Pix4D simply powerful

mapper

Getting Started

Manual

Pix4Dmapper 2.1

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CONVERT + DELIVER

The following description shows the minimum and recommended Hardware and Software requirements:

Minimum:

Windows 7, 8, 10, Server 2008, Server 2012, 64 bits (PC or Mac computers using Boot Camp).
Any CPU (Intel i5/ i7/ Xeon recommended).
Any GPU that is compatible with OpenGL 3.2. (integrated graphic cards Intel HD 4000 or above).
Small projects (under 100 images at 14 MP): 4 GB RAM, 10 GB HDD Free Space.
Medium projects (between 100 and 500 images at 14 MP): 8 GB RAM, 20 GB HDD Free Space.
Large projects (between 500 and 2000 images at 14 MP): 16 GB RAM, 40 GB HDD Free Space.
Very Large projects (over 2000 images at 14 MP): 16 GB RAM, 80 GB HDD Free Space.

Recommended:

Windows 7, 8 64 bits.
CPU quad-core or hexa-core Intel i7/Xeon.
GeForce GPU compatible with OpenGL 3.2 and 2 GB RAM.
Hard disk: SSD.
Small projects (under 100 images at 14 MP): 8 GB RAM, 15 GB SSD Free Space.
Medium projects (between 100 and 500 images at 14 MP): 16GB RAM, 30 GB SSD Free Space.
Large projects (over 500 images at 14 MP): 32 GB RAM, 60 GB SSD Free Space.
Very Large projects (over 2000 images at 14 MP): 32 GB RAM, 120 GB SSD Free Space.

Information:
An SSD hard drive can speed up processing.
The graphic card may have an improvement on the processing speed for step 1 and step 2 (if the graphic card is compatible with CUDA (NVIDIA Graphic Cards). Processing time of step 3 is not affected by the GPU. The GPU affects considerably the visualization of the rayCloud. For more information about the use of the GPU: 203405619.
For more information about Hardware components usage when processing with Pix4Dmapper: 202559519.
For recommendations for a Hardware and Software Configuration: 202559159.
For more information regarding: Mac / Windows XP / Linux / Remote Access - Virtual machine / Distributed - Parallel processing: 202556809.
For more information about processing speed: 204191535.

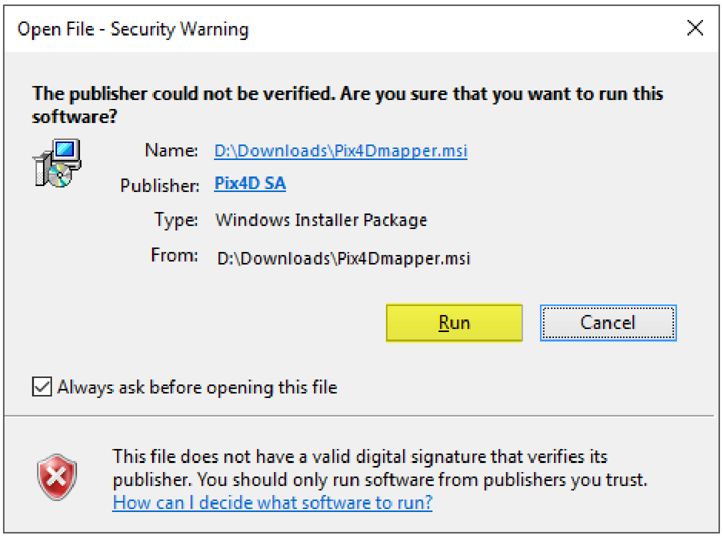
Important: Internet connection is required to download and install the software.

Download the software following:

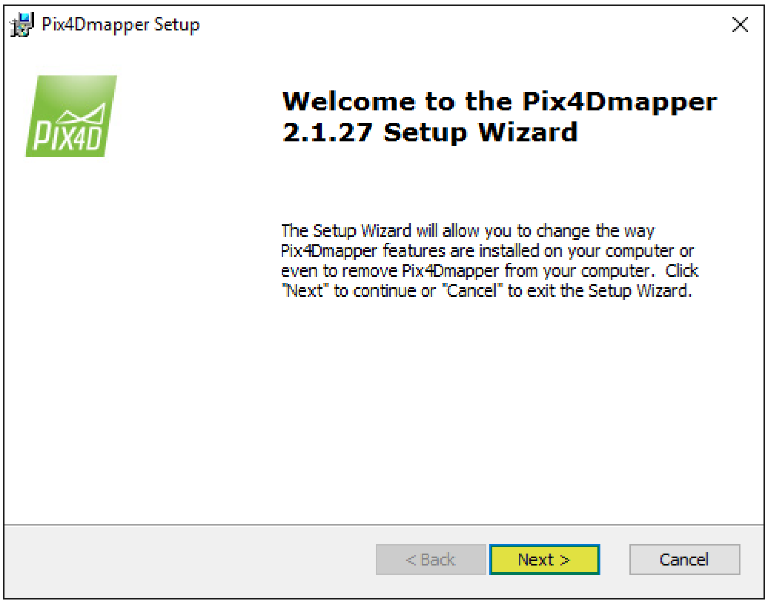
1. Go to http://pix4d.com/download/
2. Click Download.

Once the software has been downloaded, install it using the following steps:

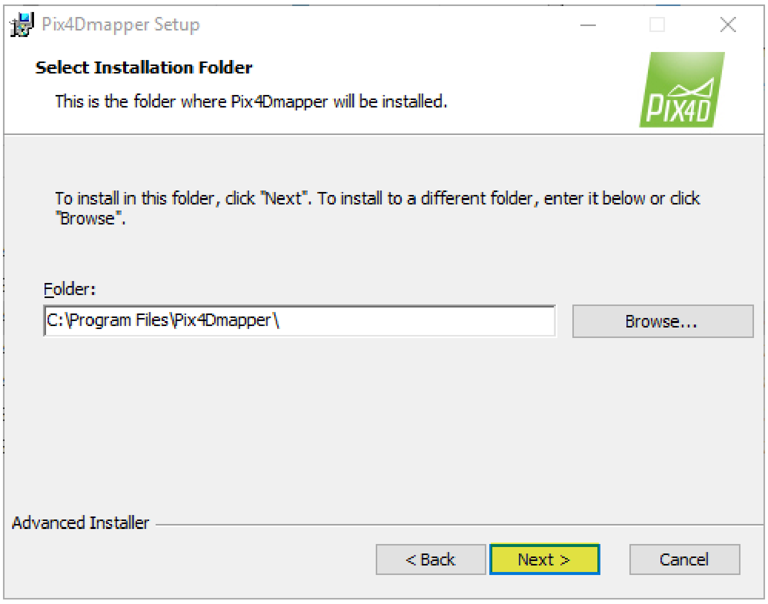
1. Double click the downloaded file. The Pix4Dmapper Setup wizard starts.
2. (optional): If the *Open file - Security Warning* pop-up appears, click Run.



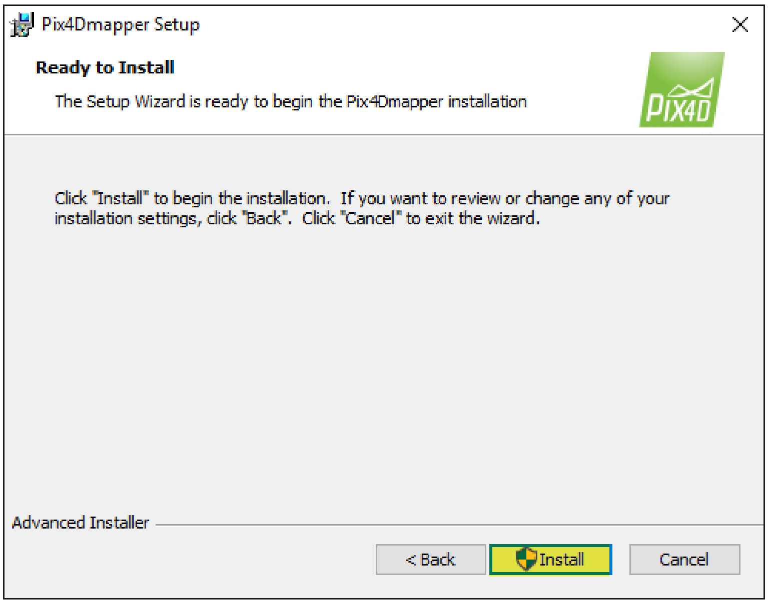
3. In the *Pix4Dmapper Setup* pop-up, in the *Welcome to the Pix4Dmapper Setup Wizard* screen, click Next >.



