STONEX

STONEX® X120^{GO}

SLAM Laser Scanner

User Guide

(September 2022)-Ver.1. -Rev.1

www.stonex.it

Contents

1. Legal Notice

1.1 Copyrights and trademarks

STONEX®, the STONEX® logo, and X120^{GO} are trademarks of STONEX® S.r.l.
STONEX® GO*app*, STONEX® GO*post* and STONEX® Reconstructor are trademarks of STONEX® S.r.l.
All other trademarks are the property of their respective owners.

2. Standard Limited Warranty

2.1 Shipping policy

The Customer or the Dealer is required to pay for the charges for shipping of fault parts or instruments to STONEX® representative office and STONEX® (will provide) the shipping for return. Dealers needs to follow STONEX® repair/service procedure to achieve a better and prompt service result.

2.2 Return policy Dead on Arrival instruments

All returned products must be shipped to STONEX® representative office.
The original Purchaser has a period of seven (7) days, starting from date (data) of purchasing to signal the existence of a defect in the instrument for a full refund (less shipping and handling), provided the merchandise is in new, resalable condition and returned in the original, undamaged packaging. Customer must pay for both the return and the original freight fees, regardless of the original freight paid by the Company. All warranty books, instruction manuals, parts and accessories must be included as well as the original box in which the item was shipped. We recommend placing the original carton inside another box, to avoid any additional damage to the carton itself. In some cases, returns of special items will require a re-stock fee. Acceptance of returned merchandise is final only after inspection by STONEX®.
Above terms and (policy shall apply as for hardware.) Dealers needs to follow STONEX® repair/service procedure to achieve a better and prompt service result.

2.3 Firmware/Software warranty

STONEX® doesn't warrant that operation of Firmware/Software on any instruments will be uninterrupted or error-free, or that functions contained in Firmware/Software will operate to meet your requirements.
STONEX® will forward the Software/Firmware Fix to the dealer or customer. Firmware/software Fix means an error correction or other update created to fix a previous firmware version that substantially doesn't conform to the instrument's specification.

2.4 Over Warranty repair(s) policy

Customer shall pay the standard repair fees for any service (whether part replacement or repairs) and performed by STONEX® under request and explicit authorization of the customer itself. In this case the customer is charged for return shipment's fees as well.

2.5 Disclaimer and Limitation of Remedy

All other express and implied warranties for this product, including the implied warranties of merchantability and fitness for a particular purpose and/or noninfringement of any third party's rights, are hereby disclaimed.

STONEX® expressly disclaims all warranties not stated in this limited warranty. Any implied warranties that may be imposed by law are limited in duration to the term of this limited warranty. Some jurisdictions do not allow the exclusion of implied warranties or limitations on how long an implied warranty lasts, so the above exclusions or limitations may not apply to customer. Customer must read and follow all set-up and usage instructions in the applicable user guides and/or manuals enclosed. If customer fails to do so, this product may not function properly and may be damaged. Customer may lose data or sustain personal injuries. STONEX®, its affiliates and suppliers do not warrant that operation of this product will be uninterrupted or error free as do all electronics at times. If this product fails to work as warranted above, customer's sole and exclusive remedy shall be repair or replacement. In no event will STONEX®, its affiliates or suppliers be liable to customer or any third party for any damage in excess of the purchase price of the product. This limitation applies to damages of any kind whatsoever including (1) damage to, or loss or corruption of, customer's records, programs, data or removable storage media, or (2) any direct or indirect damages, lost profits, lost savings or other special, incidental, exemplary or consequential damages, whether for breach of warranty, contract, tort or otherwise, or whether arising out of the use of or inability to use the product and/or the enclosed user guides and/or manuals, even if STONEX®, or an authorized STONEX® representative, authorized service provider or reseller has been advised of the possibility of such damages or of any claim by any other party. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages for some products, so the exclusions or limitations may not apply to customer. This limited warranty gives customer specific legal rights, and customer may also have other rights which vary from country/state/jurisdiction to country/state/jurisdiction.

2.6 Environmental recycling

The cardboard box, the plastic in the package and the various parts of this product have to be recycled and disposed of in accordance with the current legislation of your Country.

FOR COUNTRIES IN THE EUROPEAN UNION (EU)

The disposal of electric and electronic device as solid urban waste is strictly prohibited: they must be collected separately.

Contact Local Authorities to obtain practical information about correct handling of the waste, location, and times of waste collection centers. When you buy a new device of ours, you can give back to our dealer a used similar device. The dumping of these devices at unequipped or unauthorized places may have hazardous effects on health and environment.

The crossed dustbin symbol means that the device must be taken to authorized collection centers and must be handled separately from solid urban waste.

FOR COUNTRIES OUTSIDE EUROPEAN UNION (EU)

The treatment, recycling, collection, and disposal of electric and electronic devices may vary in accordance with the laws in force in the Country in question.

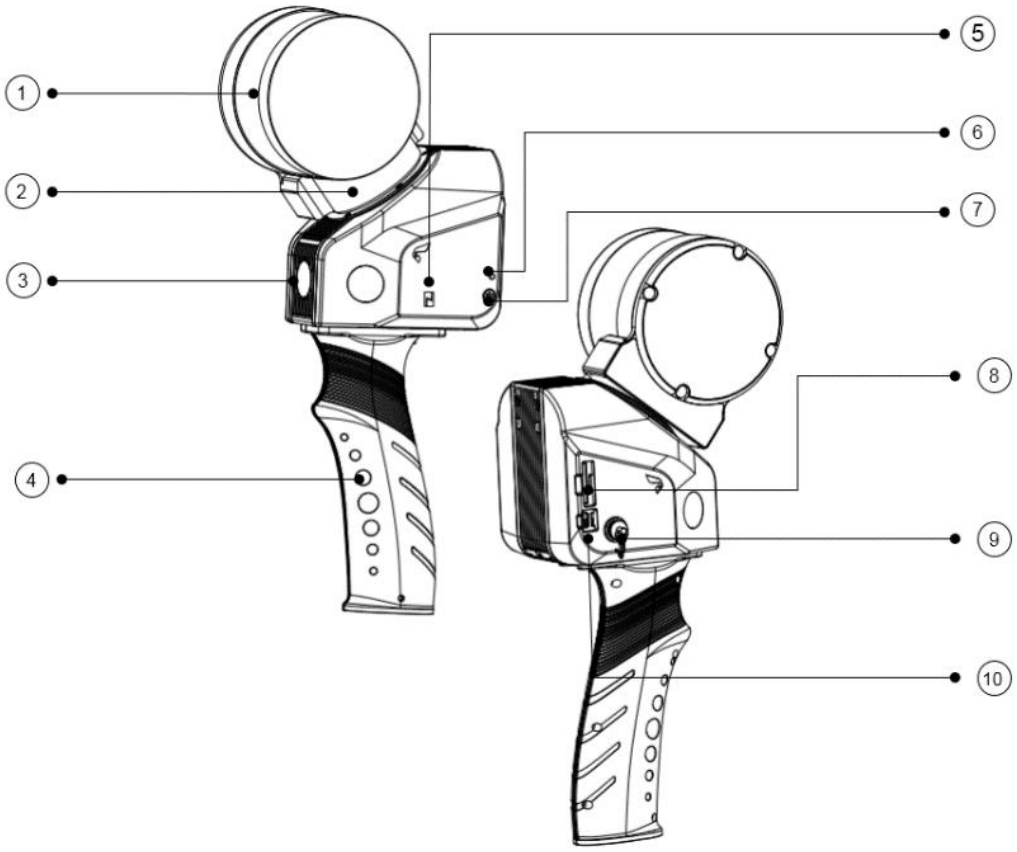
3. Introduction

3.1 General

Thank you for purchasing STONEX® X120^{GO} 3D Laser Scanner.
This manual includes important safety directions and instructions for setting up and using the product.
Please read this manual carefully before using, so that our products can serve you better.
When you begin to use the product, we assume that you are a competent user who has read through and understood the contents of this manual and is fully aware of the necessary dangers, warnings, and cautions.
In the event of any discrepancy between the information contained in this manual and the actual, the actual information shall prevail, and the Company reserves the right to make further revisions or changes to this manual without notice.

X120^{GO} 3D Laser Scanner provides a simple and quick way to obtain 3D point cloud data of objects, outdoor or indoor, significantly improving work efficiency and speed.
Laser scanning is an automatic process during which real objects are surveyed and sampled almost completely to determine their location, size, orientation, and shape.
Thanks to its Lidar sensor, X120^{GO} can collect quick, accurate scans in 45 seconds to less than 4 minutes. Its lightweight makes it perfect for multiple easy scans over the scene.

3.2 Description of the system



1. Laser sensor
2. Rotatable Gimbal
3. Camera sensor
4. Handle
5. NFC
6. Status light
7. power button
8. SD card slot
9. Extension interface
10. USB interface

3.3 Precaution for safety

1. Avoid vibrations: when transporting, keep the instrument in the case and try your best to lighten vibrations.
2. Instrument carrying: when carrying, the instrument handle must be hold tight.
3. Check the battery power: before using the instrument, you should check the battery power whether it is enough.
4. Battery maintenance: if the instrument is not in using for a long time, the battery should be taken out from the instrument and stored in separate place. Meantime, the battery should be charged every month.
5. Taking out the battery: it is not suggested to take out the battery when the instrument is on. Otherwise, stored data may be lost. So, it is better to replace the battery after powering off the instrument.
6. High temperature condition: don't put the instrument in high temperature condition for a long time, it is bad for the instrument performance, and it can damage the hardware components.
7. Temperature changing sharply: the sharp temperature changing on the instrument will shorten the distance measurement range. For example, after taking the instrument out from a warm car to a cold condition, wait for some time: it can be used when it adapts the surrounding condition.
8. Noise from the instrument: when the instrument is working it is normal if you hear noises from instrument motors. They will not affect the instrument work.
9. Stored data responsibility: STONEX® should not be held liable for the lost data because of wrong operation.

3.4 Transport and shipping

TRANSPORT IN THE FIELD

1. When transporting the equipment in the field, always make sure that you
   a. either carry the product in its original transport container,
   b. or carry the tripod with its legs splayed across your shoulder, keeping the attached product upright.

TRANSPORT IN A ROAD VEHICLE

2. Never carry the product loose in a road vehicle, as it can be affected by shock and vibration.

3. Always carry the product in its transport container and secure it.

SHIPPING

4. When transporting the product by rail, air, or sea, always use the complete original STONEX® packaging, transport container and cardboard box or its equivalent to protect the instrument against shock and vibration.

SHIPPING AND TRANSPORT OF BATTERIES

5. When transporting or shipping batteries, the person in charge of the product must ensure that the

applicable national and international rules and regulations are observed.

6. Before transportation or shipping, contact your local passenger or freight transport company.
7. Field adjustment
8. After transport, inspect the field adjustment parameters given in this user manual before using the product.

3.5 Storage

Product

Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to technical datasheet for information about temperature limits.

Field adjustment

After long periods of storage, inspect the field adjustment parameters given in this user manual before using the product.

3.6 Cleaning and drying

- Never touch the cover glass with your fingers.
- Use only a clean, soft, lint-free cloth for cleaning.
- If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids.
- Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

3.7 Definition of indication

For the safe of your product and prevention of injury to operators and other persons as well as prevention of property damage, items which should be observed are indicated by an exclamation point within a triangle used with WARNING and CAUTION statements in this manual.

The definitions of the indications are listed below.

Be sure you understand them before reading the manual's main text.

	ATTENTION:	Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.
	CAUTION:	Ignoring this indication and making an operation error could possibly result in personal injury or property damage.

ATTENTION

1. Do not perform disassembly or rebuilding. Fire, electric shock, or burn could result. Only STONEX® authorized distributors can disassemble or rebuilt.
2. Do not cover the charger. Fire could result.
3. Do not use defection power cable, socket, or plug. Fire, electronic shock could result.

4. Do not use wet battery or charger. Fire, electronic shock could result.
5. Do not close the instrument to burning gas or liquid, and do not use the instrument in coal mine. Blast could result.
6. Do not put the battery in the fire or high temperature condition. Explosion, damage could result.
7. Do not use the battery which is not specified by STONEX®. Fire, electric shock, or burn could result.
8. Do not use the power cable which is not specified by STONEX®. Fire could result.
9. Do not short circuit of the battery. Fire could result.
10. When this product encounters disturbance of severe Electrostatic Discharge, perhaps it will have some degradation of performance like switching on/off automatically and so on.

CAUTION

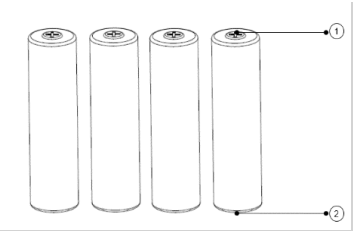
1. Do not touch the instrument with wet hand. Electric shock could result.
2. Do not stand or seat on the carrying case, and do not turn over the carrying case arbitrarily, the instrument could be damaged.
3. Do not drop the instrument or the carrying case.
4. Do not touch liquid leaking from the instrument or battery. Harmful chemicals could cause burn or blisters.
5. Do not drop the instrument. Series damage could result.
6. Before use it, check the central screw is tight.

3.8 Safety standards for lasers

STONEX® X120^{GO} series adopt the class of Laser Product according to IEC Standard Publication 60825-1 Amd. 2:2001. According to this standard, the device is classified as Class 1 Laser Product.

3.9 Battery

The X120^{GO} scanner is equipped with 8 rechargeable batteries as standard, with a single battery capacity of 3350mAh and a voltage of 4.2V. The scanner needs to be loaded with 4 standard rechargeable batteries for normal operation, and the continuous working time of each group (4 batteries) is about 2.5 hours.



1. Positive pole
2. Negative pole

Use the battery properly according to the product specification, do not disassemble or short circuit the battery.
Keep away from sources of heat or ignition: over high temperature will make the cell inflate melt the separator, causing short circuit.
The storage area should be cool, dry, well ventilated, out of direct sunlight, away from metal or sharp edge, such as keys pins or wires. Store the battery in a charged state and charge it every 6 months.

Precautions for safety

1. The battery should be placed in the battery clip during transportation to avoid contact with liquids or bumps with hard objects. Do not immerse the battery in water or get it wet. Never use the battery in the rain or a wet environment. When the inside of the battery comes into contact with water, a decomposition reaction may occur, causing the battery to spontaneously ignite or even explode.
2. If the battery accidentally falls into the water, immediately remove the battery and place it in a safe open area away from the battery until it is completely dry. Dried batteries should not be used again and should be disposed of properly according to the disposal methods in this article.
3. If the battery catches fire, please use water, water mist, sand, fire blanket, dry powder, and carbon dioxide fire extinguisher to put out the fire immediately. Please select the fire extinguishing method in the above-recommended order according to the actual situation.
4. It is strictly forbidden to use batteries not officially provided by Stonex®. If you need to replace a new battery, please buy it through designated channels. Stonex® is not responsible for battery accidents and device failures caused by the use of batteries not officially provided by Stonex®.
5. The battery storage temperature and humidity requirements are -20°C ~45°C, 45%~90% RH;
6. It is strictly forbidden to use bulging, leaking, damaged batteries and charging them. Do not use it when the battery emits an odor, heats up, the temperature of the battery itself exceeds 60°C, is deformed, discolored, or has any other abnormality. If the battery is abnormal, please contact Stonex® or other agents designated by Stonex® for further processing.
7. Please use the battery in an environment where the temperature is between -10°C and 60°C C. Excessive temperature (above 60°C) may cause the battery to catch fire or even explode. Too low temperature (below -10°C) will seriously damage the battery.
8. It is forbidden to use the battery in an environment of strong static electricity or magnetic field. Otherwise, the battery protection board will fail.
9. Do not disassemble or puncture the battery in any way with sharp objects. Otherwise, battery leakage will cause fire or even an explosion.
10. Mechanical impact, crushing, or throwing of batteries is prohibited. Do not place heavy objects on the battery or charger.
11. The electrolyte inside the battery is highly corrosive. If it accidentally comes into contact with the skin or eyes, please immediately rinse with clean water for at least 15 minutes and seek medical attention immediately.
12. If the battery is dropped or subjected to external impact, please stop using the battery.
13. Do not heat the battery. Do not place batteries in microwave ovens or pressure cookers.
14. Do not place battery cells on conductive surfaces (such as metal tabletops, glasses, watches, jewelry, etc.).
15. Do not use wires or other metal objects to short-circuit the positive and negative electrodes of the battery.
16. If the battery connector is dirty, wipe it with a clean, dry cloth. Failure to do so will result in poor battery contact, resulting in energy loss or charging failure.

Battery storage

17. Please store the battery out of the reach of children and pets.
18. Do not place the battery near a heat source (stove or heater, etc.) and in a car on a hot day. Never store batteries in an environment above 60°C. The ideal storage ambient temperature is 22°C - 28°C.
19. Please store the battery in a dry environment.
20. Do not store the battery for a long time after the battery is completely discharged, to avoid damage to the battery cell caused by the battery entering the over-discharge state, and it will not be able to be restored to

use.

Battery care

1. Do not overcharge or over-discharge the battery, otherwise, it will cause damage to the battery.
2. If the battery is left idle for a long time, its performance will be affected.
3. Do not use the battery in an environment where the temperature is too high or too low.
4. Do not store batteries where the ambient temperature exceeds 60°C.

Battery disposal

1. Be sure to completely discharge the battery before disposing of the battery in the designated battery recycling bin. Batteries are hazardous chemicals and should not be disposed of in ordinary trash cans. For details, please follow local battery recycling and disposal laws and regulations.
2. If the battery cannot be completely discharged, do not dispose of the battery directly in the battery recycling box, and contact a professional battery recycling company for further processing.

