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Introduction

LiDAR360MLS is a feature intelligent extraction and analysis software independently developed by GreenValley International. It primarily supports devices such as LiGrip, LiBackpack, LiMobile, and other third-party mobile mapping systems. The software is designed to intelligently process and analyze acquired laser point clouds and images (panoramic/planar), providing users with a one-stop solution from pre-processing to post-processing delivery.

The software framework includes data visualization browsing, measurement and editing tools, over 60 point cloud processing tools, more than 100 vector mapping tools, over 40 image processing tools, AutoCAD plugins, etc. It is equipped with multi-scenario point cloud intelligent classification models, offering intelligent annotation of point cloud and image data, and a complete production chain from AI model training to model inference.

The Asset Extraction module utilizes point cloud and image data combined with proprietary AI algorithms to intelligently extract and vectorize various traffic signs, road markings, and roadside facilities. It is applicable to scenarios such as holographic surveying (GIS asset), topographic surveys, high-precision map production, smart city development, and infrastructure management.

The Architectural Drawings module provides automatic vectorization of architectural floor plans and faced survey, suitable for architectural design and construction planning.

The Road Condition module offers various 3D analysis functions, such as damage, clearance, height limit analysis, cross-section, and road terrain production. It can be applied in fields like 3D spatial analysis, inspection and maintenance, safety warnings, railway inspection, topographic mapping, railway inspection analyses, bridge safety analyses, urban power line clearance analyses, and road limit restriction analysis.

The Road Scene module provides one-click modeling and model editing functions for road component-level elements, applicable to component-level road 3D modeling and digital twinning.

The Forestry module offers individual tree segmentation, editing, parameter calculation, and 3D analysis, suitable for urban greening, park management, tree health monitoring, and urban ecological planning.

The GSReconstruction Module provides one-click creation of realistic GS rendering models based on data from LiGrip O1Lite/O2Lite and LiGrip H300 devices, and offers functions such as mapping, measurement, and roaming based on the GS model.

LiDAR360MLS V9.1.2.0 Release Notes

Architectural Drawing Module

Floor Plan

1.Added wall creation function with real-time prompts for angle, length, and topological relationships (perpendicularity/parallelism to other lines, alignment with endpoints, midpoints, vertical extensions, etc.).

2.Added door creation function using a three-point interaction method to generate door elements in floor plans, with support for door direction switching.

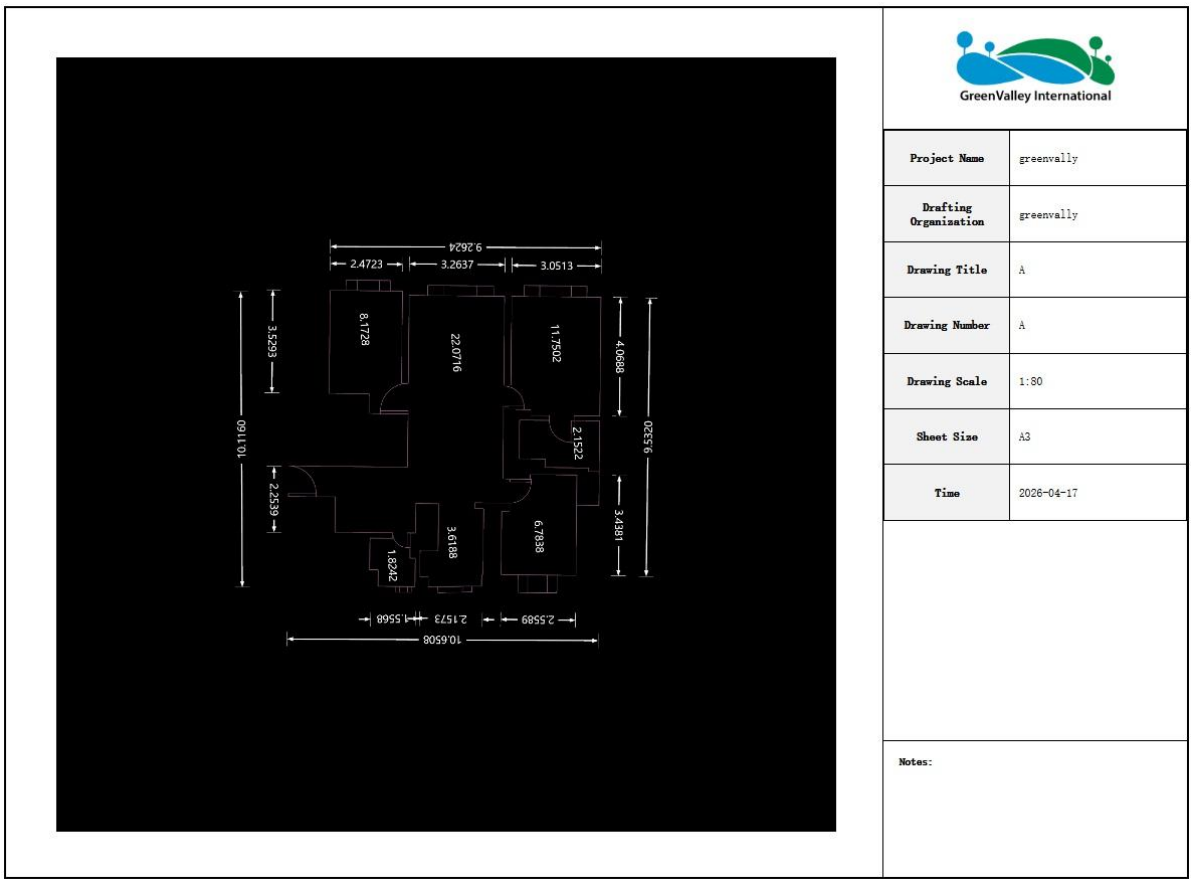
3.Added window creation function using a three-point interaction method to generate window elements in floor plans, with support for window direction or thickness adjustment.

4.Added dimension annotation function to display length values and auxiliary dimension lines.

5.Added area annotation function to display area values.

6.Added elevation annotation function to display height values and auxiliary height lines.

7.Added report export function supporting export of floor plans (with annotations), operator information, timestamps, and other metadata.



8.Optimized automatic vectorization to improve the accuracy of floor plan contour extraction.

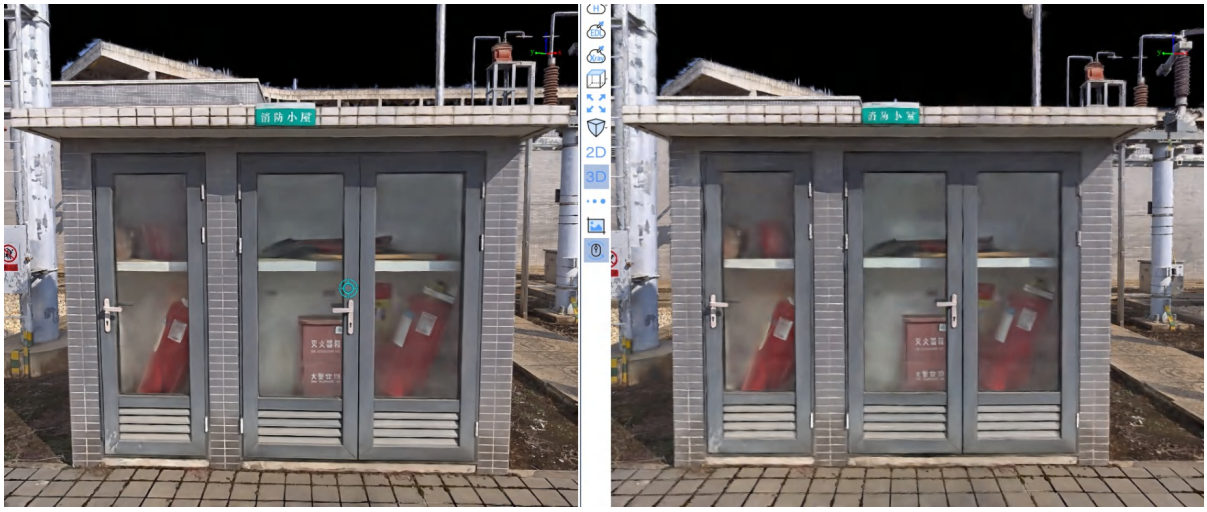
BIM

1.Optimized multi-story building drawing interaction: when editing multi-story structures, existing vector elements of other floors can be hidden based on the current horizontal section.

GSReconstruction Module

1.Fixed an occasional out-of-memory crash during block splitting of point clouds when performing Gaussian reconstruction with handheld high-density data.

2.By improving the 3DGS algorithm, the model's ground flatness and detail quality have been significantly enhanced.



Gaussian Effect Comparison 1: V9.1.2 vs V9.1.1

Gaussian Effect Comparison 2: V9.1.2 vs V9.1.1

GIS Asset Module

1.Added automatic area calculation to the traffic sign drawing function.

2.Fixed an issue where individual text elements displayed abnormally during text drawing.

Urban Forestry Module

1.Optimized single-tree segmentation performance in low-canopy scenarios.

Framework

1.Added log packaging function: when issues occur during solving, Gaussian reconstruction, etc., all relevant logs can be packaged into a compressed archive for easy transmission.

2.Added function to convert sheet frames into vector objects.

3.Added vector copy function: select any vector and copy it to any position.

4.Added vector line measurement function: after selecting a vector line, measure its original width in the point cloud; results are stored in attribute fields.

5.Optimized vector selection and navigation to jump directly to the clicked location.

6.Optimized undo operation for the connection line function, allowing a single-step undo to the pre-connection state.

7.Optimized camera view to maintain consistency when switching planar camera frames.

8.Fixed an issue where duplicate points occasionally appeared during point-to-line and line-to-line splitting.

Geo Module

New Features

1.Added multi-base station fusion positioning to improve continuity and availability.

Enhancement

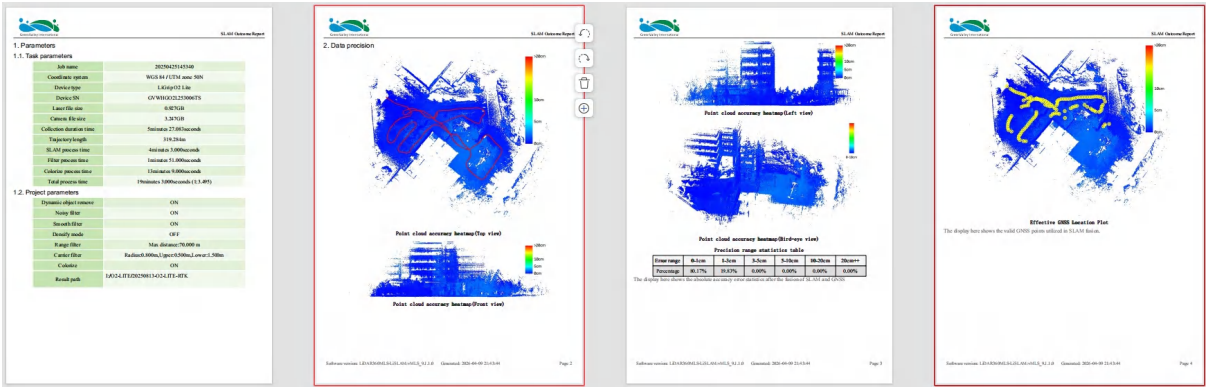
1.Optimized stability of data solution for Ladybug panoramic cameras.

BP Module

New Features

1. Supports automatic generation of SLAM reports

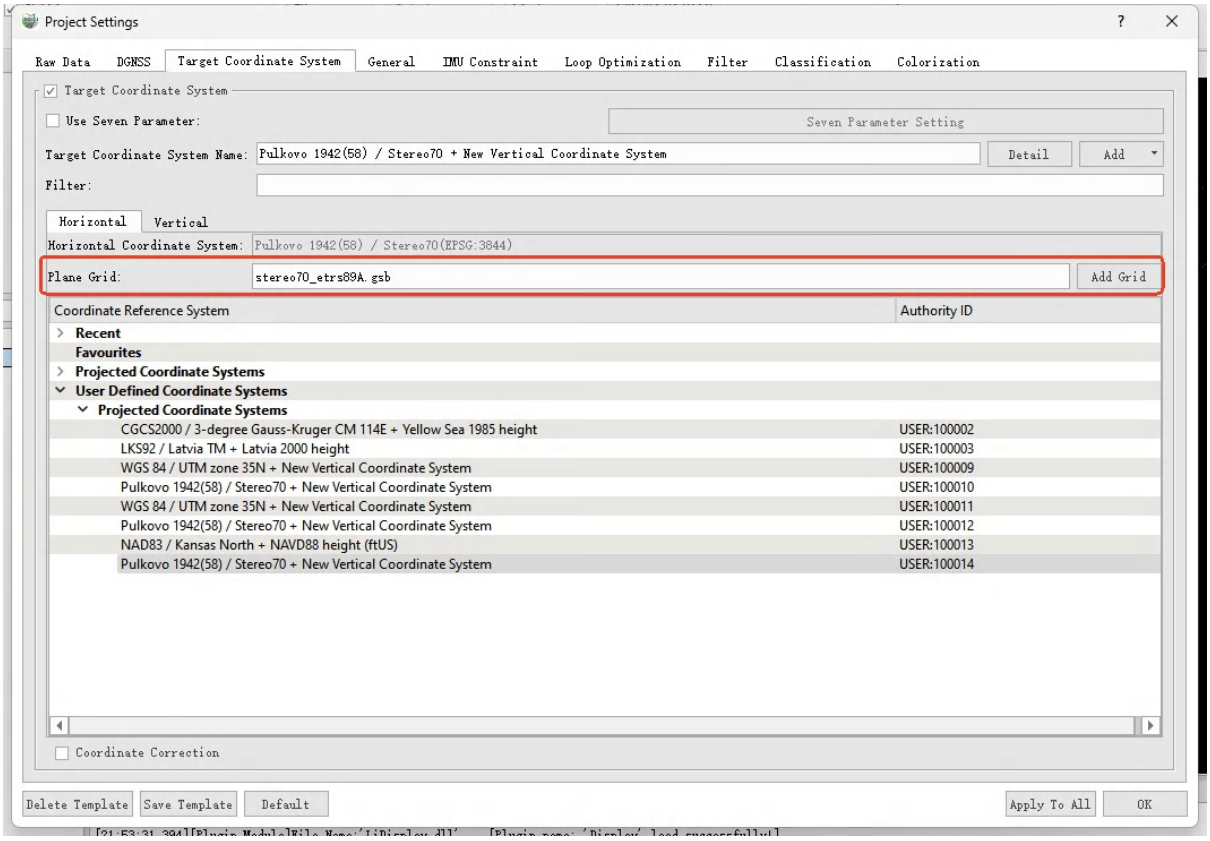
Generates SLAM reports that include: mission parameters, slam parameters, hardware specifications, SLAM errors and solutions, SLAM accuracy report, checkpoint accuracy report, and GCP report.



SLAM Report

2. Added support for Planar shift grids.

Supports planar shift grid formats such as TIF, GTX, and GSB.

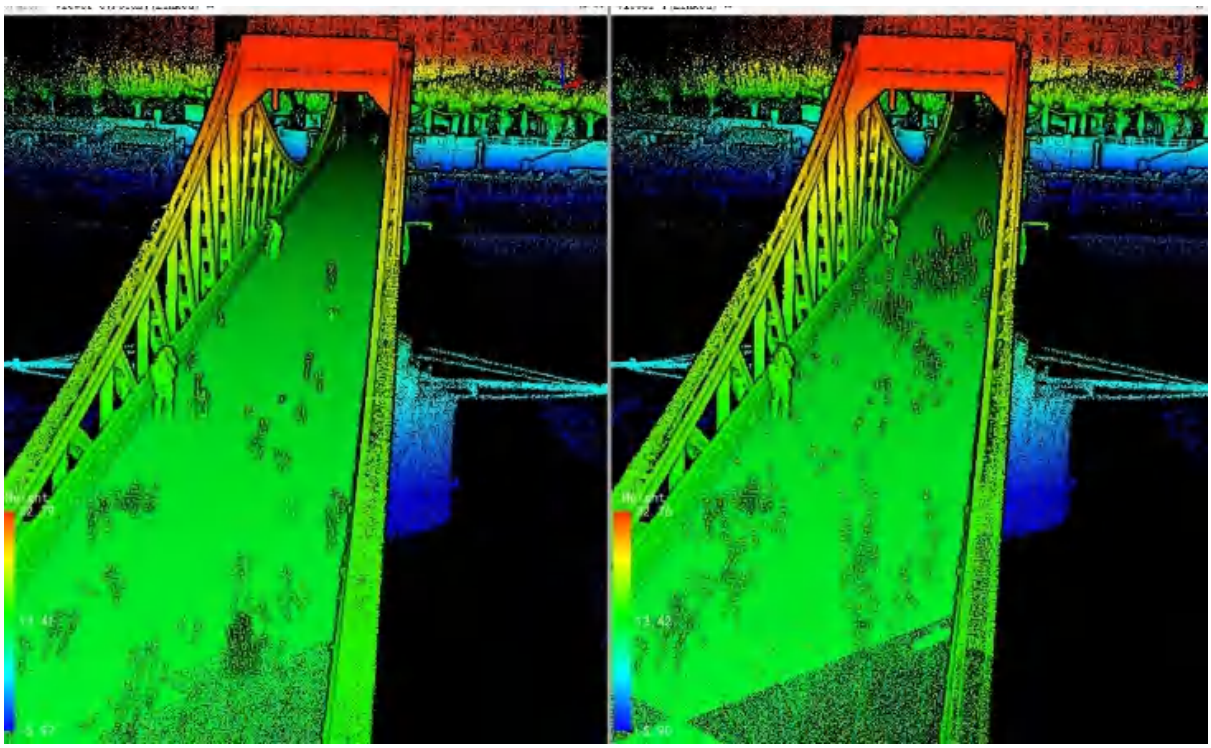


Shift Grid

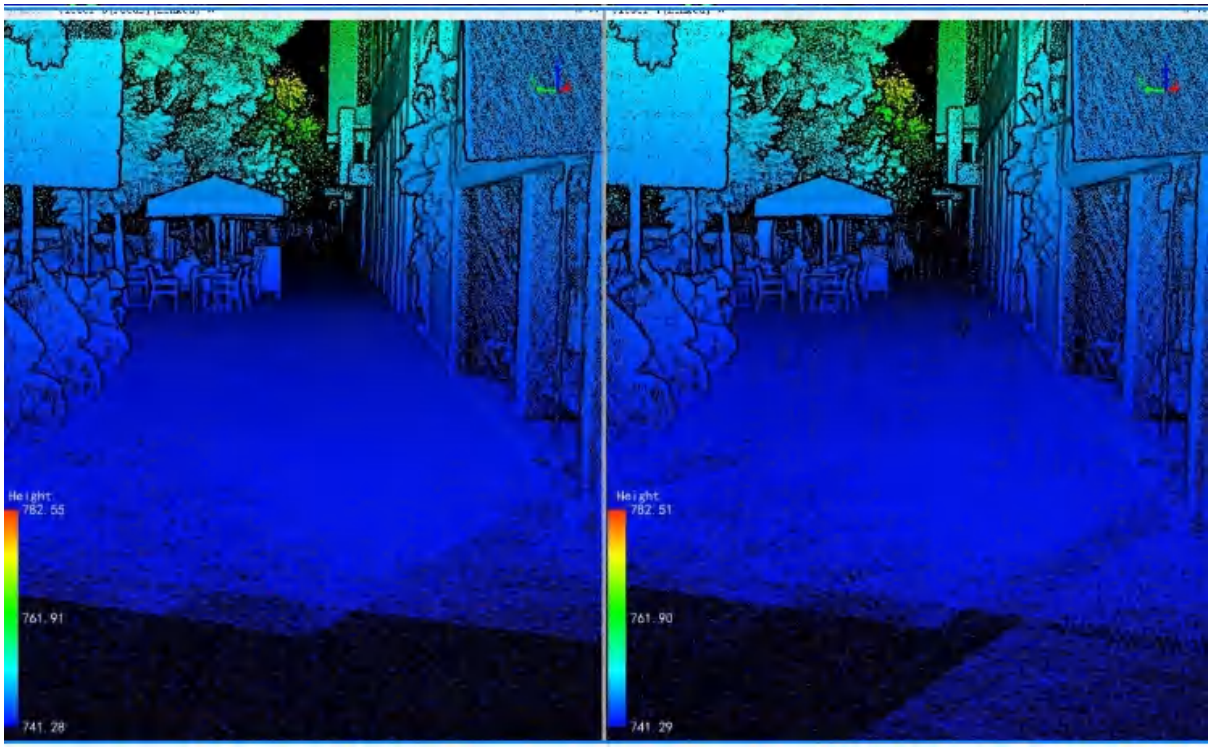
Optimizations

1. Improved the performance of dynamic object removal.

Optimized dynamic object removal.



Left: 9.1.2 Right: 9.1.1



Left: 9.1.2 Right: 9.1.1

Fixes

1. Fixed a video parsing error with the H120-A10 device.

2. Fixed an algorithm instability issue with LiGrip SE in indoor environments.

LiDAR360MLS V9.1.1.0 Release Notes

Additions and Optimizations for Mapping Project

1.Added unit conversion function to support data conversion of point clouds, trajectories, and images between different units.

2.Added an inverse selection feature for Gaussian deletion.

3.Added the ability to directly delete multiple selected blocks in Gaussian deletion.

4.Fixed an issue with the panoramic window display when linking panoramic views with point clouds or Gaussian data.

5.Fixed the problem where raster data was not refreshed in a timely manner.

6.Fixed the issue of incomplete text modeling in road modeling.

7.Fixed the occasional problem of ground black holes in indoor data during Gaussian reconstruction.

8.Fixed the incorrect elevation snapping issue when cross-drawing in the BIM module.

9.Fixed the problem where the wall drawing function in the BIM module did not automatically switch to 2D mode.

LiDAR360MLS V9.1.0 Release Notes

Gaussian Reconstruction Module

Significant Improvement in Gaussian Splatting Effects

1.Optimized the Gaussian splatting reconstruction algorithm. Compared with version V9.0, under the same GPU memory conditions, the reconstruction generates more points with significantly enhanced details.

- LiGrip Data：

Scenic Area Scene:

V9.0 Gaussian result

V9.1 Gaussian result

Substation Scene:

V9.0 Gaussian result

V9.1 Gaussian result

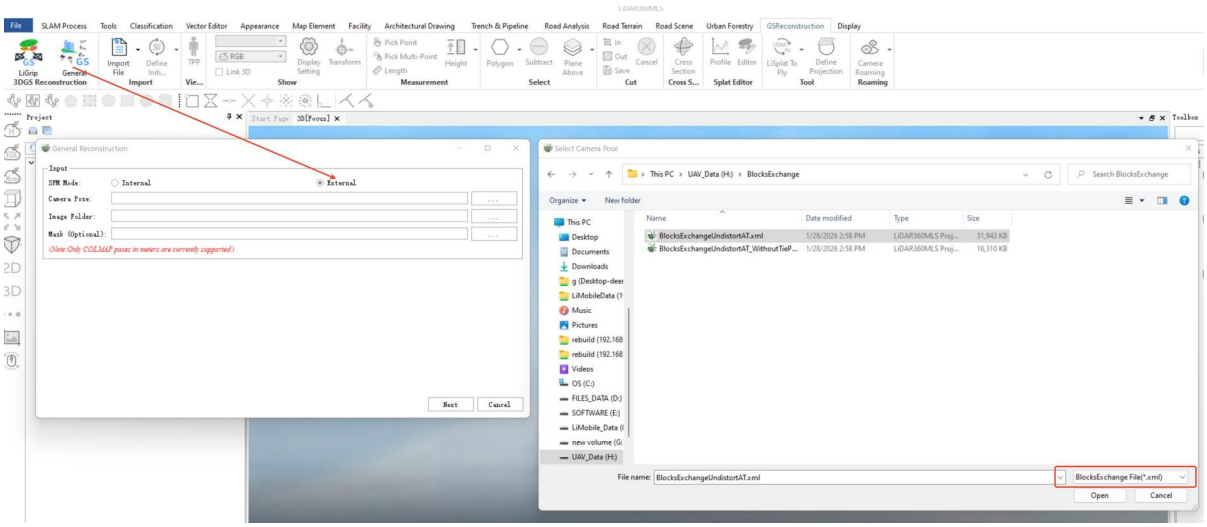
- UAV Data：

V9.0 Gaussian result

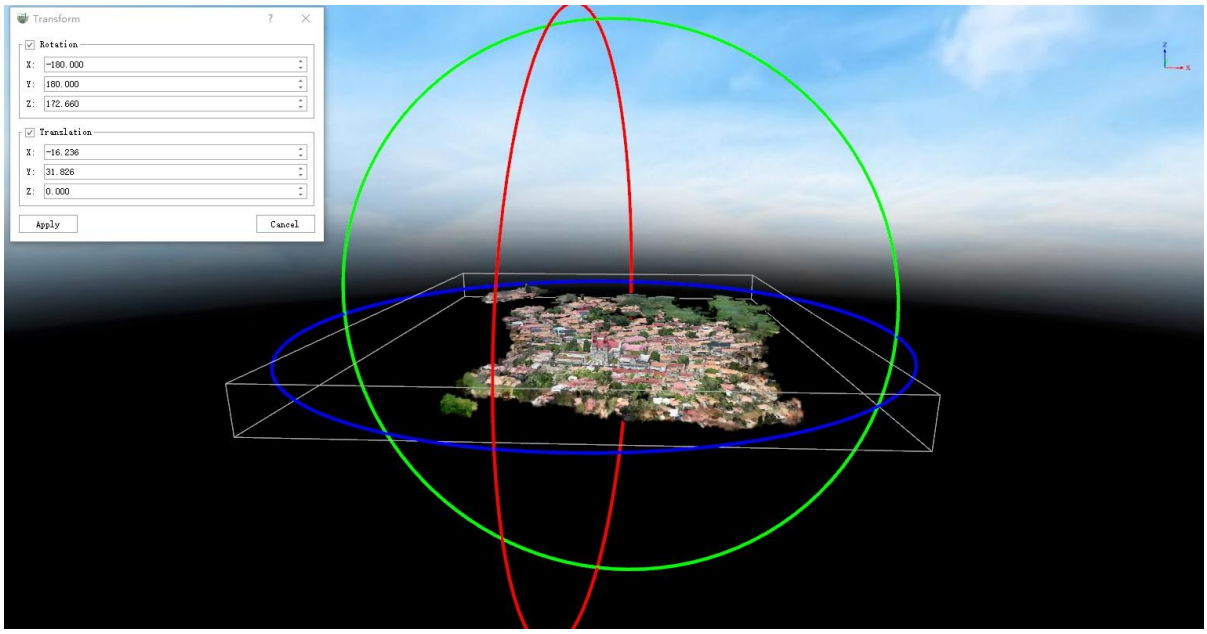
V9.0 Gaussian result

New Features

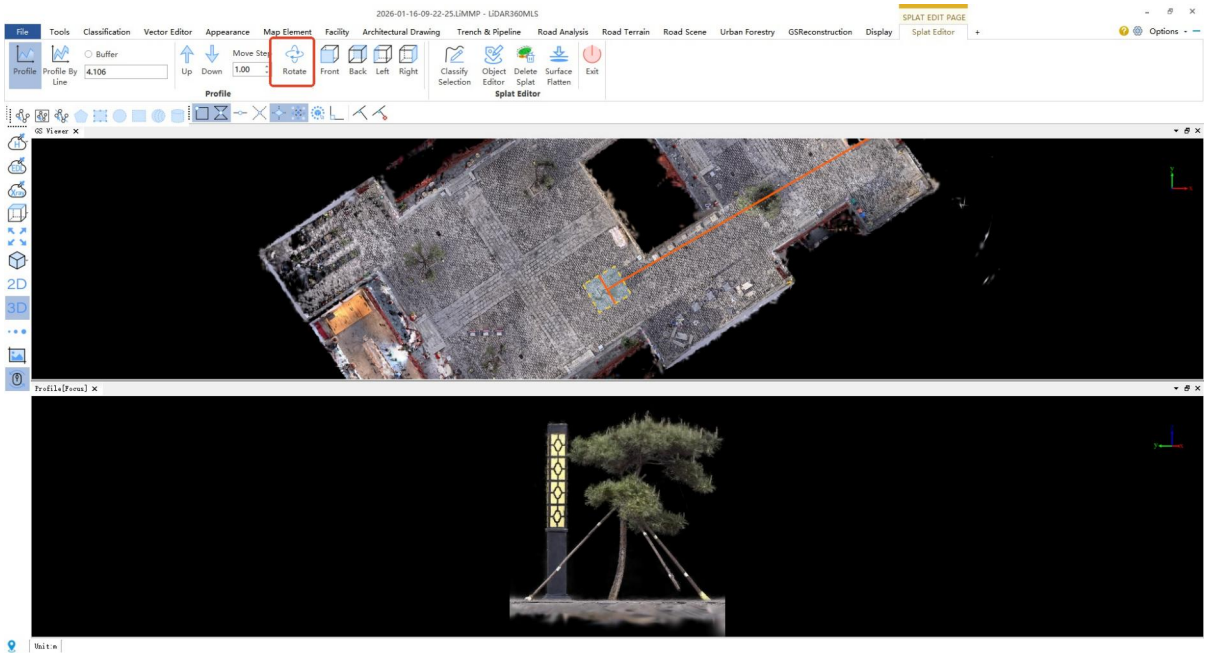
1.General Gaussian Reconstruction now supports SFM format data from BlocksExchange XML.



2.Added Gaussian Transformation function, supporting rotation and translation of Gaussian data.

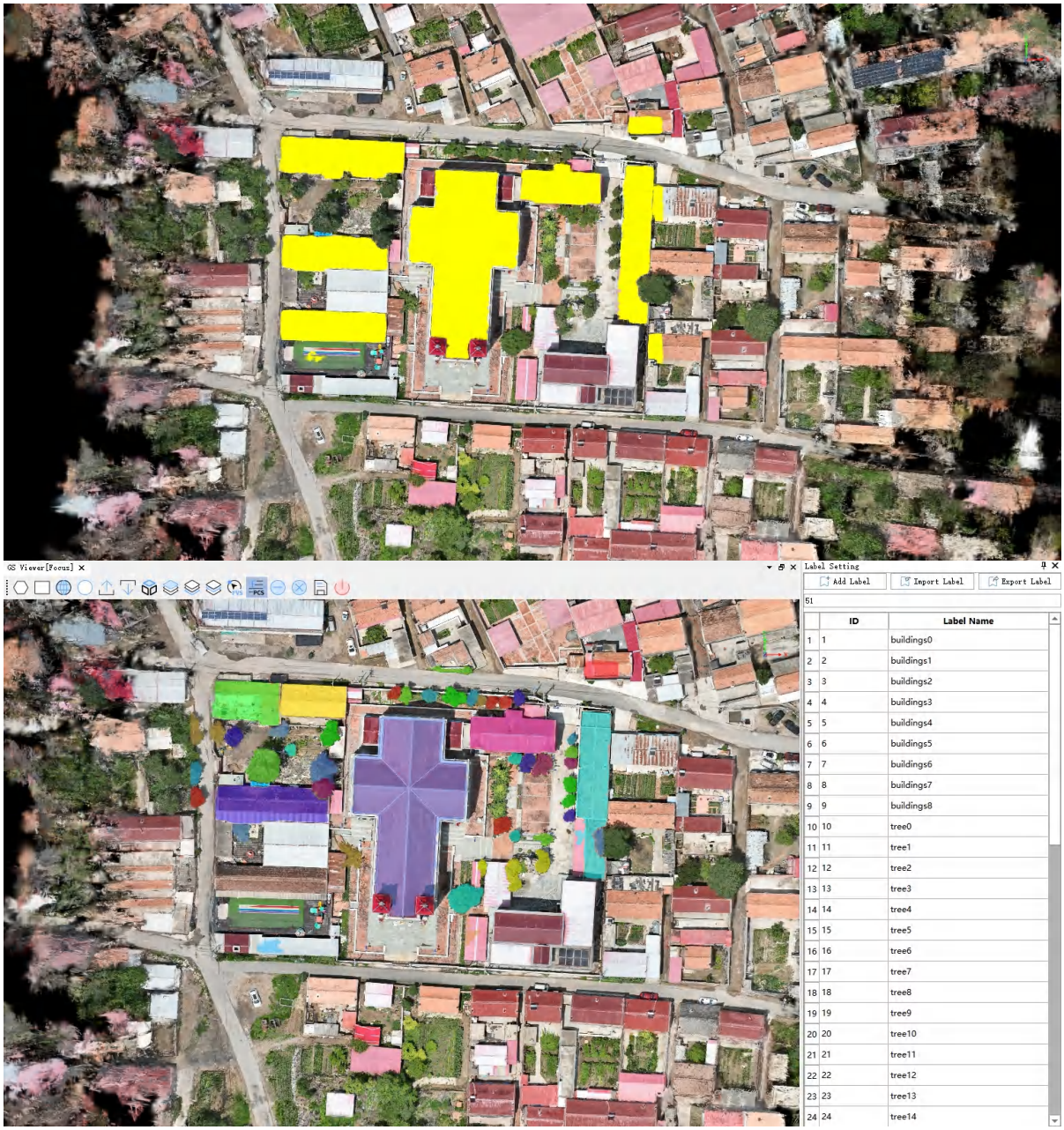


3.Gaussian Profile now includes a rotation function, allowing users to rotate and view Gaussian data within the profile window.



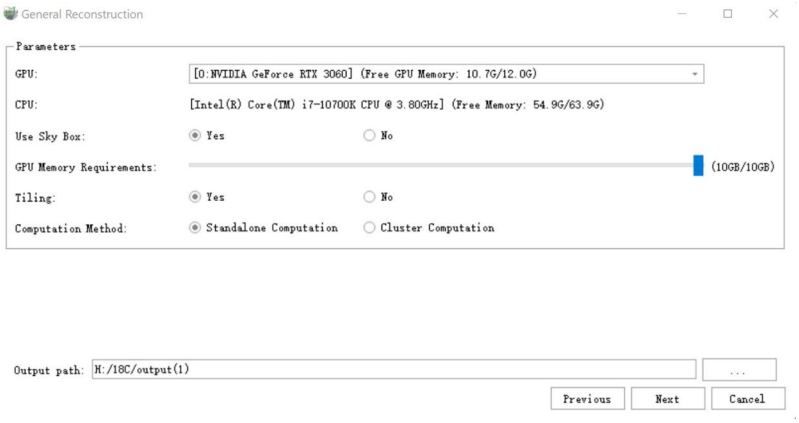
4.Gaussian Single-Object Editing now includes a PVS point selection function based on the SAM large model. Users can click anywhere on the data where annotation is needed, and the model will automatically annotate the entire target object.

5.Gaussian Single-Object Editing now includes a PCS text annotation function based on the SAM large model. Users can select from built-in text options, and the model will automatically select and isolate features within the annotation area that belong to the selected text category.



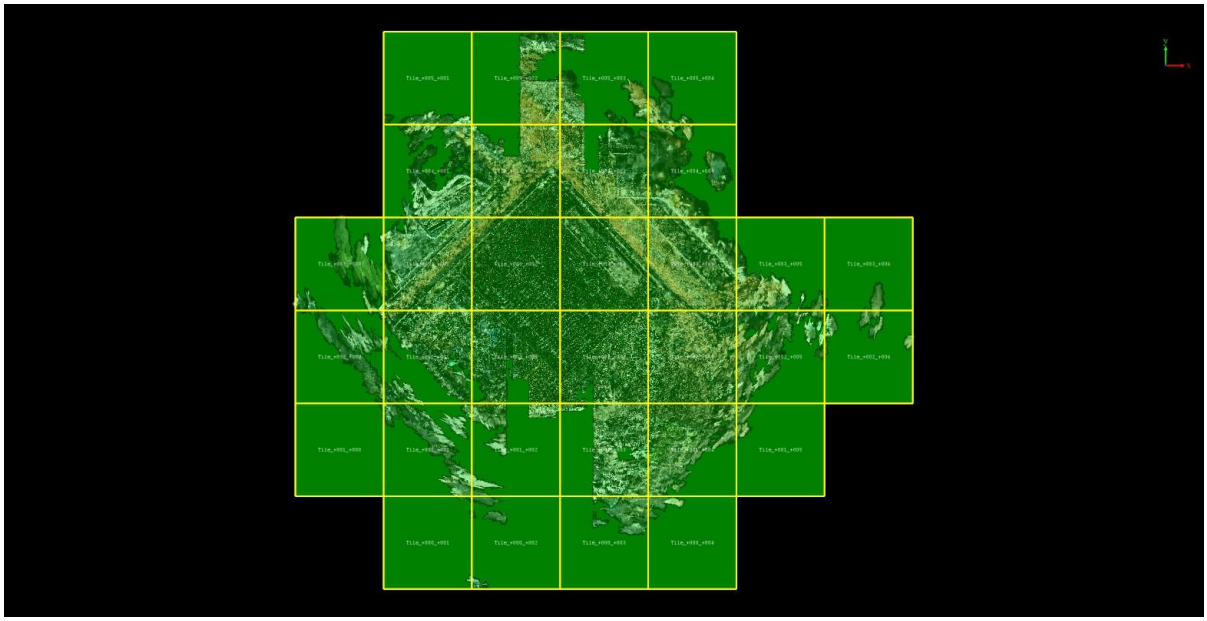
Optimizations

1.Gaussian Reconstruction now allows users to custom-set the GPU memory used for reconstruction, thereby controlling the maximum number of points.



2.Optimized Gaussian Profile editing. Users can now directly draw a profile in the Gaussian window, and the profile window will display the Gaussian data. This keeps the display and editing logic consistent with point clouds. Furthermore, Gaussian selection/classification, single-object editing, Gaussian deletion, and surface flattening functions all support the new Gaussian profile window logic.

3.Optimized editing for LOD Gaussian data. Users can now visually see the data blocks and select the block to edit. Profile editing is also supported.



4.Optimized the model used by the Gaussian cross-selection tool.

BP Module

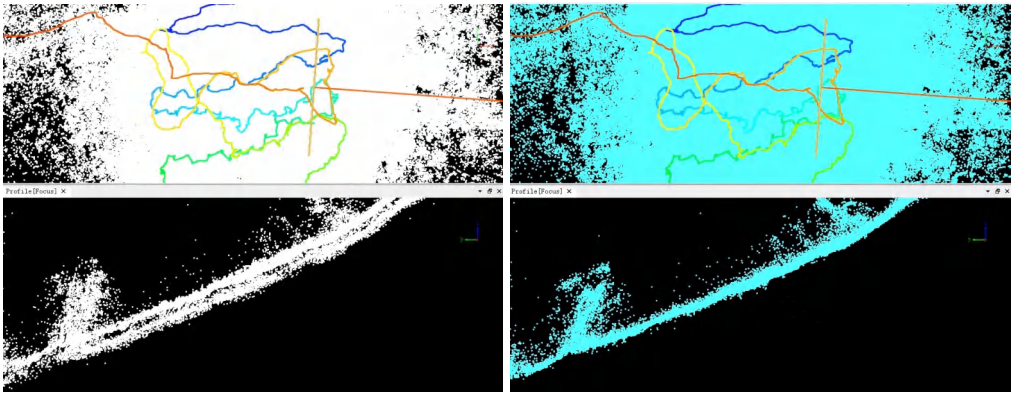
Starting with version 9.1, there are specific requirements for NVIDIA graphics card driver versions. To ensure your program runs smoothly, please update to the official NVIDIA driver.

Download link:https://www.nvidia.com/en-us/drivers/ ;

New Features

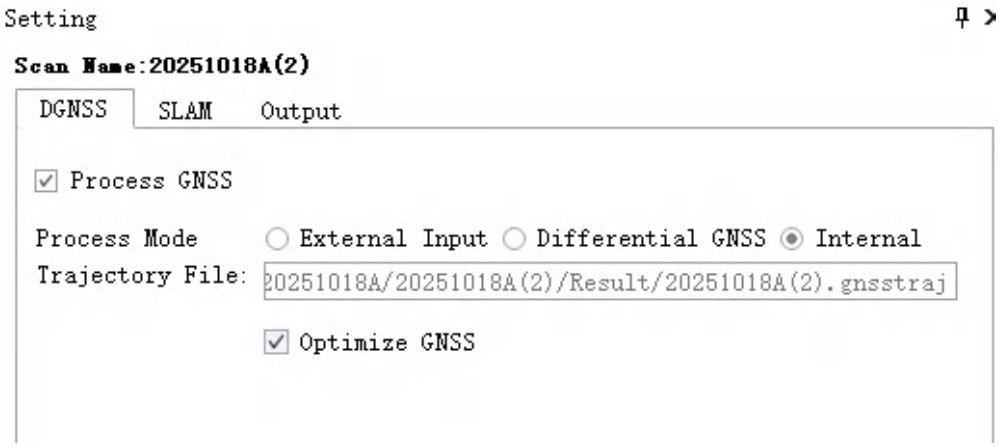
1. Added an Optimized GNSS option to effectively suppress GNSS false fix issues.

Optimizes GNSS result(RTK or PPK result) based on SLAM outcomes, applicable to under-forest, urban complex environments, substations, water areas, and similar scenarios. **This option is unchecked by default.**

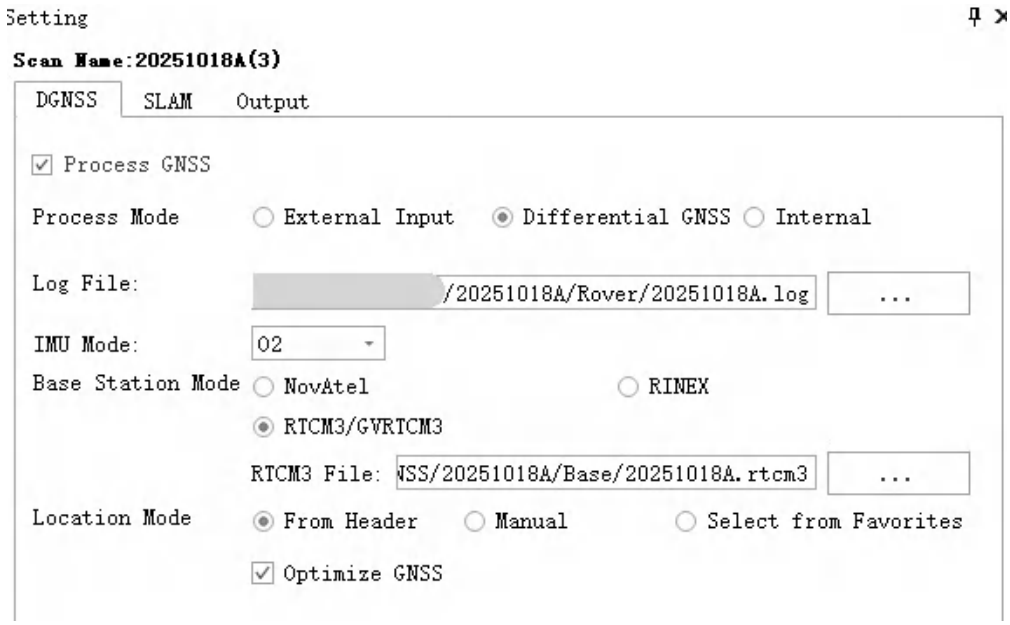


LEFT:No GNSS optimization applied;RIGHT:GNSS Optimization applied

The following devices are currently supported > **H300（B.00），O2，O2-LITE，LiAir X4** **Usage Instructions:** 1) **When RTK is configured** ① When creating a new project using a .lislam file, you may directly enable “**Optimize GNSS**.”

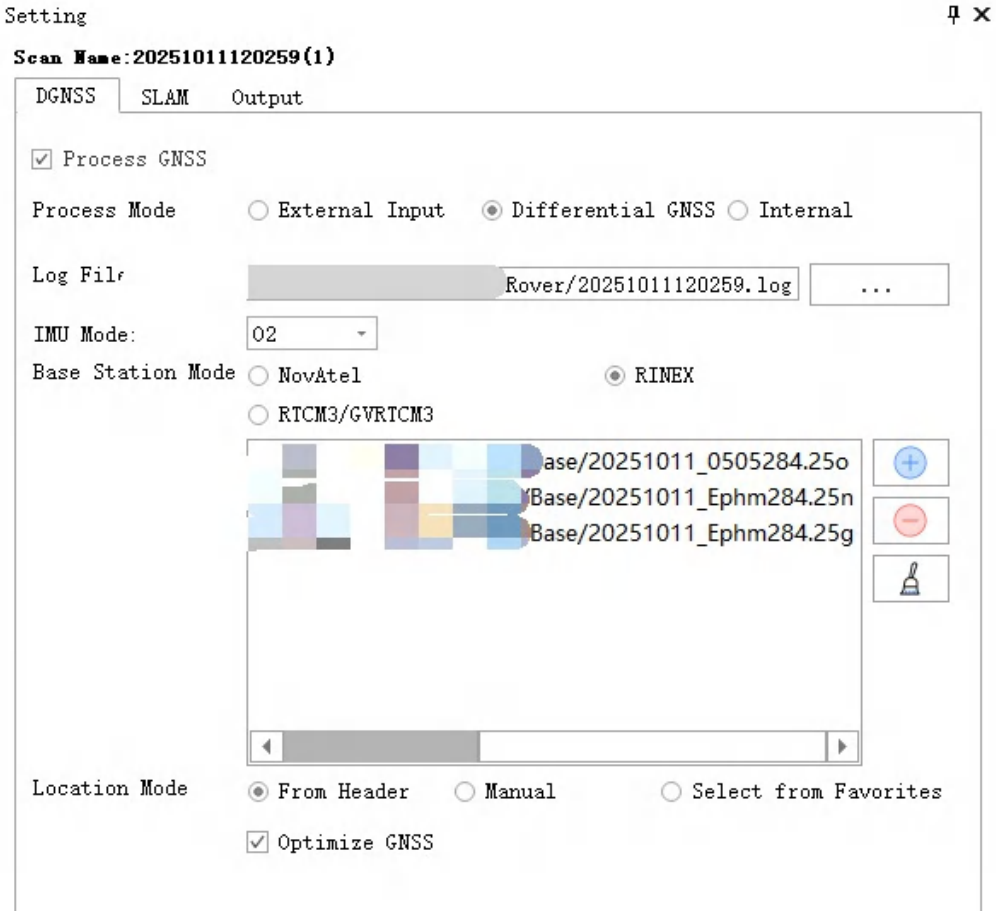


② When creating a project manually, configure the Rover file and Base Station according to the standard procedure (the Base Station may be an RTCM3 format station automatically recorded by the device or another RINEX format station).



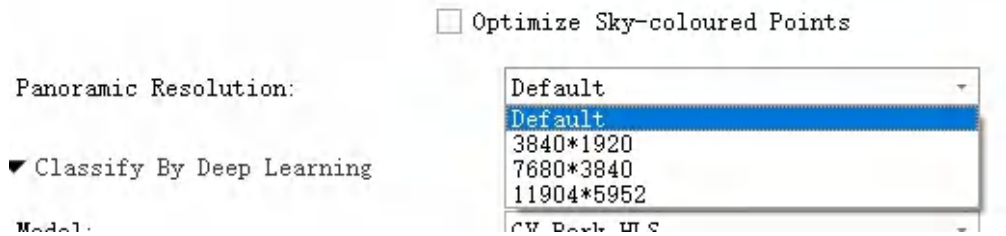
2) **When RTK is not configured**

If RTK is not configured, simply configure the Rover file and Base Station (RINEX-format Base Station).



2. Added panoramic resolution output options

Allows selection of panoramic resolution for output, with the default set to the original resolution panorama. Also supports output at labeled 4K, 8K, and 12K panoramic resolutions.



> Note: When selecting an output resolution higher than the original resolution, the requirement for that resolution is met, but image detail is not increased;

3. Supports SLAM data processing for LiGrip SE and LiAir X4-PLUS

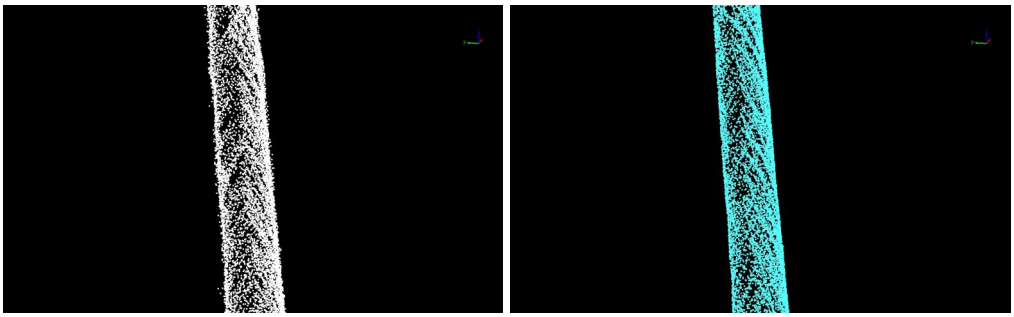
Supports SLAM data processing for LiGrip SE and LiAir X4-PLUS

Optimization

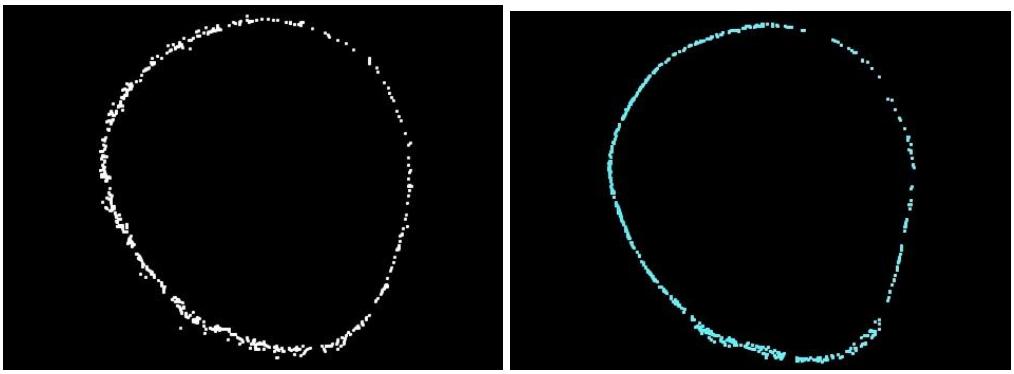
1. Optimized colorization efficiency for large datasets

Improved colorization efficiency by 15% for large areas (exceeding 10,000 square meters) or acquisition durations longer than 20 minutes;

2. Optimize trunk filtering effects in forestry mode



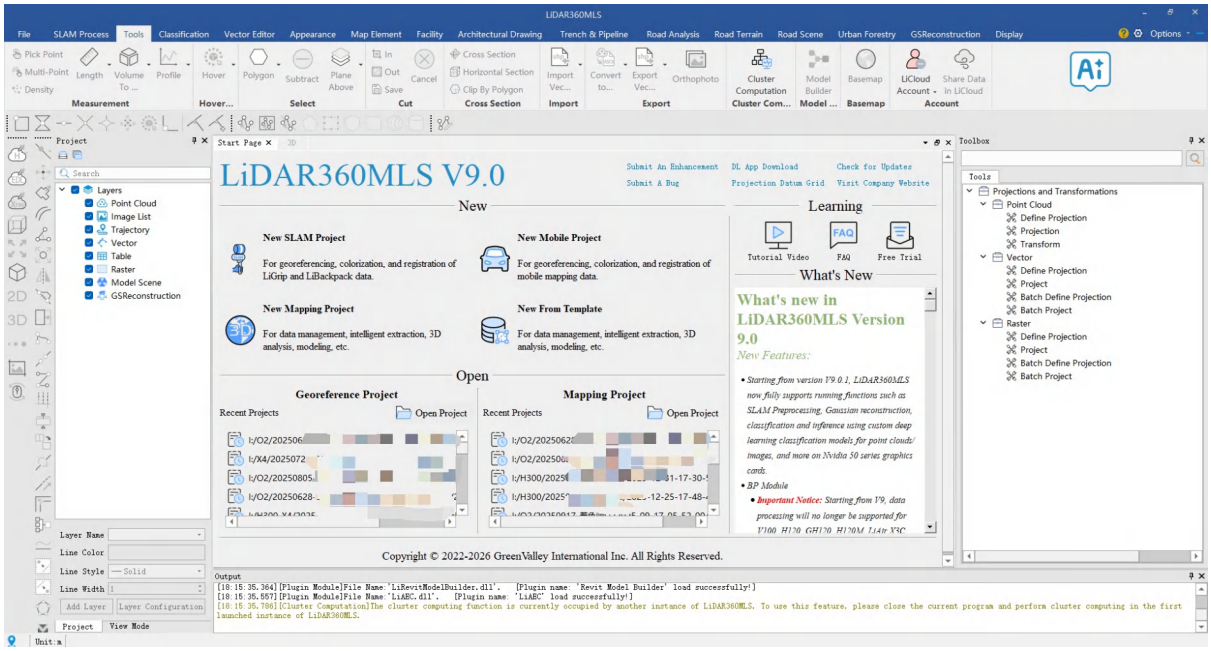
LEFT:Trunk filtering effect in version 9.0.2;RIGHT:Trunk filtering effect in version 9.1.0



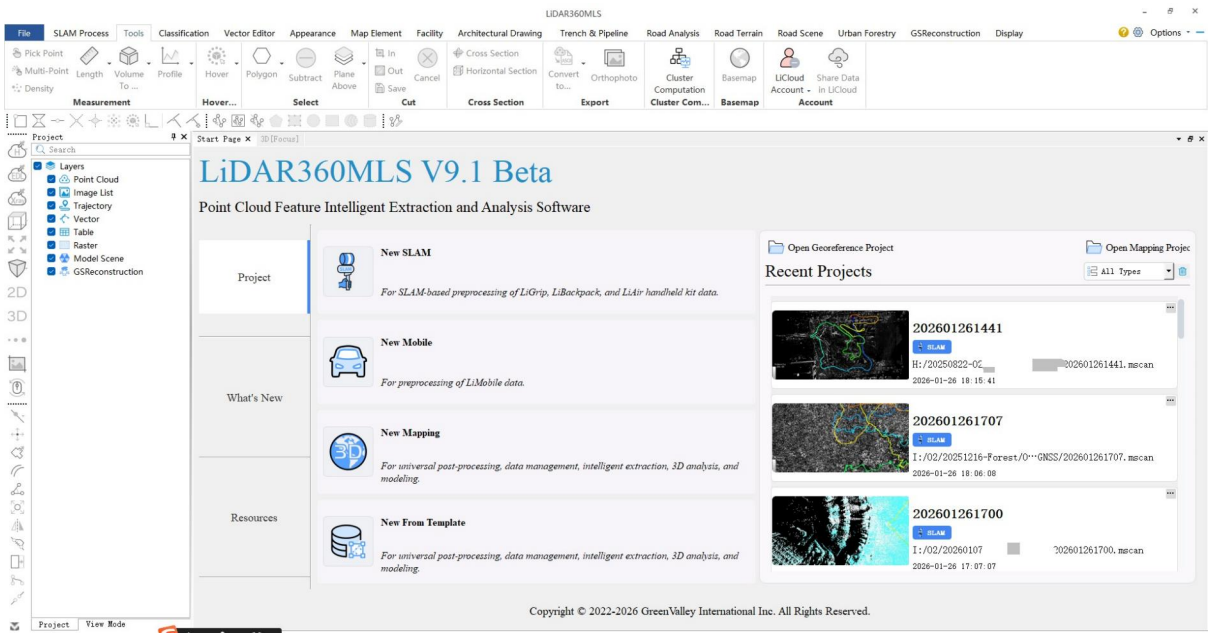
LEFT:Filtering effect at breast height in version 9.0.2;RIGHT:9.1.0 Filter Effect at DBH

3. Optimization of the Initial Startup Page

The initial page has been refined to be more concise and user-friendly. Historical projects now feature thumbnails, allowing users to quickly select relevant data.



Initial Page in Version 9.0.2



Initial Page in Version 9.1.0

4. Optimized the default naming convention for .mscan files

Changed from the original default format YYYY-MM-DD-HH-MM-SS.mscan to YYYYMMDDHHMM.mscan (e.g., 2026-01-26-17-51-23.mscan changed to 202601261751.mscan)

Fixes

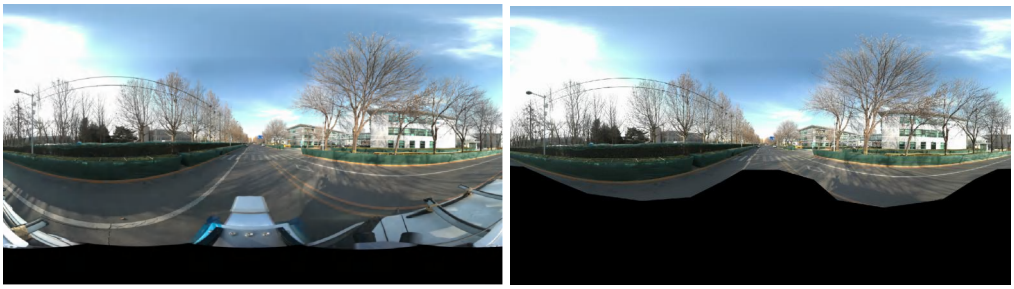
1. Fixed the occasional colorization failure issue on H300 (B.00)

2. Fixed the freezing issue of O2 in tunnel mode

Geo Module

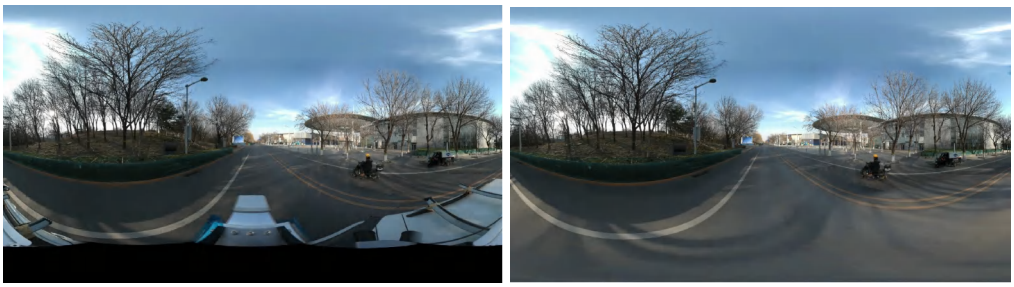
New Features

1.Added a Mask Removal feature that uses a user-defined mask file to identify and remove the vehicle body from panoramic photos.



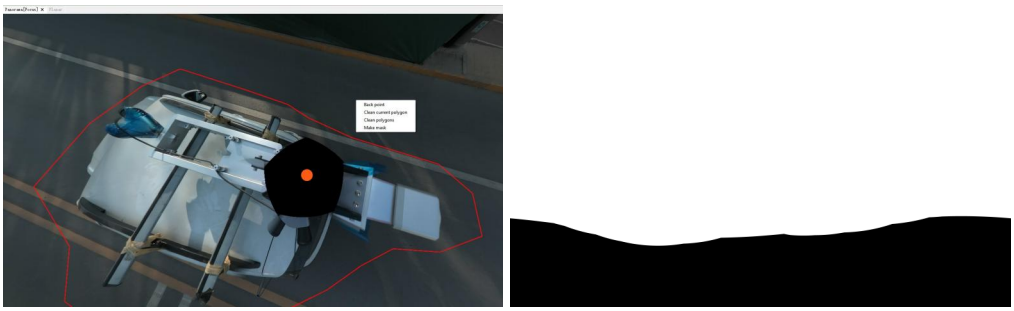
Left: Before Removal；Right: After Removal

2.Added a Panoramic Completion feature, which removes the vehicle body from images and performs intelligent completion.



Left: Before Completion；Right: After Completion

3.Introduced a Make Mask function, allowing users to directly draw masks in the panoramic view.



Left: Mask Sketch; Right: Final Mask

4.Supports velocity-based point cloud filtering to remove redundant data collected when the vehicle is stationary, thereby improving the efficiency of subsequent data processing.

