



LIPScan™ 3D Scan APP

User's Manual

V3.0.2

Version 1.1

© Copyright LIPS Corporation 2026. All rights reserved.

Under the Intellectual Property Law, no part of this book may be copied in any form or used by any means without the written consent of LIPS Corporation. Violation to the said law results in consequences and those who failed to comply could be susceptible to penalties.

Although every effort has been made to ensure the accuracy of this manual, errors and inconsistencies may remain. The manufacturer assumes no liability resulting from errors or omission in this manual, even if damages arises from the use of the information. All contents are subject to constant revision to improve its reliability and may be changed without prior notice.

July 2026

Contents

Revision History.....	3
LIPScan™ 3D Scan APP User's Manual	4
Notes for Programmers	5
I. System Requirements	5
II. Hardware Compatibility.....	6
III. Hardware Accessories.....	6
IV. Software Version.....	7
1. General Overview	7
2. Hardware Installation	8
2.1 Recognition Requirements.....	8
2.2 Camera Connection.....	9
3. Software Settings.....	11
4. License File Settings	13
5. Python Settings.....	15
6. Camera Configuration	18
6.1 Distance Modes Configuration.....	18
6.2 Distance Modes Adjustment	20
6.3 LIPSedge™ AE Series Network Configurations	21
7. 3D Scan	25
7.1 Main Page	25
7.2 Scan Settings.....	26
7.3 Scanning Process	28
7.4 Offline 3D Scan.....	29
8. 3D Model Edit / Export	35
9. Mesh Comparison.....	37
Appendix I. Enabling NVIDIA Processors.....	52

Revision History

Revision	Description	Date
V1.1	Content refactoring	July 2026
V1.0	New release	July 2024

LIPScan™ 3D Scan APP User's Manual

This document provides a step-by-step guide for using LIPScan™ 3D Scan APP, LIPS Corp.'s 3D modeling software, on a PC / laptop.

Note: When referring to the information of LIPSedge™ AE400/ AE430/ AE450/ AE470/ DL / M3, LIPScan™ 3D Scan APP utilizes LIPSedge™ AE400 User's Manual (Document Version 1.1) and LIPSedge™ DL / M3 version 2.4.1.1 as a reference.

Notes for Programmers

I. System Requirements

The following hardware are recommended for using LIPScan™ 3D Scan APP and supported 3D cameras.

Minimum Requirements		
CPU		4th Generation Intel® Core™ i5 Processor
RAM		4G RAM or above
GPU memory		1G or above
Graphic Card	Embedded	Intel® HD Graphics 630
	Card	NVIDIA GeForce GTX 1050Ti

Recommended Requirements		
CPU		Intel Core™ i7 7500U or above
RAM		8G RAM or above
Graphic Card		NVIDIA Graphic Cards with High-Performance NVIDIA Processors

II. Hardware Compatibility

LIPScan™ 3D Scan APP is compatible with the following 3D cameras:

Series	Models
LIPSedge™	AE400
	AE430
	AE450
	AE470
	L210u
	L215u
Intel® RealSense™	Depth Camera D415
	Depth Camera D435
	Depth Camera D435i
	Depth Camera D455

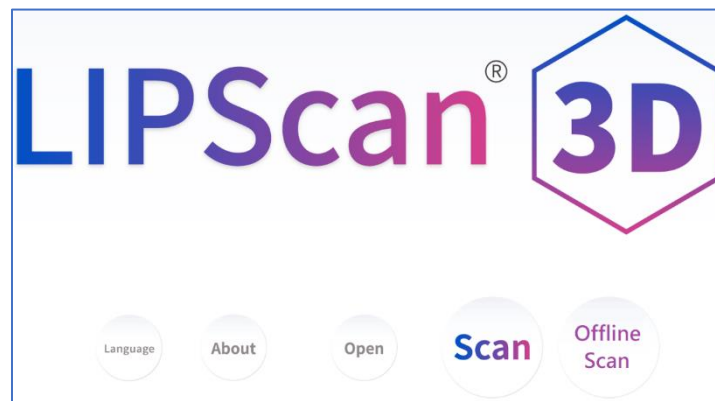
III. Hardware Accessories

Prepare the following accessories separately before installation:

- **Tripod:** A tripod with a 1 / 4-20 thumbscrew for supporting the camera.
- **Photography turntable:** A self-rotating platform for holding the target object to generate a smooth 3D model. A non-electrical turntable is also suitable.
- **Degree controller:** A controller for managing the turntable rotation degree and speed.

1. General Overview

LIPScan™ 3D Scan APP is an advanced 3D scanning software developed for a seamless digitizing experience for professionals or hobbyists in the industrial setting. Paired with high-performance 3D camera, such as the Intel® RealSense™ D400 & LIPSdege™ AE / L series, LIPScan™ 3D Scan APP allows designers to construct, edit and export 3D digital replica of medium-sized objects, with the original surface detail of the scanned object intactly retained. Once scanned, the 3D digital replica can be cleaned up or smoothened within seconds through our intuitive user interface. The 3D digital replica can then be exported to various formats, .ply, .obj, .glb,, or .stl files.



2. Hardware Installation

The instructions below detail the necessary requirements and steps to install the 3D camera for using LIPScan™ 3D Scan APP.

2.1 Recognition Requirements



- ◆ **Working Distance:** Install the camera at approximately **15 - 30 cm** from the target object.
- ◆ **Camera Position:** On a tripod, Install the camera **upright**, with the lens facing the recognition target. Note that LIPS Corp. does **NOT** provide a tripod within the package, and you need to get your own tripod for hardware installation.
- ◆ **Illumination:** **AVOID** installing the camera at places under **direct sunlight**.

2.2 Camera Connection

Install your 3D camera on your PC/laptop by following the instructions below. The instructions provided use the Intel® RealSense™ depth camera D435 as an example.

For the installation instructions of LIPSedge™ AE400/ AE450, refer to [*LIPSedge™ AE400 / 450 User's Manual*](#).

For the installation instructions of LIPSedge™ AE430/ AE470, refer to [*LIPSedge™ AE430 / 470 User's Manual*](#)

For the installation instructions of LIPSedge™ L series, refer to [*LIPSedge™ L210u / L215u User's Manual*](#).

1. Plug the **Type-C** end of the USB cable to **your camera**.



2. Install the camera **upright** on the tripod.



3. Plug the Type-A end of the USB cable to your PC / laptop.



3. Software Settings

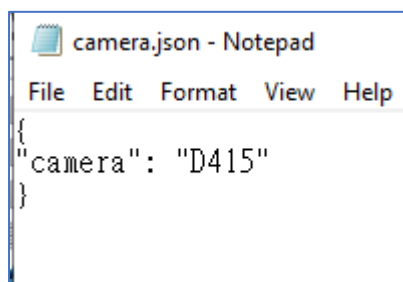
Before starting LIPScan™ 3D Scan APP, make sure the host PC / laptop meets the minimum system requirements. For details, refer to *Notes for Programmers I. System Requirements*.

1. Download and extract the downloaded file.
2. In the LIPScan™ 3D Scan APP folder, the LIPScan™ 3D APP and camera.json, its configuration files can be found.

Name	Date modified	Type	Size
pycache	2023/12/22 1:06 PM	File folder	
AE400	2023/12/22 1:06 PM	File folder	
camera	2023/12/22 1:06 PM	File folder	
Config_files	2023/12/22 1:06 PM	File folder	
gl	2023/12/22 1:06 PM	File folder	
License	2023/12/22 1:06 PM	File folder	
LIPSLicense	2023/12/22 1:06 PM	File folder	
modules	2023/12/22 1:06 PM	File folder	
RealSense	2023/12/22 1:06 PM	File folder	
tmp	2023/1/3 2:19 PM	File folder	
camera.json	2023/10/2 5:00 PM	JSON File	1 KB
CCCoreLib.dll	2023/11/10 9:53 AM	Application extension	549 KB
glbutils.py	2023/9/28 1:32 PM	Python File	1 KB
Hourglass.ani	2021/2/1 11:08 AM	Animated Cursor	6 KB
installation.bat	2023/12/26 2:00 PM	Windows Batch File	1 KB
libgmp-10.dll	2011/3/3 10:36 PM	Application extension	531 KB
liblipscan3d.dll	2023/11/10 9:53 AM	Application extension	422 KB
librealsense.dll	2023/11/10 9:52 AM	Application extension	219 KB
LIPS_3D_Scanner.res	2023/11/10 9:53 AM	Compiled Resource Script	893 KB
LIPScan 3D.exe	2023/11/10 9:53 AM	Application	1,361 KB
main.py	2023/10/2 5:37 PM	Python File	2 KB
network.json	2021/6/11 1:06 PM	JSON File	1 KB
offline3dscan.json	2022/12/29 9:38 AM	JSON File	1 KB

3. Change the identification string when connecting to different cameras. The identification string for each type of camera is listed below:

Camera Types	camera.json parameters
Intel Realsense™ D415 / 435 / 435i / 455	D415
LIPSedge™ AE400 / AE450	AE400
LIPSedge™ AE430/ AE670	AE430
LIPSedge™ L210 / 215u	L210



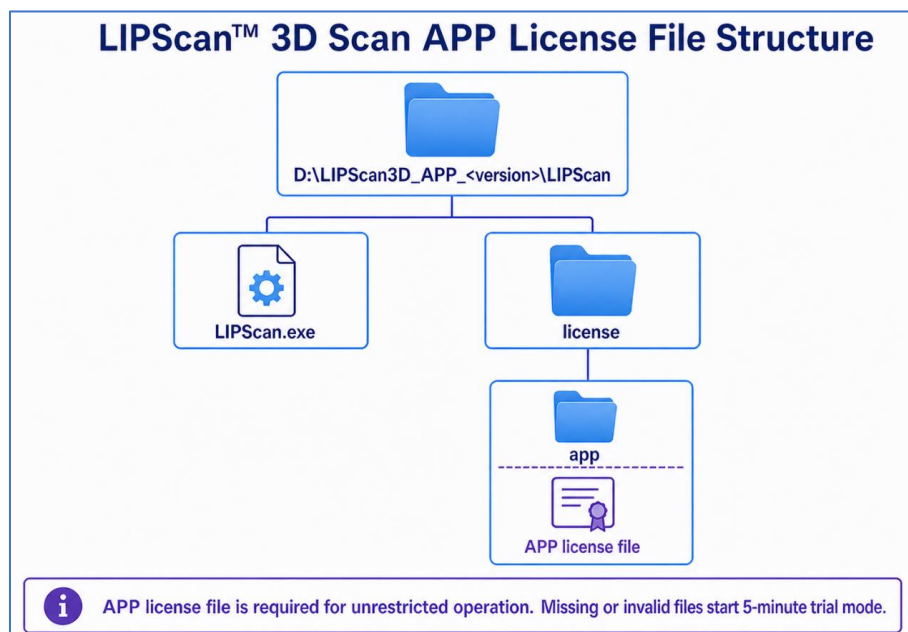
When running, LIPScan™ 3D Scan APP read the camera.json file located in the same directory to detect and connect to the configured camera types. If the camera type connected to the computer does not match the camera type specified in the camera.json file, an error message will be displayed and the application terminates.

4. License File Settings

LIPScan™ 3D Scan APP requires an **APP license** for unrestricted operation. The APP license authorizes the application to operate on the specified device. LIPScan™ 3D Scan APP checks the APP license locations while the application is running. If the APP license required license file is missing, invalid, or unreadable, the APP enters a 5-minute trial mode. When the trial period expires, a termination notice is displayed and the application closes.