Battery specifications

Type	Rechargeable 18650 pointed Lithium Battery With Protective Plate	Positive pole needs to be pointed
Rated Voltage	3.7V	
Battery Capacity	≥3000mAh	Suggested Value
Charging Limit	Full Charge Voltage 4.2V Recharging Current≥1.5A	If the charging current exceeds 4.2V or the charging current is lower than 1A, the charger provided by Stonex® cannot be used
Maximum Discharge Current	≥3A	
Battery Protection Board	Conventional Protection Functions Such as Overcharge, Over-discharge, Overcurrent, and Overtemperature	Battery must have its own protective plate, otherwise there is a safety risk, and relevant safety certification is required
Battery Outer Diameter-D	18.0mm≤D≤18.9mm	
Battery Height-H	68mm≤H≤71mm	

3.10 About User

1. The X120^{GO} Scanner must be used by trained operators only. When operating the X120^{GO}, please always follow basic safety precautions to prevent injury or damage to equipment.
2. The user is required to be a qualified surveyor or have a good knowledge of surveying, in order to understand the user manual and safety instructions, before operating, inspecting, or adjusting.
3. Do not operate the equipment if it shows obvious defects or damage. Please follow STONEX® service procedure to repair the equipment.
4. Please use only the components and accessories provided by the manufacturer.
5. Before operating the X120^{GO} for the first time, please read this manual completely.
6. The equipment contains electrical components and mechanical parts, so proper operation is required. Do not pull or bend the data transmission line forcibly.
7. Do not push any other objects into the data transmission line interface, place the device out of the reach of children, and do not modify or disassemble the X120^{GO} scanner under any circumstance without the prior written permission of STONEX. Otherwise, the warranty would not be applied.

3.11 Exceptions from Responsibility

1. The user of this products is expected to follow all operating instructions and make periodic checks of the product's performance.
2. The manufacturer assumes no responsibility for results of a faulty or intentional usage or misuse including any direct, indirect, consequential damage and loss of profits.
3. The manufacturer assumes no responsibility for consequential damage and loss of profits by any disaster, such as earthquakes, storms, floods etc.
4. The manufacturer assumes no responsibility for any damage and loss of profits, due to a change of data, loss of data, an interruption of business etc., caused by using the product or an unusable product.
5. The manufacturer assumes no responsibility for any damage and loss of profits, caused by usage except for explained in the user manual.
6. The manufacturer assumes no responsibility for damage caused by wrong transport or action, due to connecting with other products.

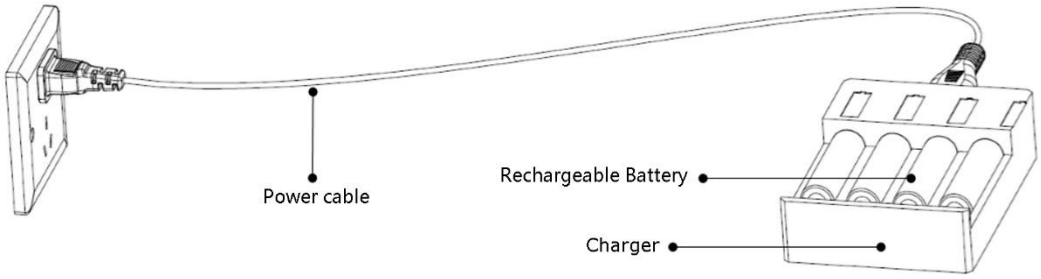
4. Setting up the STONEX®X120GO

4.1 Battery charging

Input: AC 100~240 V /50~60 Hz /600mA (MAX)
DC 12~24V 2000mA (MAX)
Output: DC 4.2V/1000mA (MAX) × 4
The four buttons A/B/C/D on the charger correspond to a charging slot respectively. Short press for 1 second, the current switches between 500mA and 1000mA; long press for 5 seconds, the two charging modes of lithium-ion battery and iron-lithium battery are switched. This charger defaults to the lithium-ion charging mode, and no switching operation is required.

AC Charging

1) Connect the power cord to the charger;
2) Put the battery to be charged into the battery slot of the charger, pay attention to the direction of the positive and negative electrodes;
3) Connect the power cord to an AC outlet with an output voltage in the range of 100~240V. The battery starts charging, and the battery is fully charged in about 3 hours.

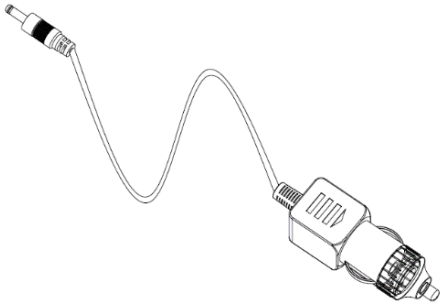


NOTE:

- The charger operating environment requirements are 0℃~40℃, 45%~90%RH;
- For safety reasons, the maximum time allowed by the charger to charge the rechargeable battery is 12 hours, and the charging will be stopped after 12 hours;
- The battery reverse connection or short-circuit charging protection is activated, the charger stops charging, and the error indicator "Err" is displayed.
- Please do not use equipment other than Stonex's official charger for charging;
- In case of damage or deformation of the battery skin, please do not continue to use it and dispose of it in time.
- Please use it in a dry environment, and disconnect the power supply in time after charging.
- Please stay away from flammable materials and charge in the isolation area;

Vehicle-mounted charging

1） Connect the vehicle-mounted charging cable to the charger;
2） Put the battery to be charged into the battery slot of the charger, and pay attention to the orientation of the positive and negative poles;
3） Connect the power cord to the vehicle power socket, and the battery will start charging. The battery will be fully charged for about 3 hours.



4.2 Led status

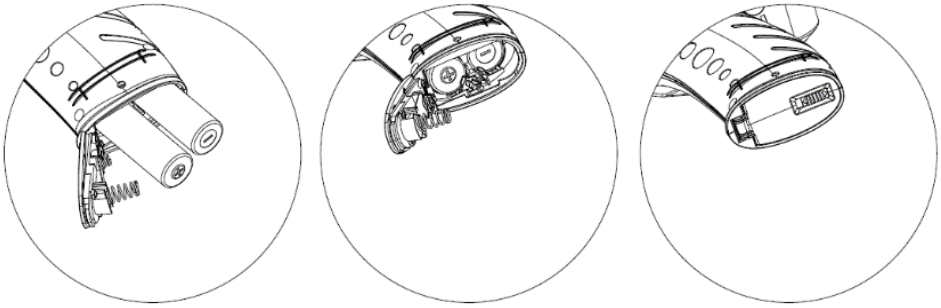
X120GO handheld lidar scanner mainly has three-color status lights (red, yellow, green), which are used to indicate the current scanner working status and battery power information display. Please refer to the following table.

	Working Status	**Indicator Status**
POWER DISPLAY	Voltage>14.0V	Green light (flashing slowly)
	14.0V<Voltage<12.3V	Yellow light (flashing slowly)
	12.3V<Voltage<11.8V	Red light (flashing slowly)
EQUIPMENT UPGRADE	Upgrading	On 200ms, cycle 400ms, white light
	Successful update	Steady on or flashing slowly (green, yellow, red)
	Upgrade failed	On 200ms, cycle 400ms, red light
	MCU upgrade	On 100ms, cycle 200ms, white light
WORKING STATUS	Device startup	Light on (green, yellow, red)
	Data collection	Light flashing on 800ms, the cycle 1500ms (green, yellow, red)
	Shutdown	Blue light flashing
SYSTEM SETTINGS	Restoration system	Press and hold the power button for 10 seconds, the status light turns blue, then press and hold the power button for 2 seconds, the status light off, and after 4 seconds, the status light changes to normal battery display mode
	Error state	Red light flashing quickly

4.3 Setting up

Move the **battery** compartment cover lock at the bottom of the scanner handle forward, open the battery compartment cover, load batteries according to the requirements of positive and negative poles, and lock the battery lock in the handle.

Move the battery compartment cover lock backward to lock the battery compartment cover.



NOTE:

- Please check the battery power before starting each time to ensure that it is fully charged;
- Beware of battery falling damage during disassembly and assembly.

Press the scanner on key for 3 seconds for a long time, and the status indicator light is always green (the battery is fully charged). Wait for the laser head to start rotating, and then the equipment starts successfully.

Insert the memory card into the **SD card** slot with the golden finger side facing the back of the scanner.

NOTE: SD card must be inserted or data will not be collected.

5. Operating the STONEX® X120^{GO}

5.1 GO*app* installation

GO*app* is mobile APP for X120^{GO} for Android (8.0 version or above), which allows to perform operations such as project management, real-time point cloud puzzle display, image preview, firmware upgrade, etc.

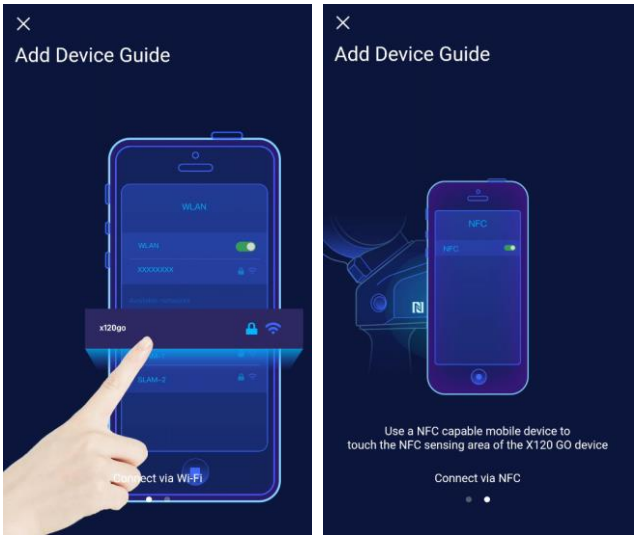
1. Download on PC from here: GO*app* for Android
2. Copy the *.apk file on the Android controller using an USB connection
3. From Android, locate the *.apk file you just copied and click to start the installation
4. Install it on your devices

5.2 Device binding

The first time you open the GO*app*, you will have the following page, where the ***Add Now*** button allows to blind a new device.

X120^{GO} supports two ways of binding to the homepage of APP:

1. Wi-fi connection
2. NFC



Wi-fi binding

Open the APP homepage, press and hold power button of X120^{GO} scanner for 3 seconds, wait for about one minute, and connect the Wi-Fi of your mobile phone.

X120^{GO} scanner equipment will automatically appear on the homepage.

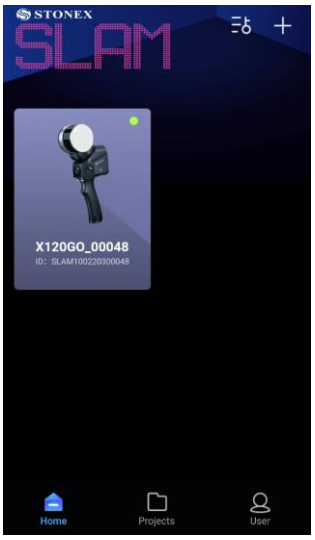
NFC binding

In the pop-up page of adding device boot, slide to the right to switch the second page to display NFC adding device boot.

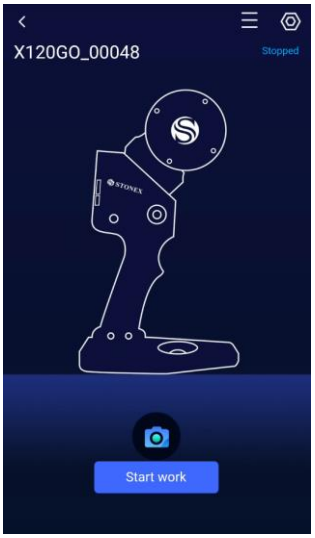
Turn on the NFC switch of the mobile phone (the mobile phone needs to support NFC function) and stick the upper part of the back of the mobile phone (NFC sensing area) against the NFC tag on the key side of X120^{GO} scanner to connect and bind.

5.3 Equipment work

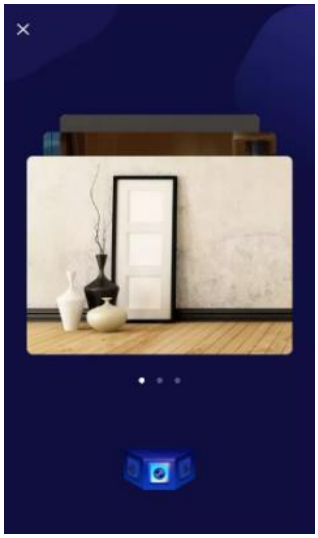
Connect the X120^{GO} scanner through mobile phone Wi-Fi, click on the online device with the green dot logo in the upper right corner of the APP page.



After successful connection, the equipment will be initialized. Click on ***Start work*** to start the scan.



You can also click on the camera icon to take a set of pictures. Swipe left or right in the preview interface to switch the preview images taken by three cameras.



Device Status-Connection failed

If the device connection fails, please recheck the device connection status and troubleshoot one by one:

1. Check whether the Wi-Fi of X120^{GO} is connected to the mobile phone.
2. Check whether X120^{GO} status indicator keeps green and bright.
3. Exit the work interface, return to the home page, and check whether there is a green cursor in the upper right corner of the connected device icon.
4. Try to completely close the GO*app*, clear the background of GO*app*, re-enter GO*app* and try to connect to the X120^{GO} device again.

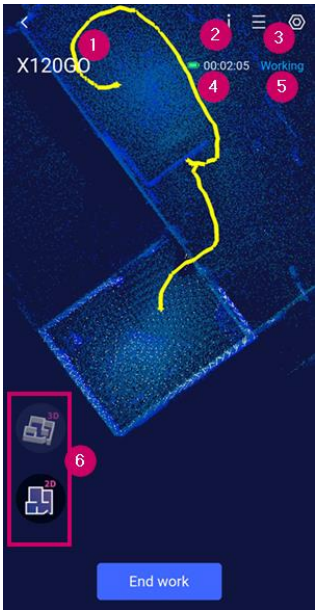
If the connection fails when you re-enter the equipment interface after the above operation, please contact your local dealer for more assistance.

Device status-out of communication range

When GO*app* is disconnected from X120^{GO}, the device status will prompt "Not in communication range". It is necessary to check whether the mobile phone is connected to the device WiFi of X120^{GO}, or the distance between the mobile phone and the device is too far, and the WiFi signal is weak or disconnected.

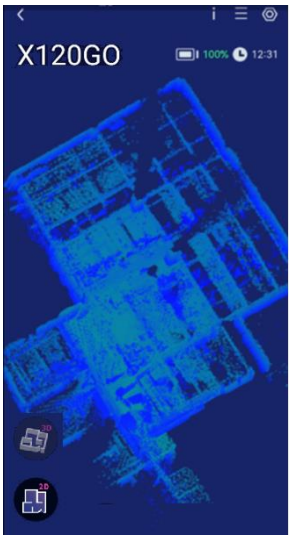
After connecting X120^{GO} through GO*app*, the APP enters the standby page, and the system will automatically enter the working page and start to display the laser scanning data in real time by pressing the power button on the instrument.

The equipment interface includes equipment name (1), equipment information (2), settings (3), working time (4), working status (5), switching 2D or 3D display function (6).



Working-real-time 3D scanning display

When the APP is in the standby interface, press the power key of X120^{GO} device briefly to start the operation, and the page will automatically jump to the 3D scanning display interface.



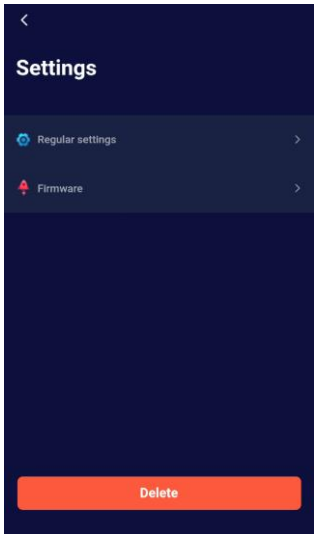
Working-View status information

In the process of X120^{GO} operation, click the "Equipment Information" button at the upper right corner of the working interface to view the current basic status information, motor status information, error status information and SD card information of X120^{GO} in real time.

5.4 Settings

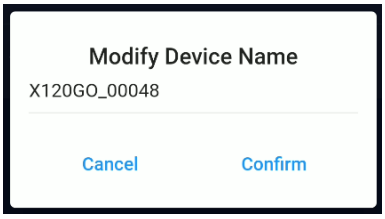
Click the "Settings" button in the upper right corner of the working interface to enter the setting interface. Click *Regular Settings* to enter the setting interface, where you can set the device name, RTK configuration and Wi-fi settings.

Click *Firmware* to check the firmware version (refer to next chapter for more details).



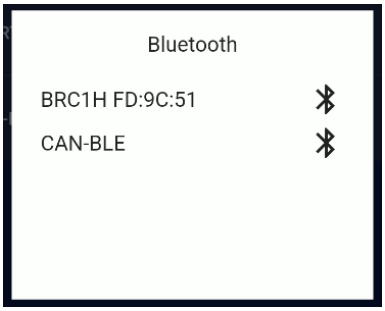
Modify device name

Click on the Device name, enter the content to be modified in the pop-up "Modify Device Name" dialog box, and click "Confirm" to modify the device name.



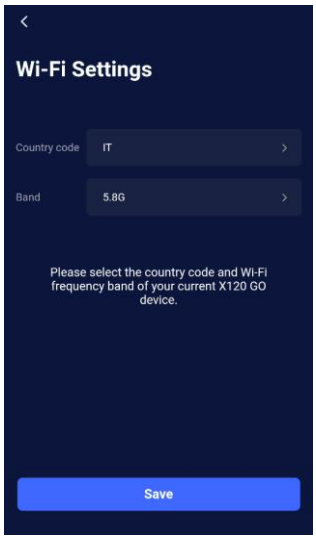
S-RTK Config

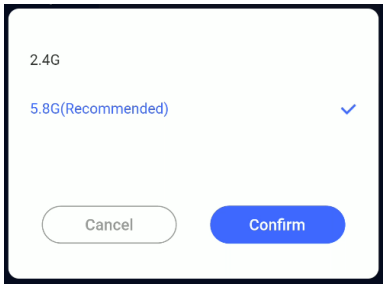
Click on S-RTK Config to select the Bluetooth of RTK device you want to connect.



