SLAM GO POST PRO
USER MANUAL

VERSION：V2.0.3.0

DATE：2022-12

Table of contents

1.Introduction 3
2.Raw Data Preparation 4
3.Data Processing 4
3.1 One-Click Processing 4
3.1.1 Create New Project 5
3.1.2 Import GCP 5
3.1.3 Data processing 6
3.1.4 GCP Edit 11
3.1.5 Add result to view 14
3.2 Step-by-step processing 15
3.2.1 Creat New Project 15
3.2.2 Import GCP 15
3.2.3 Data processing 15
4.Point cloud Edit 22
4.1 Dnoise 22
Figure30.Dnoise 22
4.2 Frame 23
4.3 Registration 23
4.4 Cut 26
5.Description of the result catalog 27
6. Results browsing 28
6.1 Point cloud browsing 28
6.2 Odometer display 28
6.3 Panorama browsing 29
6.4 Other function 30

1.Introduction

Slam Go Post Pro is a PC-side software. It has functions of point cloud and image data post-processing, such as point cloud mapping, denoising, thinning, orientation, coloring, stitching, cropping, framing, filtering, automatic extraction of control points, automatic generation of accuracy reports, and panorama stitching.

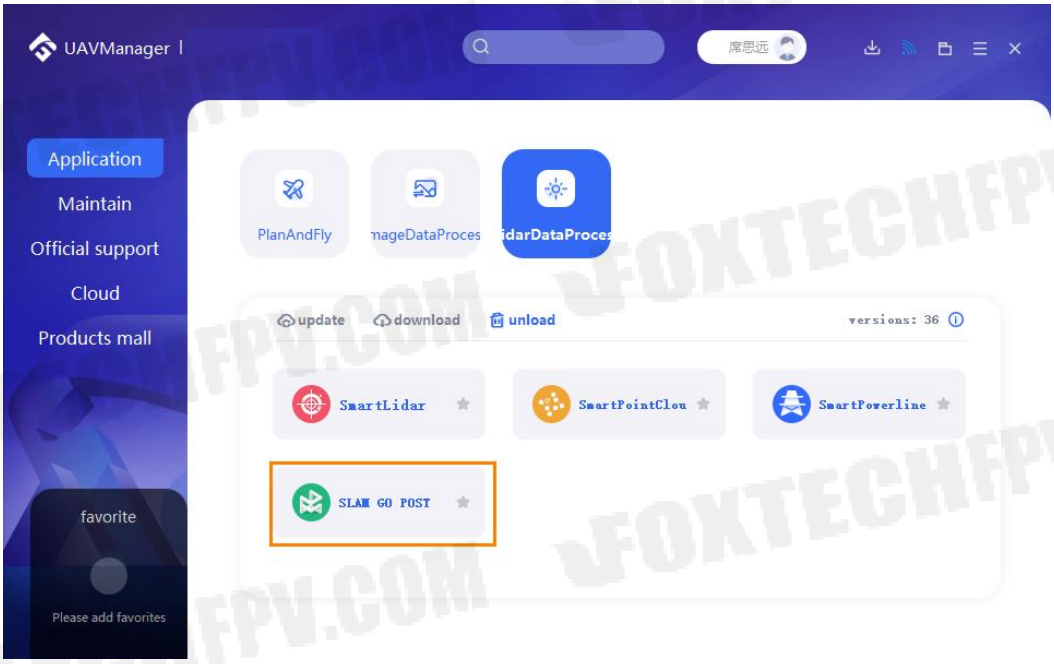


Figure1.UAVManager Application Interface

Slam Go Post Pro contains 4 parts, they are DataManager, Function bar, Display window and Run window and Log window respectively.

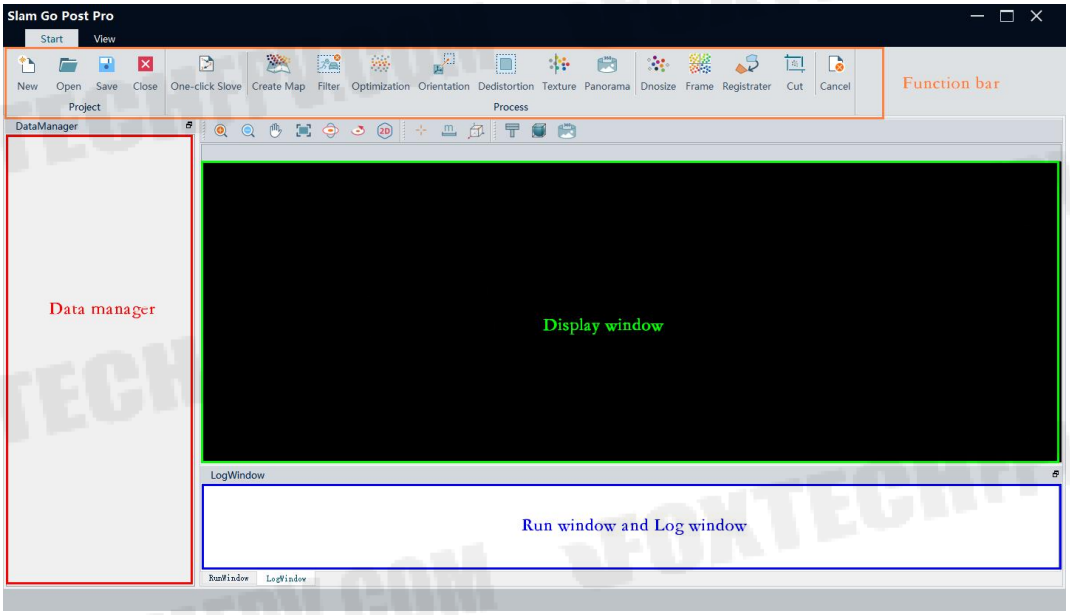


Figure2.Slam Go Post Pro Interface

2.Raw Data Preparation

Remove the SD card from your device and copy the folder named "SN_XXXXX" to your PC's local drive. The raw data includes Image data, IMU, raster data, laser data, and device calibration files.

Figure3.Raw data

3.Data Processing

Data processing is divided into one-click processing and step-by-step processing. Users can choose the processing mode according to the actual situation.

3.1 One-Click Processing

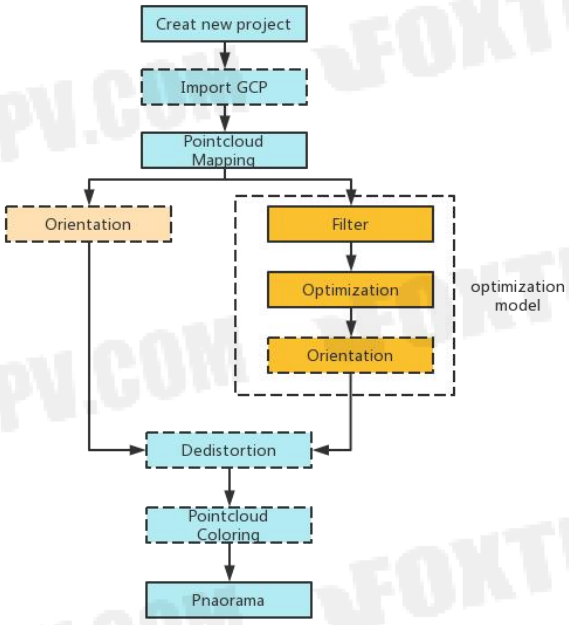


Figure4.One-click Process

3.1.1 Create New Project

Click ‘New’, set the project name and project path, choose 'Handheld' or 'Backpack' of Platform, 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.

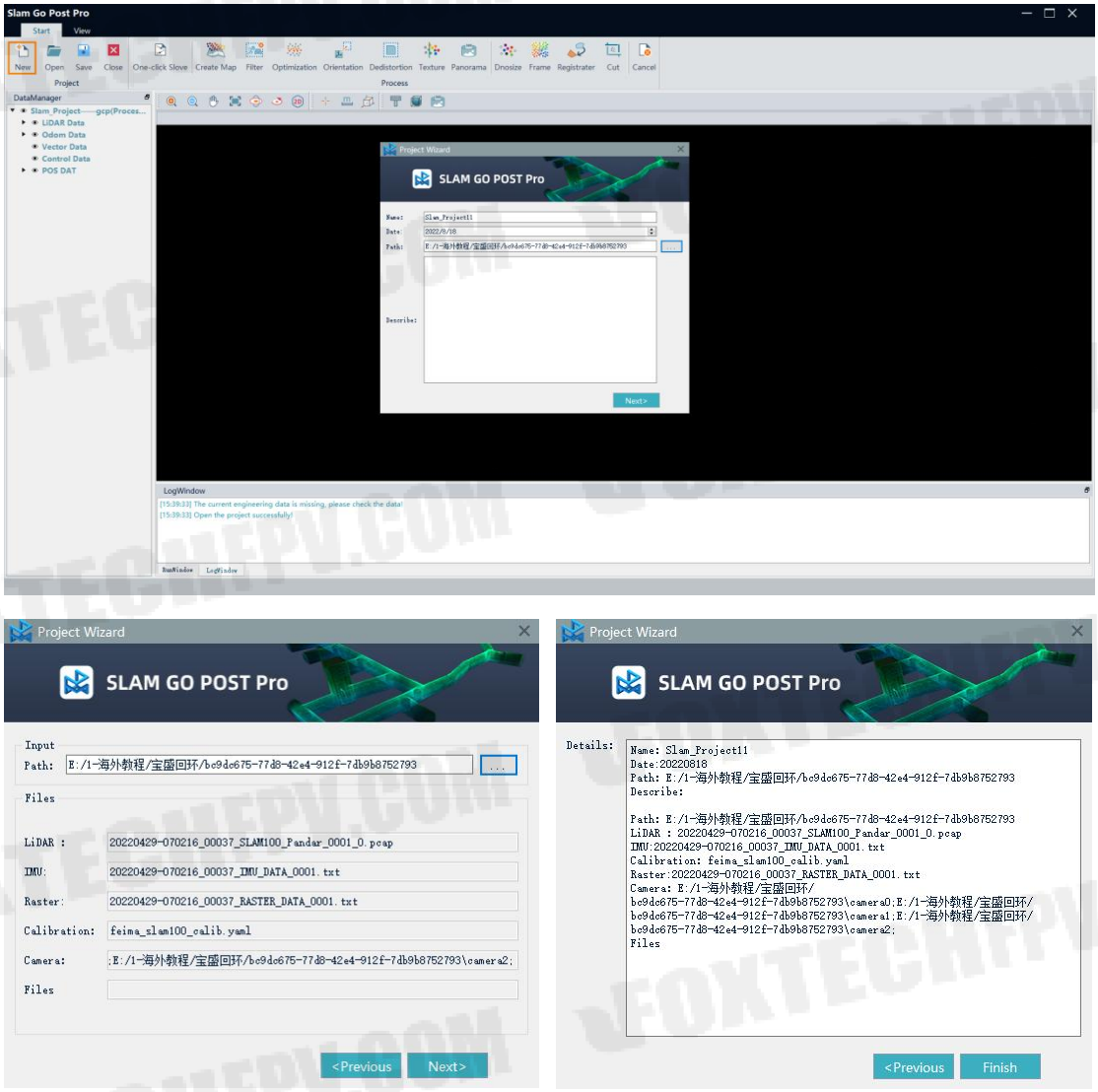


Figure5.Creat new project

3.1.2 Import GCP

Right-click the control point data function in the DataManager window, select ‘Add Data’, import the 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. A projected coordinate system must be set when using non-rigid transformation.

