SmartProcessing Lidar – v2.1.1

Release Notes

Contents

Version 2.1.1.0 3
Version 2.1.0.2 3
Bug fixes ***4***
Version 2.0.6.0 5
Version 2.0.4.0 6
Bug fixes ***9***
Known bugs ***9***
Version 2.0.3.0 10
Version 2.0.2.1 10
Bug fixes ***10***
Version 2.0.2.0 11
Version 2.0.1.2 11
Version 2.0.1.1 11

Version 2.0.1.0 12
New features ***12***
Strip Alignment Tool 12
Ground Control Point Tool 12
Bug fixes ***12***
Version 2.0.0.2 13
Bug fixes ***13***
Version 2.0.0.1 14
Improvements ***14***
Bug fixes ***14***
Version 2.0.0.0 15
New features ***15***
New interface 15
3D Panel 16
Profiles 17
NEW Boresight algorithm 18
Ground control points 19
Strip Alignment 19
Minor improvements ***21***
Bug fixes ***21***

Version 2.1.1.0

30/3/2023

SmartProcessing Lidar 2.1.1.0 introduces full support Lidar payloads based on the Livox AVIA Lidar sensors, such as the Scanfly MINI and the DJI Zenmuse L1.

It also includes several minor bug fixes and improvements.

Version 2.1.0.2

17/2/2023

SmartProcessing Lidar 2.1.0.3 introduces full support to Scanfly DUO in the different versions with SBG Quanta Extra and OxTS xOEM550 INS, and the FLIR Ladybug 5+ and iStar Pulsar+ cameras.

Boresight, strip alignment, and ground control point tools are now fully optimized for the dual Lidar architecture.

Gemalto EMS libraries are fully updated to version 8.53, with higher reliability of the license handling.

Furthermore, this version introduces two new tools: 3DT-SPL-BLUR, to automatically blur license plates and human faces from the images, and 3DT-SPL-SLAM, to improve the quality of the trajectory in GNSS denied conditions, using the LiDAR data.

3DT-SPL-BLUR

This new tool can be activated at the time the data from a panoramic camera are imported in SmartProcessing Lidar, through the option Blur license plates and faces available in the dialog window.

The process requires computing resources. It is possible to get advantage of the CUDA cores of Nvidia series 1000/2000/3000 GPU by installing separately the libraries SPLCudaPrivacyPlugin-1.0-windows-installer.exe.

With this first implementation, it is not possible reconstructing parts of the images where faces or plates were mistakenly recognized, or blurring manually parts not recognized.

3DT-SPL-SLAM

These feature, still in beta, is reserved to the SLAM early adopters who enrolled into the program.

In the current implementation, the SLAM can be used to improve the trajectory in those cases where the GNSS signal is diminished or absent: indoor, or outdoor, in tunnes or urban canyons.

The processing requires that a trajectory was previously made available.

SLAM has been fully tested with Heasi Lidar heads and Applanix INS.

SLAM includes different setting parameters, made available in different presets (CAR – Urban environment and countryside and Backpack – Nature trails, urban environment and indoor).

A faster mode is available to reduce processing time for a quick preview.

During the SLAM processing, a map of the Keypoints is available in the 3D viewer. If a point cloud was previously processed from the INS data, it si possible to compare the results in real time.

A report is also made available after the process, to highlight the differences between the SLAM and the INS solutions. An evaluation of the quality is also possible by analyzing the overlap and the keypoint used in the iterations.

For the best results:

- Lidar frequency must be 20 Hz. This is especially required for backpack data.
- The speed in car survey must be below 10 m/s, for the particular angled configuration of the Lidar head. Higher speed reduces the overlapping.
- The SLAM can be applied for a single line at each processing step. Ideally, the parts to be improved must be included between parts of the trajectory with good accuracy.
- Processing speed depends on the resources available in the processing computer.

Bug fixes

- Fixed mechanisms for which the deletion of survey lines could create unexpected results and crashes of the application.
- Orbit GT export reintroduced for all panoramic cameras.
- Fixed speed displayed in the diagrams where the sbet format did not include the wander angle
- Improved the interpolation methods for the trajectory.
- Corrected an issue creating crashes when an external LAS was imported.

Version 2.0.6.0

10/01/2023

SmartProcessing Lidar 2.0.6 introduces the support to the visualization of the **upper cube face** for the iStar Pulsar +, extending the FOV available in the 3D Viewer.

The version also includes various bug fixes (e.g. the speed calculation in the diagrams is now correct and the IDR works correctly also when the images had been previously extracted without parallax compensation) and improves the visualization with high PPI monitors

The features several improvements to the **Ground Control Point Tool,** the support to ADTi Surveyor

Version 2.0.4.0

19/10/2022

SmartProcessing Lidar 2.0.4.0 completes the introduction of the algorhithms to compensate for the rolling shutter effects in iStar Pulsar+ sensors, with the **Image Depth Remapping (IDR)** method.

The method makes it possible to increase the geometric accuracy in the spherical panoramas by remapping. the pixels of close and far objects using the depth information of the point cloud. The resulting images can then be better overlaid to the point clouds when displayed in the 3D Viewer or exported to third-party software.

