



LiGrip

Handheld SLAM-Based
LiDAR Scanning System

User Manual V1.3

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Copyright

GreenValley International

LiGrip Handheld Rotating SLAM LiDAR Scanning System

User Manual V1.3

Copyright

File version 1.3

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Website: www.greenvalleyintl.com

Respected User:

Thank you for using the LiGrip Handheld Rotating LiDAR Scanning System. It is our pleasure to provide you with mobile measurement data acquisition and processing services. GreenValley is committed to continuously improving our products. We therefore appreciate your comments and suggestions for improvements to our hardware equipment, post-processing software, training and documentation materials. Please contact us at Info@greenvalleyintl.com for any information or if you have any feedback.

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Printed January 20, 2022

1. Safety Warning

Please read this manual carefully and follow the operating specifications in the manual before using. The manual will be updated in real time as the product technology upgrades. Users can obtain the latest LiGrip hand-held rotating laser scanner through the [Official Website of GVI](#) or technicians.

LiGrip hand-held rotating laser scanner is a high-precision instrument, please take extra care when using, avoid collision and strong vibration. When transporting equipment, ensure that all items are properly placed in the protective box. Do not transport or move any equipment that is not in the protected state.

Note:

- If not to be used for a long time or for long distance transportation, please take the power supply battery out of the multi-function battery box.

In order to avoid damage to the equipment and violation of the warranty terms, please do not disassemble the equipment at will. If the product fails, it must be repaired by qualified maintenance personnel authorized by GVI.

2. Introduction

LiGrip hand-held rotating laser scanner is a new series of products launched by GVI. The product adopts a simple style design, with a compact body, light hand-held, convenient operation and flexible installation; With a variety of sensors, it can quickly capture a wide range of scene data; support multi-platform and multi-mode operations, and combine lidar and SLAM algorithms to achieve indoor multi-scene integrated measurement. With GVI self-developed LiFuser-BP point cloud processing software, the point cloud data can be post-processed quickly.

2.1 Main Technical Parameters

Performance	Parameter
Hand Part Size	220*130*405mm
Battery Box Size	128.5*64*165mm
Hand Part Weight	1.9kg
Laser Sensor	VLP16
Laser Safety Classification	Class 1 Eye-Safe
LiDAR Accuracy	±3cm
Relative Accuracy	3cm
Absolute Accuracy	5cm
Max Range	100m
Wavelength	903nm
Scan Rate	300,000pts/s
Horizontal FOV	0°~280°
Vertical FOV	0°~360°
Point Cloud Data Format	.las,.laz,.ply,.LiData
Storage Space	128GB
Ports Available	USB, Ethernet port
Battery	5870mAh
Operating Time	~4h (single battery)
Camera Type	Wide angle lens
Camera Resolution	4000*3000
Camera Operating Time	~1h (single battery)

2.2 Product Components



LiGrip Product Components

1. Handheld device host
2. Handheld device battery case
3. Strap
4. Power cable
5. Data transfer cable
6. Battery
7. Camera Battery
8. Laser scanner protective cover
9. Battery charger
10. USB Disk
11. Camera Battery charger

3. Product Assembly and Field Operation Instructions

Please operate in strict accordance with the following procedures to ensure the normal functions of the device.

3.1 Product Assembly

1. Insert battery into battery pack.



Insert battery

2. Connect one end of the power cord to the handheld scanner device and the other end to the battery pack.



3.Remove the laser cover.



Connect power cable



Remove laser cover

3.2 Field Operation

Note  :

If the camera is not installed, you do not need to operate the camera, just press the button to operate.

1.Turn on the camera: Short press the black button above the camera to turn on the camera, and the camera screen will turn on.

Note  :

Please power on the camera module before turning on the battery of the LiGrip

2.Powering on the device: Press the round button above the battery and release it, then continue to hold the button for 2 seconds, wait for the system has powered on successfully



Powering on the device

Note:

The device must be connected to the power cord before powering on

3.After the device is powered on, the green wave button on the back cover of the host will be in a flashing state. During the flashing process, the camera will take a photo. You can judge whether the photo is successful from the sound and the camera screen. After the photo is taken, the filter button is always Bright. The whole process takes about 75s.

Note  :

If the camera is present and turned on, and no photo is taken before the green button light goes out, the camera is not connected, please restart the battery box.

4.Device initialization: Select an open starting position, keep the device still (it must be placed flat), press the green wave button, the laser will initialize and rotate for about two and a half circles and then stop. After a short period of time, the camera starts to record, and then the laser rotates steadily to build the base map. The lights are flashing rapidly throughout the process.

Note:

- The laser should not be aimed at walls, ground or sky, and open spaces with few features
- If it is collecting tunnels, mines, etc., and entering from the outside, try to initialize at the entrance of the cave
- Ordinary acquisition environment, when initializing, the laser can be aimed at the acquisition scene

4.Data collection: After standstill, slowly pick up the device and walk directly according to the route planned in advance. During walking, do not make large movements of the arm holding the device. You can move slowly or change hands.

Note: Please refer to [Operation Specification](#) for the operation specifications during the scanning process.

5.Stakeout: First align the crosshair of the Dotter with the control point, press the green wave button after it is placed stably, and the button light starts to change from slow flash to fast flash for about 10s, and then change to slow flash again to complete the dotting operation. At this time, slowly pick up the equipment and continue to collect. The operation of other control points is the same.



The stand is aligned with the control point



Stakeout

Note:

- It is recommended to press and hold the device while GCP stakeout to keep the device in place

6. Stop the collection: After the data collection is completed, hold the device firmly in place, press and hold the button until the button flashes quickly, then let go, the laser stops rotating, the laser data collection ends, and then manually press the red button on the top of the camera to stop recording. The light will continue to flash rapidly for data saving. After the flashing is completed, the data is saved and the next group of projects can be started.

Note  :

- The laser must be turned off before turning off the camera, the order cannot be reversed
- After the laser stops rotating and the camera is turned off, you can hold the device at will, when the light flashes, it is in the save data
- The recording time of the camera for a single project field operation should not exceed 15 minutes, so it is recommended that the single project operation time should not exceed 15 minutes
- The red button of the camera is the end recording button, the black button is the power button, do not press the wrong button

7. Powering off the device: If you need to continue to collect data, start directly from the device initialization in step 4; if the data collection is completed, directly turn off the battery, and the specific operation is the same as turning on the battery. The camera is turned off with the black button.

Note:

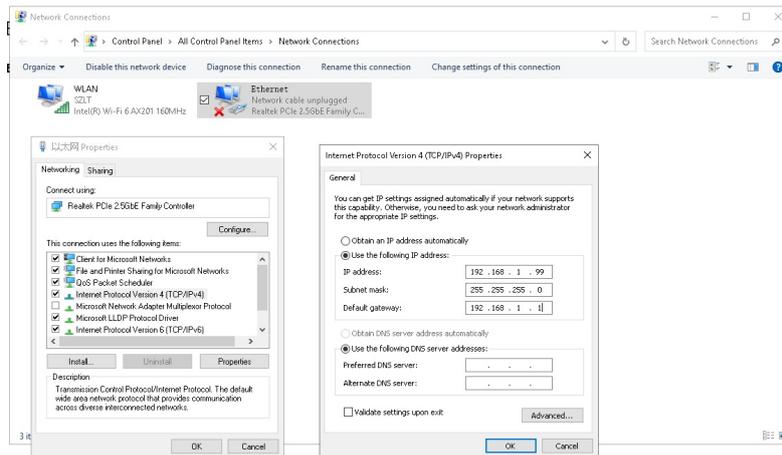
After finishing operation, the device must be powered off first, and the power cord must be unplugged. Do not unplug the power cord before turning off the battery

4. Data Transmission and Processing

4.1 Data transfer

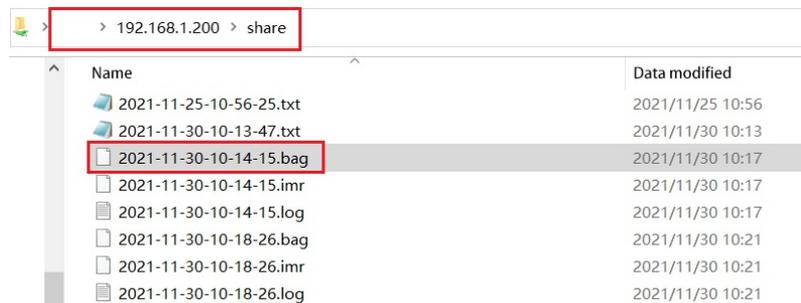
1. When the device is powered on, connect the LEMO port of the data transmission cable to the Lan port above the battery box, and the network port to the computer.

