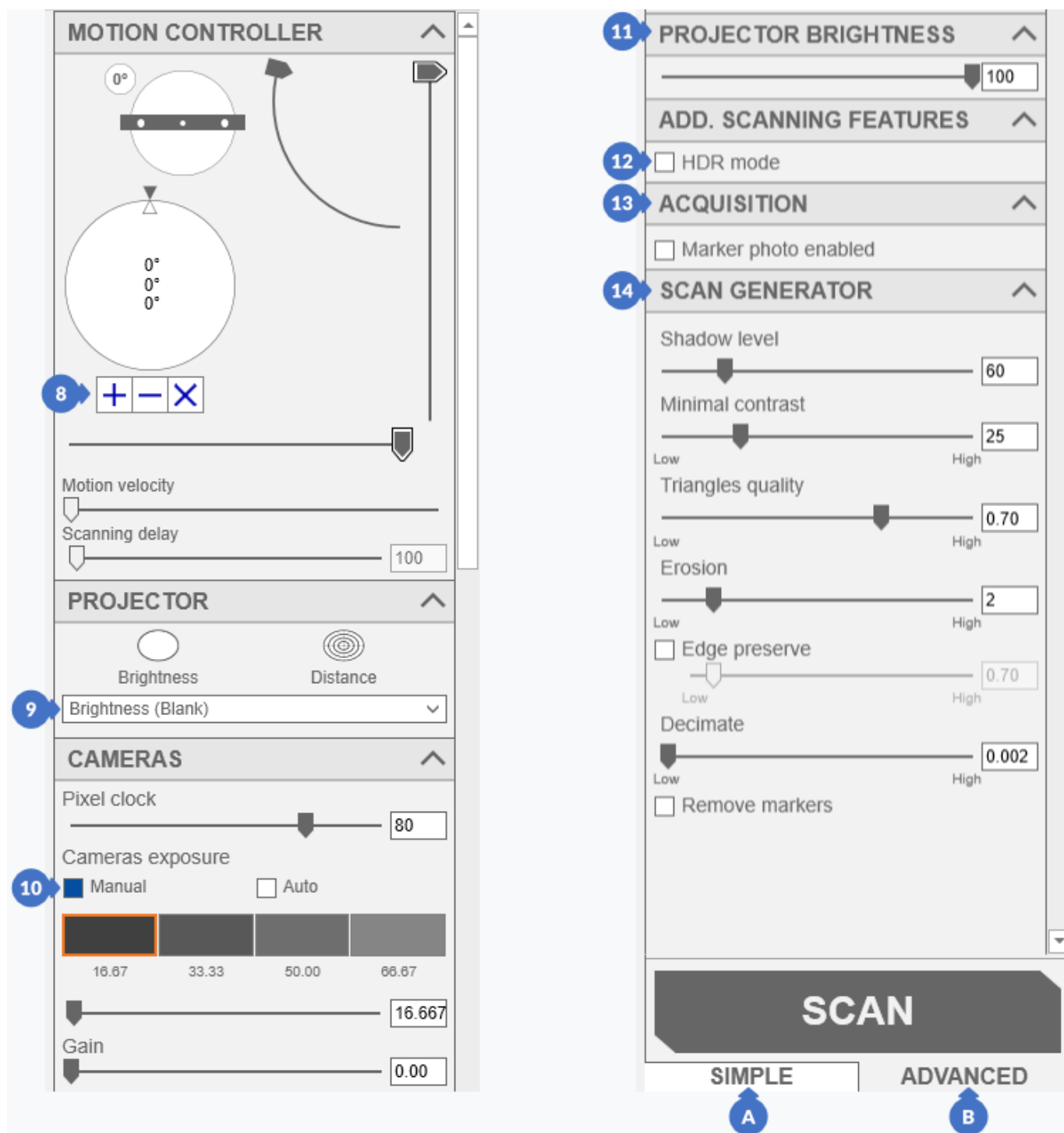


Figure 299. Scanning panel in the manual mode (the ADVANCED view)

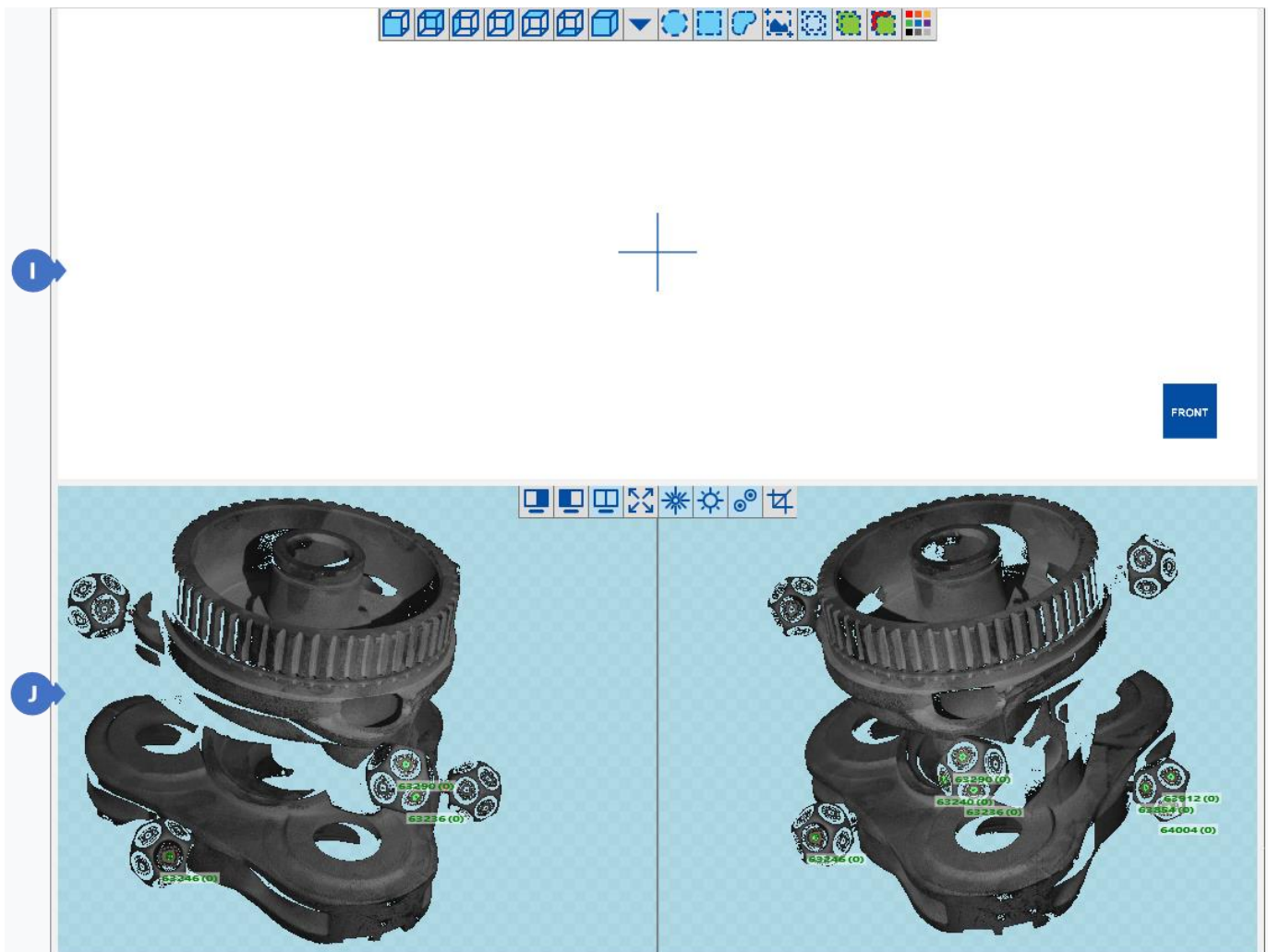


Figure 300. The layout of the middle window in manual mode

In manual mode the middle window contains the scanned model view (I) and the camera view (J).

## 16.5.2 Automatic Mode

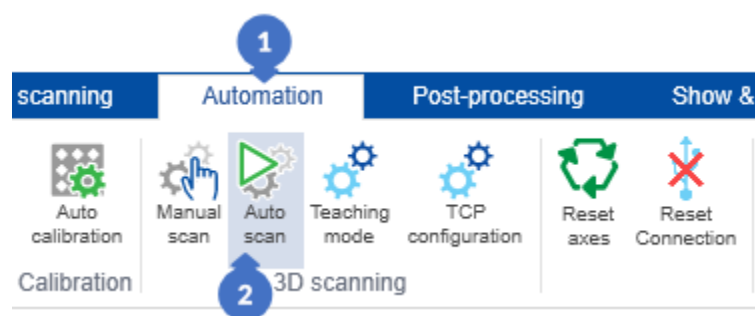


Figure 301. Opening the automatic mode window

To open the automatic mode, click the *Auto scan* button (2) from the *Automation* (1) tab.

The panel includes the following elements:



Figure 302. Automatic mode panel

(3) – (Available paths) including:

(A) – (Name),

(B) – (No. of steps),

(4) – field for searching the path(s) by name,

**NOTE**

If there are many paths in the list, you can easily find the important ones by entering a fragment of the name in the search field – then the list will only display paths for which the name contains the given phrase. Additionally, all searched elements will be arranged in alphabetical order.

(5) – **IMPORT** button that allows you to import a path from an .xml file,

(6) – **EXPORT** button that allows you to export the selected path to a file with an extension .xml,

(7) – **SELECT PATH** button opens the preview panel of the available steps with the possibility of their execution.

## 16.5.2.1 Import Path

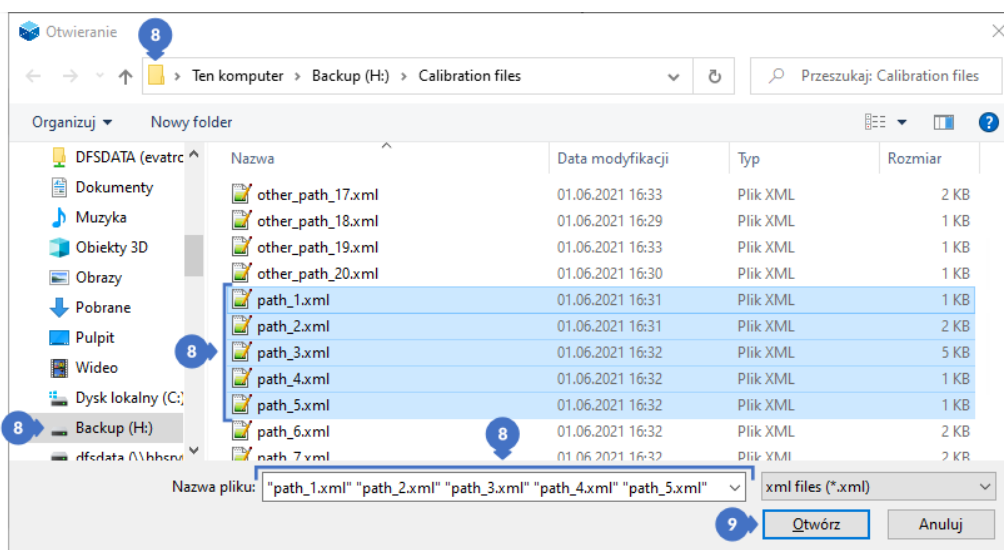


Figure 303. Importing path window

By clicking on the *IMPORT* button in the *Auto scan* panel, a window will appear in which you can select the files to be imported (8) and then click on the *Open button* (9) to import the files to the list.

**i** *NOTE*

*Each imported file is a separate step whose name in the list is the name of the imported file.*

The imported items will appear in the list:

PATH MANAGER	
Available paths	
Name	No. of steps
path_1.xml	1
path_2.xml	2
path_3.xml	13
path_4.xml	1
path_5.xml	1

Figure 304. Imported paths

## 16.5.2.2 Export Path

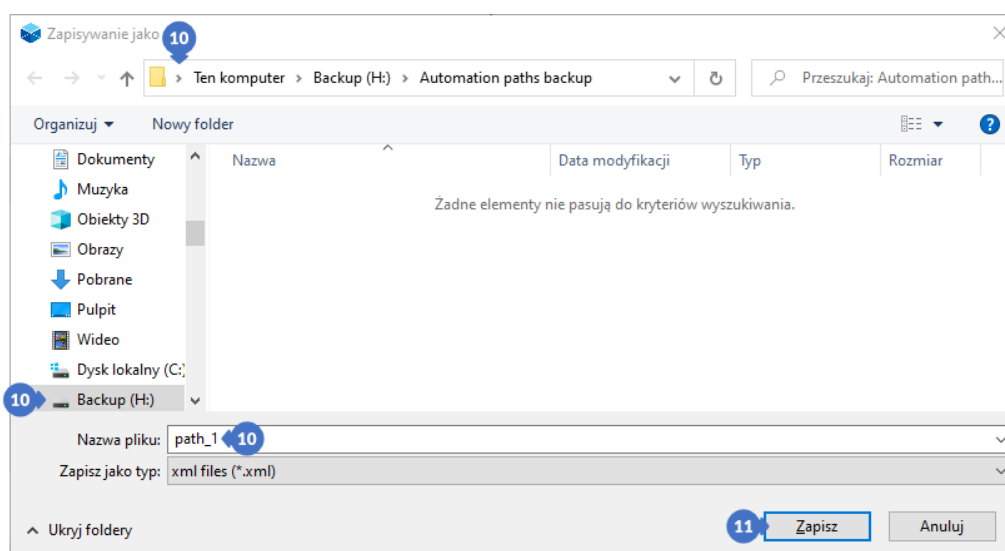


Figure 305. Export path to the file

Using the *EXPORT* button in the *Auto scan* panel, it is possible to export a step to a file with the *.xml* extension to a user-specified location and file name (10). To do this, select the path to export, click on *EXPORT* and then on *Save* (11) in the displayed window.

**i** *NOTE*

*It is only possible to export individual files.*

### 16.5.2.3 Tracklist Context Menu

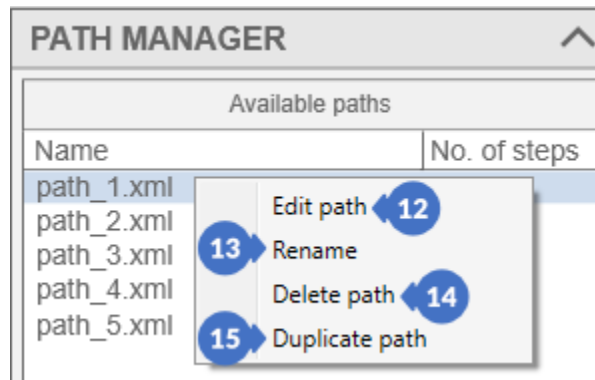


Figure 306. Context menu in auto scan paths

To open the context menu, right-click on a track in the list. The context menu allows to perform the following actions:

- (12) – *Edit path* opens the panel for editing steps in the path (*Teaching mode*),  
 ■ More information about editing steps (*teaching mode*) can be found in Subsection 16.6.
- (13) – *Rename* allows to change the name of the path,
- (14) – *Delete path* removes the path. In this case, a message will appear that requires confirmation of the action being performed,

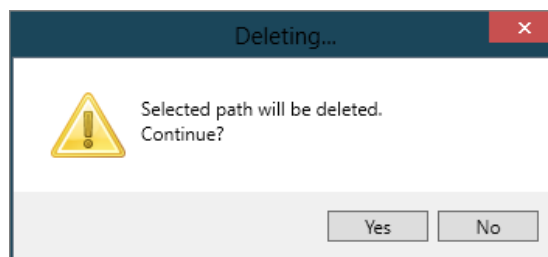


Figure 307. Message displayed when selecting Delete path from the context menu

- (15) – *Duplicate path* allows to duplicate the path on which the operation is performed

**i** **NOTE**  
 The word 'copy' is added to the name when duplicate paths are created.

### 16.5.2.4 Run the Content of a Track

To run the content of a path, select the path and click on *SELECT PATH* or by double clicking the left button on a specific path. A preview of the content of the track opens with a complete list of steps. This panel has the following elements:

- (16) – a drop-down list of all tracks, so you can easily switch between tracks
- (17) – *Back to path selection* button to the previous view of the path selection,
- (18) – a list of available steps (*Path steps*) including the sequential number of the step (*No.*), the name of the step (*Name*) and action buttons (*Action*),
- (19) – *Execute* button that starts execution of the indicated step only
- (20) – *Execute from* button that starts the sequence of steps from the indicated step to the end of the list of steps (in the example from the figure below from 2 to 13)
- (21) – *START* button that starts the full sequence contained in the path (from step number 1 to 13)



Figure 308. Run the track sequence (steps)

### 16.5.2.5 Path Execution Error

If there is an error in the path during the step execution, the whole process will be suspended, and the message (22) will appear on the notification bar to inform you about the problem. Additionally, the progress bar (23) will be "frozen" until a user action is taken.

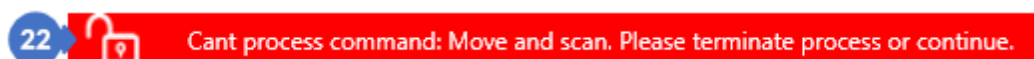


Figure 309. An example of a message after an error occurs in the step being performed



Figure 310. A bar that shows the progress of the step execution



The user has two options to choose from:

- (25) – *CANCEL* button ending the path at the step generating the error
- (26) – *continue* button which continues the path, while skipping the current step in which the error occurred

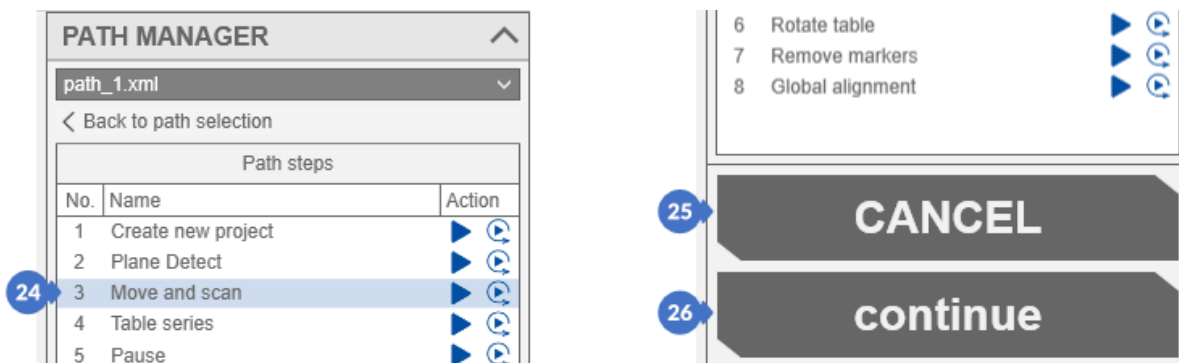


Figure 311. Stopping the path in the automatic mode

The currently performed step (24) is highlighted in bluish color in the list.

- i NOTE**  
 Clicking on the list will change the selection position but will not change the currently performed step. After completing the step and moving to the next, the item will be automatically updated.

## 16.6 Teaching Mode (Creating Path Templates)

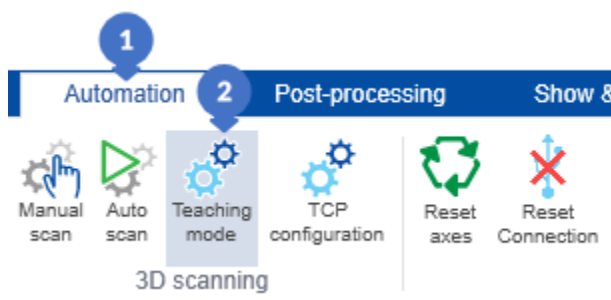


Figure 312. Opening the path creation and modification

The template creation and edition mode can be found in the *Automation* tab (1). Clicking on the *Teaching mode* button (2) opens a panel with the following options:



Figure 313. Teaching mode panel

- (3) – list of (*Available paths*) including:
  - (A) – path name (*Name*),
  - (B) – number of steps in the path (*No. of steps*),
- (4) – field for searching path(s) by name,
- (5) – *ADD NEW* button for adding a new path,
- (6) – *EDIT* button for editing or adding steps to the path,
- (7) – *DELETE* button for deleting a path selected in the list,
- (8) – *EXPORT* button for saving the path to the file.

## 16.6.1 Creating a New Path

To create a new path, use the *ADD NEW* button. Then, the path creation window will open.



Figure 314. Creating new path window

After entering the name in the field (1), the *APPLY* button (2) will become active. If the given name exists in the list, clicking the *APPLY* button will not allow you to close the window and a message informing about the existing name will appear next to the name.

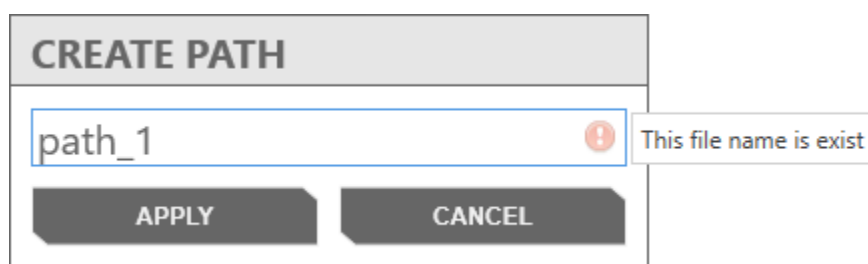


Figure 315. Message about an existing path name in the list

The *CANCEL* button (3) closes the window without creating a new path.

**i** *NOTE*

*The software, just like the Windows operating system, allows you to include spaces in the name. This enables to create paths with names such as 'path\_1' and 'path\_1 ' – the latter has space at the end of the name.*

## 16.6.2 Deleting a Path



Figure 316. Deleting a path from the list

There are two ways to delete a path. The first is to delete with the *DELETE* button (1) at the bottom of the panel. For the button to become active, select the path in the list of available paths and then press the *DELETE* button. A confirmation message is displayed. The *Yes* (2) button will delete the track, and the *No* (3) button will cancel the process.

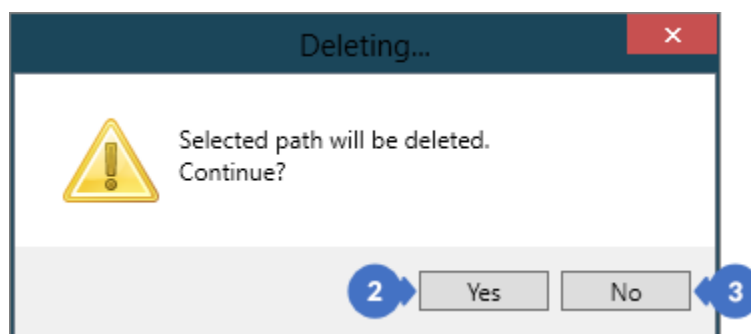


Figure 317. A message stating that the path deletion process has started

**i** *NOTE*

*Confirming that a path has been deleted is an irreversible process. A deleted path can no longer be restored.*

The second way is to open the context menu with the right mouse button and select the *Delete path* option.

🚩 More information about deleting a track using the context menu can be found in Subsection 16.5.2.3, point (14).

## 16.6.3 Path Editor (Teaching Mode)

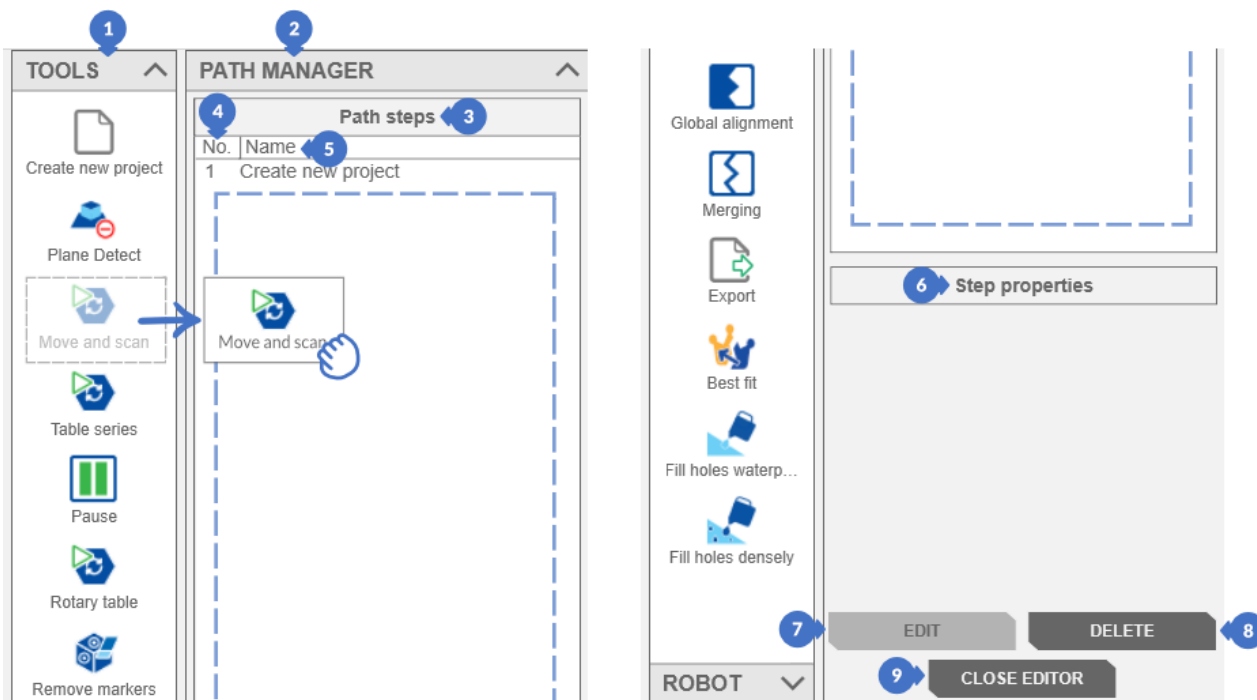


Figure 318. Path editor panel

The edit panel is used to compose the content of the path. It contains tabs, e.g., the basic *TOOLS* (1) tab, with which you can easily add successive steps of the path using the "drag and drop" method. The *Path steps* (3) is in the section called *PATH MANAGER* (2) and contains information about the step number (*No.*) (4) and its name (5). Some of the steps contain information about the step content, which is displayed in an abbreviated form in the *Step properties* (6) control. Use the *EDIT* button (7) to change the settings in a step. The *DELETE* button (8) allows you to delete a step from the list. The edit panel can be closed with the *CLOSE EDITOR* button (9).

### 16.6.3.1 Context Menu of the Track Editor

The path editor for each step includes actions hidden in the context menu under the right mouse button.

**i** **NOTE**

*If several steps are selected in the list, the action is simultaneously performed for the last selected item.*

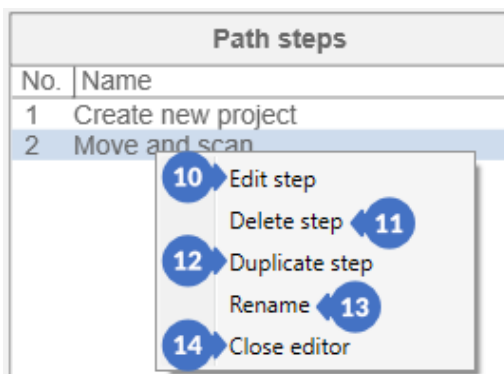


Figure 319. Path editor context menu

- (10) – *Edit step* is used to open the step editor for the selected item in the list or for the item on the secondary menu for which the opening action was performed. If you clicked on a field that is not a list item (empty list space), the editor will be opened for the selected item.

More information about steps editing can be found in Subsection 16.7.



**NOTE**

The *Edit step* option is only available for steps that allow you to edit internal parameters. This option is not available e.g., for *Create new a project step*.

Path steps	
No.	Name
1	Create new project
2	Move and scan

10 Edit step  
Delete step

Figure 320. Edit step option unavailable.