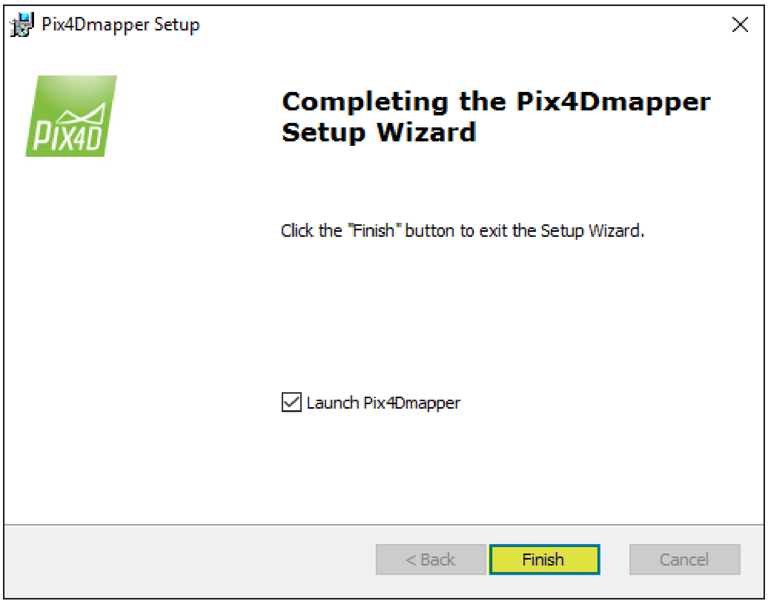
4. (optional) Click Browse... to change the destination path for the installation.
5. Click Next >.



6. Click Install.



7. (optional) In the software information window: "*Do you want to allow the following program to install software on this computer?*", Click Yes.
8. Click Finish .



9. A shortcut is created on your desktop and the software opens automatically once the installation is completed.

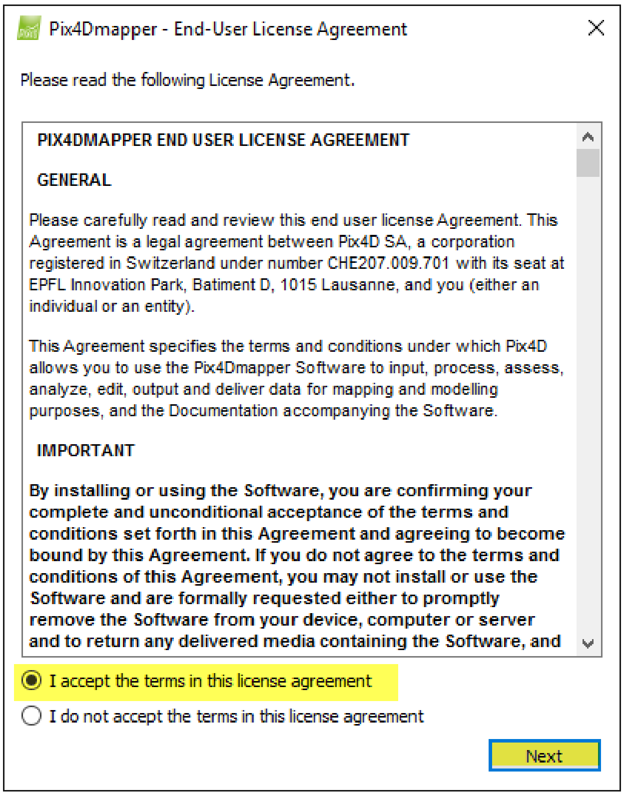
10. The first time you open the software, the *Pix4Dmapper Login* window appears:

(If a proxy server is used to connect to internet, click Proxy... and follow these instructions: 202560089)

11. If you already have an account, type your *Email* and *Password* and click Login.

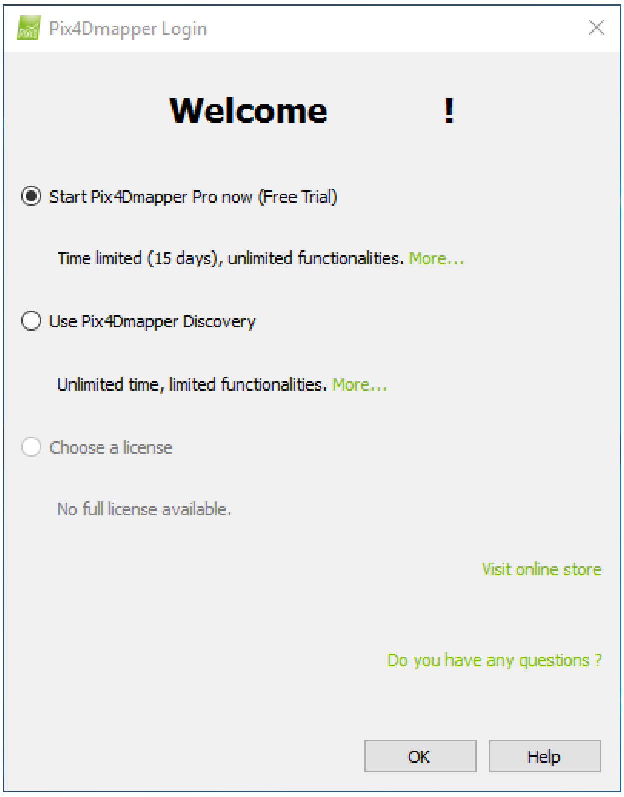
Note: If there is already a license assigned to your account: 207948656.

12. Read the *End-User License Agreement*, select *"I accept the terms in the License Agreement"* and click Next.



13. Select:

Start Pix4Dmapper Pro now to activate a 15-day trial.
Use Pix4Dmapper Discovery, to activate the limited version. For more information: 202559479.
Choose a license that is already assigned to your account.



14. Click OK.

If you do not have an account:

1. Click Sign up now.
2. Complete the online form.
3. You will receive a confirmation email to activate the account. Open the email and click Confirm my email.
4. Go back to the *Pix4Dmapper Login* window, type your *Email* and *Password* and click Login.

Pix4Dmapper opens and you are now ready to start using the software!

Warning: A dataset of insufficient quality will lead to poor results or may even lead to processing failure. This requires taking a new dataset on the field.

The dataset (*compulsory*: images, *optional but recommended*: images geolocation and GCPs "Ground Control Points") have to be obtained on the field before using Pix4Dmapper. A good dataset is required in order to automatically produce results with high quality and accuracy. In order to take a good dataset, follow the steps below:

1. Designing the Images Acquisition Plan: It is very important to design a good images acquisition plan considering:

   - Type of project (aerial, terrestrial, mixed).
   - Type of terrain / object.
   - Type of camera.
   - Purpose of the project.
   - Image rate that the images are taken.
   - Distance (flight height) at which the images are taken and with which angle to take the images.
   - Path(s) to follow to take the images.
   - etc.

   For aerial projects, this also implies:

   - Selecting corridor path or regular grid and/or circular grid.
   - Deciding whether terrestrial images will be used.
   - If more than one flights are needed to cover the full area: designing the area to cover with each flight.

2. Configuring the Camera Settings: The camera settings used to acquire the images need to be configured. Wrong configuration can result in images with blur, noise, distortions, etc.

3. Georeferencing the Images (optional but recommended): The images can be georeferenced using a camera with built-in GPS or using external GPS devices.

4. Getting GCPs on the field or through other sources (optional but recommended): Using GCPs (Ground Control Points) requires planning how many GCPs have to be acquired, as well as where and how they have to be measured.

In order to automatically get high accuracy results, a high overlap between the images is required. Therefore, the image acquisition plan has to be carefully designed in order to have enough overlap. The image acquisition plan depends on the required GSD by the project specifications and the terrain type / object to be reconstructed. A bad image acquisition plan will lead to inaccurate results or processing failure and will require to acquire images again.

When designing the image acquisition plan the following factors need to be taken into consideration:

Image acquisition plan type: The image acquisition plan type depends on the type of terrain / object to be reconstructed.
Ground Sampling Distance (GSD): The required GSD by the project specifications will define the distance (flight height) at which the images have to be taken.
Overlap: The overlap depends on the type of terrain that is mapped and will determine the rate at which the images have to be taken.

Nowadays, technologically advanced UAVs come with very good software that can design the image acquisition plan given some parameters (area of interest, the percentage of overlap between the images, the desired GSD, etc). In this case, the images are taken automatically by the UAV according to the selected images acquisition plan without any user intervention.

> Important: Pix4Dmapper allows the user to process using a *Processing Template.* The templates with the label *Rapid/Low Res* produce fast results at low resolution that can be used on the field as an indicator of how good the dataset is.
>
> If the *Rapid/Low Res* processing does not yield to good results, very probably, the dataset is not adequate and it is necessary to acquire images again. In some cases, the *Rapid/Low Res* may fail but the *Full* processing works.
>
> For more information about the difference between *Rapid/Low Res* and *Full* processing: 202558949.

The design of the image acquisition plan consists of 3 steps:

a. Selecting the Image Acquisition Plan Type
b. Computing the Flight Height for a given GSD
c. Computing the Image Rate for a given Frontal Overlap

Pix4Dmapper is an image processing software that is based on automatically finding thousands of common points between images. Each characteristic point found in an image is called a *keypoint.* When 2 *keypoints* on 2 different images are found to be the same, they are *matched keypoints*. Each group of correctly *matched keypoints* will generate one 3D point. When there is high overlap between 2 images, the common area captured is larger and more *keypoints* can be matched together. The more keypoints there are, the more accurately 3D points can be computed. Therefore, the main rule is to maintain high overlap between the images.

As the image acquisition plan has a high impact on the quality of the results, it is important to design it carefully.

Important: Pix4Dmapper allows the user to process using a *Processing Template. T*he templates with the label *Rapid/Low Res* produce fast results at low resolution that can be used on the field as an indicator of how good the dataset is.