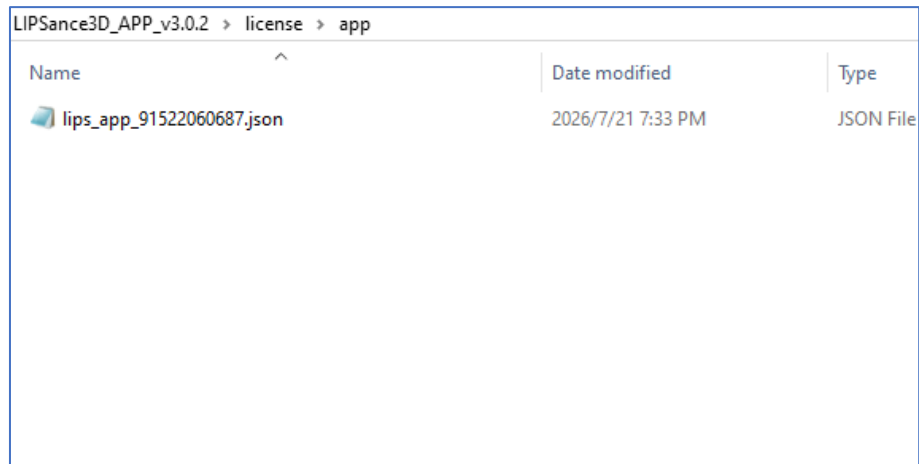
Place the **license** folder in the same application directory as LIPScan.exe. Within this folder, place the APP license file in `license\app` and the runtime license file in `license\runtime`. For example: If the executable is in D:\LIPScan3D_APP_<version>\LIPScan\LIPScan.exe,

- then place the APP license in
D:\LIPScan3D_APP_<version>\LIPScan\license\sdk\<SDK license file>
- runtime license in
D:\LIPScan3D_APP_<version>\LIPScan\license\runtime\<runtime license file>

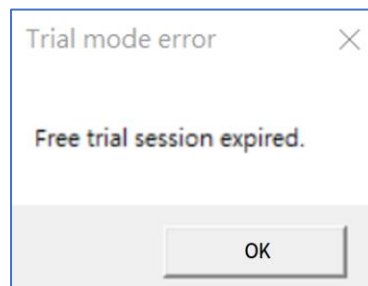


1. Place the **lips_license.json** file under the following location. In this example, a **lips_license_915422060687.json** is used.

Location: D:\LIPScan3D_SDK_<version number>\license\app\



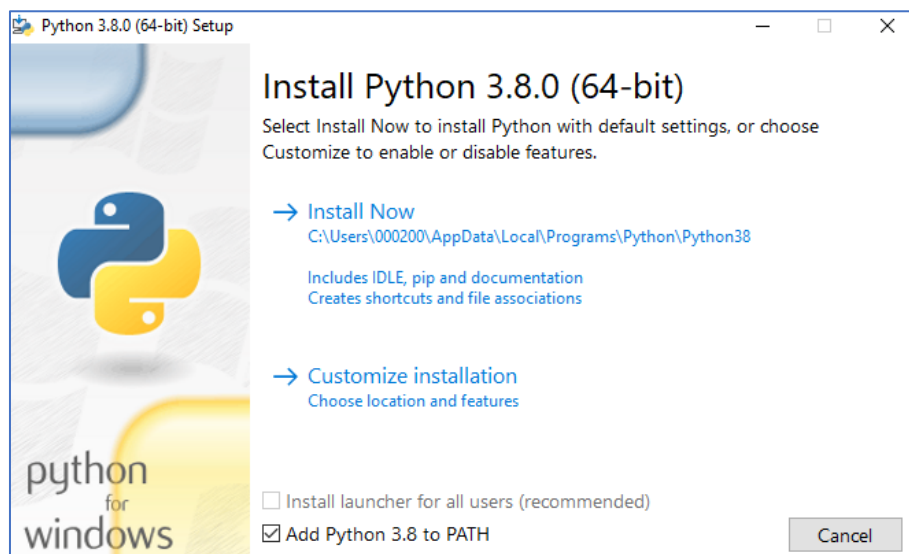
2. When the file is absent, the following notice appears when the time limit is met and the application terminates upon clicking **OK**. Once terminated, the camera images and 3D model become inaccessible.



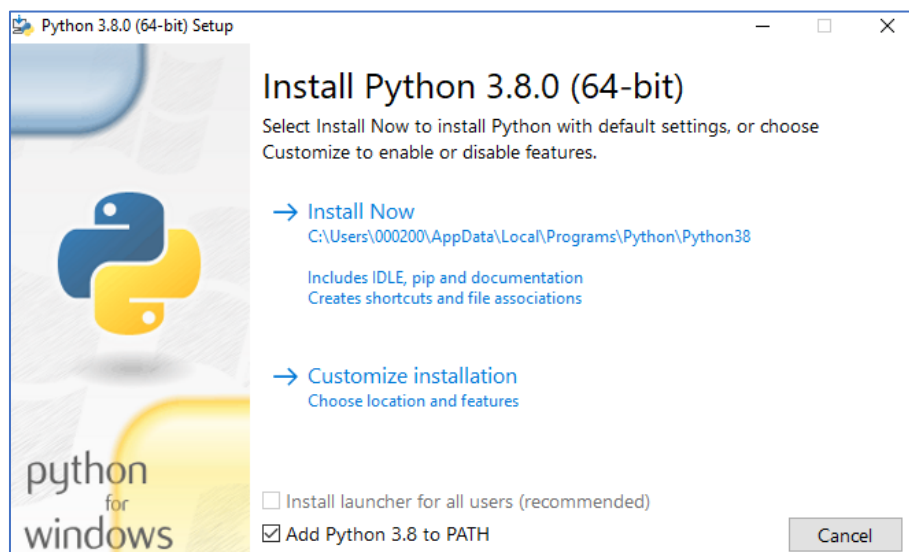
5. Python Settings

LIPScan™ 3D Scan APP requires Python 3.8 and its dependencies for file saving in .glb / .usd formats. Follow the instructions to install Python 3.8 and its associated dependencies. Python 3.8 is available <https://www.python.org/downloads/>.

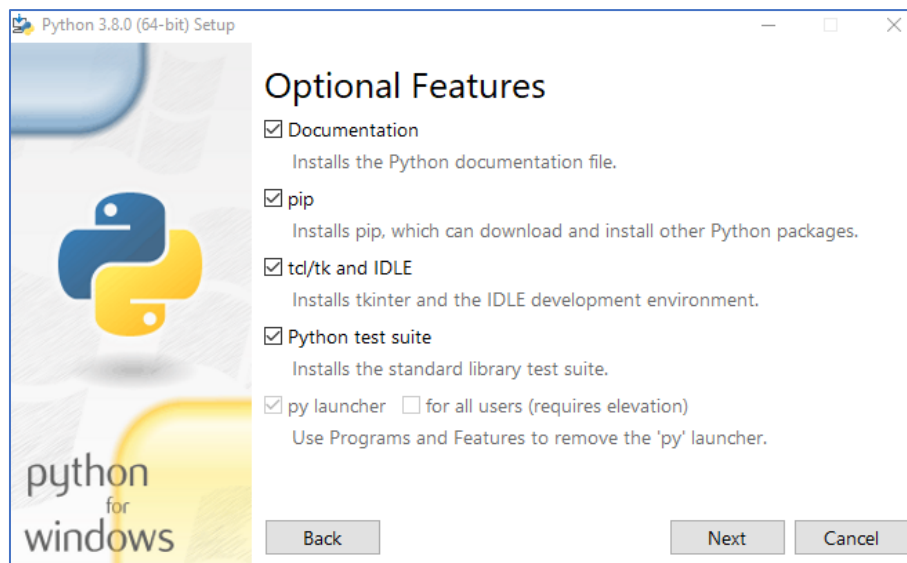
1. Download Python 3.8.
2. Select **Add Python 3.8 to PATH** for environment variables setup.



3. Select **Customize Installation**.

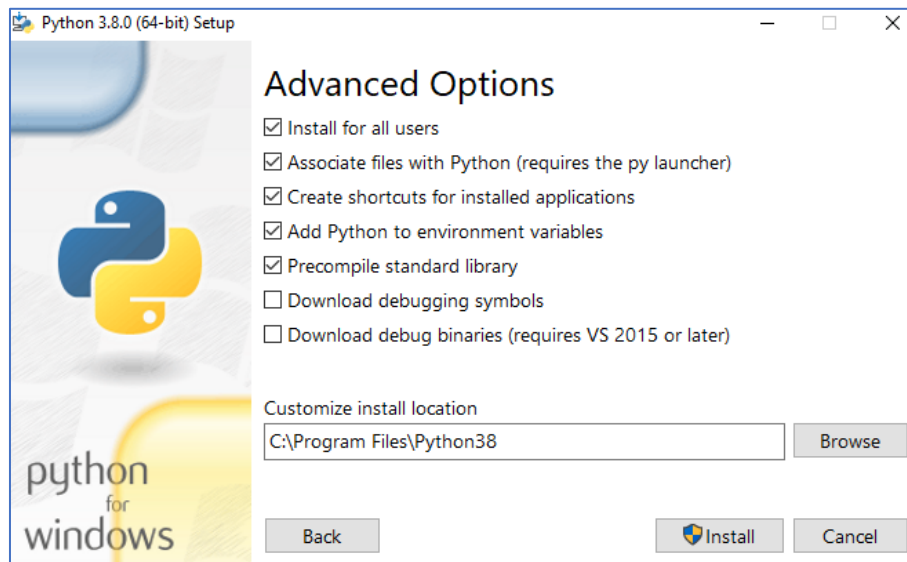


4. Click **Next**.



5. Select the following options and click **Install**.

- Install for all users
- Associate files with Python (required the py launcher)
- Create shortcuts for installed applications
- Add Python to environment variables
- Precompiled standard library



6. Go to the LIPScan™ 3D Scan APP folder and click **installation.bat**.

	glbutils.py	9/28/2023 1:32 PM	Python File	1 KB
	Hourglass.ani	2/1/2021 11:08 AM	Animated Cursor	6 KB
	installation.bat	12/26/2023 1:42 PM	Windows Batch File	1 KB
	libgmp-10.dll	3/3/2011 10:36 PM	Application extens...	531 KB
	liblipscan3d.dll	11/10/2023 9:53 AM	Application extens...	422 KB
	librealsense.dll	11/10/2023 9:52 AM	Application extens...	219 KB
	LIPS_3D_Scanner.res	11/10/2023 9:53 AM	Compiled Resourc...	893 KB
	LIPScan 3D.exe	11/10/2023 9:53 AM	Application	1,361 KB
	main.py	10/2/2023 5:37 PM	Python File	2 KB
	network.json	6/11/2021 1:06 PM	JSON File	1 KB
	offline3dscan.json	12/29/2022 9:38 AM	JSON File	1 KB
	opencv_core455.dll	6/27/2023 3:10 PM	Application extens...	16,693 KB

7. Python related dependencies are installed to the host PC.

```

C:\WINDOWS\system32\cmd.exe

C:\Users\000200\Desktop\LIPScan3D_APP_v2.4.141.20>pip install pymeshlab
Collecting pymeshlab
  Downloading https://files.pythonhosted.org/packages/16/ba/3eff5512ecd28c52d/pymeshlab-2023.12-cp38-cp38-win_amd64.whl (51.6MB)
    | 51.7MB 6.4MB/s
Collecting numpy (from pymeshlab)
  Downloading https://files.pythonhosted.org/packages/69/65/0d47953afa0ad569d/numpy-1.24.4-cp38-cp38-win_amd64.whl (14.9MB)
    | 14.9MB 6.4MB/s
Collecting msvc-runtime (from pymeshlab)
  Downloading https://files.pythonhosted.org/packages/f5/98/494d94d1bedc7466f/msvc_runtime-14.34.31931-cp38-cp38-win_amd64.whl (1.8MB)
    | 1.8MB ...
Installing collected packages: numpy, msvc-runtime, pymeshlab
  
```

6. Camera Configuration

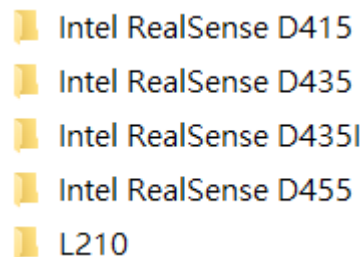
LIPScan™ 3D Scan APP is compatible with the Intel® RealSense™ D400 series, LIPSedge™ AE / L series depth cameras. Each series requires specific software / network configurations before using LIPScan™ 3D Scan APP.

For LIPSedge™ AE / L series, it is required to download the camera's SDK from <https://www.lips-hci.com/lipssdk>. For details, refer to <https://lips-hci.gitbook.io/lips-developer-documentation>.

6.1 Distance Modes Configuration

LIPScan™ 3D Scan APP detects the connected camera and loads the configuration files based on the camera and **distance modes**. For more information about distance modes, refer to section 6.3 *Distance Modes Adjustment*.

LIPScan™3D provides **3 sets** of configuration settings by default, each corresponding to the 3D camera connected.