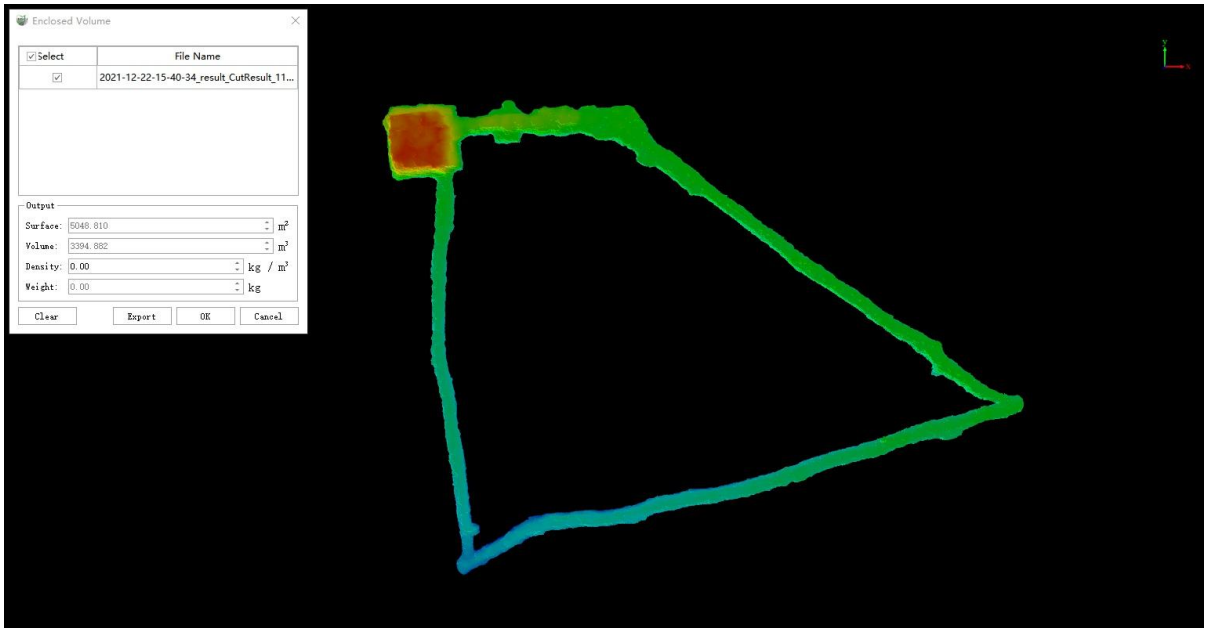
Enhancement

1.Optimization of the POS process algorithm performed.

Framework

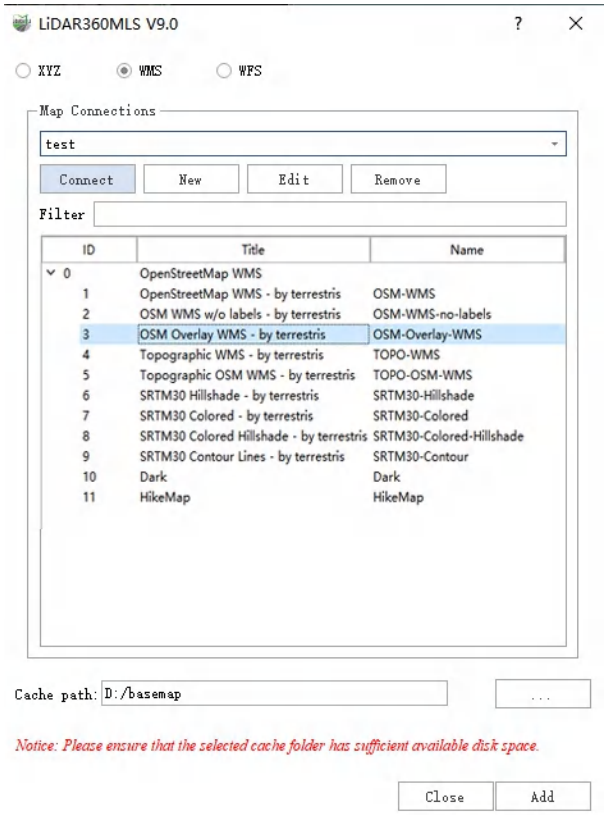
New Features

1.Added enclosed volume calculation function, which can calculate the enclosed volume in scenarios such as tanks, mine tunnels, caves, karst caves, tunnels, etc., with one click and generate a report.

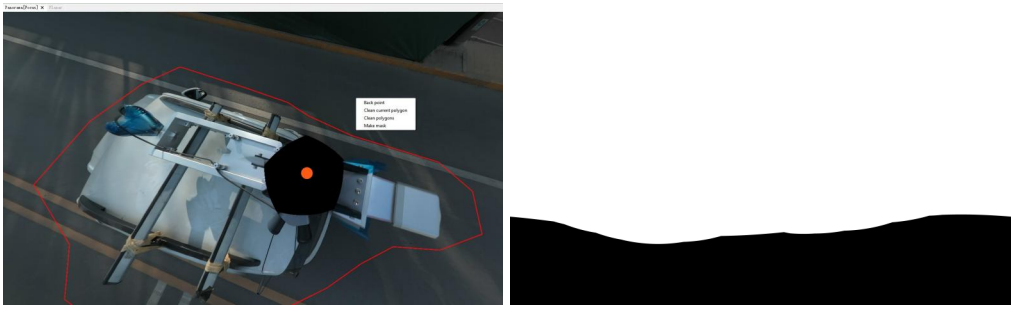


2.The volume measurement function now includes a key point saving option, which allows points used in the triangulation network to be saved to a vector layer for use in other applications.

3.The map function now supports WFS and WMS formats.



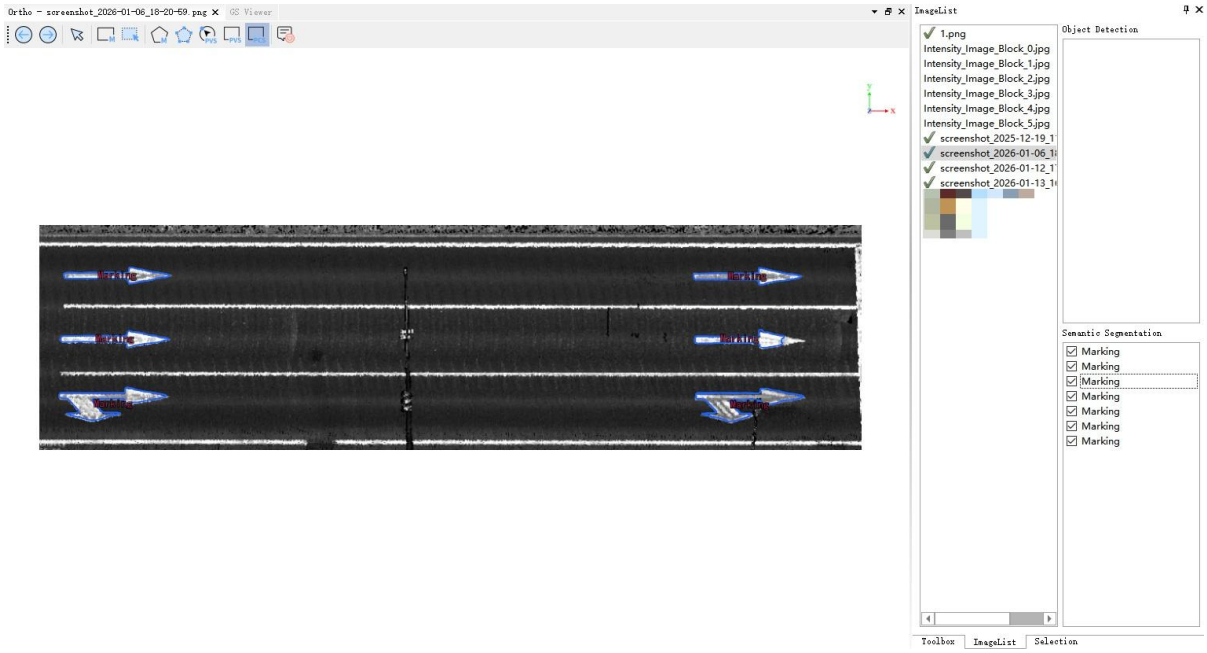
4.The panoramic image page now includes a panoramic completion function, which can fill in pixels within the masked area based on a mask file.



Left: Original captured photo; Right: Photo after completion

5.The panoramic image page now includes a mask generation function, allowing users to directly draw the mask range in the panoramic window and generate a mask file.

6.The image annotation function on the raster image page, based on the SAM large model, now includes two selection annotation methods: PVS point selection and PCS box selection, improving annotation efficiency.

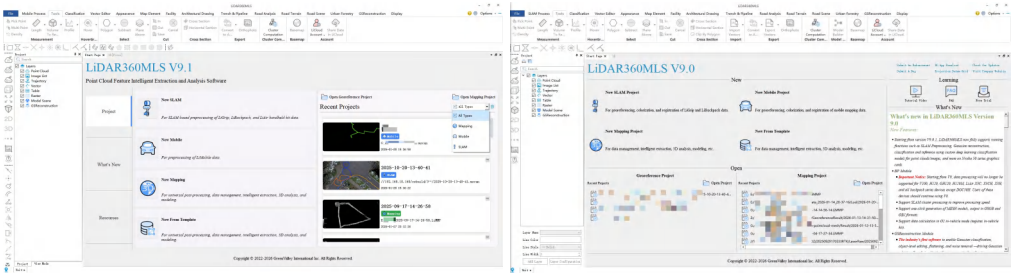


7.The preprocessing tool in the toolbox now includes an accuracy check function. Based on imported control point files, corresponding points are selected in the point cloud data to calculate RMSE, Min, Max, and other parameter metrics.

8.The point cloud registration tool in the toolbox now supports multiple trajectories.

Optimizations

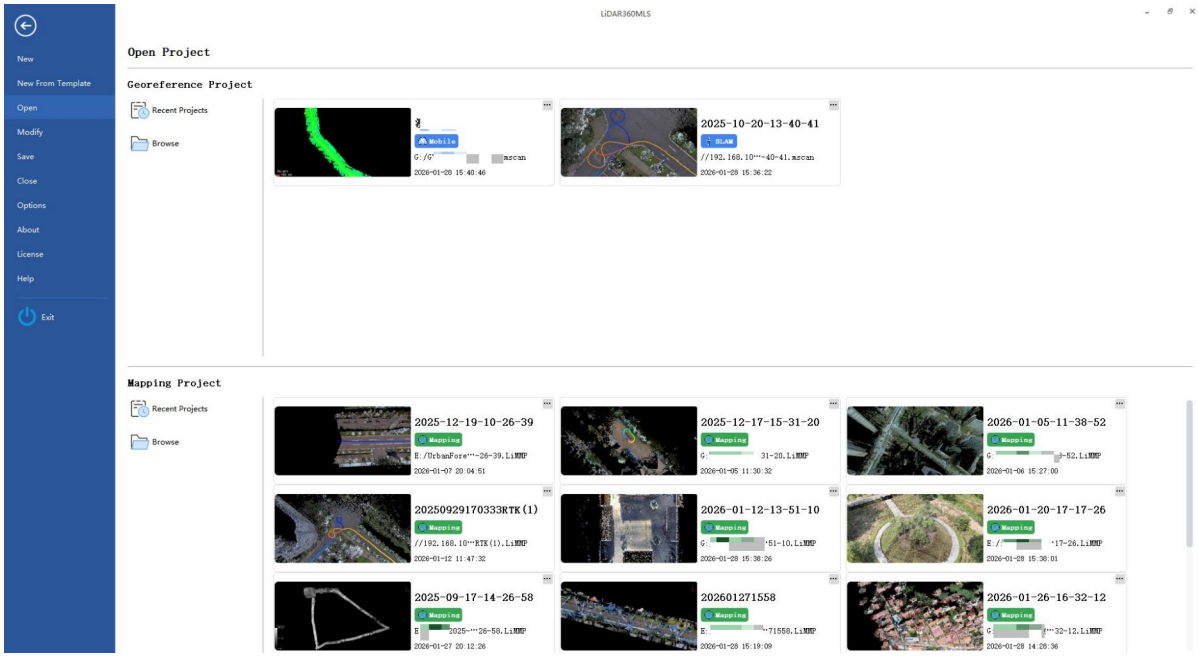
1.Optimized the software's Startpage, splitting it into three main sections: Projects, Latest News, and Resources. The Projects section is divided into New and Open. The recent projects list now includes thumbnails and project type identifiers, and allows filtering by project type for easier project searching.



Left: V9.0 Startpage; Right: V9.1 Startpage

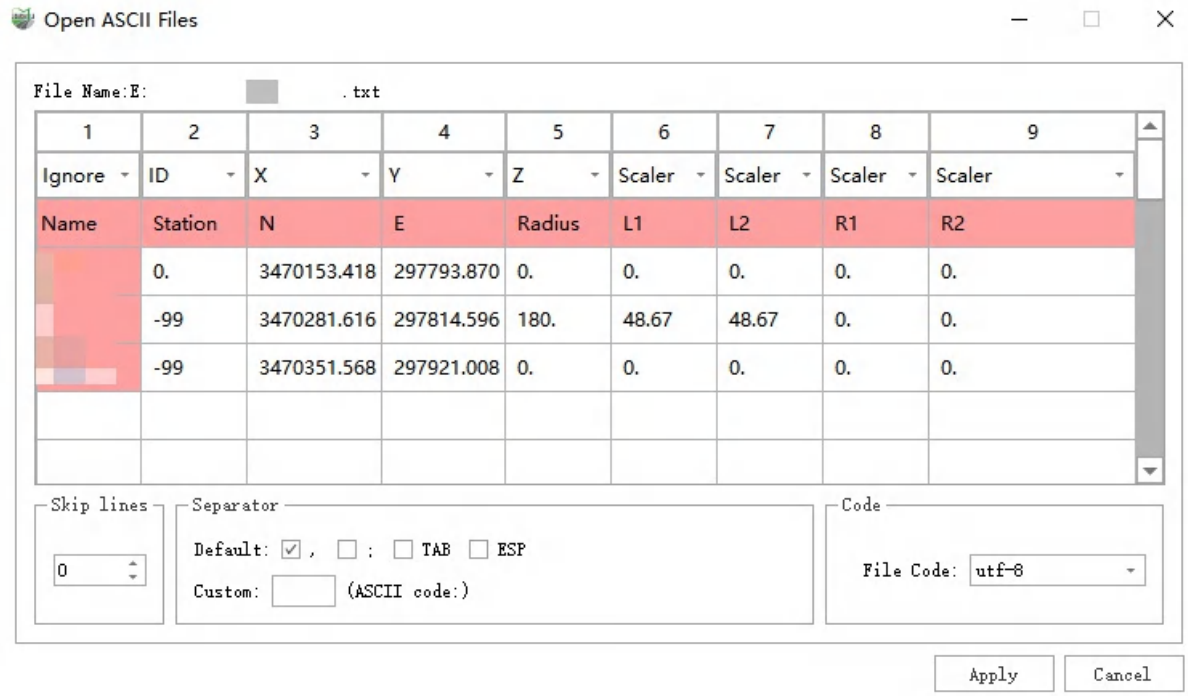
> Note: Projects solved before V9.1 did not distinguish between SLAM and Mobile solutions. Therefore, after upgrading, they are all displayed as Georeference projects by default. After reopening with V9.1, the project tags will be updated to SLAM or Mobile.

2.The "Open Project" under the File menu now also displays thumbnails, project type, project path, and creation time in the recent projects list. Clicking the "..." in the upper right corner supports opening the current project path, removing it from the list, and clearing the entire list (all current projects will be cleared).

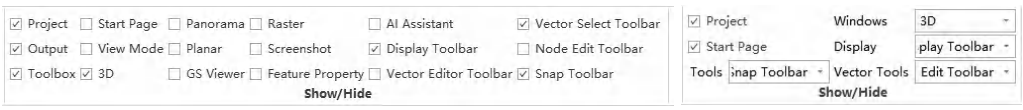


3.Optimized the default project name format, simplifying it from "Year-Month-Day-Hour-Minute-Second" to "YearMonthDayHourMinute" to shorten the name length.

4.Optimized the import locations for all TXT files in the software. The interface now includes encoding settings.



5.Optimized the "Show/Hide" tool group under the Display page, grouping them by Project, Startpage, Tools, Windows, Display, and Vector Tools. Users can now find the desired window or page via a dropdown menu.



Left: V9.0 version; Right: V9.1 version

Architectural Drawing Module

New Features

1. The BIM modeling module’s functions for creating walls, floors, roofs, etc., now support a vertical drawing mode.

Optimizations

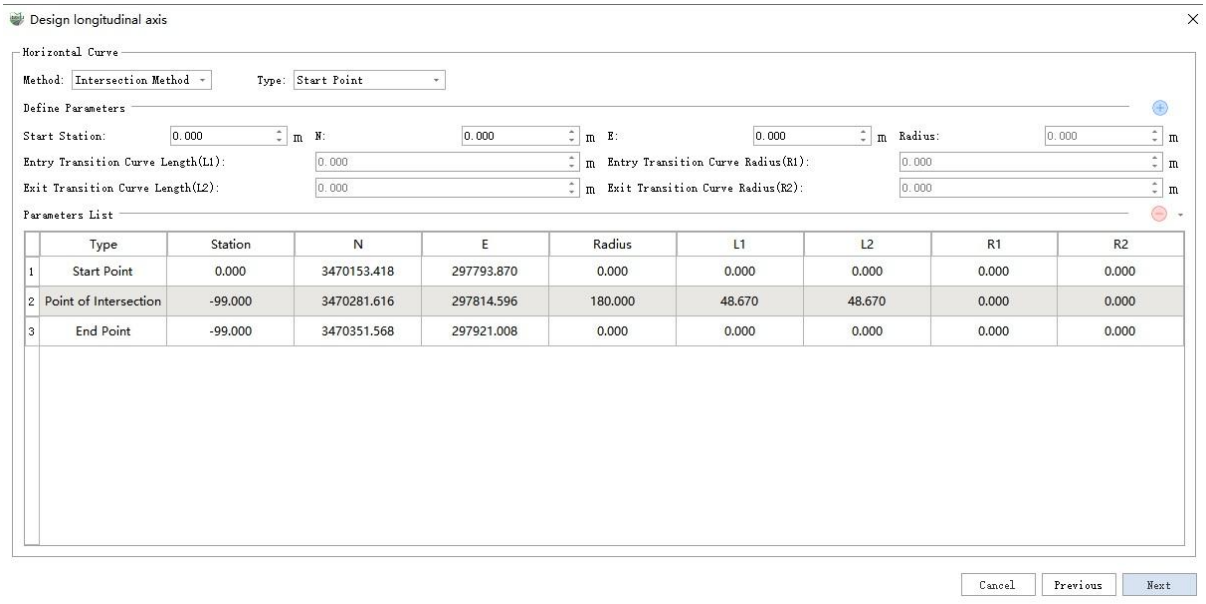
1. Optimized the logic for Gaussian-based BIM drawing synchronization with Gaussian section optimization.

Road Condition Module

New Features

1.The Section Analysis function now includes a Design Profile feature, allowing custom definition of break chains, horizontal curves, and vertical curves. The definition of horizontal curves supports both the Intersection Point Method and the String Element Method, complying with professional section analysis standards.

Break Chain



Horizontal Curve

Vertical Curve

2.The Section Analysis function now includes a Cross-Section Manager, allowing users to create new design cross-sections, import existing ones, as well as edit and export them.

Optimizations

1.Optimized and adapted the section analysis logic for road sections and tunnel sections based on the newly added design profiles and cross-sections.

2.The Section Terrain function in the Road Terrain module has been synchronized with the logic for adding design profiles and cross-sections from the Section Analysis function.

LiDAR360MLS V9.0.2 Release Notes

BP Module

Fixed Bugs

1. Fixed the filter process getting stuck when point cloud data is 2mm density.
2. Fixed bugs where vehicle mode data occasionally failed to resolve and displayed abnormal coloring.
3. Fixed bugs where certain coordinate systems had abnormal coloring.
4. Fixed the bug where manual MASK failed to take effect.
5. Fixed the bug where GCP could not be performed under certain abnormal conditions.

Gaussian Reconstruction

1.Optimized LOD data to reduce storage usage

Architectural Drawing

1.Optimized middle mouse wheel operation in the section window

2.Fixed issue where point cloud does not display when pressing the spacebar in the section window

Road Condition

1.Optimized the point cloud-based road damage detection algorithm, improved damage detection accuracy, and refined the damage analysis process

Framework

1.Fixed issue where Modelbulider could not modify function names and attributes

2.Fixed issue where splitting by attribute in Modelbulider was unavailable

3.Fixed software crash during SAM model initialization in image annotation

4.Fixed issue where point cloud registration and coordinate system definition did not update the trajectory display in the current project view

5.Fixed issue where exporting attribute tables failed

6.Fixed issue where the software failed to launch on Windows 7 systems

7.Optimized the extraction by additional attributes function to support selecting files for extraction

LiDAR360MLS V9.0.1 Release Notes

GSReconstruction Module

New Features

1.Gaussian Reconstruction now supports reconstruction on NVIDIA 50 series graphics cards.

2.Added a transformation function. If third-party reconstructed data has a coordinate system where the Z-axis is not upward, this function can be used to perform local coordinate system rotation to adjust the Z-axis upward, facilitating display and editing within the software.

Optimizations

1.Optimized Gaussian rendering by utilizing GPU scheduling to reduce artifacts during rapid movement.

2.Fixed the issue where the projection could not be defined for some formats.

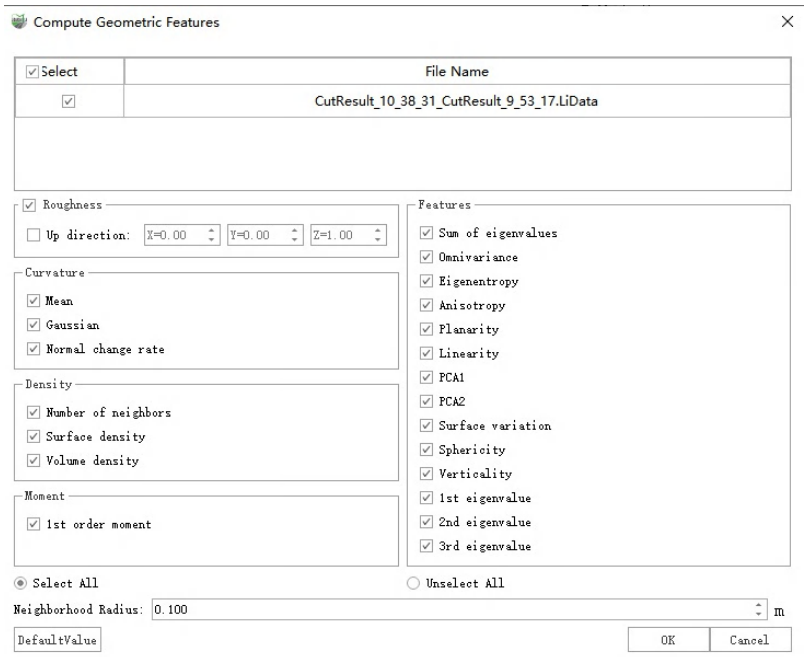
Framework

New Features

1.Custom deep learning model training and inference for point cloud classification and custom deep learning model training and inference for images now support running on NVIDIA 50 series graphics cards.

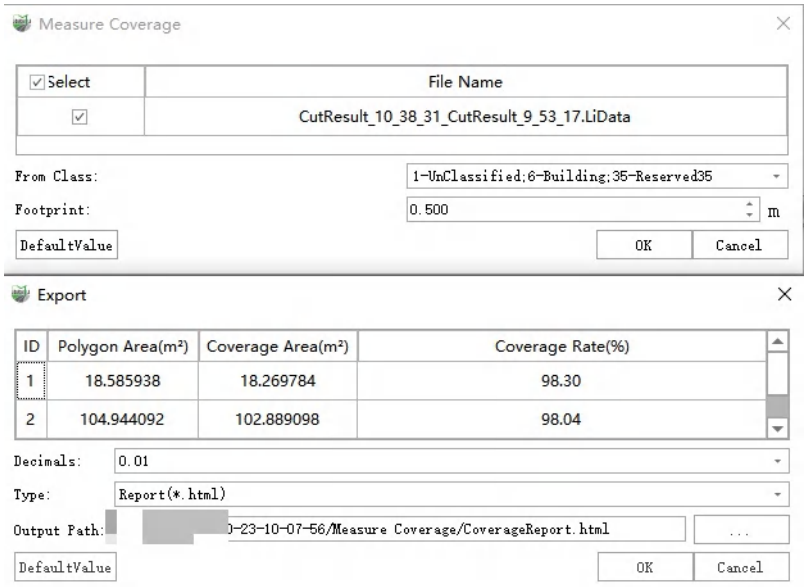
2.Added a manual vector registration function, allowing manual rotation/translation or point-pair registration between vector layers, as well as manual rotation/translation or point-pair registration of vector layers onto point cloud data.

3.Added a geometric feature calculation function, capable of computing 23 geometric features for point cloud data, such as curvature, point density, and principal components.

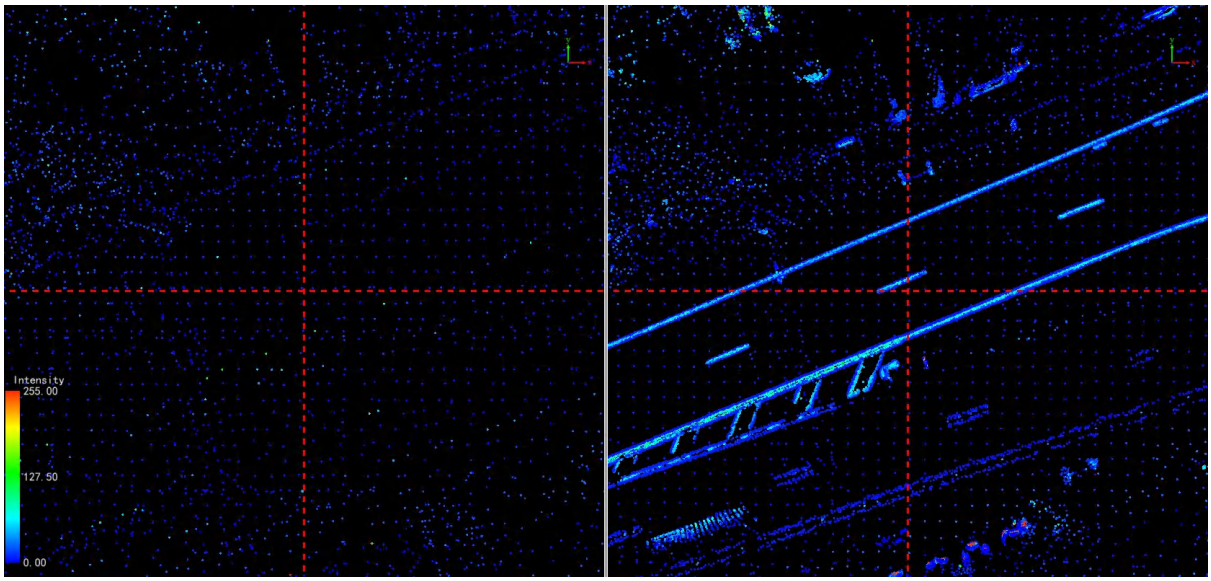


4.Added a 'Measure Point Noise' function, which calculates the distance from a point on a horizontal surface to the plane fitted by its neighboring points to assess noise levels.

5.Added a 'Measure Coverage' function, which calculates the proportion of actually collected data within the planned acquisition area and generates a coverage report.



6.Added an adaptive downsampling function, which performs adaptive data downsampling based on the point cloud's curvature, intensity, and RGB values, ensuring that the downsampled data retains more effective features.



Left: Voxel downsampling; Right: Intensity-based voxel downsampling

Optimizations

1.Fixed the issue of precision loss when exporting DXF files.

2.Fixed the issue with additional attribute recognition when importing point cloud data in TXT format.

3.Fixed the crash issue when clipping using polygons.

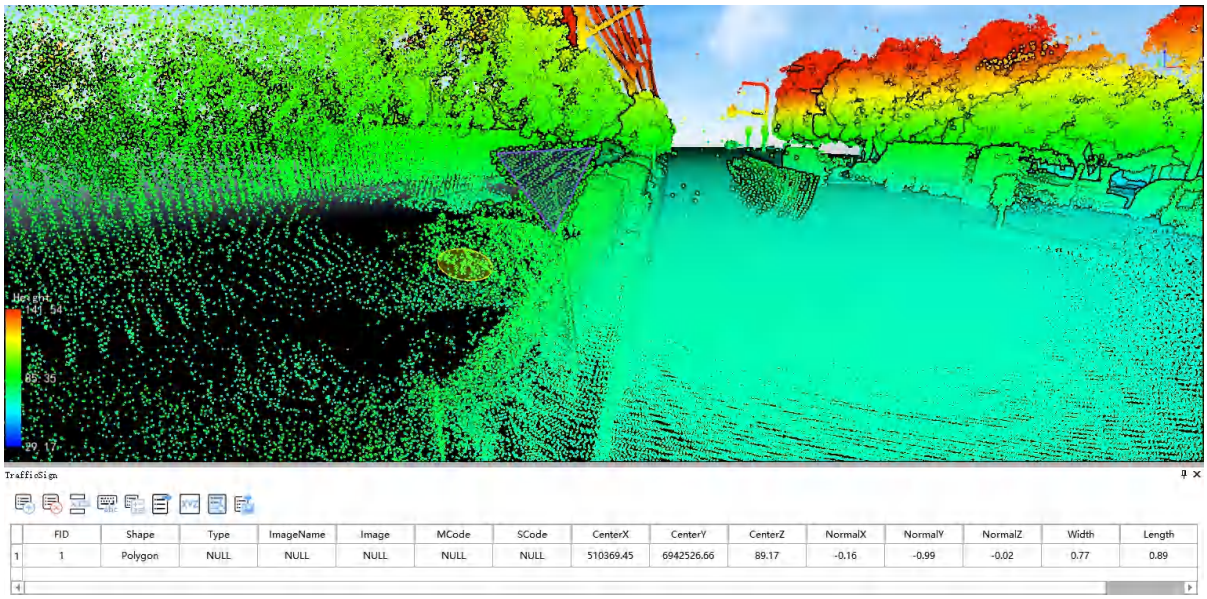
4.Fixed the issue with the abnormal progress bar during deep learning-based point cloud classification.

Asset Extraction Module

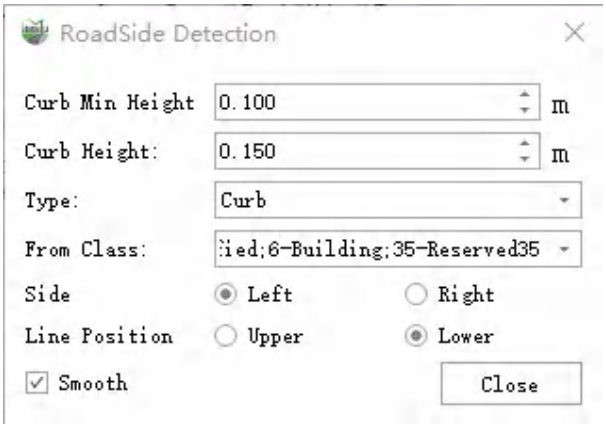
New Features

1.Road marking training and matching, and road facility training and detection functions now add support for the NVIDIA 50 series graphics cards.

2.The Add Traffic Sign function now automatically calculates the center point coordinates, normal vector, length, and width, and populates these values into the attribute table.



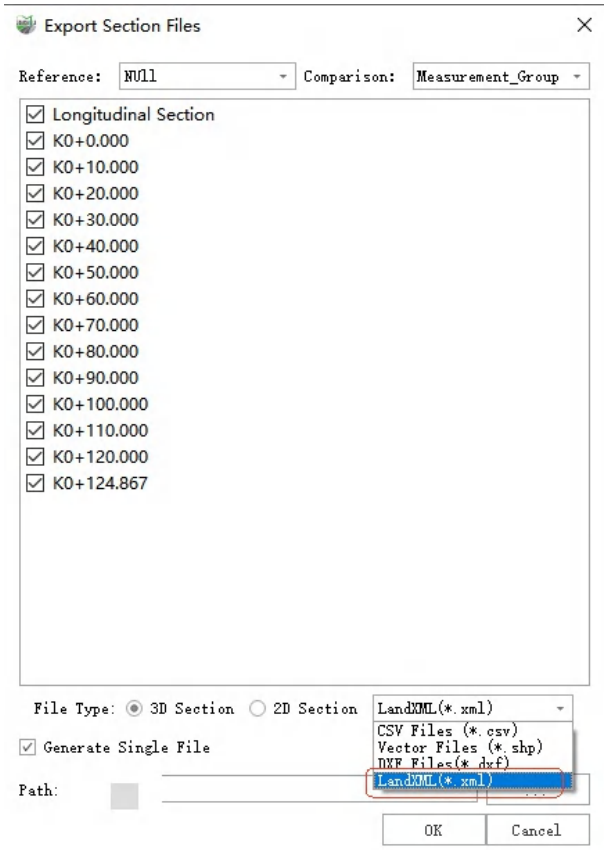
3.Detect Road Side Line adds a class filter option to reduce the impact of noise on curb extraction.



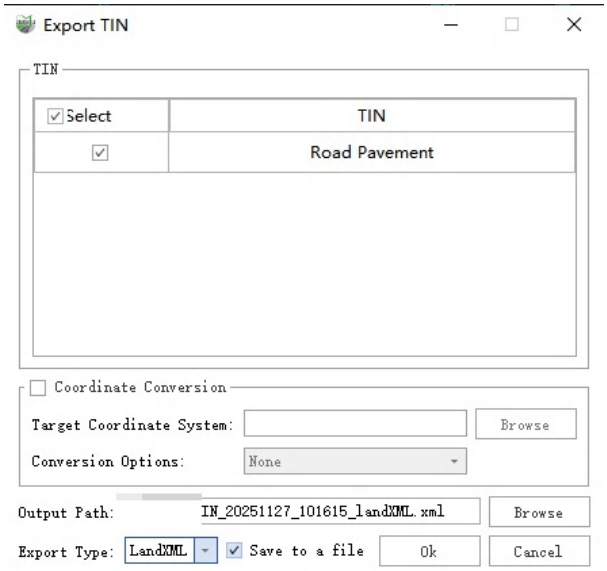
Road Condition Module

New Features

1.Cross-section analysis now supports exporting cross-sections in LandXML format.



2.TIN models now support export in LandXML format.



Optimizations

1.Optimized the refresh of the 3D window point cloud display by category after performing key point extraction.

2.Optimized image-based road damage detection results by adding a distance filtering option to reduce results with higher errors near image edges.

BP module

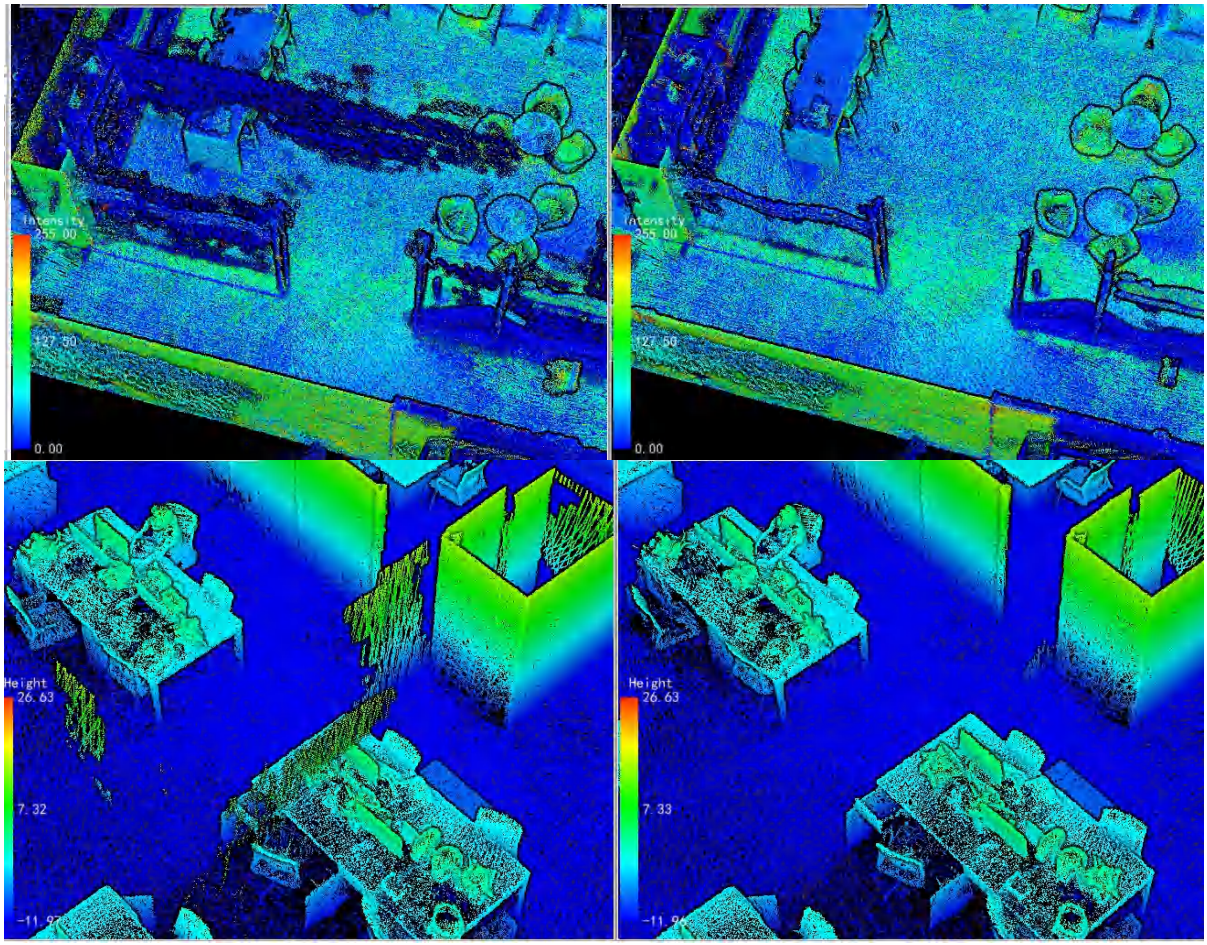
Improvements

1. Improved coloring performance

Improved LiGrip coloring performance: **reduced discontinuities and improved coloring clarity**

2. Improved filtering performance

Improved the removal of indoor mirror noise



3. Algorithm improvements

1. Improved loop closure stability;
2. Improved adaptability to small spaces in General mode
3. Improved stability of the multi-project stitching algorithm
4. Expanded support for ephemeris files

Bug Fixes

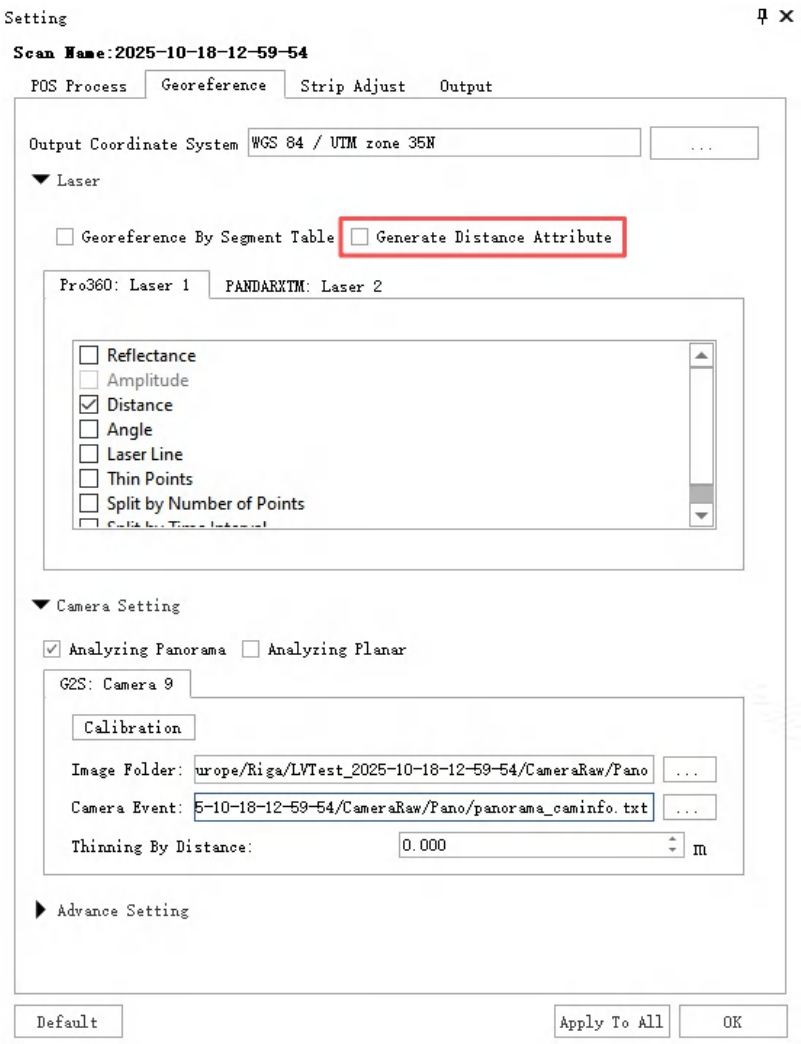
1. Fixed a low-probability GCP bias issue

Geo Module

New Features

1.Support data process for LiMobile M2 Pro devices.

2.Adding an option to generate a distance auxiliary attribute file.



Georeference Settings

Enhancement

1.SLAM algorithm optimization for a more stable process.

LiDAR360MLS V9.0.0 Release Notes

BP Module

New Features

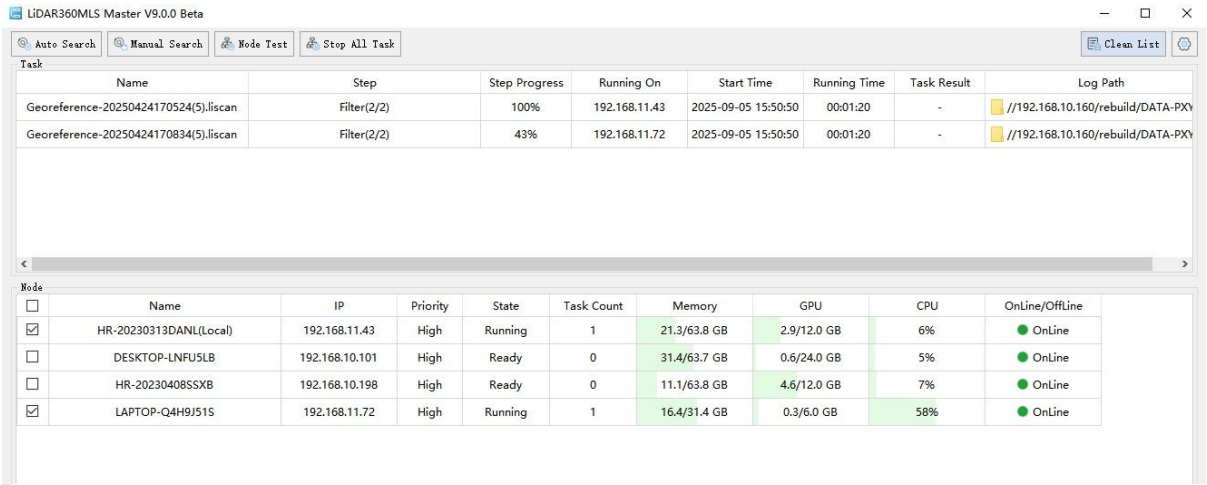
1. Adjusted Range of Supported Devices for Processing

supported	unsupported
H120(A.10) H300 O1-LITE O2-LITE O2 LiAir X4 LiBapckpack DGC50H	V100 H120 GH120 H120M LiAir X3C LiAir X3CH LiAir X3H LiBapckpack series except LiBapckpack DGC50H

> Note: Unsupported devices can still be opened with MLS 9.0, but SLAM processing is unavailable.

2. Support for Distributed SLAM Processing

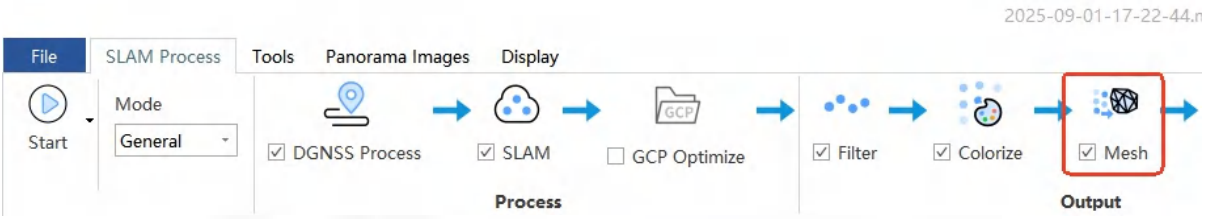
Supports forming a computing cluster with multiple computers on a local area network, effectively utilizing computational resources and improving processing speed.

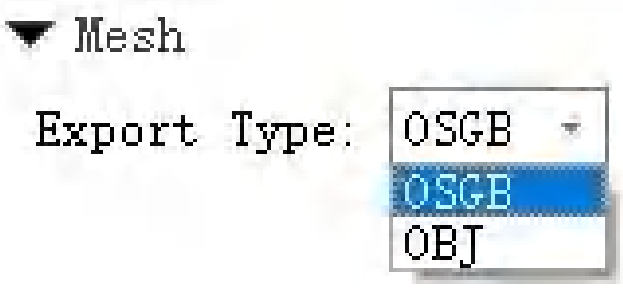


> Note: The Master computer (master node, used to control the computation nodes) requires authorization; computation computers (computation nodes) also require authorization.

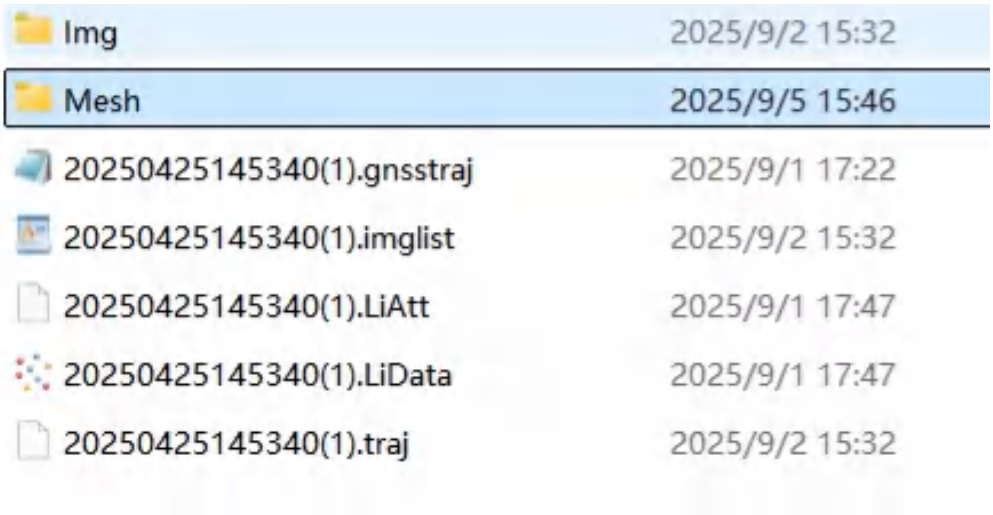
3. Support one-click mesh model generation

Support one-click MESH model generation, with export available in both OSGB and OBJ formats





Results are located in the **Result** directory



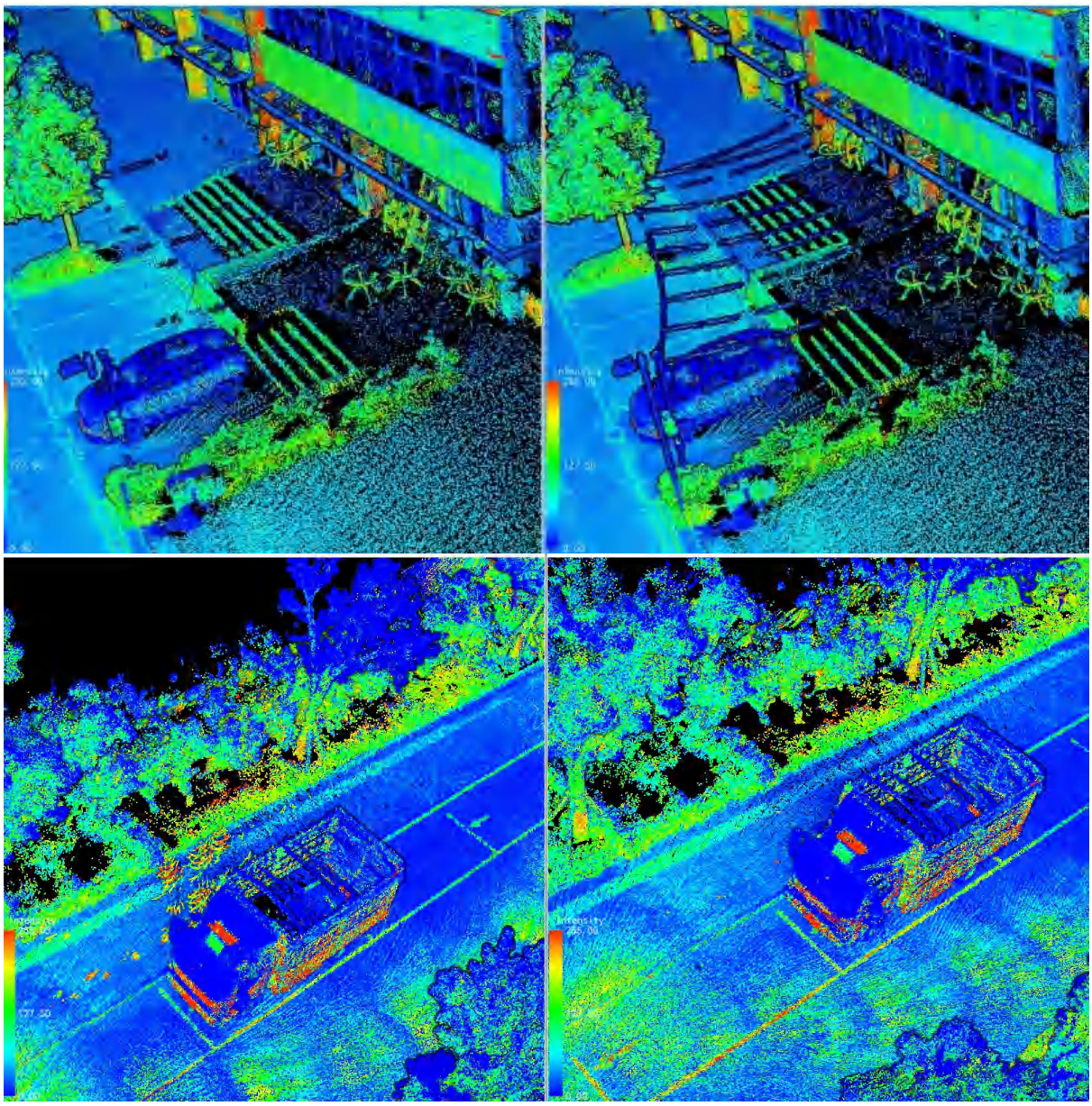
4. Support O2 vehicle-mounted data processing

Supports O2 car mode data processing (requires vehicle kit). Select '**car**' mode.

Optimization

1. Optimized Dynamic Object Removal

Compared to version 8., *Dynamic Object Removal is now cleaner (**validated on the same dataset as 8.**\)*. The probability of incorrectly removing pole-like objects is greatly reduced, and Dynamic Object Removal for pedestrians and vehicles is significantly improved.



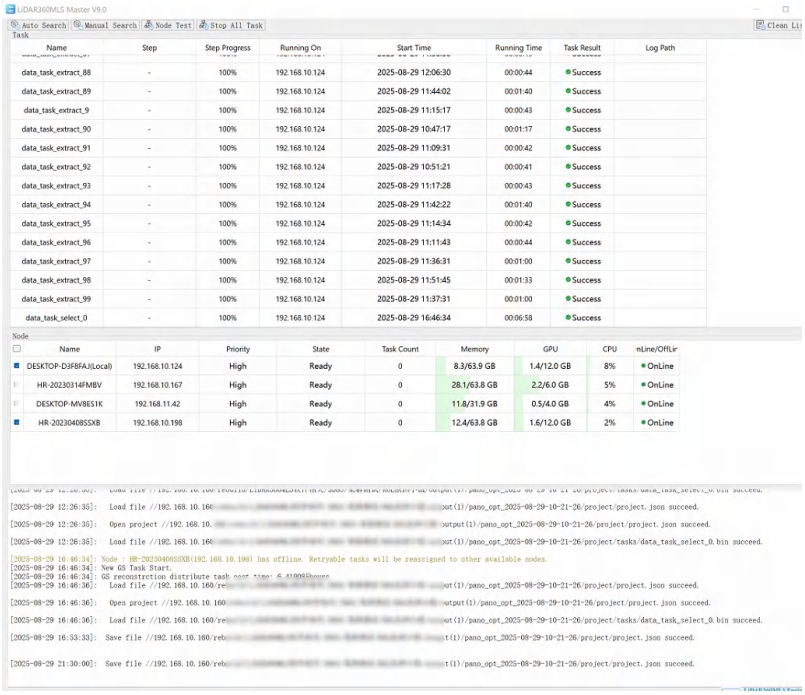
2. Optimized oblique model generation

Optimized issues with colored points in certain modeling scenarios

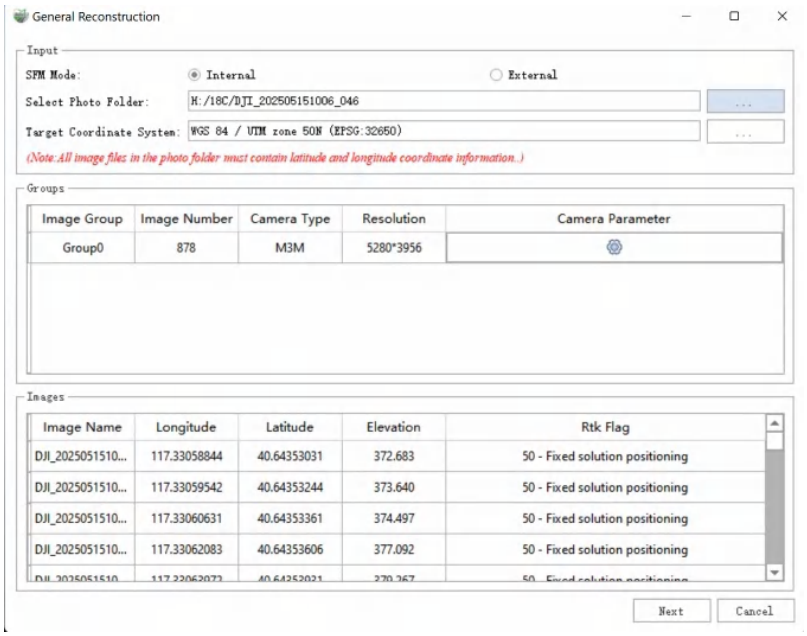
GSReconstruction Module

New Features

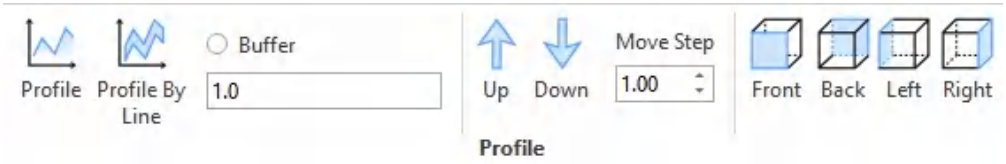
1.Gaussian Reconstruction added a cluster processing mode, utilizing multiple nodes for simultaneous reconstruction to improve efficiency.



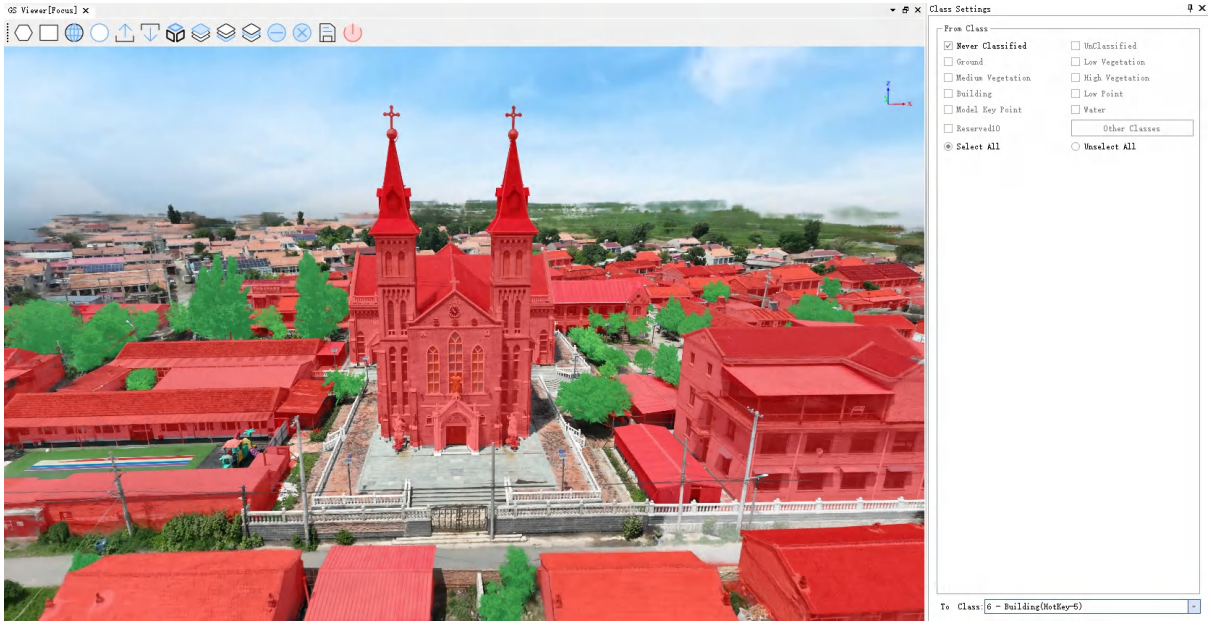
2.Added General Gaussian Reconstruction functionality, supporting UAV data processing with internal SFM mode, enabling one-click full workflow processing from SFM to Gaussian Reconstruction.



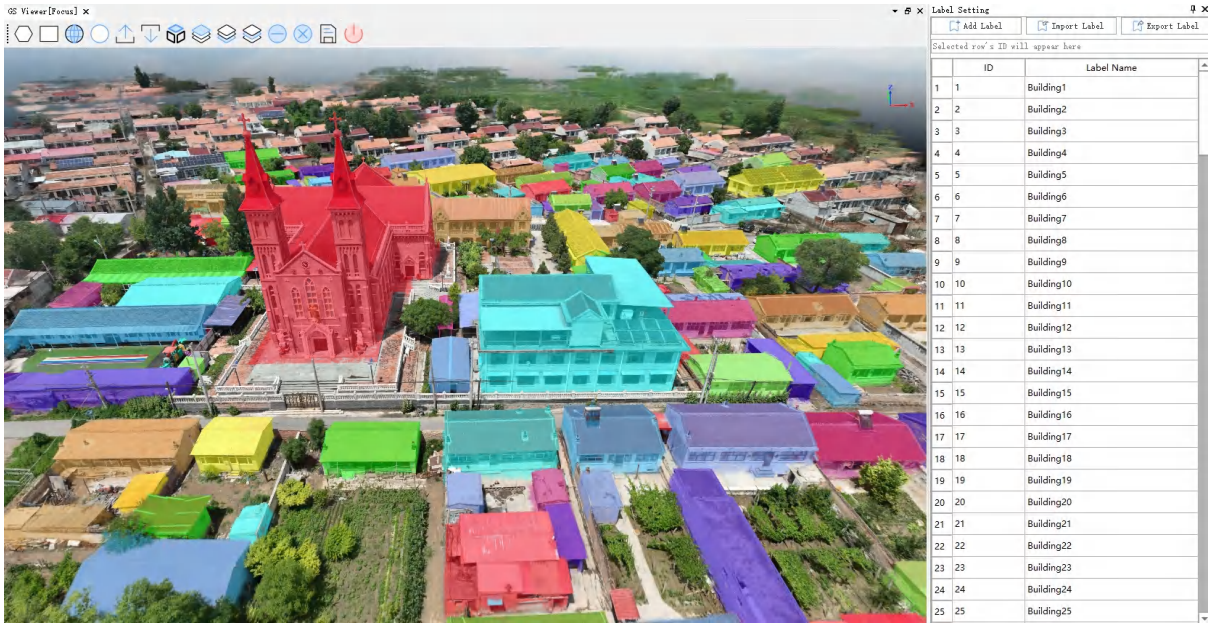
3.Added Gaussian Profile and Vector Line-based Gaussian Profile functionalities, allowing users to create sections on Gaussian data for inspection. Supports buffer setting for sections, moving sections up/down, and viewing from front/back/left/right perspectives.



4.Added Gaussian Classification Editing functionality. Based on multiple selection methods, users can edit the categories of Gaussian data in 3D mode or section mode, assigning semantic information.