Wi-Fi Settings

Click on Wi-Fi Settings. Here you can define the Country and the available bands for wi-fi.



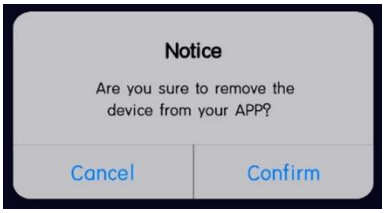


Once selected and confirmed, wait few seconds for it to be applied.

Delete equipment

If you want to remove the device, click on Delete dialog box, and click "Confirm" to delete the device.

The Delete Device function allows you to delete devices that do not need to appear on the front page.



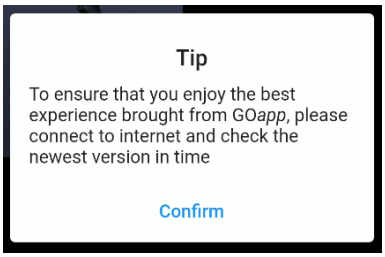
5.5 Firmware

Firmware update will optimize the performance of firmware or device drivers, as well as the performance of processors or other device hardware. Firmware upgrade can also fix the problems found in the old version.

Automatic firmware upgrade reminder

Every time you open the application to log in, the application will automatically detect the latest firmware version and the local current firmware version. If the latest firmware file is not downloaded locally, you will be reminded to download the latest firmware in the pop-up window on the home page, so that you can directly update the firmware after connecting the device.

To make sure you have the latest Firmware version, open the application, before connecting to the scanner's wi-fi. Otherwise, the following message will appear.



Latest firmware download

After the firmware of the homepage pop-up window is upgraded, click OK, which will jump to the firmware download window. Click Download to start downloading. At this time, don't operate your mobile phone, wait for the download to complete, and then click OK to exit the firmware upgrade window.

Firmware upgrade process

When the pop-up window on the home page prompts to download firmware, the firmware package has been downloaded locally.

1. When opening the app, log in to the account, click Download the latest firmware in the pop-up window to upgrade the firmware, and close the download page after the download is completed.
2. Turn on the X120^{GO} device, connect the device WiFi, click "Home" to enter the device details, click the "Settings" button in the upper right corner of the page, and click "Firmware Upgrade".
3. Click "Firmware Upgrade" in the firmware upgrade interface, and then click "Update". Please wait patiently for the firmware upgrade package to be transmitted to the X120^{GO} device. Do not operate the mobile phone or X120^{GO} device at this time.
4. After the transmission is completed, click OK. At this time, please wait for 35s before manually restarting the equipment. After restarting the equipment, wait for the white light of the equipment indicator to blink and turn green. At this time, the firmware update is successful, and the equipment can be used normally.

In case the latest firmware package is not downloaded on the home page.

1. Turn on the X120^{GO} device, connect the device Wi-Fi, and click the "Home page" to enter the device details, and click the "Settings" button in the upper right corner of the page.

2. When checking the firmware upgrade, you need to disconnect the Wi-Fi connection of X120^{GO} device (if the device has not acquired the latest firmware version, you will be prompted to disconnect the Wi-Fi of the device and re-enter the firmware upgrade page), keep your mobile phone connected to the Internet, and click "Firmware Upgrade".
3. After the download is completed, reconnect the Wi-Fi of X120^{GO} device, exit the firmware upgrade page, and click the device on the home page again to enter the device standby page.
4. Click "Settings" in the upper right corner of the standby page, enter the firmware upgrade page, click "Firmware Upgrade" and then click "Update". Please wait patiently for the firmware upgrade package to be transmitted to X120^{GO} equipment. Please do not operate your mobile phone or X120^{GO} equipment at this time.
5. After the transmission is completed, click OK. At this time, please wait for 35s before manually restarting the equipment. After restarting the equipment, wait for the white light of the equipment indicator to blink and turn green. At this time, the firmware update is successful, and the equipment can be used normally.

5.6 Data download

The results of the scanning sessions are stored in the SD Card.

1. Remove the card from the SD card slot

2. Insert it in a SD reader, provided in the scanner case

3. Select the folders of the scans you want to download. Folders are named "SN_XXXXX" and are automatically generated by the system after each data acquisition, and the sequence of data acquisition can be identified according to the size of the tail number of the folder name. The raw data includes Image data, IMU, raster data, laser data, and device calibration files.

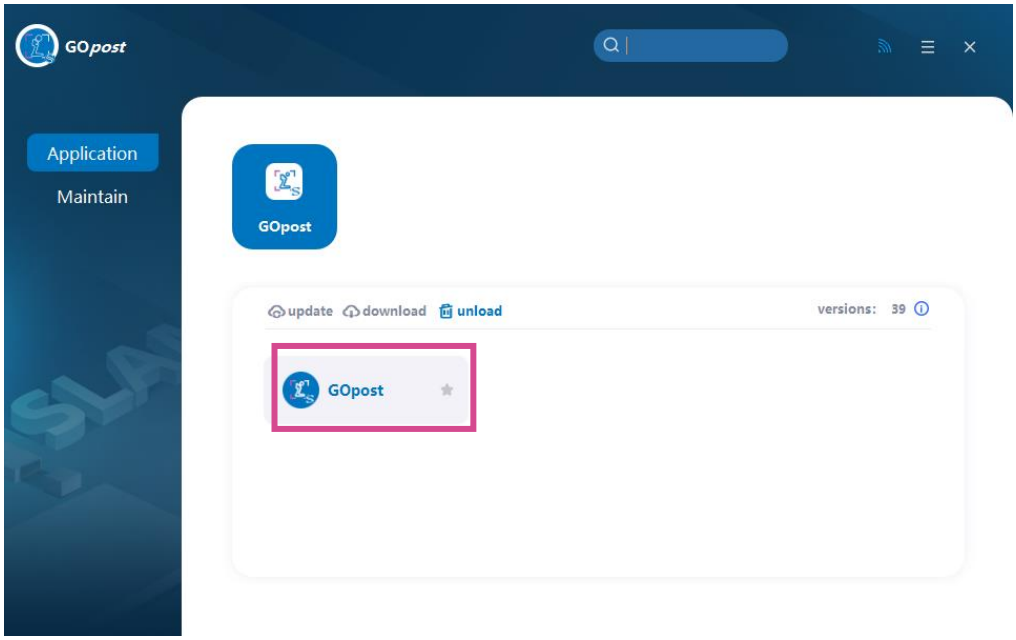
4. Copy and paste the folders on your device.

6. GO*post* software

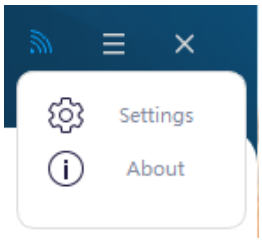
GO*post* software can post-process the data collected by X120^{GO}, produce high-precision point clouds, produce local panoramas, optimize point cloud results, and browse point cloud.

1. Download on PC from here: GO*post*
2. Follow the installation procedure

When you click on the GO*post* icon, the following page is shown. To open the software, click on its icon.

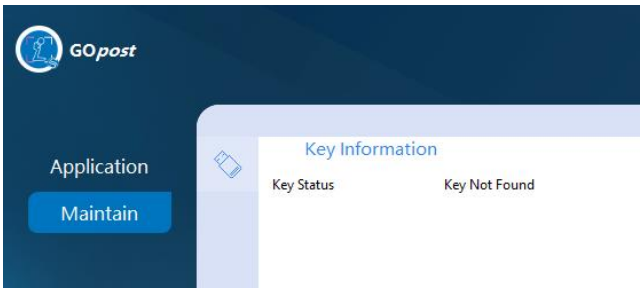


If you want to change software language, click on ☰ and *Settings*: English, Italian and Chinese are available.



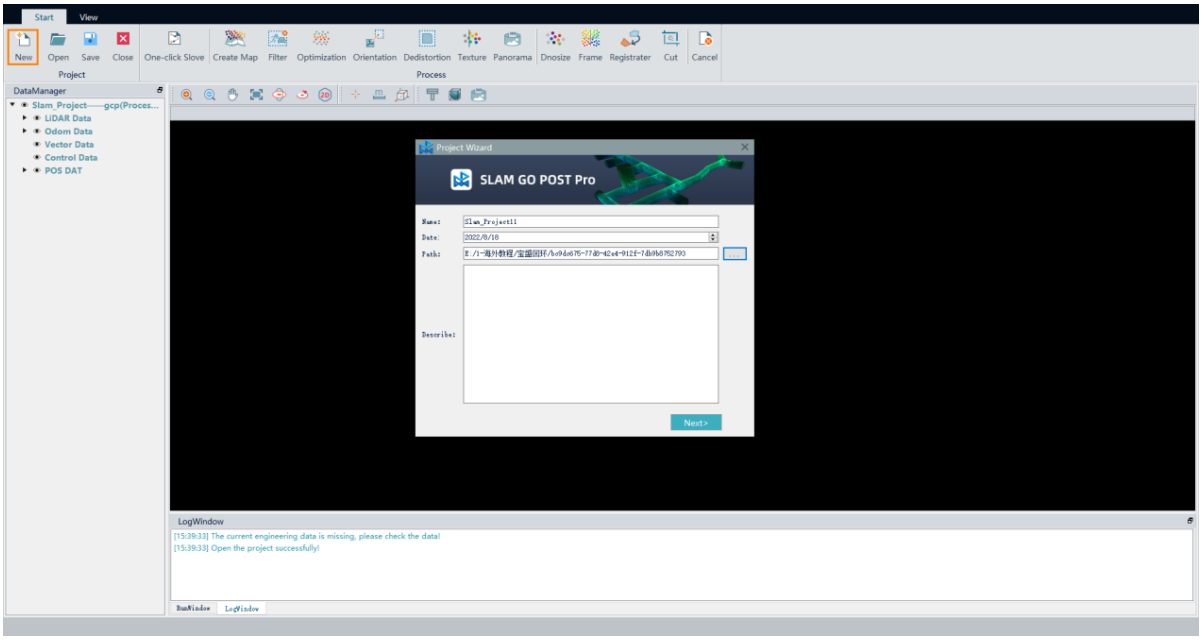
Select *About* to check software version

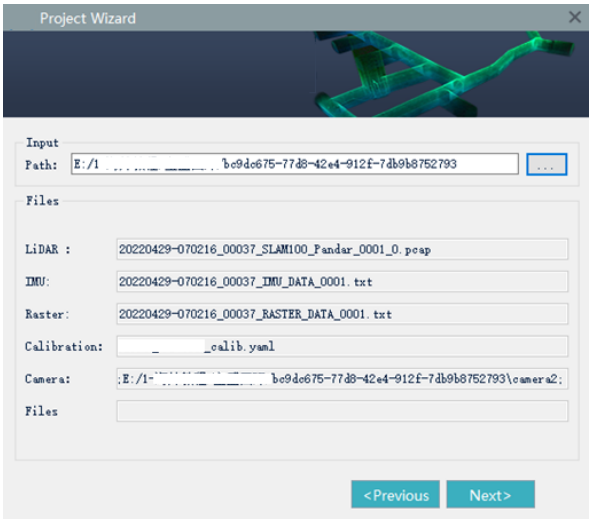
USB dongle license is provided in the carrying case. If the dongle is not inserted, the software cannot process the data properly. Check license status from *Maintain* page.

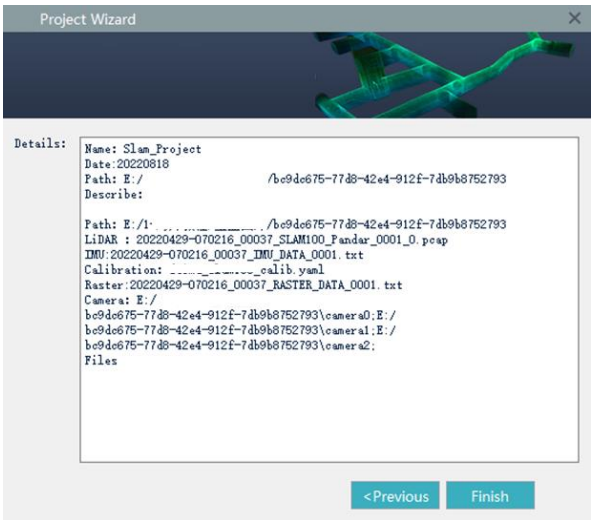


6.1 New project

Click *New*, set the project name and project path, click *Next*, select the folder path where the data file is located in the Input Path, that is, the next lower path of the SN_XXXXX, the software will automatically identify the data in the folder, click *Finish* to complete the project creation.

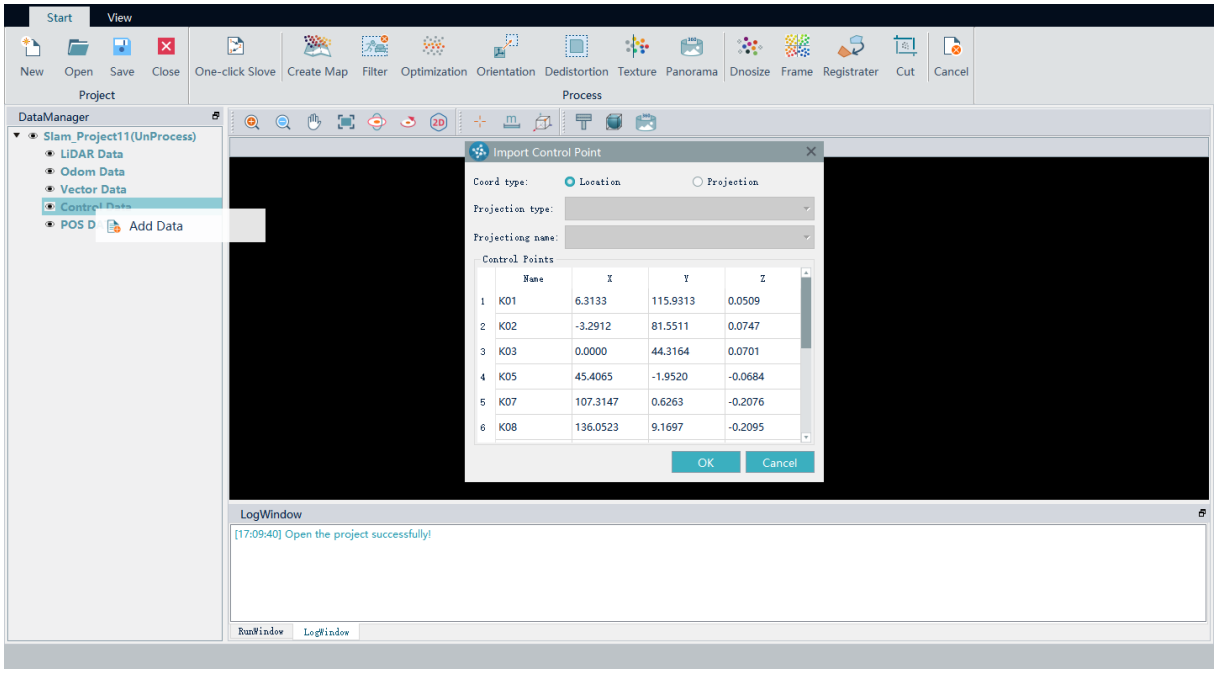






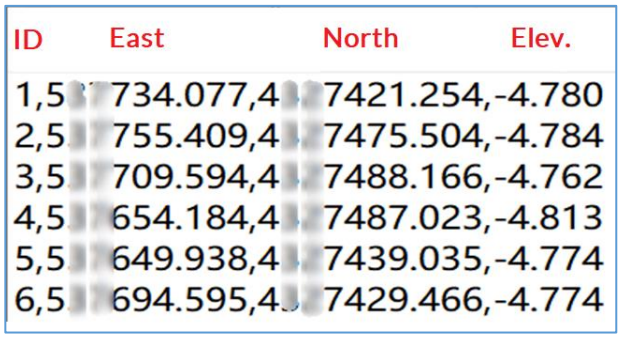
6.2 Import GCP

Right-click the control point data function in the DataManager window, select *Add Data*, importing the organized GCP into the software. The software supports local coordinate system and the projected coordinate system. Please note this setting does not affect the final output of the point cloud coordinates.



NOTE: About GCP:

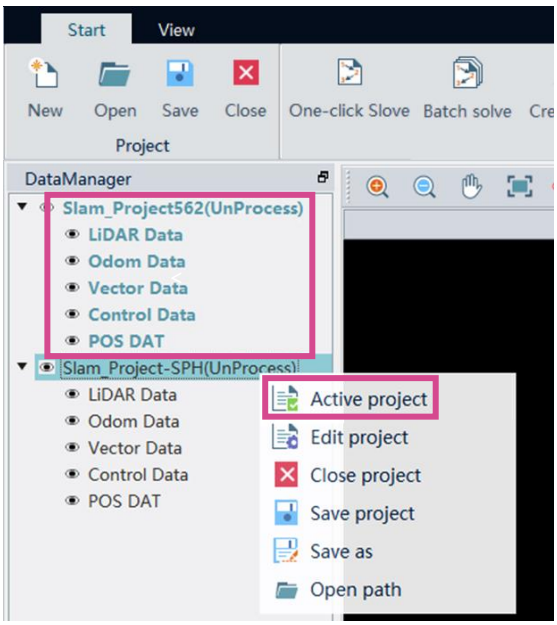
1. If there are no control points, you can ignore the step.
2. The order of control points in GCP file must be consistent with the order and quantity of the scanner's actual acquired control points, otherwise the processing will result in an error in the orientation.
3. The control point function does not support latitude and longitude for the time being, and supports projected coordinates or spatial Cartesian coordinates. And the control point file's format should be *.txt, in which contains four columns in order: ID, East Coordinates, North Coordinates, Elevation, separated by spaces or commas.