For example, when a Intel® RealSense™ D415 camera is detected, LIPScan™3D first navigate to `\Config_files\Intel RealSense D415\1280x720` and loads the `scan3d_config.txt` file, which stated the configuration files assigned to each distance mode:

```
small disparity200_1280x720_medium_density.json  
medium disparity100_1280x720_medium_density.json  
large disparity40_1280x720_highaccuracy.json
```

Distance Modes	Configuration Files (.json)
small	disparity200_1280x720_medium_density.json
medium	disparity100_1280x720_medium_density.json
large	disparity40_1280x720_highaccuracy.json

According to the **Distance Modes** selected, LIPScan™3D loads from 1 of the 3 camera configuration files (.json) scripted above. The configuration files need to be placed in the **same folder** as shown in the figure below:

Name	Date modified	Type
 disparity0_1280x720_high_accuracy.json	2021/11/29 6:39 PM	JSON File
 disparity50_1280x720_high_accuracy.json	2021/11/30 4:04 PM	JSON File
 disparity150_1280x720_high_accuracy.json	2021/11/29 6:58 PM	JSON File
 scan3d_config.txt	2022/1/11 2:24 PM	Text Document

If you need to change the configuration file loaded in the scan mode, for example, set the medium scan mode to load disparity100_1280x720_highaccuracy.json, then modify the scan3d_config.txt content as shown below:

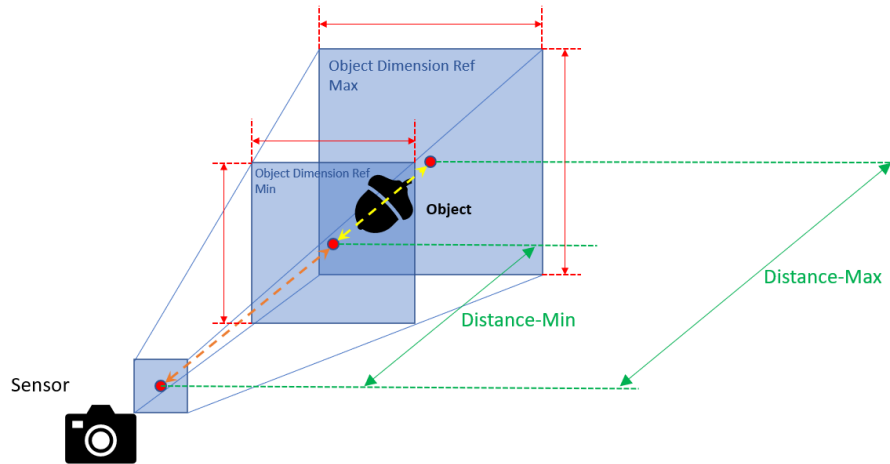
```
small disparity200_1280x720_medium_density.json
medium disparity100_1280x720_highaccuracy.json
large disparity40_1280x720_highaccuracy.json
```

Place the configuration file in the above-mentioned location:

Name	Date modified	Type
 disparity0_1280x720_high_accuracy.json	2021/11/29 6:39 PM	JSON File
 disparity50_1280x720_high_accuracy.json	2021/11/30 4:04 PM	JSON File
 disparity150_1280x720_high_accuracy.json	2021/11/29 6:58 PM	JSON File
 disparity200_1280x720_medium_density.json	2021/11/29 6:58 PM	JSON File
 scan3d_config.txt	2022/1/11 2:24 PM	Text Document

6.2 Distance Modes Adjustment

Select the **distanced-based scanning quality** indicators based on the metrics of scanning objects.

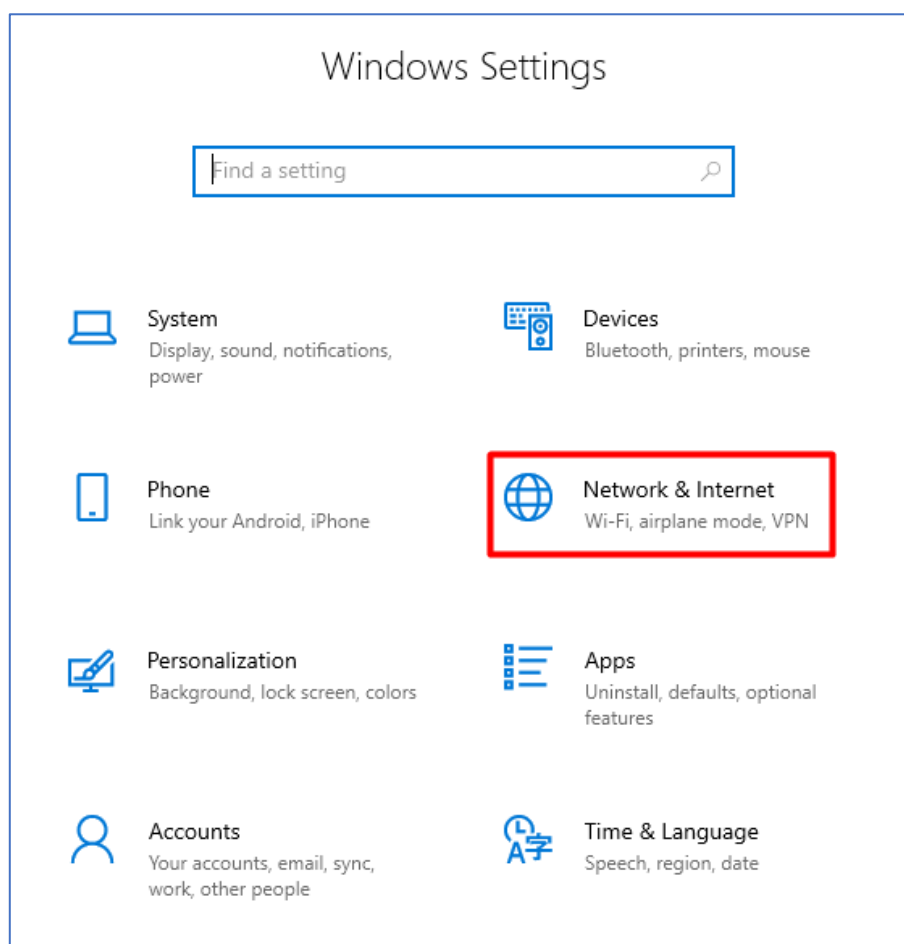


The scanned object should be placed within the range Depth Range-Min and Depth Range-Max for the best scanning performance. The range should include the object from every possible scanning angle. Make sure the scanned object is at least 1 cm apart from the Depth Range-Min and Depth Range-Max to avoid missing point cloud data.

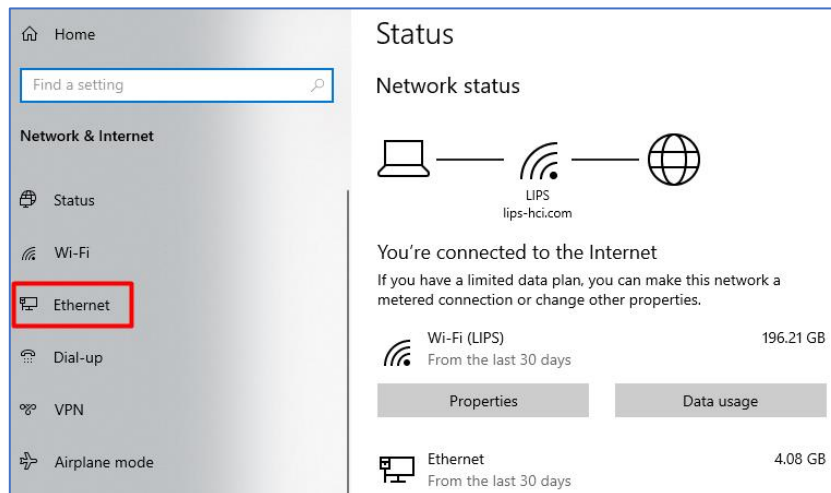
6.3 LIPSedge™ AE Series Network Configurations

LIPSedge™ AE Series relies on Ethernet for data connections and PoE for power supply. For LIPSedge™ AE400 connection, activate the Ethernet connection on your PC / laptop and configure the camera's IP address.

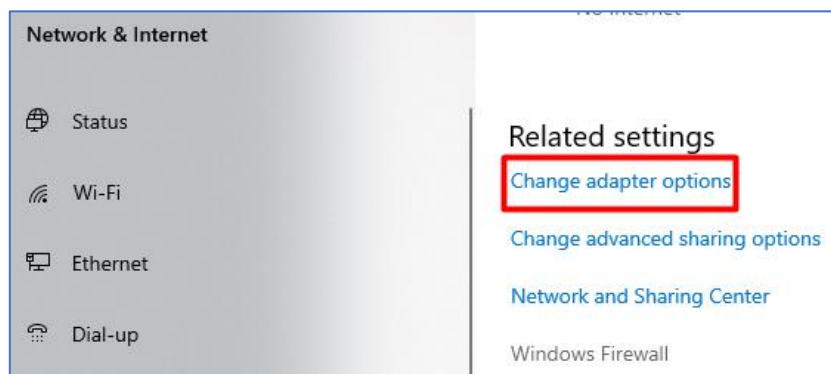
1. Open **Windows Settings** and click **Network & Internet**.



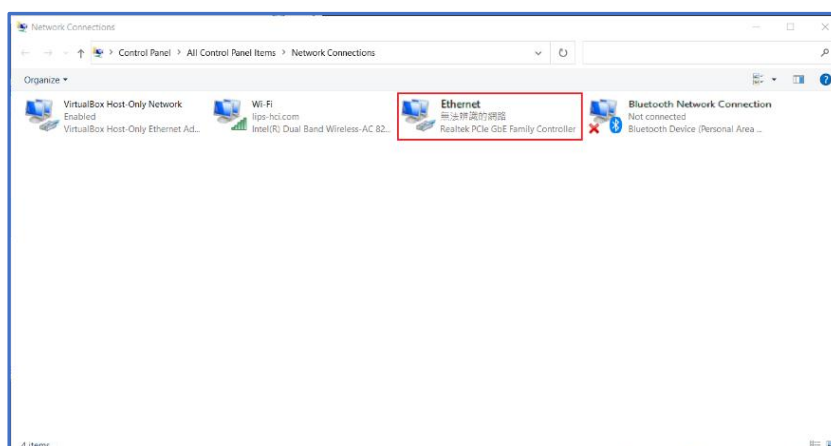
2. On the left menu, click **Ethernet**.



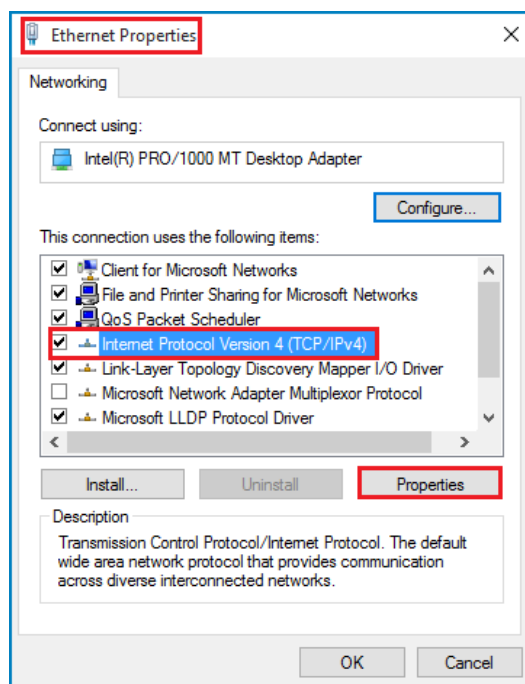
3. Click **Change adapter options**.



4. Right-click **Ethernet** and select **Properties**.



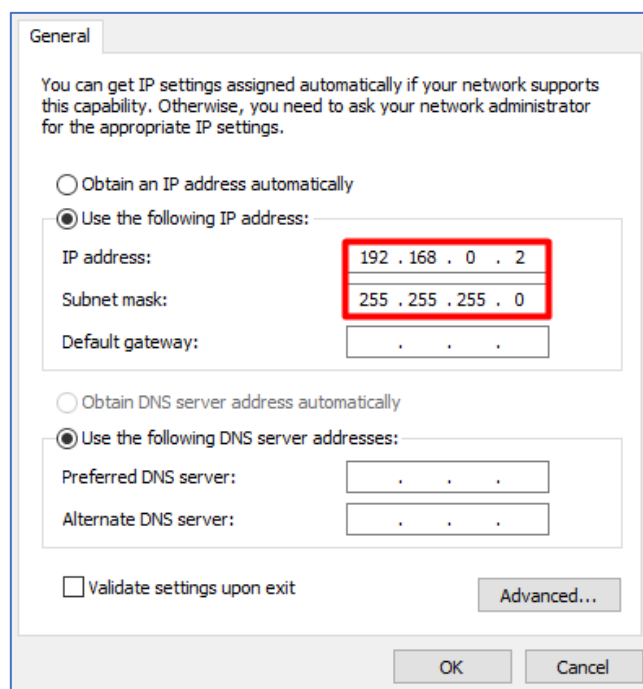
5. Select **Internet Protocol Version 4 (TCP / IPv4)** and click **Properties**.



