CHCNAV CoPre 2

Release Note

Mobile Mapping | June. 2025

Contents

Dear All,

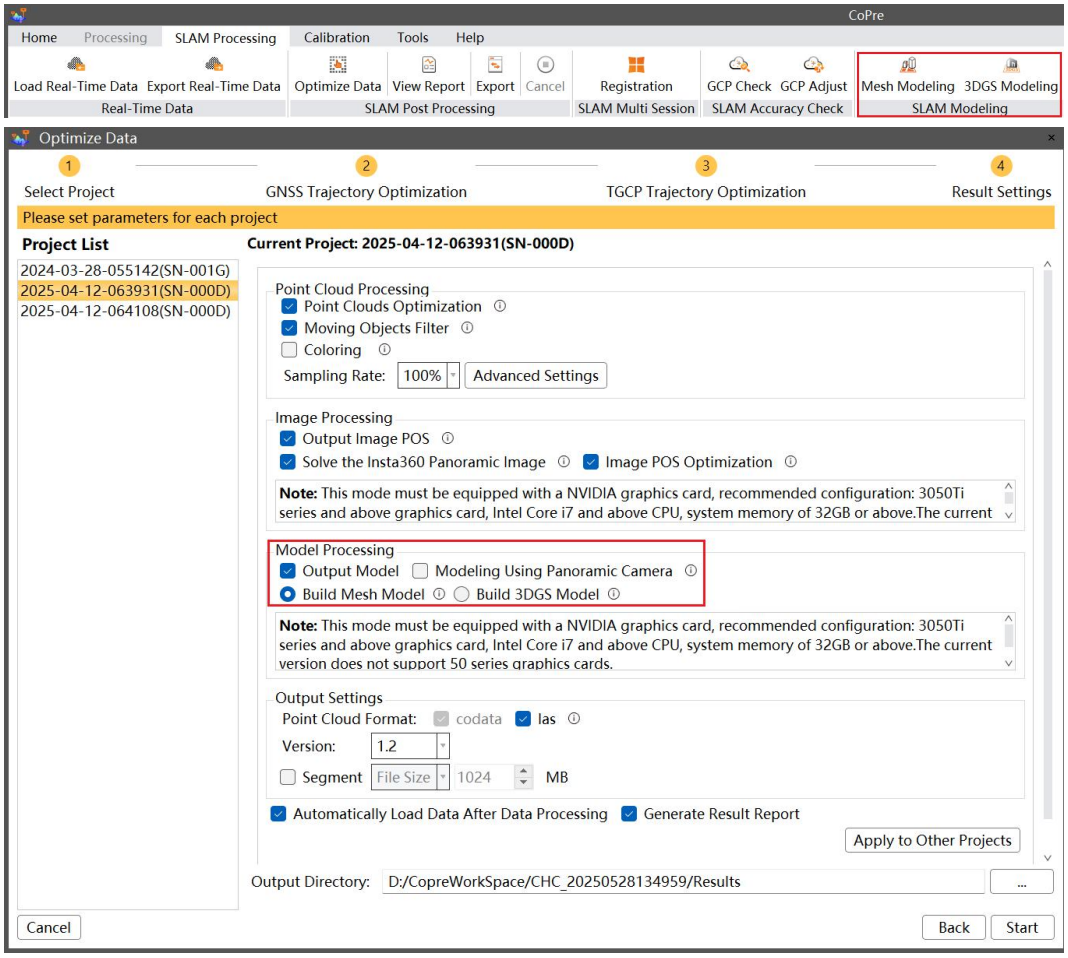
We are pleased to inform you about the upcoming product release of the updated CHCNAV CoPre desktop SW V2.9.2 The main history of updates are listed below.

1. CoPre-2.9.2-202506

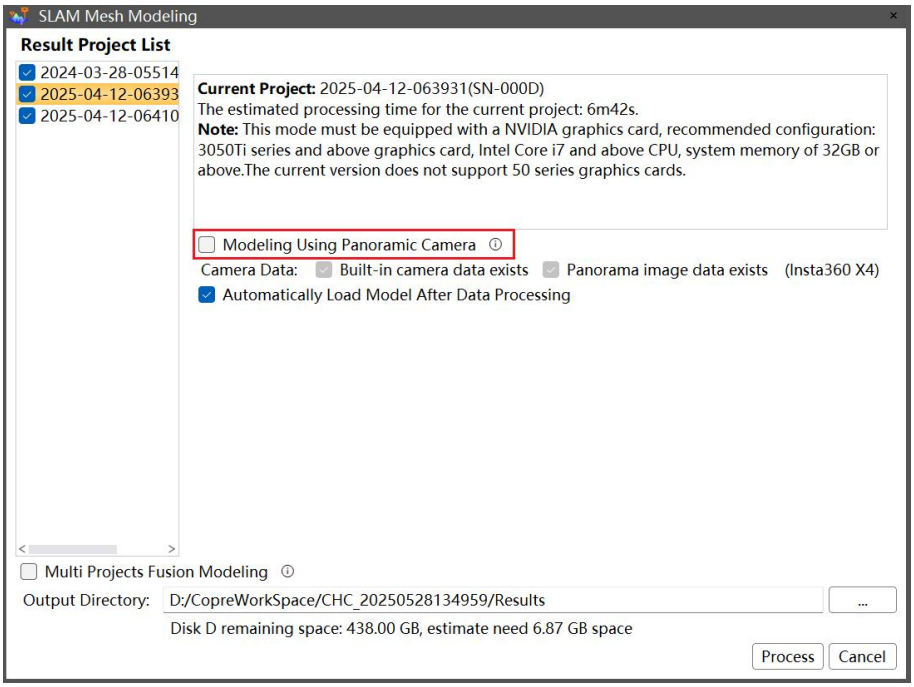
New Functions and Improvements

SLAM Scenario:

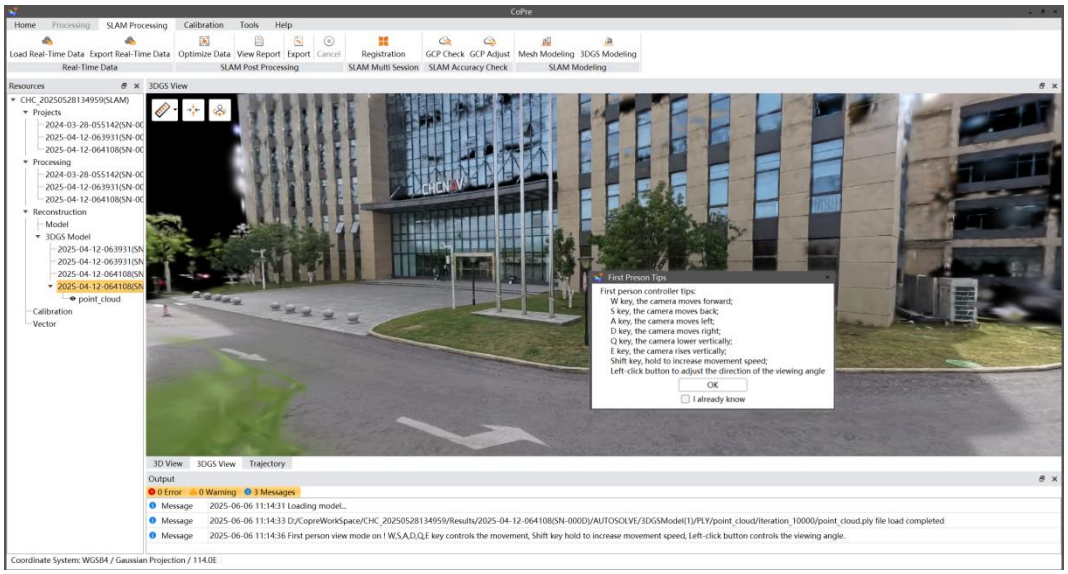
- Added 3DGS modeling function, renamed the previous modeling function to Mesh modeling. Currently there are two types of modeling: Mesh modeling and 3DGS modeling;



① Mesh modeling: If you check the "Modeling Use Panoramic Camera" option, the panoramic image modeling will be used, otherwise the model will be built using a photo from the built-in camera. In most scenarios, the panoramic image modeling will have a better effect.

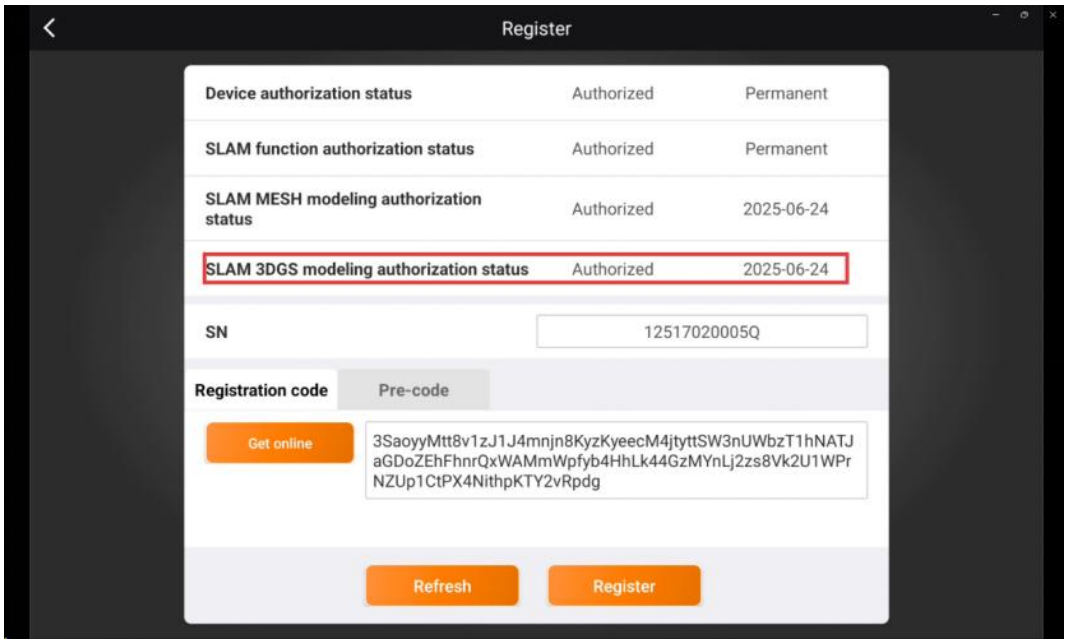


②3DGS modeling: It is required to check the option to solve insta360 panoramic images during Optimize. After 3DGS modeling is completed, the model can be loaded and browsed in the 3DGS view. Compared with Mesh modeling, 3DGS is more realistic in visual effects, but it takes longer.

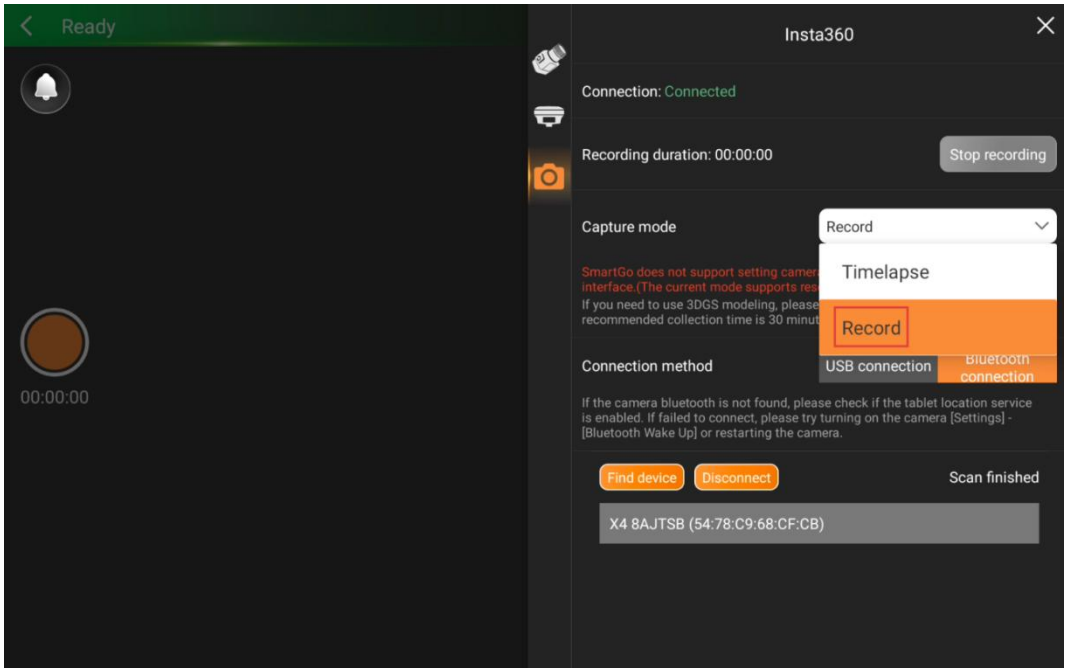


Data requirements:

1. SmartGo version requires 1.4.1.2 and above , the firmware version of RS10 must be 1.7.2 or above. You need to enable the 3DGS modeling permission of the RS10-RS series in the SmartGo software before you can use 3DGS modeling;



2. 3DGS modeling only supports external panoramic cameras in video mode: insta360 X4;



3. 3DGS modeling requires an NVIDIA graphics card, The current version does not support 50 series graphics cards and AMD graphics card.

Minimum configuration: GeForce RTX 3080, 12G video memory, 32G memory.

Recommended configuration: GeForce RTX 4090, 24G video memory, 64G memory.

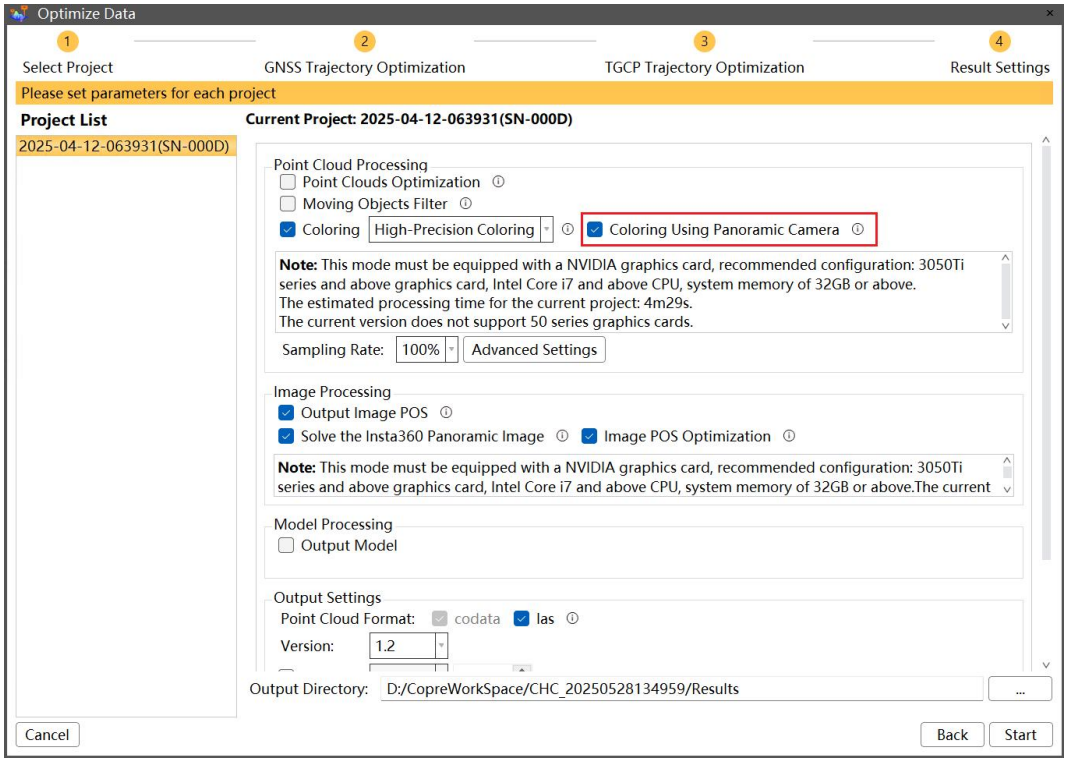
4. 3DGS modeling requires solving the insta360 panoramic image;

5. You need to download the 3DGS modeling resource package in CoPre through the "About->Resource Package->Resource Package Downloader" function;

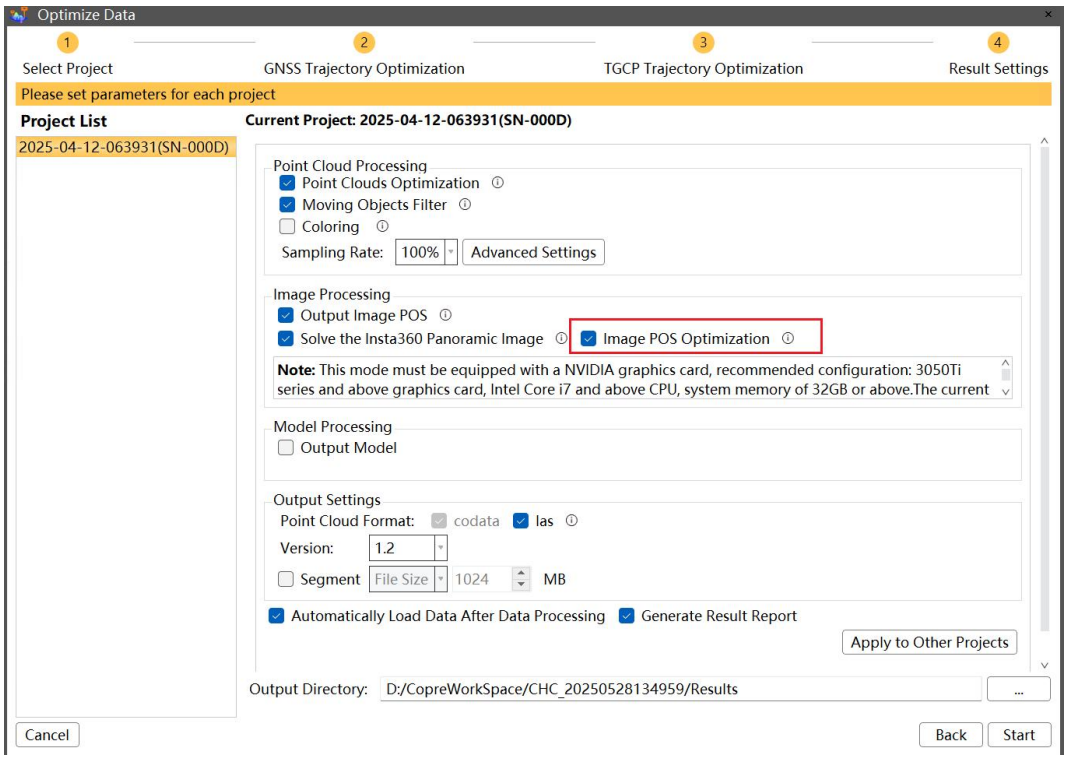
6. The recommended data collection time is about 30 minutes.

- Optimize Data function adds a new panoramic image coloring function. If you check Use panoramic image coloring, the panoramic image coloring will be used, otherwise use the built-in camera photo colorization. In most scenes, using panoramic image coloring will have

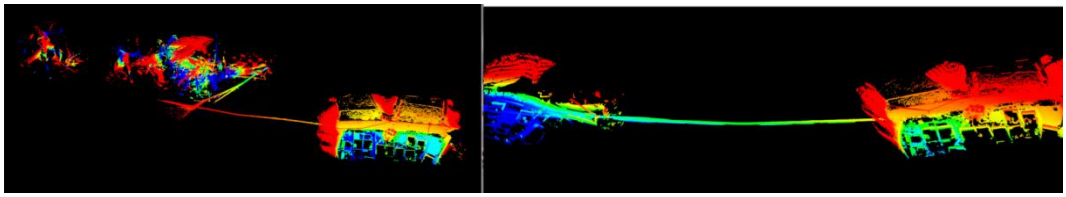
a better effect;



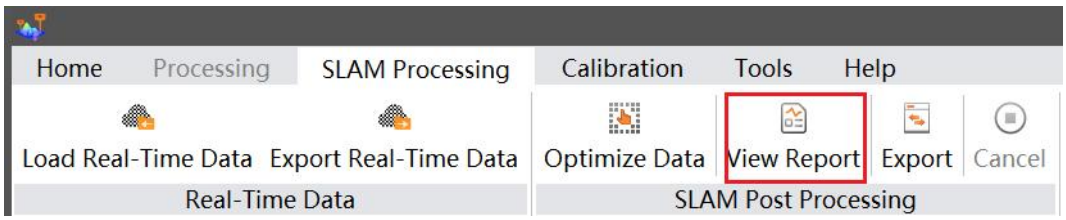
- Optimize Data: A new insta360 image trajectory optimization function is added to improve the alignment accuracy and coloring accuracy between panoramic images and point clouds, which is usually used in the scene of disassembly and assembly of insta360 cameras;

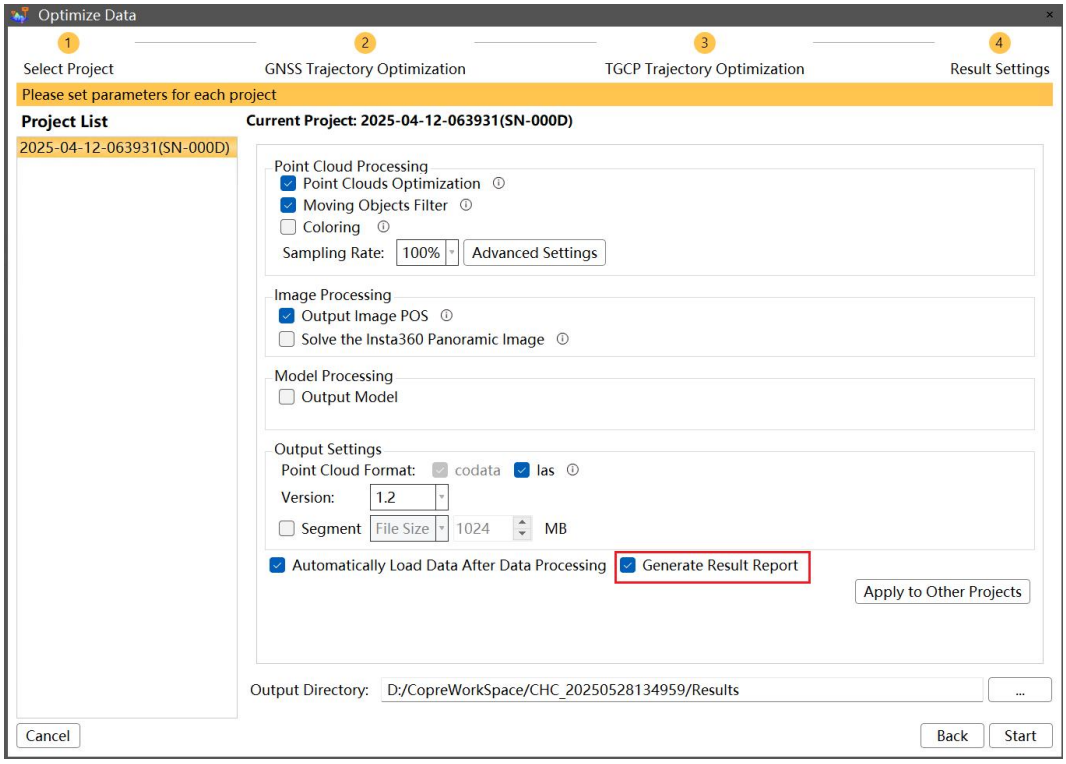


- Optimize the accuracy of SLAM tunnel scene data calculation (left: before optimization; right: after optimization);



- Added the function of outputting SLAM accuracy report;





The SLAM results report includes data solution parameters, data accuracy overview and GNSS quality.

Solution parameters: including Optimize parameters and computer hardware parameters.

Data accuracy overview: including main accuracy information table, trajectory relative error.

GNSS quality: including PPK data quality and GNSS quality rendering effect.

Solution parameters:

Parameters

- **Task Parameters**

Solftware Version	2.9.2.20250522
Coordinate system	WGS84 / Gaussian Projection / 114.0E
Project name	2025-04-12-064108(SN-000D)
Device Type	RS10
SN	12411020000D
Data Size	1.04412 G
Collect Time	1m35s
Process Time	41m38s

- **Hardware Parameters**

CPU	12th Gen Intel(R) Core(TM) i7-12700KF
Computer Memory	64G
Nvidia GPU	NVIDIA GeForce RTX 3060;12GB

- **Process Parameters**

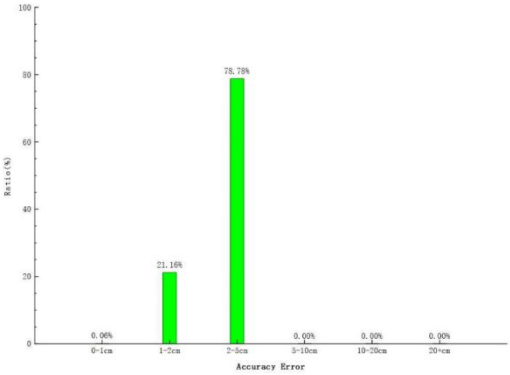
Process Mode	PPK
Scene	Outdoor
Use TGCP	No
Coloring Mode	No Coloring
Point Clouds Optimization	Yes
Moving Objects Filter	Yes
Output Image POS	No
Output Model	Yes
Noise Filtering	No
3D Distance Filtering (m)	1.000~60.000
Intensity Filtering	No

Data accuracy overview:

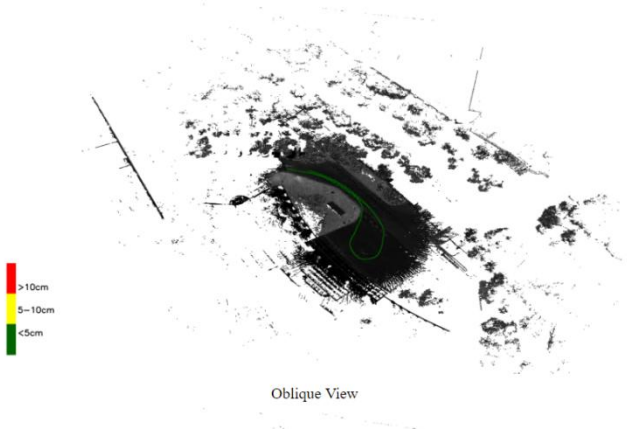
- **Main Precision Information Table**

Predefined Precision Threshold for Reporting	5.00cm	Percentage of Points Meeting Precision Threshold	100.000%

Error Range	Ratio	Point Count
0-1cm	0.063%	5185
1-2cm	21.158%	1745028
2-5cm	78.779%	6497209
5-10cm	0.000%	0
10-20cm	0.000%	0
20+cm	0.000%	0



- **Trajectory relative error (accuracy error of multiple back and forth scans)**



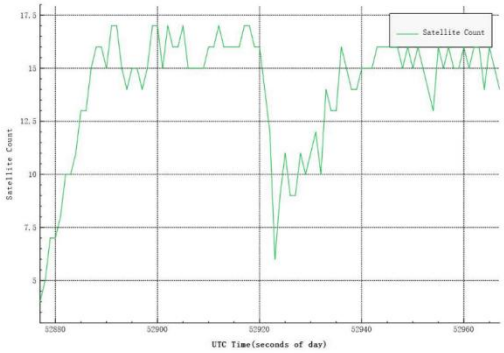
Oblique View

GNSS Quality :

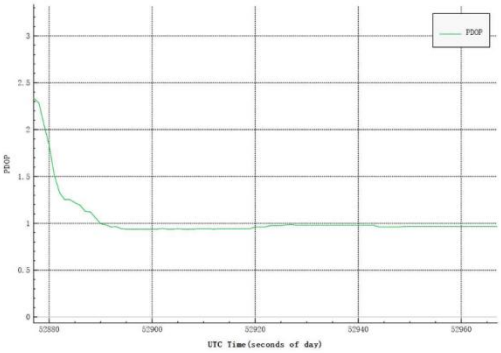
GNSS Quality

• PPK Data Quality

PPK accuracy is primarily evaluated based on several key metrics, including the number of satellites, PDOP, fix rate, sdx, sdy, and sdz. For more details, please refer to the distribution chart below:



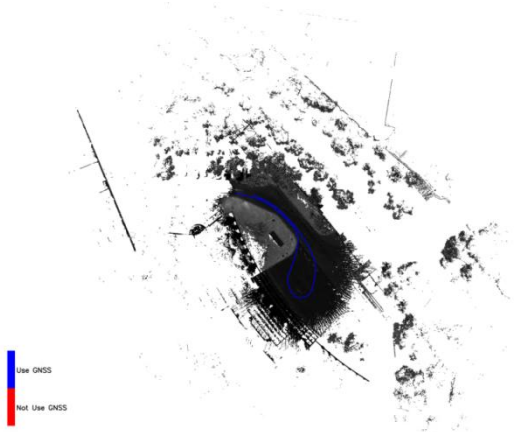
Number of Satellites: More Satellites Mean Better



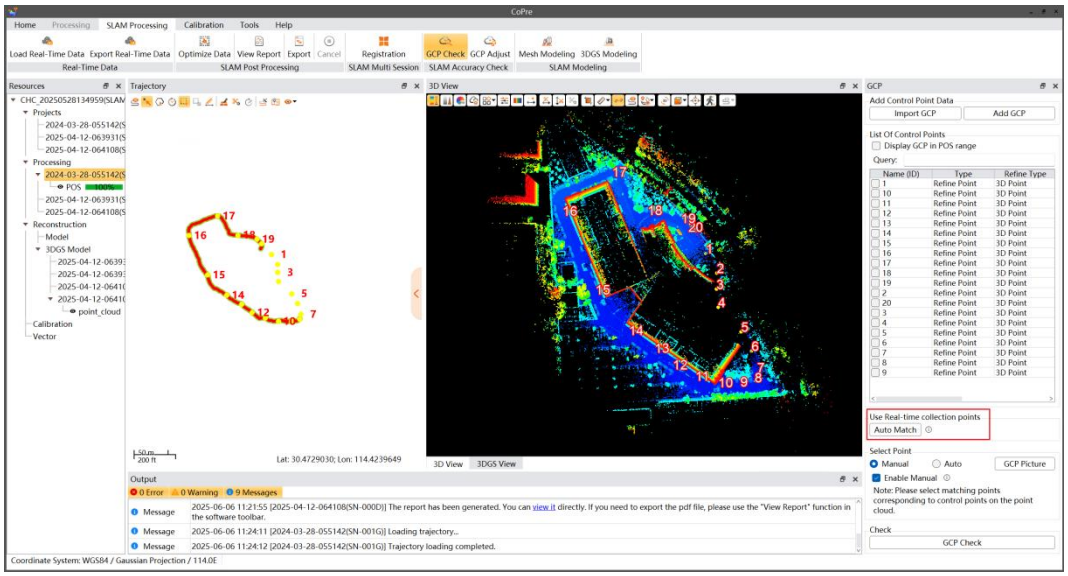
PDOP Value: The Smaller, the Better

• GNSS Quality Rendering Effect

The following figure shows the rendering effect that whether GNSS data participates in SLAM trajectory optimization. The blue area represents GNSS data participates in processing, and the red area represents no GNSS data participates in processing.

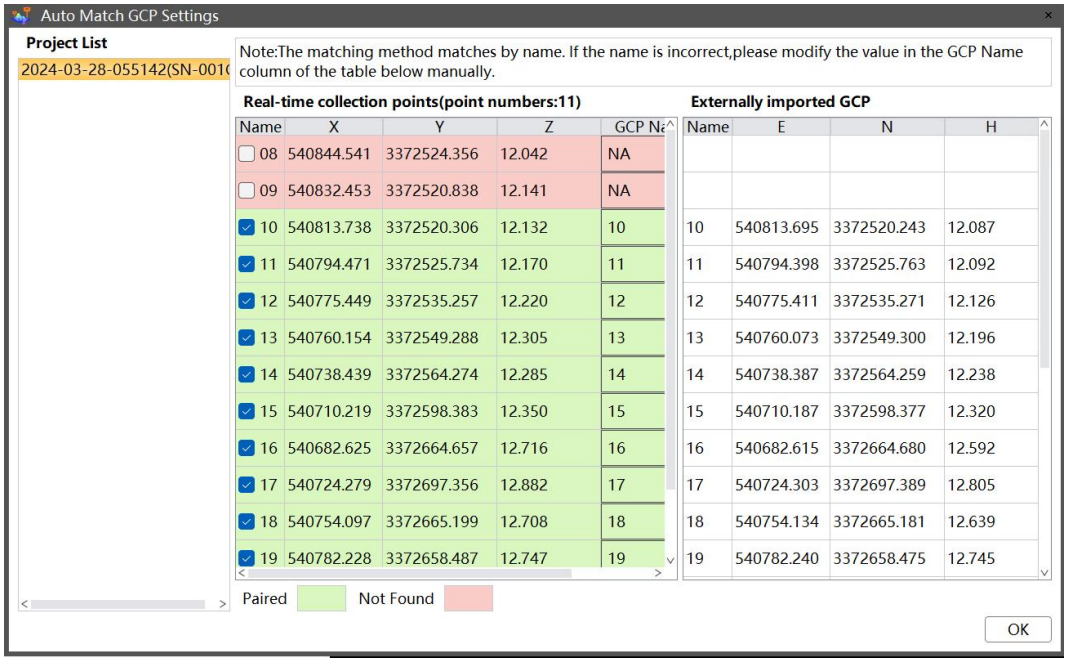


- Added the function of automatically matching the real-time collected GCP of SLAM with the imported GCPs ;

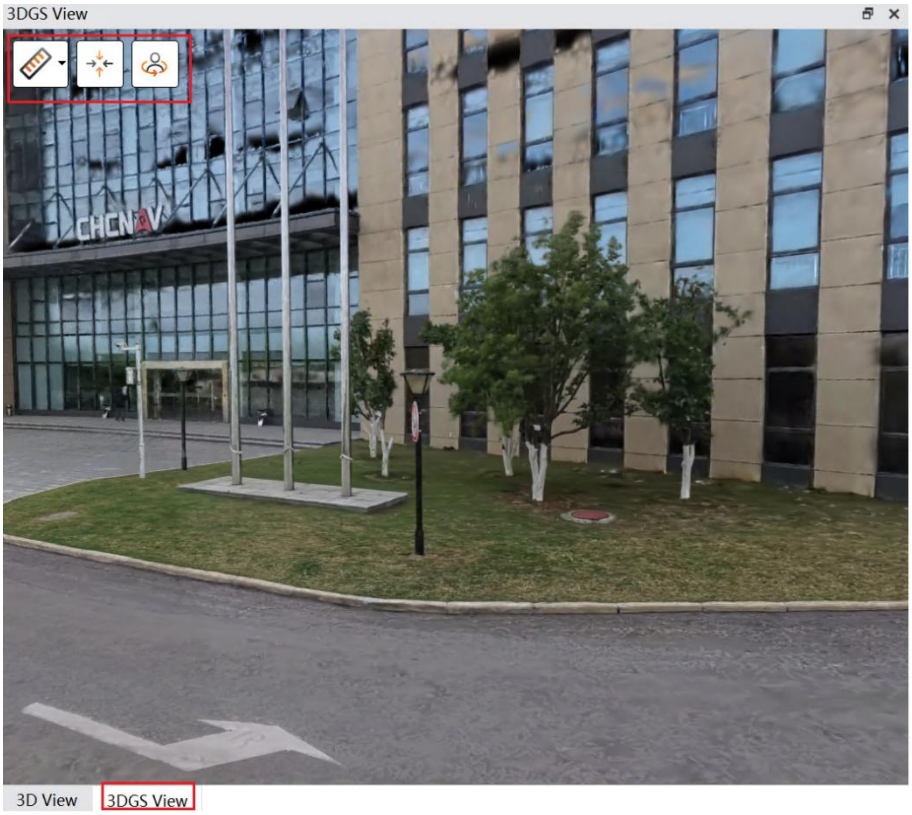


After clicking "Auto Match", the autom atic matching window will pop up and the GCP

collected in real time will be used as the matching point.



- Added 3DGS view for browsing 3DGS models. The view has point measurement, distance measurement, and perspective reset functions;

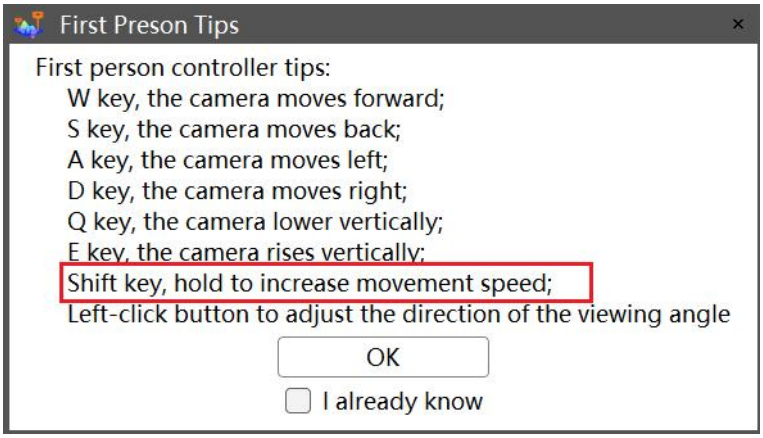


①Measurement: used to measure point coordinates and distance.

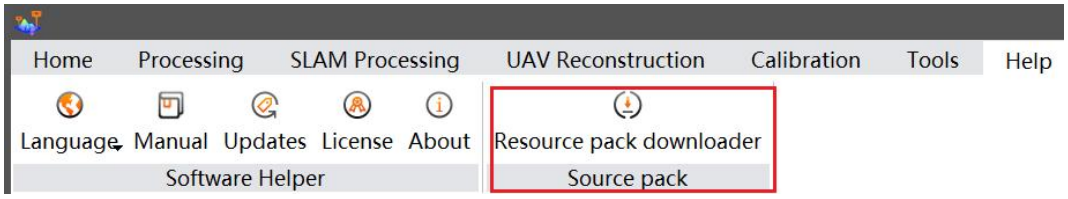
②Reset: The model returns to its initial position.

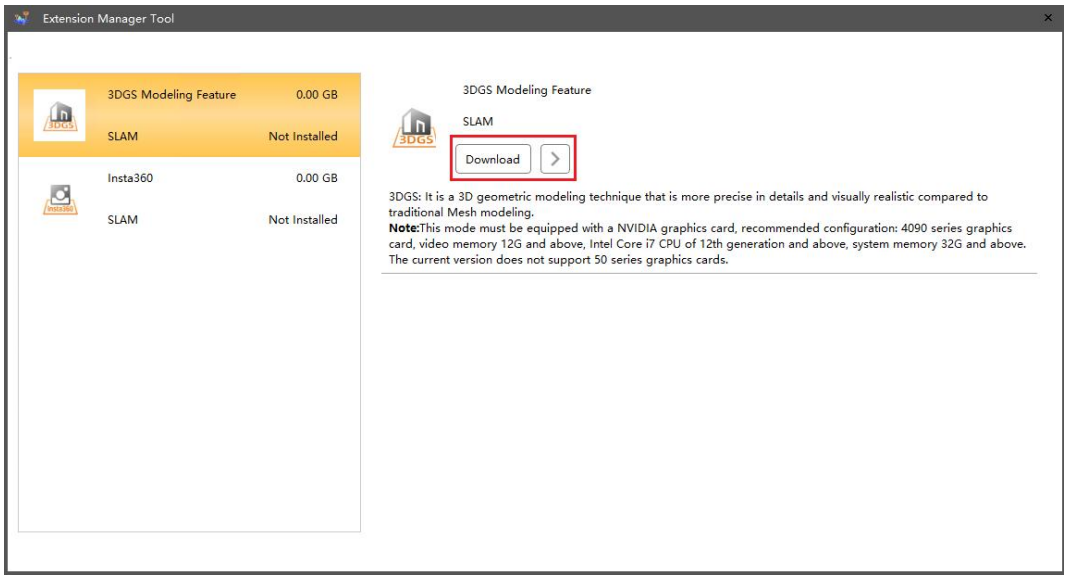
③Third person: Enter the third person perspective to browse the 3DGS model: Use the left mouse button to rotate the perspective, and the right mouse button to translate the perspective.

- Added the shift key to accelerate movement in the first-person browsing mode;



- Added online resource package update function. Supports online download of resource packages and online/offline updates. After downloading the resource package, the corresponding functions can be used normally. The current version supports resource package functions: insta360 solution and 3D Gaussian modeling.





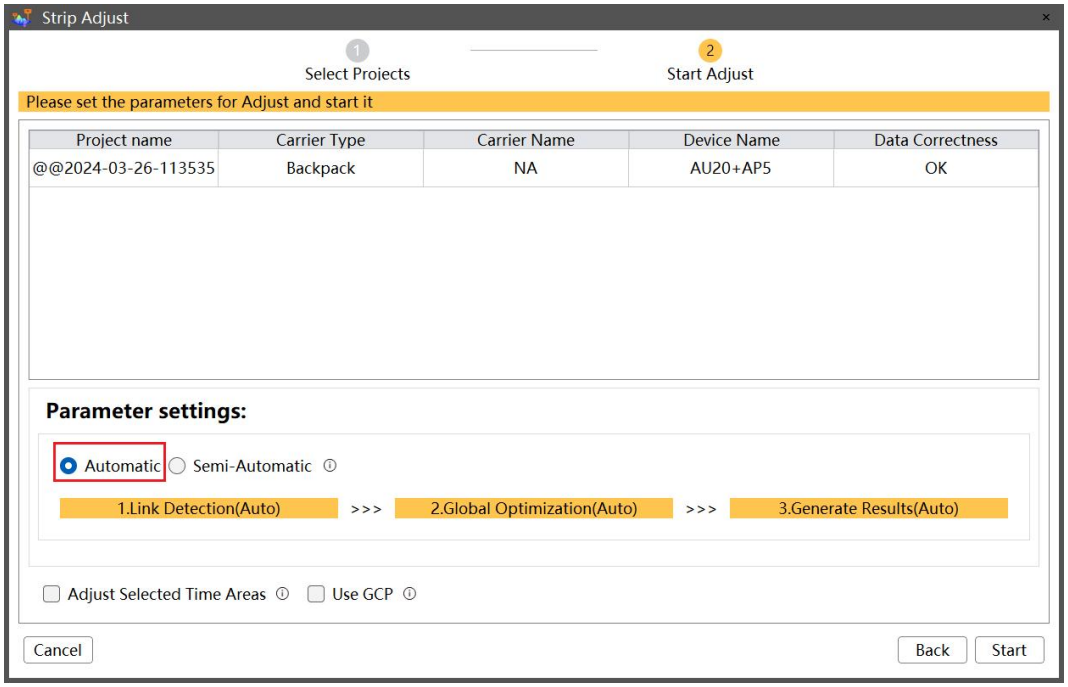
Airborne/vehicle scenarios:

- Optimize the vehicle-mounted adjustment function. There are two types of vehicle-mounted adjustment: fully automatic and semi-automatic . Add error display before and after adjustment.

  ①Automatic

  Automatically generate Link, and then perform global optimization and generate results based on the error value provided by Link. If the stratification effect after fully automatic adjustment does not meet expectations, you can continue to manually edit Link on the basis of fully automatic adjustment , and then perform global optimization and generate results,

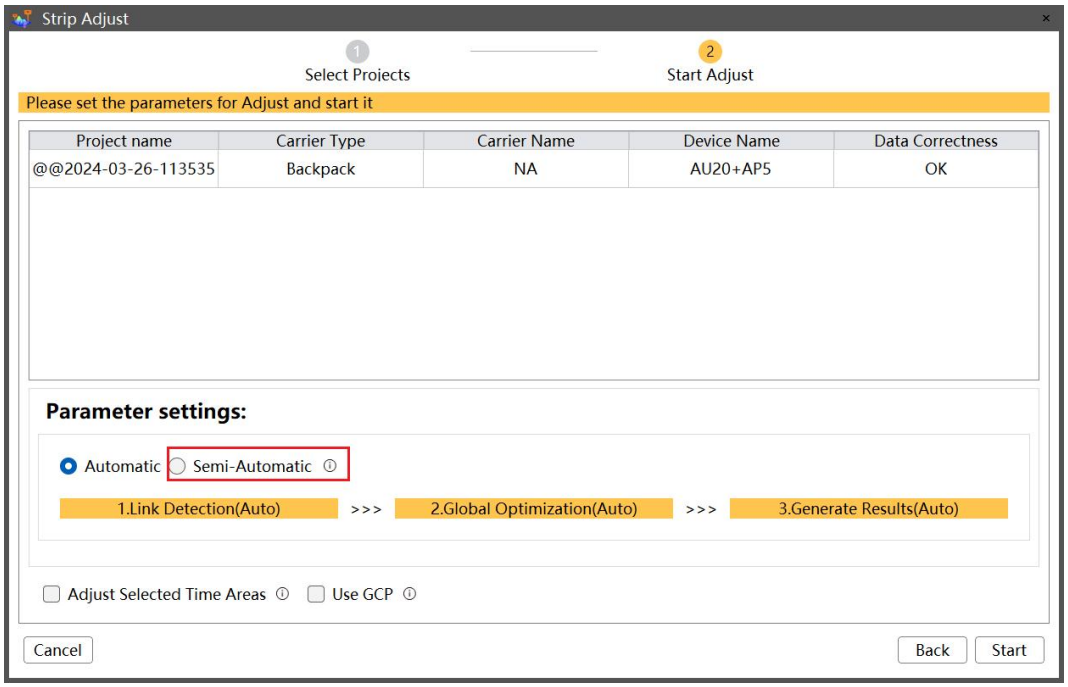
or you can directly choose to use the semi-automatic adjustment function.



②Semi-automatic

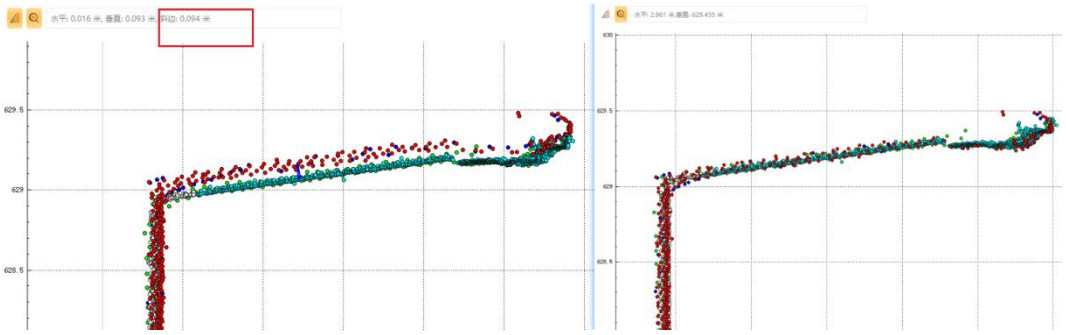
It is generally used in scenarios that cannot be solved by automatic adjustment and require manual intervention. Manual adjustments can be made to locations with large stratification based on the error values provided by the Link. Links can also be regenerated and manually inserted until the estimated stratification effect reaches the expected level. Global optimization can then be performed to generate results.

