simactive
HIGH-END PHOTOGRAMMETRY SOFTWARE

CORRELATOR3D™ QUICKSTART GUIDE

DJI
Zenmuse L1 LiDAR

OVERVIEW

SimActive's Correlator3D™ software is a photogrammetry solution for the generation of high-quality geospatial data from satellite and aerial imagery, including UAVs. Powered by GPU technology and multi-core CPUs, Correlator3D™ ensures matchless processing power to support rapid production of large datasets.

Correlator3D™ performs aerial triangulation (AT) and generates the following outputs:

- Digital surface models (DSM)
- Digital terrain models (DTM)
- Point clouds
- Orthomosaics
- Textured 3D models
- Vectorized 3D features

This guide is designed for DJI L1 LiDAR users and supports the use of LiDAR for GCP collection as well as Point Cloud Colorization. A more detailed description of the software can be found in the user's manual.

USER INTERFACE

The main toolbar provides access to the different modules of Correlator3D™. Some modules have their own specific toolbar, displayed vertically on the right side of the main window when active. Once processing is completed within a given module, results can be viewed by selecting an element from the project tree on the left side of the main window.

The main toolbar provides a direct access to Correlator3D™ modules, in the exact order of a standard workflow. From left to right, they represent the following operations:

- Create a project
- Open a project
- Automated workflow
- Aerial triangulation
- DSM creation
- DTM extraction
- DEM editing
- Orthorectification
- Mosaic creation
- Mosaic editing
- 3D model generation
- Feature extraction

PROJECT CREATION

To assist in the creation of a new project, the software features a wizard to easily specify inputs. The user is first requested to select the type of data to be processed.
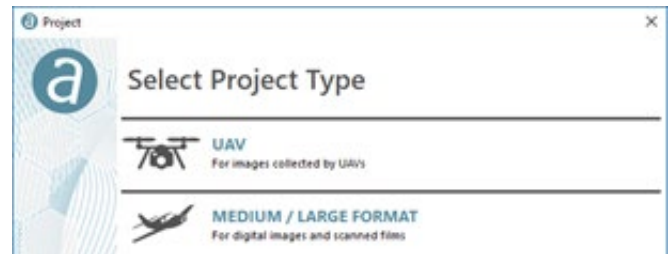
Once a data type is selected, the project creation wizard consists of the following three steps.

STEP 1: CAMERA CONFIGURATION

- In most cases, a project consists of only one camera.

STEP 2: IMAGE SELECTION

- The images to be processed must be selected.
- Exterior Orientations will auto populate via the EXIF data provided with the images, or they can be added via txt file.
- Images are assumed to be WGS 84 Lat\long by default.
- An output projection must be specified.
- If a GEOID offset is known, it can be applied under Altitude Offset.

STEP 3: CAMERA PARAMETERS

- In most cases, the camera parameters are automatically determined by the software.
- Values for the focal length, principal point, pixel size and distortion can also be manually set.
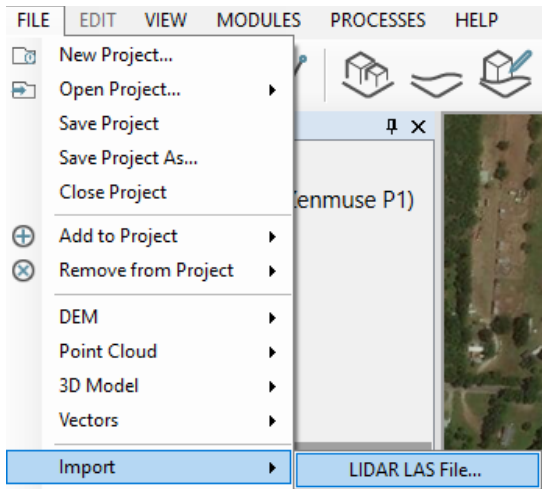
STEP 4: PROJECT PARAMETERS

- The project location on the PC must be specified.
- Optionally, a ground control point (GCP) file can be added.
- A reference DEM can be added.
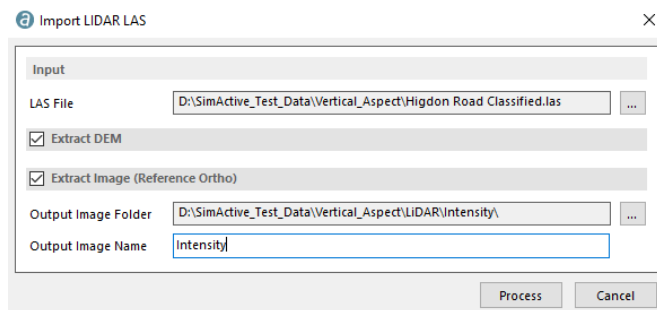- Reference orthophotos can be added.