6. Assign the host PC / laptop to the **same subnet** as the LIPSedge™ AE series camera (default IP address: 192.168.0.100) and click **OK**.

IP Address : 192.168.0.2

Subnet mask : 255.255.255.0



7. In the **Command Prompt**, type the following command: **ping 192.168.0.100** and press **Enter**. When the ping packets sent equals to the ping packets received, the camera connection is properly setup.

```
Microsoft Windows [Version 10.0.19042.1052]
(c) Microsoft Corporation. All rights reserved.

C:\Users\000200>ping 192.168.0.100

Pinging 192.168.0.100 with 32 bytes of data:
Reply from 192.168.0.100: bytes=32 time<1ms TTL=64
Reply from 192.168.0.100: bytes=32 time=1ms TTL=64
Reply from 192.168.0.100: bytes=32 time<1ms TTL=64
Reply from 192.168.0.100: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.0.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\000200>
```

7. 3D Scan

Before the scanning starts, make sure the 3D camera is properly connected to your PC / laptop. For NVIDIA Graphic Cards users, enable **Manage 3D settings > High-performance NVIDIA processor**. Otherwise, the application won't start. For more information about NVIDIA graphic card configuration, refer to *Appendix. I. Enabling NVIDIA Processors*.

7.1 Main Page

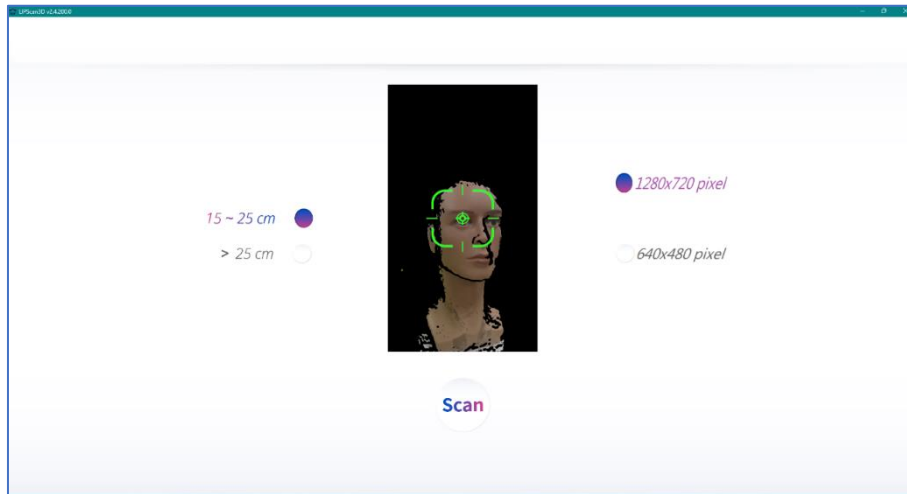
The main page of LIPScan™ 3D Scan APP is shown as the figure below. Click **Scan** to start scanning your middle-sized object (15 cm - 25 cm). To change settings or edit an existing 3D file, refer to the table below.



No.	Name	Function
1.	Language	Changes the system languages. Choose English or Traditional Chinese .
2.	About	Shows the current software version.
3.	Open	Opens 3D files in your PC / laptop. For details, read <i>8. 3D Model Edit / Export</i> .
4.	Scan	Creates new 3D models.
5.	Offline Scan	Creates new 3D models from camera binary image files

7.2 Scan Settings

After clicking **Scan**, you will be directed to the scan settings page. In this stage, you can optimize the optical settings for optimal 3D scanning results by **adjusting the lens focus on the object** and selecting the appropriate **distance modes** or **resolution**. Typically, longer scanning distances generate more noise in depth images, whereas shorter scanning distances preserve finer surface details.

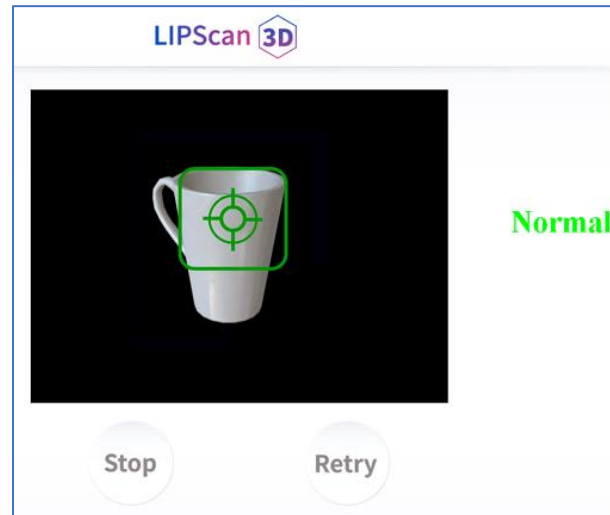


No.	Name	Function
1.	15 ~ 25 cm	Scans the object with the standard scanning quality. Recommended for objects around 25 cm – 40 cm.
2.	> 25 cm	Recommended for tall or large volume objects, such as the human body.
3.	Scan	Starts the scanning process.

No.	Name	Function
5.	Focal Window	Displays the object and its distance from the 3D camera. one of the following Focal Indicators will appear on screen. Adjust the distance until the green sign appears, indicating the object is in focus.
		Object in focus
		The object is too far / near
		Out of focus
6.	High Resolution	Changes the camera resolution to 1280 * 720. This is the default resolution.
7.	Low Resolution	Changes the camera resolution to 640 * 480

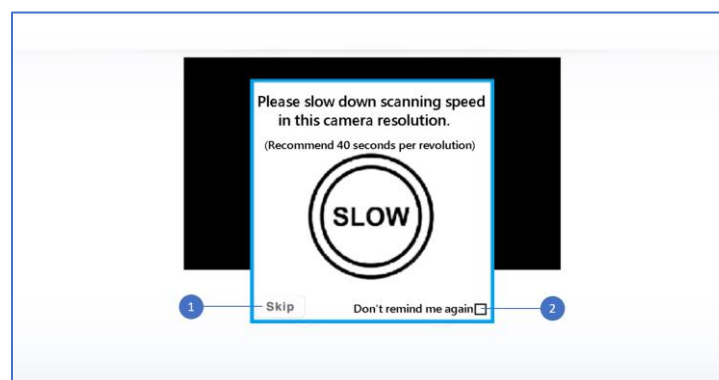
7.3 Scanning Process

After clicking , the following window appears. It means the scanning process has started until you click **Stop** or **Retry**.



Use the photography turntable to rotate your object while scanning, which allows LIPScan™ 3D Scan APP to construct the 3D model of your object from every direction. You can also partially scan the object by stopping the scanning process at any time.

For high resolution (1280 * 720) users, a reminder pops-up after clicking  to suggest slowing down the rotation speed for scanning. Click **Skip** to continue the scanning process.



No.	Name	Function
1.	Skip	Closes message box
2.	Don't remind me again	Conceals the pop-up message box.

7.4 Offline 3D Scan

LIPScan™ 3D Scan APP supports offline 3D scanning, which can render previously saved continuous 3D, RGB and point cloud image into 3D models in an offline environment.

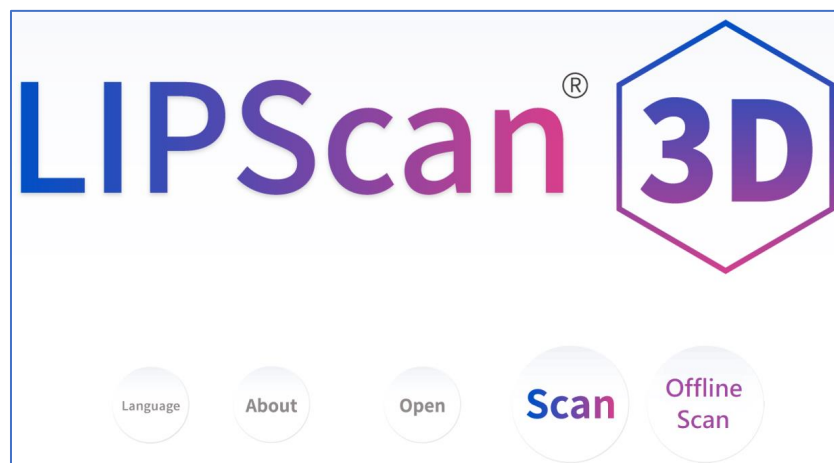
[Saving Source Files]

Before performing offline 3D scan, you must create a folder in the LIPScan™ 3D Scan APP location for storing the source files (.bin), which is the collection of 3D, RGB, and point cloud images. Then, use the photography turntable to create a series of source files for rendering. For optimal results, it is recommended to have at least 16 frames or more.

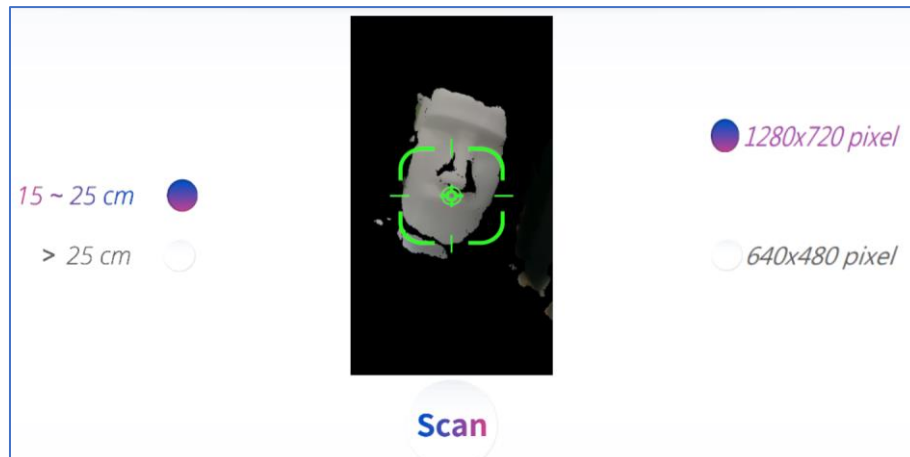
1. In LIPScan™ 3D Scan APP's location, create a **tmp** folder.

Name	Date modified	Type
camera	2023/3/7 2:56 PM	File folder
Config_files	2023/3/7 2:56 PM	File folder
License	2023/3/7 2:56 PM	File folder
modules	2023/3/7 2:56 PM	File folder
tmp	2023/3/7 5:37 PM	File folder
camera.json	2023/2/13 6:48 PM	JSON File
CCCoreLib.dll	2023/2/21 11:11 AM	Application extension
Hourglass.ani	2021/2/1 11:08 AM	Animated Cursor
libgmp-10.dll	2011/3/3 10:36 PM	Application extension
liblipscan3d.dll	2023/2/23 10:42 AM	Application extension
librealsense.dll	2023/2/23 10:42 AM	Application extension
LIPScan 3D.exe	2023/2/22 5:06 PM	Application
network.json	2021/6/11 1:06 PM	JSON File

2. Place the target object on the photography turntable. Make sure the target object is in focus.
3. Open LIPScan™ 3D Scan APP and click **Scan**.