Original stitched panoramic image

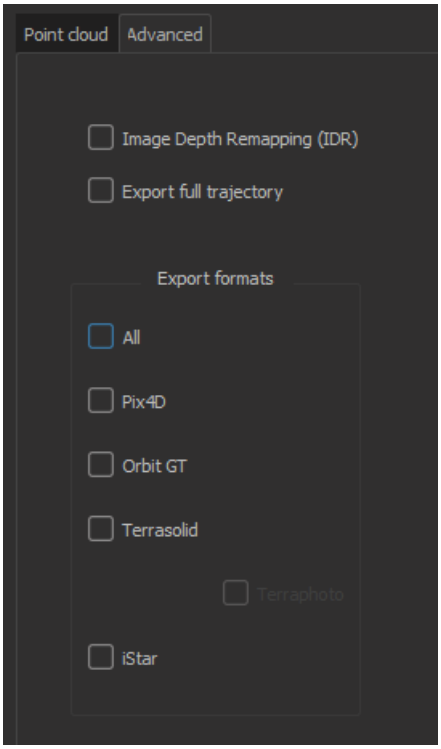
Remapped image, with rolling shutter compensated

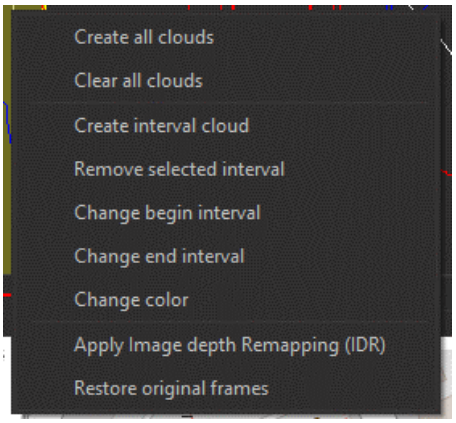
Remapped image with gaps reconstructed from nearby pixels

Some data, lacking in the remapped images, are reconstructed from the surrounding pixels. This algorithm may then cause artifacts in the final images. For documentation or displaying purposes, always prefer the original images.

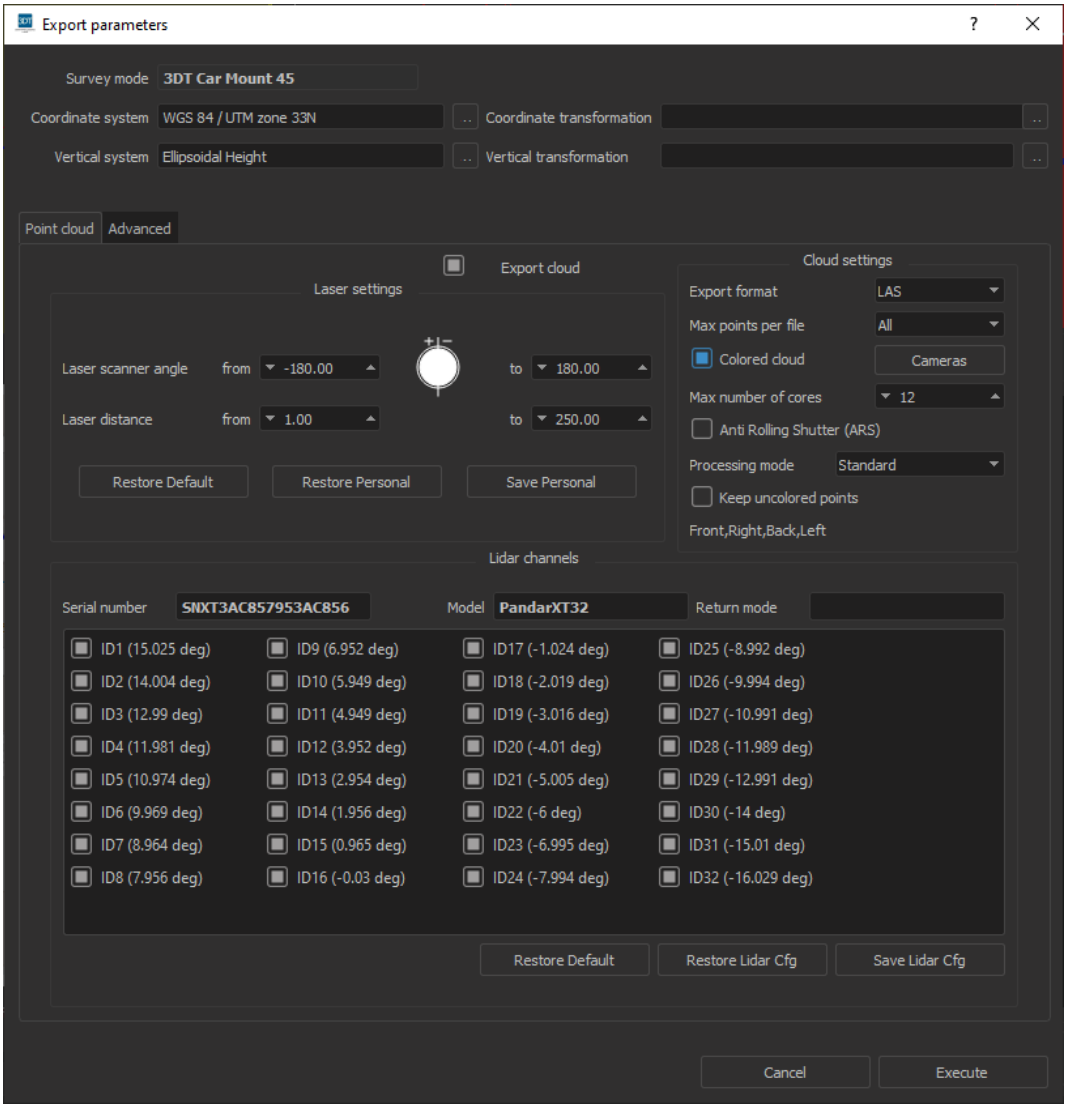
For the best results, the boresight calibration must be performed accurately before launching the process.