LIDAR IMPORT

If available, existing LiDAR data can be imported to support the creation of project deliverables.

From the file menu select: Import > LiDAR LAS File

This will open a new window asking for the input .las file. It will also ask if C3D should create a DEM from the .las file and a reference ortho (intensity image). The DEM can be used in lieu producing an autocorrelated surface with C3D. When combined with the intensity image these two outputs can be used to pick GCPs for use with drone imagery and the AT solution.


When processing is complete, the DEM and Reference Ortho will be added to the processing directory for further use.
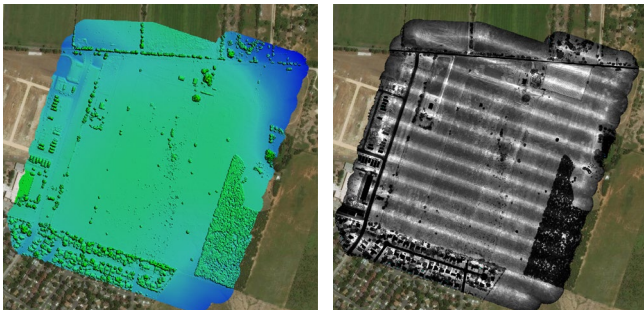

AERIAL TRIANGULATION

Aerial Triangulation (AT) is the most critical step of a photogrammetry project. It allows for calibration of the camera and refining of exterior orientation parameters.

The AT toolbar on the right-hand side of the window contains direct access to all AT steps.

A graphical tool for removal of unwanted photos as well as ability to edit and merge (or connect) flight lines.

Allows import of GCPs and/or CPs which ensures absolute accuracy of the results (optional).

Allows for the creation GCPs and/or CPs which ensures absolute accuracy of the results (optional).

Automatically extracts tie points between the images.

Provides manual tie point creation for the user (optional).

Performs bundle adjustment to calibrate the camera and adjusts the exterior orientation of each image.

Filters AT results by removing images with a tie point residual higher than a specified threshold (optional).

Coarse DEM generation.

In Correlator3D the user can extract photo identifiable GCPs from the Intensity Image created when importing the LiDAR data. Select the feature to be used as a GCP in the intensity image, Correlator3D will open the corresponding images allowing for measurement.
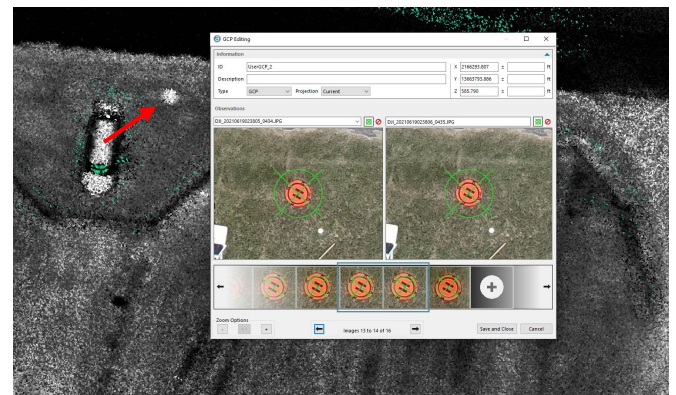
Correlator3D captures the XY value from the cursors position in the LiDAR generated Reference Ortho, and the Z value from the DEM.
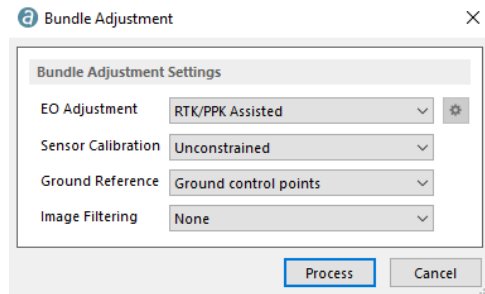
BUNDLE ADJUSTMENT

Multiple options are available in the Bundle Adjustment dialog. However, the two used with RTK/PPK enabled drones are:

- RTK/PPK Assisted
- Full AT Unconstrained

With the RTK/PPK Assisted bundle adjustment, Correlator3D™ will hold the images XYZ values assuming they are accurate.

With the Full AT Unconstrained bundle adjustment (the default), Correlator3D™ will adjust all image position and orientation parameters.

Bundle adjustment results should give an average tie point residual error smaller than 1 pixel. Higher residuals lead to inaccurate subsequent results.