2. Set the computer "IP address: 192.168.1.99, subnet mask: 255.255.255.0"



Computer Settings

3. Enter the URL "\\192.168.1.200" in the computer network to enter the internal storage space of the device, open the "share" folder, find the corresponding .bag file according to the collection time, copy it to the computer, and complete data transmission.



Data Transfer

Note:

- When connecting the device to a computer for the first time, a pop-up box for entering network credentials may pop up, where the user name is: share, and the password is: 111111
- If it prompts "You can't access this shared folder because your organization's security policy prevents unauthenticated guest access." error warning when entering the change directory, please refer to the link: <http://www.winwin7.com/jc/16842.html> Modify the computer security configuration.

4.2 Camera Data Transfer Copy

1. Use the usb cable to connect to the computer, turn on the power of the camera, the camera is in the USB disk mode, and copy the corresponding video files. When the image data is exported, it has no effect if the LiDAR is powered on/off.

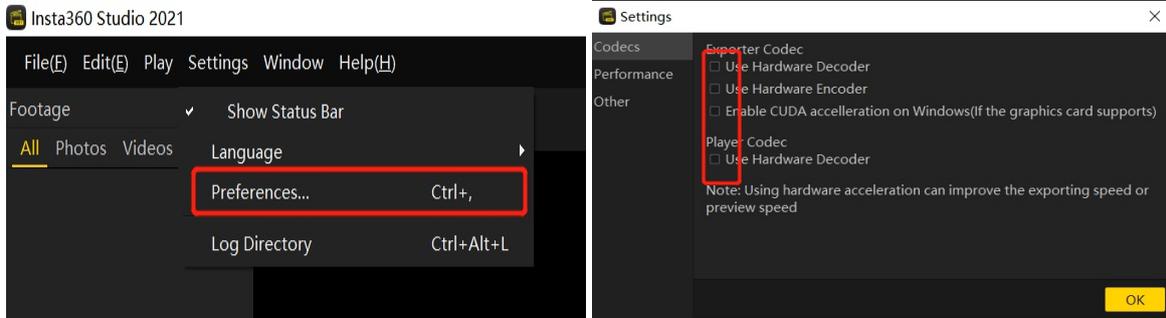
Note:

- If the CollectionRecords.txt file is used when copying the bag, the camera file will be copied through the corresponding relationship between the bag and mp4 recorded in this file.
- If there is no CollectionRecords.txt for the time being, you can only use artificial memory at present. The last group of mp4 is the camera file corresponding to the last project, and the sequence is reversed.
- The data file is large, please make sure to keep enough disk space.

- Please clear the data on the camera memory card in time to prevent the data from being too large and the storage space being insufficient. Please pay attention to the camera memory space on the interface at any time.
- The camera files and bag files are stored in the same directory, and different projects are stored in sub-folders

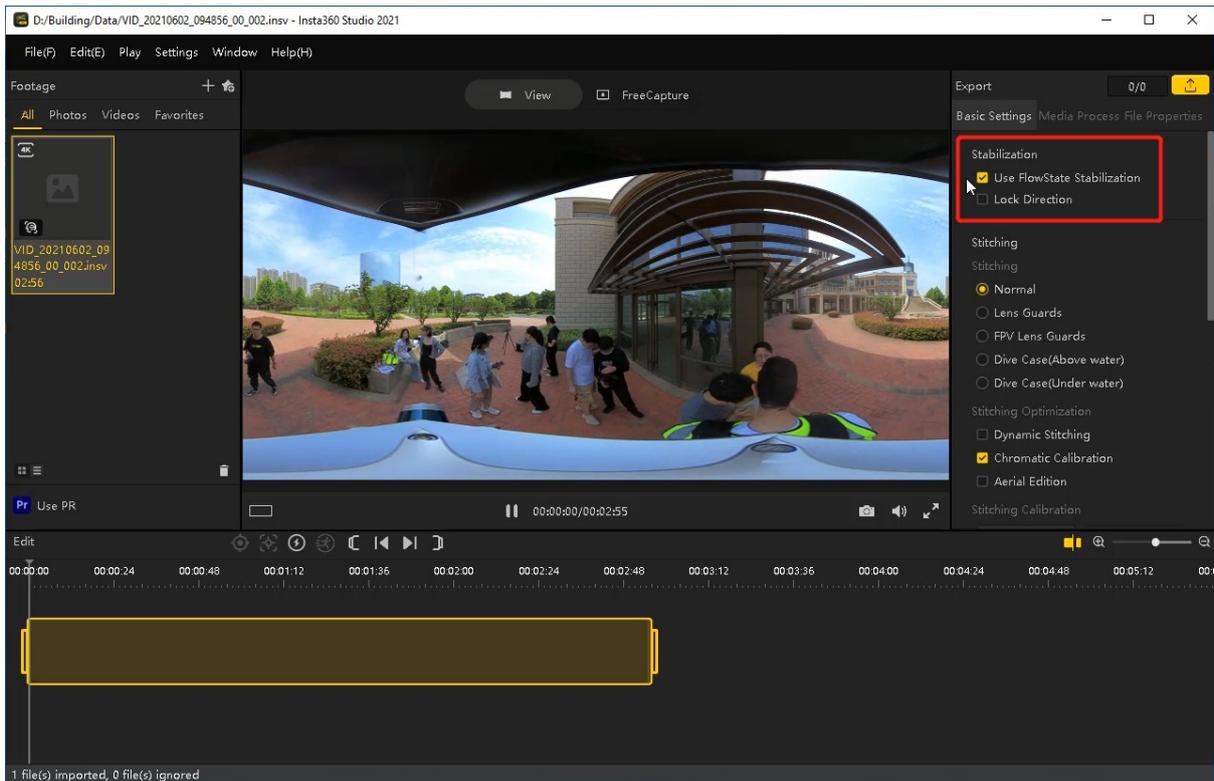
1. Video stitching

2. Open the insta360 studio 2021 (Version: 3.6.2) software, and modify the preferences: uncheck all the "Codec Settings", as shown in the figure.



