



**SHINING 3D<sup>®</sup>**

# FreeScan UE

## User Manual



V1.2.0.0

**SHINING 3D<sup>®</sup>**

# Foreword

## General

The Manual introduces the information concerning the installation and use of FreeScan UE (hereinafter referred to as the “Scanner”).

## Safety Instructions

Signal	Meaning
	Additional information for particular situation.
	Improper actions or conditions that may damage the product or injury, and consequently void your warranty or service contract or lose the customer data or system data.
	The safety instructions that you must precisely follow to avoid injury. Failure to observe can cause damages to your product, or result in personal injuries.

## Revision History

No.	Version	Revision Content	Release Date
1	V1.2.0.0	Revised calibration and scanning content.	September, 2021
2	V1.1.0.0	First release.	June, 2021

## About the Manual

The User Manual is related to your safety, lawful rights and responsibilities. Read it carefully before installing and using the product.

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- Disputes arising from the Manual and related Products thereof shall be governed by the laws of the People's Republic of China.
- In the event of any ambiguity and/or any advice on the contents of the Manual, contact us by the contact information provided herein.

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# 1. Hardware

## 1.1 Introduction

FreeScan UE scanner is a handheld laser 3D scanner independently developed by Shining 3D, featured in the fast scanning speed, complete data acquisition, light weight, and convenient handholding operation. Besides, the device supports repeatable high-precision operations, without discrimination on the material and color of the objects to be scanned. Therefore, black or reflective surfaces are still scannable. This device is mainly used in industries such as automobile industry, transportation, aerospace, mold inspection and machinery manufacturing.

## 1.2 Appearance

Before using the Product, carefully read the content on the yellow sticker, including Device serial number, laser precautions, etc.

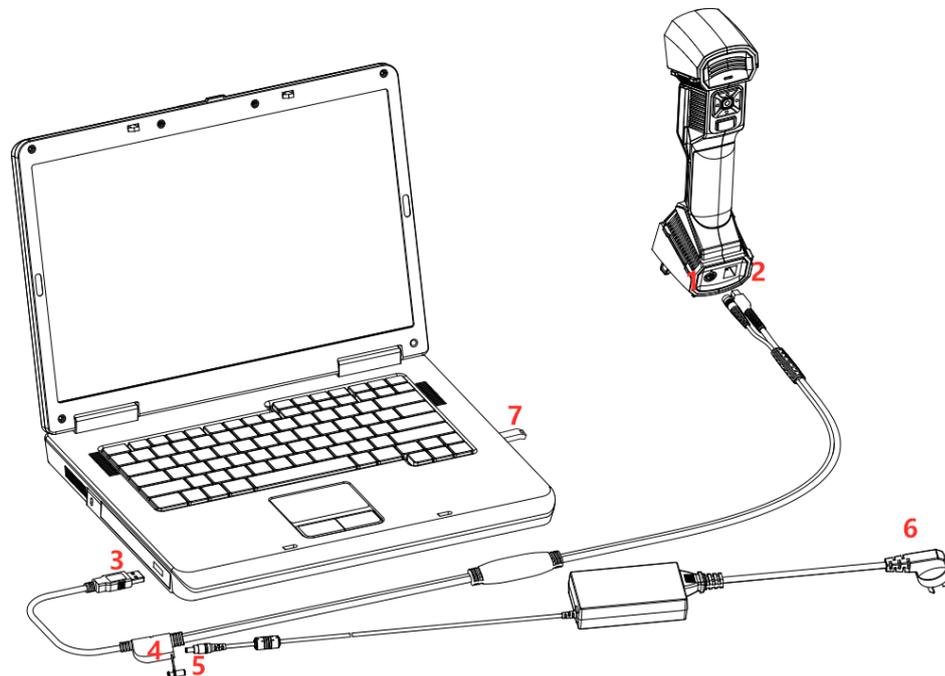


Description of buttons on the Scanner

No.	Description	No.	Description
1	Menu	2	Camera brightness adjustment

3	Adjustment of the size of display in the software window	4	<p>Point cloud indicator: Only after the indicator of the Device lights up can the user enable the software for operations. When the light is on, the point cloud indicator lights up around the menu button.</p> <p> <span style="display: inline-block; width: 20px; height: 10px; background-color: cyan; margin-right: 5px;"></span> Standby  <span style="display: inline-block; width: 20px; height: 10px; background-color: green; margin-right: 5px;"></span> Pre-scan  <span style="display: inline-block; width: 20px; height: 10px; background-color: red; margin-right: 5px;"></span> Scanning  <span style="display: inline-block; width: 20px; height: 10px; background-color: blue; margin-right: 5px;"></span> Scanning paused </p>
5	<p>Scanning button</p> <ul style="list-style-type: none"> <li>● Single click: Prescan/scan/pause</li> <li>● Press and hold: Generate point cloud</li> </ul>	6	<p>Scanning distance indicator:</p> <p> <span style="display: inline-block; width: 20px; height: 10px; background-color: blue; margin-right: 5px;"></span> Too far  <span style="display: inline-block; width: 20px; height: 10px; background-color: green; margin-right: 5px;"></span> Suitable distance  <span style="display: inline-block; width: 20px; height: 10px; background-color: red; margin-right: 5px;"></span> Too close </p>

### 1.3 Connect Cables



Step 1 Connect aviation cable (4) to power port (2) and USB port (1) on the Scanner.

Step 2 Connect power cord (6) and the power adapter (5).

Step 3 Connect power adapter (5) into aviation cable (4).

Step 4 Connect USB port (3) on the aviation cable to the PC USB 3.0 port.

Step 5 Insert the Dongle (7) into the PC USB port.



Ensure that cables are not loose during the above operations. You are suggested to use fastening tools to prevent the device from being offline.

## 2. Software

### 2.1 Introduction

FreeScan software supports UE scanners. With user-friendly software interface, full process scanning guidance, simplified software settings, you can operate the Scanner easily.

### 2.2 Operating Environment

Recommended operating environment of the software:

- Operating system: Windows 10 Pro. and above (64-bit only)
- CPU: Intel Core™ i7 and above
- Graphics card: NVIDIA standalone graphics card, RTX3060 (with 6G graphics card memory, RTX series recommended) and above
- Memory: 32G and above



Notes:

The device is only compatible with Windows 10 and above. Mac OS not available for now.

### 2.3 Install Software



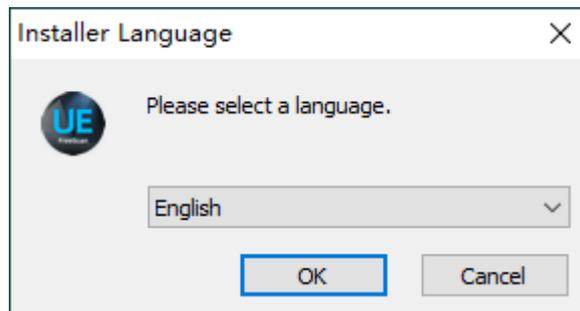
Notes:

Before installing the software, plug the provided dongle into the USB port of the computer for authentication of the encrypted software.

Step 1 Open the USB flash drive and copy the installation package onto the computer.

Step 2 Double-click to run the installation package. The “Installer Language” window pops up.

Step 3 Select the desired language and click “OK”.



Step 4 After “FreeScan UE XXXX” Installation Wizard pops up, click “Next”.

Step 5 On the License interface, click “I accept”.

Step 6 On the Privacy Policy interface, check “I have read and agree to the privacy policy”, and click “Next”.

Step 7 After selecting the path for the installation, click “Install”. To change installation path, click “Browse”.



**Attention:**

Do not install the software under the Program Files or Program Files (x86) folders in the partition where

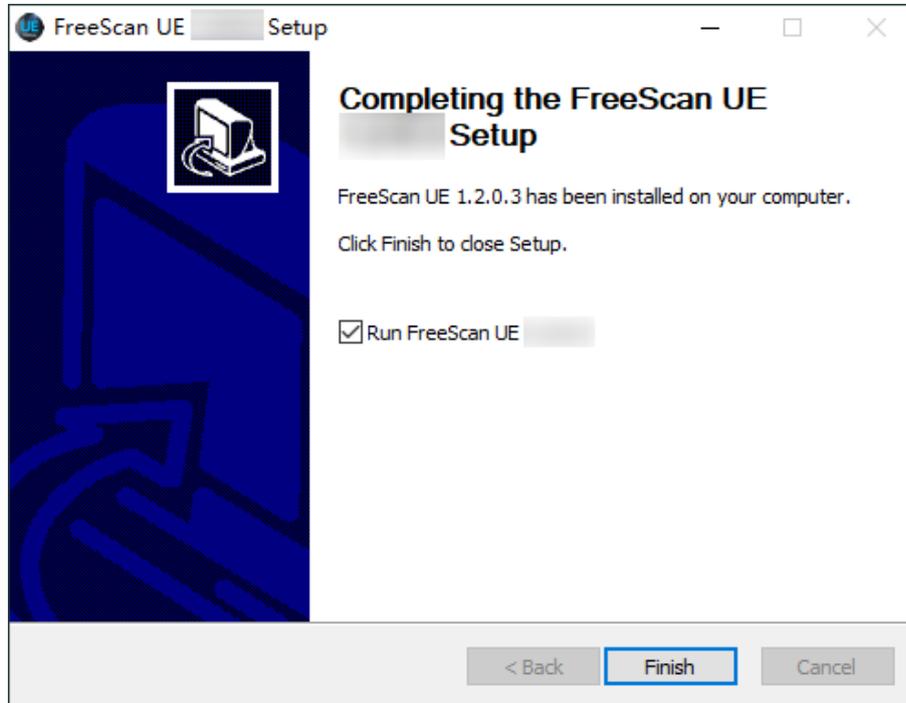
the windows system is. The software may work abnormally due to conflicts in authorizations.

Step 8 Click “Finish” to complete the installation.



**Notes:**

Check “Run FreeScan UE 1.2.X.X”, then click on “Finish”. The software will run automatically after installation is completed.



## 2.4 Upgrade

### 2.4.1 Upgrade Firmware

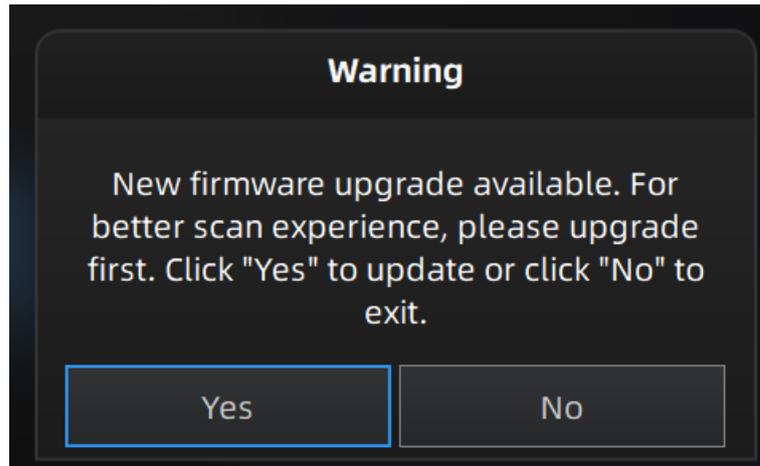
The basic working software of the Device is firmware. When the firmware version is too low and incompatibility becomes an issue, it is necessary to upgrade the firmware, to get access to more updated features.

Preparation before firmware upgrade:

- Make sure that the device is powered on during the upgrade; avoid interrupted upgrade due to power failure.
- Back up the original firmware so as to retrieve it in case of upgrade failure or in case that the user finds the new version unsatisfactory.
- Download the new firmware files to the local computer where the software has been installed.

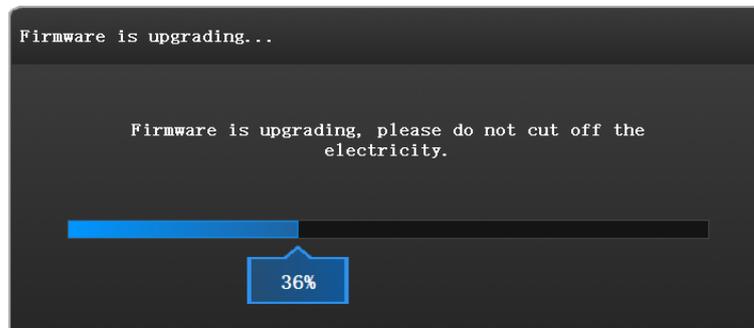
Upgrading process:

Each time when the software is run, the firmware status is automatically detected. If incompatible firmware is detected, the system prompts the necessity for firmware upgrade, as shown in the figure below. Click “Upgrade” to start the firmware upgrade.