- (11) – *Delete step* deletes the selected step in the list – if you clicked with the right mouse button within the list, but not on any of its elements – or the step on which the action was performed with the right mouse button,
- (12) – *Duplicate step* creates a copy of the path (considering all changed parameters inside the path) of the selected element with the annotation ‘\_copy’,

Path steps	
No.	Name
1	Create new project
2	Move and scan

12 Edit step  
Delete step  
Duplicate step

Path steps	
No.	Name
1	Create new project
2	Move and scan
3	Move and scan_copy

Figure 321. Duplicating steps in the path

- (13) – *Rename* option is used to change the name of the step. Selecting this option changes the displayed text into a text field that can be closed with the *Enter* key – accepting the changes made, and *Escape* – cancelling all changes made to the text. Clicking on another item in the list while renaming it will have the same effect as pressing the *Enter* key,

Path steps	
No.	Name
1	Create new project
2	Move and scan

Edit step  
Delete step  
Duplicate step  
Rename

Path steps	
No.	Name
1	Create new project
2	Move and scan

Figure 322. Changing the name of step

- (14) – *Close editor* closes the step editor view and returns to the panel listing all paths.

### 16.6.3.2 Changing the Sequence of Steps

Path steps		Path steps	
No.	Name	No.	Name
1	Create new project	1	Create new project
2	Move and scan	2	Plane Detect
3	Plane Detect	3	Move and scan

Figure 323. Changing the sequence of steps in the list

The position of each step in the list can be changed by grabbing the item with the left mouse button and then moving the mouse cursor up or down the list. Each position where a step can be inserted will be indicated by a red line.

### 16.6.4 Pathlist Context Menu

Under the right mouse button there is the same context menu as described in the previous section of the *Automatic* mode.

More information about deleting a path using the context menu can be found in Subsection 16.5.2.3.

## 16.7 Track Editor – Available Step Templates

Predefined step templates can be used in the process of creating paths. Most of the steps can change the values of the parameters required to perform the activity for which the given step is defined.

### 16.7.1 Basic Templates (TOOLS)

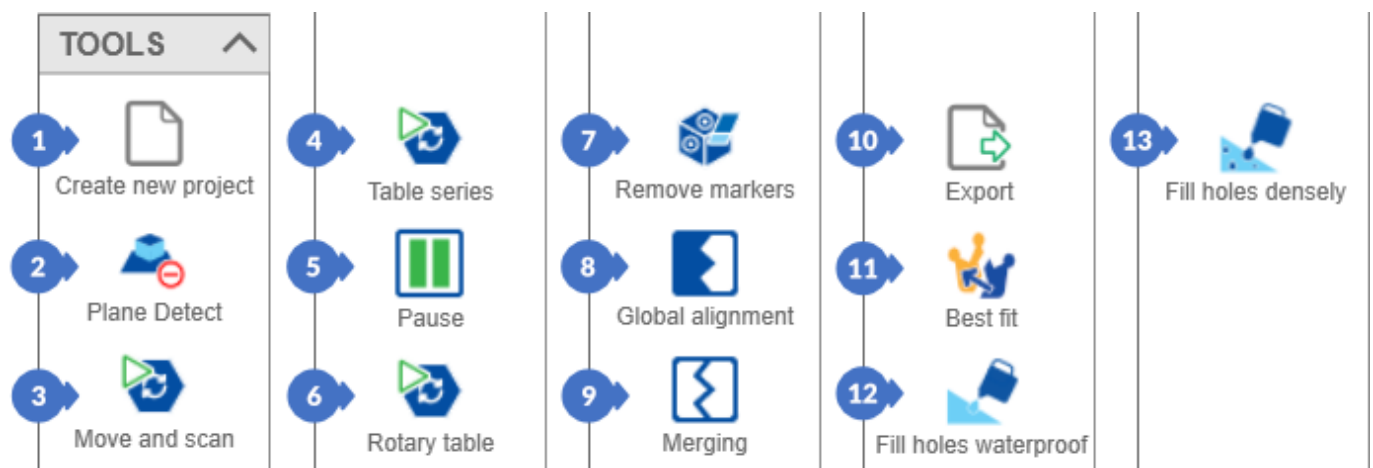


Figure 324. Basic templates from TOOLS tab

### 16.7.1.1 Creating New Project

Create new project (1) is the template of a step responsible creating a new project. This is a semi-automatic step as it requires user intervention. Calling up this step displays a window which suspends the automation process until its completion,

More information about the window for creating a new project can be found in Subsection 12.1.1.

### 16.7.1.2 Plane Detect

Plane detect (2) is a template for detecting a plane (e.g. of a rotary table) that will be omitted when generating scans. The step parameters editor contains the following items:

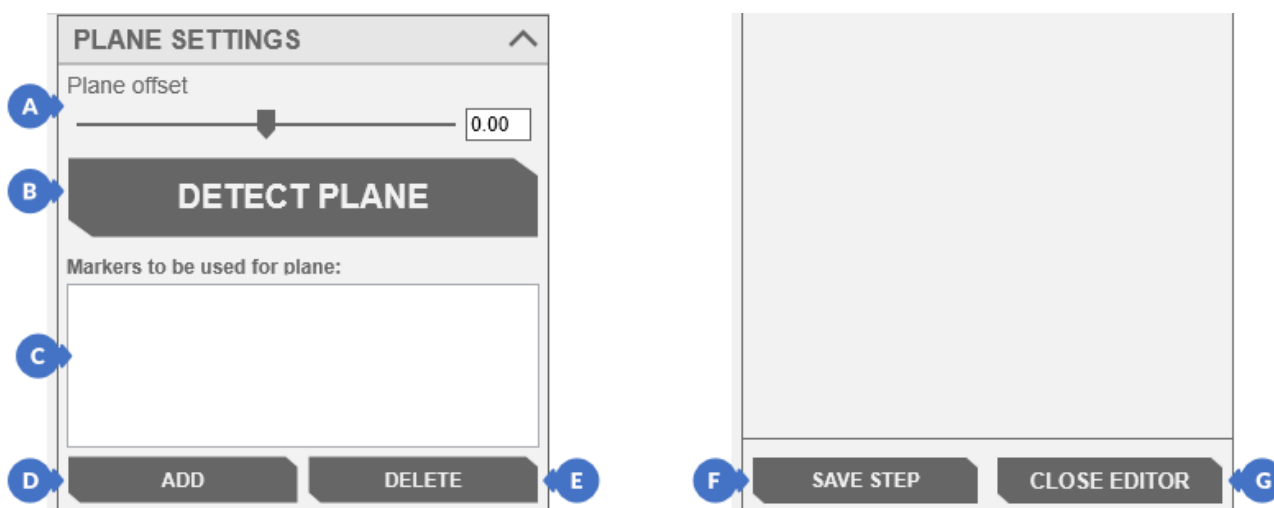


Figure 325. Plane detect panel

(A) – Plane offset parameter defining the shift of the plane position up or down,

More information about Plane offset option can be found in Subsection 5.1.1.1, point (7).

(B) – DETECT PLANE button is used to detect markers on the plane. Detected markers will appear in the list containing markers defined as a plane (C),

(C) – list of markers detected as a plane,

(D) – ADD button is used to manually enter the ID numbers of the markers. The window contains:

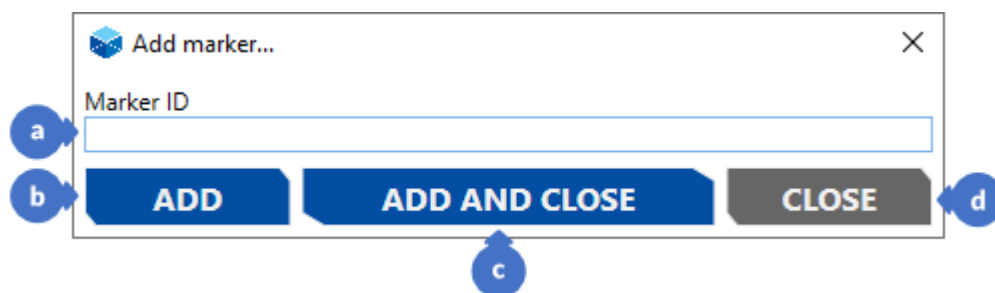


Figure 326. Manual addition of marker ID number

(a) – textbox,

(b) – ADD button adds a marker ID to the list,

**i** NOTE

Clicking on the button does not close the window but clears the textbox (a).

(c) – ADD AND CLOSE button adds a marker ID to the list and closes the window,

(d) – CLOSE button closes the window without making any changes,

- (E) – **DELETE** button deletes all selected ID numbers of markers in the list,
- (F) – **SAVE STEP** button saves the changes made to the step parameters,
- (G) – **CLOSE EDITOR** button closes the step edition.

**i NOTE**

Clicking on the **CLOSE EDITOR** button without saving the changes made with the **SAVE STEP** button will reject all modifications introduced to parameter settings.

### 16.7.1.3 Move and Scan

*Move and scan (3)* is a step that sets the *eviXmatic* device in a position defined by the setting parameters and performs a single scan in that position. The following parameters can be set in this template:

The screenshot displays the 'Move and Scan' step parameters editing panel. It is organized into several sections, each with a set of controls:

- SYSTEM STEERING (A):** Includes a diagram of a camera's field of view with a 0° angle indicator. Below the diagram are sliders for 'Motion velocity' and 'Scanning delay' (set to 100).
- PROJECTOR (B):** Features two icons: 'Brightness' and 'Distance'. A dropdown menu is set to 'Brightness (Blank)'.
- CAMERAS (C):** Contains a 'Pixel clock' slider (set to 80), a 'Cameras exposure' section with 'Manual' and 'Auto' options, a row of four exposure time buttons (16.67, 33.33, 50.00, 66.67), a 'Gain' slider (set to 16.667), and a 'Gain' input field (set to 0.00).
- PROJECTOR BRIGHTNESS (D):** A slider set to 100.
- ADD. SCANNING FEATURES (E):** Includes a checkbox for 'HDR mode'.
- ACQUISITION (F):** Includes a checkbox for 'Marker photo enabled'.
- SCAN GENERATOR (G):** Contains several sliders: 'Shadow level' (set to 60), 'Minimal contrast' (set to 25), 'Triangles quality' (set to 0.70), 'Erosion' (set to 2), 'Edge preserve' (set to 0.70), and 'Decimate' (set to 0.002). There is also a checkbox for 'Remove markers'.
- SCAN (H):** A large button to initiate the scan.
- SAVE STEP (I) and CLOSE EDITOR (J):** Buttons at the bottom to save changes or exit the editor.

Figure 327. Move and scan step parameters editing panel



(A) – the **SYSTEM STEERING** tab contains a panel for controlling overhead cranes, the angle of rotation of the scanner (front, back, right, left) and the table of the eviXmatic device,

More information about **SYSTEM STEERING** tab can be found in Subsection 16.5.1 point (3) called **MOTION CONTROLLER**.

(B) – **PROJECTOR** tab contains patterns displayed by the projector,

More information about projector patterns can be found in Subsection 10.2.



**NOTE**

The settings of this tab are not saved in the step settings.

(C) – **CAMERAS** tab with settings for the Pixel clock parameter, camera exposure and the HDR mode,

More information about Pixel clock can be found in Subsection 5.1.1.1 point (3).

More information about exposure can be found in Section 9.

More information about HDR mode can be found in Subsection 15.1.7.



**NOTE**

Pixel clock parameter settings or the method of exposure selection are not saved. Only information about the set exposures and HDR mode is recorded.

(D) – **PROJECTOR BRIGHTNESS** tab contains the brightness settings of the projector,

More information about projector brightness can be found in Subsection 10.1.

(E) – **ADDITIONAL SCANNING FEATURES** tab includes an option to enable / disable **HDR mode** – this option is available only in the manual exposure mode of cameras,

More information about HDR mode can be found in Subsection 15.1.7.

(F) – **ACQUISITION** tab contains settings for the parameter responsible for taking a photo of markers with a specific exposure (if the option is selected)

More information about acquisition parameters can be found in Subsection 5.1.1.2, point (16).



**NOTE**

If the marker auto exposure option is selected in the Start menu, Options, General Options tab, in the **ACQUISITION** tab, the button that triggers the automatic search for exposure of markers appears:

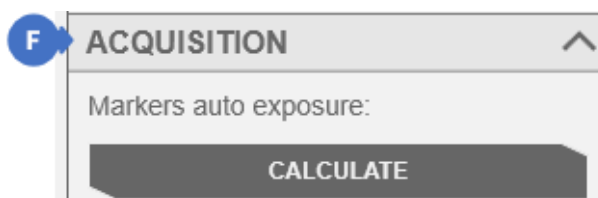


Figure 328. Button activating automatic marker search

More information about Marker auto exposure can be found in Subsection 5.1.1.1, point (11).

(G) – **SCAN GENERATOR** tab contains point cloud generator settings – parameter values are taken at the time of generating scans,

More information about the parameters of the point cloud generator can be found in Subsection 5.1.1.3.

(H) – **SCAN** button allows to test the entered settings during the scan – performs an ordinary scan, on which you can check whether the algorithm values generate the correct model,

(I) – **SAVE STEP** button saves the parameter values,

(J) – **CLOSE EDITOR** button closes the editing panel.



**NOTE**

Clicking on the **CLOSE EDITOR** button without saving the changes made with the **SAVE STEP** button will reject all modifications introduced to parameter settings.

### 16.7.1.4 Table Series

The *Table series* (4) step is almost identical in structure to the *Move and scan* (5) step. It is used to perform a series of scans on the table using the *eviXmatic* device.

More information about *Move and scan* step can be found in Subsection 16.7.1.3.

This step differs from the *Move and scan* (5) step only in two details in the *SYSTEM STEERING* (A) tab:

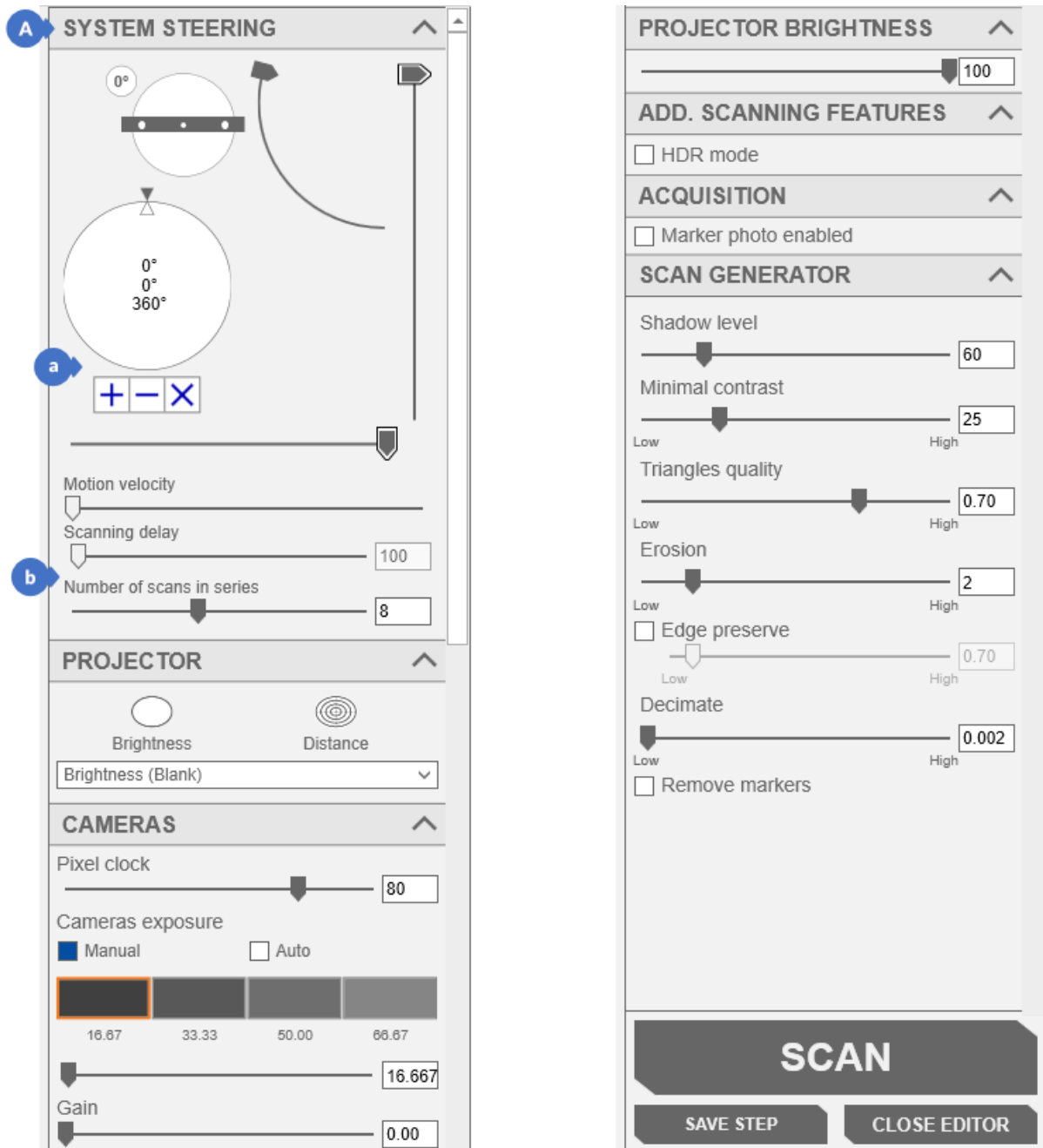


Figure 329. Table series step parameters editing panel

- (a) – buttons for setting the position of the table in which the scans are to be made,  
More information about setting the table angles can be found in Subsection 14.3.1, points (3), (5) and (6).
- (b) – slider responsible for the number of scans on the rotary table.  
More information about setting the table can be found in Subsection 14.3.1, point (1).

### 16.7.1.5 Pause

The *Pause* step (5) does not have an edit panel. It is used to suspend the execution of the entire automation process until the user closes the window named *PAUSE* by pressing the *CONTINUE* button.

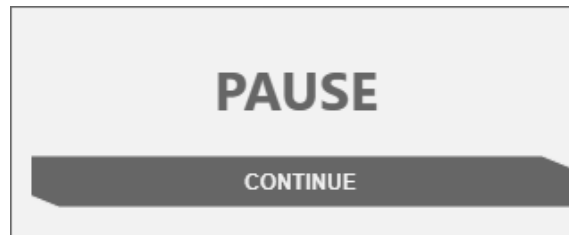


Figure 330. The window suspending the automation process

### 16.7.1.6 Rotary Table

*Rotary table* (6) is a step for setting the table in a specific position indicated with the slider. The step editing panel has the following parameters:

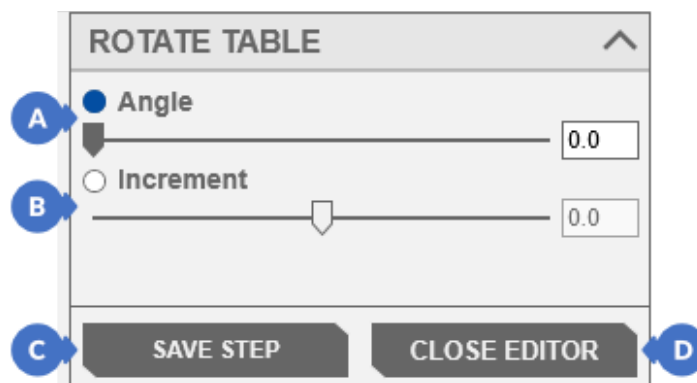


Figure 331. Rotary table step parameters editing panel

- (A) – if the *Angle* option is selected, the slider allows you to set the table angle in a position from 0° to 360°. This is the angle the table will turn to.
- (B) – if the *Increment* option is active, the slider allows you to set the angle from -180° to 180°. It is the value by which the table will rotate from the current angle to the right or left, depending on the value entered,
- (C) – *SAVE STEP* button saves the settings,
- (D) – *CLOSE EDITOR* button closes the step editing panel.

**i NOTE**

Clicking on the *CLOSE EDITOR* button without saving the changes made with the *SAVE STEP* button will reject all modifications introduced to parameter settings.

### 16.7.1.7 Remove Markers

The *Remove markers* step (7) is used to remove markers from scans. This panel has the following options:



Figure 332. Panel for editing parameters of the *Remove markers* step

(A) – *Margin size* slider defines the margin by which the opening will be additionally enlarged to remove distortions at the edges,

More information about deleting markers can be found in Subsection 17.2.

(B) – *SAVE STEP* button saves the settings made in the panel,

(C) – *CLOSE EDITOR* button closes the step editing panel.

**NOTE**

Clicking on the *CLOSE EDITOR* button without saving the changes made with the *SAVE STEP* button will reject all modifications introduced to parameter settings.

### 16.7.1.8 Global Alignment

*Global Alignment* (8) is the step for invoking the global alignment algorithm (ICP). It has the following options:



Figure 333. Global alignment parameters edit panel

(A) – *METHOD* tab is used to select the global match algorithm mode. In the *Simple* mode all settings are selected by the algorithm and tabs (B), (C) and (D) become invisible. This is the user mode best suited for novice users. The *Advanced* mode offers more possibilities in setting the parameters of the algorithm, but is intended for more experienced users,

More information about adjusting the table angles can be found in Subsection 17.3.3.1.

- (B) – *MESH SELECTION METHODS* tab contains methods used in the selection of meshes by the algorithm,  
 More information about adjusting the table angles can be found in Subsection 17.3.3.1, point (8).
- (C) – *FITTERS* tab contains sliders allowing to set the searching method for points and to set the level of meshes permeability,  
 More information about adjusting the table angles can be found in Subsection 17.3.3.1, point (9).
- (D) – *SAVE STEP* button saves the settings made in the panel,
- (E) – *CLOSE EDITOR* button closes the step editing panel.



**NOTE**

Clicking on the *CLOSE EDITOR* button without saving the changes made with the *SAVE STEP* button will reject all modifications introduced to parameter settings.

### 16.7.1.9 Merging

The *Merging* step (9) is used to combine the scans into one grid. It has the following options:



Figure 334. Merging parameters edit panel

- (A) – the *MERGING PARAMETERS* tab contains the settings of the scans merging parameters used to determine the precision with which the alignment algorithm will perform the scan adjustment – the *Precision level* slider, the smoothing settings - *Smoothing iterations* slider and a button resetting the slider settings to default values - *Set default values*, the settings of the filling algorithm - *Max size of holes* to fill and reducing the number of points and triangles - *Simple decimation* option,  
 More information about setting scan merge parameters can be found in Subsection 17.4, points (4), (5), (6), (7) and (8).
- (F) – *SAVE STEP* button saves the settings made for the algorithm combining the scans,
- (B) – *CLOSE EDITOR* button closes the editor.

### 16.7.1.10 Export

The *Export* step (10) serves - as the name suggests - to export scans. This step includes:

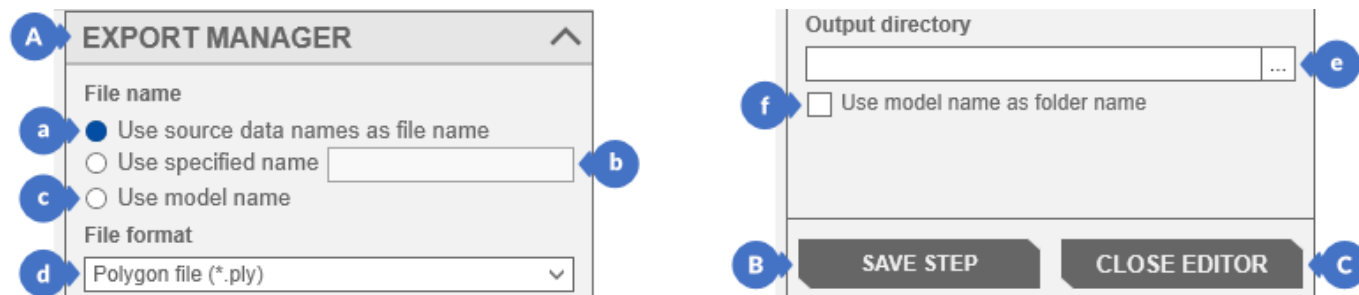


Figure 335. Export parameters editing panel

(A) – *EXPORT MANAGER* tab for entering the file export settings, the file format and the output location:

(a) – *Use source data names as file name* option saves files with names appearing in the scan tree,

(b) – *Use specified name* option saves files with the name defined in the neighboring text box,

**i NOTE**

*After the name is entered in the text field, the file number is automatically added to it, so that the files do not overwrite any other files with the same name in the indicated location.*

(c) – *Use model name* option allows to save the files with the name of the project,

**i NOTE**

*If there are more files to save or files with a given name already exist, the numbering is added after the project name, so that none of the previous files is overwritten.*

(d) – list of available formats in which the files will be exported. The user can choose from extensions: *.ply, .stl, .asc, .bin, .obj, .glb, .evx i .wrl*,

(e) – field with the path to the location where the output files are to be saved. You can select a folder with three dots,

(f) – when the *Use model name as folder name* option is selected, it creates a folder in the indicated location with the name of the project where the files will be saved,

(B) – *SAVE STEP* button saves the file export settings,

(C) – *CLOSE EDITOR* button closes the editor.

### 16.7.1.11 Best Fit

The *Best fit* (11) step is for matching scans. This step includes:



Figure 336. Best fit parameters editing panel

(A) - **BEST FIT PARAMETERS** tab contains the option to set the degree to which individual scans may have a common part – *Target mesh cover* slider,

More information about setting scan matching parameters with best fit can be found in Subsection 17.3.4.

(B) - **SAVE STEP** button for saving the settings made for the algorithm combining scans,

(C) - **CLOSE EDITOR** button closes the editor

### 16.7.1.12 Fill Holes Waterproof

The *Fill holes waterproof* (12) step is used to fill the holes in the scans on the mesh base simultaneously. This step includes:



Figure 337. Fill holes waterproof parameters editing panel

(A) - **FILL HOLES PARAMETERS** tab enables to set the depth of the analysis, and thus the speed of the *Fill holes* algorithm, which is used, among others, to create filled model to prepare STL for the 3D printing

More information about setting *Fill holes waterproof* parameters can be found in Subsection 17.9.

(B) - **SAVE STEP** button for saving the settings made for the algorithm,

(C) - **CLOSE EDITOR** button closes the editor.

### 16.7.1.13 Fill Holes Densely

The *Fill holes densely* step (13) is used to fill the hole-by-hole in the scans at the base of the edge around the hole. This step includes:

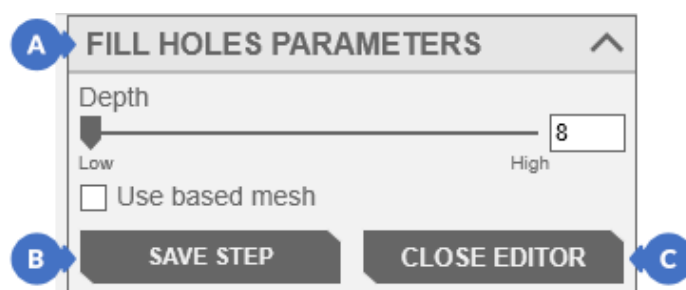


Figure 338. Fill holes densely parameters editing panel

(A) - **FILL HOLES PARAMETERS** tab enables to set the minimum size of the opening to be filled,

More information about setting parameters for filling holes with the method *Fill holes densely* can be found in Subsection 17.10.

(B) - **SAVE STEP** button for saving the settings made for the algorithm,

(C) - **CLOSE EDITOR** button closes the editor.