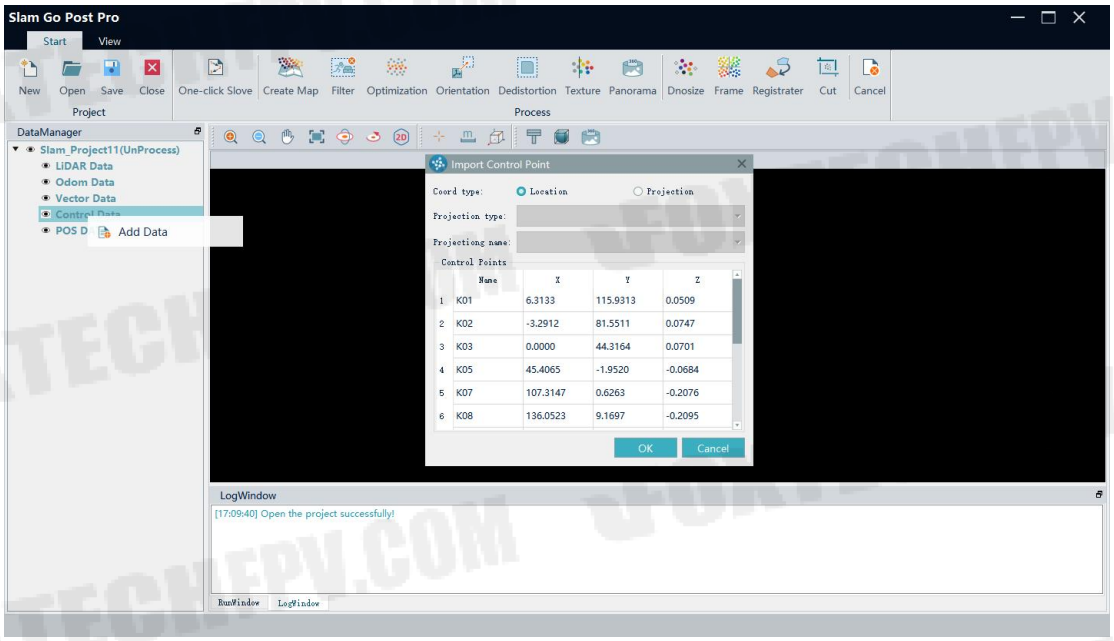


Figure6.Import GCP

There are some notices of GCP:

①If there are no control points, you can ignore the step.

②The 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.

③The 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.

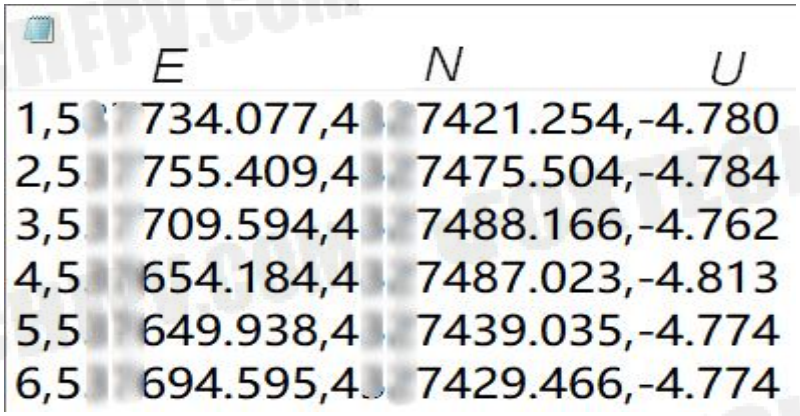


Figure7.GCP

3.1.3 Data 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 process it.

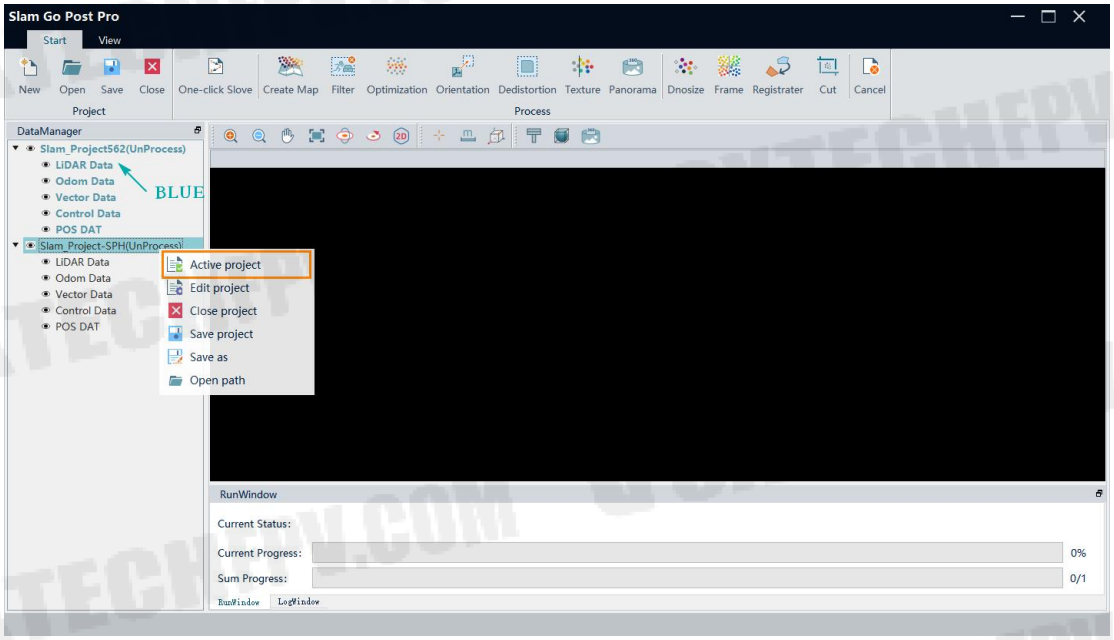


Figure8.Activate project

Click ‘One-click Solve’ in the data processing toolbar to set the Solve Parameters. The meanings of the parameters are explained as follows.

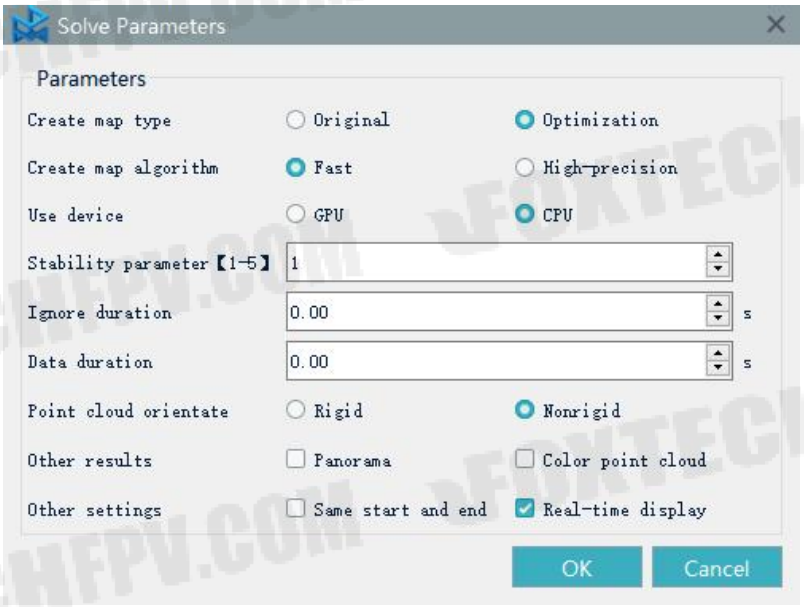


Figure9.Solve parameter

3.1.3.1 Create map Type

Creat map type contains original creat map and optimized creat map.

①The original creat map only outputs original point cloud.

②The optimized creat map outputs original point cloud and optimizes original point cloud，such as filtering, denoising, thinning point clouds.

3.1.3.2 Create map Algorithm

Creat map algorithm contains Fast and High-precision mode.

①Fast mode has fast processing speed but low accuracy of point cloud.

② High precision mode has slow processing speed but high precision of point cloud.

3.1.3.3 Device

Processing device refers to the hardware equipment used by software to process data,the software uses the CPU by default.So far the GPU has only been used for stitching panoramas.

3.1.3.4 Stability

Stability refers to the degree of mutation of the scanning scene, not the stability of the instrument at the time of scanning. The stability value ranges from 1 to 5. The larger the stability value, the stricter the matching.

Fast Mode: Set the parameter to 5 if the acquisition environment is wide and open, and set the parameter to 4/3 if the acquisition environment is in constant change, such as stairs.

High-Precision Mode: Run the resolving with a stability of 5 as priority use.

If Log Window appears “Solution failed” in processing,This is due to the stability being too high. In this case ,we suggest to decrease the stability value and try the processing again.

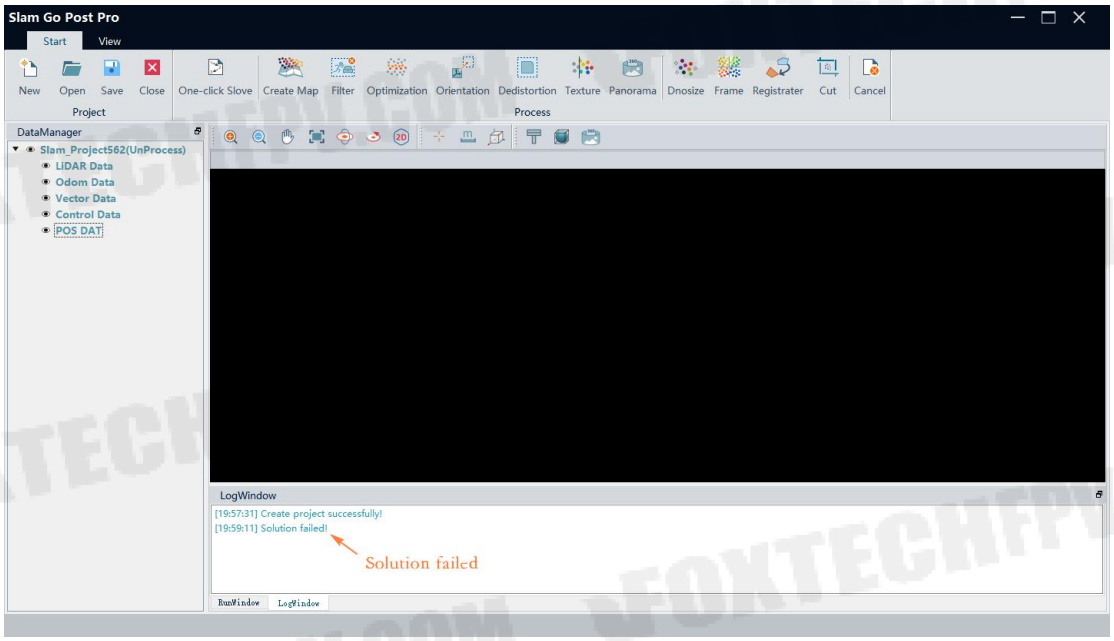


Figure10.Solution Failed

3.1.3.5 Data process duration

①Ignore duration: Eliminate redundant static/poor quality data.

②Data duration: This parameter is combined with the Ignore duration to solve the point cloud data of any time the user defined.For example,if the user wants to solve data for 10-70s,the ignore duration is 10s and data duration is 60s.

3.1.3.6 Point Cloud Orientation

Point cloud orientation includes rigid and non-rigid transformation. In non-rigid transformation, GCP will offer lastic compensation for point cloud to improve accuracy.

Placing SLAM100 on the control point for about 10s rather than using Control Point Mode to get the control point information, and rigid transformation is suitable.

Connect the APP and choose Control Point Mode when doing field collection. After the collection, a gcp.txt file will be generated in the original folder and the software will pick out the control points according to the gcp.txt file when running the solving. Non-rigid transformation will be applied in this case.

When using S-PACK100 with S-RTK100, copy the RTK data to SLAM original data folder and choose Pack Mode when adding a new project. Directional results based on RTK data will come out using One Click Solve, and the directional algorithm used here is only available for non-rigid transformation.

3.1.3.7 Other Result

In addition to the original point cloud, optimized point cloud, sw can output panoramas and coloring point cloud.Client check them according to the actual requirment.