TIE POINT RESIDUAL ERROR AFTER ADJUSTMENT

| N/A | 0-0.75 pixels | 0.75-1.5 pixels | >1.5 pixels |
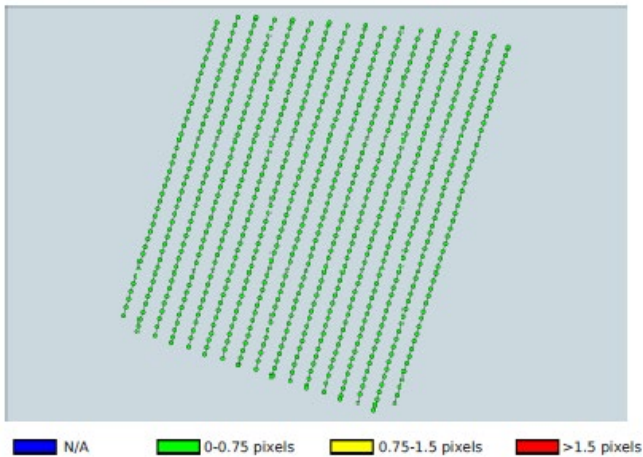
Note that a single bundle adjustment step is sufficient to achieve optimal output for most projects.

An AT Report is generated and presented upon completion of the bundle adjustment. This multiple page report is saved as a PDF in the project folder.

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1. PROJECT SUMMARY

PROJECT

Project type	Aerial
Projection	EPSG:6588 NAD83(2011) Texas South Central
Planar units	FEET
Elevation units	FEET
Camera 1	863 images (DJI Zenmuse P1)
Total images	863

GROUND CONTROL POINTS

Average XY error	0.009	ft
RMS Z error	0.023	ft
Average projection error	0.40	pixels
Standard deviation	0.20	pixels
Number of GCPs	5	

CHECK POINTS

Average XY error	0.408	ft
RMS Z error	0.234	ft
Average projection error	0.35	pixels
Standard deviation	0.28	pixels
Number of check points	5	

IMAGE TIE POINTS

| Quality assessment	EXCELLENT	
Average projection error	0.42	pixels
Standard deviation	0.22	pixels
Average number of tie points per image	151.2	

DSM GENERATION

With the DJI L1 LiDAR system, the user has the option of using the DEM generated on LiDAR import or allowing Correlator3D to generate and DEM through autocorrelation.
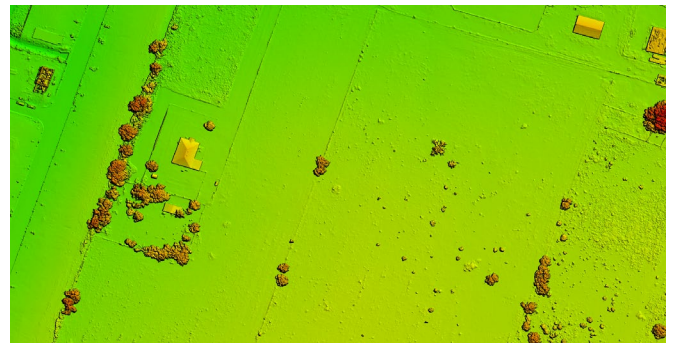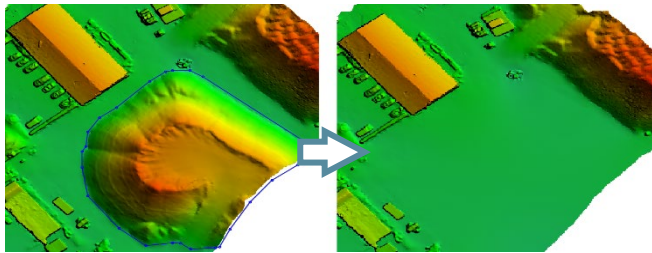

DTM EXTRACTION

Through automatic filtering of the DSM, a DTM can then be extracted.
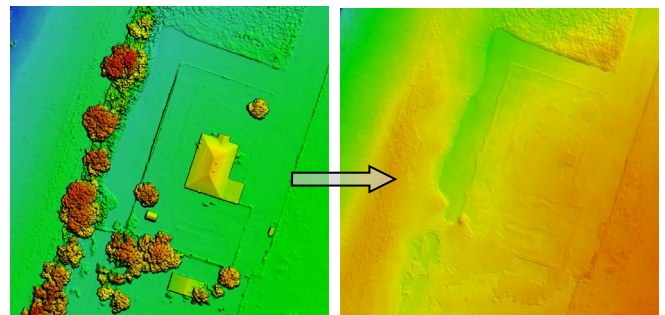
The software analyzes the DSM and removes structures lying on the ground. DTMs are useful for generating orthophotos as they avoid visual artifacts (e.g. along building edges) caused by using DSMs.