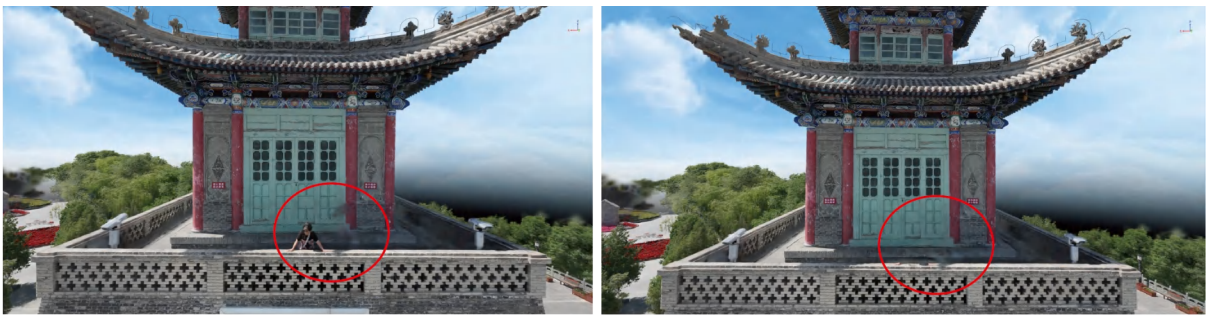


5.Added Gaussian Primitive Editing functionality, allowing for customizable primitive information. Utilizing various selection tools, users can quickly edit primitives of the Gaussian model in either 3D or profile mode, assigning instance information to Gaussian data. Primitive information can be queried at any time, and labels can be imported and exported, facilitating collaborative work among multiple users.



6.Added Gaussian Deletion functionality. Switch between Perspectiveand Surface modes. Using flexible polygon, rectangle, lasso selection tools, quickly select and delete Gaussian points. Supports editing in both 3D and section views. Applicable for deleting Gaussian noise and fine model editing.

Gaussian Surface Mode (Ellipsoid Display)



Before Splat Editor　　After Splat Editor

7.Added a Flattening Tool, which can flatten raised areas within a drawn region, suitable for repairing and editing bulges in water bodies, ground, etc.

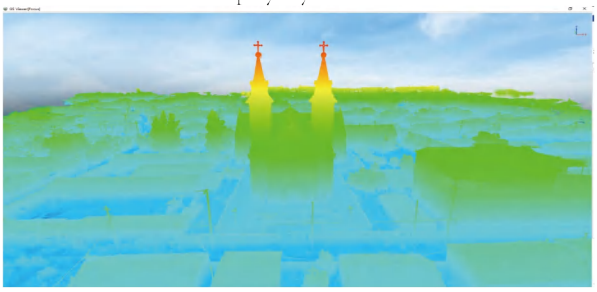
Before Water Area Flattening

After Water Area Flattening

8.Added display based on three attributes: by category, by label, and by height, enriching data rendering effects.

Display by RGB

Display by Classification

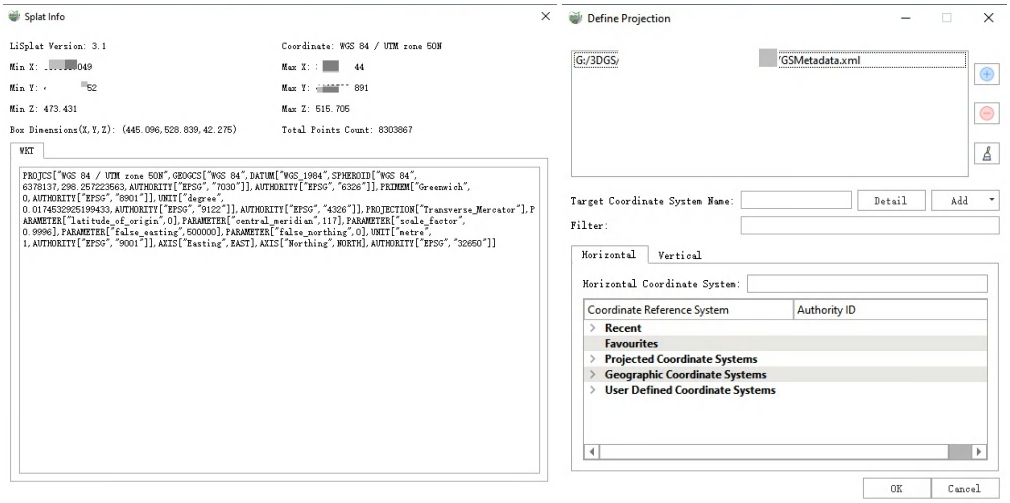


Display by Height

Display by Label

9.Added Map Display functionality in the Gaussian window, allowing overlay display of Gaussian data with OpenStreetmap or other online map sources.

10.Added Define Projection functionality for Gaussian data, allowing definition of the projected coordinate system information.



Optimizations

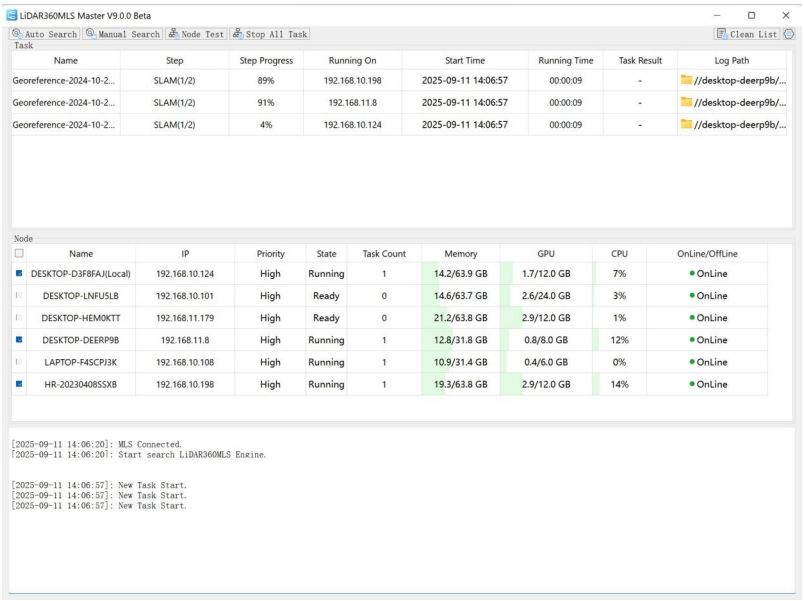
1.Optimized the Gaussian Reconstruction algorithm, increasing the number of points in the reconstructed Gaussian data for better visual effect.

2.Improved the visual quality of reconstructions from handheld devices.

(New) Cluster Computing Module

New Features

1.Added cluster computing functionality. By deploying computing modules on multiple devices within a local area network (LAN), large-scale processes that originally executed sequentially are split into smaller tasks that can be processed in parallel, thereby improving data processing efficiency.



- Note:
- 1.The efficiency improvement of cluster computing may vary due to factors such as different device configurations, switches, network bandwidth, and data volume. The above table is for reference only.
-
- 2.Cluster computing requires separate permission application. This includes the LiDAR360MLS cluster computing master node and the cluster computing engine. The master node computer must also have permissions for the services intended for clustering.
-
- 3.For detailed requirements and configuration of cluster setup, please refer to the User Manual.

2.Supports distributed cluster processing for functionalities such as BP Solution, Mobile Solution, Gaussian Reconstruction, and workflows built with the Model Builder. A reference table comparing the efficiency improvement of cluster computing for some functions is shown below:

Device Configuration	Function	Data Size	Number of Computing Engines	Efficiency Improvement
System： Windows 11 CPU： Intel(R)Core(TM)i7-10700K RAM： 64GB GPU： NVIDIA GeForce RTX 3060 GPU Memory： 12GB	LiGrip GSReconstruction	Data Collection: 60 minutes Coverage Area: 200m*200m	2	90%
			4	210%
	COLMAP GSReconstruction	Image Count: 20,000 Coverage Area: 3.8 km*1.8 km	2	100%
			4	200%
	Point Cloud Generation	5 Projects	2	200%
			5	400%
	Deep Learning Classification+Conversion of Point Clouds	137GB	2	201%
			3	298%

3.Supports automatic node discovery.

4.Supports cluster node task control.

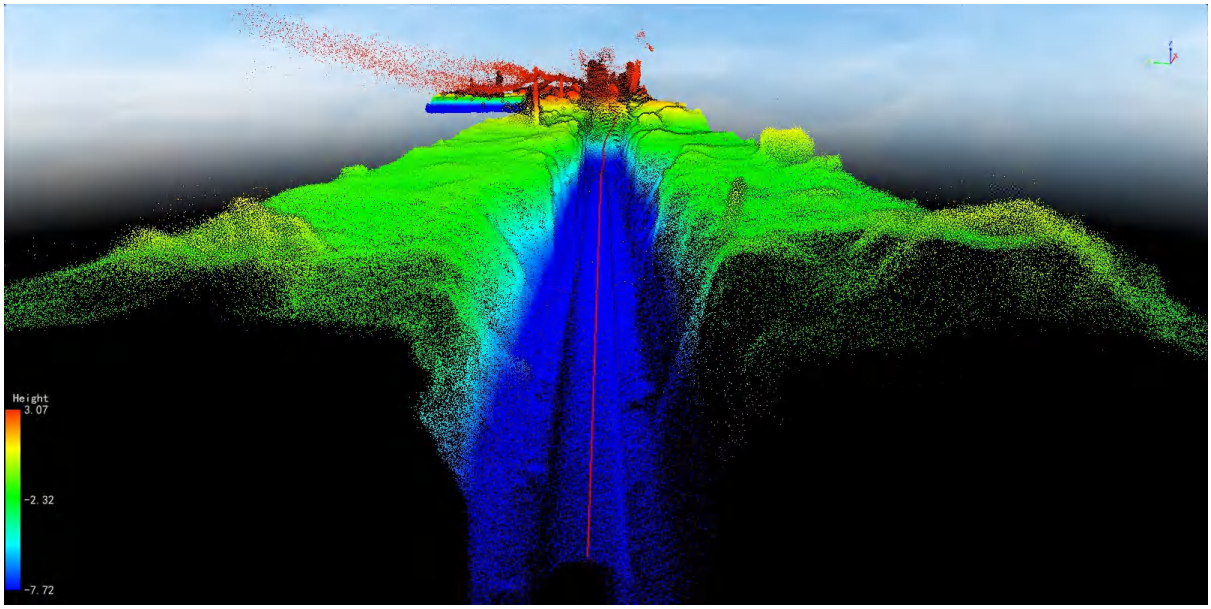
5.Cluster nodes support starting/stopping task reception.

6.Supports log viewing and export.

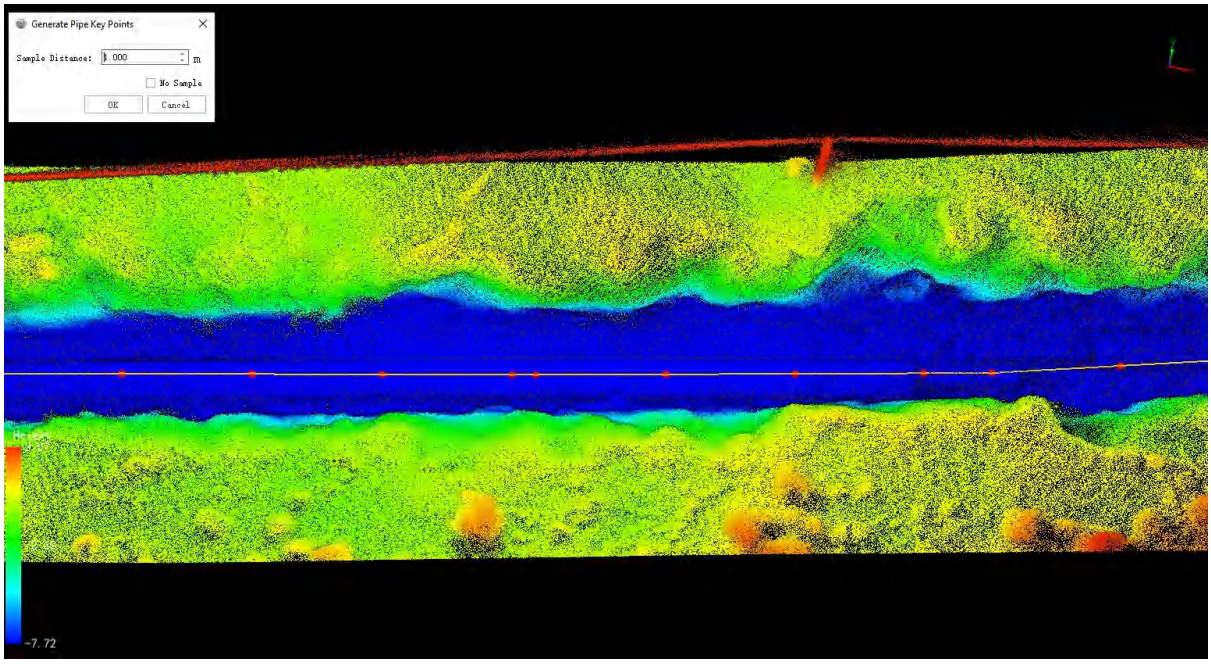
(New) Trench & Pipeline Module

New Features

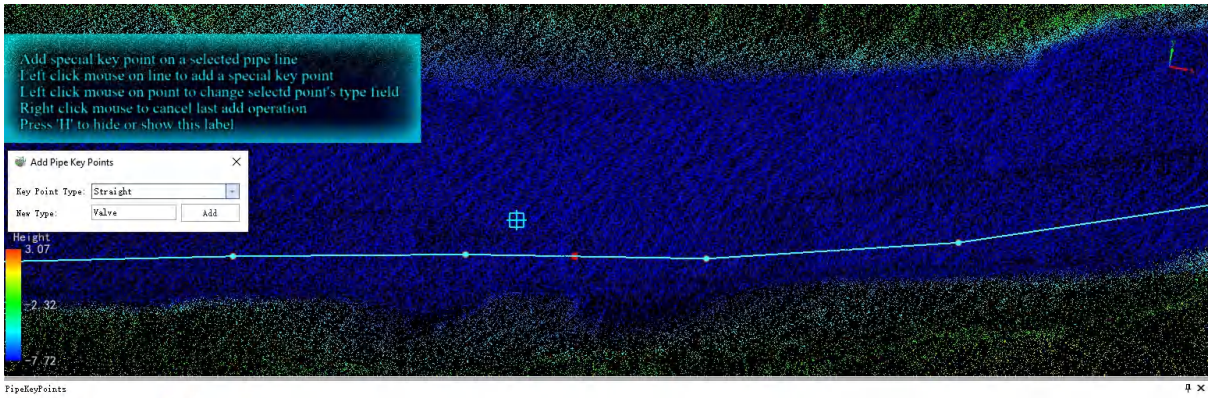
1.Added Pipeline Extraction functionality for semi-automatic detection and extraction of pipeline vector lines.



2.Added Generate Pipeline Key Points functionality, automatically generating pipeline key points in batches based on step spacing.



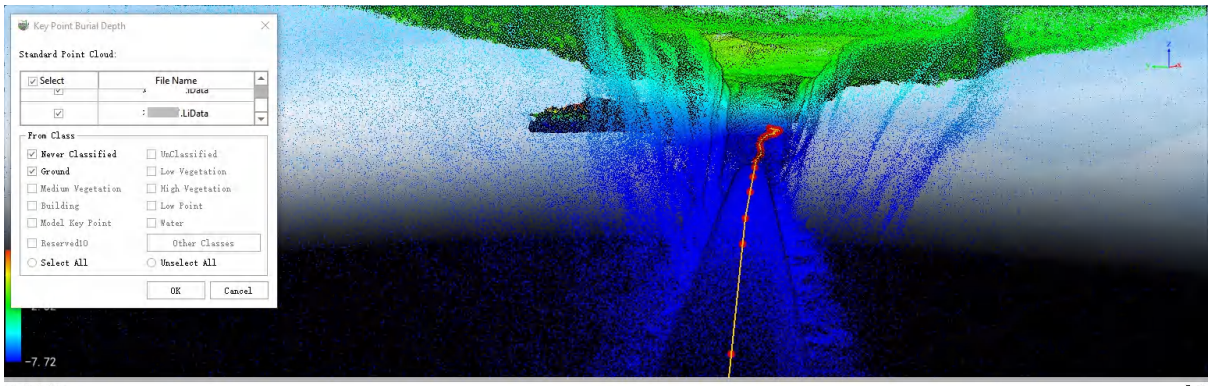
3.Added Add Special Key Points functionality, allowing interactive addition of arbitrary key points at required locations, supporting definition of key point types which are automatically stored in attributes.



PipeKeyPoints

	FID	Shape	Type	ImageName	Image	ID	BurialDepth	KP Type
43	43	Point	NULL	NULL	NULL	1	NULL	Straight
44	44	Point	NULL	NULL	NULL	1	NULL	Straight
45	45	Point	NULL	NULL	NULL	1	NULL	Straight
46	46	Point	NULL	NULL	NULL	1	NULL	Straight
47	47	Point	NULL	NULL	NULL	1	NULL	Straight
48	48	Point	NULL	NULL	NULL	1	NULL	Straight
49	49	Point	NULL	NULL	NULL	1	NULL	Valve

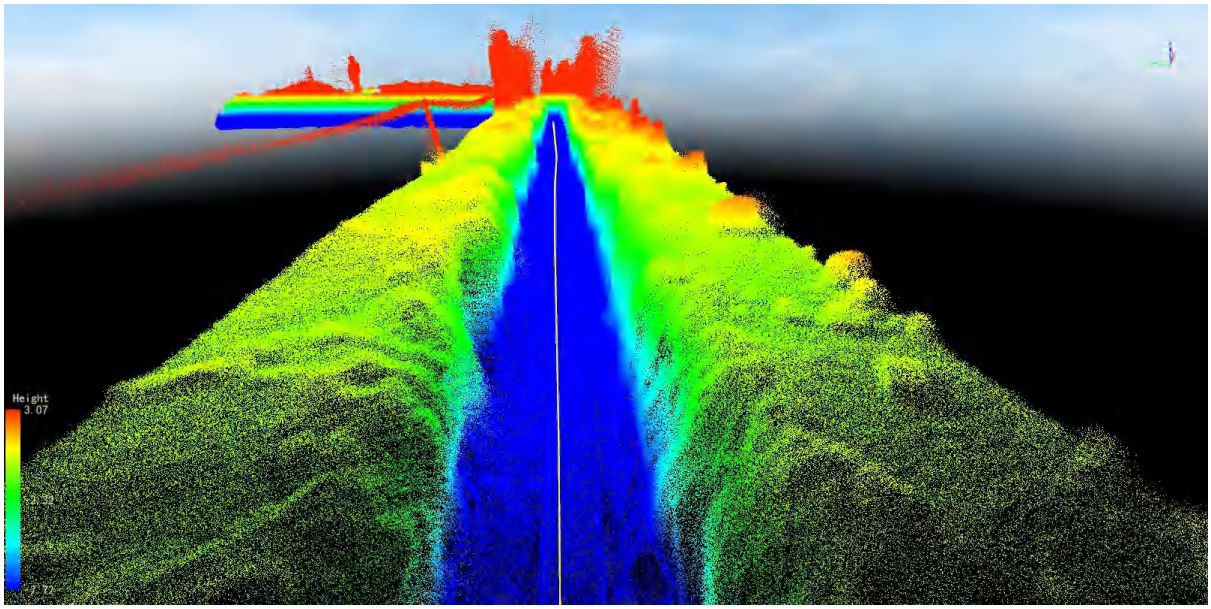
4.Added Key Point Burial Depth Calculation functionality, automatically calculating the burial depth of key points relative to the ground based on existing key points and reference ground point cloud data.



PipeKeyPoints

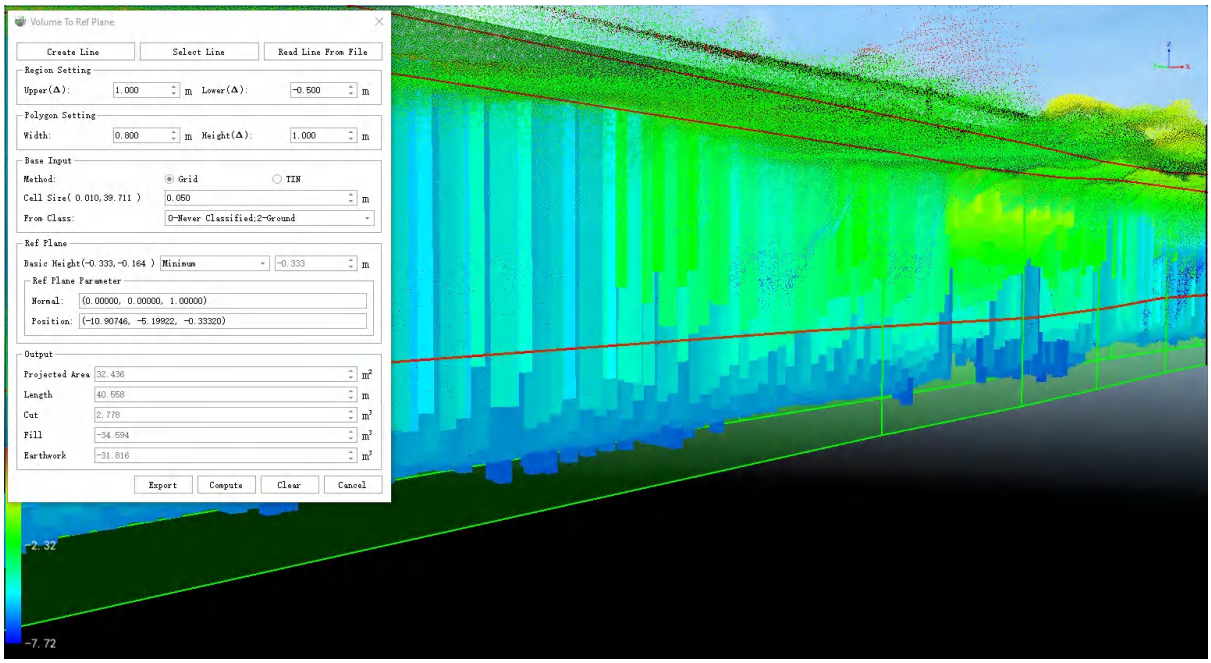
	FID	Shape	Type	ImageName	Image	ID	BurialDepth	KP Type
43	43	Point	NULL	NULL	NULL	1	1.035642	Straight
44	44	Point	NULL	NULL	NULL	1	1.011522	Straight
45	45	Point	NULL	NULL	NULL	1	1.014106	Straight
46	46	Point	NULL	NULL	NULL	1	0.986275	Straight
47	47	Point	NULL	NULL	NULL	1	0.983239	Straight
48	48	Point	NULL	NULL	NULL	1	1.117608	Straight
49	49	Point	NULL	NULL	NULL	1	1.031925	Valve

5.Added Trench Extraction functionality for semi-automatic detection and extraction of trench centerlines.

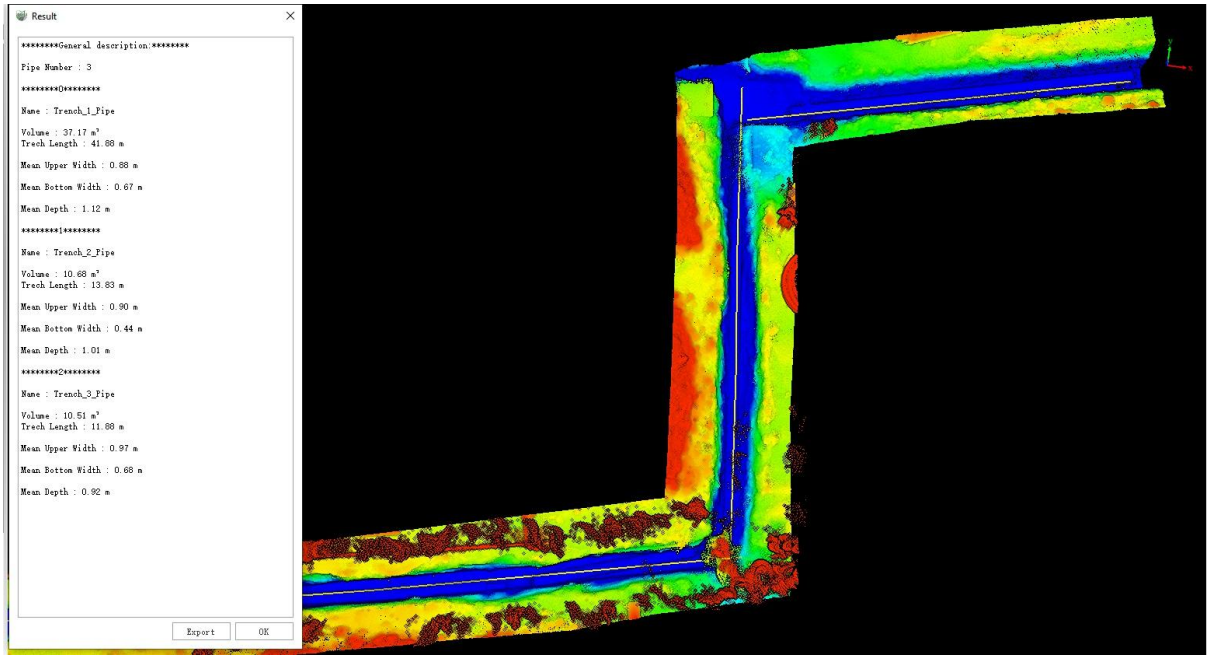


6.Added Point Cloud Extraction functionality. Based on any vector line layer, extract point cloud data within a user-defined buffer range and save it to a new file.

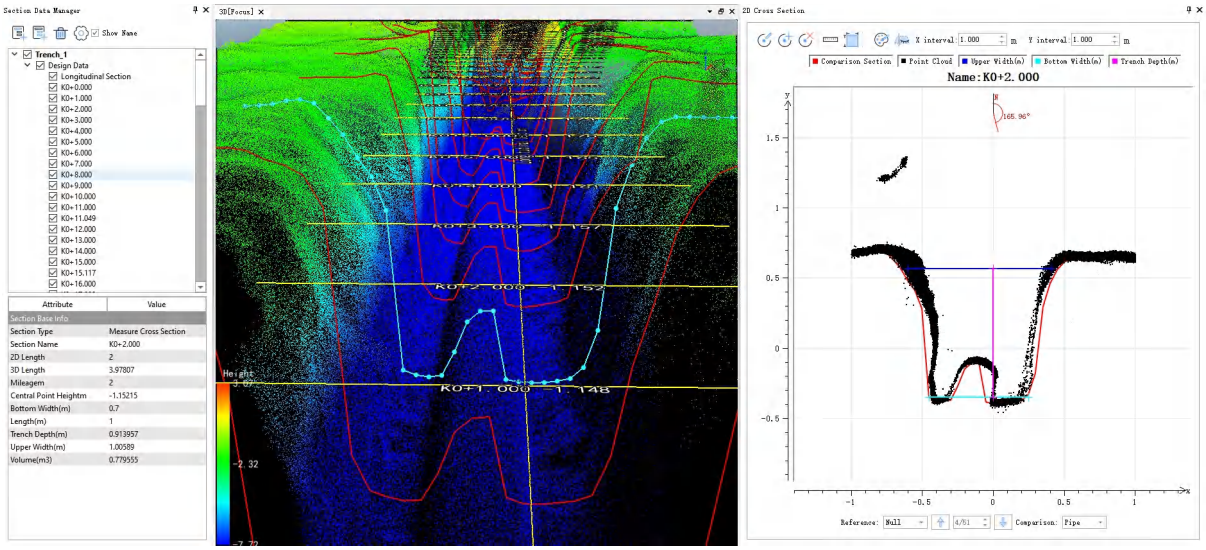
7.Added Volume Measurement functionality. Different from the volume measurement tool on the general Tools page, this function is better adapted for trench scenarios. It allows defining calculation areas based on trenches or any custom lines, provides volume calculation methods based on TIN and grid, enabling precise volume calculation for trench scenarios.



8.Added Trench Volume Calculation functionality. This function internally uses the trench cross-section method to automatically and in batch calculate trench earthwork volume, length, average upper/lower trench width, and average trench depth with one click.



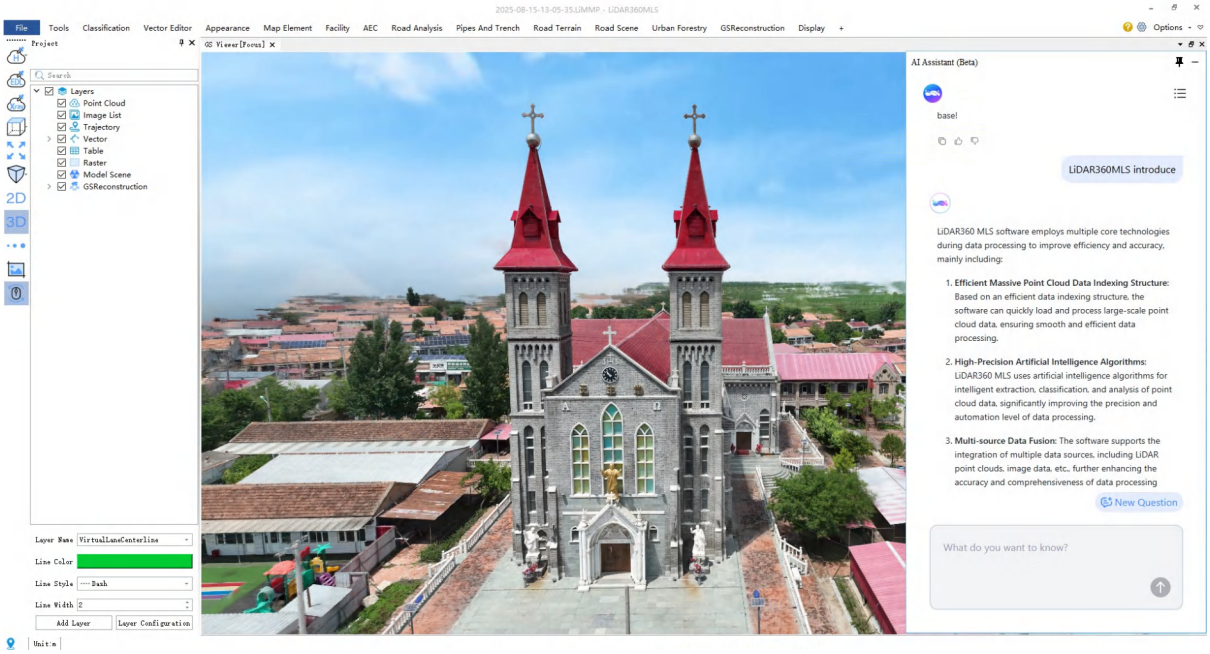
9.Added Trench Cross-Section functionality. This function can open cross-sections from trench volume calculations or custom arbitrary cross-sections for editing, recalculating cross-sections and trench parameters, and generating trench volume reports.



Framework

New Features

1.Added an AI Assistant. After logging into a LiCloud account, users can ask questions and get answers.



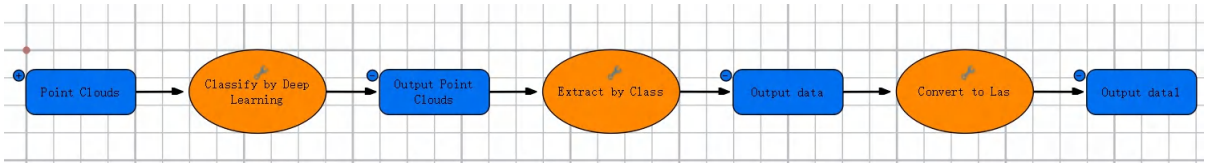
2.Added Model Builder, allowing custom batch processing workflows for any data including point clouds, vectors, rasters, etc.

2.1 Adjustable canvas supporting auto-layout, undo, redo, 1:1 display, zoom in, zoom out, full extent display, etc.

2.2 Supports dragging functions directly onto data sources for automatic connection.

2.3 Supports saving batch processing models for export and distribution.

2.4 Supports model builder construction for functions including: point cloud extraction, export, classification, projection, coordinate conversion, and others like filtering, normalization; vector conversion, extraction, overlay analysis, proximity analysis, simplification/encryption, projection/coordinate conversion, export; raster conversion, surface analysis, raster analysis, projection/coordinate conversion; map feature road marking extraction, automatic road facility extraction, power line height limit analysis, road damage analysis, road terrain DEM/DSM generation and contour generation, Urban Forestry module functions, etc.



Streamlined Point Cloud Tool Processing

2.5 Pre-built model builders are included for functions like power line height limit analysis, road damage analysis, road terrain DEM/DSM generation and contour generation, urban forestry individual tree segmentation, parameter extraction, and report generation, allowing one-click execution.

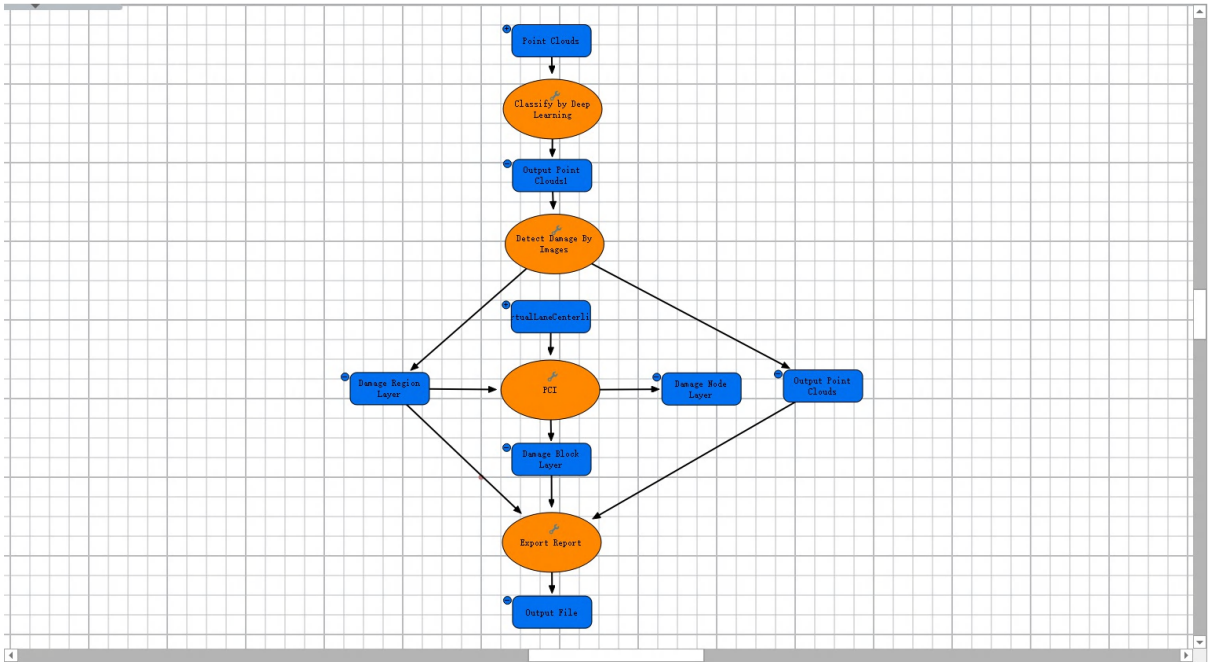
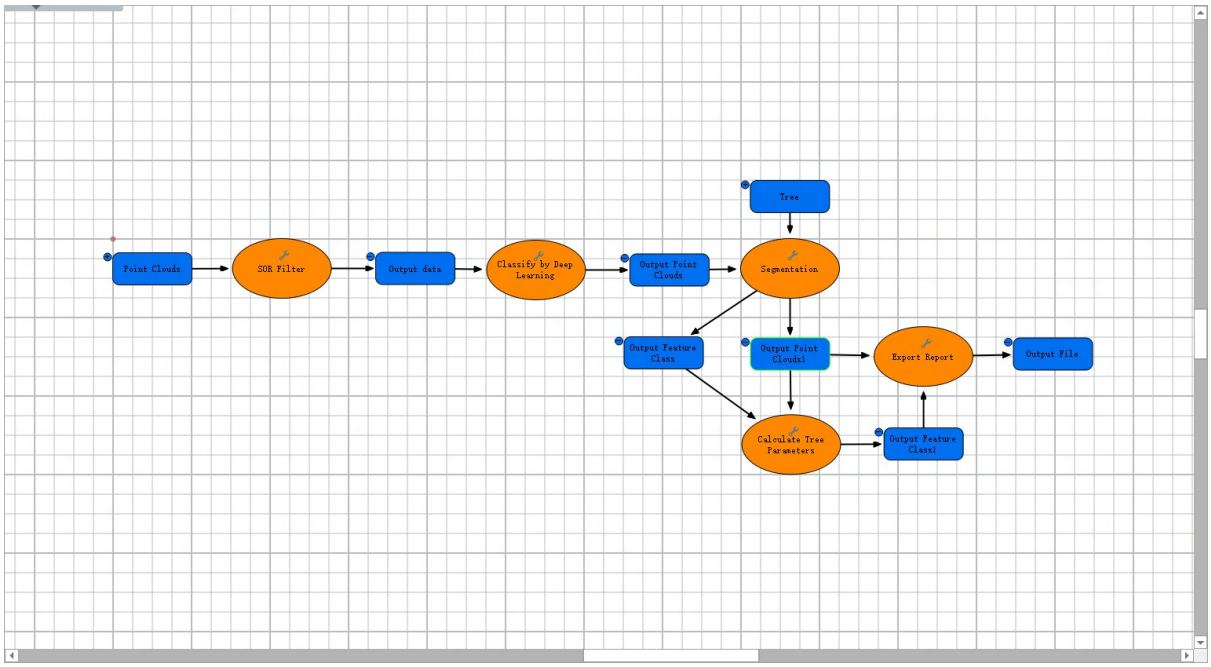


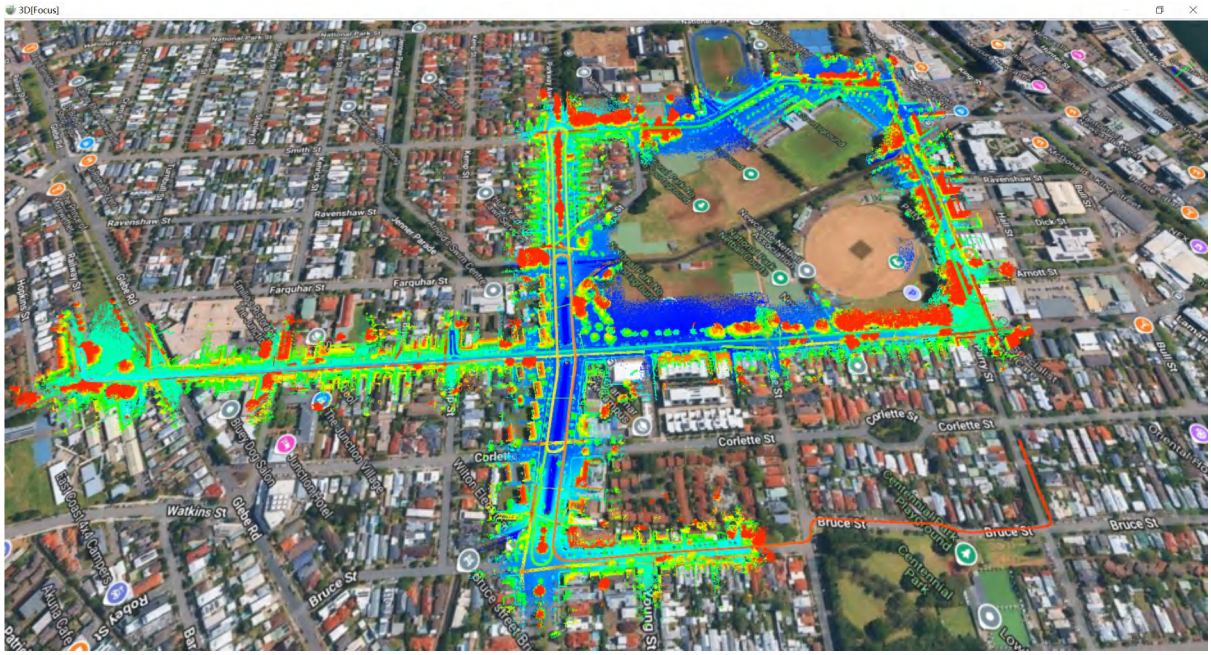
Image-based Damage Detection Streamlined Processing



Individual Tree Segmentation Streamlined Processing

2.6 Model Builder supports cluster computing.

3.Added online maps. After configuring OpenStreetMap, GoogleMap and other map sources, online maps can be displayed in the 3D, Raster, and Gaussian windows. Point clouds, vectors, rasters, Gaussian data, etc., can be overlaid for 2D and 3D display. Measurement, drawing, and path planning are also supported on the map.



4.Added point cloud classification by height difference, allowing target classification based on point cloud elevation data.

5.Added point cloud classification by noise function, searching for noise points based on a radius parameter and classifying them into a target category.

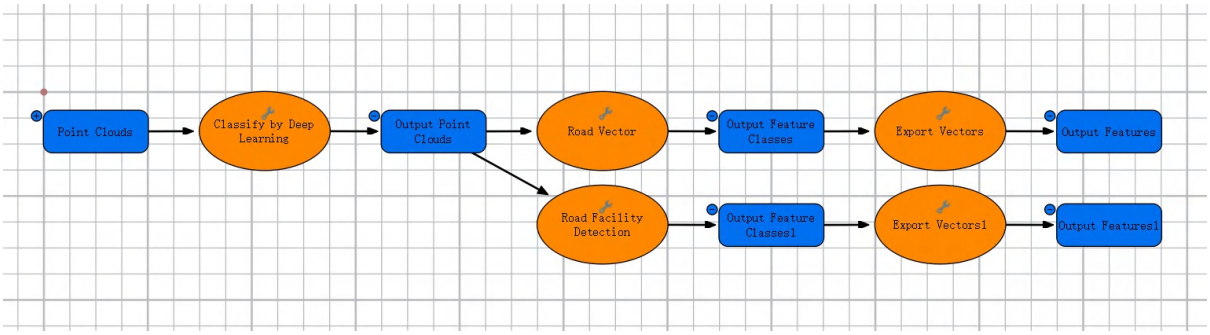
6.Added point cloud tiling functionality, allowing users to define tile size and buffer to process point clouds in tiles.

7.Share data in LiCLoud: Fixed upload failures after prolonged standby and login session expiration; added Gaussian data packaging and upload functionality.

Asset Extraction Module

New Features

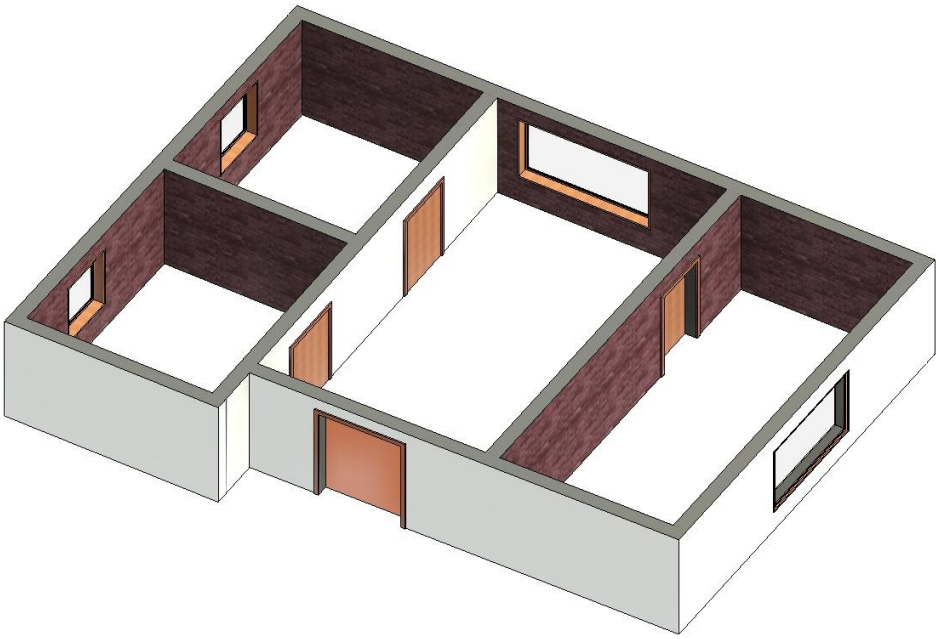
1.The deep learning-based road vector and facility detection functionality now supports building streamlined batch processing models for multi-data, multi-step batch processing.



Architectural Drawing Module

New Features

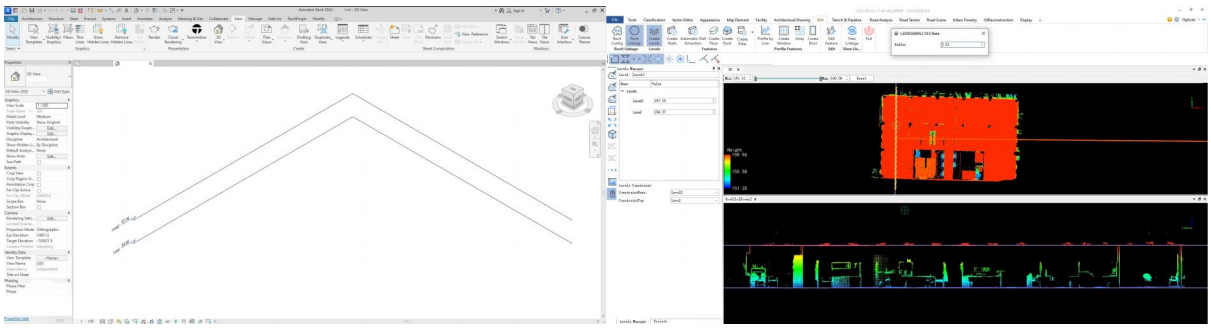
1.Added a new BIM modeling module, linking with the Revit software plugin to perform vector extraction and drawing within LiDAR360MLS software, and automatically create architectural BIM models in Revit.



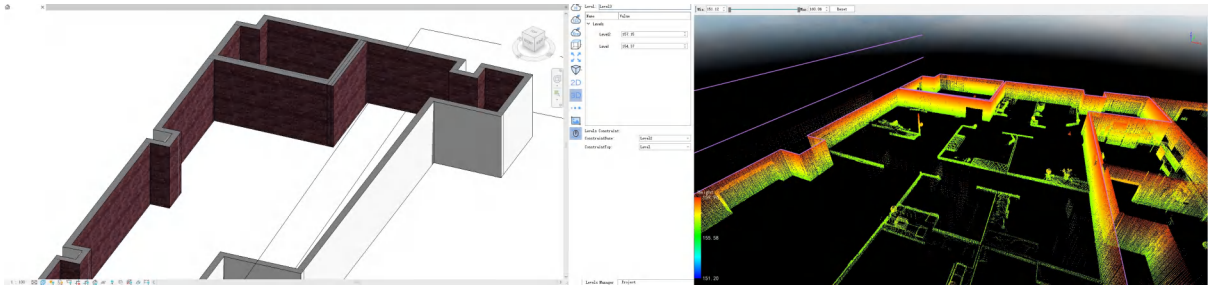
1.1 No additional installation required, one-click configuration for the Revit plugin.

1.2 Build BIM models from point clouds or 3DGS data,precisely recreating every architectural detail.

1.3 Automatically create arbitrary level lines in section view mode.



1.4 Added manual wall drawing and modeling tools.



1.5 Added a one-click automatic wall extraction tool, which can automatically extract all walls in the scene from point cloud data and connect them as much as possible.

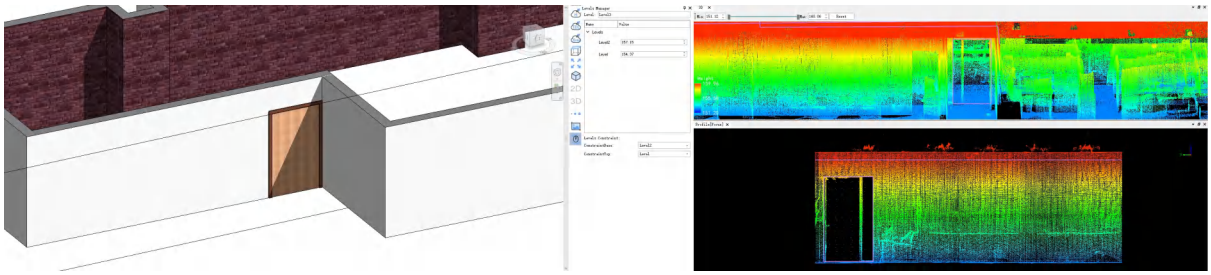
1.6 Added floor drawing and modeling functionality.

1.7 Added flat roof drawing and modeling functionality.

1.8 Added column drawing and modeling functionality.

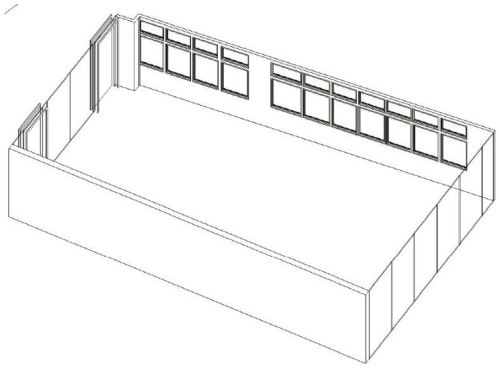
1.9 Added window manual drawing / automatic batch extraction and modeling functionality based on sections, supporting batch creation and modeling using array tools.

1.10 Added door manual drawing and modeling functionality based on sections.



1.11 Added element editing functionality, allowing detailed editing of element nodes, with synchronized updates to the model in Revit. Also supports synchronized deletion of corresponding BIM models when elements are deleted.

1.12 Added view synchronization functionality, allowing simultaneous viewing of the BIM model in Revit and the point cloud/vector/GS in LiDAR360MLS software from the same perspective.

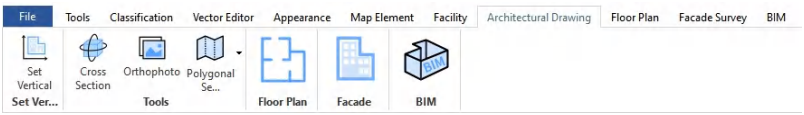


BIM

3DGS

2.The Elevation Measurement module added automated window extraction, allowing one-click batch extraction of similarly shaped windows on an entire wall, improving drawing efficiency.

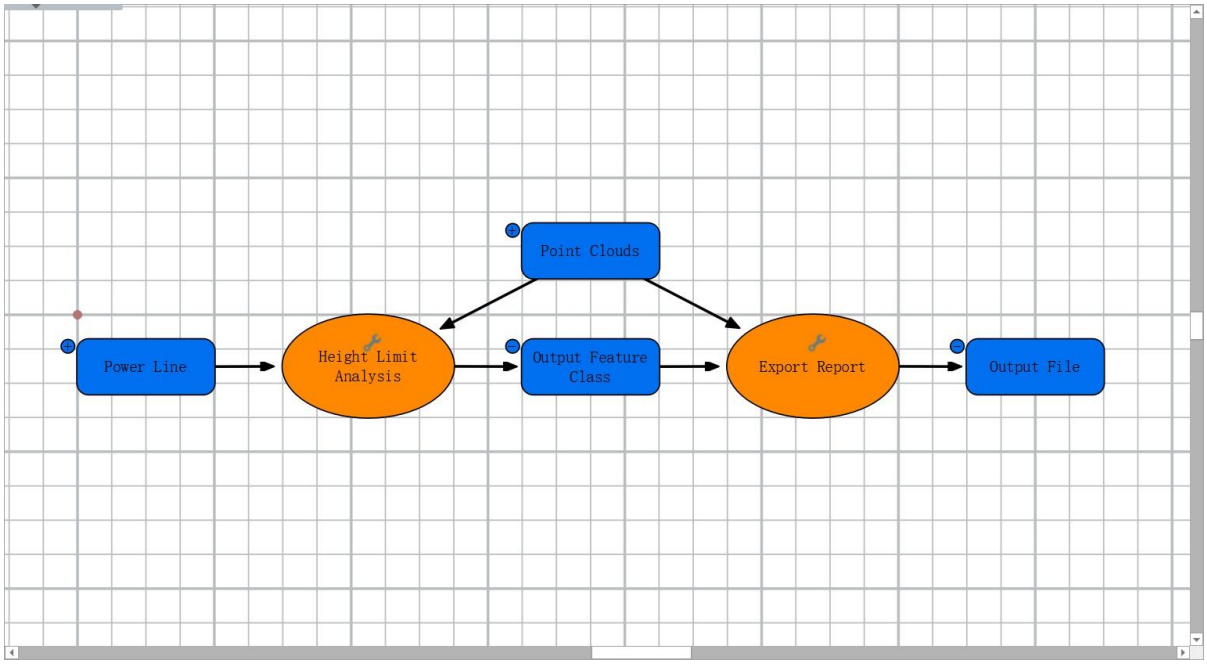
3.Added an "Architectural Drawing" page, integrating the original "Floor Plan" and "Faced Survey" pages. Click the corresponding button for the desired task to access its interface. Functions like Set Vertical, Section, Orthophoto, Polygon/Surface/Cylinder Section are also represented on this page for convenience. Supports exporting point clouds or orthophotos in formats such as DXF and LAS.


File
Tools
Classification
Vector Editor
Appearance
Map Element
Facility
Architectural Drawing
Floor Plan
Facade Survey
BIM
Set Vertical
Set Ver...
Cross Section
Orthophoto
Polygonal Se...
Tools
Floor Plan
Facade
BIM

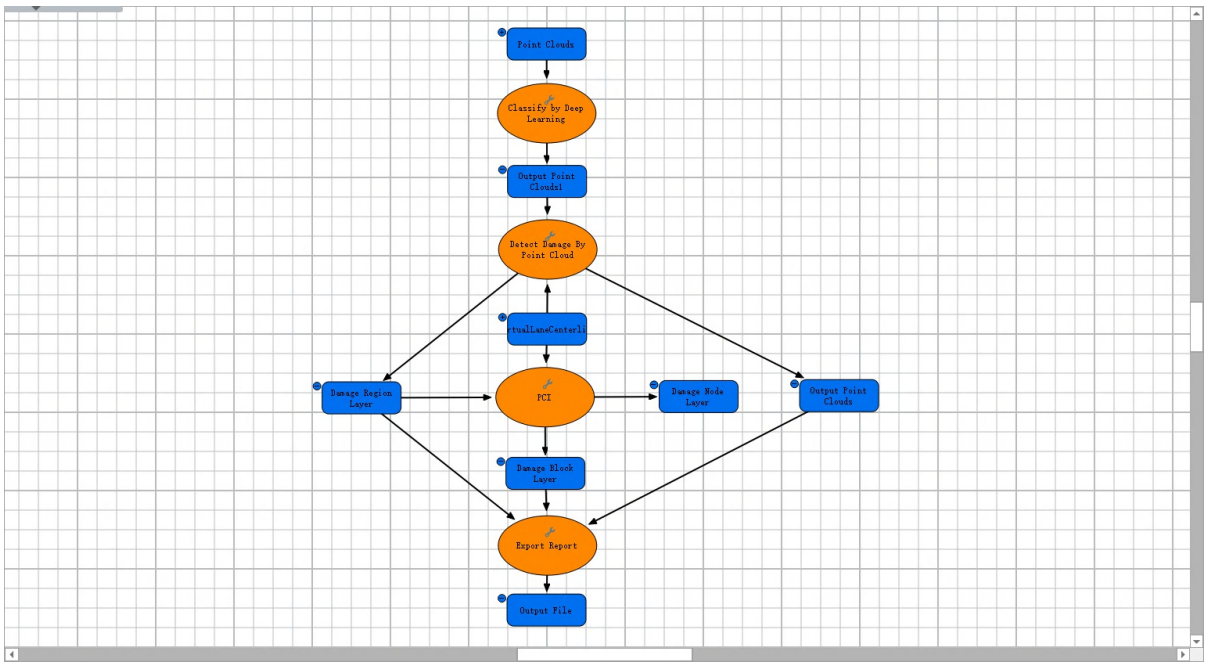
Road Condition Module

New Features

1.Added built-in processing pipline templates for four analysis functions: Power Line Height Limit Analysis, Damage Detection by Point Cloud, Damage Detection by Image, and Terrain Output. Users can run batch processing with one click.



Power Line Height Limit Analysis Processing Pipline

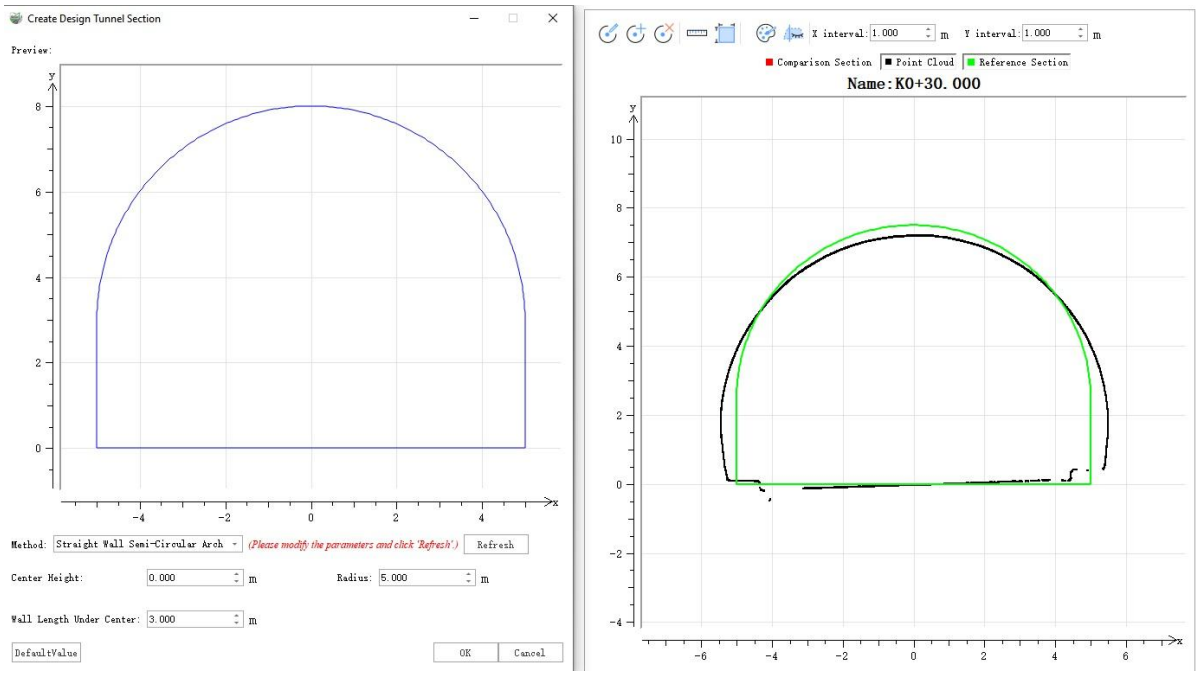


Damage Detection by Image Processing Pipline

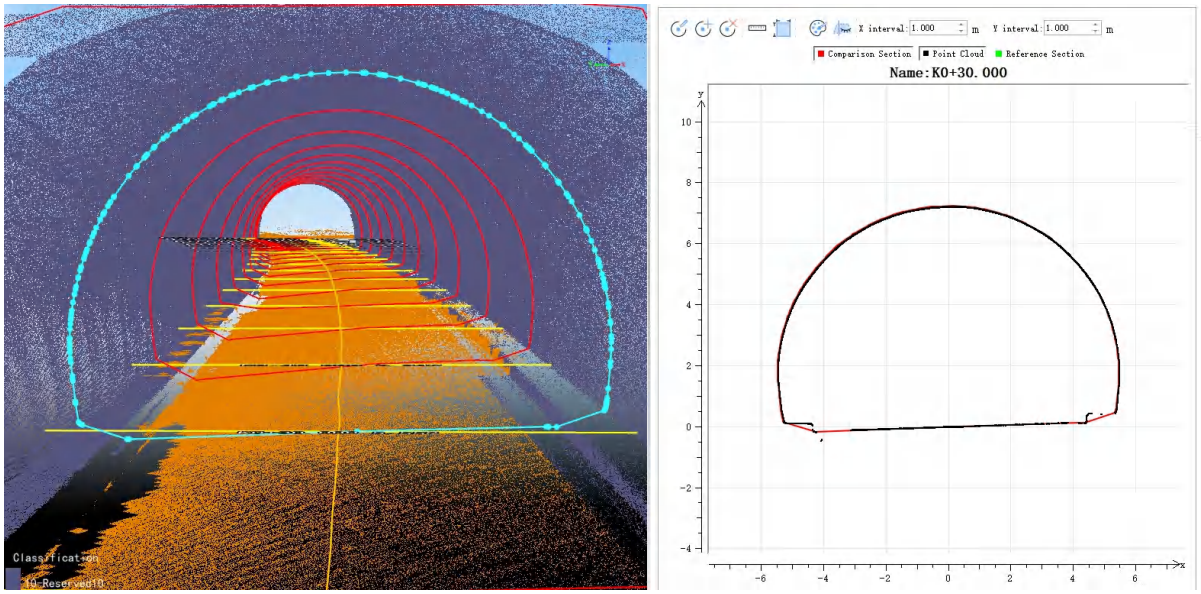
2.Split the original damage detection function into two distinct buttons: Damage Detection by Point Cloud and Damage Detection by Image, making functionality clearer.