**Notes:**

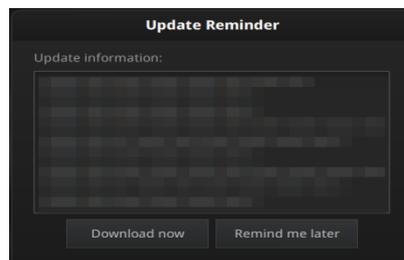
- After upgrade is confirmed, the software will be shut off automatically.
- The upgrade takes about 5 minutes.



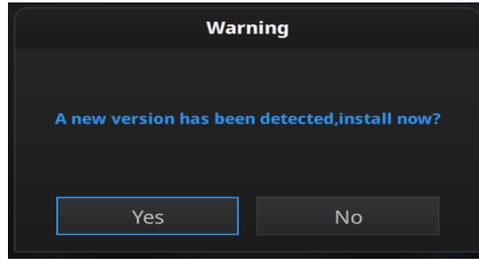
## 2.4.2 Upgrade Software

Software upgrading is conducted to better satisfy the users by providing patches they can download to their system to optimize its performance and/or append new features.

Always make sure that the software in use is of the latest version. If it is not, there will a reminder popping up immediately after opening the software, prompting updates.



Click "Download Now". The software will automatically download the installation package in the background. Do not close the software during the download. When the download is completed, a window automatically pops up for users to decide whether the new version shall be installed immediately. Click "Yes" to start installing the new updates.



## 3. Operation

This Chapter mainly explains how to perform scanning, cutting, and setting to the models through the software.

Double-click  to enter the operational interface of FreeScan UE.

### 3.1 Workflow

If it is the first time you operate the system, refer to the following process.

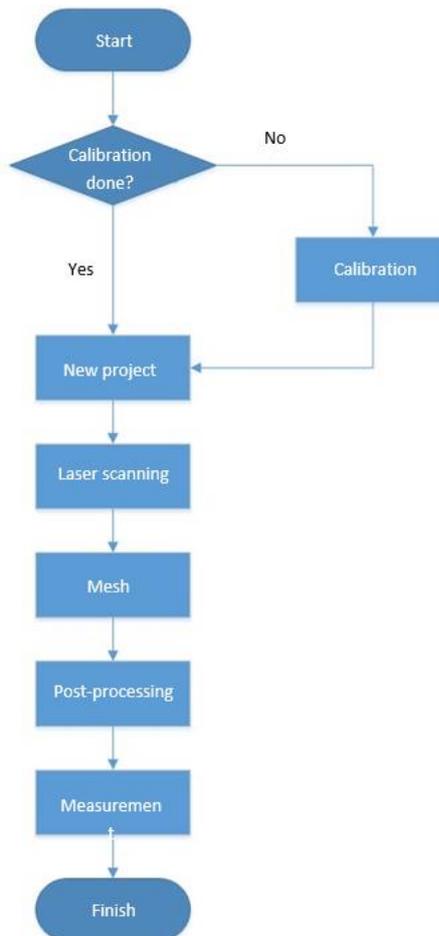


Figure 3-1 Operation flowchart

### 3.2 Calibration

Calibration is performed to the whole Device. Through the calibration, the device parameters are recalculated, which not only ensures the accuracy of the Device, but also improve the quality of its scanning.

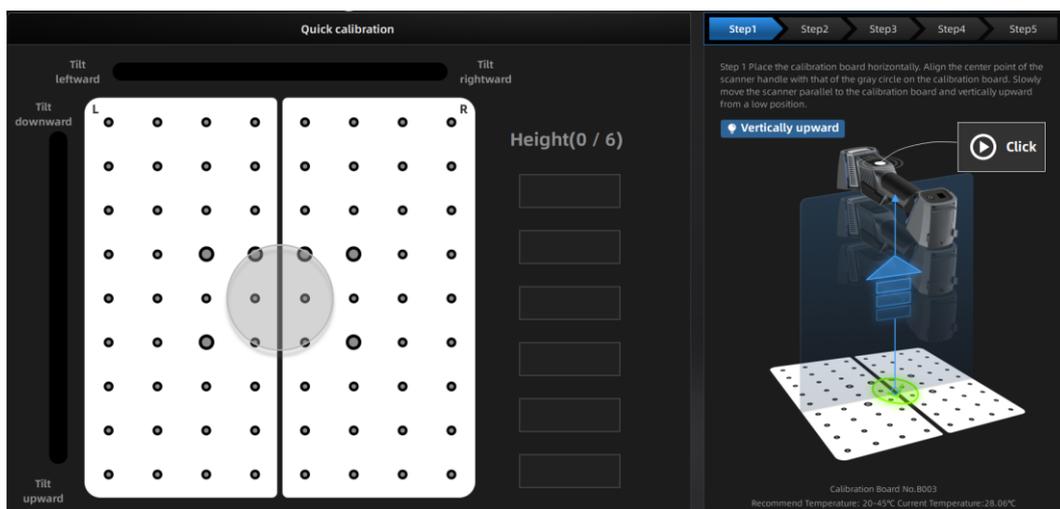
#### 3.2.1 Notes

- The accuracy of calibration directly affects the scanning accuracy of the System. Re-calibration is required in the following circumstances:
  - When the scanner is used for the first time, or when it is reused after being laid idle for a long period of time.

- The scanner was severely shaken or shocked during transportation.
- Severe accuracy reduction, such as frequent errors in alignment, is observed during the scanning.
- Incomplete data is acquired during the scanning or serious deterioration of the quality of scanned data.
- Always make sure that the working side of the calibration board is clean and free of scratches.
- Do not place heavy objects or sundries on the calibration board to avoid damage to the working side of the calibration board.
- Keep the calibration board away from corrosives, metals and sharp objects to avoid corrosion or damages.
- It is not recommended to wipe the calibration board. When cleaning the board becomes very necessary, gently wipe it with a piece of clean moisture cloth. Do not wipe the calibration board with chemicals or alcohols.
- After using the calibration board, put it in a flannel bag.

### 3.2.2 Introduction to the Calibration Interface

Calibration shall be performed before using the Device for the first time and you will directly enter the calibration interface.



When calibrating, 3 dimensions shall be taken into consideration, namely tilt leftward and rightward, tilt upward and downward, and height. When the height requirement is met, the blue bordered box becomes green; when tilting leftward/rightward or upward and downward all meet the requirements, the sliders in the bar box overlap and become green.

Item	Description
Tilt leftward/rightward	Tilt leftward or rightward along Axis Y.
Tilt upward/downward	Tilt upward or downward along Axis Z.
Height	Move upward along the upper Axis of Axis Y.

You can refer to the steps and diagram shown on the right to perform the calibration.

### 3.2.3 Quick Calibration

The system directly enters the calibration interface when it is used for the first time. Alternatively, users can select “Calibration” located on the navigation bar to switch to the calibration interface.

Follow the steps provided by the calibration wizard on the right side of the interface.

Step 1 Place the calibration board horizontally.

Step 2 According to the height indicating box, adjust the distance between the scanner and the calibration board.

Step 3 Align the center point of the Device’s handle with the center point of the gray circle on the calibration board.

Step 4 Place the scanner in the same direction as shown in the figure.

Step 5 Press the scan button on the scanner to start data collecting.

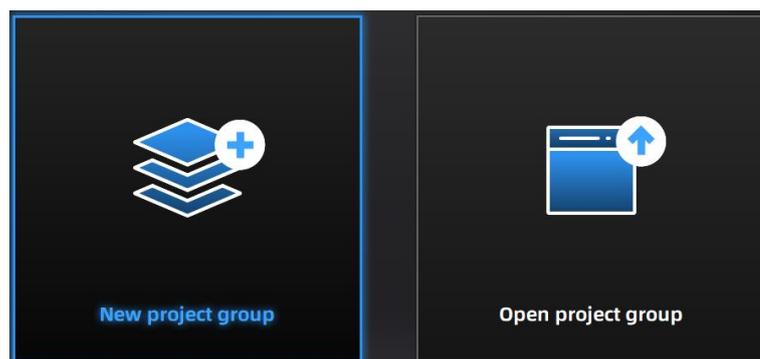
Step 6 Move the Device slowly upwards from lower point alongside the central axis.

Step 7 Keep moving until the height box turns green.

### 3.3 Create a Project

Create a project (or import multi-projects) before scanning any objects. A newly created project provides a path to save the scanned model data, which facilitates the users to process the acquired data.

Step 1 In the project management window, click “Creating Multi-Projects”, and the window of creating new projects will pop up.



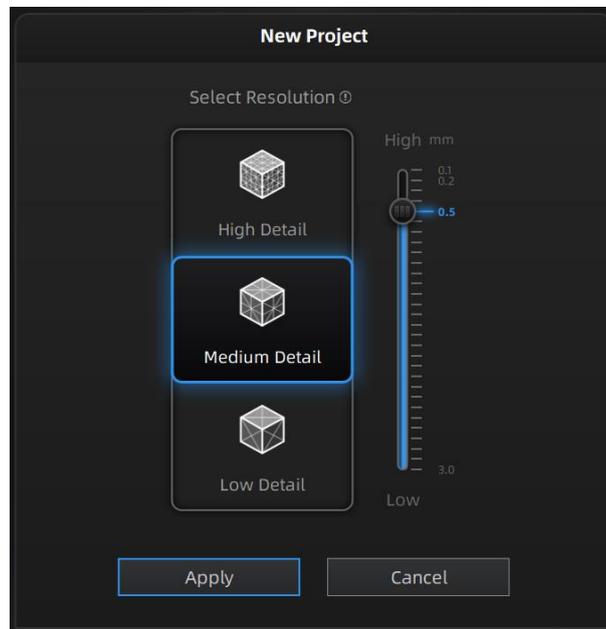
Step 2 Create a new folder or select an existing folder as the path for the storage of the project data. The folder name is generally named after the project name.

Step 3 Enter the resolution setting window, where “High Detail”, “Medium Detail” or “Low Detail” can be selected for default resolution options; alternatively, the slider can be dragged to set the resolution.

- Resolution: The higher the resolution is set to be, the finer the scanning effect will be. Models scanned at lower resolution can be easily distorted. In contrast, models scanned at high resolution occupy larger amount of storage space and take longer time to scan. Therefore, when scanning small

models that require high precision, such as stamps, it is recommended to select high resolution. On the other hand, larger models without high requirements on precision, such as doors of automobiles, are recommended to be scanned under lower resolutions.

- Point distance: Refers to the distance between points in the point cloud. Drag the slider on the right to adjust the point distance. The higher the resolution is, the smaller the point distance shall set to be.

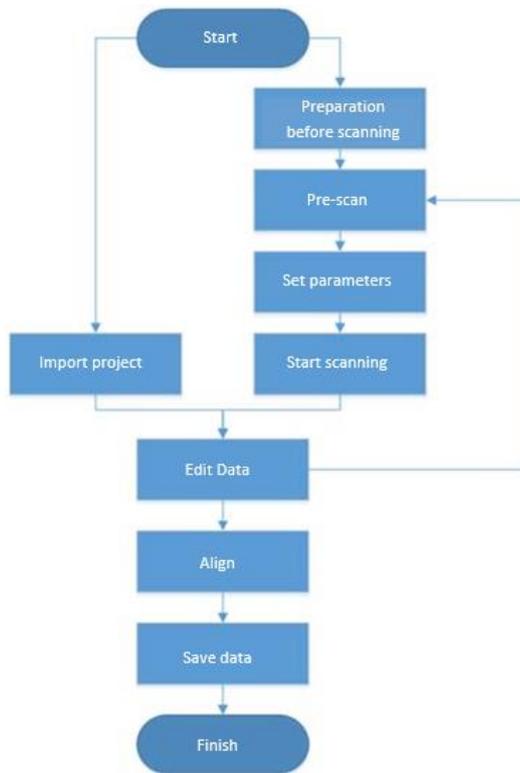


Step 4 Click “Apply”.