4. Click **Scan** again.

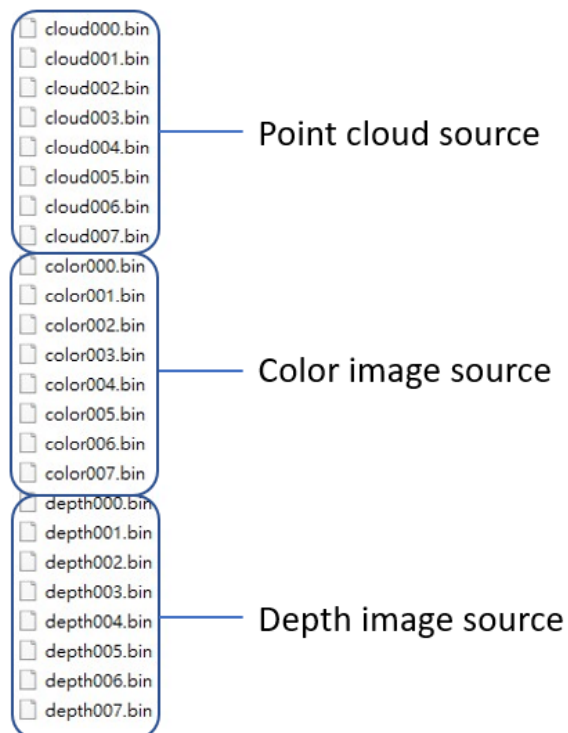


5. During scanning, press **S** to save the current 3D / RGB / point cloud image.

Name	Date modified	Type
 cloud000.bin	2019/12/7 10:49 PM	BIN File
 cloud001.bin	2019/12/7 10:49 PM	BIN File
 cloud002.bin	2019/12/7 10:49 PM	BIN File
 color000.bin	2019/12/7 10:49 PM	BIN File
 color001.bin	2019/12/7 10:49 PM	BIN File
 color002.bin	2019/12/7 10:49 PM	BIN File

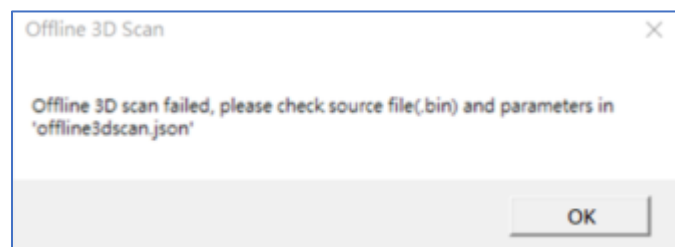
6. Use the controller to adjust the target object's degree and repeat Step 5.

7. The source files for offline 3D reconstruction are organized as below.

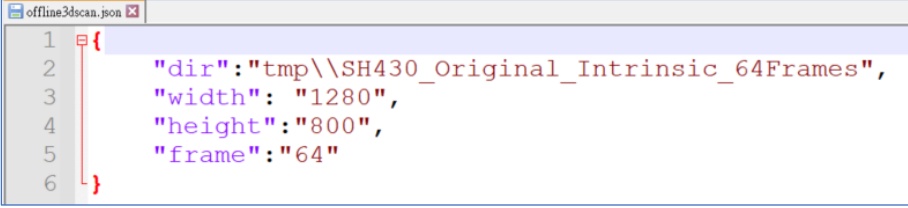


[Source Files Settings]

After saving the source files (bin), you must configure the offline3dscan.json (saved in the LIPScan™ 3D Scan APP location) and the source files for execution. Otherwise, an error message pop up.



The offline3dscan.json indicates the information of binary source files for rendering the 3D model. The file is formatted as below.

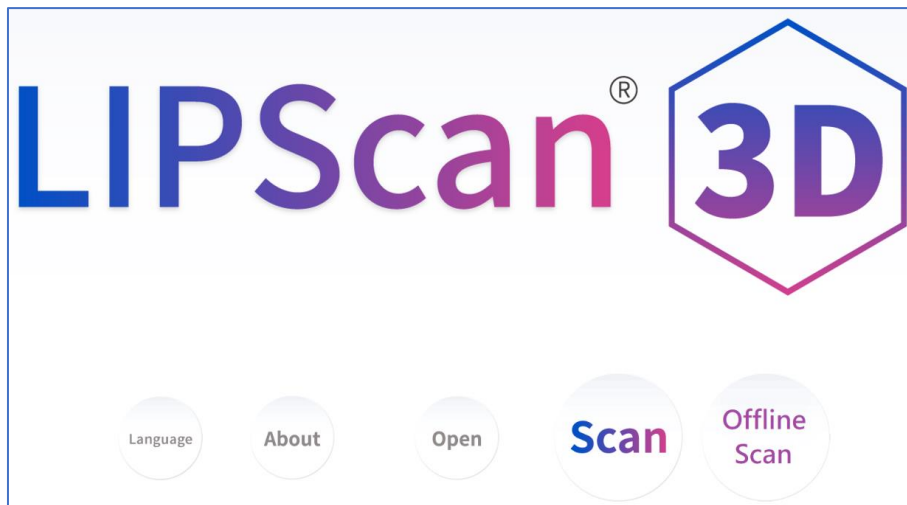


```
1 {  
2   "dir": "tmp\\SH430_Original_Intrinsic_64Frames",  
3   "width": "1280",  
4   "height": "800",  
5   "frame": "64"  
6 }
```

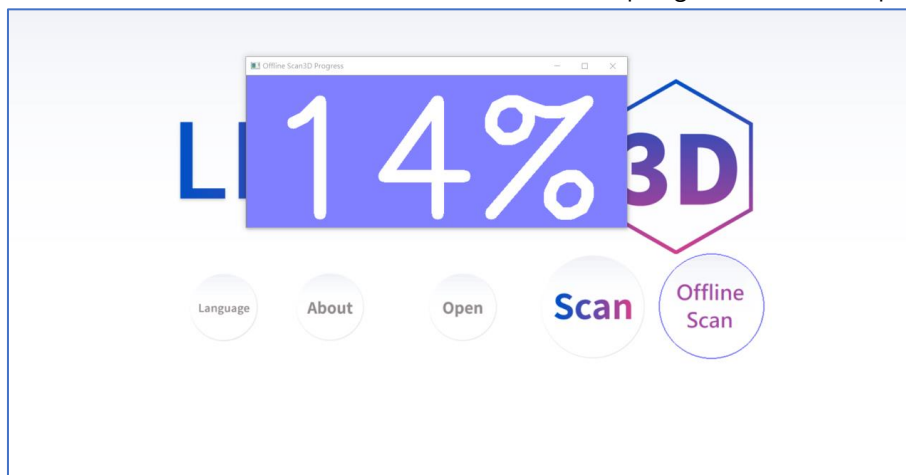
- **dir**: Path of encoded color image, depth image and point cloud source file(.bin).
- **width**: Width of encoded image source file(.bin) for offline 3D reconstruction.
- **height**: Height of encode image source file(.bin) for offline 3D reconstruction.
- **frame**: Counts of frames to 3D reconstruction.

[Offline Scanning]

1. Restart LIPScan™ 3D Scan APP and click **Offline Scan**.



2. LIPScan™ 3D Scan APP renders the 3D model. A progress bar is displayed:



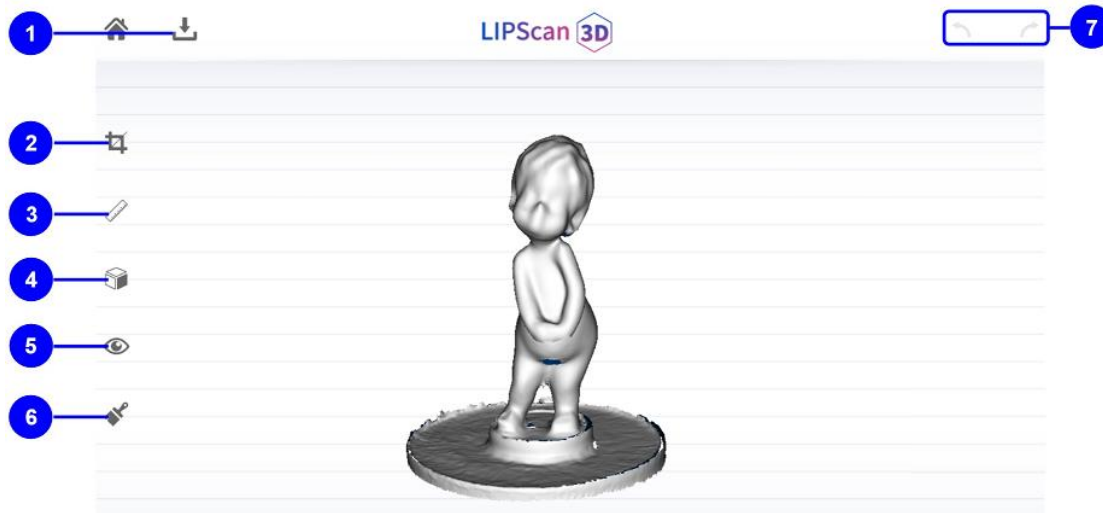
3. When the progress window is closed during offline 3D reconstruction, LIPScan™ 3D Scan APP shows it again until the progress reaches 100%.

4. After the offline 3D scan is completed, the application will render the 3D model in the editor's window.



8. 3D Model Edit / Export

After the scanning process is completed, you will be directed to the **LIPScan™ 3D Scan APP's editor**. Here, you can edit, view measure and cleanup the 3D model of the target object. Scroll your mouse to **zoom in** or **out** for better view. Refer to the table below for each specific function. After you finished editing, click **Export** to save the 3D model on your PC / laptop.



No.	Name	Function
1.	Export	Exports the 3D file to your PC / laptop.
2.	Split	Crops the unwanted area from the 3D model. You can delete the unwanted area by pressing Delete on your keyboard.
3.	Measure	Measures the 3D model's length and width on screen by drawing lines across the 3D model with your mouse.

No.	Name	Function
4.	View	Displays the 3D model in predefined angles. Default, Top, Bottom, Front, Back, Right and Left buttons appears when you click View. Select the desired angle and LIPScan™ 3D Scan APP quickly turns the 3D model to the selected angles. The Default represents the Front View.
5.	Display	Displays the surface of the 3D model. Surface, Mesh, and Color buttons appears when you click Display. ◆ Surface: The 3D model in polygon surfaces. ◆ Mesh: The 3D model in polygon wireframe ◆ Color: The 3D model (Surface / mesh) with its original color.
6.	Smooth	Removes the gradient information of in a part of your 3D model. A Slide Bar appears when you click Smooth. Slide the bar from left (weak) to right (strong) to adjust the strength of the gradient eraser.
7.	Previous / Next	Restores the previous action or go to the next action.

9. Mesh Comparison

In LIPScan™ 3D Scan, you can compare the reconstructed mesh models (known as **compared entities**) with predefined 3D CAD models (known as **referenced entities**) to calculate the accuracy / precision differences between them. The statistics of the mesh model differences can be exported as histogram files (.csv) for analysis. The following are the procedures for mesh analysis:

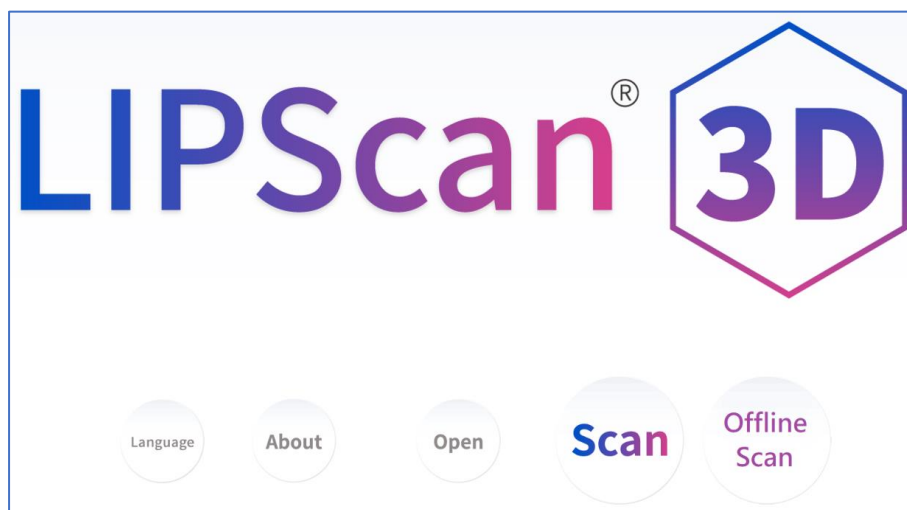
Actions	Purpose
1. License file settings	Mesh comparison is an advanced feature for LIPScan™ 3D Scan APP. Obtain the license file by contacting your LIPS Corp. sales representatives.
2. Import	Import both the compared entities and the reference entity to enable comparison. The compared entity will act as the agent for comparison while the reference entity will serve as the basis for comparison.
3. Alignment	Select three unique anchor points on both the compared entities and the reference entity. LIPScan™ 3D Scan APP will initiate a transformation matrix to align the disorganized 3D models so that they are in the same orientation and position.
4. Registration	Register the 3D mesh distribution data by the mesh comparison ICP and mesh comparison sampling parameters, allowing for accurate comparison.
5. Mesh Differences	Compute the differences in mesh distribution between the compared entities and the reference entities and generate a color-coded model to visualize the calculation results.
6. File Exportation	Assess the computation results to determine whether to export the computed model as a .csv file.
7. Reinitialization	Assess the computation results to determine whether to reinitialize the mesh model alignment / registration process.

Actions	Purpose
8. Color Scale Modification	Assess the computation results to determine whether to change the color scale for registered mesh models.
9. Mesh Differences Analysis	Use Microsoft Office Excel to generate infographics based on the mesh comparison data for analysis.