3.Cross-Section Analysis added support for tunnel cross-section calculation, comparative analysis, and result export, specifically including:

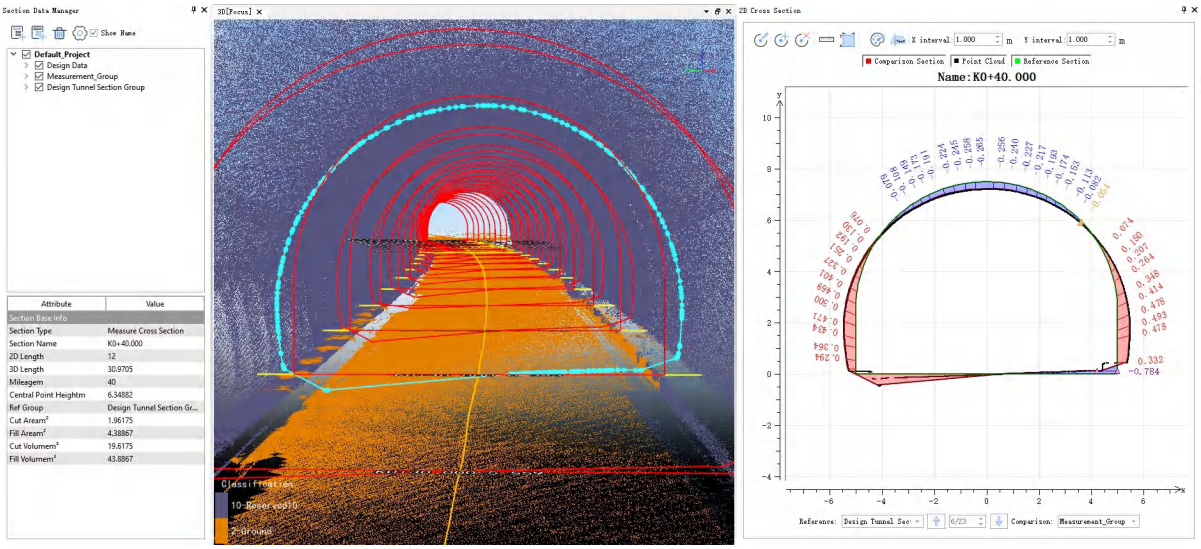
3.1 Support for creating tunnel design cross-sections, multiple creation methods with adjustable parameters for flexible adaptation to various scenarios.



3.2 Support for calculating measured tunnel cross-sections and fine editing of measured sections.



3.3 Support for comparative analysis of two-phase cross-sections, calculating cut and fill volumes, and generating comparison reports.

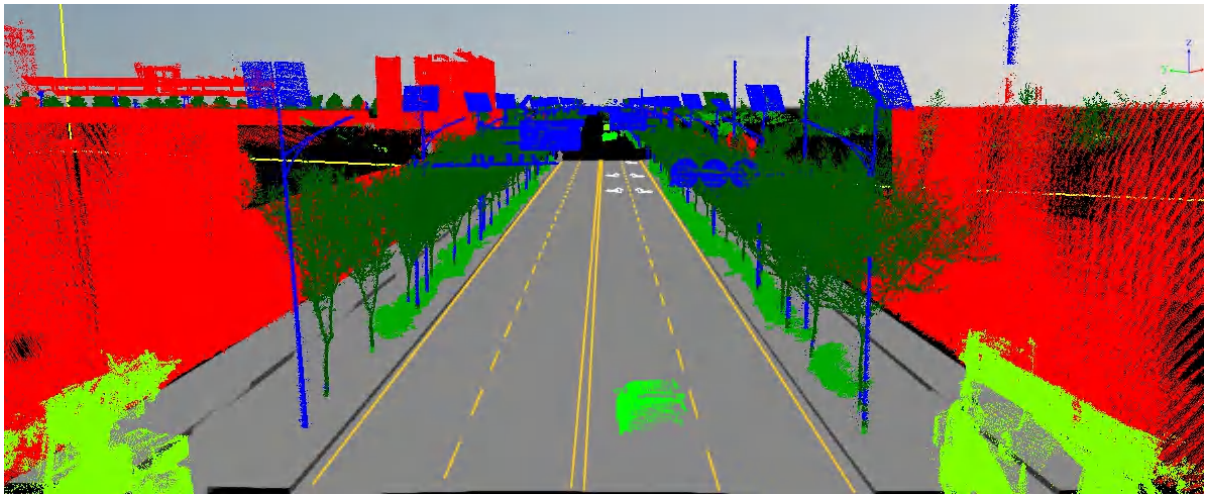


3.4 Support for cross-section export to formats like DXF, SHP, etc.

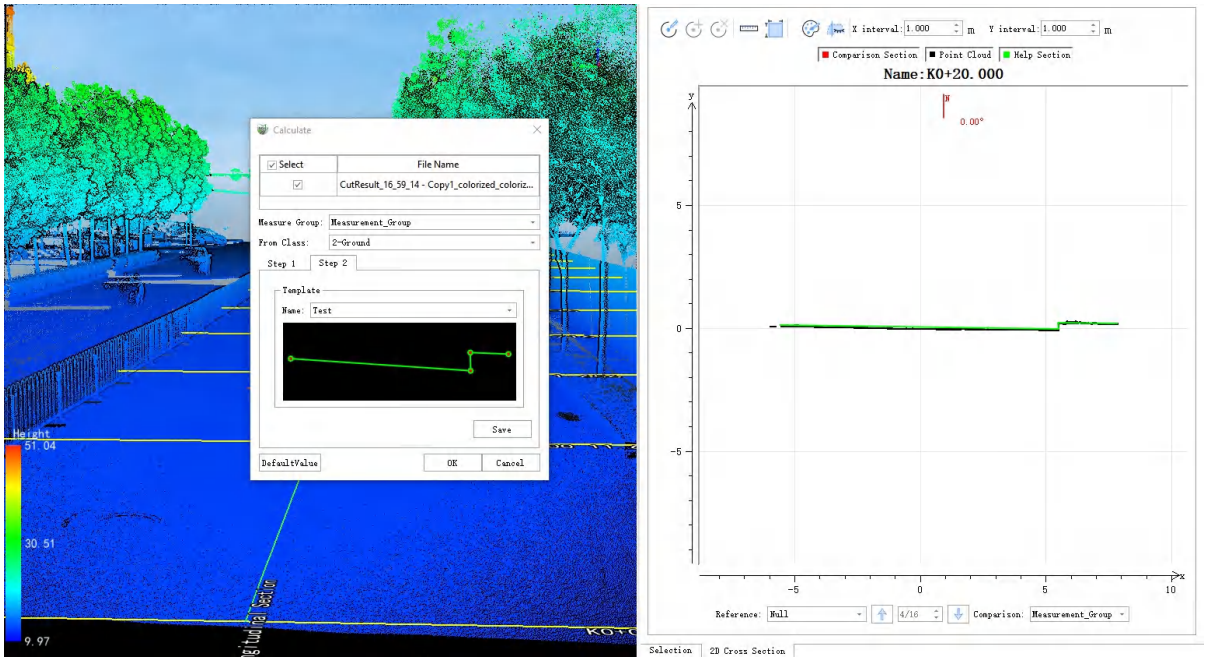
3.5 Support for PDF export, saving an image of each cross-section (including both phases if two-phase data exists) in a PDF.

4.Renamed the original "Road Surface" page to "Road Terrain" page.

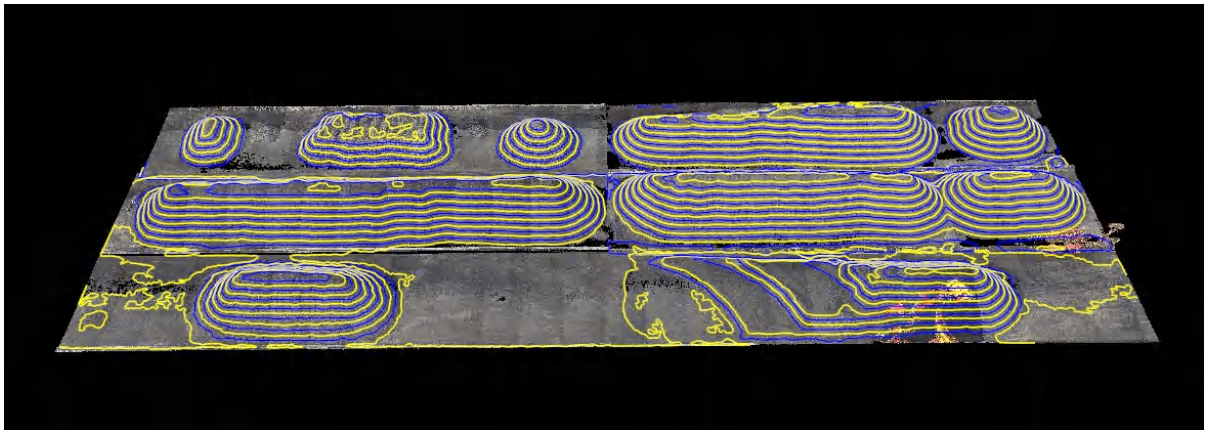
5.The Create TIN function within Road Terrain added a Breakline option, enabling more accurate terrain generation where slope changes drastically, based on breaklines.



6.Road Terrain added functionality to create terrain based on cross-section templates, allowing batch generation and fine editing of road cross-section terrain, and supporting the export of feature lines.



7.Added functionality to generate contours from both point cloud and raster data sources. Coupled with the software's vector export, users can export to formats like SHP, DXF, etc.



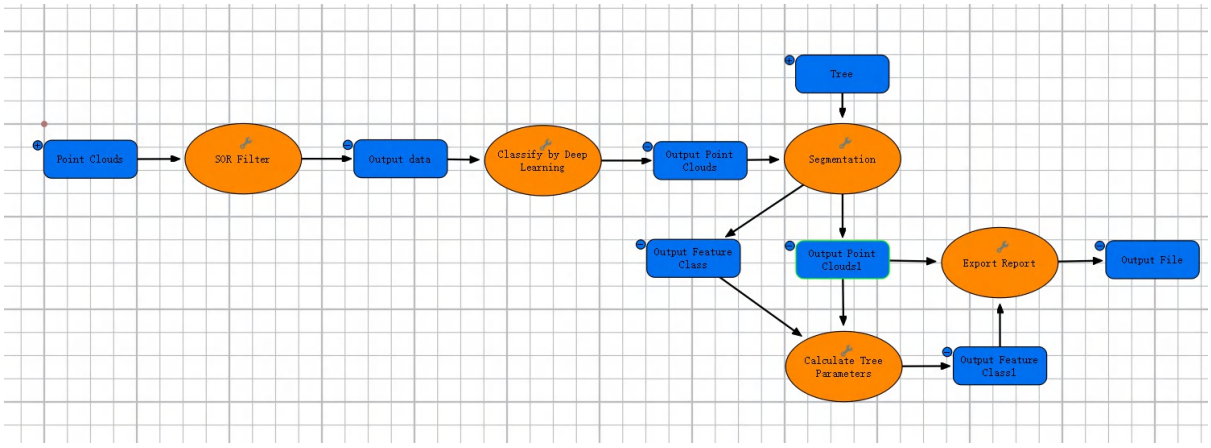
8.Added TIN Export functionality, allowing export of TIN to OBJ or PLY format.

9.Added a new feature for generating orthophotos from images, which can produce georeferenced road orthophoto deliverables based on panoramic/planar camera data.

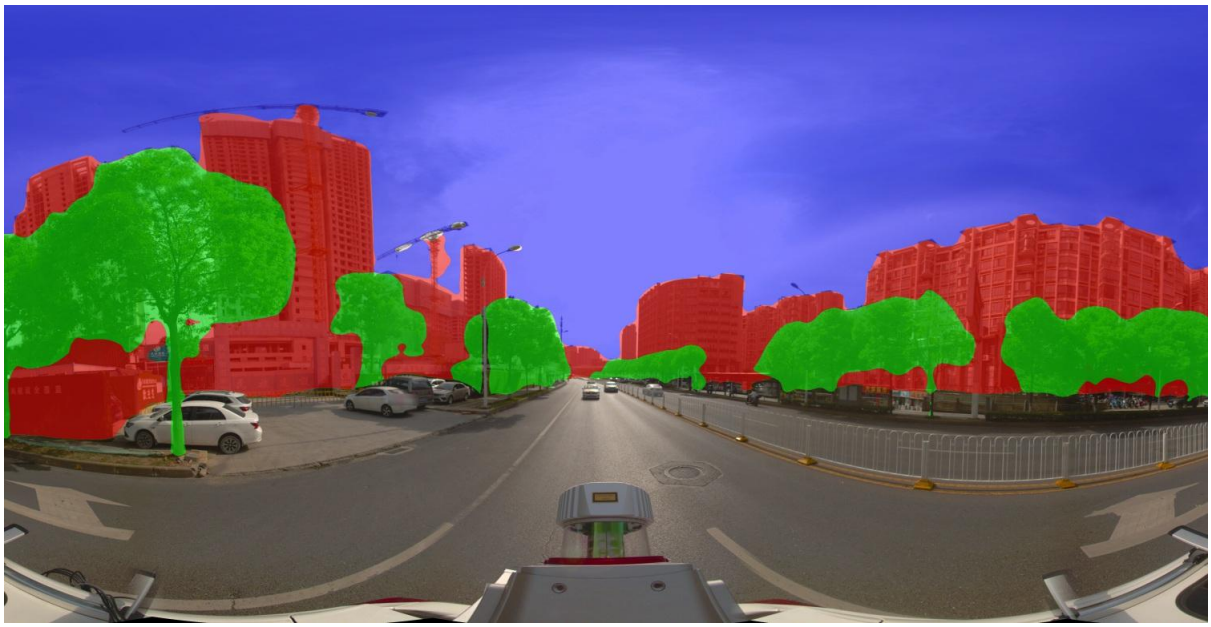
Forestry Module

New Features

1.Added a complete streamlined processing template for urban forestry, from individual tree segmentation to parameter calculation and report generation, allowing batch execution with one click.



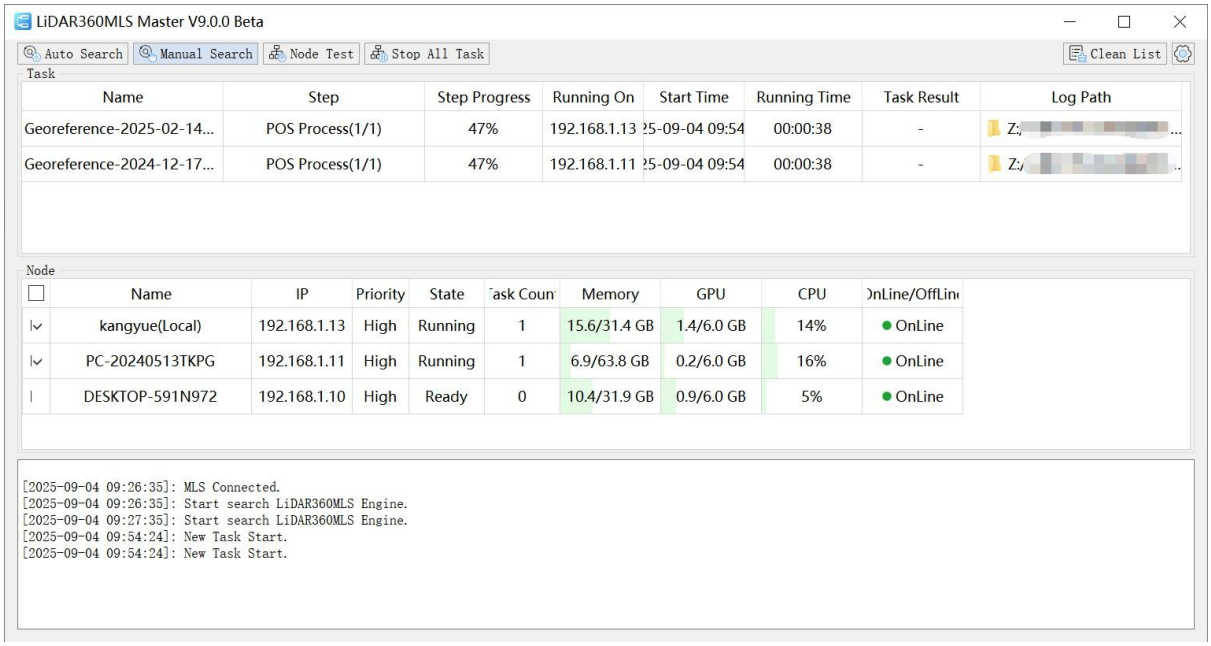
2.Added Ecological Landscape Analysis and Parameter Calculation Based on Deep Learning Semantic Segmentation of Imagery, Enabling Measurement of Green View Index, Building Visibility Rate, and Sky View Factor.



Geo Module

New Features

1.Mobile Process newly supports cluster computing function, which can assign multiple tasks to different engine devices for parallel processing. This significantly improves data processing efficiency.



LiDAR360MLS Master V9.0.0

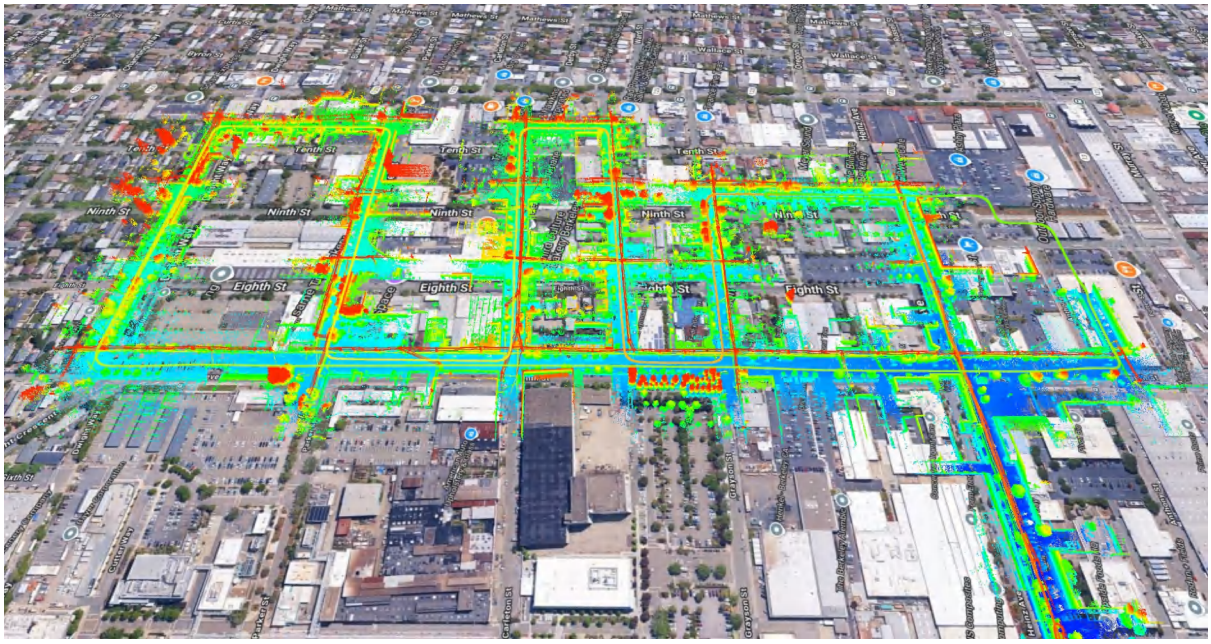
System	CPU	Memory	GPU	Memory
Windows 11	Intel(R)Core(TM)i7-9700	32 GB	NVIDIA GeForce RTX 2060	6 GB

Step	Cluster		Single	Performance Improvement
	Engine 1	Engine 2	Engine 1	
POS Process	0:03:50	0:04:23	0:08:13	106.3%
Georeference	0:25:23	0:27:58	0:53:21	90.7%
Strip Adjust	1:03:02	1:06:53	2:09:54	94.2%
Filter	0:56:50	1:03:40	2:00:30	89.3%
Colorize	1:00:14	1:11:40	2:11:53	84.0%
Total	3:54:34 (Engine2 Processing Time)		7:23:51	89.2%

Top: Engine Configuration; Bottom: Efficiency of Each Step of Mobile Cluster Process

> The efficiency improvement of cluster computing may vary depending on factors such as hardware configurations, switches, network bandwidth, and data volume.

2.The software has added a map feature, supporting the overlay display of maps, trajectories, and point clouds in the 3D window, making it convenient for users to view the operation area.

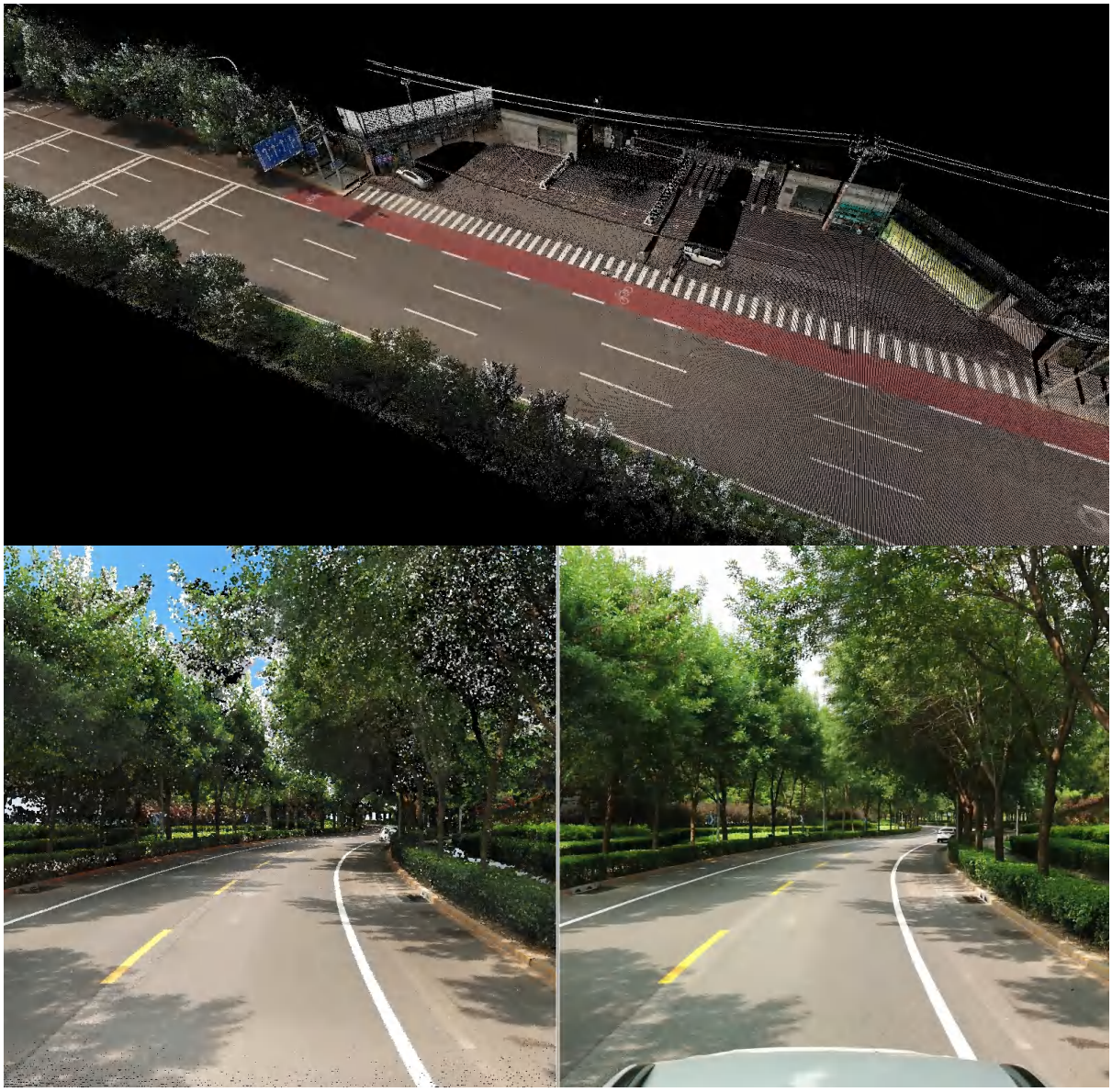


Map Feature

Enhancement

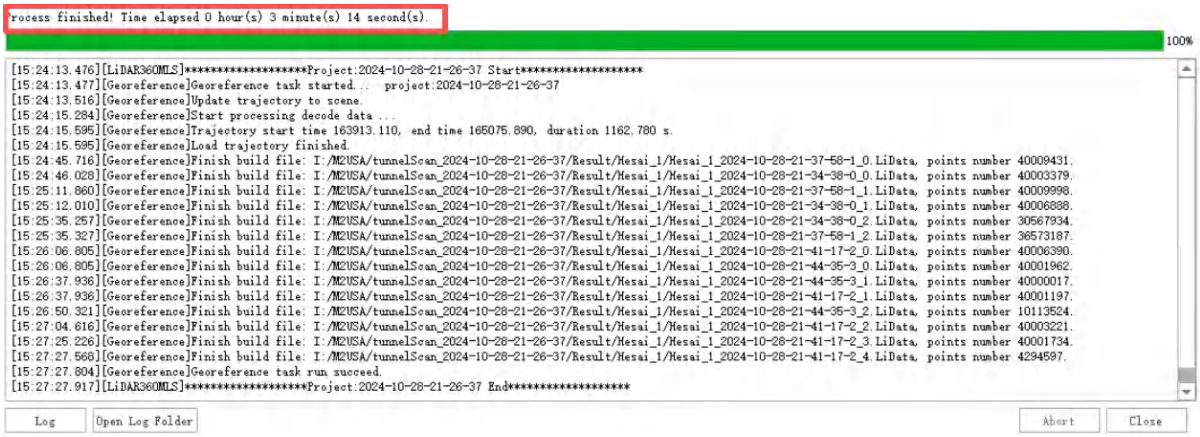
1.Point cloud coloring algorithm optimized, coloring effect more accurate, truly restoring 3D scenes.

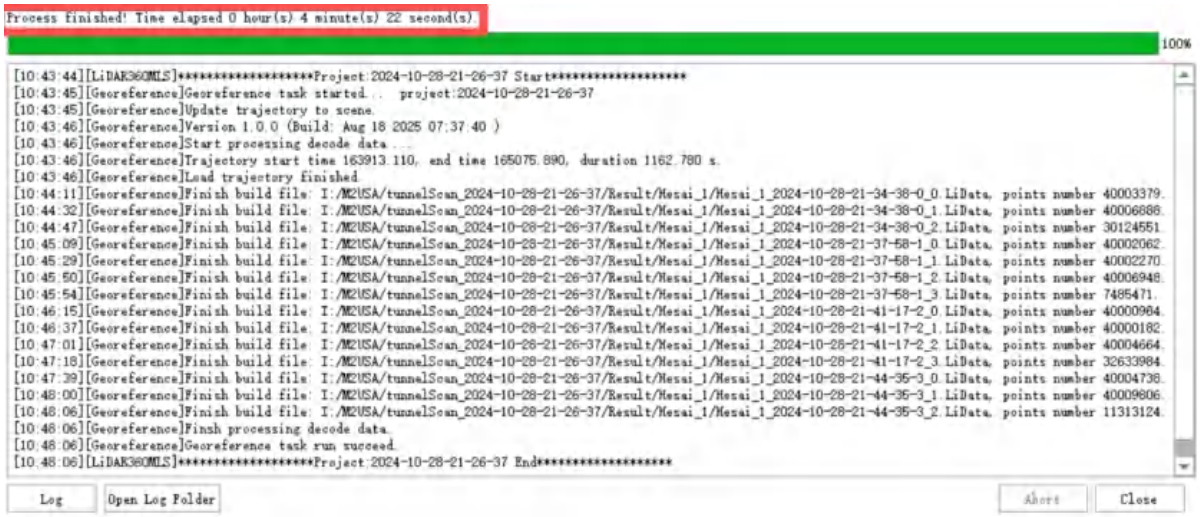
Left：SoftwareV9.0 Colorization Effect；Right：SoftwareV8.2 Colorization Effect



SoftwareV9.0 Colorization Effect

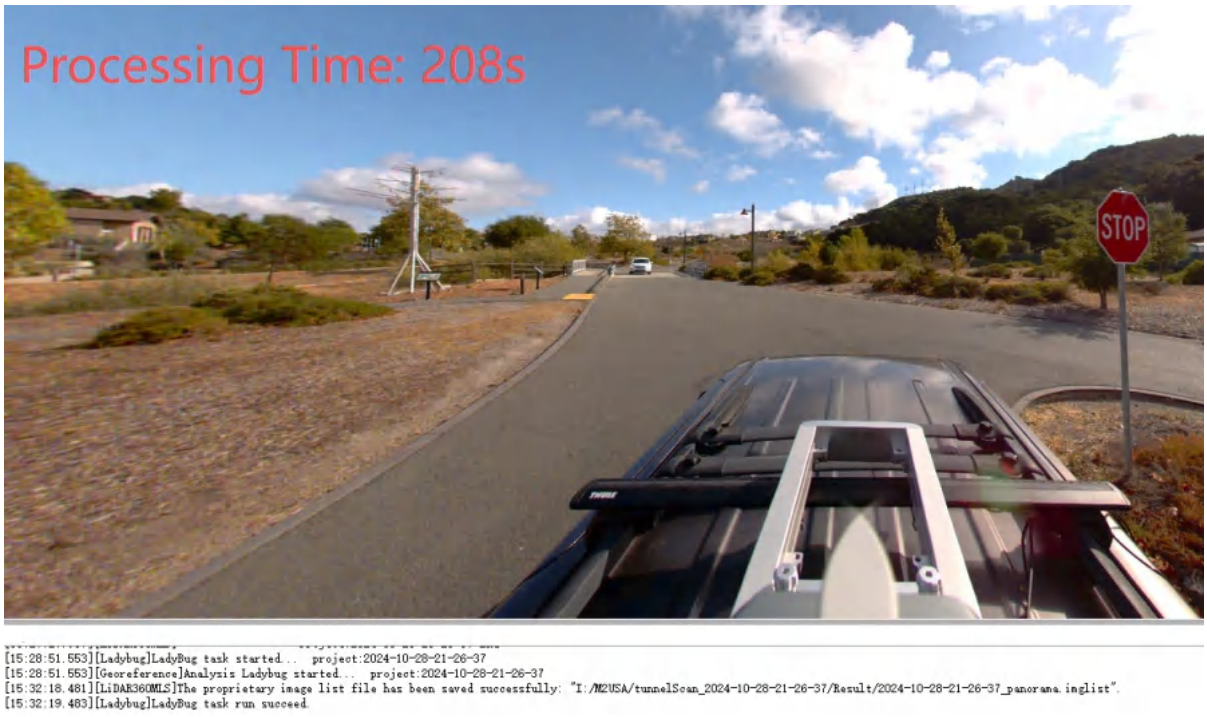
2.Point cloud georeference algorithm optimized, processing efficiency improved by about 33%.





Top: SoftwareV9.0 Georeference Log; Bottom: SoftwareV8.2 Georeference Log

3.Panoramic image parsing algorithm optimized, speed increased by about 190%.



Top: SoftwareV9.0 Log; Bottom:SoftwareV8.2 Log

> The efficiency improvement of cluster computing may vary depending on factors such as hardware configurations, network bandwidth, and data volume.

LiDAR360MLS V8.2.2.1 Release Notes

BP Module

New

1. Support VSLAM image of O2 Lite/O2 to participate in tunnel mode Process;
2. Support the General mode of LiAir X4;

Optimization

3. Optimize the thickness of Point cloud in LiAir X4 general mode;

Fixed

1. Fixed a bug causing point cloud confusion after GCP optimization;
2. Fixed a bug causing point cloud coloring confusion after merging;
3. Fixed a bug causing PGO errors when using GCP pick points functions with GNSS;

GSReconstruction Module

Enhancement

1. Fixed an error in the general Gaussian reconstruction of wide character data.
2. Fixed an issue where data imported from third-party Gaussian reconstructions was displayed incorrectly.

Framework

Enhancement

1. Fixed an issue where DXF import failed.
2. Fixed an issue where adding symbols caused the program to crash.
3. Optimized the panoramic exposure point display control settings and displayed this option on the panoramic page.
4. Fixed an issue where Chinese path road scene model export facility layers failed and coordinates were abnormal.

LiDAR360MLS V8.2.2 Release Notes

GSReconstruction Module

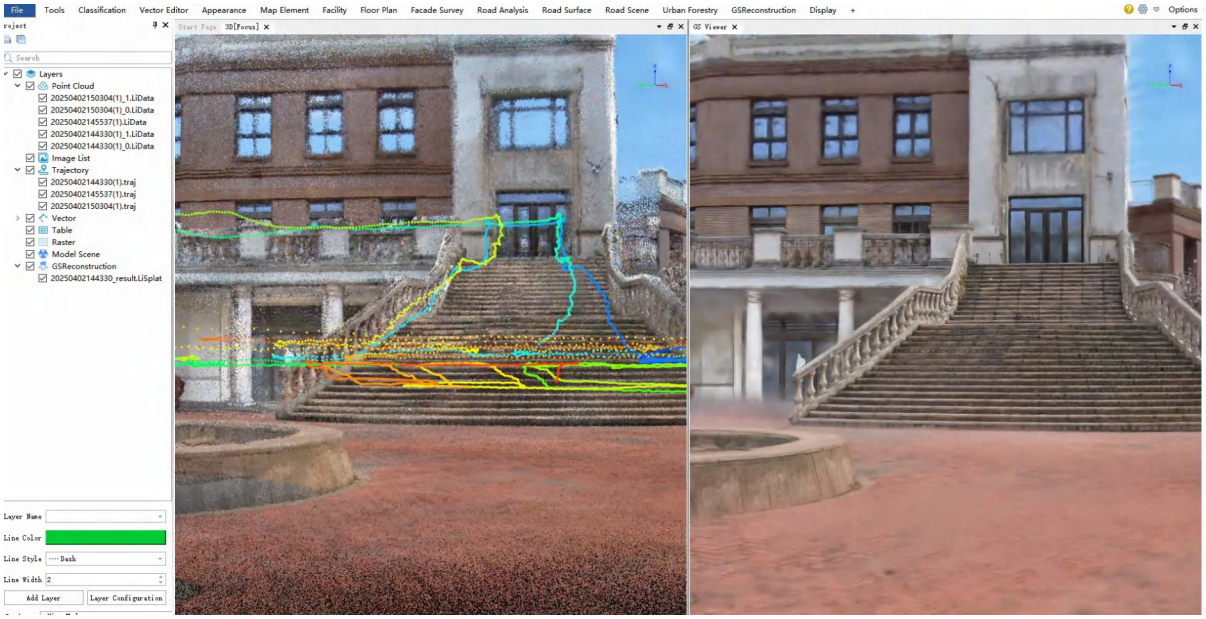
New Features

1.Added support for Gaussian Reconstruction of handheld O2 device data

Gaussian Reconstruction Results - O2 Data

2.Added Gaussian reconstruction support for multi-project handheld data. This enables joint reconstruction of multi-station data from:

- Various devices (O1/O2Lite, O2, H300)
- Multiple acquisition modes (resumable scanning, multi-station RTK)
- Mixed environments (outdoor multi-station, indoor multi-station, indoor-outdoor fused stations)



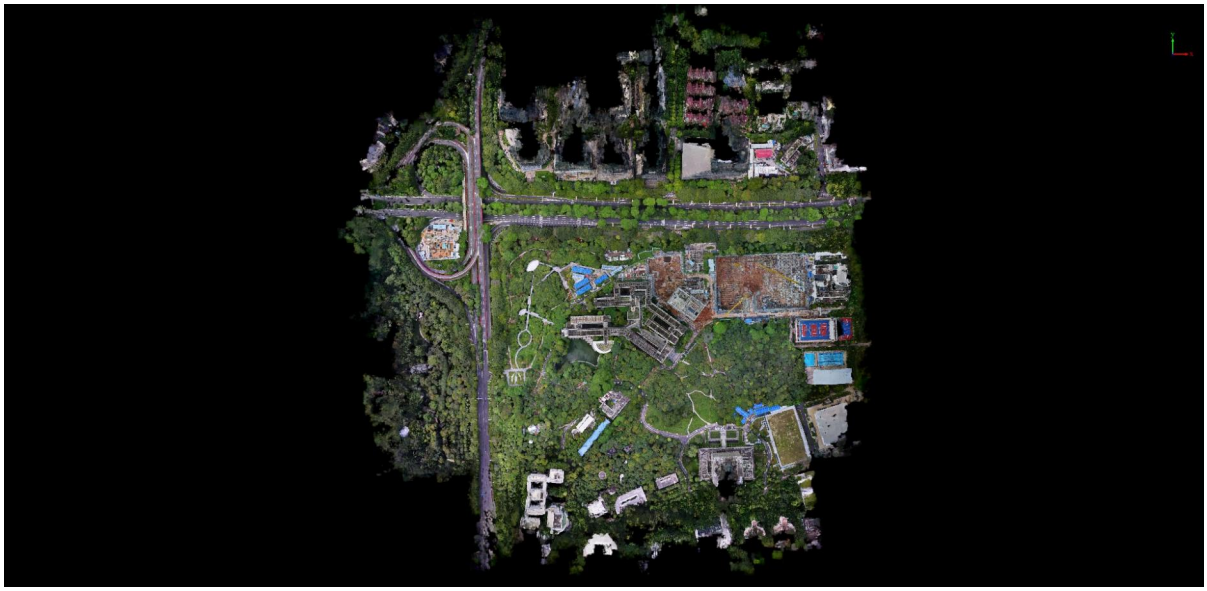
Multi-project Gaussian Reconstruction Results

3.Added universal COLMAP Gaussian Reconstruction: Processes imagery from drones, smartphones, and digital cameras into colmap format for Gaussian reconstruction

Drone Data Gaussian Reconstruction Results

4.Added LOD rendering for large-scale scenes (supports 100M+ Gaussian points) with:

- Selective clipping of LOD data
- Measurement and mapping tools
- Format conversion capabilities



Large-Scene Gaussian LOD Display

5.Added Gaussian Cross-Section Selection Tool using SAM AI model for intelligent object recognition

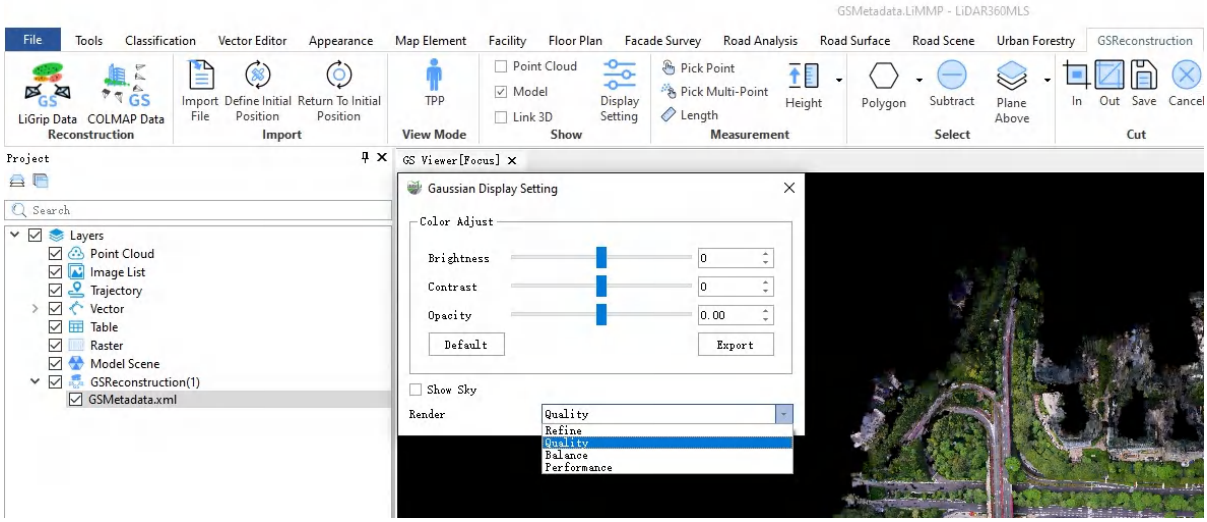
Gaussian Cross-Section Selection

6.Added Skybox Visibility Toggle:

- Automatically generated for outdoor reconstructions
- Unaffected by clipping operations

7.Added Gaussian Rendering Quality Control:

- Performance Mode: Faster rendering (lower hardware requirements)
- Quality Mode: Enhanced visual clarity (higher hardware demands)



Gaussian Cross-Section Selection

8.Added Gaussian Reconstruction and Measurement for data in different coordinate systems and units

Gaussian Measurement on Foot-based Data

BP Module

New Features

1. Support for processing O2 series devices

2. Support for MESH model generation (Beta version)

Added support for generating LOD-MESH (3D mesh) outputs, compatible with all LiGrip/LiBackPack series devices.

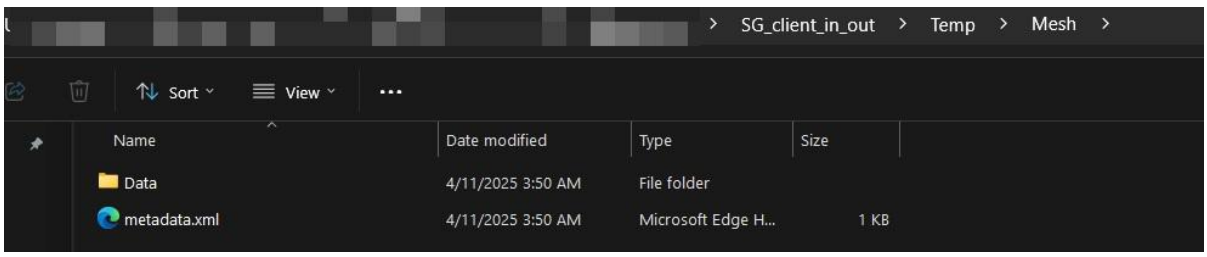
Hardware requirements are as follows:

At least 32GB RAM and an i5 CPU or above.

MESH generation is highly dependent on CPU performance; higher performance results in faster processing.

> Note: MESH generation is highly CPU-intensive, typically consuming over 80% of CPU resources. It is recommended not to run SLAM processing or other CPU-intensive software simultaneously during MESH generation.
>
> Mesh generation speed is typically between 1:10 and 1:25, depending on the computer.

The final MESH output is generated in the Temp folder.

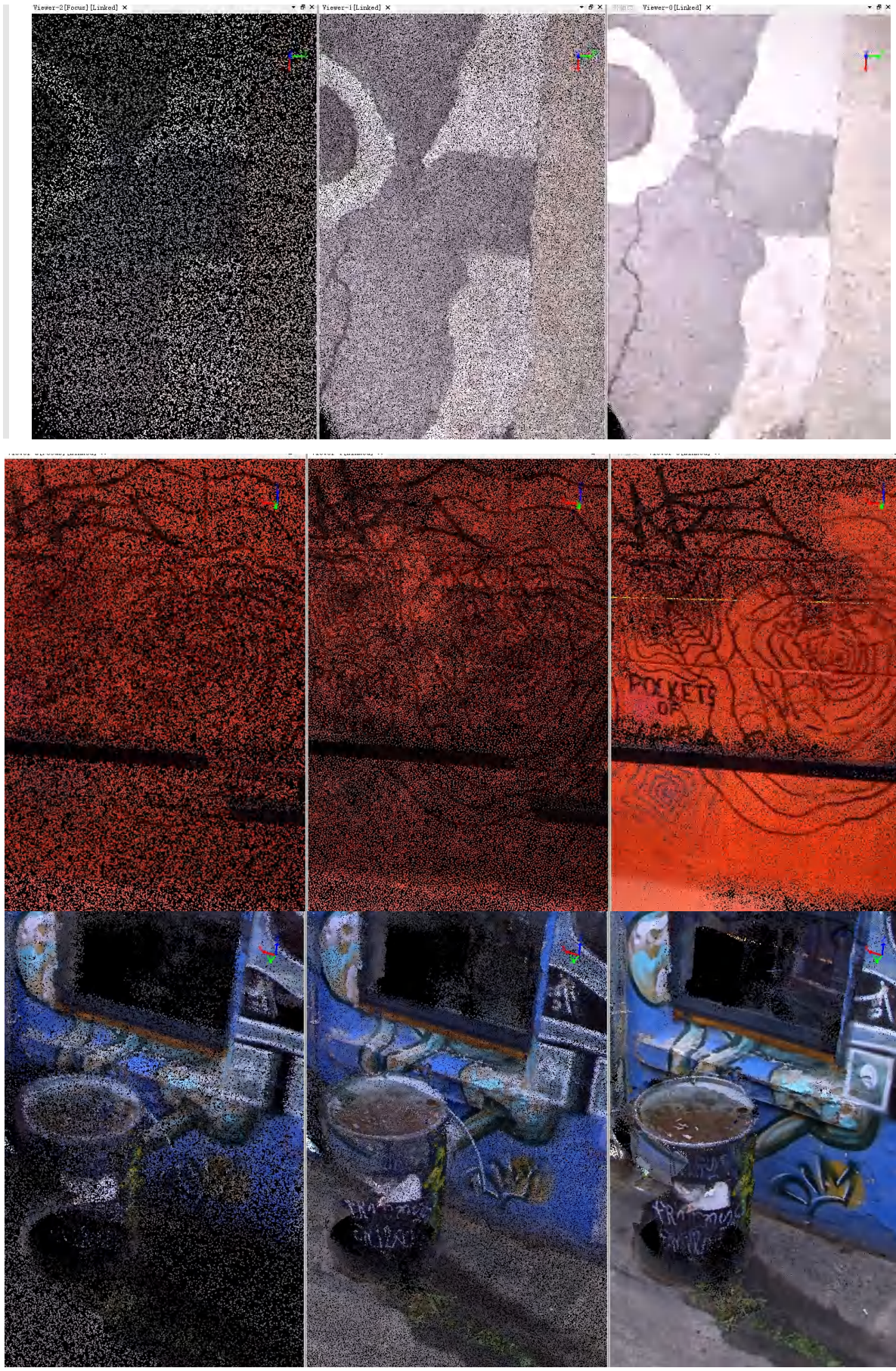


3. New 2mm High-density Point cloud Output

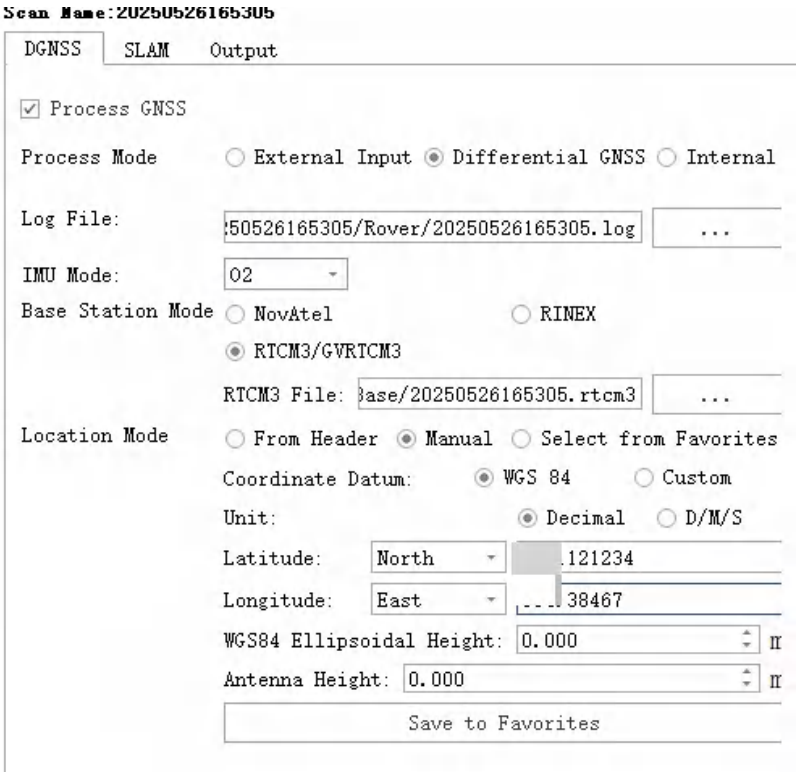
Supports O2 series and H300 (B.00) devices.

The following is a comparison of the original point cloud | standard high-density point cloud | 2mm high-density point cloud (from left to right).

> Note: The 2mm option is only supported for projects created by dragging or importing *.lislam files.

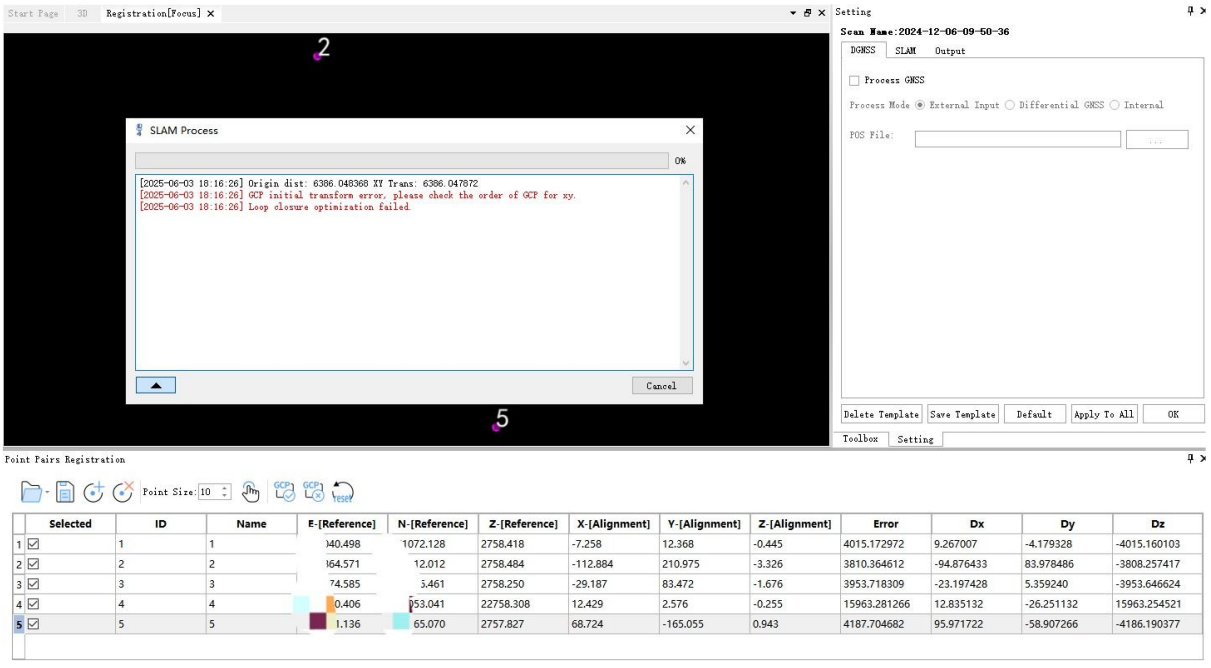

Viewer-2 [Focus] [Linked]
Viewer-1 [Linked]
Viewer-0 [Linked]

4. Support for setting base station coordinates in RTCM3 format



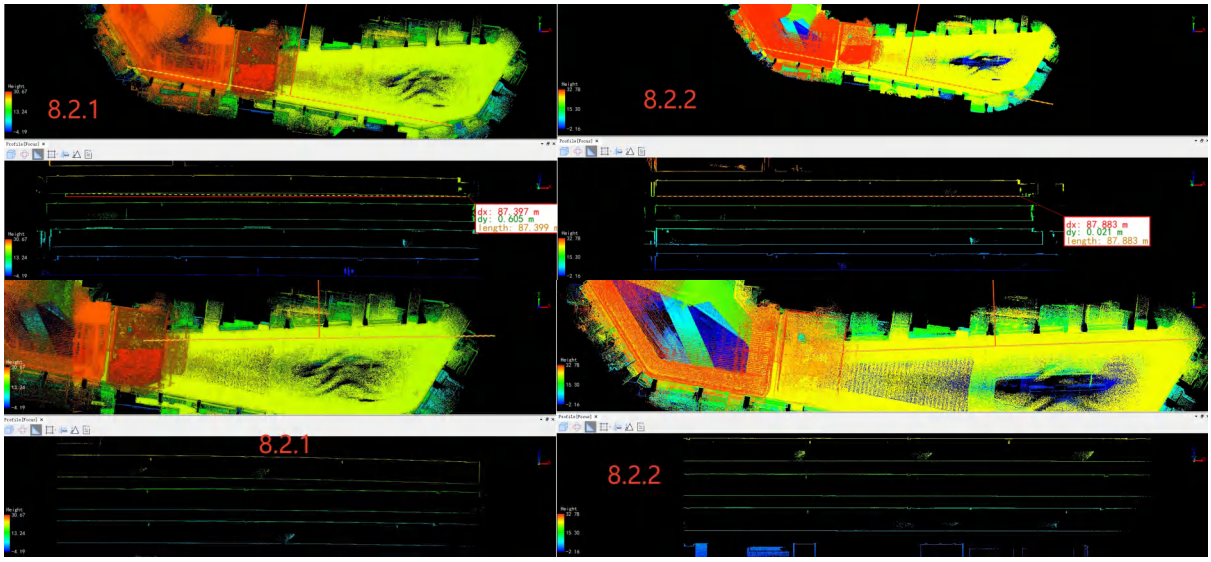
5. Added prompt when East and North coordinates of GCP are reversed

If the East and North coordinates are reversed during GCP, the following error will be reported: '**GCP initial transform error, please check the order of GCP for xy**'



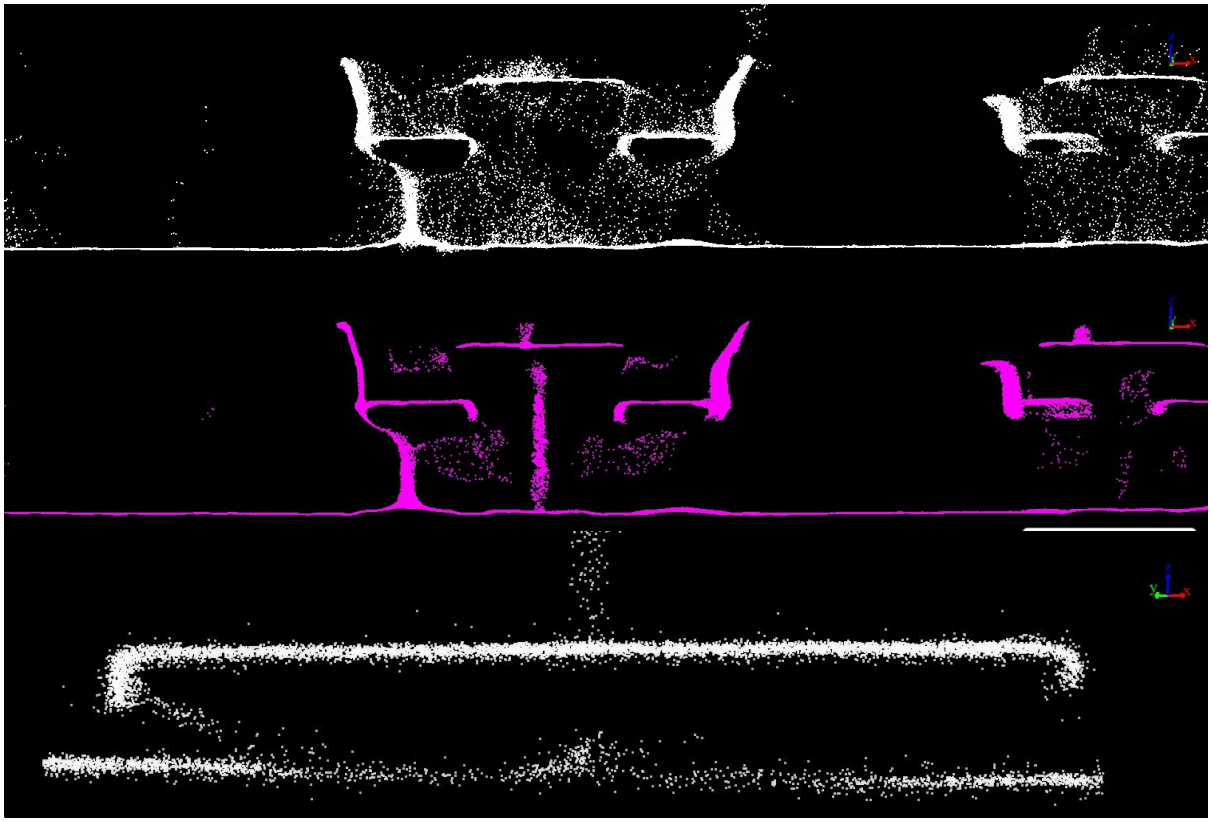
Optimization

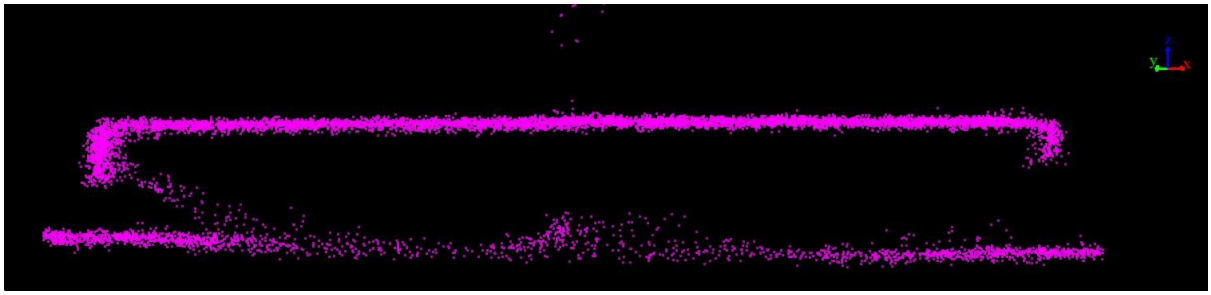
1. Optimized floor level performance for O2-LITE / H300(B.00)



2. Optimized Noise filter (white: 8.2.1, purple: 8.2.2)

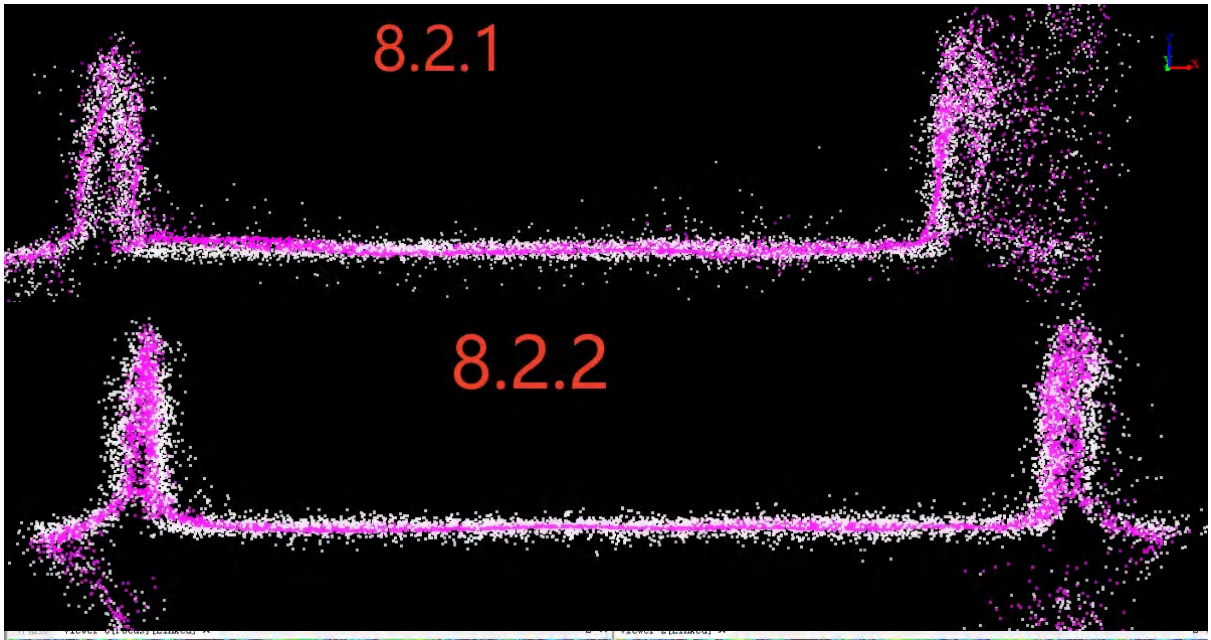
Significant optimization for indoor noise points and trunk noise points.