Figure11.Panorama

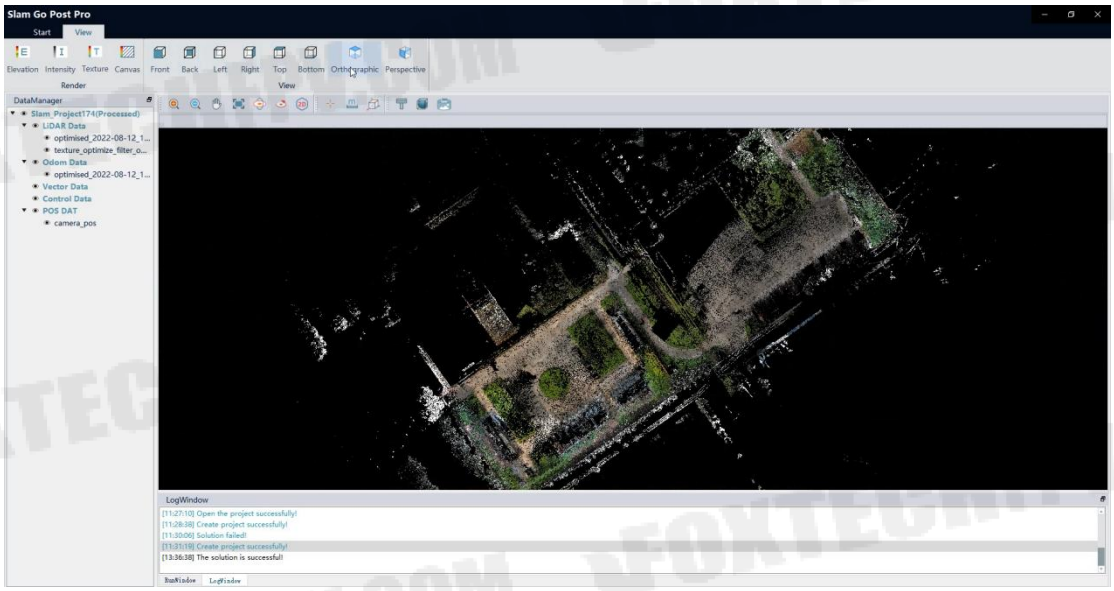


Figure12.Colored point cloud

3.1.3.8 Same start and end

The same start and end means that the start point and the end point are the same or the distance between them is not more than 1m.This function adds an enforced constraint to eliminate layering around the start and end points.However, This parameter is conditional, that is, when collecting in the field, the distance between the starting point and the endpoint must be same or not exceed 1m, so generally speaking, there is no need to select this in normal situation.

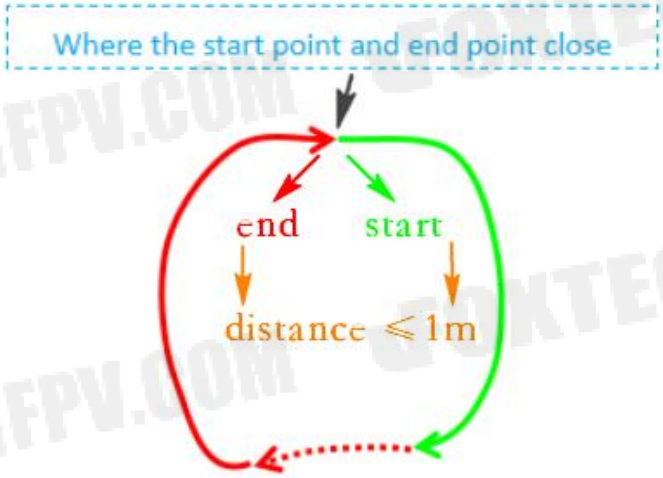


Figure13 Same start and end point

3.1.3.9 Real-time display

This function display the real-time point cloud mapping process in main window.

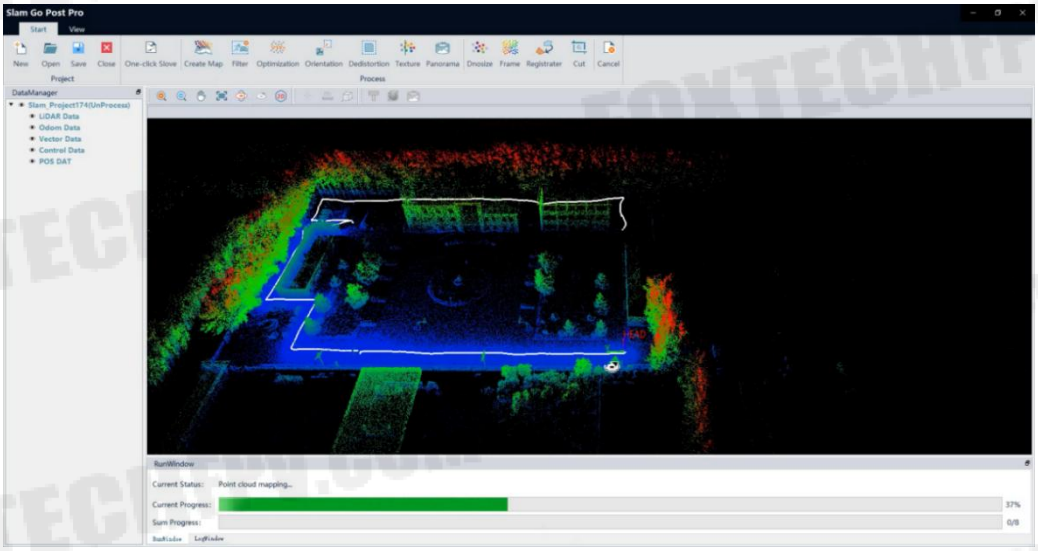


Figure14.Real-time display

3.1.4 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.

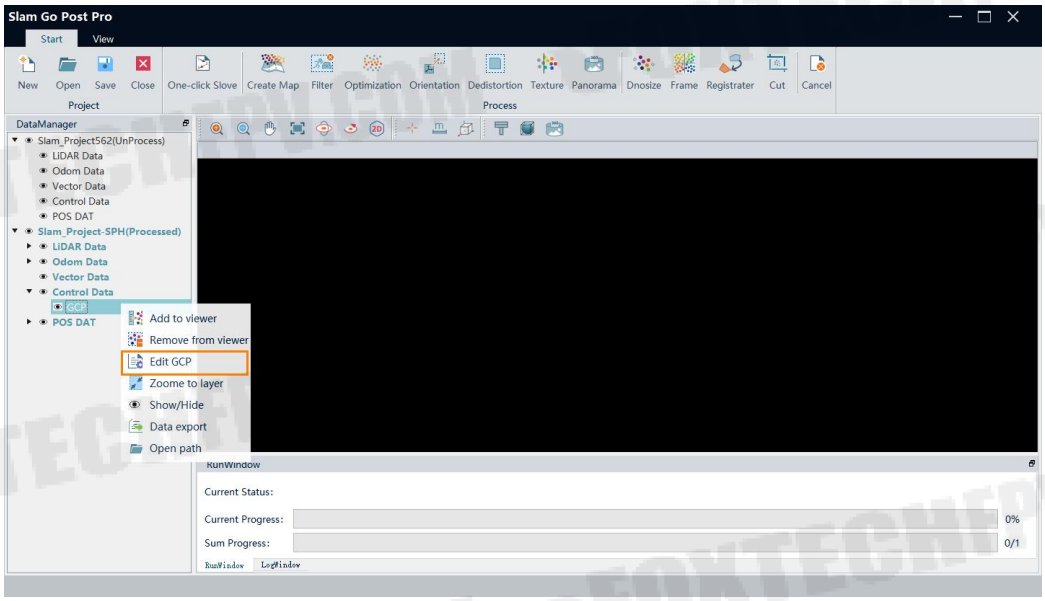


Figure15.Edit GCP

One situation is the number of 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 16 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.

Figure16.Edit GCP interface

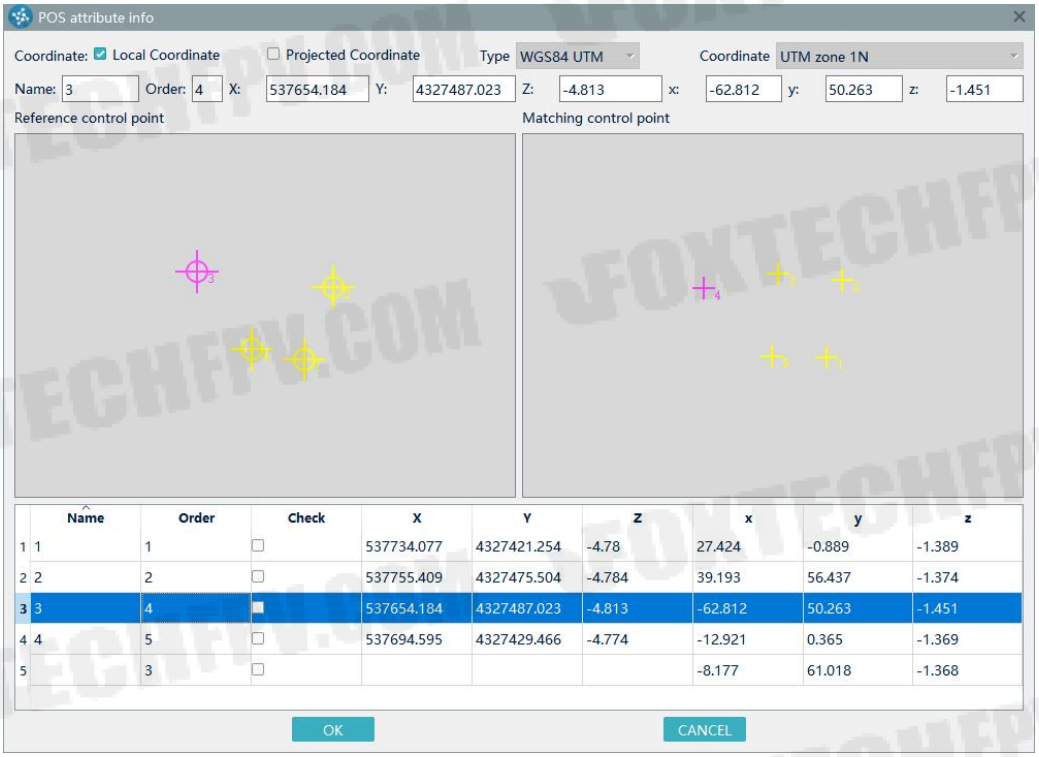
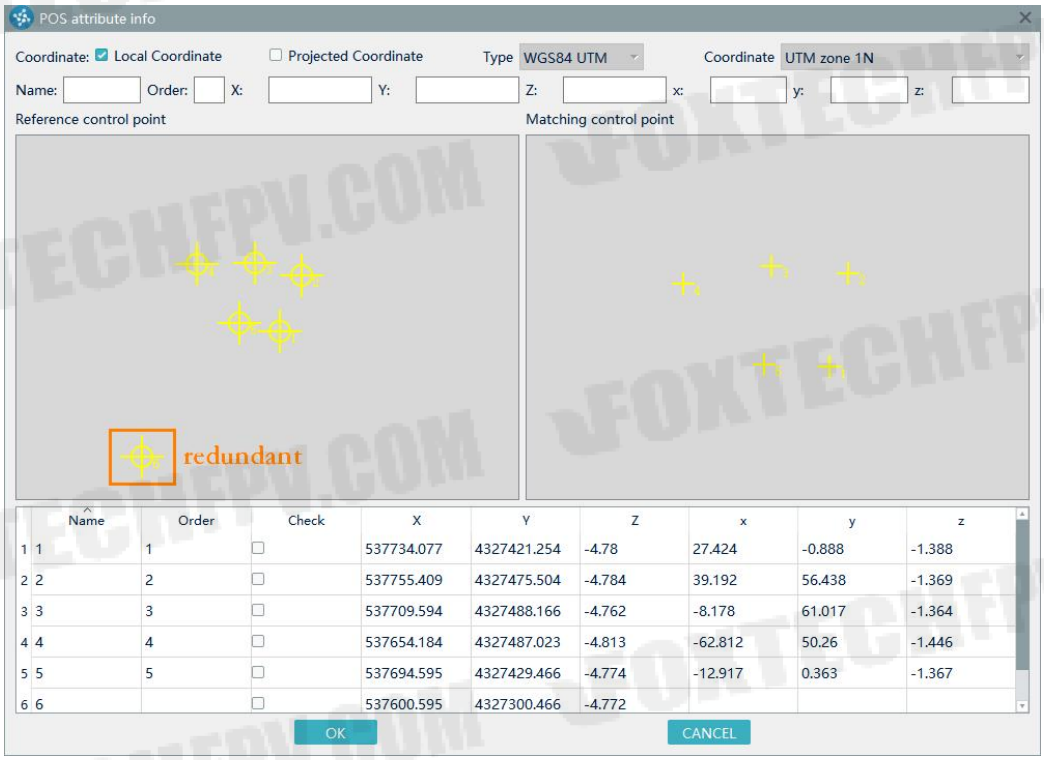


Figure17.Edit GCP interface

Another situation is the number of matching points is less than the imported control point, user need 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.