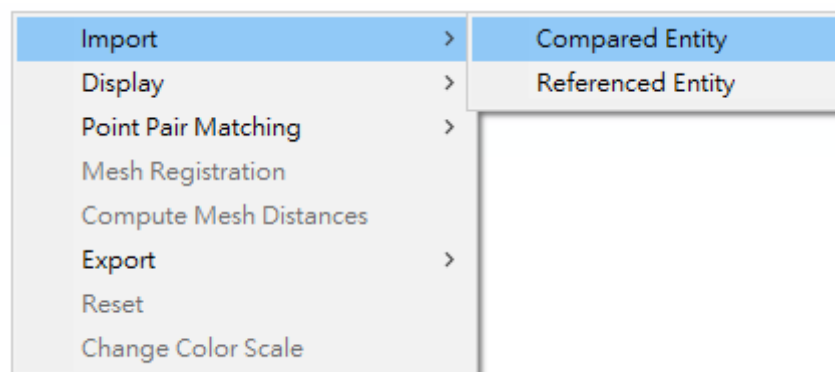
8.1. Import

In this stage, import both the compared entities and the reference entity to enable comparison. The compared entity will act as the agent for comparison while the reference entity will serve as the basis for comparison. Upon import, both entities may appear disorganized in the software window.

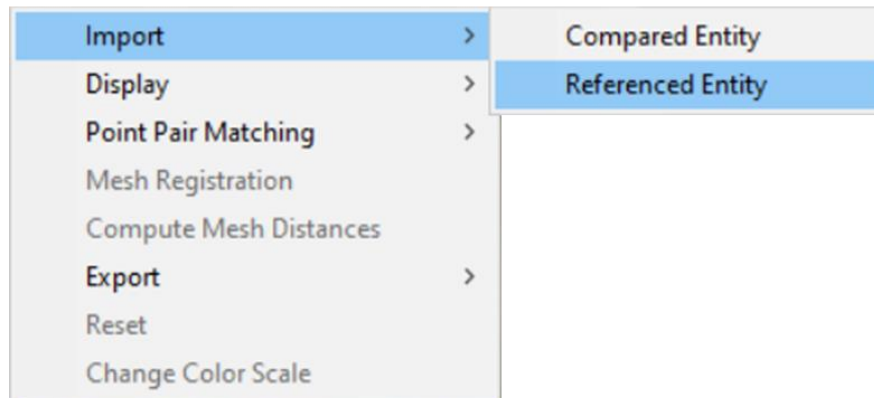
1. Launch LIPScan™ 3D Scan APP.
2. Click **Scan** to initialize the LIPScan™ 3D Scan APP and then right-click the main page. A drop-down menu pops-up.



3. From the menu, select **Import > Compared entity** and select the mesh model you wish to compare (.ply). The model will then be displayed on the window.

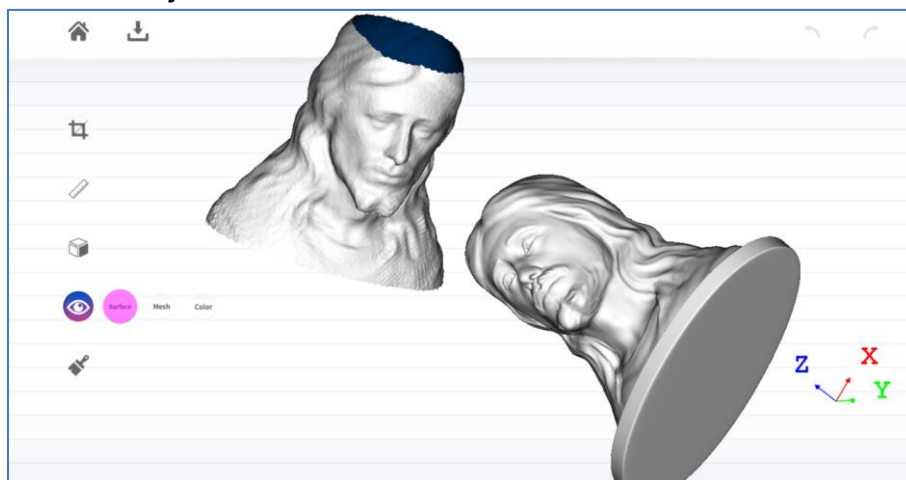


4. Select **Import > Referenced Entity** and select the mesh model that serves as a reference (.ply).



Note: In rare occasions, LIPScan™ 3D Scan APP may terminate when the same model is used as both the compared entity and the referenced entity. To resolve this issue, repeat the import process.

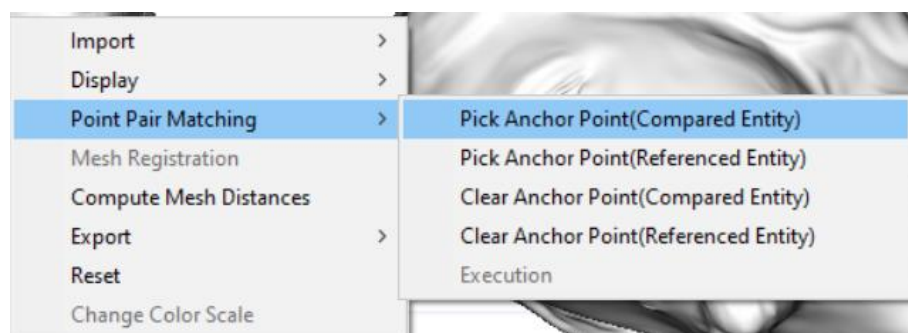
5. Imported entities will be rendered mesh in LIPScan™ 3D Scan APP Editor. To examine the overlapping parts of the models, select **Display > Compared / Referenced Entity**.



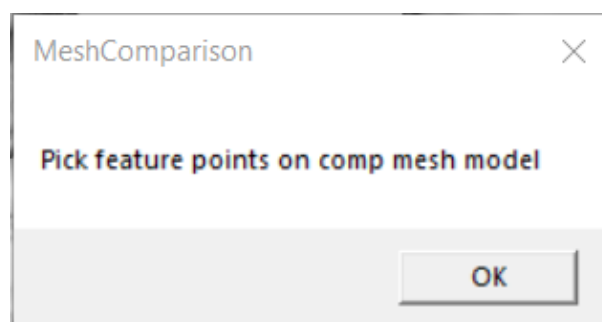
8.2 Alignment

In this stage, select three unique anchor points on both the compared entities and the reference entity. LIPScan™ 3D Scan APP will initiate a transformation matrix to align the disorganized 3D models so that they are in the same orientation and position.

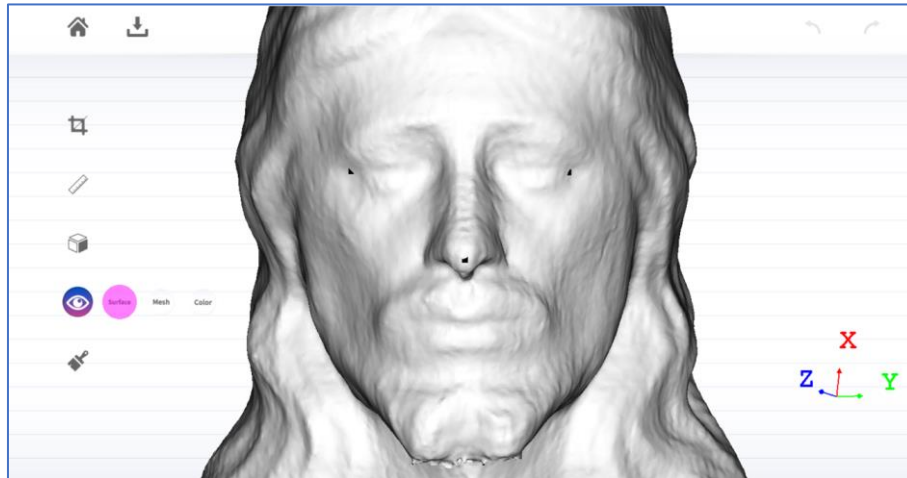
1. Right-click the LIPScan™ 3D Scan APP. From the menu, select **Point pairs matching > Pick Anchor Points (Compared entity)**.



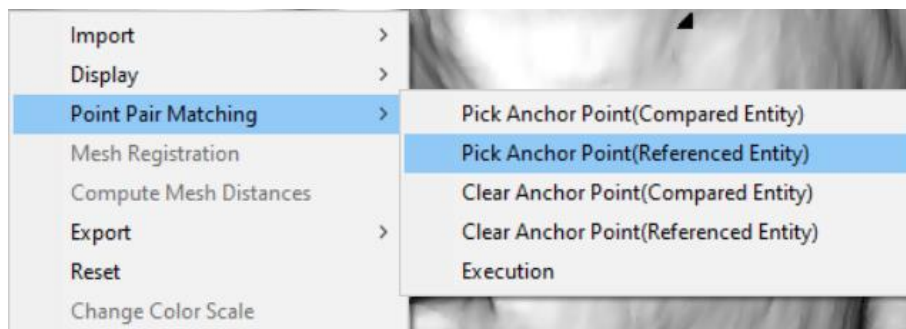
2. A pop-up message appears. Click **OK**.



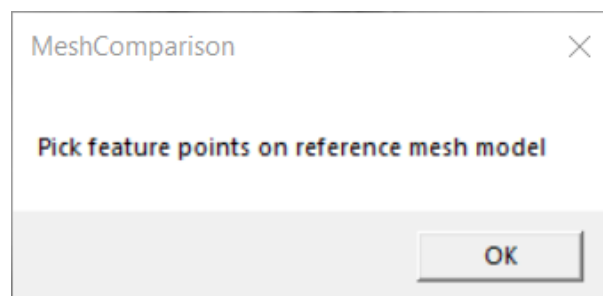
3. On the mesh model's surface, select 3 unique anchor points. The anchor points should be the model's distinctive features, such as the nose or the eye corner.



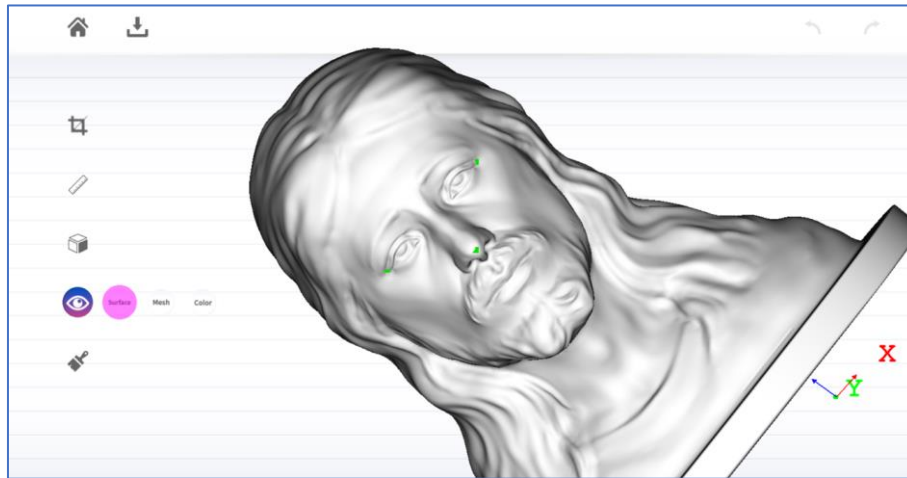
4. Right-click the LIPScan™ 3D Scan APP. From the menu, select **Point pair matching > Pick Anchor Points (Reference)**. Upon selecting the option, LIPScan™ 3D Scan APP ceases to display the compared entity and its anchor points.



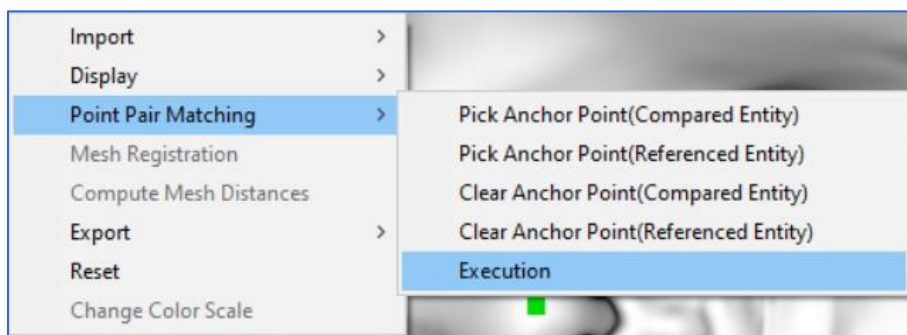
5. A pop-up message appears. Click **OK**.