If the *Rapid/Low Res* processing does not yield to good results, very probably, the dataset is not adequate and it is necessary to acquire images again. In some cases, the *Rapid/Low Res* may fail but the *Full* processing works.

For more information about the difference between *Rapid/Low Res* and *Full* processing: 202558949.

Ideal image acquisition plan

The ideal image acquisition plan depends on the type of terrain / object to be reconstructed.:

General case: For projects that do not include forests, snow, lakes, agricultural fields and/or other terrain that is difficult to reconstruct.
Forest and dense vegetation: For project with areas covered by forest or dense vegetation.
Flat terrain with agriculture fields: For flat terrain with homogeneous visual content such as agriculture fields.
Building reconstruction: For 3D modelling of buildings.
Special cases: For snow, sand, and water surfaces (oceans, lakes, rivers, etc).
Corridor mapping: For projects with linear area of interest (roads, rivers, etc).
Multiple flights: For projects with images taken using multiple flights.
City reconstruction (visible facades): For 3D modelling of urban areas.
3D interior reconstruction: For 3D modelling of the interior of buildings.
Mixed reconstruction: For combined datasets (interior/exterior and/or aerial/terrestrial and/or nadir/oblique).
Large Vertical Objects recontsruction: For 3D modelling of objects like power towers, wind turbines, etc.
Tunnel reconstruction: For 3D modelling of a tunnel.

Important: Below it is described the recommended different image acquisition paths and overlap for different cases, despite it may work with lower overlap than the suggested ones, in order to obtain the best possible results, it is suggested to use the recommended overlaps.

General case

The recommended overlap for most cases is at least 75% frontal overlap (with respect to the flight direction) and at least 60% side overlap (between flying tracks). It is recommended to take the images with a regular grid pattern (Figure 1). The camera should be maintained as much possible at a constant height over the terrain / object to ensure the desired GSD.

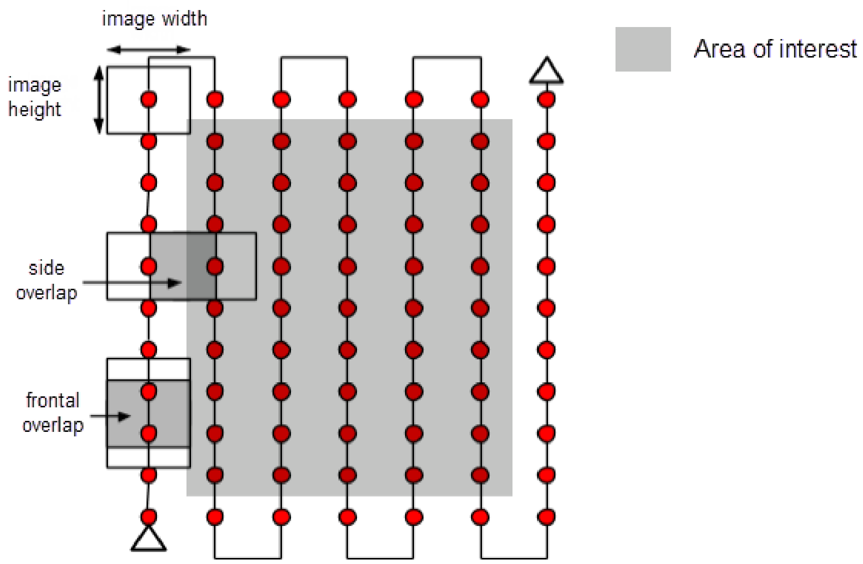


Figure 1. Ideal Image Acquisition Plan - General case.

Forest and dense vegetation

Trees and dense vegetation often have a very different appearance between overlapping images due to their complex geometry (thousands of branches and leaves). Therefore, it is difficult to extract common characteristic points (keypoints) between the images. In order to achieve good results, it is recommended to use a grid image acquisition plan as the one described in the General Case section by applying the following changes:

- Increase the overlap between images to at least 85% frontal overlap and at least 70% side overlap.
- Increase the flight height: At higher altitude, there is less perspective distortion (therefore causing less appearance problems) and the dense vegetation has better visual properties. In other words, it is easier to detect visual similarities between overlapping images in such areas. The flight height in combination with the image pixel resolution and the focal length determine the Ground Sampling Distance (spatial resolution) of the images. Best results are obtained with a GSD higher than 10cm/pixel.

For more information about how to improve the results of dense vegetation areas selecting the correct processing options: 202560159.

Flat terrain with agriculture fields

In cases where the terrain is flat with homogeneous visual content such as agriculture fields, it is difficult to extract common characteristic points (keypoints) between the images. In order to achieve good results, it is recommended to use a grid image acquisition plan as the one described in the General Case section by applying the following changes:

Increase the overlap between images to at least 85% frontal overlap and at least 70% side overlap.
Fly higher. In most cases, flying higher improves the results.
Have accurate image geolocation and use the *Agriculture* template. For more information about the *Agriculture (Ag)* template: 205319155.

Building reconstruction

Reconstructing 3D buildings requires a specific image acquisition plan (Figure 2):

- Fly around the building a first time with a 45° camera angle.
- Fly a second and third time around the building increasing the flight height and decreasing the camera angle with each round.

> Note: For more information about oblique imagery: 202559859.

It is recommended to take one image every 5-10 degrees to ensure enough overlap, depending on the size of the object and distance to it. Shorter distance and larger objects require images every less degrees.

> Note:
> The flight height should not be increased more than twice between the flights, as different heights lead to different spatial resolution. For more information: 202558979.
> Pix4Dmapper generates a high quality point cloud for oblique images of buildings. However, no orthomosaic is generated, when the selected template is *3D Models*: 05319155.

> Important: By default, Pix4Dmapper generates orthomosaics that are parallel to the (X,Y) plane. Therefore, to generate mosaics of facades, the *Orthoplane* tool needs to be used. For more information: 202559889.

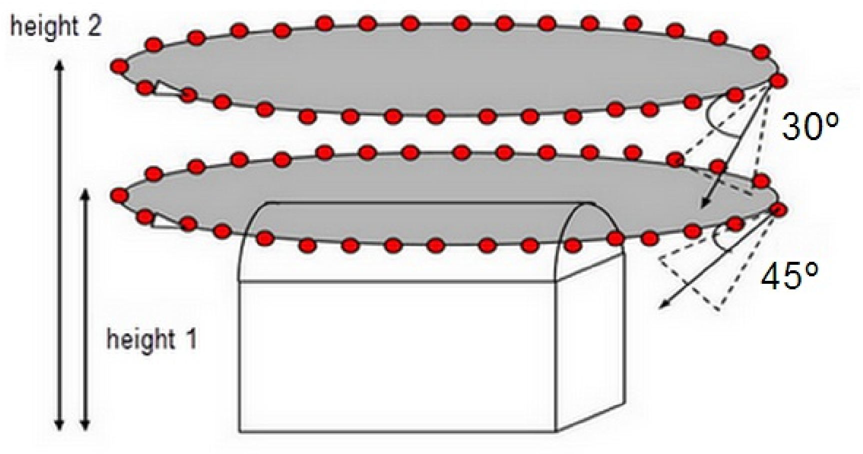


Figure 2. Ideal Image Acquisition Plan - Building.

> Note: It is possible to combine aerial nadir and/or aerial oblique and/or terrestrial images.
>
> The images should have enough overlap in each dataset and between datasets. For such cases it is strongly recommended to use GCPs or Manual Tie Points to properly adjust the different sets of images. For more information: 202561599

Special cases

This section presents some hints for terrain that is difficult to map such as terrains with snow, sand, lakes, etc.

Snow and sand
Snow and sand have little visual content due to large uniform areas. Therefore: Use a **high overlap: At least 85% frontal overlap and at least 70% side overlap.** Set the exposure settings accordingly to get as much **contrast** as possible in each image.
Water
Water surfaces have almost no visual content due to large uniform areas. Sun reflection on the water and waves cannot be used for visual matching. **Oceans** are impossible to reconstruct. To reconstruct other water surfaces such as **rivers** or **lakes**, each image needs to have land features. Flying higher may help to include more land features.

Corridor mapping

Mapping corridors such as railways, roads or rivers requires at least 2 flight lines (Figure 3). GCPs are not required, but are recommended to improve the georeference and accuracy of the reconstruction. For more information about the number and distribution of GCPs in corridor mapping: 202559299.

For a dual track it is recommended to use at least 85% frontal overlap and at least 60% side overlap.

It is possible to use nadir images or oblique images (with an angle between 0º and 45º pointing in both tracks to the center of the corridor). For flat terrain it is recommended to use nadir images.

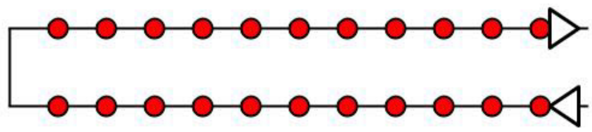


Figure 3. Dual track image acquisition plan for corridor mapping.

If a dual track image acquisition plan is not possible, a single track image acquisition plan can be used if (Figure 4):

Overlap is high enough: At least 85% frontal overlap.
Ground control points (GCPs) are defined along the flight line in zig zag.