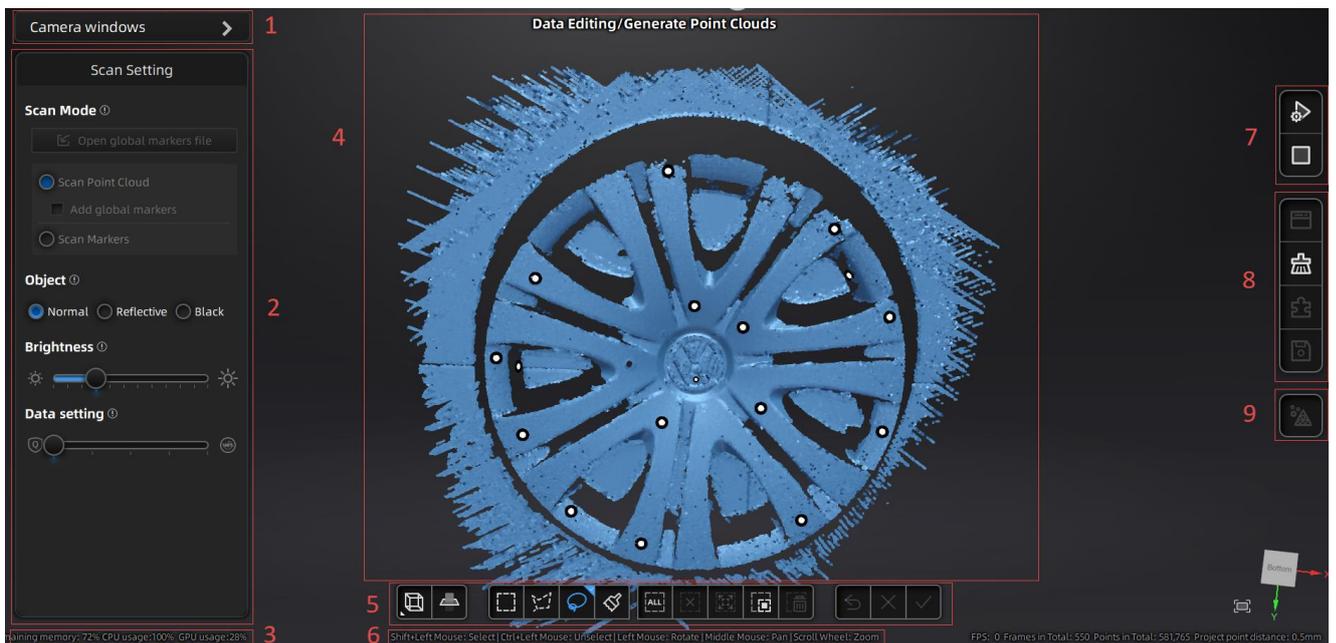
### 3.4 Scan

Laser scanners can quickly and accurately obtain 3-dimensional data of objects scanned. Laser scanners are featured in non-contact measurement, high data sampling rate, active emission of scanning light source, low requirements for use, and strong environmental adaptability. These devices can be used in the complex environments and spaces for scanning operations, and directly and completely acquire the 3D data of physical objects with various sizes and complicity and store them into computers, and then quickly reconstruct the 3D model of the target as well as various geometric data concerning the points, lines, surfaces, and solids. 3D data of the objects’ surfaces are obtained in form of point clouds, which is convenient for multiple subsequent processes.

For the first scan, operate by following the procedures below.



Introduction to the scanning interface:



### Introduction to the scanning interface

No.	Item	Description
1	Camera window	It is used to preview the actual scene during scanning. Parameters can be adjusted accurately through the camera window.
2	Scan Setting	Through scanning settings, the scanning mode and parameters can be set. <ul style="list-style-type: none"> <li>● Scan mode</li> </ul>

		<p>Default is scan point cloud. You can choose scan point cloud, scan markers or open global markers file.</p> <ul style="list-style-type: none"> <li>◆ Scan point cloud: Acquire the data as point cloud. It could be switched to scan point cloud mode after scanning markers. It is also feasible to import the generated global marker file and then scan the point cloud.</li> <li>◆ Add global markers: When scanning markers in the specific area, you might also scan markers around the specific area (simply to say, surrounding global markers). To add surrounding global markers into the original global markers, import global markers, switch to point cloud scanning and select Add Global Markers.</li> <li>◆ Scan markers: Only scan markers. Acquire marker data fast. There is no laser line in the scanning process. Markers can be scanned to supplement in the global marker file generated before.</li> </ul> <ul style="list-style-type: none"> <li>● Object Select the object surface material accordingly: Reflective, Normal, Black.</li> <li>● Brightness Adjust the camera brightness: View the camera window and adjust the brightness until you can see clear data and markers.</li> <li>● Data setting: Scanning some black glossy object, when brightness is already set to its limits, but still very less data is captured. Please turn the data setting cursor from left to right. It will help scanning, but with noise.</li> </ul>
3	Remaining memory, CPU occupancy rate and video memory occupancy rate	<ul style="list-style-type: none"> <li>● Remaining memory: the remaining space of the memory is displayed.</li> <li>● CPU occupancy rate: this is the display of the computer's memory occupied by the active programs. If running programs occupy a large proportion of the computer's memory, it is recommended to close other non-scanning related programs and wait patiently.</li> <li>● Video memory occupancy rate: the is the rate of utilization of the graphics card.</li> </ul>
4	Preview window	Window for viewing the pre-scan and scanning model.
5	Data editing	Editing and perspective adjustments to the model can be performed. For related operations, please refer to 3.4.9 Data Editing.
6	Shortcut keys	Quickly move the model or adjust its angles through shortcut keys.
7	Scan and generate point clouds	<p>Click  to start scanning; click  to pause scanning.</p> <p>Click  to generate a point cloud data file.</p>
8	Functions	Importing projects, manual alignment, deleting and data saving can be performed. For related content, please refer to 3.4.8 Project Management and 3.4.10 Alignment.
9	Mesh	For related operations, refer to 3.4.11 Mesh.

### 3.4.1 Preparation

In order to obtain ideal scanning effects, please pay attention to the following details when scanning:

- Markers shall be attached to models to be scanned. If the Device fails to scan markers, it will not emit laser rays.
  - Attach the markers as homogeneously as possible, and avoid attaching markers that follow a pattern.
  - Four markers are required for the alignment at communal areas.
  - Ensure that the Device's camera is able to scan at least 4 markers within the normal scanning range.
  - Please attach markers smaller than 3mm on the edges and/or at small facets of the model.
  - Do not attach the markers on the surface with high curvature.
  - Do not use damaged or incomplete markers.
  - Do not use greasy, dusty, or dirty markers.
- The sizes of the models to be scanned range from 30mm to 4m.
- When scanning a model prone to being deformed, make sure deformation does not occur.

### 3.4.2 Pre-scan

Pre-scan allows users to adjust the parameters according to the effect previewed to achieve the best scanning effects.

Click  located on the right side of the interface or press the Scan button on the Device to enter the pre-scan mode.



Notes:

- Under the pre-scan mode, model data are not collected.

- The pre-scan mode can be switched on after operations such as creating a new project, importing a project, pausing scanning, and finishing scanning.

Click  or press the Scan button on the Device again to exit the pre-scan mode and start scanning.

### 3.4.3 Parameter Setting

Scanning parameters can be set during pre-scan or scanning, including setting of scanning distance, light source modes, scanning objects, brightness and data settings.

- Adjustment of the scanning distance: There is a bar on the left side of the pre-scan interface, displaying the scanning distance. If the bar is green, that means the scanning distance is the best; if it is red, then the distance is too close; blue means the distance is too far. Do adjustments according to these color messages until the best scanning distance is achieved. Lights indicating the scanning distance are also available on the handle of the Device. When the indicator is green, the distance is the best; if it is blue, the distance is too far; if red, too close.

Table 3

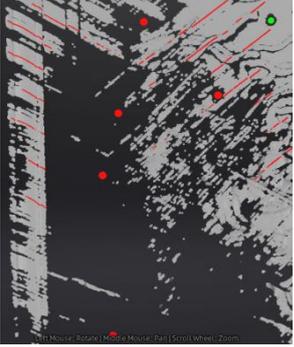
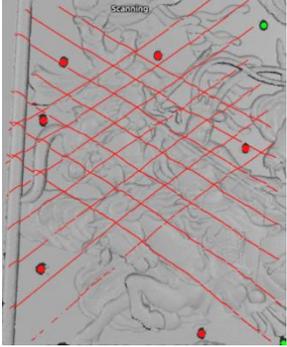
		
Too close	Suitable distance	Too far

- Scanning objects: Roughly select different brightness levels according to the materials of different objects, and then make fine-tunes. Select “Reflective” when scanning reflective objects and select “Black” when scanning dark or black objects.
- Brightness: By sliding the slider on , the scanning brightness can be adjusted. While viewing the camera window, adjust the brightness until data and mark points are clearly visible.

#### Attention:

If the brightness is too high, a large amount of noise can occur to the scanned data.

Table 4

	
<p>The parameters are inappropriately adjusted. Please adjust the scanning distance and/or scanning brightness</p>	<p>Parameters are appropriately adjusted.</p>

- Data setting: When adjusted to high quality , less noise is present in the data; and if adjusted to high completeness , black objects that are difficult to scan can be scanned. At this time, more complete data can be obtained, but more noise will be resulted.



**Attention:**

When setting the scanned object, simultaneously adjust the interlinked parameters of “Brightness” and “Data Setting”.

### 3.4.4 Point Cloud Scanning

A point cloud is a set of data points in the coordinate system. In a 3D coordinate system, these points are defined by values on axis X, Y, and Z, and are used to identify the external surface of the objects to be scanned. When the Device scans a large number of markers on the surface of an object, it acquires a point cloud data file. Users can obtain a large amount of point cloud data by scanning an object, which is convenient for the subsequent model rendering and measurement.



**Attention:**

After scanning the point cloud, switching to scanning global markers or importing frame point files will clear the current scanning data.

Step 1 After completing the pre-scan, click  on the right side or press the Scan button on the Device to start scanning.

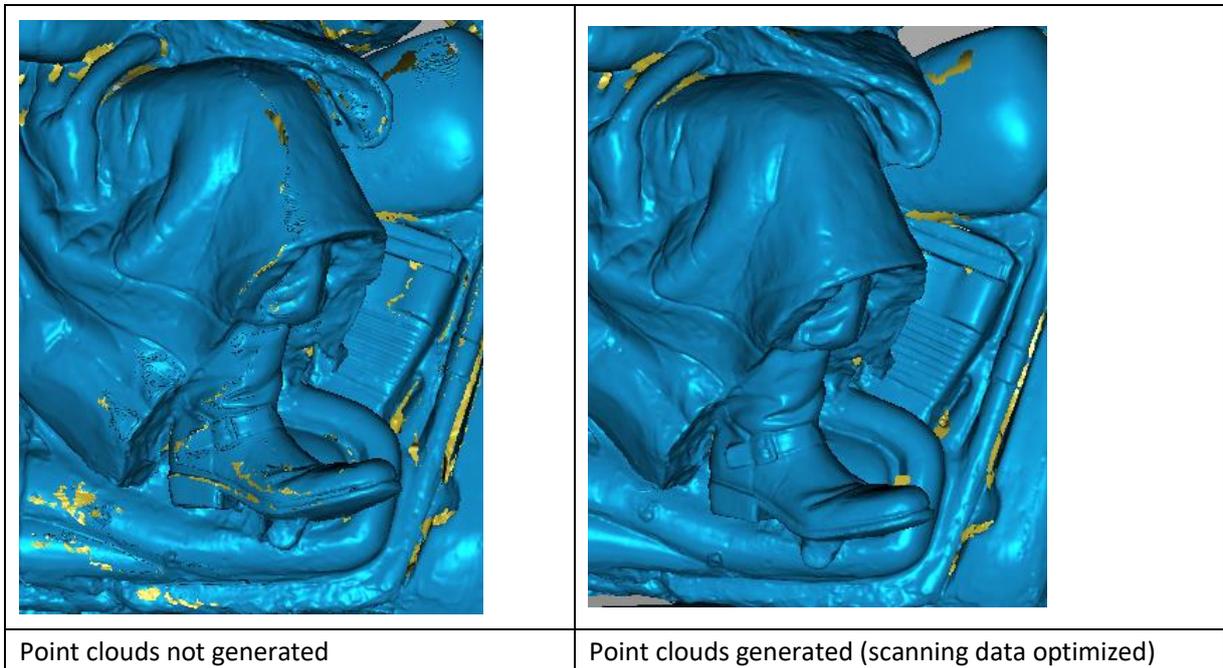
Click  or press the Scan button on the Device to pause scanning; click  again or press the Scan button on the Device again to resume scanning.