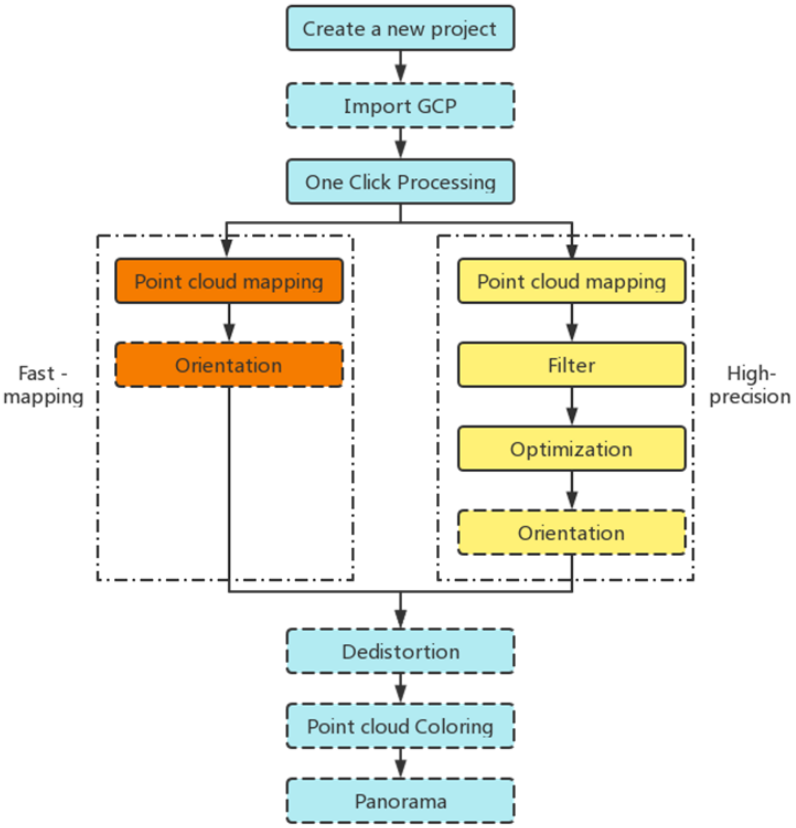
6.3 One-click processing

If there is only one project in DataManager, the default status of the project is active, and the colors of project words are in blue. User can process the data directly.

If there are two or more projects in DataManager, the default status of the first project is active and others are inactive and in black. Please activate the project before processing it.

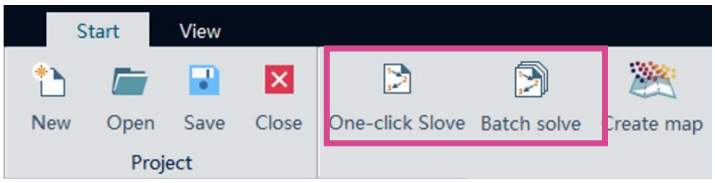


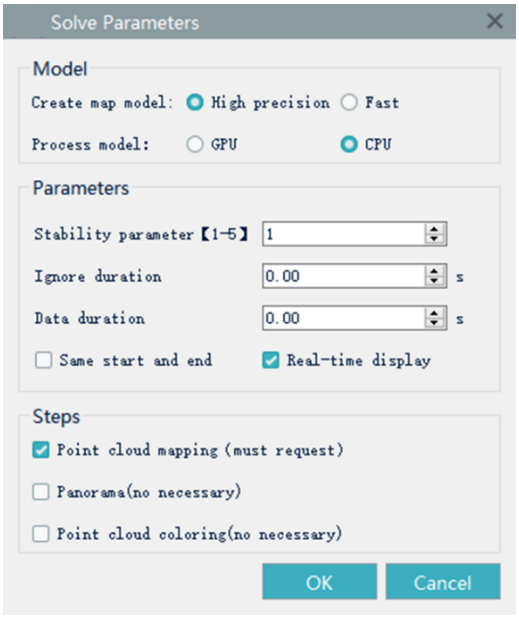
The software allows to elaborate data defining in a single window all the processing to do (like filtering, coloring, panorama calculation, and so on).



You can do it for the active project only choosing *One-click solve*; or for all the project loaded using *Batch solve*. For instance, suppose you have 5 datasets, you can queue up to solve them with Batch solve, instead of processing one by one with One-click solve. When you use Batch solve, you don't need active project before solving.

Click *One-click Solve* or *Batch solve* in the data processing toolbar to set the Solve Parameters. The meanings of the parameters are explained as follows.





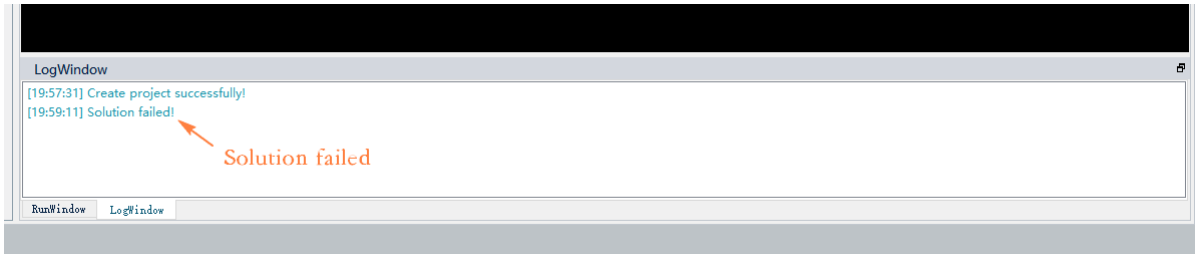
Create map model

- Fast mode: In this mode, the original point cloud data results are output, the software does not optimize the point cloud, and the subsequent steps are based on the original point cloud for processing.
- High-precision mode: In this mode, the software automatically performs pedestrian filtering and point cloud optimizing process after creating mapping, and the subsequent steps are based on the optimized point cloud processing.

Process model: Currently limited to the Panorama stitching function, if computer do not have a graphics card which supports universal computing, you can manually switch to CPU mode.

Stability parameter: This refers to the degree of mutation of the scanning scene, not the stability of the instrument at the time of scanning. The number ranges from 1 to 5. The larger number means the scanning space is easy to connect. For example, if user only scan an open street it takes value 5, but if user scan a street and continuously scan into a room, it should set the value to 3 or 4, or even smaller.

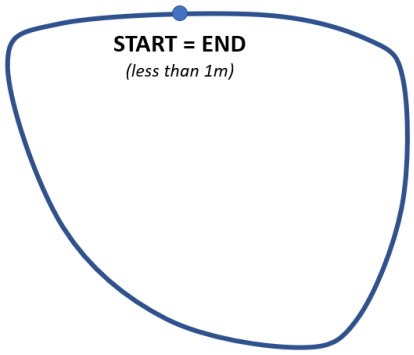
! If user set the value too high and in processing the LogWindow appears “Solution failed”, we suggest resetting and lower down the value to try the processing again.



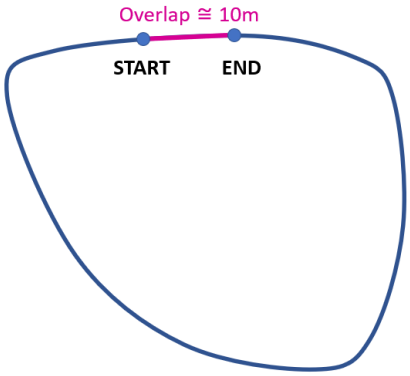
Ignore duration: Eliminate redundant static/poor quality data.

Data duration: This parameter is combined with the Ignore duration to solve the point cloud data of any time the user defined.

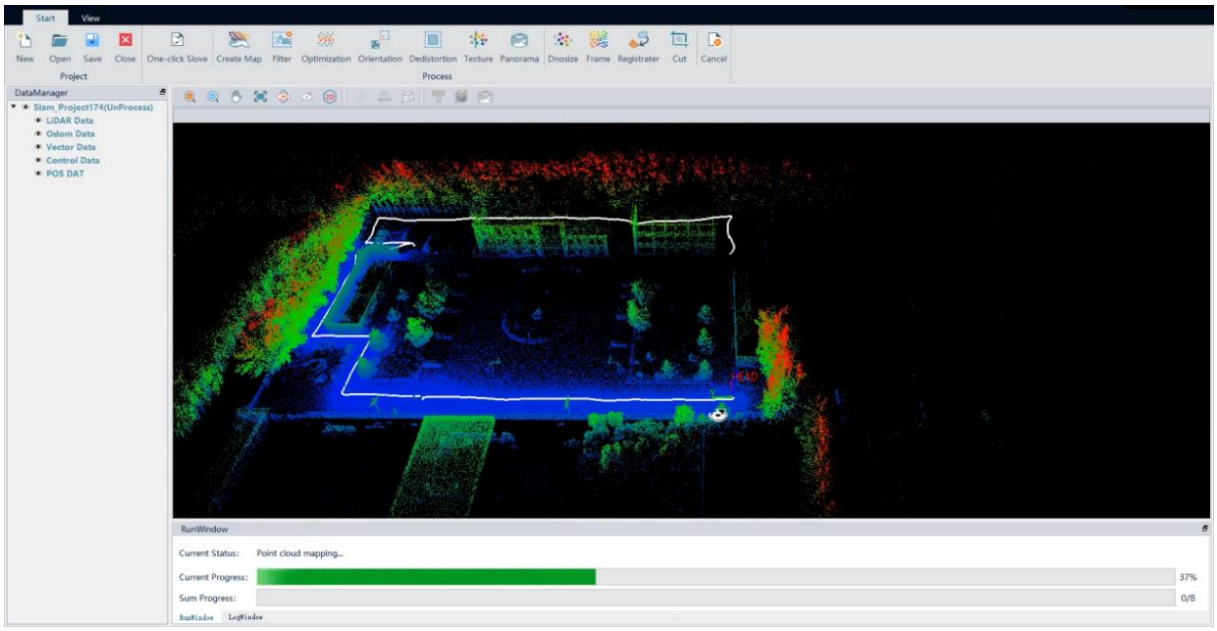
Same start and end: There is no need to select this checkbox when solving. Select it **only** if you collected data closing a loop (difference between start and end point is less than 1 meter)



With an overlapping between the starting point and the endpoint around 10 meters, the software automatically recognises the closure: no need to tick the option "Same start and end".



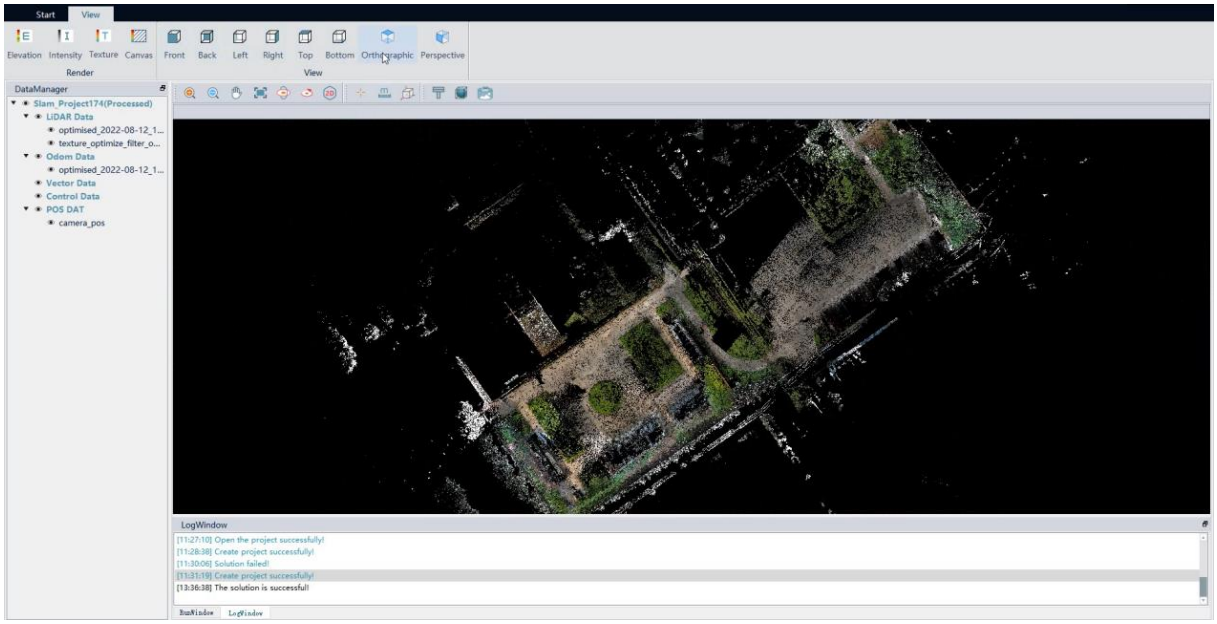
Real-time display: display the point cloud mapping process in display window.



Steps

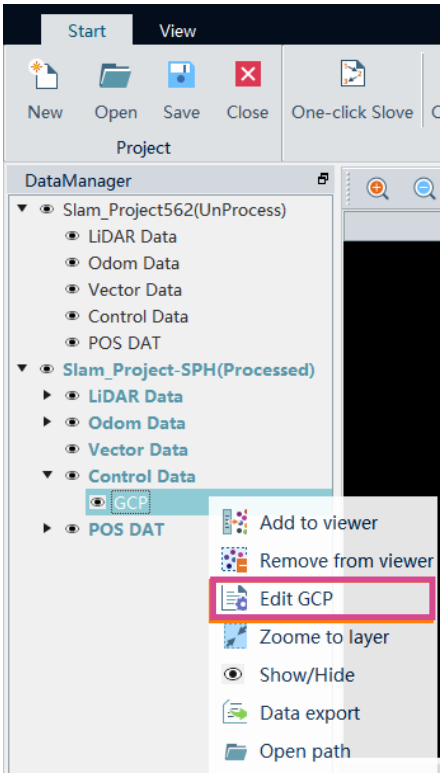
- **Point cloud mapping**: When the fast mode is selected, the original point cloud results are output; When high-precision mode is selected, the optimized point cloud results are output.
- **Panorama**: A panorama image from single distortion-free images.

- **Point cloud coloring**: Coloring based on single distortion-free images. This procedure isn't related to Panorama function.



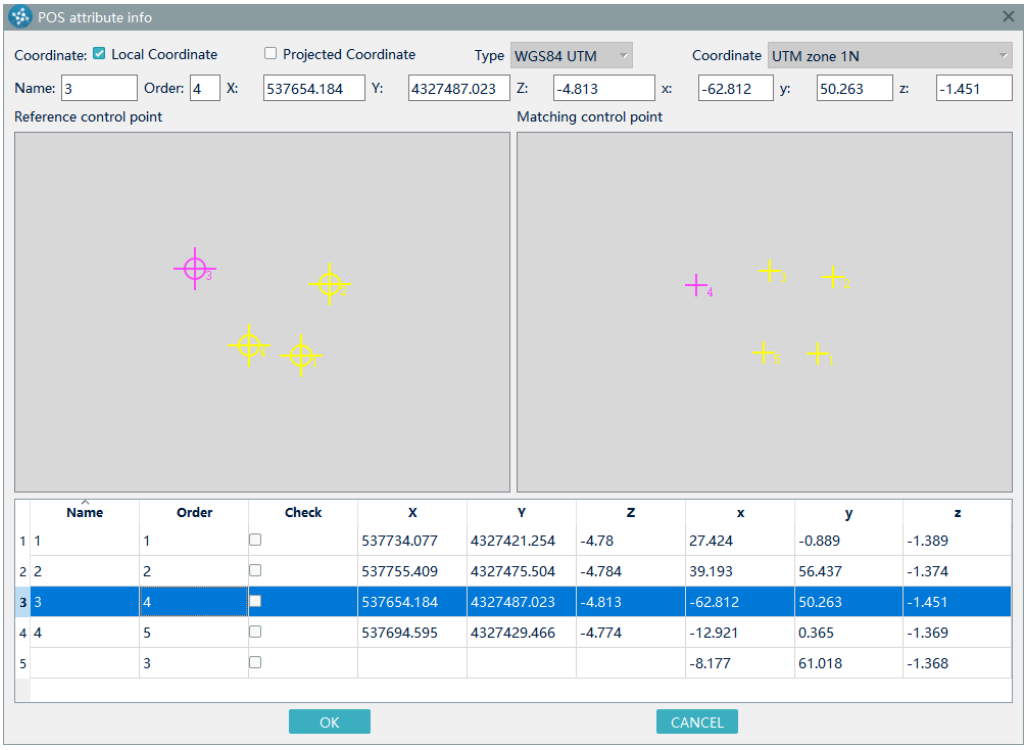
6.4 GCP Edit

If you import GCP when the project is created, and the point cloud is not orientated after data processing, you need to use the GCP edit function. There are two situations result in not-orientated points. We will explain them respectively. Right-click *Edit GCP* to enter the control point editing interface.