DEM EDITING

While automatically generated DSMs/DTMs are highly accurate, users may still desire to alter them for specific project requirements. The DEM editing module allows selecting a polygonal selection and performing operations such as crop/delete, set/offset elevation values and filter regions. A "Delete and Fill" function is also available for quick removal of structures.

ORTHORECTIFICATION
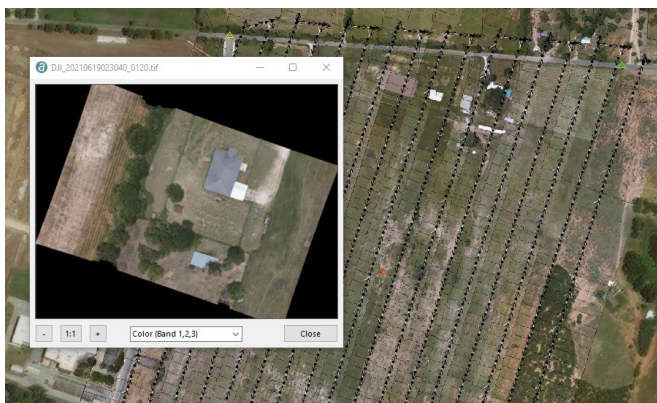
Before an orthomosaic can be generated, individual orthophotos must be created. Orthorectification consists of geometrically correcting the raw images such that they provide an accurate representation of the ground surface. The photos are thus adjusted for topographic relief, lens distortion and camera orientation. Once all orthophotos have been produced, they can be visualized through the software interface.

MOSAIC CREATION

Mosaic creation allows the merging of individual orthophotos to obtain a unique image covering the entire project area. The software automatically selects which portion of which image must be included in the final mosaic. Hence, seamline generation and color balancing are performed to provide smooth and seamless transition between adjacent images composing the mosaic.

MOSAIC EDITING
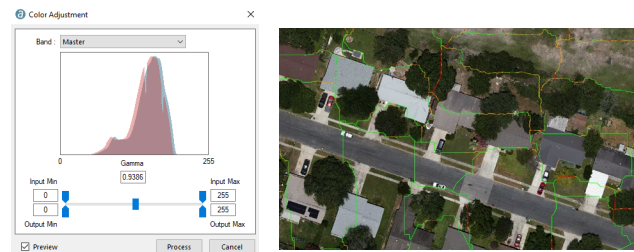
Automatically generated mosaics can be interactively edited using the mosaic editing module. This allows for manual modification of seamlines with real-time visual feedback on the effect of changes.

The module can also be used for tuning the global mosaic colors and to enhance its appearance. Once editing is completed, the mosaic can be exported following a tiling scheme defined by the user

POINT CLOUD COLORIZATION

Correlator3D will create a colorized point cloud using the color balanced mosaic.

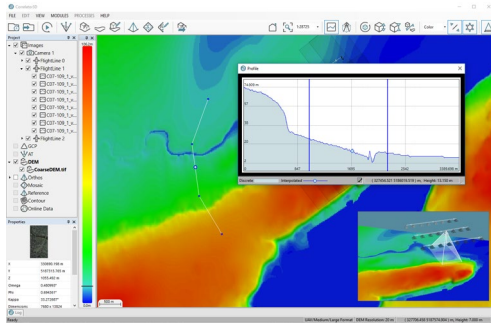From the menu select: Process > Point Cloud Colorization
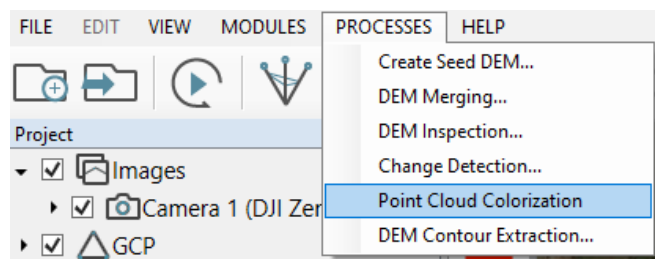
The resulting colorized point cloud is much more visually pleasing.

Correlator3D™ also features additional tools, which allow the following:

- Index map creation
- Reflectance map creation
- DEM inspection
- Feature Extraction
- 3D Model Generation
- Volume calculations
- 3D profile
- Online data sharing
- Contour extraction