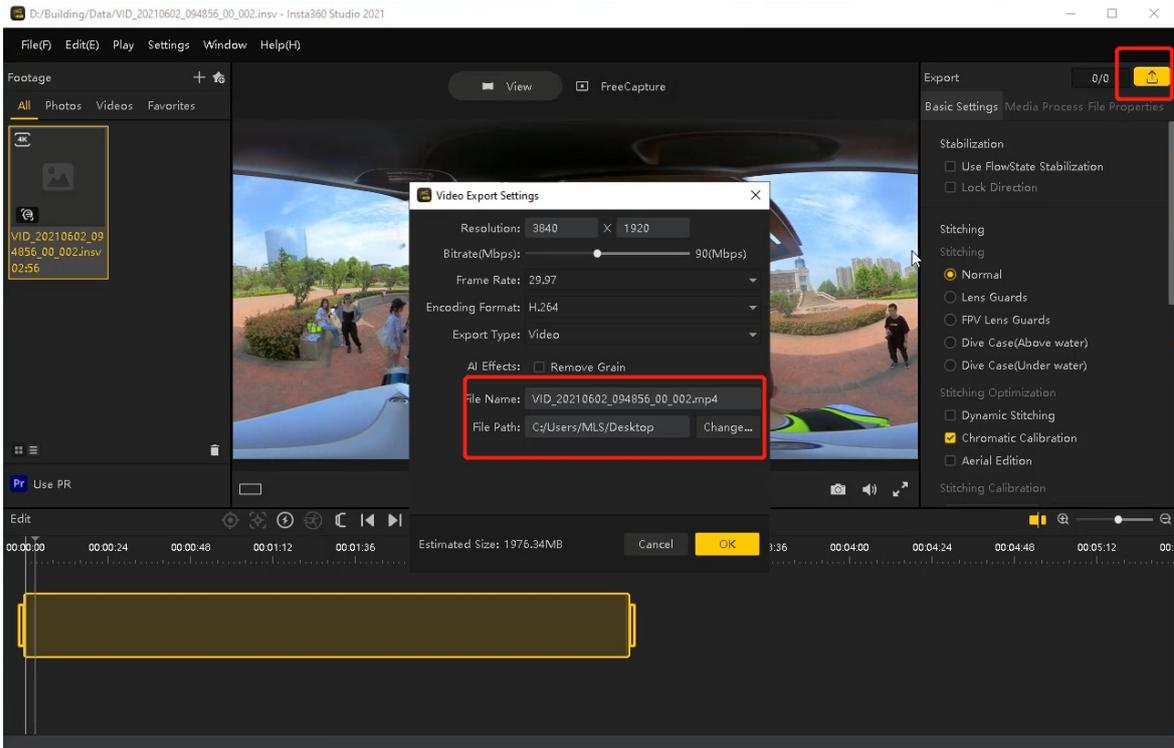
Software Preferences

- Modify the suffix name of the video file copied in step 1, change mp4 to insv, and open the modified file in the software. As shown in the figure, for the loaded video, select the corresponding option according to the red box on the right, that is, "Enable FlowState stabilize" is not selected.

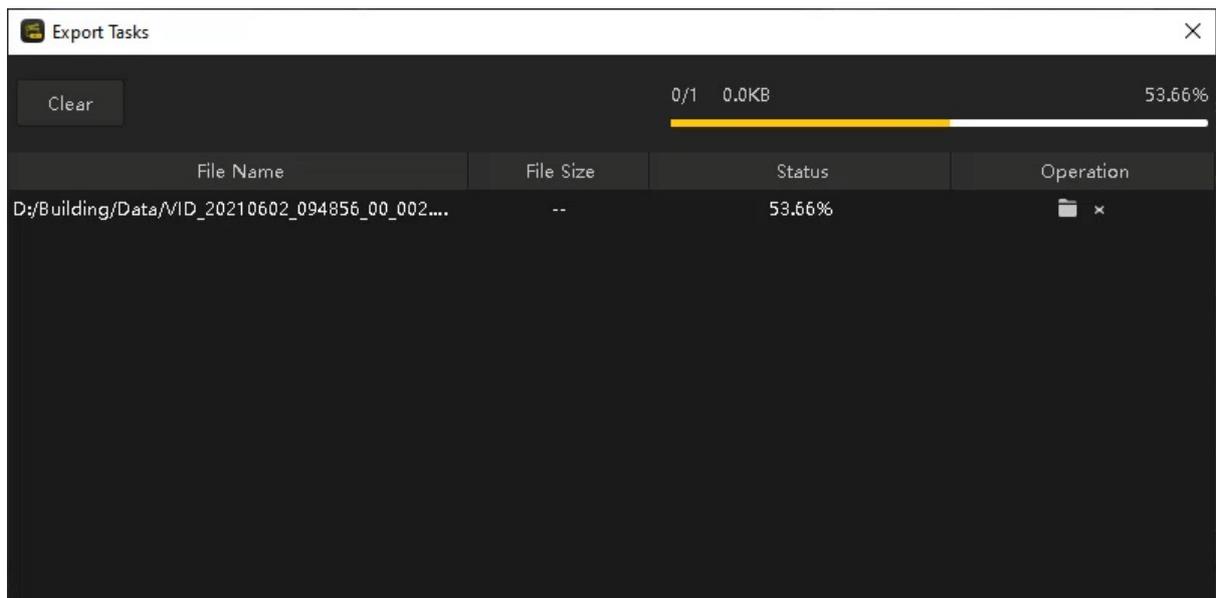


Video loading

- Click the "Export" button in the upper right corner, as shown in the figure, do not modify the file name in the red box, the path setting and the corresponding insv file are located in the same directory, other parameters can be defaulted, and then click the OK button, as shown in the figure, Wait for the file stitching to be completed to get the final panoramic video file.