## 16.7.2 ROBOT Step Templates

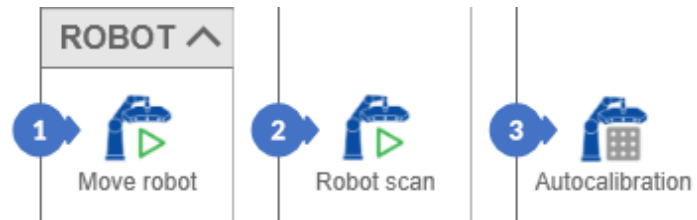


Figure 339. Step templates in the ROBOT tab

### 16.7.2.1 Move Robot

The *Move robot* step (1) includes full automation of the scanning process. The edit panel for this step has the following options:

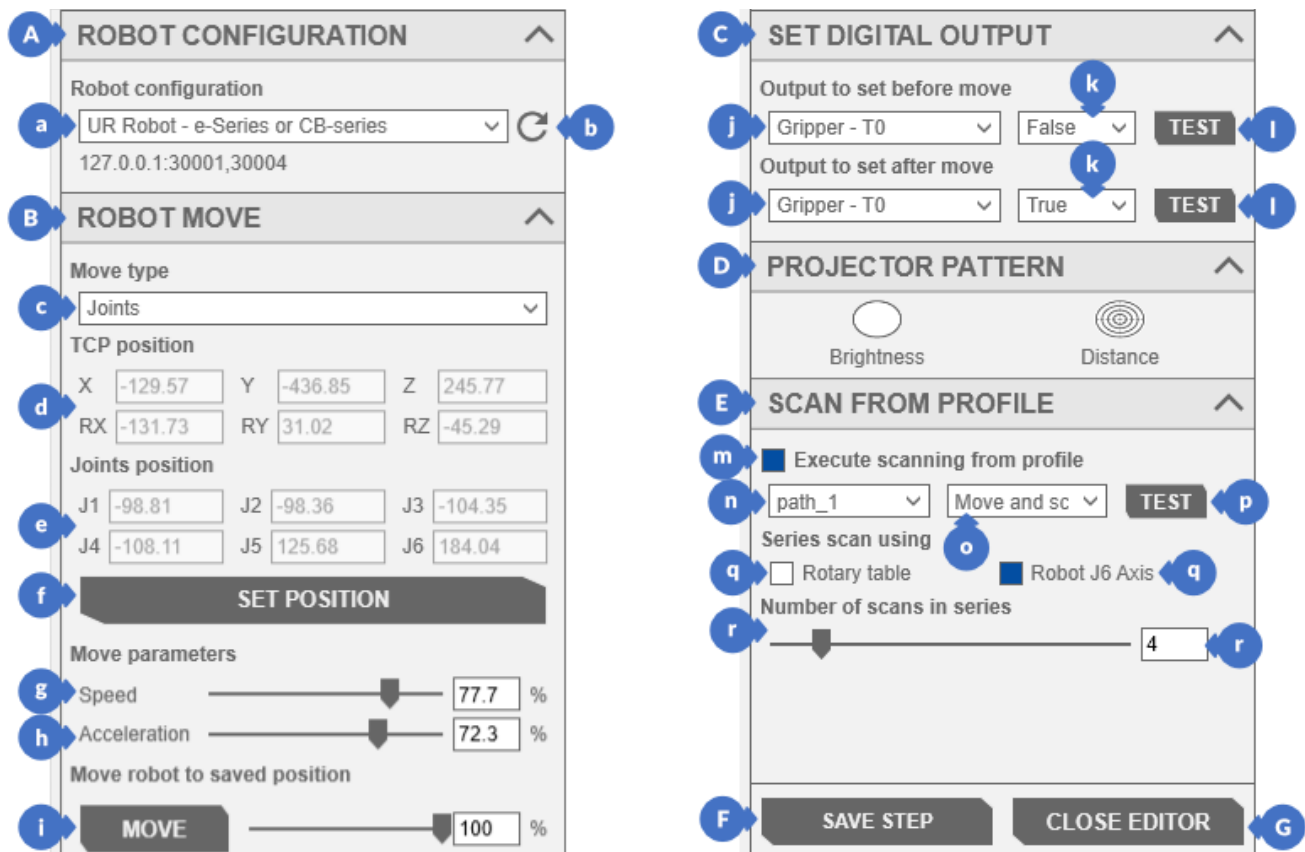


Figure 340. Move robot parameters editing panel

(A) – *ROBOT CONFIGURATION* tab consists of:

(a) – list of available robot configurations,

More information about creating configuration can be found in Subsection 16.9.

**i** NOTE

Below the list there is an information about the connection settings of the selected configurations, i.e., the IP address and the set ports.

(b) – button that allows you to reload the configuration file (refreshing the list of robots),



(B) – **ROBOT MOVE** tab with the settings related to the robot's movement. This tab contains the following items:

(c) – a list with a choice of two types of robot movement: *Joints* and *Line*. *Joints* – these are so-called joint movements. It is the safest way to move the robot arm (all moving parts move simultaneously) – with this method the path of the robot is always the same (it is fully repeatable). *Line* – it is the movement along the line. In this movement, the robot arm must preserve the movement along a straight line all the time, so that not all of its moving parts move at the same moment. Additionally, the *Line* movement repeated will not always be the same, as it is in the case of the *Joints* type. This way of moving is also prone to collisions. If the line is e.g., drawn through the center of the robot, it will lead to a collision

(d) – preview of the saved position of the tool center point – TCP position (tool center point) – represents three linear axes X, Y, Z indicating the positions and three rotation axes RX, RY, RZ indicating the rotation,

(e) – *Joints position* indicates the saved position of individual robot "joints". This position is equivalent to the TCP position,

(f) – the **SET POSITION** button is used to open the panel for setting the robot's position. Before opening the panel, the connection with the robot is checked, and if for some reason there is an error establishing the connection, the panel will not open,

■ More information about the item setting panel can be found in Subsection 16.7.2.1.1.

(g) – *Speed* slider is used to change the movement speed of the robot. The value of the parameter ranges from 0.1% to 100% and allows its value to be changed by 0.1%,

(h) – *Acceleration* slider is used to change the acceleration of the robot. The value of the parameter is the same as in the case of the *Speed* parameter, ranging from 0.1% to 100% and allows you to change its value by 0.1%,

(i) – **MOVE** button allows you to test the movement to the target position. The robot moves at the test speed defined next to the slider. This slider takes values from 1 to 100% and its value can be changed by 1%. The robot's movement continues until the button is pressed or the target position is reached. Releasing the button will cause the robot to stop immediately,

(C) – **SET DIGITAL OUTPUT** tab allows you to test the operation of mapped outputs before the movement (*Output to set before move*) or after the movement (*Output to set after move*) by the robot. The tab allows you to choose:

(j) – outputs from the list of available outputs,

(k) – the status value sent to the output,

**i NOTE**

*An example may be a gripper, which will receive the gripper opening command (false) before the movement, and the closing / grabbing button (true) after the movement.*

(l) – a button testing a given output,

(D) – the tab for managing projector patterns (**PROJECTOR PATTERN**). It allows to set the appropriate distance of the robot from the scanned object,

■ More information about projector patterns can be found in Subsection 10.2.

(E) – **SCAN FROM PROFILE** tab allows you to scan using a specified step in the path. The tab contains:

(m) – *Execute scanning from profile* option - selecting this option allows you to activate scanning from a profile. When the option is unchecked, scanning with the use of a profile is not active,

(n) – the drop-down list allows you to select the path from the path list (*Teaching mode*, *Auto scan*),

■ More information about list of paths can be found in Subsection 16.6, point (3) or Subsection 16.5.2, point (3).

(o) – the drop-down list allows you to select the step responsible for the scan from the selected path (n),

(p) – **TEST** button allows to test a selected profile,

(q) – allows to select a device for rotation (*Rotary table*) or a robot axis (*Robot J6 Axis*),

(r) – the slider *Number of scans in series* allows to set the number of scans in a series on the table / axis of the robot,

- (F) – *SAVE STEP* button used to save the step responsible for moving the robot,  
 (G) – *CLOSE EDITOR* button used to close the editor panel.

### 16.7.2.1.1 SET POSITION Panel

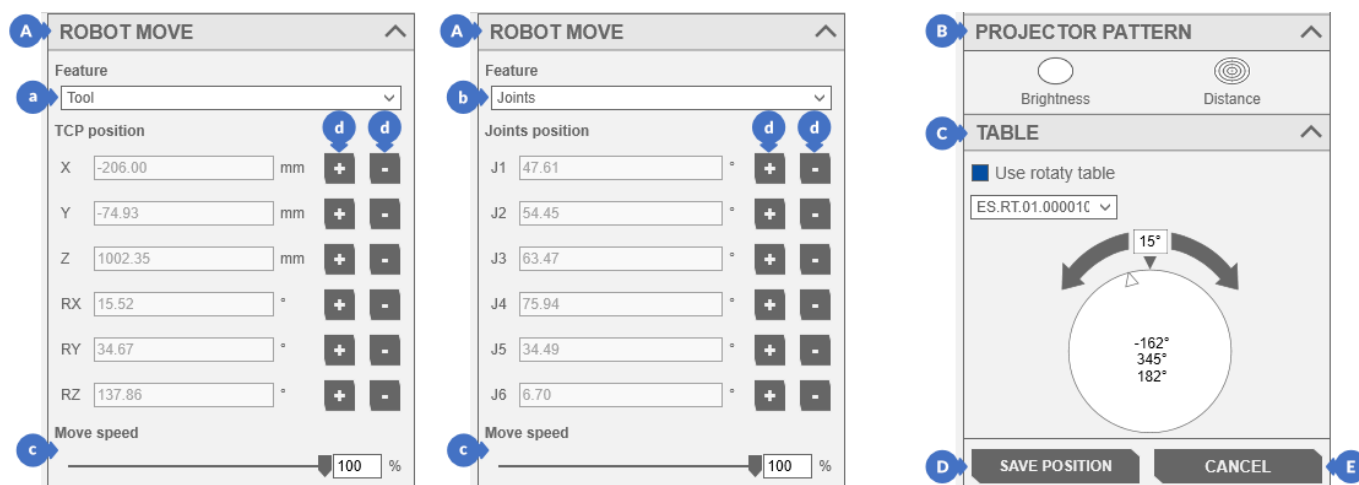


Figure 341. Robot position change panel

The panel for setting the robot's position is intended, for example, to preserve the correct distance between the scanner and the scanned object. This panel has the following options:

- (A) – *ROBOT MOVE* tab is used for setting the robot's position:
- (a) – *Tool* feature is used to set the position of the tool center point – *TCP position*,  
 ■ More information about tool center point position settings can be found in Subsection 16.7.2.1, point (d).
  - (b) – *Joints* is used to set the position of individual „joints” of the robot,  
 ■ More information about robot connector position settings can be found in Subsection 16.7.2.1, point (e).
  - (c) – *Move speed* slider is used to change the speed of the robot's movement. The value of the parameter ranges from 0.1% to 100% and allows its value to be change by 0.1%,
  - (d) – buttons for increasing (+)/decreasing (-) the value of a particular axis,  
 ⓘ **NOTE**  
*The control is stepwise - pressing the key once causes the robot to move a step - depending on the speed scale - and to stop the robot movement. The higher the speed, the faster the robot moves and the bigger step. Holding the button repeats the step sequence.*
- (B) – the tab for managing projector patterns (*PROJECTOR PATTERN*). It allows to set the appropriate distance of the robot from the scanned object,  
 ■ More information about projector patterns can be found in Subsection 10.2.
- (C) – *TABLE* tab is used to set the position of the rotary table in case the *Use rotary table* option is active,
- (D) – *SAVE POSITION* button saves the set position,
- (E) – *CANCEL* button closes the panel.

## 16.7.2.2 Robot Scan

The *Robot scan* step (2) fully automates the scanning process with settings entered by the user. The edit panel for this step has the following options:

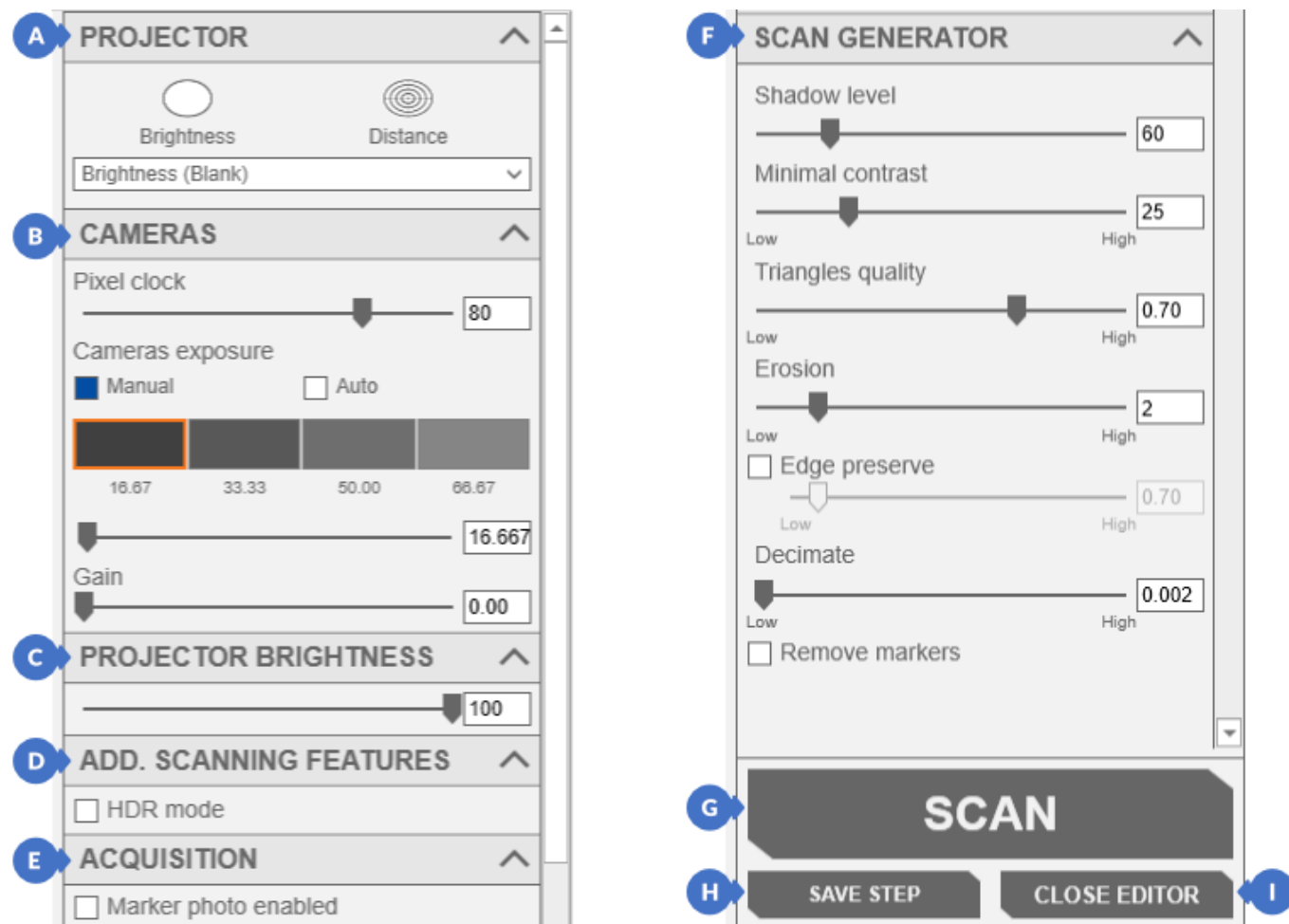


Figure 342. Robot position change panel

(A) – **PROJECTOR** tab consists of patterns that can be displayed by the projector,

More information about projector patterns can be found in Subsection 10.2.



**NOTE**

The settings of this tab are not saved in the step settings.

(B) – **CAMERAS** tab contains the *Pixel clock* parameter settings, the camera exposure and the *Gain* slider used to „artificially” increase the brightness of photos,

More information about *Pixel clock* can be found in Subsection 5.1.1.1, point (3).

More information about exposition can be found in Section 9.

More information about *Gain* parameter can be found in Section 11.



**NOTE**

The *Pixel clock* settings or exposure mode are not saved. Only the information about the set exposures is preserved in the settings.

(C) – **PROJECTOR BRIGHTNESS** tab contains the projector brightness settings – the tab is available only and exclusively in the *Manual* mode of exposure,

More information about projector brightness can be found in Subsection 10.1.

(D) – *ADDITIONAL SCANNING FEATURES* tab contains the *HDR mode* but only and exclusively in the *Manual* mode (in the automatic mode this option is disabled),

More information about HDR mode can be found in Subsection 15.1.7.

(E) – *ACQUISITION* tab contains settings for the parameter for taking a photo of markers with a specific exposure (if the option is selected),

More information about this option can be found in Subsection 5.1.1.2, point (16).

(F) – *SCAN GENERATOR* tab contains the point cloud generator settings – the parameter values are taken at the time of generating scans,

More information about point cloud generator settings can be found in Subsection 5.1.1.3.

(G) – *SCAN* button allows to test the settings entered during scanning,

(H) – *SAVE STEP* button saves the parameter values being modified,

(I) – *CLOSE EDITOR* button closes the editing panel.



#### NOTE

Clicking on the *CLOSE EDITOR* button without saving the changes made with the *SAVE STEP* button will reject all modifications cause that the introduced to parameter settings will be rejected.

### 16.7.2.3 Autocalibration

The *Autocalibration* step (3) fully automates the scanner calibration process using the robot arm. The edit panel for this step has the following options:

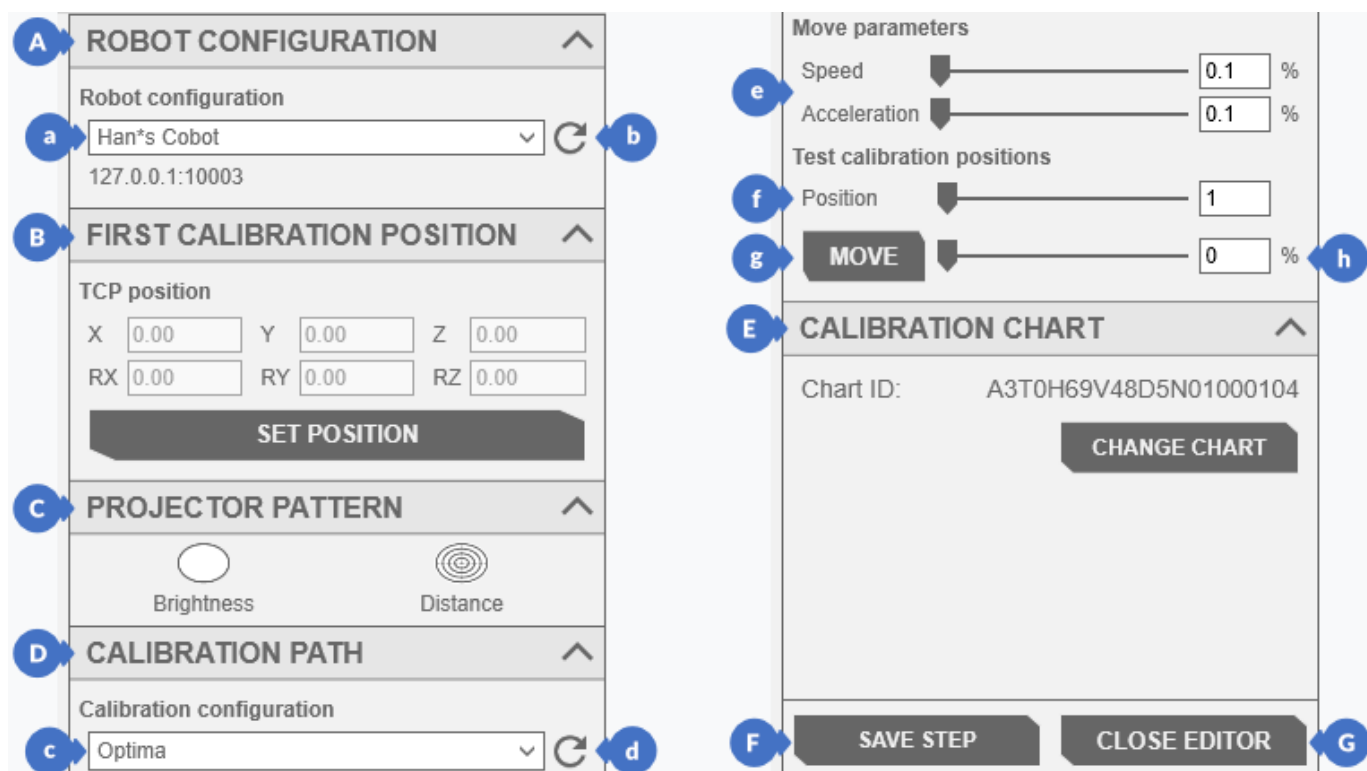


Figure 343. The panel for editing the parameters of the Autocalibration

(A) – *ROBOT CONFIGURATION* category includes:

(a) – the list of available robot configurations,

More information about robot's configuration can be found in Subsection 16.9.

(b) – the button that allows to refresh the content of the list,

(B) – the *FIRST CALIBRATION POSITION* category allows to set the starting position of the robot in the TCP system. The *SET POSITION* button opens the panel that allows to enter the settings,

✚ More information about robot TCP can be found in Subsection 16.7.2.1, point (d).

✚ More information about the home position setting panel can be found in Subsection 16.7.2.4.

(C) – *PROJECTOR PATTERN* category contains buttons for changing the displayed pattern,

✚ More information about projector patterns can be found in Subsection 10.2.

(D) – *CALIBRATION PATH* category includes:

(c) – the list of available scanner calibration files acquired using the robot arm - positions in the *Tools* system described in relation to the first position (start),

(d) – the buttons that allow to refresh the content of the list,

(e) – *Speed* slider is used to change the speed of the robot's movement and *Acceleration* is used to change the robot's acceleration,

✚ More information about Speed slider can be found in Subsection 16.7.2.1, point (g).

✚ More information about Acceleration slider can be found in Subsection 16.7.2.1, point (h).

(f) – *Position* slider for selecting the calibration position from the calibration file (c),

(g) – *MOVE* button is used to move the robot through the subsequent calibration positions to test whether the calibration will run without any problems and the robot will not encounter any obstacles. Holding the button down causes the robot to reach the next positions and the slider (f) to move to the next calibration position,

#### **i** NOTE

*Finishing one step and starting the next one is preceded by a short stop of the robot before proceeding to the next step.*

(h) – the slider used to change the speed of the robot's movement in the phase of testing the calibration positions,

(E) – the *CALIBRATION CHART* category is used to select or change the calibration chart using the *CHANGE CHART* button,

✚ More information about selecting calibration chart can be found in Subsection 8.3.4.

(F) – *SAVE STEP* button saves the parameter values,

(G) – *CLOSE EDITOR* button closes the editing panel

#### **i** NOTE

*Clicking on the CLOSE EDITOR button without saving the changes made with the SAVE STEP button will reject all modifications cause that the introduced to parameter settings will be rejected.*

### 16.7.2.4 Panel for Setting the Start Position (SET POSITION)

The panel used to change the starting position of the robot in the calibration process. The panel includes the following options:

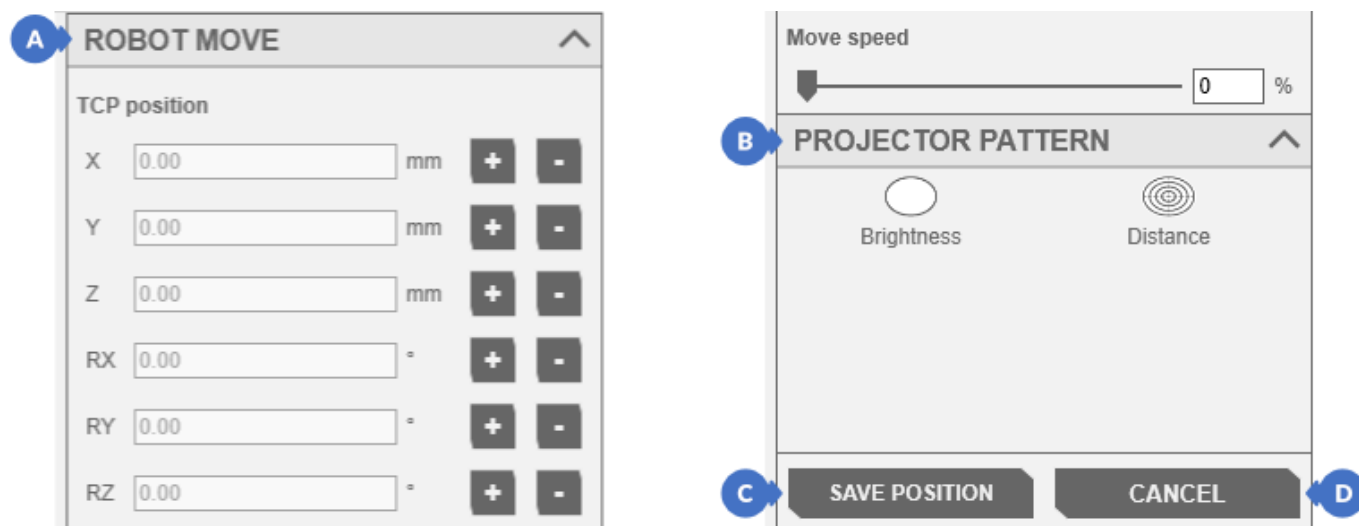


Figure 344. The panel for changing the start position of the robot

(A) – **ROBOT MOVE** category contains the position of the tool center point – *TCP position* and the *Move speed* slider used to change the speed of the robot,

More information about setting position tools can be found in Subsection 16.7.2.1.1, point (a).

More information about Move speed slider can be found in Subsection 16.7.2.1.1, point (c).

(B) – the category for changing the pattern „projected” by the projector

More information about projector patterns can be found in Subsection 10.2.

(C) – **SAVE POSITION** button to save the position settings,

(D) – **CANCEL** button cancels the changes made and closes the window.

## 16.8 TCP Configuration

The *TCP configuration* panel (2) is located on the *Automation* tab (1).

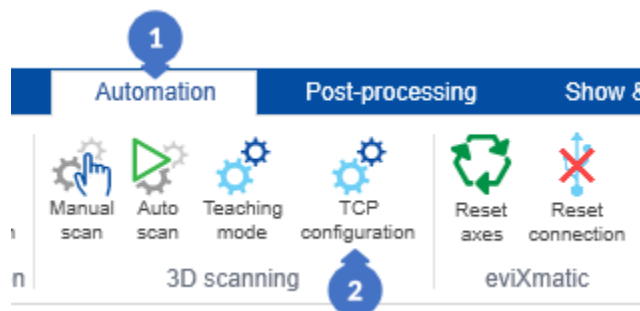


Figure 345. Open the TCP configuration panel

In the opened server configuration panel, there are the following options:

Figure 346. TCP configuration panel

(1) - *Path from list* - server configuration mode that requires the preparation of an appropriate .xml file with the port number, which should then be selected from the server configuration list,

Name	No. of steps
Initialize_tcp_connection.xml	0

Figure 347. List with the server configuration file



```

1  <?xml version="1.0"?>
2  <ScanningAutomationConfig xmlns:xsd="http://www.w3.org/2001/XMLSchema"
3  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
4    <Commands />
5    <CommandsController>
6      <TcpCommandControllerSettings Port="12345" />
7    </CommandsController>
8  </ScanningAutomationConfig>

```

Figure 348. Sample contents of the .xml configuration file

**NOTE**

Before starting the server, the path must be marked in the list.

- (2) – *Custom port* – simplified server configuration mode. It only requires specifying the port (3) on which the server should listen,
- (3) – the port number on which the server will listen for commands sent by the client,
- (4) – the *Status* field informs about the connection status between the client and the server. *Disconnected* in red indicates that there is no connection established between the client and the server. Establishing a connection by the client changes the state to green *connected*,



Figure 349. Server without established connection with the client



Figure 350. Server with established connection with the client

- (5) – *Remote end point* contains the information about the client's IP address and the port from which it sends commands,
- (6) – *Local end point* contains the information about the IP address and the port of the workstation on which the server was started,
- (7) – The *network adapters list* contains the information about the available network adapters on the workstation. Clicking on an item automatically sets the card as the default (the color of the default card will change to navy blue). The selected network adapter contains the IPv4 address with which the client should connect to the server,

**NOTE.**

It is not possible to change the default selected network adapter while the server is running. To do this, stop the server, select the network card from the list and restart the server.

- (8) – *REFRESH* button is used to refresh the list of available network adapters,
- (9) – *Last received commands list* contains all correct commands sent to the server while it is running,
- (10) – *START SERVER* button starts the server with parameters set in this panel and the button itself turns into *STOP SERVER* used to stop listening to the server.