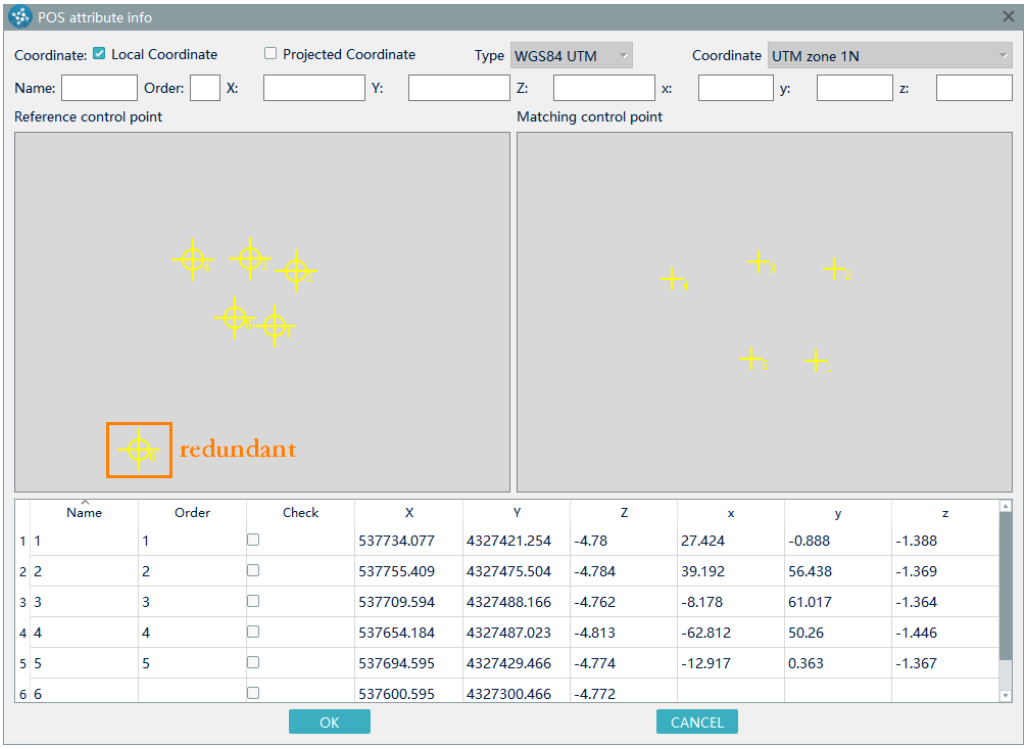


CASE 1: matching points are more than the control points. You can click the control point to be edited, modify the matching point sequence number at the upper toolbar, correspond the control point to the correct matching point, so that the excess matching point can be ignored at the end, and it will not participate in any calculation. Take figure below as an example, The correspondence between "GCP3" and "Matching point3" is

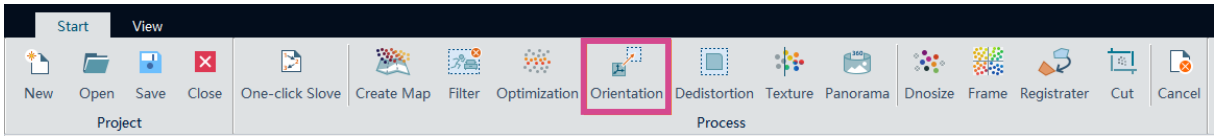
wrong, and the correspondence between “GCP 3” and “Matching point4” is correct. Select this pair of points, then modify the order number from 3 to 4.



CASE 2: the number of matching points is less than the imported control point, user needs to edit the control point file and delete the surplus control points.

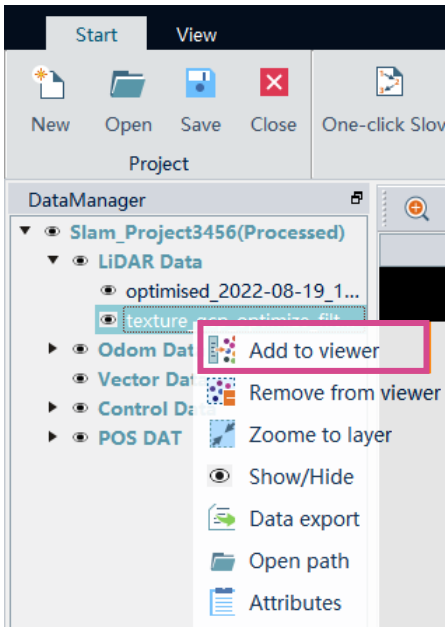


After the modification is complete, user can check the checkpoints according to the control point distribution, and then re-orient the point cloud in the function bar.



6.5 Add result to view

Select the point cloud data in DataManager, right-click, and select *Add to View* to add the point cloud to the display window. Other results can be viewed the same way as well.

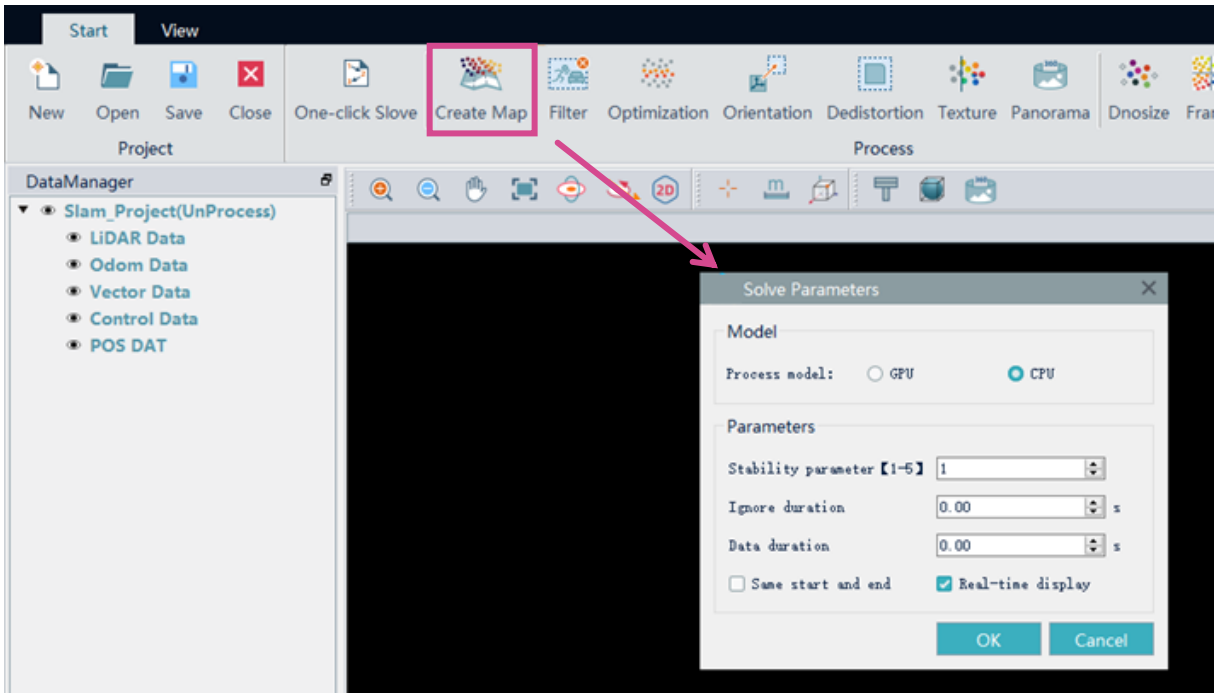


6.6 Step-by-step processing

The purpose of step-by-step processing is to give user choices to select the corresponding processing steps according to the needs.

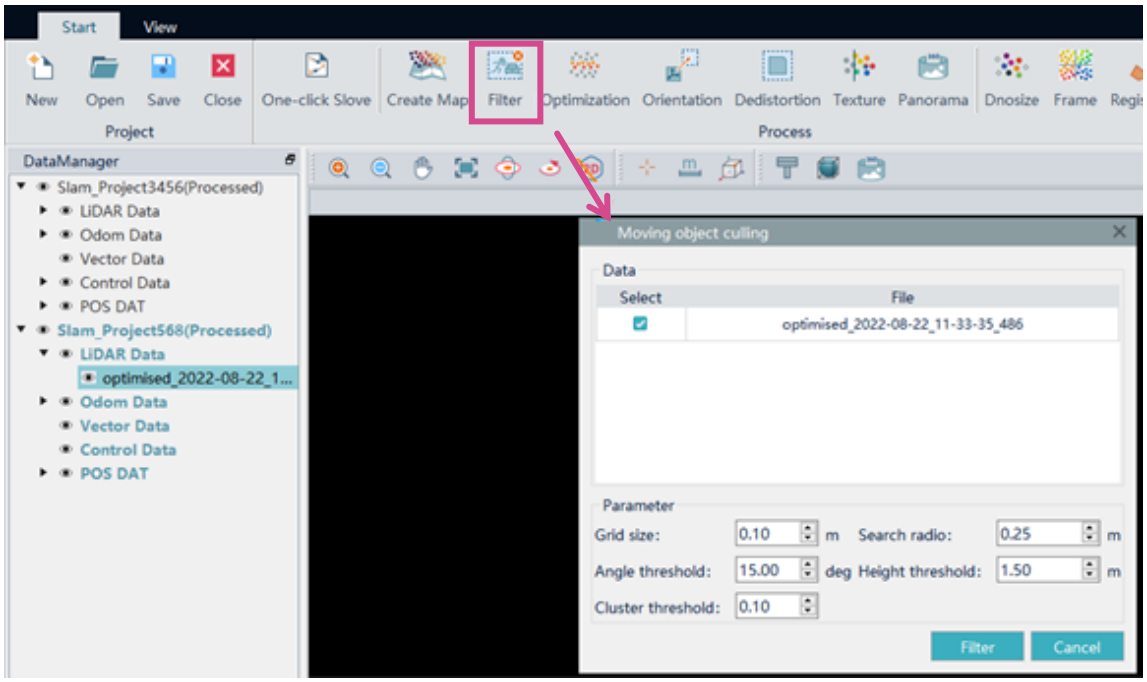
Create map

Activate the project, click *Create map*, select the Process mode and set the parameters, Click OK to start the calculation. This step is to generate original point cloud with no further processing. Therefore, it may contain some noise. The processed result begins with a prefix 'optimized' in the file name under LIDAR Data in DataManager.



Filter

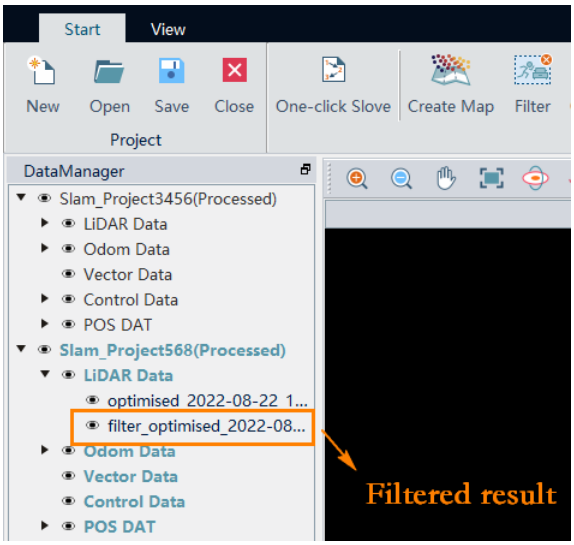
It is used to remove moving targets in original point cloud. Click the Filter button and select the data to filtered.



The meaning of the filter parameters is shown as following

- **Grid size**: The filter mesh size, unit is meter, into which the point cloud data is divided, the default is 0.1m
- **Search Radius**: The size of the range used to search for clustering
- **Angle threshold**: The angle of the normal vector between two adjacent points, less than the threshold is considered to be a surface-like object, which is retained
- **Height threshold**: The height of a point to the detection center, and points above this threshold do not participate in the calculation
- **Cluster threshold**: The percentage of points after clustering to participate in the calculation of points, and if more than this value, it is considered non-moving object.

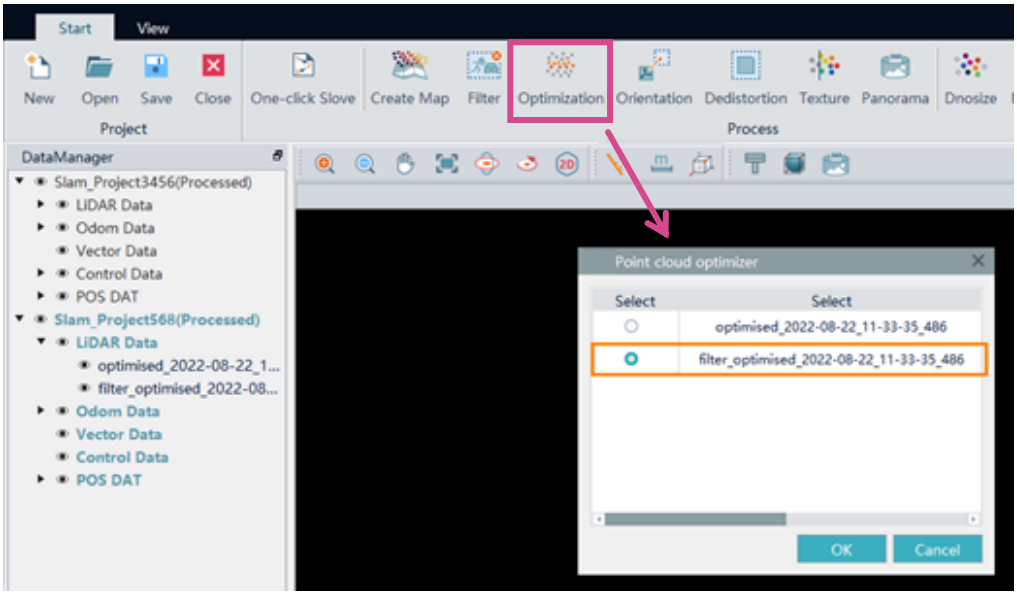
Point clouds beginning with “filter” are the filtered result.

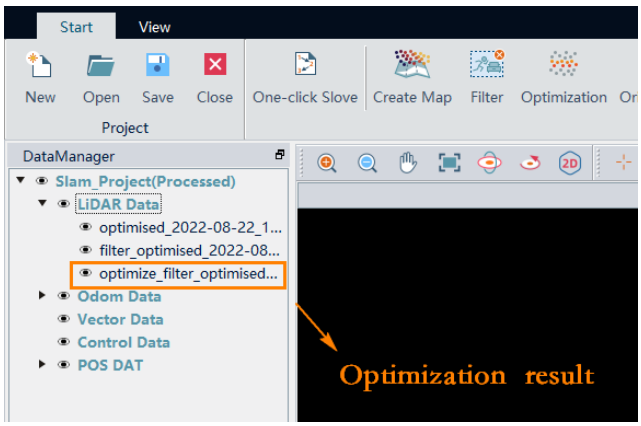


Optimization

This function will optimize and denoise the original point cloud to reduce the thickness of the point cloud and improve the accuracy of the point cloud.

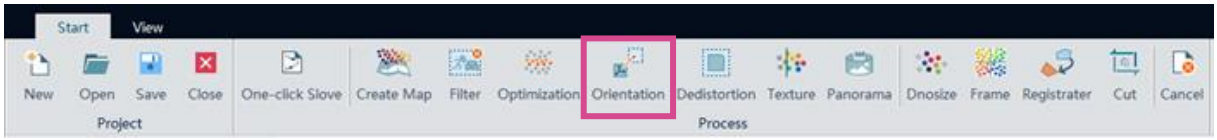
Click the Optimization tool and select the data you want to optimize. Select filtered result to optimize: point clouds beginning with 'optimize' in DataManager are optimization result.





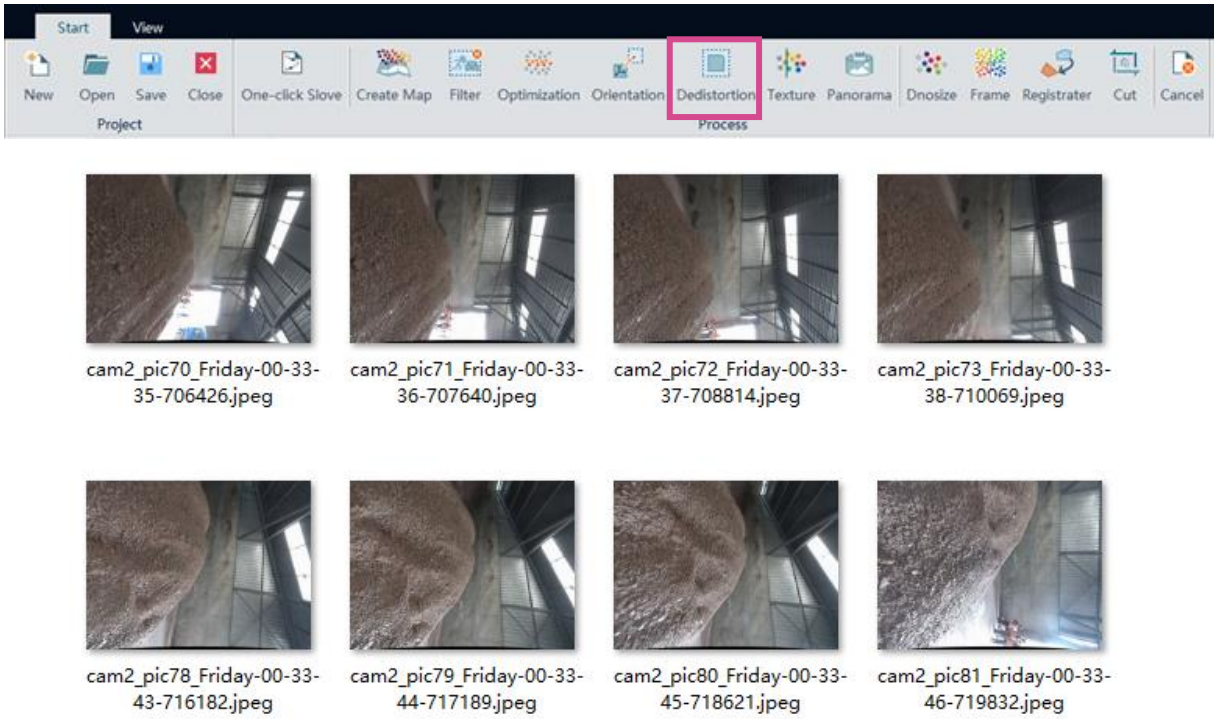
Orientation

This function transfers the point cloud to the absolute coordinate system in which the control point is located. Coordinate transformation is performed on the point cloud when the order and number between GCP and matching points are consistent.