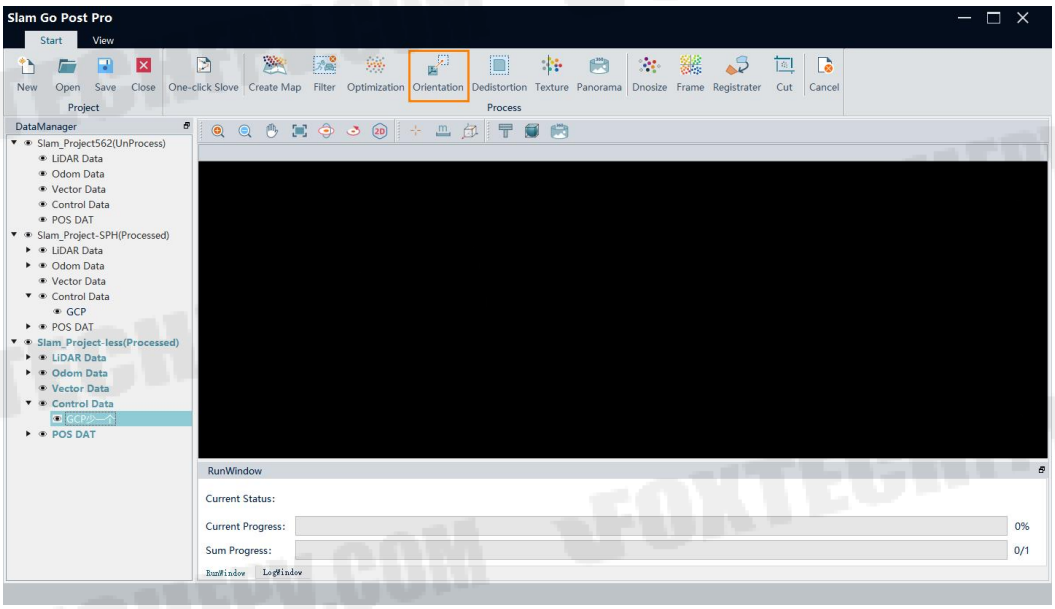


Figure18.Orientation

3.1.5 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.

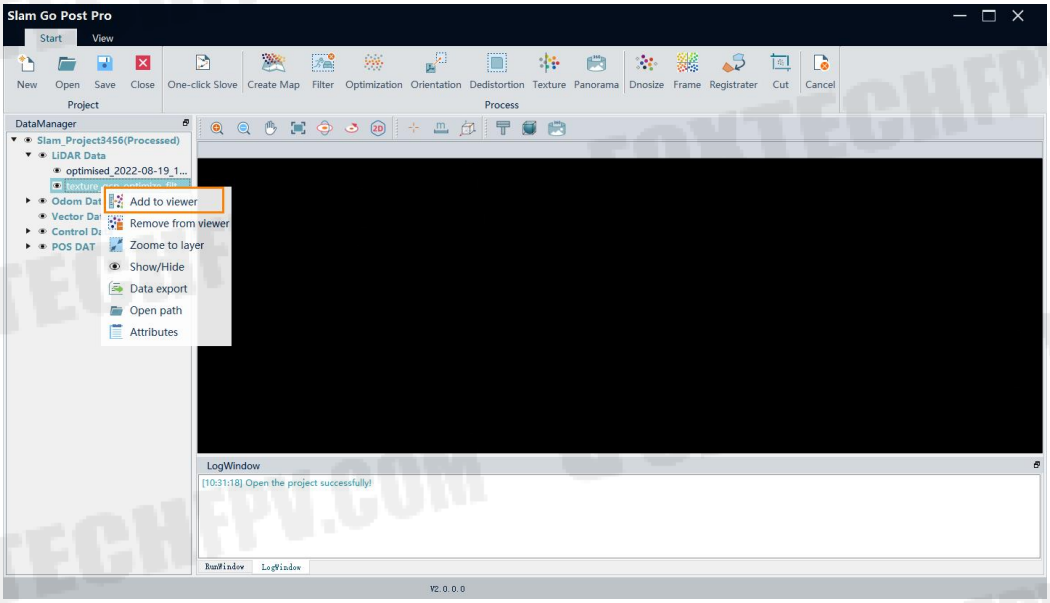


Figure19.Add result to view

3.2 Step-by-step processing

3.2.1 Creat New Project

This step can be referred to Chapter3.1.1

3.2.2 Import GCP

This step can be referred to Chapter3.1.2

3.2.3 Data processing

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

3.2.3.1 Create map

Activate the project, click‘Create map’, set the parameters, Click OK to start the calculation. The means of parameter can referred to Chapter3.1.3

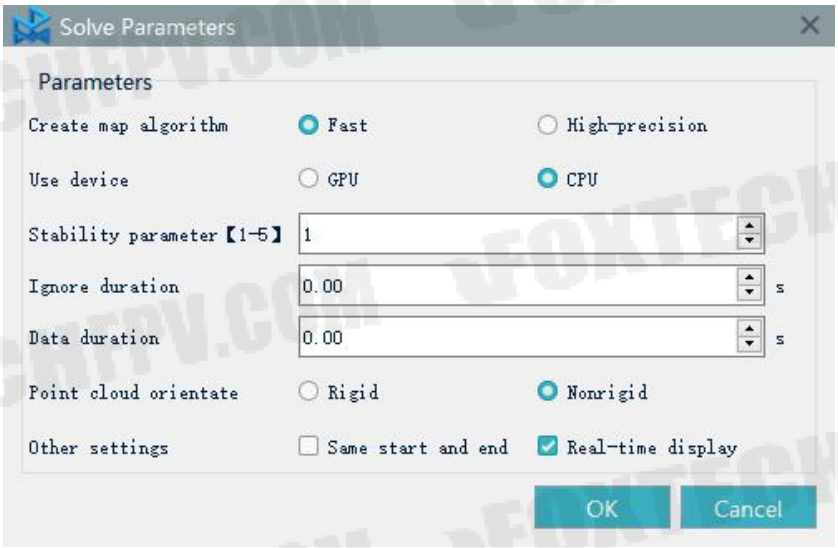


Figure20.Create map parameter

3.2.3.2 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.

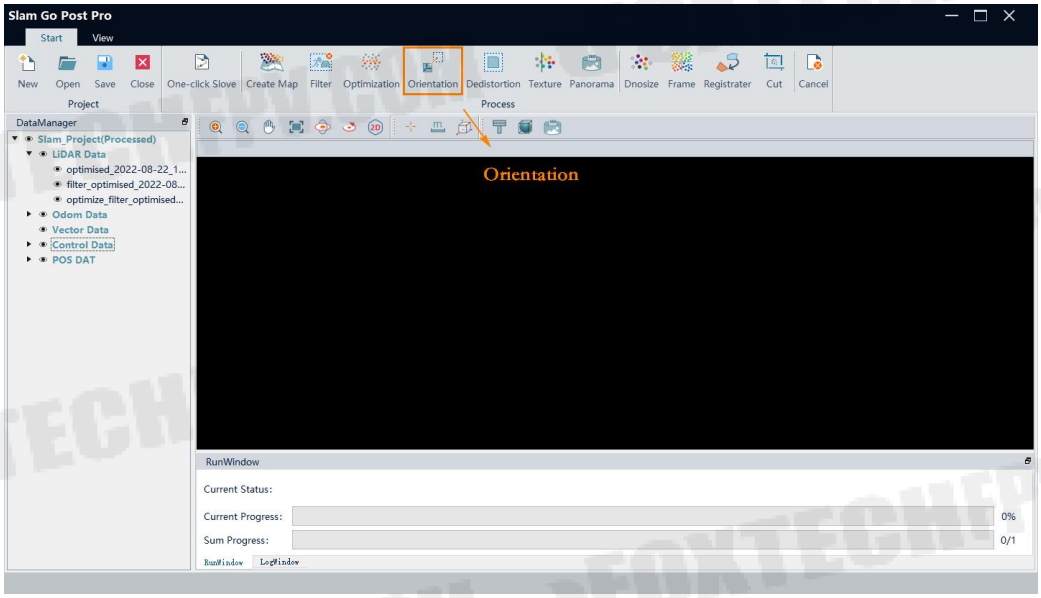


Figure21.Orientation

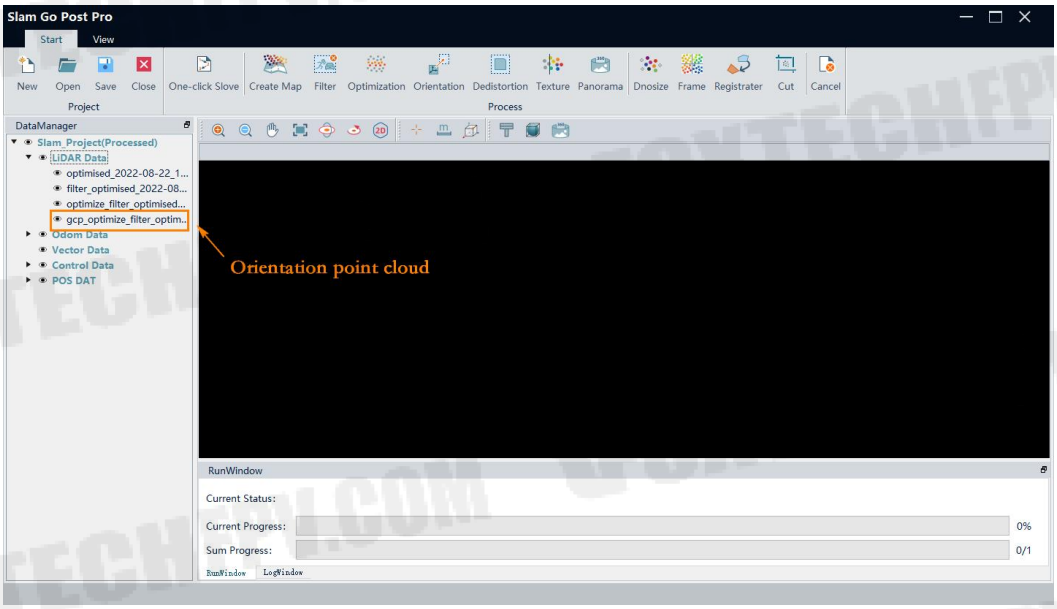


Figure22.Orientation result

3.2.3.3 Filter

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

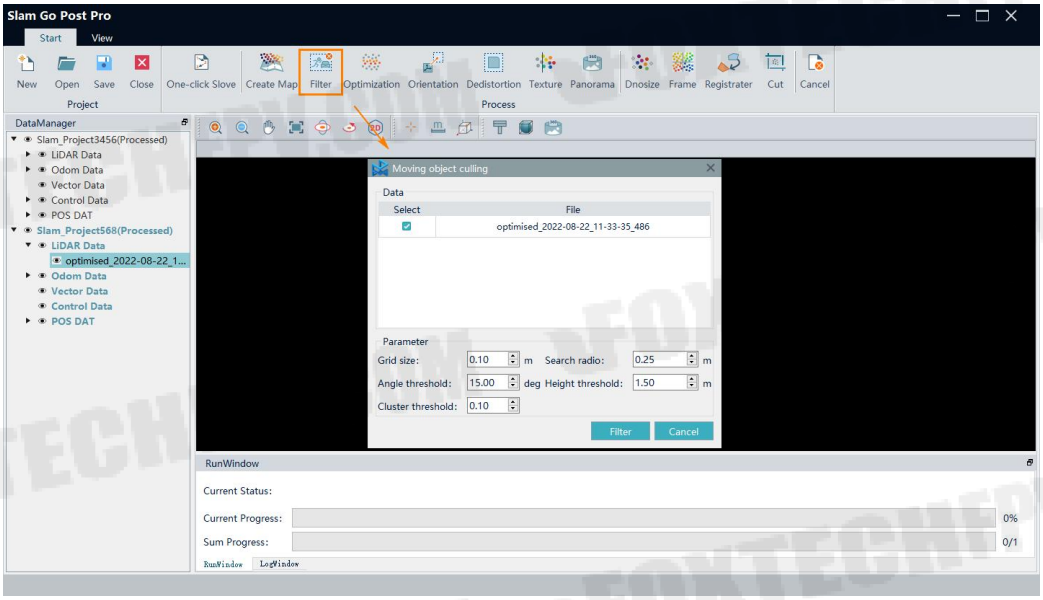


Figure23. Filter

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 with a prefix “filter” are the filtered result.