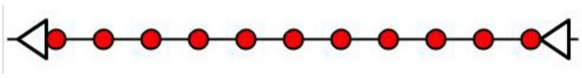


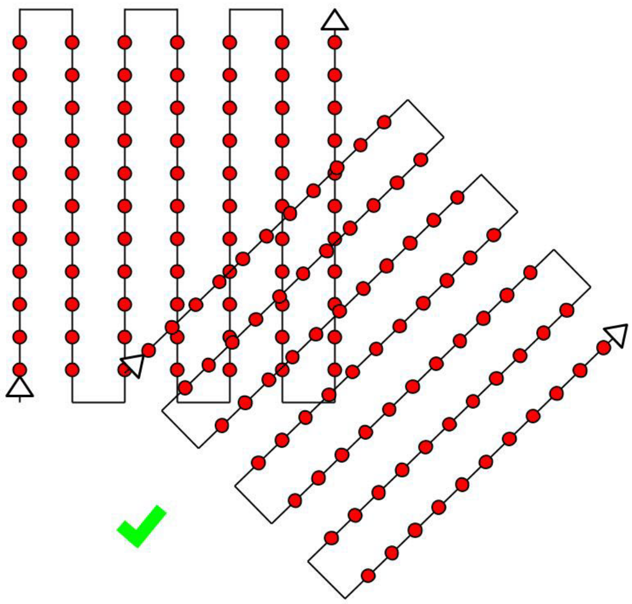
Figure 4. Single track flight NOT RECOMMENDED.

Multiple flights

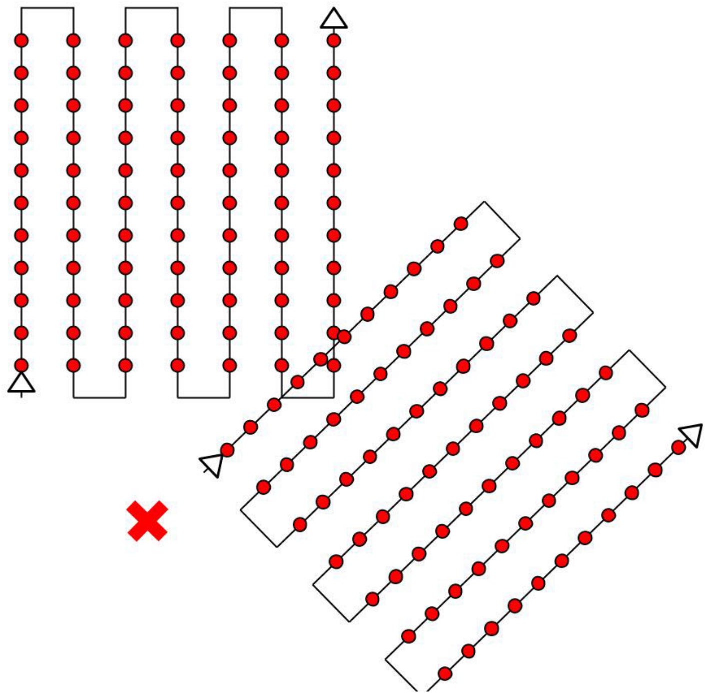
Pix4Dmapper can process images taken from multiple flights. When designing the different image acquisition plans, make sure that:

Each plan captures the images with enough overlap.
There is enough overlap between 2 image acquisition plans (Figures 5 and 6).
The different plans are taken as much as possible under the same conditions (sun direction, weather conditions, no new buildings, etc.).

> Important: The flight height should not be too different between the flights, as different height leads to different spatial resolution. For more information: 202558979.
>
> There is a special way to process datasets taken from multiple flights, for step by step instructions: 202558579.



Enough overlap between 2 flights



Not enough overlap between 2 flights

Figure 5. Overlap between 2 flights.

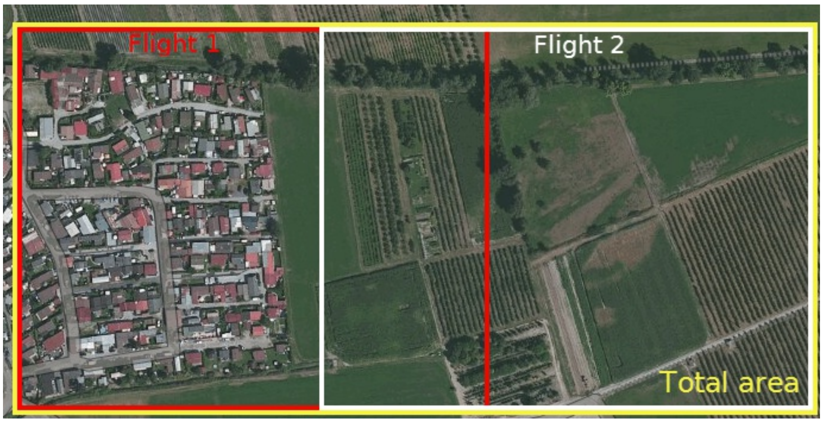


Figure 6. Recommended image acquisition plan for 2 flights.

City reconstruction (visible facades)

The 3D reconstruction of urban areas requires a double grid image acquisition plan, so that all the facades of the buildings (north, west, south, east) are visible on the images. The overlap should be the same as in the General Case.

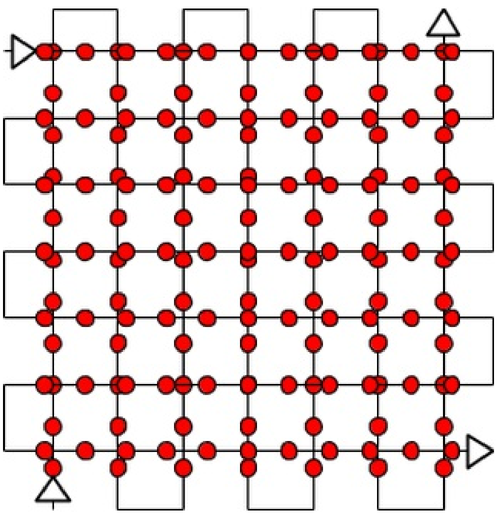


Figure 7. Double grid image acquisition plan.

For the facades to be visible, the images should be taken with an angle between 10º and 35º, for more information about the definition of the angles: 202559859) and not pointing to the nadir. If much detail is needed, aerial and terrestrial images should be combined.

> Note: It is possible to combine aerial nadir and/or aerial oblique and/or terrestrial images.
>
> The images should have enough overlap in each dataset and between datasets. For such cases it is strongly recommended to use GCPs or Manual Tie Points to properly adjust the different sets of images. For more information: 202561599

3D Interior reconstruction

For interior reconstruction, it is strongly recommended to use terrestrial images. High overlap is needed (90%). Therefore, it is recommended to use a fisheye lens camera.

Manual Tie Points improve the reconstruction and help to properly adjust the model. For more information: 202970309.

Mixed reconstruction

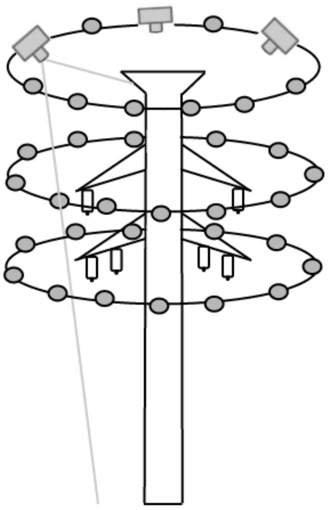
It is possible to combine interior/exterior and/or aerial/terrestrial and /or nadir/oblique. Any combination is possible.

The images should have enough overlap in each dataset and between datasets. For such cases it is strongly recommended to use GCPs or Manual Tie Points to properly adjust the different sets of images. For more information: 202561599.

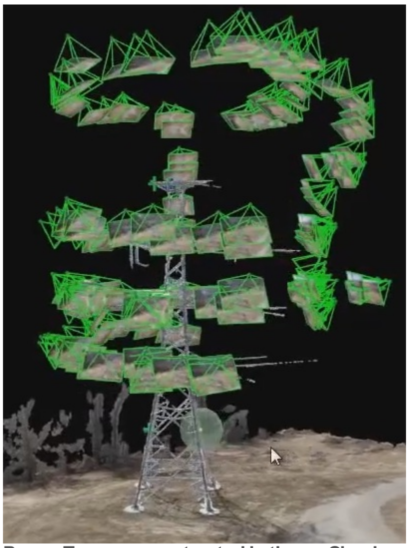
Large Vertical Objects reconstruction

The 3D reconstruction of objects like power towers, wind turbines etc requires a specific image acquisition plan (figure 8):

Fly close to the structure.
Turn several times around the structure at several heights.
Images should be taken with high overlap: 90% of overlap between images taken at the same height and 60% of overlap between images taken at different heights.
The optimal camera angle for the top circle is 45 degrees. By pointing to the ground, the content of the images is easier to be matched and the results are better.
The images should be as focused as possible (both the main object and the background should be focused).
Having image geolocation is recommended. For more information about the image geolocation: 202557499.



Power Tower



Power Tower reconstructed in the rayCloud

Figure 8. Image Acquisition Plan - Power tower.