Note: If multiple projects are checked at the same time in the adjustment interface, adjustment will be performed between multiple projects!

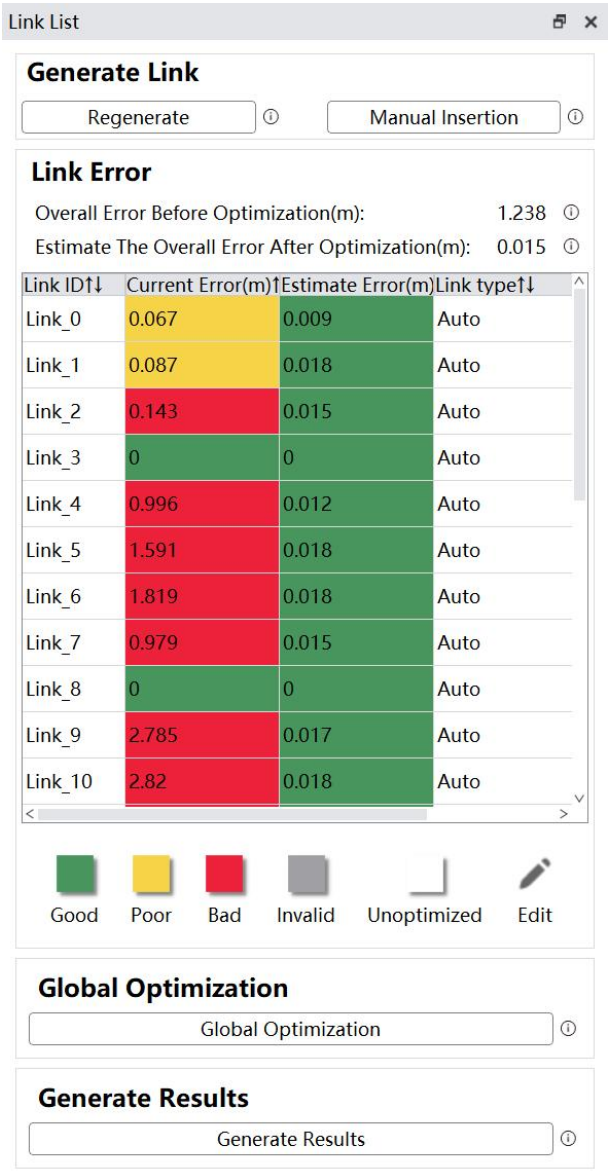


Comparison of fully automatic adjustment and semi-automatic adjustment effects: (left: fully aut

omatic; right: semi-automatic)



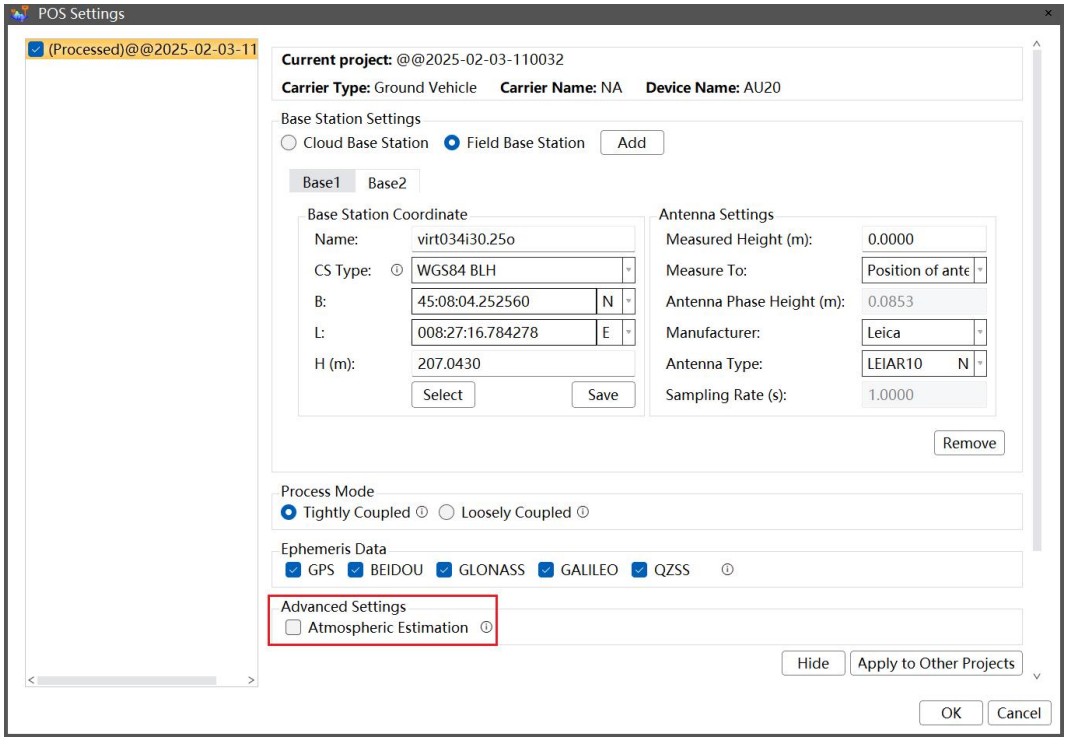
Link interface:



Note: Error accuracy is affected by the data environment and may be inaccurate in areas where point cloud features are not obvious.

Edit Link:

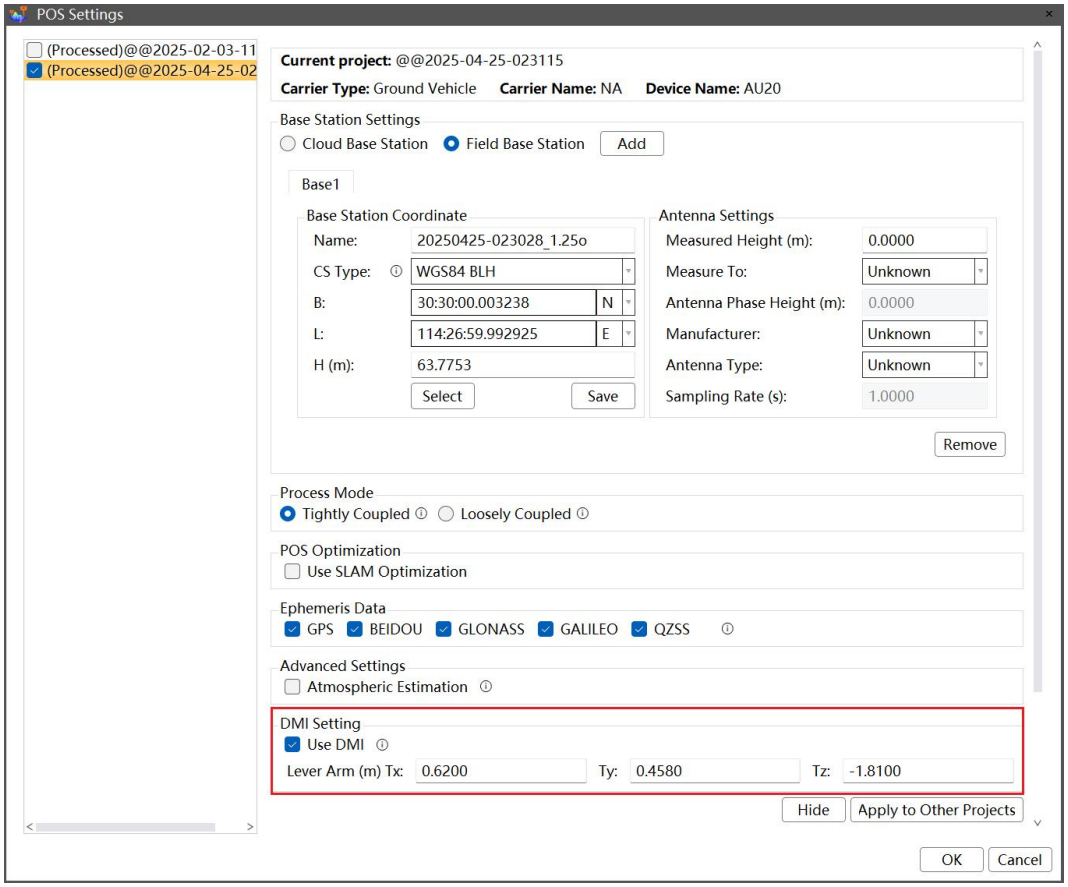
- A new Atmospheric Estimated option has been added to the Tightly Coupled mode of the POS solver;



- The vehicle-mounted POS solve has a new DMI function, which can optimize the POS jump problem and improve the POS accuracy in long-term GNSS signal-free environments (such as long tunnel scenarios);

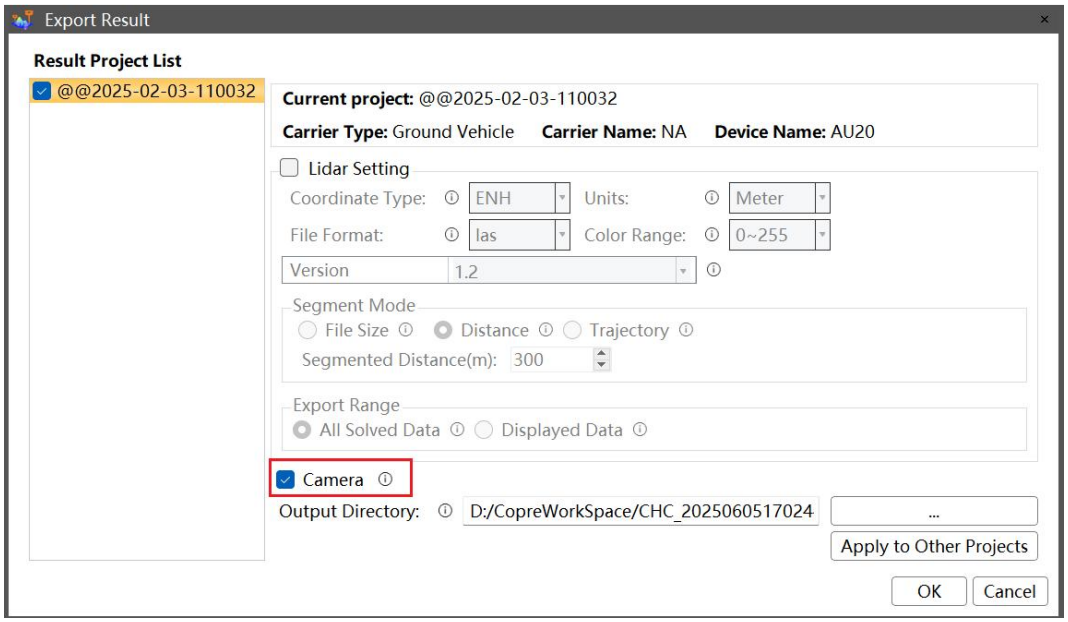
  Note: The firmware version of the vehicle-mounted device needs to be upgraded to 1.18.5 and above and requires a hard-axis wheel encoder. Currently, only AP7 devices are suppor

ted.



hard-axis wheel encoder：

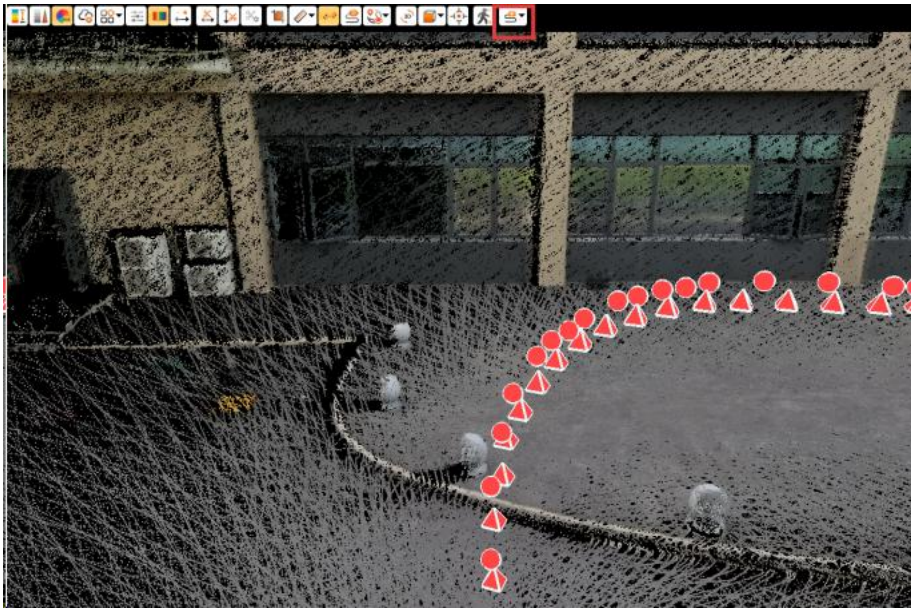
- When laser images exist at the same time, it supports separate image solving and separate i mage data export. You can control the display/hide of exposure points through "3D View->";



Common scenarios:

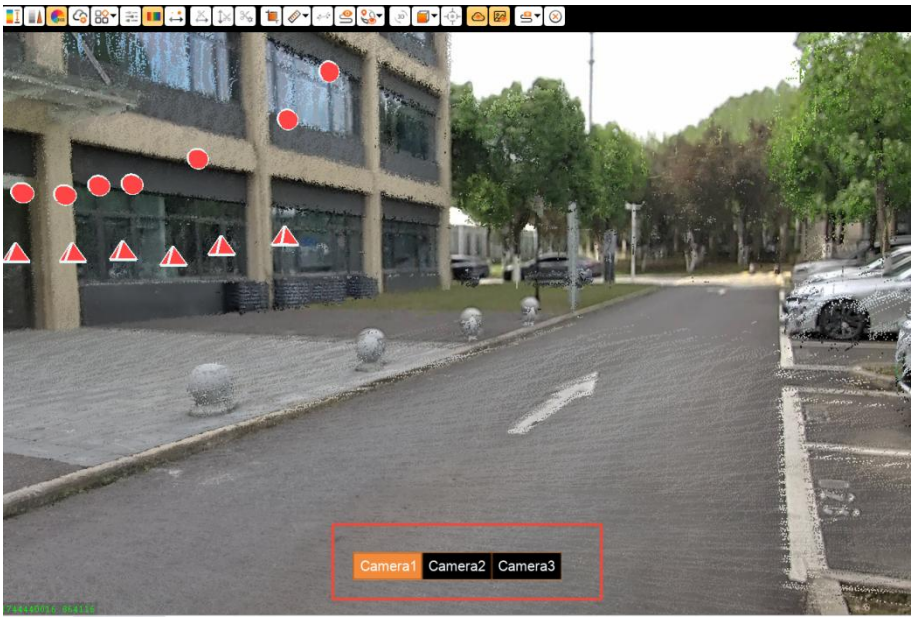
- Added camera exposure point function and optimized photo viewing function . The operation steps are as follows:

① Load the result trajectory, and the 3D view displays the non-panoramic camera exposure points (triangles) and panoramic camera exposure points (circles).

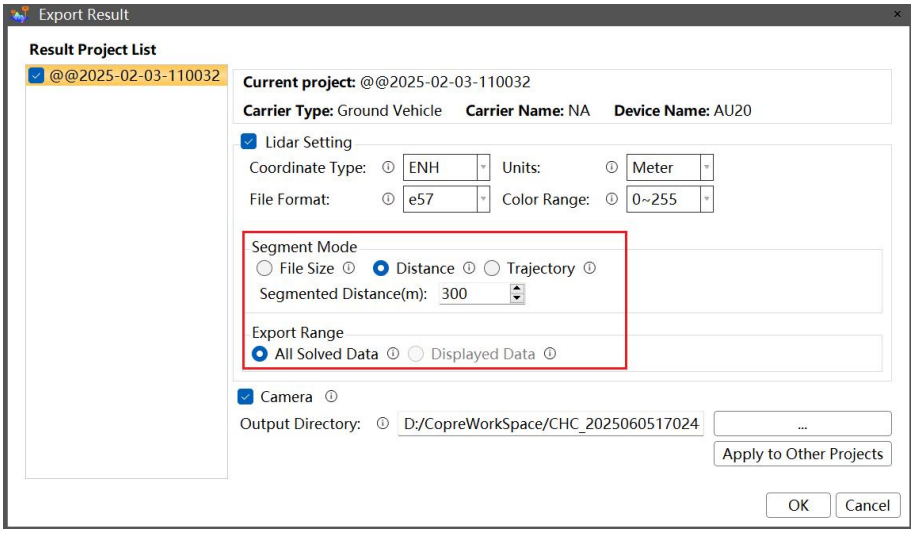


②Double-click the exposure point to enter the photo browsing mode. At this time, the 3D

view will display a single camera switching button (there is no camera switching button for the panoramic camera exposure point) and an exit photo browsing mode button. You can browse other camera photos of the same exposure point by switching cameras.

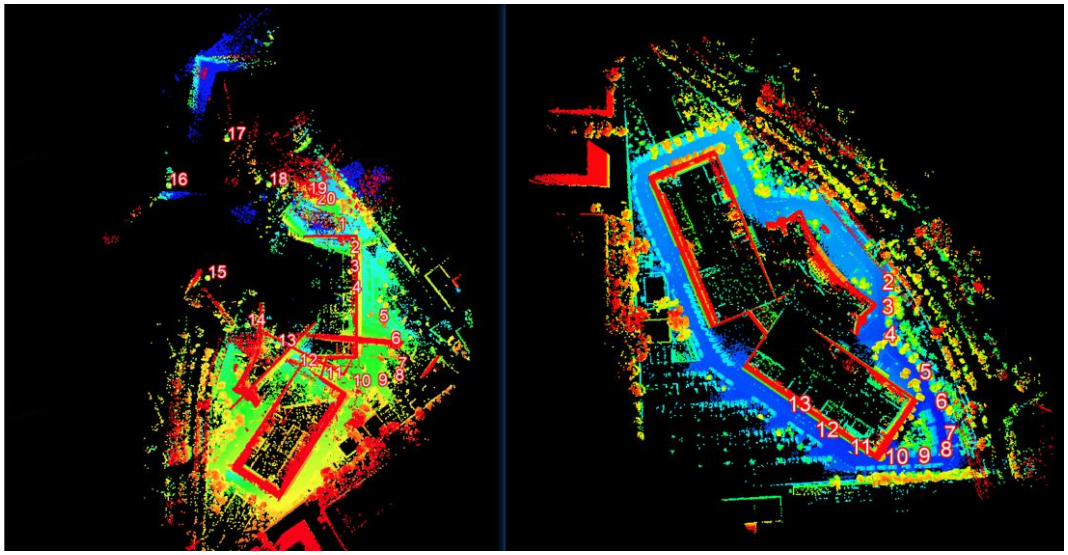


- Support exporting point clouds in e57/laz/pts formats, selecting segmentation method and export range;

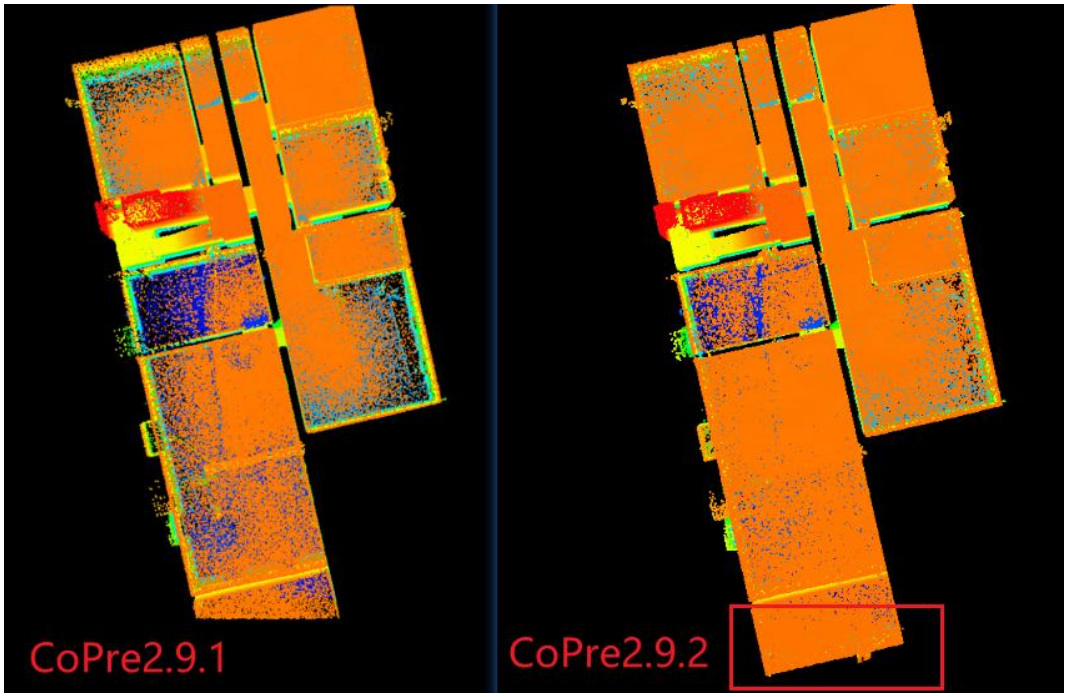


Bug Fixed in CoPre 2.9.2

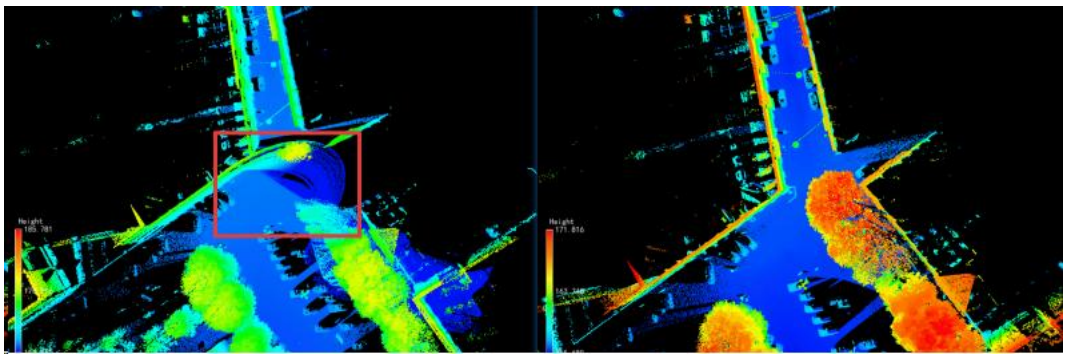
- Fixed the problem of Optimize SLAM data with disordered point clouds in some cases (left: before repair; right: after repair);



- Fixed the problem of missing part of the point cloud after Optimize of SLAM data in some cases (left: before repair; right: after repair) ;



- Optimize point cloud clipping function:
  ①Fixed the problem of excessive memory usage and software freeze during cropping and saving;
  ②Fixed the problem that some point clouds were not cropped after cropping and saving;
- Fixed the problem of point cloud distortion in some areas after control point adjustment in some cases (left: before repair; right: after repair);



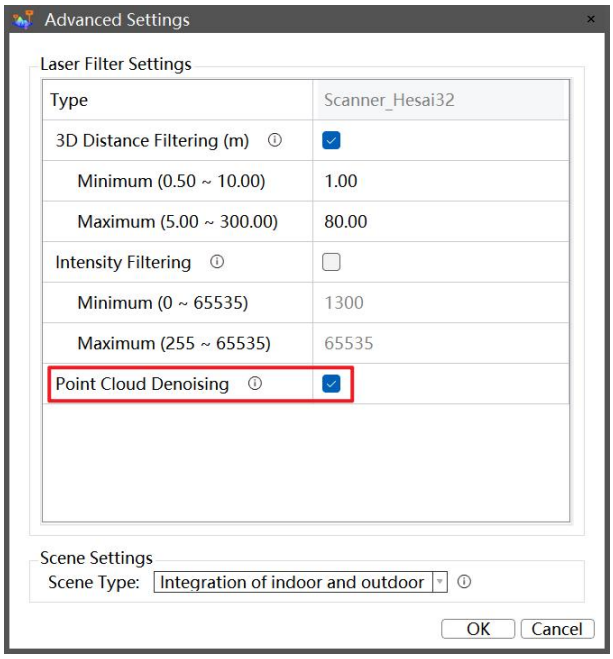
- Fixed the issue that the onboard calibration parameters could not be updated to the device in some cases;
- Fixed the issue where RS10 displayed incorrect base station coordinates when using PPK solution data in some cases;
- Fixed the issue that when copying P60 data, the pop-up window indicated that the carrier type (AirborneP60) was different from that recorded in the file;
- Fixed the issue that the corresponding carrier could not be set when copying BB4+AU20 data in some cases.

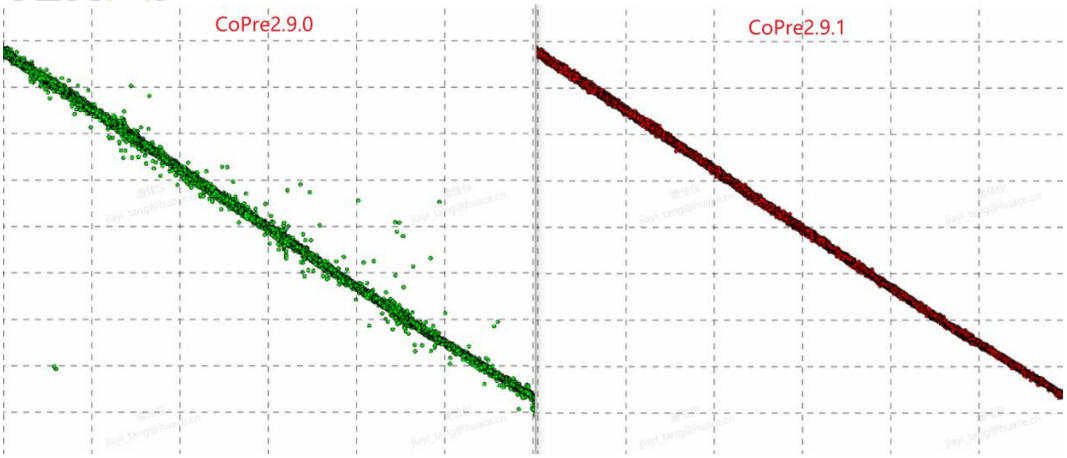
2. CoPre-2.9.1-202502

New Functions and Improvements

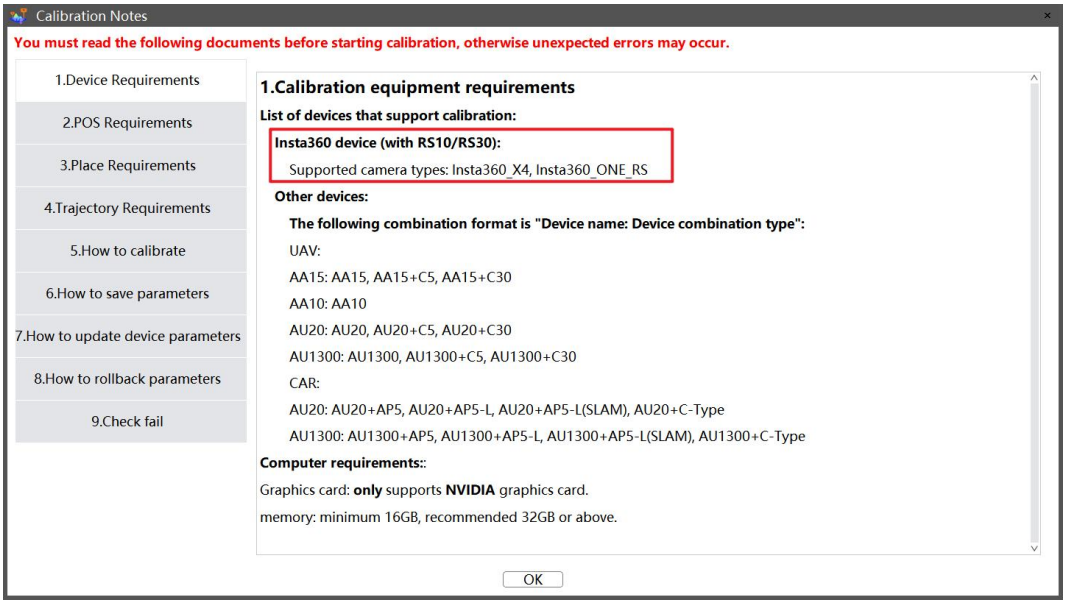
SLAM Scenario:

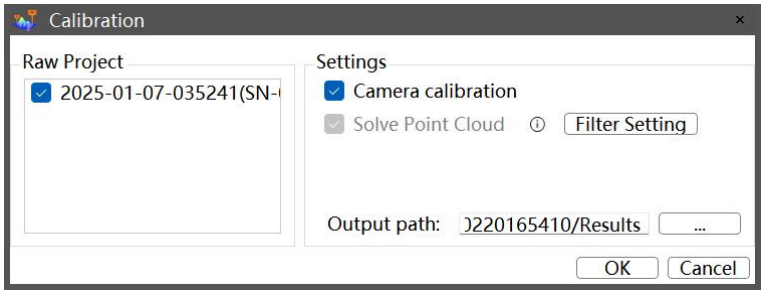
- Added SLAM point cloud denoising feature, which can improve wall floating point issues;



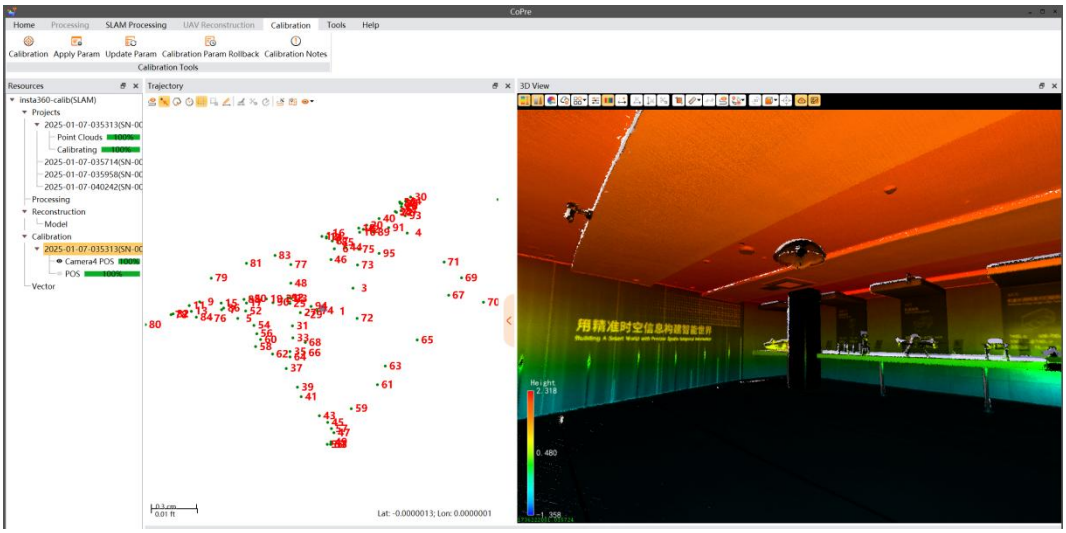


- Supports automatic calibration of Insta360 data, and allows saving the calibration parameters to the original project upon completion;

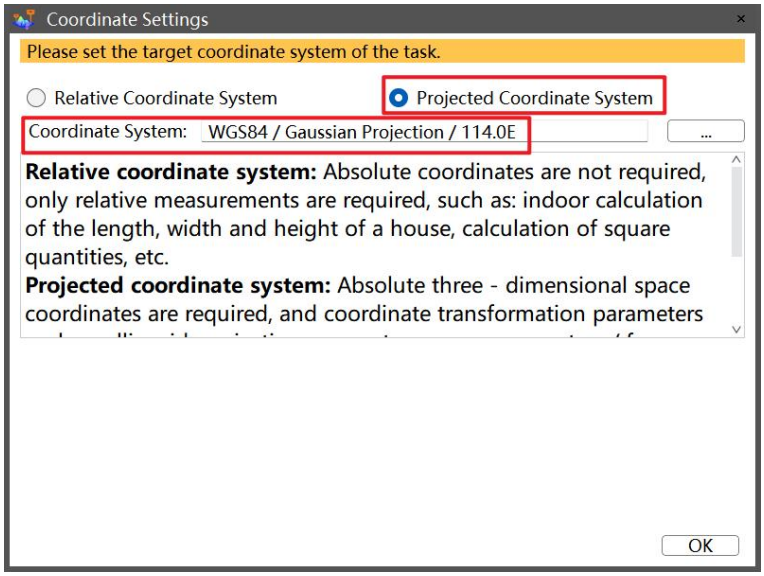




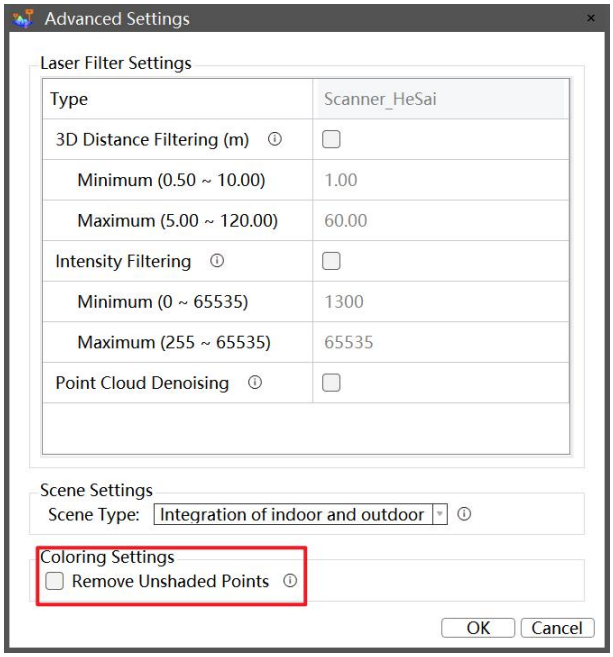
Calibration effect:



- The creation of a new projection system task for SLAM data supports the default selection of a coordinate system;

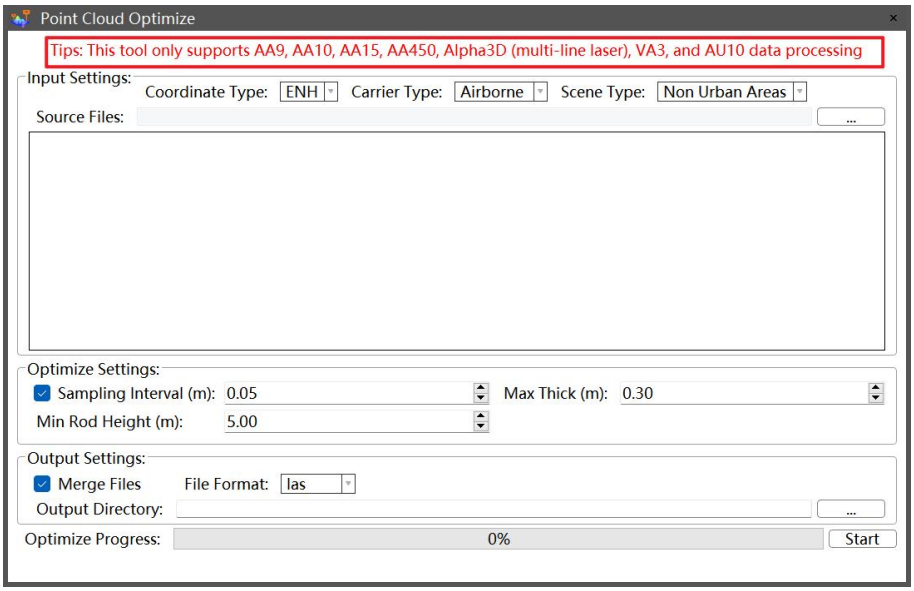


- Added a feature to remove unshaded points in SLAM shading;

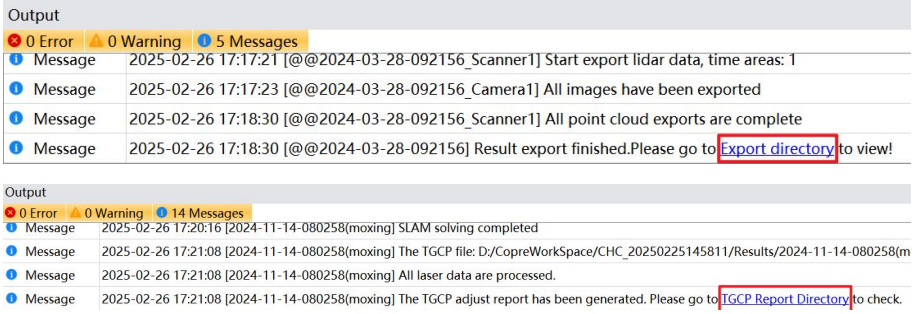


Airborne/Vehicle-mounted Scenarios：

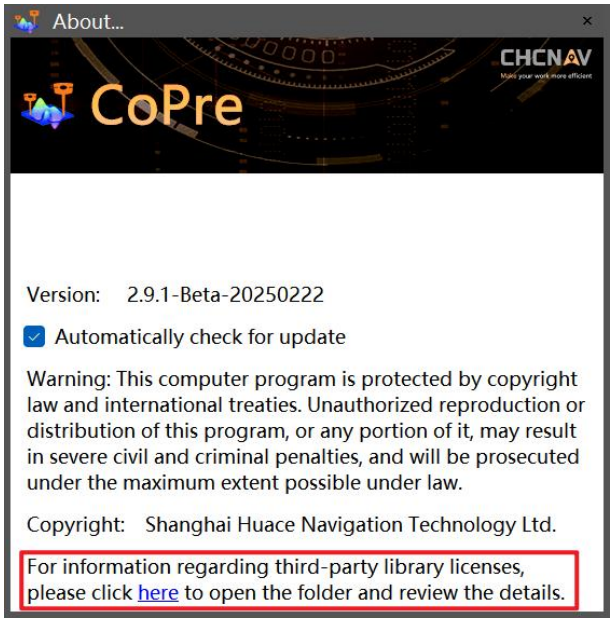
- The Points Optimize tool supports AA9 and AA15 data;



- Supports the resolution of AA15L data;
- The information output for exporting and generating TGCP reports supports clicking on hyperlinks to navigate to the corresponding folder directory;



- Added third-party library Licenses description.



Bug Fixed in CoPre 2.9.1

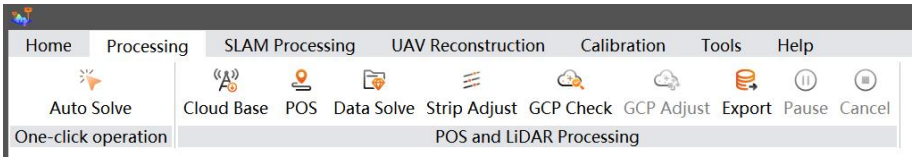
- Fixed the issue of uneven SLAM point cloud display under certain conditions;
- Fixed the issue where the exported KML and POSL ranges based on the displayed data were inconsistent with the point cloud range;
- Fixed the issue where exporting results in e57 format would result in many small file fragments.

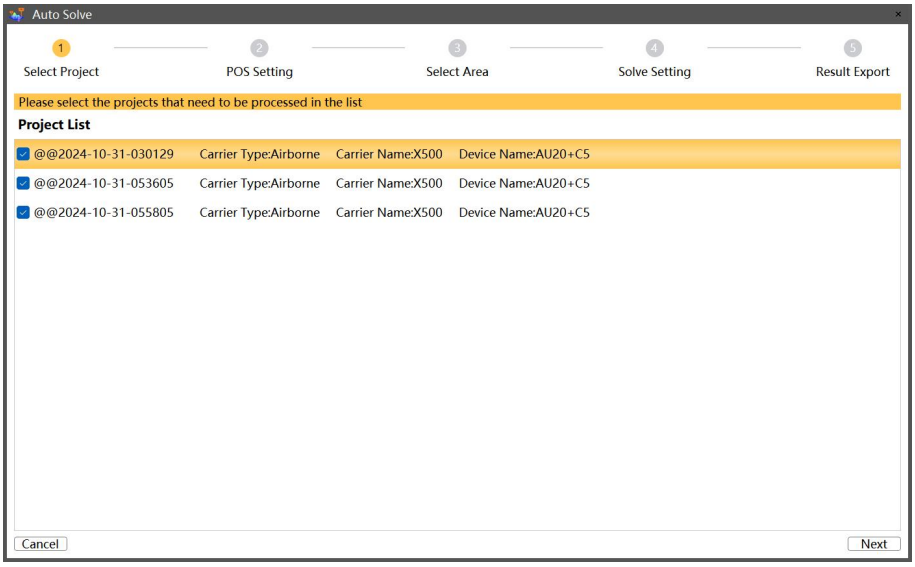
3. CoPre-2.9.0-202412

New Functions and Improvements

Airborne /Vehicle-mounted mode:

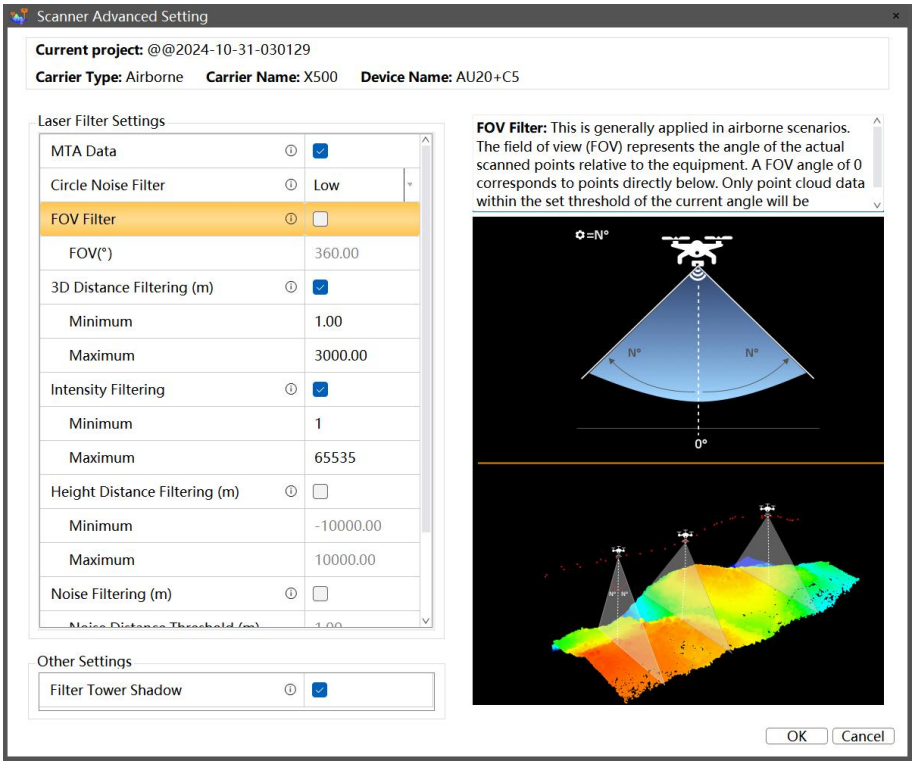
- Added one-click solution function for airborne and vehicle-mounted data;



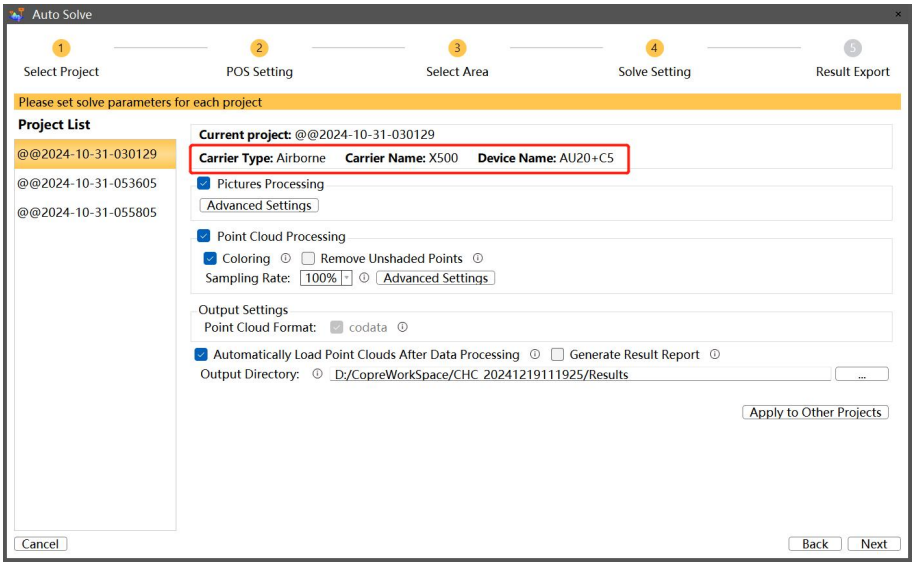


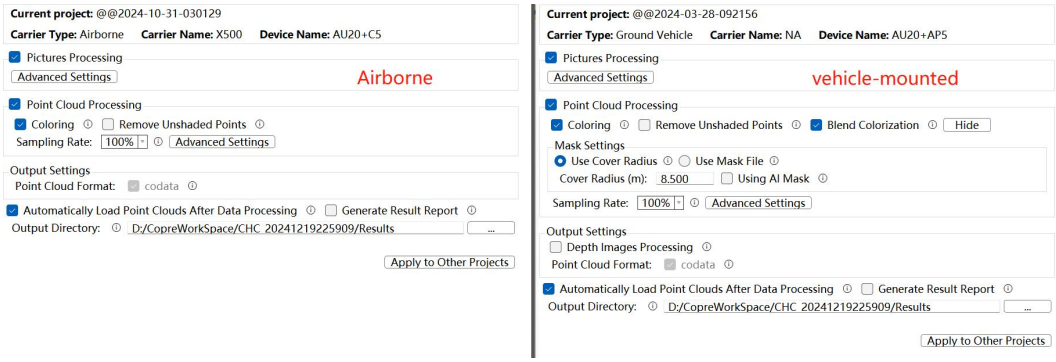
- Optimize the data solution interface:

➢ Adds a detailed explanation of the parameter prompt information and the image corresponding to the parameter functions in laser Advanced Settings;



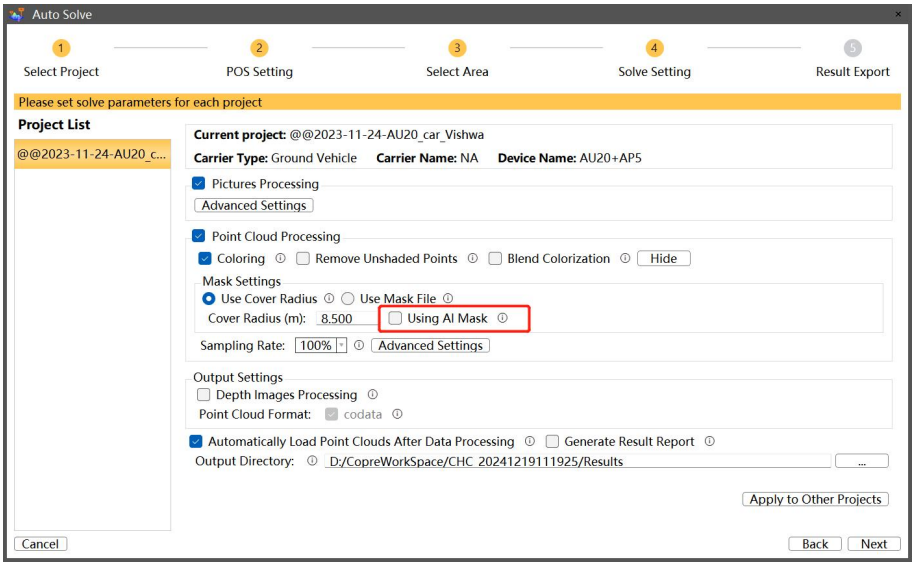
➢ Added the function of displaying carrier type, carrier name, and device name.