**Notes:**

During the scanning, make sure that the scanner directly faces the object and keeps a proper distance from it. Adjust the brightness according to the characteristics of the object and the ambient light.

Step 2 After scanning, click  on the right to generate a point cloud. After the point cloud is generated, the system will automatically optimize and generate a point cloud. This function can also be used under offline mode.



Step 3 Click  to save the scanned data in .asc or .p3 format.

### 3.4.5 Scanning Global Markers

Scanning global markers refers to the collection of data of the markers. By collecting such markers, the frame point data of an object can be quickly obtained. During the scanning, no laser rays are emitted. Continual scanning or rescanning can be done after importing the global markers generated by a third party. After the global markers are scanned, users can switch to point cloud scanning, which makes point cloud scanning easier.

Step 1 Select the frame point scanning mode.

Step 2 Click  located on the right-hand side of the interface or press the Scan button on the Device to enter pre-scan mode. The scanning parameters are adjustable.

Step 3 Start scanning. Click  on the right-hand side or press the Scan button on the Device to start collecting markers.

Step 4 After scanning, click  on the right-hand side to optimize the global markers.

Step 5 Click  to save the scanned data in .asc or .p3 formats.

 Notes:

After scanning the global markers or after importing a frame point file, users can choose to switch to the scan point cloud mode and check the “New Global markers” option. During the scanning of the point cloud, global markers other than the existing ones, once identified, will be added to the scanned data; if

the “New Global markers” option is not checked, new global markers identified in the scanning will not be added to the scanned data.

### 3.4.6 Project Management

#### Import a Project

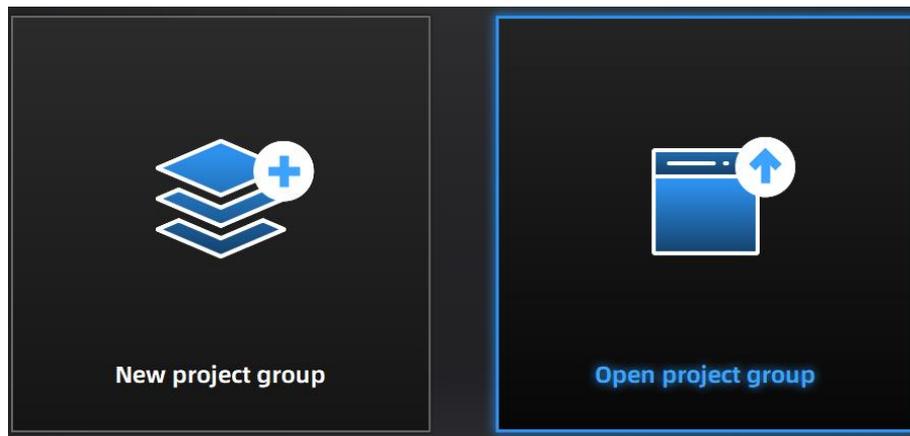
The system allows to create a project instantly by importing the existing scanned data into it.

In the project management window, click “Open multiple projects”; or in the scanning interface, click  on the right; the project file window will pop up. Then select a project file, click “Open” at the bottom right to import the project. This facilitates the subsequent editing and processing on the scanned data.



Notes:

After importing, the system directly enters the scanning task, and scanning will be performed according to the resolution and alignment mode of the imported project.



#### Project Management

Users can create, import, remove and/or delete projects. After creating multiple projects, projects can be created or opened under multi-project, and the projects will be displayed in the project list.

In the scanning interface, click “Multi-Project” in the upper left corner and the operation area for project management will be seen.

Icons	Names	Descriptions
	New project	After clicking, a project file will be created automatically.  The last project in the project list is the current project, and only the current project can resume scanning.  Reopening another project in the list, that project will

		become current project.
	Open a project	After clicking, a project file will be imported. Select a project in the project list and right-click on it, select "Rename" to rename the project.
	Remove a project	After clicking, the project will be removed from the list. This operation does not delete the project. It remains under the plans folder and can be restored by opening the project.
	Delete a project	After clicking, the data will be deleted permanently from the project folder and cannot be recovered.
	Dropdown button	After creating a new project group, users can choose to scan point cloud or scan markers
	Visible/invisible	After clicking, the point cloud or markers can be displayed; click it again to hide the point cloud or markers.



Notes:

- If the last project in the list (i.e., the current project) is deleted or removed, the last project in the current list becomes the current project, which can perform scanning.
- If the project under another path is opened and it has the same as the existing project in the list, "\_1" will be added to the name of the opened project and such added numbers will be given in a numerical order to other projects sharing the same name.

### 3.4.7 Edit Data

A variety of tools are provided to process the 3D data. During the scanning process, the scanner may vibrate slightly, or the surface of the object may be dark, or the light may change. Such factors may cause noise. Therefore, users can customize selected areas for editing. Users are allowed to manually delete noise points and isolated points outside the model to reduce noise and obtain accurate 3D point cloud data. Users are also able to edit and adjust the perspectives to the model. The model can be directly rotated by using the mouse. Preview under various perspectives can be realized through the perspective selecting button on the software's interface.

## Adjust View

- Hold down the left button and move the mouse to rotate the model.
- Alternatively, select the perspective selecting button, click  located at the bottom of the interface, and select different previews under various perspectives.

### Introduction to perspective adjustment

Icon	Description
	Front view, viewing the object to be scanned from the front perspective.
	Top view, viewing the object to be scanned from the top perspective.
	Left view, viewing the object to be scanned from the left side perspective.
	Rear view, viewing the object to be scanned from the rear perspective.
	Bottom view, viewing the object to be scanned from the bottom perspective.
	Right view, viewing the object to be scanned from the right side perspective.

## Create a Cutting Plane

Taking a cutting plane as reference, scanning above this plane is deemed as valid. Users can choose whether the scanned data below the cutting plane shall be saved. If the user chooses not to save the scanned data below the said plane, the invalid data will be deleted instantly. On the other hand, if the user chooses to save the scanned data below the said plane, the invalid data obtained through scanning will not be deleted and when a new scanning is conducted, no new data will be appended pertaining to the area below the reference cutting plane.

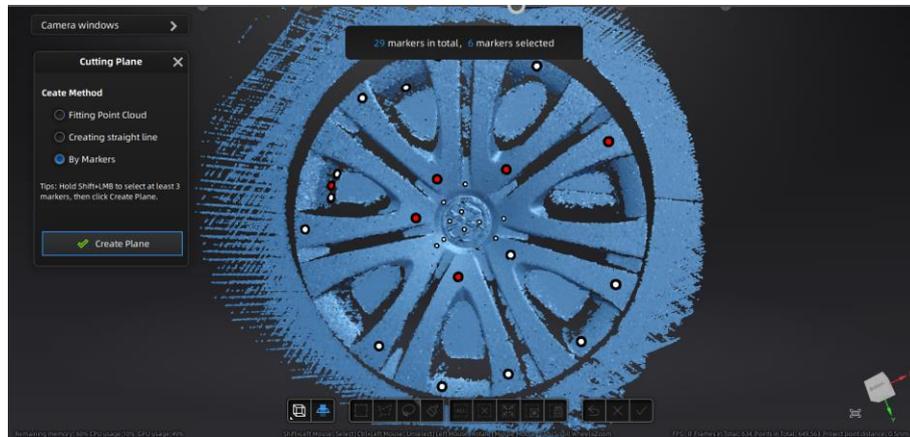
Step 1 Click  and the cutting plane window pops out.

Step 2 Choose how to create the cutting plane.

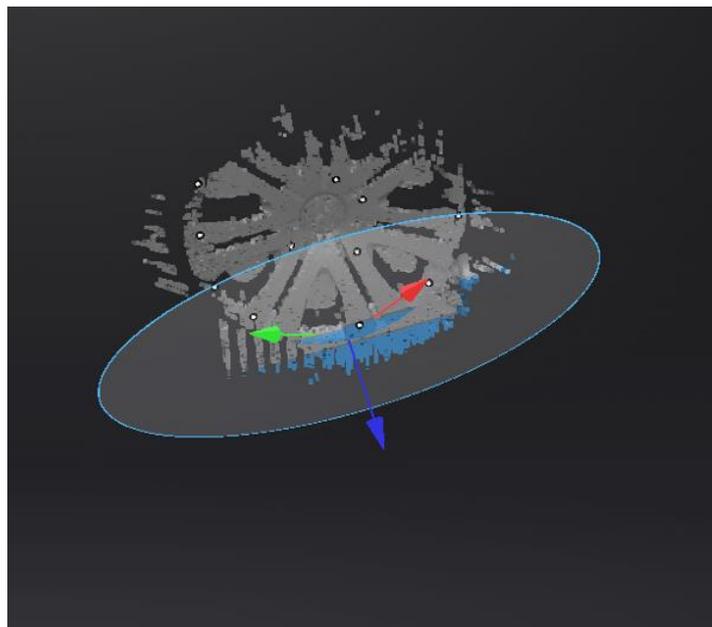
- Point cloud fitting: the plane formed by the selected point cloud data is deemed as the cutting plane.

- Create a straight line: Draw a straight line on the object to be scanned, and the plane formed by such a straight line is deemed as a cutting plane.
- Markers: At least 3 markers shall be chosen and the plane formed by these 3 or more markers shall be deemed as the cutting plane.

Step 3 Hold down Shift + Left button of the mouse, or select at least 3 markers to create a cutting plane.

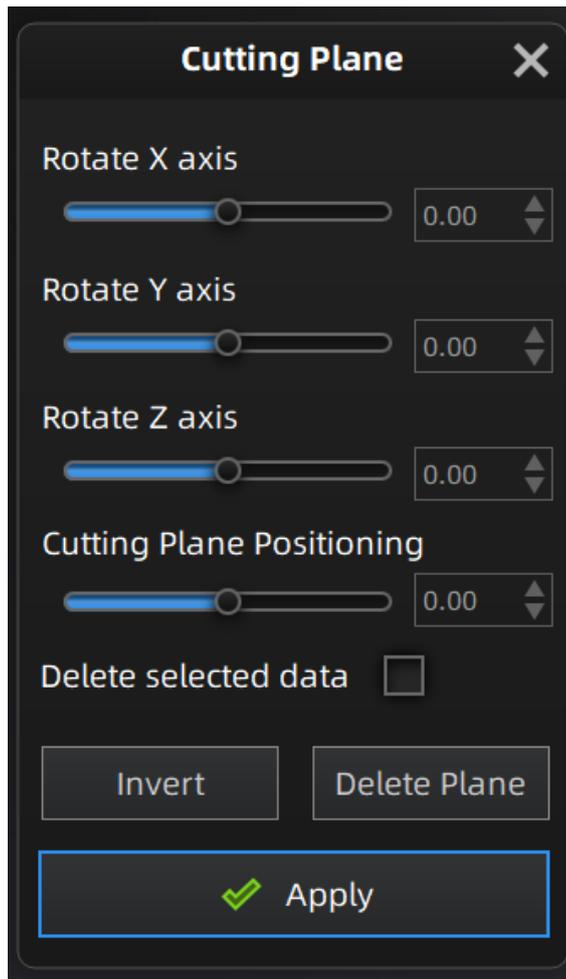


Step 4 Click "Create Plane" and a cutting plane will be generated for the object to be scanned.



Step 5 Adjust the X, Y, Z axis or translation increment to determine the direction and angle of the plane.

- Delete a plane: After clicking, the scanned data below the plane will be deleted.
- Invert selection: After clicking, the scanned data above the plane will be deleted.

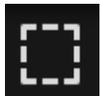


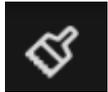
Step 6 Click “Apply”. No data below the cutting plane will be collected.

## Edit Model

Users can select data to edit the model at their own discretion.