Video export settings

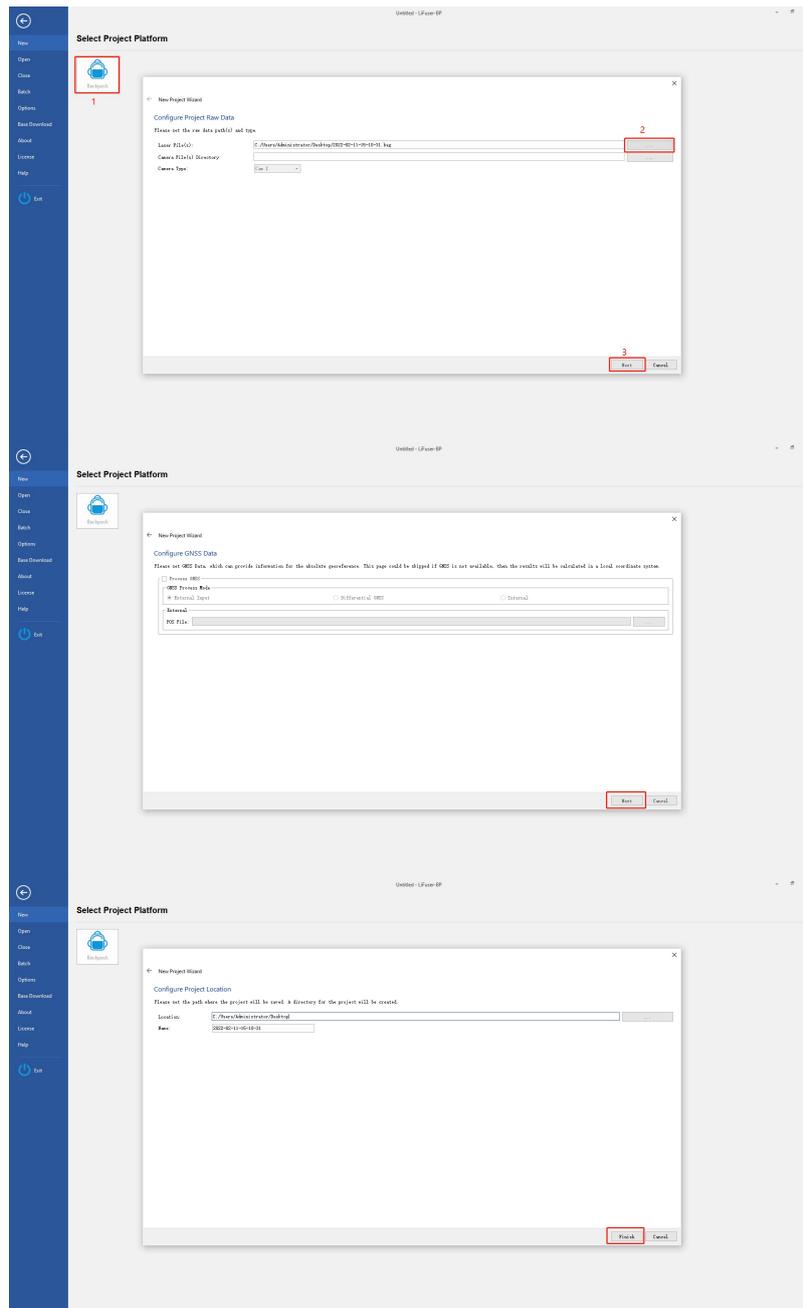


Progress display

4.3 Data Processing

The handheld data calculation uses the LiFuser-BP post-processing software developed by GreenValley. The specific operations are as follows:

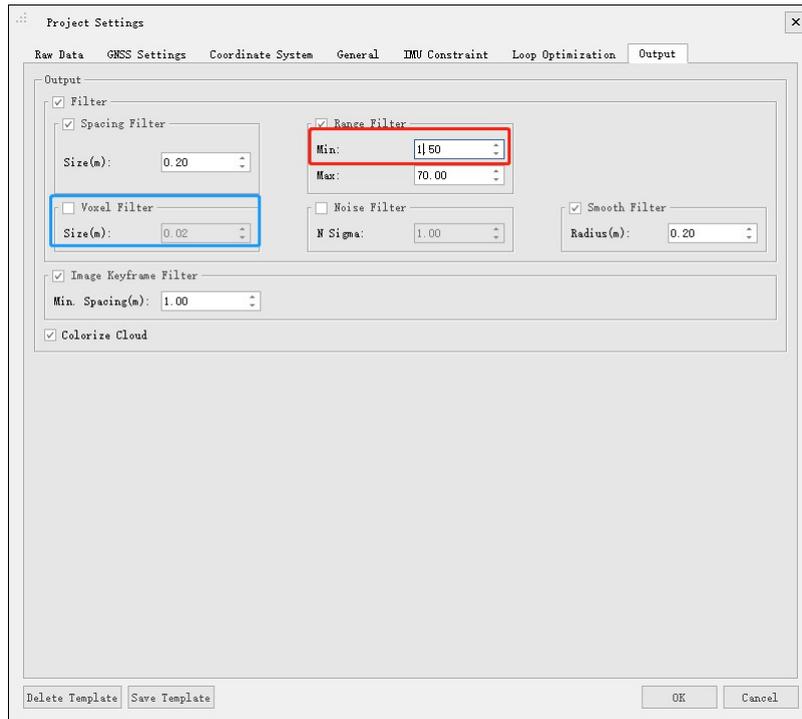
1. New project: Open the solution software, click "Backpack" to create a new project, select the copied .bag file in the laser file column, select the folder directory where MP4 and insv are stored in the camera file path, go directly to the next step, and finally click Finish.



New Project

2. Modify parameters:

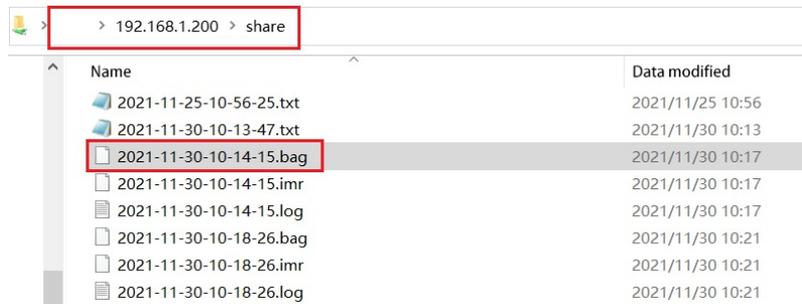
- In the project settings, output, change the minimum distance filter to 1.5, and the voxel filter size to 0 or directly remove the check box, click OK to save the changes.



Parameter Configuration

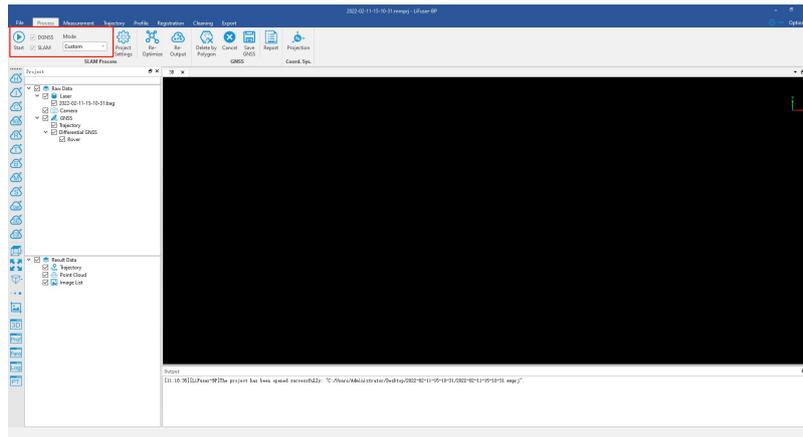
Note:

- (1) Voxel filtering: If you keep the default, the density of the point cloud after the solution is relatively sparse, about 3000-5000 points/square meter, set to 0, the point cloud density is above 10000 points/square meter;
 - (2) Distance filtering: The setting can be adjusted according to the height of the field collector to the ground when holding the device, and the shadow can be filtered out directly
- If the collection is in an indoor space, change the feature filter size to 0.1. There are relatively few indoor space features, so more points are used to calculate the features, and the data can be solved better.



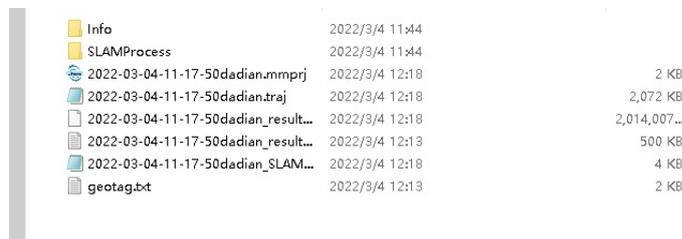
Data Transfer

3.Point cloud calculation: Under the processing column, click "Start" to directly perform point cloud calculation.