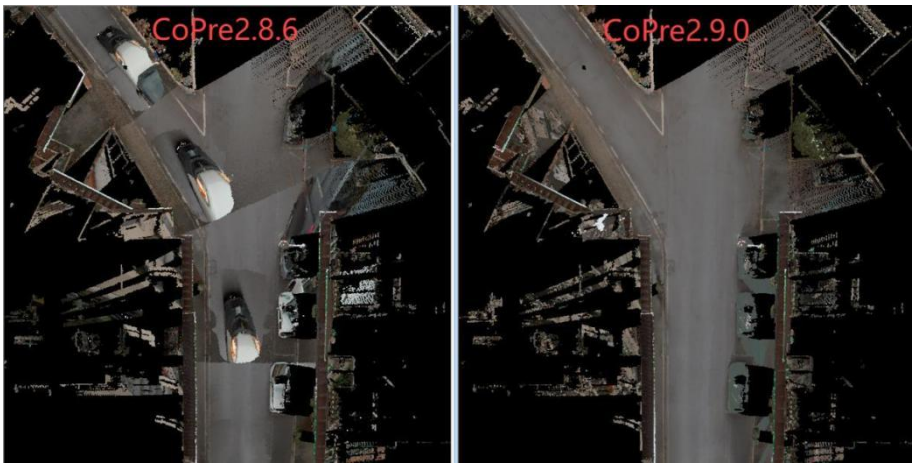


- Optimize vehicle-mounted mode coloring:

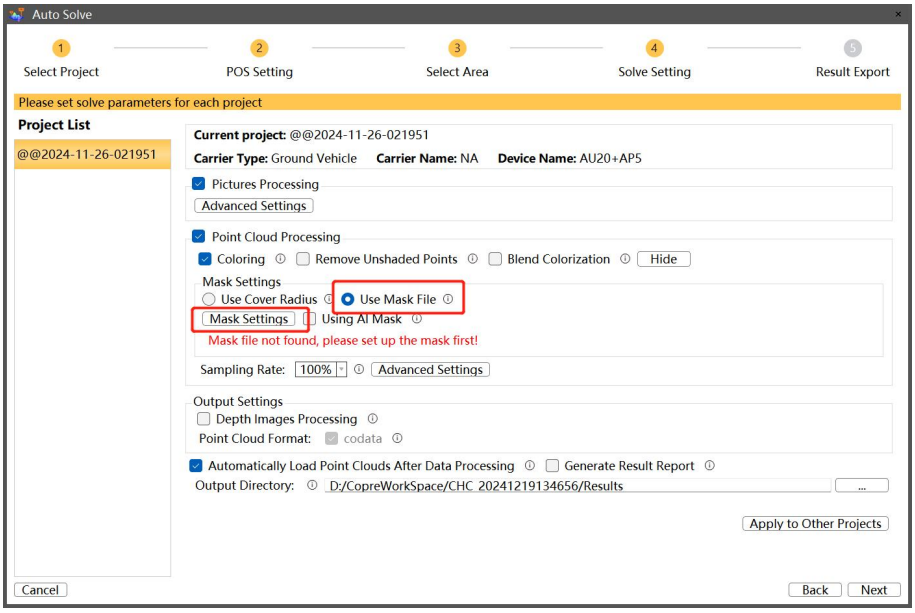
➢ Added AI mask to filter dynamic vehicles and occlusions for more accurate coloring;



➢ AI mask before and after comparison;



➢ Optimizes the use of mask files by manually drawing mask files through mask Settings.

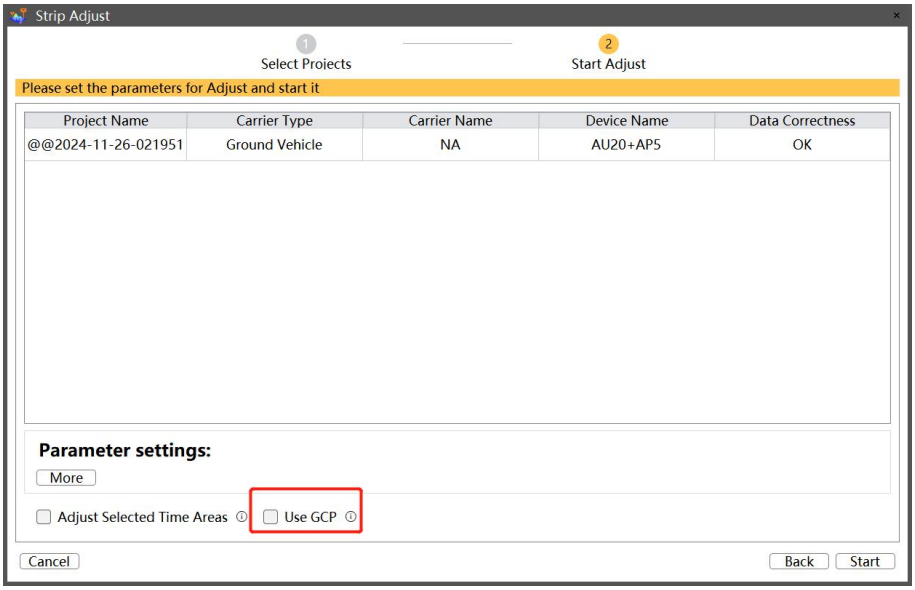


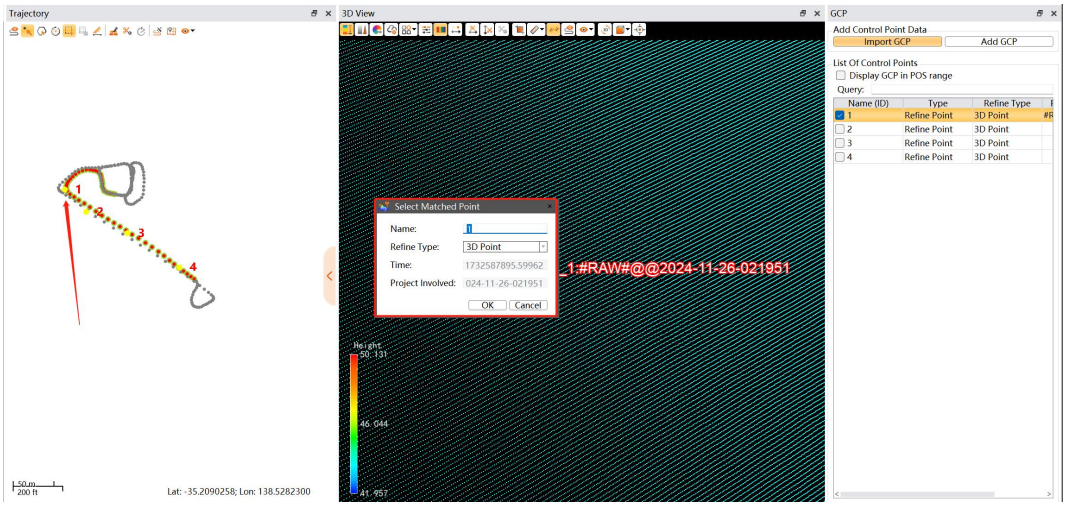
- Optimize vehicle strip adjust;

The control point function is supported for vehicle-mounted data adjustment. Before adjustment,

select a point with the same name in the point cloud, and then check "Use control point" during adjustment, which can improve the absolute accuracy of point cloud and point cloud layering.

Note: For multiple trajectories and point cloud data, you only need to select a point with the same name in the data of one trip.



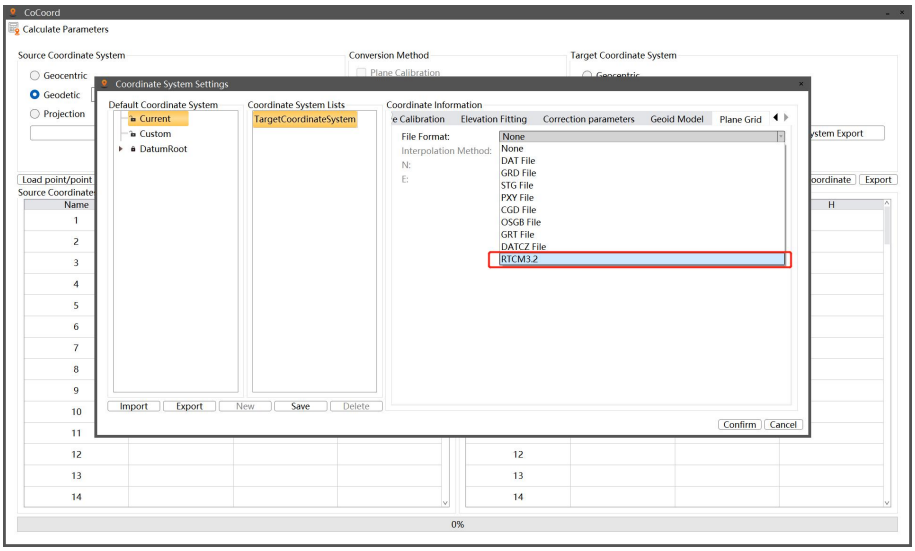


- Data solution for UAV X500;
- Optimize the copy tool function:

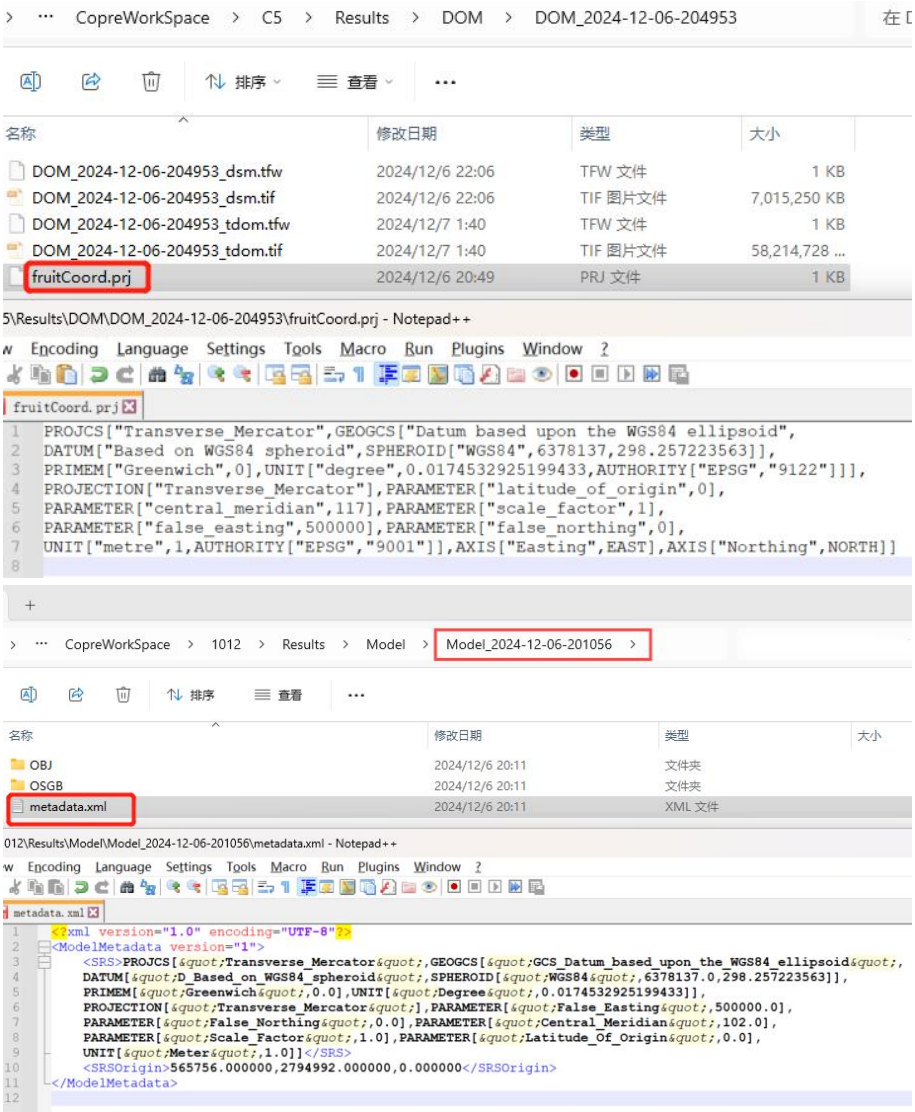
➢ If no EPX/CPX file exists in the EPX/CPX folder, an EPX/CPX file without parameters will be created and data will be copied;

➢ Fixed disk formatting failure without administrator permission.

- Optimize software interface prompts;
- Coordinate conversion tool supports geoid and planar grid using RTCM3.2 mode;



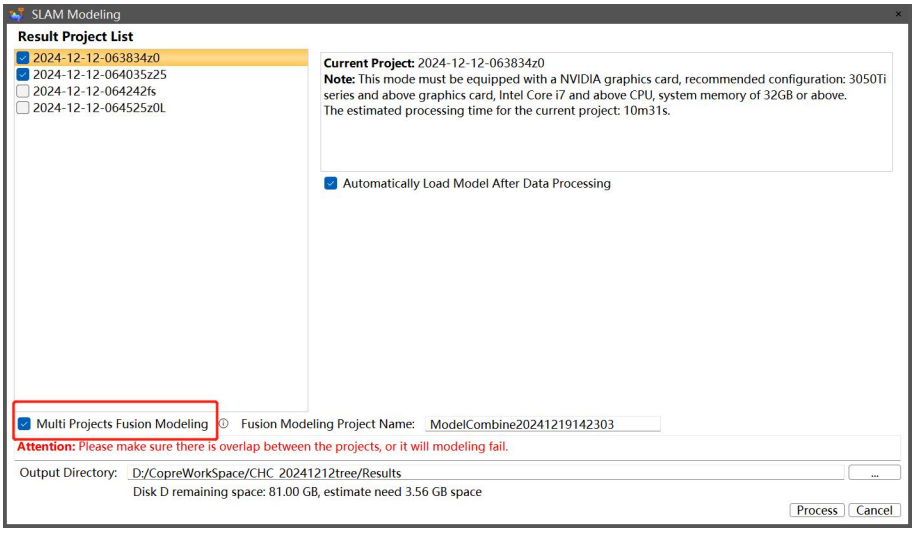
- Support the output of positive DOM loading in CASS;
- DOM and model data support output coordinate system information;



SLAM Scenario:

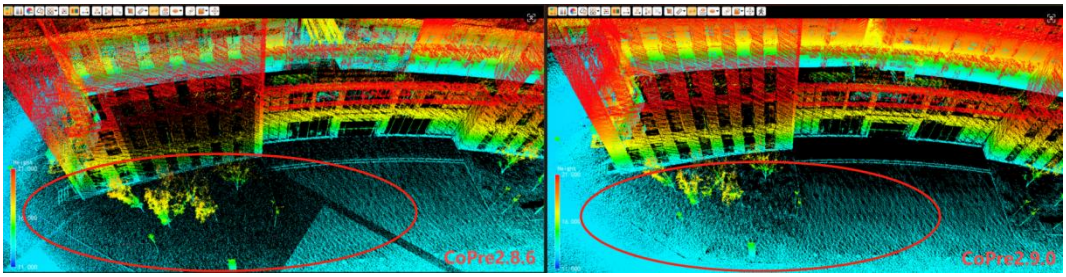
- Add SLAM data multi-project fusion modeling function, which can customize the name of fusion modeling project;

Note: Make sure that the engineering point clouds for fusion modeling have some overlap, otherwise the modeling may fail.

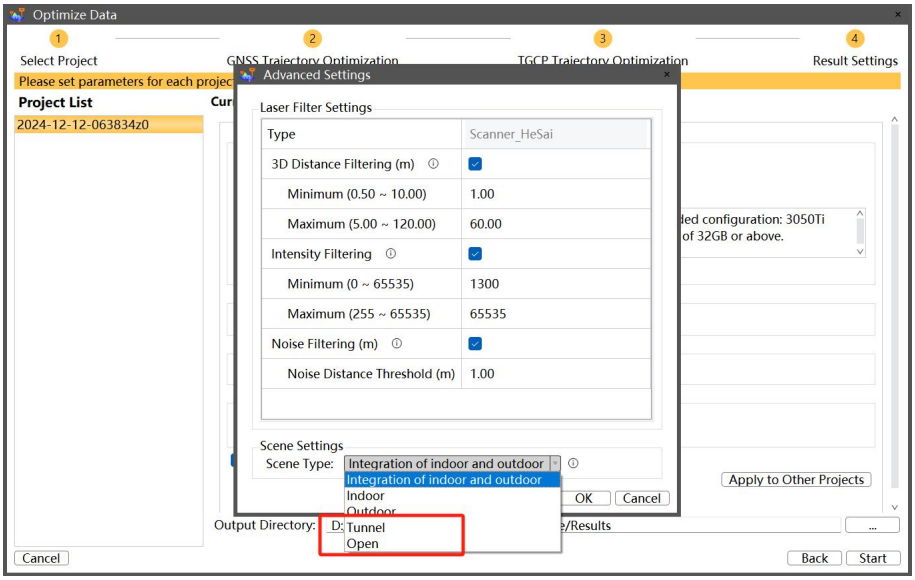


Fusion modeling effect:

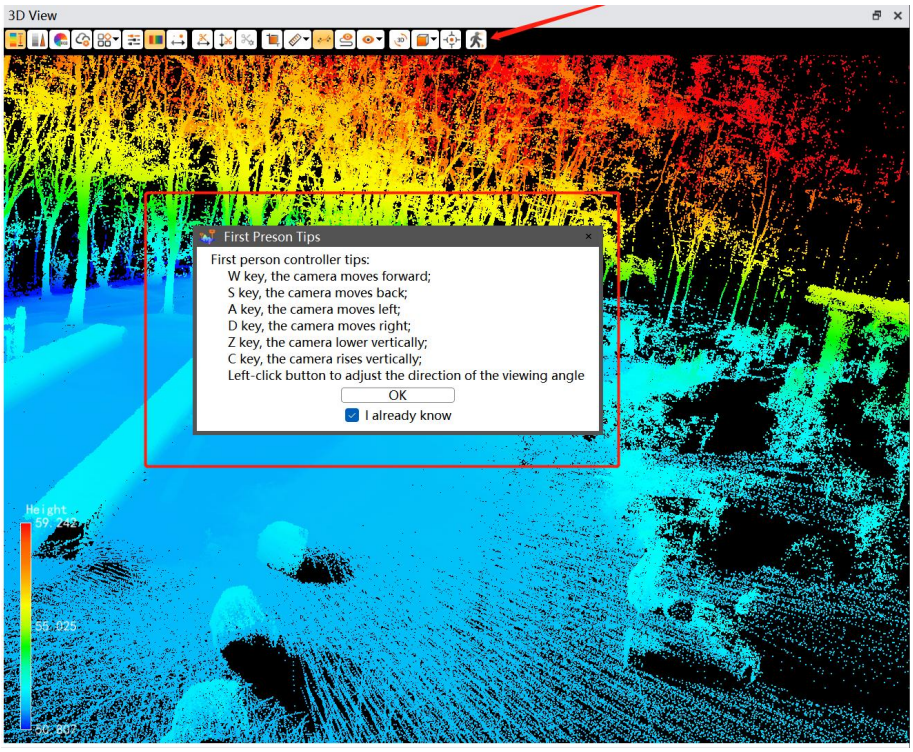
- Optimize SLAM data browsing effect(CoProcess is updated synchronously to CoProcess version 2.7.2);



- Add new tunnel and open scene types to SLAM data one-click solution;



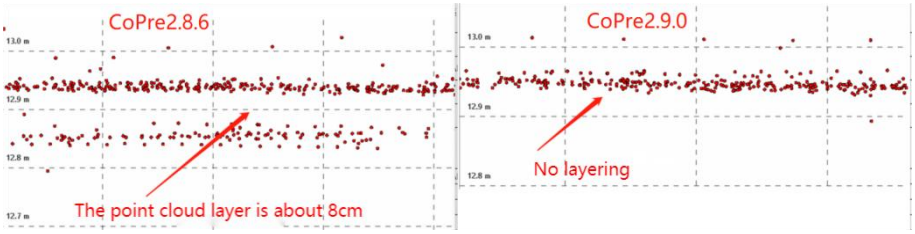
- 3D view added the function of browsing point cloud and model from the first-person perspective, which can be controlled by the left mouse button rotation Angle and the W(forward), S(back), A(left), D(right), C(up), Z(down) key controls the first person perspective for browsing within a point cloud or model;



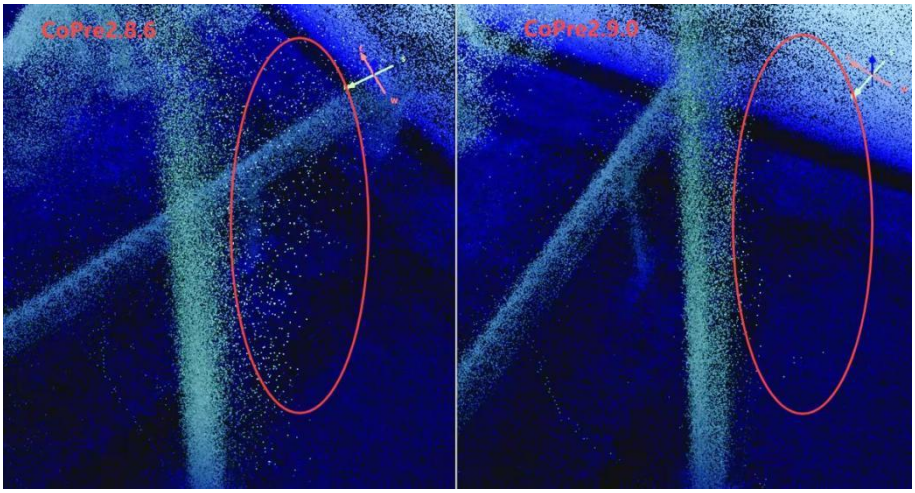
- Optimization of SLAM algorithm:

➢ Improved TGCP control point optimization accuracy and stability in weak feature scenarios;

➢ Single project layer optimization;



➢ Trailing noise optimization.



Bug Fixed in CoPre 2.9.0

Airborne /Vehicle-mounted mode:

- Fixed the problem that the Alpha3D double-headed .pcap file data was stuck and the data quality inspection flash back in some cases;
- Fixed incomplete solution of cross-equatorial data under UTM projection;
- Fixed the problem that the 3rd-party camera is equipped with Lidar, and the data calculation indicates that the device SN does not match;
- Fixed the problem that POS solution interface could not recognize I76 antenna type;
- Fixed POS solution stuck or failed in some cases;

SLAM Scenario:

- Fix overlapping of SLAM point cloud locations in a same place;
- Fixed the problem that the software prompts "camera POS file does not exist" during SLAM data modeling in some cases;
- Fixed the problem that the point cloud after SLAM multi site match is displayed abnormally when the clipping tool is used;
- Fixed an automatic matching failure and no prompt message during height matching.

Others:

- Fix the relatively large error of quadratic interpolation in geoid interpolation method;
- Fixed the problem that the anti-virus software displays error when using the software in some cases;
- Fixed the problem that the software cannot be registered in some cases;
- Fix the problem that software does not respond or crashes in some cases.

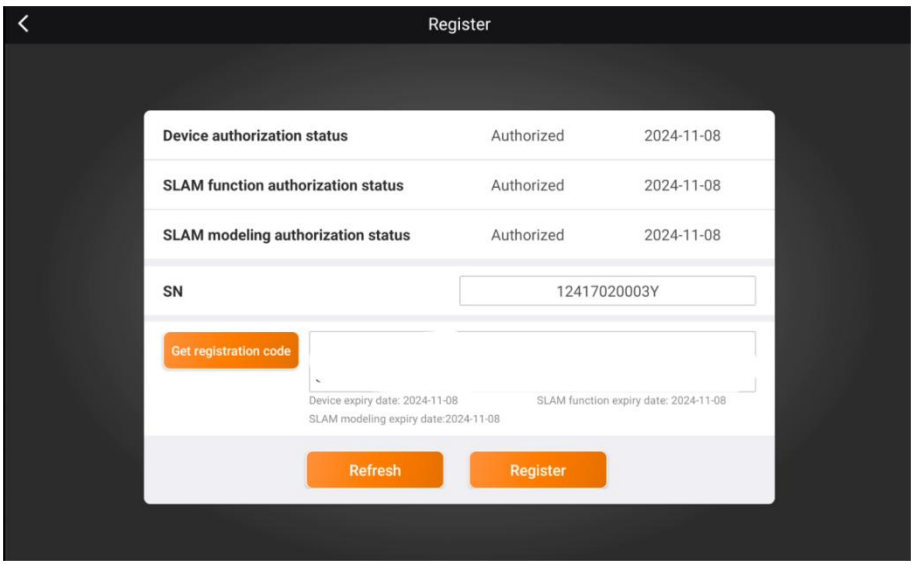
4. CoPre-2.8.6-20241010

New Functions and Improvements

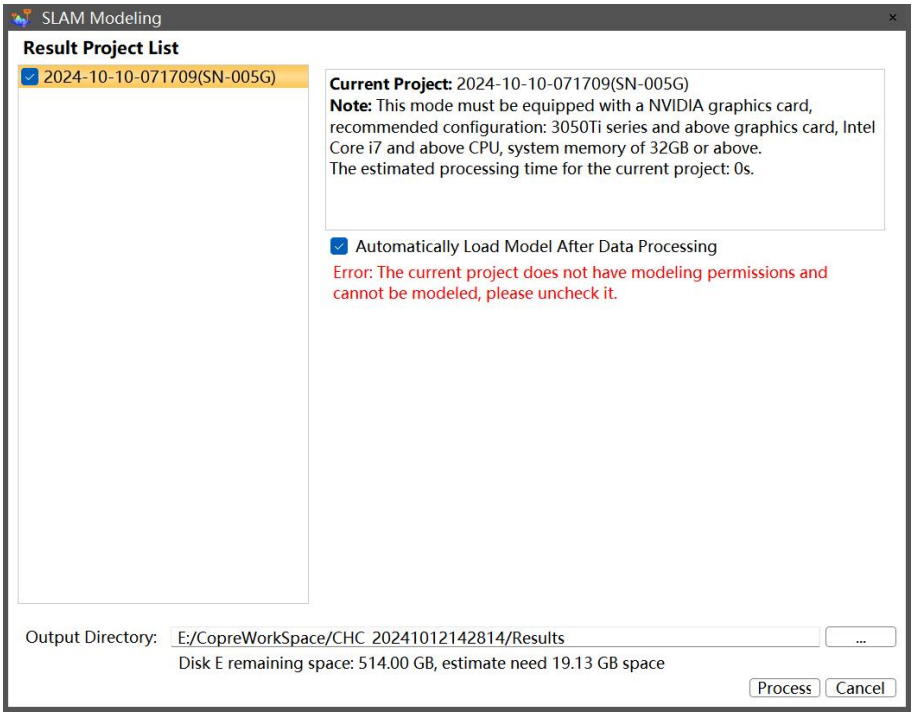
- Added SLAM modeling function;

Note: You need to enable the modeling permission for RS10 devices in SmartGo software. Only after the permission is enabled can the collected data be used for modeling. SmartGo needs to be updated to version **1.3.2.1**, and the firmware version of RS10 needs to be updated to version **1.4.1**.

Authorization in SmartGo:

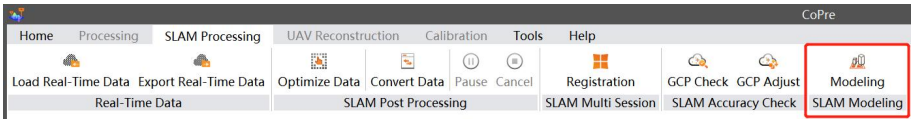


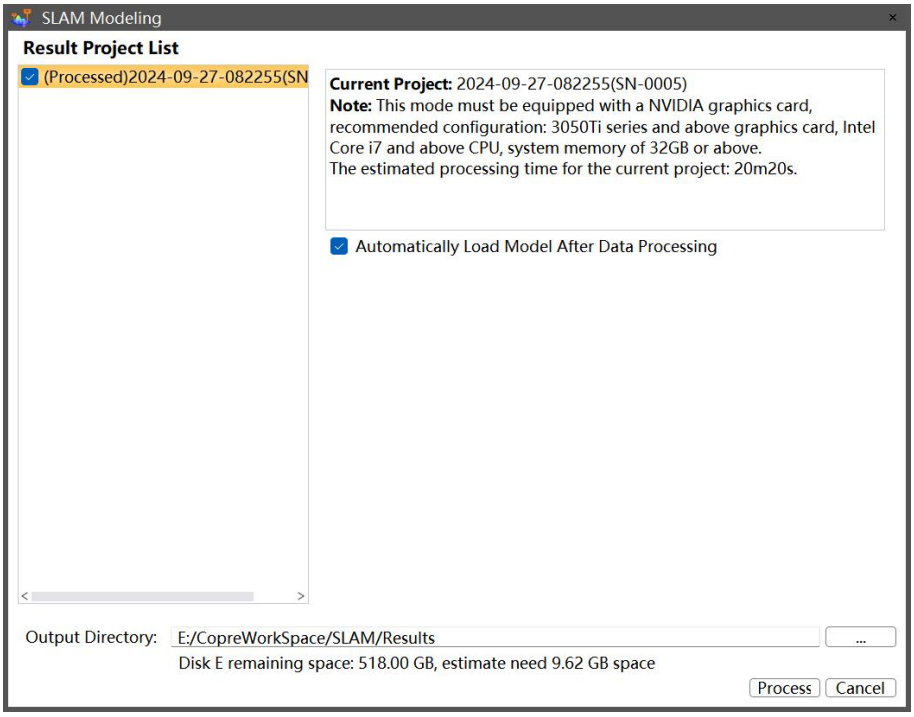
When modeling with data collected when SmartGo modeling is not authorized, the software prompts that there is no permission:



- SLAM modeling menu:

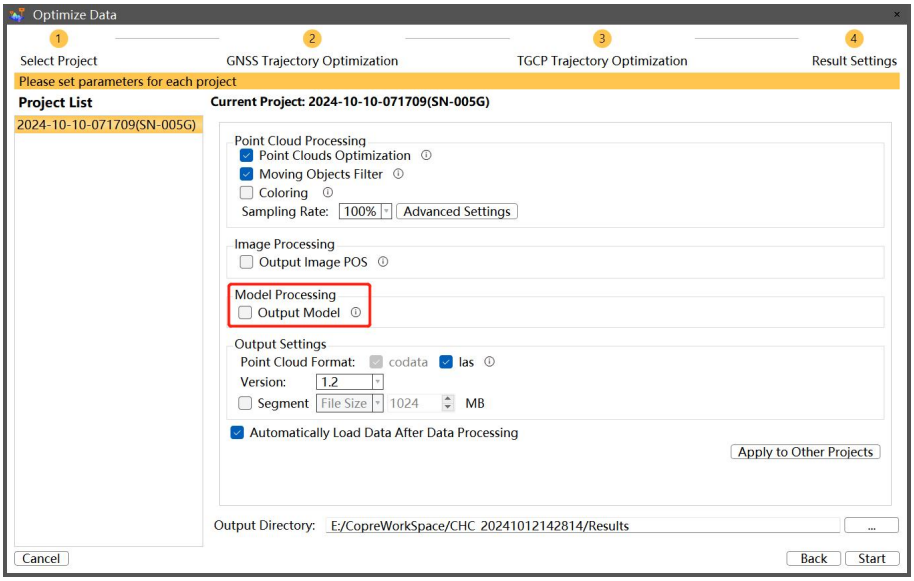
Note: Modeling requires the results of the project to output image POS.





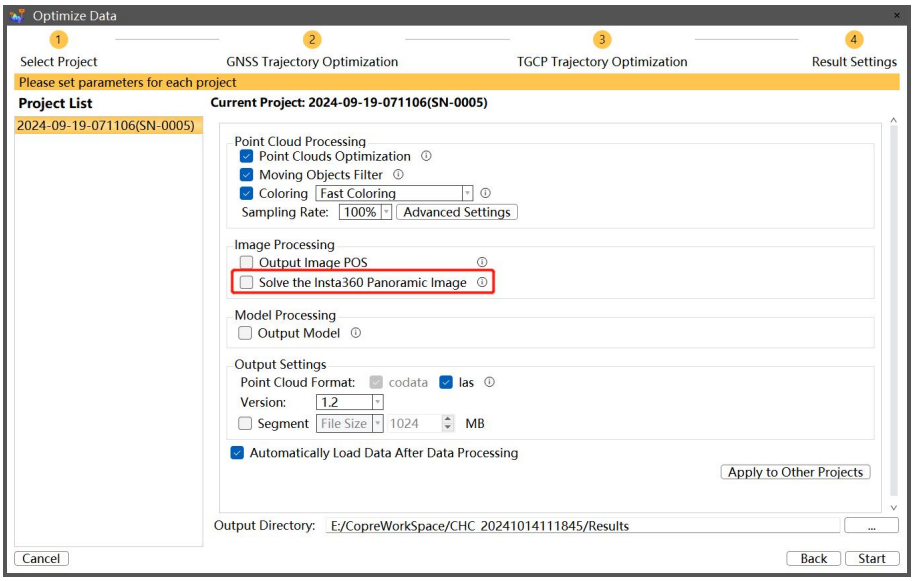
➢ SLAM modeling in optimization interface:

Note: Modeling requires the results of the project to output image POS.

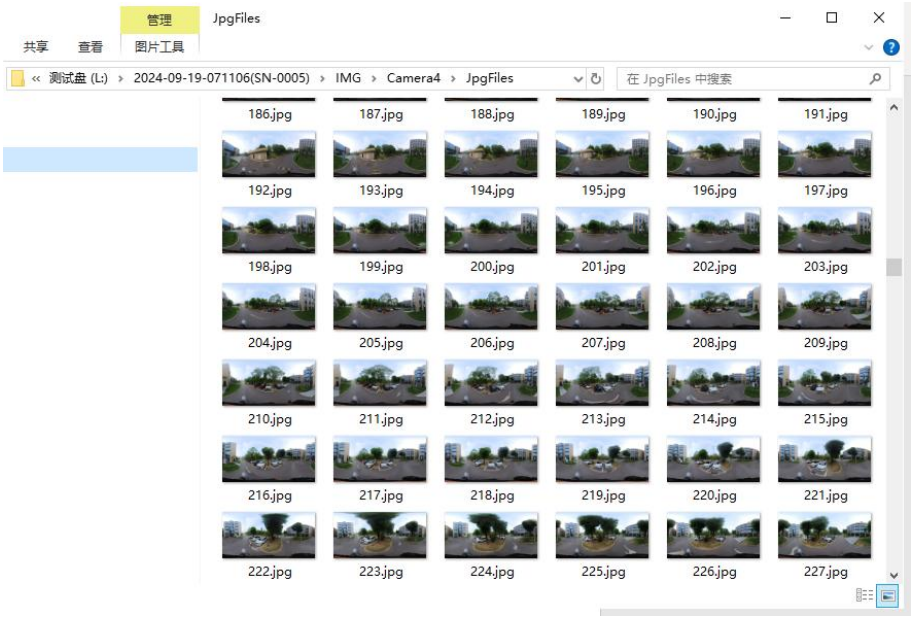


➢ Model example:

- Supports processing of data collected by RS10 with Insta360 camera. CoPre can export panoramic images and camera POS, also supports panoramic images displaying together with point cloud;

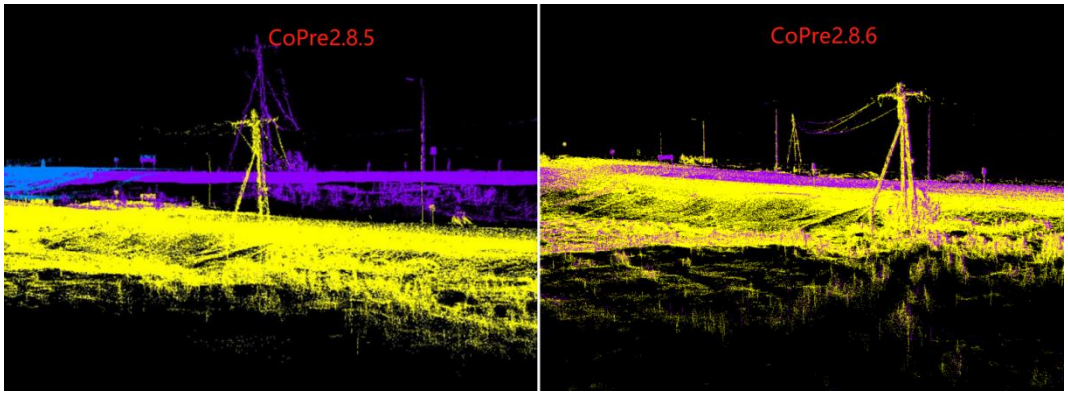


➢ Storage path of processed panoramic images: in Camera4/JpgFiles folder of raw project.

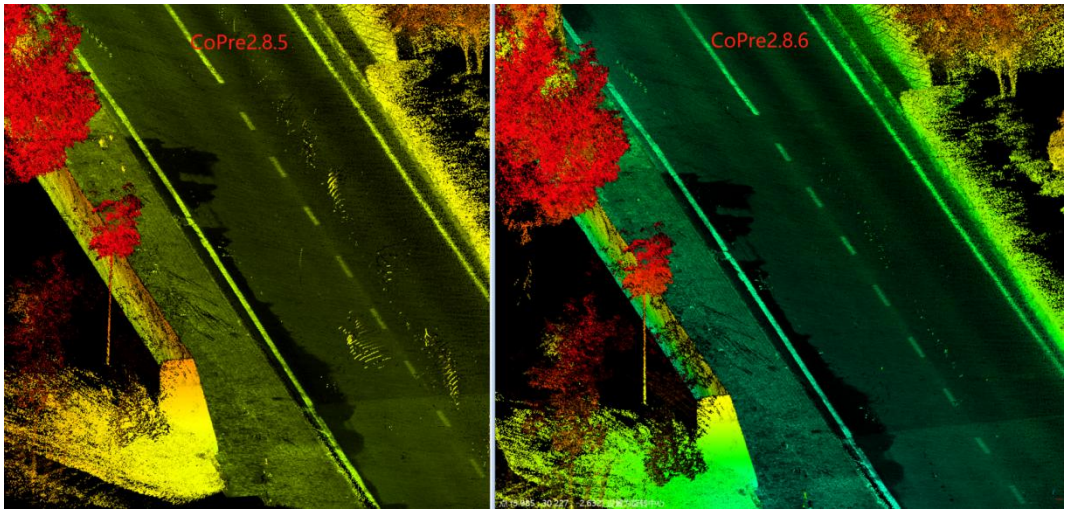


- Panoramic images display with point cloud:

- Optimized of SLAM related algorithms;
  - Fixed the issue that multiple projects have misalignment after SLAM optimization in some scenarios.

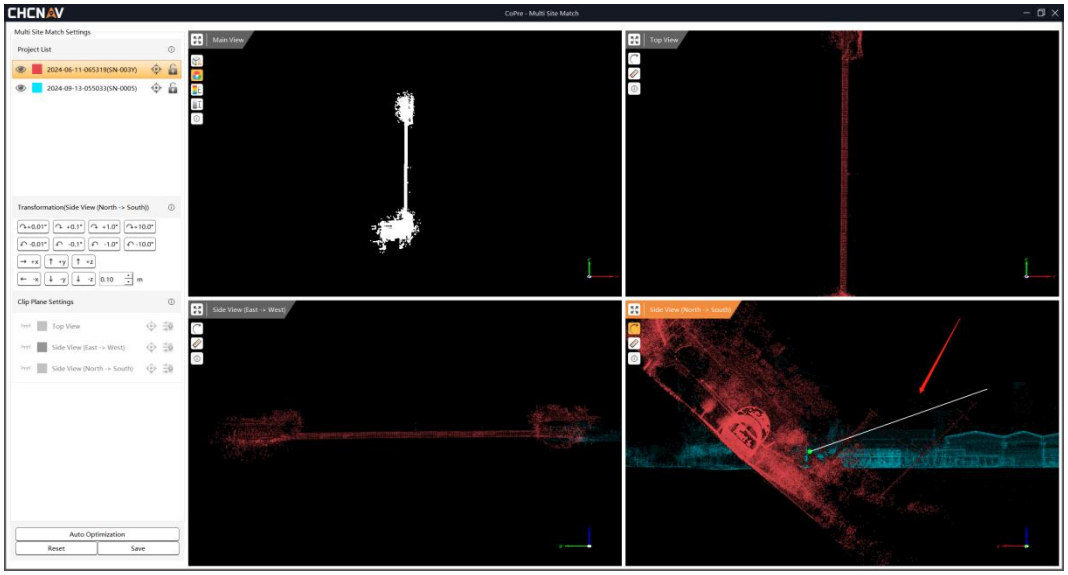


- Fixed the issue that point loud has misalignment when RS10 collection without loops or in long straight trajectory scenarios.
- Optimized the pedestrian filtering algorithm to filter dynamic objects better.



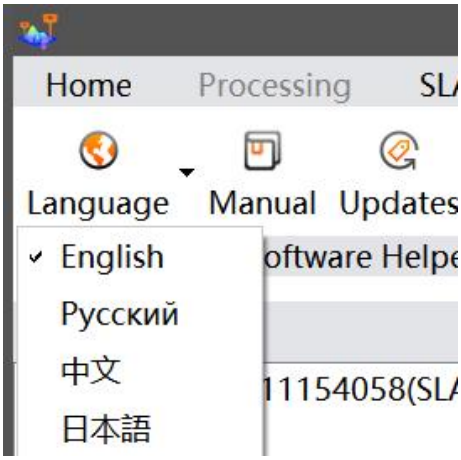
- Improved the TGCP optimization accuracy, and the accuracy is improved by 1 cm.

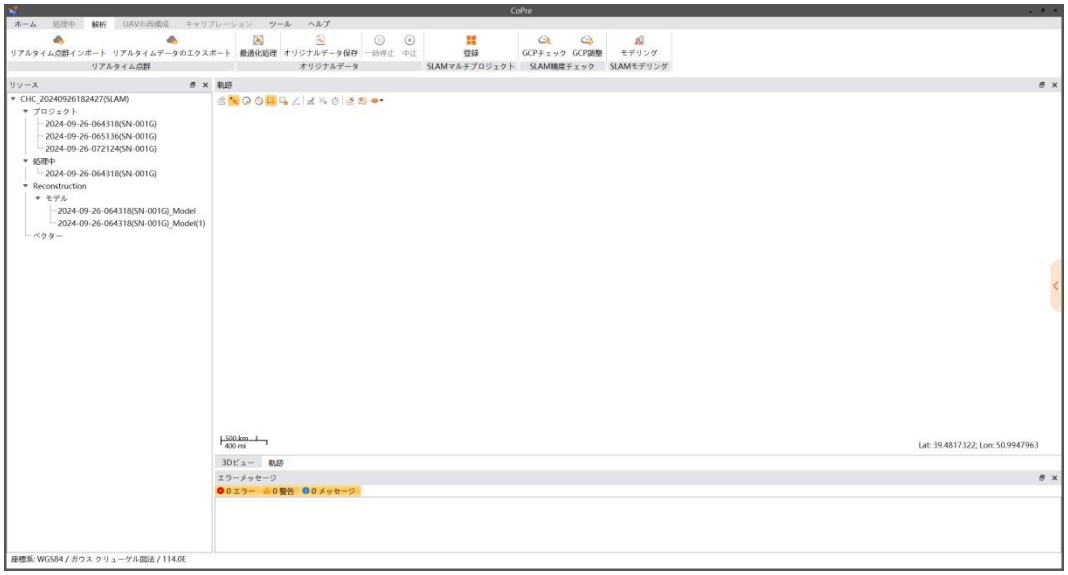
- Optimized the multi-session function;
  - Updates the POS when saving point cloud result after multi-session processing;
  - Added shortcut keys for point cloud rotation;



- Optimized the shortcut key rotation operation of the clipping plane in the section view.

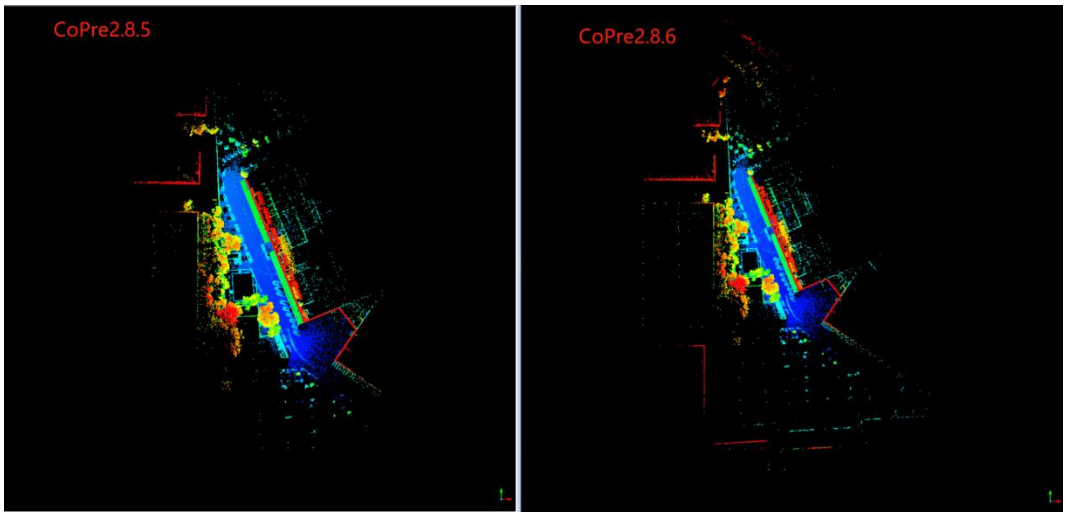
- Supports using software without administrator privileges. CoPre logs will be saved to the path: C:\Users\Public\Documents\CoPre\Logs;
- Supports Japanese language.