The feature is avaialble from the renamed Advanced tab in the Export window, or from the context menu associated to the selected line in the trajectory diagram or the processing data tree.





New export functions related to the colorization of the point cloud are available in the Export window.



The **Anti Rolling Shutter (ARS)** function is now a separate option, available for the datasets with iStar Pulsar+ only.

Furthermore, new processing modes are now available:

Standard: Default mode. Point color is determined by the closest, non-occluded camera; only the closest cameras are considered for coloring.

No occlusion (faster): With this mode, obstructions are not considered. Points in the foreground may be colored with data from other objects between the point and the camera position, making the process extremely fast. With this mode combined with the ARS option, it is possible to quickly assess the boresight calibration quality in the case of the use of an iStar Pulsar+.

Accurate (slower): With this mode, additional far cameras can be used to determine each point color. While the process is relatively slower compared to the standard mode, it allows for more valid colored points at large distance, such as the highest part of the buildings in case of a narrow road.

Pixel average (slowest): with this option, the RGB value of each point is calculated by averaging several unobstructed cameras. It gives a more equalized and smooth appearance of colors, but with a reduced overall sharpening. Processing requires an additional time (between 2 and 3 times longer than the accurate mode).

Bug fixes

- Removed the conflicts when different versions of SmartProcessing Lidar, featuring different versions of the geographic reference system handler were installed on the same computer.
- Improved support of UTF-16 characters in the folder names.
- Minor additional bug fixes.

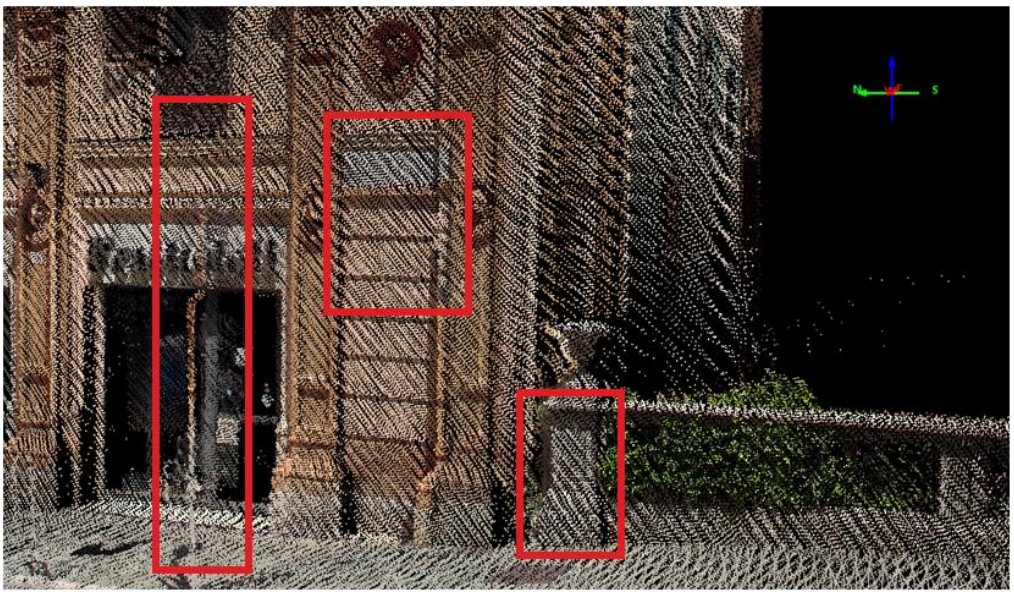
Known bugs

- Due to a conflict in the license management libraries, which are being updated, this version of the software requires that the SmartProcessing Lidar v2.0.0.0 was previously installed in the same computer to activate a new license.
- Software crashes when a not overlapping, trajectory file is mistakenly selected. In most part of cases this is due to the wrong T04 found in the Scanfly project folder: retrieve the correct T04 file in your device and try again.
- When SmartProcessing Lidar exits while processing the Lidar data for the first time in a project, the relative thread may remain active in the background, preventing the opening of a new session of the software. In this case, exit the previous session of SmartProcessign Lidar from the task manager and try again.

Version 2.0.3.0

28/09/2022

SmartProcessing Lidar 2.0.3.0 introduces a new **Anti Rolling Shutter (ARS)** to compensate for the rolling shutter effect in the iStar Pulsar+ sensors. The method keeps into account the actual time each line of each sensor has been actually shot with a millisecond accuracy and uses this information to apply the correct RGB value to the point cloud. Artifacts like those seen in the image below are now removed.



This version also integrates an update of the **Geographic Reference System** handler, which now supports **local grid shift** for rigorous **2D and 3D transformations**.

Version 2.0.2.1

09/08/2022

SmartProcessing Lidar 2.0.2.1 introduces the possibility of changing the color of the line selected for a better visualization and discrimination in the 3D panel views.

This version also improves the **synchronization** between the panoramas acquired with the **iStar Pulsar** plus camera and the trajectory.

Bug fixes

- Fixed an issue preventing the correct boresight calibration of multi-camera devices.
- The app no longer gets stuck if a project folder is not selected at the start.
- Fixed an issue preventing the availability of the ground truth mode when strips did not overlap each other.