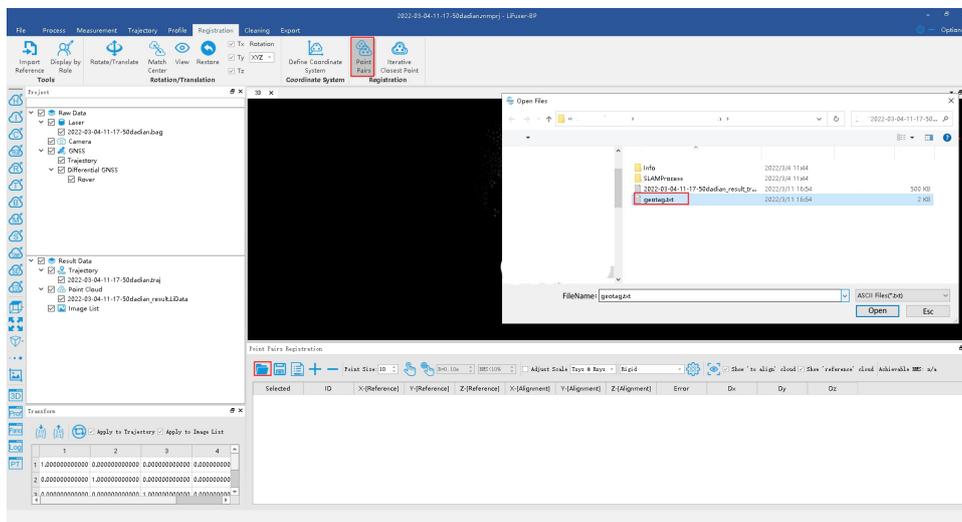
Start Processing

4. Register absolute coordinates: If the device collects control point information during the acquisition process, the control point file is geotag.txt in the project directory after the solution.



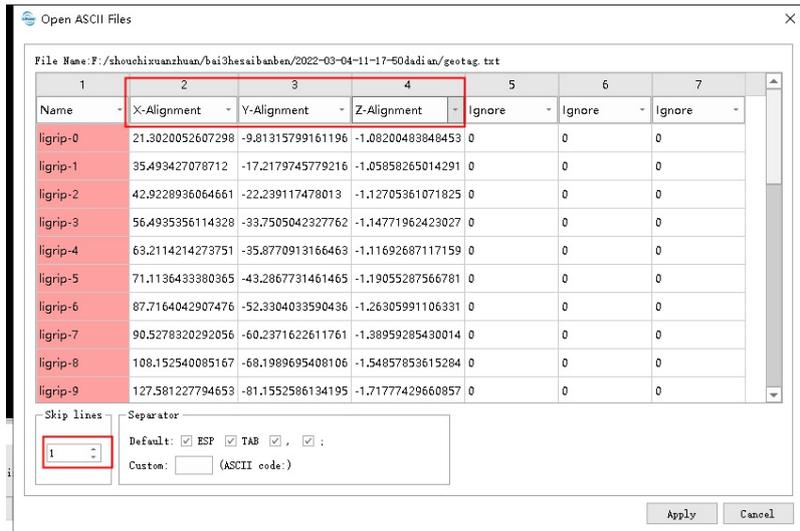
Point File Location

In the BP software, click the point-to-point button under the registration, and by importing the control point information, load the control points made with the equipment in order to perform absolute coordinate registration.



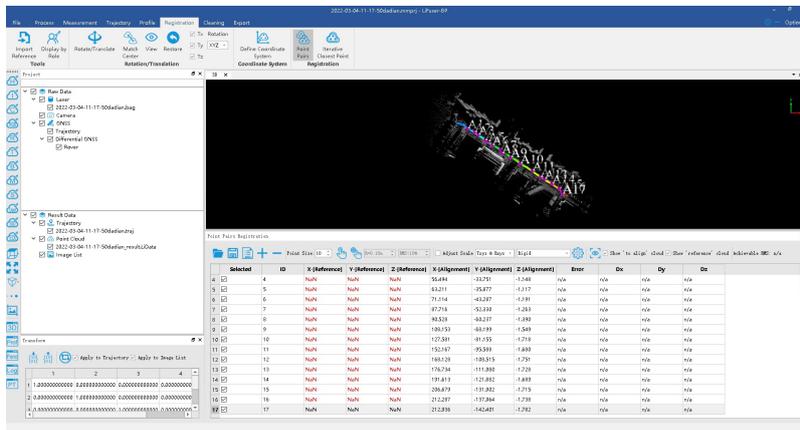
Load Control Point

When importing the loaded control points, remember to skip the first line and change XYZ to XYZ to be registered.



Edit Control Point

After loading, the control points are as follows, and then you only need to input the corresponding RTK absolute coordinate information one by one, and use "Adjust Zoom + Rigid Transformation" to convert.



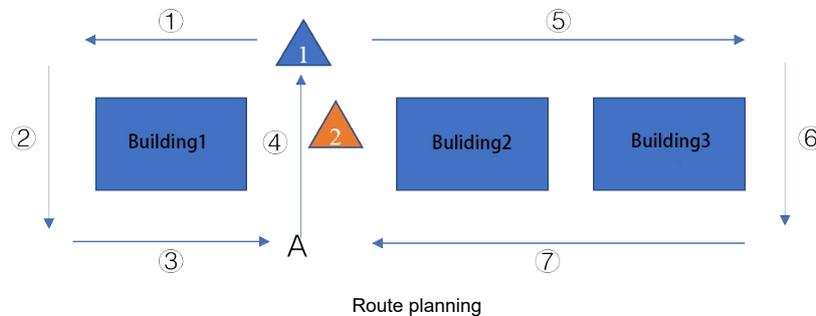
Registration

Note : Absolute coordinate registration can be done according to "scaling + rigid transformation", if the accuracy is not enough Consider using "scale + rigid + non-rigid transform". At the same time, if you find that the matching effect is very poor after the "zoom + rigid" registration, please contact technical support for feedback.

5. Operation Specifications and Guidelines

A scanning environment of rich 3D structures is recommended for the LiGrip. For route planning in different scenarios, please refer to the following suggestions:

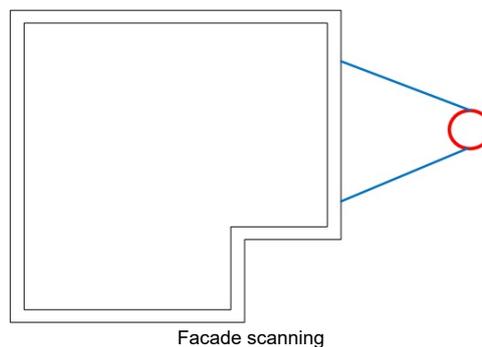
1. Crossing short routes is better than a long straight route;



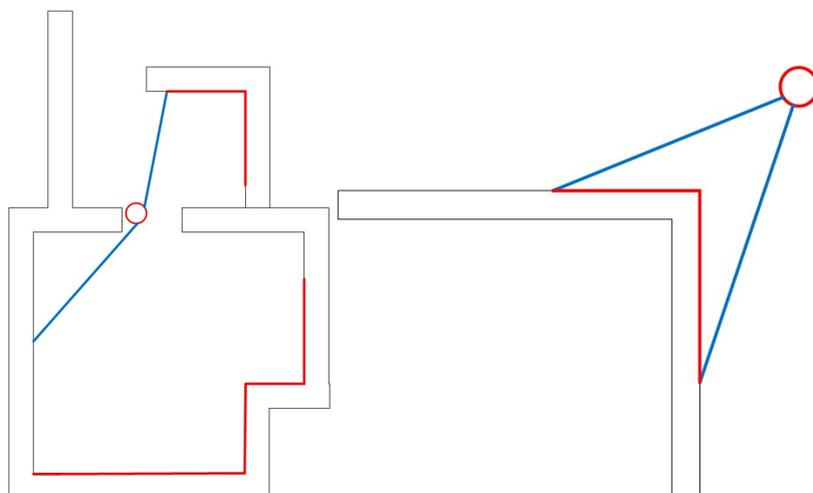
As shown in the figure above, buildings 1, 2, and 3 are objects to be scanned. It is recommended to start scanning from 1 instead of 2. Before starting the scan, plan the scan route first. According to the above rules, the driving route for this scene scan is ①②③④⑤⑥⑦ or ⑤⑥⑦④①②③.