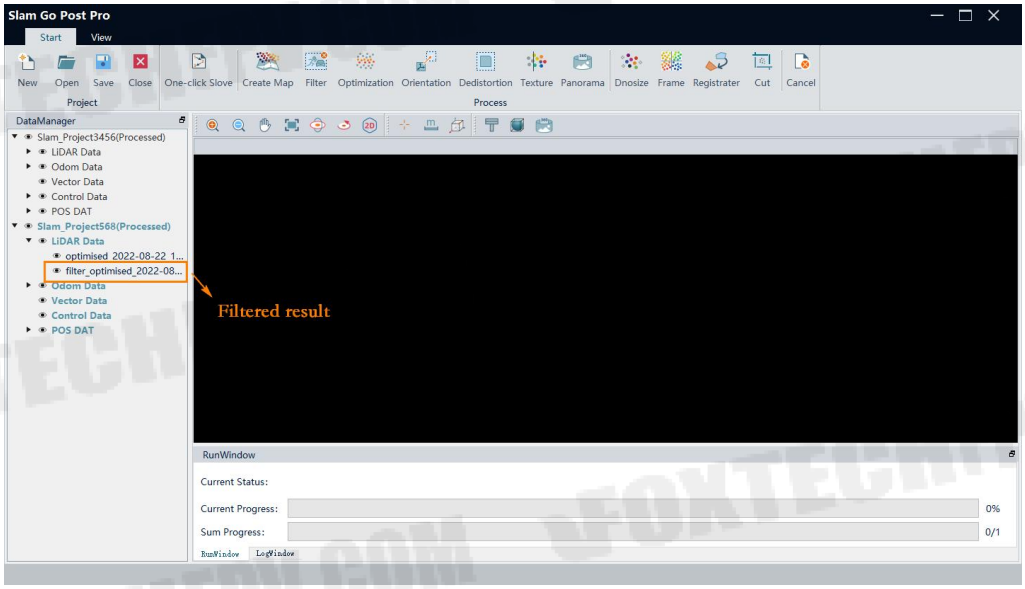


Figure24.Filtered result

3.2.3.4 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. User select 'Filter' result to optimize. Point clouds with a prefix 'optimize' in DataManager are optimization result.

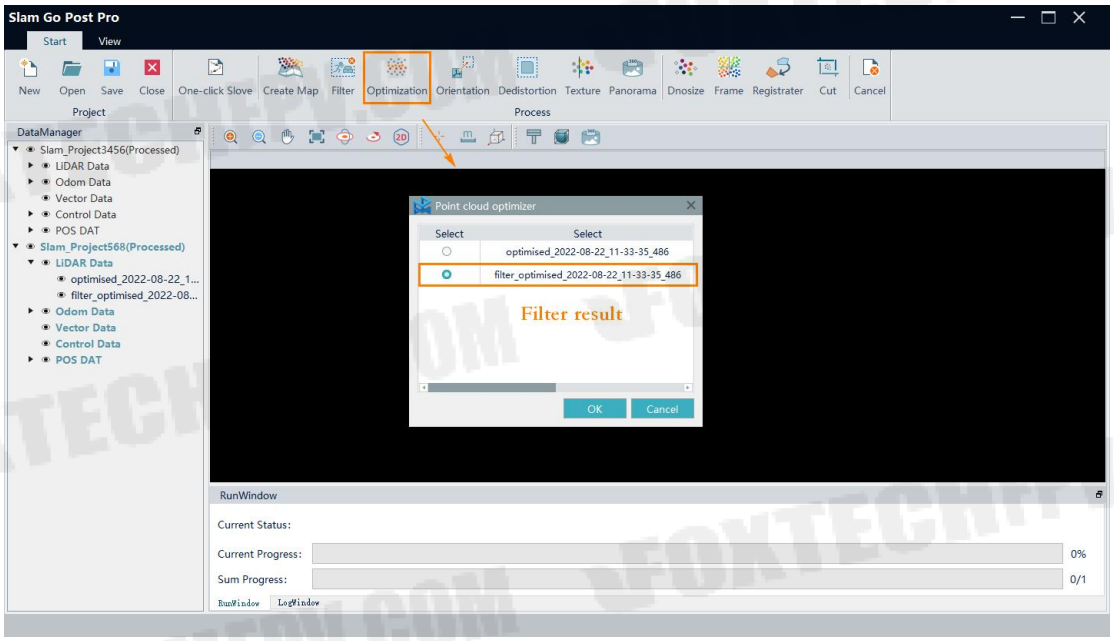


Figure25.Optimization

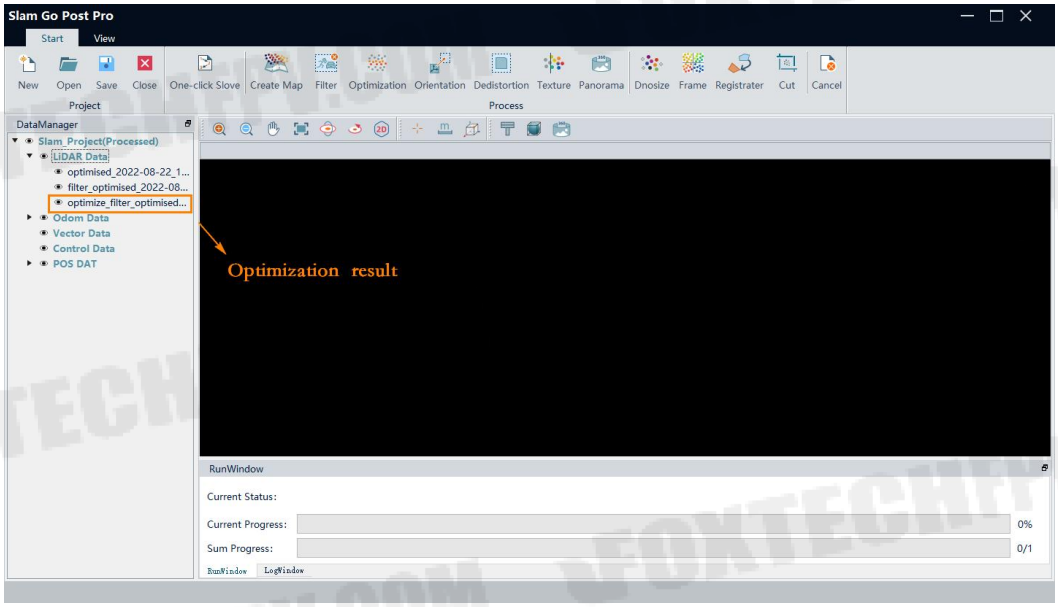


Figure26.Optimization result

3.2.3.5 De-distortion

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

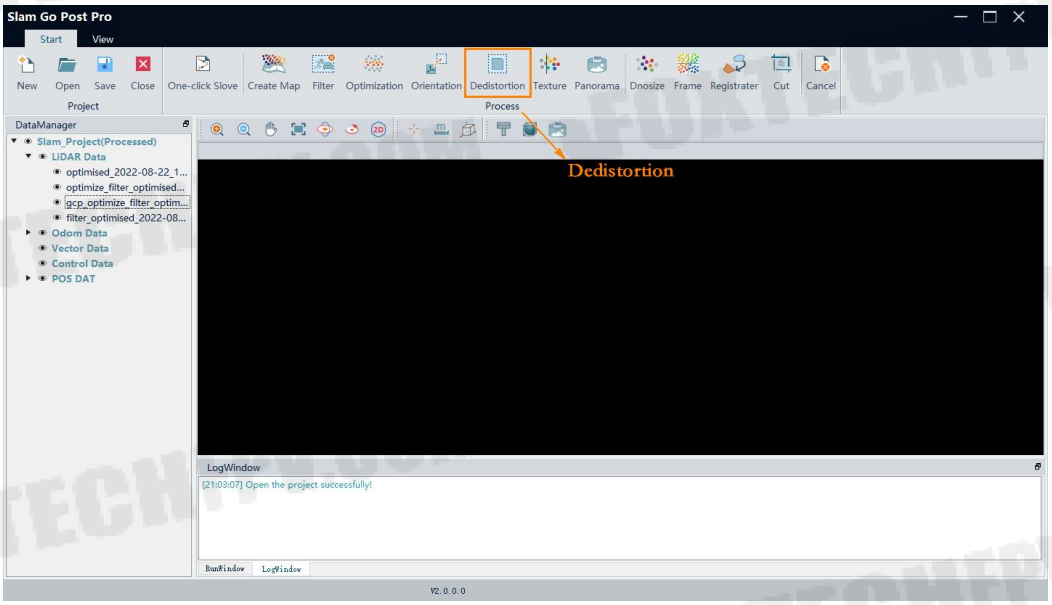


Figure27.Dedistortion

Figure28.Dimage result

3.2.3.6 Texture

This function use 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 with a prefix ‘texture’ are colored point cloud.

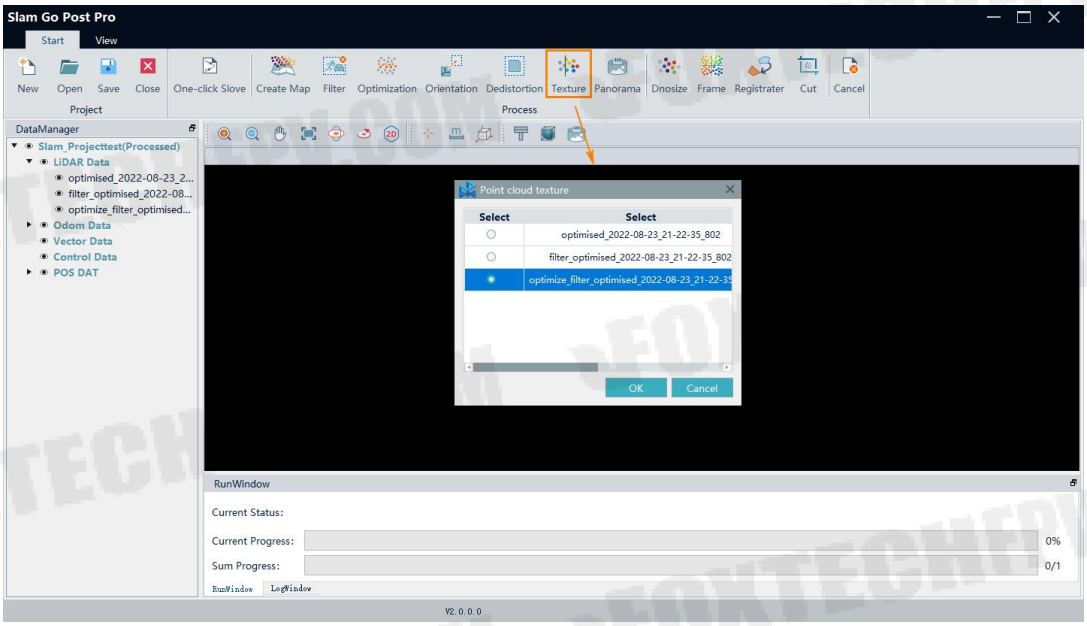


Figure29.Point cloud coloring

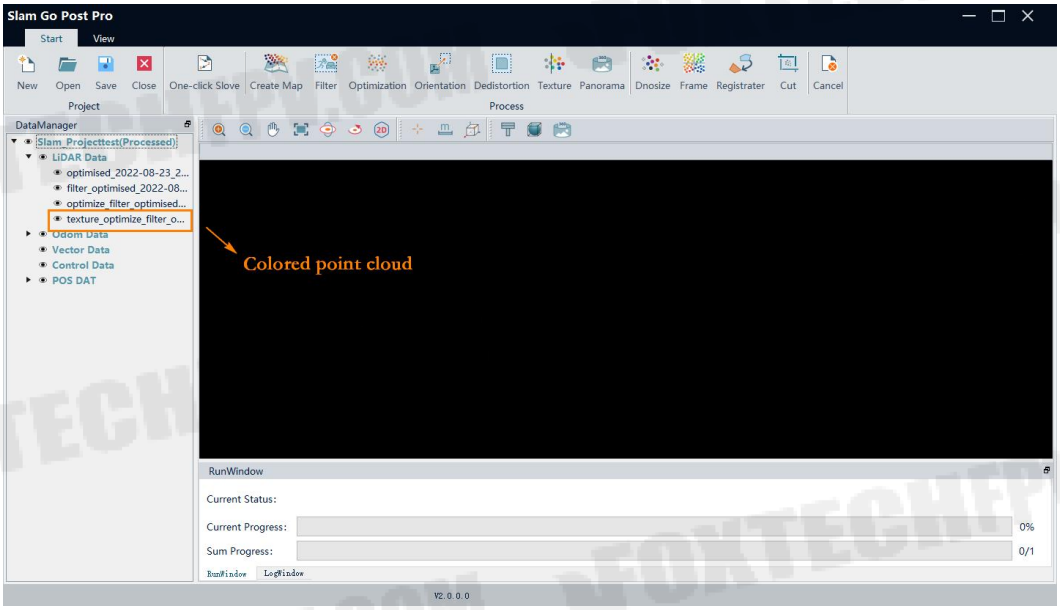


Figure30.Colored point cloud

3.2.3.7 Panorama

This function processes undistorted image to generate panorama.