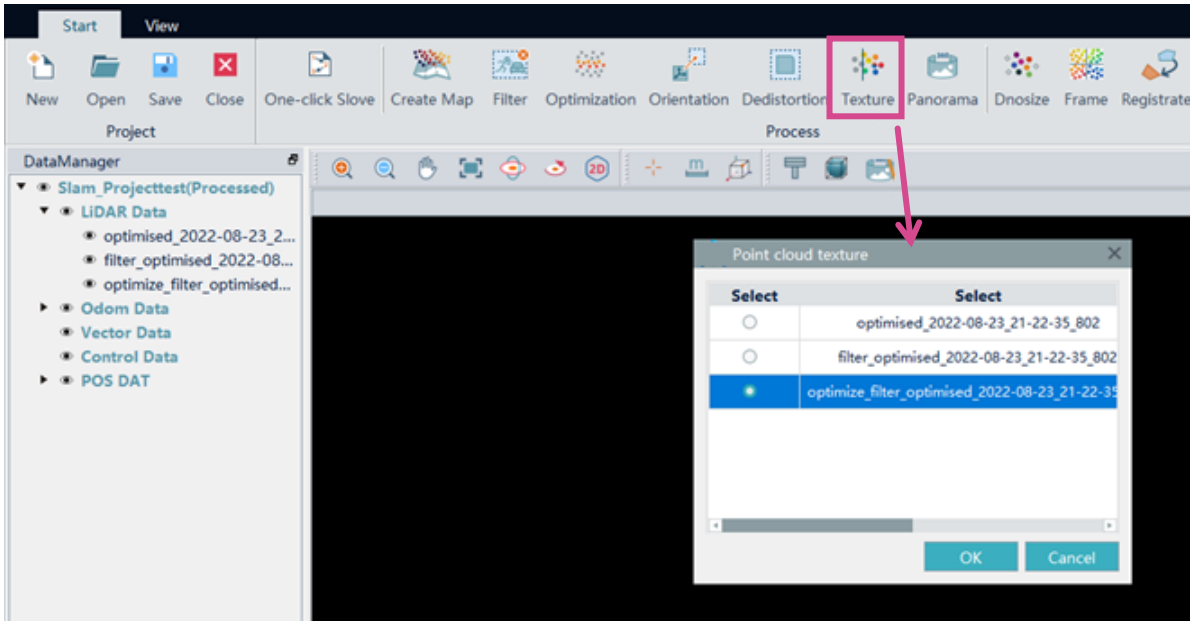
Dedistortion

This function is designed to remove distortion from the image, and this step is necessary for subsequent point cloud coloring and panoramas. A single undistorted image is stored in a folder named "dimage".



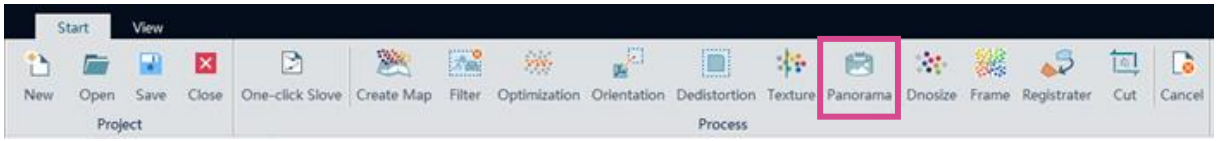
Texture

This function uses the undistorted image to color the point cloud. Click *Texture* in the data processing toolbar and select existed point cloud to perform point cloud coloring. Point cloud beginning with 'texture' are colored point cloud.



Panorama

This function processes undistorted image to generate panorama.

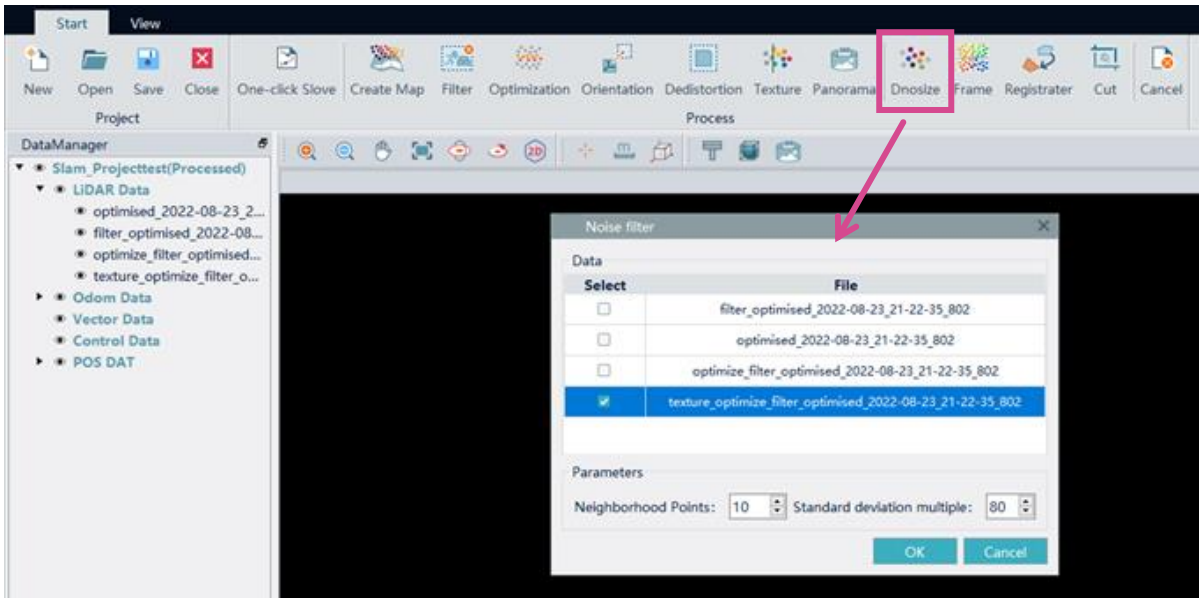


6.7 Point cloud edit

Denoise

This function can remove noise by Statistical Outlier Removal algorithm.

Selecting point cloud you want to process, Setting neighborhood points number and standard deviation multiple. The meanings of parameter are as following.

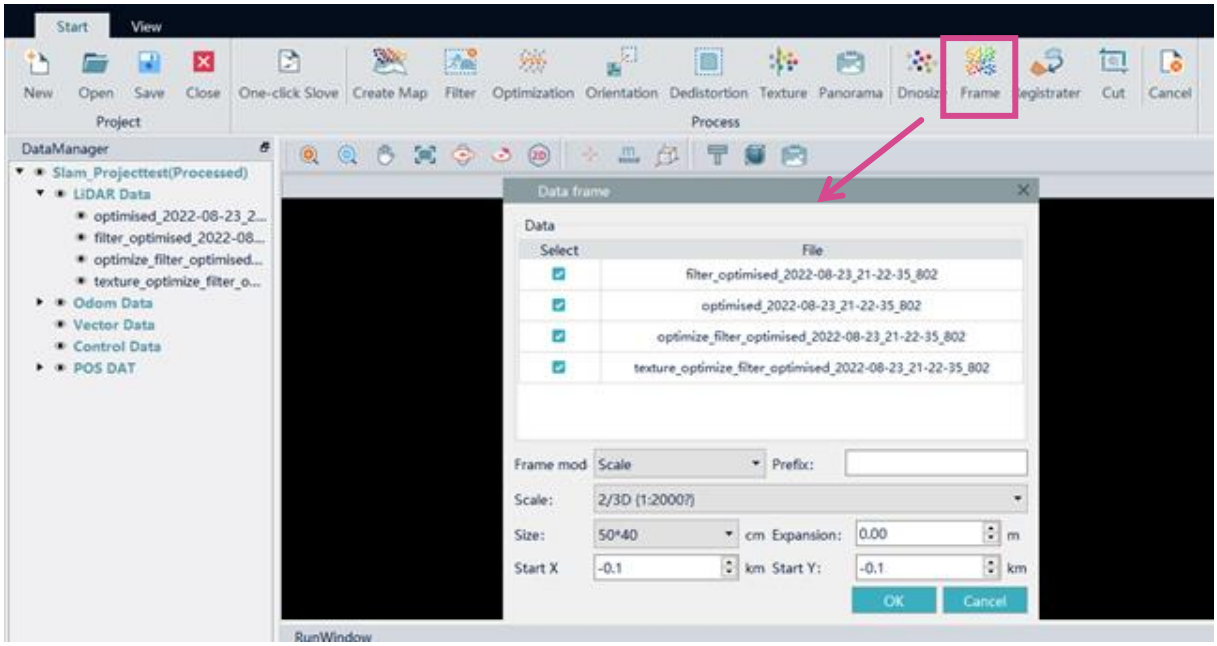


- Neighborhood Points: This represents the required number of points within the neighborhood to calculate the average distance and standard deviation from each point.
- Standard deviation multiple: This is the value multiplied by the standard deviation.

Frame

This function is for framing the point cloud.

Select the framing method (scale bar or fixed size), prefix, framing scale, frame size, expansion range and rang, etc. Then click *framing* to process the data in framing.

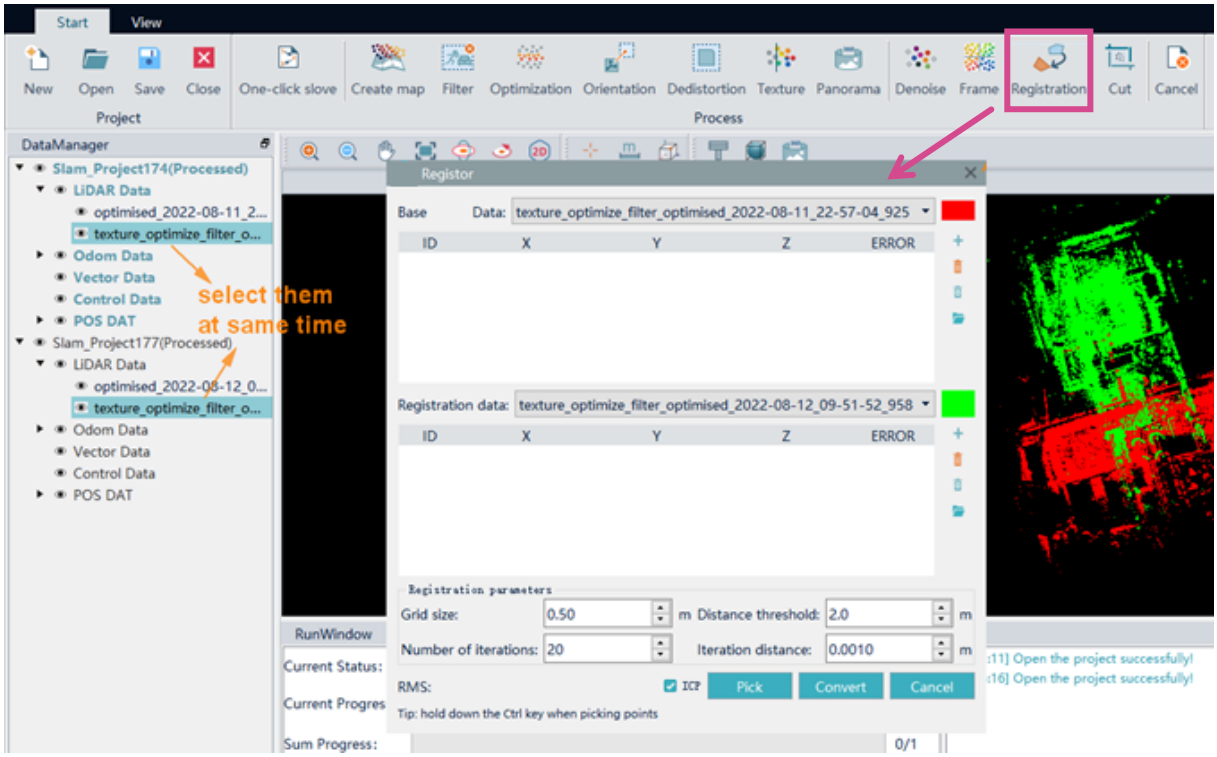


Registration

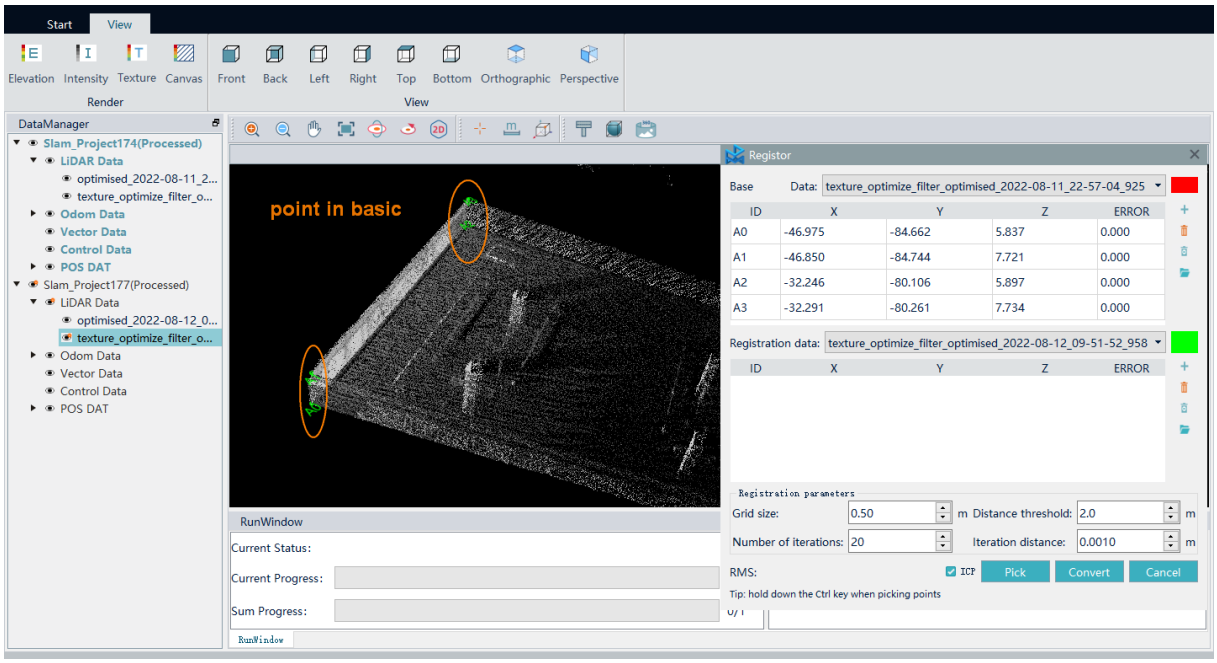
This function is to stitch several sets of point clouds into an integration.

Before point cloud registration, you need to add the basic point cloud and the registered point cloud to the display window. There are steps of registration:

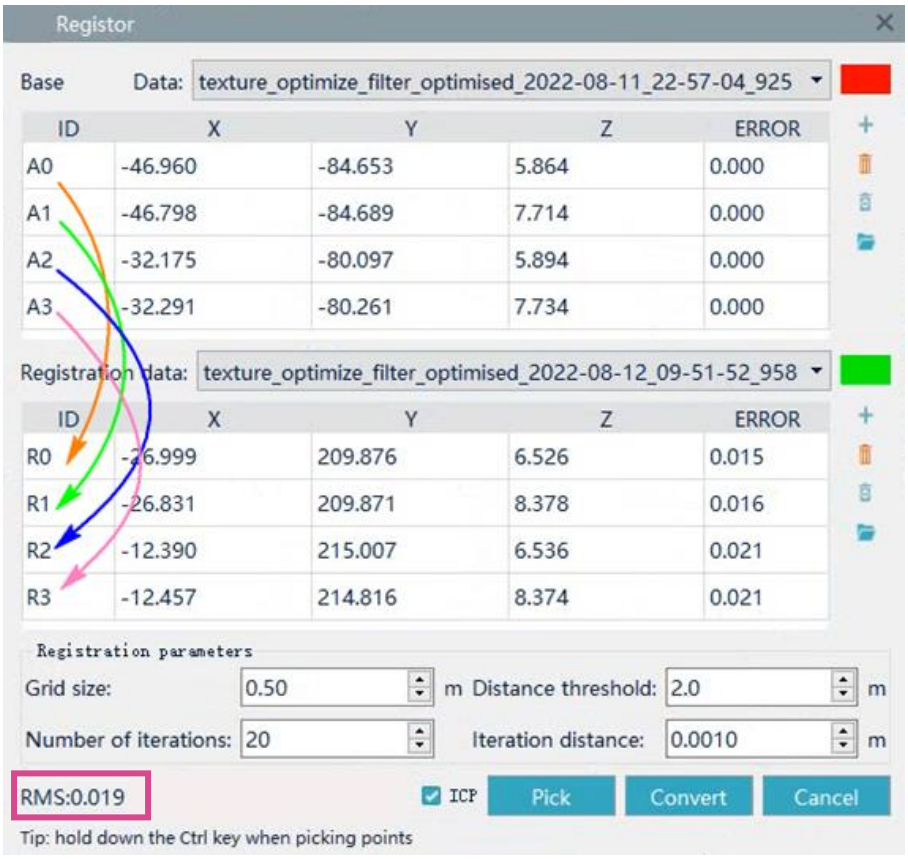
- Add reference point cloud and the point cloud to display window.
- Select basic point cloud and registered point cloud at the same time, then click *Registration*



- Click *pick*，then select point pairs in basic point cloud and registered point cloud. The order of same name point must be consistent.