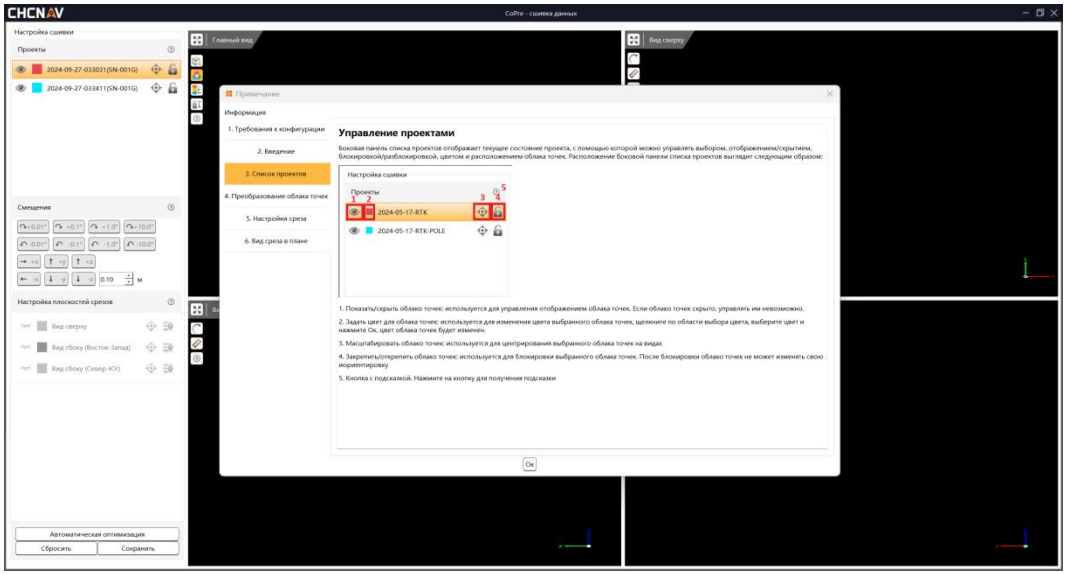


Bug Fixed in CoPre 2.8.6

- Fixed the issue that point cloud has no coordinate system information in Las file after SLAM optimization;
- Fixed the issue of inaccurate distance measurement of multi-session splicing in some cases;
- Fixed the issue of POS solution failure of P60+DG6Pro data in some cases;
- Fixed the issue that the SLAM data did not check the 3D distance filter but actually used the default parameter to filter;



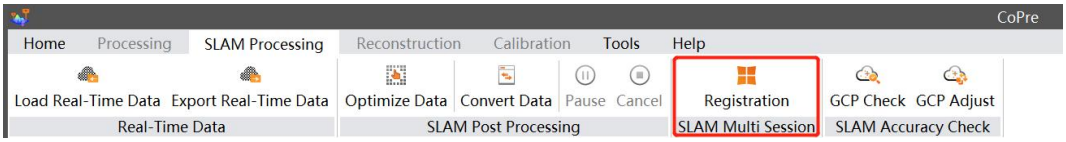
- Fixed the issue that CoPre lacked instructions for multi-session splicing in the Russian interface.

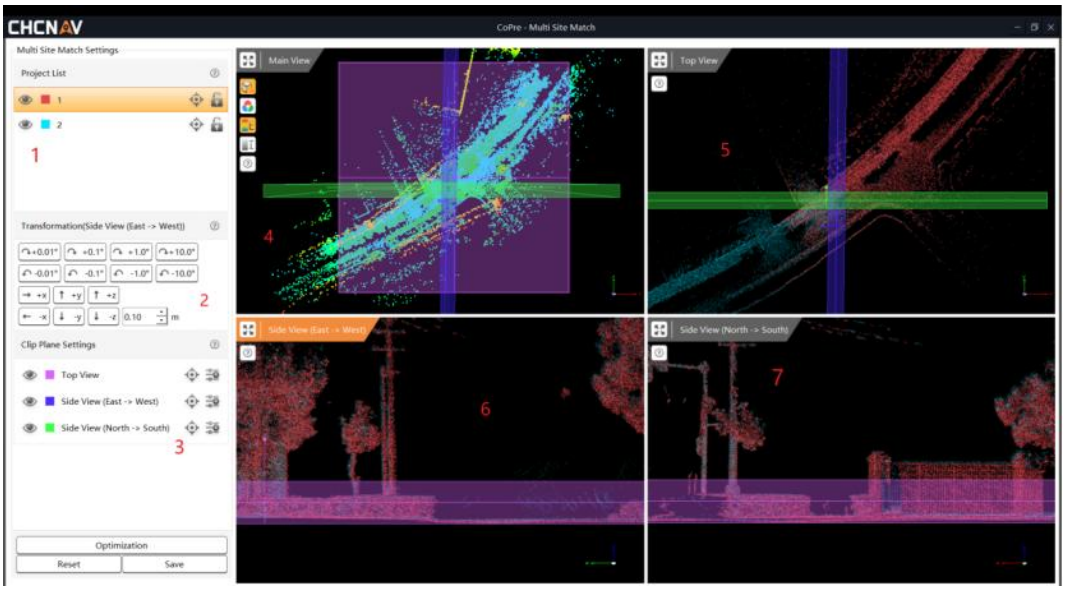


5. CoPre-2.8.5-20240902

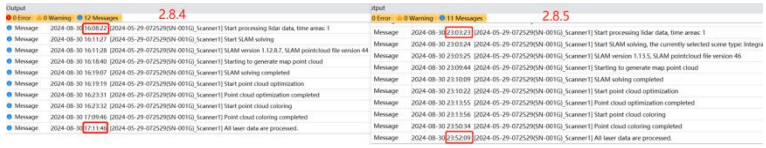
New Functions and Improvements

- Added Multi Site Match for SLAM processing, supporting manually match and automatically match. It can improve the layering problem between multiple projects.

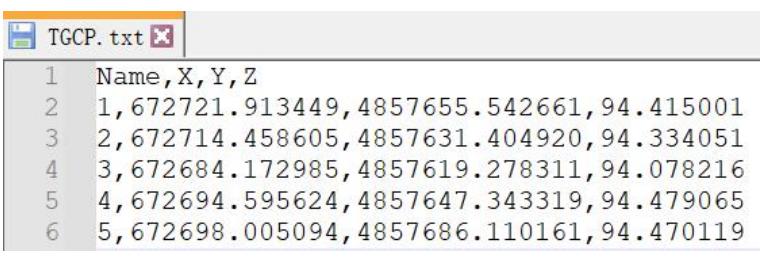




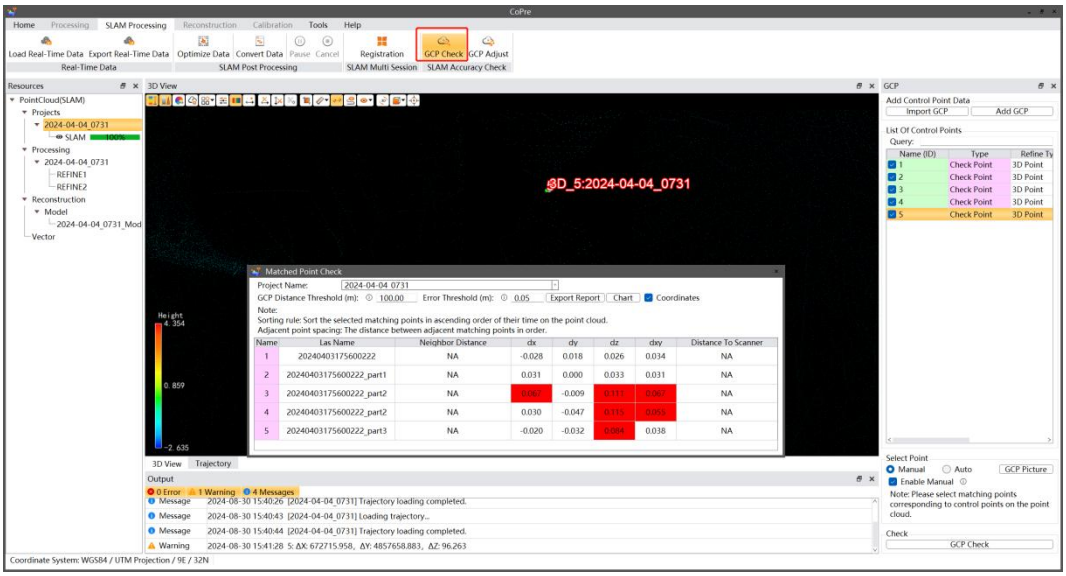
- Optimized the HPC coloring function, which is more efficient and has clearer textures.



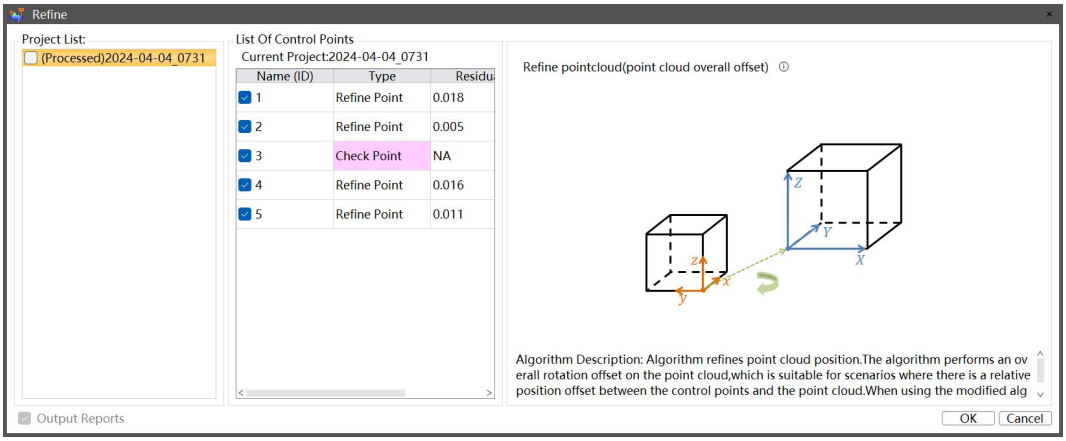
- Supports exporting TGCP file, which name is “TGCP.TXT”.



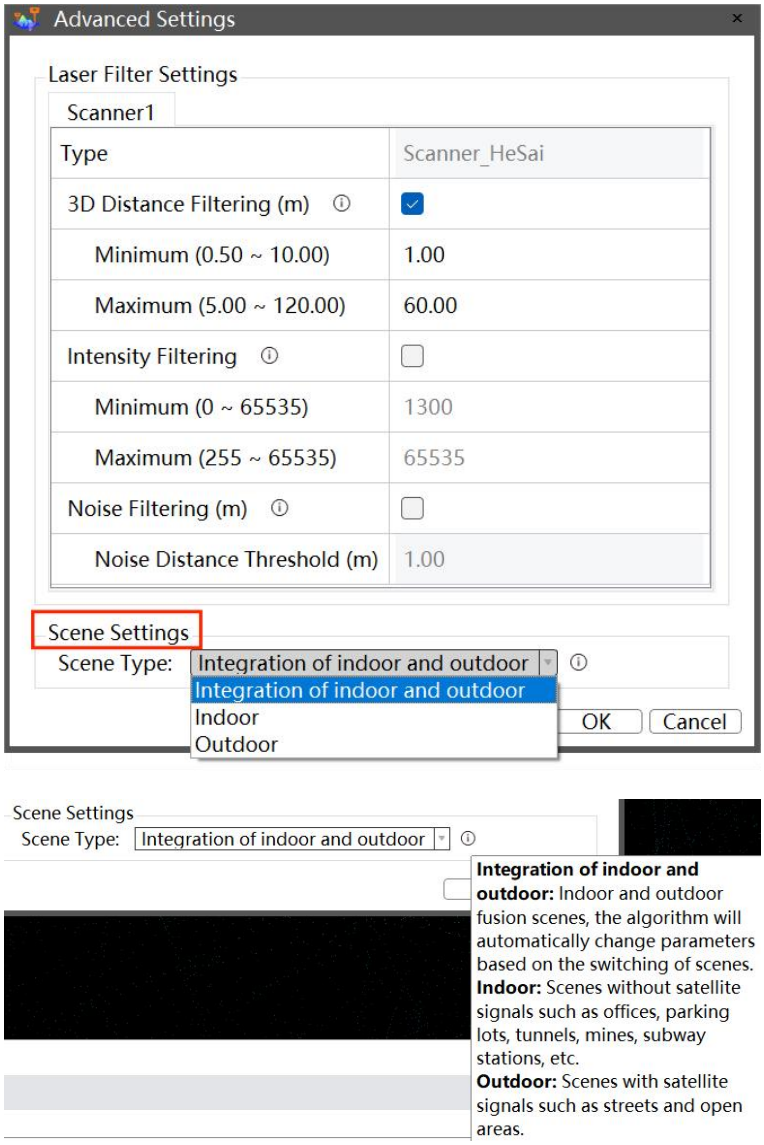
- Added GCP check function for real time point cloud.



- Added residual display in GCP Adjust interface.



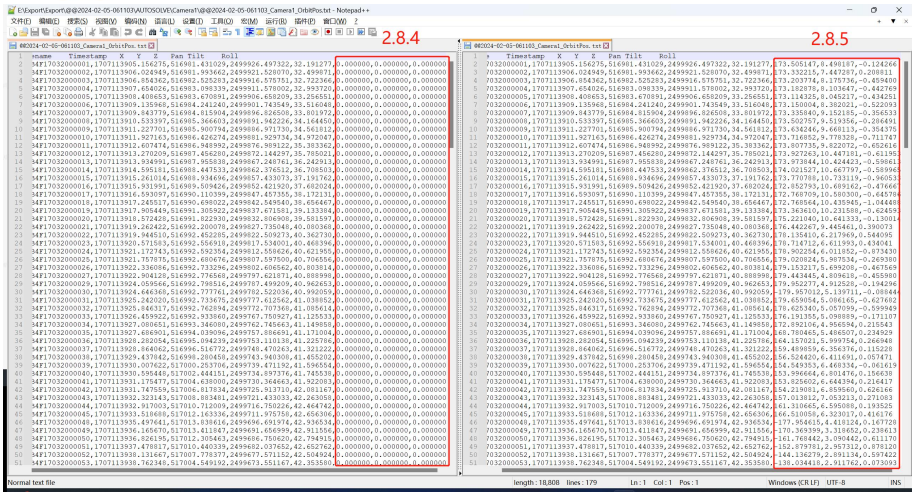
- Added scene selection in advance settings, including Integration of indoor and outdoor, indoor, and outdoor.



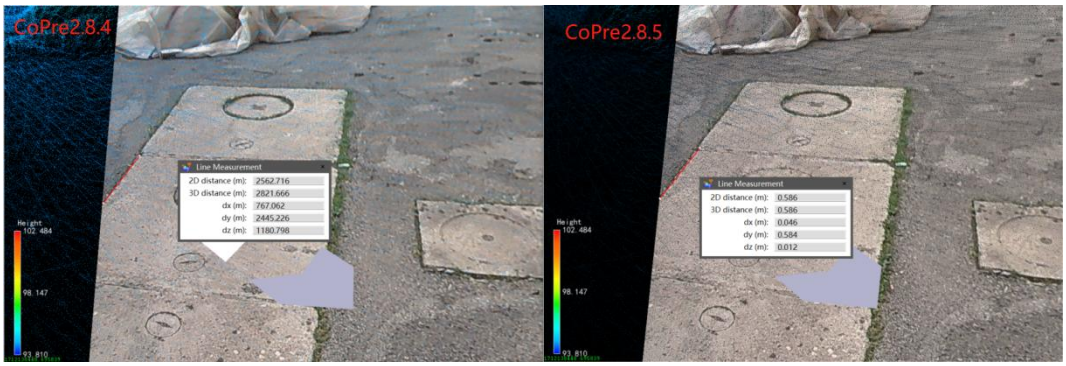
- Supports the network doogle, which means computers in the same LAN can share the network doogle permissions and use the CoPre.
- Added the function of showing/hiding TGCP in 3D view.

Bug Fixed in CoPre 2.8.5

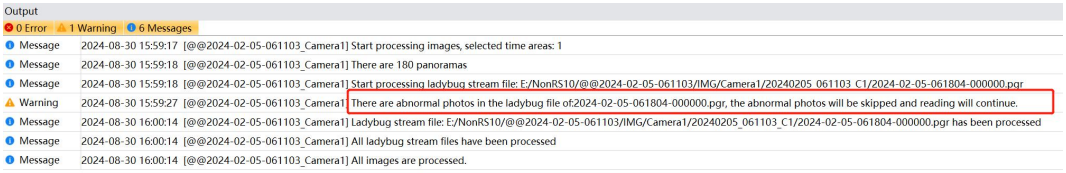
- Fixed the issue that doogle cannot be recognized when the registration code expired.
- Fixed the issue that the values of OMEGA, PHI and KAPPA in the metashape.txt file are all 0 when exporting the image data.



- Fixed the issue that inaccurate distance and area measurement when displaying images and point clouds in 3D view at the same time.



- Fixed the problem of abnormal progress bar display during multi-project processing.
- Fixed the problem that the number of LAS files after exporting results is inconsistent with the number of LAS files recorded in the KML file in the same directory.
- Fixed the problem of abnormal display of connection points in AT reports.
- Fixed the issue that Ladybug file processed failure due to abnormal images.



6. CoPre-2.8.4-20240710

New functions and Improvements

- RS10 coloration function adds High-Precision Coloring mode, which effectively improves the misalignment problem and provides better coloration effect. Changes: The old coloration mode is renamed as Fast Coloring.

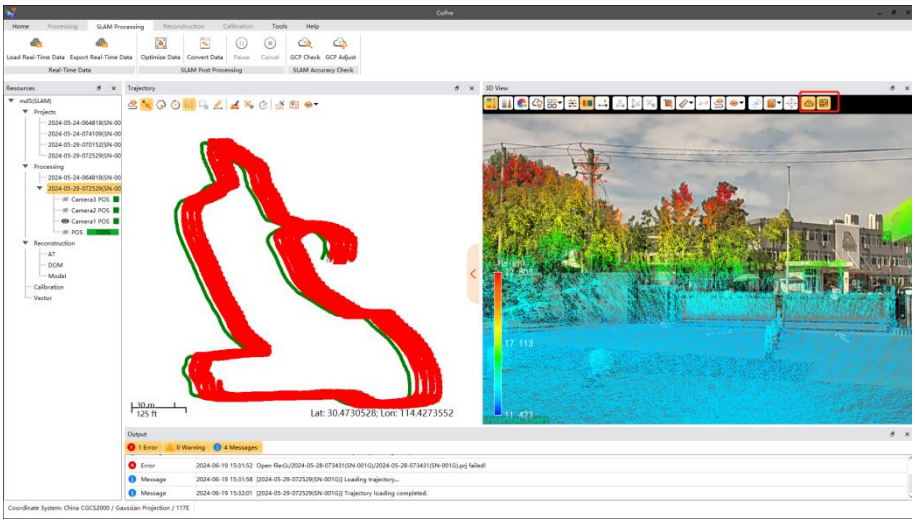
Bug Fixed in CoPre 2.8.4

- Fixed the issue of parts of real-time point cloud missing;
- Fixed the issue of some RS10 data accuracy optimization processing with thickness optimization checked stuck at 87%;
- Fixed the issue of RS10 point cloud has big misalignment when importing GGF grid files in coordinate setting.

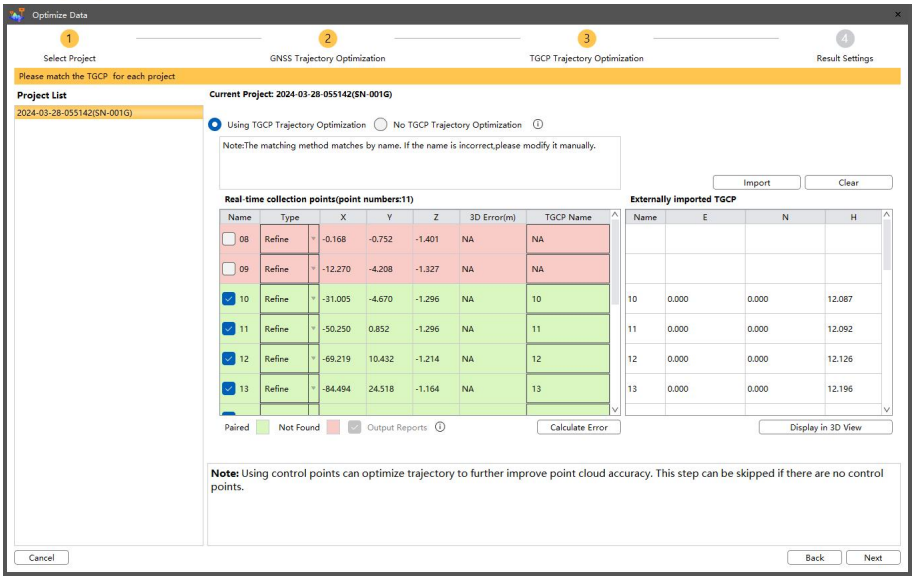
7. CoPre-2.8.3-20240620

New functions and Improvements

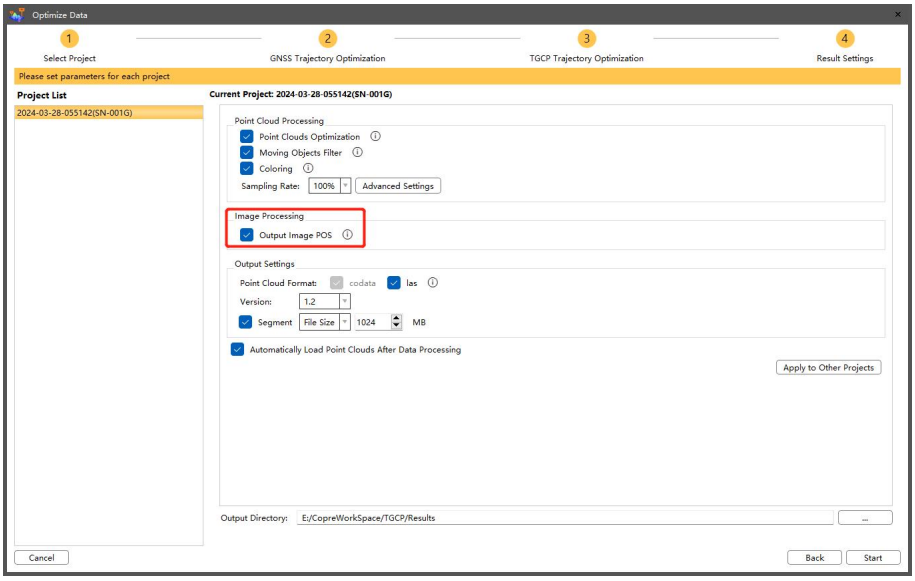
- Added camera POS output feature, which can be overlaid with point cloud for display and used for 3D modeling in third-party software;



- Optimized TGCP optimization function, allowing for the setting of refine/check types, and supporting the output of refine reports and check reports;

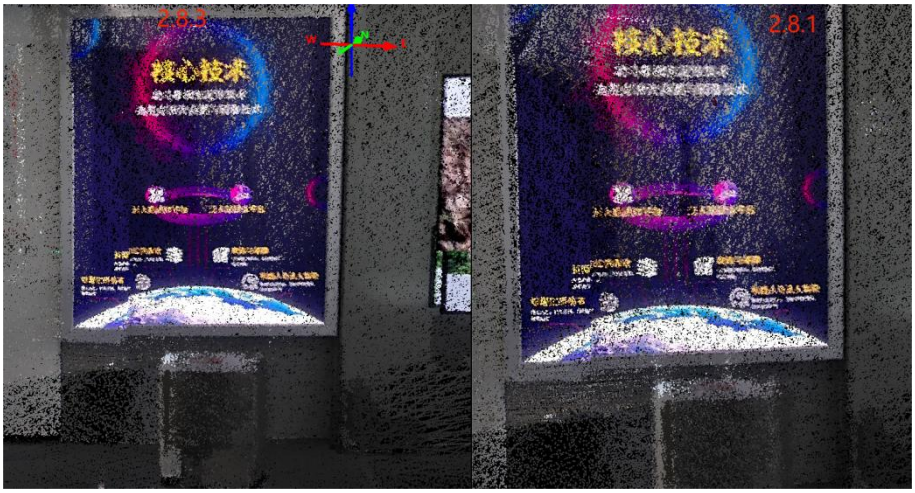


- Supports the image solution function for the new version of RS10 firmware 1.2.7 and above;

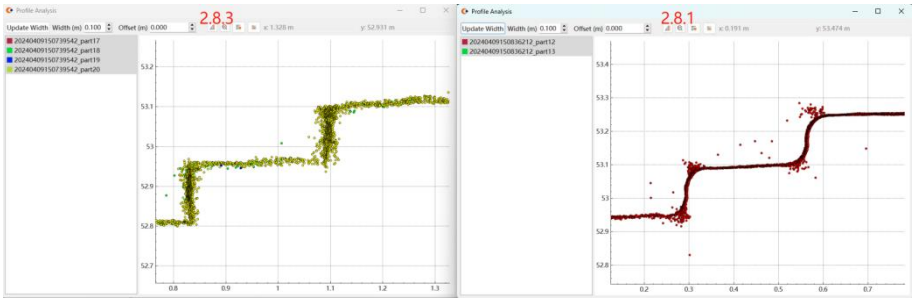


Bug Fixed in CoPre 2.8.3

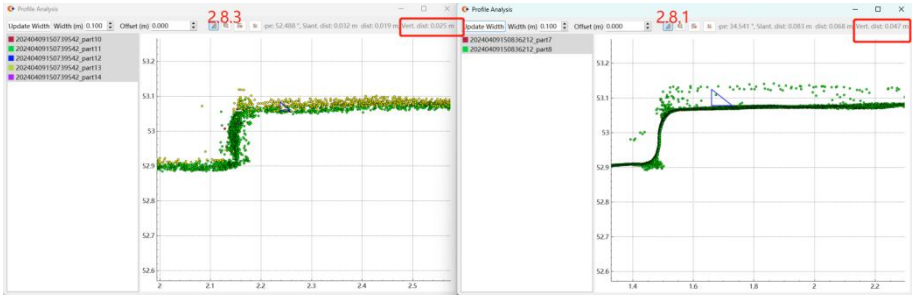
- Updated colorization algorithm to optimize the clarity issue of RS10 point cloud coloring;



- Updated thickness optimization algorithm to address the issue of non-right angles after RS10 point cloud thickness optimization;



- Updated PPK algorithm to optimize the layering issues of RS10 point cloud;



- Updated SLAM algorithm to improve the processing efficiency in high-quality mode, with the default use of high-quality mode processing.

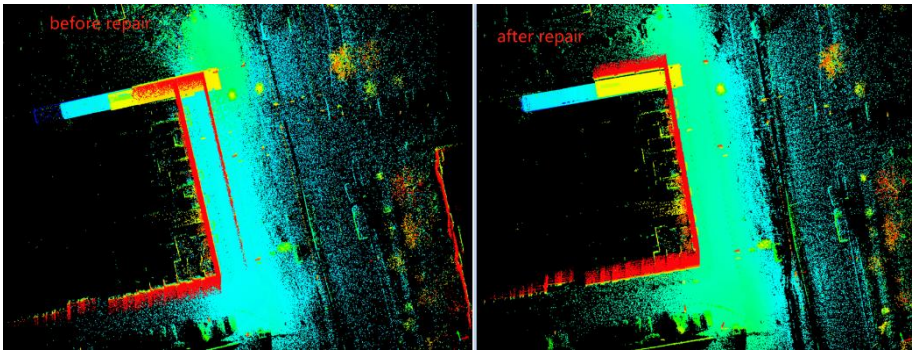
8. CoPre-2.8.1-20240517

New functions and Improvements

- Improved the effect of RS10 point cloud coloring.
- Improved the effect of RS10 real-time point cloud and accuracy optimization.
- Improved point cloud density of SLAM devices(The density level is increased, and the balanced mode is equal to the previous high quality).

Bug Fixed in CoPre 2.8.1

- Fixed the crash issue when loading real-time point cloud of RS10 in some cases.
- Fixed RS10 point cloud misalignment in some cases.

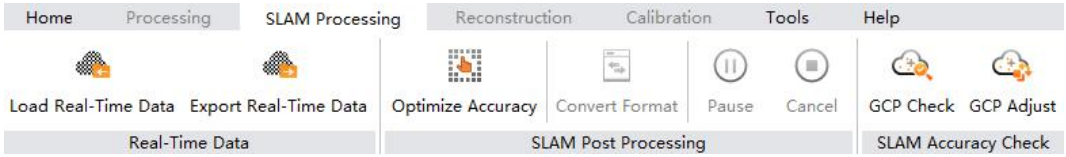


9. CoPre-2.8.0-20240420

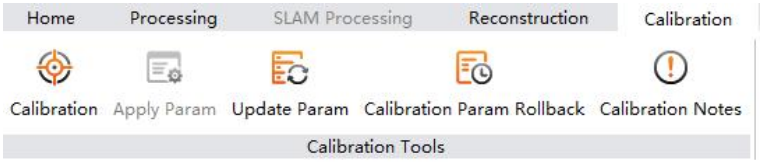
New functions and Improvements

- Added SLAM processing module for RS10.

Supports real-time point cloud browsing and export, accuracy optimization, GCP check and adjustment, format conversion and other processing of such data collected by RS10.

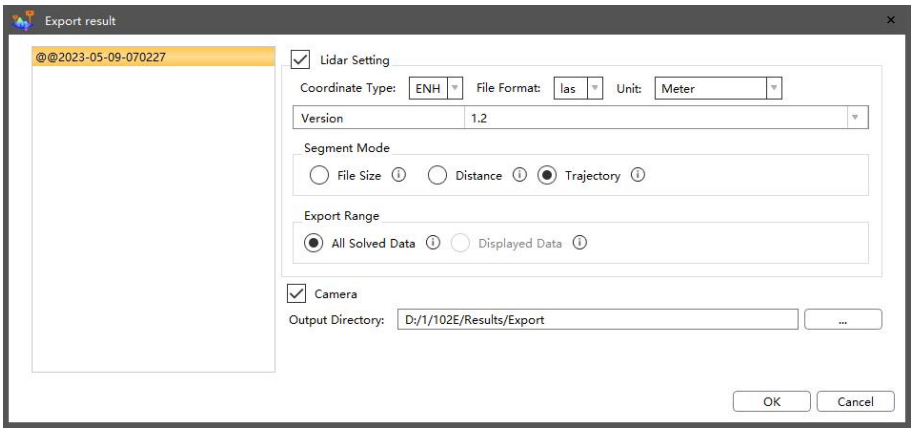


- Supports processing of data collected by AA9.
- Added calibration module which can automatically adjust equipment parameters.



Supports AA15, AA10, AU20, AU1300 surveying system calibrating, also supports when C5 or C30 camera mounted on them.

- Added segment option when exporting point cloud result.



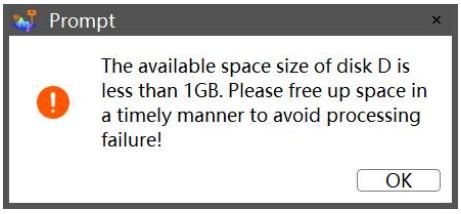
Supports point cloud segment according to file size, distance or trajectory.

Distance: The point cloud will be segmented according to the set trajectory distance. The default value is 300 meters. It means exporting point cloud one file every 300 meters.

Trajectory: The point cloud will be segmented according to the selected trajectories. It means exporting one point cloud file every trajectory.

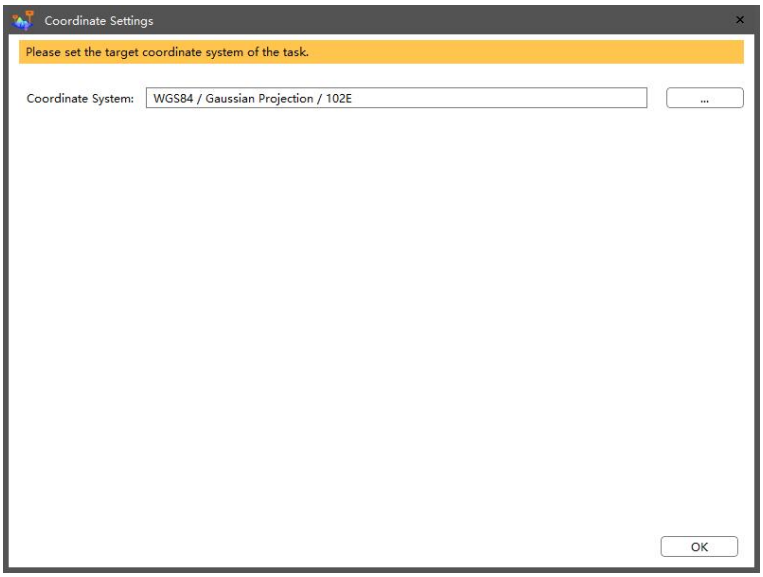
- Added the remaining disk memory check.

If the remaining disk memory is less than 1 GB during creating a new task or data processing, it will display a warning.



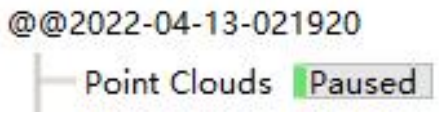
- Added coordinate system recommendation according to the position of project data.

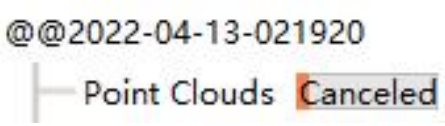
When creating a new project, it automatically recommends a coordinate system based on the first project data in the task. The recommended coordinate system is WGS84 ellipsoid and Gaussian projection.



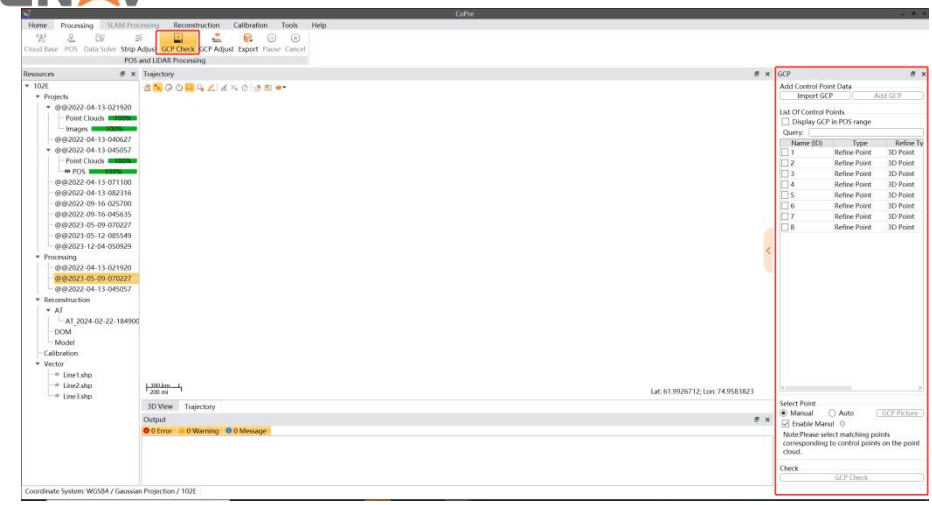
- Optimized the display of process bar.

The progress bar is now displayed in different colors when the process pauses, cancels, and fails.





- Adjusted the display of GCP check and adjustment window.



- Increased modeling computing capability, can support graphics cards with compute capability of 3.5 and above.
- Optimized some prompt and warning messages.

Bug Fixed in CoPre 2.8.0

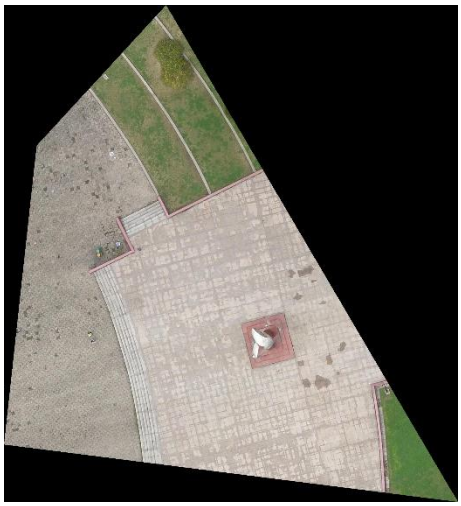
- Fixed the issue that “Adjust selected time areas” function did not take effect.
- Fixed the issue that MTA filtering may cause data misalignment in some scenarios.
- Fixed the issue that GCP coordinate coverts to the target CS incorrectly when importing WGS84 BLH coordinate.
- Fixed the issue that duplicate images caused aerial triangulation to fail.
- Fixed the issue that software can’t be opened in some Windows 7 systems.
- Fixed the issue that online map didn’t load properly sometimes.
- Reduced memory consumption and space occupation of C disk when modeling.
- Fixed the issue that camera POS generation failed when processing data collected by C30 mounted on M300.

10. CoPre-2.7.7-20240222

Bug Fixed in CoPre 2.7.7

- Fixed the data copy issue when AU10 is mounted on AP5 or AP5-L.
- Fixed the issue that the dongle was inserted indicating that there was no permission when the license of the reconstruction function expired.
- Fixed the issue that the Canadian list of the default coordinate system is empty in the coordinate settings.
- Fixed the issue that POS accuracy of AU1300 is poor in poor signal environment.
- Fixed the issue that there is no camera POS generated after strip adjustment then GCP adjustment.
- Fixed the issue that check point setting did not work when marking in reconstruction module.
- Fixed the issue that Aerial Triangulation failed sometimes when multi-project processing meantime.
- Fixed the issue that DOM built by model had a large black edge.
  Before repair：

After repair：



- Fixed the issue that parts of data modeling failed and progress bar was stuck.
- Fixed the issue that CoPre crashed when the last bit of the host IP address was 1 during

cluster modeling.

- Fixed the issue that CoPre crashed when building DOM in some cases.
- Changed the format of DOM built by model from *.tiff to *.tif.

11. CoPre-2.7.6-20231228

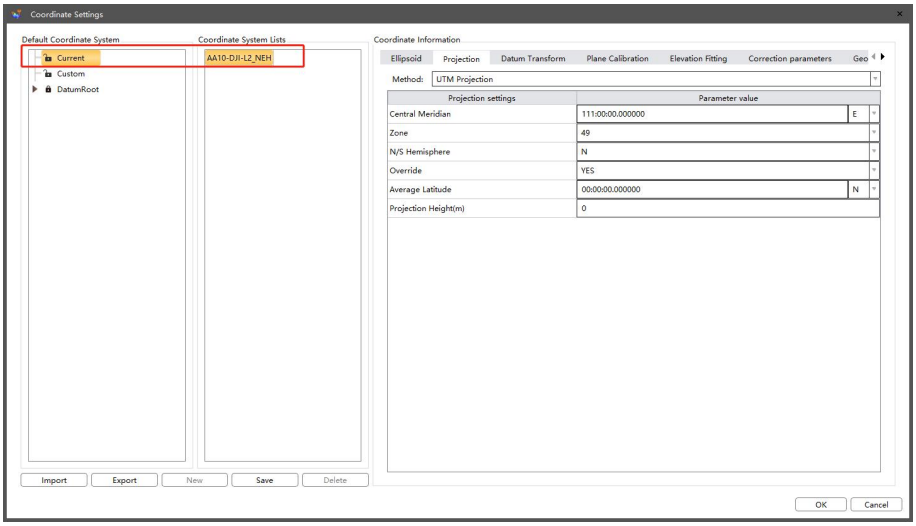
Bug Fixed in CoPre 2.7.6

- Fixed the issue that the strip adjustment did not work properly during AA10 data processing.
- Fixed the error of the CS Manager when converting geodetic coordinates to projection coordinates using four params.
- Fixed the issue of the CS Manager file recognition garbled characters which is non-utf-8 encoded with latitude and longitude symbol (° ' ").
- Fixed the issue that the AU10 V2 data cannot be copied.

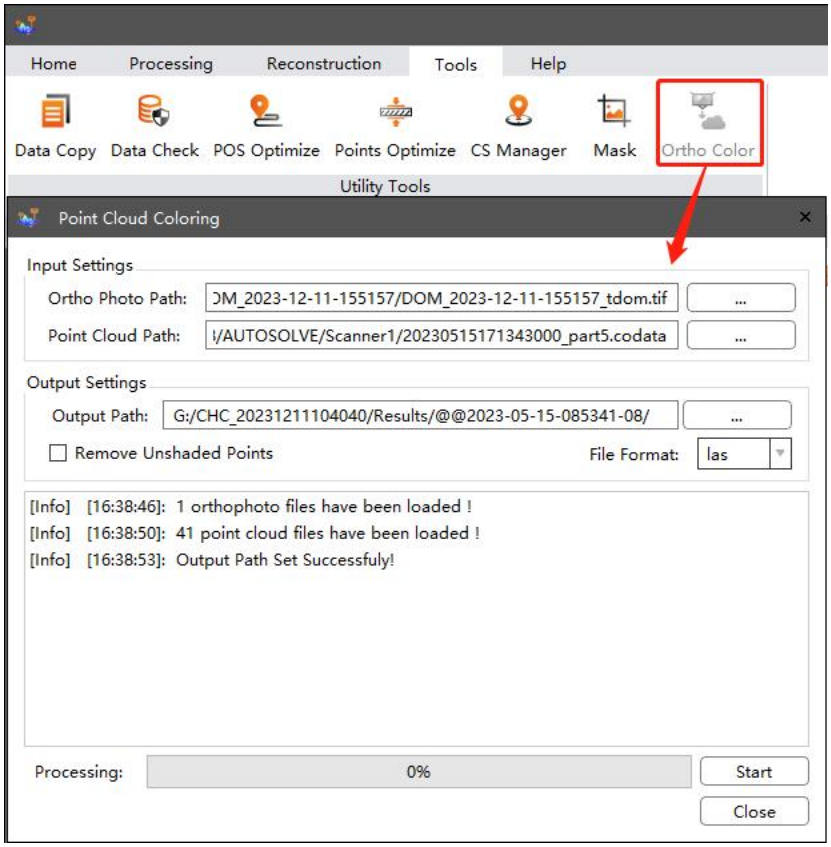
12. CoPre-2.7.5-20231219

New Functions and Improvements

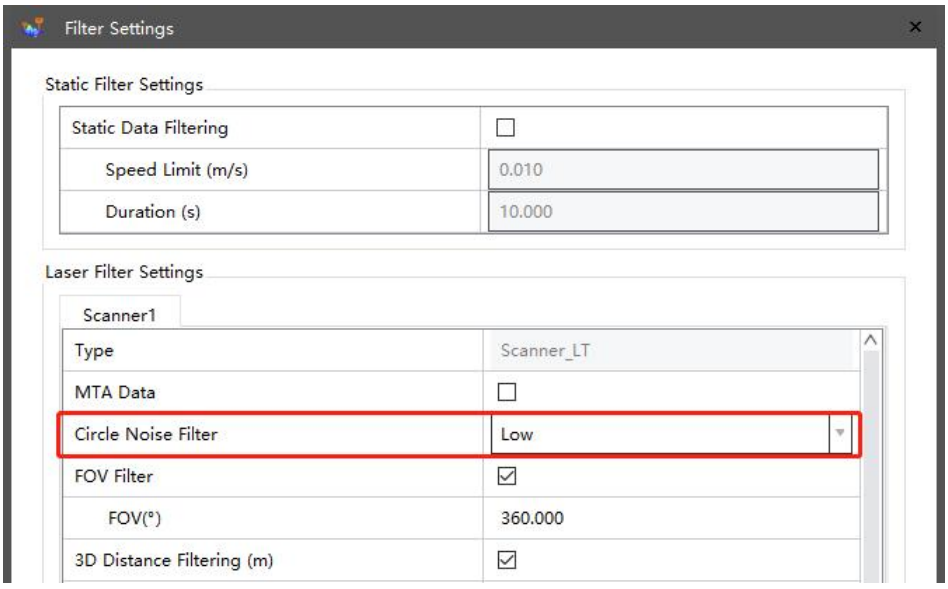
- Added the display of the current project coordinate system in the coordinate system settings interface. When creating a new task, the coordinate system settings will not default to retaining the settings from the previous task.

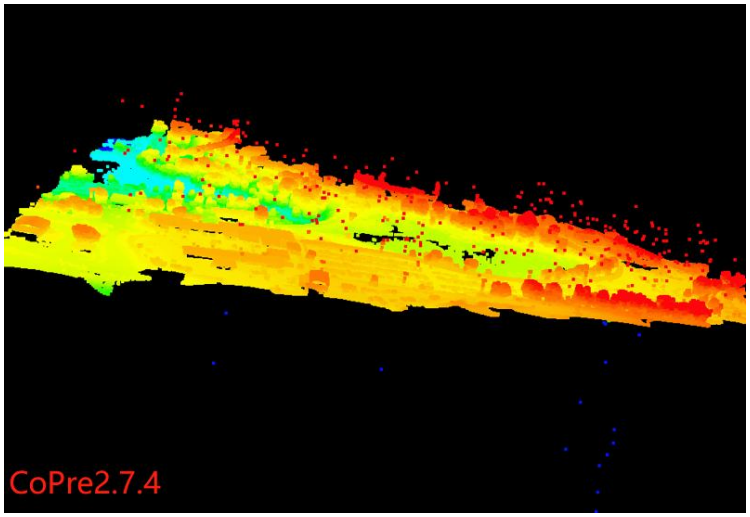


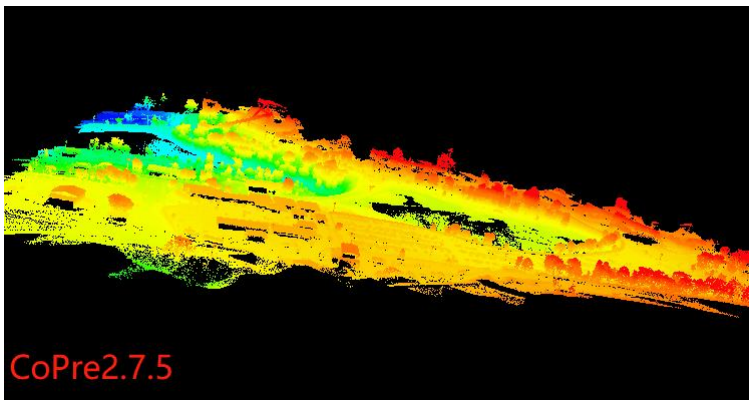
- Added the new function of coloring the point cloud with DOM. Users only need to input DOM and projected coordinate point clouds from the same location to coloring the point cloud with DOM.