Version 2.0.2.0

11/08/2022

SmartProcessing Lidar 2.0.2 introduces full support to **Scanfly LITEX** and to the images generated with the **Micasense Altum-PT** multispectral camera.

It also solves a minor bug related to the 3D viewer.

Version 2.0.1.2

20/07/2022

SmartProcessing Lidar 2.0.1.2 solves a series of minor bug and introduces optimations to the Strip Alignment and Boresight procedures. Also, the wrong labels in the **3D Viewer** have been removed or fixed.

Version 2.0.1.1

14/07/2022

SmartProcessing Lidar 2.0.1.1 solves a bug that prevented in some cases considering the correct **camera boresight calibration** while exporting for **Orbit GT**.

Version 2.0.1.0

07/07/2022

SmartProcessing Lidar 2.0.1 features several improvements to the **Ground Control Point Tool,** the support to ADTi Surveyor camera series and minor improvements and bug fix..

- **Strip Alignment improvements:**
  - Automatic selection of strips based on INS accuracy
  - Optimization can now run on all strips – no ground truth is needed!
  - New, improved **report**, with active **graphs**, more statistic and **orthoprojected images**
  - Speed optimization through multithreading, with very fast execution on multicore CPUs
- **Support to external .LAS files**:
  - External Las can be imported for visualization and line profiles
  - LAS coordinate transformation from any source system to the internal one
  - External LAS can be used as a **reference for strip alignment**
- **New Surveyor Lite 24 S camera integratio**n
- **Upgraded Sentinel runtime to v8.31.123608.1**
- **Improved tools for camera frame shift identification**

New features

Strip Alignment Tool

The **Strip Alignment tool** can now adjust the survey lines with an algorhithm based on statistical considerations on the accuracy of the point cloud, making the selection of a ground truth optional. At the same time, importing an external LAS file as defined ground truth for the adjustment is now possible. We also further improved the report, with active graphs, more statistics and ortho images to visualize the correction applied. Everything is also much faster, thanks to the extension of the multithreading in the optimization processes which improves the execution on multicore CPUs.

Ground Control Point Tool

The **Ground Control Points tool** now features a more efficient way to associate the ground control points to the same feature seen in multiple point clouds

Bug fixes

- Fixed export on some geodetic and geocentric coordinate systems
- Progress bar and fixes for Automatic Boresight
- Updated handling of Basler cameras

Version 2.0.0.2

17/05/2022

SmartProcessing Lidar 2.0.0.2 solves a bug.

Bug fixes

- Fixed problem with horizontal and vertical datum change in cloud export

Version 2.0.0.1

21/04/2022

SmartProcessing Lidar 2.0.0.1 introduces various improvements and bug fixes.

Improvements

- The selection of the first image of the dataset can now be changed in the project tree, without reimporting the project.
- Removed the lag when switching to a different image position in the preview window. The issue occurred especially with large datasets featuring panoramic images.
- The panoramic images are now extracted correctly in tunnels or other environments with bad or denied GNSS conditions.

Bug fixes

- Wrong handling of the internal id on long strips
- Fix return number while reading pcap files
- Other minor bugs

Version 2.0.0.0

31/03/2022

SmartProcessing Lidar 2.0 is focused on giving a more user-friendly experience:

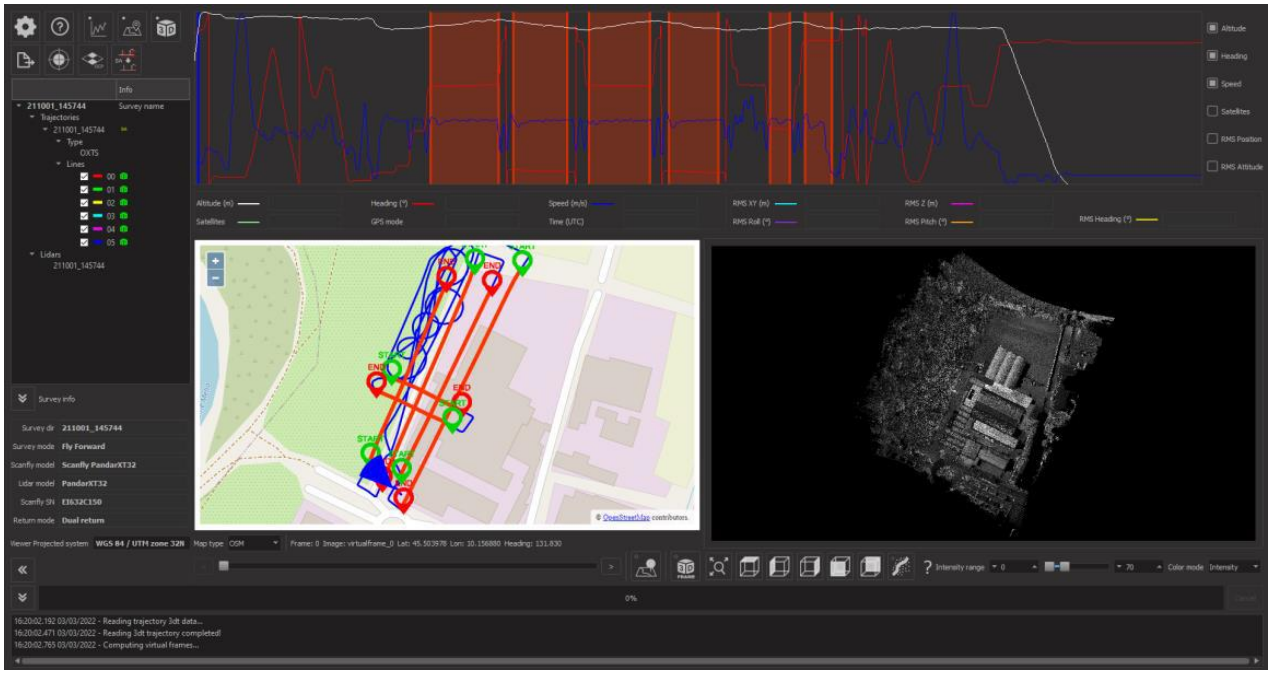
- **New interface**
  - Context menus
  - Collapsable areas
  - Lines **clouds visualization**
  - **Profile** viewer
- **Faster than ever**: all processes have been optimized
- New tools for enhancing the point cloud quality!
  - **New boresight algorithm**
  - **Ground Control Points**
  - **Strip Alignment**