### Introduction to editing icons

Icons	Name	Description
	Rectangular	After clicking, a rectangular area can be selected for editing. Press and hold the left button of the mouse to select an area to be edited. The selected area will be displayed in red.
	Polygon	After clicking, hold down Shift and click to select a polygon area. When editing area selection is completed, release the Shift or double-click the left mouse button. The selected area will be displayed in red.

	Lasso	After clicking, hold down both “Shift and Left Mouse Button” and a blue circle will appear. At this time, roll the mouse wheel will zoom in and out of the blue circle. Move the blue circle to select the area to be edited. The selected area will be displayed in red.
	Paint Brush	After clicking, press and hold the left button of the mouse to paint the area to be edited. The selected area will be displayed in red.
	Select all	After clicking, all scanned data is selected.
	Unselect	After clicking, the selected area for editing is cancelled.
	Connected Domain	To enable domain connecting function, selecting a patch of data and click this button, model area associated with such data will be automatically selected.
	Invert	After clicking, areas other than the selected editing areas will be selected.
	Delete selected data	After clicking, the selected editing area will be deleted.
	Undelete	After clicking, the last deletion will be undone.
	Cancel edit	After clicking, all edits are cancelled and the edit mode is quitted.
	Apply edits	Clicking this button or press the space bar to quit the edit mode.

 Attention:

After processing to data is confirmed, the data’s initial state cannot be restored, unless by reloading the initial file.

## Shortcut Keys

The objects to be scanned can be edited through shortcut keys.

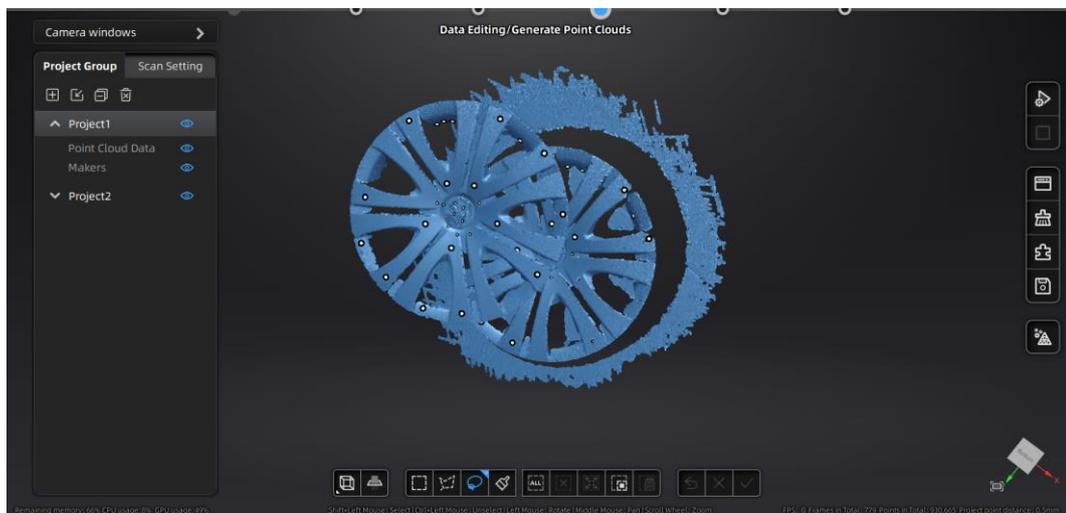
Shortcut keys	Instruction
Hold down the left mouse button and move the cursor	Rotate the model
Hold down the middle mouse button and move the cursor	Translate the model
Roll the mouse wheel up and down	Zoom in and zoom out the model
Space bar	Confirm editing when editing data
Delete	Delete selected data

### 3.4.8 Align

Since the scanning technology is unable to obtain the point cloud data of the entire model at one time, multiple and multi-angle scanning is required. While scanning, usually the point cloud data for multiple individual scanned area may overlap. Therefore, alignment is done to obtain identical surface features based on the repeatedly scanned areas, connecting such point cloud data obtained through multiple scans into one complete set of data. Through alignment, multiple scan data are combined into a whole set of point cloud data, thereby effectively solving the problem of incomplete data collection.

When more than two project files are present in the project list, and scanned point cloud data exist in those project files, the project can be aligned.

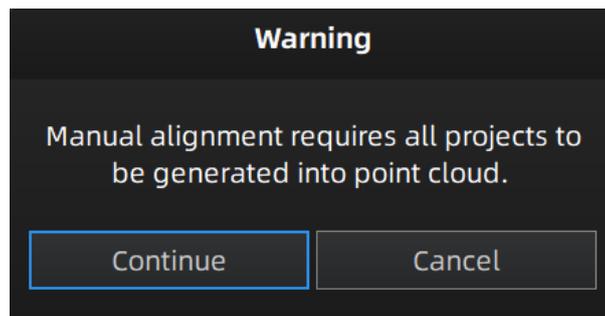
Click  on the right side of the interface to enter the project alignment interface.





#### Notes:

If there is a project that has not generated a point cloud, click “Align” and the following prompt box will pop up. If “Continue” is clicked, the point cloud will be automatically generated and then aligned; if “Cancel” is clicked, alignment interface will appear and the project that has not generated point cloud will not be displayed on the alignment interface.



## Feature Alignment

When the scanned point cloud files share common features, feature alignment can be chosen, which is the most effective way to solve the alignment problem. This method can adjust the manual alignment to minimize the error between the model and the original data.

Select “Feature alignment” and click “Apply”, the software will automatically conduct alignment according to the features of the data.

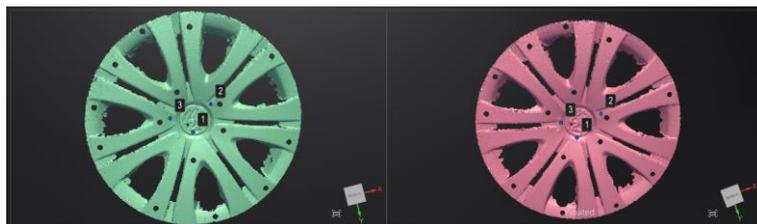


## Manual Alignment

Manual alignment refers to obtaining the initial position of the point cloud through three points. For large-scale point clouds, the less precise manual alignment method can be selected. The best matches of the selected points are calculated and, alignment is realized through the best fitting of all the points from the floating viewport to the fixed viewport.

After selecting “Manual Alignment”, press Shift + left mouse button to select no less than 3 non-collinear points in each of the fixed and floating viewports respectively; click “Apply” and the software will automatically conduct alignment.

Press Ctrl + Z or ESC to undo the selected points in sequential order.



## Marker Alignment

If the currently selected project is a Markers project, the markers can be aligned. It is necessary to ensure that the number of shared markers in the two projects is not less than 3. Otherwise, the alignment will fail. The software will automatically align according to the markers.

Select “Markers Alignment”, click “Apply”, and the software will automatically align.

Table 6

Button names	Description
Apply	Perform the alignment operation.

Next step	The aligned projects will be merged into a group, which can be further aligned.
Cancel	Undo the completed alignment.
Exit	Exit the project alignment interface.

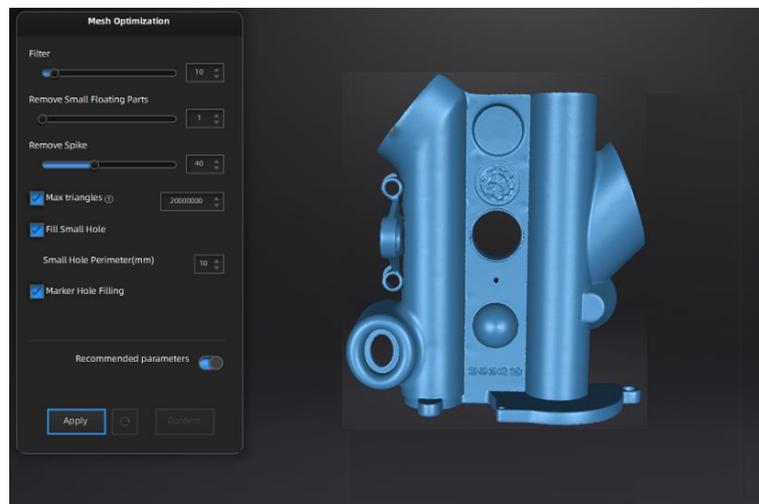
### 3.4.9 Mesh

Meshing is to convert the point cloud into a triangular mesh surface. After meshing, the model can be enlarged, and any triangle surface can be manually selected for observation. The encapsulated data can be directly used for rendering or measurement.



When scanning and editing are completed, click  to create mesh.

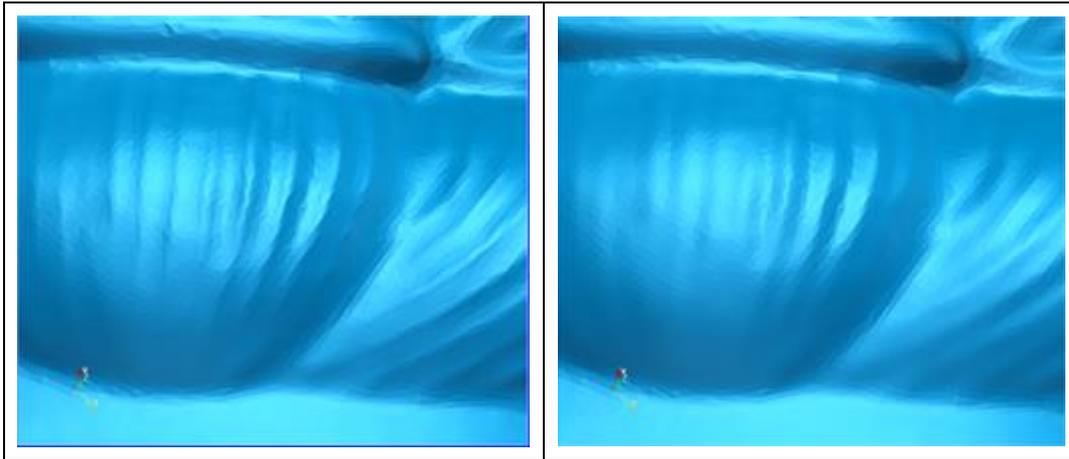
Through the toolbar on the left, you can simplify, optimize, remove small floating parts, remove spike and fill marker hole.



Use recommended parameters: To get FreeScan UE help you optimize a specific model, enable the function. To customize parameters, disable the function.

Filter: Optimize data.

<b>Filter 10%</b>	<b>Filter 60%</b>
-------------------	-------------------

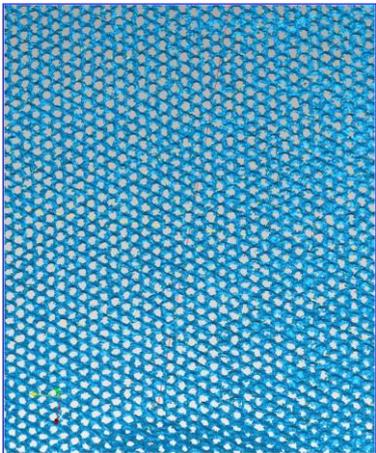
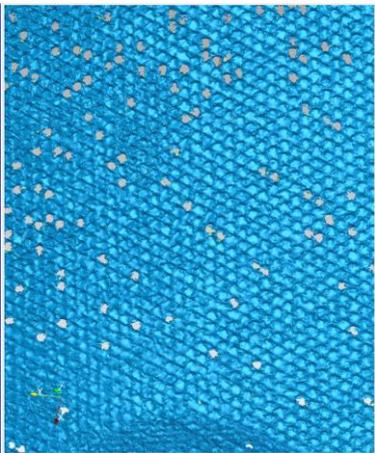


Remove small floating parts: Remove small floating parts on the model.