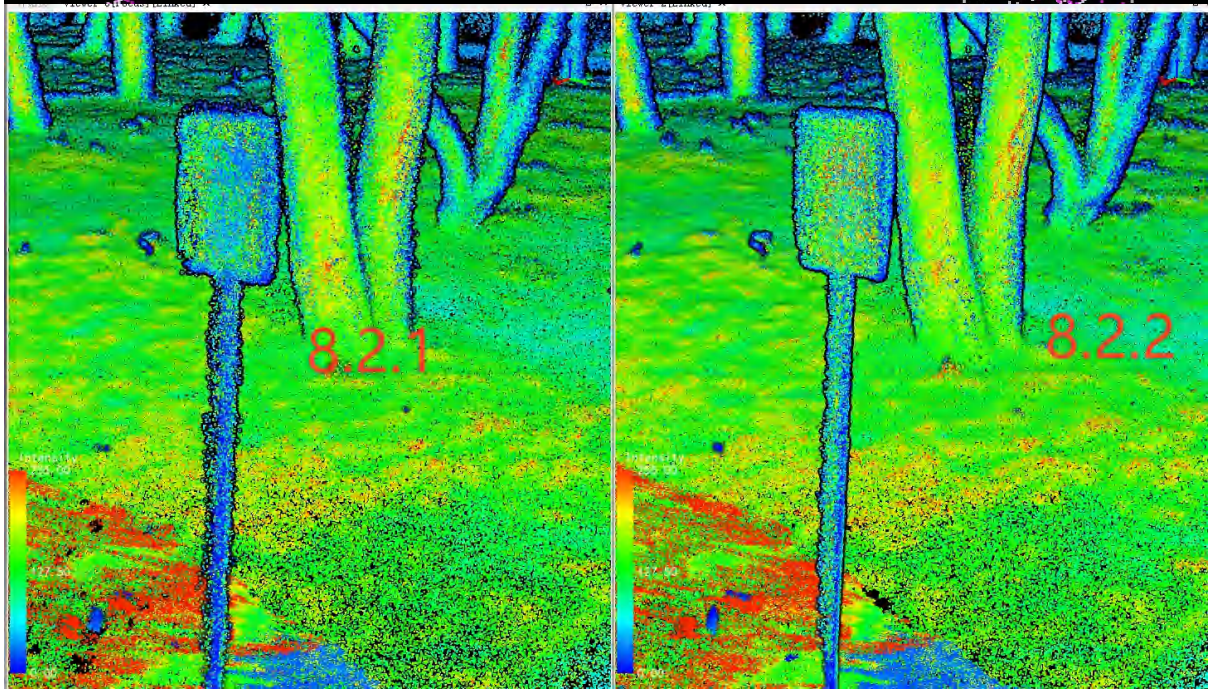


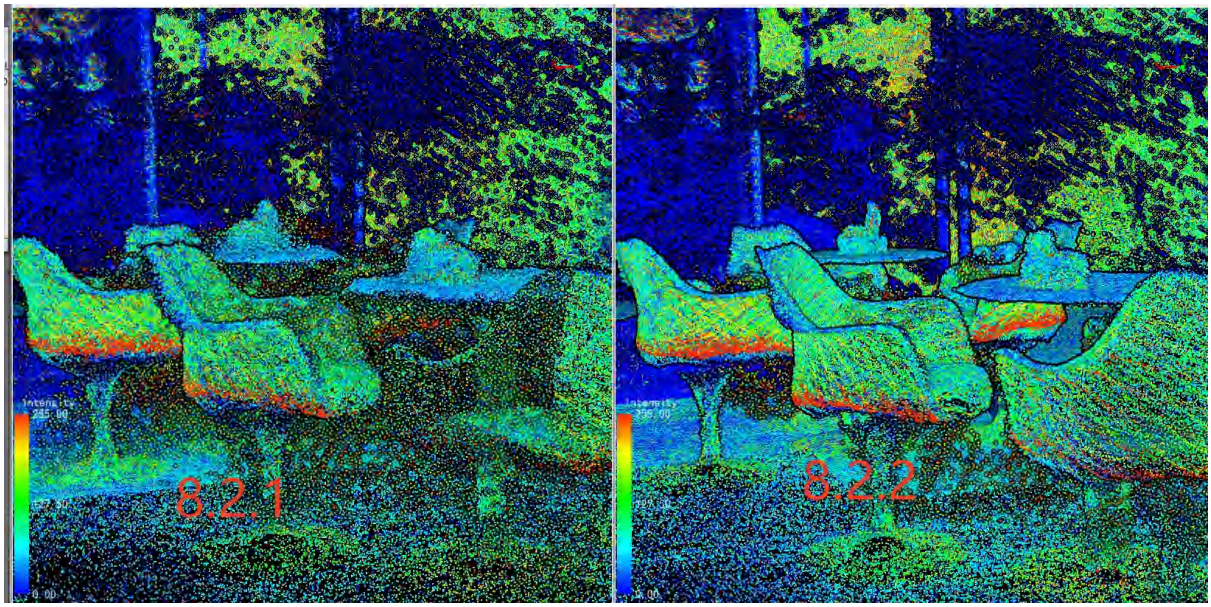


3. Optimized Smooth filter (white: before smoothing, purple: after smoothing)

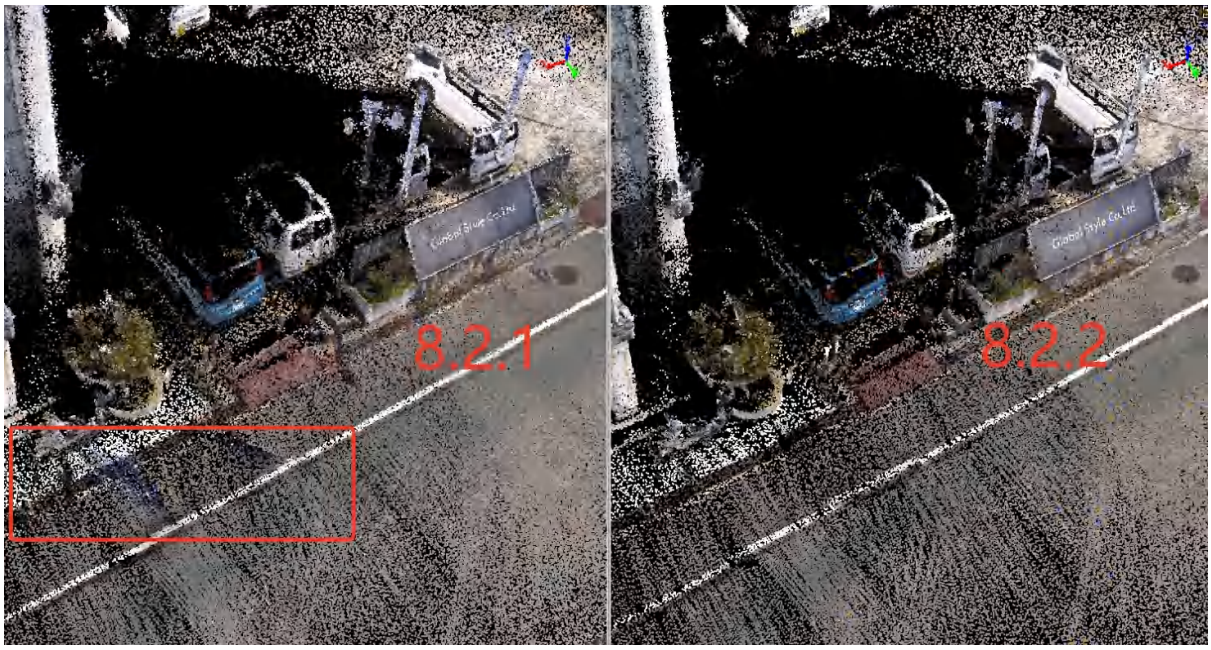
The optimized smoothing is now more effective, enabling more accurate extraction of the central region of the original point cloud (especially noticeable indoors), resulting in a more clustered smoothed point cloud.







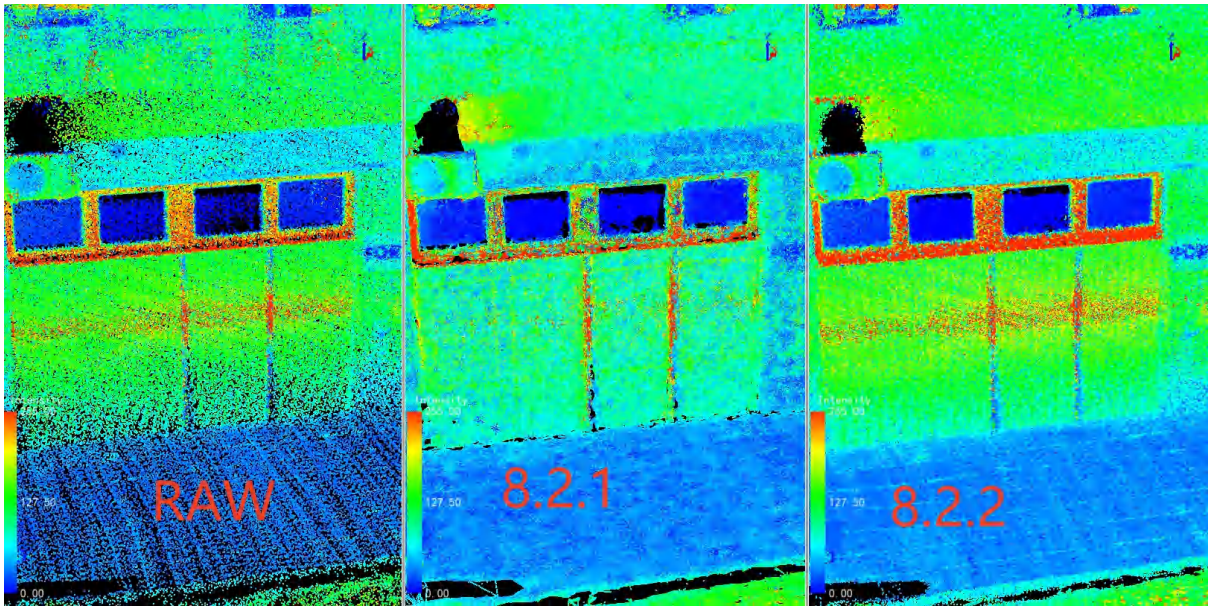
4. Reduced the faces and mobile phones being colorized onto objects.

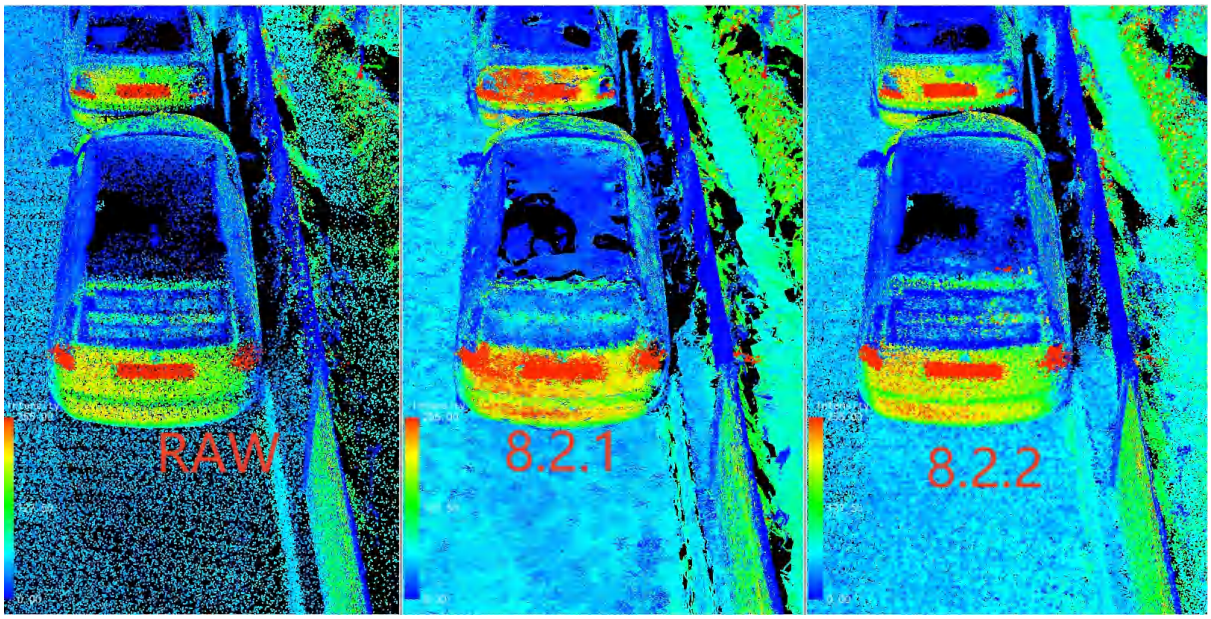


5. Optimized the Intensity effect of High-density Pointcloud.

In High-density point cloud effects prior to version 8.2.1, Intensity may have exhibited speckling and scattering issues. Version 8.2.2 optimizes this effect.

From left to right: original point cloud | 8.2.1 High-density point cloud Intensity | 8.2.2 High-density point cloud Intensity.





Fixed bugs

1. Fix the bug where GCP does not support small coordinates.
2. Fixed the bug where the O2-LITE device occasionally produced severely tilted data when processing long straight lines.

Geo module

Enhancement

1.Added automatic disk space check before Strip Adjust processing to prevent failures due to insufficient storage.

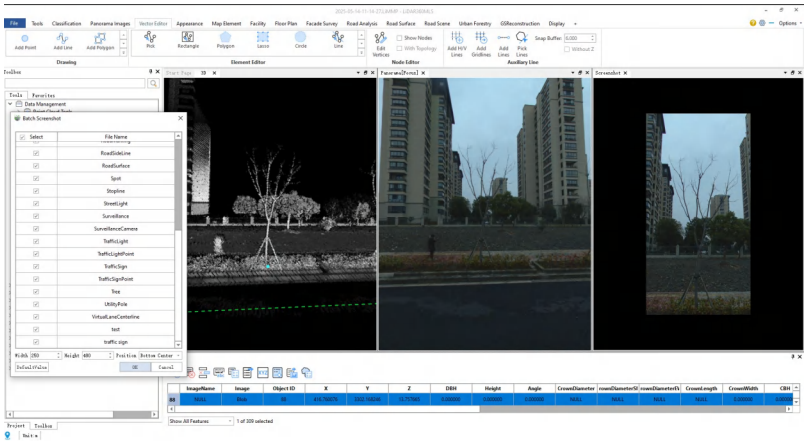
2.Optimized the POS Process algorithm to improve positioning accuracy during extended stationary periods in GNSS-challenged environments.

3.Fixed known issues and improved module stability.

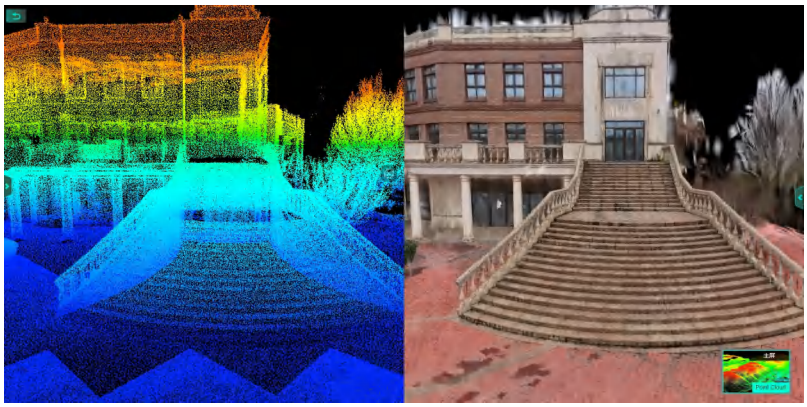
Framework

New Features

1. Added **Batch Screenshot Function**: When imagery exists in the project, automatically captures the closest imagery to all vectors based on distance and stores screenshots in the database.



2. Added **Attribute Linking by Field Value** functionality.
3. Added **LiCLoud Account Login, Switching, and Logout** capabilities.
4. Added **Data Upload & Publishing** support for point clouds, imagery, vectors, and Gaussian data.



5. **AutoCAD Plugin** now compatible with **Civil 3D**.

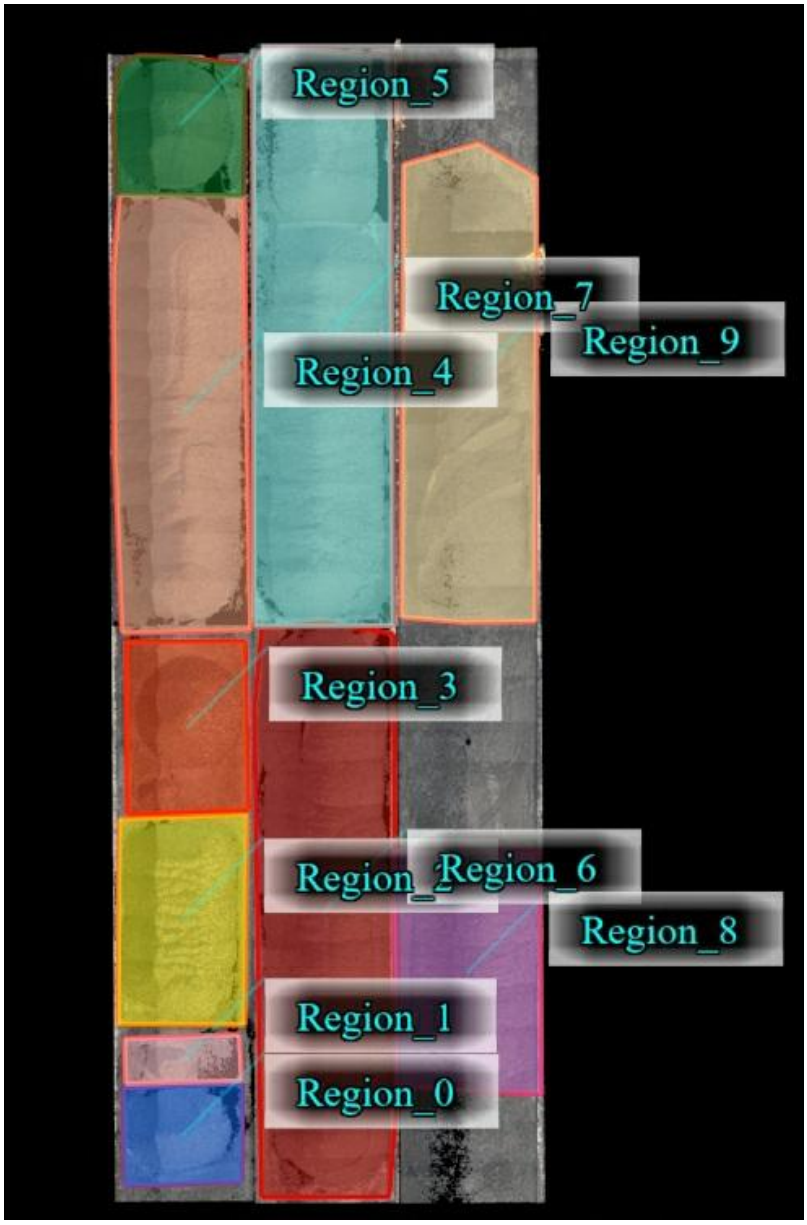
Enhancement

1.Optimized vector export functionality to support exporting the FID field.

2.Enhanced attribute table with column dragging support.

3.Improved orthophoto export by fixing the coordinate system loss issue for colorized imagery.

4.Volume To Ref Plane and Volume Between Surfaces add support for plotting and importing multiple ranges for analysis.


Region_5
Region_7
Region_9
Region_4
Region_3
Region_2
Region_6
Region_8
Region_1
Region_0

LiDAR360MLS V8.2.1 Release Notes

BP Module

New Features

1. Support for O2-Lite and H300 (B.00) Equipment Data Decoding

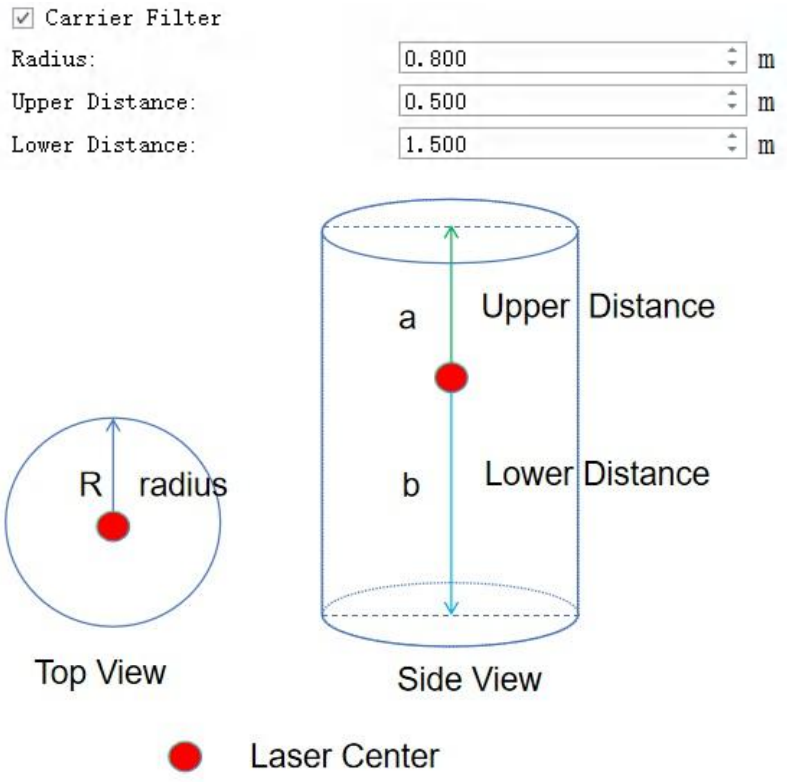
2. Introduction of Open Area Mode

Support for decoding in open space scenarios for O2-Lite. When RTK configuration is available, it will automatically read the stored base station data.

> Note: This mode is only applicable to the O2 series and relies on base station data.

3.Introduction of Carrier Filte

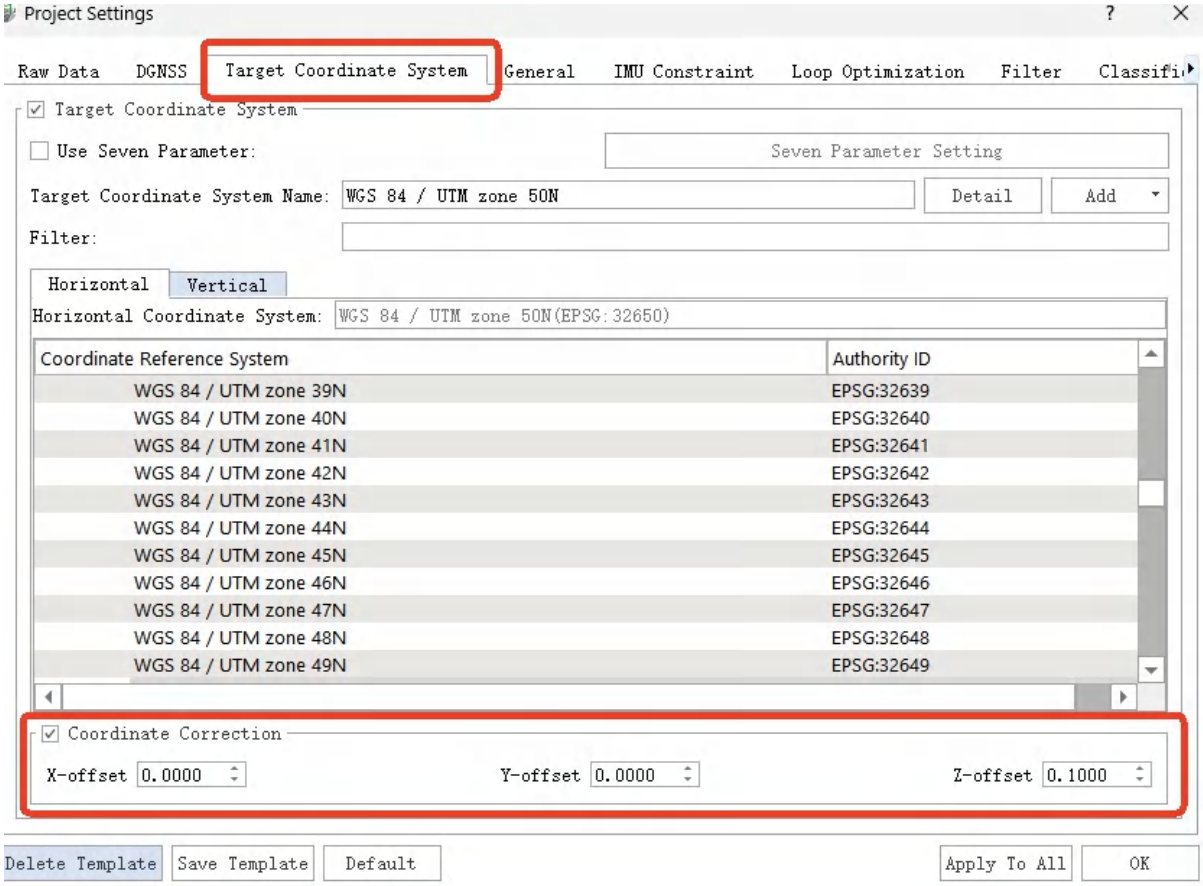
Carrier filter is primarily used to remove the point clouds of the data collector itself. Compared to the previous range filter, it can retain more ground points.



Carrier filter, as the name implies, carrier filter is a way to filter out the point cloud of the collector or the carrier of the collection by forming a cylindrical range with the laser as the center. It forms a cylinder with a radius of R centered on the laser, removing **a: points above the upper distance** and **b: points below the lower distance**.

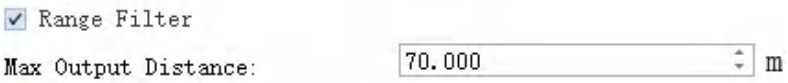
4.Introduction of Coordinate Correction

The new feature of coordinate correction allows for an overall shift of the data during decoding, which is generally used for elevation correction.



Optimization

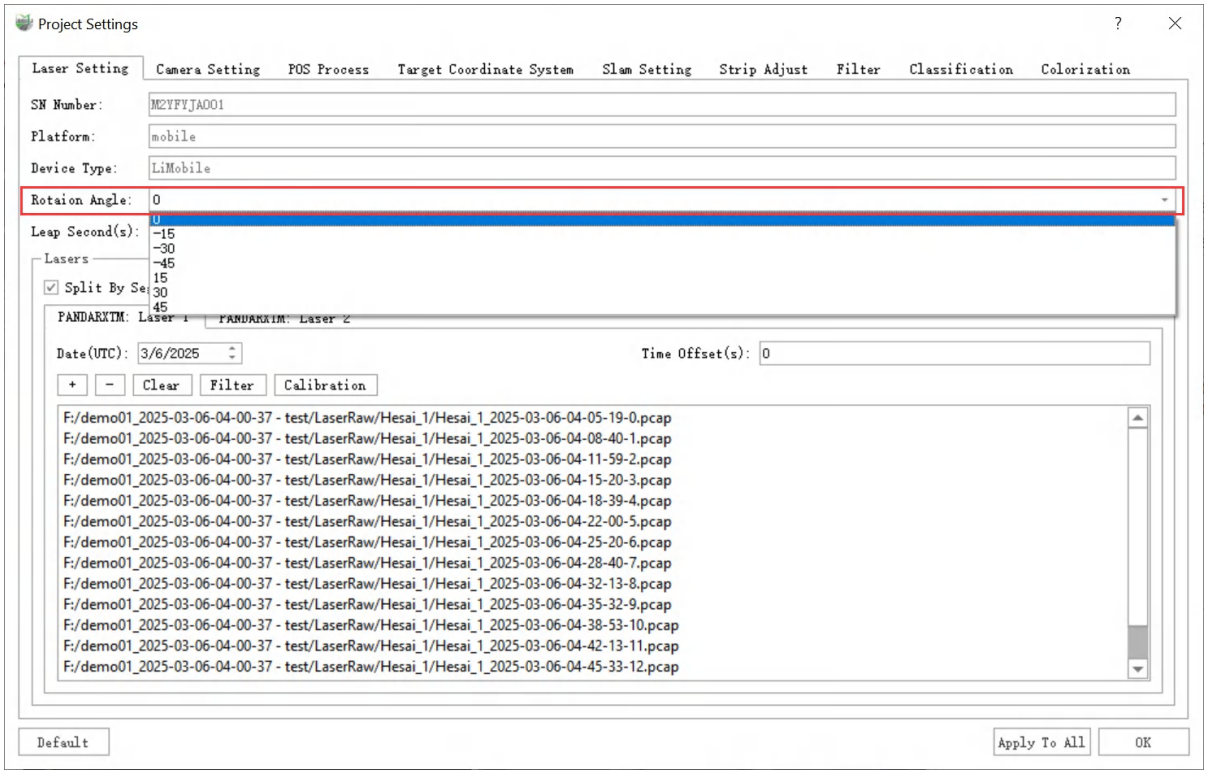
1. Support for automated copying of insv format video.
2. Optimization of the search method after liscan migration. The previous method of specifying each item one by one has been changed to a batch search method by specifying the search path.
3. Distance filtering now only retains the maximum distance, with the minimum distance being removed (the function of the minimum distance is similar to that of carrier filtering).



Geo module

New Features

1.Support installation rotation angle parameter modification to adapt to the data collected by LiMobile M2 in different installation angle.



Laser Settings-Rotation Angle

2.Update the reading method of multi-frequency point data in Rinex format.

Enhancement

1.Blend algorithm optimization to improve the coloring effect of point cloud.

Left: No blend function; Right: Use blend function

2.Adjustment of default parameters of Colorize function.

GSReconstruction Module

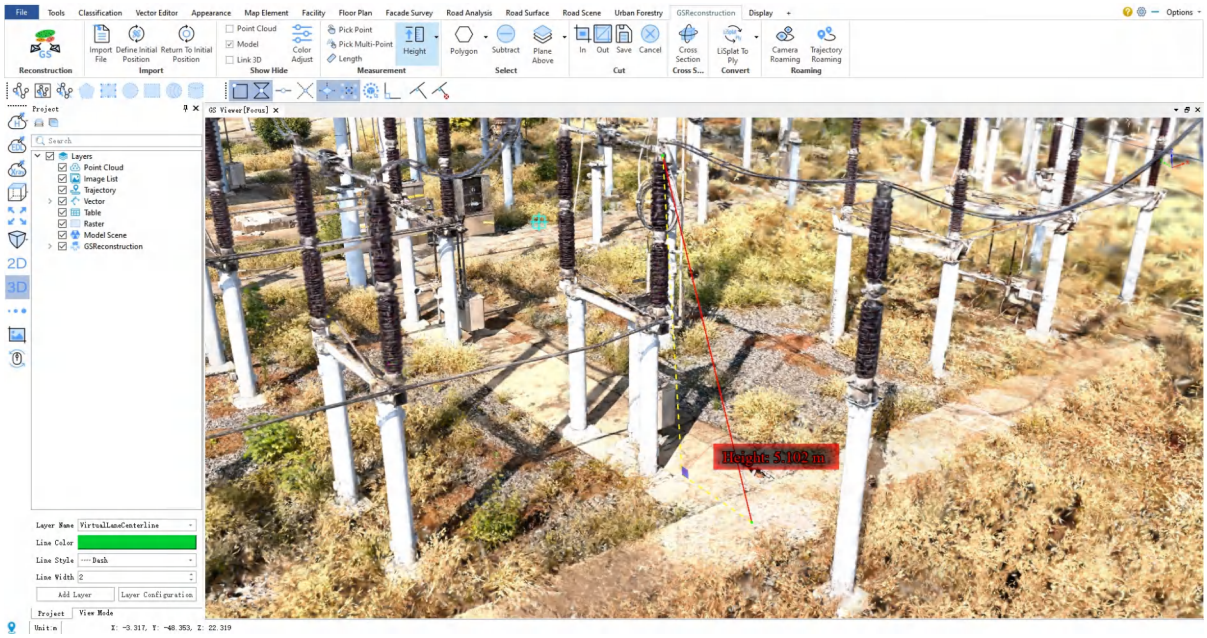
New Features

1.Added Gaussian reconstruction support for LiGripO2Lite and LiGripH300(B.00）devices.

LiGripO2Lite Gaussian reconstruction results

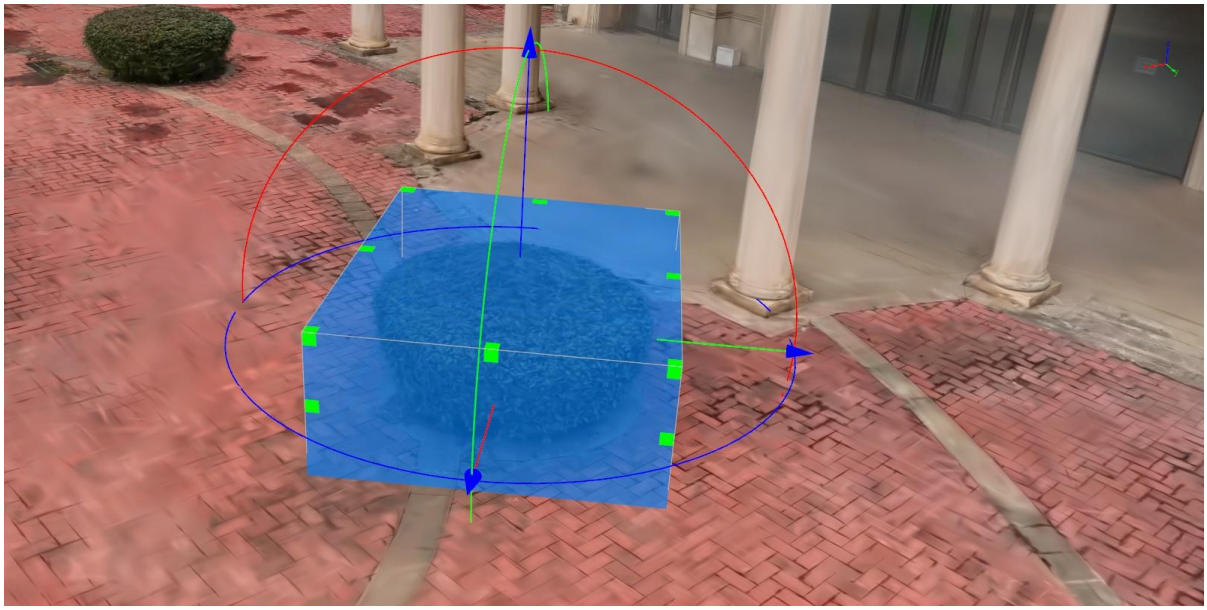
LiGripH300(B.00 Gaussian reconstruction results

2.Added Gaussian data measurement feature: Perform point selection, length, height, angle, and area measurements on Gaussian data without point cloud availability.



Point cloud free Gaussian data height measurement

3.Added Gaussian Box Selection tool, which selects Gaussian points by drawing a box at four points, and supports rotation, translation and scaling of the box selection range.



Box Selection

4.Added Third-Person Perspective (TPP), enabling this mode allows immersive data exploration in a third-person perspective.

Enhancement

1.The Gaussian reconstruction process added geometric constraints to remove float from inconsistencies between photos.

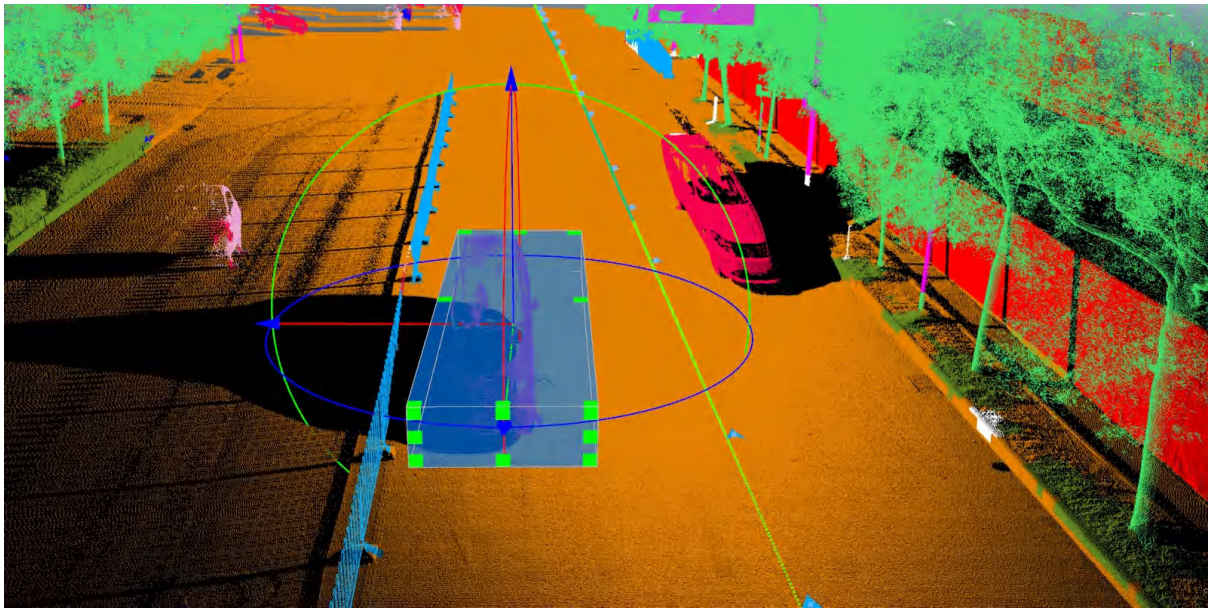
Top: before algorithm optimization; bottom: after algorithm optimization

2.Gaussian Camera Roaming supports synchronized roaming with 3D and Gaussian windows following the same viewpoint when roaming is turned on.

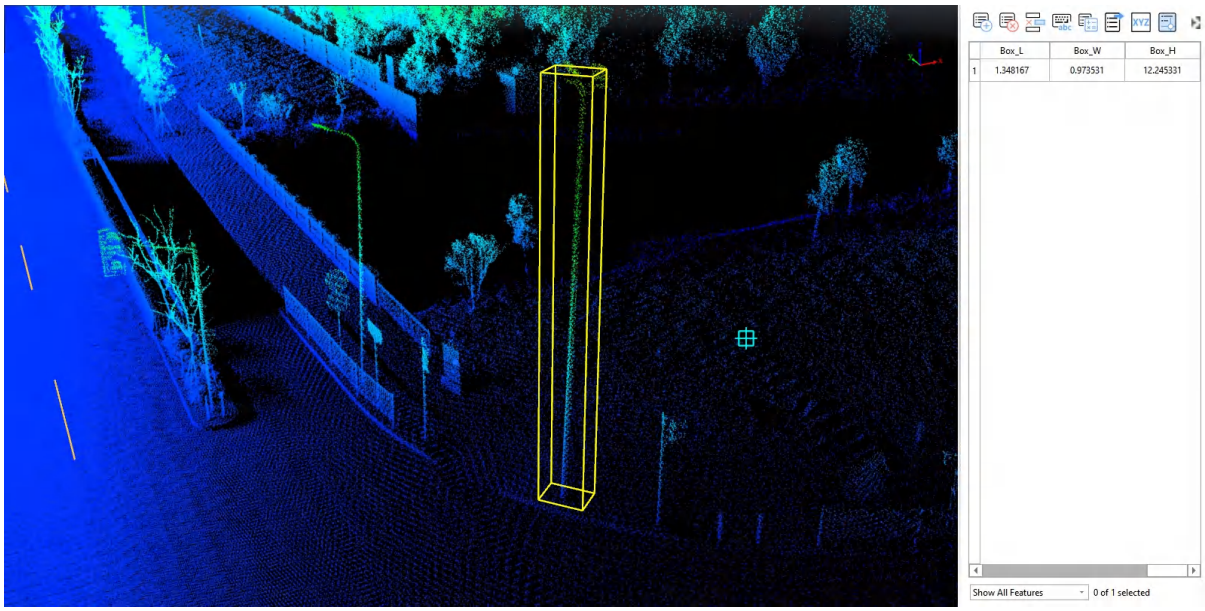
Framework

New Features

1.Added a point cloud box selection tool, enabling real-time rotation, translation, and scaling operations on the selected region during the selection process.

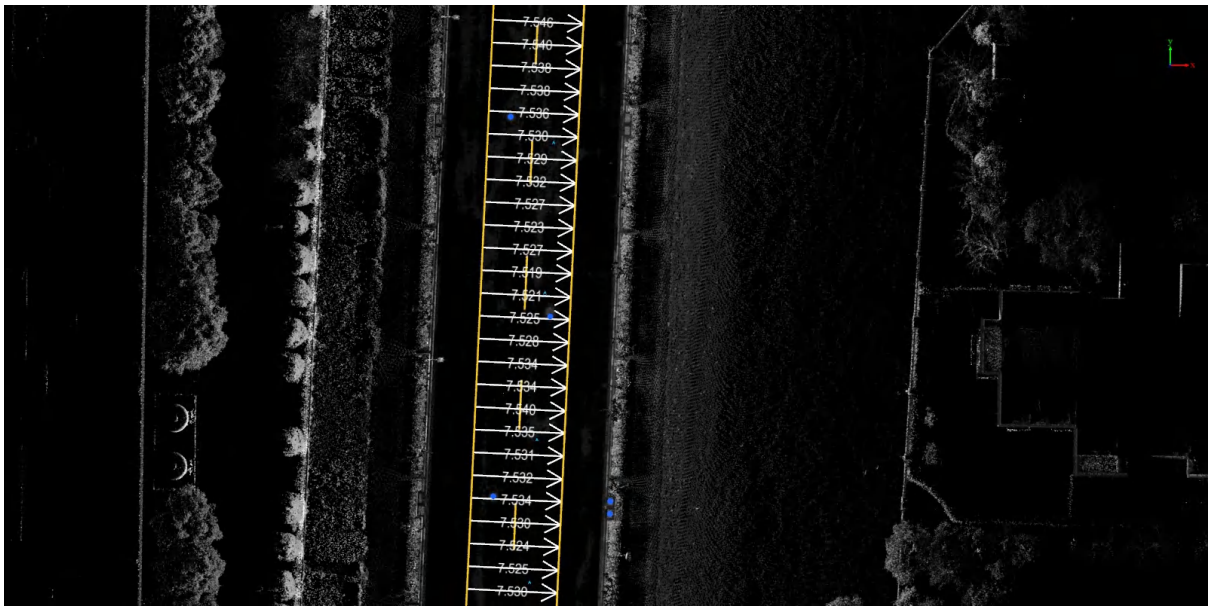


2.New Add Box function is added to draw any rectangle by four-point drawing, and you can rotate, pan and zoom it while drawing. The drawn rectangle will automatically calculate its length, width and height and save it in the property sheet.

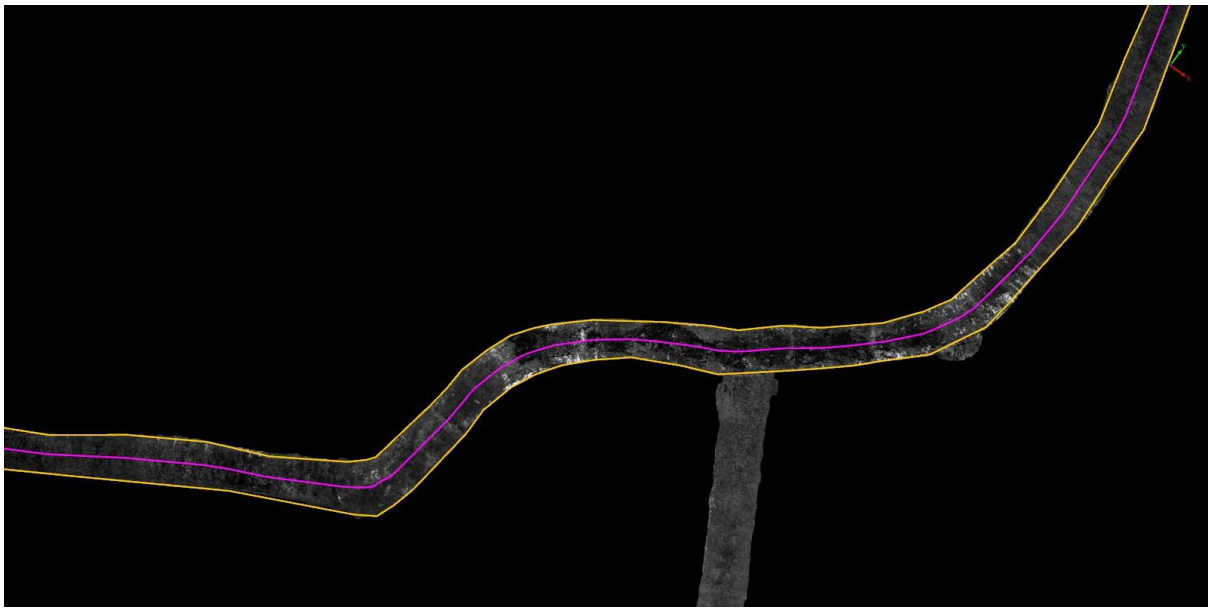


3.Added the calculation of azimuth angle feature: For any vector points in sequence, compute the angle between each point and true north direction.

4.Added the width between lines calculation feature: Compute the spacing between any two lines at specified intervals, applicable to scenarios such as calculating lane width, road width, or any width measurement between two lines.



5.Added the center line generation feature: Generate center lines between any two lines.



6.Added the trajectory-based extraction feature: Extract point clouds, trajectories, and images within a specified trajectory range to new files.

7.Added the GPKG export feature: Export current project results to GPKG format.

Enhancement

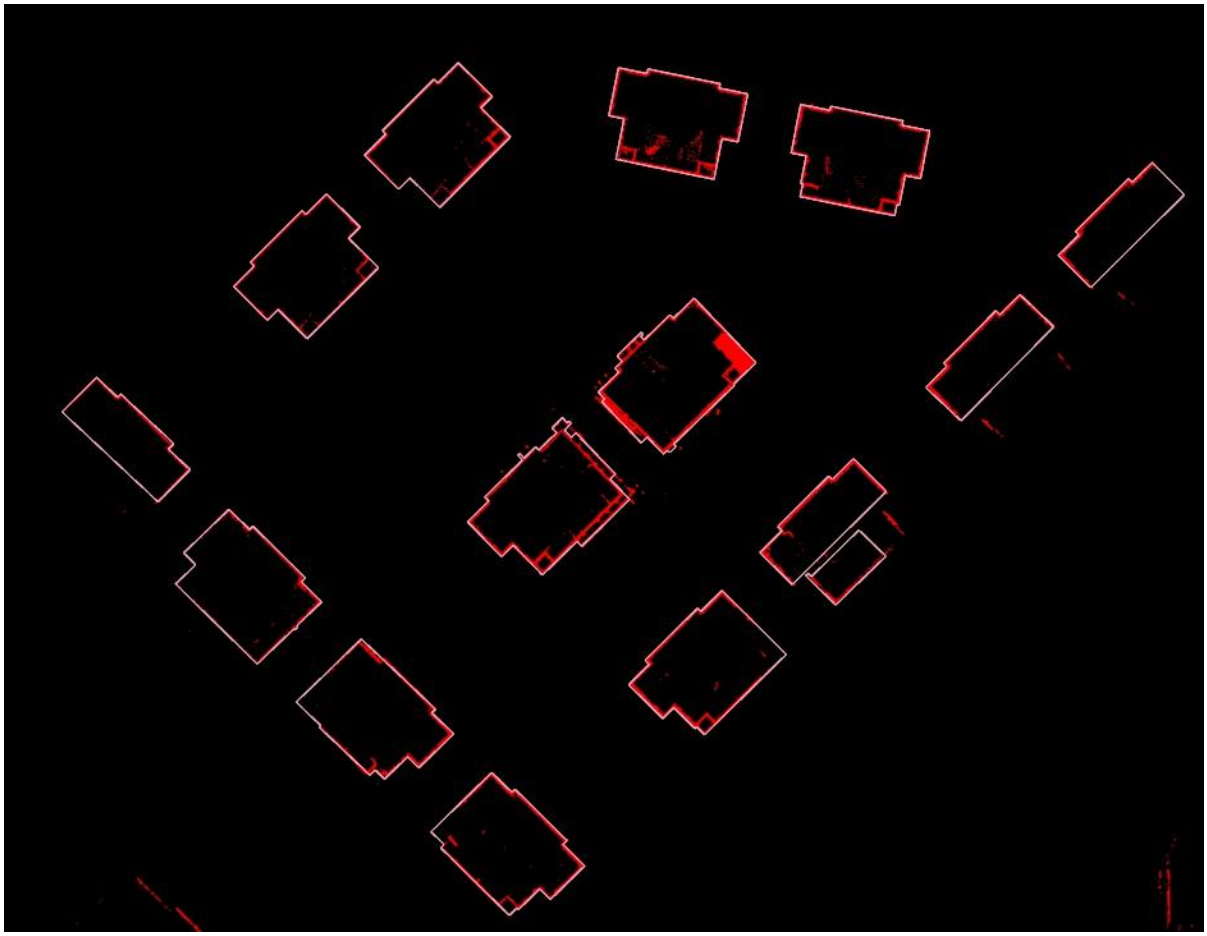
1.Optimized the measurement of length, angle, area, slope, and elevation: Support measurement on selected vector features.

2.Optimized the horizontal section function: Add snapping height settings to separate the drawing reference plane from the point cloud section, ensuring 2D drawing consistency on a unified plane.

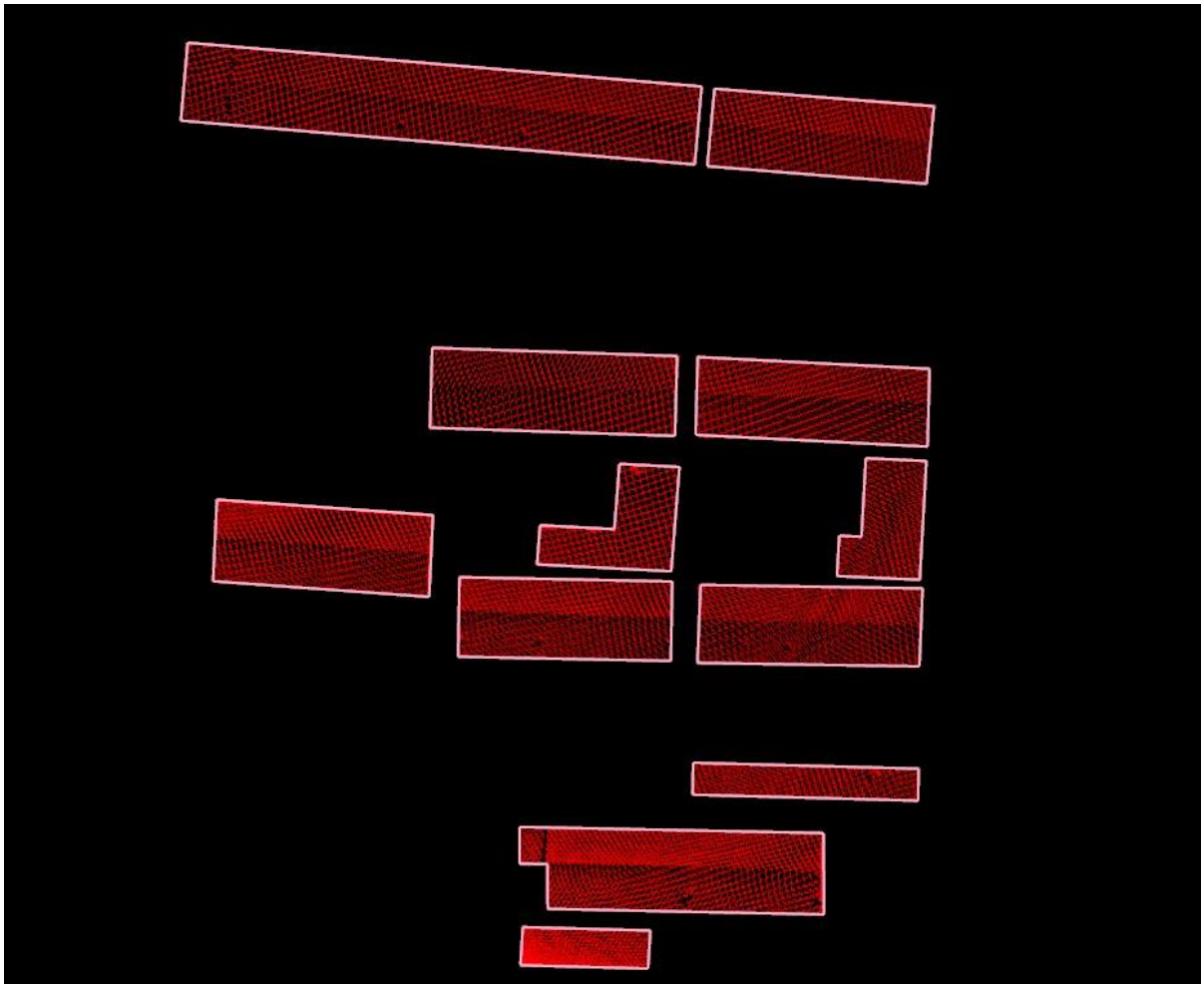
Asset Extraction Module

New Features

1.The road facilities page has added a building contour extraction feature, which supports laser point cloud data collected from handheld, backpack-mounted, vehicle-mounted, and airborne platforms to extract external building outlines.



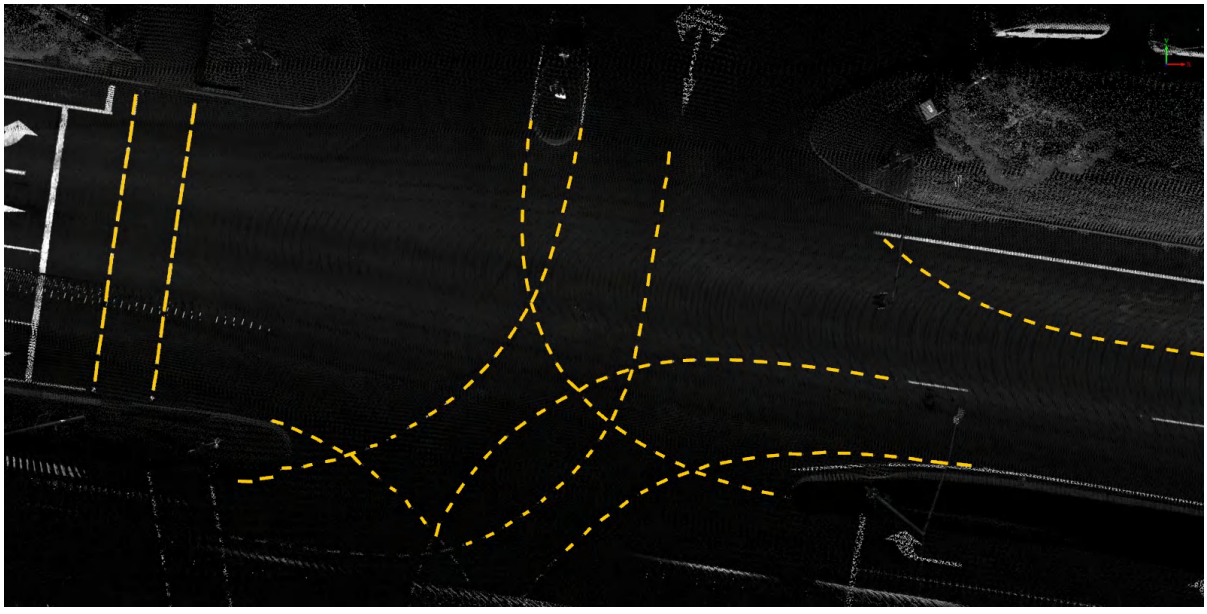
Building exterior contour extraction results from handheld LiDAR point cloud data



Building exterior contour extraction results from airborne LiDAR point cloud data

Enhancement

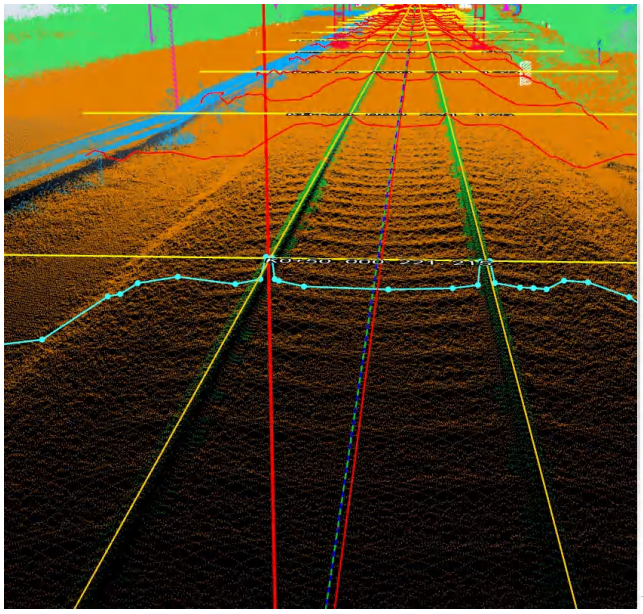
1.Optimized the automatic dashed line extraction in the lane line detection function to support fully automatic extraction of dashed lines shorter than 1 meter or with arc-shaped trajectories.

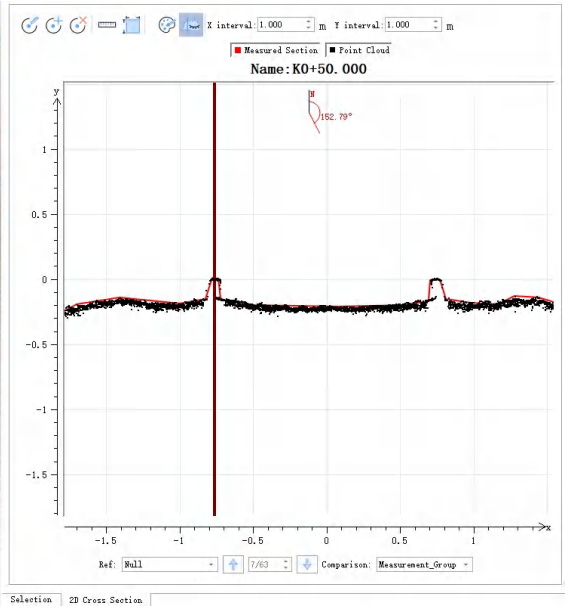


Road Condition Module

Enhancement

1.Optimized cross-section analysis algorithms to improve the accuracy of fine terrain cross-section generation

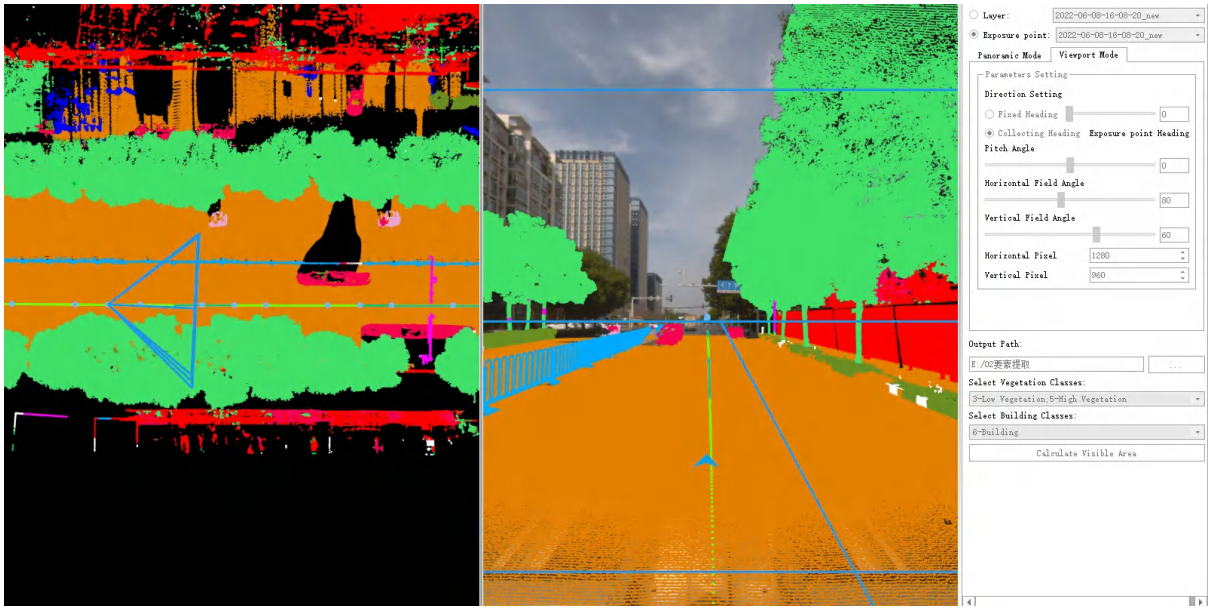




Forestry Module

Enhancement

1.When processing in frustum mode within the ecological landscape batch viewshed analysis function, display the analysis extent position-by-position during execution.