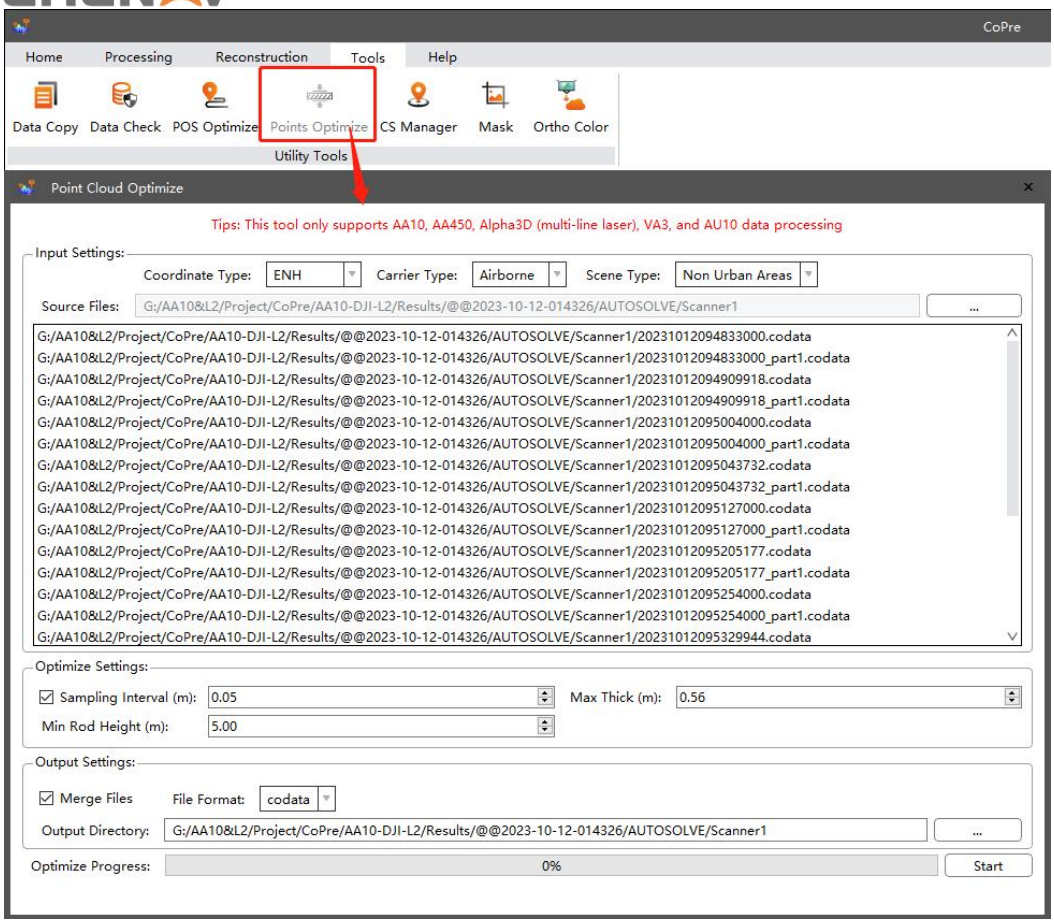
- Support enabling ” Circle Noise Filter” settings without using MTA to solve the issue of excessive noise in point cloud processing of partial data.



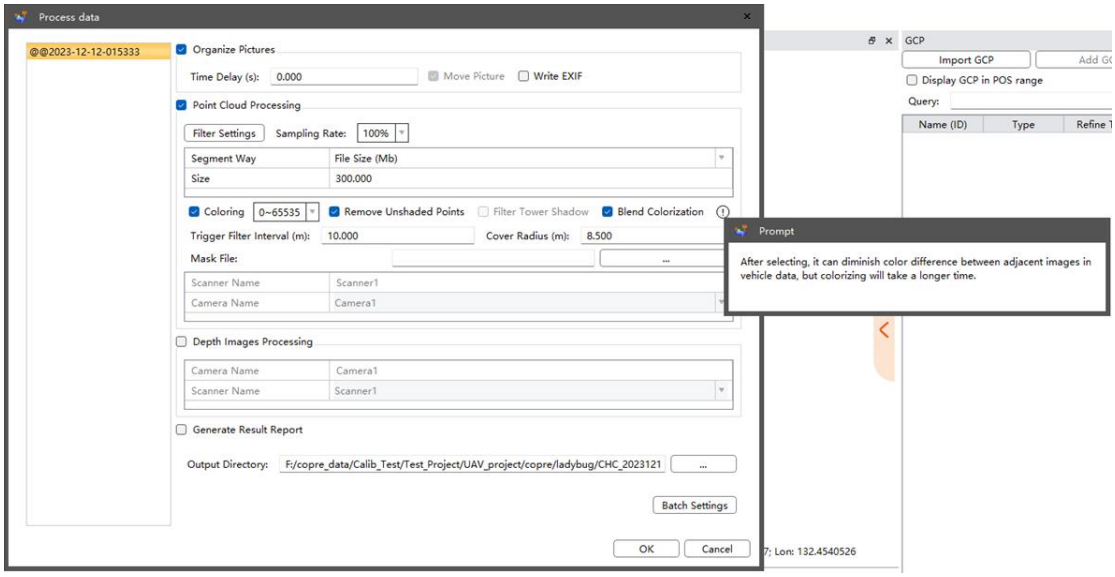


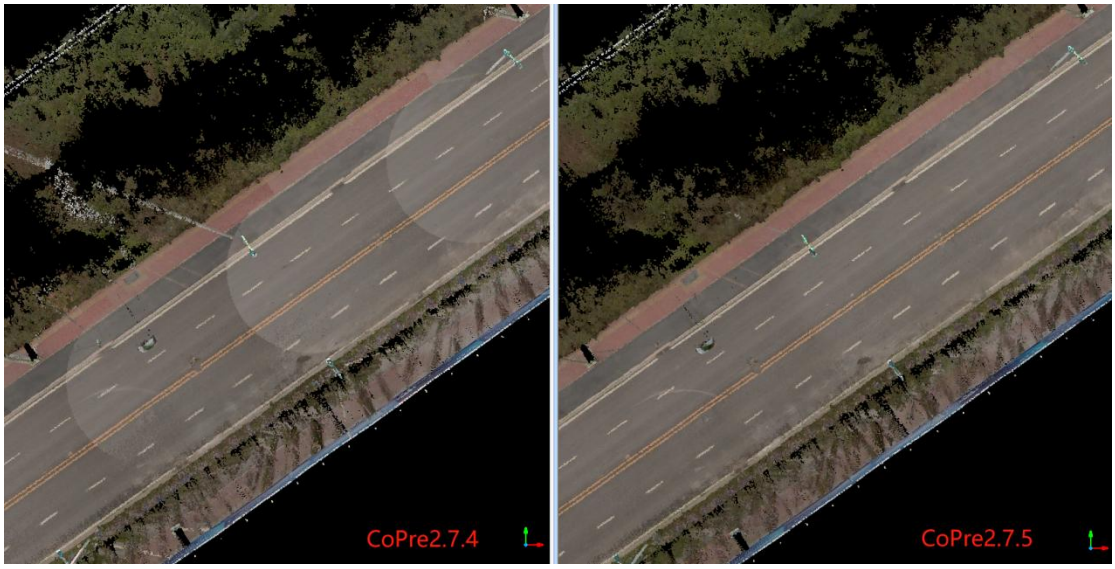


- Support the thickness optimization of data collected by AA10, and the average thickness of the optimized point cloud is within 2cm.



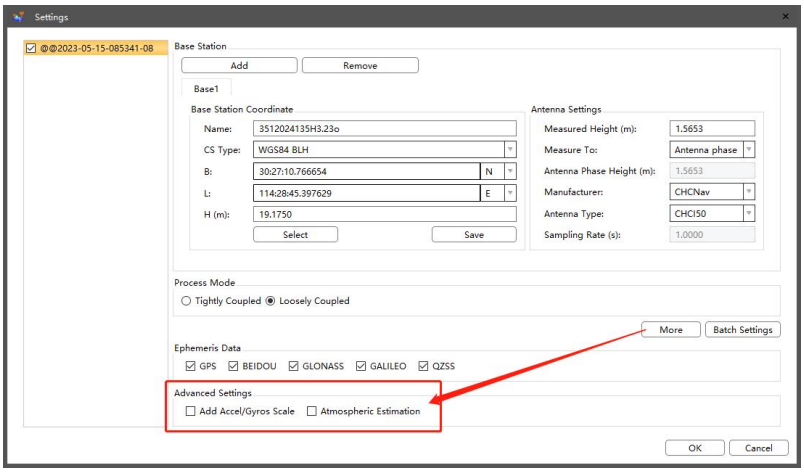
- Optimized the memory usage of the adjustment algorithm. Solved the problem of software crash caused by excessive data.
- Added the function of smoothing light and color to optimize color differences of colored point clouds in vehicle-mounted mode.



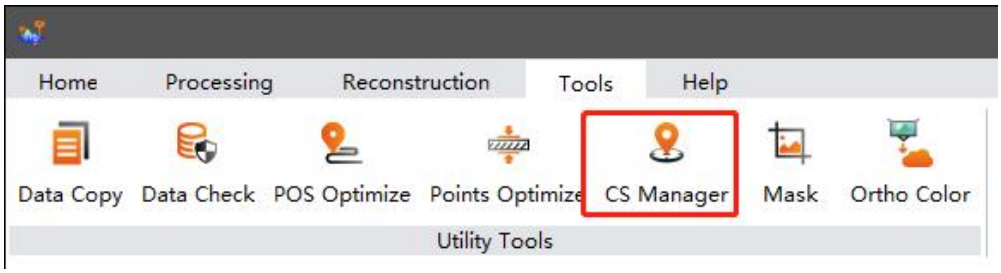


- Added advanced Settings during Pos processing, to solve the problem that the accuracy of POS is not enough in some cases.

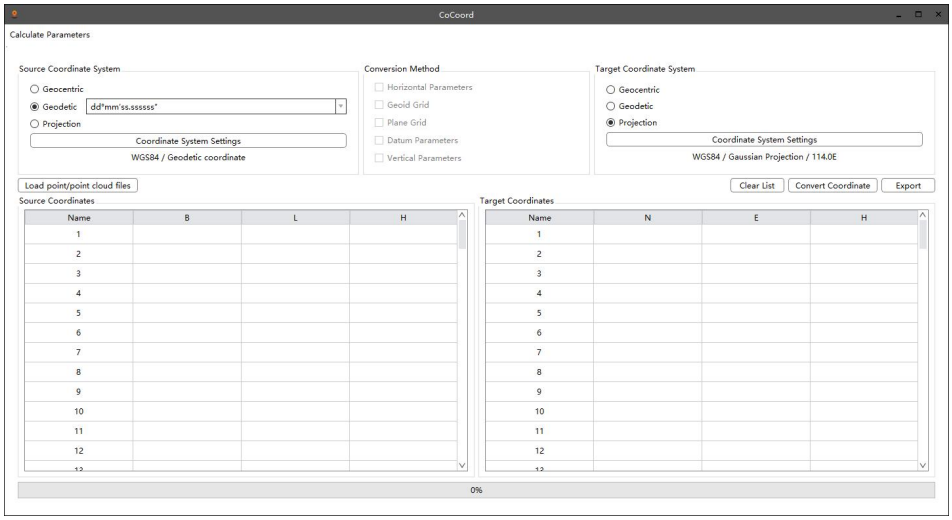
- Add Accel/Gyros Scale: Enabling this setting can solve the errors calculated by the IMU.
- Atmospheric Estimation: If the base station is far from the survey area, it is recommended to enable this setting to improve pos accuracy.



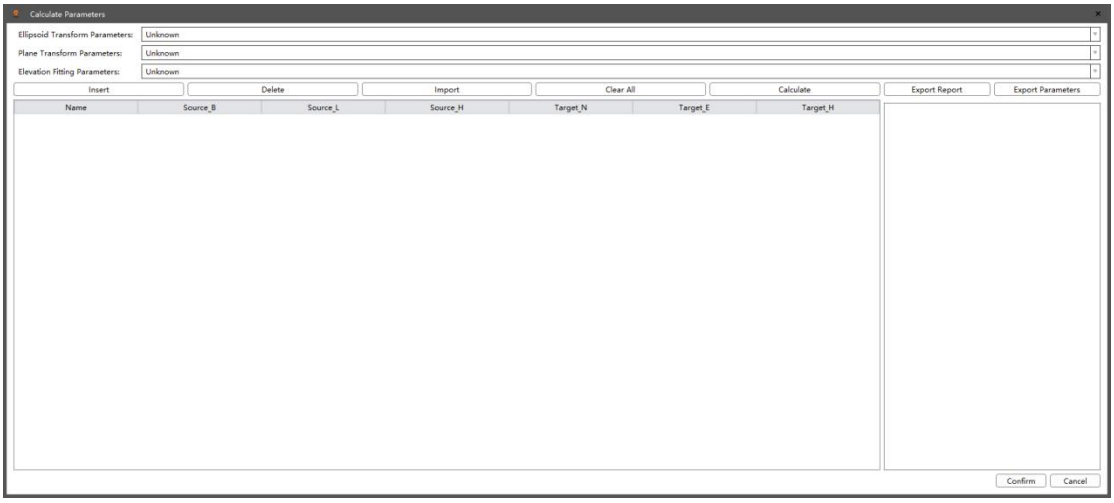
- Added English and Russian versions to the trial registration page's verification code SMS/email. The software will send the verification code in the language currently used in the CoPre.
- Optimized the interface, coordinate conversion algorithm logic, and operational steps of the coordinate conversion tool.



- Support importing batch point or point cloud files for conversion.

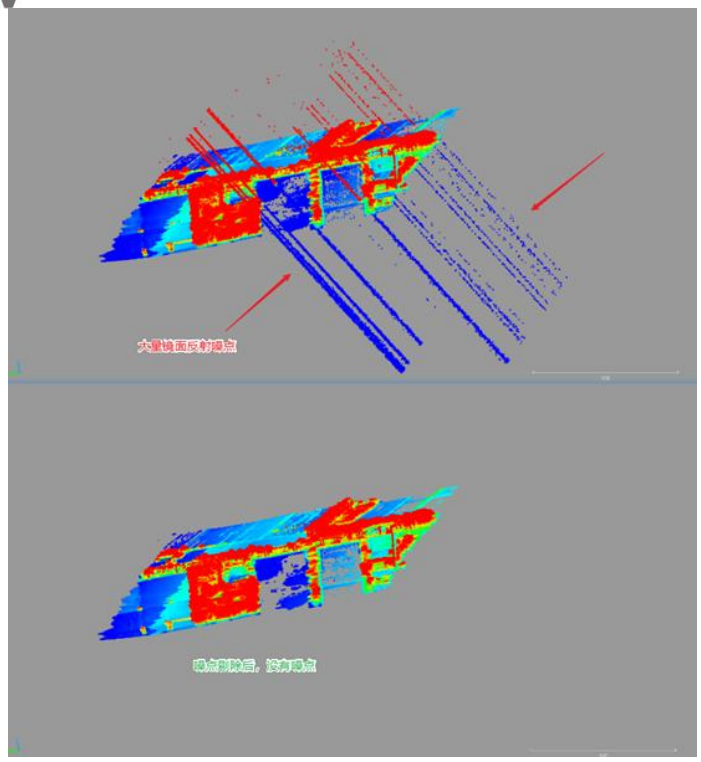


- Support to choose different ellipsoids for the projected coordinate conversion.



Bug Fixed in CoPre 2.7.5

- Fixed the issue in AA10 data where specular reflection noise occurred in areas with direct sunlight.



- Fixed the issue where meters were still displayed in some functions when the unit was selected feet during data processing .
- Fixed the issue where the software sometimes reported “POS interpolation failed” error when processing data in batches.
- Fixed the issue of incorrect display of base station coordinates near -0° in the southern hemisphere .
- Fixed the issue where when importing a range line with the same starting and ending points, the software failed to recognize the closure and could not control the modeling range.
- Fixed the issue that the trajectory was seriously deformed due to the long base line of the base station and only single frequency signal during some data calculation.
- Fixed the issue of severe trajectory distortion during POS processing of certain data due to long baseline and single-frequency signals in the base station.
- Fixed the issue of failure in adjusting vehicle-mounted data with longer mileage.
- Fixed the issue where POS accuracy was missing when there are multiple instances of 9999 in the base station coordinates.
- Fixed the issue where POS algorithm filtered the beginning of the static part, leading to a

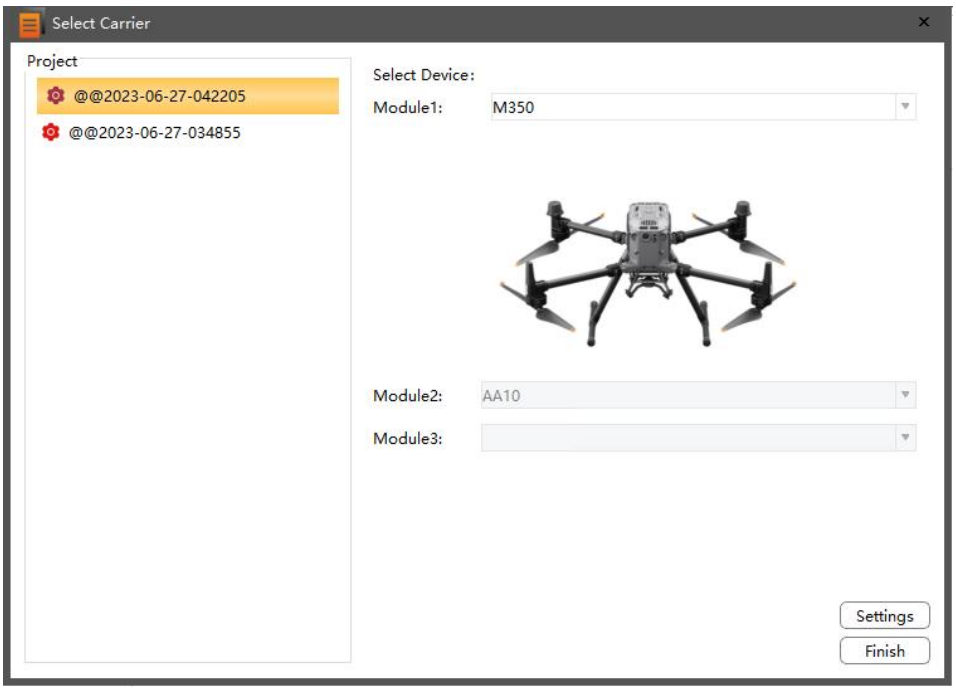
failure in calculating the camera POS during photo processing.

- Fixed the issue of software crashing when processing partially corrupted AU20+AP5 raw data .

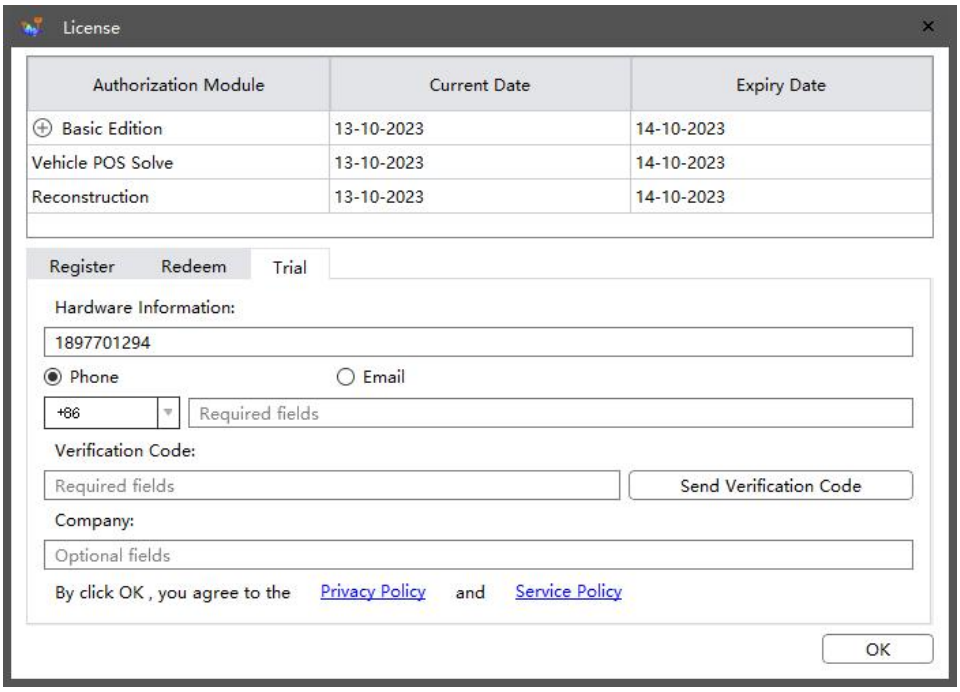
13. CoPre-2.7.4-20231024

New Functions and Improvements

- Carrier options now include the M350 drone, support copying data collected by the M350 drone.



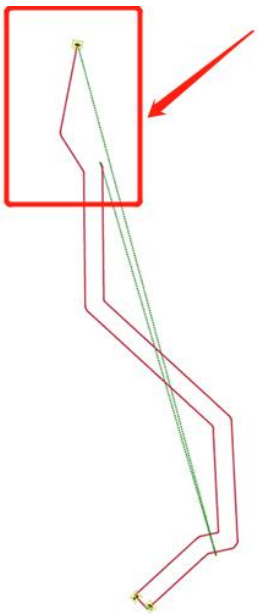
- Added the trial registration function where users enter their phone number or email, along with the corresponding verification code, to get one month of trial permission.



- Optimized the adjustment algorithm for vehicle-mounted single project data, and increase efficiency by 1-2 times.

Bug Fixed in CoPre 2.7.4

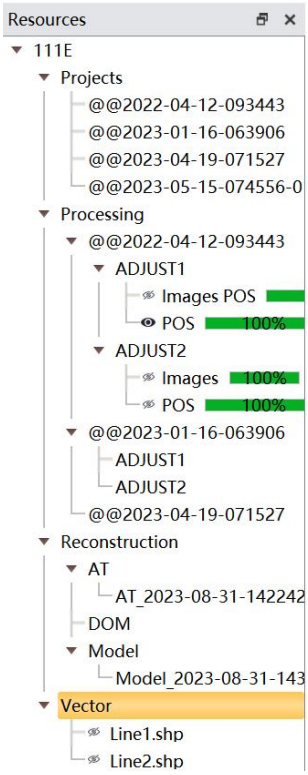
- Fixed the bug of precision loss when inputting coordinate system transformation parameters with more than 6 significant digits during coordinate system setup.
- Fixed the bug where only one type of carrier was displayed in the carrier drop-down box on the copy tool's main interface.
- When the device serial number (SN) doesn't match, the software will prompt whether to continue copying ; previously, data couldn't be copied.
- Fixed the issue of software crashing when importing certain KML files.
- Fixed the bug where it was not possible to input negative values for the rotation angle in TGO four parameters during coordinate system setup.
- Fixed the bug of software crashing during coloring due to missing photos in the raw data.
- Solved the issue that the data shift becomes larger after the adjustment in partial vehicle-mounted single project data.
- Fixed the bug of distortion in the AA10 point cloud processing of some flight routes as below.



14. CoPre-2.7.3-20230909

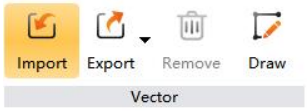
New Functions and Improvements

- Combined the foundation function and modeling function of CoPre into a single installation package.
- Added vector node in task management, and added import/export functions for DXF and SHP format vectors in vector management.



Description

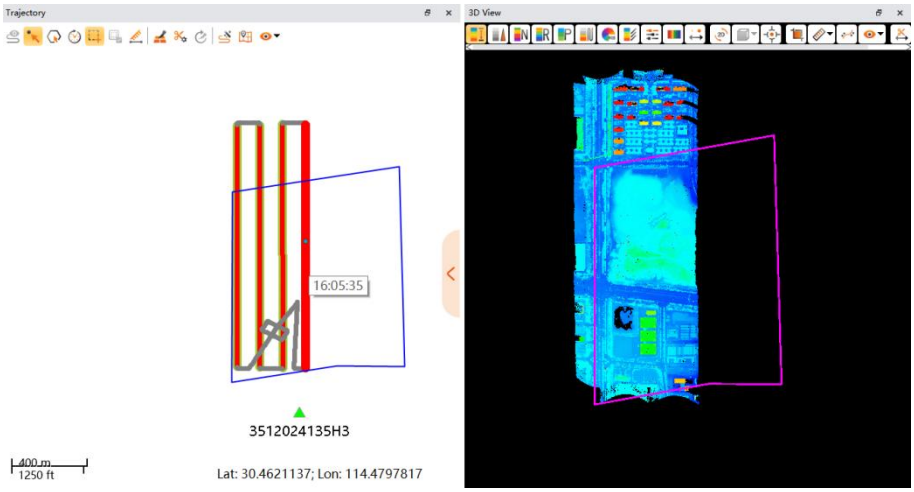
The Vector Management Function includes importing, exporting, removing, and drawing capabilities. The import feature supports importing KML, SHP, or DXF files to assist in selecting tracks and modeling areas of interest. The export feature allows for exporting files in SHP or DXF formats based on the selected trajectories.



Vector Import steps

（1）Click on "Home -> Vector -> Import";

（2）After selecting a KML, SHP, or DXF file, click "OK," and the chosen file will be loaded into the track view and 3D view;



Vector Export Steps

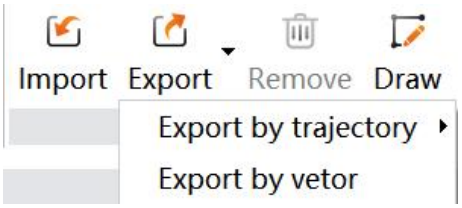
There are two ways to export vectors: exporting from loaded trajectories and exporting from selected vector nodes.

Method 1

Exporting from Loaded Trajectories: Choose the original project trajectories for export.

（1）Display the original project trajectories in the trajectory view, select the trajectories you want to export, and click on "Home -> Vector -> Export."

（2）Click on "Export by trajectory", choose the file format (SHP or KML), and then select the output directory to initiate the export.

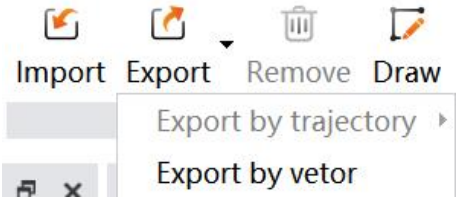


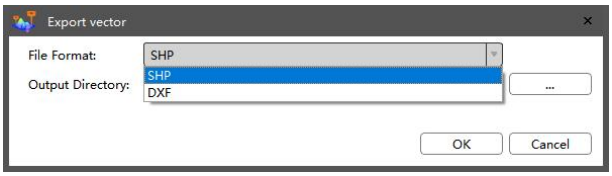
Method 2

Exporting from Selected Vector Nodes: Select a vector node for export.

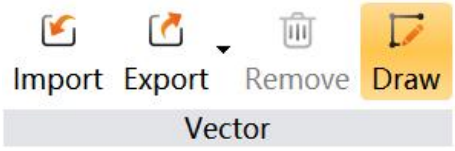
（1）In task management, select the vector, then click "Home -> Vector -> Export".

（2）Click on "Export by vector", choose the file format (SHP or DXF), and then select the output directory to initiate the export.





- Added vector node in task management, and added vector drawing function.



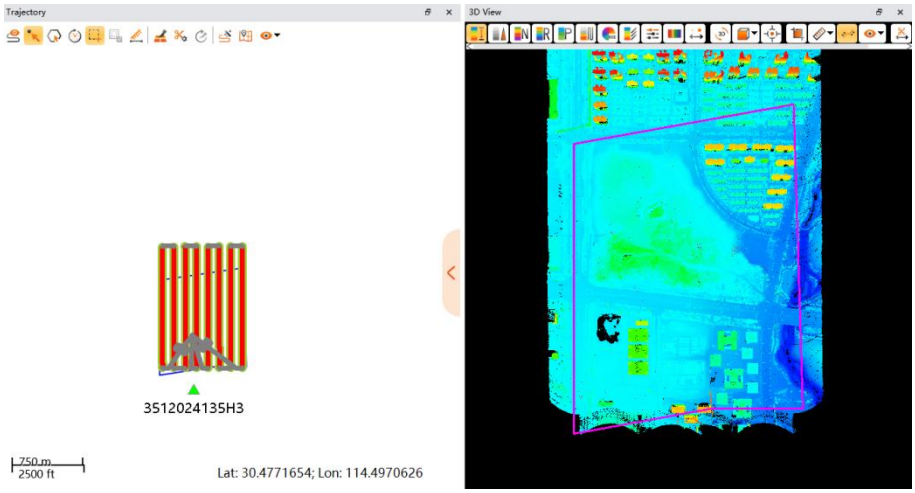
Description

This function is used to draw SHP format vectors in the 3D view.

Steps

（1）Click on "Home-> Vector -> Draw";

（2）In the 3D view, use the left mouse button to click and draw. Right-click to access a menu for cancel and redrawing. Click "End" to conclude the drawing .



Menu Description

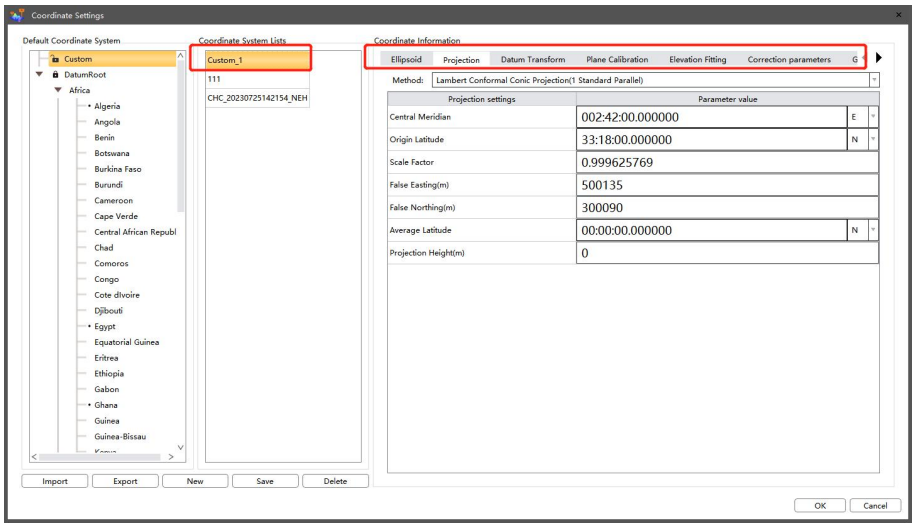
End(Ctrl+E): The vector's starting point and endpoint automatically connect to form a closed vector, completing the vector drawing.

Cancel(Ctrl+Z): Go back to the previous drawing step.

RedrawCtrl+Y): Proceed to the next drawing step.

Exit(ESC): Exit vector drawing.

- Optimized the coordinate system settings interface , and solved lag issues in the coordinate system configuration.



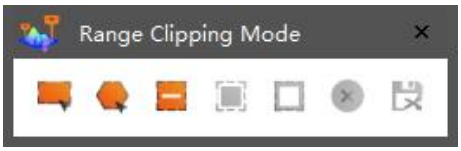
- Added the point cloud clipping function, which allows for point cloud clipping to remove noise.

Description

This function is used for point cloud clipping to remove noise.

Steps

（1）Click "3D View -> " to activate the clipping command, and the clipping mode window will pop up.



Icon Description

Rectangle box selection: Select point cloud data by dragging the mouse to create a rectangular selection box.

Polygon box selection: Select point cloud data by clicking the mouse to draw a polygonal selection box.

Remove Selection: Remove selected point cloud data by dragging the mouse to create a rectangular selection box.

Interior clipping: Keep the point cloud within the selection box

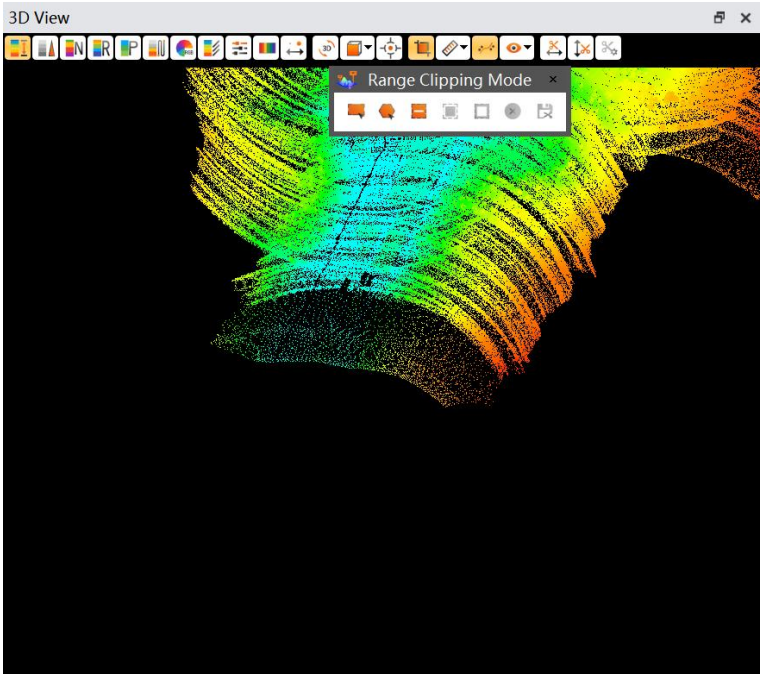
Exterior clipping: Keep the point cloud outside the selection box.

Clear： Undo the selection or clipping.

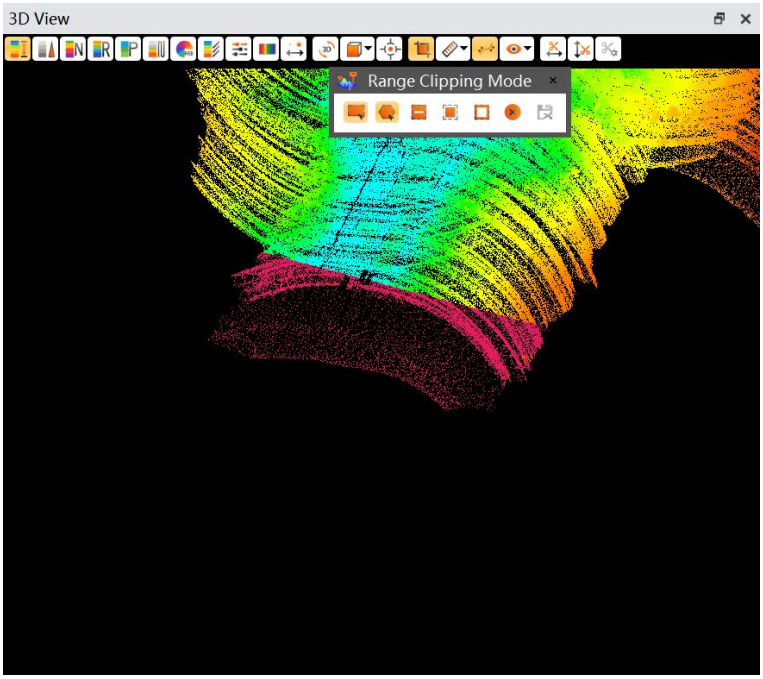
Save； After saving the clipped point cloud data, overwrite the original point cloud data.

（2） Select the rectangle (or polygon) box selection tool, draw a rectangle (or polygon) on the point cloud, and then click on " Interior clipping " (or " Exterior clipping ").

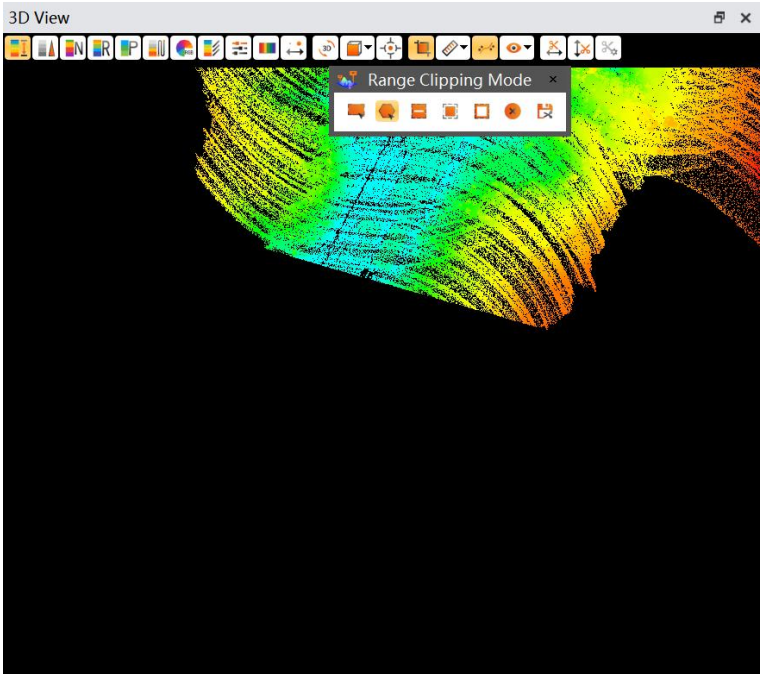
Point cloud before clipping:



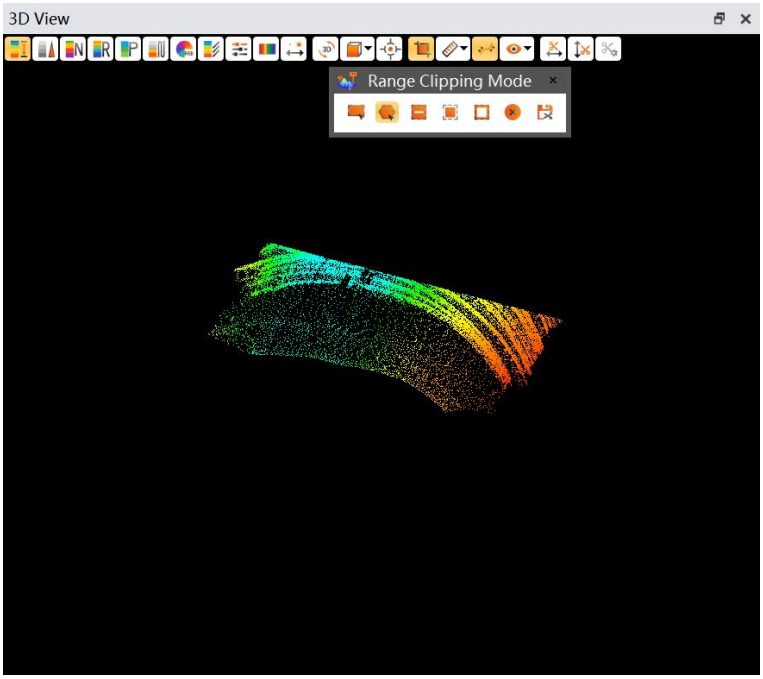
Point cloud selected by Box:



interior clipping:

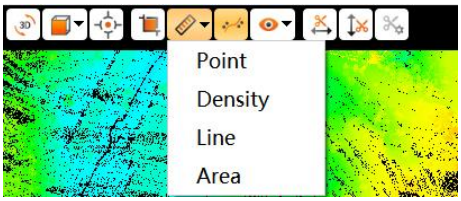


Exterior clipping:



（3） Click "Save," then click "Confirm" in the pop-up window. When the progress bar reaches 100%, it indicates that the point cloud clipping is complete. After clipping, the point cloud data in the project will be overwritten and automatically reloaded into the 3D view.

- Added measurement tool, which includes point measurement, density measurement, distance measurement, and area measurement.



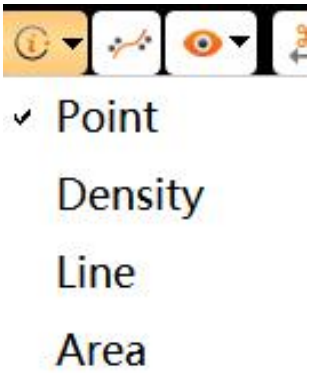
1.Point Measurement

Description

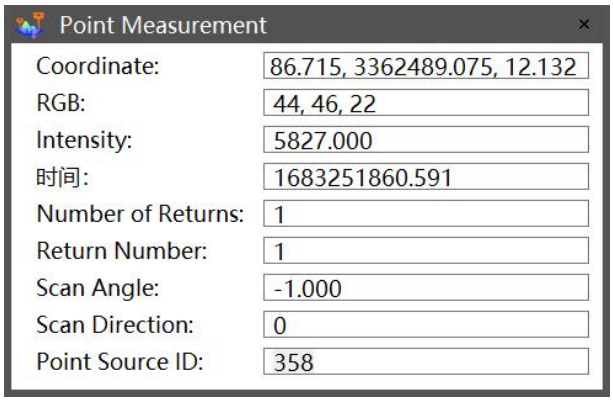
This function is used to measure the coordinates, RGB, intensity, time, echo, scan angle, scan direction, and point source ID of a point cloud.

Steps

（1） Click "3D View -> " to activate the measurement command. Select "Point Measurement" from the pop-up menu to open the point measurement window.



（2）Click on a point , and the measurement information for that point will then appear.



Note: Point measurement is only effective for measuring the point cloud.

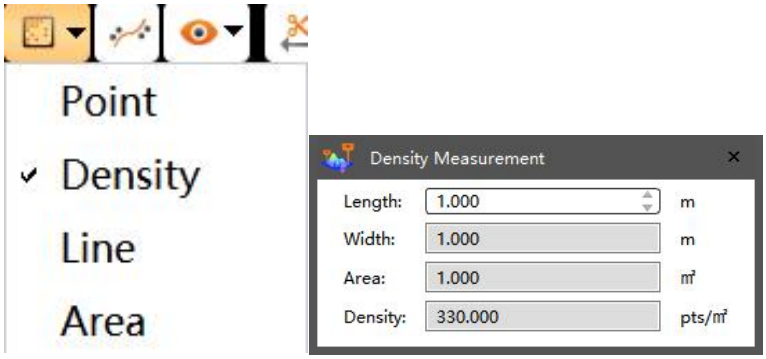
2.Density Measurement

Description

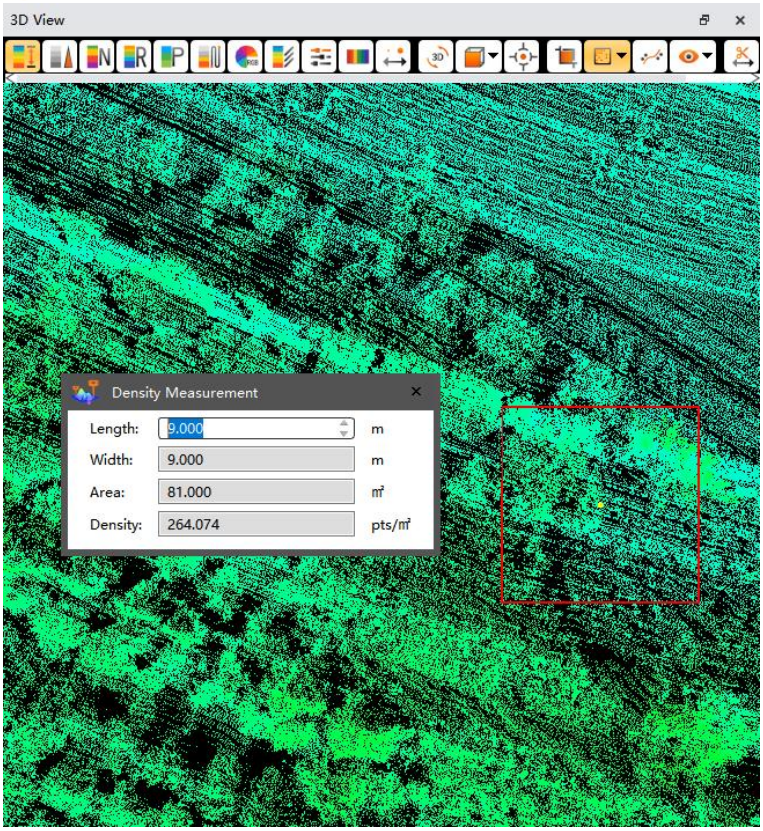
This function is used to measure the density of the point cloud.

Steps

（1） Click "3D View -> " to activate the measurement command. Select "Density Measurement" from the pop-up menu to open the density measurement window.



（2）Set the length, then click on the point cloud you want to measure. The point cloud density information within the red box will be displayed in the window.



Note: Density measurement is only effective for measuring the point cloud.

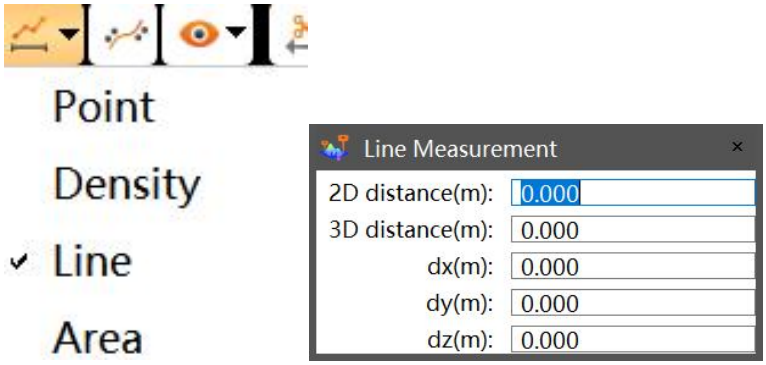
3.Line Measurement

Description

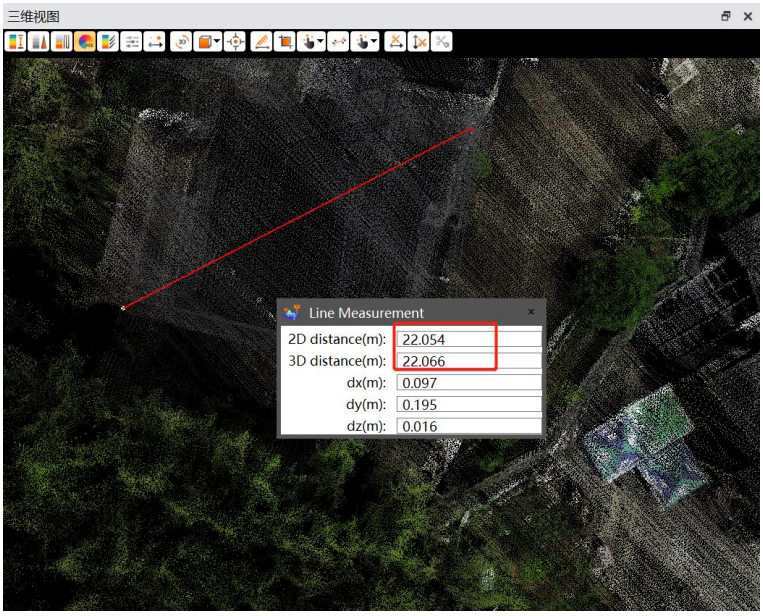
This function is used to measure distance.

Steps

（1） Click "3D View -> " to activate the measurement command. Select "Distance Measurement" from the pop-up menu to open the distance measurement window.



（2）Measure the distance on the point cloud by clicking with the mouse to start drawing a line and double-clicking to finish the line segment.