Figure 351. The button is active after starting the server

**NOTE**

In case of problems with establishing a connection, make sure that exceptions are added to the antivirus firewall or the Windows firewall. If adding exceptions does not solve the problem, check whether the connection will be successful if the firewall is temporarily disabled.



## 16.9 Robot's Configuration

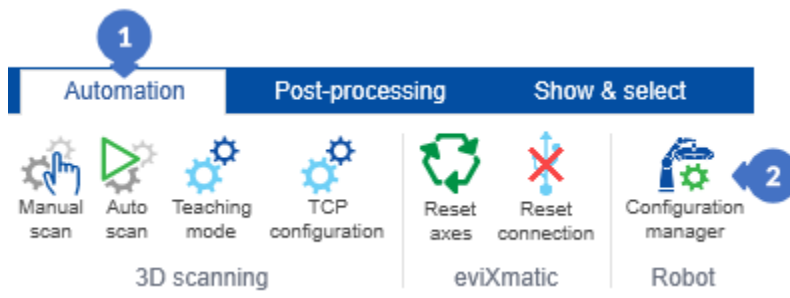


Figure 352. Open the robot's configuration panel

To start working with a robot, it must be added and configured first. The *Configuration manager* panel (2) is in the *Automation* tab (1).

By default, there are two pre-defined configurations in the panel for the *UR* robot and for the *Han\*s Cobot*. The following options are available in the robot configuration panel:

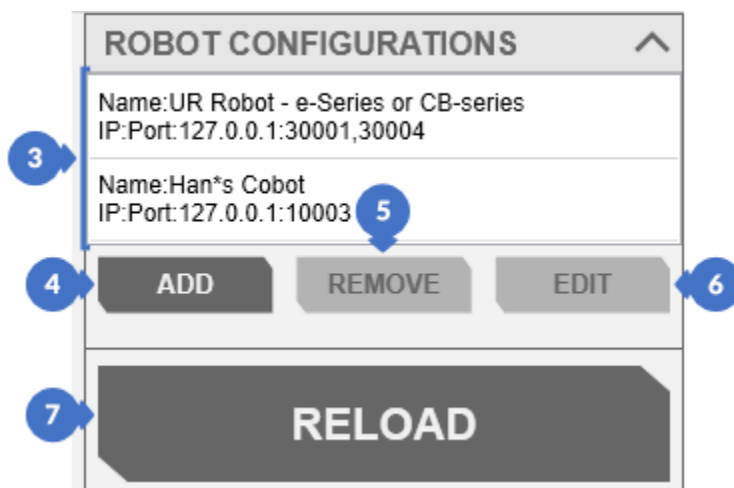


Figure 353. Robot's configuration panel

- (3) – the list of available robot configurations available, including the configuration name (*Name*) and the IP address and ports (*IP:Port*) through which the communication will take place,
- (4) – *ADD* button for entering a new configuration for the next robot. The added configuration (A) already has a predefined name, an IP address and ports that can be changed in the edit panel,

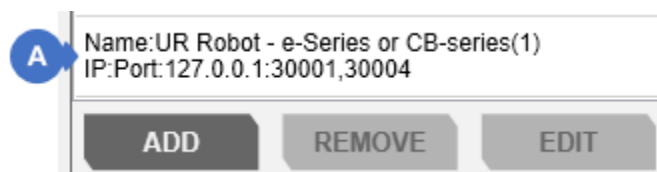


Figure 354. New added configuration

**i** NOTE

A new configuration is always created for the first (default) controller on the list. A default name is also selected based on the controller. Because the UR is the first on the list, a configuration for this type of robot will always be created by default. To introduce modifications, go to the edit panel.

(5) – *REMOVE* button used to remove a selected configuration (B) from the list (3),



Figure 355. Removing configuration from the list

**i** NOTE

The *REMOVE* button becomes active only after selecting an item in the list.

(6) – *EDIT* button opens the configuration edition window of the selected element (C)

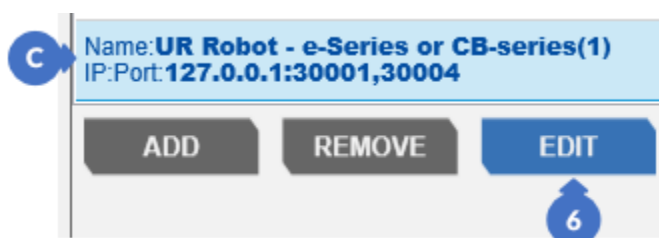


Figure 356. Edition of configuration

More information about editing configuration can be found in Subsection [16.9.1](#).

**i** NOTE

The *EDIT* button becomes active only after selecting an item in the list.

(7) – *RELOAD* button used for refreshing the content of the list of available configurations (3).

## 16.9.1 Configuration Editing

After switching to the edit mode by pressing the *EDIT* button, a panel with the following elements will be displayed:

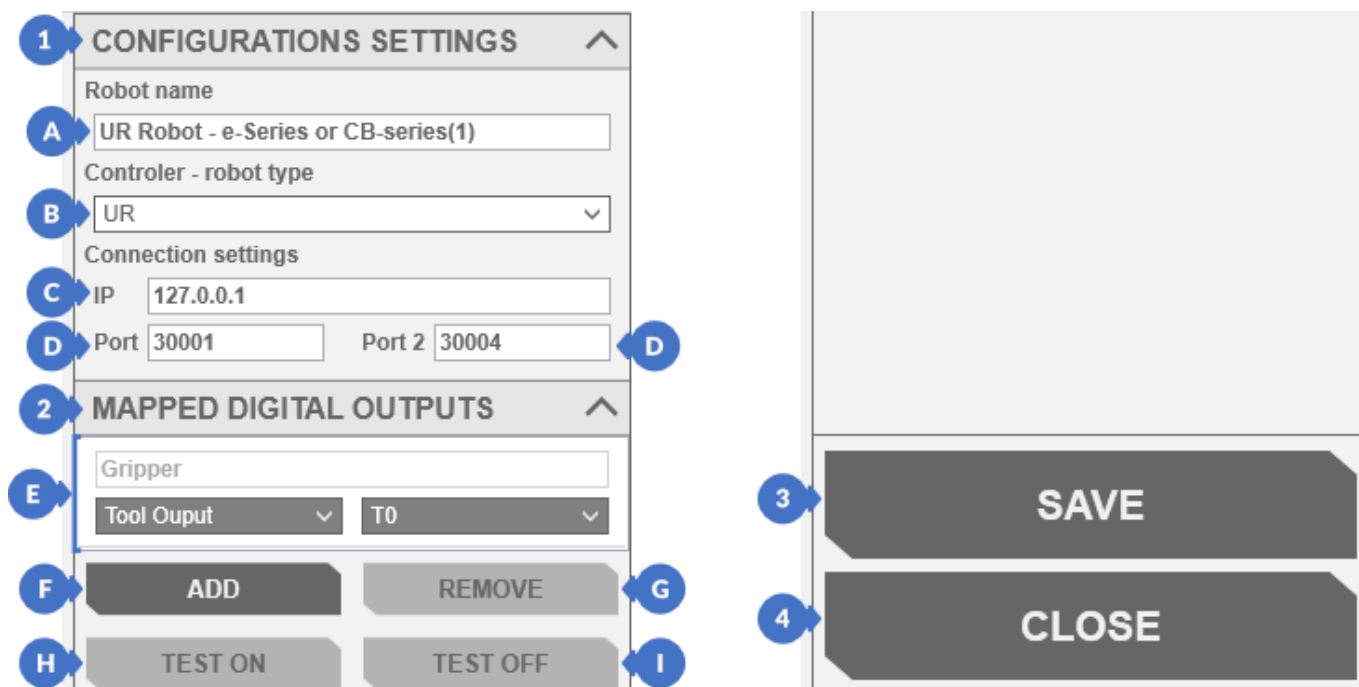


Figure 357. Configuration editing panel

- (1) – *CONFIGURATION SETTINGS* category contains basic configuration settings:
  - (A) – field to edit the configuration name (*Robot name*),
  - (B) – robot controller type selection list (*Controller – robot type*) – currently available *UR* and *Hans*,

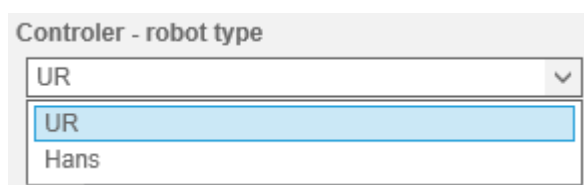


Figure 358. Robot controller type selection list

**i** **NOTE**

Changing the controller type changes the robot configuration name (*Robot name*).

- (C) – the robot's IP address,
- (D) – the ports (*Port*, *Port 2*) for communication with the robot,

- (2) – the category of *MAPPED DIGITAL OUTPUTS* includes:
  - (E) – the list of all mapped outputs (there may be one or more or there may also be none)
  - (F) – *ADD* output button to add one of three types of outputs from the drop-down list depending on the selected robot controller. There are output types for the *UR* controller: *Tool Output*, *Standard Output* and *Configurable Output*. For *Tool Output*, the output numbers from *T0* to *T1* are available. For *Standard Output*, the output numbers *S0* to *S7* are available. In *Configurable Output* the output numbers available are from *C0* to *C7*. There are several types of outputs for the *Hans* controller: *End Output*, *Common Output* and *Configurable Output*. For *End Output*, the output numbers from

*E0 to E3* are available. For *Common Output*, the output numbers from *D0* to *D7* are available, whereas in *Configurable Output* the output numbers available are from *C0* to *C7*.

Figure 359. Types of available outputs for the UR controller

Figure 360. Types of available outputs for the Hans controller

- (G) – *REMOVE* button is used to remove the selected mapping from the list,
- (H) – *TEST ON* button activates the marked mapped output, e.g., from a gripper,
- (I) – *TEST OFF* button deactivates the output for the selected element from the list of mapped outputs,
- (3) – *SAVE* button saves the settings,
- (4) – *CLOSE* button closes the edit panel without saving changes.

# 17 POST-PROCESSING

The *post-processing* tab is intended for processing acquired scans.

## 17.1 Point Cloud Generator

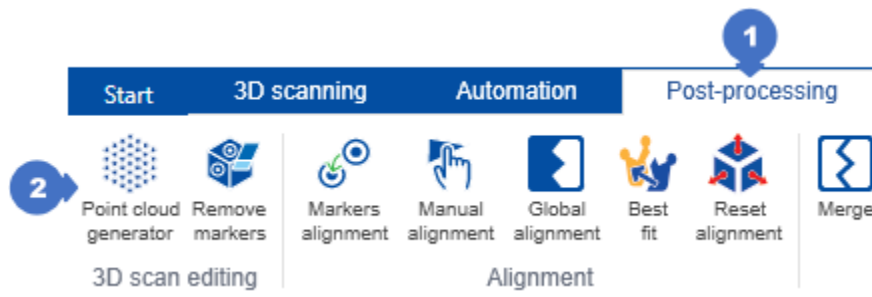


Figure 361. Opening the Point Cloud Regeneration panel

To open the panel with the point cloud generator, select the *Post-processing* tab (1) and then click on the *Point cloud generator* (2).

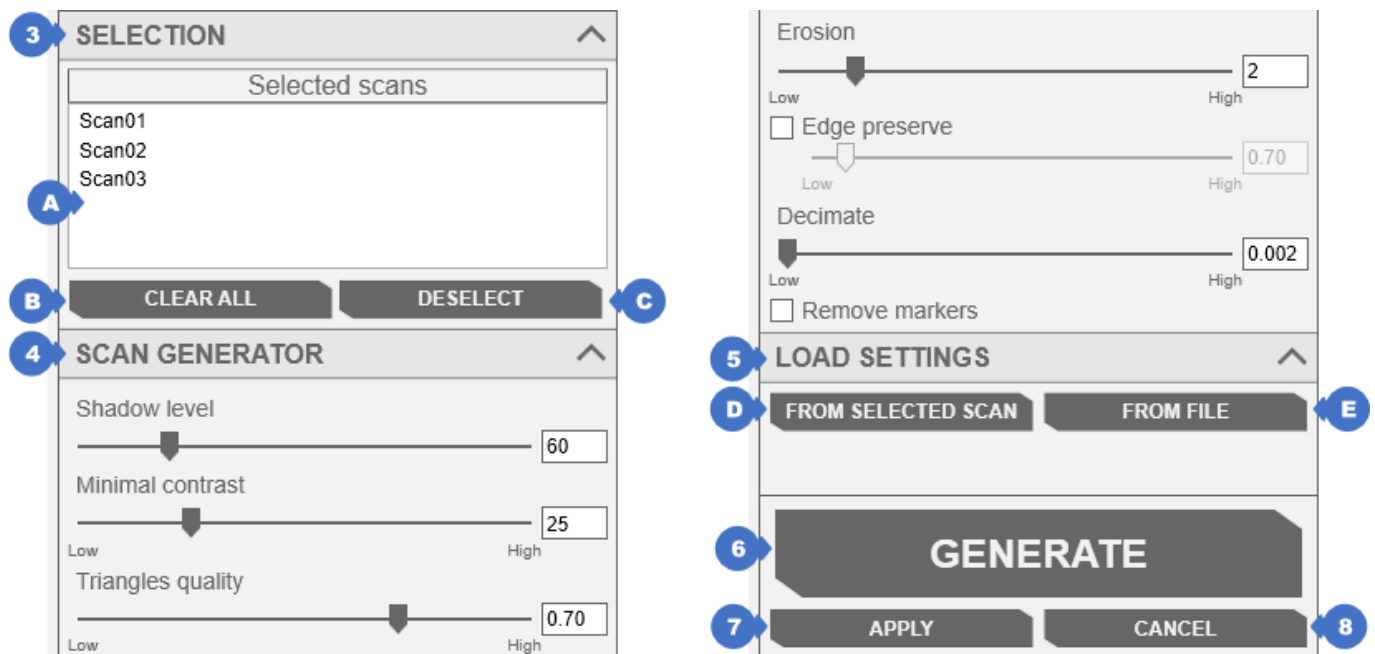


Figure 362. Point cloud generator panel

The point cloud generator panel contains the following:

- (3) – *SELECTION* category contains a list of selected scans in the tree,
  - (A) – list of selected scans to regenerate,
  - (B) – *CLEAR ALL* button clears the list of selected scans,
  - (C) – *DESELECT* button deselects the selected item from the list and the tree in *Selected scans* (A)
- (4) – Parameter settings of *SCAN GENERATOR* are *Shadow level*, *Minimal Contrast*, *Triangles quality*, *Erosion*, *Edge preserve*, *Decimate*, *Point omitting*, *Remove markers*,
  - Standard scan generator parameters are described in Subsection 5.1.1.3.

(5) –*LOAD SETTINGS* category is used to load settings:

(D) – from the selected scan

■ More information about loading settings from a scan later can be found in this Section –Subsection 17.1.1.1.

(E) – from a file with the extension .scn

■ More information about loading settings from a scan later can be found in this Section –Subsection 17.1.1.2.

(6) –*GENERATE* button triggers the process of generating/regenerating the mesh based on the parameter settings from the *SCAN GENERATOR* (4) category for the *Selected scans list* (A).

**i** NOTE

*The regeneration process makes changes to the files on the disk. To restore scans before regeneration, exit the panel with the CANCEL button (8) and then save the project – otherwise the project will have changes from the process after regeneration.*

(7) – *APPLY* button confirms the re-generation of scans,

(8) – *CANCEL* button restores scans to the state before regeneration.

**i** NOTE

*After using the CANCEL button (8), save the project if a red dot appears in the tree with the scans indicating changes made in the project.*

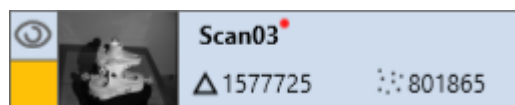


Figure 363. A red dot symbolizing changes in the point cloud (grid) of the scan

## 17.1.1 Loading Settings of the Point Cloud

In the *point cloud generator* panel (in the *Post-processing* tab), there are two ways to load the existing settings of the point cloud. One of them is loading the information from the generated scan, the other is loading the settings based on the scan file.

### 17.1.1.1 Settings from the Selected Scan

To load the settings from a specific scan in the project tree, select the scan and then click on the *FROM SELECTED SCAN* button (in the *LOAD SETTINGS* category). The settings will be entered into the control in the *SCAN GENERATOR* tab with the points generator settings.

**i** NOTE

*If more than one scan is selected in the tree, the settings are read from the first selected item. If no tree element is selected, the FROM SELECTED SCAN button is inactive.*

### 17.1.1.2 Settings from the Selected File

Loading settings from a file does not require selecting scans in the tree. After clicking on the *FROM FILE* button (in the *LOAD SETTINGS* category), pop up a window requiring the location of the file (1) with the .scn extension. After selecting the file, click on *Open* (2) to load the settings to the program.

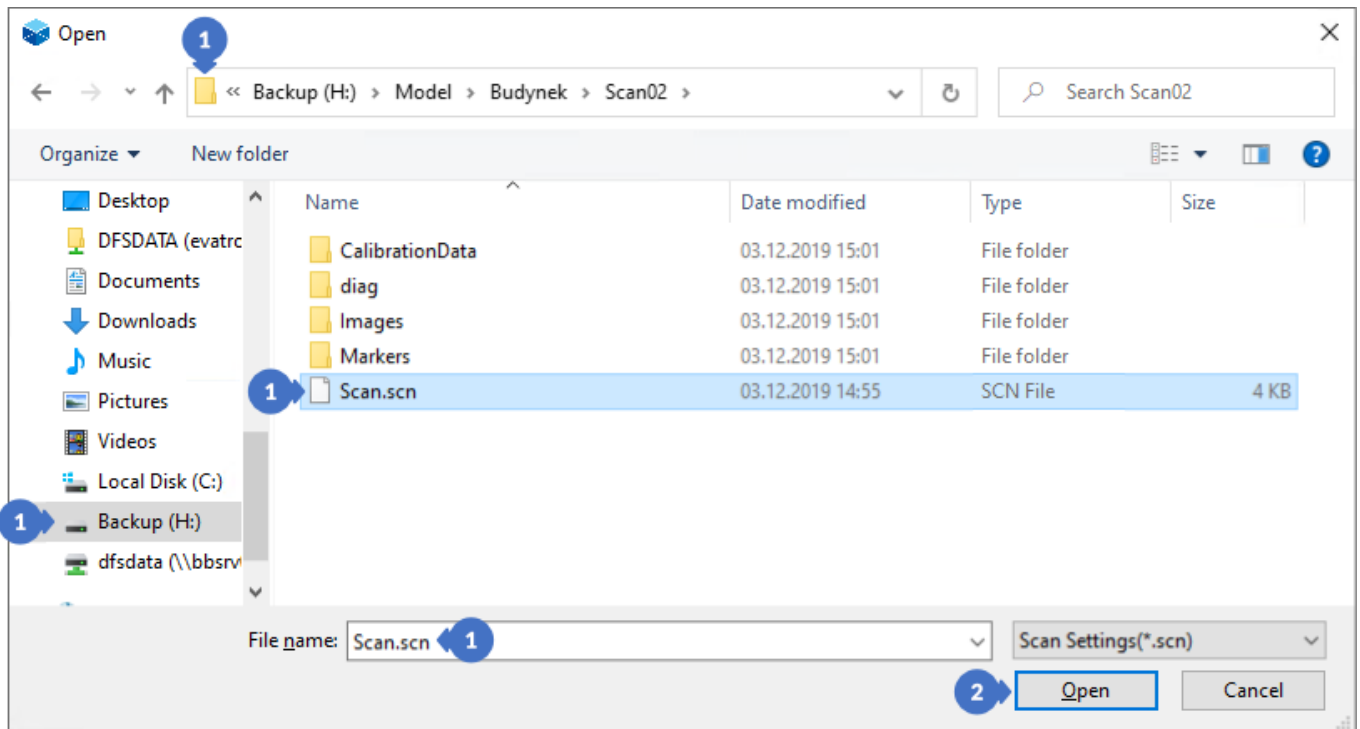


Figure 364. Loading settings from Scan.scn

## 17.2 Removing Markers

The marker removal algorithm is designed to remove scanned and generated markers from the scan grid, leaving holes, which can later be patched in other external programs for point cloud processing.

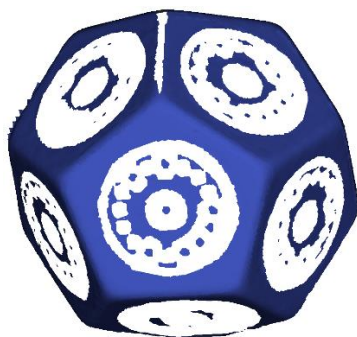


Figure 365. Scanned object with markers

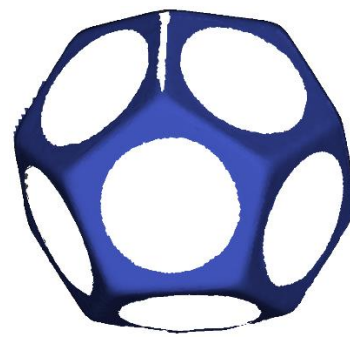


Figure 366. Scan with markers removed

## 17.2.1 Automatic Marker Removal

Markers can be removed in the cloud regeneration process or even before the scanning process starts. To do this, select the *Remove markers* option in settings of the *SCAN GENERATOR* category. Based on the detected unique marker, the algorithm determines the size and then drills a hole in the scan grid in the place where the marker is placed.

More information about the *Remove markers* option can be found in Subsection 5.1.1.3, point (24).

Automatic marker removal can be a problem with non-unique markers. In this case, the markers should be removed using the *Remove markers* panel described later can be found in Subsection 17.2.2.



### NOTE

For the marker to be removed, it must be detected on at least one of all scans performed in the current scanning process. If scans are successfully matched to markers during scanning, then all markers recognized on other scans are deleted.

## 17.2.2 Removing Markers Using the *Remove Markers* Panel

To open the *Marker removal* panel, go to the *Post-processing* tab (1) and then select *Remove markers* (2) from the *3D scan editing* category.

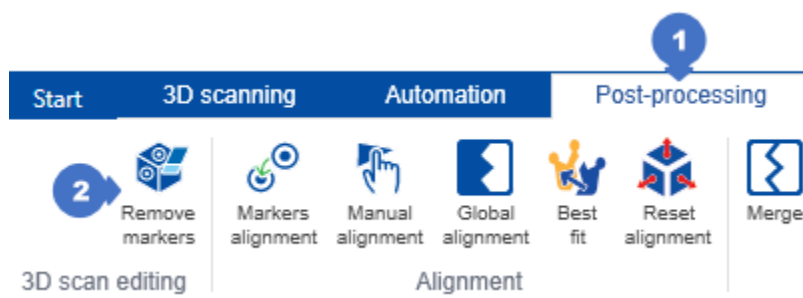


Figure 367. Opening the marker removal panel

The panel includes the following elements:

- (3) – the list of selected scans in the tree, which will be the subject to the process of removing markers.
  - *CLEAR ALL* button is used to remove all items from the list and to remove the selection in the tree.
  - *DESELECT* button is used to remove a selected element from the list (it is also deselected in the tree),
- (4) – *COMMON MARKER RADIUS* category contains fields from which the size of the radius (in millimeters) of the marker to be removed can be selected,



### NOTE

This parameter is only relevant for non-unique markers. When removing unique markers, it does not play any role in the process of marker detection and removal.

- (5) – *Margin size* slider enables to select the dimension of the margin by which the opening will be additionally enlarged to remove distortions on the marker edges. The slider takes values from 0 to 4 mm with the 0.1 mm resolution,



(6) – **REMOVE** button triggers the marker removal process,

**i NOTE**

Marker removal process requires saving the project to preserve the changes to the scan files, otherwise the information will be lost when the project is closed.

(7) – **APPLY** button confirms the changes made. To keep modified scan grid on disk the project must be saved,

(8) – **CANCEL** button cancels the changes made.

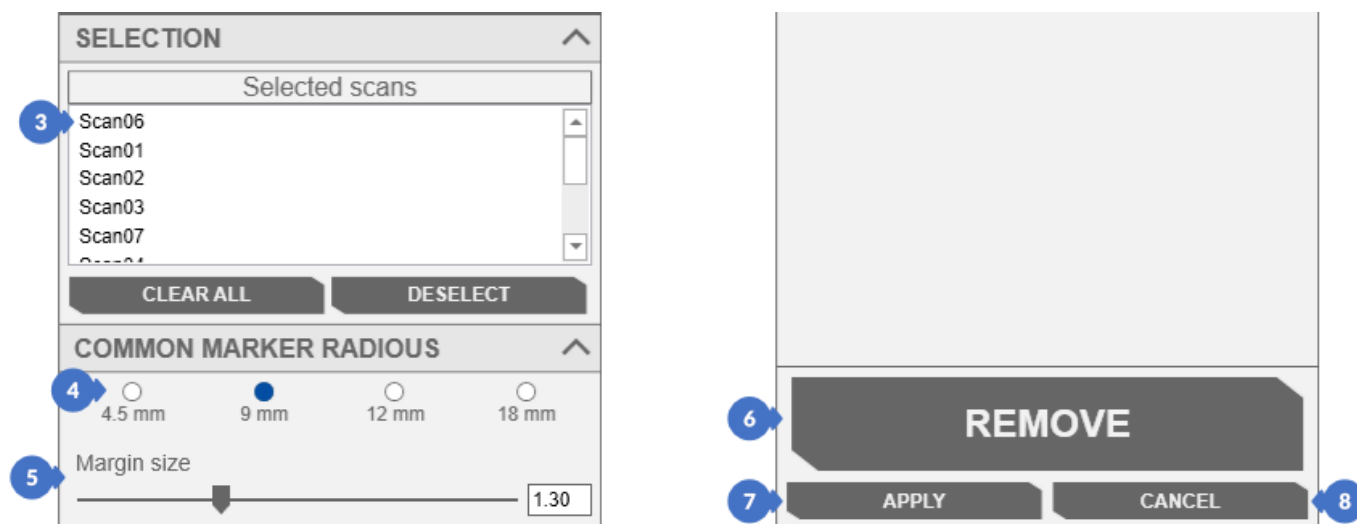


Figure 368. Panel for removing markers

**i NOTE**

For the marker to be removed, it must be detected during the scanning process, otherwise it will not be deleted. Markers detected on other scans but not detected on a scan that is subject to the marker removal process will not be removed.

The figures below show the difference between markers deleted depending on the *Margin size* (5) value. With the margins of 0 mm, 1 mm and 1.3 mm, the algorithm did not cut off the entire surface of the marker and its borders were left. At 2 mm, there are still some small leftovers of the marker. With a margin of 3 and 4 mm, the marker is removed, and there is no longer any difference noticeable on the scan.