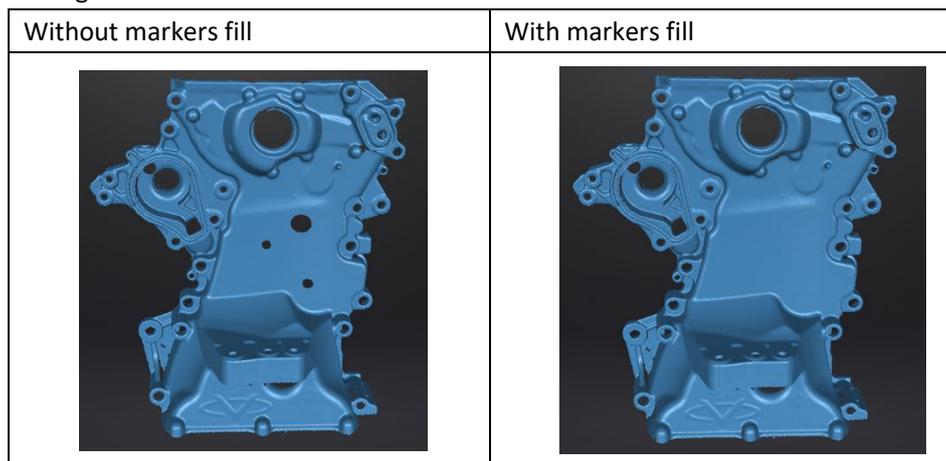
Remove spikes: Remove spike-like data on the image edge.

Max triangles: Set max. plate number to get mesh model's triangle plate number is within configured plate number.

Fill small hole: For objects with tiny holes (larger than 10 mm), use the function to fill tiny hole to make the scanned image look better. For objects with holes (smaller than 10 mm), you are not recommended to use the function or you can set the function parameter value to a smaller one.

Situation when You Don't Fill Holes	Situation when You Fill Holes (for Holes Larger Than 10mm)
	

Marker hole filling:



### 3.5 Post-processing

After the model data is encapsulated, the software automatically switches to the post-processing interface.

Alternatively, users can directly click  on the navigation bar to enter the post-processing interface and import data. Post-processing can then be performed on the data, including simplifying, mesh optimization, smoothing, removal of isolated faces, automatic hole mending and manual hole mending.

Click  to select the file for post-processing; or directly drag the file in STL, OBJ, PLY formats into the measurement interface.

Shift+ Left Button of the mouse: Select the redundant part of data, and the selected data will be displayed in red.

Ctrl+ Left Button of the mouse: Deselect part of the selected data.

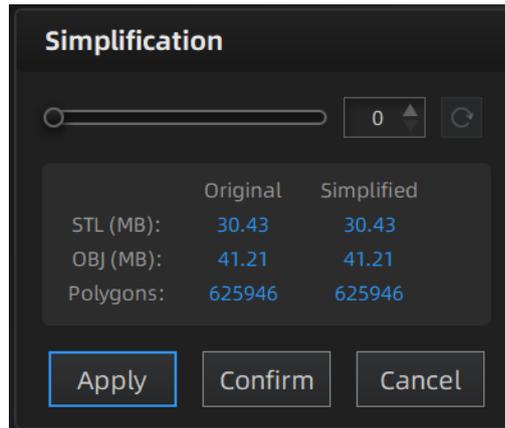
Icon	Name	Description
	Select visible	When selecting the model processing area, only one side is selected, that is, visible data is selected.
	Select thorough	After selecting, the front and back sides of the model will be simultaneously selected.

#### 3.5.1 Simplification

After simplification, the polygon numbers, file size and level of detail of data will be reduced accordingly. Set the ratio from 1 to 100, the default is 0.

The comparison of detail between before simplification and after simplification (at 70% simplify proportion).

### Simplification menu

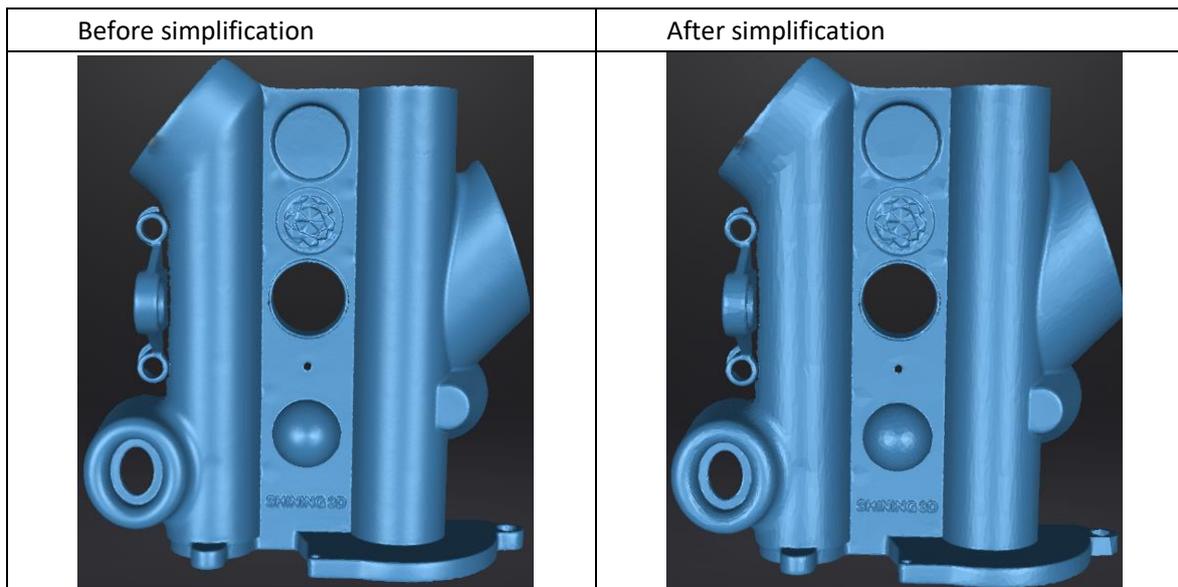


Click **Apply** to simplify data, preview the result of current setting.

Click **Confirm** to apply the “Simplification” setting.

Click **Cancel** to quit, and go back to the original data.

Multiple operations on “Simplification”, the result will not be added. It will always operate on the original data.



### 3.5.2 Mesh Optimization

Mesh optimization can optimize the quality of the data. There are 3 ratio options of mesh optimization. Processing time will be different. Below shows the result of 3 different ratios.

Original



Mesh optimization 10	Mesh optimization 50	Mesh optimization 100
		

Click **Apply** to optimize data, preview the result of current setting.

Click **Confirm** to apply the “Mesh Optimization” setting.

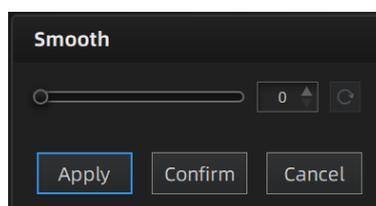
Click **Cancel** to quit, and go back to the original data.

Multiple operations on “Mesh Optimization”, the result will not be added. It will always operate on the original data.

### 3.5.3 Smooth

Smooth the possible noise on the surface of the scan data. It might remove some small details or smooth some sharp edges at the same time. The example of before and after smoothing is shown below. Run 2 times, data will be smoothed twice.

Smooth menu



Original



Smooth 10	Smooth 50	Smooth 100
		

Click **Apply** to smooth data, preview the result of current setting.

Click **Confirm** to apply the “Smooth” setting.

Click **Cancel** to quit, and go back to the original data.

Multiple operations on “Smooth”, the result will not be added. It will always operate on the original data.

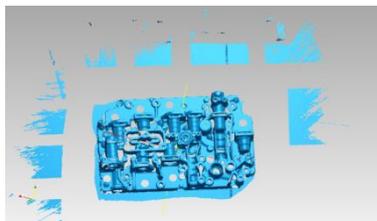
### 3.5.4 Remove Small Floating Parts

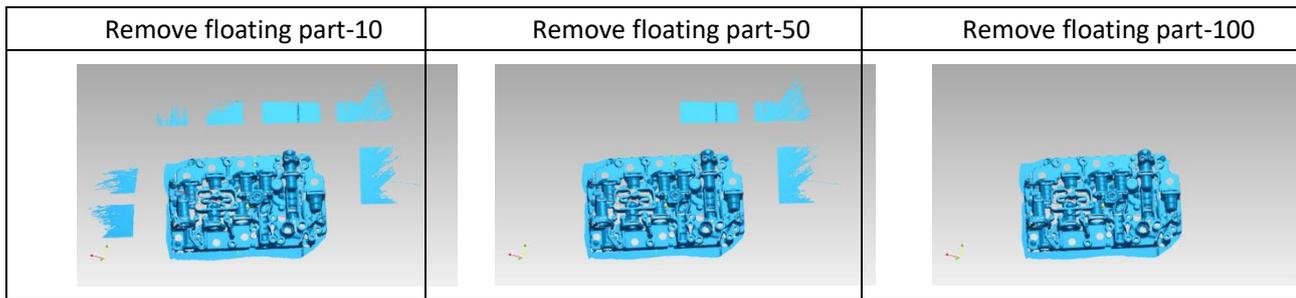
Remove small floating parts in the scan data.

0 means no operation, 100 is the maximum. The maximum value is the square of the diagonal length of the floating part/10,  $MAX=(L/10)^2$ .

Diagram of removing floating parts shows as below:

Original data





Click **Apply** to remove floating part, preview the result of current settings.

Click **Confirm** to apply the “remove floating part” setting.

Click **Cancel** to quit, and go back to the original data.

Multiple operations on “Remove floating part”, the result will not be added. It will always operate on the original data.

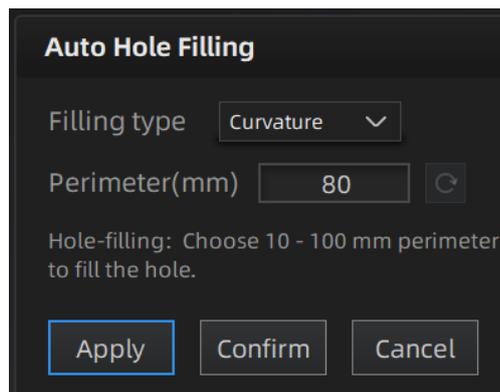
### 3.5.5 Fill Holes

Due to the loss of point cloud data in some areas, holes may occur after the 3D scanned model is meshed, resulting in incomplete models. The model can be made complete through the hole mending operation. Holes can be mended either automatically or manually. Each method realizing hole mending according to the changes of the curvature of the area around the hole. Types of tangent and plane are also available to be chosen for hole filling. When there are multiple holes to be mended, automatic hole mending method is recommended.

#### Auto Hole Filling

Input the perimeter of the biggest hole to be filled. Less than 100mm is recommended. This function will fill every hole with a smaller perimeter than the number input.

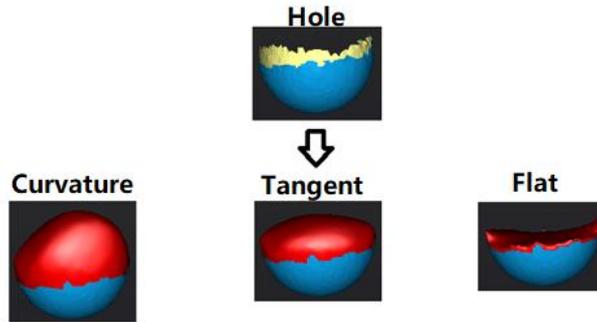
Auto hole filling



Choose Curvature, Tangent or Flat before filling hole.

- **FLAT** calculates the solution for the hole filling considering the point position on the boundary.
- **TANGENT** calculates the solution considering the point position and the normal of the last row of triangles forming the boundary.
- **CURVATURE** calculates the solution considering the point position and the normal of the 2 last rows of triangles forming the boundary.

Effect of Curvature, Tangent or Flat

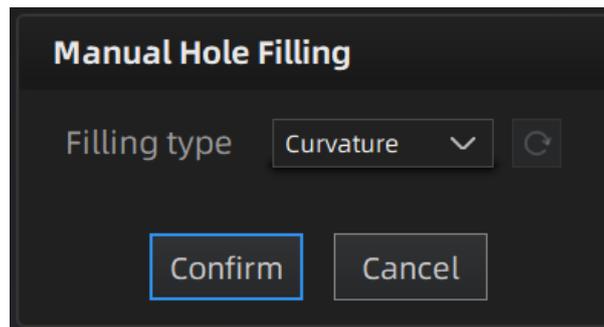


Click **Apply** to auto fill hole, preview the result of current setting.  
 Click **Confirm** to apply the “Auto hole filling” setting.  
 Click **Cancel** to quit, and go back to the original data.

### Manual Hole Filling

The hole edges are displayed green, and get red after picking. The number of the holes and the number of holes filled will be displayed on the interface. Choose Curvature, Tangent or Flat before picking a hole.

Manual hole filling



Click the edge of the hole to fill it.