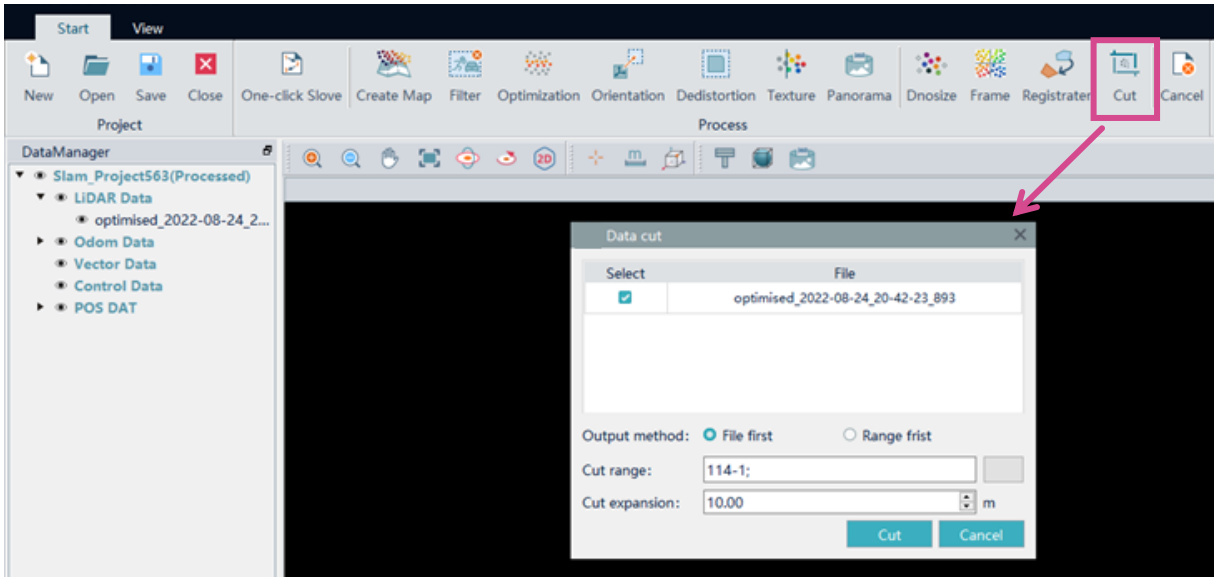
- Select at least 3 pairs of points with the same name in basic point cloud and registered point cloud, The order of same name point must be consistent.
- Adjust the registration parameter (ICP), when registration RMS of error meets precision requirements, click *convert* to complete registration. The meanings of ICP parameter are as follow：
    1. Grid size: Point cloud tile grid size.
    2. Number of iterations: The number of iterations of the ICP algorithm, generally 20.
    3. Distance threshold: the maximum distance between points with the same name. If the searched matching point is greater than the threshold, it will not participate in the calculation.
    4. Iterative distance: the difference between the distances calculated before and after, if it is less than this value, exit the iteration.
    5. RMS is the root mean square error related to registration.



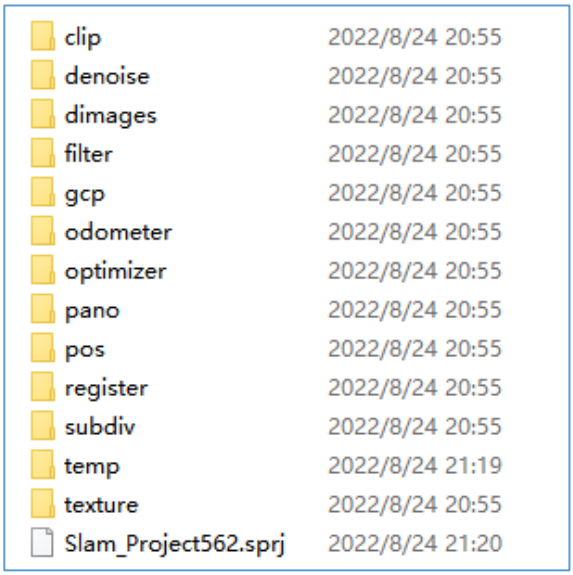
Cut

This function can clip the point cloud according to the range.

Select the data to be clipped, determine the output method, import the cropping range (vector files support shp, dxf, fmb, kml formats), and determine the expansion range.



6.8 Description of the result catalog

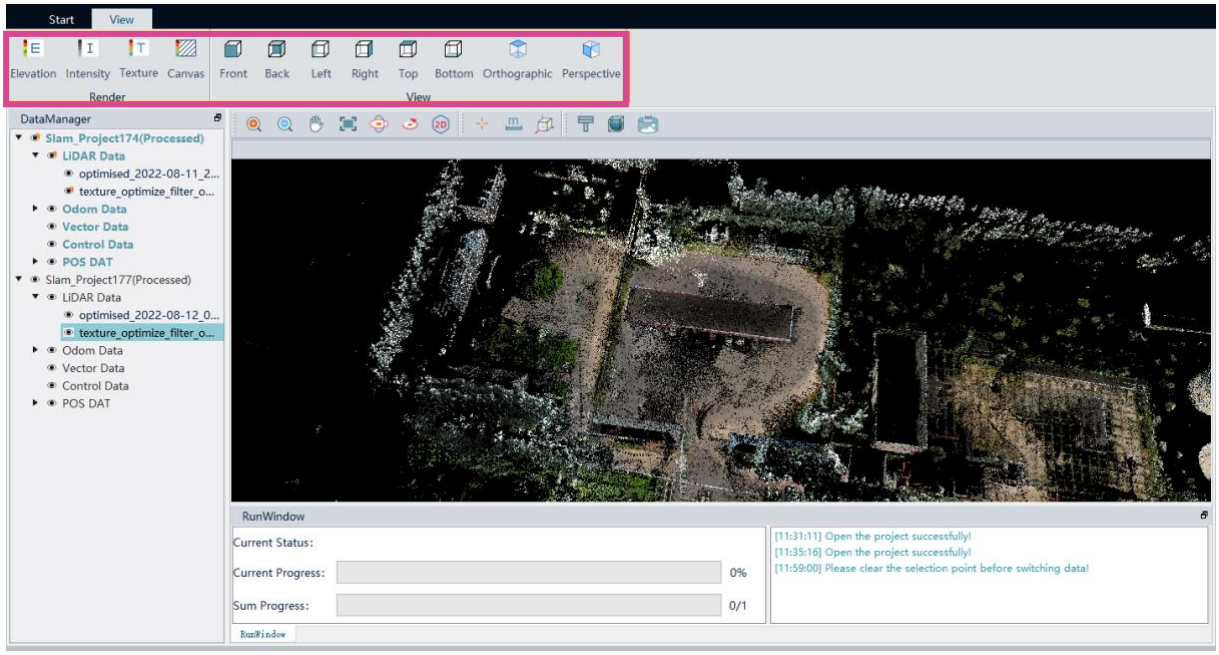


- Clip: Clipped point cloud data
- Denoise: Point cloud data after denoising
- Dimages: Single image without distortion
- Filter: Point cloud data after removing moved object
- GCP: Absolute Orientation Odometer and Point Cloud
- Odometer: Odometer data, in which HF_odometry.txt is the high frequency odometry, LF_odometry.txt is the sparse odometer, and optimized_odometry.txt is the optimized odometer
- Optimizer: Point cloud data after optimization
- Pano: panorama
- Pos: Image POS data, where camera_pos.txt is the image POS file, camera_trajectory.txt is the camera trajectory file, lidar_trajectory.txt lidar trajectory file
- Register: Point cloud data after registration
- Subdiv: Point cloud data after framing
- Temp: Project temporary folder, containing project information, original point cloud data and log. If users face problems, pls give log to Technical Engineer
- Texture: Point cloud data after coloring
- .sprj: Project file

6.9 Results browsing

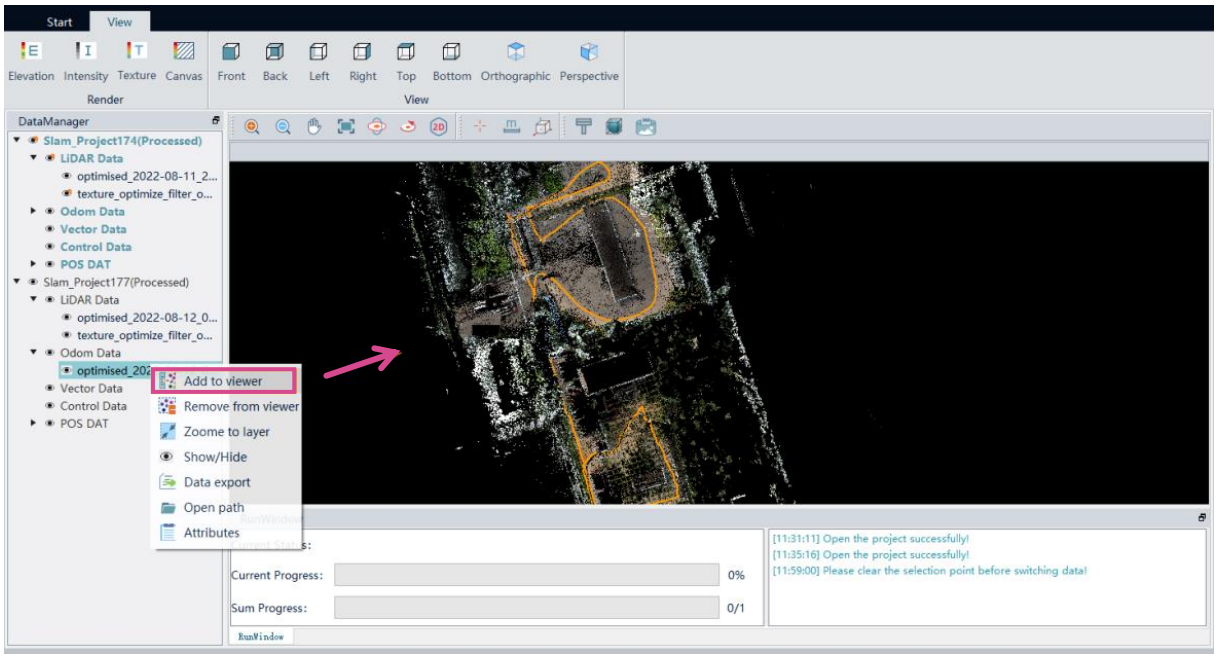
Select the point cloud you want to browse and right-click - Add to View.

User can change display methods that contain elevation, intensity, texture and canvas. In addition, user also can change display view angle, such as front, top, etc.



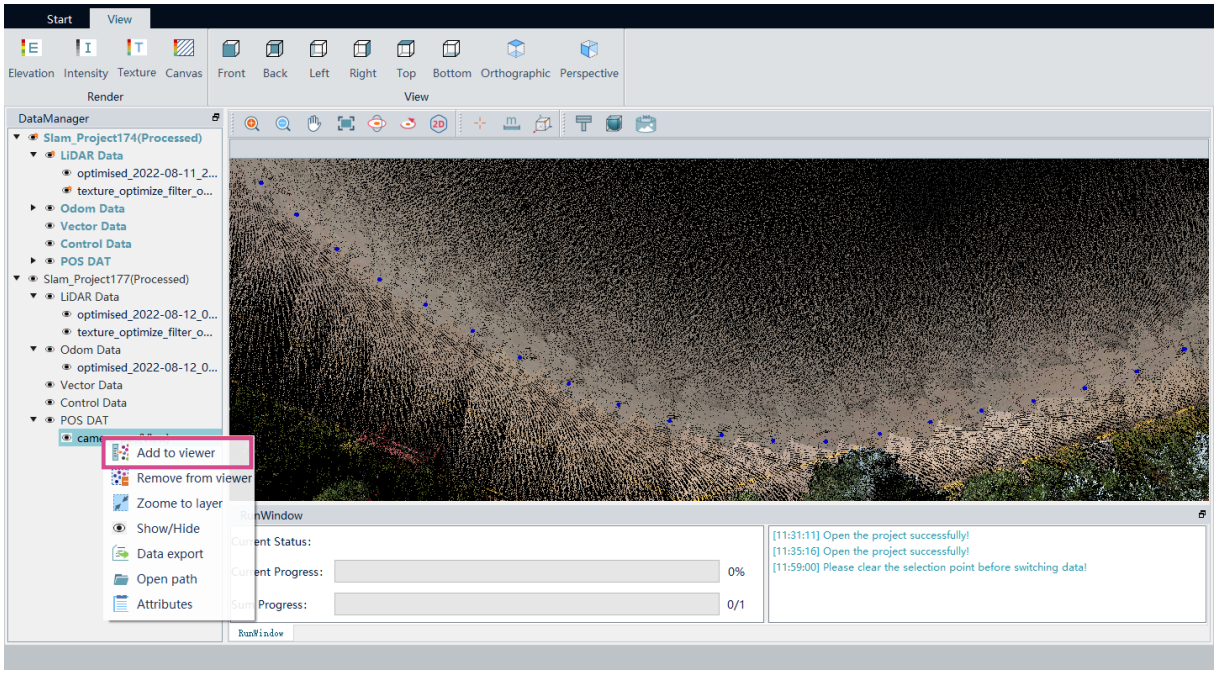
6.10 Trajectory

Select Odom Data and right-click - Add to View. The points in orange are the odometer trajectory.

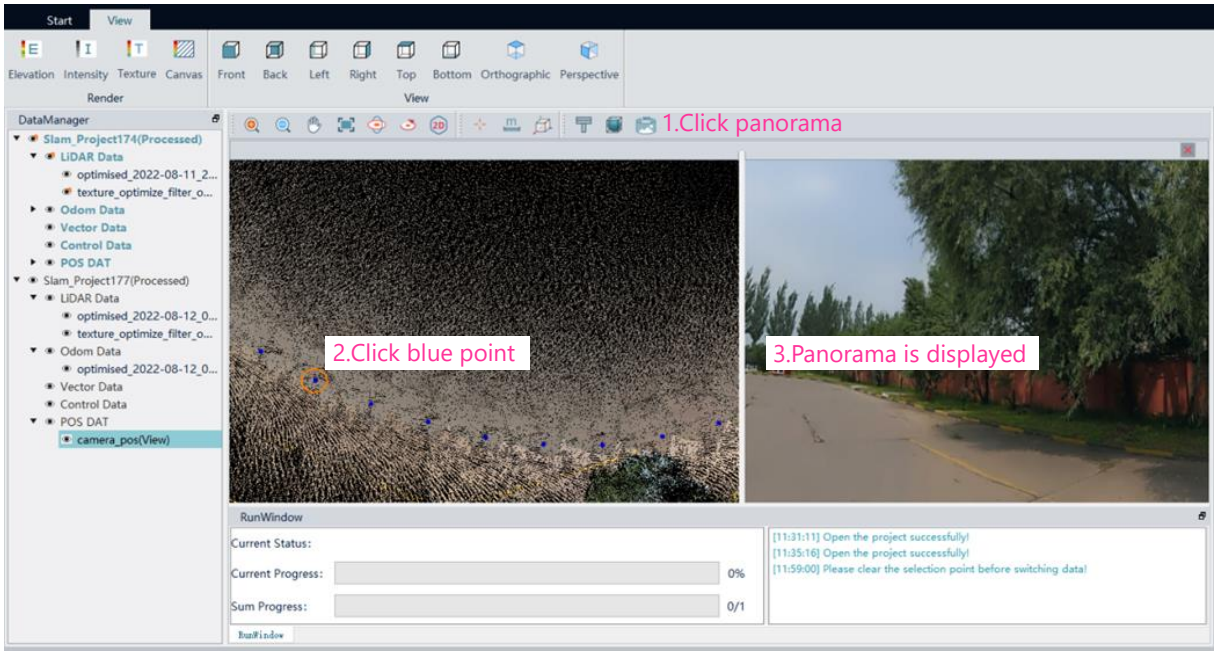


6.11 Panorama browsing

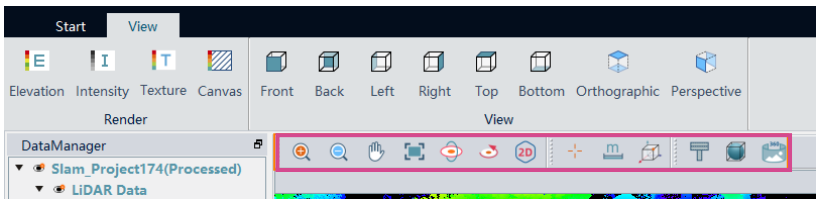
Select the cam_pos and right-click - Add to View. The point in blue is the odometer trajectory.



Select the cam_pos and right-click - Add to View. The point in blue is the odometer trajectory. Hold down the left button and move the mouse to browse the panorama.