Furthermore, this release also includes minor fixes and improvements.

New features

New interface

This new version of the SmartProcessing Lidar makes a whole series of operations more accessible by adding many features not present in version 1.3.



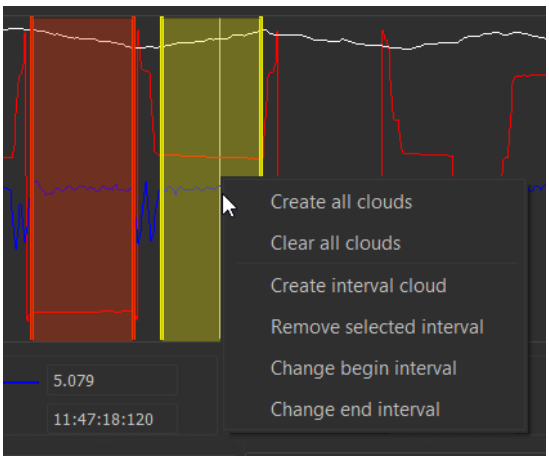
On the top part, we have graphs showing the trajectory data (altitude, heading, speed and satellites), while the bottom part simultaneously displays all relevant information on a map view, and in the new 3D preview of the lines point cloud.

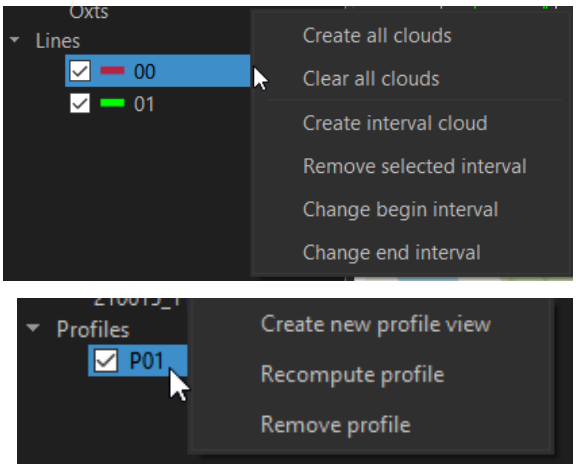
At the bottom, there is a log section and on the left side there is a new control panel composed of three main areas:

- Operational buttons: buttons for various user operations on the application or the survey data.
- Data processing tree: lists the different survey elements, organized in a tree structure.
- Survey information: contains principal survey info.

These two sections can be collapsed and the user can decide the visibility of the three main panels (graphs, map and 3D).

New contextual menus appear upon a right-click on specific objects in the Processing's data tree and the graphics area.



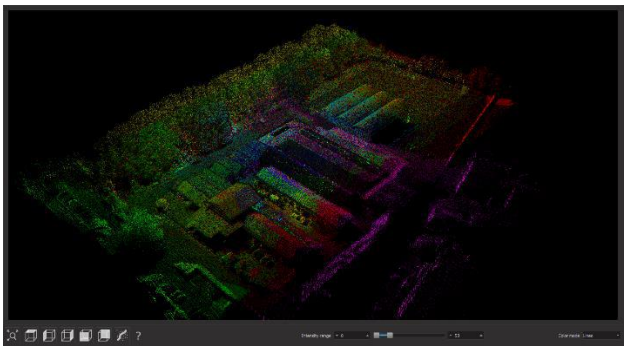


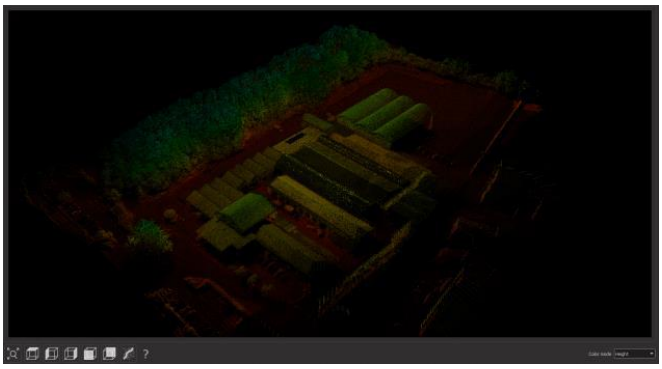
3D Panel

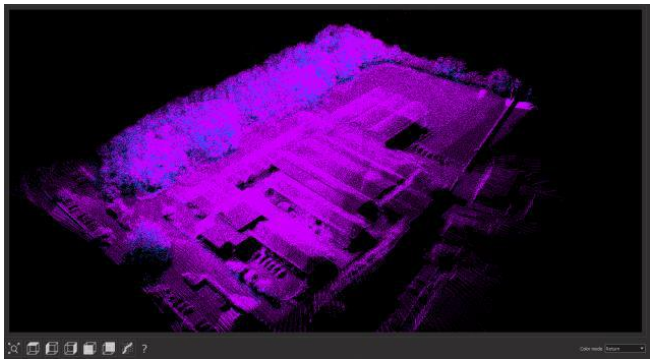
The 3D panel is an area containing a 3D viewer for point clouds extracted from trajectory lines and other additional controls.