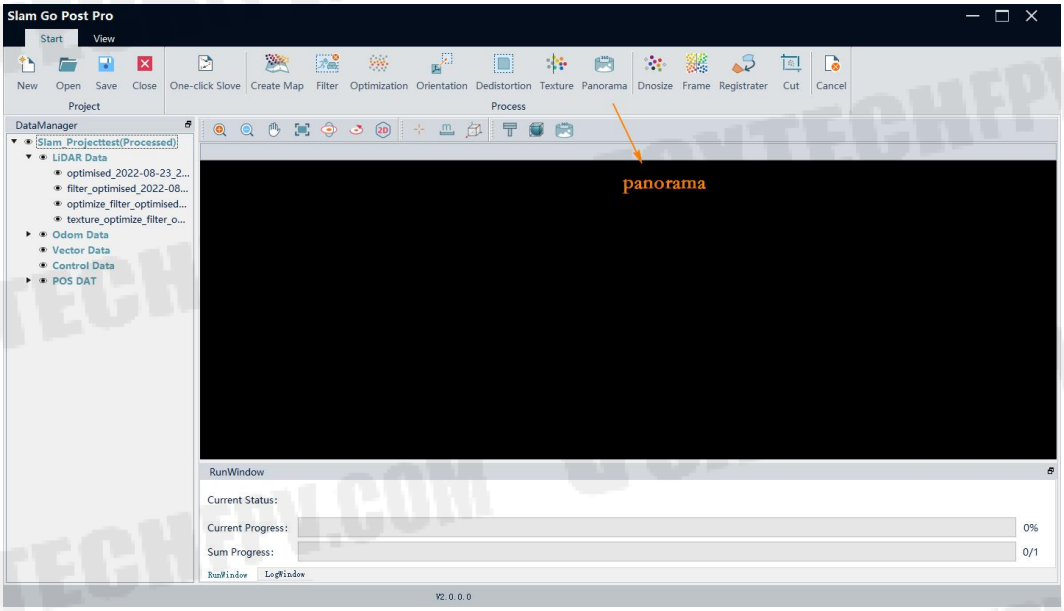


Figure31.Creat panorama

Figure32.Panorama result

4.Point cloud Edit

4.1 Dnoise

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.

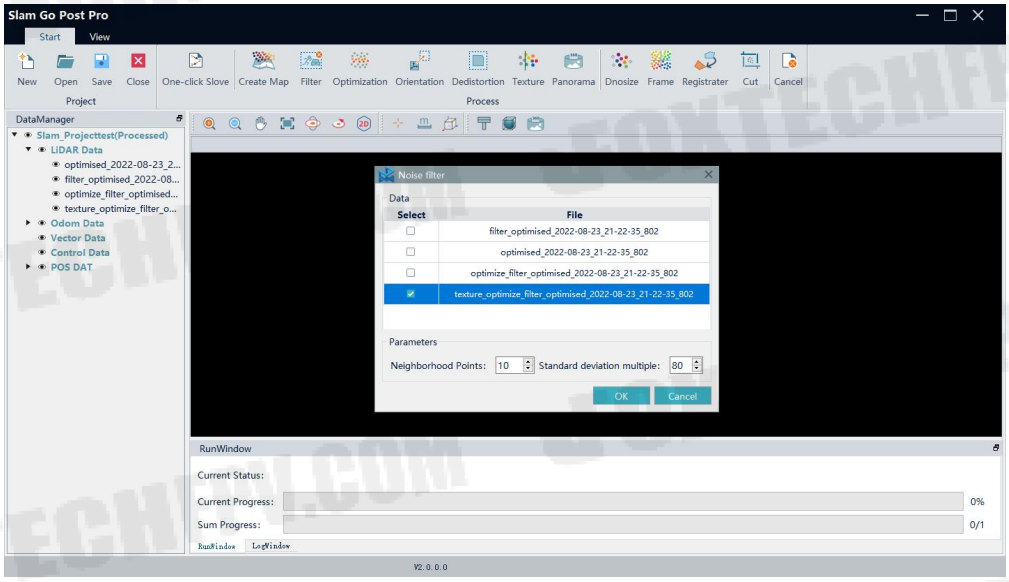


Figure33.Dnoise

➢ 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.

4.2 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.

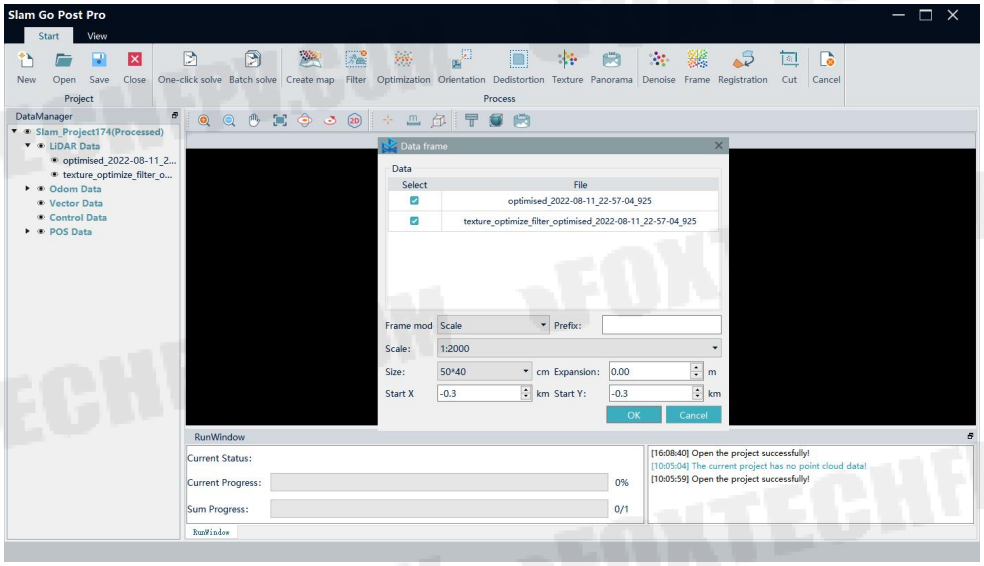


Figure34.Frame

4.3 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’

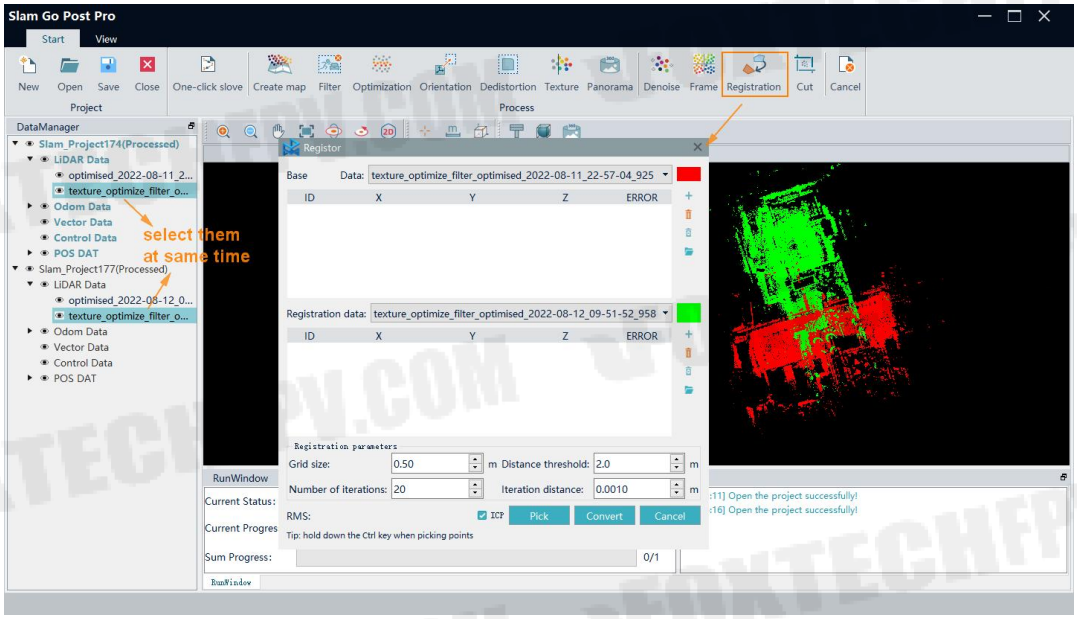


Figure35.Resiatration

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

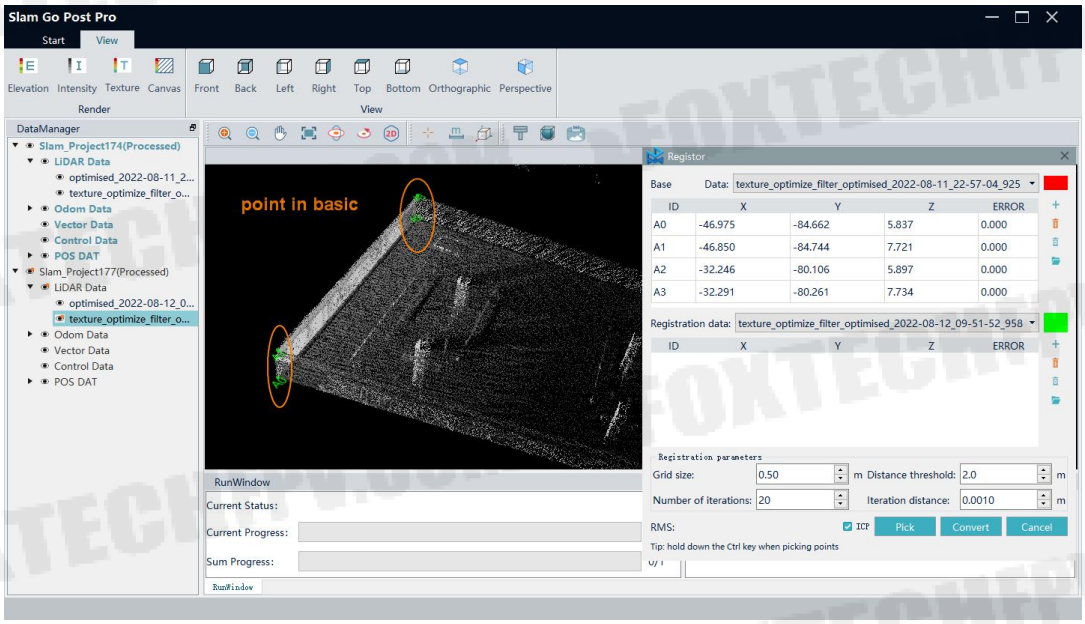


Figure36.Point in basic

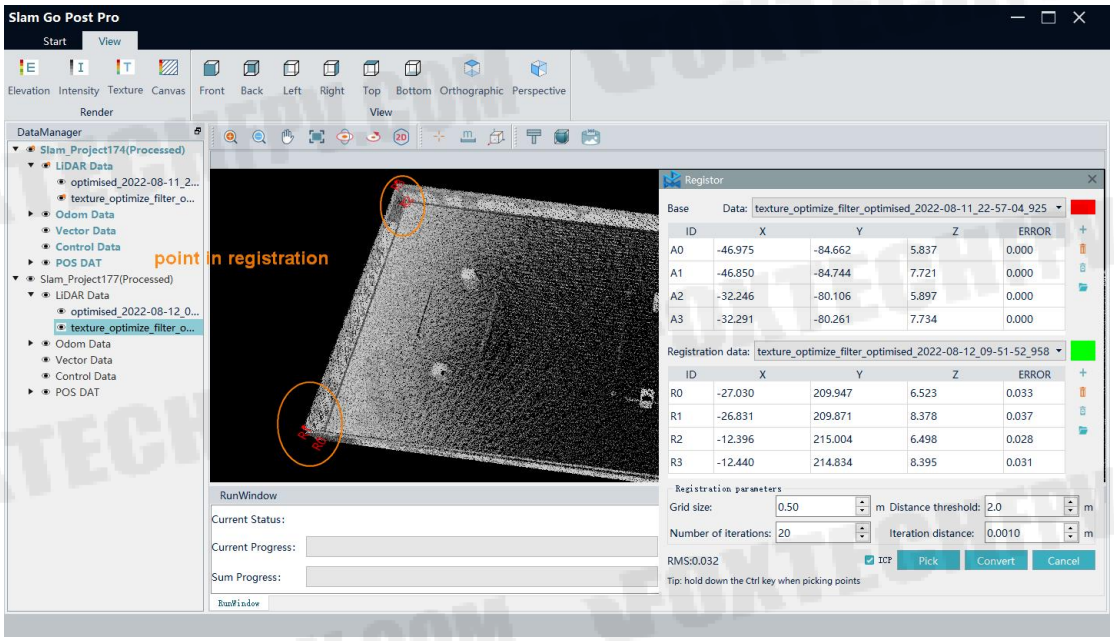


Figure37.Point in registration

➢ 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：

①Grid size: Point cloud tile grid size.