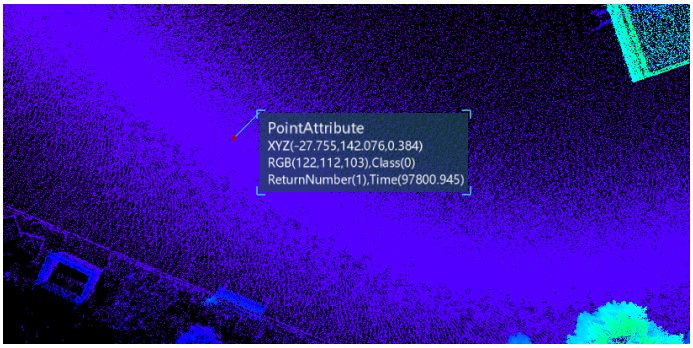


6.12 Tool bar

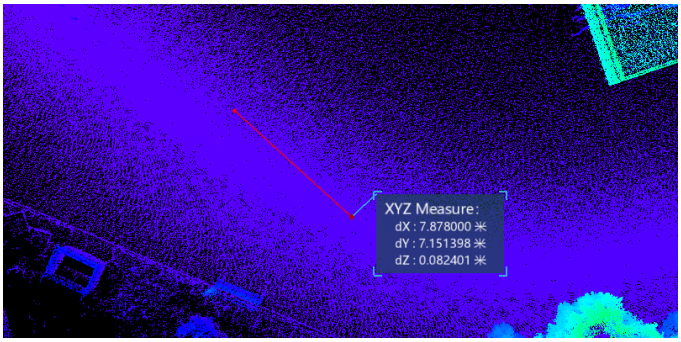


Here are meaning of tools:

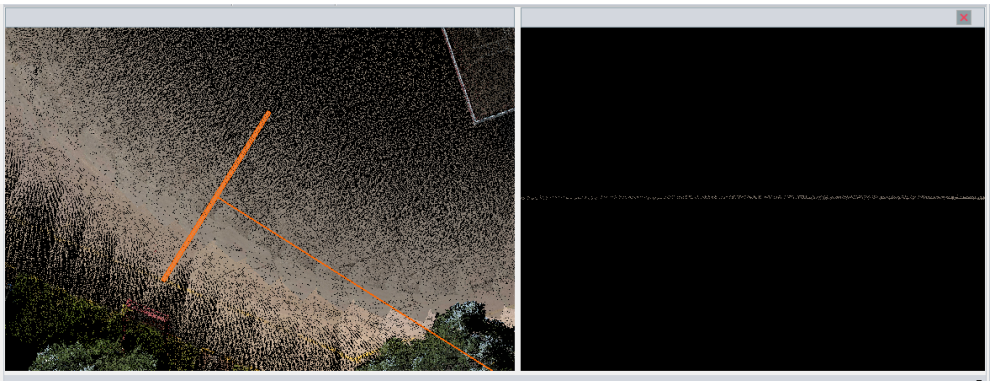
- Zoom in: Zoom in on the point cloud
- Zoom out: Zoom out on the point cloud
- Pan: Pan the point cloud
- Extent: Zoom to layer
- Rotation: rotate point cloud
- Rotation center: change rotation center for easy browsing
- 2D: Lock the plan view
- Pick point: pick single point to show its information



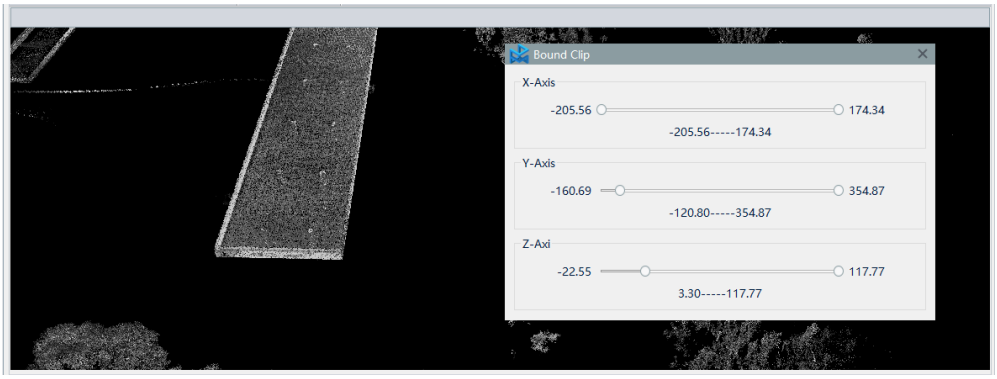
- Measure distance: measure 3D distance between two points
- Measure XYZ: measure distance between two points in XYZ Axis.



- Profile: Show point cloud details in a cross-sectional view



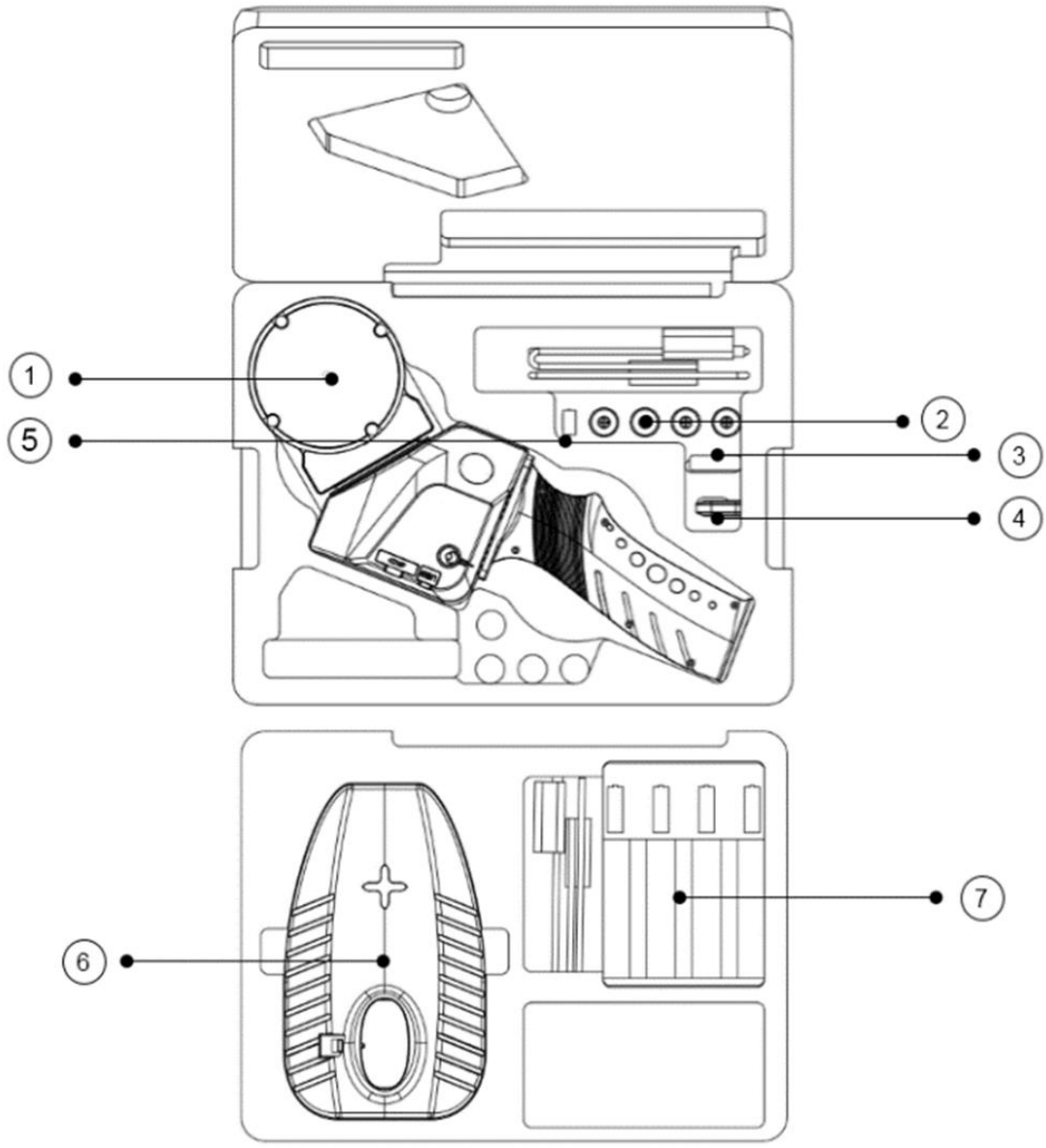
- Plan cut: Show point cloud details by change box boundary



- Panorama: refer to previous chapter

7. Technical data

7.1 Bundle components



N	PART NAME	QUANTITY
1	Scanner	1
2	Rechargeable battery	4
3	SD Memory card	1
4	SD card reader	1
5	USB License key for GO*post*	1
6	Scanner base bracket for GCP	1
7	Battery charging hub, Car/EU/US chargers	1

8. Appendix

8.1 X120GO technical features

PERFORMANCE	
Max Range	120 m
Min Range	0.5 m
Relative Accuracy	Up to 6 mm [1]
Absolute Accuracy	5 cm
Vertical resolution	16 channels
Scanning Point Frequency	320.000 pts/s
Field Of View	Horizontal 360° Vertical 270°
Laser class	1
Echo strength	8 bits

CAMERA	
N. of camera	3 (5 MP each)
Cameras FOV	200°x100°
Image	Semi-spherical

SYSTEM	
Data Storage	32GB (expandable)
Operation Mode	Realtime visualization (Android 8 or above)
Communication	NFC, Wi-fi

PHYSICAL SPECIFICATION	
Dimension	372mm*163mm*106mm (without bracket)
Net Weight	1.6 kg (without battery)

POWER	
Battery Life	2.5h (each set of batteries)
Power consumption	25W
Capacity	3350mAh×4
Voltage	20-30V

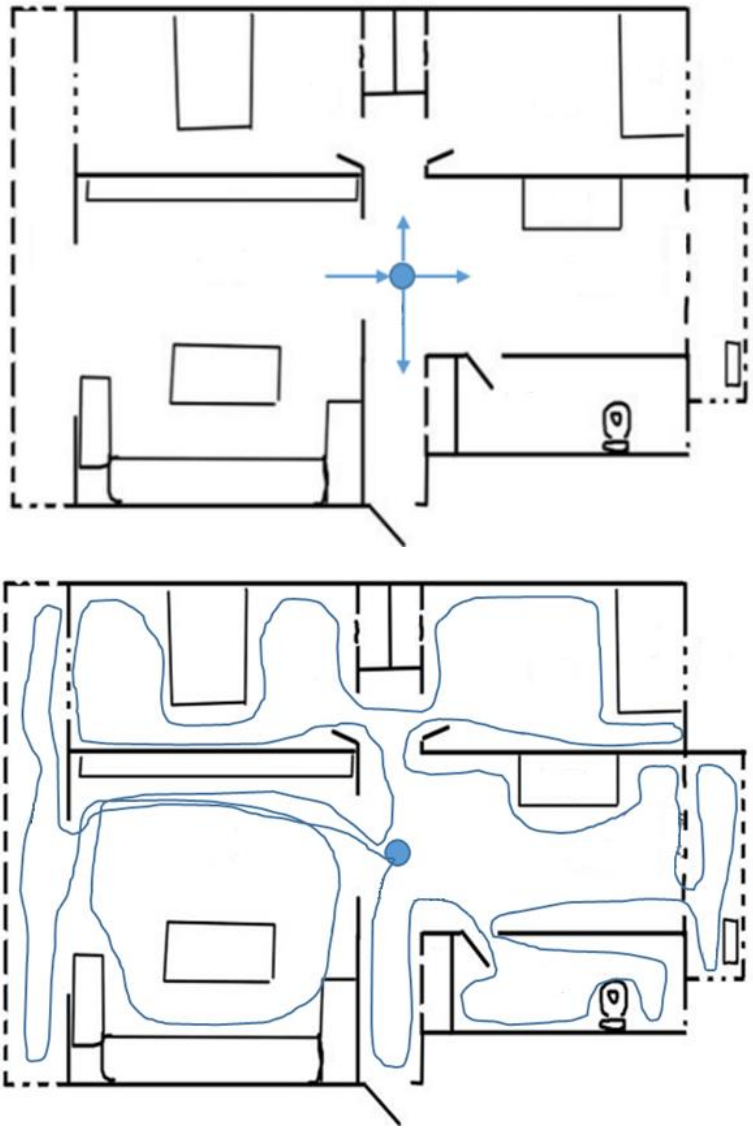
ENVIRONMENTAL CONDITIONS	
Working environment temperature	-10°C to 45°C
Working humidity	<85% RH
Waterproof/Dustproof	IP54

[1] In controlled environment

8.2 Data collection guidelines

Indoor Climate

If it is an indoor environment, multi-path locations should be selected as far as possible as the starting and ending points of data collection. After the site survey, plan the closed route of the survey area.



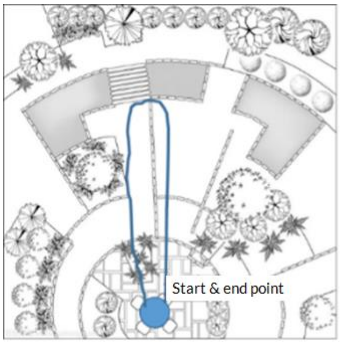
Outdoor Environment

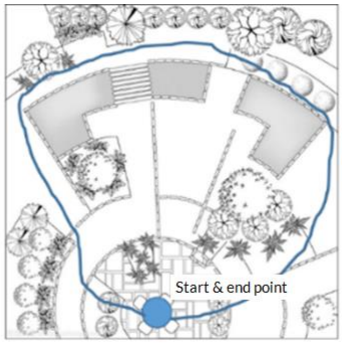
If it's an outdoor environment, besides finding multi-path locations and planning closed routes, it is also necessary to ensure that the measured object is within the effective measurement range of the scanner (because of the different reflectivity of ground objects, the distance is also different).

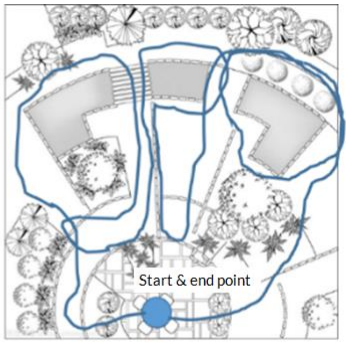
Notice: A multipath location refers to a location that can be reached from multiple directions.

Closed routes

1. The slender closed route is similar to **U-Shaped**, and the U-shaped route can barely meet the accuracy requirements. If conditions permit, users are advised not to choose this route.
2. The trajectory is similar to **O-route**, there is no redundant closed-loop, and the accuracy of data calculation is good, which is one of the most basic requirements for route selection.
3. **Multi O-route:** the whole track is similar to O-shaped, with many closed circles, and the data solution accuracy is the best. It is composed of many closed O-shaped routes, which greatly improves the data solution accuracy and is the best route planning.







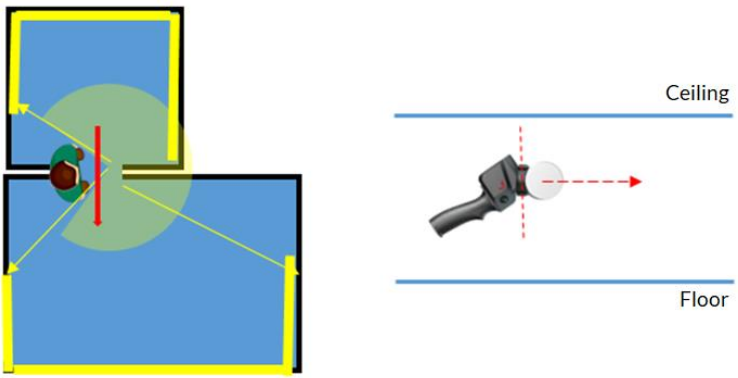
Typical surroundings data collection considerations

X120^{GO} scanner can acquire point cloud data in the range of 360× 270, and the point density decreases with the increase of measurement distance. In the process of data acquisition, the device should be stable and avoid violent shaking, and non-measurement objects such as pedestrians and vehicles should be prevented from blocking the front of the device for a long time, to ensure the integrity of data acquisition.

Matters needing attention when passing through the door

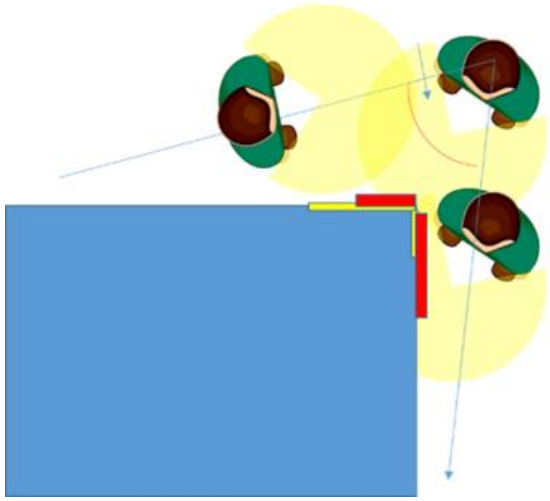
When the hand-held scanner passes through the indoor door, it is recommended to pass slowly sideways to

ensure that the scanner is relatively stable, and the door is open as much as possible. If the door is closed, when approaching the door, you need to turn the scanner back to the door and open the door with the other hand. During the process of passing through the door, you should fully consider the scanning field of vision and scan the scenes outside the door as much as possible in the room. When closing the door, try to avoid the scanner scanning the moving door as much as possible, to prevent data calculation errors.



Matters needing attention when turning corners

When the hand-held scanner passes through the corner, it is recommended to avoid too fast corners, and the way of the corner should be considered in route planning. Get as many point cloud data at the same position before and after the corner as possible to improve the accuracy of data calculation.



Matters needing attention in large-scale data acquisition

When the scanner is used to collect large-scale data, the whole survey area should be divided to facilitate the data calculation efficiency, improve the calculation accuracy and facilitate the survey area management. Divide the larger survey area into several small survey areas. It is suggested that the planned data collection time of each survey area should be 25-30 minutes, and the overlapping range of survey areas should be at least 30%.

Suggestions for scanning long corridors (Tunnels)

Generally, the data obtained in areas with rich features and textures will have good calculation results. To ensure the calculation accuracy, it is necessary to manually set a feature point with a diameter of about 1 meter every 10

meters or place some objects with complex structures such as chairs and stools in this area. Improve the accuracy of the solution. In addition, during data acquisition, attention should be paid to the incident angle of the laser, and data acquisition should be done in the middle of the corridor or tunnel as far as possible, and meaningless in-situ rotation should not be carried out, to avoid the sudden decrease of the incident angle caused by object occlusion and errors in data calculation.

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