Click , according to the order of filling holes, from the last hole to cancel hole filling. Ctrl + Z can also cancel hole filling.

Click **Confirm** to apply current setting and exit the manual hole filling.

Click **Cancel** to quit, and go back to the original data.

### 3.6 Measurement

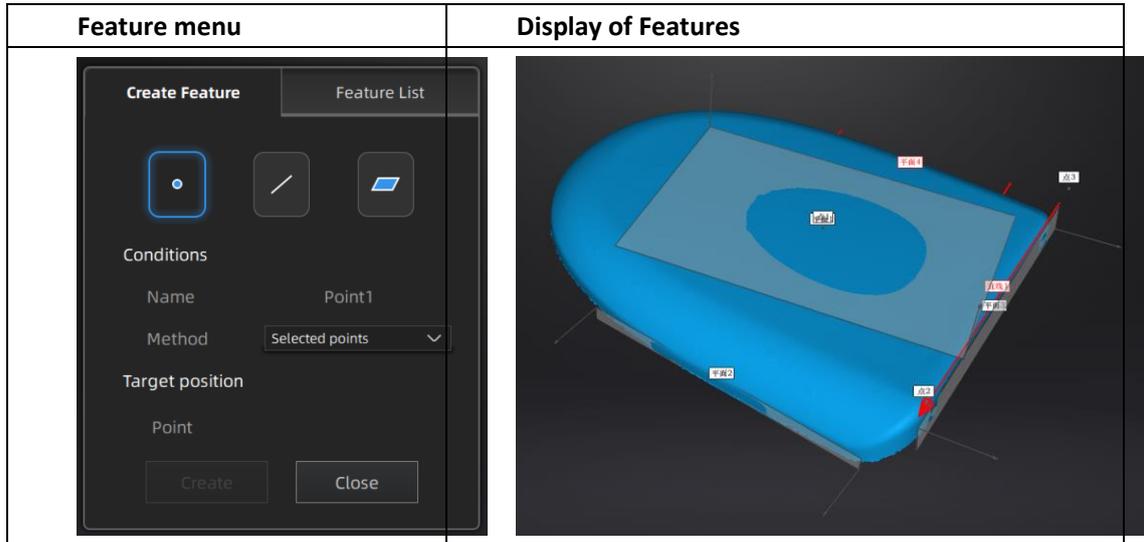
After Meshing, the software can switch to the measurement interface, or directly enter the measurement interface to import data, and perform operations such as measurement and alignment on the data. The measurement interface and the post-processing interface share the same data.

On the operation progress bar, click  to enter the measurement interface.

Click  to select the file to be measured; or directly drag the file in STL, OBJ, PLY format to the measurement interface.

### 3.6.1 Create Feature

Click the feature button to display the menu, click again to close the menu.



Click on the corresponding icon to create points, lines, planes.

Then select the creation method and follow the instructions, click “Create” to generate, or “Close” to cancel and close the window.

The features created displaying in gray, the selected feature is in Red. In the feature list, click “delete button” to remove (Delete action cannot undo).

Feature	Creation Method	Requirement	Description
Point 	Selected Points	—	<ul style="list-style-type: none"> <li>● Click on the data to select a point.</li> <li>● Click create to create a point.</li> </ul>
	Line-Plane Interface	Line and Plane should be created in advanced	<ul style="list-style-type: none"> <li>● Click on the created line, or select it on the dropdown.</li> <li>● Click on the created plane, or select it on the dropdown.</li> </ul> The point generated is the intersection between the non-parallel line and plane. <b>Feature creation failed! Error code 9:</b> The line is parallel to the plane.
Line 	Point-Point	—	<ul style="list-style-type: none"> <li>● Pick 2 points.</li> <li>● Click on the data to select a point or click on a feature point previously created.</li> </ul> In the Choice list select one of the points to redo it. The line generated is define as point from to point to point.
	Plane-Plane Intersection	2 planes should be created in advanced	<ul style="list-style-type: none"> <li>● Click on the plane previously created, or select it on the dropdown, repeat for the second plane.</li> <li>● The created line is the intersection between the 2 non-parallel planes.</li> </ul> <b>Feature creation failed! Error code 1:</b> the

			planes are parallel.
Plane 	3 Points Fit	—	<ul style="list-style-type: none"> <li>● The plane is generated by 3 points not co-linear.</li> <li>● Click on the data to select one point or click on a previous created feature point.</li> <li>● In the Choice list select one of the points to reselect it.</li> </ul> <b>Feature creation failed! Error code 6=</b> the points selected are co-linear.
	Point-Line Fit	Line should be created in advanced	<ul style="list-style-type: none"> <li>● The plane generated includes the point and the line (The line should be created in advanced).</li> <li>● Click on the line previously created, or select it from the drop-down.</li> <li>● Click on the data to select a point or click on a feature point previously created.</li> <li>● In the Choice list select one of the elements to reselect it.</li> </ul> <b>Feature creation failed! Error code 6=</b> the point selected belongs to the line
	Best Fit	—	<ul style="list-style-type: none"> <li>● Press Shift+ LMB to select an area, press ctrl+ LMB to unselect.</li> <li>● The plane generated is the position with the smallest deviation from the selected area.</li> </ul>

### 3.6.2 Align

Use this mode to modify the alignment of the data to the global coordinate. This action is useful for post processing or reverse engineering.

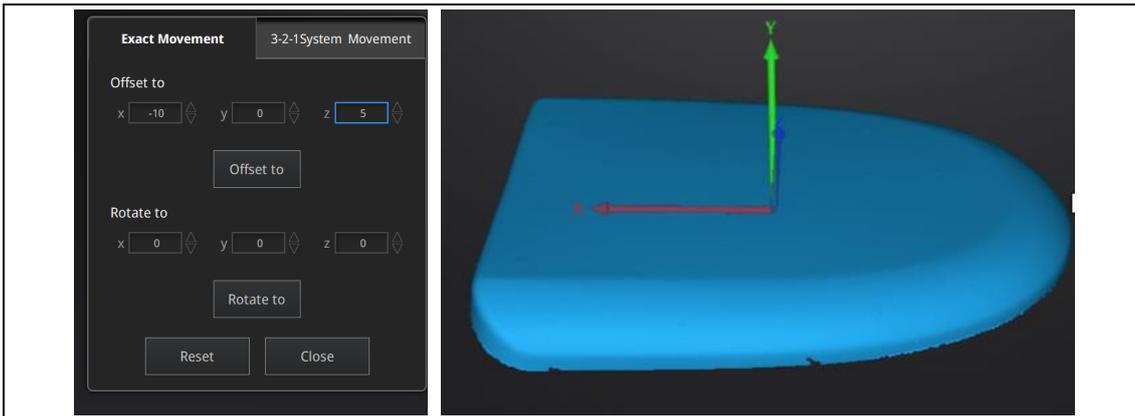
The transformations do not affect the shape and size.

	Enter/Exit the Movement menu.
--	-------------------------------

Click the Movement button to display the menu, click again to close the menu.

#### **Exact movement**

<i>Exact movement menu</i>
----------------------------



Enter the value in mm and degrees, click **Apply** to match the data origin to the input coordinate and orientation.

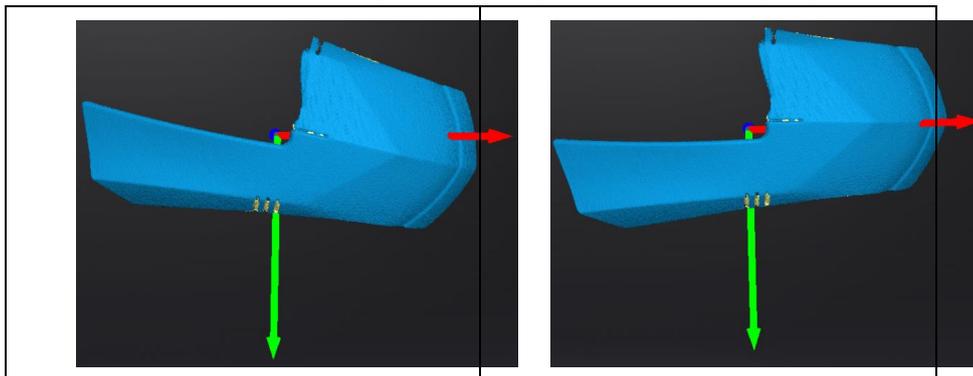
The arrows represent the global coordinate system, Red=X+, Green=Y+, Blue=Z+.

Click **Reset** to cancel the transformation to original position.

Click **OK** to confirm the transformation.

**Tips:**

- Start from data reposition (offset to 0,0,0).
- Edit rotations prior to transformation.
- Change the view normal to a reference plane to change the corresponding angle.



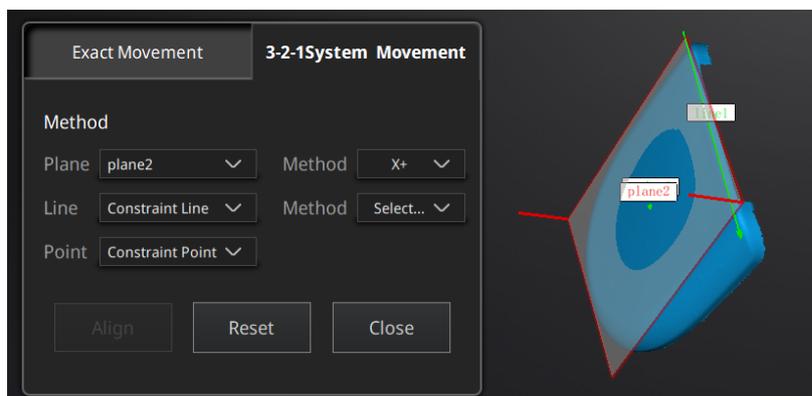
**3-2-1 Movement**

Prior to 3-2-1 movement, the creation of a plane, line not normal to the plane and point are required.

3-2-1 movement (plane-line-point alignment) aligns the data by deletion of the Degrees of Freedom.

The arrows represent the global coordinate system, Red=X+, Green=Y+, Blue=Z+.

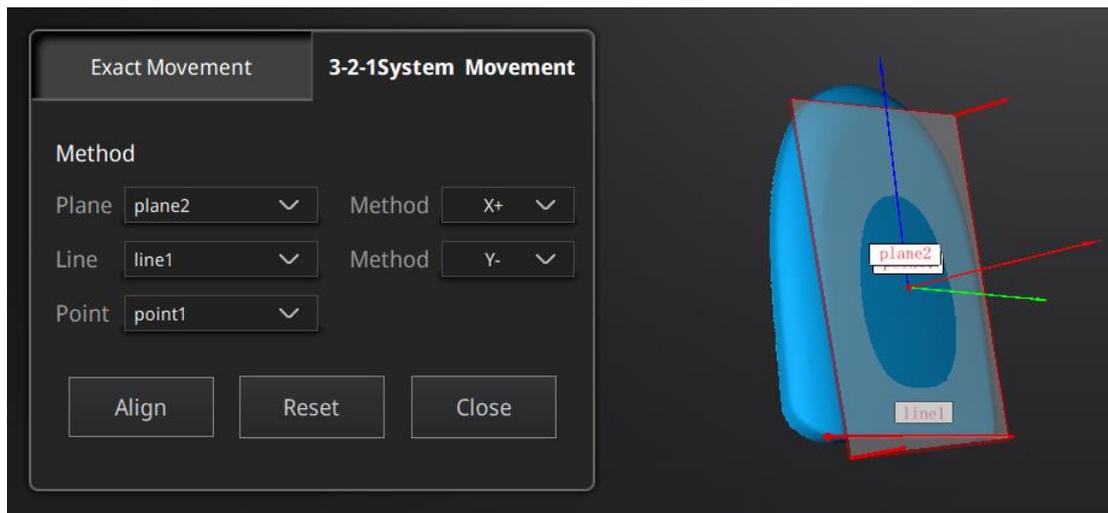
3-2-1 Movement menu



- Select a Plane in the drop-down menu, match it to the first axis in the Method drop-down. The arrows on the corners of the plane represent the plane positive direction. The normal vector of the plane will match the axis direction.
- Select a Line in the drop-down menu, match it to the first axis in the Method drop-down. Beware the direction of the line to match it to the + or - axis. The projection of the line to the first plane will be parallel to the corresponding axis.
- Select a Point in the drop-down menu. The data will be translated to match the point with the origin point (coordinate 0,0,0).