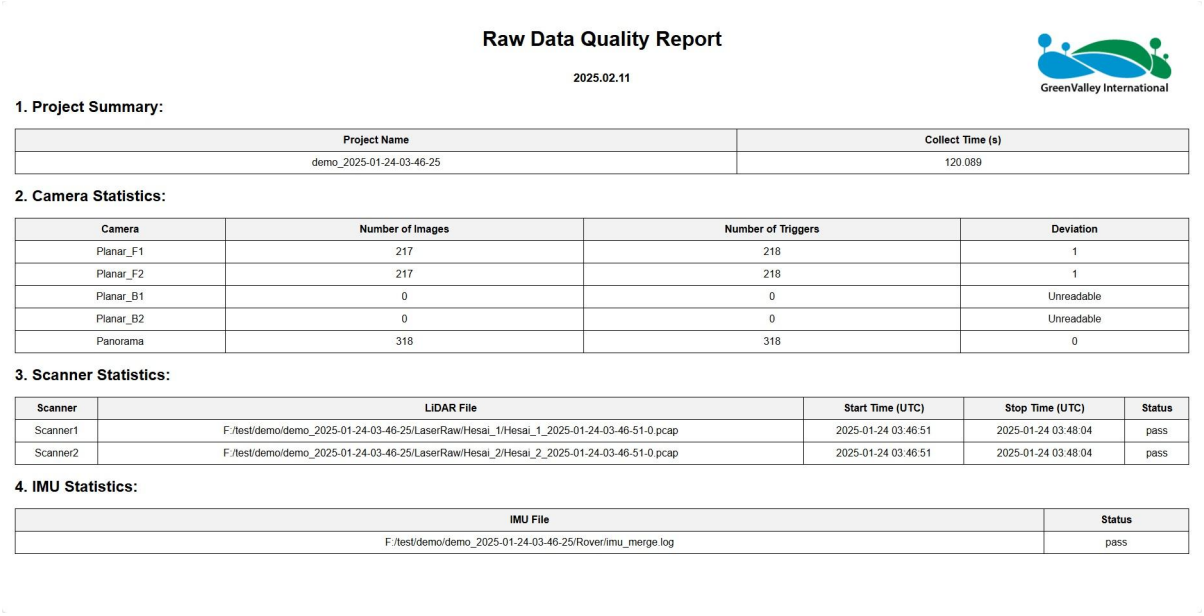


LiDAR360MLS V8.2.0 Release Notes

Geo Module

New Features

1.Added a new Data Copy function, enabling the batch copying of data from the collection disk to the local machine. It also supports simultaneous data quality inspection during the copying process and provides an Raw Data Quality Report for reviewing any data anomalies.



Raw Data Quality Report

2025.02.11

GreenValley International

1. Project Summary:

Project Name	Collect Time (s)
demo_2025-01-24-03-46-25	120.089

2. Camera Statistics:

Camera	Number of Images	Number of Triggers	Deviation
Planar_F1	217	218	1
Planar_F2	217	218	1
Planar_B1	0	0	Unreadable
Planar_B2	0	0	Unreadable
Panorama	318	318	0

3. Scanner Statistics:

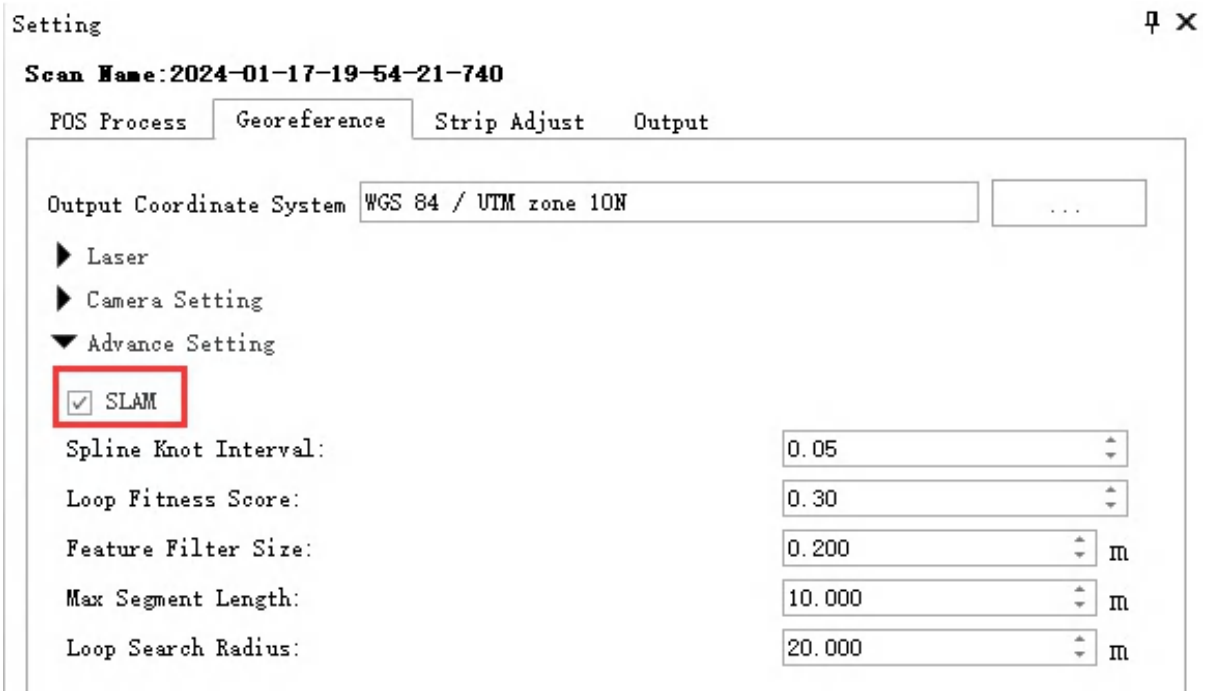
Scanner	LiDAR File	Start Time (UTC)	Stop Time (UTC)	Status
Scanner1	F:/test/demo/demo_2025-01-24-03-46-25/LaserRaw/Hesai_1/Hesai_1_2025-01-24-03-46-51-0.pcap	2025-01-24 03:46:51	2025-01-24 03:48:04	pass
Scanner2	F:/test/demo/demo_2025-01-24-03-46-25/LaserRaw/Hesai_2/Hesai_2_2025-01-24-03-46-51-0.pcap	2025-01-24 03:46:51	2025-01-24 03:48:04	pass

4. IMU Statistics:

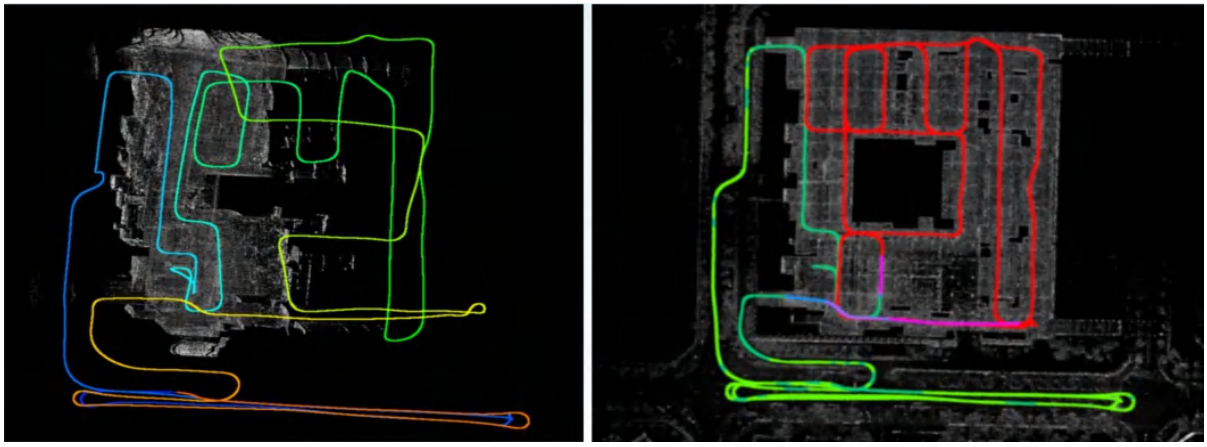
IMU File	Status
F:/test/demo/demo_2025-01-24-03-46-25/Rover/imu_merge.log	pass

Raw Data Quality Report

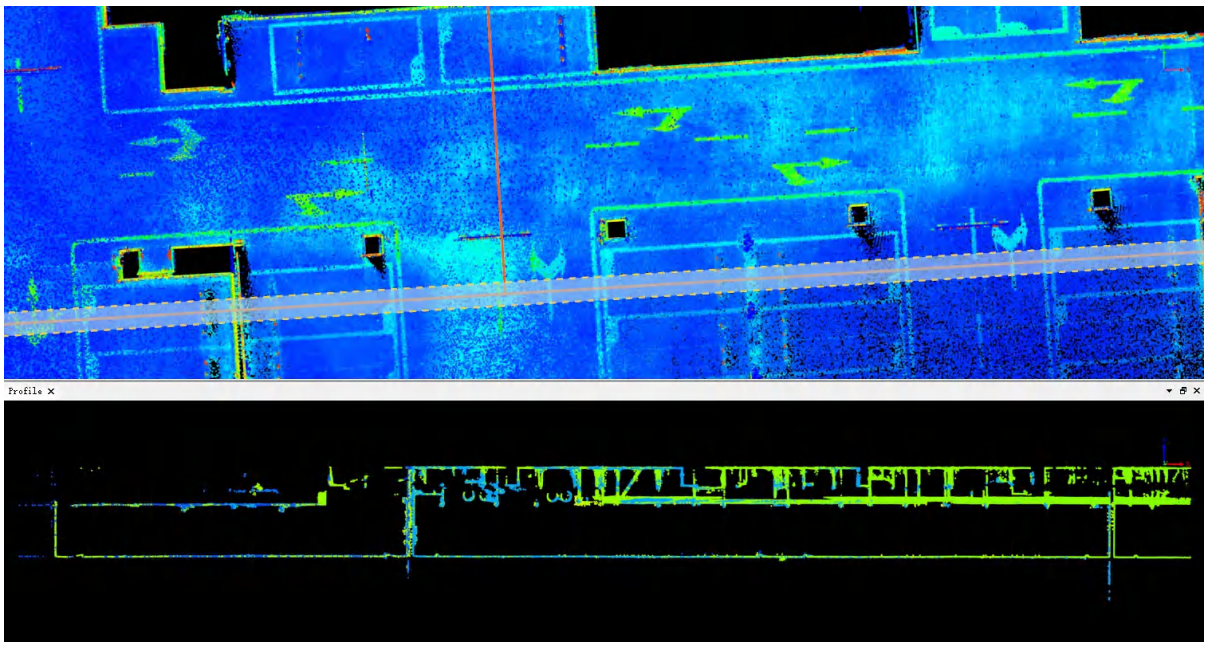
2.LiMobile data SLAM process function has been introduced, which effectively optimizes trajectory in scenarios such as underground parking lots where GPS signals are obstructed but feature-rich environments are present.



SLAM Settings

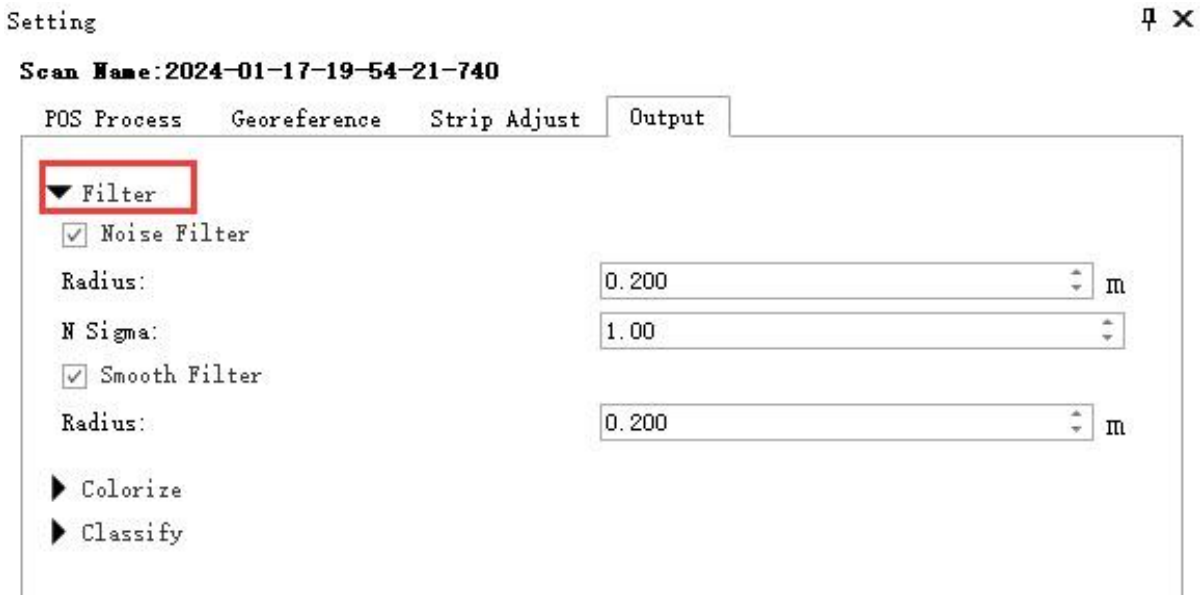


Left: SLAM function not used; Right: SLAM function used

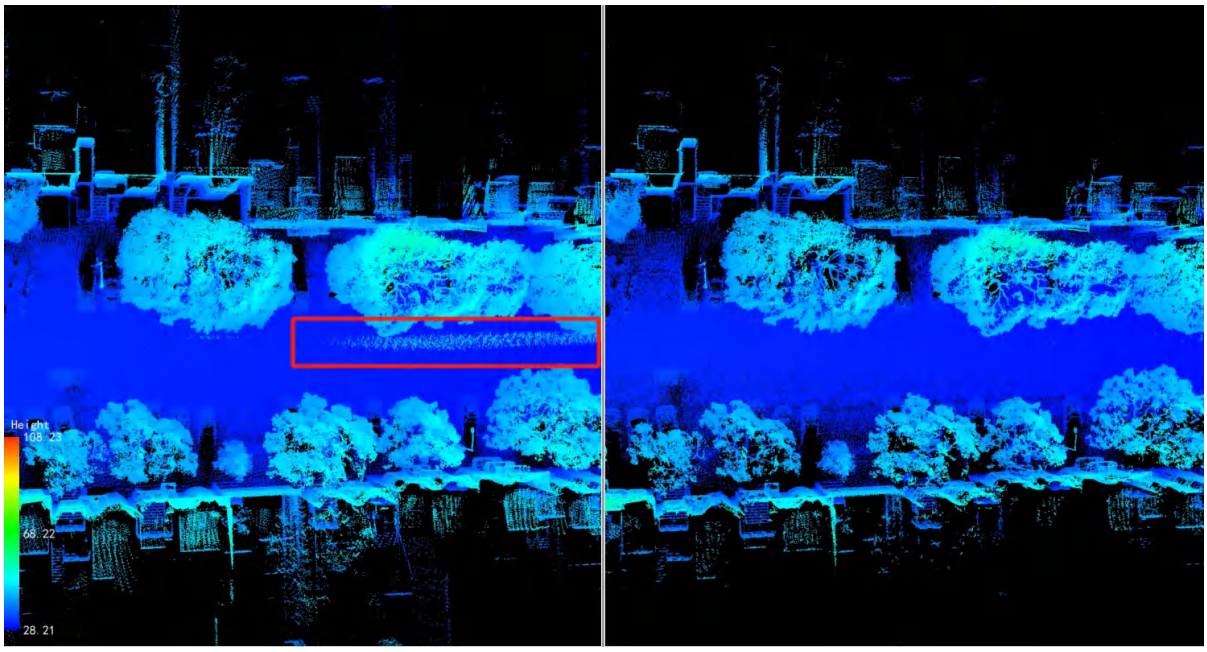


LiMobile Data Collection for Underground Parking Garage Scene

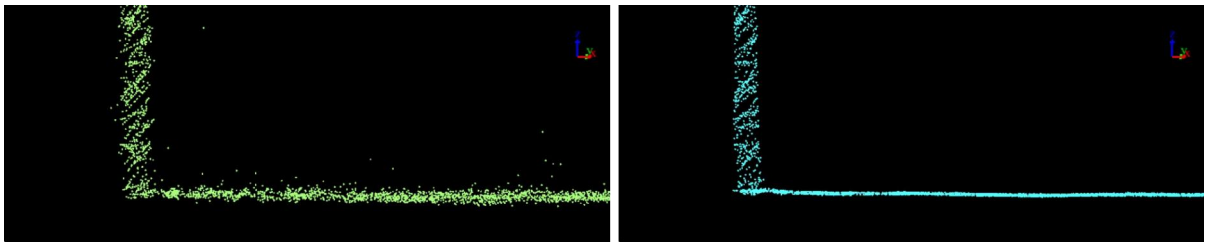
3.Added filter output options for noise and smooth filtering.



Filter

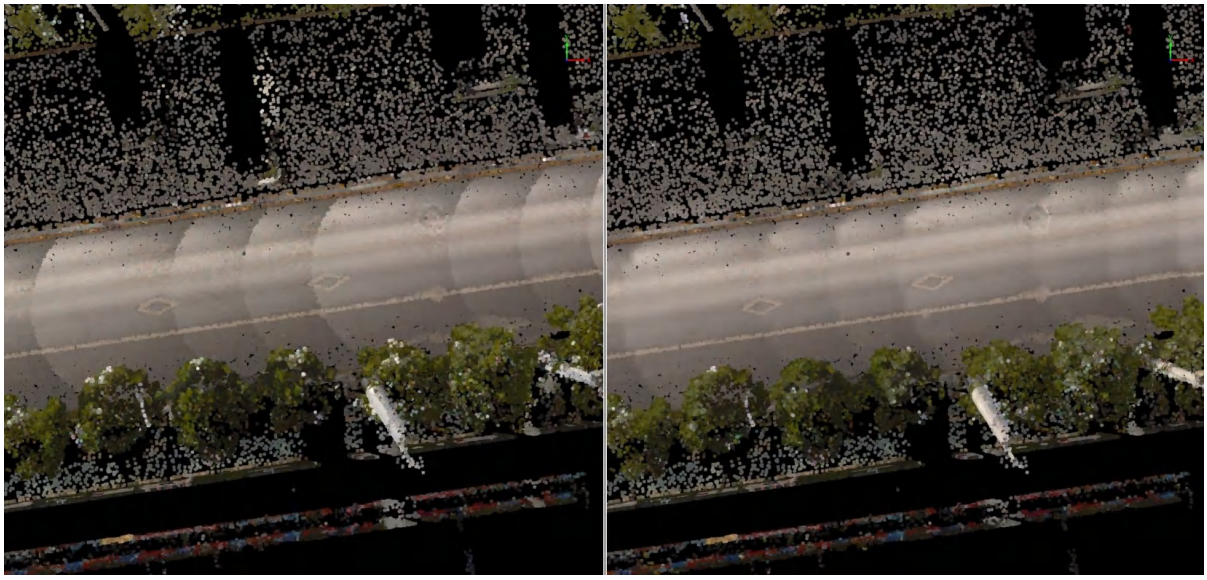


Left: Before noise filter; Right: After noise filter



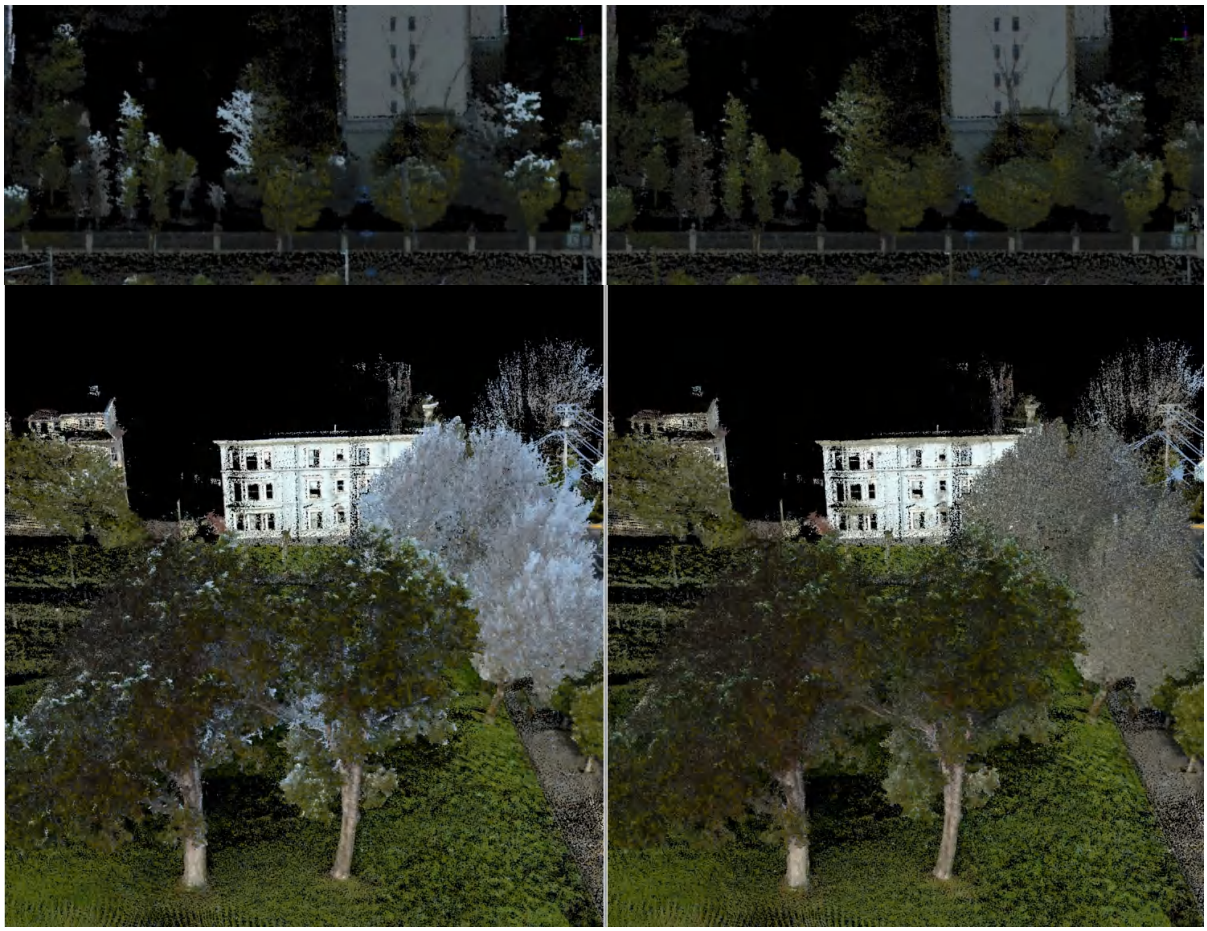
Left: Before smooth filter; Right: After smooth filter

4.Added color smoothing settings to improve coloring effects.



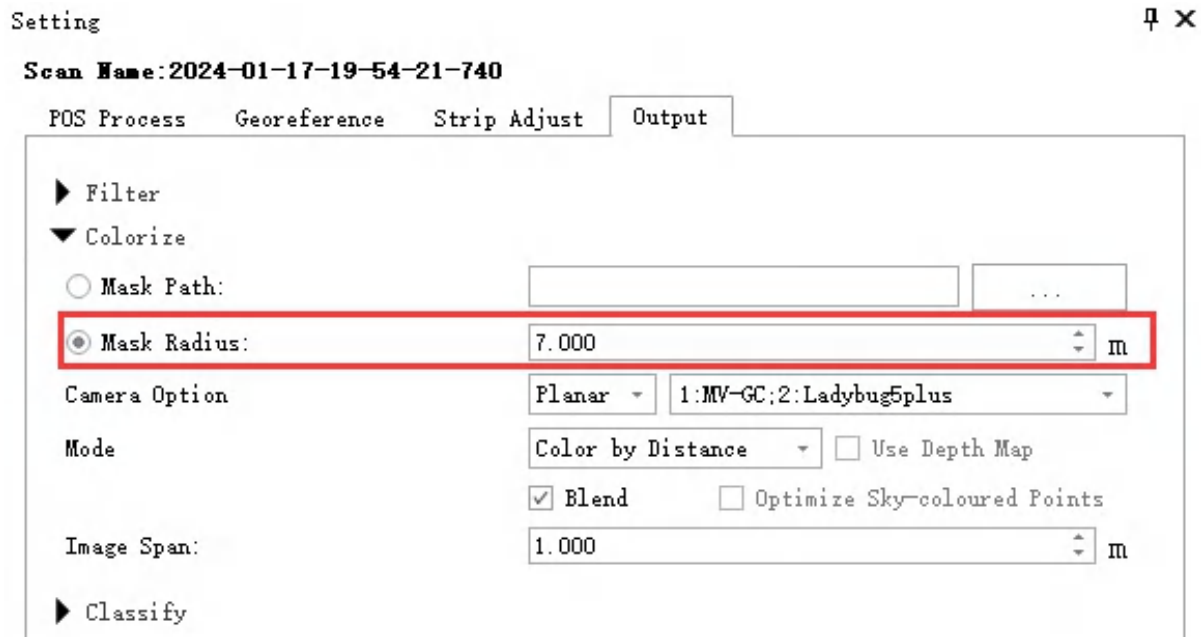
Left: Before smoothing; Right: After smoothing

5.Added sky color optimization for coloring, solving the issue of sky color on top of vegetation.



Left: Before sky color optimization; Right: After sky color optimization

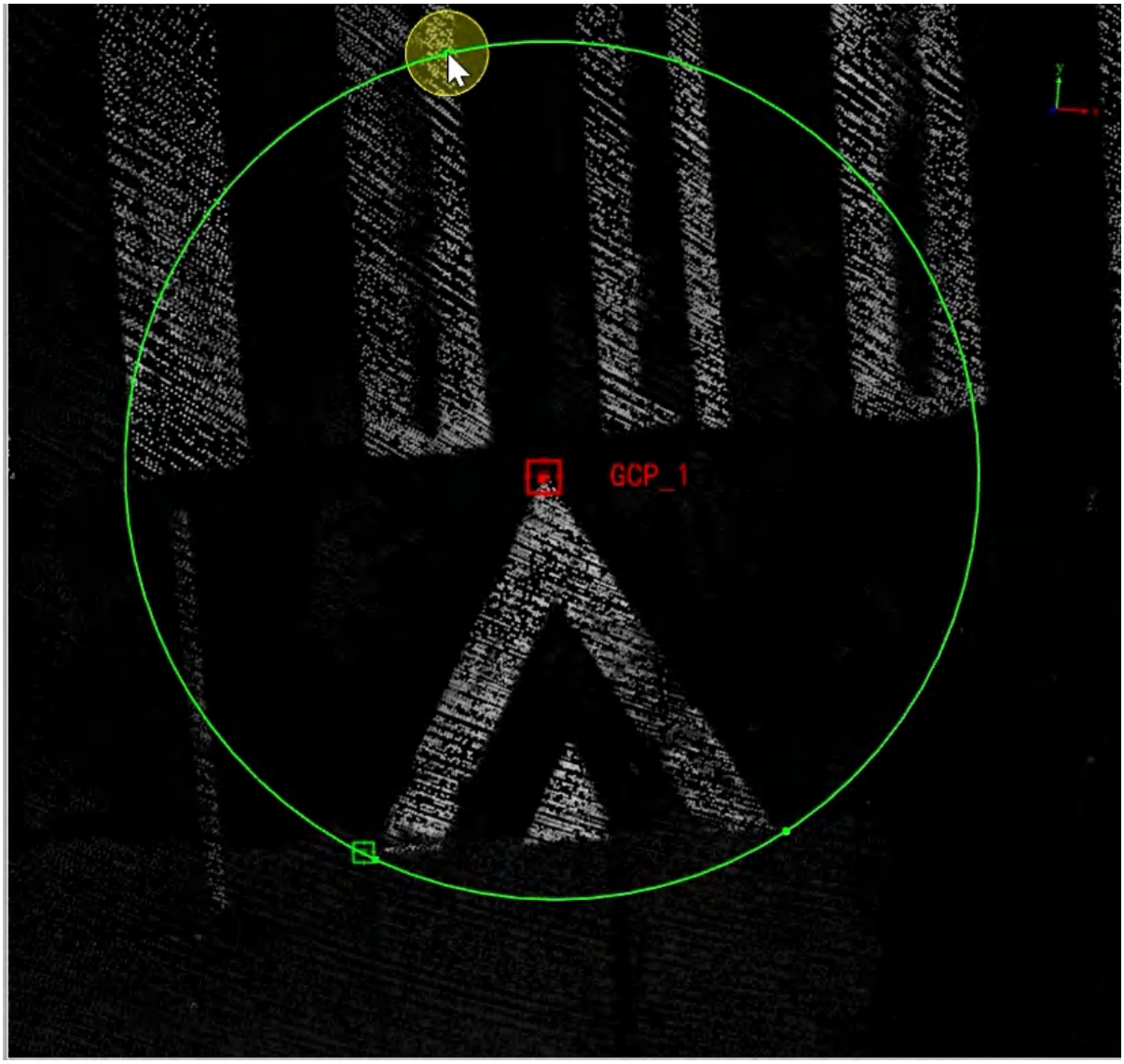
6.Added color masking radius option, allowing for better color application even in the absence of a mask file.



Mask Radius Setting

Colorized Point Cloud Effect

7.The GCP Edit function added two point marking methods: fitting a circle and intersecting lines.



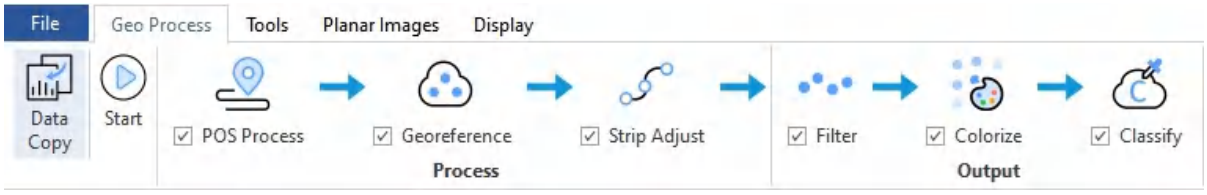
Fitting a Circle

Intersecting Lines

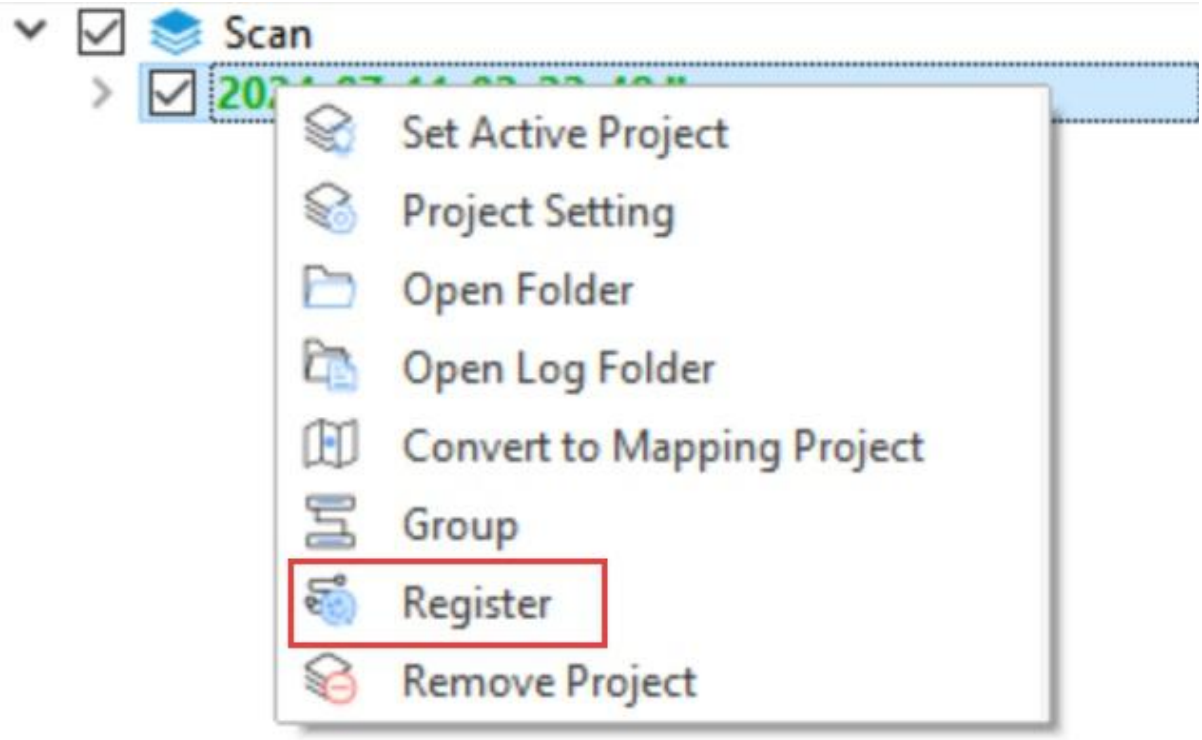
8.Support for LiMobile M2 series data process, along with a new Planar Parsing function that can independently parse the planar camera data from LiMobile M2 and simultaneously perform distortion correction.

Enhancement

1.Optimized the computation process by defaulting the Register options to hidden. Users can manually open them through the liscan or Group right-click options, as well as the Register options in the display settings when editing registration.



Optimized Process Steps



Register

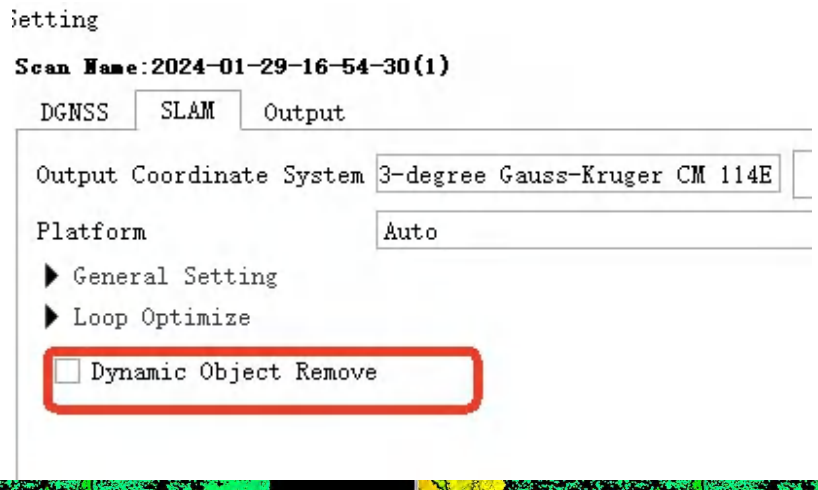
2.The computation results are stored by default with each Lidata being approximately 1GB to prevent data processing errors caused by excessively large Lidata files.

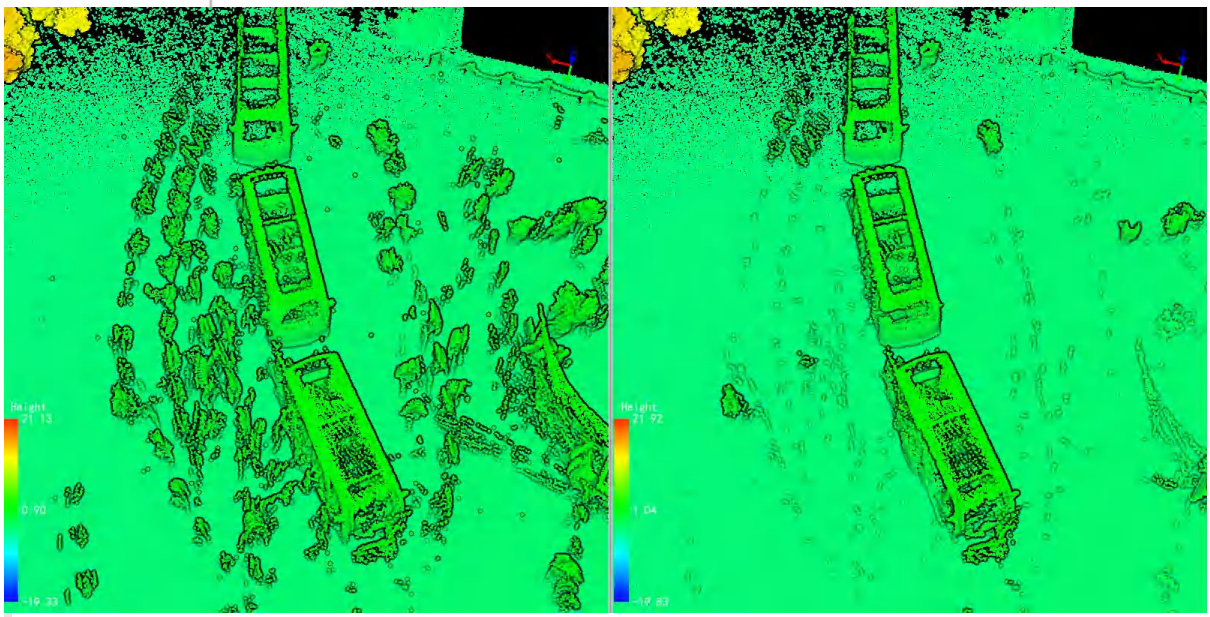
BP module

New feature

1. Added dynamic object removal algorithm

Added dynamic object removal option in the slam settings interface

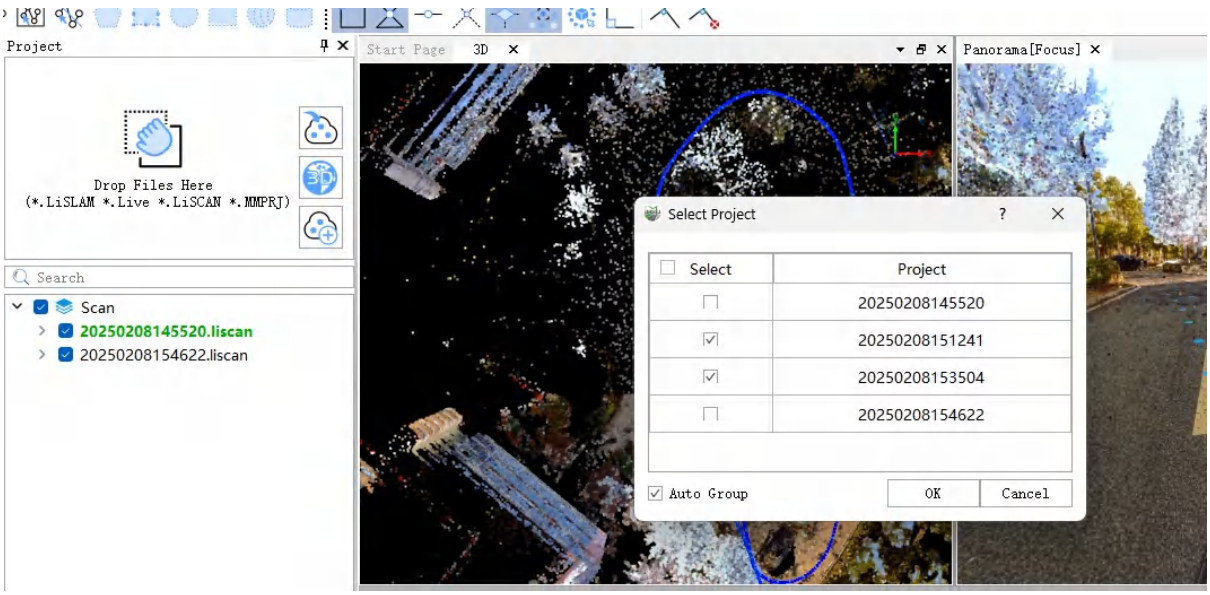




> Note: Dynamic object removal will slow down the SLAM process and require additional computation time. Compared to the collection time, O1-LITE/H120/GH120 slows down by 33%, H300 by 90%, and V100 by 15%.

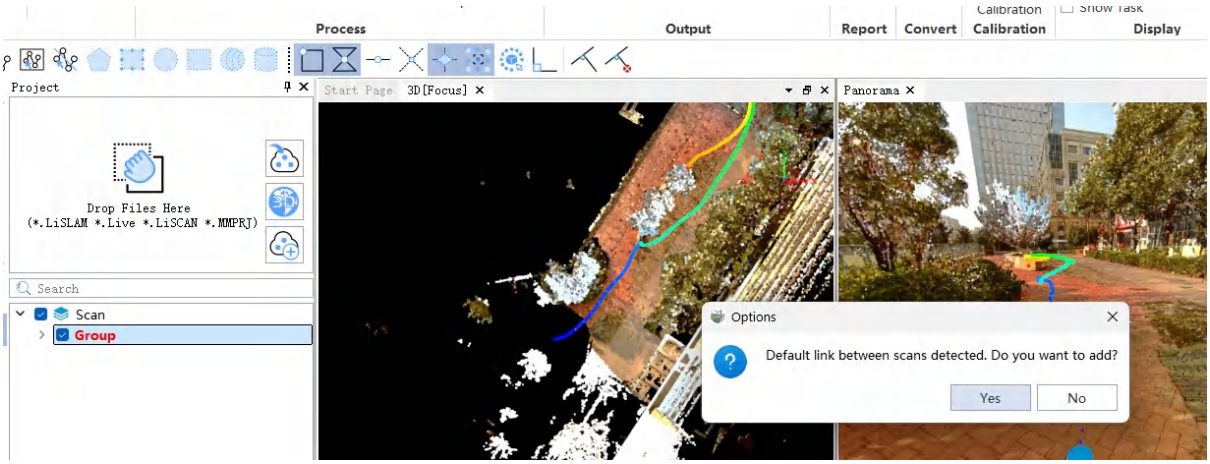
2. Selective project import when importing *.lislam file

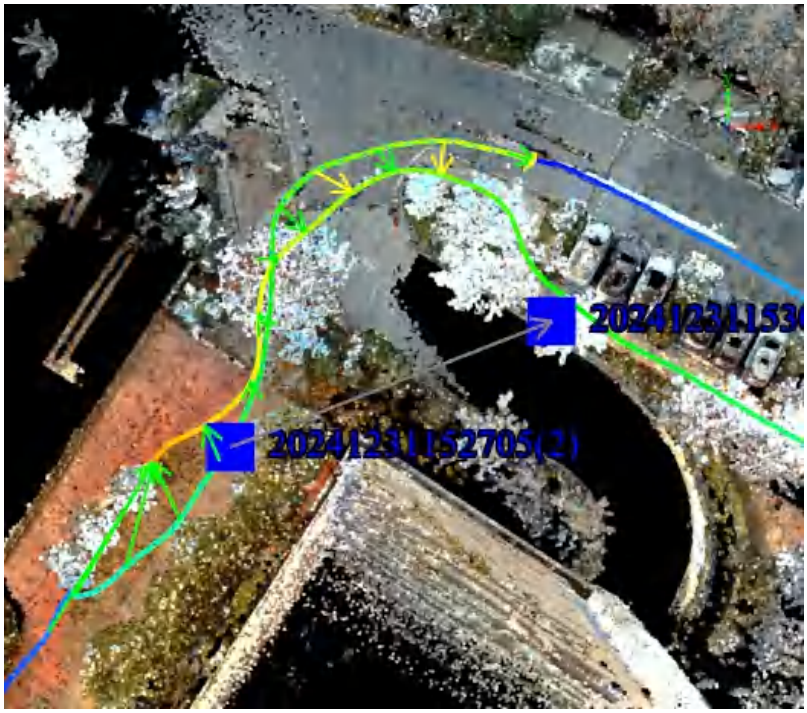
Since .lislam records multiple projects, but in actual production, some projects do not need to be imported, you can choose to import selectively according to your needs;



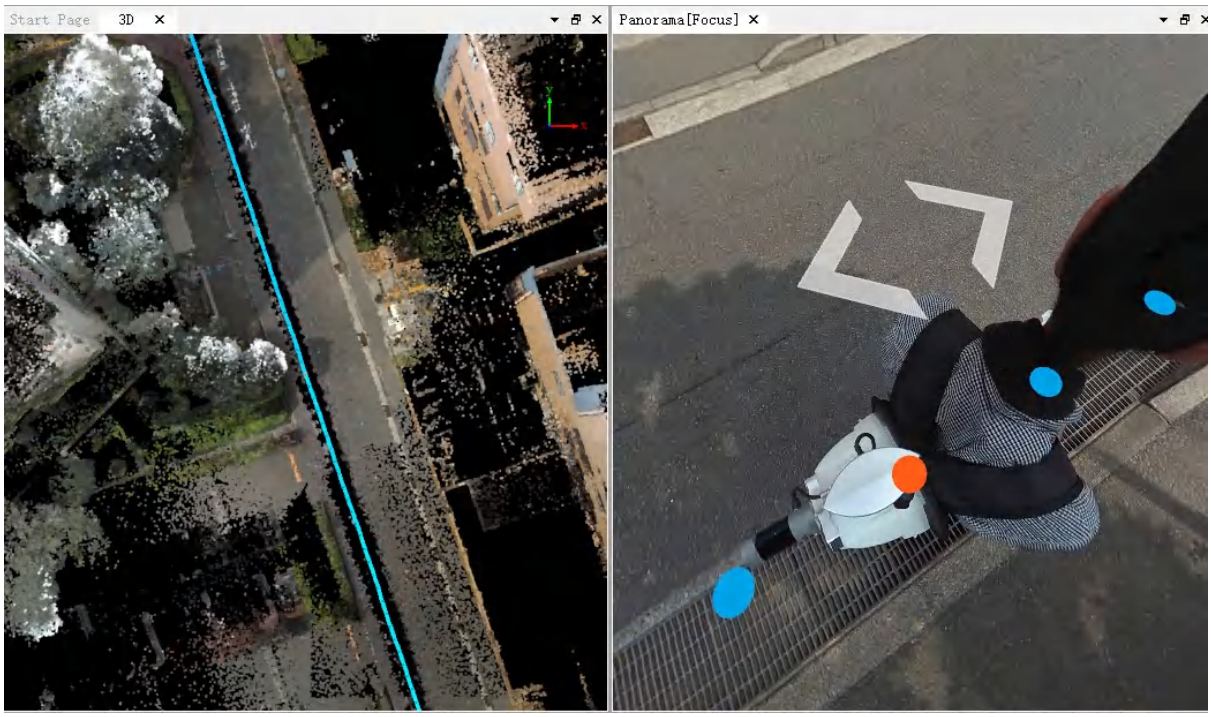
When importing, you can choose to automatically group, eliminating the need for manual grouping later.

3. Automatically recognize the connection relationship for breakpoint resumption scanning.





4. Support for point cloud colorization to the DGC50 Garmin camera

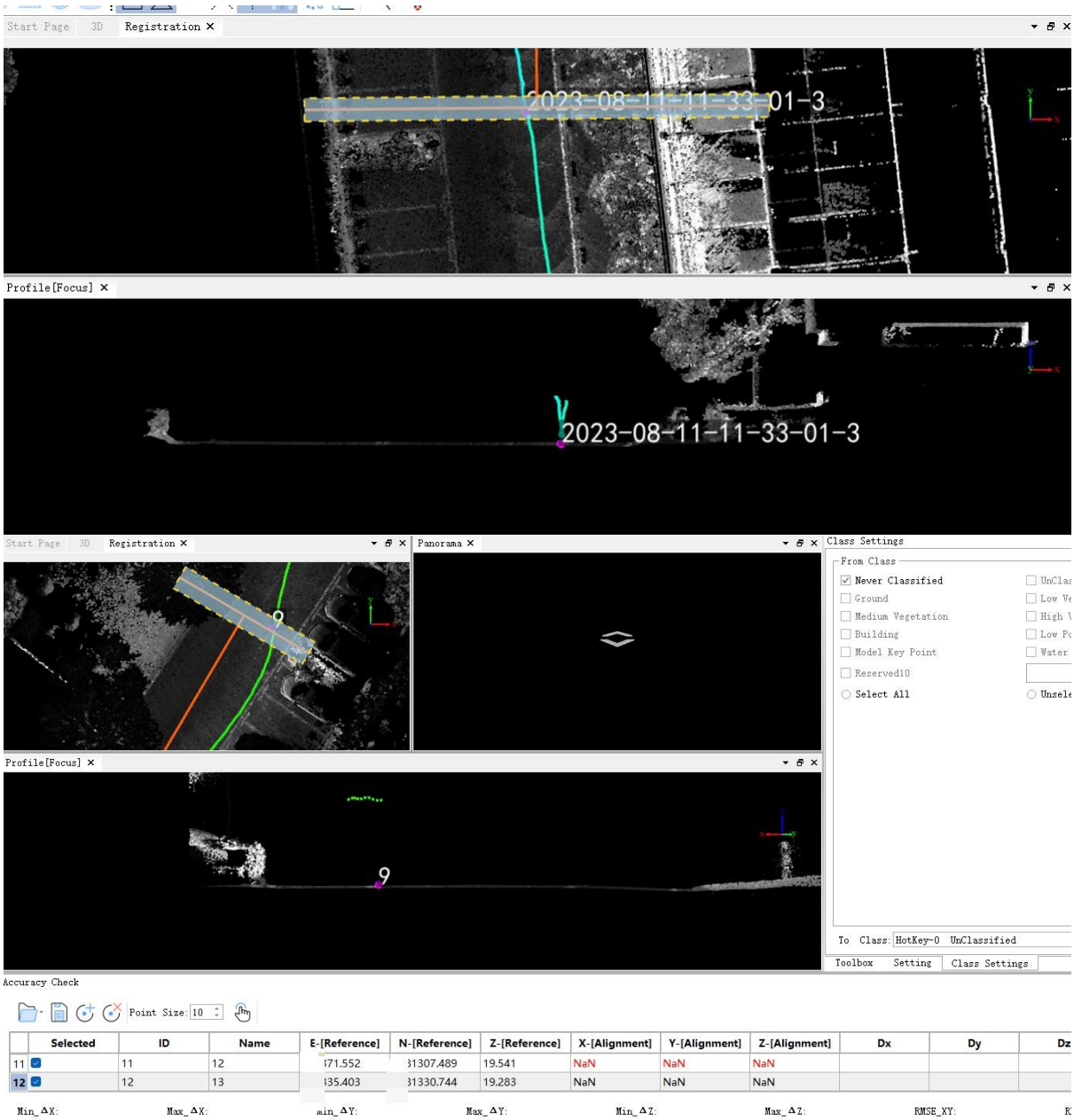


Optimization

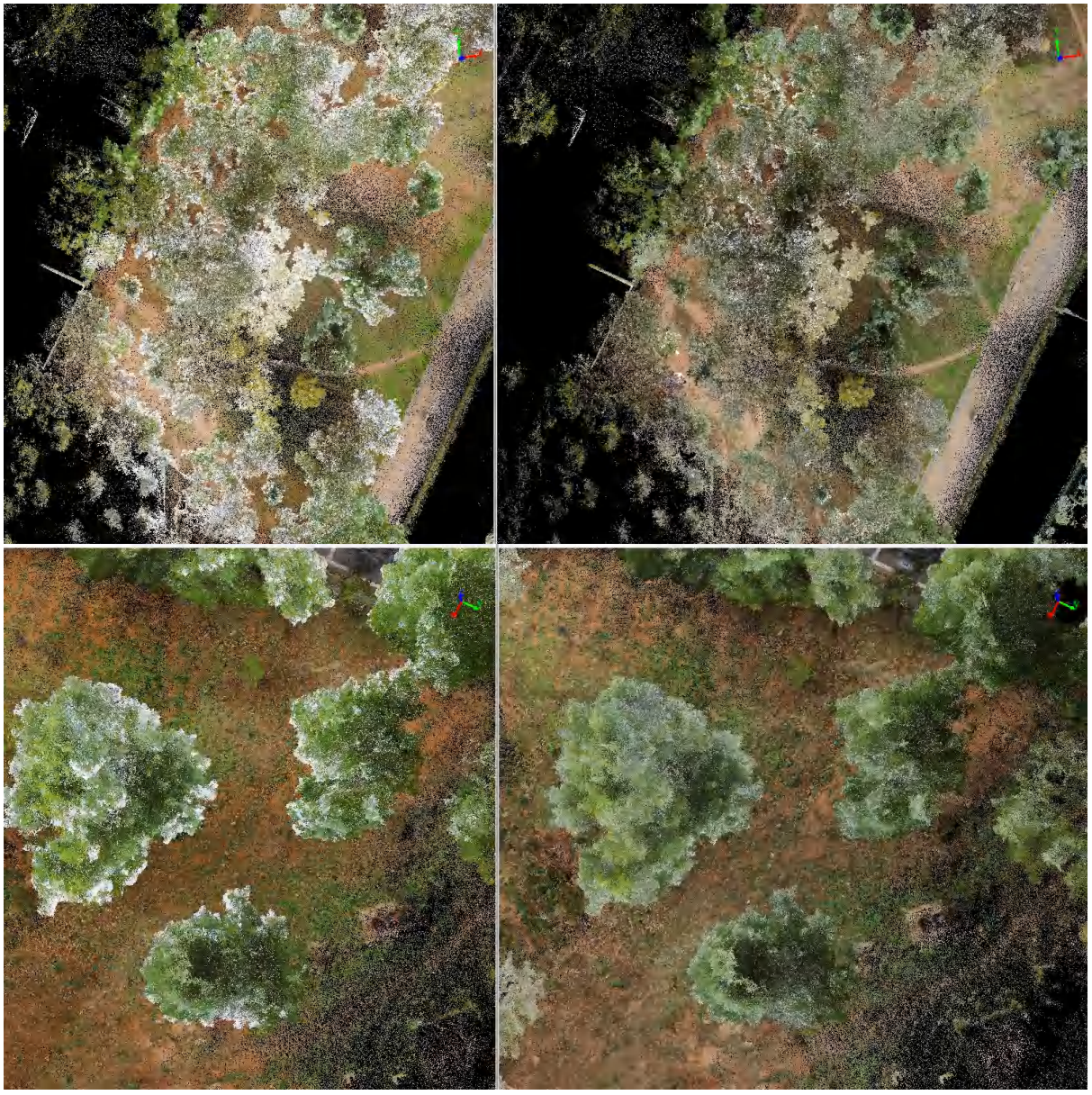
1. GCP window display optimization

The point names displayed in the 3D window are consistent with the point names entered GCP collecting, and after importing control points, they remain consistent with the control point names.

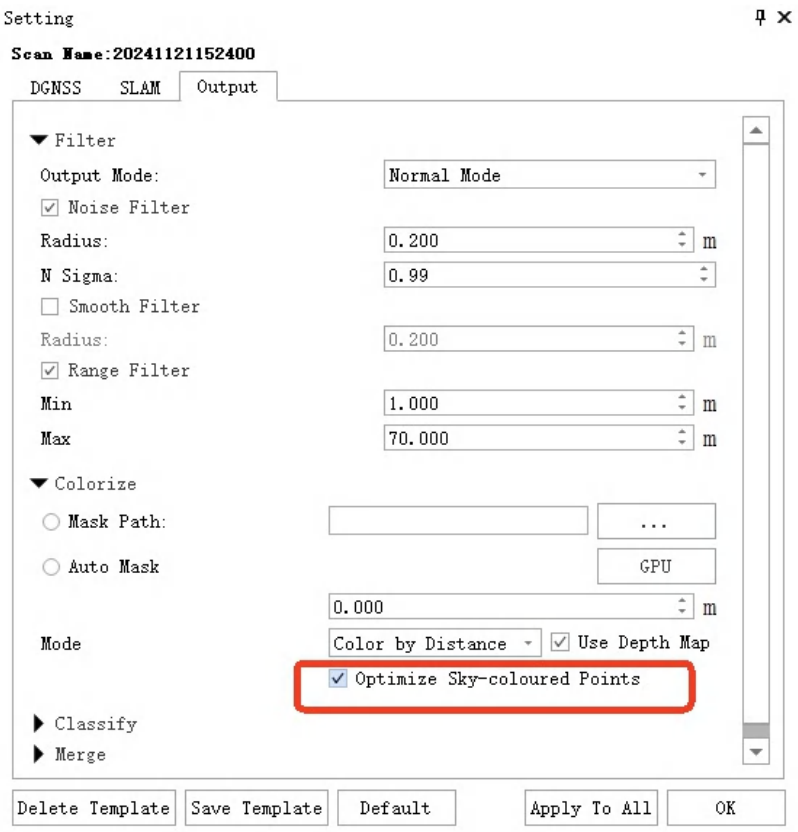
2. Points in the GCP registration and control point report can be displayed in the profile



3.Optimizing the color of tree tops (left: before optimization, right: after optimization)



The optimization of sky color requires selecting '**Optimize Sky-coloured Points**' in the output settings



> Note: Enabling Optimize Sky-coloured Points will slow down the color rendering speed by about 1-2 times

GSReconstruction Module

New Features

1.Added Gaussian data color adjustment functionality.

Before color adjustment

After color adjustment

2.Added support for WASD shortcut keys in the Gaussian window.

Enhancement

1.Achieved 65% improvement in Gaussian data rendering efficiency - Using demo dataset, average frame rate increased from 30 FPS to 50 FPS, with 20% reduction in GPU memory consumption through data type conversion and compression.

2.Implemented adaptive density-controlled Gaussian reconstruction algorithm that more accurately fits models' actual shapes, enhancing detail representation in critical areas while improving visual fidelity of models.

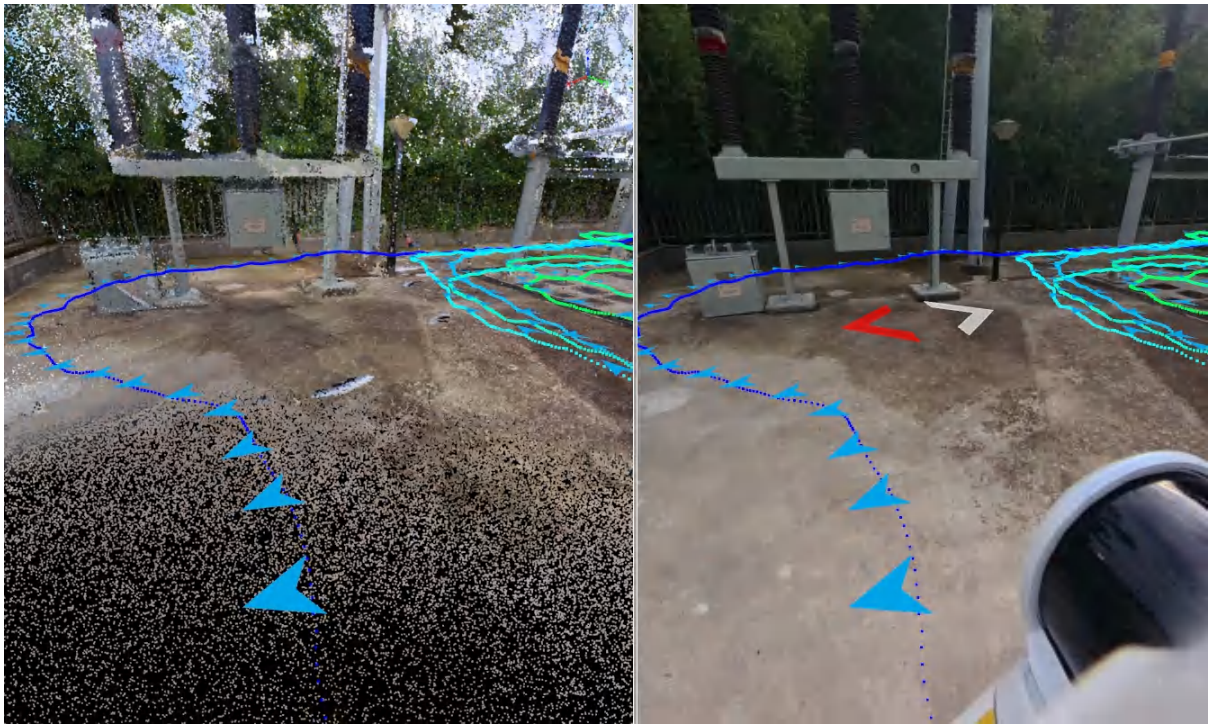
3.Supported directly importing Gaussian data for viewing when the map project has not been created.

4.The ↑ and ↓ shortcut keys in the Gaussian and 3D windows now respond by moving forward and backward.

Framework

New Features

1.Added a quick jump button for panorama/planar images that allows for frame switching up and down by clicking the arrow in the window.



2.Added the ability to define coordinate systems, supporting the redefinition of the UCS coordinate system for data.

3.Added ASCII projection functionality, supporting the reprojection of single points or ACISS files.

4.Added the ability to cut long range point clouds, supporting automatic calculation and removal of point cloud data that is duplicated and distant.

5.Added a raster surface analysis tool, supporting calculations such as slope, aspect, hillshade, and roughness.

6.Added a raster field calculator, allowing for band calculations on raster data.

Enhancement

1.Optimized point cloud display by file in the combination view, supporting random colors or setting a color scale.

2.Optimized the background display for image annotations.

3.Optimized the import and export of image annotation labels.

4.Optimized the vector editing reshape function to better support polygons.

5.Optimized the split or merge polygon functions in vector editing, restructuring them into separate split and merge functionalities, and supporting lines and polygons.

6.Optimized the vector editing move function, restructuring the original right-click move into a standalone feature.