2. Take the closed-loop route to prevent accumulated error drift, resulting in the final data deformation. As shown in the figure above, the scanning route is ①②③④⑤⑥⑦, it is recommended that the end position of ⑦ should exceed A, exceed 5m with the previous repeated route, and have an overlapping area with ③ or ④;

3. If you would like to place more attention to building facade information during the collection process, it is recommended to select a time when there are fewer moving targets, and during the collection process, pointing the laser at the facade.



4. When moving from one house to another or turning a corner, since the local environment has changed, it is necessary to travel at 1/5 of the normal speed during the movement; at the same time, try to ensure that the laser can scan to the door when passing through the door. Features on both sides, passing sideways.



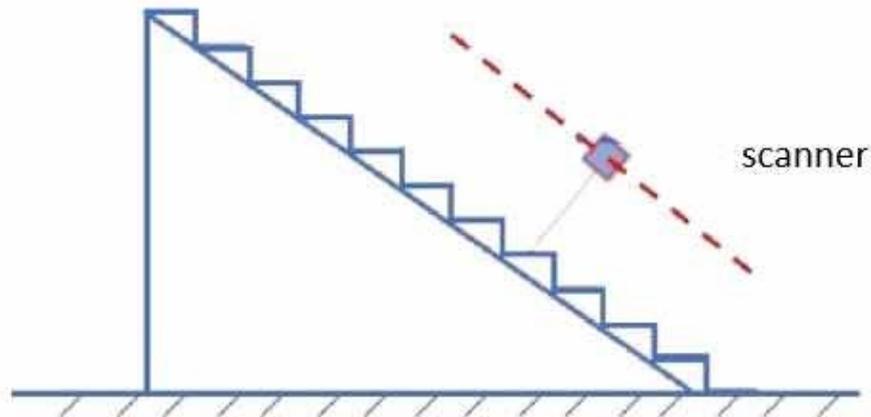
Change of scanning environment

Note: If it is some very small rooms, such as bathrooms, small storage rooms, etc., you can scan through the laser from the door, and it is not necessary to enter the room

5. If you need to turn around in place, it should be as slow as possible, and the rotation speed should be less than 30 degrees/second. The rotation area needs a rich and evenly distribution of three-dimensional structures. For example, it cannot be rotated in the center of an empty square house;

6. When scanning indoors, open the doors of the rooms to be scanned in advance, and do not move the doors during the scanning process;

7. When collecting multi-story stairs, if you are very concerned about the quality of the stairs, it is recommended to tilt the device back about 10-15° and slowly lift the device every time you walk to the platform on the first floor to sweep the overall outline of the ascending stairs. Slowly descend to a normal angle, and when walking up, it is recommended to hold the laser parallel to the stairs.

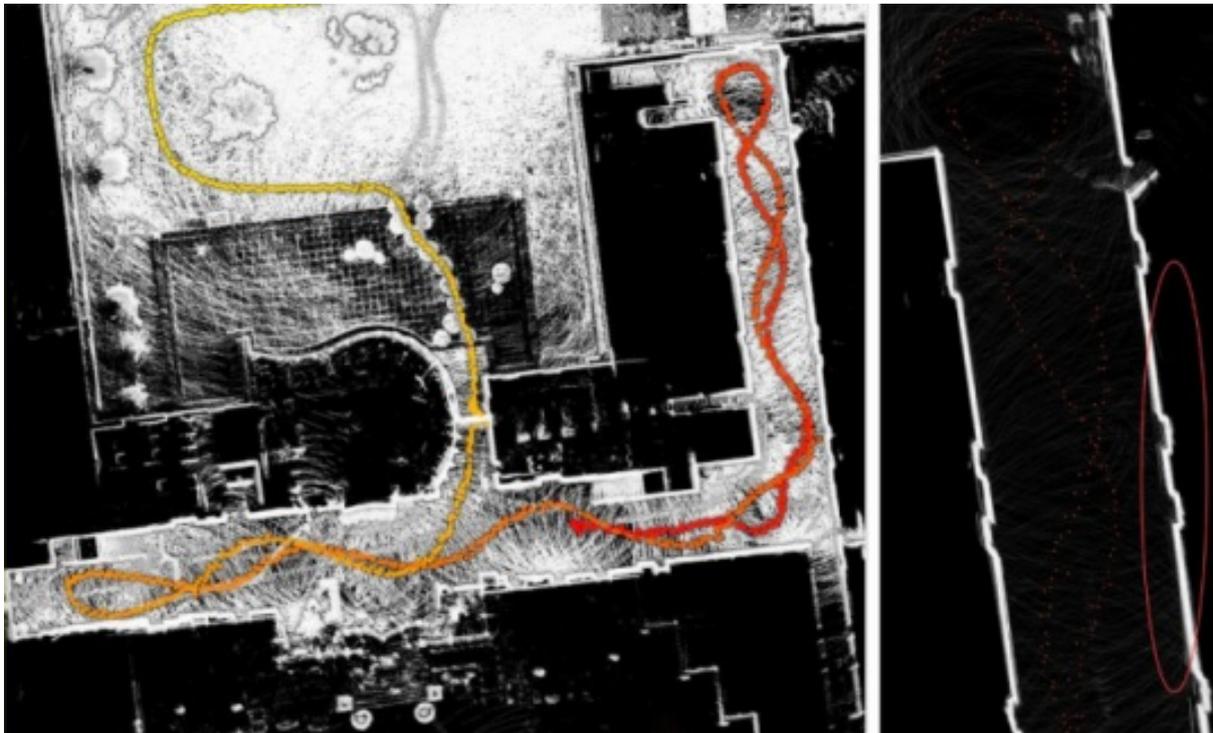


Scanning staircases

8. If you are very concerned about the quality of stair steps when descending multi-story stairs for collection, it is recommended to stick to the wall and walk down horizontally, so that the laser can scan the steps behind the person.

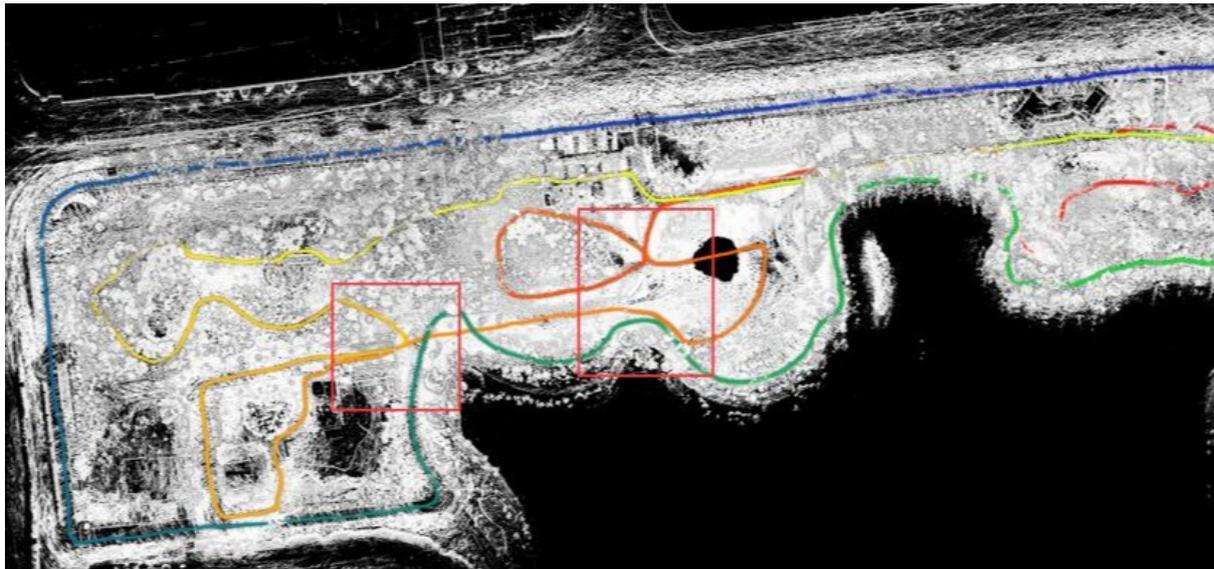
Note: Points 7 and 8 may improve the quality of the steps to a certain extent, but the quality of objects such as walls may be affected. It is recommended to choose the scanning method according to the target concerned.