Click **Align** to perform the transformation.

Data after 3-2-1 movement



Click **Reset** to cancel.

Click **Apply** to confirm the transformation.

### 3.6.3 Measure

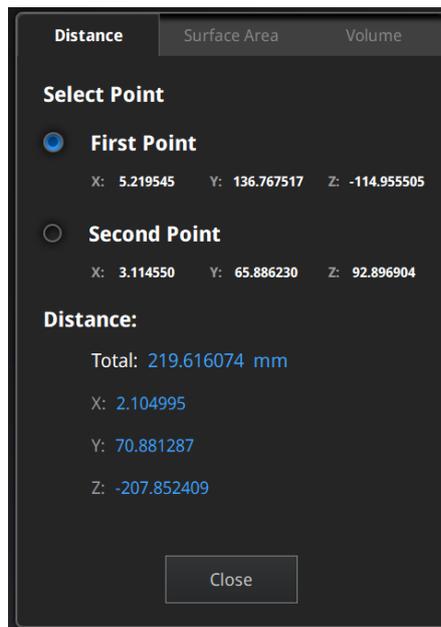
Click  measurement button to display the menu, click again to close the menu.

#### DISTANCE

This tool calculates the distance between two points belonging to the surface of the data.

Click on the data to pick the first and second point, select one of the two points to redo it.

### Distance menu



Total is the 3D distance, X, Y and Z are the projection of the segment to the respective planes.

### SURFACE AREA

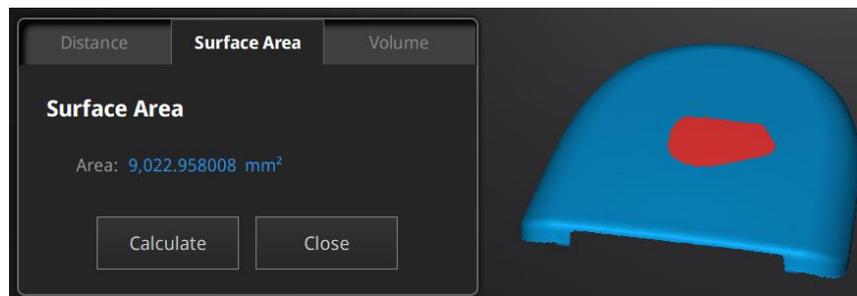
Press **Shift+ LMB** to select an area, press **ctrl + LMB** to unselect.

**Ctrl + A** to select all.

Click **Calculate** to display the Area value of the selected data in mm<sup>2</sup>

Redo the selection and click calculate again to update.

### Surface area menu

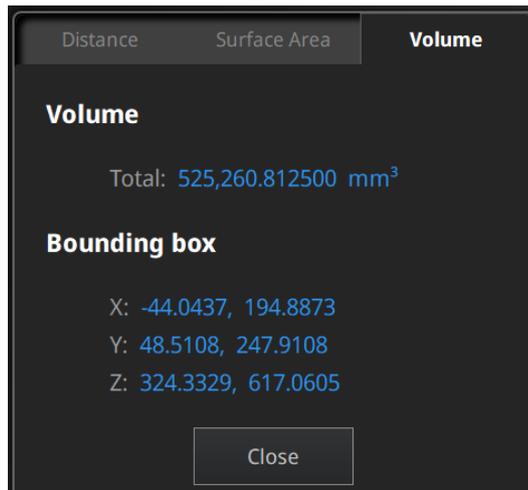


### VOLUME

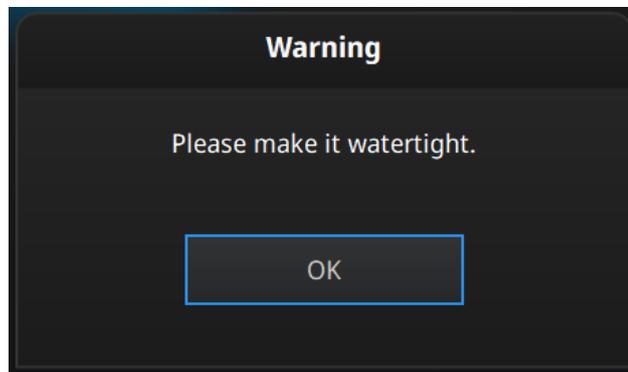
This tool calculates the volume contains in a watertight mesh.

It returns the volume in mm<sup>3</sup> and the coordinates of the smallest box, parallel to the global coordinates, containing all the data.

### Volume menu



File not watertight alert





Enter/exit the measurement interface

Click the “Measure” button to enter the measurement interface and display the measurement menu, click the button again to exit the measurement interface.

## 3.7 Save

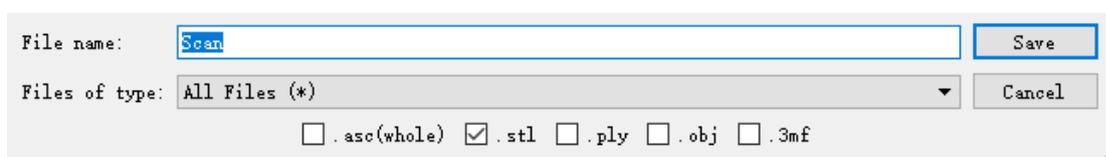
### 3.7.1 Save Data



Save data.

Enter the file name and click the save button.

Export data



First select the saving path, enter the file name, and select the file type. The files for non-texture scanning is to be saved as stl by default and, files for texture scanning is saved as obj by default. At least one type is required to be selected.

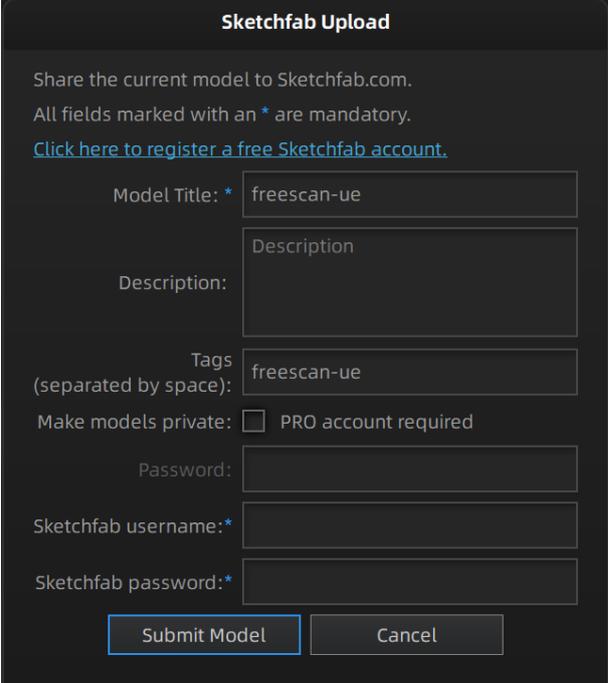
The default saving path is the desktop.

Format	Types of data	Save as	Recommendation
ASC (single piece) (suitable only for fixed scanning)	Single point cloud, alignment performed	scan_0.asc scan_1.asc scan_2.asc etc...	<ul style="list-style-type: none"> <li>● Check the data;</li> <li>● Quick export (post-processing not needed);</li> <li>● Post-processing can be done through other software.</li> </ul>
ASC (whole piece)	Optimized point cloud	scan.asc	<ul style="list-style-type: none"> <li>● Check the data;</li> <li>● Quick export (no need for post-processing for handheld scanning);</li> <li>● Post-processing can be done through other software.</li> </ul>
STL	Mesh data	scan.stl	<ul style="list-style-type: none"> <li>● 3D printing;</li> <li>● Reverse designing;</li> <li>● Compatible with most post-processing software.</li> </ul>
OBJ	Mesh data	scan.obj scan.jpg scan.mtl	<ul style="list-style-type: none"> <li>● Used in artwork;</li> <li>● 3D rendering;</li> <li>● Compatible with most post-processing software.</li> </ul>
PLY	Mesh data	scan.ply	<ul style="list-style-type: none"> <li>● The file is small;</li> <li>● Easy for texture editing.</li> </ul>
3MF	Mesh data	scan.3mf	<ul style="list-style-type: none"> <li>● The file is small;</li> <li>● Compatible with Microsoft 3D printing software.</li> </ul>
P3	Markers file	scan.p3	<ul style="list-style-type: none"> <li>● Universal framework point file of Einscan software;</li> <li>● Identifying the positional relationship between markers.</li> </ul>

### 3.7.2 Share Data



Click the Share button to upload the encapsulated data to Sketchfab.

 A dark grey dialog box titled "Sketchfab Upload". It contains the following fields and options: "Model Title: \*" with the value "freescan-ue"; "Description:" with an empty text area; "Tags (separated by space):" with the value "freescan-ue"; "Make models private:" with an unchecked checkbox and the text "PRO account required"; "Password:" with an empty text area; "Sketchfab username:\*" with an empty text area; and "Sketchfab password:\*" with an empty text area. At the bottom are two buttons: "Submit Model" and "Cancel".

Sketchfab Uploading Window

The scanned model can be shared to the Sketchfab website, where the title, username and password are required to be provided. You can register an account on the Sketchfab (<http://sketchfab.com>) to view the shared models.

#### Attention:

- Normal accounts allow for uploading model files up to 50M; PRO premium accounts allow for uploading up to 200M; Besides, only PRO account users can set private models.
- The uploaded file is in stl format without texture.

### 3.7.3 Third-party Software

Five third-party software, including Geomagic ControlX, Verisurf, Geomagic Design X, Geomagic Essentials and Einsense are included. Users can import scanned mesh data into the third-party software with one click.

### Geomagic Control X



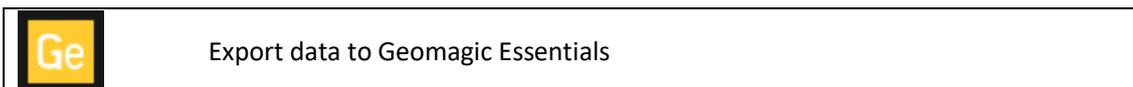
Mainly used for reverse design of mesh data. If the GeomagicControl X software has been installed, clicking this button will open the GeomagicControl X software and import the mesh data.

### Verisurf



If the Design with Verisurf software has been installed, clicking this button will open the Design with Verisurf and import the encapsulated stl data into Design with Verisurf.

### Geomagic Essentials



Mainly used for reverse design of mesh data. If the GeomagicEssentials has been installed, clicking this button will open the GeomagicEssentials and import the mesh data.

### Geomagic Design X



Mainly used for reverse design of mesh data. If the GeomagicDesign X has been installed, clicking this button will open the GeomagicDesign X and import the mesh data.

### Solid Edge



Solid Edge is a 3D CAD software. If Solid Edge has been installed, clicking this button will open the Solid Edge and import the encapsulated stl data into Solid Edge.

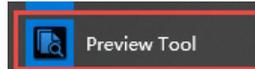
### 3.7.4 Preview Model



Double-click the Preview Tool shortcut on the desktop

Or open the Model Preview Tool in the start menu, i.e., start menu>Shining3d\_Freescan UE>Preview Tool

As shown in the figure below:



Drag the desired file into the Preview Tool to preview it:



Model Preview

STL, OBJ, PLY, ASC, and 3MF can all be previewed. However, files generated by third-party tools may fail to import, and the tool will prompt “Failed to import files”.

**⚠ Attention:**

When importing Obj texture files, ensure that mtl and jpg sharing the same file name are under the same directory as obj.

### 3.8 Other Operations

Table 8

Icons	Functions	Descriptions
	Official website	Open the official website of Shining 3D to learn about the company’s products and information.

	WeChat account	Enter Shining 3D's public WeChat account to view product introduction and their operations.
	Advanced mode	After checking this option, the point distance can be selected as 0.05 when creating a new project.
	User feedback	You can communicate any of your advice or questions with us through "User Feedback" and supply your email to "My Email" so that we can contact you.
	Restore factory setting	All settings can be restored to the initial settings, and the software will automatically restart.
	Languages	A language selection window pops up, allowing users to choose multiple languages.
	About	View related software release information, contact information, etc.
	Display help information	Open the real-time help file.
	TeamViewer	The quick access to remote assistance. Please send the ID and password in the pop-up window to the technical supporters for remote assistance.

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