7.Optimized the assign color to points function, supporting preview and undo.

8.Optimized point cloud coloring, supporting radius masking, color smoothing, and sky color optimization operations.

9.Optimized the function for converting trajectories to vectors, supporting decimation based on distance.

10.Fixed the issue where data with a 0-65535 intensity range could not calculate the average intensity.

11.Fixed the issue with generating raster coordinate systems.

12.Fixed the local coordinate system definition issue.

13.Fixed the issue with abnormal angle and slope measurement displays.

14.Fixed the deep learning classification crash issue with 15G+ point cloud data.

15.Optimized the software license management module code display.

Road Condition Module

Enhancement

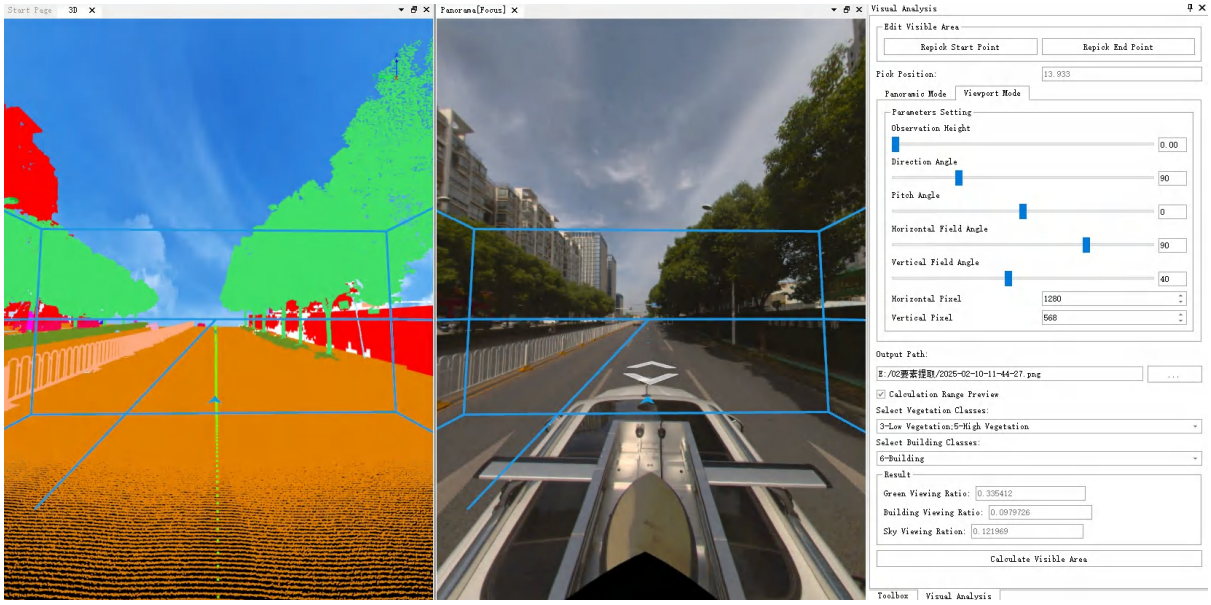
1.Fixed the issue where exporting the analysis report after multiple power line height limitation analyses caused an error.

2.Fixed the issue of holes in the DEM generated from sparse point clouds.

Forestry Module

New Features

1.The ecological landscape viewshed analysis / batch viewshed analysis feature supported a viewport mode, enabling simulations at any location or camera position with customizable viewport parameters to generate simulated point cloud diagrams.



LiDAR360MLS V8.1.0 Release Notes

(New)GSReconstruction Module

New Features

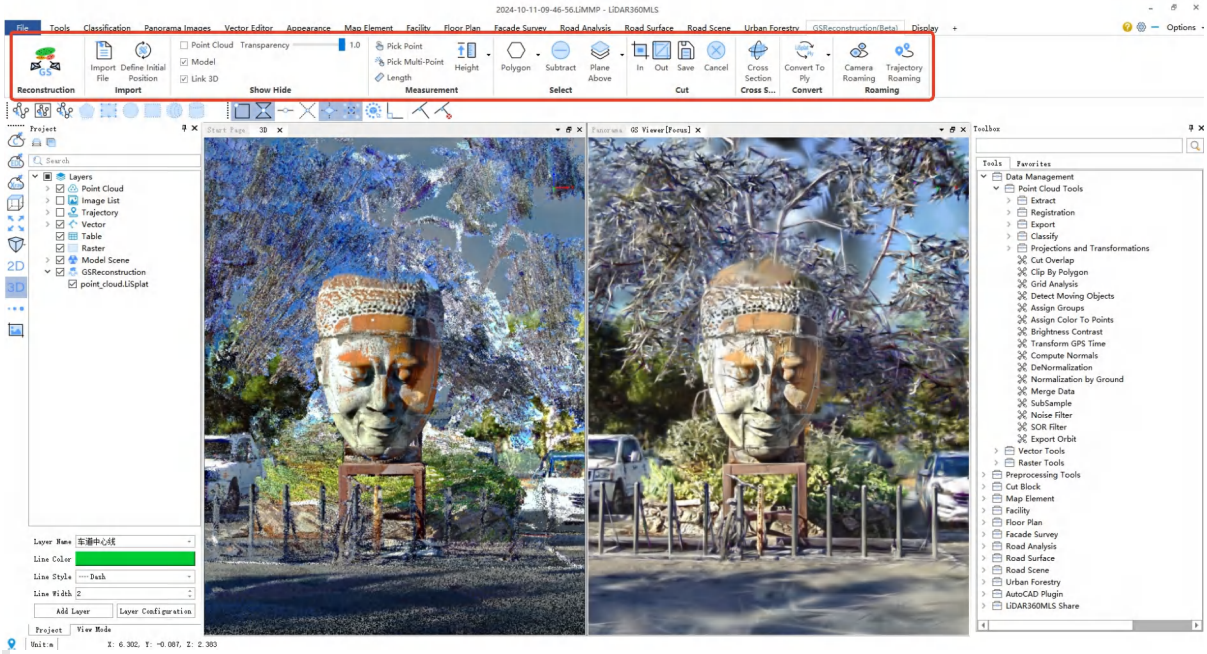
1.Added Gaussian reconstruction module, supporting one-click reconstruction of data collected by LiGrip O1Lite and LiGrip H300 handheld devices.

2.Supported the import and export of Gaussian models, as well as format conversion.

3.Supported display rendering, measurement, selective cutting and editing, and mapping of Gaussian models.

4.Supported linkage between the Gaussian window and the 3D window/panoramic window.

5.Supported Gaussian data roaming by perspective and by trajectory.

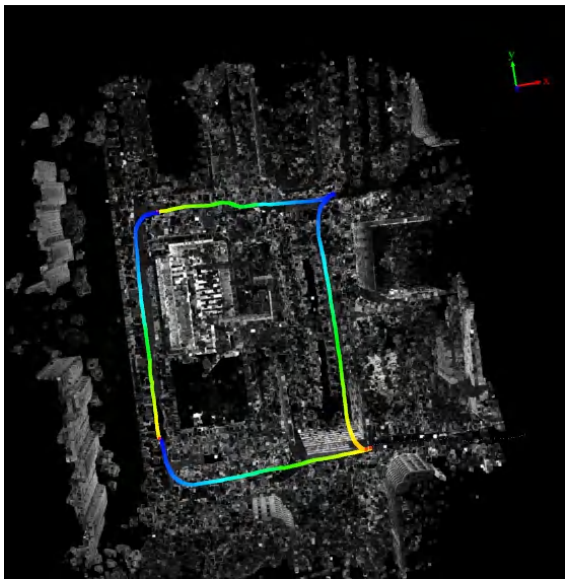


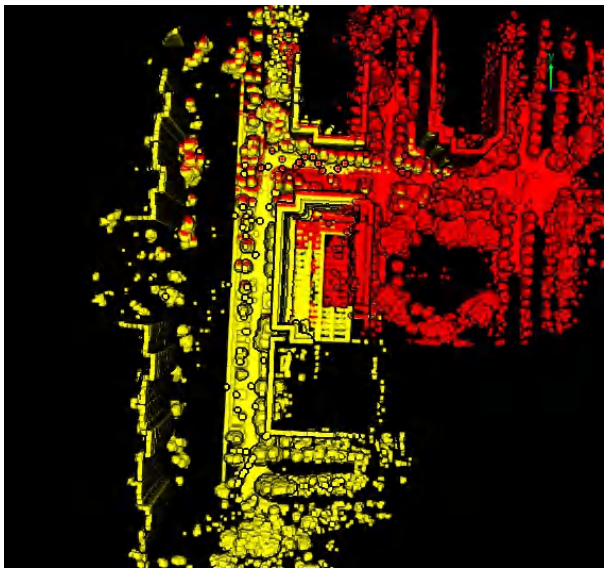
> Note:
>
> - The reconstruction function of the Gaussian reconstruction module requires authorization for the new module. Other functions such as display, browsing, and measurement can be used with either the LiDAR360MLS framework module or the BP module.
> - For specific operation instructions of this module, please refer to the user manual or tutorial videos.

BP module

Add new

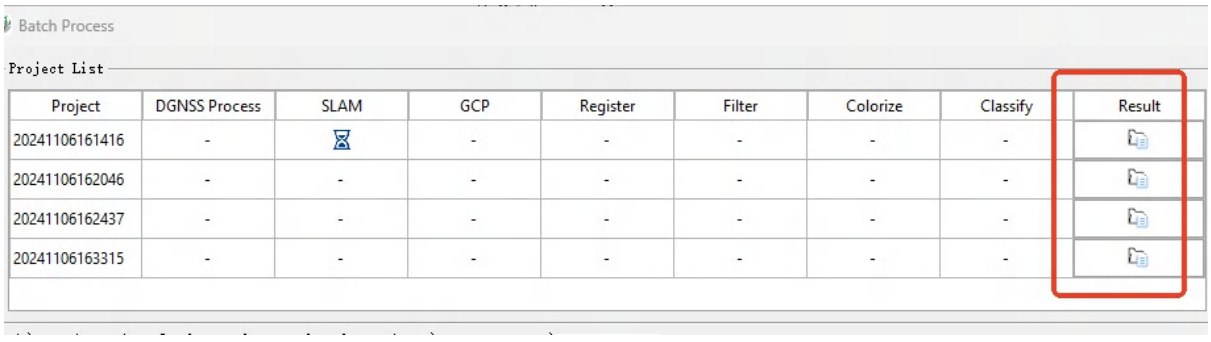
1.Support SLAM process for breakpoint continuation scan

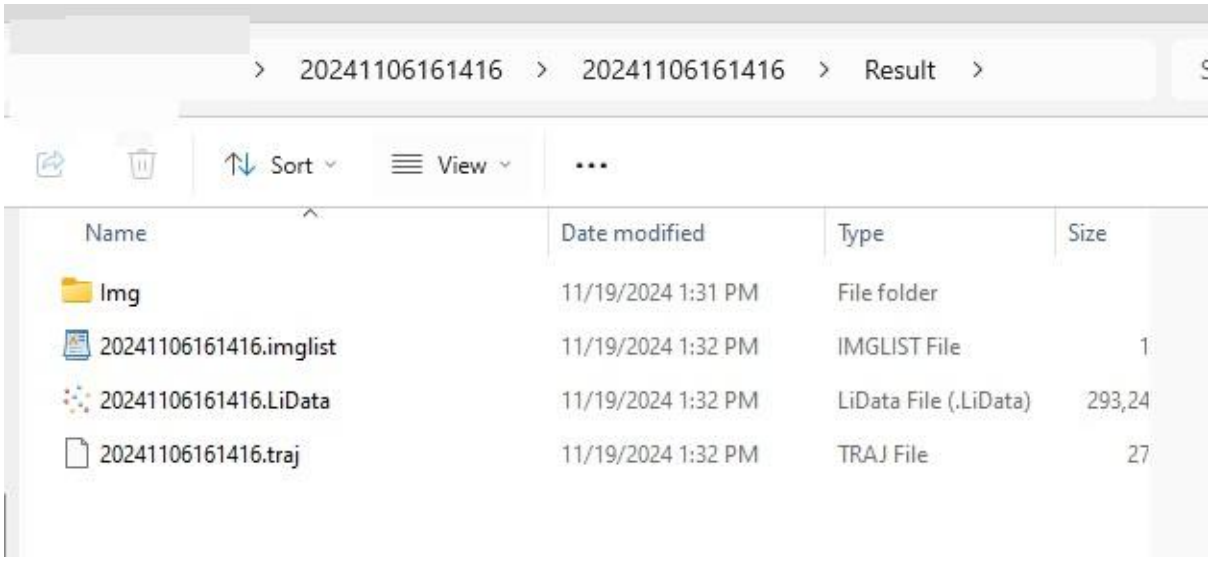




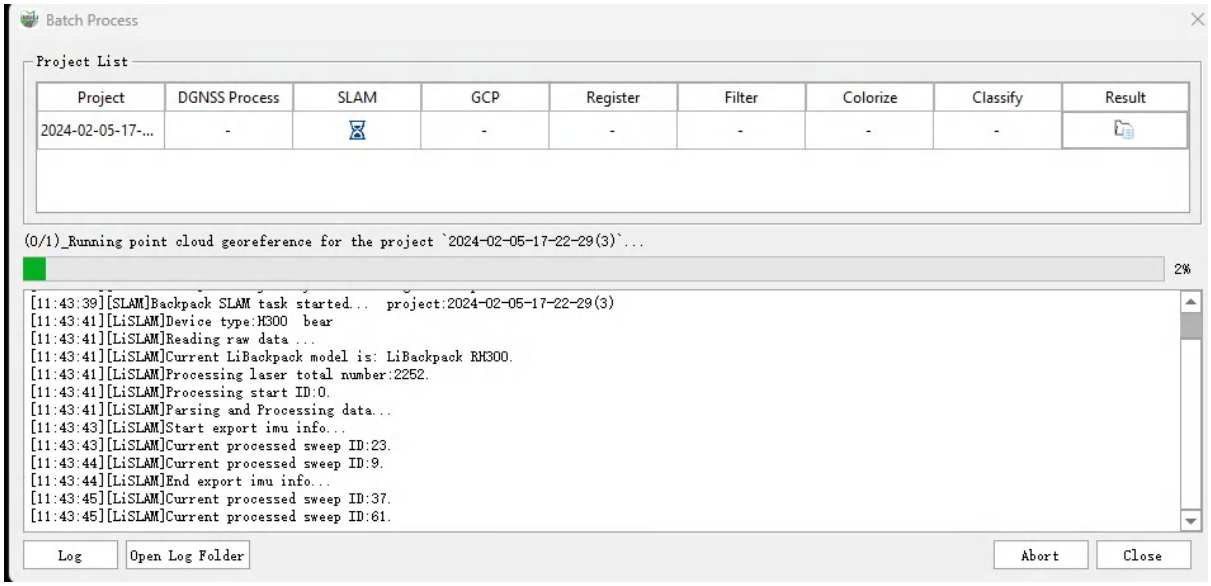
> After the breakpoint continuation scan is processed, the point clouds are roughly together, reducing the rotation and translation operations during registering

2.Added result folder in the batch process interface, clicking the result can directly open the data directory

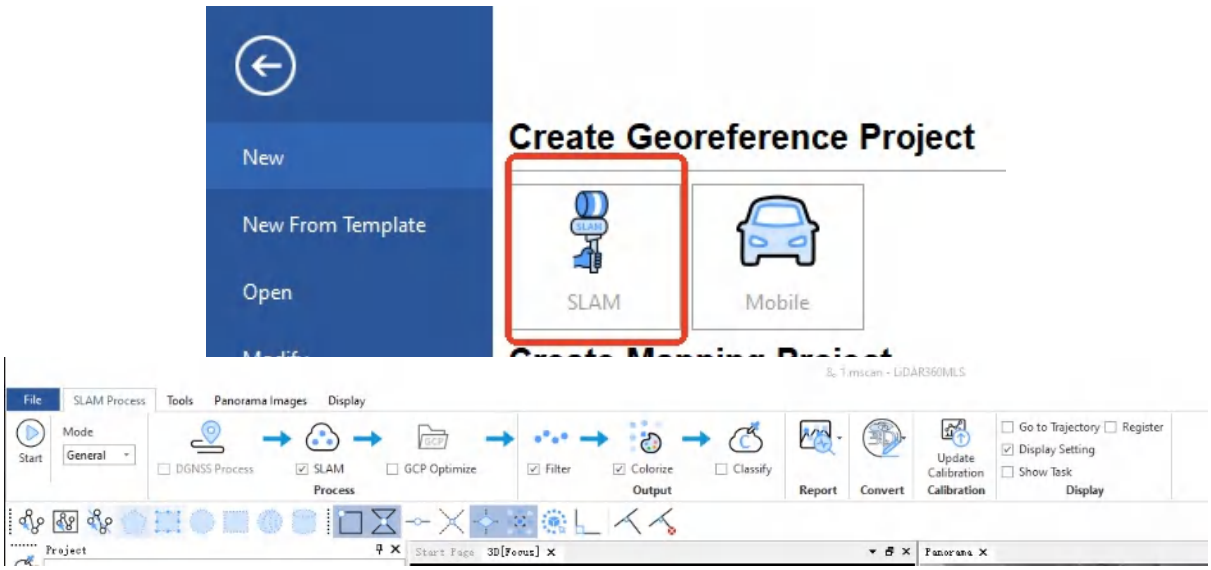




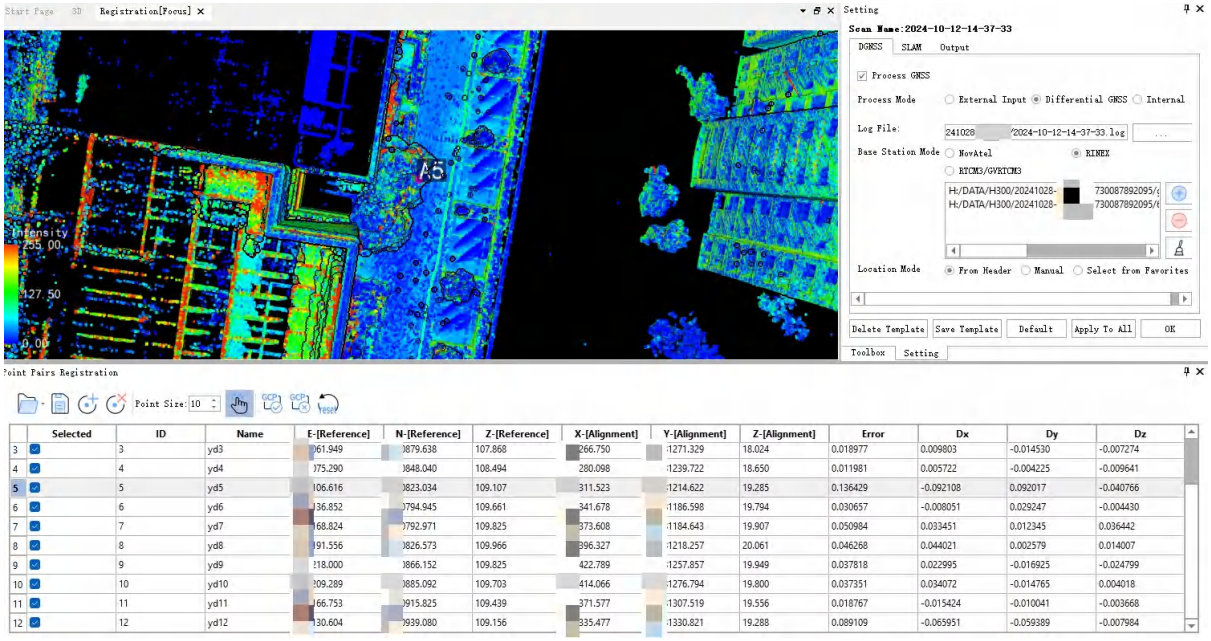
3.Added system log in batch process: You can directly see the running logs of the software on the batch interface



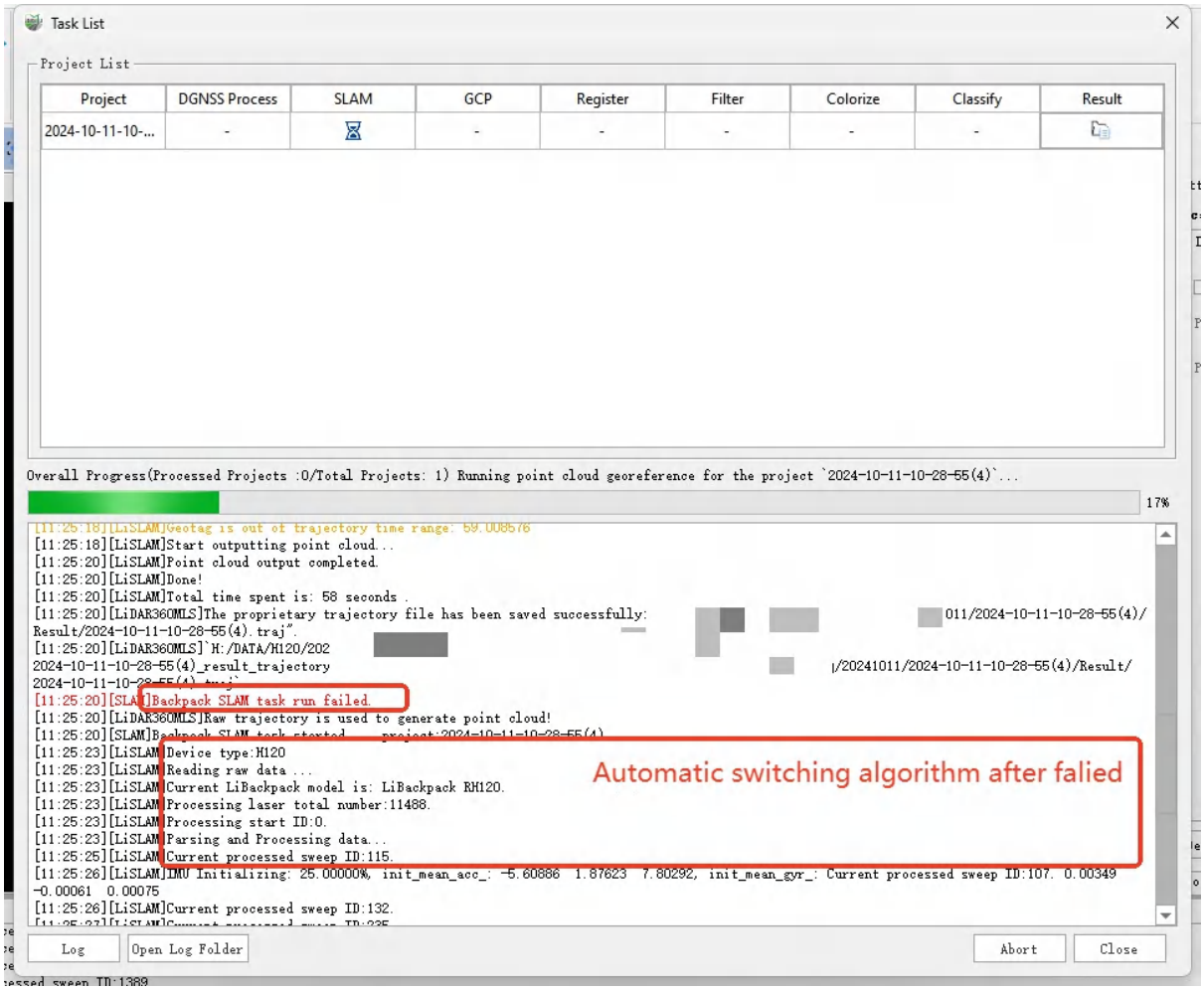
4.Supported simplified SLAM interface: After creating a new SLAM project, only display SLAM related interfaces



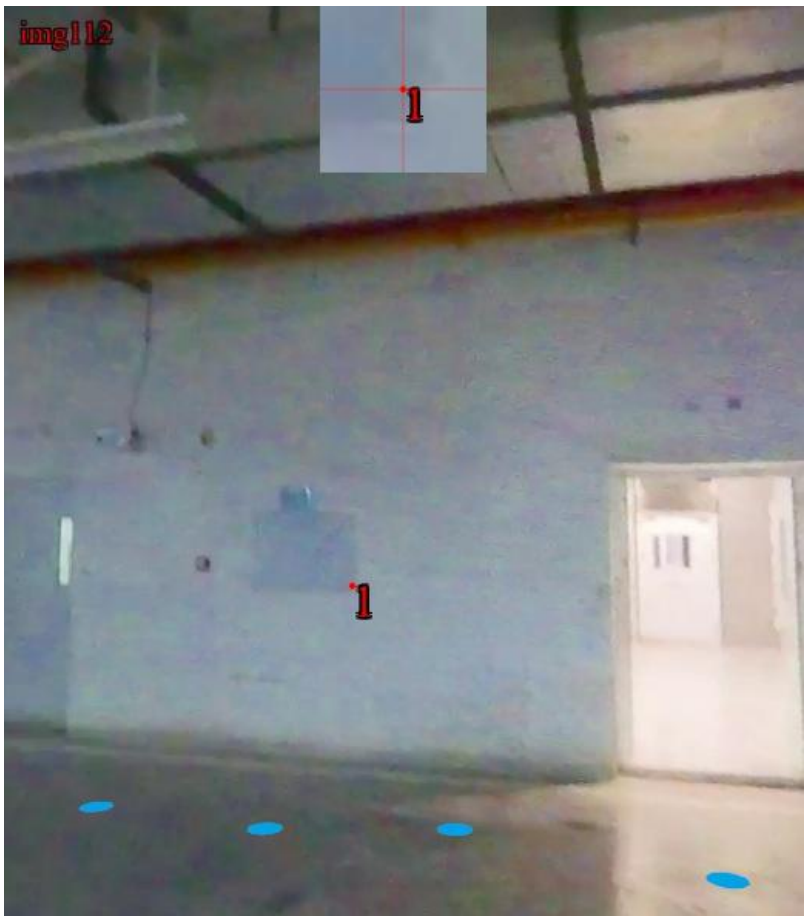
5.Supported GNSS+GCP: Support customers to convert absolute coordinates obtained from GNSS to other coordinate systems through GCP



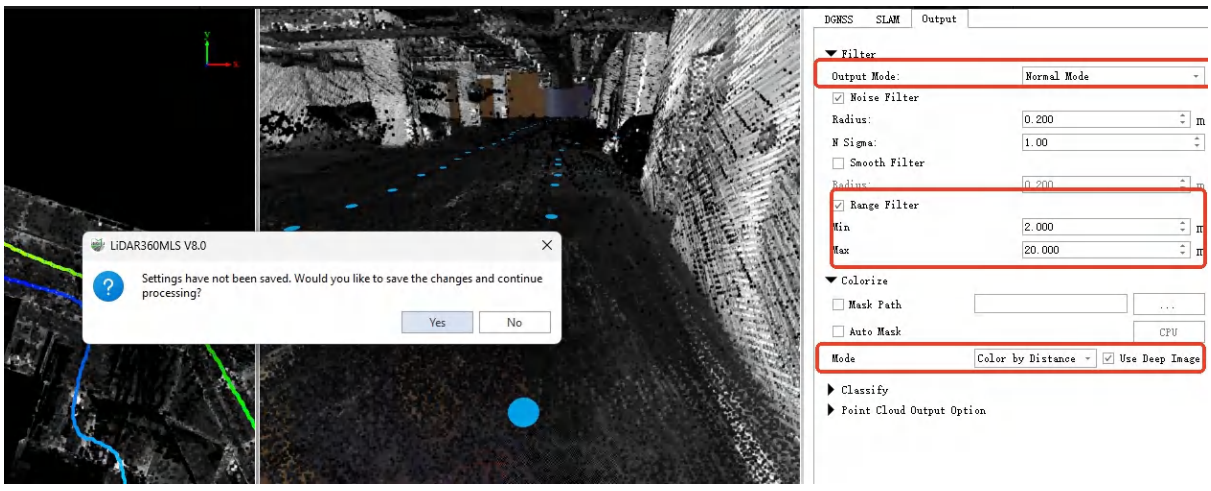
6.Supported automatic switching algorithm: When the default algorithm fails, the program will automatically switch to the stricter SLAM algorithm (up to 4 times) to improve the success rate. When the data is not successfully processed after 4 switches, retain the best result (the one with the highest number of solution frames is the best)



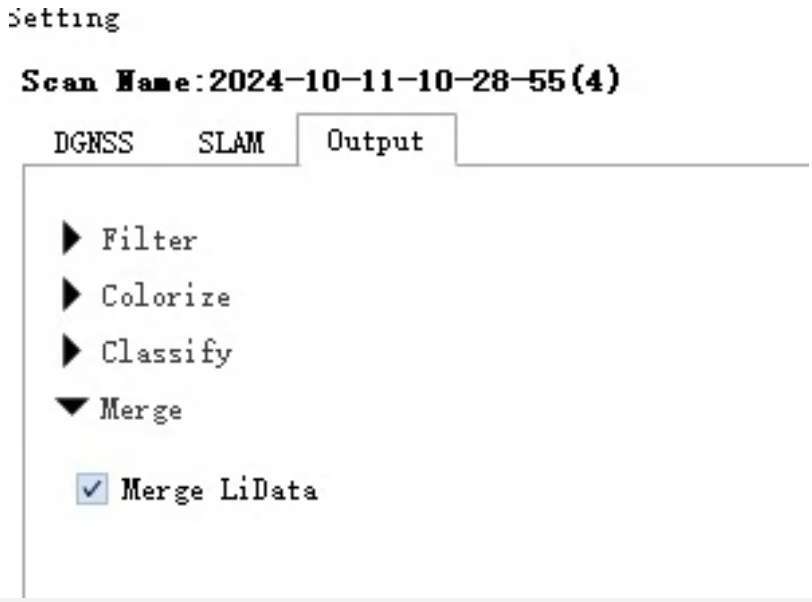
7.Added small window for panoramic point display: Supports displaying marker points in a small window during camera calibration

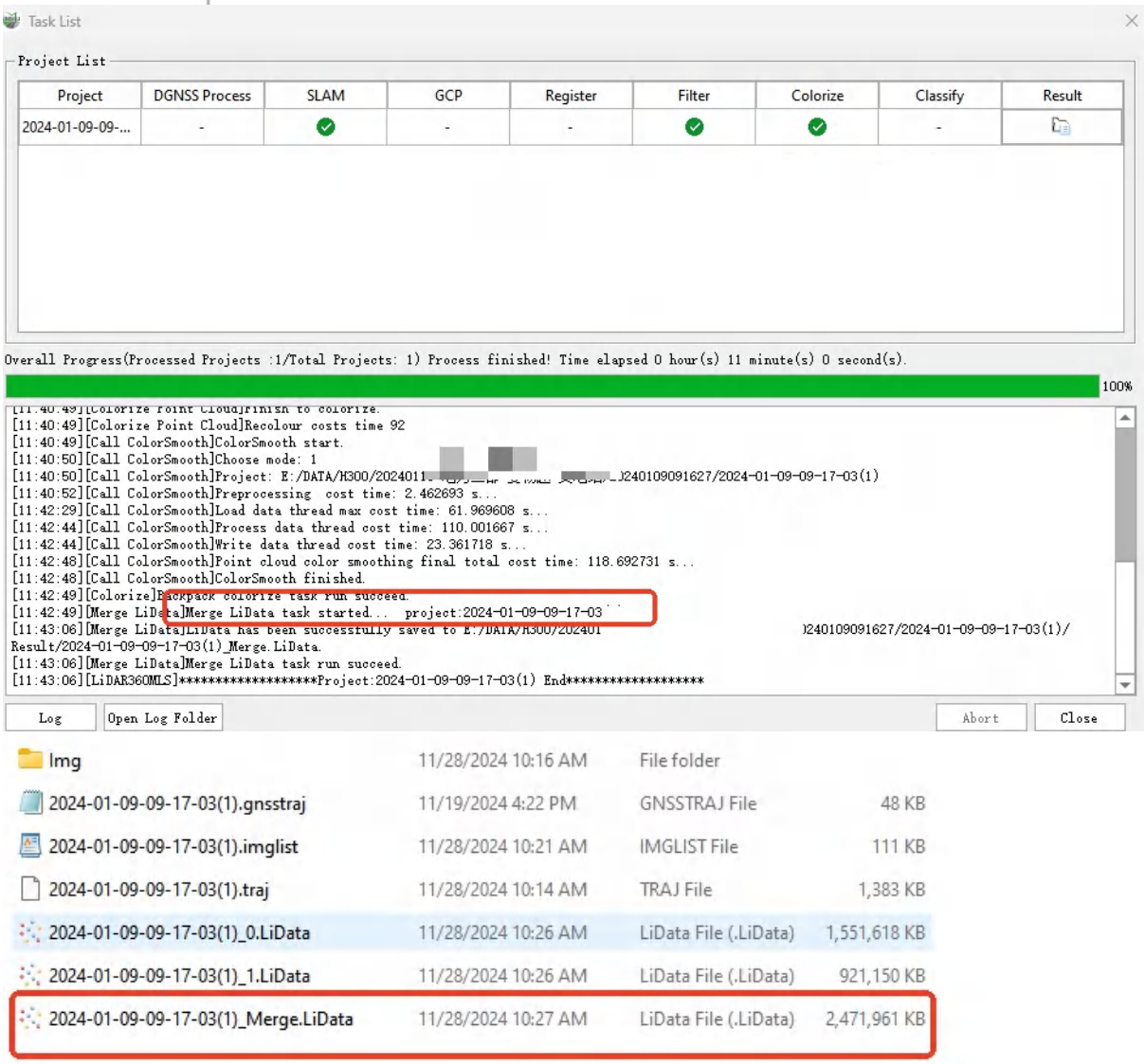


8.Added unsaved parameter reminder: Modifications to range filtering, output mode, and colorization mode will automatically remind you that parameters are unsaved



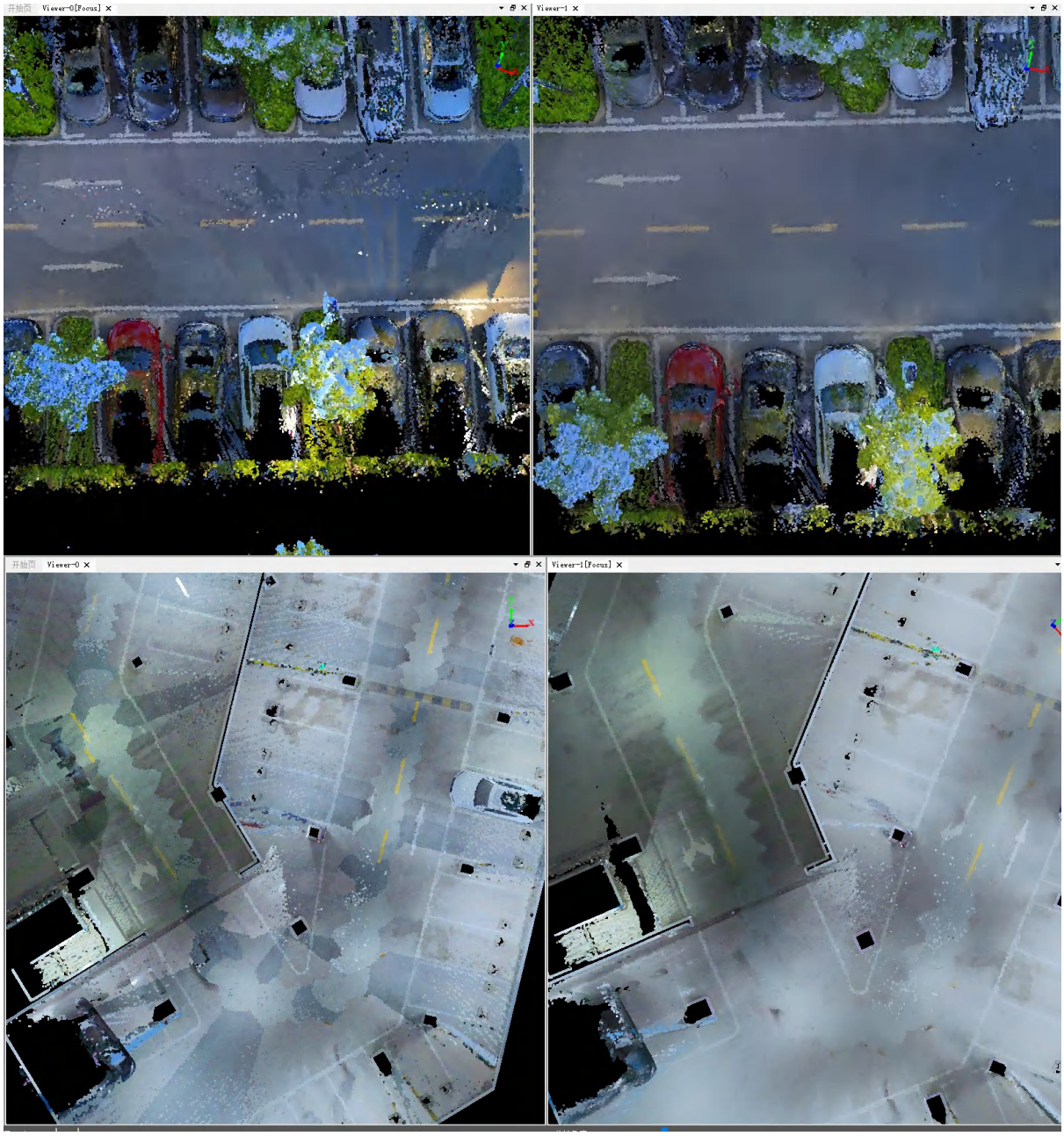
9.Added merging lidata option: Allows custom selection of whether to merge pointclouds during output. The final merged pointcloud is saved in the Result folder





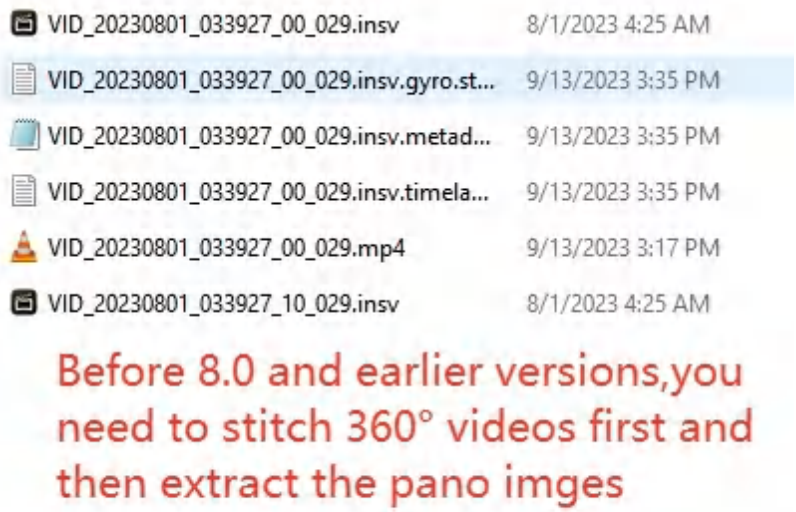
Optimization

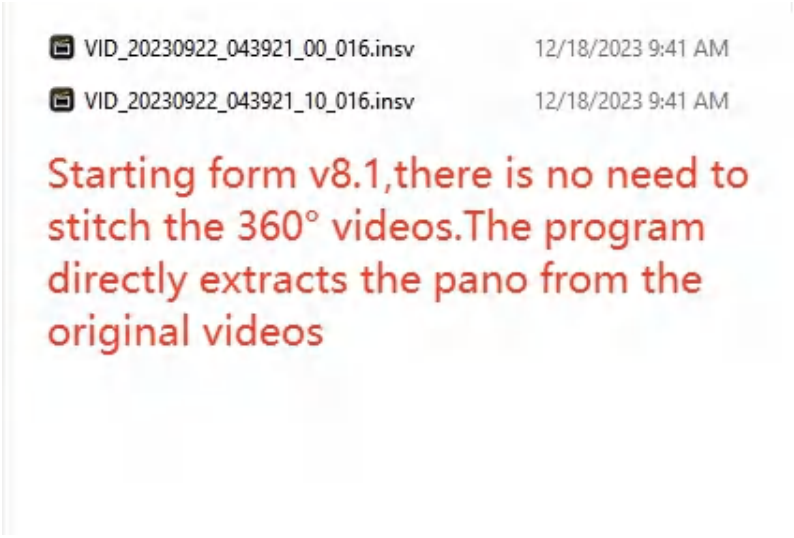
1.Optimized point cloud color speckle situation (Left:**8.0** Right:**8.1**)



2.Optimized the panoramic extraction process for INSTA cameras

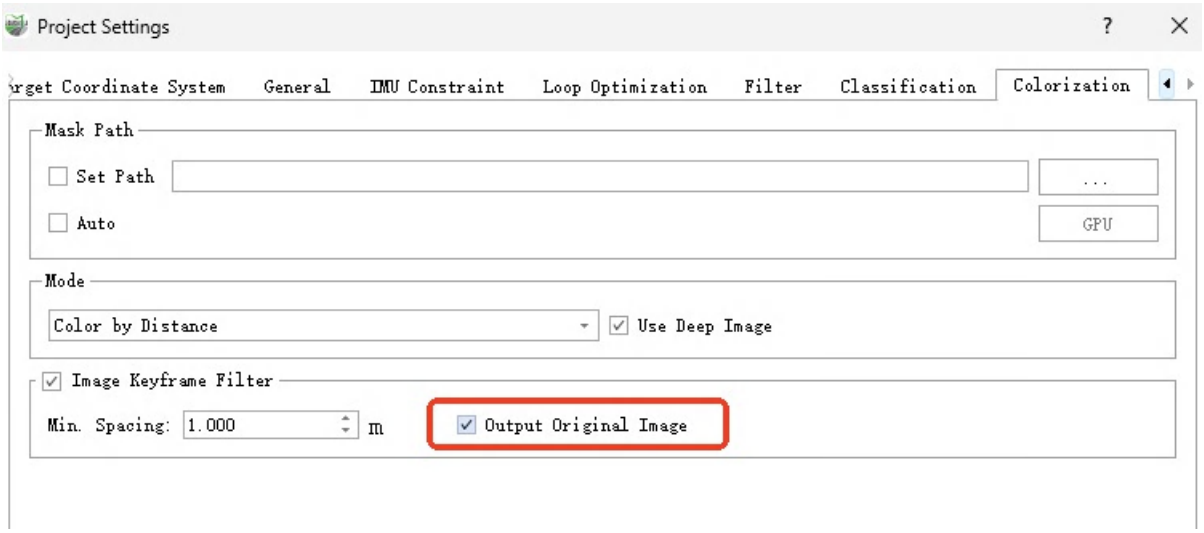
Utilize self-developed software for panoramic photo stitching, removing the intermediate step of panoramic video stitching. Panorama extraction is faster, the program is more stable, and it is less likely to be mistakenly terminated by antivirus software.



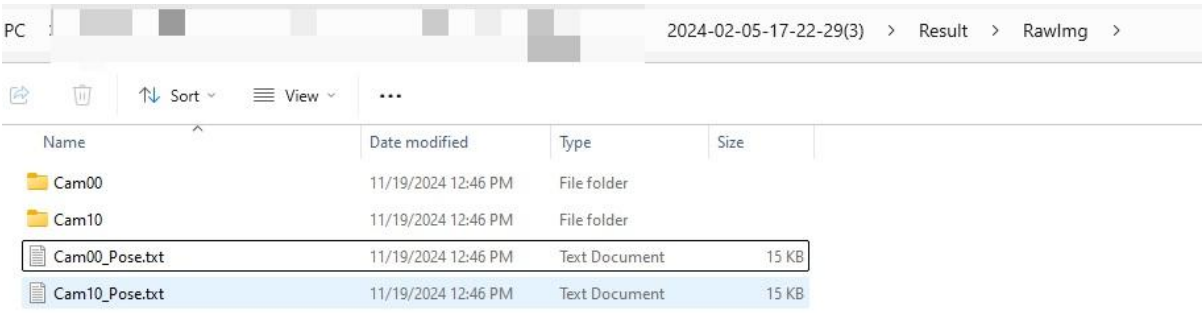


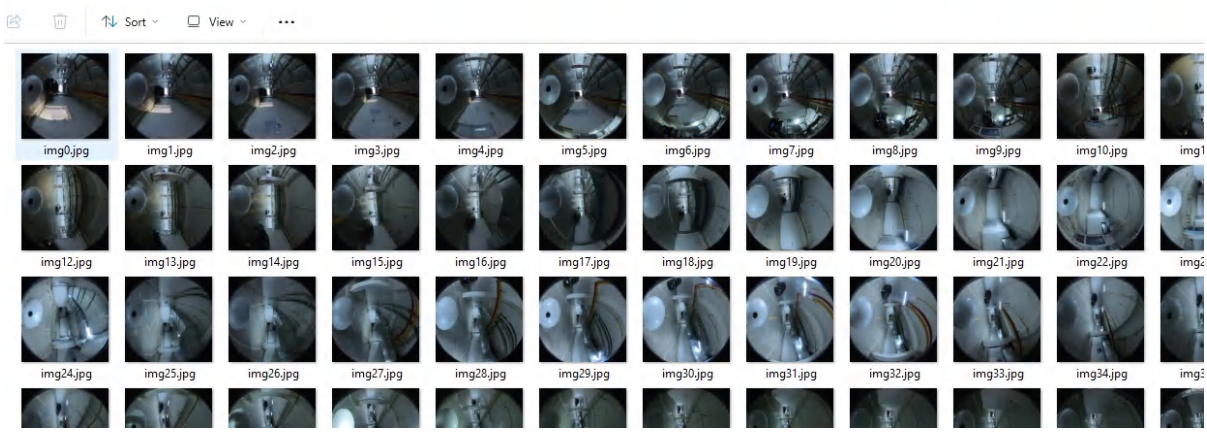
3.Fixed the issue of RTK not supporting seven parameter settings

4.Fixed the crash issue when outputting original images.

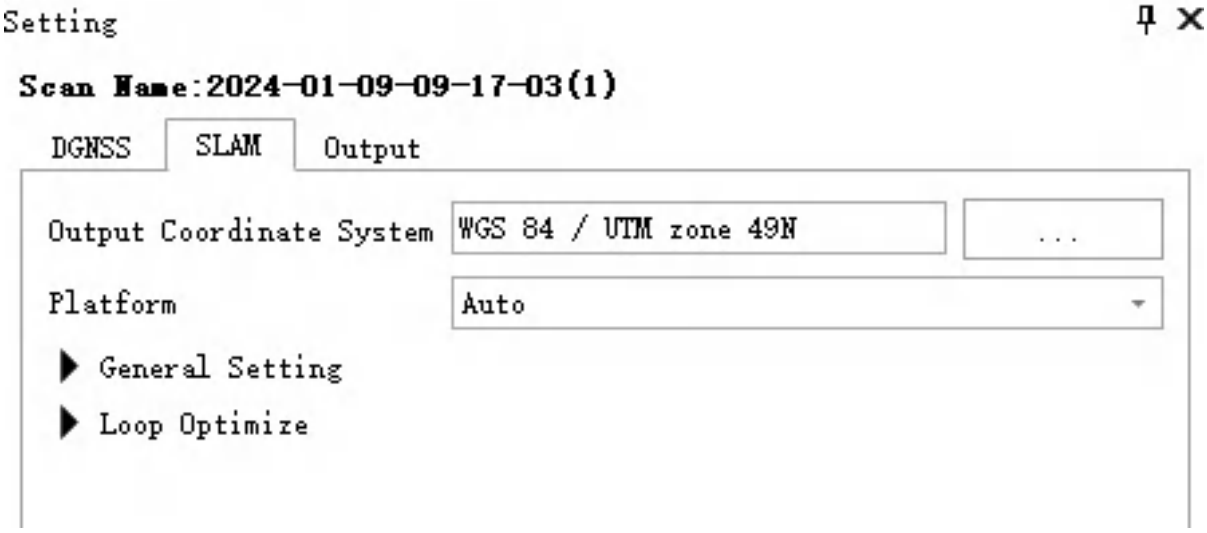


The original images consist of the original photos and the corresponding POS. The O1-LITE original has one fisheye lens, while the INSTA has two fisheye lens folders.





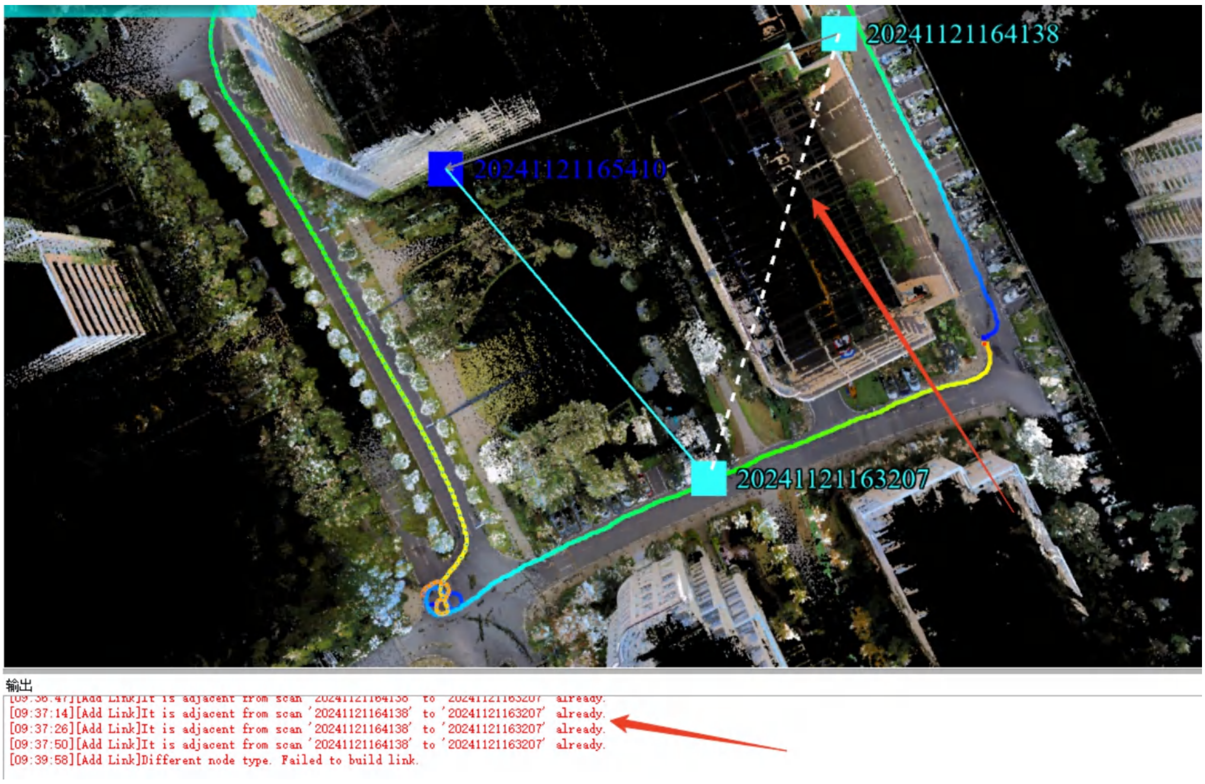
5.Fixed the bug where setting the coordinate system in the main interface was ineffective.



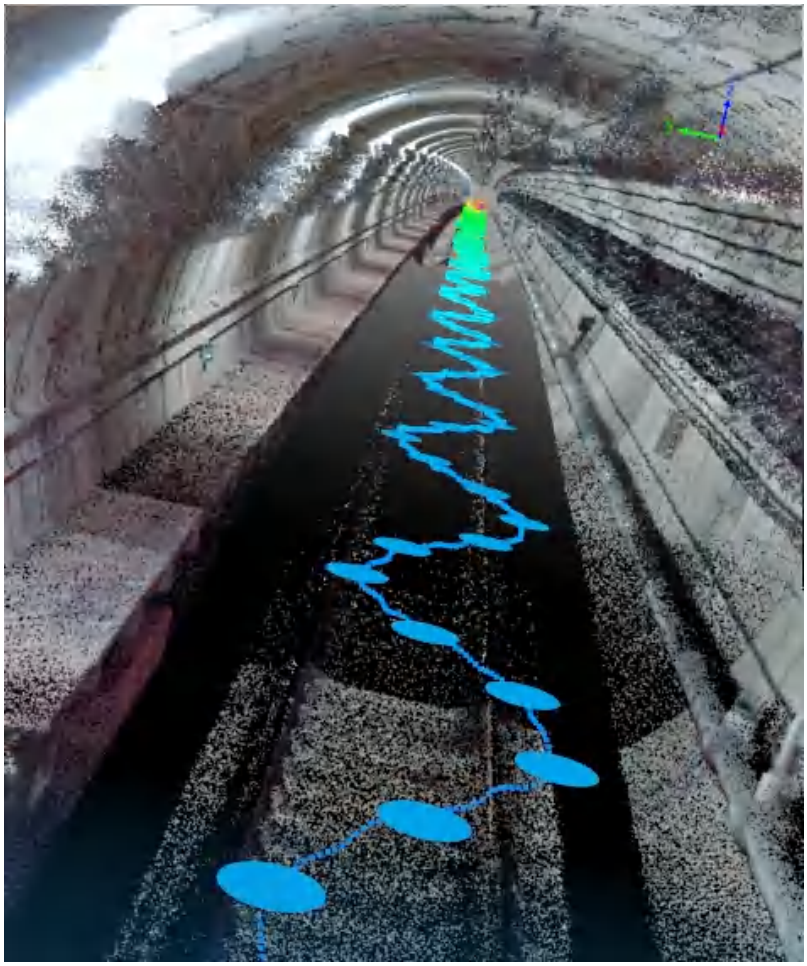
6.Optimized PPK log

```
(Single Base)Base station observation file path: H:\DATA\H300\20240824-PPK-wuhan\20240823AM\LB1U020212360035.24O
Base station ephemeris file path:
    H:\DATA\H300\20240824-PPK-wuhan\20240823AM\LB1U020212360035.24N
    H:\DATA\H300\20240824-PPK-wuhan\20240823AM\LB1U020212360035.24C
    H:\DATA\H300\20240824-PPK-wuhan\20240823AM\LB1U020212360035.24G
Rover file path: H:\DATA\H300\20240824-PPK-wuhan\2024-08-23-09-51-00.log
Rover RTK file path:
Rover ephemeris file path:
Base station location mode: 2 ---- From Base Header
Output elevation model: 0 ---- Ellipsoidal Height
Base file format: 2----Rinex
Rover file format: 0----Novatel Oem6
IMU file format: 0----Novatel(default)
System ---- All
Output time mode: 1 ---- UTC Time
-------------------------- Project settings (end) --------------------------
    <info> Enable IMU time offset compensation (time offset amount):0.000 ms),value from preset parameter
Extract base station file
    <info>:Base station RINEX version is identified as Ver.3.02
Extract rover file
    <info>:Statistics of Mobile Station Coverage by Base Stations(Mobile station duration:683.0 s, Mobile station coverage ratio:100.0 %, Missing proportion at the beginni
    <info>:baseline length(remote and base #0) = 0.181km
Navigation Process 1
    (Time statistics) Running time of this program<data extract>:   0.6 s
Navigation Process 2
    <info>:Base info1(Approxi):Longitude     16.57589(1 .504604413 deg),Latitude      6.80374  551889928 deg),Ellipsoidal height 76.794 m
    <info>:Base info2(Ant Delta):E 0.000, N 0.000, H 1.800 m
    <info>:Base Pos(info1+info2):Longitude   16.57589  .504604413 deg),Latitu      6.80374 .551889928 deg),Ellipsoidal height 78.594 m
    <info>:Base info3(PCV, not in Base Pos, but compensated in cal):
           NONE   (from <igs14.atx>)
           Antenna_Phase_Offset (L1):    0.000m    0.000m    0.000m
           ---------------------(L2):    0.000m    0.000m    0.000m
           ---------------------(L3):    0.000m    0.000m    0.000m
    <info>:Base info1(Approxi):Longitude         57589(      4604413 deg),Latitude      6.80374(      89928 deg),Ellipsoidal height 76.794 m
    <info>:Base info2(Ant Delta):E 0.000, N 0.000. H 1.800 m
    <info>:Base Pos(info1+info2):Longitude   ...7589(   4604413 deg),Latitude       30374       889928 deg),Ellipsoidal height 78.594 m
    <info>:Base info3(PCV, not in Base Pos, but compensated in cal):
           NONE   (from <igs14.atx>)
           Antenna_Phase_Offset (L1):    0.000m    0.000m    0.000m
           ---------------------(L2):    0.000m    0.000m    0.000m
           ---------------------(L3):    0.000m    0.000m    0.000m
    <info>:Signal quality score (0~100):100.0, the longest lost time is 0.0 seconds!
    (Time statistics) Running time of this program<data extract>:  49.6 s
    (Time statistics) Running time of this program<data extract>:   0.0 s
    (Time statistics) Running time of this program<data extract>:   0.0 s
    <info>:debug pos time form: utct.
    <info>:Extraction result: total(683points) expo(683points) Partial matching succeeded
    <info>:Result Quality:(1)Fix:100.00%  (2)Float:0.00%  (3)Single:0.00%  (4)others:0.00%
    <info>:Signal quality score (0~100):100.0, the longest lost time is 0.0 seconds!
Total running time:   50.3 s
Data processing succeeded!
```

7.During registering, there is a warning on connecting the start and end.

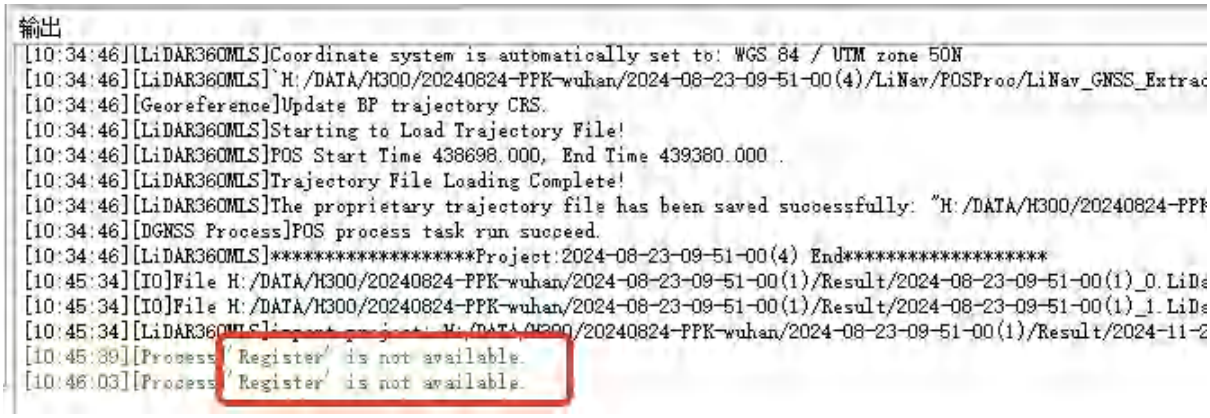


8.Fixed the issue of missing ground points in O1-LITE in rare cases.



9.Fixed blue background issues: On objects with a blue background, a gray phenomenon may occur.

10.In the SLAM interface, the added reference point cloud is prohibited from registration.