> Note: For more information on how to map and measure pole and tower structures: 202560479

Tunnel reconstruction

Pix4Dmapper can reconstruct tunnels. The biggest challenge for tunnel reconstruction is the lighting conditions. If the lighting is good either with natural light (if the tunnel is not too long) or with technical light, the reconstruction could be very good.

In case of very dark tunnels, a tripod is recommended.

Tip: It is recommended to:
Use fisheye lens camera.
Take images in more than one line (avoid single track shooting). If a multiple tracks image acquisition plan is not possible, a single track could work.
GCPs are highly recommended in this case.

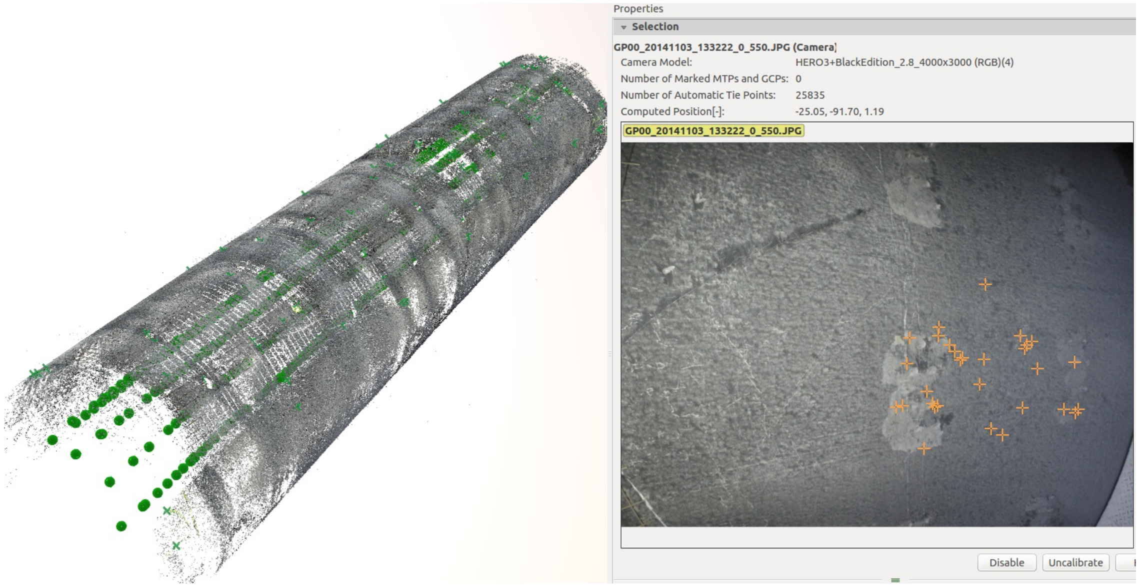


Figure 9. Automatic Tie Points of a tunnel.

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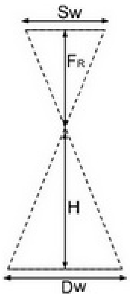
The Ground Sampling Distance (GSD) is the distance between the center of two consecutive pixels on the ground. It influences the accuracy and the quality of the final results as well as the details that are visible in the final Orthomosaic.

The flight height H that is needed to obtain a given GSD can be computed and depends on the camera focal length, the camera sensor width [mm], and the image width [pixels].



Sw = real sensor width [mm]

F_R = real focal length [mm]

H = flight height [m]

Dw = distance covered on the ground by one image in the width direction (footprint width) [m]

Some lens manufacturers give the focal length (F_{35}) in the 35 mm equivalent. It is the real focal length that should be used in Pix4Dmapper. In order to find the real focal length, some computations are needed. In the case of a 4:3 ratio, the formula for the real focal length F_R is given by:

F_R [mm] = $(F_{35} * S_W) / 34.6$ (1)

Where

F_{35} = focal length that corresponds to the 35 mm equivalent

F_R = real focal length

Sw = the real sensor width

For more information about the 35mm equivalent focal length concept: Wikipedia article.

Using the fact that

$H / F_R = D_W / S_W$,

the flight height H is given by:

$H = (D_W * F_R) / S_W$.   (2)

The distance covered on the ground by one image in the width direction (footprint width) is given:

$D_W = (imW * GSD) / 100$.   (3)

where

D_W = distance covered on the ground by one image [m] in the width direction (footprint width)

imW = image width [pixel]

GSD = desired GSD [cm/pixel]

Combining equation (2) and (3), the flight height is given by:

H [m] = $(imW * GSD * F_R) / (S_W * 100)$ (4)

Note: The result is given in [m], considering that the GSD is in [cm/pixel].

Example: Computation of the flight height to get a GSD of 5 [cm/pixel] using a camera with a real focal length of 5 [mm] and a real sensor width of 6.17 [mm]. Assuming that the image width is 4000 [pixels] and using the equation (4), the flight height should be 162 [m].

$H = (imW * GSD * F_R) / (Sw * 100) = (4000 * 5 * 5) / (6.17 * 100) = 162.07$ [m]

Tools: The GSD Calculator is available to make this computation easier: 202560249.

The image shooting rate to achieve a given frontal overlap depends on the speed of the UAV/plane, the GSD and the pixel resolution of the camera.

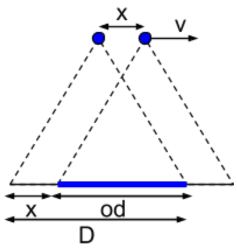


Figure 1.

D = distance covered on the ground by one image in the flight direction [m]

overlap = percentage of desired frontal overlap between two images

od = overlap between two images in the flight direction [m]

x = distance between two camera positions in the flight direction [m]

v = flight speed [m/s]

t = elapsed time between two images (image rate) [s]

From Figure 1, we obtain the following equations:

$od = overlap * D$ (1)

$x = D - od$ (2)

$t = x / v$ (3)

Two cases are possible:

Camera oriented with the sensor width (long dimension) perpendicular to the flight direction (usual case)
Camera oriented with the sensor width (long dimension) parallel to the flight direction

Camera oriented with the sensor width (long dimension) perpendicular to the flight direction (usual case)

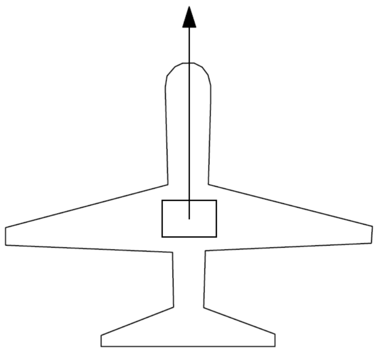


Figure 2. Sensor width placed perpendicular to the flight direction.

$D = D_h = (imH * GSD) / 100$ (4)

Where:

D_h = *distance covered on the ground by one image in the height direction (footprint height) [m]*

imH = image height [pixel]

GSD = desired GSD [cm/pixel]

Combining Equations (1) and (4) into Equation (2):

$x = D_h - overlap * D_h$

$x = D_h * (1 - overlap)$

$x = ((imH * GSD) / 100) * (1 - overlap)$ (5)

Note: x is given in [m], considering that the GSD is in [cm/pixel].

Combining the equations (3) and (5):

$t = x / v = ((imH * GSD) / 100) * (1 - overlap) / v$ (6)

Example: In order to achieve an overlap of 75% (overlap = 0.75) and a GSD of 5 [cm/pixel], supposing that the image height is 4000 [pixels] and the speed of the UAV/plane is 30 [km/h] = 8.33 [m/s], based on the equation (6), the image rate should be 6 seconds:

$t = ((imH * GSD) / 100) * (1 - overlap) / v = ((4000 * 5) / 100) * (1 - 0.75) / 8.33 = 6$ [s]

Camera oriented with the sensor width (long dimension) parallel to the flight direction

If the camera is placed on the plane / UAV having the sensor width (long dimension) parallel to the flight direction:

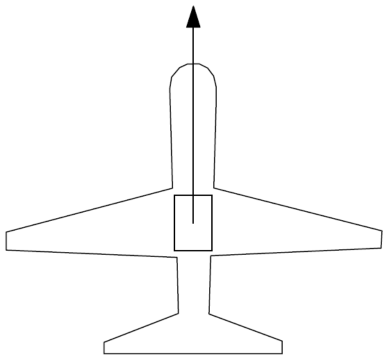


Figure 3. Sensor width placed parallel to the flight direction.

$D = D_W = (imW * GSD) / 100 \quad (7)$

Where:

D_W = *distance covered on the ground by one image in the width direction (footprint width) [m]*

imW = image width [pixel]

GSD = desired GSD [cm/pixel]

Combining equations (1) and (7) into the equation (2):

$x = D_W - overlap * D_W$

$x = D_W * (1 - overlap)$

$x = ((imW * GSD) / 100) * (1 - overlap) \quad (8)$

Note: The result is given in [m], considering that the GSD is in [cm/pixel].

Combining equations (3) and (8):

$t = x / v = ((imW * GSD) / 100) * (1 - overlap) / v \quad (9)$

Pix4Dmapper is able to process images taken with any camera:

Lightweight compact cameras.
DSLR cameras.
Large format cameras.
Action cameras.
Camera Rigs.