9. It is strictly forbidden to bend the scanning route back and forth, which will easily lead to an increase in the thickness of the wall;



Meandering routes

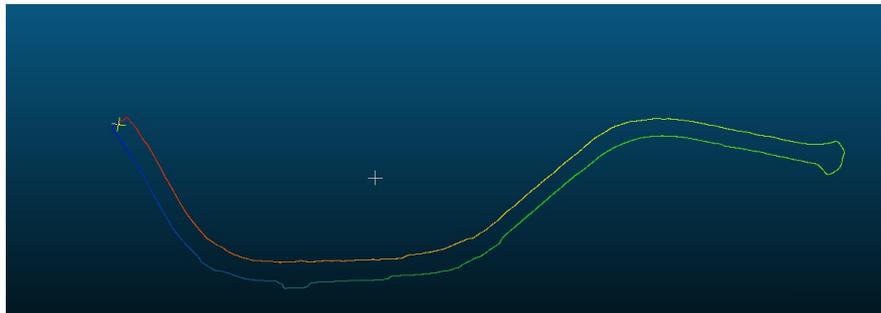
10. Avoid scanning the same location multiple times as much as possible;



Repetitive scanning locations

11. When scanning a large-scale scene, it is not recommended to repeat the scan in a large circle. After completing the small-scale area as much as possible, move to the adjacent area to scan, and finally return to the starting area to complete the closed-loop route;

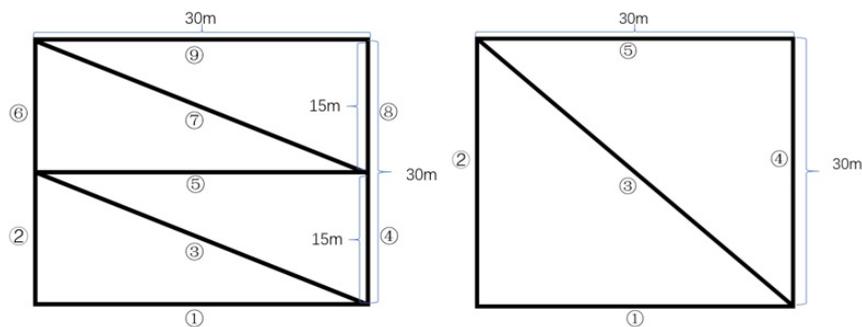
12. Try to avoid that the trajectory when collecting data is a closed loop back and forth along both sides of the same road, and the back and forth road line should be the same trajectory line as much as possible. Because the distance between the two sides of the road is relatively close, but most of the scanned objects are inconsistent, only a small part overlaps, and the closed loop cannot solve the cumulative problem, and the cumulative error cannot be eliminated;



Repetitive routes

Take 30m*30m forestry quadrats as an example:

Carry out path planning for the collection sample area. The purpose of route planning is to collect all the information of the trees and reduce data redundancy. For the 30m*30m sample area, if the trees are dense, use the path planning shown on the left of the figure below. If the trees are relatively sparse, the path planning shown on the right of the following figure can be used:



Path planning (dense trees: left, sparse trees: right)

13. When scanning an environment with very few features, if the direct scanning is unsuccessful, it is recommended to place a fixed target with distinctive features every 50 meters in the survey area, such as boxes, chairs, tables, etc.

5.FAQ

Why does the system not power on?

- Please check:

(1) Whether the battery power is sufficient;

(2) Whether the battery connection cable is connected.

- Be careful not to regularly over-discharge the battery to avoid damage to the battery.
- It is recommended to stop the collection operation when the power is below 30%, replace the battery or fully charge the battery. Also ensure that the power cable is disconnected when the device is turned off.

How long is does the LiGrip work on one battery cycle?

A fully charged battery can support up to 4 hours of uninterrupted data collection.

What safety precautions should i be aware of when using the LiGrip?

LiGrip devices have an IP65 IEC rating, meaning the LiGrip offers protection provided by mechanical casings and electrical enclosures against intrusion, dust, accidental contact, and water. Thus, the system is safe to operate in most day-to-day environments.

Is the laser used by the LiGrip system safe?

The lasers used in LiGrip have a safety class of 1: Safe for the human eye.

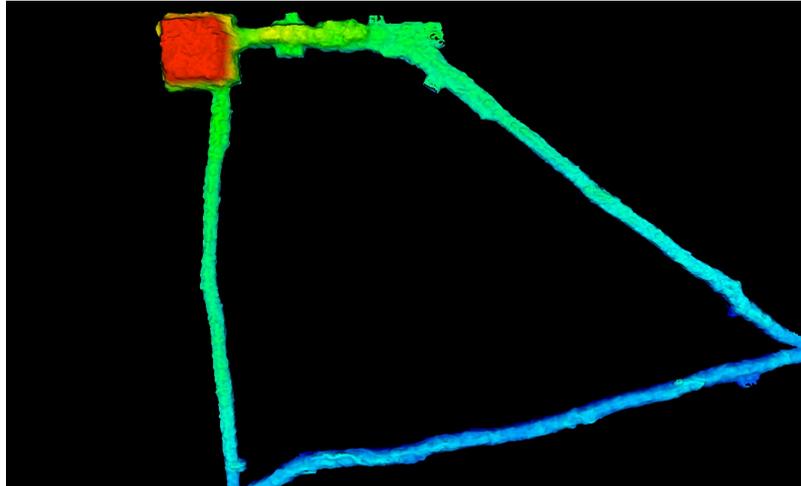
Is the data collected by LiGrip kept private to me?

All data collected by LiGrip is only stored in the device internally and is not uploaded to any network. The scanned data is only copied through the network cable, and can be deleted at any time after copying.