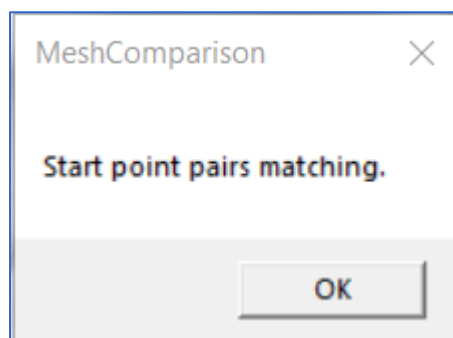
6. Adjust the referenced entity's orientation and select **anchor points that are the same as the compared entity's anchor points**. Otherwise, the point pair matching will fail.



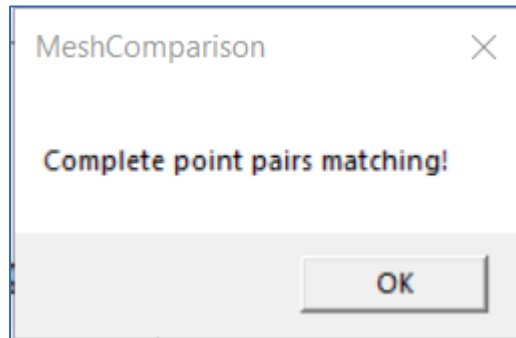
7. Once the anchor points for both models are set up properly, the Execution option becomes available. Select **Point pair matching > Execute**.



8. LIPScan™ 3D Scan APP starts computing the point pairing conversion matrix. Click **OK**.

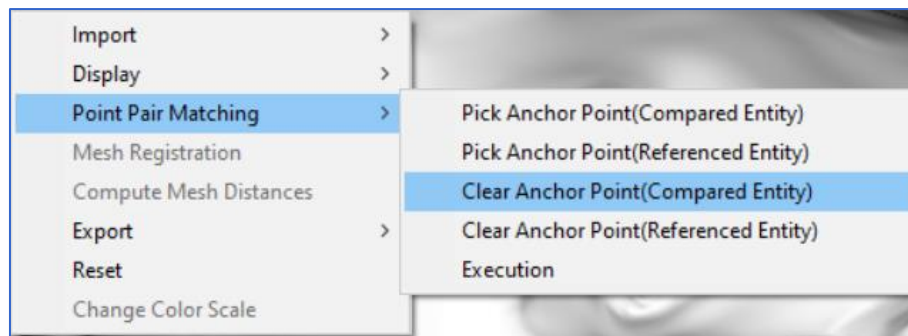


9. Once the point pairing is completed, a pop-up message appears. Click **OK**.



10. In the following cases, select **Point pair matching > Clearing Anchor Points (Compared / Referenced Entity)**.

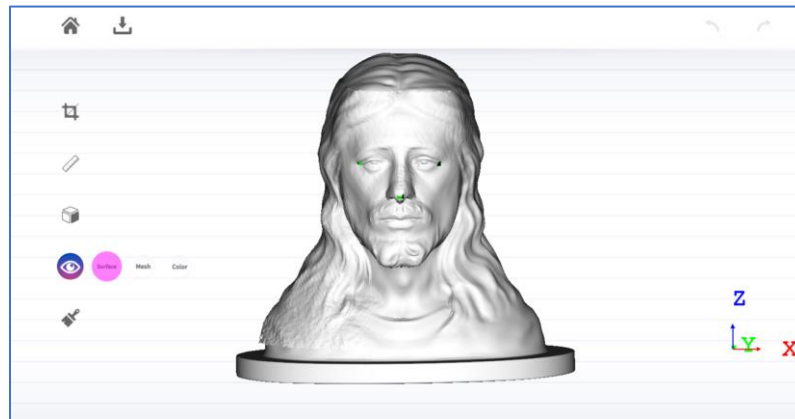
- Importing entities with different volume scales. The volume scales for 2 entities must be the same.
- Selecting different anchor points for 2 entities



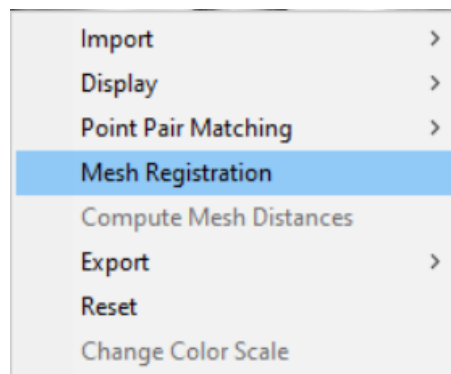
8.3 Registration

In this stage, LIPScan™ 3D Scan APP will take the aligned entities and render 2 partially overlapping mesh models. The APP will register the 3D mesh distribution data by the mesh comparison ICP and mesh comparison sampling parameters, allowing for accurate comparison.

1. Examine the entities aligned.



2. Right-click the LIPScan™ 3D Scan APP. From the menu, click **Mesh Registration**.



3. The entities will be rendered in LIPScan™ 3D Scan APP.



4. To adjust the parameters of mesh registration, open **set_edit.xml** in the LIPScan™ 3D Scan APP folder.
 - **MeshComparisonICP**: A smaller value enhances the accuracy of the registration process but results in longer computation time, and conversely, a larger value reduces accuracy but improves computation speed. The range of values for this parameter is between 0.00001 – 0.01.
 - **MeshComparisonSampling**: A smaller value decreases the computation time but results in poorer precision, and conversely, a larger value improves the precision but compromised the computation speed. The range of values for this parameter is between -20000 – 50000.

```

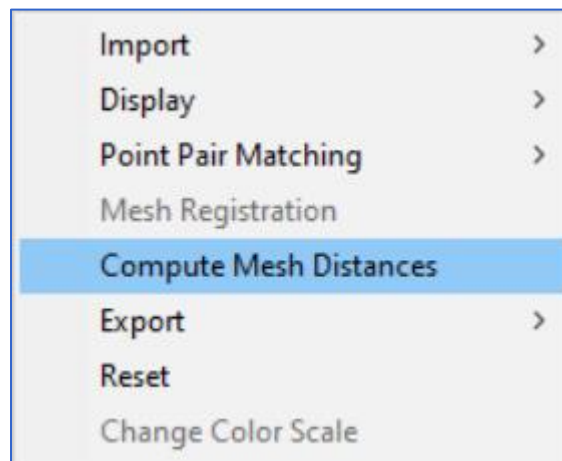
set_edit.xml
1  <?xml version="1.0" encoding="utf-8"?>
2  <Editor>
3    <ResolutionMode>0</ResolutionMode>
4    <FillHoleSize>100000</FillHoleSize>
5    <PenSize>10</PenSize>
6    <CheckSurface>true</CheckSurface>
7    <CheckLine>false</CheckLine>
8    <CheckPoint>false</CheckPoint>
9    <CheckLight>true</CheckLight>
10   <CheckColor>false</CheckColor>
11   <CheckWorldPlan>false</CheckWorldPlan>
12   <BoundingBox>false</BoundingBox>
13   <LanguageIndex>0</LanguageIndex>
14   <SmoothTimes>483</SmoothTimes>
15   <BuzzerActive>false</BuzzerActive>
16   <SizeMode>2</SizeMode>
17   <ViewMode>0</ViewMode>
18   <DoNotRemindMe>true</DoNotRemindMe>
19   <RemindScan>true</RemindScan>
20   <MeshComparisonICP>0.01</MeshComparisonICP>
21   <MeshComparisonSampling>50000</MeshComparisonSampling>
22 </Editor>
  
```

5. After modifying the parameters, close and reopen application to reload them.

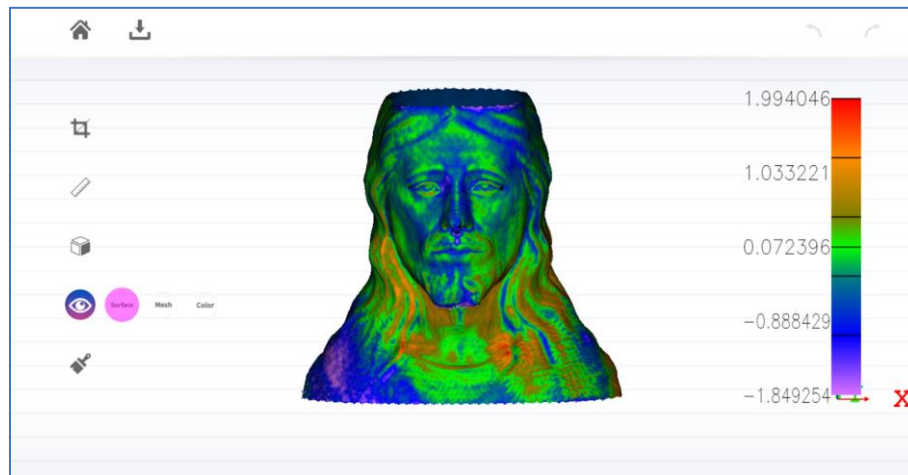
8.4 Mesh Distances

In this stage, LIPScan™ 3D Scan APP computes the differences in mesh distribution and generates a color-coded model to visualize the mesh differences. The distance unit is millimeter (mm) and the color scale is displayed at the right side of the editor

1. Right-click the LIPScan™ 3D Scan APP. From the menu, select **Compute Mesh Distances**.



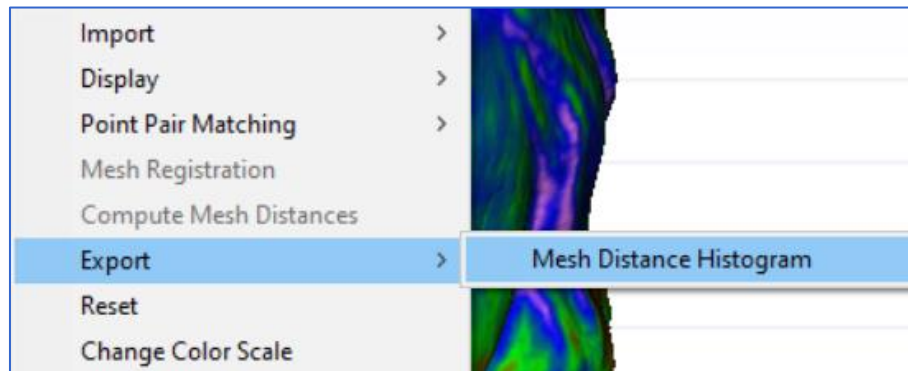
2. LIPScan™ 3D Scan APP will generate a color-coded model and the mesh differences will be visualized by corresponding colors.



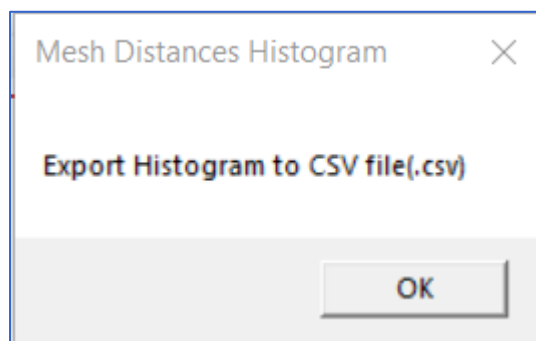
8.5 File Exportation

In this stage, you can assess the computation results to determine whether to export the computed model as a .csv file.

1. Right-click the LIPScan™ 3D Scan APP. From the menu, select **Export > Mesh distance histogram**.



2. Assign a file name and click **Save**. A pop-up message appears indicating successful saving process.

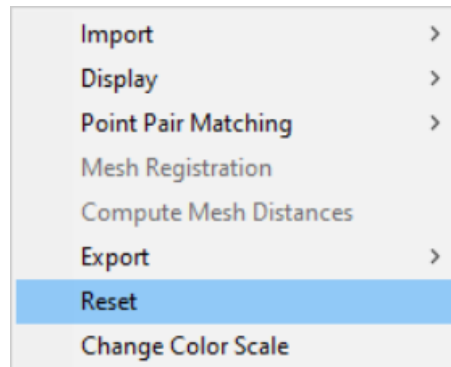


The exported .csv file can be used for further analysis. For detail, refer to 8.8 *Mesh Differences Analysis*.