Compact	DSLR	Large format	Action	Rig
				

Using any lens:

Perspective (narrow and wide focal length)
Ultra wide focal length (Fisheye).

The cameras can be loaded on any platform:

UAVs from the hobby world.
Professional UAVs.
Manned aircrafts.
Helicopters.
Terrestrial vehicles.
No platform, for terrestrial imagery (taken by hand).

Pix4Dmapper can process images regardless of the spectral specifications of the camera:

RGB cameras.
NIR cameras
Thermal cameras.
etc.

Summary

Camera body and lens	
Perspective and fisheye lens supported. The zoom should be stable. Fixed focal length is recommended. Video frames are not recommended due to rolling shutter and low resolution.	
Camera settings	
Stabilization settings should be off. Shutter/aperture/ISO should be on automatic. If images are blurry or noisy, manually set shutter/aperture/ISO. For more information: Camera settings. Select Manual Focus on Infinity.	

Camera Body

As a rule of thumb: Heavier cameras (higher pixel resolution) provide better results but require a flying platform with a higher payload.

Recommended Cameras

Camera Type	Recommendation	Tips
Compact	Canon IXUS 220HS (135 g) Sony RX 100 (240 g)	Let parameters on automatic and disable image stabilization.
DSLR	Sony Nex 5/7 (270 g - 350 g) Canon 5D mark ii (>800 g)	Use a fixed focal length lens to improve the results.
Action	GoPro Hero 4	Recommended for close range (up to 50 meters). Take the images with the widest angle and highest resolution possible.

Video cameras

Videos are not recommended for accurate mapping: The quality of the results will almost always be inferior to the results from still imagery.
4K video from camera such as GoPro 4 and DJI provides reasonable results.
Full HD video is usually not sufficient to get good results.
When using a video for processing, it is important to consider the following: 205294735.

Recommended Camera Focal Length

There is no limit in the focal length that can be used with Pix4Dmapper.

Application	Recommendation	Why
Mapping: aerial project with a flight height above 50 meters.	Perspective lens: between 22 mm and 80 mm focal length (in 35 mm equivalent).	To ensure a good GSD that will lead to higher accuracy results.
Indoor / close range reconstruction.	Fisheye lens: very small focal length.	Flexibility in data acquisition: Ensuring higher overlap.

Most lens manufacturers give the focal length (F_{35}) that corresponds to 35 mm equivalent. In order to find the real focal length:

$$F_R = (F_{35} * Sw_R) / 34.6 \ (mm)$$

where:

F_{35} = focal length that corresponds to 35 mm equivalent [mm]
F_R = real focal length [mm]
Sw_R = the real sensor width [mm]

For a given height, the wider the field of view (small focal length), the fewer the images to achieve sufficient overlap. This is especially useful if a regular and dense flight plan cannot be setup. The spatial resolution, though, will be low leading to less accurate results.

If the field of view is narrow (large focal length), more images will be required to ensure enough overlap when mapping the same area. The spatial resolution will be higher in this case, leading to more accurate results.

For more information about how to select camera focal length and flight altitude considering the desired spatial resolution (GSD) and the area to map: 202558849.

Tip: Use a fixed focal length lens, as it will usually result in sharper images with reduced noise.

Camera Settings

The shutter speed, aperture and ISO should be set on automatic. If images are blurry or noisy, it is recommended to manually set these parameters.

There is a tradeoff between the shutter speed, the aperture, and the ISO sensitivity. For processing, the images should be sharp and have the least amount of noise. Such images can be obtained when the scene is well illuminated (scattered clouds should be avoided) and the parameters of the camera are well adjusted. If the scene is not sufficiently illuminated, images will be more noisy and less sharp, thus lowering the accuracy of the results.

As a rule of thumb, the shutter speed should be fixed, the ISO needs to be set at a low value that does not produce noisy images, and the aperture should be set to automatic to adjust for varying levels of brightness in the scene. If the tradeoff is not correct you may also obtain overexposed or underexposed images.

The shutter speed should be fixed and set to a medium speed (as an indication: between 1/300 second and 1/800 second), but fast enough to not produce blurry images. If more than 5% of the images are subject to a directional blur, it is a good indication that the shutter speed should be slightly increased.

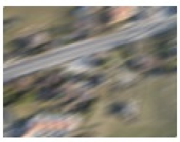
The ISO should be set as low as possible (minimum 100). High ISO settings generally introduce noise into images and drastically reduce the quality of processed results.

The aperture minimum and maximum values depend on the lens. High aperture is translated into low numbers, for example f2.7 (which will capture a lot of light). if both the shutter speed and ISO are adjusted, it is better to leave the aperture (f) on automatic.
The electronic and mechanical stabilization should be disabled as it interferes with the algorithms.

The recommended focus mode is Manual Focus on Infinity. This mode of focusing should always give focused images for aerial projects. For terrestrial projects, this mode will probably lead to out of focus results, if a long focal length is used.

Tip: For terrestrial projects it is recommended to use a wide angle lens.

Problems with images due to wrong camera parameters or inadequate equipment that interfere with the processing:

Blur due to slow shutter speed.	Noise due to high ISO sensitivity.	Overexposed or underexposed (wrong aperture and/or shutter speed).	Distortions due to electronic or mechanical image stabilization.	Distortions due to the rolling shutter. Pix4Mapper models the rolling shutter improving the results:202558159.

>> Skip this step if no Georeferencing will be used for the images <<

Pix4Dmapper can process images both with and without geolocation. However, it is strongly recommended to know the position of the camera for at least 50% of the images to get high quality and faster results. Pix4Dmapper does not require the IMU parameters. Orientation parameters are computed during the processing.

Images without geolocation
Images with known position using a camera with built-in GPS tagging
Images with known position using an external GPS logger

Images without geolocation

Pix4Dmapper can process images without geolocation. When images have no geolocation, Pix4Dmapper needs additional information to locate, scale and orient correctly the model. Ground Control Points (202557489) will place the model at the correct location, scale and orient it. If no GCPs are used, then the scale (205360375) and orientation (205360385) constraints can be used.

Warning: If neither GCPs no constraints are used, the final results have no scale, orientation and absolute position information. Therefore, they cannot be used for measurements, overlay and comparison with previous results. Besides, they may produce an inverted 3D model in the rayCloud.

Images with known position using a camera with built-in GPS tagging

Most of the major manufacturers push their weight behind GPS tagging; Panasonic, Sony, and Canon are some well known camera manufacturers that have released such cameras so far. Most of these cameras save the GPS coordinates in the images' EXIF data. Pix4Dmapper reads this information from the EXIF data in order to automatically import the image geolocation into the software. For more information about the EXIF information read by Pix4Dmapper: 205732299.

Warning: If the GPS refresh rate is lower than the shooting images rate, more than one image will have the same GPS position and the processing may fail or may not calibrate correctly some of the images.

Images with known position using an external GPS logger

GPS loggers are very light devices (easily placed on a UAV) that can collect position information for the images. They register latitude, longitude and altitude values for each camera position while shooting. These values are saved to a file that can be imported into Pix4Dmapper if it has the correct file format. Otherwise, the file requires some editing before being imported in order to comply with Pix4Dmapper's geolocation file format.

Figure 1. GPS logger

Recommended GPS Logger

RTK GPS can capture accuracy of 2-4 cm at a high refresh rate. Having a RTK GPS, no GCPs are needed to obtain high accuracy.

Information: Some loggers come with image geotagging software. If not, GPS data and images can be synchronized by using other software such as:
GPicSync (free)
Geosetter (free)
RoboGeo (commercial)

A list of available loggers is maintained by OpenStreetMap.

For more information about geolocation file formats supported by Pix4Dmapper 202558539.

For more information about how the onboard GPS affects the accuracy of a project: 202558909.

>> Skip this step if no GCPs will be added <<

Warning: Using GCPs is HIGHLY RECOMMENDED when processing a project with no image geolocation.

If no Ground Control Points are used:

The final results have no scale, orientation, and absolute position information. Therefore they cannot be used for measurements, overlay, and comparison with previous results.
They may produce an inverted 3D model in the rayCloud.
The 3D reconstruction may not preserve the shape of the surveyed area. For more information: 202561199.

Ground Control Points (GCPs) are points of known coordinates in the area of interest. Their coordinates have been measured with traditional surveying methods or have been obtained by other sources (LiDAR, older maps of the area, Web Map Service). They are not required for processing a project with Pix4Dmapper, but they increase significantly the absolute accuracy of the project. GCPs can also be used as *Check points* to verify the accuracy of the results. They can be used:

In projects with image geolocation: GCPs increase the absolute accuracy of a project, placing the model at the exact position on the Earth. They reduce the shift due to GPS from meters to centimeters. For more information about the shift due to GPS: 202558909.
In projects without image geolocation: GCPs are required if there is need for georeferenced outputs. In this case, the GCPs will scale, oriente and position the final results. Additionally, they are very useful for increasing the relative accuracy of the outputs, i.e. the reconstruction of the 3D model.

When using GCPs the following points need to be taken into consideration:

Number and distribution of GCPs
GCP acquisition

Number and distribution of GCPs

The GCPs should be placed homogeneously in the area of interest. Imagine the area as a large table and the GCPs as the legs that will support it. If all the "legs" are placed at the same location of the "table," then it will tilt. If the legs are homogeneously spread, then the "table" will be stable. Additionally, it is also recommended to place one GCP in the center of the area in order to further increase the quality of the reconstruction (figure 1).