11.Fixed the issue of displaying Chinese characters for GCP control points

Point Pairs Registration

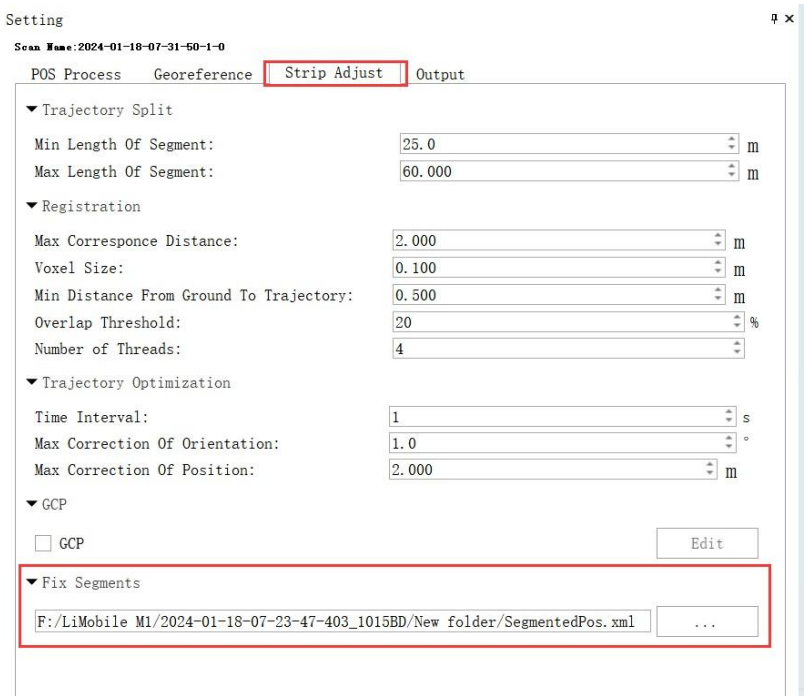
Point Size: 10

	Selected	ID	Name	E-[Reference]	N-[Reference]	Z-[Reference]	X-[Alignment]	Y-[Alignment]	Z-[Alignment]
1	☑	1	1月1日	82064.457	-15574.455	226.471	82064.457	-15574.456	226.471
2	☑	2	1月2日	82322.425	-15575.624	227.704	82322.426	-15575.624	227.704
3	☑	3	1月3日	82288.925	-15531.377	228.587	82288.924	-15531.377	228.587
4	☑	4	1月4日	82072.690	-15495.614	227.363	82072.690	-15495.613	227.363

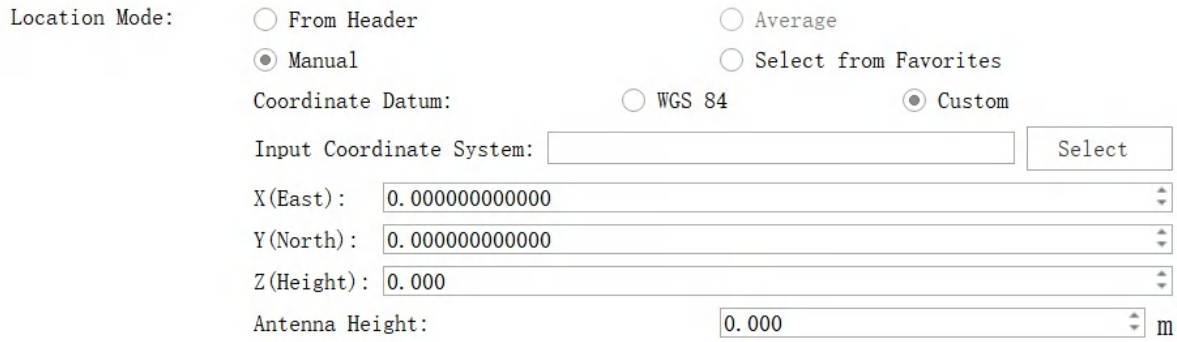
Geo Module

New Features

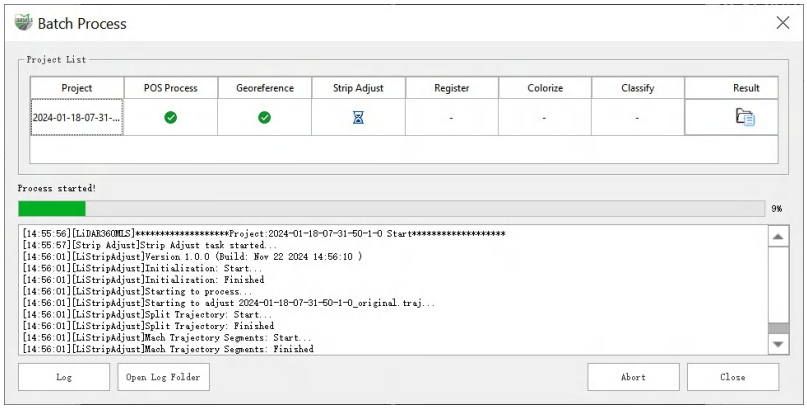
1.In the Strip Adjust setting interface, a new Fixed Segment parameter setting is added. The trajectory segment file corresponding to the current project is imported. When executing strip adjusting, the software will not process the point cloud data corresponding to the selected trajectory.



2.POS Process setting interface, base station location mode supports custom input of base station coordinates x, y, z values.



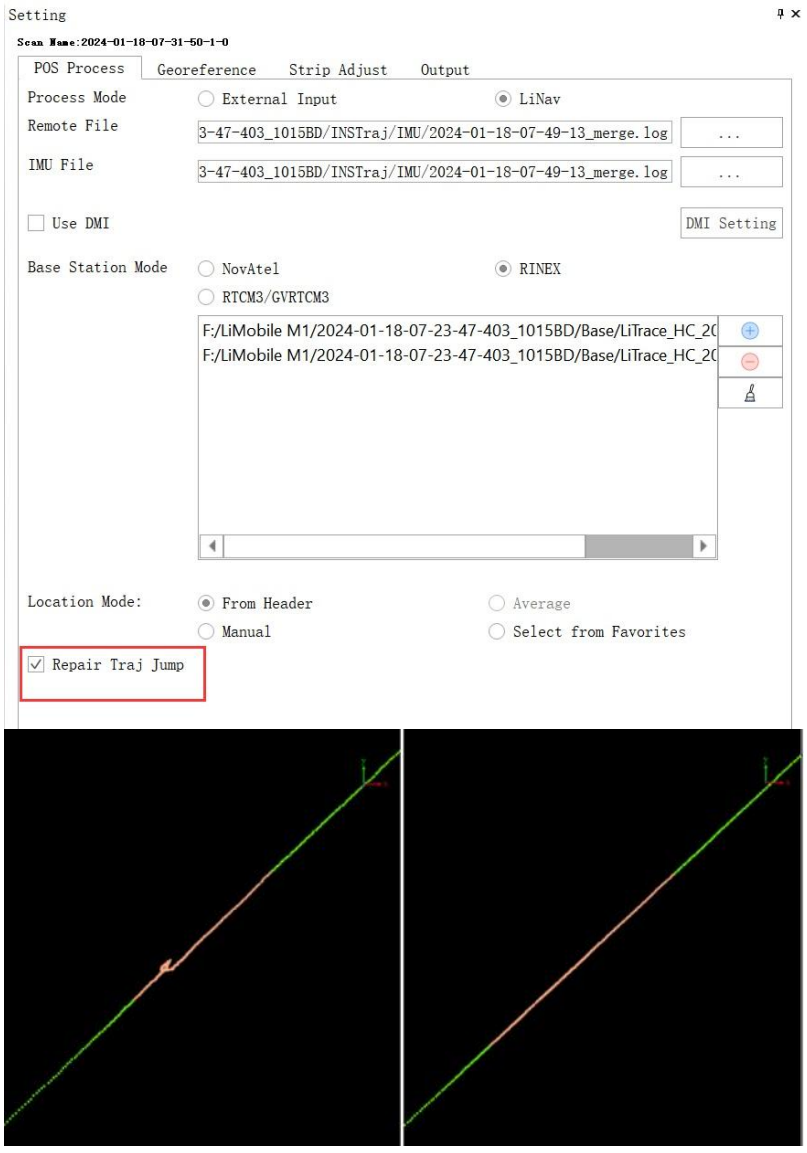
3.The Batch Process interface adds a Result button, output log display, and integrates the logs of each step. After clicking the Open Log Folder button, you can easily view the integrated log files.



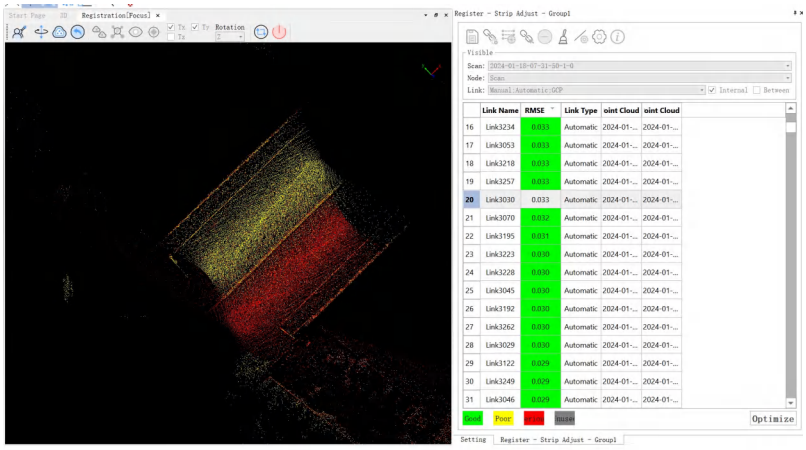
Enhancement

1.The progress display of the progress bar in the task list has been optimized.

2.The Repair Traj Jump function in POS process setting interface, supports both z-direction and xy-direction trajectory repair at the parking position.



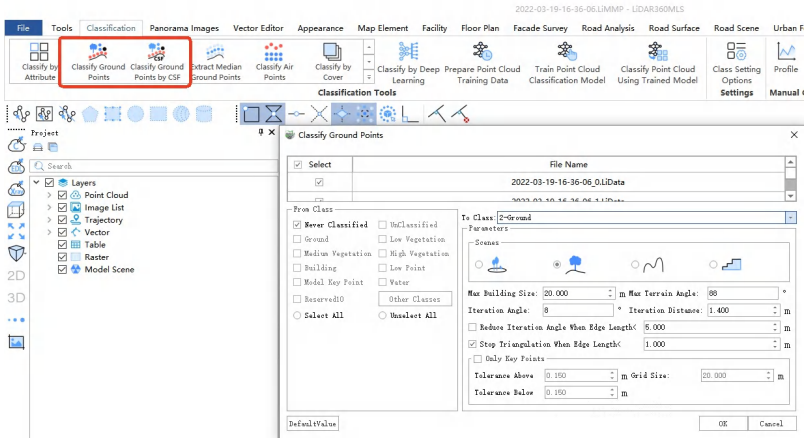
3.The Manual Registration function in the register step has a more friendly interactive mode. The Registration window will not be closed after clicking the Apply button, and the link can be switched freely.



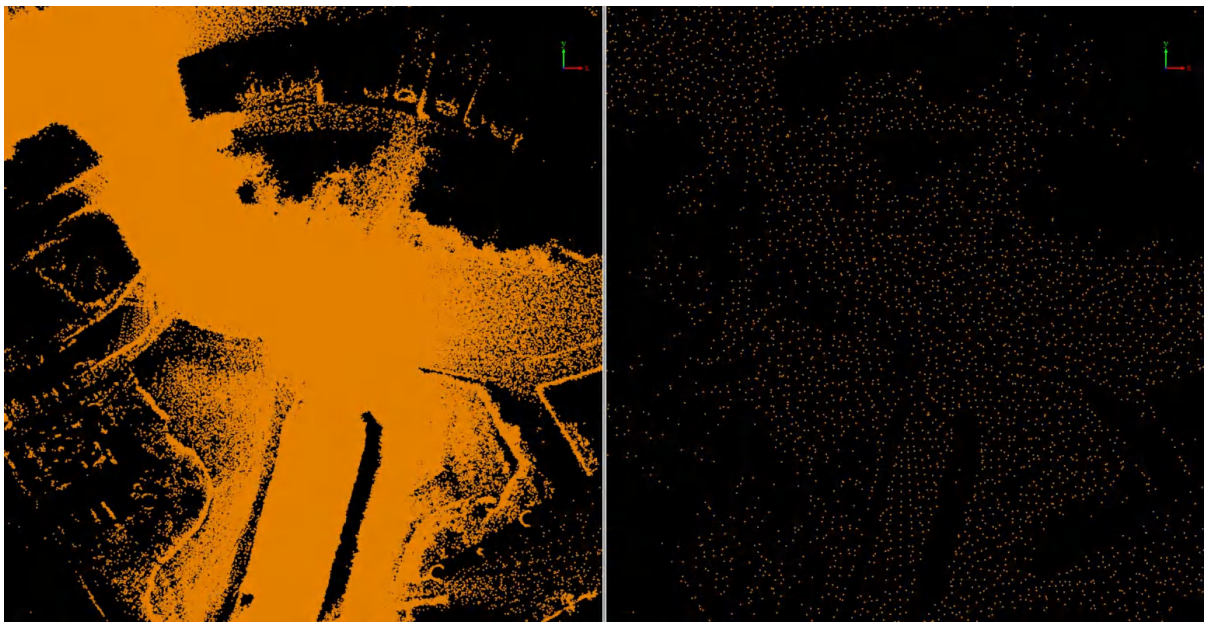
Framework

New Features

1.Added ground point classification, which is based on the triangular mesh filtering method. The original ground point classification function has been renamed to CSF ground point classification.

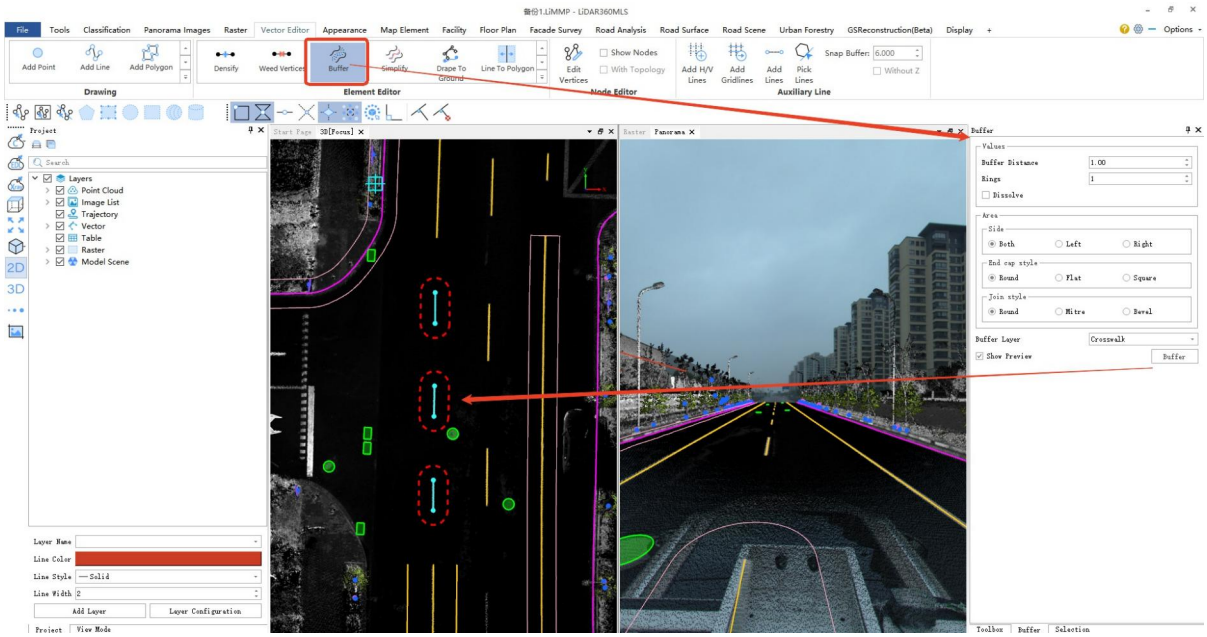


2.Added extract median ground point function.

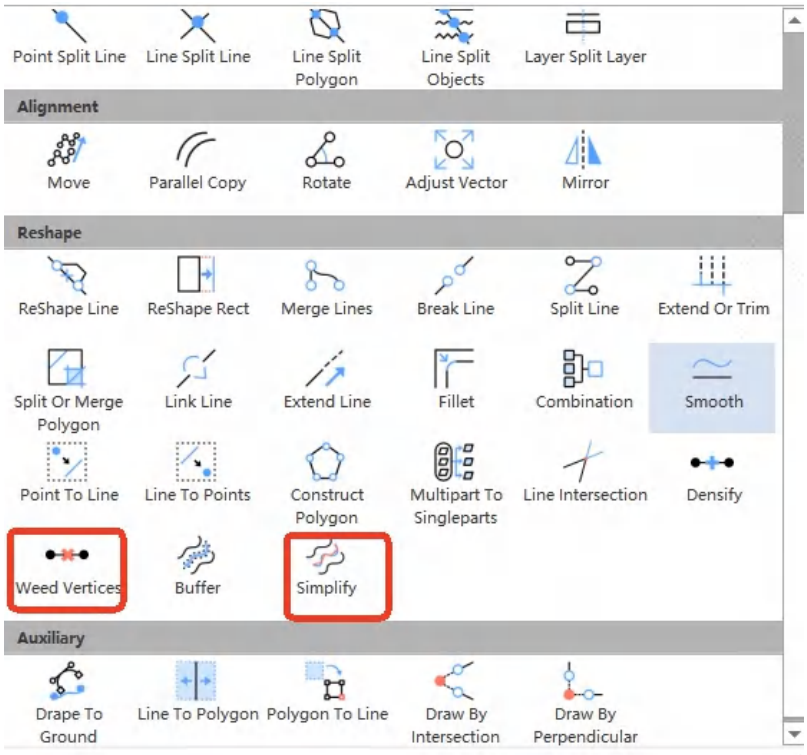


Left：Ground Point；Right：Median Ground Point

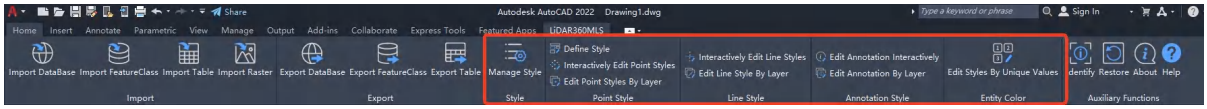
3.Added vector buffer function for interactive buffer analysis



4.Added simplify function to simplify the line object according to different algorithms, and rename the original weed function to weed vertices



5.CAD plug-in new management styles, define styles, edit styles and other related functions, support for point layers for symbolization, lines, annotation layer for style changes, and support for editing styles by unique values



6.Added Cut Overlap function, which can extract redundant data collected in multiple strip and reduce the amount of data

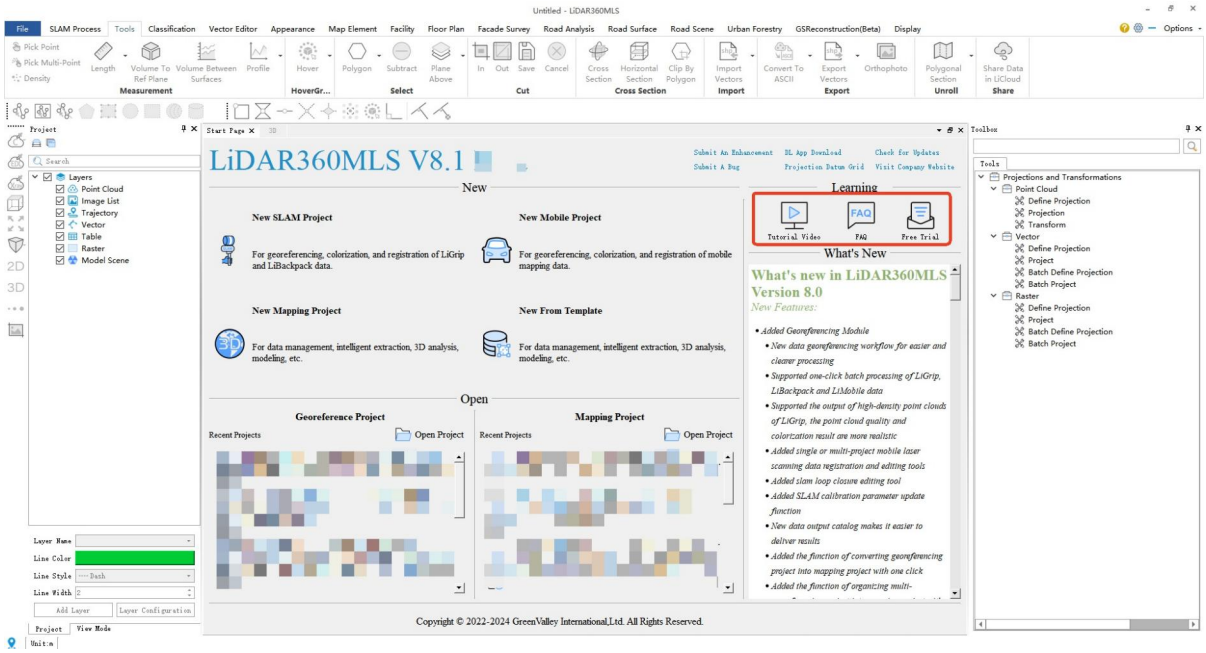
7.Added assign groups and detect moving objects function, which can be used with deep learning classification of data to quickly re-separate moving targets.

Enhancement

1.Mapping project Limmp file version upgrade to optimize file organization

> Note: Due to file version upgrade, V8.0 series software can not open V8.1 Limmp project, V8.1 software is compatible with all previous versions of the Limmp project generated!

2.Optimized the software start page, new learning resources, you can directly click to view the tutorial videos, FAQ and apply for a trial of the software.



3.Optimized the algorithm and interface of the volume measurement function.

4.Optimized vector-based profiles with support for classify editing.

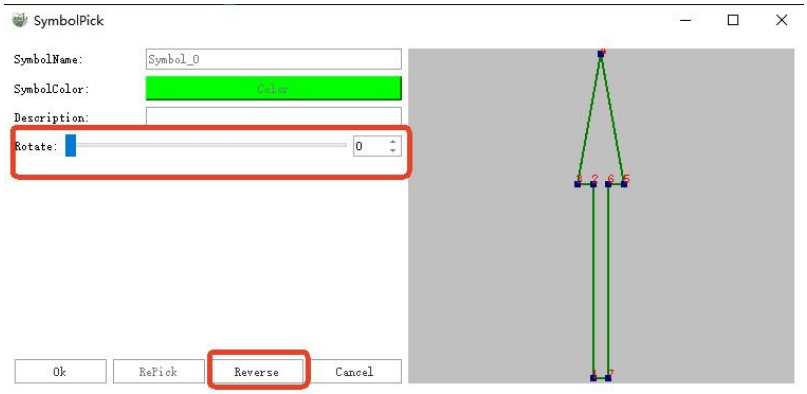
5.Optimized the function of calculating normal direction, support the calculation based on trajectory when there is trajectory.

6.Optimized the interaction of vector extend or trim function

Asset Extraction Module

Enhancement

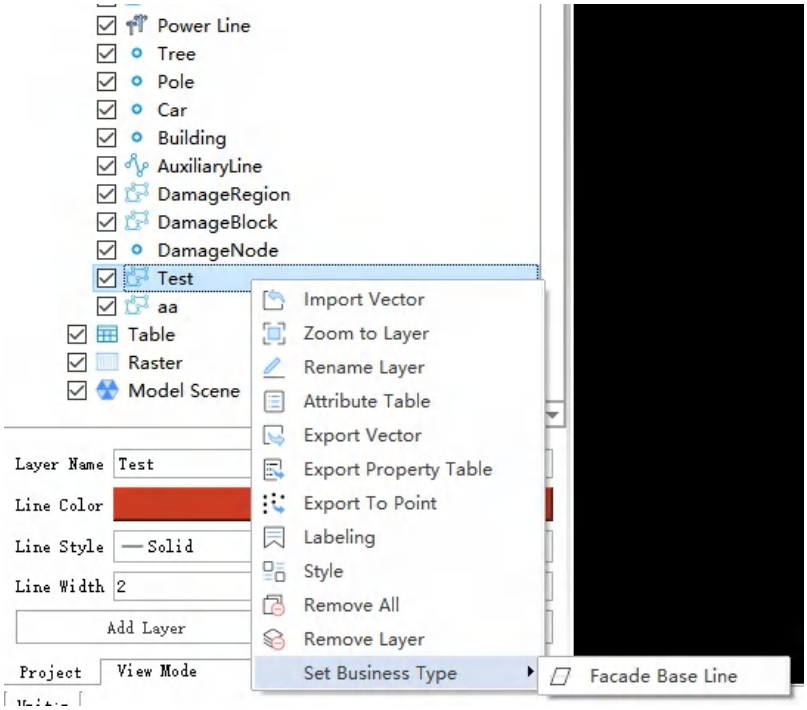
1.Optimized the function of importing shp templates for map element training, support to set the contents of shp fields as template names and adjust the direction and node order of templates



Architectural Drawings Module

New Features

1.Added the function of converting custom surface layer to "Faced Based Line" by right-clicking on the layer, which is convenient for the vector imported from outside to be used directly as the based line for subsequent drawing.

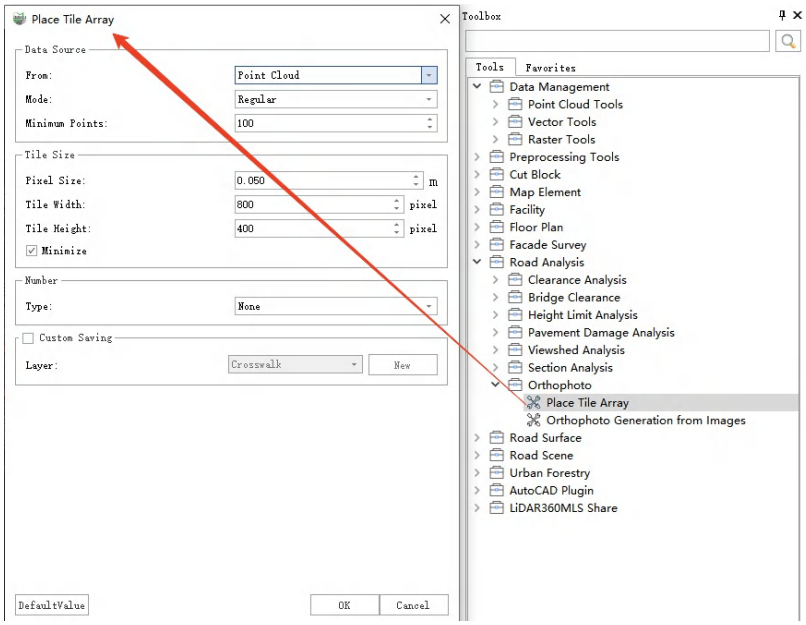


> Note: When the custom surface layer is already a faced based line layer, the right-click menu will not show this button

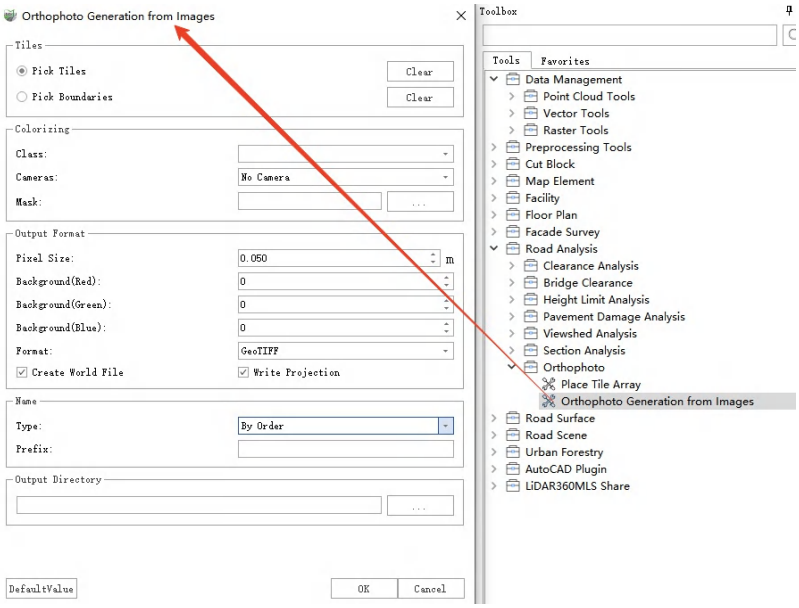
Road Condition Module

New Features

1.Added place tile array function, supporting multiple data tiling methods.



2.Added a feature to orthophoto generation from images, supporting the creation of orthophotos from point clouds derived from panoramic/planar images.



Enhancement

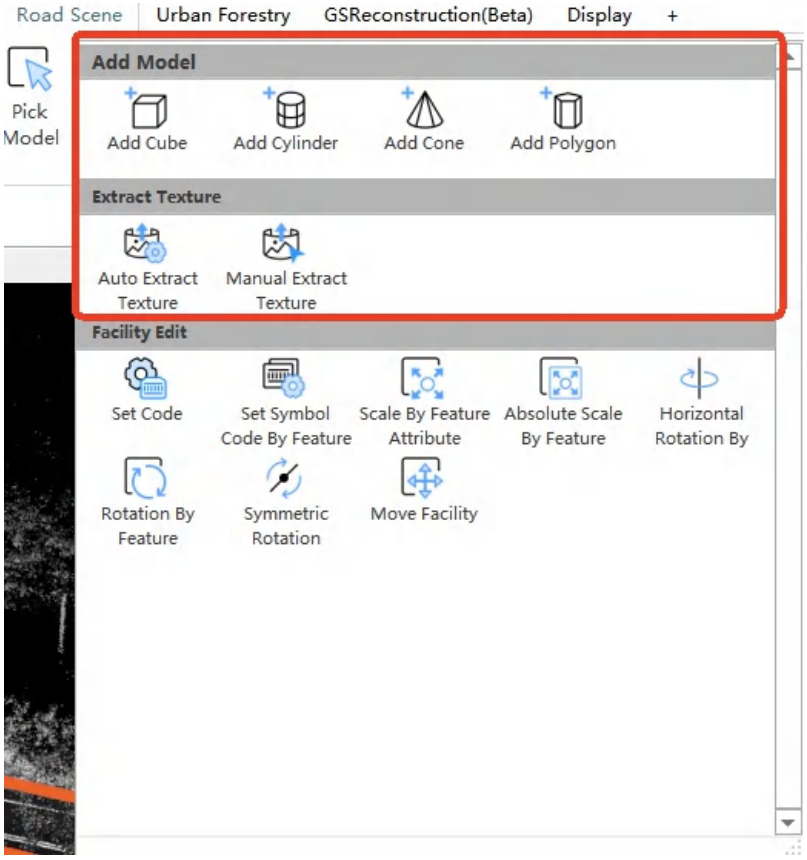
1.Optimized the clearance analysis function, supporting color modification of the clearance analysis surface and custom drawing of horizontal (shortcut key H) and vertical (shortcut key V) lines when drawing surfaces.

Road Scene Module

New Features

1.Added the functionality to manually add cube, cylinder, cone, and polygon solid models.

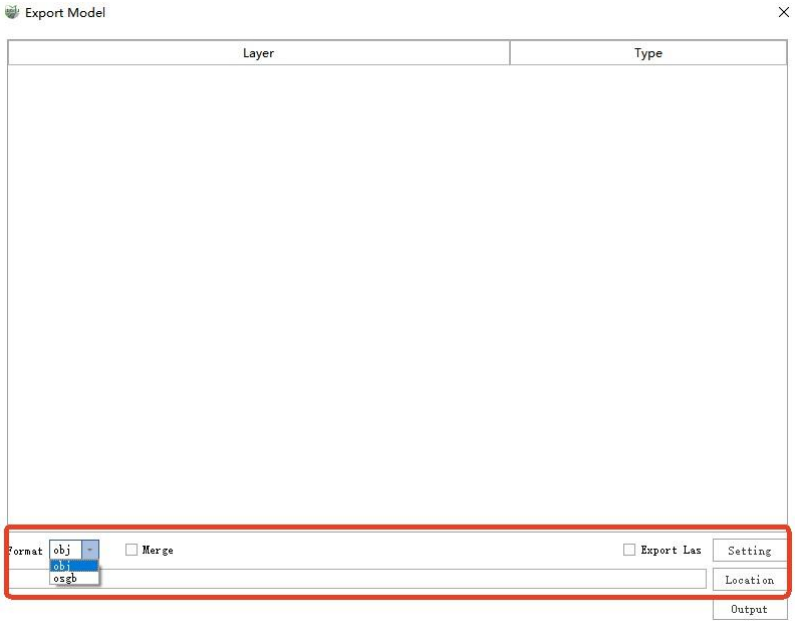
2.Added the functionality to automatically and manually extract textures from architectural models.



3.Added a feature to toggle light.

Enhancement

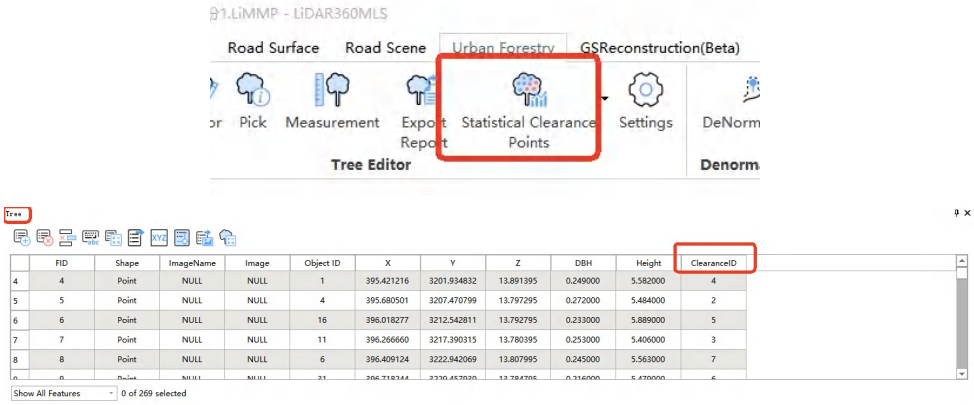
1.Optimized the function of exporting road models, added support for exporting in osgb format and merged obj format, and simultaneously supported exporting point clouds in LAS format with offsets.


Export Model
Layer
Type
Format
obj
obj
osgb
Merge
Export Las
Setting
Location
Output

Forestry Module

New Features

1.Added Statistical Clearance Points function, when the single tree point cloud has participated in the clearance analysis, the single tree clearance ID can be automatically counted into the single tree attribute table, which is convenient for dangerous point query.



LiDAR360MLS V8.0.0.5 Release Notes

1.Fixed the issue of failed save imglist error in GCP for colored data.

2.Fixed other bugs.

LiDAR360MLS V8.0.0.4 Release Notes

1.Fixed software language switching problems

2.SLAM Projection

2.1 Supported FLIGHTS SCAN HANDY datageneration.

2.2 Fixed the problem of point cloud color assignment confusion after GCP.

2.3 Fixed the problem of no color assignment when GCP is checked for color assignment and not for filtering.

3.Mobile Projection

3.1 Optimized the function oftrajectoryjumprepair.

3.2 Fixed the problem of exporting control point report ofstrip adjustment.

3.3 Fixed the problem that GCP function cannot import low version control point files.

3.4 Fixed the problem that the GCP function can't stab points when the point size is 0.

4.Mapping Projection

4.1 Fixed the problem that the strip adjustment of mapping project can not add the project.

4.2 Fixed the problem of abnormal flashback of cross-section analysis due to wrongclassificationselection.

4.3 Fixed the problem of abnormal results of panoramic measurement.

4.4 Fixed the problem that the downward growth parameter cannot be set as a negative value in the function of drop to ground.

4.5 Fixed other bugs.

LiDAR360MLS V8.0.0.3 Release Notes

1.SLAMProjection

1.1 Fixed the issue where Chinese paths cause program failures in the English system.

1.2 Fixed the issue of color assignment failure in vehicle and forestry modes.

1.3 Fixed the occasional accuracy loss issue in GCP mode.

1.4 Fixed the occasional calculation failure issue with backpack data.

1.5 Optimized photo extraction rules in forestry mode.

1.6 Fixedother GNSS-related bugs.

2.Mobile Projection

2.1 Fixed the issue withGCP during the stripadjustprocess.

2.2 Fixed other bugs

3.Mapping Projection

3.1 Optimized the unit display of the volume measurement function parameters interface.

3.2 Fixed the crash issue when importing external vectors for roadmarkingtraining.

3.3 Fixed the crash issue when checking the export vector checkbox.

3.4 Fixed the issue of missing attributes when importing geojson.

3.5 Fixed the issue where modifying the Z value was ineffective in absolute mode of vector movement.

3.6 Fixed the crash issue when calculating multiple times in the field calculator.

3.7 Fixed the crash issue when recalculating point clouds after trajectory jumps.

3.8 Fixed the language display issue on the software's initial activation page.

3.9 Fixed other bugs

LiDAR360MLS V8.0.0.2 Release Notes

1. Fixed the problem of mismatch between SLAM trajectory and GNSS trajectory caused by the GNSS synchronization problem in October of leap year.
2. Fixed the problem of anomalous splicing alignment caused by solving the project space.
3. Fixed the problem that CAD can not be opened after exporting DXF of elevation measurement module.
4. Fixed the problem of calculating the area of elevation polygon.
5. Fixed the problem of abnormal exit of road facility detection.
6. Fixed the problem of storing ecological landscape batch extraction results
7. Fixed the problem of occasional crashes when selecting .o and .p files for solving projects
8. Fixed the problem of abnormal flashback in passability analysis
9. Fixed the problem of special data normalization
10. Fixed the problem that version 1.4 las exported from old BP software cannot be imported.

LiDAR360MLS V8.0.0 Release Notes

Software version upgraded to 8.X

1.Added Georeferencing Module

1.1.New data georeferencing workflow for easier and clearer processing

1.2.Supported one-click batch processing of LiGrip, LiBackpack and LiMobile data

1.3.Supported the output of high-density point clouds of LiGrip, the point cloud quality and colorization result are more realistic

1.4.Added single or multi-project mobile laser scanning data registration and editing tools

1.5.Added slam loop closure editing tool

1.6.Added SLAM calibration parameter update function

1.7.New data output catalog makes it easier to deliver results

1.8.Added the function of converting georeferencing project into mapping project with one click

1.9.Added the function of organizing multi-georeferencing project into mapping project with one click

2.Added Road Scene Module

2.1.Added automatic road modeling function

2.2.Added automatic road facilities modeling function

2.3.Added model texture manager

2.4.Added pavement construction function

2.5.Added road facilities and building single-layer modeling function

2.6.Added road scene import and export

2.7.Added model symbol library import extension function

2.8.Added model selection function

2.9.Added model encoding settings function

2.10.Added element-based data model encoding function

2.11.Added element-based attribute scaling / absolute scaling model function

2.12.Added element-based rotation / horizontal rotation / relative rotation function

2.13.Added model movement and editing function

2.14.Added model export to third-party obj format function

3.Asset Extraction

3.1.Added template-based road sign training and inference function

3.2.Added North American road marking extraction model

3.3.Added intensity map generation function

3.4.Added average intensity calculation function

3.5.Added road facilities training function

3.6.Added road facilities detection with custom models

3.7.Added rectangular mode for individual editing

4.Road Analysis

4.1.Pavement Damage Analysis

4.1.1.Added AI-based road damage detection

4.1.2.Added interactive road damage editing

4.2.Road Section Analysis

4.2.1.Supported for road section analysis and parameter calculation

4.2.2.Added high-precision terrain generation based on cross-sectional key points

4.2.3.Added point cloud extraction along cross-section lines

4.2.4.Added export of cross-section parameters to vector format

4.3.Road Surface Analysis

4.3.1.Added point cloud-based DEM/DSM generation

4.3.2.Added TIN-based DEM/DSM generation

5.Urban Forestry

5.1.Added rectangular mode for individual tree editing, with transformations for range, angle, and position

5.2.Added individual tree point selection feature

5.3.Added table-based additional attribute assignment feature

5.4.Added batch processing for visual analysis

6.Platform

6.1.All functions supported units such as feet.

6.2.Profile

6.2.1.Added vector-based cross-section and longitudinal profile functionality

6.3.Toolbox - Data Management

6.3.1.Point Cloud Tools

6.3.1.1.Added point cloud registration tool

6.3.1.2.Added point cloud conversion to COPC

6.3.1.3.Added point cloud conversion to structured E57

6.3.1.4.Added point cloud conversion to PCD

6.3.1.5.Added unit definition function

6.3.1.6.Added projection surface elevation conversion function

6.3.1.7.Added transformation relationship calculation function

6.3.1.8.Added elevation jump function

6.3.1.9.Added elevation adjustment report function

6.3.1.10.Added assign color to points function

6.3.1.11.Added grid statistics function

6.3.1.12.Added image export in orbit format

6.3.2.Vector Tools

6.3.2.1.Added vector densify function

6.3.2.2.Added vector weed function

6.3.2.3.Added labeling to annotation conversion function

6.3.2.4.Added JSON to feature conversion function

6.3.2.5.Added feature to JSON conversion function

6.3.2.6.Added KML to feature conversion function

6.3.2.7.Added feature to KML conversion function

6.3.2.8.Added XY table to point conversion function

6.3.2.9.Added XY table to line conversion function

6.3.2.10.Added 3D ASCII file to feature class conversion function

6.3.2.11.Added feature class Z to ASCII conversion function

6.3.2.12.Added attribute-based feature to 3D conversion function

6.3.2.13.Added polygon to line conversion function

6.3.2.14.Added feature vertex to point conversion function

6.3.2.15.Added feature to point conversion function

6.3.2.16.Added feature to line conversion function

6.3.2.17.Added feature to polygon conversion function

6.3.2.18.Added feature to raster conversion function

6.3.2.19.Added point to raster conversion function

6.3.2.20.Added polygon to raster conversion function

6.3.2.21.Added polyline to raster conversion function

6.3.2.22.Added clipping function

6.3.2.23.Added splitting function

6.3.2.24.Added attribute-based splitting function

6.3.2.25.Added selection function

6.3.2.26.Added table filtering function

6.3.2.27.Added overlay analysis tools

6.3.2.28.Added count overlapping features function

6.3.2.29.Added erase function

6.3.2.30.Added identification function

6.3.2.31.Added intersection function

6.3.2.32.Added remove overlaps function

6.3.2.33.Added symmetrical difference function

6.3.2.34.Added union function

6.3.2.35.Added update function

6.3.2.36.Added proximity analysis tools

6.3.2.37.Added buffer function

6.3.2.38.Added graphic buffer function

6.3.2.39.Added multi-ring buffer function

6.3.2.40.Added projection and transformations tools

6.3.2.41.Added projection definition function

6.3.2.42.Added projection function

6.3.2.43.Added batch projection definition function

6.3.2.44.Added batch projection function

6.3.2.45.Added select by attributes function

6.3.2.46.Over 300 built-in functions expanded in the field calculator

6.3.2.47.Added new python scripting functionality

6.3.2.48.Added latitude and longitude coordinates function

6.3.3.Raster Tools

6.3.3.1.Added conversion tools

6.3.3.2.Added raster copy function

6.3.3.3.Added raster to ASCII conversion function

6.3.3.4.Added raster to point conversion function

6.3.3.5.Added raster to polyline conversion function

6.3.3.6.Added raster to polygon conversion function

6.3.3.7.Added projection and transformations tools

6.3.3.8.Added projection definition function

6.3.3.9.Added projection function

6.3.3.10.Added batch projection definition function

6.3.3.11.Added batch projection function

6.3.4.Panorama

6.3.4.1.Added label display function

6.3.4.2.Added 3D linkage function

6.3.4.3.Added control settings function for displaying point clouds, vectors, models, and trajectories in the panoramic view

6.3.5.Planar

6.3.5.1.Added label display function

6.3.5.2.Added 3d linkage function

6.3.5.3.Added control settings function for displaying point clouds, vectors, models, and trajectories in the planar view

6.3.6.Raster Image

6.3.6.1.Added raster window display settings

6.3.6.2.Added raster image measurement function

6.3.6.3.Added image labeling function

6.3.6.4.Added mask creation function

6.3.6.5.Added training image deep learning model function

6.3.6.6.Added target detection or segmentation function using trained models

6.3.6.7.Added 3d mapping function

6.3.7.Preprocessing

6.3.7.1.Added conversion of trajectories to vector function

6.3.8.AutoCAD Plugin

6.3.8.1.Added cad plugin, no format conversion required, directly opened files with attribute data

6.3.8.2.Supported attribute query function

6.3.8.3.Supported geographic database import and export function

6.3.8.4.Supported feature class import and export function

6.3.8.5.Supported raster import function

6.3.8.6.Supported table import and export function

6.3.9.LiDAR360MLS Share

6.3.9.1.Added results publishing function, allowing point clouds, images, and vector data to be published for viewing on the web

6.3.10.Display

6.3.10.1.Added window linkage function

6.3.10.2.Added rolling screen function

6.3.10.3.Added go to function

6.3.10.4.Added 3D mouse function

6.3.10.5.Added open log file function

LiDAR360MLS V7.2.2 Release Notes

1.Optimized the size of the zoom window of panorama and planar camera

2.Fixed the problem of EXIF export in point cloud without coordinate system

3.Fixed the problem of not displaying images in panorama and planar camera zoom window

4.Fixed a problem with drawing vectors in the image window

5.Fixed the problem of group authorization activation

LiDAR360MLS V7.2.1 Release Notes

1.Platform

1.1 Added support for importing TXT files via right-click on point layers

1.2 Added a secondary prompt for removal function via right-click on directory tree

1.3 Optimized efficiency issues with TXT/CSV import

1.4 Fixed issues with failed imports of third-party vector data

1.5 Fixed the problem of result file size increase in time-based extraction function

1.6 Fixed issues with importing multi-station E57 data

1.7 Fixed abnormal point selection in planar camera calibration

2.Slam Module

2.1 Added the slam's setting parameters information to LOG.TXT under slamprocess

2.2 Optimized the issue of color breakage when using time-lapse mode (using outdoor mode, color by disatnce)

2.3 Keep the output parameter of the forestry same with the general mode

2.4 Fixed the bug with black stripes on the colored pointcloud of some O1-LITE devices

2.5 Fixed the bug that the application on the login interface in the upper right corner of the software did not respond after clicking it

2.6 Fixed the bug that SLAM processing is stuck due to no data behind the IMU

2.7 Fixed the bug where O1 LITE runs in tunnel mode with immediate errors

2.8 Fixed the bug of incorrect point cloud when GCP function uses small coordinates

2.9 Fixed the bug that causes black stripes when using the H120 backpack

2.10 Fixed the bug that the memory crashes when the device is in a long period of static

3.Floor Plan Module

3.1 Optimized the category setting interface

3.2 Optimized category naming issues

4.Vector Editing

4.1 Optimized the interaction for reshape line

4.2 Optimized the interaction for moving vector

5.Road Analysis Module

5.1 Optimized IRI parameter calculation for road cross-sections

5.2 Optimized minimum parameter threshold for road damage

5.3 Fixed issue with exporting DXF for road cross-sections

5.4 Fixed problem with bridge height limit not displaying measurement values in profile window

5.5 Fixed crash issue with power line height limit

5.6 Fixed issue where custom range window was not displaying in clearance analysis

6.Urban Forestry Module

6.1 Added seed point extraction methods for circular and rectangular selections

6.2 Added the ability to import seed points via CSV

6.3 Optimized efficiency of large-scale data segmentation

6.4 Optimized efficiency of seed point updates

6.5 Optimized the ability to set parameters that do not update during individual tree parameter calculations

6.6 Fixed coordinate conversion issues with externally imported seed points

LiDAR360MLS V7.2.0 Release Notes

1.Supported for LiGrip and LiBackpack data processing.

2.Improved the success rate of SLAM calculation.

3.Enhanced the efficiency of SLAM calculation.

4.Ensured consistency between the data collection end and the post-processing end.

5.Optimized point cloud colorization

6.Added Floor Plan Module

7.Added automatic vectorization function for floor plan.

8.Added DXF export function for floor plan vectors.

9.Added one-click export function for blue print.

10.Supported intersecting and perpendicular line drawing models.

11.Supported line intersection、line merging、line breaking and moving.

12.Supported vertices editing.

13.Supported length,area,angle measurement.

14.Added point cloud polygonal section unrolling function.

15.Added point cloud curved section unrolling function.

16.Added point cloud curved section unrolling function.

17.Added X-ray rendering for point clouds.

18.Added enhanced surface rendering for point clouds.

19.Added Blur Plates and Faces function for panoramic/planar images

20.Added EXIF update function for panoramic/planar images.

21.Added brightness contrast export functionality for point clouds.

22.Added point cloud vector clipping functionality.

23.Added section move step adjustment settings.

24.Supported Traditional Chinese language pack

25.Added line intersection function

26.Added auto-close mode for right-click on line drawing function.

27.Added precision setting function for attribute field.

28.Added the function of extracting seed points globally.

29.Fixed the problem of losing DXF layer styles when exporting.

30.Fixed the failure of exporting vectors from point layers imported via TXT.

31.Optimized the function of railway track detection, support category filtering

32.Optimized power line detection function, support category filtering

33.Fixed the problem of exporting DXF layer name anomaly.

34.Optimized the calculation results of road longitudinal section parameters

35.Optimized road damage detection

36.Fixed other bugs

LiDAR360MLS V7.1.1 Release Notes

1.Optimized orthophoto density map export.

2.Optimized the import shp from table, supported direct import into points, lines and surfaces, and supported coordinate conversion.

3.Optimized track jump detection and repair function

4.Fixed the issue of manually editing the label settings in the profiling module.

5.Fixed AMD graphics card display issues.

6.Fixed imagelist update problem

7.Fixed track version reading problem

8.Fixed node editing crash problem.

9.Fixed other bugs in the software

LiDAR360MLS V7.1.0 Release Notes

1.Added point cloud brightness contrast setting function

2.Added screenshot position setting

3.Added project organization functionality

4.Added import point layers from tables

5.Added image file update functionality.

6.Added data transformation functionality.

7.Added detection and correction for lateral jumps in trajectories

8.Added railway detection feature.

9.Added functionality to add XYZ to the attribute table.

10.Added the ability to export point layers in CSV format.

11.Added layer styling with support for styling based on attributes.

12.Added functionality for individual tree orientation measurement.

13.Added functionality for exporting individual tree reports.

14.Optimized volume measurement algorithm, supporting category filtering and calculation based on selected vectors.

15.Fixed the issue of not being able to copy when exporting to DXF.

16.Optimized software interface, distinguishing between Chinese and English prompts.

17.Optimized feature reports, differentiating between Chinese and English reports.

18.Fixed the issue of updating imagery data in aerial strip stitching

19.Optimized control point correction function, supporting tie points on RGB information

20.Optimized point cloud coloring algorithm.

21.Optimized functionality for extracting linear features.

22.Optimized operations for functions like line-to-point conversion, point-to-line conversion, and surface construction.

23.Enhanced interactive operations for functions such as move, parallel copy, etc.

24.Expanded the line-to-point conversion function to support converting all nodes of a line vector to a point layer.

25.Optimized the algorithm and process for individual tree segmentation.

26.Enhanced the functionality for creating thematic maps in ecological landscape analysis, now supporting the independent generation of thematic maps for multiple files.

27.Fixed other bugs in the software

LiDAR360MLS V7.0.0 Release Notes

Software version upgraded to 7.X

1.Platform

1.1.Added point cloud data format batch conversion

1.2.Added configurable project templates

1.3.Added export functionality for geojson data format

1.4.Added orthophoto window, supporting display, measurement, and mapping of orthophotos.

1.5.Added multi-window display modes for point cloud data based on different attributes.

1.6.Added Addeditional attributes for trajectories.

1.7.Added a tool for selecting within surfaces.

1.8.Added volume measurement reporting.

1.9.Added volume measurement functionality for two phases.

1.10.Added point cloud reprocessing functionality.

1.11.Added functionality for Addeditional operations on point cloud attributes.

2.Added Point Cloud Tool Module Added SOR filtering.

2.1.Added noise filtering.

2.2.Added point cloud resampling functionality.

2.3.Added point cloud merging functionality.

2.4.Added functionality to normalize based on ground points.

2.5.Added de-normalization functionality.

2.6.Added point cloud normal calculation functionality.

2.7.Added GPS time conversion functionality.

2.8.Added projection definition functionality.

2.9.Added coordinate transformation functionality.

2.10.Added functionality to extract based on Addeditional attributes.

3.Preprocessing

3.1.Added colorization functionality for mobile laser scanning point clouds.

4.Point Cloud Classification and Extraction

4.1.Added classification pre-training models for indoor, outdoor, underground parking garagescene point cloud data obtained by SLAM device.

4.2.Added custom deep learning classification functionality.

4.3.Added plane detection

4.4.Added cylinder detection

4.5.Added classify by cover

4.6.Added region growing functionality.

5.Feature Extraction

5.1.Supported automatic extraction of all types of road markings

5.2.Supported merge to lane

5.3.Added Pole Seed Point Transformation Functionality.

5.4.Added Pole Seed Point Update Functionality.

5.5.Added Pole Seed Point Editing Functionality.

5.6.Added individual segmentation of cars and buildings functionality.

6.Vector Editing

6.1.Added image (panoramic, planar, orthophoto) based vector drawing and editing.

6.2.Added radius circle and diameter circle drawing function.

6.3.Added Bezier and B-spline curve drawing modes.

6.4.Added tracking drawing mode.

6.5.Added point-to-line conversion functionality.

6.6.Added line-to-point conversion functionality.

6.7.Added polygon-to-line conversion functionality.

6.8.Added line-to-polygon conversion functionality.

6.9.Added layer interrupt layer function

6.10.Added construction surface function

6.11.Added multi-part to single-part feature

6.12.Added topological edge editing

6.13.Added auxiliary line mode

6.14.Added field calculator.

6.15.Added object photo database storage .

6.16.Added attribute quality check tool.

6.17.Added geometry quality check tool.

7.Road Analysis

7.1.Added custom clearance analysis.

7.2.Added intersecting lines clearance analysis .

7.3.Added bridge height limit analysis and analysis report.

7.4.Added urban power distribution line analysis and analysis report .

7.5.Added road damage detection.

7.6.Added pavement condition index(PCI) calculation and report generation.

7.7.Added longitudinal section analysis.

7.8.Added model key point extraction.

7.9.Added road TIN generation.

7.10.Added vehicle collision simulation analysis .

8.Added Urban Forestry Module

8.1.Added seed point transformation functionality.

8.2.Added seed point update functionality.

8.3.Added seed point editing functionality.

8.4.Added tree height and diameter calculation based on seed points functionality.

8.5.Added measurement of urban tree parameters.

8.6.Added point cloud extraction based on TreeID.

8.7.Added measurement of parameters including DBH, Height, Crown Width, Crown Length, Crown Diameter, Crown Diameter SN, Crown Diameter EW ,CBH, Angle, Area, etc.

8.8.Added ecological landscape thematic map , supporting green viewing ratio(GVR), green volume, sky view factor(SVF), etc

8.9.Added generation of ecological landscape reports.

8.10.Added ecological landscape simulation analysis functionality.

9.Expanded orthophoto export based on intensity, height and RGB attributes

10.Optimized image and vector linkage setting

11.Fixed other bugs in the software

LiDAR360MLS V2.0.4 Release Notes

1.Optimized node editing function, Supported “Z value” and “move to” function for quick modification by picking Z

2.Supported various vector selection tools to change the line direction, and Optimized shortcut keys and tips

3.Supported Riegl MMS panoramic image file import and Optimized Orbit format

4.Supported for South-North crown diameter (SN), East-West crown diameter (EW), crown length (CL) and crown width (CW) in the calculation of individual tree parameters

5.Updated trajectory data

6.Fixed the problem of Ligeo and LiFuser-BP project opening failure

7.Fixed the problem of strip adjustment

8.Fixed the problem of invalid horizontal section dragging

9.Fixed other bugs in the software

LiDAR360MLS V2.0.3 Release Notes

1.New 2D mode

2.Optimized horizontal section function

3.Optimized edit vertices function

4.Optimized drape to ground function

5.Optimized vector objects and the corresponding panoramic image window linkage jumping

6.Fixed other bugs in the software

LiDAR360MLS V2.0.2 Release Notes

1.Added new project from template

2.Added import gpkg function

3.Added road damage report export function

4.Added clearance analysis report export function

5.Added DXF and KML import and export functions

6.Added dashed line batch drawing mode

7.Added custom template drawing method for cross walk and parking spot

8.Added line smoothing function

9.Supported lane line and road edge detection with shortcut keys to switch between semiautomatic and manual modes

10.Supported layer renaming

11.Supported vector objects and the corresponding panoramic image window linkage jumping

12.Fixed other bugs in the software

LiDAR360MLS V2.0.1 Release Notes

1.Optimized the field selection limit when import trajectory

2.Optimized the right click menu of the directory tree

3.Optimized the interface of vector export function

4.Optimized the emptying tips of the directory tree layers

5.Fixeded the problem of database storage

LiDAR360MLS V2.0.0 Release Notes

The software was renamed as LiDAR360MLS

In order to develop the software into a general terrestrial mobile laser scanning（MLS） point cloud processing software platform, the software name was replace with LiDAR360MLS.

1.New Construction

1.1.Supported drag and drop point cloud to create a new project, and save as to the specified path

1.2.Supported for importing original projects of LiFuser-BP and LiGeo

1.3.Supported point cloud and panoramic data entry software for more than 90% of mobile surveying devices on the market in formats such as Trimble MX9, Leica Pegasus, Orbit Pos, etc.

2.Database

2.1.Supported database for vector storage

2.2.Supported Addeding, deleting, modifying and querying layers in the database

3.Basic Platform

3.1.Added point cloud and vector projection conversion function

3.2.Supported point cloud format conversion

3.3.Supported basic tools such as point cloud selection and cropping

3.4.Supported vector data format conversion

3.5.Supported category display 0-255 categories

3.6.Supported cross-sectional export of color orthophotos

3.7.Supported for mobile measurement device travel direction arrows and default view settings

4.Vector Editing

4.1.The right-click menu has been added to the movement function, which Supported moving in a specified distance and direction

4.2.Added arbitrary polygon, circle selection, ball selection, random selection, three-dimensional selection, and cylinder selection

4.3.Added polygon combination and split functions

4.4.Added one-to-many interrupt function

5.Symbol library and labels

5.1.Added feature symbolization function

5.2.Supported domestic standard road facility symbol library

5.3.Supported for common symbol libraries

5.4.Supported symbol number storage

5.5.Supported to set symbols for collected point features

5.6.Supported for modification of symbols

5.7.Added annotation function

5.8.Supported for annotation layers

5.9.Supported for annotations to independent objects

5.10.Supported for annotations to object nodes and edges

5.11.Supported 3D, elevation annotation

5.12.Supported annotation style modification

5.13.Added layer label function

5.14.Supported all layer properties for label display

5.15.Configurable styles for labels

5.16.Facilitate operations such as attribute entry

5.17.New vector line object direction display

6.Road feature extraction module

6.1.Added the template extraction function of strip features

6.2.Added single segmentation function

6.3.Added individual editing function

6.4.Added single parameter extraction function

6.5.Added AI-based road surface marking recognition function

6.6.Added batch processing function for road surface marking recognition

6.7.Added AI-based batch extraction of road facilities

7.Point cloud classification

7.1.Supported point cloud deep learning classification

7.2.Supported polygon-based point cloud classification

7.3.Supported point cloud classification based on vector lines

7.4.Supported air noise classification

7.5.Supported subsurface classification

7.6.Supported above ground point classification

7.7.Supported for separating lows

7.8.Supported outlier classification

7.9.Supported proximity point classification

7.10.Supported ground point classification

7.11.Supported classification by attribute

7.12.Supported classify by cluster size

8.Point cloud extraction

8.1.Supported extraction by category

8.2.Supported extraction by elevation

8.3.Supported extraction by intensity

8.4.Supported to extract by GPS time

8.5.Supported extraction by echo times

9.Planar camera browsing measurement

9.1.Added planar camera data and point cloud overlay browsing display

9.2.Added planar camera measurement

9.3.Added planar camera calibration

9.4.Added planar camera undistort

10.Vehicle point cloud preprocessing

10.1.Supported trajectory segmentation

10.2.Supported laser boresight

10.3.Supported track quality check and repair

10.4.Added control point correction function

10.5.Added strip adjust

11.Road Analysis Module

11.1.Added road damage detection function

11.2.Added headroom analysis function

11.3.Added visual field analysis function

11.4.Added road section analysis function

11.5.Added road cross section parameter extraction function

LiDAR360MLS V1.2.0 Release Notes

1.Supported vertical vertical

2.Supported horizontal guide line drawing

3.Supported range line drawing

4.Supported taking a section based on a reference/extent line and making adjustments

5.Supported the drawing of the basic elements of the facade

6.Supported for construction line drawing

7.Supported array drawing

8.Supported translation and rotation

9.Supported for exporting DXF and orthophotos

10.Added shortcut key configuration function

11.Added layer manager function

12.Added combined display function

13.Added cross drawing and vertical drawing functions

14.Added capture module

15.Optimized the drawing method of rectangular traffic signs

LiDAR360MLS V1.1.0 Release Notes

1.Added data block module

1.1.Supported track segmentation

1.2.Supported area block node editing

1.3.Supported region block merging

1.4.Supported point cloud segmentation based on block

1.5.Supported area block selective display

1.6.Supported display and hide of area blocks and their labels

2.Added more road feature template symbol library

2.1.Supported all types of arrow reticle drawing

2.2.Supported for manhole covers, parking spaces, and drainage grate to be drawn according to templates

2.3.Supported traffic signs to be drawn according to templates

2.4.Supported Chinese and English character drawing

2.5.Supported nonmotor vehicle signs, no Uturn signs are drawn according to the template

3.Added template matching function

3.1.Supported automatic vectorization matching based on default templates

3.2.Supported custom feature templates and auto-vectorization or manual-vectorization

4.Added multi-type vector editing function

4.1.Supported for modifying the shape of line features

4.2.Supported tracing other vectors when drawing vectors

4.3.Supported point break line, line break line, line break surface

4.4.Supported vector stickers

5.Added attribute table calculation and predefined functions

5.1.Added attribute batch filling function

5.2.Added line feature length calculation function

5.3.Added character replacement function

6.Added node editing function

6.1.Supported for individually modifying node coordinate values

6.2.Supported batch modification of node Z value

7.Added the function of modifying the project

8.Added layer vector copy function

8.1.Supported copying of elements on the same layer

8.2.Supported vector geometry copy between different layers

First version release of LiStreet V1.0