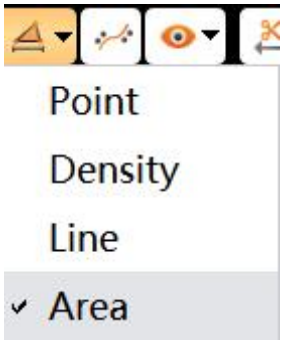
4.Area Measurement

Description

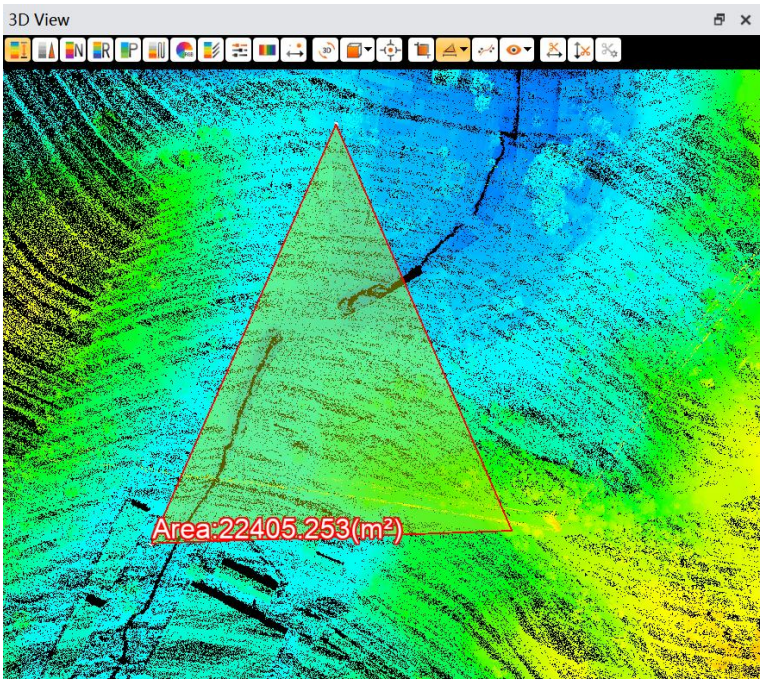
This function is used to measure area.

Steps

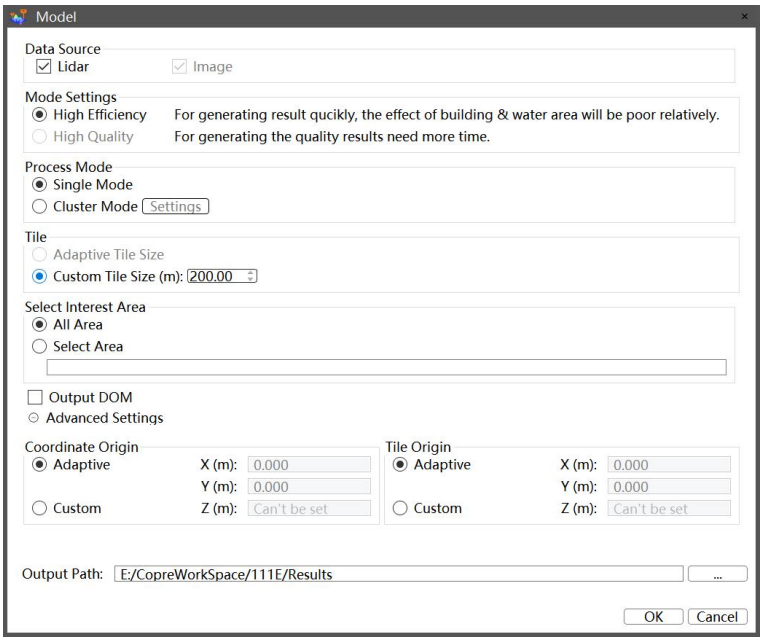
Step 1: Click "3D View -> " to activate the measurement command, then select "Area Measurement" from the pop-up menu.



（2）Click to select points and double-click to finish drawing a closed region on the point cloud. The region will be highlighted, and the area will be displayed.

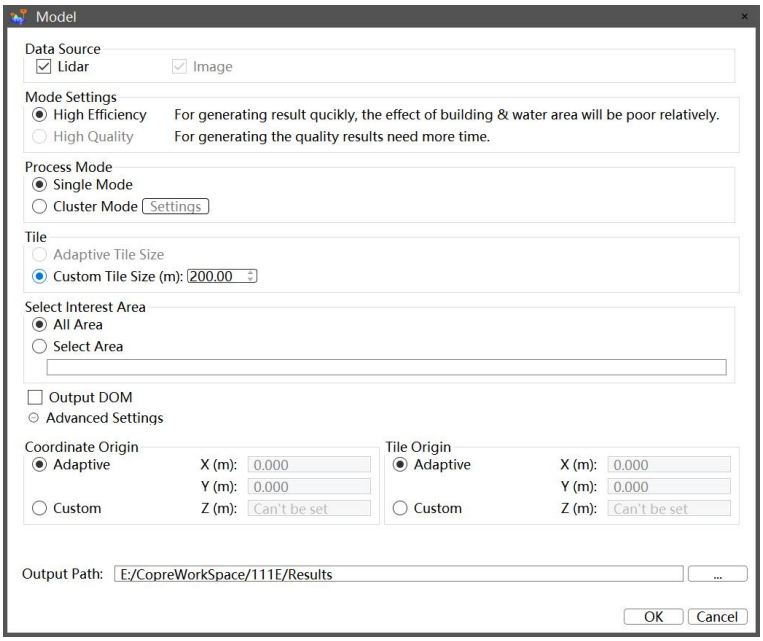


- Added coordinate origin and tile origin settings, both of which can be chosen as adaptive or customized according to requirements.

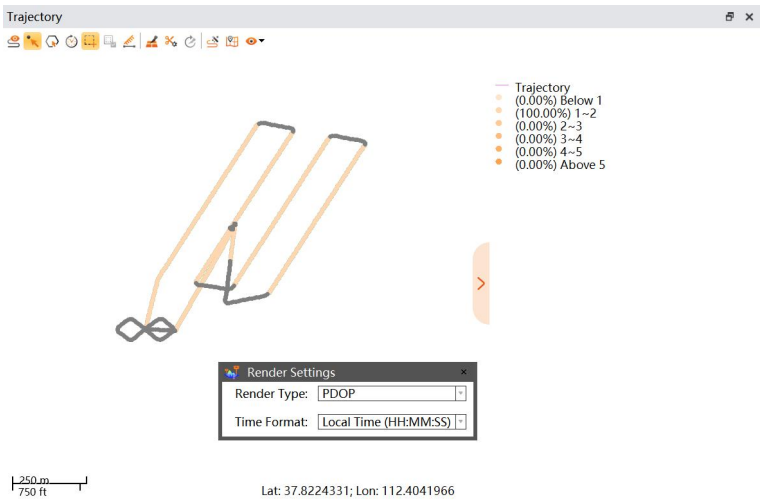


- Added the function to set a region for reconstruction.

Selecting 'All Area' models the entire point cloud or images, while choosing 'Select Area' models only the point cloud or images within the vector-defined range.



- Point clouds now can be colored by number of echoes, echo number, project, and user can show/hide color bars.
- Improved the rendering colors and precision rendering threshold display in the trajectory view for better visual effects.



- Support MTA solution for AU20 1000kHz vehicle-mounted data.
- Support data copy for self-developed cameras on P60, and other cameras on P330Pro.
- Added Google Maps as a map source in the trajectory view.

Bug Fixed in CoPre 2.7.3

- Fixed the issue where the progress bar during POS calculation with slam optimization would get stuck at 90% in certain cases.
- Fixed the issue of requiring entering reversed values when setting the lever arm value for user-defined carrier.
- Fixed the issue of abnormal point cloud processing when users selected a local

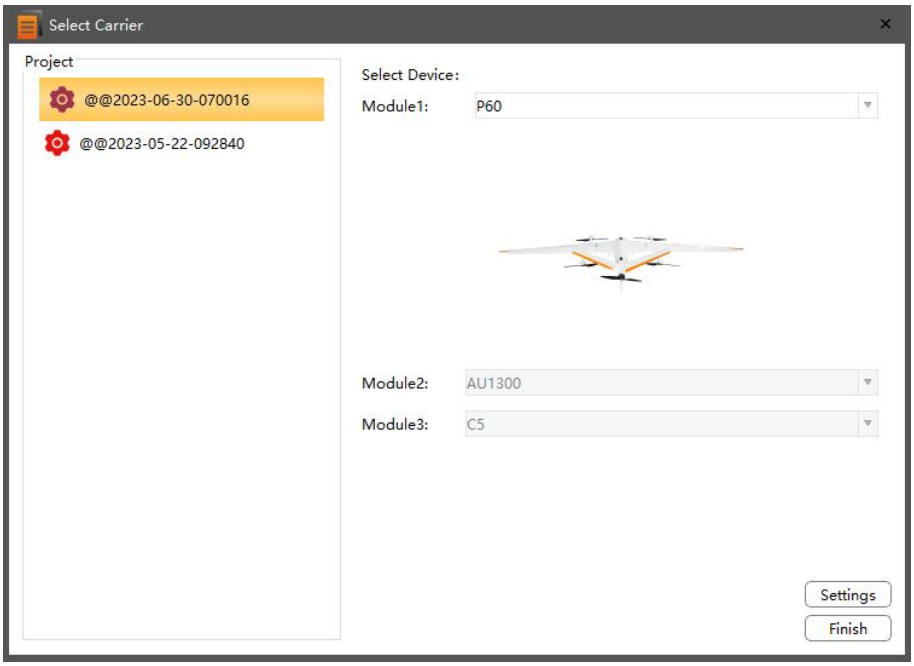
coordinate system .

- Fixed the issue of being unable to copy more than 10,000 photos at once.
- Fixed the issue of software not recognizing camera sensor size when importing external image files with filenames longer than 20 characters.
- Fixed the issue of inconsistency between KML time and point cloud time records in the result folder.
- Fixed the issue of the progress bar getting stuck during modeling in certain cases.
- Fixed the issue of CoPre crashing during adjustment when importing GGF models.

15. CoPre-2.7.2-20230809

New Functions and Improvements

- Support processing data collected by P60 UAV.

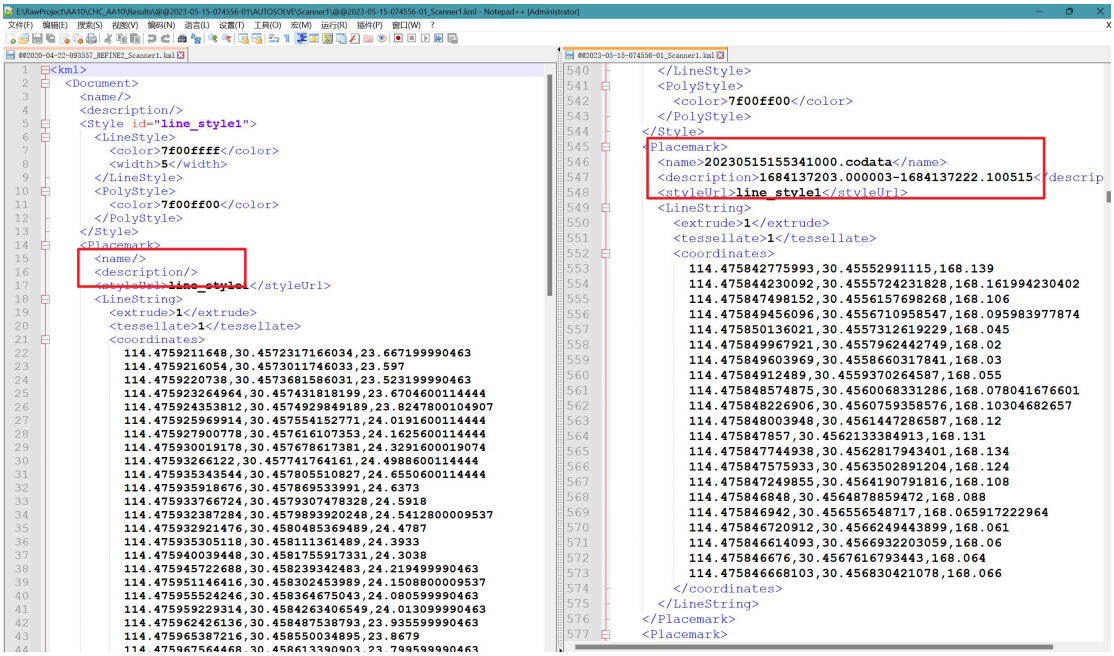


- Optimized the point cloud processing result of the data collected by Alpha3D-L Dual.
- Added Fixed Rate and Pass Rate to Image POS calculation result when P330Pro or P60 equipped with C5/C30 .

```
ProcessInfo: 1 by Mode 3 on 8/3/2023 at 13:58:23
Master 1:    Name 3238220262B
             Antenna height 1.477900 m, to L1PC
             Lat, Lon, El Hgt 29 39 3.516823, 114 38 36.387379, 42.886000 m
IMU to GNSS Antenna Lever Arms:
             x=0.000000, y=-0.429100, z=0.145900 m (x-right, y-fwd, z-up)
Body to Sensor Rotations:
             xRot=-1.000000, yRot=-2.000000, zRot=3.000000 degrees (Rotate IMU into Vehicle Frame)
IMU->Secondary Sensor Lever Arms:
            x=0.000000, y=0.000000, z=0.000000 m (x-right, y-fwd, z-up, IMU->SENSOR)
Statistical Results: Fixed Rate(100.00), Pass Rate(99.91)
UTC Offset:  18.000000 s
```

Bug Fixed in CoPre 2.7.2

- Fixed the bug that there is no las file name in the exported kml file.



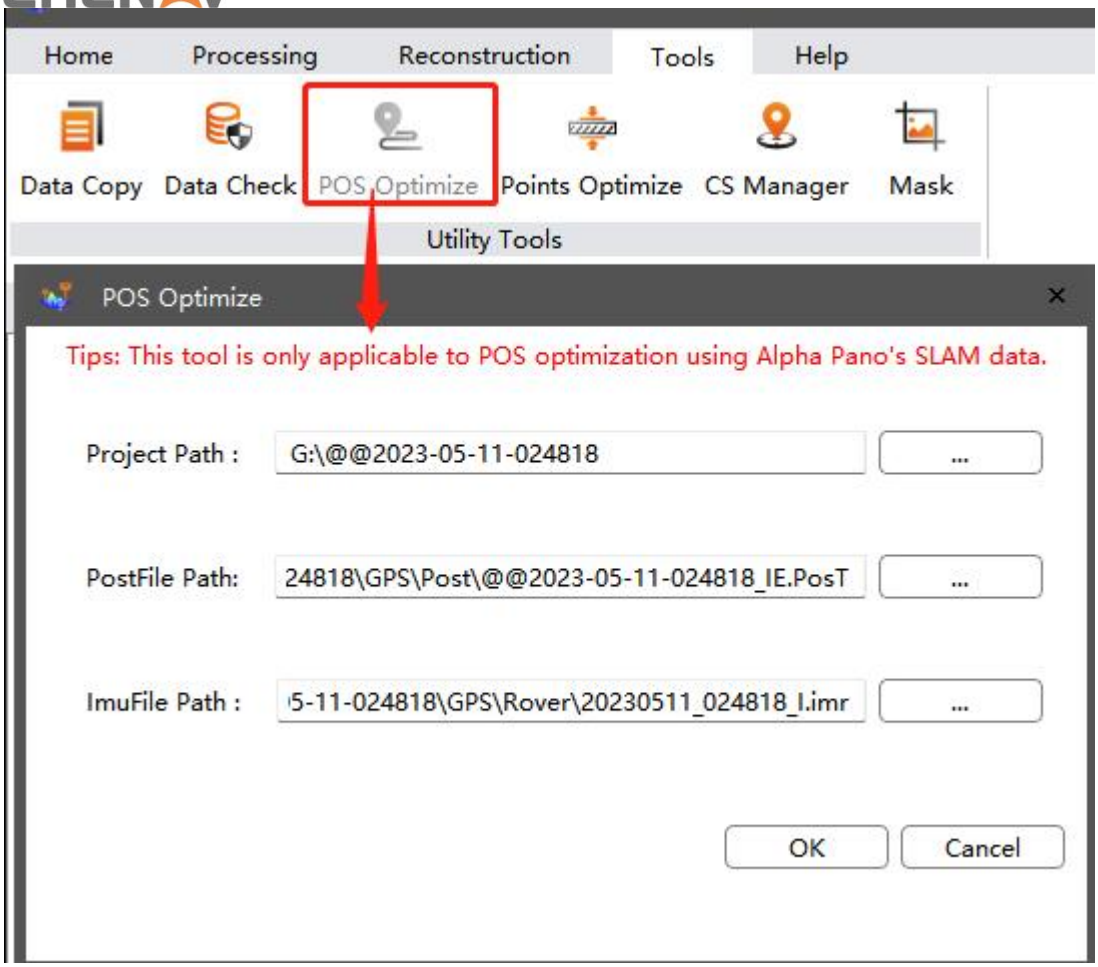
- Fixed the bug that there is no GLO satellite info in the POS report.
- Fixed the bug that the quality check of Alpha3D-L Dual data failed.
- Fixed the bug that failed to process the Alpha3D-L Dual data when raw laser data is segmented.
- Fixed the bug of data distortion after adjustment of point cloud data under tunnels and viaducts.
- Fixed the bug that POS processing failed when P330Pro equipped with C5/C30.
- Fixed the bug that the Loosely Coupled Mode configuration for vehicle-mounted POS computation was not taking effect.

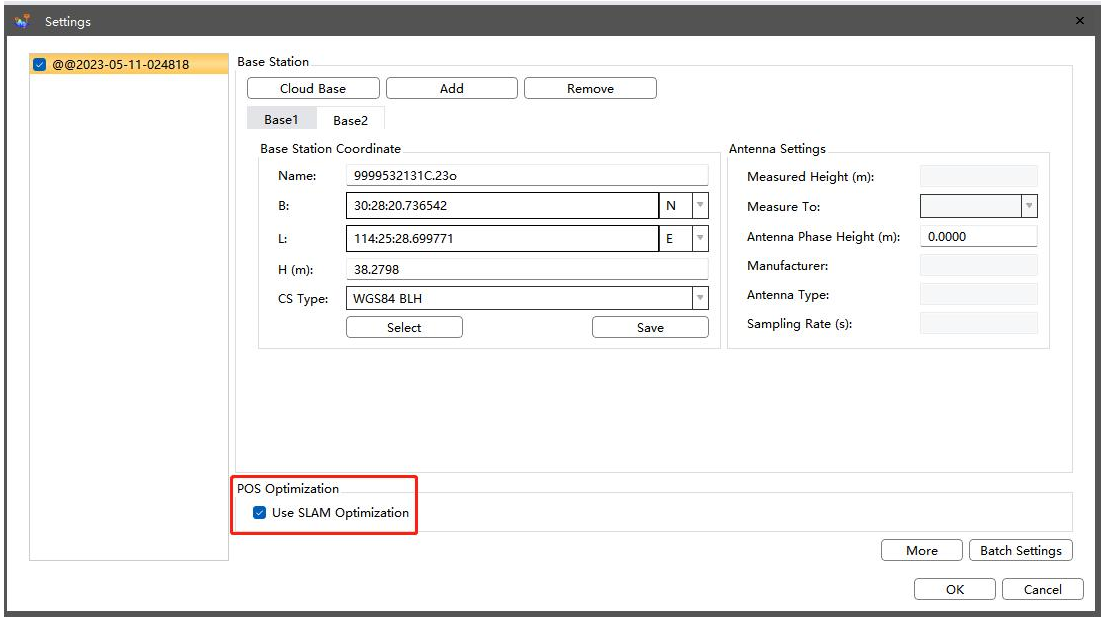
16. CoPre-2.7.1-20230716

New Functions and Improvements

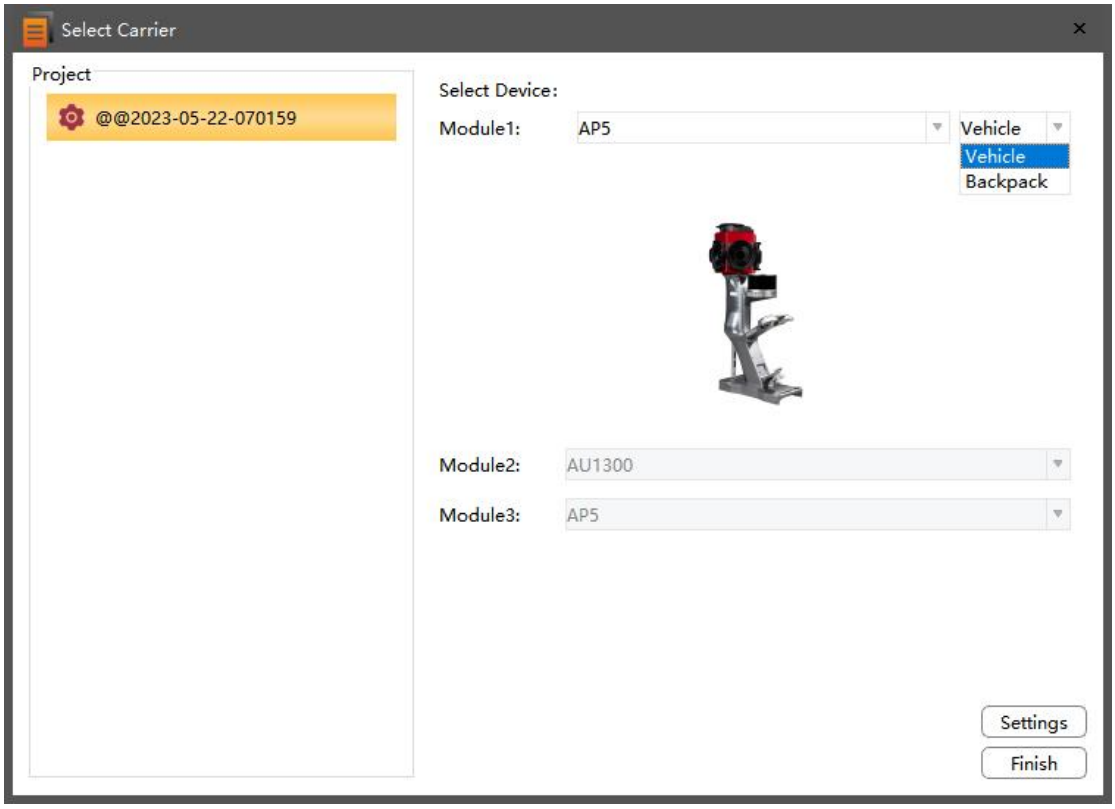
- Added the function of using SLAM and INS tightly coupled solution to improve POS accuracy, can repair POS jumping.

Click Tools→POS optimize, or check the POS optimization function when processing POS:

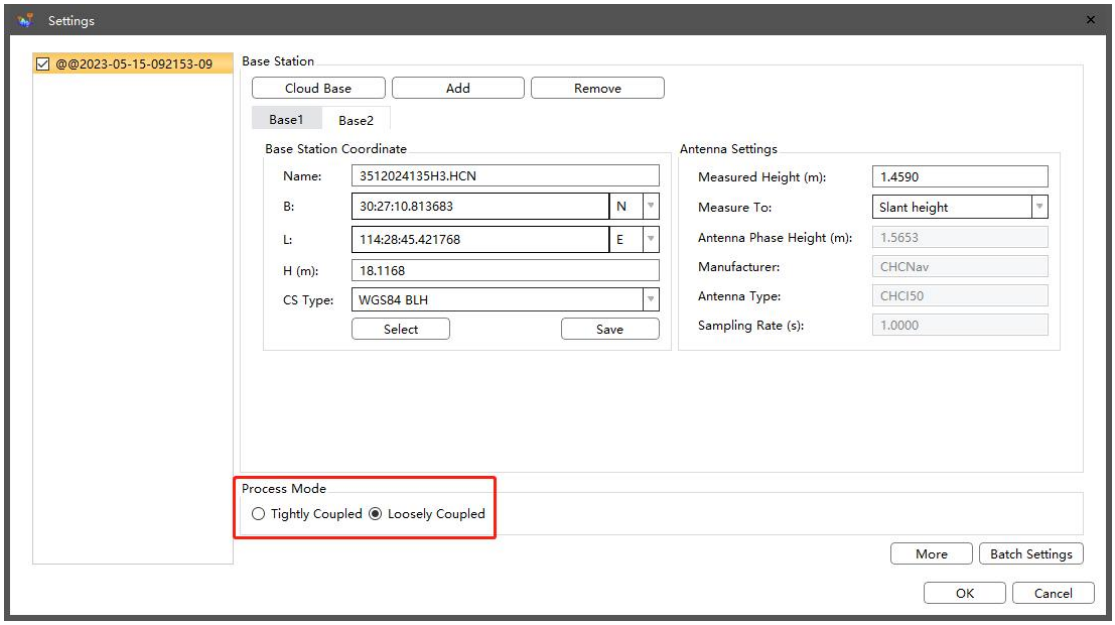




- When copying AP5 data, distinguish between backpack mode and vehicle mode.



- Optimized the POS processing algorithm, added settings for loosely coupled and tightly coupled algorithms.



Bug Fixed in CoPre 2.7.1

- Fixed the bug that incomplete generation of power lines from data collected by AU20 caused by MTA algorithm.
- Fixed the bug that CoPre occasionally prompts "calibration parameters do not match the device" during data processing.

17. CoPre-2.7.0-20230531

New Functions and Improvements

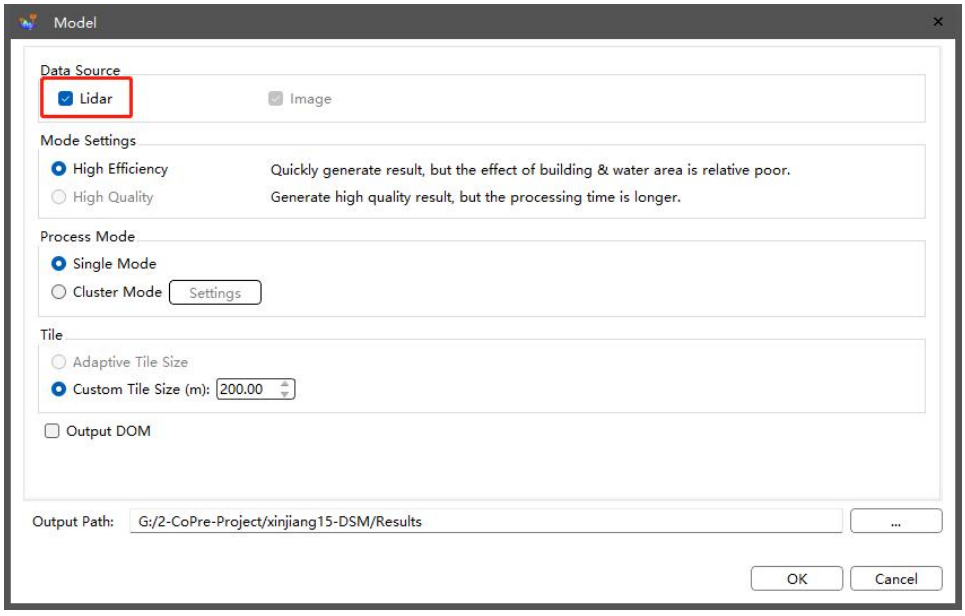
1.1 Point Cloud Modeling

- Point cloud modeling is 30% faster than image modeling.
- The requirement of lateral overlap rate in point cloud modeling is reduced, which can improve the operation efficiency.

Steps：

（1） Select Modeling Function at AT node, which will pop up a window that let you set parameters.

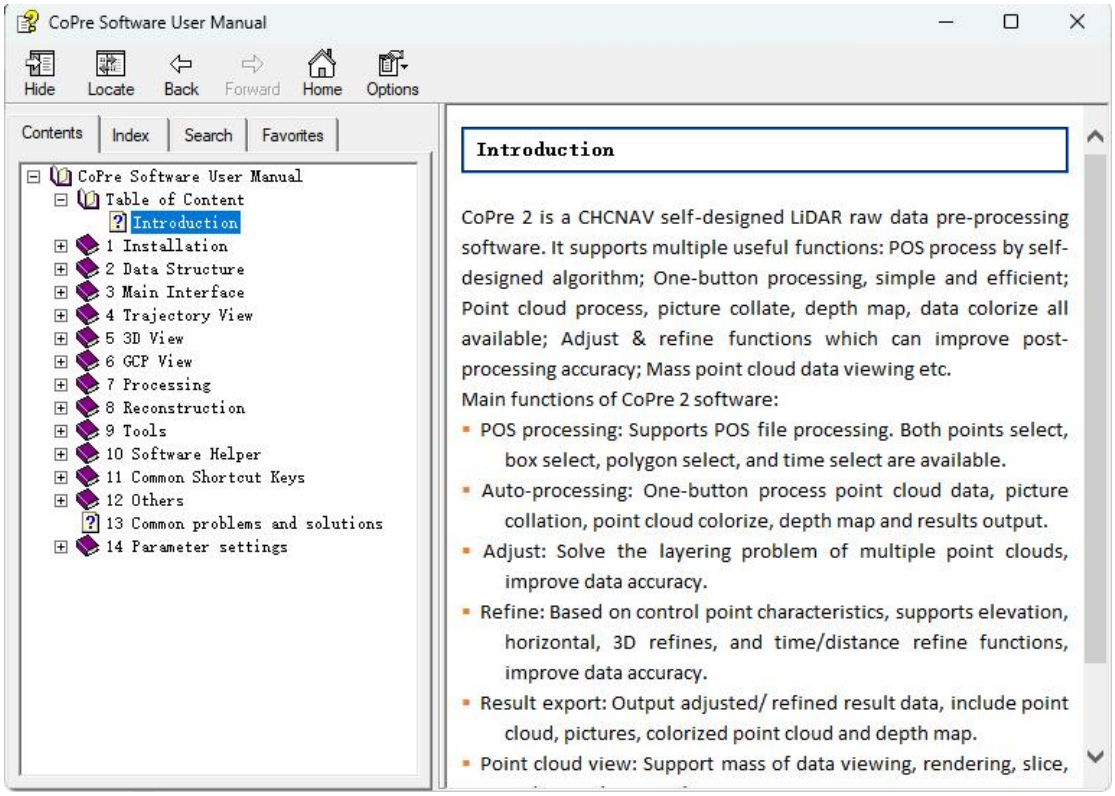
（2）Select Lidar as data source.



（3）Set the relevant parameters in the pop-up window, click OK, and the software will use the point cloud results for modeling.

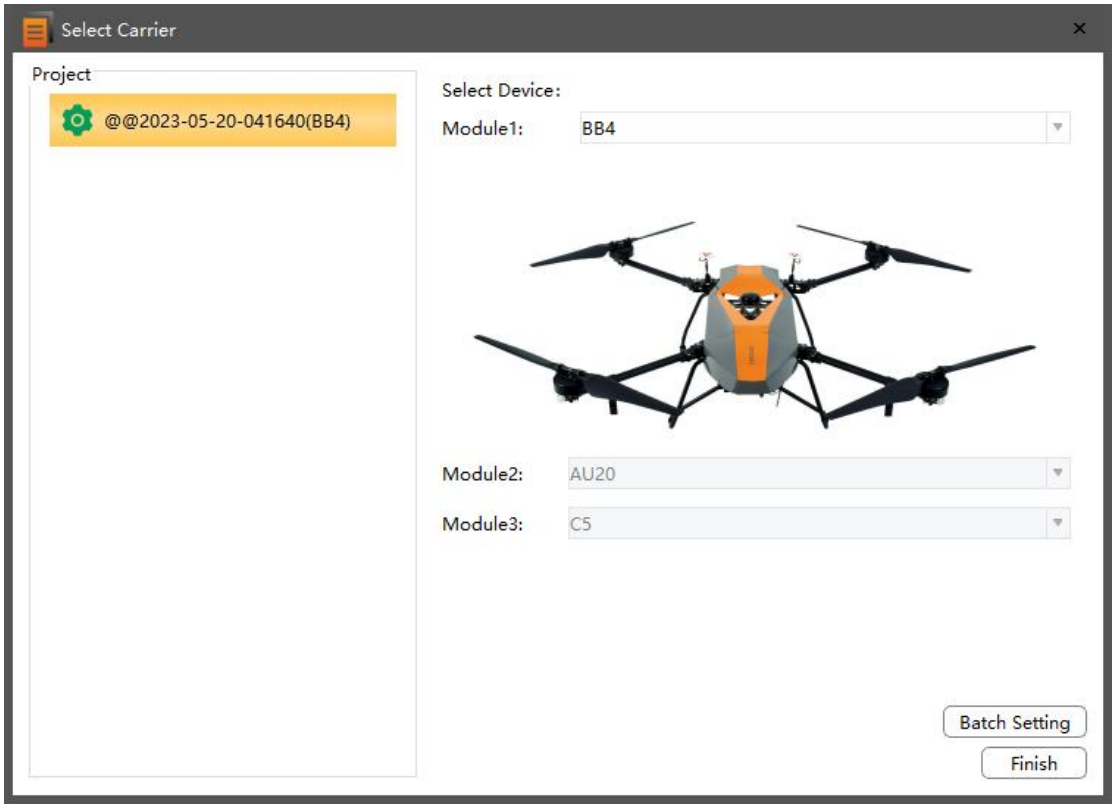
1.2 Optimize the point cloud coloring algorithm , improve the efficiency of colorization by 50%.

1.3 The user manual is in chm format for easy browsing.



1.4 Updated the data copy process of partial devices

For current AU20, AlphaPano and AA10 units, please manually select the mount carrier before data copy.



Bug Fixed in CoPre 2.7.0

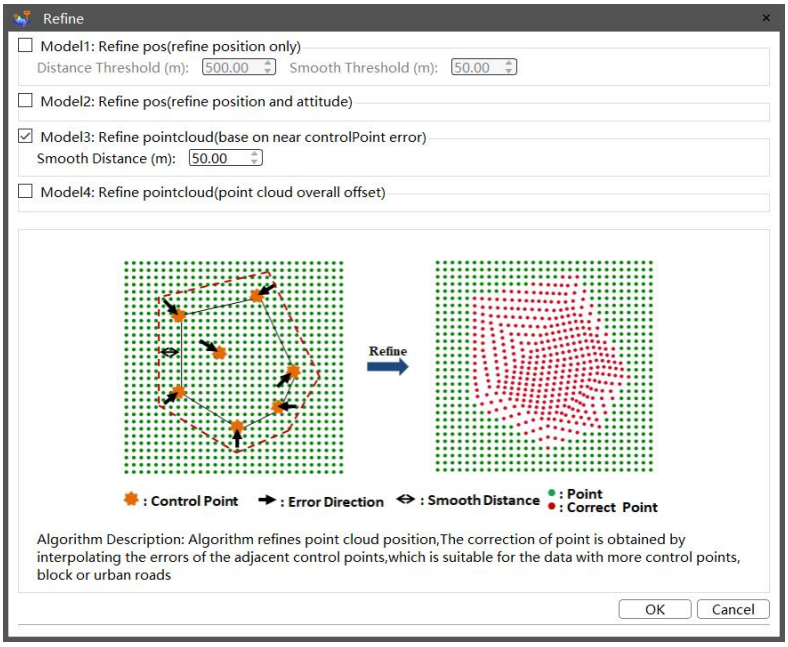
- Fixed the bug of incorrect display of fixed/float status in POS accuracy curve.
- Fixed the bug of the original data could not be solved completely due to the repeated laser acquisition.
- Fixed the bug of Post file could not be output properly when copying M300+C30 data.

18. CoPre-2.6.1-20230427

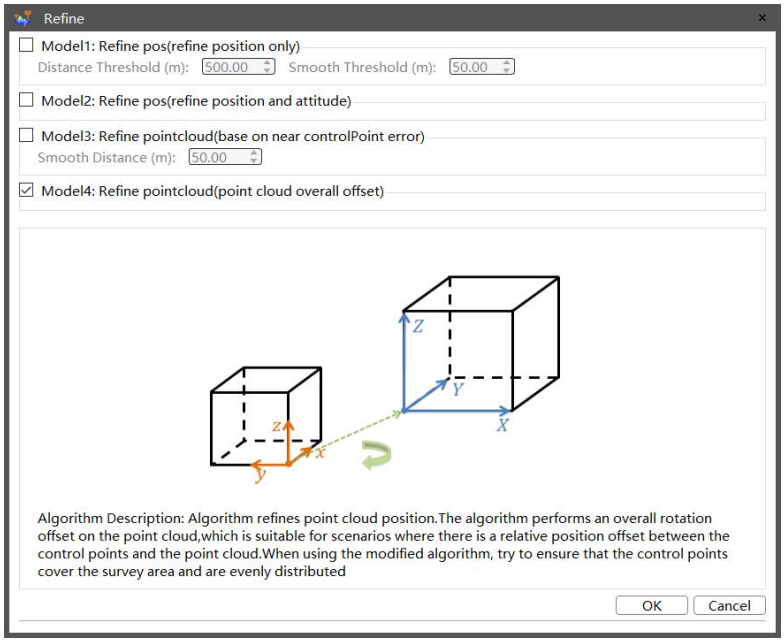
New Functions and Improvements

- Added two new modes to the refinement function, just refine the position of point cloud, won't reprocess POS.

1) Mode 3： Refine point cloud (base on near control point error),the point cloud refinement value is calculated by interpolating the error of adjacent control points, used for the scenario with many control points, block or urban road.



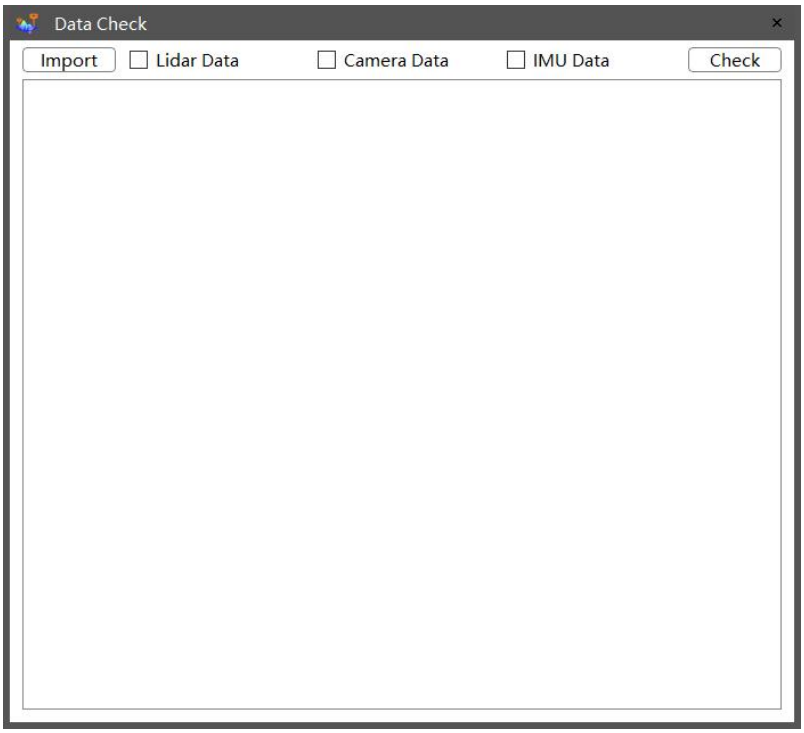
2) Mode 4： Refine point cloud (point cloud overall offset), the whole point cloud is rotated and offset.,used for the scenario where the relative position of the control point is offset from the point cloud. When using this algorithm, ensure that the control points cover the survey area and distribute evenly.



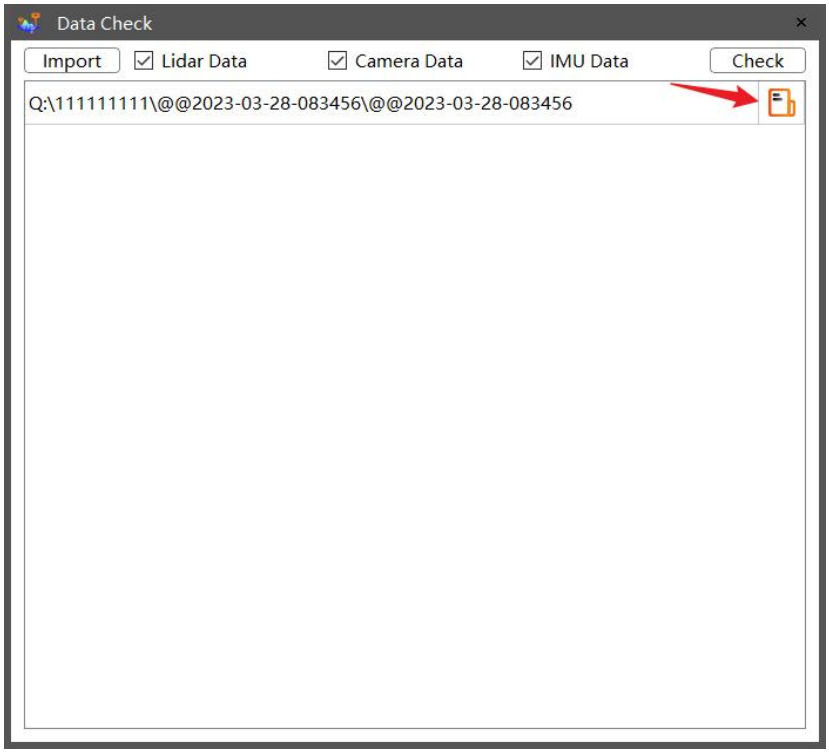
- Added the function of data quality check, can detect data loss and jump of Lidar and IMU, and detect whether the images are missed.

Step:

1) Click ”Tools→Data Check”, the data check window will automatically pop up;



2) Click “Import” button to import the data to be checked;



3) Check the items to be checked, including Lidar data, camera data and IMU data,then click ”Check”button.

4) Wait until the progress bar reaches 100%, click can open the “Source Data Quality Report”, as follow:

Source Data Quality Report

2023-03-30 11:09:43

1. Project Summary:

Project Name	@@2023-03-28-083456
Collect Time(min)	19.124

2. Camera Statistics:

Camera	Number of Images	Number of Trigger	Status
Camera1	186	186	Pass

3. Scanner Statistics:

Scanner	Lidar File	Start Time	Stop Time	Status
Scanner1	20230328_083834_000.ltp	8:38:41	8:44:04	Pass
Scanner1	20230328_083834_001.ltp	8:44:04	8:49:25	Pass
Scanner1	20230328_083834_002.ltp	8:49:25	8:51:00	Pass

4. IMU Statistics:

IMU File	Status
20230328_083456_I.imr	Pass

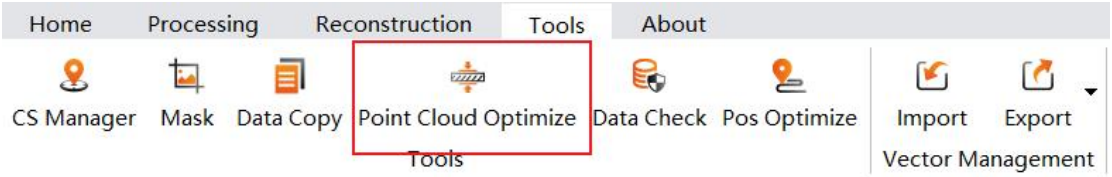
- Added the function of point cloud thickness optimization.

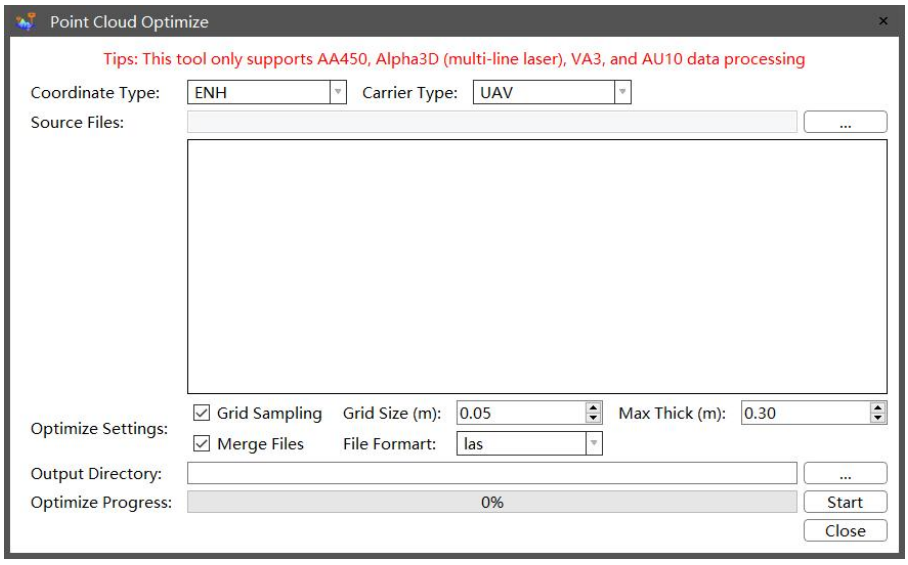
description:

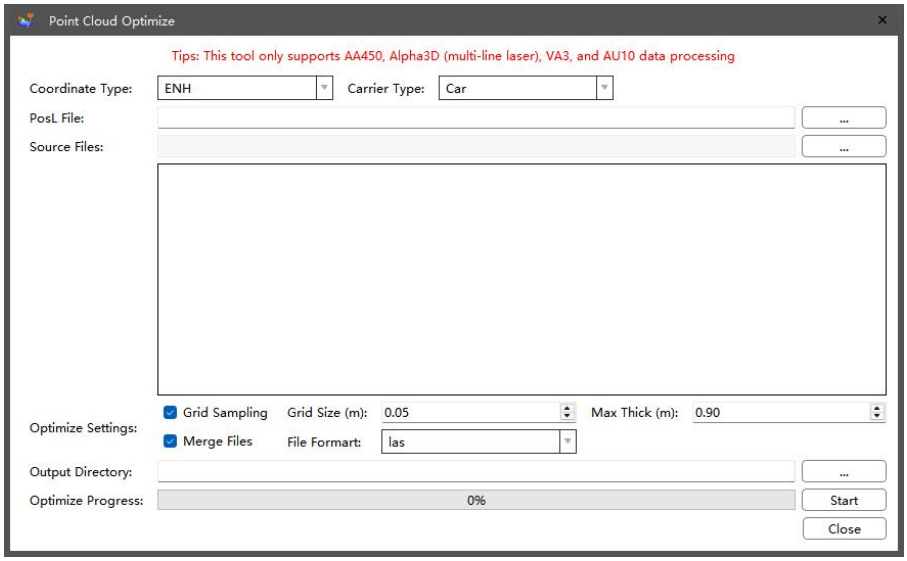
Only used for data from AA450（AA450Pro）、Alpha3D、VA3 and AU10, can reduce the thickness of point cloud.