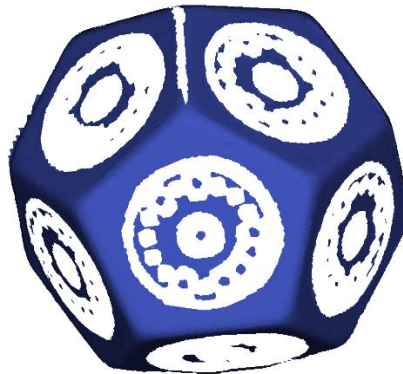


Figure 369. Original scan with markers

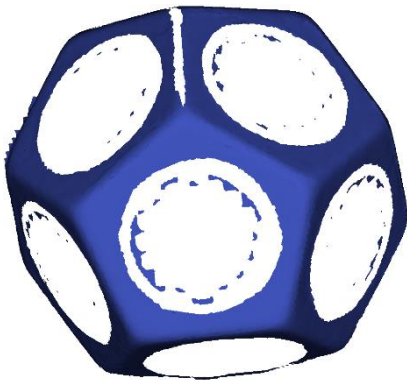


Figure 370. Removed markers – 0 mm margin

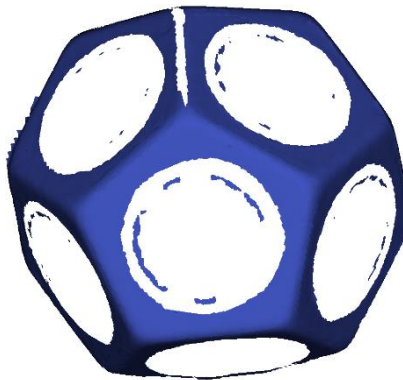


Figure 371. Removed markers – 1 mm margin

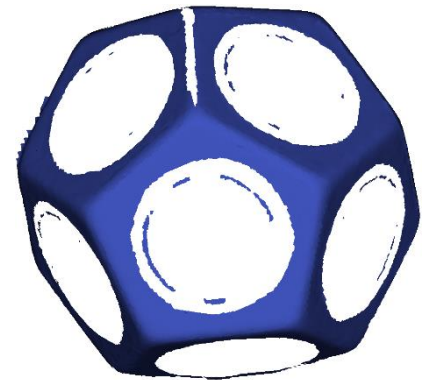


Figure 372. Removed markers – 1.3 mm margin

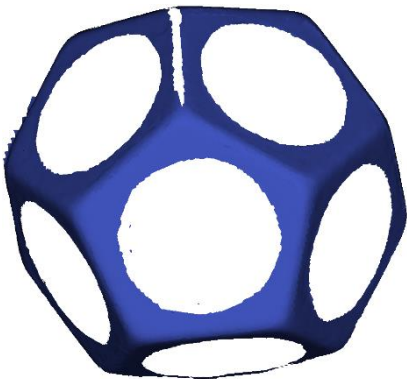


Figure 373. Removed markers – 2 mm margin

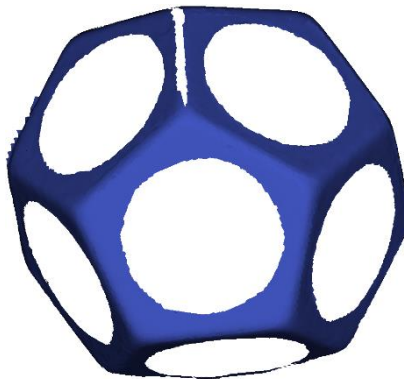


Figure 374. Removed markers – 3 mm margin

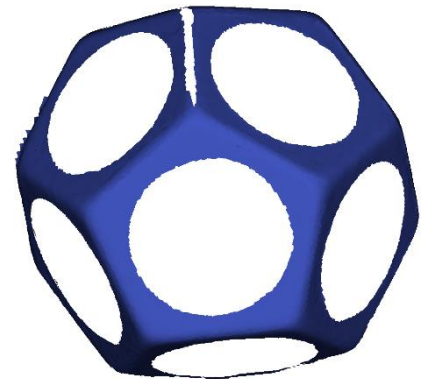


Figure 375. Removed markers – 4 mm margin

## 17.3 Methods of Matching Scans

There are four ways to align scans in the *eviXscan 3D Suite* software. All these methods are described in this section.

### 17.3.1 Markers Alignment

The *marker alignment* panel can be opened by selecting the *Post-processing* tab (1) and then in the *Alignment* category by clicking on *Markers Alignment* (2).

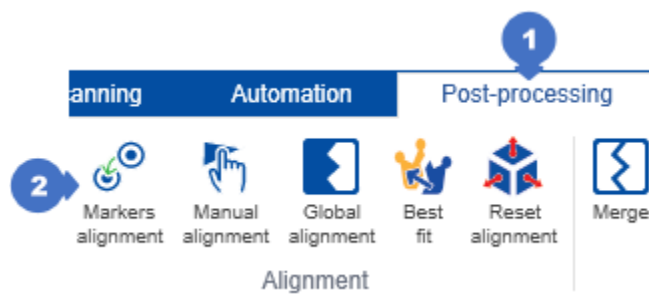


Figure 376. Markers matching panel

The *marker alignment* panel contains a list of selected scans (selected scans in the SELECTION (3) category) for further matching process (Figure 377).

**i NOTE**

*Groups do not accept mesh only scans. The marker matching process requires information about detected markers that the meshes do not contain.*

Selecting the *Align with group persevere* (4) will match only the individual groups of scans with each other without interfering with the transformations of individual scans. If this option is not selected, each of the scans is adjusted individually. The *ALIGN* button (5) is used to start the process of matching scans from the list in *SELECTION* (3). The *APPLY* button (6) accepts the changes made and closes the panel. *CANCEL* (7) is only used to close the panel and restore the scans to the state before entering the panel.

**i NOTE**

*Undoing the match by the CANCEL (7) button works only for operations triggered by the ALIGN (5) button with the Align with group persevere (4) option selected. Not selecting this option is an irreversible process, so it is recommended to leave always this option activated.*

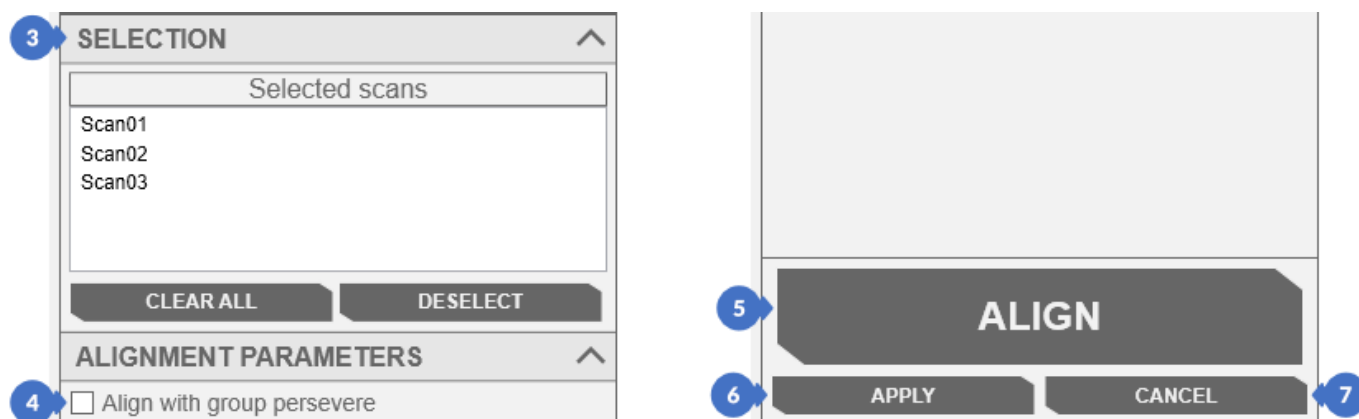


Figure 377. Fitting with markers panel

After the adjustment, two aligned groups appear in the *ALIGNMENT PARAMETERS* tab – a group (8) contains matched scans and the group *Not aligned scans* (9) – the scans that have not been matched.

In *Aligned groups* (8) there are scans with a pin element (A), which is used to select the reference scan. The reference scan does not have the pin because all the other scans are pinned to this reference scan.

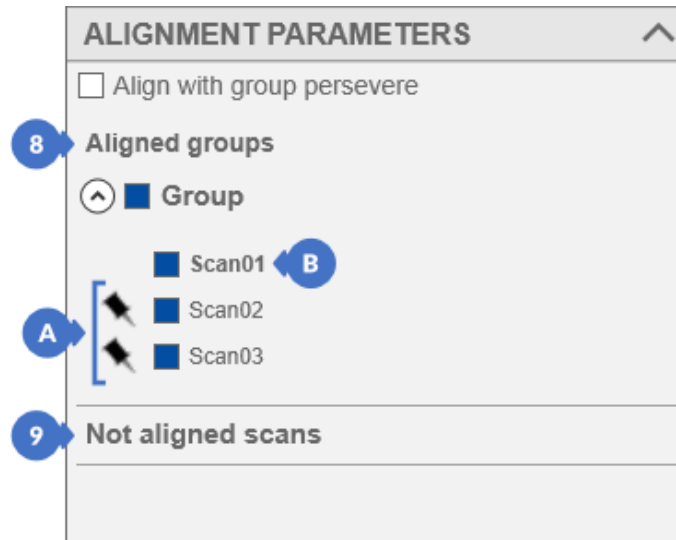


Figure 378. Summary of the fitting process

**i** **NOTE**  
Within each group, there can be only one reference scan.

Below are shown the scans before (C) and after (D) the alignment with the use of markers.

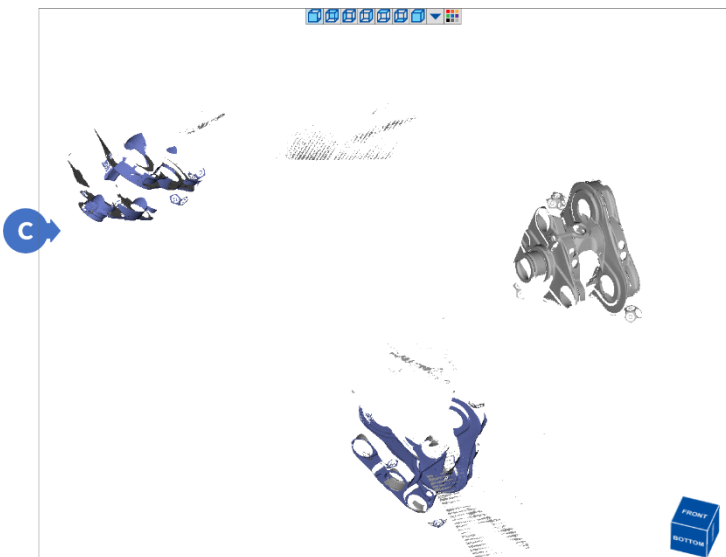


Figure 379. Scans before the alignment

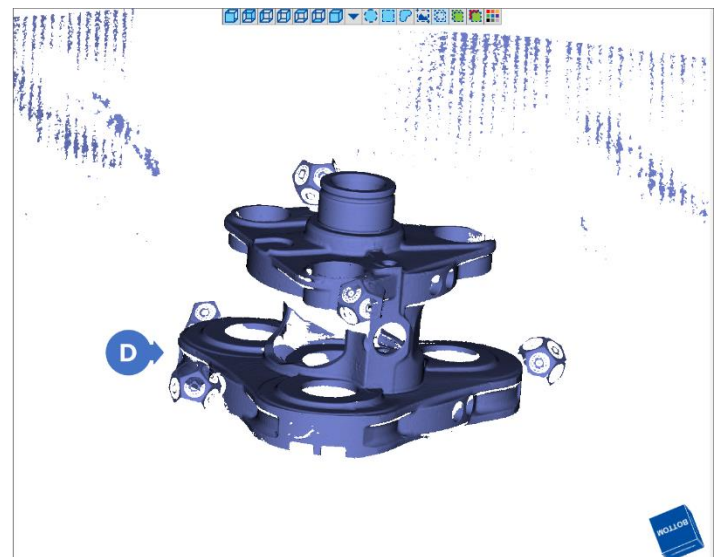


Figure 380. Scans after the alignment

## 17.3.2 Manual Alignment

To open the panel of manual scans adjustment, go to the *Post-processing* (1) tab and then *Manual alignment* (2). The main use of manual alignment is to match at least two scanned groups on a turntable in case the markers cannot be used.

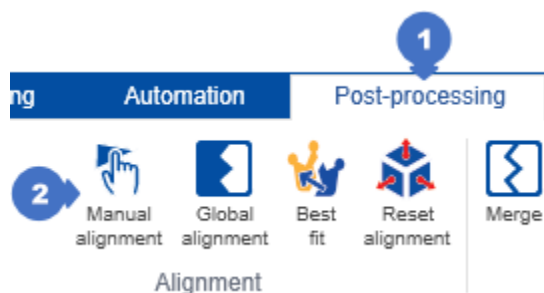


Figure 381. Opening the manual adjustment panel

The manual adjustment mode panel includes (Figure 382):

- (A) – the list of scans / reference mesh (*Reference*),
- (B) – the list of scans / matched mesh (*Moving*),
- (3) – the button to start the registration (*BEGIN REGISTRATION*), that launches the manual adjustment of scans,  
 ■ The manual adjustment process is described later in this Section – Subsection 17.3.2.1.
- (4) – the button ending the registration (*END REGISTRATION*) – the manual adjustment,
- (5) – *Standard deviation* is a matching error calculated in the matching process,
- (6) – *APPLY* button confirms the changes and exits the panel,
- (7) – *CANCEL* button closes the window and restores the scans to the state before opening the panel.



Figure 382. Manual alignment panel

In the manual fit mode, the middle window shows three views:

- (A) the reference scan view (*Reference*),
- (B) the matching scan view (*Moving*),
- (C) the combined view of all scans.

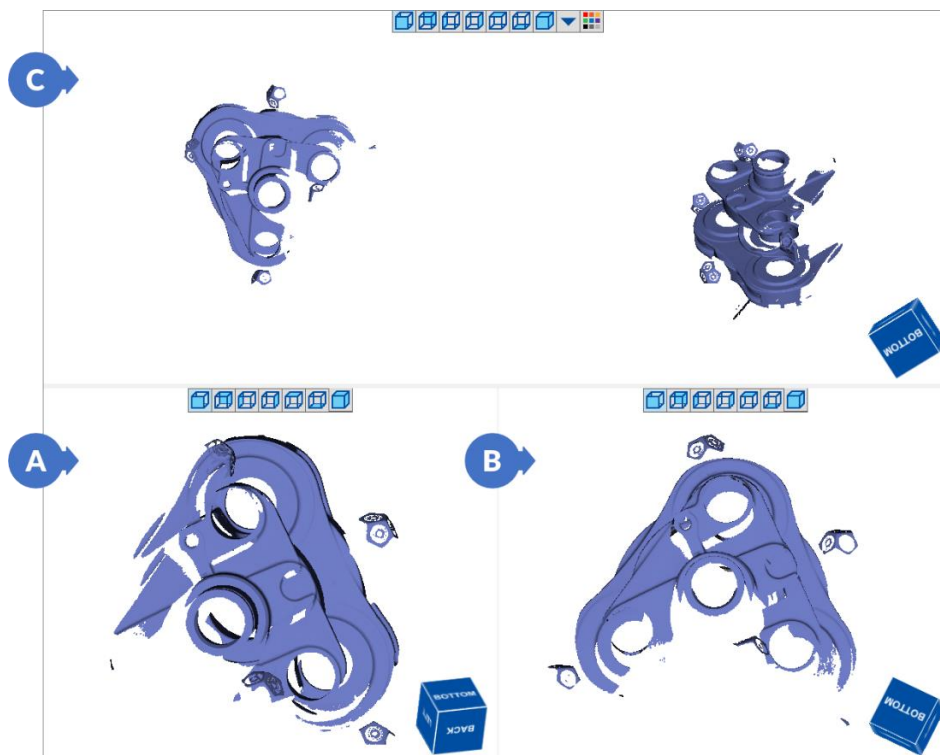


Figure 383. Views in the manual adjustment panel

### 17.3.2.1 Manual Scan Matching Process

Before starting the matching process, select a given list by clicking on its bar with the header. The header bar from the unselected state (7) (10) will go into the selected state (8) (9). The selected state is represented by a blue header.

Clicking on the scan name in a list will automatically shift the item from the *Reference* to *Moving* state or the other way round.

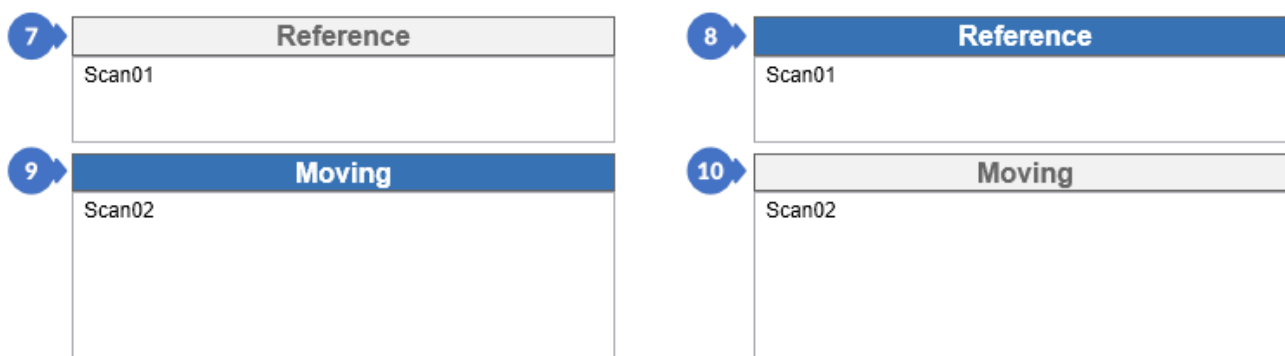


Figure 384. Checked and unchecked list with scans



**NOTE**

Selecting one list, e.g. Reference (8), automatically deselects the Moving (10) scan list and vice versa.



Once the reference scans (A) and the scans to match (B) have been selected, start the adjustment process by pressing the *BEGIN REGISTRATION* button (3) (Figure 382). This will block the possibility of modifying the content of both lists and will prevent from exiting the panel until the entire process is completed. After the completion, the *BEGIN REGISTRATION* (3) button will be replaced by the *UNDO LAST POINT* button (Figure 385) that can be used to undo the added points – this feature will be explained in detail later in this subsection. The *END REGISTRATION* button (4) is also unlocked, which enables to finish the manual registration process.

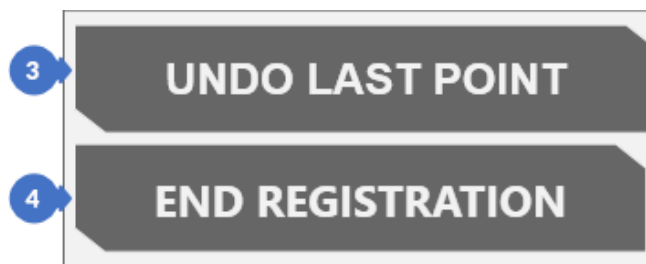


Figure 385. View of the buttons after starting the manual adjustment process

**i NOTE**

When you click on the *END REGISTRATION* button, a process is triggered that tries to quickly correct the manual adjustment. Depending on the size of the scans you match, this process may take some time.

It is required for manual adjustment to indicate minimum three points on the reference scans view and the adjusted scans view.

**i NOTE**

In the case of objects without characteristic edges, it may be difficult to find corresponding matching points.

The order of adding points does not matter, it is important that the given color of the point shows the same surface on the reference scans and the matching scans. Each of the added points can be undone using the *UNDO LAST POINT* button (3) (Figure 385). This button removes points in the opposite order to the order in which they were added – starting from the last added. When the scans are matched, all the points can be removed and marked again.



Figure 386. Marked points on the reference scan

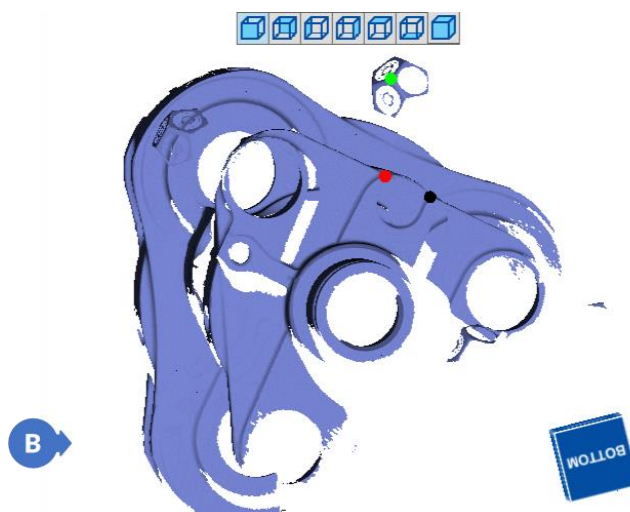


Figure 387. Marked points on the alignment scan

After selecting three points, the adjustment scans will change their position in the three-dimensional space so that the points selected in both views accord. Since the points are marked manually, the fitting process is prone to errors, which is calculated based on the spacing between the selected points in the views (A) (B). After

matching, an error is displayed in the *Standard deviation* field (5). Too large gap between the marked points results in a larger error.

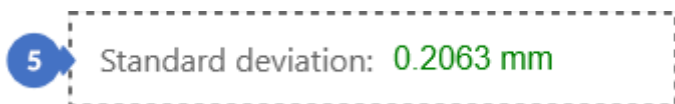


Figure 388. Acceptable error of the manual match

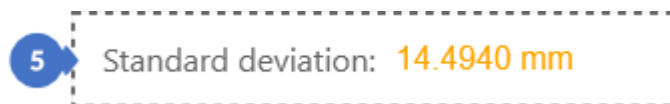


Figure 389. Significant error of the manual match

The illustration below shows a correctly performed process of manual adjustment. You can see how the scans interpenetrate each other to form one common scan grid (the bluish reference scan and the orange matched scan).

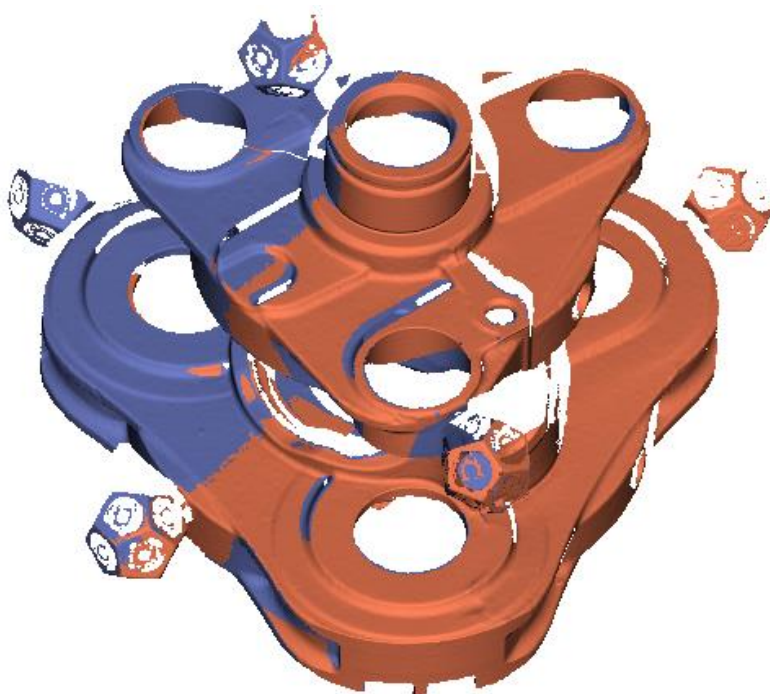


Figure 390. Adjustment of scans by the manual matching

### 17.3.3 Global Alignment

The global alignment panel can be opened from the *Post-processing* (1) tab by selecting the *Global alignment* button (2).



Figure 391. Opening the global alignment panel (ICP - Iterative Closest Point)

*Global alignment* is used to match scans considering the closest points between them. The whole process is to minimize the distance between the two-point clouds.



The panel includes the following parameters:

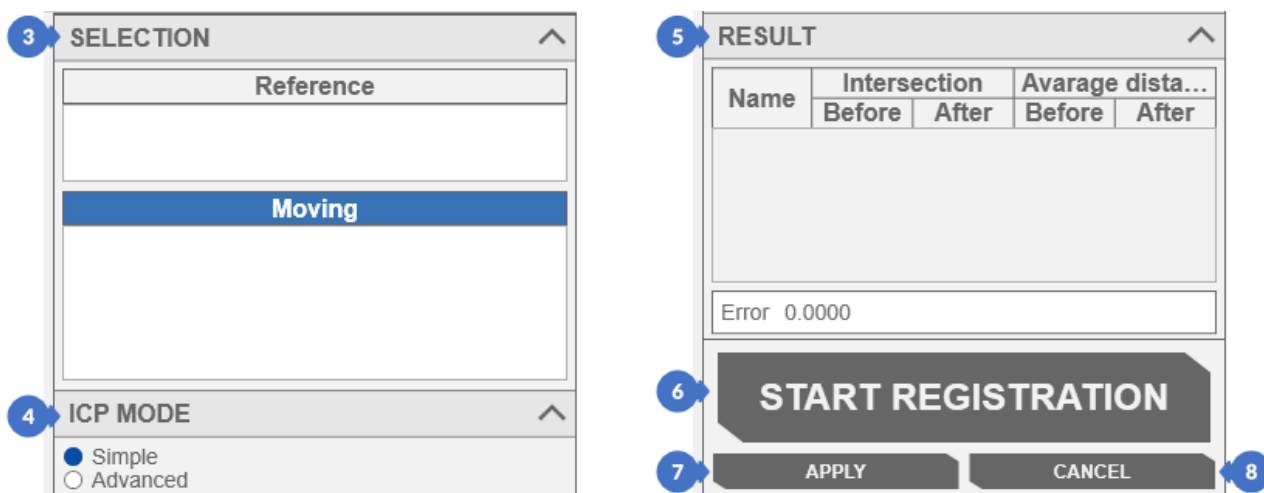


Figure 392. Panel of global alignment

- (3) – *SELECTION* category comprises two lists (as in the case of manual fitting): *Reference* containing the scan/reference mesh and *Moving* containing the scans/matched meshes,

**i NOTE**

*In this case, there can be only one reference scan selected. When you try to select multiple scans, the last selected will always appear in the list. The Reference list does not accept groups. If a group is selected, it will not be added to the list.*

- (4) – *ICP (Iterative Close Point)* category contains two modes: the *Simple* fitting mode, where there is no need to select any options, and the *Advanced* fitting mode for more experienced users,

■ Matching modes are described later in this Section – Subsection 17.3.3.1.

- (5) – *RESULT* category contains the results of the scan matches.

■ The matching results are described in Subsection 17.3.3.3.

- (6) – *START REGISTRATION* button starts the adjustment.

- (7) – *APPLY* button confirms the changes made and to close the panel,

- (8) – *CANCEL* button restores the changes to the state from before opening the panel and closes the panel

### 17.3.3.1 Iterative Close Point Mode (ICP)

The *Simple* mode is for the first-time users and does not require any settings. The *Advance* mode contains the following parameters:

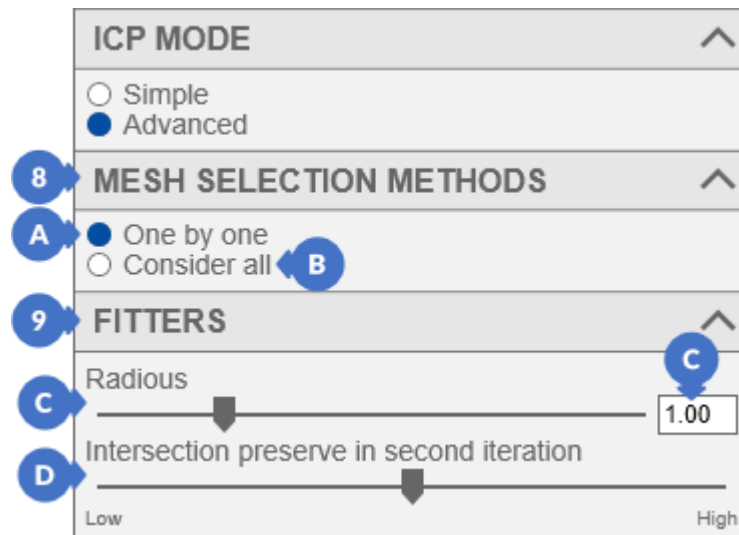


Figure 393. Advanced ICP settings

- (8) – **MESH SELECTION METHODS** includes two methods for selecting meshes when matching scans:
  - (A) – *One by one* method searches for meshes one-by-one. From the list of matching scans, it selects the one that has the highest number of edges intersecting the reference scan grid. Once identified, the mesh is fitted to the reference mesh and then transferred to the reference scan list. Then, successive iterations are performed following the same process until all meshes from the list of matched scans are matched,
  - i NOTE**  
*It should be remembered that each iteration increases the reference group of meshes and these meshes are treated as one large mesh to which subsequent scans are adjusted.*
  - (B) – *Consider all* method applies the best method to match the scan grids. Suppose we have four scan grids named after the first letters of the Greek alphabet:  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ . Let  $\alpha$  be the reference grid. More than one matching group may result from the matching processing. The algorithm can fit  $\beta$  to  $\alpha$  (considering the position of the reference grid  $\alpha$ ) and  $\gamma$  to  $\delta$ . In this way, the resulting groups are treated as two entire grids  $\alpha\beta$  and  $\gamma\delta$ , which in turn are fitted to each other (in this case,  $\gamma\delta$  to  $\alpha\beta$ , as  $\alpha$  is the reference scan). When the error of matching between the groups is too large, the algorithm ungroups the created groups and then tries to create a group with a different grid alignment,
- (9) – **FITTERS** category includes the following two sliders:
  - (C) – *Radius* slider defines the maximum distance at which corresponding points are searched. The value can be set from 0.10 mm to 4 mm with 0.05 mm increments.
  - (D) – *Intersection preserved in second iteration* slider enables to set the degree of freedom of permeability between the scan meshes. For objects with a small number of characteristic points – like the cube type – it is recommended to set the parameter to high values (*High*), which prevents changes that may have a negative impact on the adjustment of scans. In the case of objects with diversified shapes, it is recommended to reduce the value (towards *Low*).