There are different Color mode options for cloud visualization:

- **Intensity**: each point in the cloud will be colored by its lidar intensity value. The user can also change the intensity range increasing the contrast and thus increasing the cloud visibility.
- **Lines**: Each point in the cloud is drawn according to the color of the line to which it belongs, modulated by its intensity value.
- **Height**: the color of each point is defined by its relative altitude.
- **Return**: the color of each point in the cloud is defined by its lidar return index.

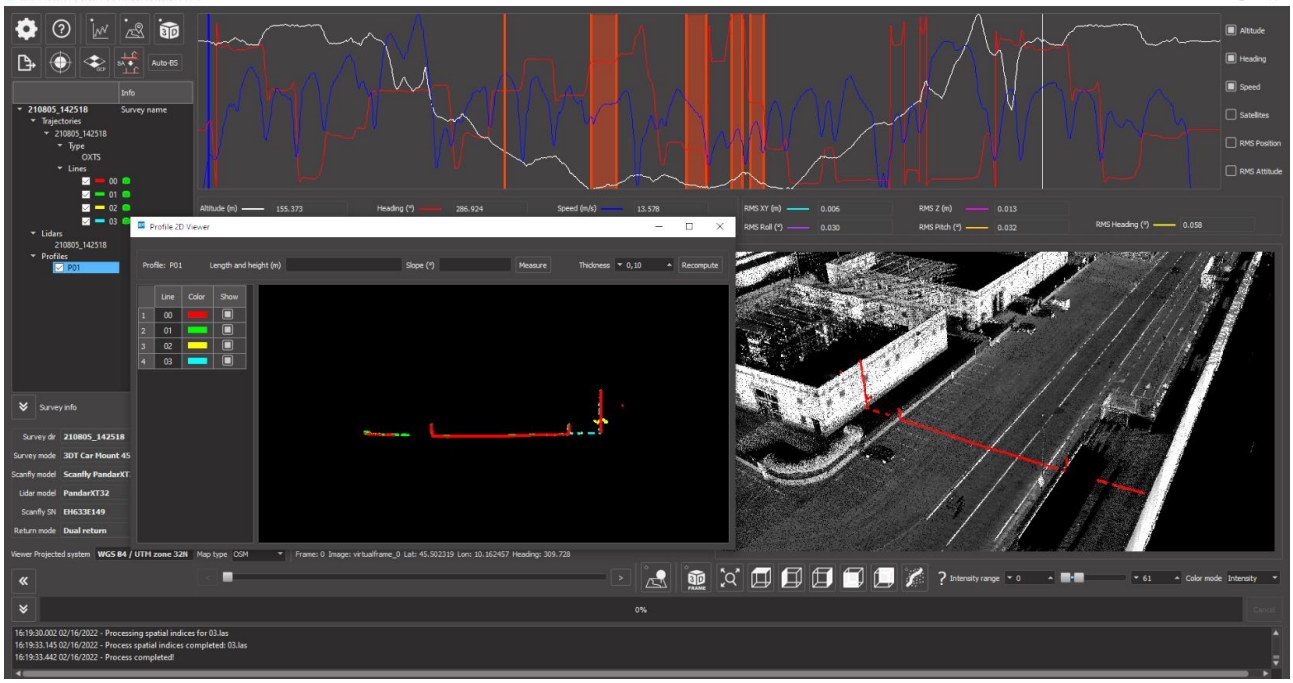




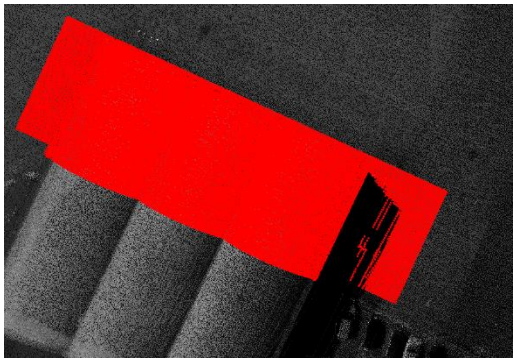


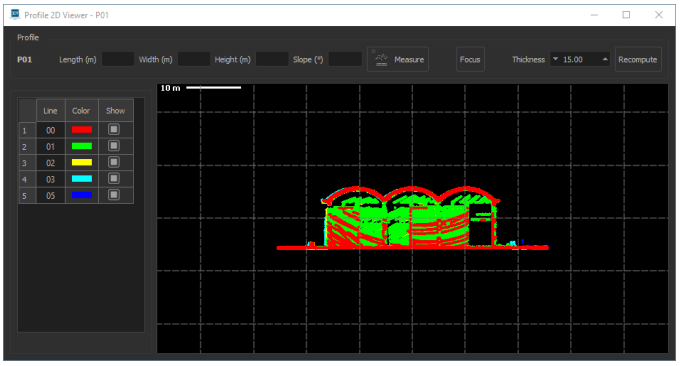
Profiles

A profile is defined in the 3D panel by selecting two points in the clouds: their in-plane (xy) coordinates are used to extract a vertical plane subsection of the cloud.