Important:
A minimum number of 3 GCPs is required so as to take them into account in the reconstruction. Each one should be clicked in at least 2 images.
A minimum number of 5 GCPs is recommended. 5 to 10 GCPs are usually enough, even for large projects. More GCPs do not contribute significantly to increasing the accuracy.
In cases that the topography of the area is complex, then more GCPs will, indeed, lead to better (more accurate) reconstruction.
It is recommended to use at least 5 GCPs, each of which is identified in 5 images, as it minimizes the measurement inaccuracies and helps to detect mistakes that may occur when inserting the GCPs.
The GCPs should be placed evenly on the landscape to minimize the error in Scale and Orientation.
Do not place the GCPs exactly at the edges of the area, as they will only be visible in few images.
For corridor mapping: 202559299.

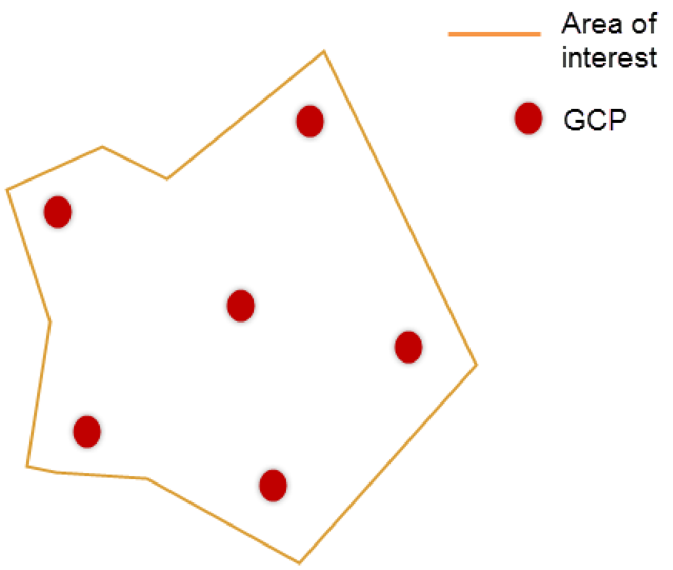


Figure 1. Distribution of the GCPs.

GCP acquisition

The Ground Control Points can be:

GCPs measured in the field
GCPs defined from other sources

GCPs measured in the field

Measuring GCPs in the field requires spending some time in the area and locating the position where the GCPs should be measured. This process requires the terrain to be accessible. Before measuring the GCPs coordinates, the following items must be defined:

GCP coordinate system
GCP accuracy
Topographic equipment

GCP coordinate system

A coordinate system is a set of numbers and parameters that is used in order to define the position of any object in the 2D or 3D space. The chosen GCP coordinate system depends on the needs of the end-user. Usually the coordinate systems can be:

Global coordinate systems: They are defined using 3D ellipsoid coordinates (latitude, longitude, altitude).
National coordinate systems: They are usually defined using a projection defined for a specific country (X, Y, altitude).
Local coordinate systems: They are defined using a projection. The user sets the origin and orientation where it is most convenient (X, Y, altitude).

Note: The altitude can be either geometric (using as reference the level of the ellipsoid) or orthometric (using as reference level the Mean Sea Level).

GCP accuracy

In order to define the accuracy with which the GCPs will be measured, the following factors must be taken into account:

Accuracy needed for the final results: The accuracy of the GCPs should correspond to the final absolute accuracy the user needs. For example, for projects for which an accuracy of some meters is acceptable (e.g. fast assessment tasks), then the accuracy of the GCPs is NOT required to be of some centimeters. For projects for which the accuracy is very important (e.g. construction sites) then the GCPs should be measured with an accuracy of some centimeters in order to comply with the project requirements. In general, the accuracy of the GCPs should be slightly better than the expected accuracy of the final results.
Ground Sampling Distance of the images: The GCPs should:
Be visible in the images. The GCP photogrammetric target (figure 2) should have about five to ten times the dimensions of the GSD. If the GCP is natural (a characteristic point in the area that is not signed by a photogrammetric target), then the GCP can be even more difficult to identify and mark.

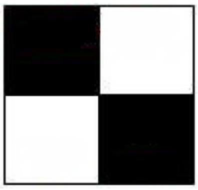


Figure 2. GCP photogrammetric target.

Not be more accurate than 1/10 of the GSD. For example, if the GSD is 10 cm, the GCP accuracy should not be below 1 cm, since they cannot be marked in the images with such accuracy.

Important: The accuracy of the GCPs must be known in order to correctly set the GCP accuracy (*Horizontal* and *Vertical*) for processing. For more information about the GCP accuracy: 202557919.

Topographic equipment

Total station accuracy: They can reach millimeters accuracy (depending on the distance of the measured points from the station).
GPS system accuracy: They can reach several centimeters accuracy (depending on the equipment, the area, and the country).

GCPs defined from other sources

If no GCPs have been measured in the field, they can be extracted from other sources. The advantage of such GCPs is that they can be extracted at any time while being at the office. The disadvantage is that they give no control over the accuracy and that the coordinate system is the coordinate system of the GCP source.

GCPs can be extracted from 2 type of sources:

GCPs extracted from high accuracy sources: GCPs can be extracted from sources such as existing maps and laser scanning outputs of the same area. If these sources are updated, then the GCPs can be very accurate. The coordinate system and the accuracy of these points depend on the source.
GCPs extracted from Web Map Services: Web Map Services provide online georeferenced maps using a standard protocol called Web Map Service (WMS). Some servers have their GIS databases publicly available and free-of-charge. Well-known free WMS servers are Google Maps and Bing Maps. They cover the whole planet but the accuracy of the map georeference may not be high enough. In addition, their data is not available with the same accuracy for different parts of the world. It is recommend to use GCPs derived from such sources when:
The images are not geolocated and therefore the project has **no georeference.**
The desired output is a **.kml** file, which can align perfectly with Google Maps.

For more information about how to obtain the georeference using 2D or 3D GCPs taken from a Web Map Service server: 202560149.

To create a project, follow these steps:

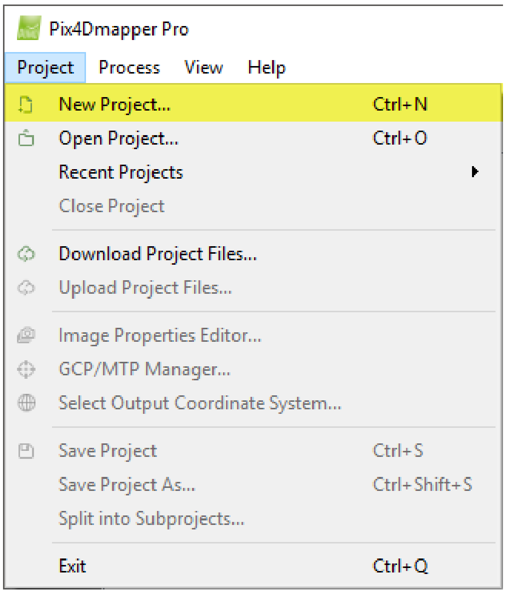
1. Creating a New Project.
2. Importing the Images.
3. Configuring the Image Properties:

If the images have geolocation:
Define the coordinate system and import the image geolocation information.
If the software cannot recognize the camera model or it is needed to use different camera parameters:
Edit the camera model.

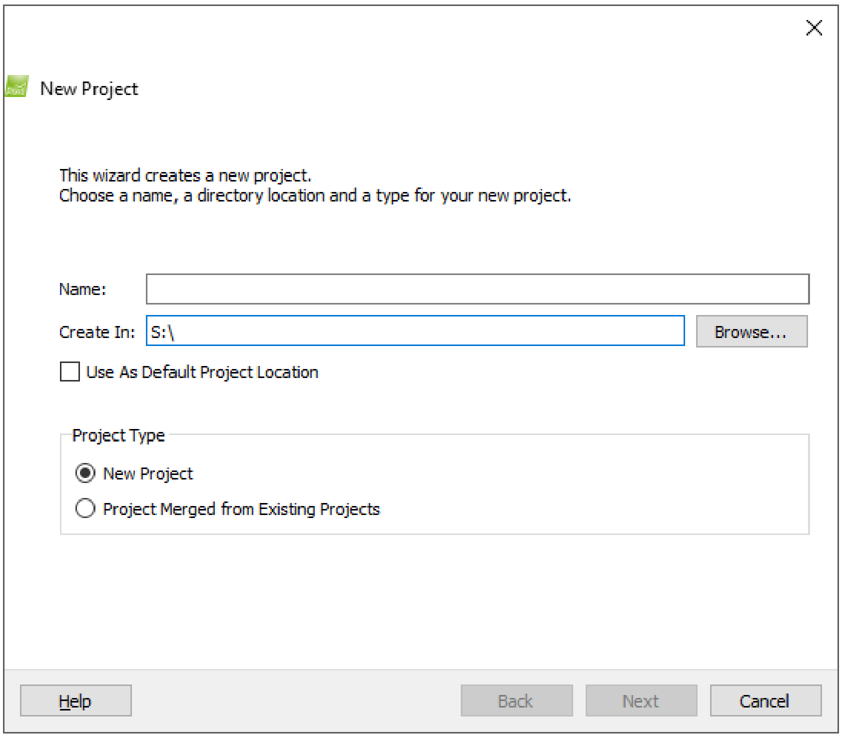
4. Selecting the Output / GCP Coordinate System.
5. Selecting the Processing Options Template.