### + ADDITIONAL INFORMATION

The following illustrations (in the side view) show the influence of the *Intersection preserved in second iteration* slider on the permeability of the scan meshes. The scan points (F) from the *MOVING* list, after the alignment performed by the algorithm, are located at the distance (H) being the average length of the triangle side from the reference scan points (E). These are the points closest to each other from both scans. The border (G) is the distance (H) from the reference scan points (E). The distortion (I) in the (F) scan, caused by e.g., contamination during the scanning, will ultimately affect the quality of the matching depending on the value of the *Intersection preserve* in second iteration slider. The closer the slider value is too *Low*, the more permeability the algorithm adopts; the closer to *Heigh*, the less (or even zero) permeability it adopts.

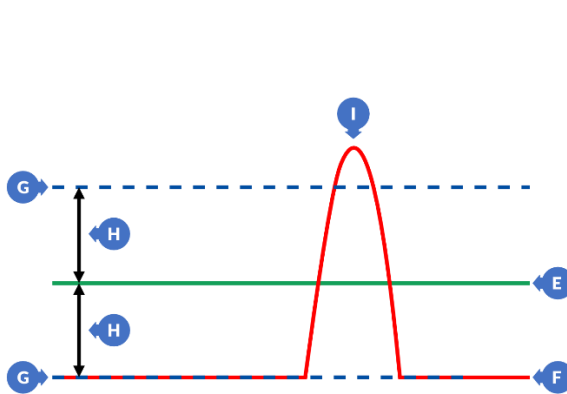


Figure 394. Fitting with less freedom for permeability – Intersection preserves in second iteration slider at the maximum *Heigh* position

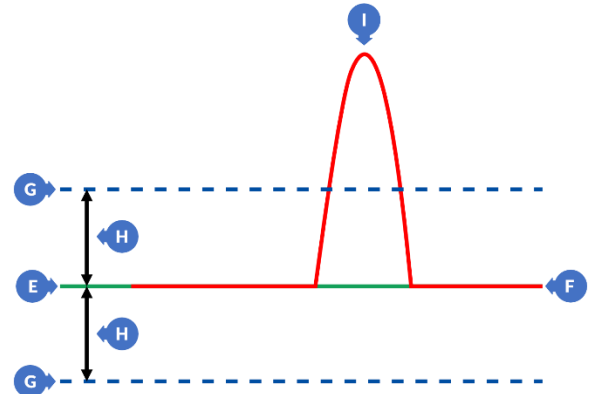


Figure 395. Fitting with more freedom for permeability – Intersection preserves in second iteration slider at the maximum *Low* position

### 17.3.3.2 Matching Scans

Before starting the scan alignment, you must select the reference scan and the matching scans. Meshes are also accepted. Clicking on the bar with the name activates the list (10), to which the data will be added when selecting elements in the tree, deactivating the previously active list (9).

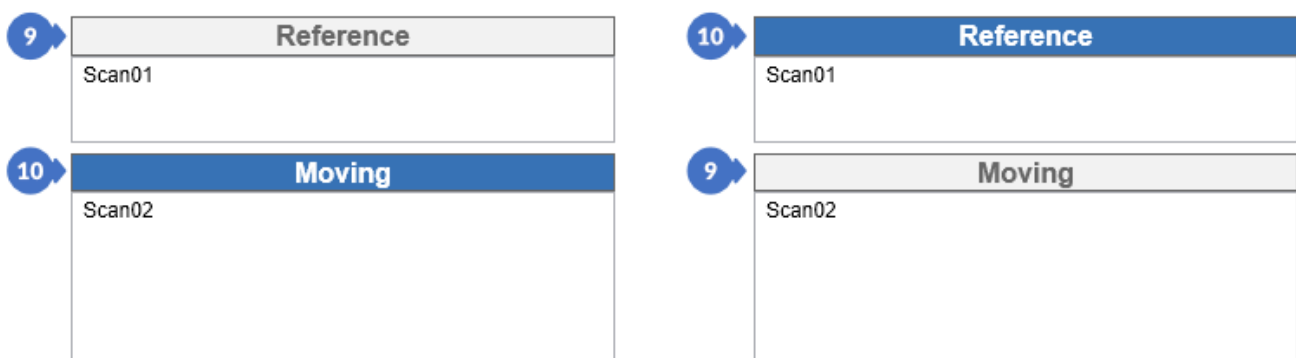


Figure 396. Switching between scan lists

Clicking on a scan inside the list shifts the selected item between the lists. After selecting the scans and the appropriate setting of the *ICP (Iterative Close Point)* algorithm mode, click the *START REGISTRATION* (6) button (Figure 392) which starts the global adjustment process.



#### NOTE

It is important that the processed scans are either pre-adjusted by the manual adjustment or scanned using a rotary table. Scattered scans in the 3D space of the project will not fit.

Below you can see the differences between the manual match and the match performed using the default global match settings (the brighter scan is the reference scan; the darker scan is the match).

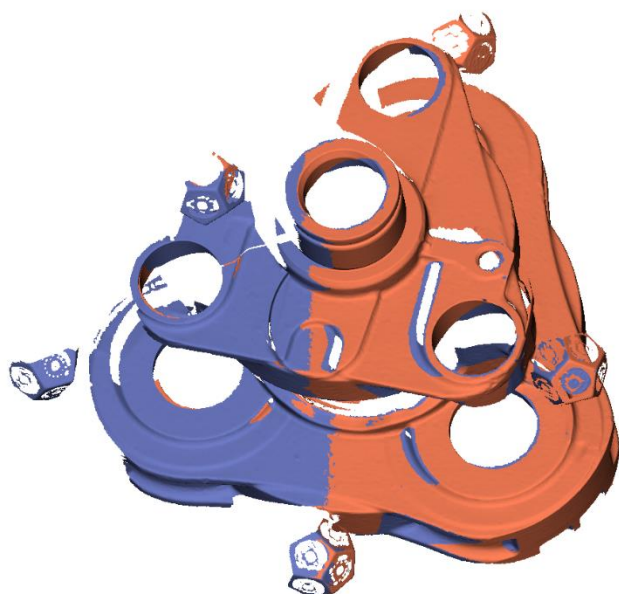


Figure 397. Scans after manual fit

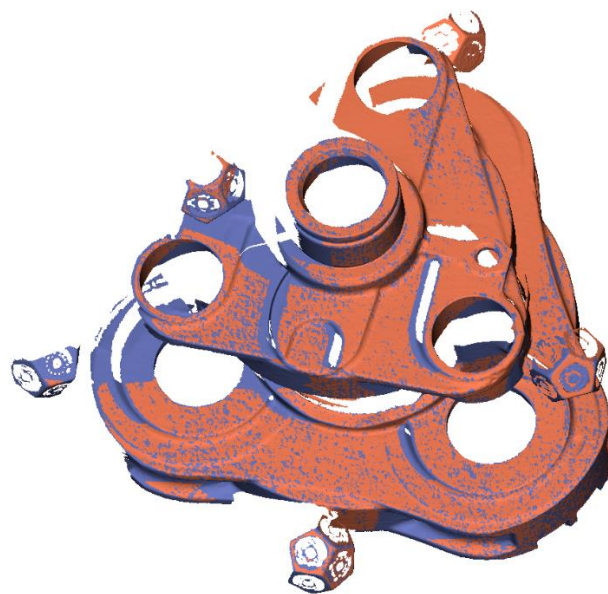


Figure 398. Scans after global fit

After the global match has been performed, the reference scan (brighter) and the fitted scan (darker) interpenetrate more deeply compared to the manual match.

**i** NOTE

No reference scan is required to perform the global matching. In this case, the algorithm will automatically select the first scan from the list of matching scans.

### 17.3.3.3 Fitting Errors

The *RESULT* table (5) shows the qualities of the match after using the global matching. The percentage values of *Intersection* (J) inform about the fraction of the grid points of a given scan that corresponds to the points of the scans fitted at a distance shorter than the average length of the triangle edge. *Average distance* (K) shows the average distance between points in each mesh to points in meshes of other scans. The values are measured before and after the fitting. The *Error* (L) value is the average of the *Average distance* (K) results after the fit has been done.

Name	Intersection		Avarage dista...	
	Before	After	Before	After
Scan01	36.650 %	63.467 %	0.269 mm	0.013 mm
Scan02	35.982 %	68.500 %	0.282 mm	0.013 mm

Error	0.0128
-------	--------

START REGISTRATION
APPLY CANCEL

Figure 399. Matched scans result table

### 17.3.4 Best Fit

The fitting panel based on the shape analysis can be opened from the *Post-processing* tab (1) by selecting the *Best fit* button (2).



Figure 400. Opening the fitting panel based on the shape analysis

*Best fit* is used to match scans taking into account the coverage declared by the user between scans. The algorithm is trying to match the group of scans / meshes adjusted (moving) to the scan / reference mesh at various levels of detail. It begins matching from the lowest to the highest level of detail until either the user-specified coverage is achieved or the algorithm's maximum runtime is exceeded. The coverage is understood as the ratio of the number of points in the scan / mesh, which – within a radius equal to 1 – have a point close to a point from another group to the number of all points in the mesh.

The panel includes the following parameters:

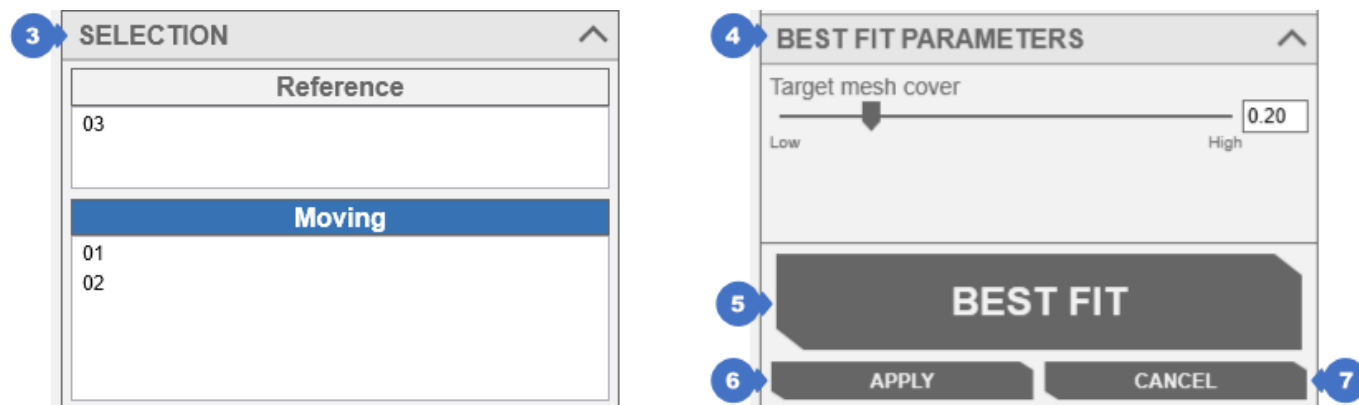


Figure 401. The fitting panel based on the shape analysis

- (3) – **SELECTION** category contains two lists (as in the case of manual fitting): *Reference* containing the scan / reference mesh and *Moving* containing the scans / matched meshes,
- (4) – **BEST FIT PARAMETERS** category – includes a slider that can be used to determine what is the intersection between the reference scan / mesh and matched scans / meshes. If the value is too small, there is less chance of a correct mesh match and / or the algorithm may mismatch the groups. If the parameter value is too high, the algorithm will run longer,
- (5) – **MERGE** button starts the matching process,
- (6) – **APPLY** button accepts matching of scans,
- (7) – **CANCEL** button returns the project to the state before the panel was opened.

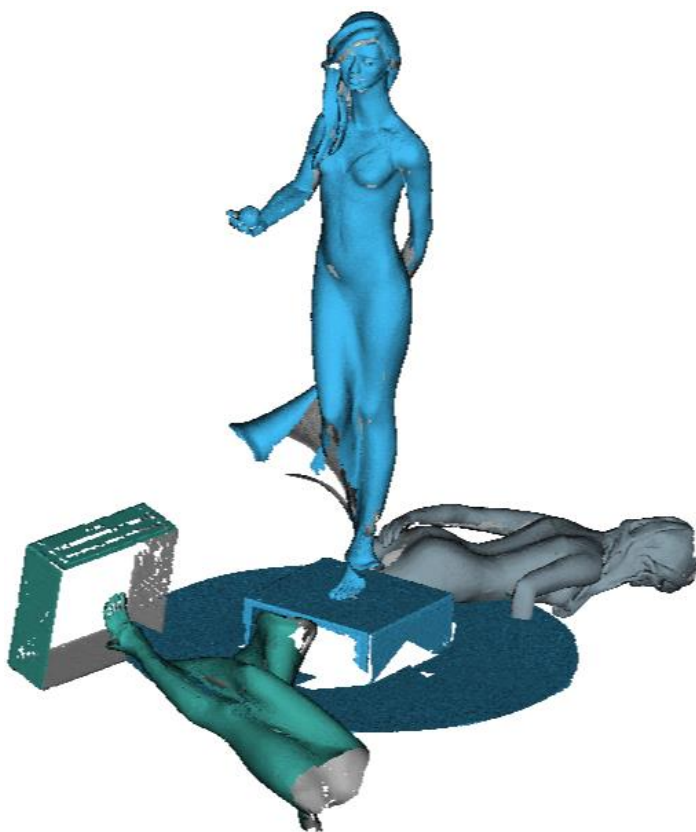


Figure 402. The view before fitting



Figure 403. The view after fitting

## 17.3.5 Reset Alignment

The *Reset alignment* button (2) for resetting the scan transformation to the initial transformation, e.g., calculated during a scan with a rotary table, is located in the *Post-processing* tab (1).

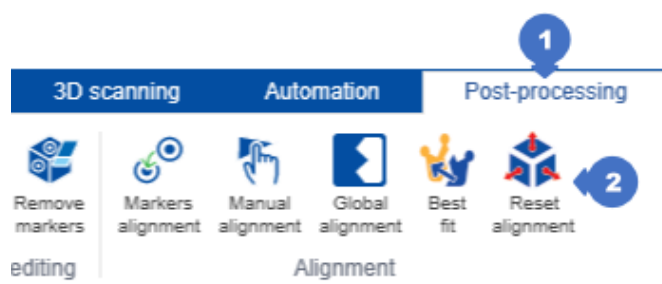


Figure 404. A button to reset the adjustment of scans to the initial settings

To perform the reset, select the scans in the tree and then click the *Reset alignment* button (2). Calling this process maintains the division into groups obtained during the scanning of the object with the use of a rotary table. An example would be to run several series of scans around the table and then align them using the *Global alignment (ICP)* algorithm or *Markers alignment*. In the event of a problem, e.g., due to the lack of scans, it is possible to restore the initial positions of each series of scans with the *Reset alignment* button, and then perform additional scans of the missing parts of the object and execute again the re-alignment.



### NOTE

Resetting a transformation only works on scans, not on meshes.



The example below shows the execution of two series of scans on a rotary table connected by markers (A) and then the same series with the *Reset alignment* (B) option used.

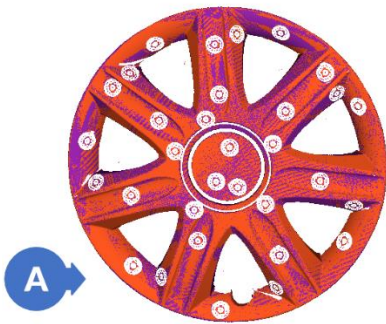


Figure 405. Table series with marker alignment

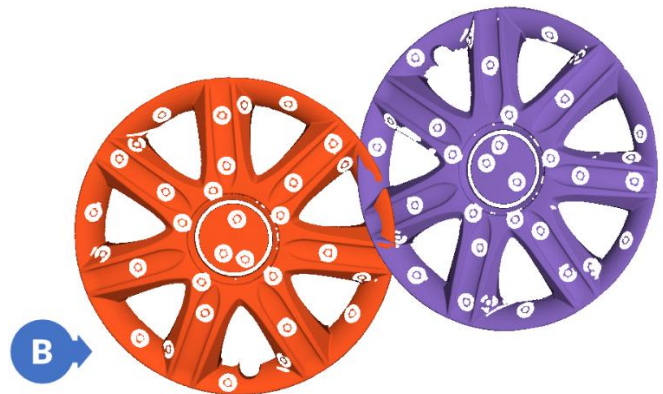


Figure 406. Table series after using Reset alignment (restore initial transformations)

## 17.4 Merging of Scans

The scan merging panel can be opened by going to the *Post-processing* tab (1) and then selecting the *Merge* option (2) from the *Mesh editing* category.



Figure 407. Opening the panel for merging scans

As the name suggests, the panel is used to combine scans and meshes into one mesh.



### NOTE

The mesh created using the merge panel is always a mesh and therefore will not contain any other essential information typically found in scans, such as images required for model re-generation or a file with information about detected markers.

The scan merge panel includes the following options (Figure 408):

- (3) – *SELECTION* category contains a list of *Selected scans* in the tree. The *CLEAR ALL* button removes all scans from the *Selected scans* list and deselects the items in the tree. The *DESELECT* button removes the selected element from the list of *Selected scans* and removes its selection in the tree.

The *MERGING PARAMETERS* category defines the method of combining scans and includes the following parameters:

- (4) – *Precision level* slider is used to define the precision of the scan merging process. The slider value can be set from  $-5.00$  to  $-0.75$ . The smaller the parameter value, the smaller the merging precision will be,
- (5) – *Smoothing iterations* slider is used to smooth the mesh. If the scan contains a lot of noise, it is recommended to set this parameter to *High*, so that the areas with differentiated normal are treated as noise, not as an edge. Noise should be understood as distortions (undulations) occurring in the

scanned model, not present in the original. If there is no noise in the scans, set the parameter to *Low*, which allows to create a new mesh with edges preserved (precisely represented). Increasing the parameter towards *High* will smooth the final mesh,

- (6) – *Set default values* button to set the default parameters of the *Precision level* (4) and the *Smoothing iterations* (5) sliders,
- (7) – *Max size of holes to fill* slider is used to set the maximum number of edges of a hole in order to fill it in. When the number of edges of the hole is less than or equal to the set value, the algorithm will fill it in. Otherwise, it is omitted,

**i NOTE**

*The number set on the slider is increased by 2.*

- (8) – *Simple decimation* option is used to reduce the number of points and triangles during the scan merging process,
- (9) – *MERGE* button is used to start the process of merging the selected scans,

**i NOTE**

*The newly created mesh of combined scans automatically changes the visibility of the scans in the tree, hiding the scans and conserving only the resulting combined mesh.*

- (10) – *APPLY* button accepts the resulting meshes of merged scans,
- (11) – *CANCEL* button returns the project to the state before the panel was opened.

**i NOTE**

*All meshes created in the process of combining scans will be removed after clicking the *CANCEL* button.*

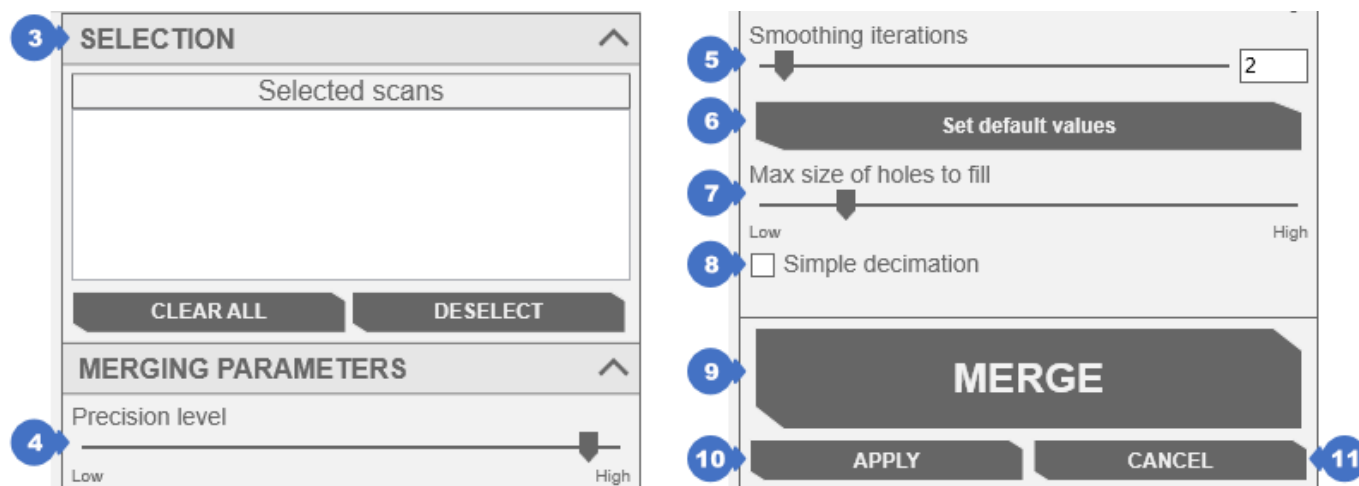


Figure 408. Scans merging panel



The pictures before and after the merging scans are shown below.

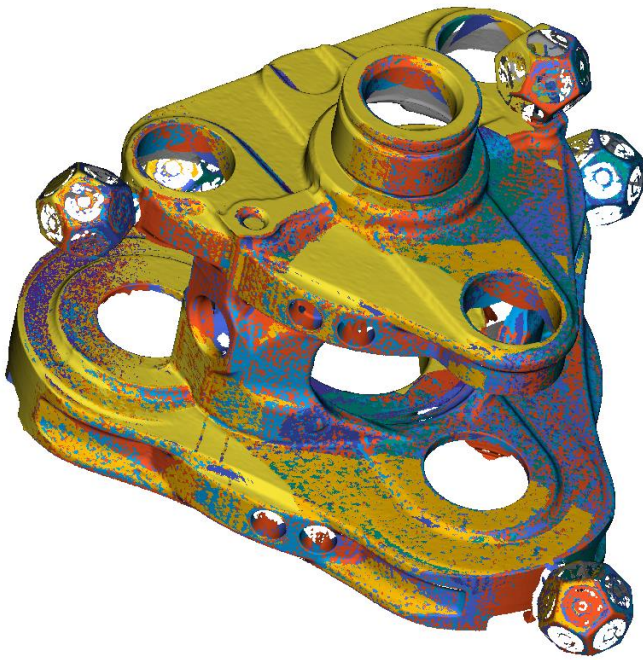


Figure 409. Scans before merging

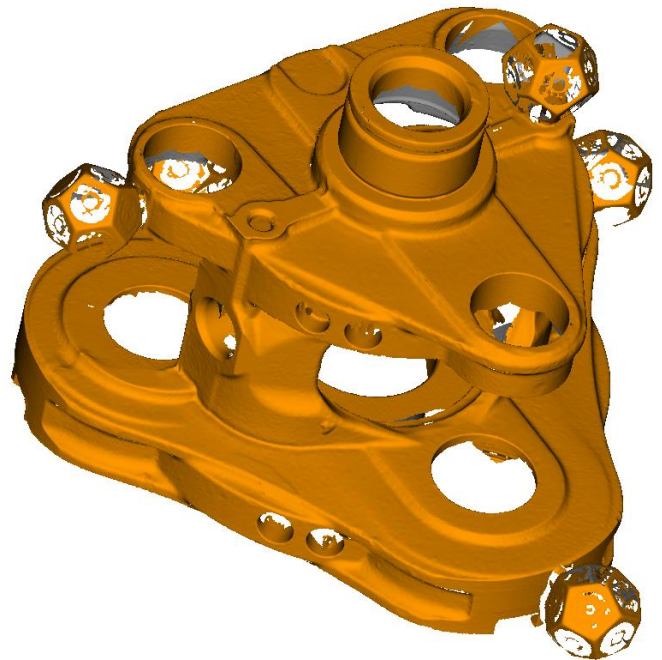


Figure 410. Scans merged into one grid

## 17.5 Mesh Cleaning and Fixing

To open the *Clean mesh* panel (2) for cleaning and repairing scans, go to the *Post-processing* tab (1) and from the *Mesh editing* category, click the icon with the word *Clean mesh* (2).

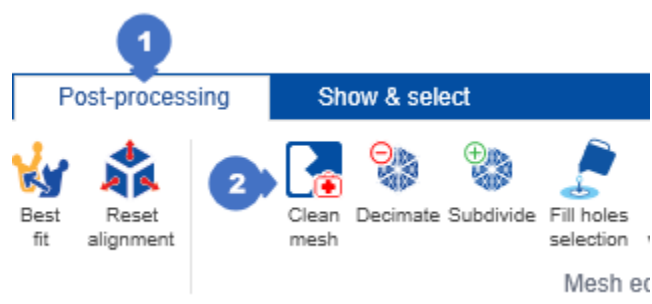


Figure 411. Opening panel of mesh cleaning

The *Clean mesh* panel contains the following items:

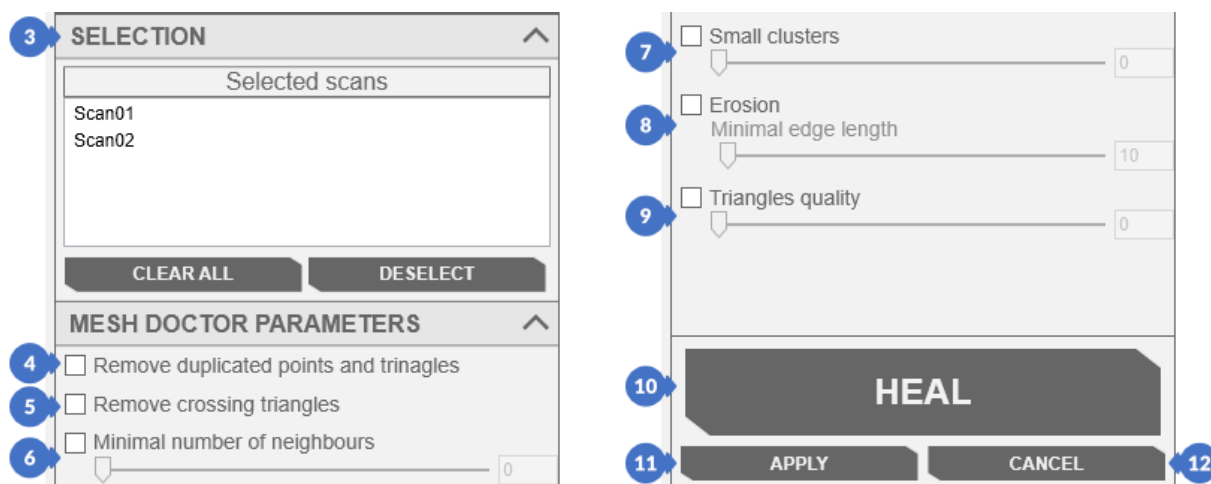


Figure 412. Panel for cleaning scan grids

(3) – *SELECTION* category contains the list of selected scans and two buttons: *CLEAR ALL*, used to clear the list and selected scans from the tree, and *DESELECT* which is used to remove the selected scan and deselect it in the tree.

The options in the panel parameters *MESH DOCTOR PARAMETERS* can be activated or deactivated by modifying their settings (if they have sliders). This part of the tab includes:

(4) – *Remove duplicated points and triangles* is used to remove duplicate points with the same coordinates.