②Number of iterations: The number of iterations of the ICP algorithm, generally 20.

③distance 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.

④Iterative distance: the difference between the distances calculated before and after, if it is less than this value, exit the iteration.

TIPS:User can refer official tutorial about registration.

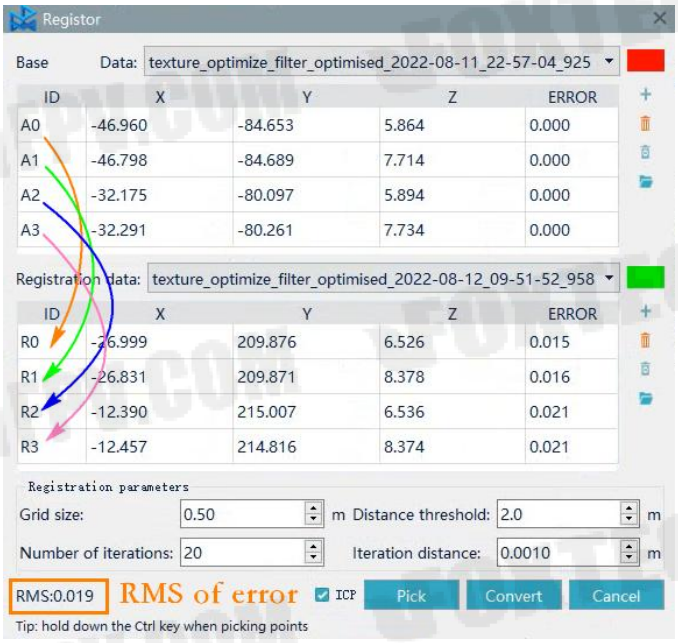


Figure38. registration error

4.4 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.

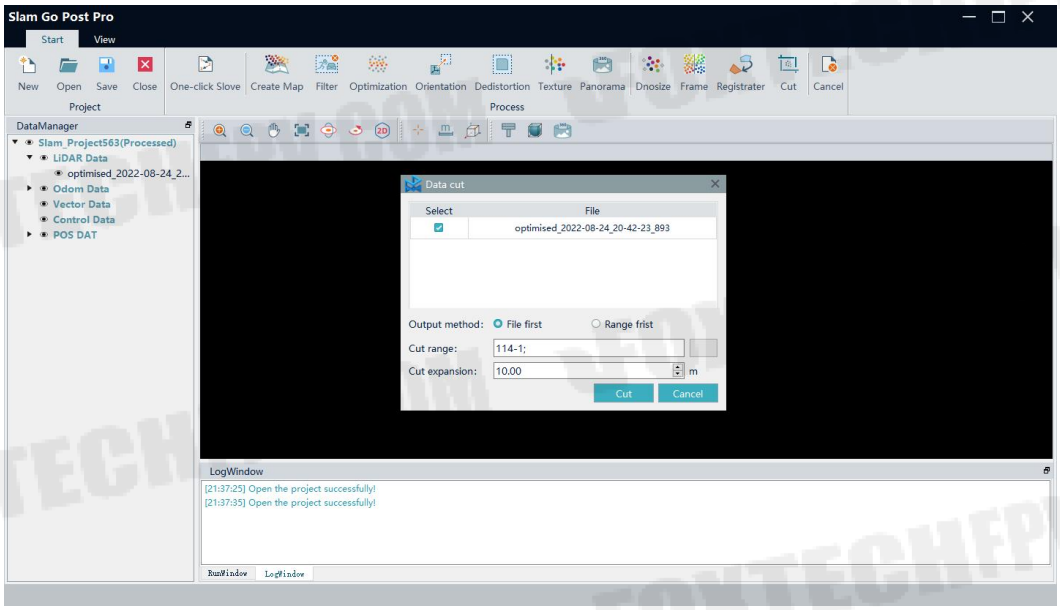


Figure39.Cut

5.Description of the result catalog

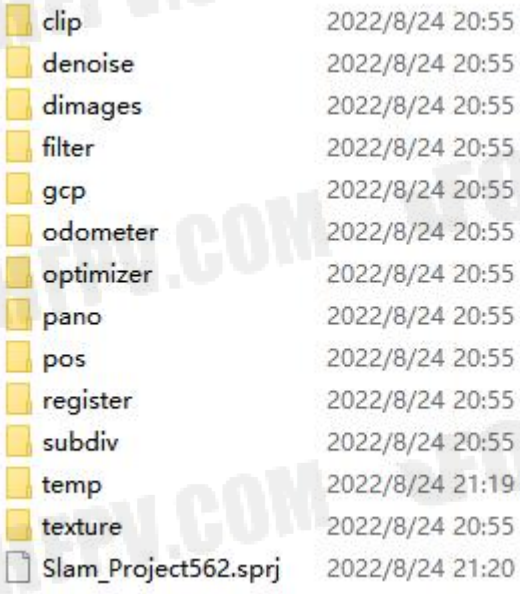


Figure40.Result catalog

- Clip: Clipped point cloud data
- Denoise: Point cloud data after denoising
- Dimages: Single image without distortion
- Filter: Point cloud data after removing moved targets
- 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. Results browsing

6.1 Point cloud 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.

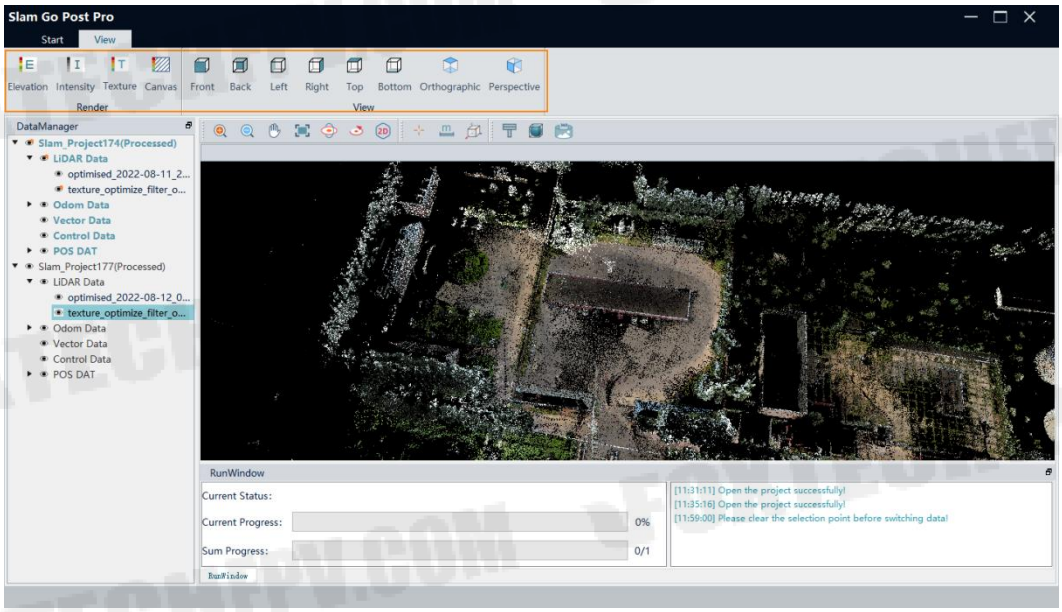


Figure41.point cloud display

6.2 Odometer display

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

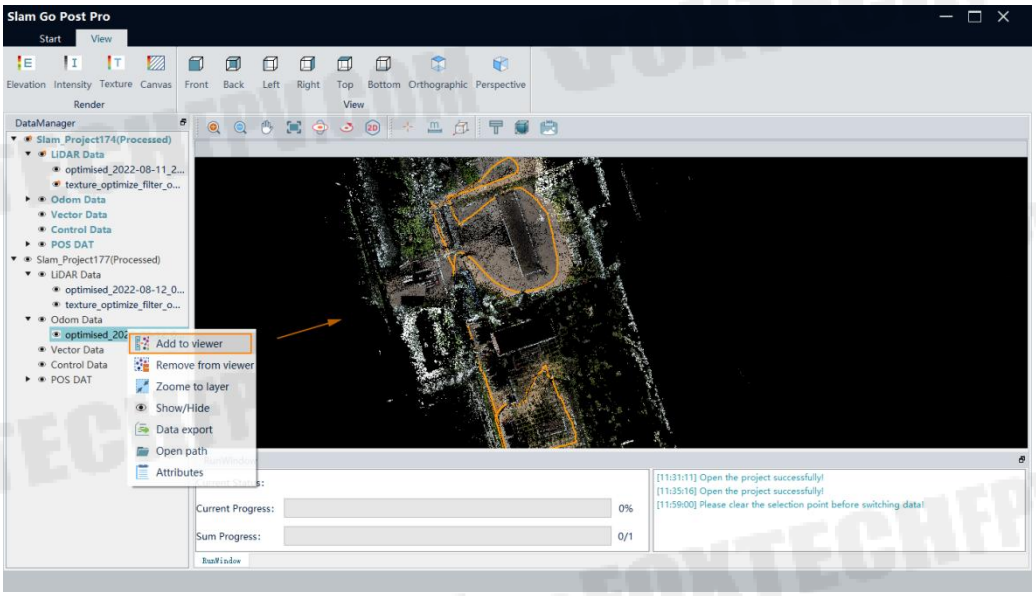


Figure42.Odometer display

6.3 Panorama browsing

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

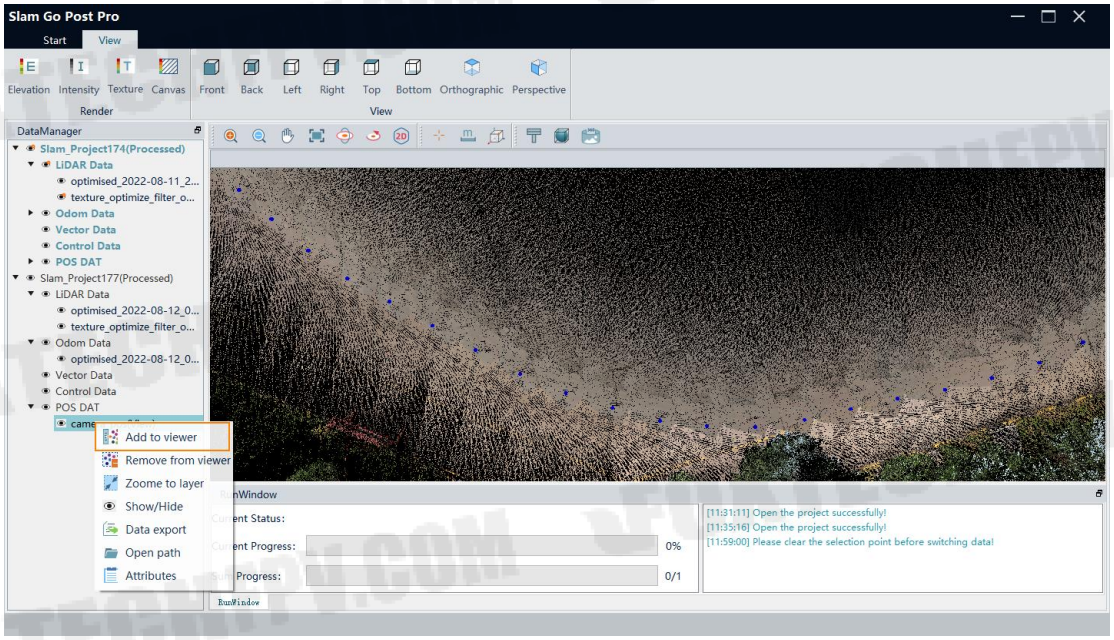


Figure43.Cam_pos display

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.