Each profile has a thickness parameter, which can be specified in the 2D viewer of the profile. Multiple profiles can be selected simultaneously, and each profile can have a different thickness.

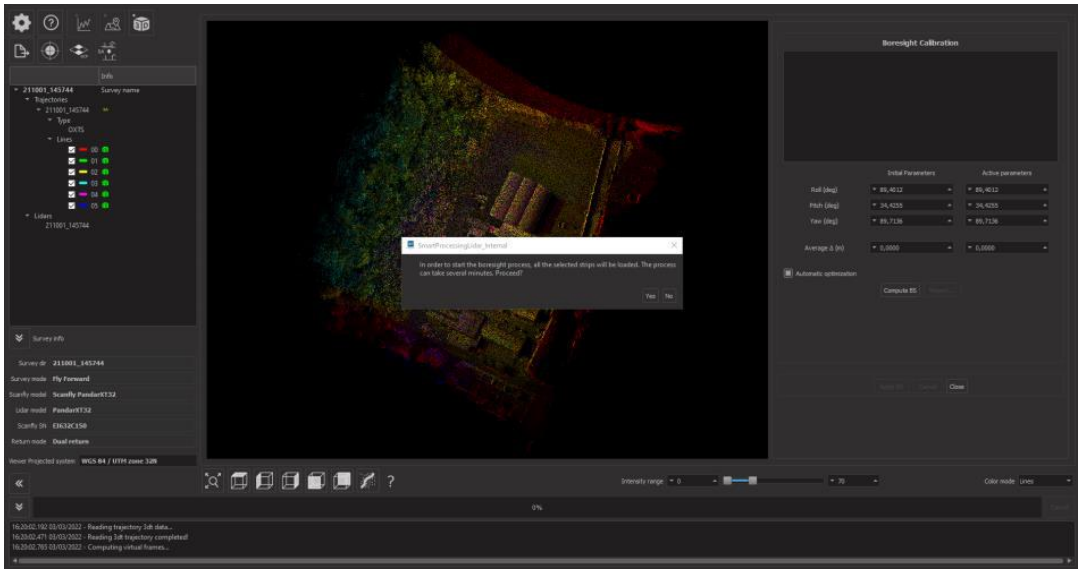




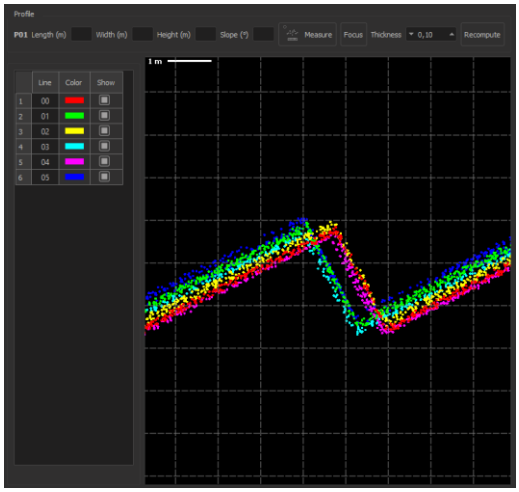
NEW Boresight algorithm

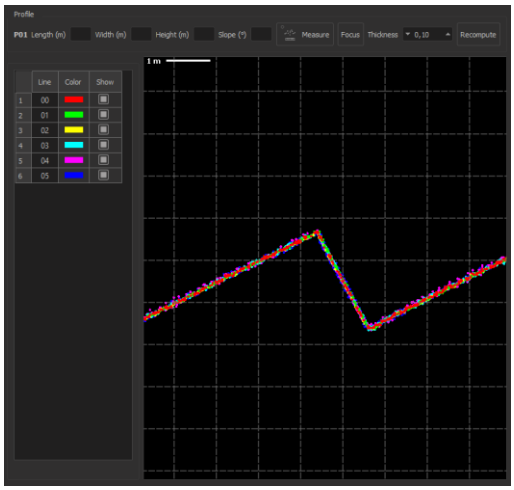
SmartProcessingLidars provides a new module for the Lidar Boresight Calibration. This new algorithm:

- is fully automatic → there is no need for the user to select points manually
- can work on several lines → there is no longer the constraint of working with only two lines
- it is extremely faster



At the end of the process a report is generated with the parameters of the initial and final situation, but thanks to the use of the profiles it is possible to immediately indicate the result obtained.