Duplicate triangles (having the same points, not necessarily in the same order) are also removed,

(5) – *Remove crossing triangles* is used to remove intersecting triangles,

(6) – *Minimal number of neighbors* is used to set the minimum number of neighboring points. All points with fewer neighbors to which the point connects by the edge are removed,

(7) – *Small clusters* is a parameter responsible for removing areas with fewer points than the value set on the slider,

(8) – *Erosion* is used to set the minimum edge length. If the edge length is greater than the value set on the slider, it is trimmed,

(9) – *Triangles quality* is a parameter that corresponds to the minimum angle value of a triangle. Triangles with angles smaller than the value defined by the slider are removed,

(10) – *HEAL* button starts the scan mesh repair process,

(11) – *APPLY* button accepts changes introduced in the repair process,

(12) – *CANCEL* button cancels the changes made and closes the panel.

Examples below present the results of applying various values to the parameters: *Minimal number of neighbors*, *Small clusters* and *Erosion*:

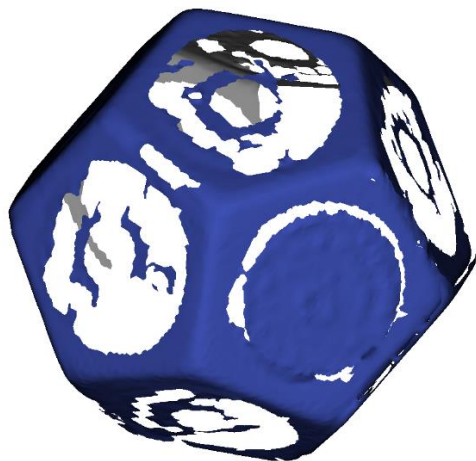


Figure 413. Before changing the parameter



Figure 414. After changing the parameter to 0 and 1

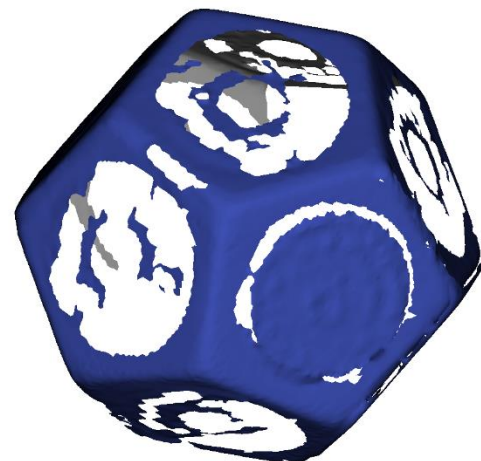


Figure 415. After changing the parameter to 2



Figure 416. After changing the parameter to 3

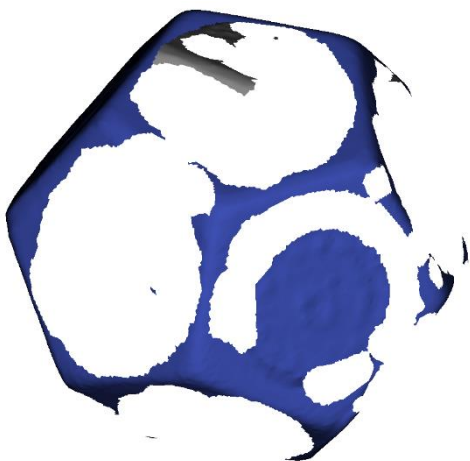


Figure 417. After changing the parameter to 4



Figure 418. After changing the parameter to 5

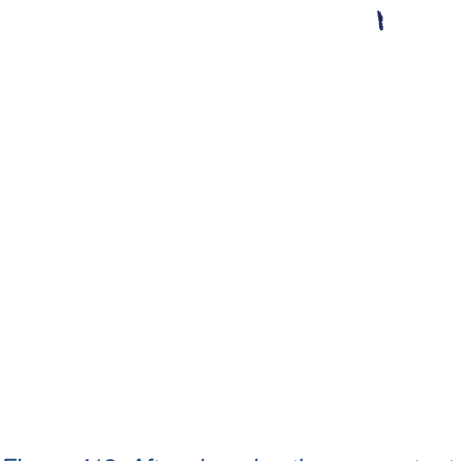


Figure 419. After changing the parameter to 6

One can see that in this example, setting the *Minimal number of neighbors* parameter to 0, 1 and 2 makes changes that are invisible to the naked eye. With values from 3 to 6, changes are already visible.

Changing the *Small clusters* parameter from 0 to 5000 every 500 gives the following results:



Figure 420. Before changing the parameter

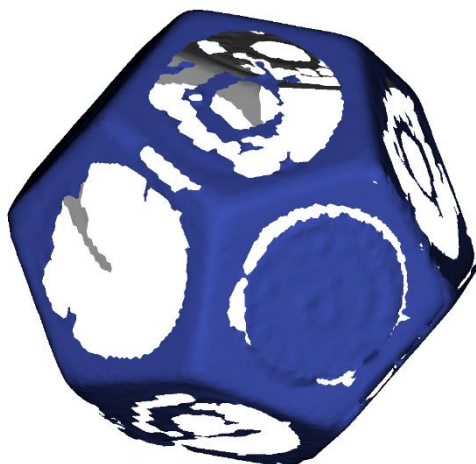


Figure 421. After changing the parameter to 500

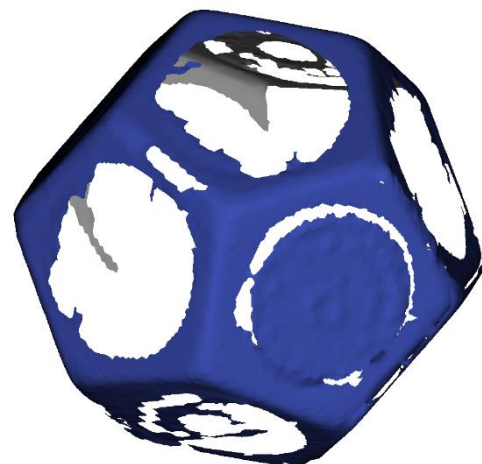


Figure 422. After changing the parameter to 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000

From the above illustrations, one can only see changes when the *Small clusters* parameter is set to 500 and 1000 up (1000 to 5000 changes are identical).

Changes in the *Erosion* parameter, where the *Minimal edge length* value is 10 and from 50 to 300 every 50, are as follows:



Figure 423. Before changing the parameter

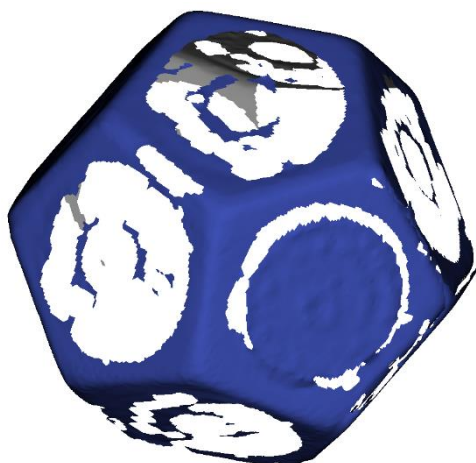


Figure 424. After changing the parameter to 10

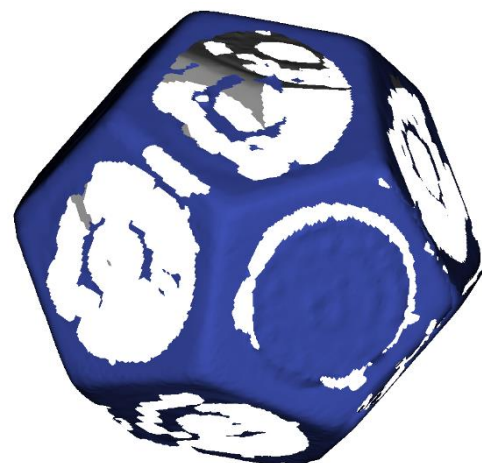


Figure 425. After changing the parameter to 50





Figure 426. After changing the parameter to 100



Figure 427. After changing the parameter to 150



Figure 428. After changing the parameter to 200



Figure 429. After changing the parameter to 250



Figure 430. After changing the parameter to 300

Impact of individual parameter changes and the mesh before modifications are often small and hardly noticeable at the first glance. Only a detailed inspection of scans allows for spotting the differences.

The parameters *Remove duplicated points and triangles*, *Remove crossing triangles* and *Triangles quality* are difficult to present on real examples in the manual, so that the changes are visible.

## 17.6 Scan Decimation

The *Decimate* panel can be opened by going to the *Post-processing* tab (1) by clicking on the *Decimate* button (2). The algorithm is used to intelligently reduce the number of points and triangles, trying to keep shapes and details on the meshes of the scans.



Figure 431. Opening decimate panel

A panel will appear with the following options:

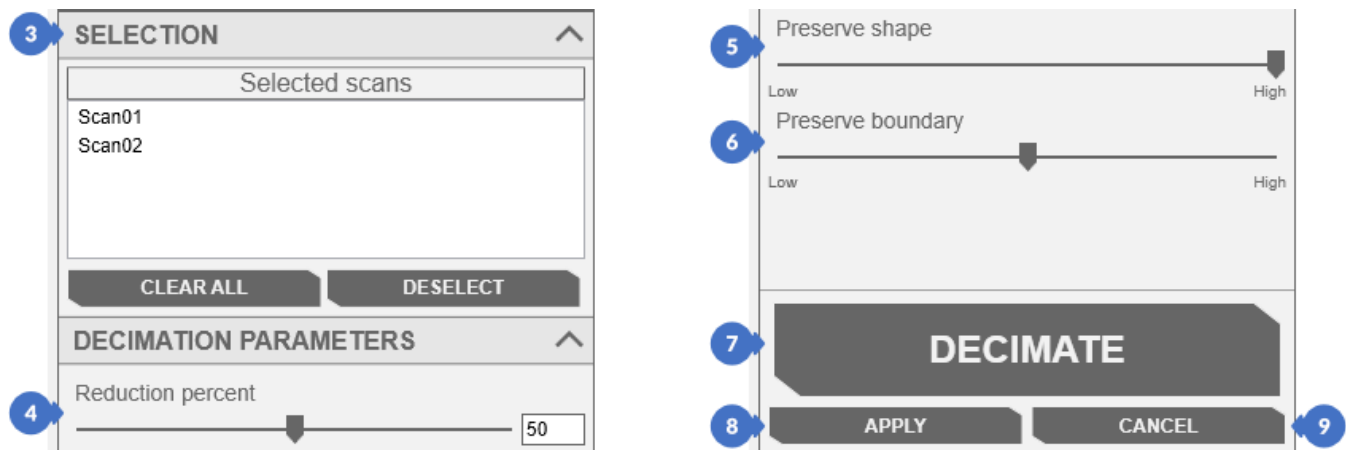


Figure 432. Decimate panel

- (3) – *SELECTION* category contains a list of selected scans in the tree. The *CLEAR ALL* button removes the selection from the tree and the items from the list. The *DESELECT* button removes the selected element from the Selected scans list and marks it off in the tree,

There are three sliders in the *DECIMATION PARAMETERS* category:

- (4) – *Reduction percent* specifies the maximum percentage of point reduction in the target mesh,
- (5) – *Preserve shape* is responsible for the degree of shape retention. The closer the slider is too *High*, the more emphasis the algorithm places on maintaining the shape. In this case – as far as it is possible – only points slightly affecting the shape retention are removed and other points are not removed. The closer the parameter is too *Low*, the less emphasis the algorithm puts on shape retention,
- (6) – *Preserve boundary* has a similar operating principle to the *Preserve shape* slider described above, but in this case the emphasis is on the edge preservation. The closer the value is to *High*, the greater is the emphasis of the algorithm on the edge preservation; while the closer to *Low*, the less stress is on the edge behavior.

There are three buttons below the parameters section:

- (7) – *DECIMATE* triggers the process of thinning out selected scans,
- (8) – *APPLY* confirms the changes made and closes the panel,
- (9) – *CANCEL* closes the panel, restoring the meshes to the state before entering the panel.

The following illustrations show a fragment of the grid before (blue scan on the left) and after (orange scan on the right) decimating with the default parameters of the algorithm.

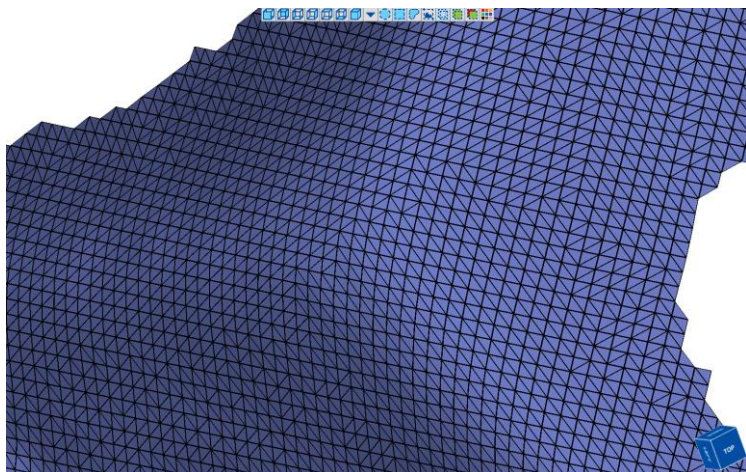


Figure 433. Before decimating

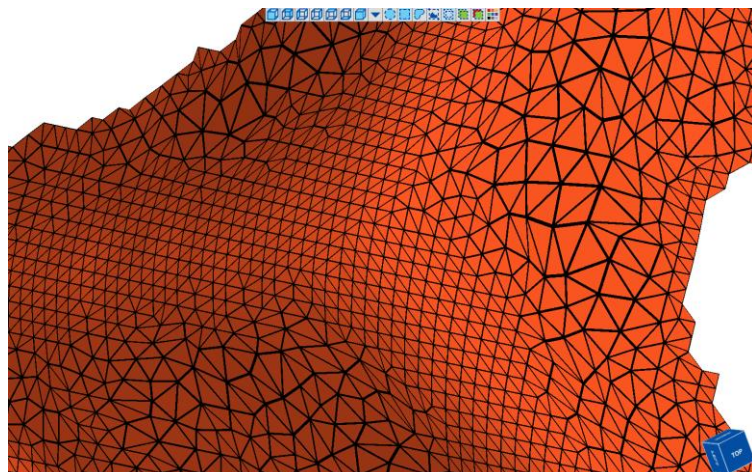


Figure 434. After decimating

It can be observed that the left fragment of mesh has more points and triangles compared to the right mesh. This is also confirmed by the information displayed in the tree:

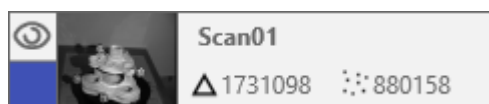


Figure 435. Number of triangles and points before decimating

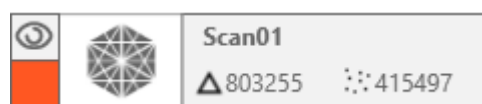


Figure 436. Number of triangles and points after decimating

## 17.7 Mesh Subdivide

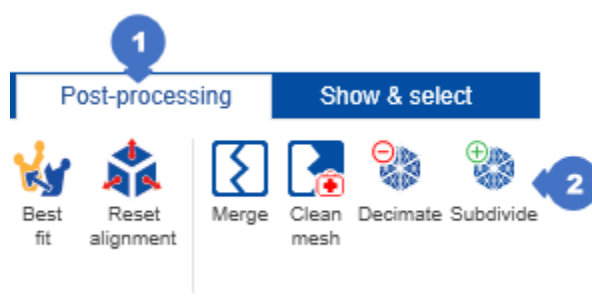


Figure 437. Opening of the subdivide panel

The *mesh subdivide* panel can be opened by going to the *Post-processing* tab (1) and clicking the *Subdivide* option (2) in the *Mesh editing* category. The algorithm is used to distribute the triangles more evenly on the scan, which increases the file size.



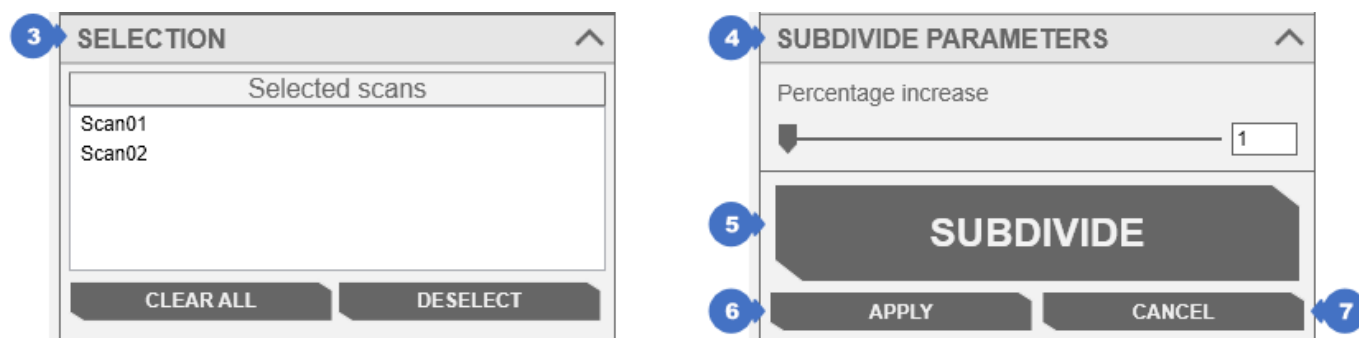


Figure 438. Mesh subdivide panel

The panel includes:

- (3) – *SELECTION* category contains the list of selected scans. The *CLEAR ALL* button clears the content of the list and unchecks the scans in the tree. The *DESELECT* button deselects the selected scan and at the same time removes the selection of the scan in the tree,
- (4) – *Percentage increase* in the *SUBDIVIDE PARAMETERS* category is used to set the maximum value in percent by how many triangles the mesh will be increased,
- (5) – *SUBDIVIDE* triggers the subdivision process of the mesh,
- (6) – *APPLY* button accepts the changes made and closes the window,
- (7) – *CANCEL* button closes the window, restoring the changes to the state before opening the panel.

Below is an example of the scan grid before the compacting (blue – left) and after the compacting (orange – right) with the *Percentage increase* set to 100%.

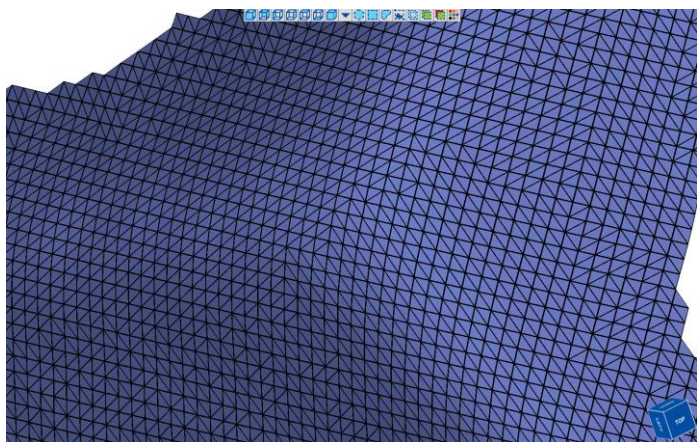


Figure 439. Before compacting the mesh

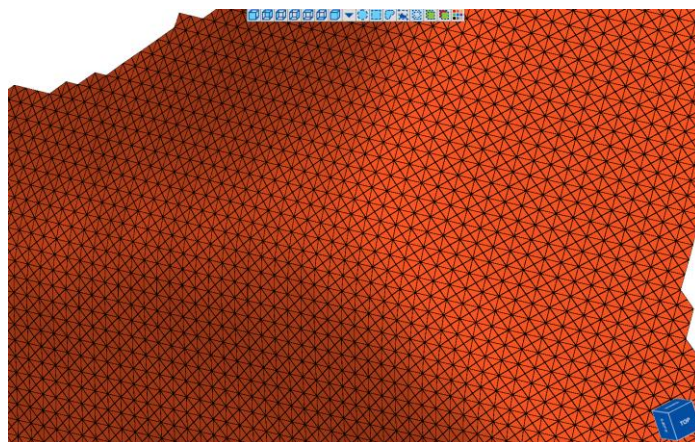


Figure 440. After compacting the mesh

The left side of the mesh shows that it has fewer points and triangles compared to the right mesh. It is also visible in the tree information:

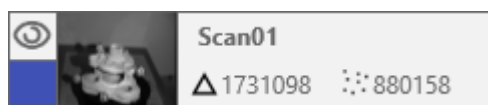


Figure 441. Number of triangles and points before subdividing

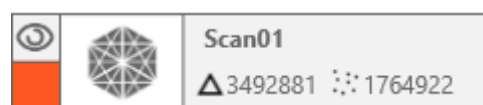


Figure 442. Number of triangles and points after subdividing



## 17.8 Fill Holes Selection

To open the *Fill holes selection* (2) panel used to fill in individual holes in scans, go to the *Post-processing* tab (1) and in the *Mesh editing* category, click the icon with the inscription *Fill holes selection* (2).

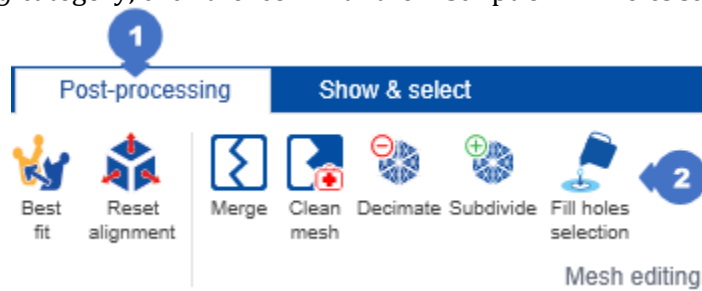


Figure 443. Opening the fill holes panel with the selection method

The panel includes:

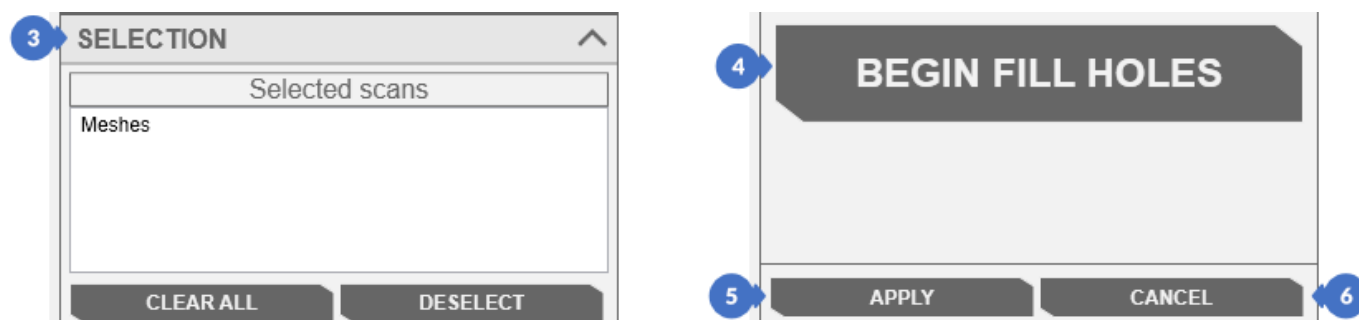


Figure 444. The fill holes panel with the selection method

- (3) – *SELECTION* category contains the list of *Selected scans*. The *CLEAR ALL* button clears the content of the list, unchecking the scans in the tree. The *DESELECT* button deselects the selected scan, at the same time removing the selection of the scan in the tree,
- (4) – *BEGIN FILL HOLES* button allows to start the process of hole filling,
- (5) – *APPLY* button accepts the changes made and closes the window,
- (6) – *CANCEL* button closes the window, restoring the changes to the state before opening the panel,

After pressing the *BEGIN FILL HOLES* button it is possible to start filling the holes in the scan / mesh. Then the visible button on the panel will change:



Figure 445. The panel after starting the hole filling process

- (7) – the *END FILL HOLES* button stops the action of hole filling.

After pressing the *BEGIN FILL HOLES* button, select one point which is close to one of the holes, and then wait for the algorithm to fill the hole. Then you can select another point and fill another hole. During its operation, the algorithm tries to fill the hole as best as possible, taking into account the curvature of the mesh. The duration of the execution depends on how large the opening is and how complex the curvature of the mesh is.



Figure 446. The mesh before filling the hole



Figure 447. The mesh after filling the hole

When all holes have been marked and filled, press the *END FILL HOLES* button. If the results are satisfactory, one can accept the changes with the *APPLY* button. Otherwise, the *CANCEL* button cancels all the changes.

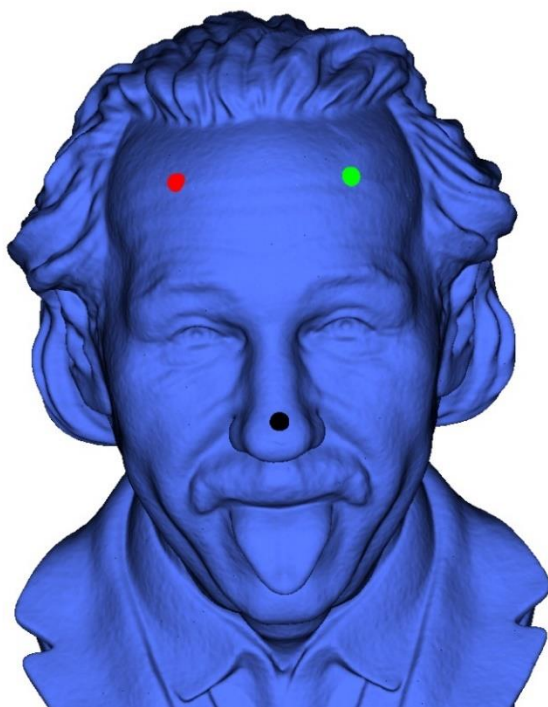


Figure 448. The mesh with filled holes before finishing the editing process



Figure 449. The mesh with filled holes before finishing the editing process

## 17.9 Fill Holes Waterproof

To open the *Fill holes waterproof* panel (2), which is used to fill in all the holes in the scans, go to the *Post-processing* tab (1) and in the *Mesh editing* category, click the icon with the inscription *Fill holes waterproof* (2).

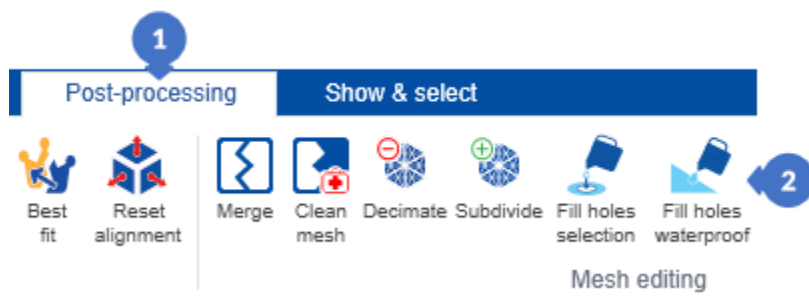


Figure 450. Open the hole filler panel from a point cloud

The panel includes:

- (3) – *SELECTION* category contains the list of *Selected scans*. The *CLEAR ALL* button clears the content of the list, unchecking the scans in the tree. The *DESELECT* button deselects the selected scan, at the same time removing the selection of the scan in the tree,
- (4) – The *Depth* slider in the *FILL HOLES PARAMETERS* category is used to determine the depth of the analysis, and thus the speed of the algorithm. The more this slider is moved to the right, the more the algorithm analyzes the curvature of the mesh around the hole and tries to fill the hole as best as possible, keeping the original curvature around the hole,
- (5) – *FILL HOLES* button runs the algorithm,
- (6) – *APPLY* button accepts the changes made and closes the window,
- (7) – *CANCEL* button closes the window, restoring the changes to the state before opening the panel.