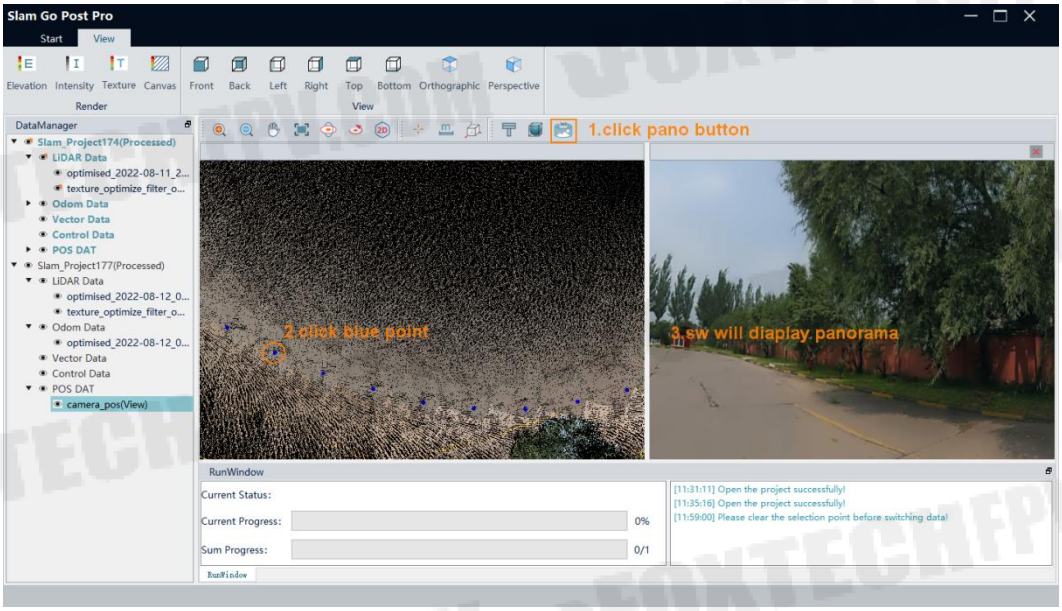


Figure44.Panorama display

6.4 Other function

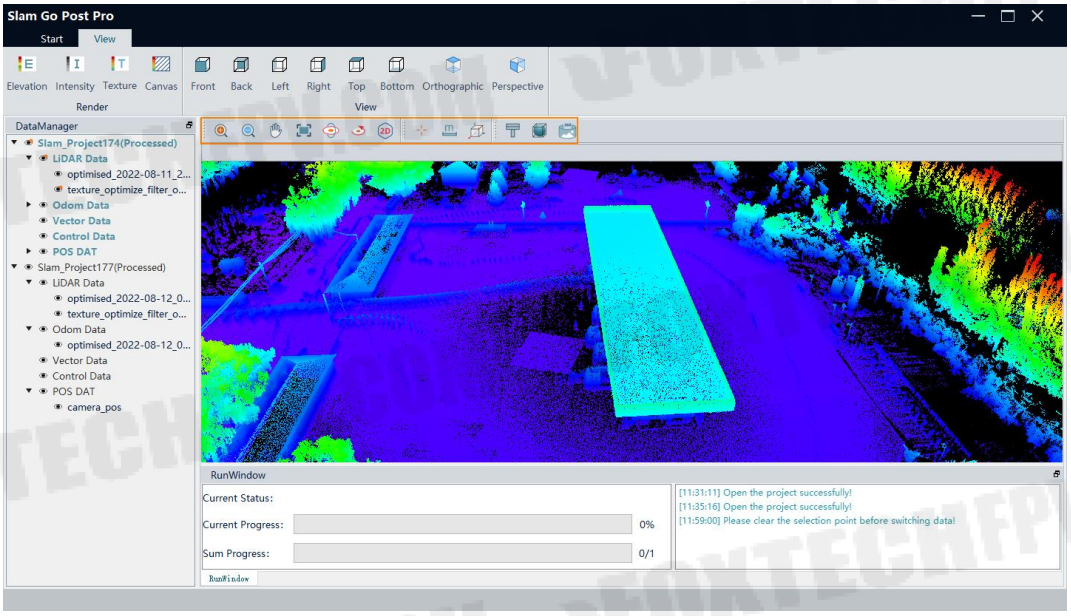


Figure45.Tool bar

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

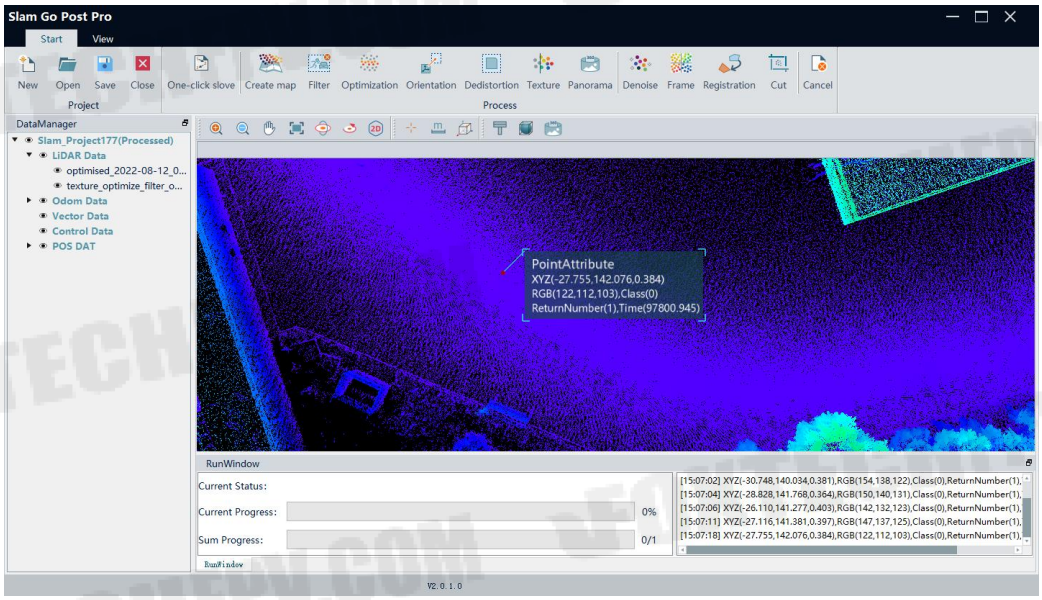


Figure46.Single point information

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

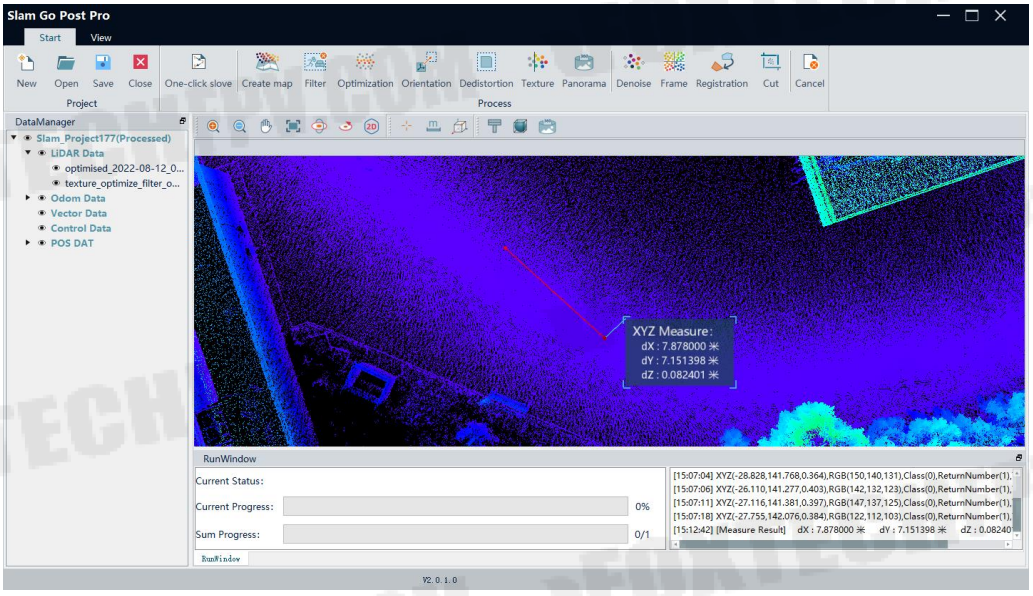


Figure47.Measure distance in X axis

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

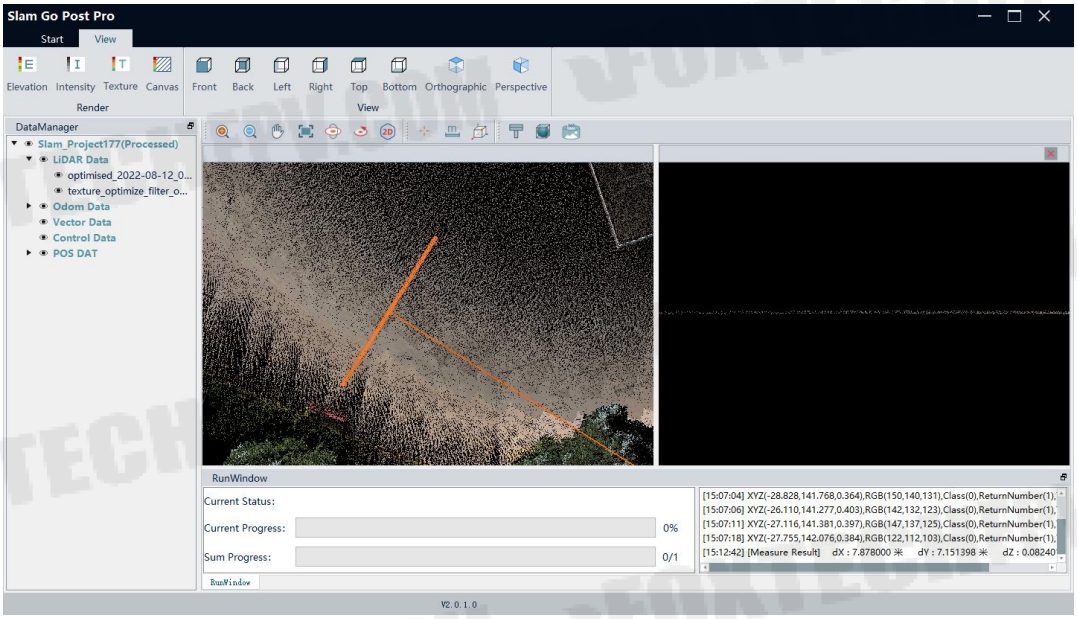


Figure48.Profile

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

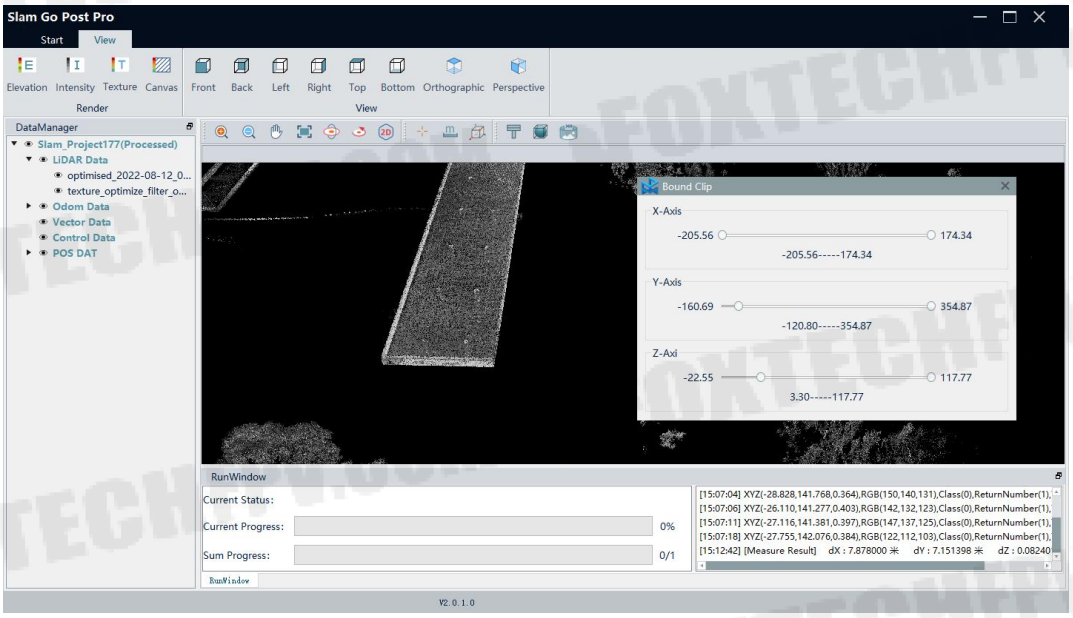


Figure49.Plan cut