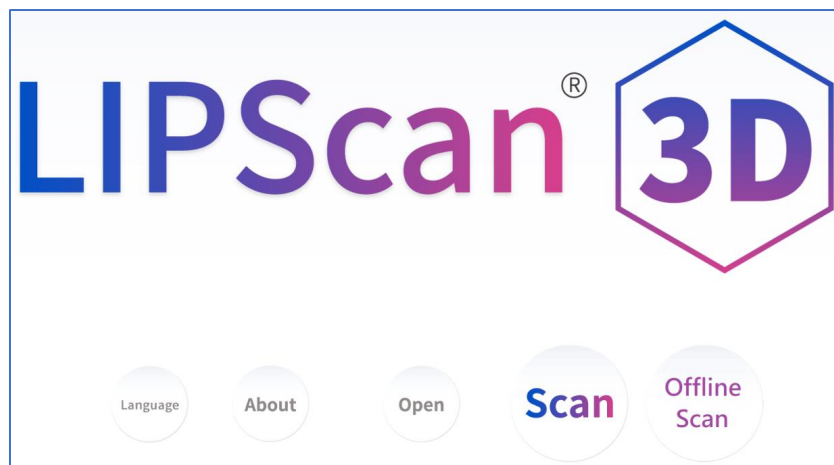
8.6 Reinitialization

When error occurs during the mesh model alignment / registration process, you may need to reinitialize the anchor point section process and release memories.

1. Right-click the LIPScan™ 3D Scan APP. From the menu, select **Reset**.



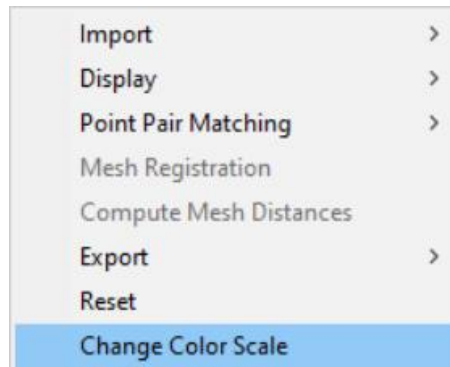
2. Click **OK**. LIPScan™ 3D Scan APP will return to the main page and its original status.



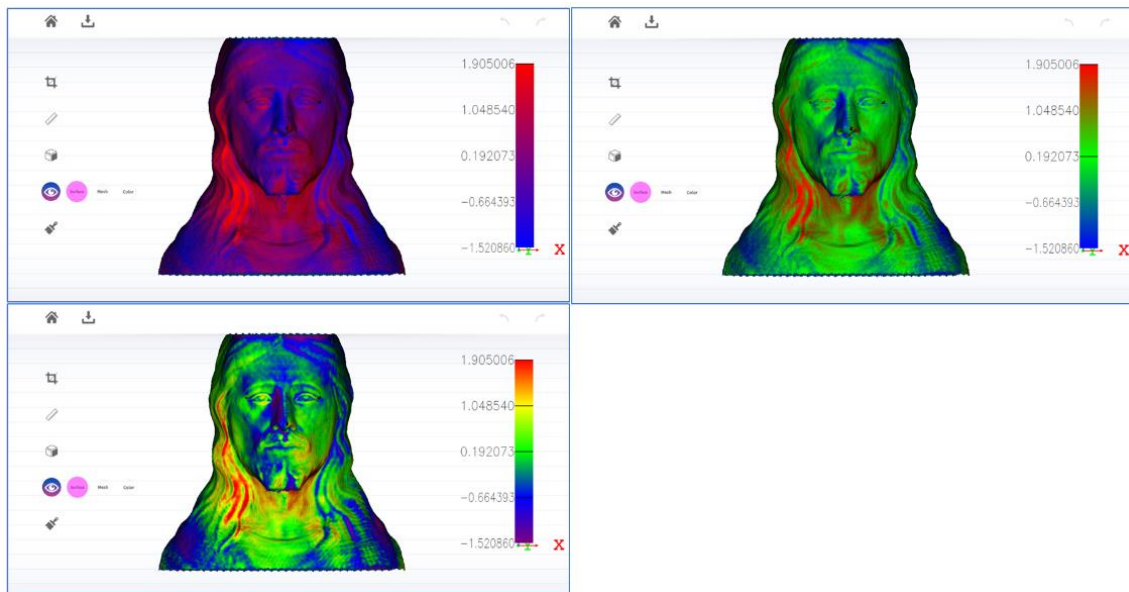
8.7 Color Scale Modification

LIPScan™ 3D Scan APP offers 4 sets of color scale to visualize the mesh surface distances.

1. Right-click the LIPScan™ 3D Scan APP. From the menu, select **Change Color Scale**.



2. Repeat the previous step to switch between the color scales.



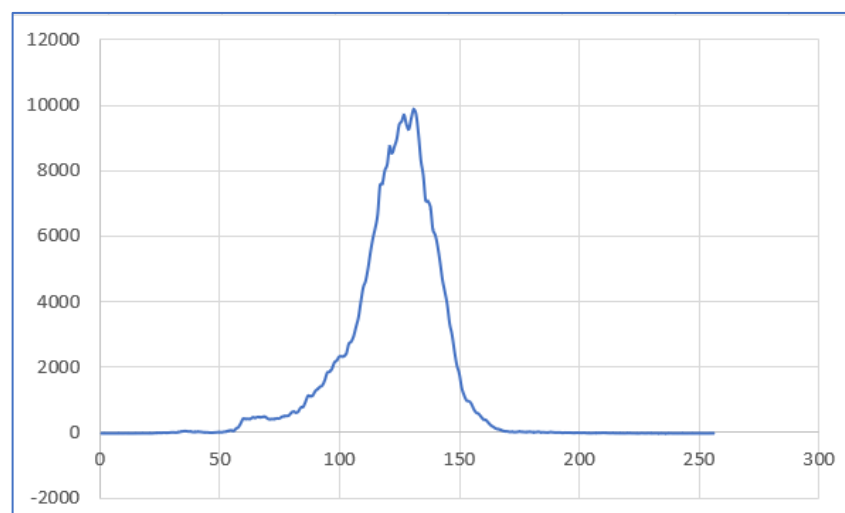
8.8 Mesh Differences Analysis

In this stage, you can import the mesh difference statistics (.csv) to Microsoft Office Excel to generate infographics based on the mesh comparison data for analysis. The .csv file contains 4 columns.

	A	B	C	D	E
1	Column1 ▾	Column2 ▾	Column3 ▾	Column4 ▾	Column5 ▾
2	1	1	-6.43403	-6.38235	
3	2	0	-6.38235	-6.33066	
4	3	0	-6.33066	-6.27897	
5	4	0	-6.27897	-6.22729	
6	5	0	-6.22729	-6.1756	
7	6	0	-6.1756	-6.12391	
8	7	0	-6.12391	-6.07223	
9	8	0	-6.07223	-6.02054	
10	9	1	-6.02054	-5.96886	
11	10	0	-5.96886	-5.91717	
12	11	2	-5.91717	-5.86548	

- **A column:** [interval] index, the default value is 1~256, which means that the distance of the point cloud is divided into 256 intervals, and each interval has a corresponding count and end value.
- **B column:** [count] the sum of point count.
- **C column:** [interval] starting value
- **D column:** [interval] ending value

1. Open Microsoft Office Excel.
2. Go to **Data > From Text / CSV** and select the .csv file exported from mesh comparison.
3. Establish a distribution diagram in which the column A is the X axis data and column B as the Y axis data.

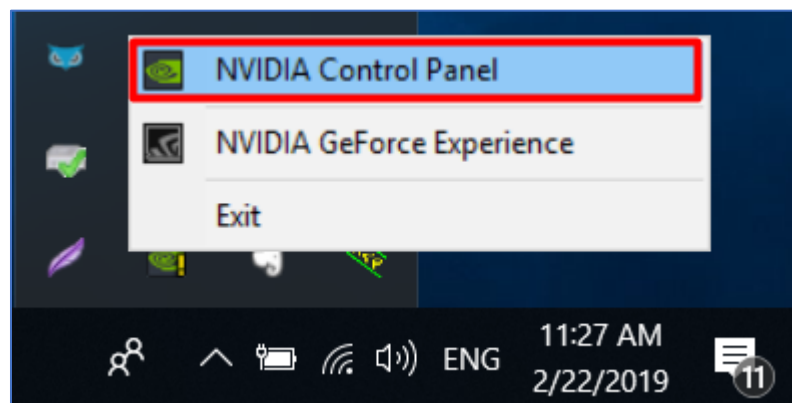


Appendix I. Enabling NVIDIA Processors

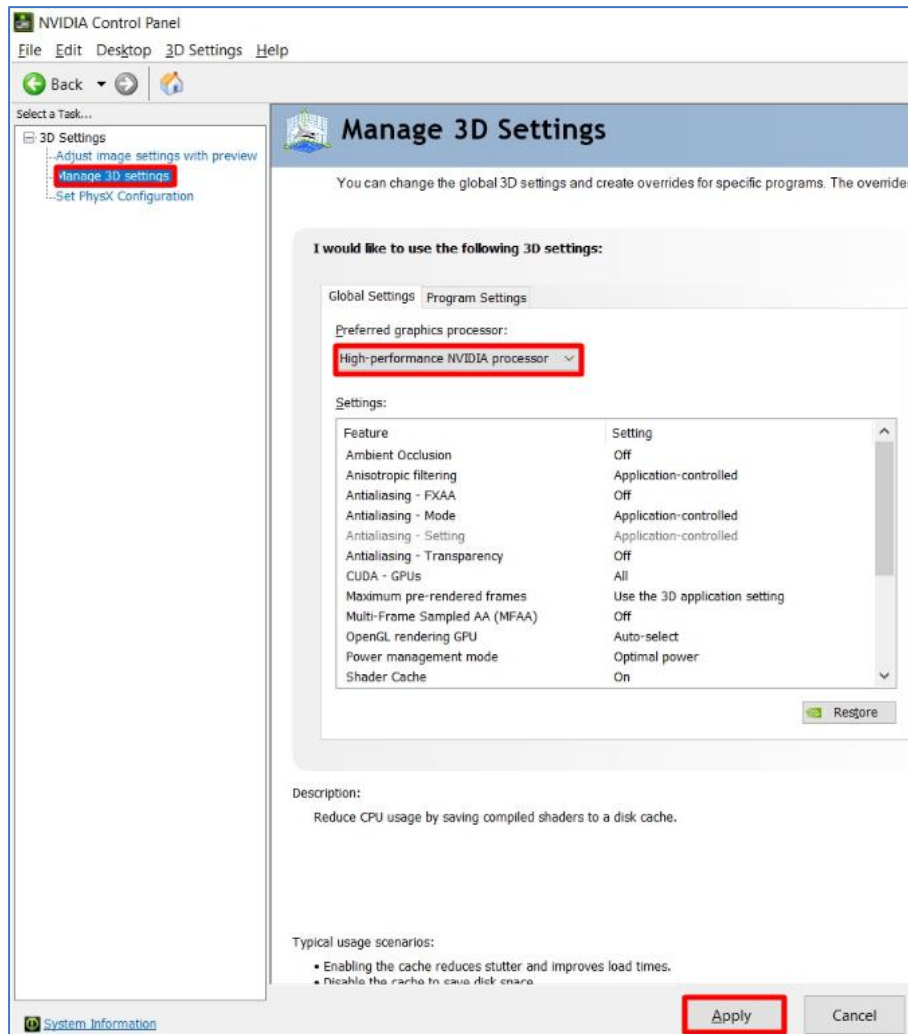
To start LIPScan™ 3D Scan APP on PC / laptops with NVIDIA graphic cards, make sure the graphic card is equipped with high-performance processors, as the processor must be enabled through the **NVIDIA Control Panel** software before starting LIPScan™ 3D Scan APP. You can download the software, contained within the latest driver packet, from [NVIDIA website](#).

Note: In rare cases, the installation of NVIDIA Control Panel may fail even when the driver is successfully installed. To resolve this issue, boot your PC / laptop in the **Safe Mode** under which the driver is removed. After the remove process is finished, restart your PC / laptop, and install the driver packet again.

1. Install the latest driver packet for your NVIDIA graphic card model.
2. Right-click the NVIDIA icon on the taskbar and select **NVIDIA Control Panel**.



3. Click **Manage 3D settings**. Under **Global Settings**, select **High-performance NVIDIA processor**, and click **Apply**. You can now start LIPScan™ 3D Scan APP.





LIPS CORPORATION

2F, No. 100, Ruiguang Road, Neihu District,

Taipei City 114, Taiwan

Tel.: + 886-2-8791-6998

Fax: +886-2-8791-8996

Official Website: <https://www.lips-hci.com/>

E-Mail: info@lips-hci.com