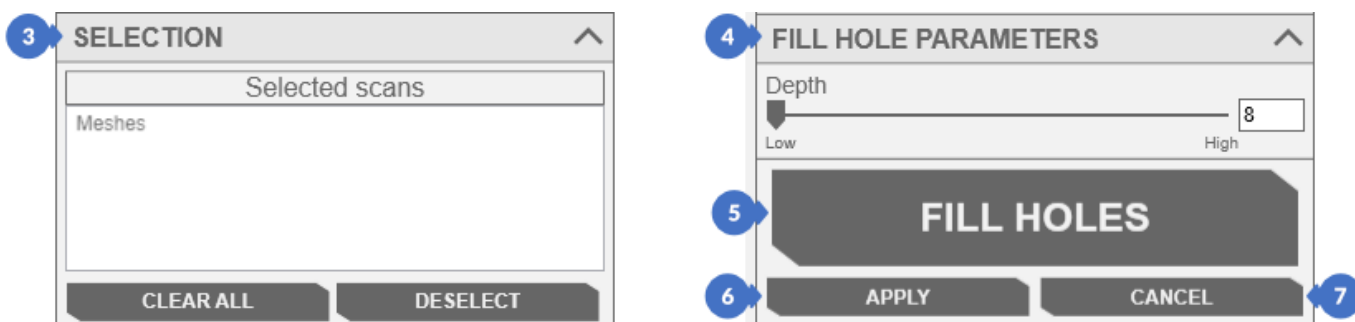


Figure 451. The hole filler panel from a point cloud

The algorithm itself tries to fill all possible holes, which is why it is not as accurate in meshing as other algorithms for filling holes. However, it is ideal when it is important to produce a complete STL file on the basis of which e.g., 3D printing can be made.

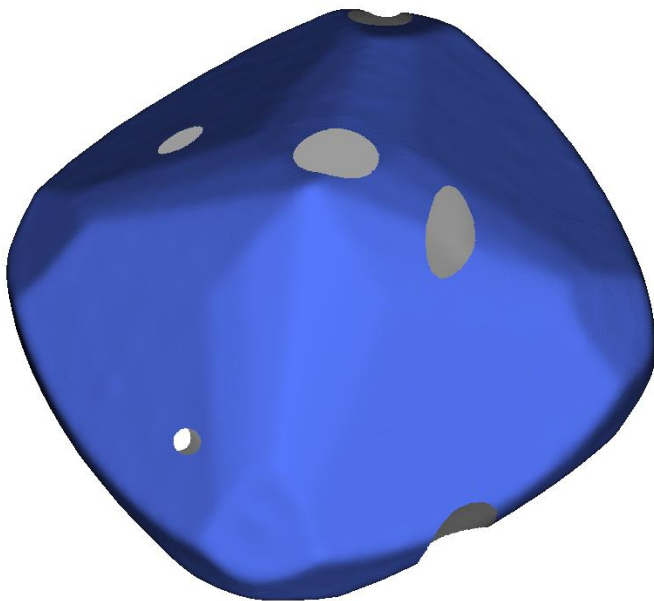


Figure 452. The mesh before using fill holes waterproof algorithm

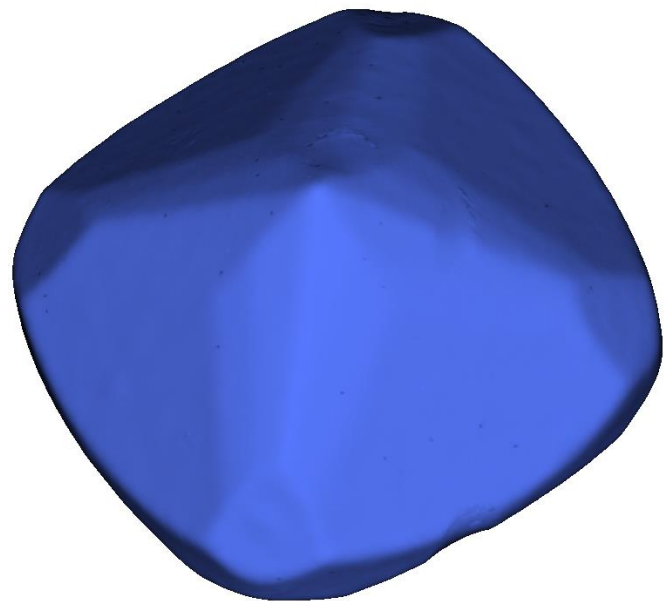


Figure 453. The mesh after using fill holes waterproof algorithm

## 17.10 Fill Holes Densely Based on Surroundings around the Hole

To open the *Fill holes densely* (2) panel, which is used to fill all the holes in the scans, go to the *Post-processing* tab (1) and in the *Mesh editing* category, click the icon with the inscription *Fill holes densely* (2).

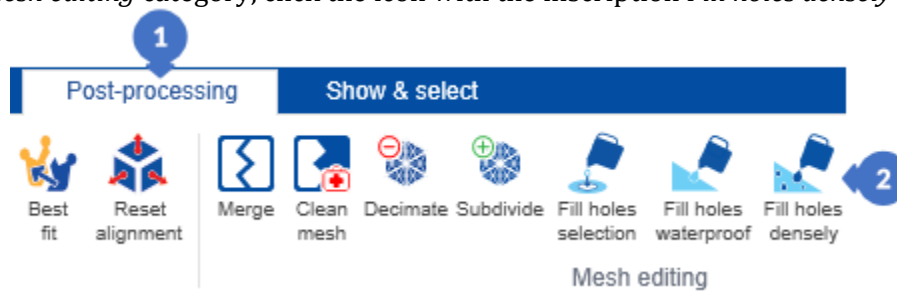


Figure 454. Open the hole filler panel based on the surroundings around the hole

The panel includes:

- (3) – *SELECTION* category contains the list of *Selected scans*. The *CLEAR ALL* button clears the content of the list, unchecking the scans in the tree. The *DESELECT* button deselects the selected scan, at the same time removing the selection of the scan in the tree,
- (4) – *Min size of holes* slider in the *FILL HOLES PARAMETERS* category is used to set the minimum hole size to be filled by the algorithm,
- (5) – *FILL HOLES* button runs the algorithm,
- (6) – *APPLY* button accepts the changes made and closes the window,
- (7) – *CANCEL* button closes the window, restoring the changes to the state before opening the panel.

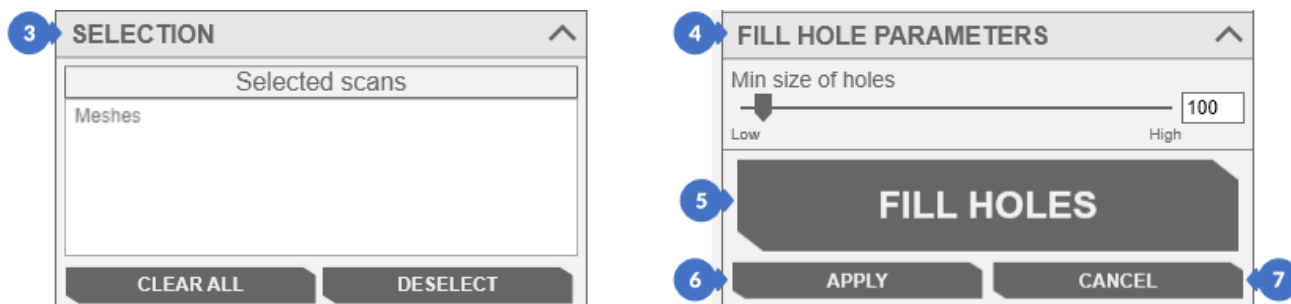


Figure 455. The hole filler panel (separately) based on the surroundings around the hole

The *fill holes densely* algorithm fills all holes in the same way as the *fill hole waterproof* algorithm but is much more accurate than the previous algorithm. In its operation, it tries to match the filled hole as much as possible to the curvature of the mesh around this hole.



Figure 456. The mesh before using fill holes densely algorithm



Figure 457. The mesh after using fill holes densely algorithm

## 17.11 Laplacian Smoothing of the Mesh Surface



Figure 458. Open the mesh surface smoothing panel using the Laplacian method

The mesh smoothing panel can be opened by going to the *Post-processing* tab (1) and clicking on the *Laplacian Smoothing* button (2). The algorithm is responsible for the process of smoothing the noise, while preserving the characteristic points in the scan.



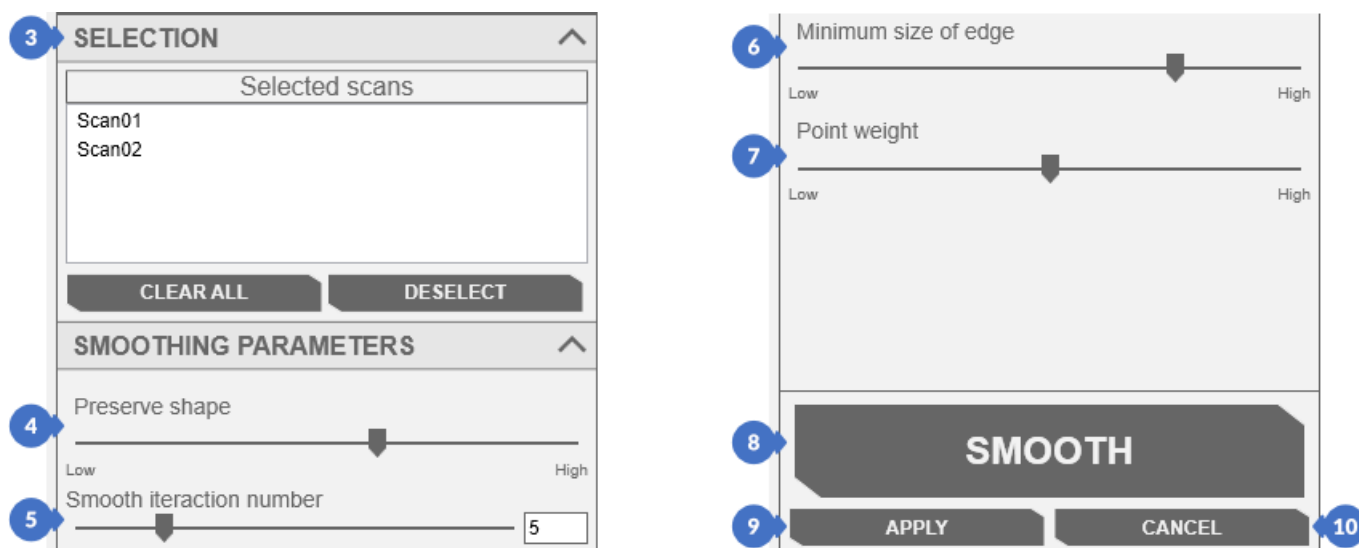


Figure 459. The mesh surface smoothing panel using the Laplacian method

The panel includes:

- (3) – *SELECTION* category contains the list of *Selected scans* for further processing. The *CLEAR ALL* button clears the list and removes the element in the tree. The *DESELECT* button deselects the selected element in the list and the selected element in the tree,

The *SMOOTHING PARAMETRES* category contains:

- (4) – *Preserve shape* slider determines the threshold between smoothing the noise and the characteristic points. The closer the slider value is too *High*, the less smoothing, the closer to *Low*, the greater the smoothing will be,

**i NOTE**

*Setting the value too high may result in an insignificant or no smoothing at all. Too low value may result in the loss of characteristic points.*

- (5) – *Smooth iteration number* is the number of repetitions of the algorithm execution,

**i NOTE**

*Each subsequent repetition has the data obtained from the previous execution – the algorithm is run several times.*

- (6) – *Minimum size of edges* slider indicates the minimum number of points in the edge above which the area is treated as an edge. The number of points below this value is considered as noise that the algorithm can smooth out,

**i NOTE**

*Scans based on normal grid are segmented, which facilitates the later noise smoothing.*

- (7) – *Point weight* slider is used to set the value used to calculate point weights enforced later in the scan smoothing process,
- (8) – *SMOOTH* button activates the smoothing process,
- (9) – *APPLY* button confirms the changes made and closes the panel,
- (10) – *CANCEL* button closes the panel and disregards all changes made in this panel.

The illustrations below show a fragment of the mesh before (blue left) and after (orange right) the smoothing is performed with the default parameter settings – only the default number of iterations (*Smooth iteration number*) has been changed from 5 to 25.



Figure 460. The mesh before Laplacian smoothing

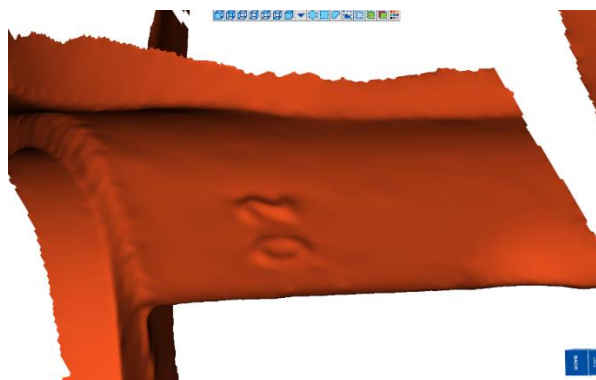


Figure 461. The mesh after Laplacian smoothing

The rough surface with slight protrusions has become smooth while maintaining the shape and the edges.

## 17.12 Taubin Smoothing of the Mesh Surface

To open the *Taubin Smoothing* panel (2), which is used to more precisely fill in all the holes in the scans, go to the *Post-processing* tab (1) and in the *Mesh editing* category, click the icon with the *Taubin Smoothing* button (2).

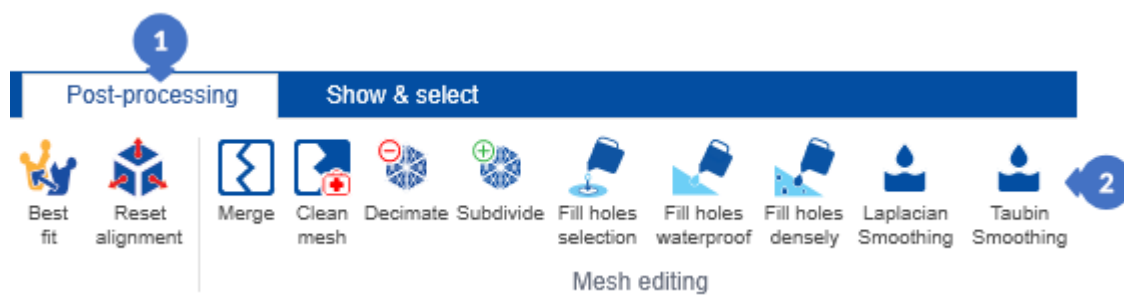


Figure 462. Open the mesh surface smoothing panel using the Taubin method

The panel includes:

- (3) – *SELECTION* category contains the list of *Selected scans* for further processing. The *CLEAR ALL* button clears the list and removes the element in the tree. The *DESELECT* button deselects the selected element in the list and the selected element in the tree,
- (4) – *Smooth iteration number* slider in the *FILL HOLES PARAMETERS* category is used to set the number of iterations for the algorithm execution, the greater the number of iterations, the better the smoothing of the surface will be, but also the longer the algorithm will execute,
- (5) – *SMOOTH* button activates the smoothing process,
- (6) – *APPLY* button confirms the changes made and closes the panel,
- (7) – *CANCEL* button closes the panel and disregards all changes made in this panel.



Figure 463. The mesh surface smoothing panel using the Taubin method

The *Taubin Smoothing* algorithm works more locally and tries to smooth out only the noise without interfering with the mesh shapes at the edges. Its operation is quite fast and should be chosen in situations in which the least possible interference with the shape of the edges in the scans / meshes is sought.

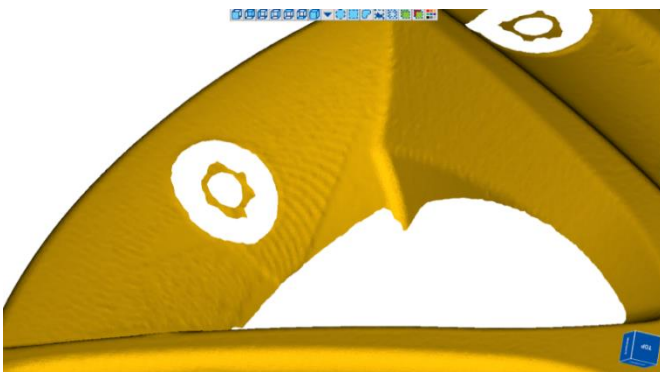


Figure 464. The mesh before Taubin smoothing

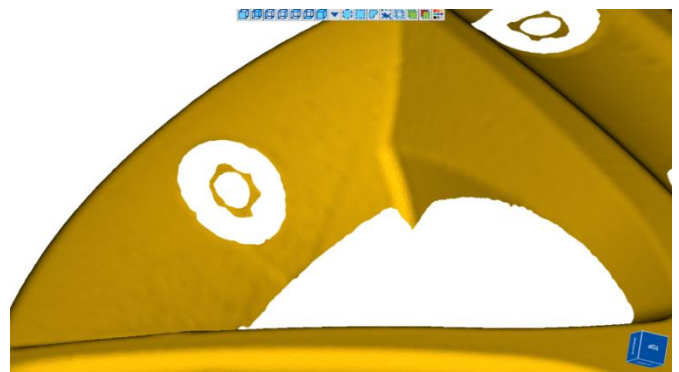


Figure 465. The mesh after Taubin smoothing



## 18 SHOW & SELECT



Figure 466. Show & select tab option

The *Show & select* tab contains the following options:

- (1) – *Select all* – selects all scans in view,
- (2) – *Clear selection* – deselects all scans in the view,
- (3) – *Invert selection* – inverts the selection in the view,
- (4) – *Duplicate mesh* – creates a copy of the scan/mesh selected in the tree,
- (5) – *Delete mesh* – deletes the mesh selected in the scan tree,
- (6) – *Fit view* - sets the view with scans in an isometric position,

■ The isometric view can also be turned on by clicking on the *Isometric* icon in the view – the topic is discussed in Subsection 4.9.2, point (7).

- (7) – *Zoom in* – zooms in the object in the view,
- (8) – *Zoom out* – zooms out the object in the view

# 19 ADDITIONAL FUNCTIONS

## 19.1 Software Version



Figure 467. Window visible at startup

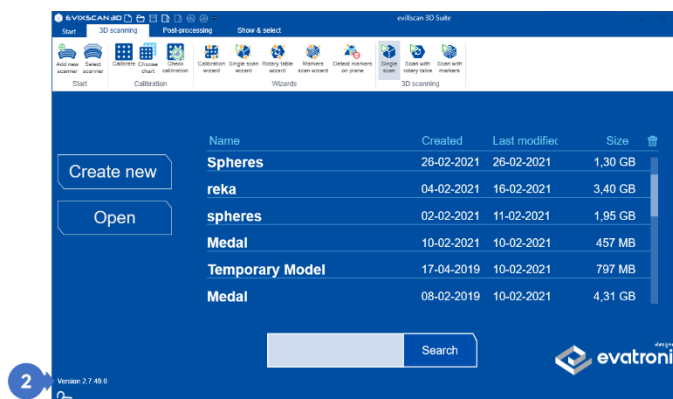


Figure 468. Welcome screen

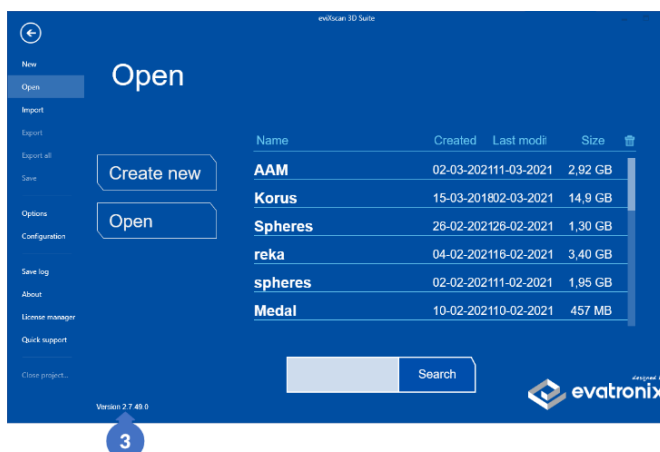


Figure 469. Open tab in the menu

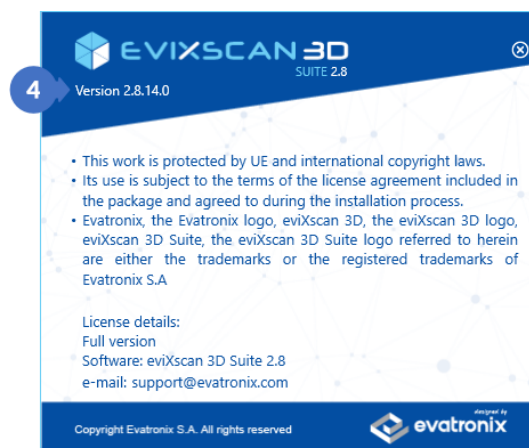


Figure 470. Window with information about the software

You can check the software version in four places. The first is the splash window (1). The second place is the welcome window (2) where you can check the software version number. The *Open* tab (3) in the menu is the third place, while the fourth and the last is the window *About* the software (4) which can be called from the menu with the *About* button.

## 19.2 Log File Saving

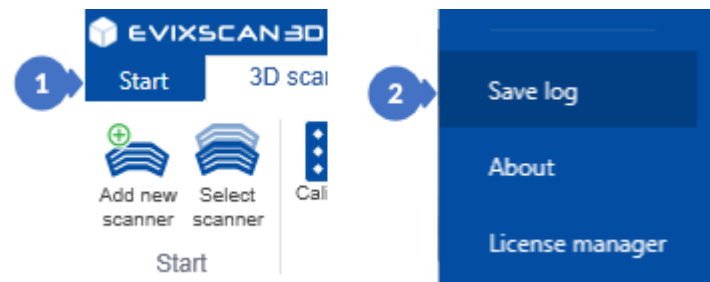


Figure 471. Opening the log file saving window

Log files are an important element when reporting information about the software malfunction. To save the log file, enter the *Start* menu (1) and then click the *Save log* button (2).

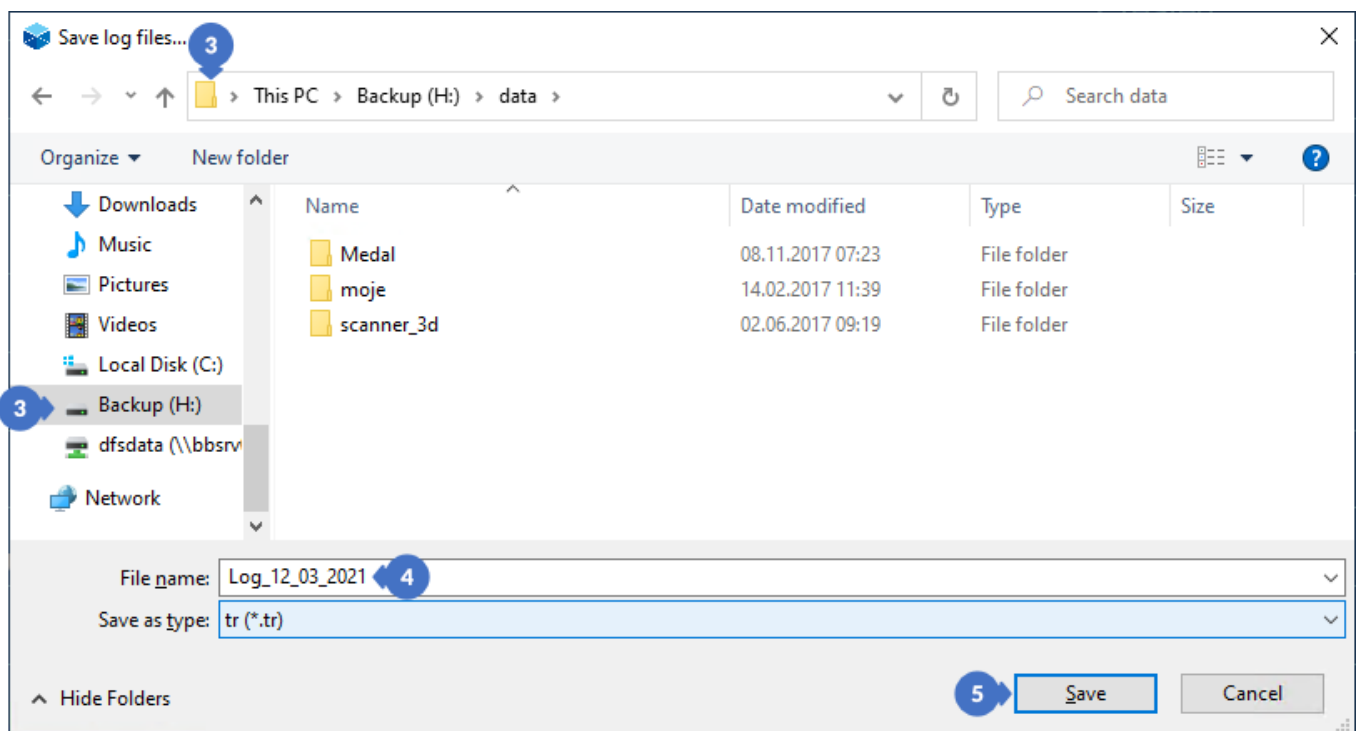


Figure 472. Log saving window

In the window, indicate the location to save (3), enter the name (4) and click on the *Save* button (5). The information file generated in this way should be sent to the Technical Support contact.

✉ Contact details are provided in Subsection 19.3.

## 19.3 Technical Support (*Quick Support*)

In case of problems, technical support can be obtained by contacting the Support Team by phone or e-mail.

☎ (+48) 33 499 59 32

✉ [support@evatronix.com](mailto:support@evatronix.com)

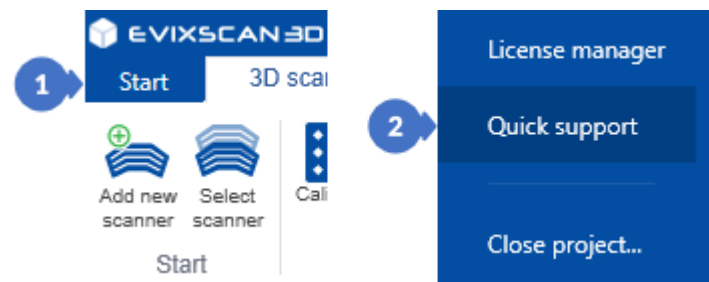


Figure 473. Launching the Quick support application

To facilitate the process of verifying the problem at the customer's site, the *Quick support* application was developed based on the TeamViewer tool, which can be launched by entering the *Start* menu (1) and selecting *Quick support* (2). The applications can also be launched by entering the Windows start bar and searching for the *eviXscan 3D Suite* folder in the Applications and the *Quick support* shortcut in it. Enter the ID number (3) displayed by the application and the password (4) in the running application to connect with the Support Team.

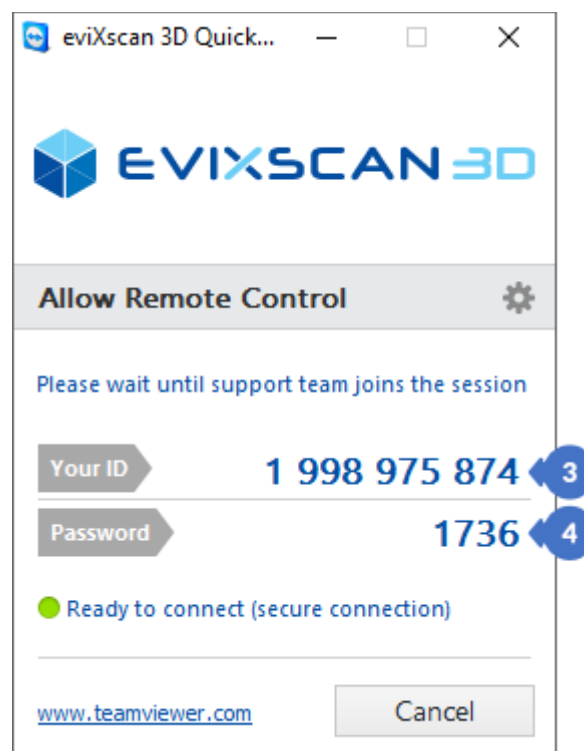


Figure 474. Window of Quick support

Each time the application is launched, a new password is generated. The password can also be changed by clicking on the password options icon (5) that appears next to the password when the mouse is hovered over it. There are two options available: the option to create a new random password (*Create a new random password*) (A) and the option to copy the password to the clipboard (*Copy random password to the file clipboard*) (B).



Figure 475. Password management options



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