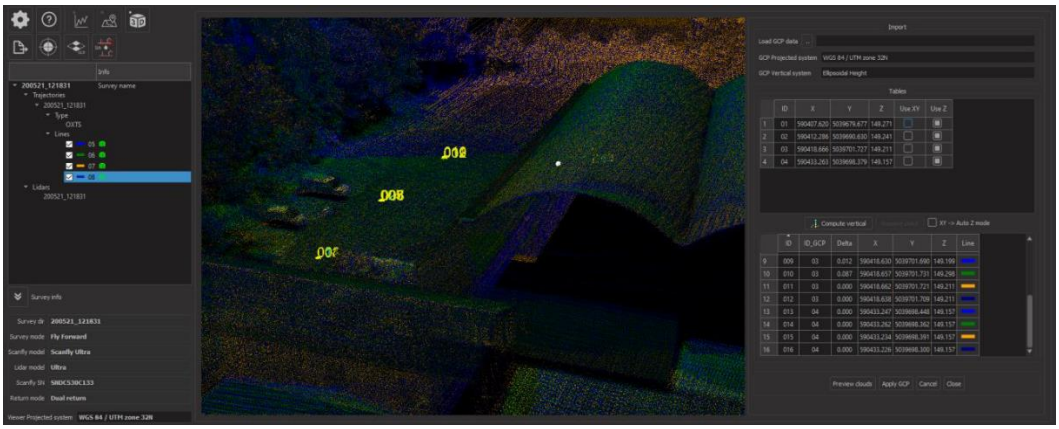




Ground control points

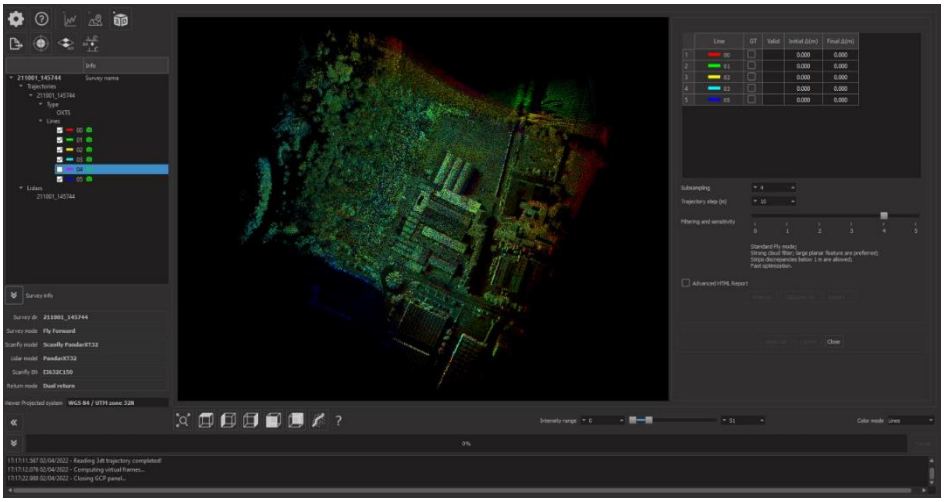
The purpose of the new GCP correction module in SmartProcessingLidar is to improve the absolute accuracy of the geo-referencing by matching cloud points with corresponding GCPs. This process is particularly useful when the INS system is not providing reliable position information.

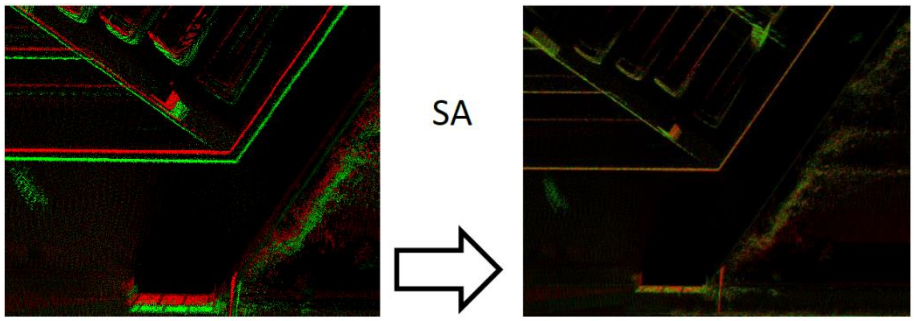
While the correction by GCP is often carried out on georeferenced data, SPL exploits the knowledge of the INS and the Lidar raw data to directly modify the trajectory path.



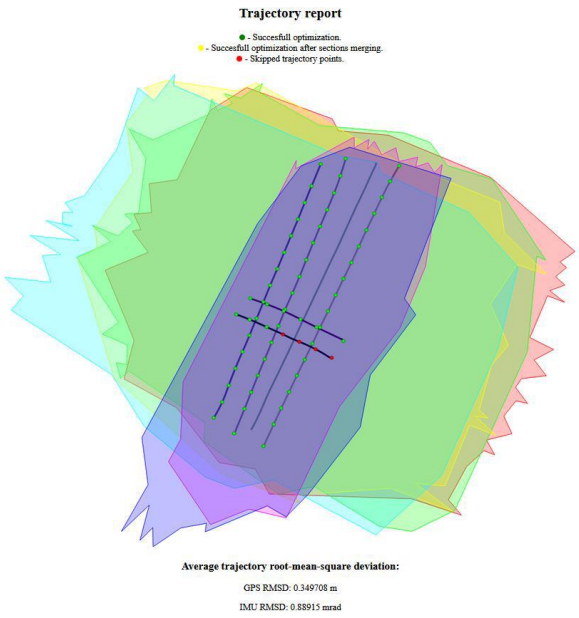
Strip Alignment

The purpose of the Strip Alignment (SA) process is to align several point clouds ("strips" in aerial or automotive surveys) so that they are aligned in their overlap region. SPL works directly on the trajectory to match the sub clouds obtained at different time intervals. This process can be used to recover clouds obtained in conditions of poor INS signal.





At the end of the process, a report is generated with the parameters of the initial and final situation.



Minor improvements

- Revised **export plugins** to third-party software:
  - Orbit GT
  - Terrasolid
  - Pix4D
- Added geodetic and geocentric export

Bug fixes

- Fixed an issue preventing SmartProcessingLidar to start if some folders were missing
- Fixed other minor bugs