Step:

1) Click ”Tools→Point Cloud Optimize”, the Point Cloud Optimize window will automatically pop up;







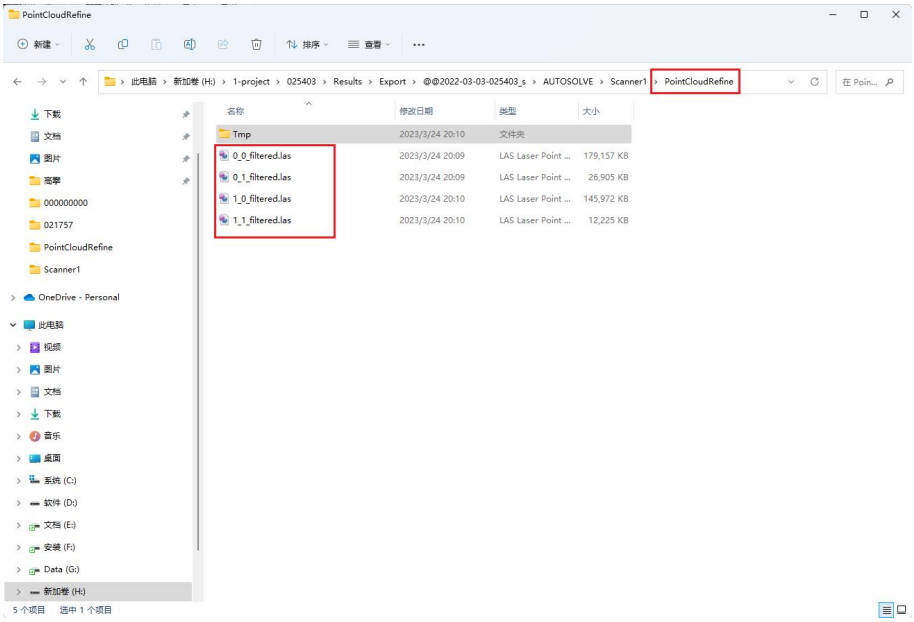
2) Set Coordinate Type and Carrier Type.

3) Import the point cloud that needs thickness optimization, can import las, laz, and codata format.

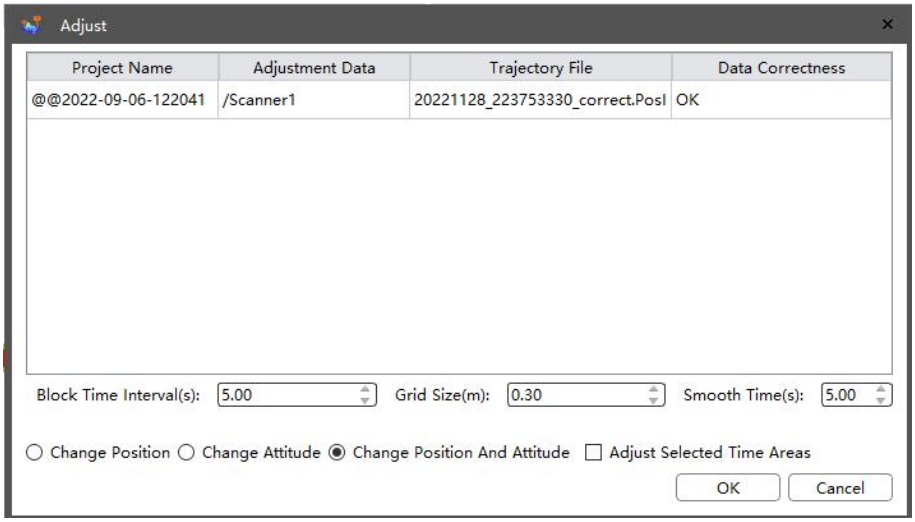
4) Set thickness optimization parameters, including **Grid Sampling,Grid Size (m),Max Thick (m),Merge Files and File Formart**.

5) Set **Output Directory**.

6) Click Start to start thickness optimization， wait until the progress bar reaches 100%, can check the result in the PointCloudRefine folder of the Output Directory path, as follow:



- Added the function of adjust selected time areas when adjusting vehicle-mounted data.When checked **Adjust Selected Time Areas**, only point clouds within the time range of the selected trajectory are adjusted.



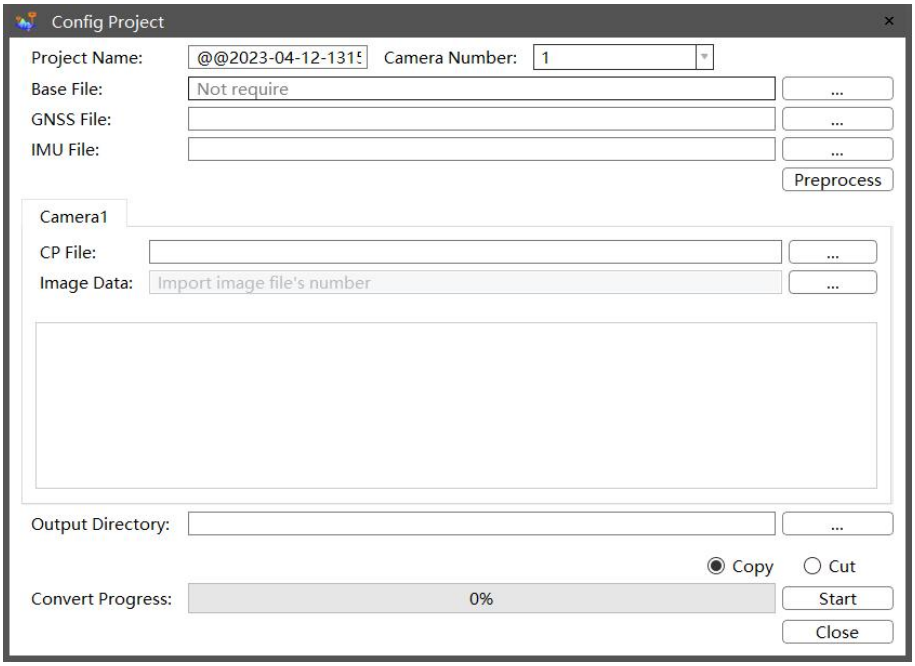
- Added the function of project configuration in project management;

Description：

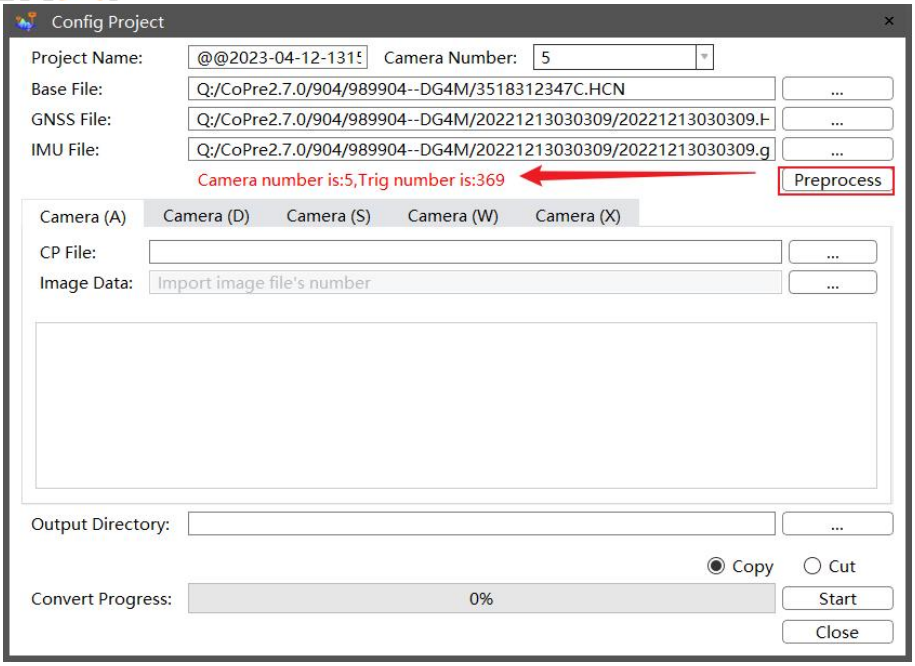
Used for data processing for P330Pro with 3rd party camera.

Step:

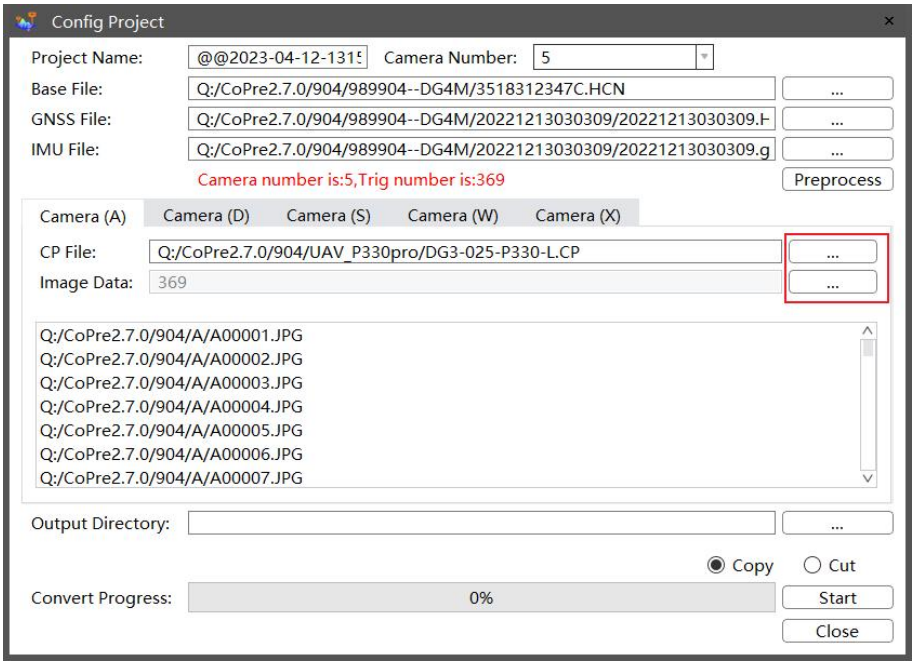
1) Click ”Project Management→Config Project” in the main view, the Config Project window will automatically pop up;



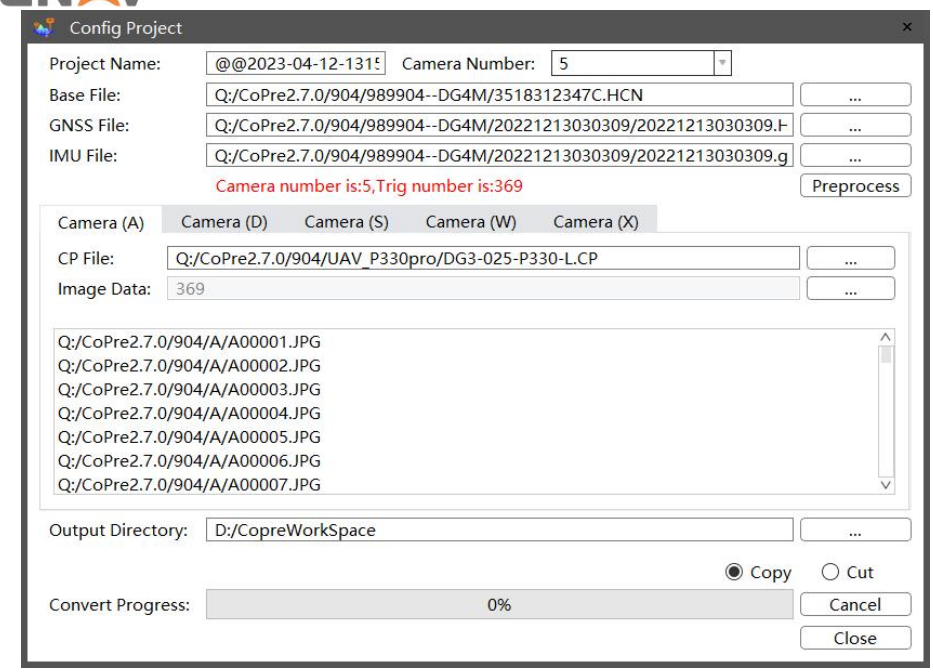
2) Import base file, GNSS file, IMU file, click “Preprocess” to check whether the number of photos and trigger are the same.

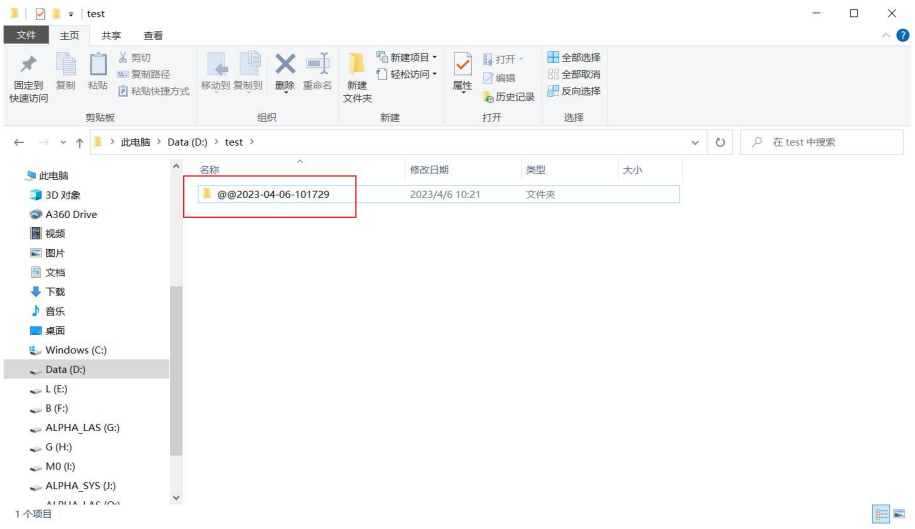


3) Import CP file and image data.

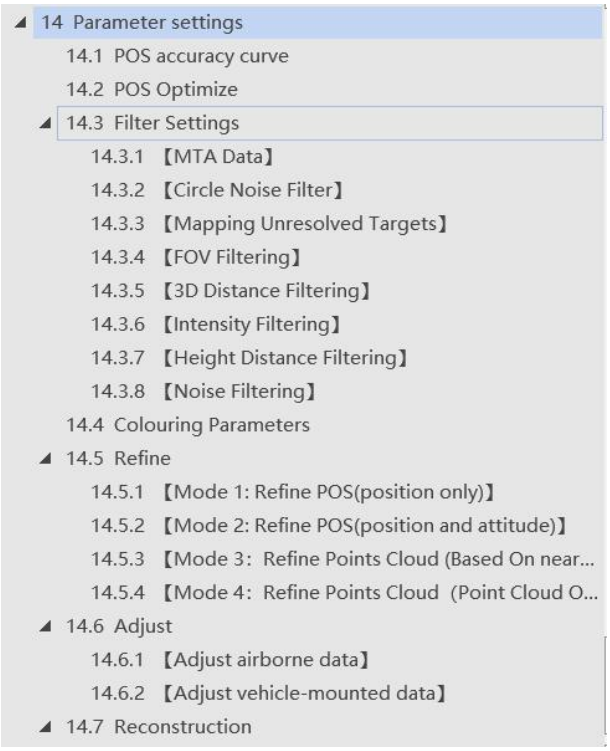


4) Select the output directory, click “Start” to convert data, wait until the progress bar to reach 100%.

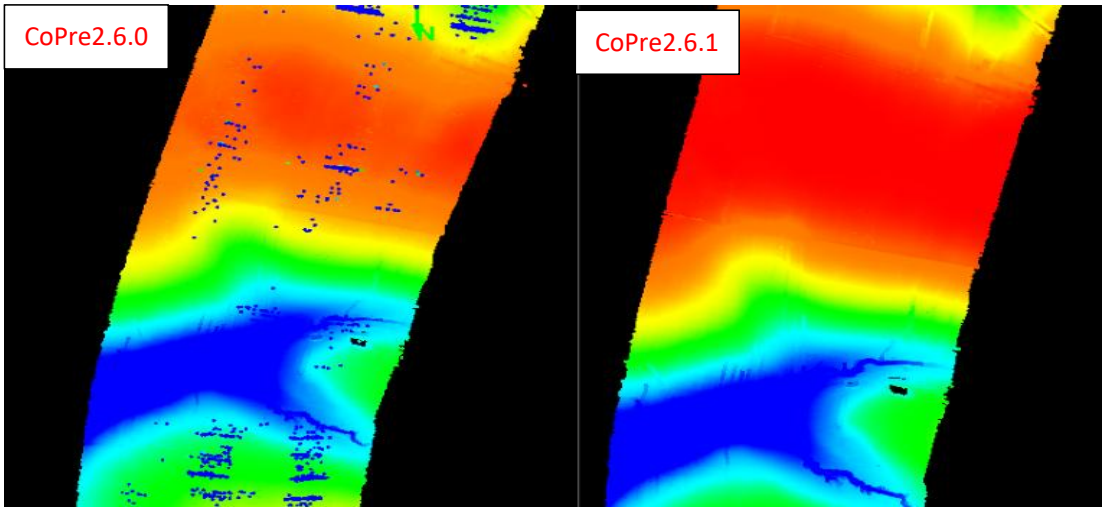




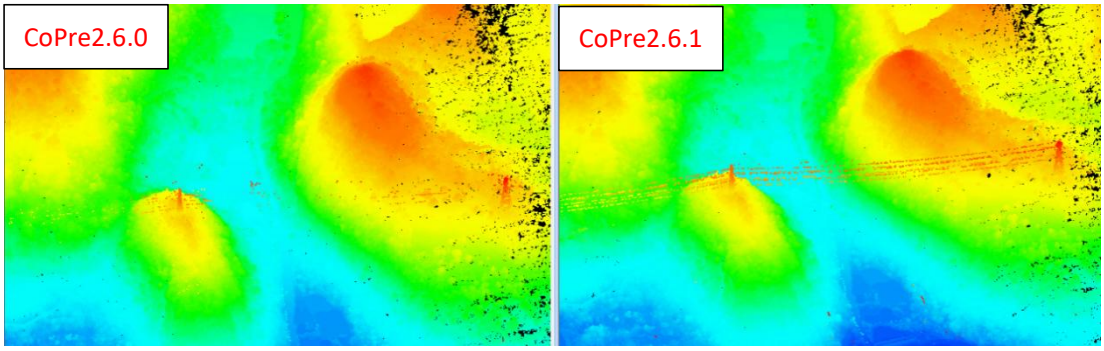
- Added data processing function for AA10 Lidar system;
- Added software parameter setting section in user's manual;



- Deleted the function of preprocessing.
- Optimized the MTA algorithm for AU20 data to solve the data noise problem;



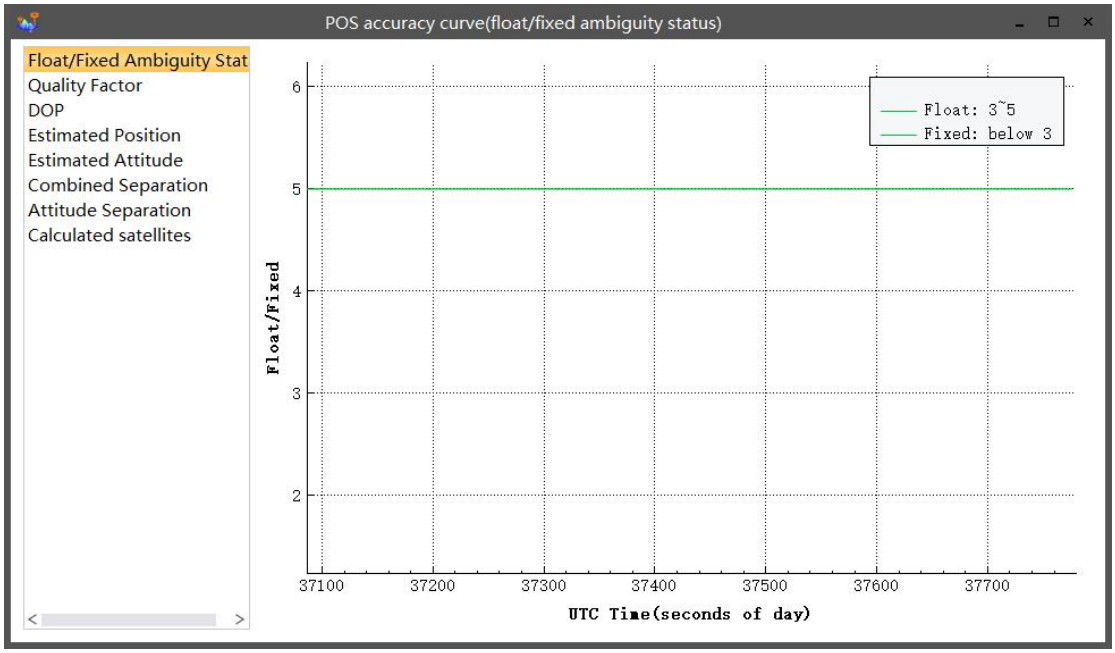
- Optimized data processing function for AA1400 data, mainly for power line data;



- Added the function of outputting error message during aerotriangulation, DOM

generation, and modeling;

- Optimized POS accuracy curve chart display of float/ fixed ambiguity status;



- Optimized the logic of organizing pictures;

When organizing pictures in CoPre 2.6.0，copy and rename photos to the result path.

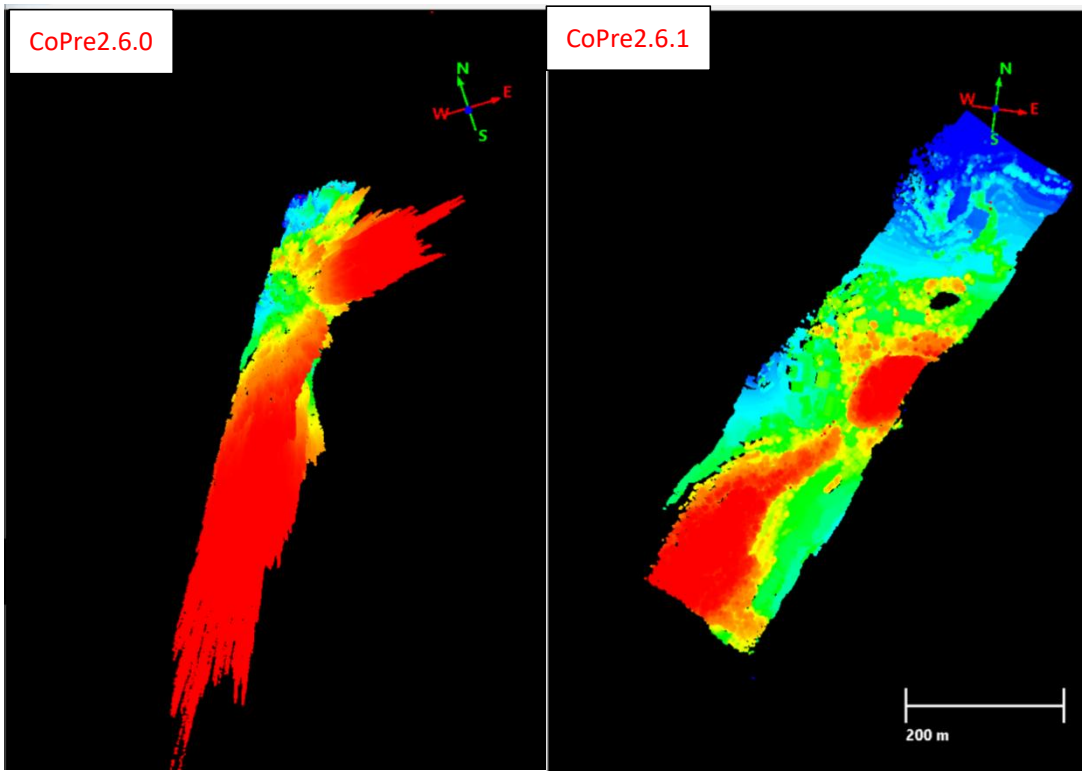
When organizing pictures in CoPre 2.6.1，rename photos to the original project path.

- Optimized point cloud coloring algorithm for Airborne data;

- Optimized the POS accuracy of partial data is not high.

Bug Fixed in CoPre 2.6.1

- Fixed the bug of abnormal data conversion in I83 receiver.
- Fixed the bug of data distortion and incomplete process of partial AA450 data.
- Fixed the bug that CoPre failed to delete historical base stations.
- Fixed the bug of abnormal point cloud coordinate conversion.



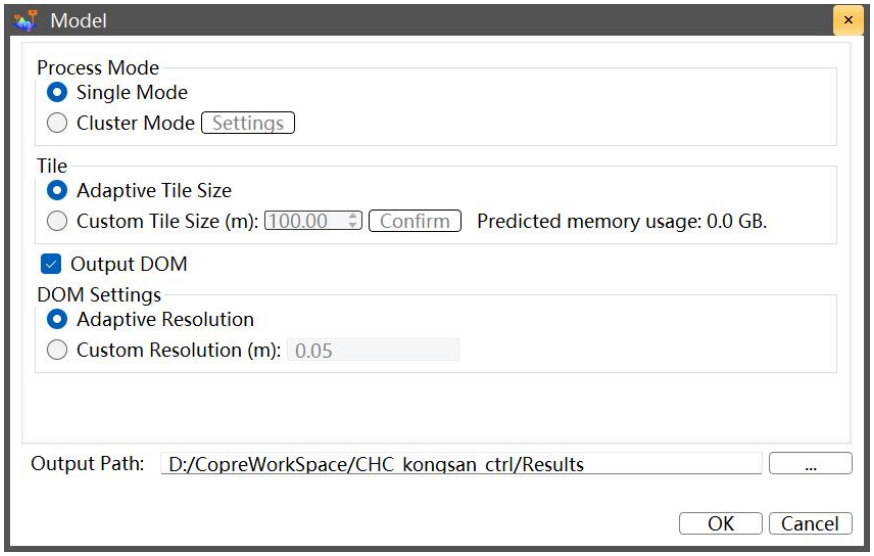
19. CoPre-2.6.0-20221231

New Functions and Improvements

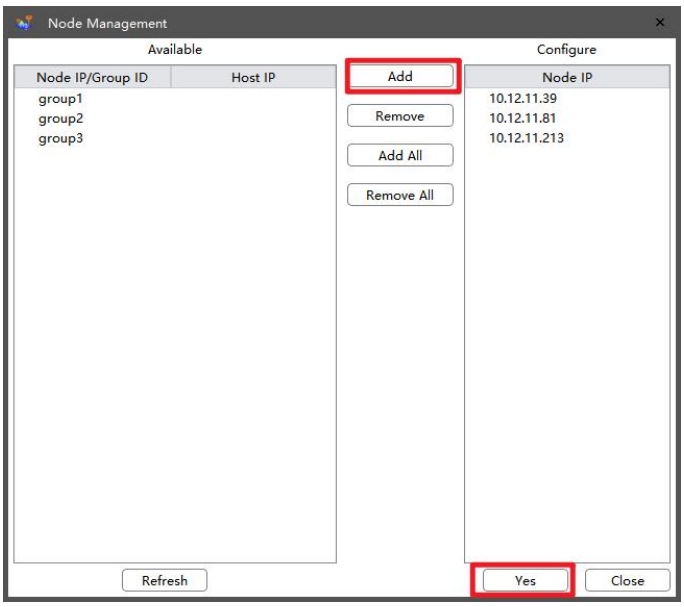
- Added the function of configuring multiple servers into a cluster to do Image-Based Modeling;

Steps:

(1) Select a AT node, click “Model”



(2) Select the “cluster mode” and click “Settings” to pop up “Node Management” dialog box. CoPre will automatically read the machines on which the cluster service is enabled in the LAN, and the Node IP/Group ID is displayed on the left. Select the Node IP/Group ID that needs to be the child node of the engineering task, click “Add” to join the node, and click “Yes” after the configuration is finished

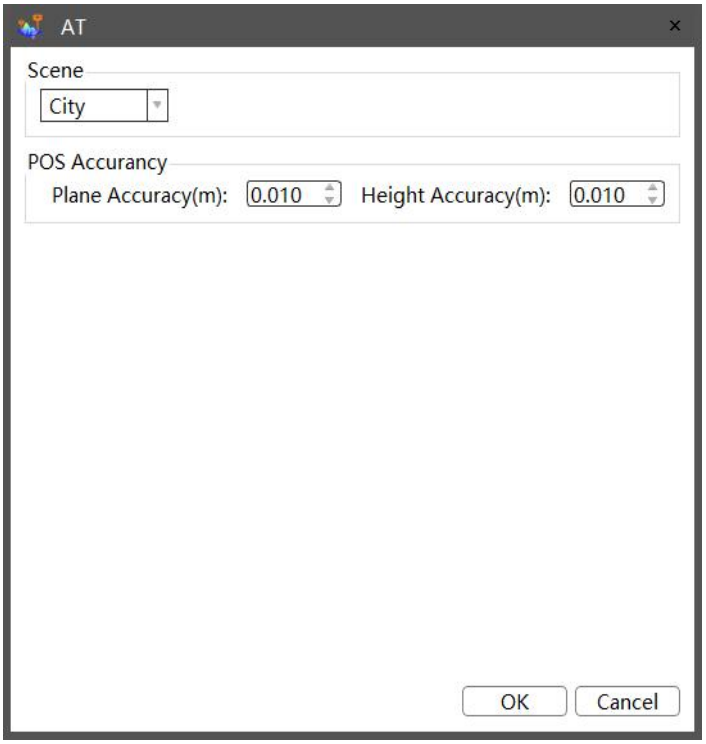


Notes:

1. When using cluster mode, the raw data and tasks should be stored on the server
2. When using cluster mode, need to ensure that each child node can successfully access the server and have read and write permissions
3. Host node (computer for the new task) to participate in modeling, also need to open the cluster service and add the node IP

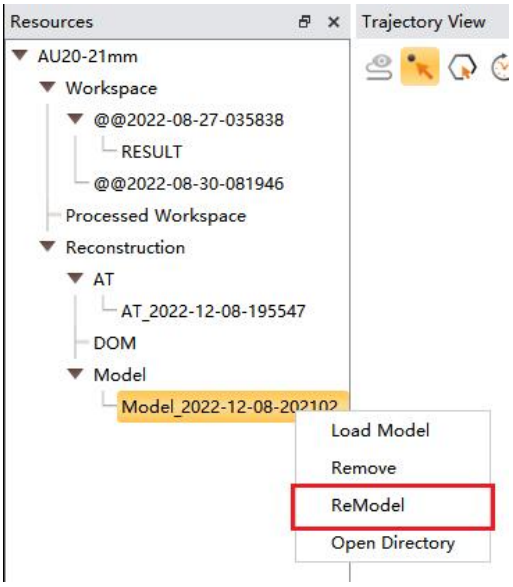
- Added the function of POS accuracy setting in three-dimensional triangulation process;

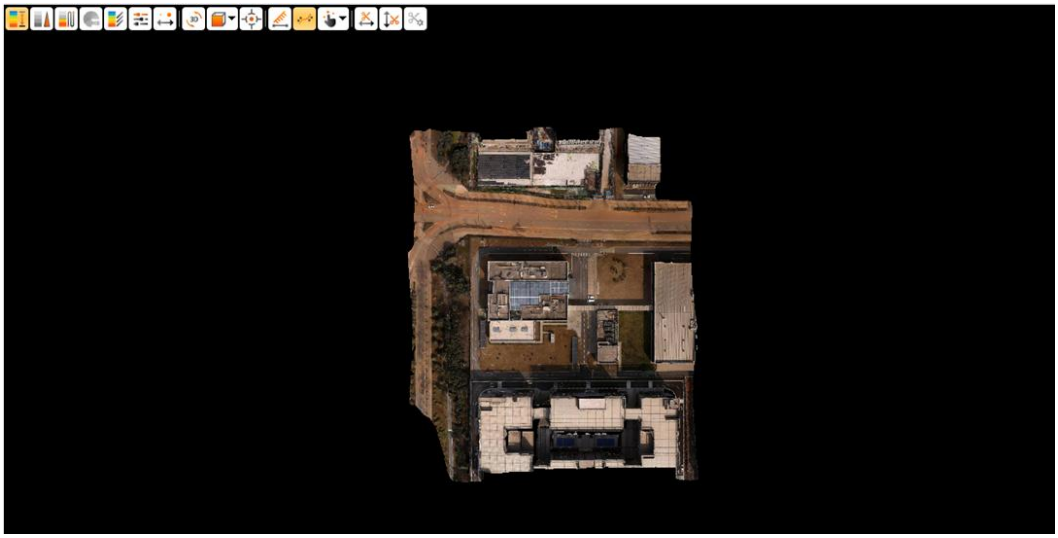
Added the function of POS accuracy setting in three-dimensional triangulation process, can set the plane and height accuracy to improve the accuracy



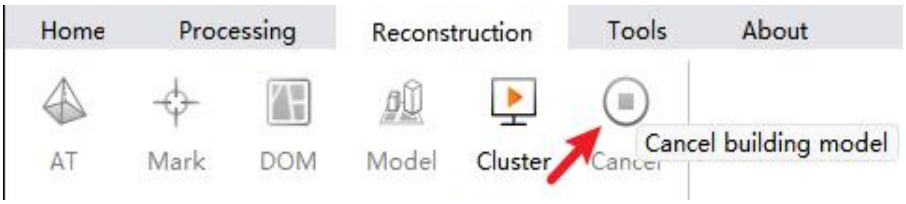
- Added the function of remodel failed tiles on the model node;

Click ”ReModel” on the model node.





- Added the function of cancel building model;



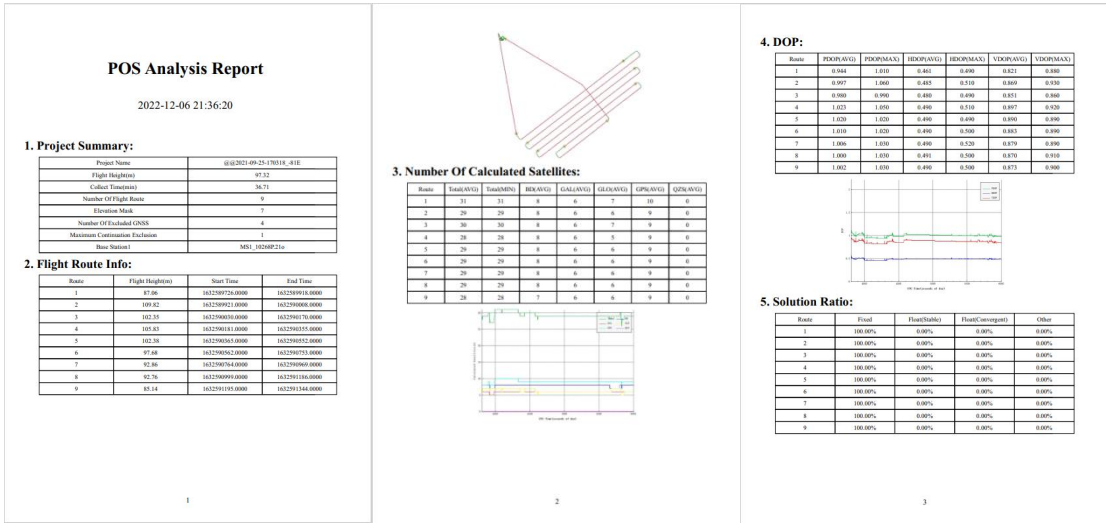
- Added the function of generating POS report;

  POS report can be used to check the quality of POS accuracy. CoPre SW can generate POS report in two places:

  (1) After POS processing, you can manually select “Generate POS Report” on the original project. After the POS report being generated successfully, can right-click “Open POS Report” on the original project to open the POS report

  (2) After generating result, the POS report is automatically generated, can right-click “Open POS Report” on the original project to open the POS report

  The POS report is as follows:



POS Analysis Report

2022-12-06 21:36:20

1. Project Summary:

Project Name	@@2021-09-25-170318_-81E
Flight Height(m)	97.32
Collect Time(min)	36.71
Number Of Flight Route	9
Elevation Mask	7
Number Of Excluded GNSS	4
Maximum Continuation Exclusion	1
Base Station1	MS1_10268P.21o

2. Flight Route Info:

Route	Flight Height(m)	Start Time	End Time
1	87.06	1632589726.0000	1632589918.0000
2	109.82	1632589921.0000	1632590068.0000
3	102.35	1632590331.0000	1632590170.0000
4	105.83	1632590181.0000	1632590355.0000
5	102.38	1632590365.0000	1632590552.0000
6	97.68	1632590562.0000	1632590753.0000
7	92.86	1632590764.0000	1632590969.0000
8	92.76	1632590999.0000	1632591186.0000
9	85.14	1632591193.0000	1632591344.0000

1

3. Number Of Calculated Satellites:

Route	Total(AVG)	Total(MIN)	BD(AVG)	GAL(AVG)	GLO(AVG)	GPS(AVG)	QZS(AVG)
1	31	31	8	6	7	10	0
2	29	29	8	6	6	9	0
3	30	30	8	6	7	9	0
4	28	28	8	6	5	9	0
5	29	29	8	6	6	9	0
6	29	29	8	6	6	9	0
7	29	29	8	6	6	9	0
8	29	29	8	6	6	9	0
9	28	28	7	6	6	9	0

2

4. DOP:

Route	PDOP(AVG)	PDOP(MAX)	HDOP(AVG)	HDOP(MAX)	VDOP(AVG)	VDOP(MAX)
1	0.944	1.010	0.461	0.490	0.821	0.880
2	0.997	1.060	0.485	0.510	0.869	0.930
3	0.980	0.990	0.480	0.490	0.851	0.860
4	1.023	1.050	0.490	0.510	0.897	0.920
5	1.020	1.020	0.490	0.490	0.890	0.890
6	1.010	1.020	0.490	0.500	0.883	0.890
7	1.006	1.030	0.490	0.520	0.879	0.890
8	1.000	1.030	0.491	0.500	0.870	0.910
9	1.002	1.030	0.490	0.500	0.873	0.900

5. Solution Ratio:

Route	Fixed	Float(Stable)	Float(Convergent)	Other
1	100.00%	0.00%	0.00%	0.00%
2	100.00%	0.00%	0.00%	0.00%
3	100.00%	0.00%	0.00%	0.00%
4	100.00%	0.00%	0.00%	0.00%
5	100.00%	0.00%	0.00%	0.00%
6	100.00%	0.00%	0.00%	0.00%
7	100.00%	0.00%	0.00%	0.00%
8	100.00%	0.00%	0.00%	0.00%
9	100.00%	0.00%	0.00%	0.00%

3

6. Inner Consistency Position Accuracy:

Route	Std E(AVG)	Std N(AVG)	Std U(AVG)	Std E(MAX)	Std N(MAX)	Std U(MAX)
1	0.00551	0.00454	0.00759	0.00500	0.00400	0.00700
2	0.00559	0.00457	0.00812	0.00500	0.00400	0.00800
3	0.00556	0.00453	0.00800	0.00500	0.00400	0.00800
4	0.00552	0.00457	0.00807	0.00500	0.00400	0.00800
5	0.00550	0.00451	0.00751	0.00500	0.00400	0.00700
6	0.00550	0.00453	0.00772	0.00500	0.00400	0.00700
7	0.00550	0.00451	0.00751	0.00500	0.00400	0.00700
8	0.00555	0.00468	0.00777	0.00500	0.00400	0.00700
9	0.00553	0.00461	0.00800	0.00500	0.00400	0.00800

4

7. Inner Consistency Attitude Accuracy:

Route	Std R(AVG)	Std P(AVG)	Std H(AVG)	Std R(MAX)	Std P(MAX)	Std H(MAX)
1	0.16516	0.13196	0.97909	0.13200	0.12600	0.95600
2	0.17210	0.13143	0.95929	0.12600	0.12600	0.92400
3	0.14135	0.13172	0.95998	0.12600	0.12600	0.93600
4	0.18617	0.13148	0.99601	0.12600	0.12600	0.96000
5	0.14099	0.13165	1.00479	0.12600	0.12600	0.96600
6	0.18010	0.13167	1.02732	0.13800	0.12600	0.99000
7	0.14566	0.13186	1.03926	0.12600	0.12600	0.98400
8	0.18734	0.13619	1.15050	0.13800	0.13200	1.06200
9	0.15199	0.13800	1.13099	0.13800	0.13800	1.20600

8. Position Forward/Reverse Separation:

Route	Sep E(AVG)	Sep N(AVG)	Sep U(AVG)	Sep E(MAX)	Sep N(MAX)	Sep U(MAX)
1	-0.00030	-0.00023	0.00019	-0.00700	-0.00600	0.00000
2	0.00168	-0.00113	0.00144	0.00000	-0.00700	0.00000
3	0.00074	-0.00035	0.00047	0.00000	-0.00600	0.00000
4	0.00042	0.00055	-0.00050	-0.00600	-0.00400	-0.00800
5	0.00002	-0.00000	0.00001	0.00000	-0.00100	0.00000
6	-0.00018	-0.00039	0.00040	-0.01000	-0.00700	-0.00200
7	0.00022	-0.00010	0.00015	0.00000	-0.00600	0.00000
8	-0.00058	0.00005	-0.00015	-0.00500	-0.00600	-0.00700
9	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

5

9. Attitude Forward/Reverse Separation:

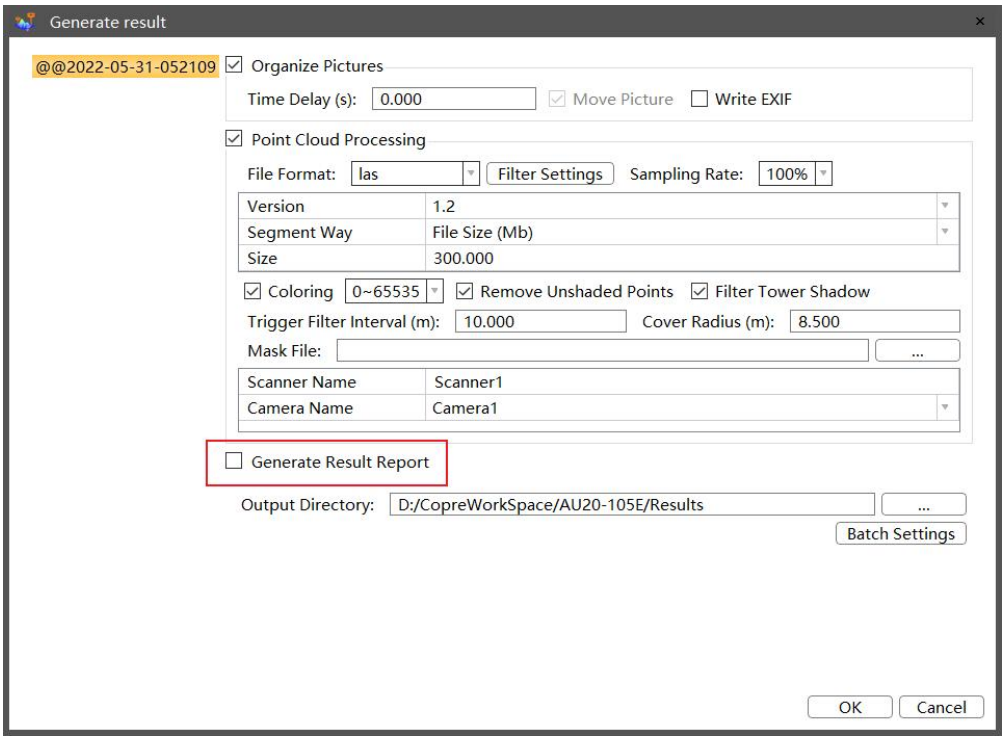
Route	Sep R(AVG)	Sep P(AVG)	Sep H(AVG)	Sep R(MAX)	Sep P(MAX)	Sep H(MAX)
1	-0.00136	-0.00210	0.12996	-0.01850	-0.01060	0.12640
2	-0.00145	-0.00324	0.13390	-0.01310	-0.01290	0.13160
3	0.00121	-0.00020	0.09100	-0.02040	-0.00700	0.09600
4	0.00013	-0.00104	0.02321	-0.01330	-0.01460	0.01010
5	0.00105	-0.00315	0.06042	-0.00670	-0.00520	0.03680
6	0.00104	-0.00356	0.18867	-0.00840	-0.01010	0.08870
7	0.00162	-0.00445	0.05064	-0.01960	-0.00880	-0.02360
8	-0.00370	-0.00202	-0.11097	-0.01920	-0.00900	-0.16900
9	0.00334	0.00866	-0.22256	-0.01510	-0.00110	-0.27160

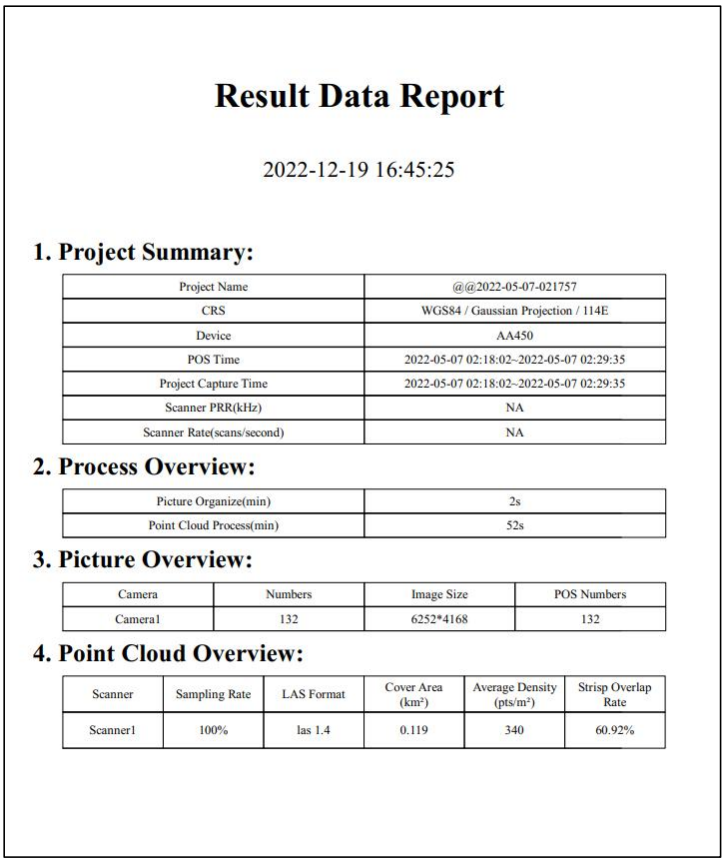
6

Note: the file path of POS report is under the original project "\GPS\Post".