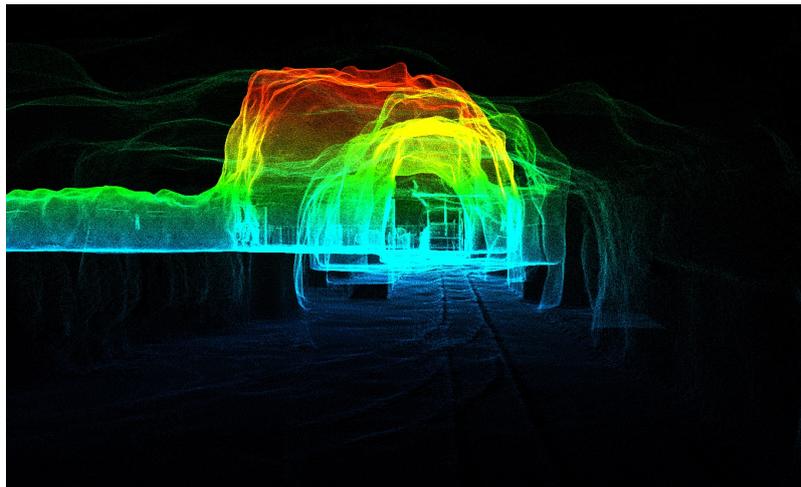
6. Appendix

LiGrip results in different Environments and Applications

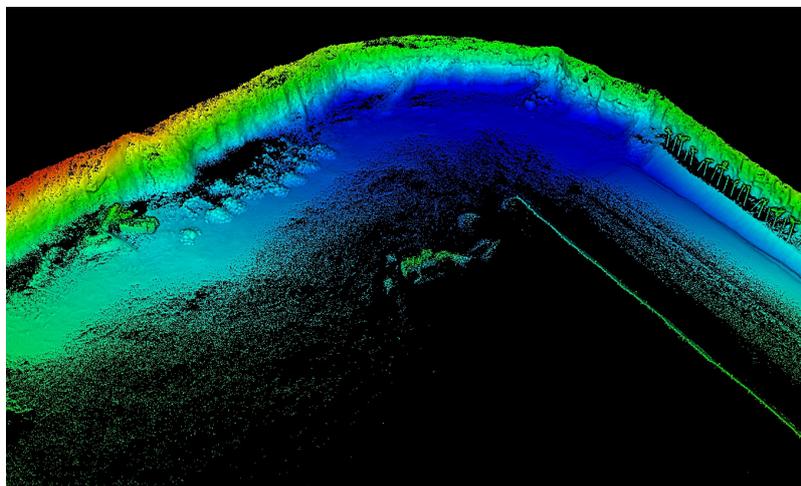
The LiGrip can be widely used in mining, forestry, power construction, surveying, 3D mapping and other fields. The collected data results are seamlessly compatible with GreenValley's cutting edge pre-processing and post-processing softwares. The data shown below uses LiDAR360 software. The software not only provides conventional display modes such as elevation, intensity, category, and echo times, but also provides EDL and GLASS special effects display, which can improve the data display effect.



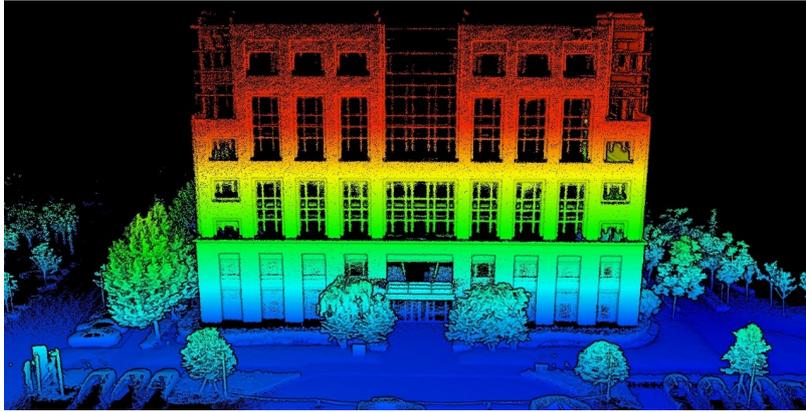
Mine Tunnel



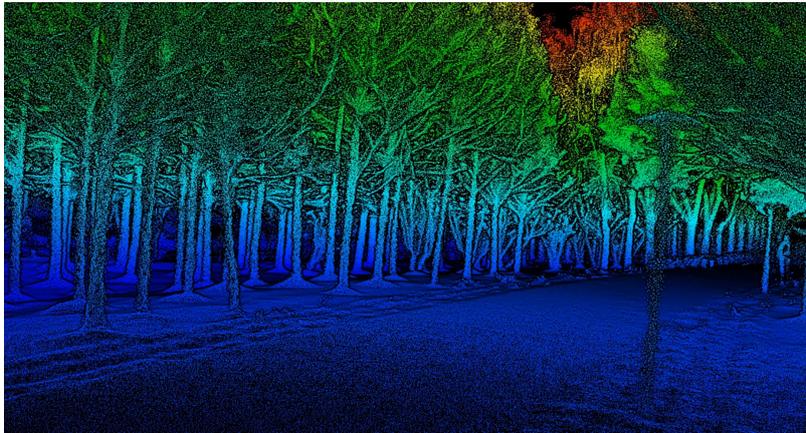
Mine tunnel



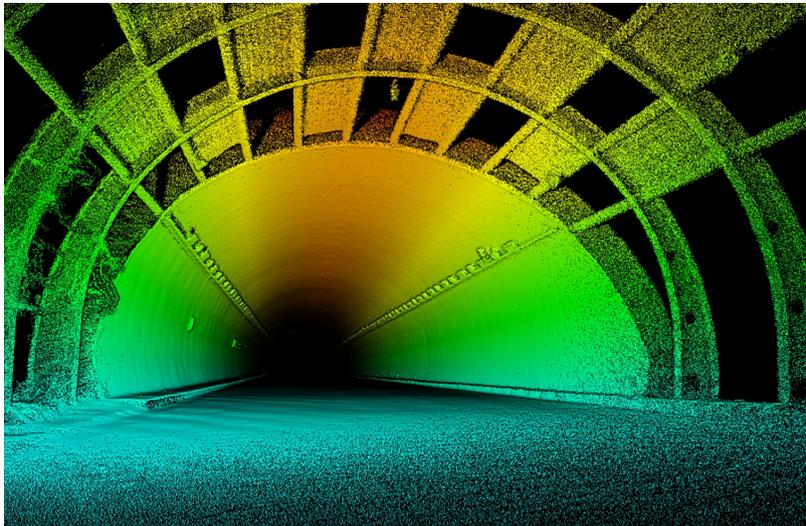
Open Pit



Buildings



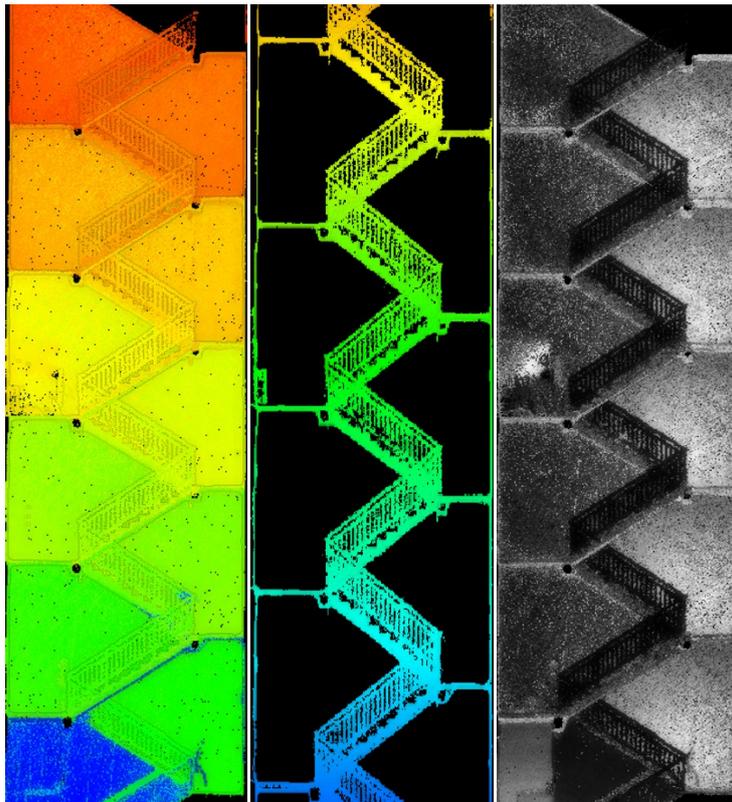
Fores



Tunnel



Parking Lot



Stair Case