- Added the function of generating result report;

  Check "Generate Results Report" when generating the results, a result report will be generated. The result report includes four parts: project summary, process overview, picture overview and point cloud overview. The result report is as follows:





Result Data Report

2022-12-19 16:45:25

1. Project Summary:

Project Name	@@2022-05-07-021757
CRS	WGS84 / Gaussian Projection / 114E
Device	AA450
POS Time	2022-05-07 02:18:02~2022-05-07 02:29:35
Project Capture Time	2022-05-07 02:18:02~2022-05-07 02:29:35
Scanner PRR(kHz)	NA
Scanner Rate(scans/second)	NA

2. Process Overview:

Picture Organize(min)	2s
Point Cloud Process(min)	52s

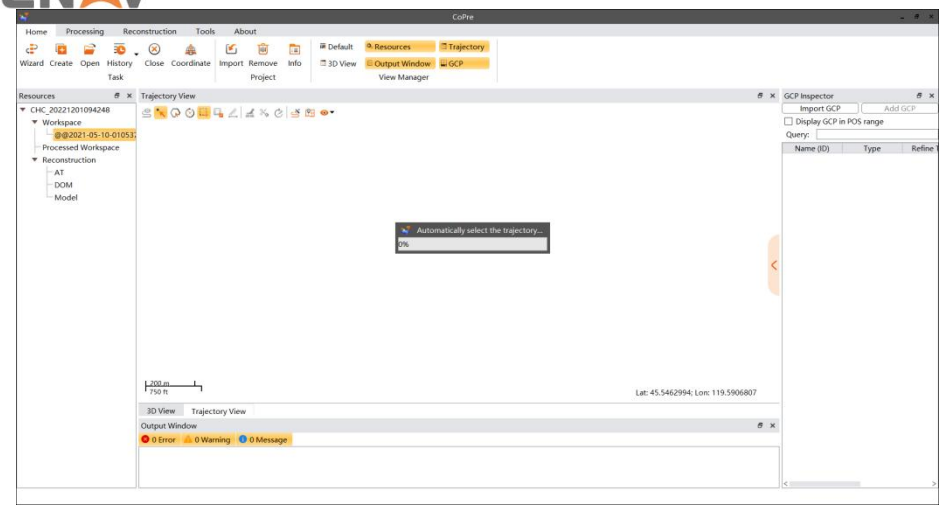
3. Picture Overview:

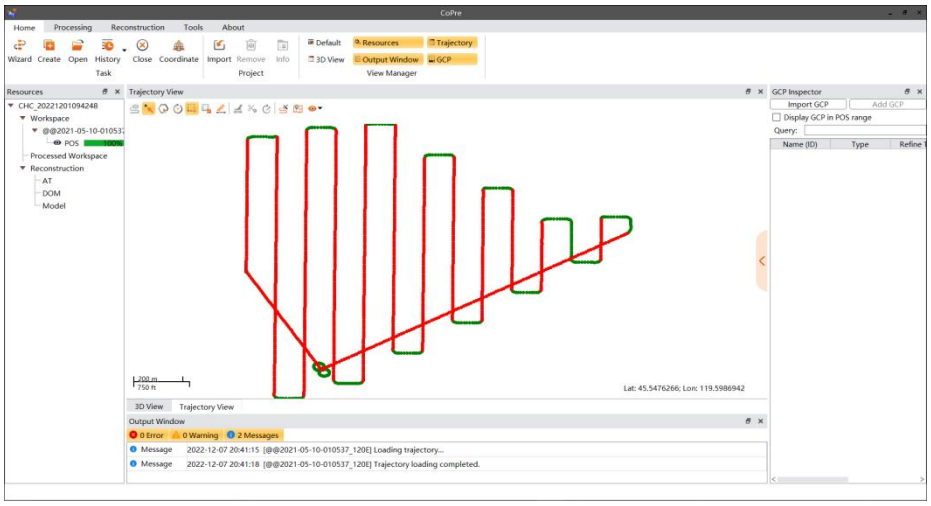
Camera	Numbers	Image Size	POS Numbers
Camera1	132	6252*4168	132

4. Point Cloud Overview:

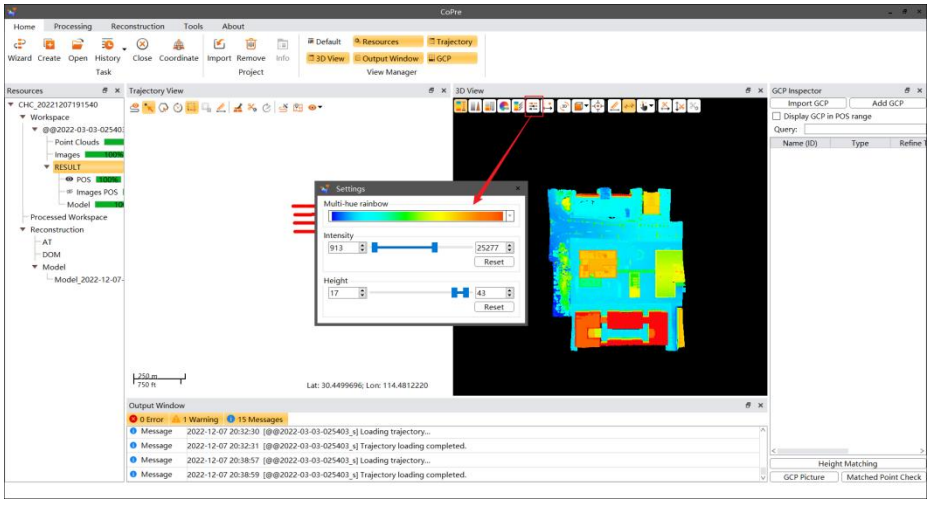
Scanner	Sampling Rate	LAS Format	Cover Area (km^2)	Average Density (pts/m^2)	Strisp Overlap Rate
Scanner1	100%	las 1.4	0.119	340	60.92%

- Added the function of automatic trajectory selection for UAV data;
  Right-click on the original project to display trajectory, and the software will automatically select the straight trajectory of the UAV data
  Note: only straight trajectory longer than 25 sec will be selected.

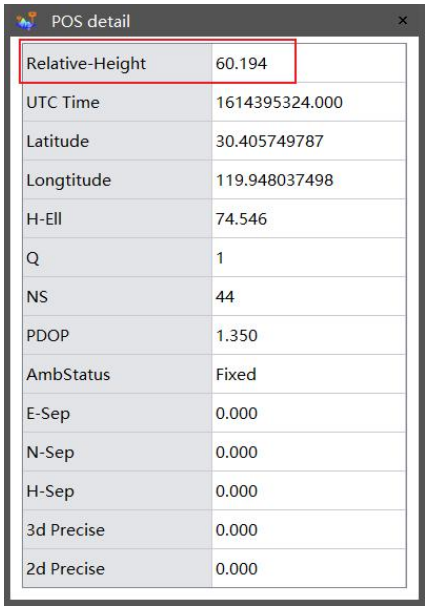




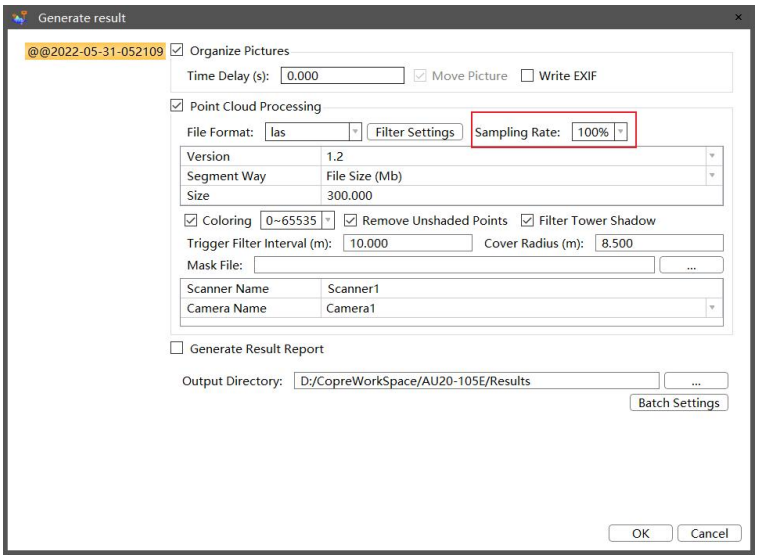
- Added Multi-hue rainbow options for height and intensity coloring;



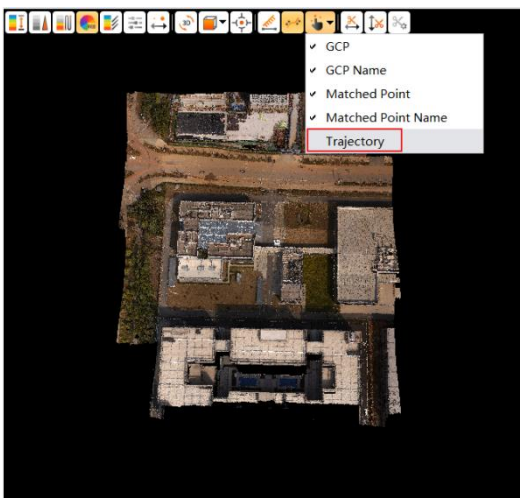
- Added the function of displaying relative height;
  After the POS trajectory being displayed in the trajectory view, “CTRL+ left mouse button” to select the POS trajectory point, and the “POS detail” window will pop up, can check the relative height to the first POS trajectory point

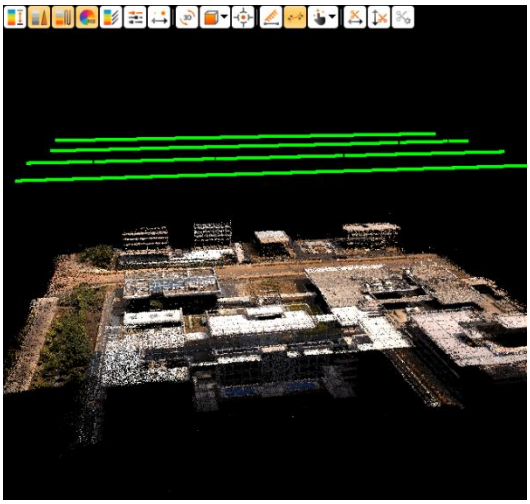


- Added the function of setting point cloud sampling rate when generating results;
  When generating results, can set the sampling rate through the drop-down box at the sampling rate, and the sampling rate can be set to 25%, 50%, 75%, 100%. The default sampling rate is 100%, which means no sampling

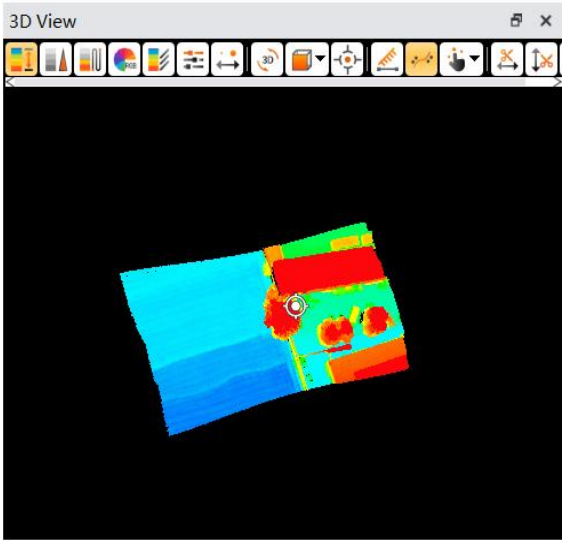


- Added the function of displaying trajectory in the 3D view;

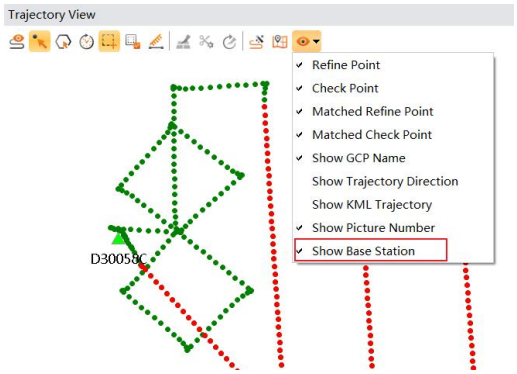


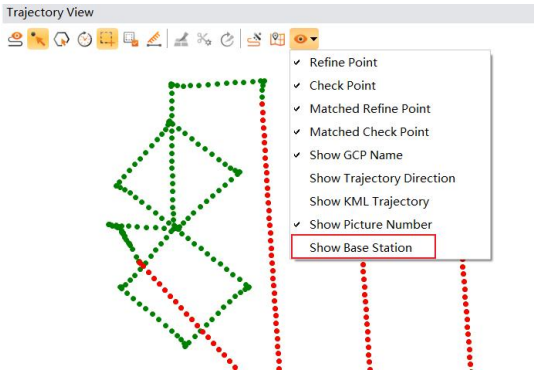


- Added the function of displaying rotation center in 3D view;

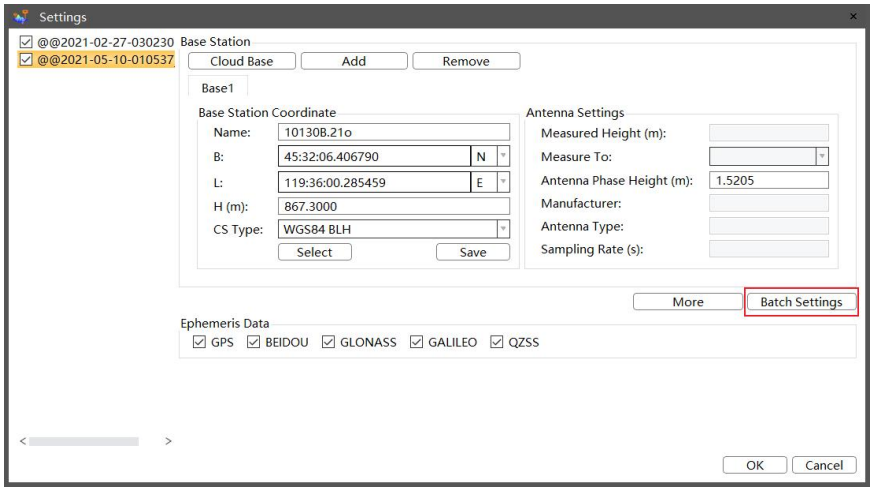


- Added the function of showing / hiding base stations in trajectory view;

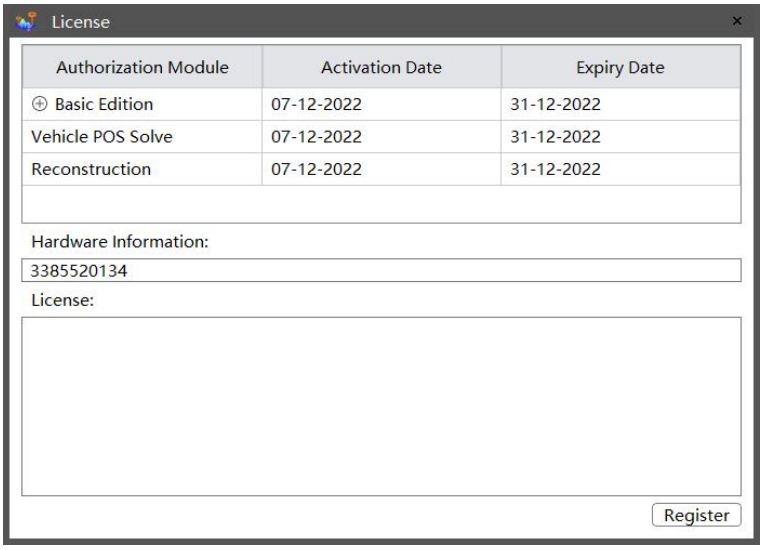




- POS processing supports batch setting of base station parameters;
  When multiple sets of raw project data use the same base station, set the base station coordinates once and click “Batch settings” to complete the base station coordinate settings for all projects

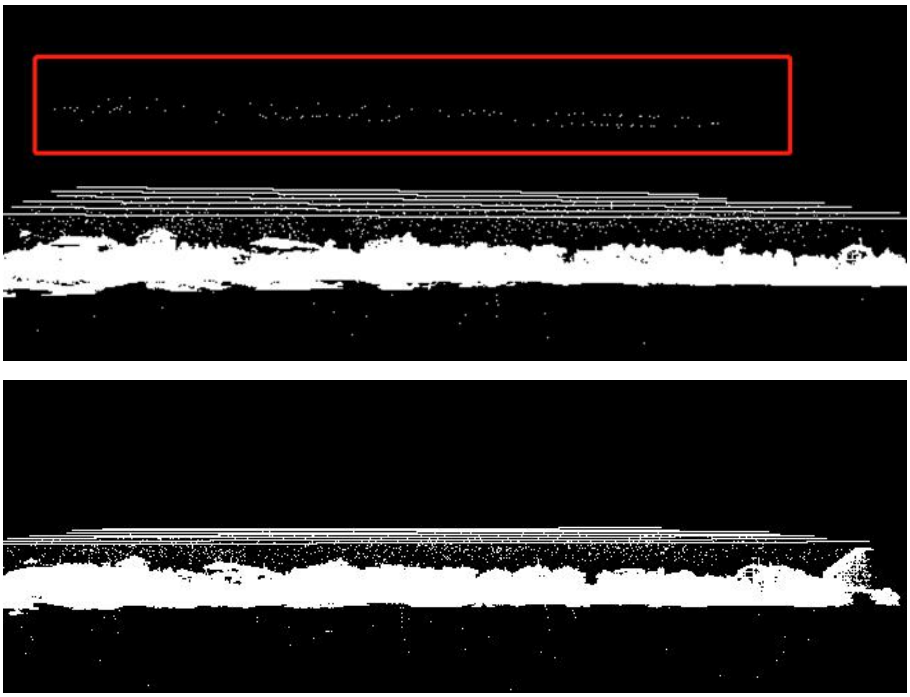


- After picking out the correspondence point, you can use the left, right, up, and down keys of the keyboard to fine-tune the position;
- Optimized license management for modeling module;

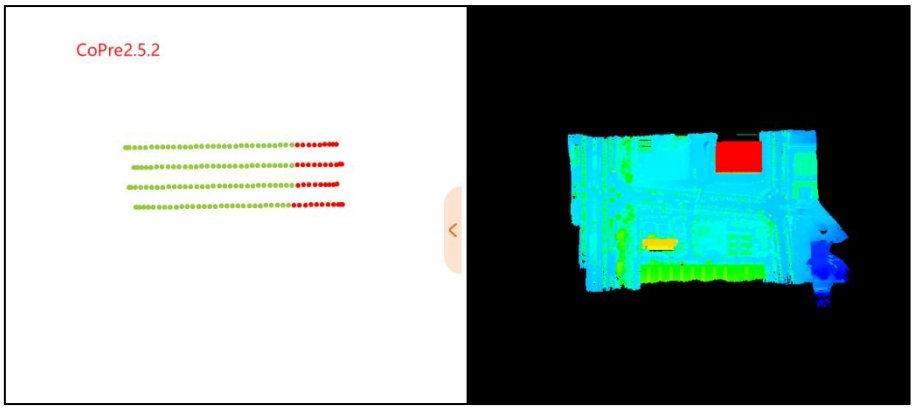


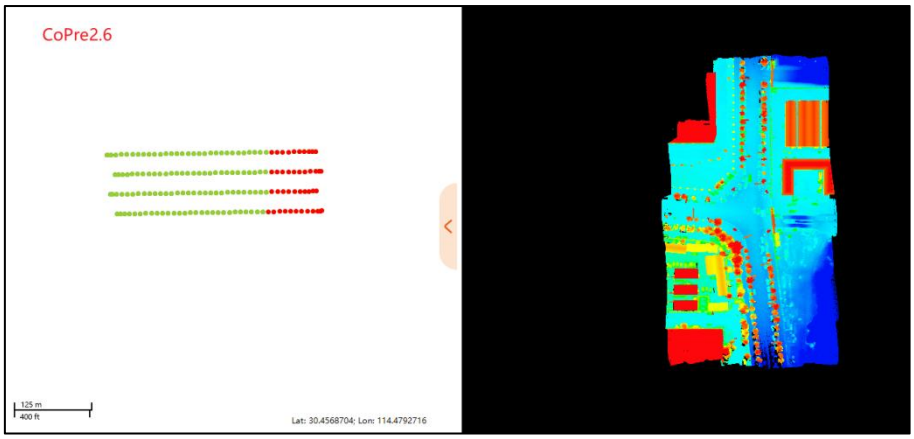
Bug Fixes

- Fixed the bug that the POS trajectory failed to display after POS processing in wizard mode;
- Fixed the bug of failing to set LAS version when doing thickness optimization for AA450 data;
- Fixed the bug of inconsistent point cloud between preprocess and result of preprocess;



- Fixed the bug that the point cloud cannot be displayed according to the selected trajectory after thickness optimization;





- Fixed the bug that POS processing will crash in WIN10-LTSC system;

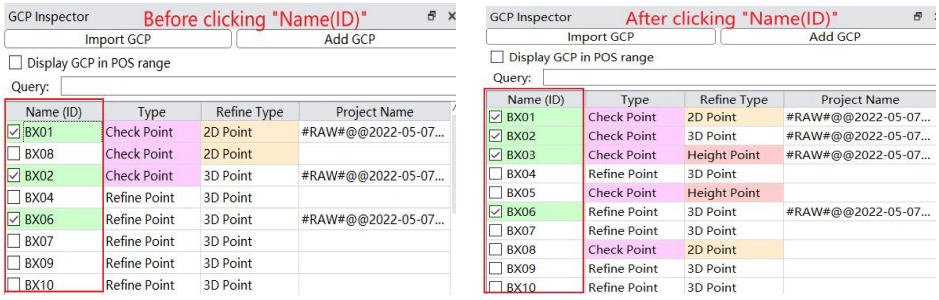
20. CoPre-2.5.2-20221117

New Functions and Improvements

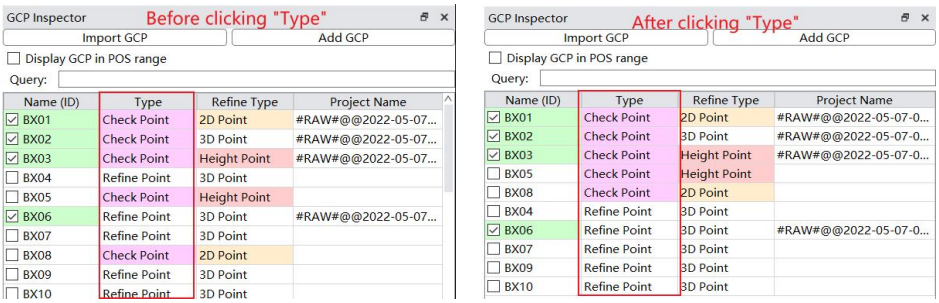
- Added the function of sorting the control points;

  Click the table header to sort the control points.

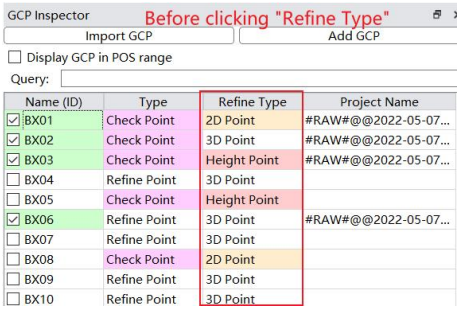
  (1) Click “Name (ID)”, the control points will be sorted in order by the names of the control points, as shown below:

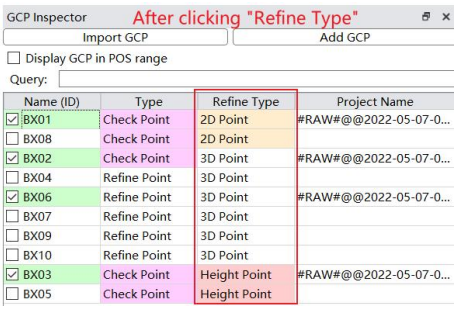


  (2) Click “Type”, the control points will be sorted by “Check Point” and “Refine Point”, as shown below:

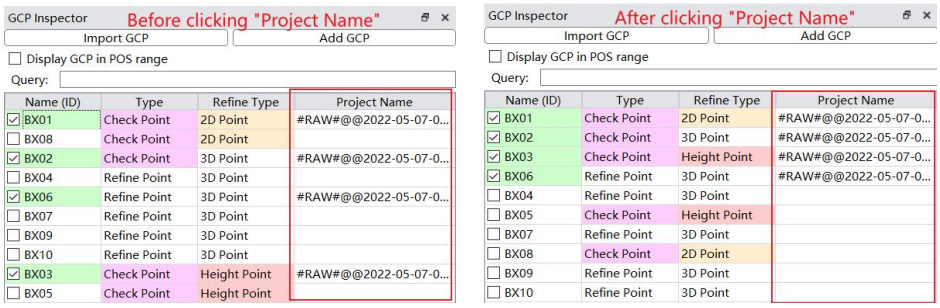


  (3) Click “Refine Type”, the control points will be sorted by “2D Point” , ”3D Point” and “Height Point”, as shown below:


GCP Inspector
Before clicking "Refine Type"
Import GCP
Add GCP
Display GCP in POS range
Query:
Name (ID) Type Refine Type Project Name
BX01 Check Point 2D Point #RAW#@@2022-05-07...
BX02 Check Point 3D Point #RAW#@@2022-05-07...
BX03 Check Point Height Point #RAW#@@2022-05-07...
BX04 Refine Point 3D Point
BX05 Check Point Height Point
BX06 Refine Point 3D Point #RAW#@@2022-05-07...
BX07 Refine Point 3D Point
BX08 Check Point 2D Point
BX09 Refine Point 3D Point
BX10 Refine Point 3D Point

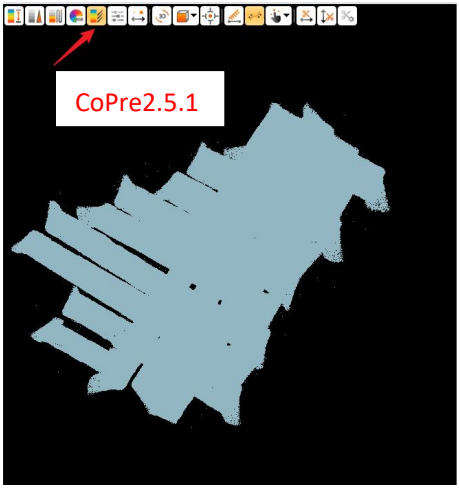

GCP Inspector
After clicking "Refine Type"
Import GCP
Add GCP
Display GCP in POS range
Query:
Name (ID) Type Refine Type Project Name
BX01 Check Point 2D Point #RAW#@@2022-05-07-0...
BX08 Check Point 2D Point
BX02 Check Point 3D Point #RAW#@@2022-05-07-0...
BX04 Refine Point 3D Point
BX06 Refine Point 3D Point #RAW#@@2022-05-07-0...
BX07 Refine Point 3D Point
BX09 Refine Point 3D Point
BX10 Refine Point 3D Point
BX03 Check Point Height Point #RAW#@@2022-05-07-0...
BX05 Check Point Height Point

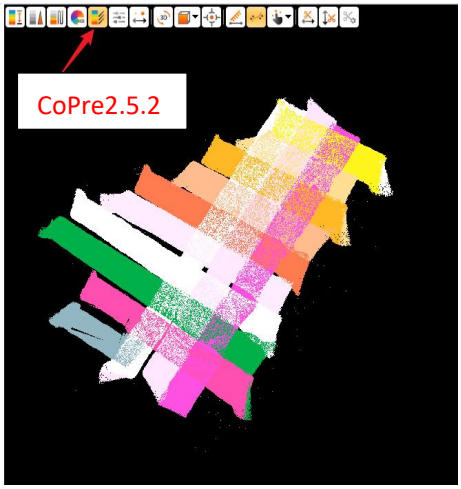
(4) Click “Project Name”, the control points will be sorted by the name of the project, as shown below:



Bug Fixes

- Fixed the bug that Codata format data converted in CoPre 2.4 failed to color by flight in CoPre 2.5.1;



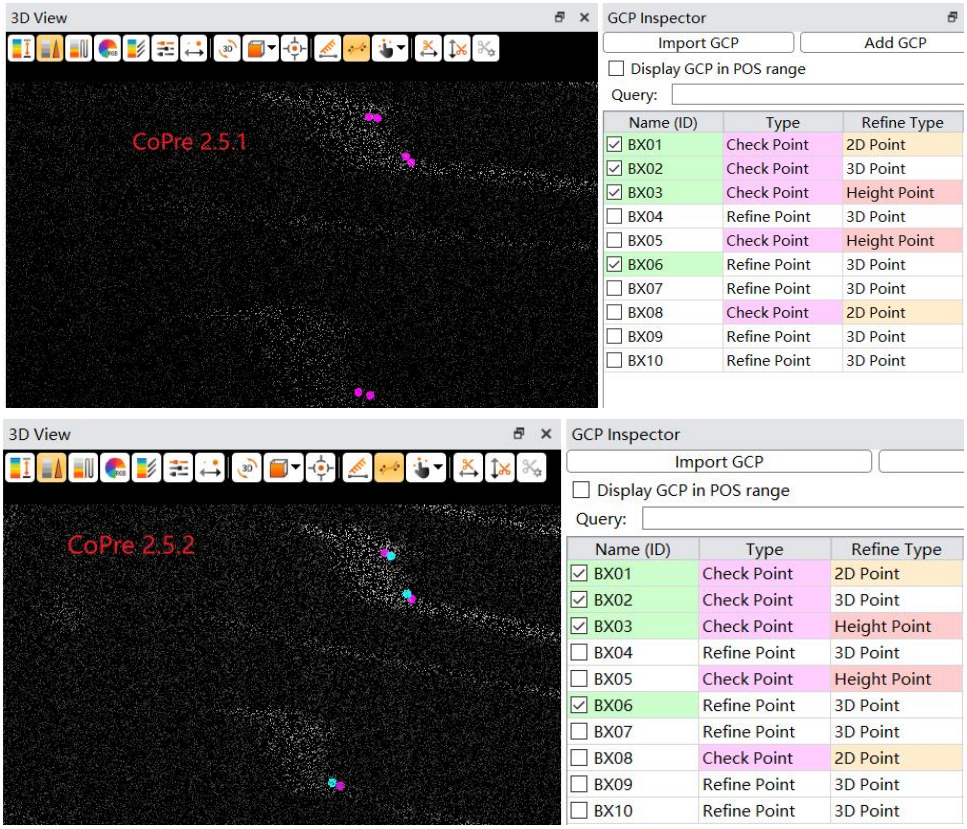


- Fixed the bug that failed to enter the focal length manually when importing images collected by third-party devices;

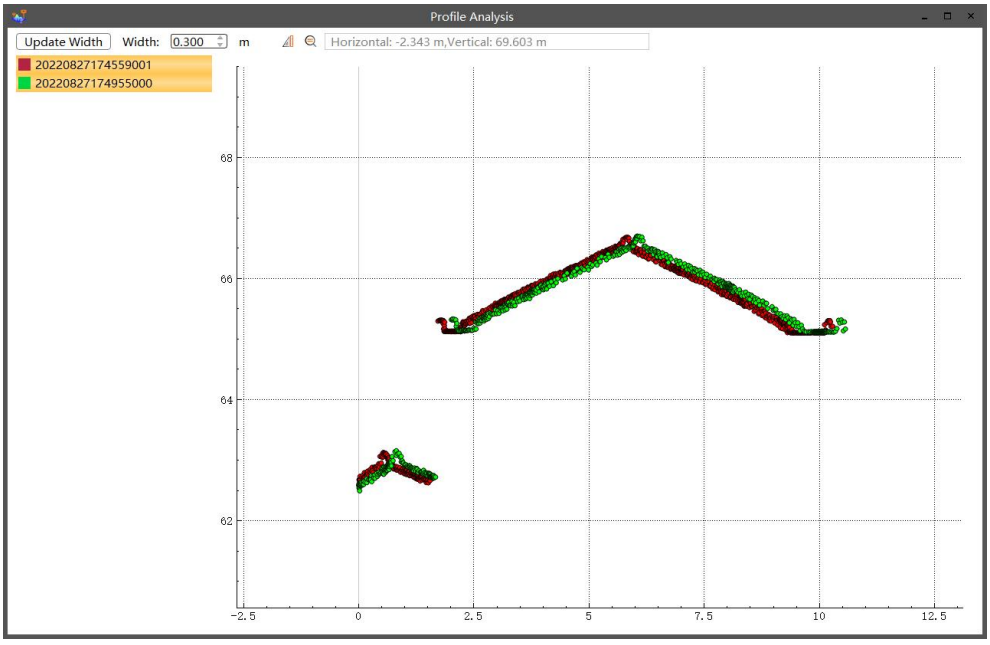
  When importing images collected by third-party devices, if the focal length info is not recorded in the exif, clients need to enter the focal length manually in CoPre. CoPre 2.5.1 failed to enter the focal length manually, and CoPre 2.5.2 fixed the bug

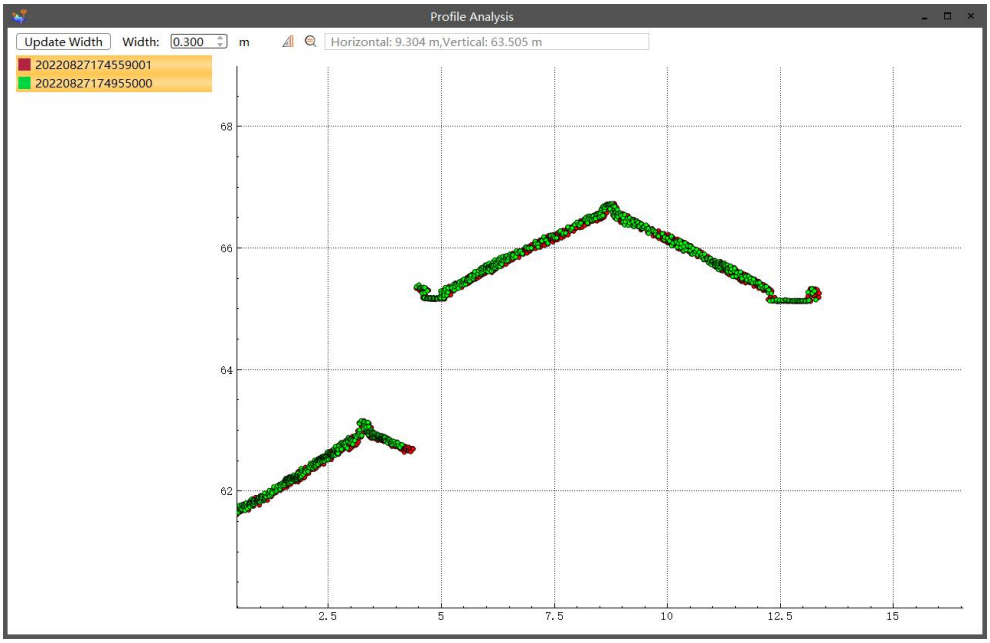
- Fixed the bug that check points are indistinguishable from matched points;

  Both check points and matched points are purple in CoPre 2.5.1, so it is difficult to distinguish them. The check points are purple, and the matched points are blue in CoPre 2.5.2



- Solved the problem that when the single flight is long the adjustment result will be not good;





21. CoPre-2.5.1-20221017

- Support the import of images collected by the third-party equipment to generate DOM and reconstruction;
- Optimized the adjustment algorithm of single flight, and improve the data processing efficiency by 2-5 times;
- Optimized the refinement algorithm, and improve the data processing efficiency by 2 times;
- Optimized CoData format for compatibility with CoProcess;
- Optimized the stumbling problem during point cloud browsing;
- Optimized the output of abnormal information when processing POS;
- Fixed the bug that sometimes there is a missing trajectory in POS processing;
- Solved data processing problem of AA1400;
- Fixed the bug that an abnormal prompt will pop up when adding new control points;
- Fixed the bug that data could not be processed and displayed when the PosT output frequency more than 200 Hz;
- Fixed the bug that when the mission time is too long, may fail to download the cloud base station data;

22. CoPre-2.4.6-20220914

- Added the function that support data copy of C5 21 mm camera;

23. CoPre-2.5.0-beta-20220902

- Added the 3D reconstruction function, including aerial triangulation, generating DOM, modeling functions;

- Adjusted the layout of the software interface;
- Set the coordinate system when creating a new task;
- When processing POS, the coordinates of the base station can use the local coordinate system;
- Added the data copy function of C5;
- Optimized the information output window;
- Delete the repetitive POS of images when organizing pictures;
- Fixed the bug that during POS processing “authorization expiration” info will pop up;
- Fixed the bug that “Degree. Minute Second” format file was incorrectly read in Coordinate Conversion Tool;
- Fixed the bug that the POS processing fails caused by too many base stations;
- Fixed the bug that the antenna height of some HCN files was incorrectly read;
- Fixed the bug of UAV data stop at 50% during POS processing;

24. CoPre-2.4.5-20220821

- Added function of AU20 data MTA processing;
- Added function of Riegl laser data MTA processing;
- Optimized image matching logic of Data Copy Tools;
- Added the SD card security eject function after the data copy is complete;
- Fixed data missing issues of SDC solution;
- Fixed image organizing issues of C30;
- Fixed crash issues when multiple laser files exist in AA1400/AA2400 project;

25. CoPre-2.4.4-20220722

- Turn on the scale factor of IMU;

26. CoPre-2.4.3-20220621

- Added function of C30 + P530/P330 data copy and data process;
- Support to convert las file in Coordinate Conversion tool;
- Support to display the location of control points used in Coordinate Conversion tool;
- Fixed bug with the CoPre would crash in some cases;
- Fixed bug with AA1400 multi-prism data process is abnormal;
- Fixed bug with abnormal display according to the flight;
- Fixed bug with RXP data was deleted when SDC data was added;
- Fixed bug with I50 receiver data model read error;
- Fixed bug with laser data matching errors on some devices when copy data;
- Fixed bug with the abnormal display of drive on some devices when copy data;
- Fixed bug with Data Copy tool window text color display error;
- Fixed bug with E57 format point cloud content error;

27. CoPre-2.4.2-20220430

- Added function of downloading cloud base station;
- Added function of displaying base station location in trajectory view;
- Optimized software interface style;
- Adjusted the software interface of the Data Copy tool;
- Support data copy for C30 and C6 devices;
- The coordinate transformation tool supports transformation of point clouds;
- Support displaying control point distribution when parameter calculation in Coordinate conversion tool;
- DOM in OSGA format can be imported;
- Fixed some translation errors;
- Fixed displaying bug when the coloring point cloud RGB value was (0, 0, 0);

28. CoPre-2.4.1-20220402

- Added laser data processing function of AA1400/AA2400;
- Fixed a bug that SW will crash when processing a single flight data;

29. CoPre-2.4.0-20220316

- Added DOM quick generation and DOM browsing functions;
- Added the function to refine both Position and Attitude;
- Added Geodetic coordinate system, Earth-fixed coordinate system and Space rectangular coordinate system;
- KML import supports displaying attribute information;
- Added authorization expiration notification function;
- Added plane filtering function;
- Added trajectory jump check and repair function;
- Added the function of coloring by flight;
- Support to load the solved point cloud during data processing;
- Support loading point clouds of refining and point clouds of adjustment simultaneously;
- Optimized GCPS import function;
- The import project and import control point locate the last path by default;
- Fixed a bug that point cloud solved using 7 parameters does not match the map;
- Fixed a bug of incorrect names of taskbar window;
- Fixed a bug of point cloud browsing with AMD processor;
- Fixed a bug where CoPre would prompt expired authorization in case of data problems;
- Fixed a bug where western hemisphere data projection coordinate value was 0;
- Fixed a bug of 4 parameter calculation error in Coordinate Conversion Tool;

30. CoPre-2.3.2-20211223

- Fixed the bug of coordinate conversion error when the central meridian is 0;
- Fixed the bug of multi laser point could loading;
- Fixed bug with invalid LAS / LAZ echo in version 1.4;
- Fixed the bug of UAV data coloring error;
- Fixed bug with wrong separator of onboard orbit template;
- Fixed the bug that the point cloud cannot be loaded by the POSC of the GPS1980 system;
- Fixed the bug of point cloud coordinate error when some data are converted with ellipsoid;

31. CoPre-2.3.1-20211127

- Fixed bug of central meridian reading error during adjustment;
- Fixed the bug that the scanning angle and echo times of RIEGL data calculate error;
- Fixed the bug of incorrect information recording in the northern and southern hemispheres of the result point cloud coordinate system header file;
- Fixed the bug that point clouds display abnormal of section analysis;
- Fixed the bug that automatic slicing display abnormal in adjustment;

32. CoPre-2.3.0-20211117

- Added the function of Task Wizard;
- The result data supports the height matching;
- Support SLAM data processing;
- Automatic slicing adds automatic check layering function;
- Added POS accuracy curve;
- Result point cloud adds the scan angle information;
- Added mask function of vehicle data coloring;
- Result point cloud adds the coordinate system information;
- Added images Mask tool;
- Optimized software interface and some data processing logic;
- Optimized the function of point select, the nearest control point will be automatically matched after selecting points;
- Unified the section style of vertical slice and automatic slice;
- Unified Chinese and English coordinate system setting page;
- Optimized the echo information of result point cloud;
- Optimized data processing stability of AA450;
- Optimized the window of import project;
- Optimized the size of log files;
- Fixed the bug that the Data Copy tool crashes after matching data;
- Fixed the bug that the Data Copy tool matches incorrectly project data;
- Fixed the bug of point cloud data color rendering;

- Fixed the bug that some camera data match incorrectly of the Data Copy tool;
- Fixed some bugs caused after formatting of the Data Copy tool;
- Fixed the bug of wrong picture naming;
- Fixed the bug with the wrong time of adding SDC data;
- Fixed the bug of HCN conversion failure with multi project POS solving;
- Fixed the bug of software crash when refine under network path;

33. CoPre-2.2.3-20210907

- Fixed the bug of software crash when generating refine Codata;
- Fixed bug that refine Codata cannot generate;
- Fixed the bug that the threshold from GCP to pos is wrong under foot project;
- Fixed the bug of data time reading error in some RINEX 3.02 data;
- Fixed some bugs with incorrect prompt information;
- Fixed the bug of wrong point time of three-point fitting circle center;

34. CoPre-2.2.2-20210827

- Supported new device protocol resolution;
- Picture solving supports exception data processing;
- Fixed some bugs in Russian system;
- Fixed Hesai laser echo bug;

35. CoPre-2.2.1-20210804

- Fixed the bug of partial data solution failure of CoPOS;
- Fixed the bug of inconsistent center display of point cloud in 2D view and 3D view;
- Fixed the bug that only display GCP in the current pos range is abnormal of result trajectory;
- Fixed several bugs in accuracy report of Refine;
- Fixed the bug with invalid intensity render when switching result point cloud;
- Fixed the bug that when central longitude displayed as zero during the Western Hemisphere data adjustment;
- Fixed the bug of multiple camera data matching in the Copy Data tool, only one camera is successfully matched;
- Optimization: Data Copy tool checks the remaining disk space before copying data;
- Copy Data tool adds the function of opening the output directory;
- Added function of auto-slicing ;
- Added stop function;
- Added MTA function;
- Rearranged some icons on the software page;
- Optimized processing efficiency of AA450 data and fix the problem of data solution failure;
- Fixed the problem of partial POS solution failure;

- Fixed the bug that Chinese version of the coordinate system settings error;

36. CoPre-2.0.9.102-20210528

- Added the function of unit selection when importing control points, and support the degree, minute and second format;
- Unified the English coordinate system with LS7;
- Fixed the bug that multi project POS solution doesn't work at the same time;
- Fixed the bug that adjustment and refine cannot generate colored point cloud without movie picture;
- Fixed the bug that generated DD file with wrong format;
- Fixed the bug of base station coordinate display error in POST file header of Western Hemisphere and southern hemisphere;

37. CoPre-2.0.9.101-20210514

- The base station data of POS solving supports HCN format (HCN to RINEX 3.02);
- Fixed the bug that the original project can't display the point cloud without photo data;
- Optimized the photo missing detection function;
- Optimized the compatibility of Data Copy tool;

38. CoPre-2.0.9-20210416

- Added the unit of US feet and international feet;
- Added the Data Copy tool;
- Added accuracy evaluation items of CoNAV: satellite number, PDOP, forward and backward solution accuracy;
- Added the function of result accuracy verification;
- Fixed the bug of license reading error;

39. CoPre-2.0.8-20210329

- Optimized file directory structure;
- Optimized CPU utilization in data solving;
- Added the function of result project import;
- Added the laser solution of Hesai;
- Fixed the bug that the point cloud cannot be solved with the noise filtering selected;
- Fixed bug that the color LAS cannot be generate after refine process;

40. CoPre-2.0.7.104-20210305

- Fixed the BUG that laser type identification is invalid of point cloud optimization;
- Fixed the BUG of single camera photo size reading error;
- Improved algorithm of point cloud optimization;

41. CoPre-2.0.7.103-20210303

- Fixed some translation problems;
- Fixed the segmentation error of LAS when generating results;

42. CoPre-2.0.7.102-20210303

- Fixed the problem of incorrect display of the collection time in the viewing project;
- Fixed that when reading post files, the files with the suffix of "post" are not recognized;
- Fixed the problem that fail to color point cloud with the error of "The picture result is not generated by the modified post/cp file, please check!" when generating result;
- Fixed the problem that the track view user selects the path, and the map does not take effect;
- Fixed the problem that the solution is not complete when the photo is organized in Ladybug multiple series Pgr;
- Fixed the problem of low real-time coloring efficiency of point cloud;
- Fixed the problem that the central meridian value of the coordinate system set last time can't be recorded;
- Fixed the problem that crash when removing the result project after switching the item;
- Select the point cloud list according to Codata and arrange in order of part number;
- The naming suffix format of the copy control point is changed to: _1, _2, _3, and it will be automatically extended every time it is copied;
- Added the function of point cloud optimization;

43. CoPre-2.0.7.101-20210207

- Fixed the crash when importing seven parameters;
- Fixed that the base station in the selected base station coordinate database cannot be solved;
- Fixed the failure of photo finishing and recognition test shooting;
- The Data Trans tool adds inertial navigation type setting items;
- The CoNav pos solution opens the estimated tropospheric model;

44. CoPre-2.0.7-20210118

New Functions and Improvements

- SolvedProjects supports the combined display of point cloud and panoramas;
- Added the selection and storage of base station data;
- Adjust and refine added the function of manually updating the camera pos;
- Added the function of GCP leakage inspection;
- One control point is shared for one project, and the matching point corresponds to the project;
- The GCP can be displayed according to the project pos range;

- Trajectory view and cloud point view added control GCP prefixes to facilitate viewing the correction type of GCP;
- The camera pos displays the corresponding photo number in the trajectory view, and supports the function of display and hiding;
- The Adjust provides the option of whether to generate Codata;
- Trajectory view time period and actual solution time period are displayed separately;
- In the trajectory view, Polygon Select and Measure support mouse double click to end;
- Trajectory view optimization: remove the gray outer border of the track point;
- Accuracy verification report adds average value and coordinate system attributes;
- The laser supports three echoes;
- Solved speed conversion: convert ENH to IMU;
- Added tooltip descriptions for parameter settings of Adjust and generated Result;
- The pos solve of CoNav speed is converted from the ENH to the carrier speed;

Bug Fixes

- Fixed issue when Latitude is set to 036:00:00.000000, the interface is displayed as 03:60:00:00.000000;
- Solved the problem of software crash when closing the project during pos solving;

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