To create a new project:

1. Start Pix4Dmapper.
2. On the Menu bar, click Project > New Project...



3. The *New Project* wizard opens:



4. In *Name:* type a name for the project.
5. (optional) In *Create in:* click Browse... On the *Select project location* pop-up, navigate to select the folder where the project and results will be stored and click Select Folder.

> Warning: Ensure that:
> The project name DOES NOT use special character(s).
> The path where the project will be created DOES NOT use special character(s).
> The project name and the path together contain less than 128 characters.

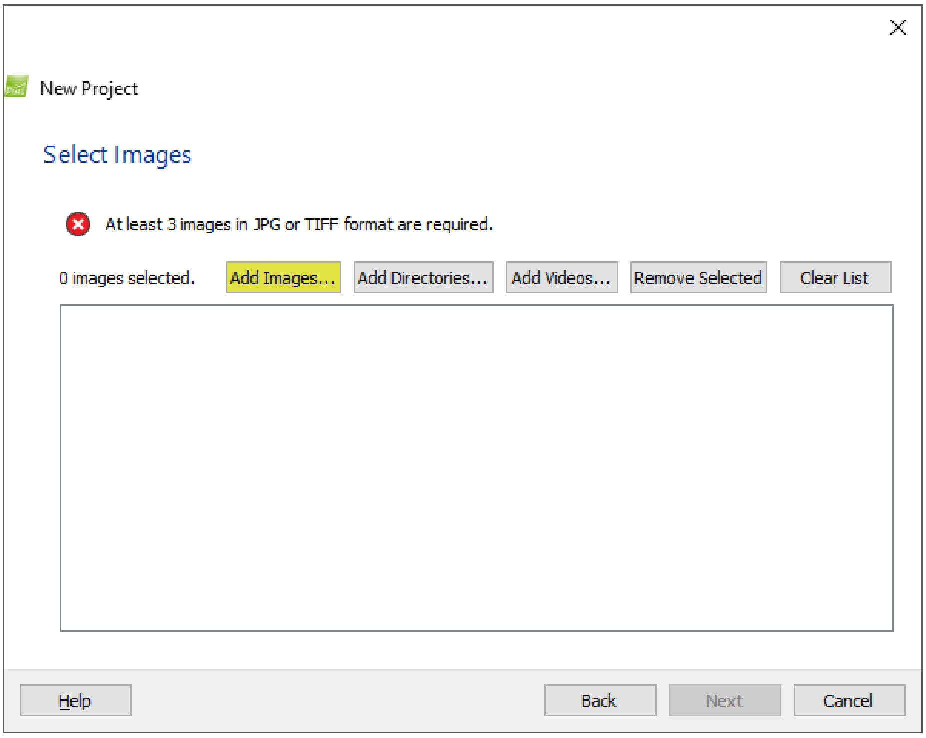
> Note: When the wizard is completed, a folder named after the project will be created in the selected folder and it will store all the results.

6. (optional) Select the check box *Use As Default Project Location* to save all new projects in the selected folder.
7. In *Project Type,* keep the default option *New Project* selected.
8. Click Next.

On the *Select Images* window:

1. Click Add Images... to add the images.

> Warning:
> Images should not contain any symbol such as time and date stamps. Images that contain such symbols cannot be processed.
> Images should not be edited manually, i.e. should not be scale, rotated, etc.
> Images taken during take-off or landing should not be used.



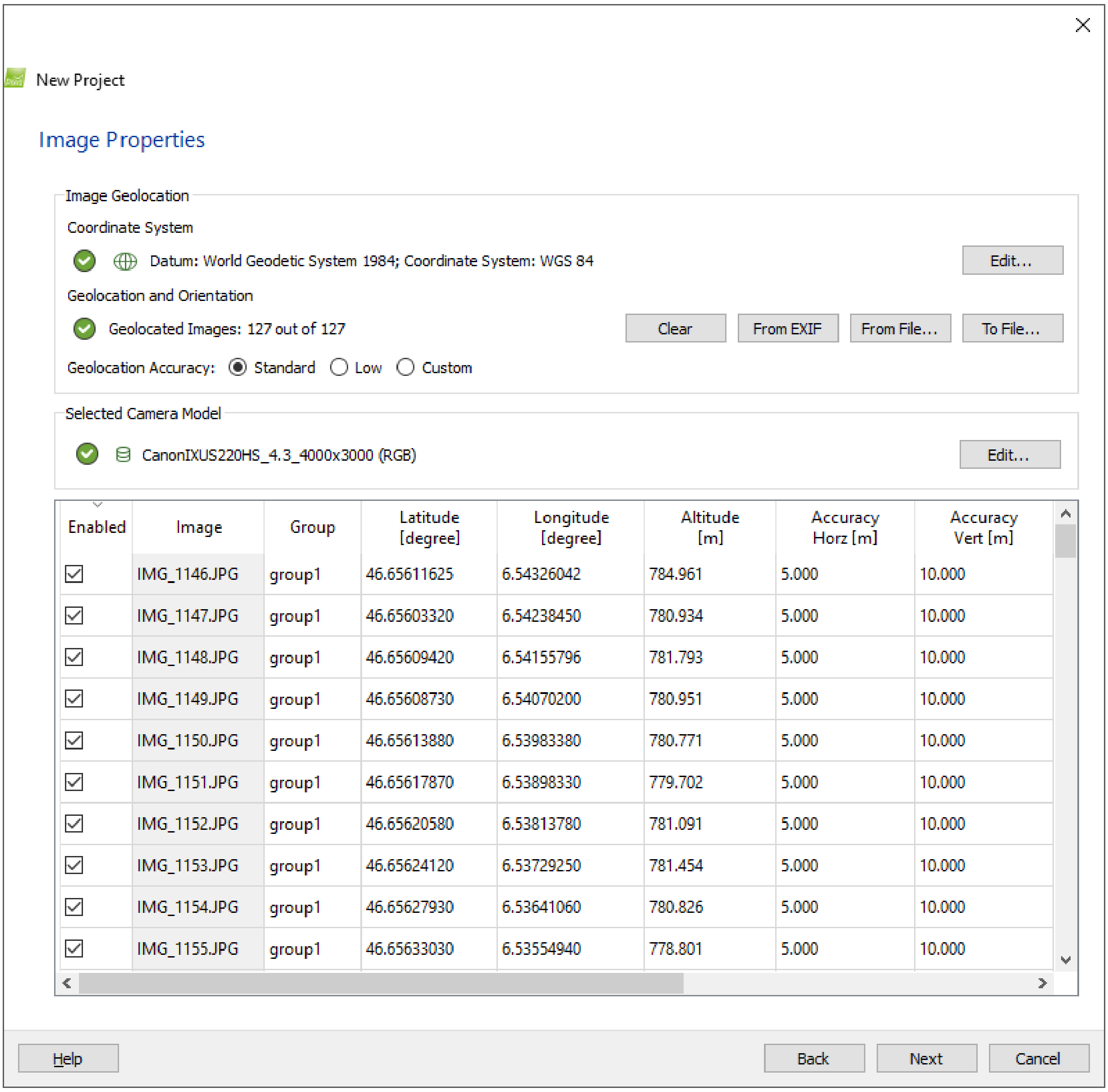
2. On the *Select Images* pop-up, navigate to select the folder where the images are stored, select the images to be imported (it is possible to select multiple images), and click Open.

> Note:
> Images can be imported as *.jpg, *.jpeg, *.tif, or *.tiff. By default all supported image formats can be selected. To filter images according to their format change the input format to JPEG images (*.jpg,*.jpeg) or to TIFF images (*.tif, *.tiff).
> It is possible to select images stored in different folders. Once images are imported from one folder, click Add images again to add more images from another folder.

3. (optional) It is possible to remove images by selecting them in the image list (use Ctrl+click or Shift+click for multiple selection) and clicking Remove Selected.
4. (optional) It is possible to clear the list of images that have been added by clicking Clear List.
5. Click Next.

The *New Project* wizard displays the *Image Properties* window which contains 3 sections:

Image Geolocation:
Sets the coordinate system to which the image geolocation refers.
Imports/exports the coordinates and, optionally, the orientation of the images and/or the accuracy of the coordinates.
Sets the accuracy of the image geolocation.
Selected Camera Model: Sets and configures the camera model associated to the images.
Images table: Displays the selected images, as well as the group, position, position accuracy and orientation of each image and if the image is enabled or not (an enabled image will be taken into account for processing).



Enabled	Image	Group	Latitude [degree]	Longitude [degree]	Altitude [m]	Accuracy Horz [m]	Accuracy Vert [m]
☑	IMG_1146.JPG	group1	46.65611625	6.54326042	784.961	5.000	10.000
☑	IMG_1147.JPG	group1	46.65603320	6.54238450	780.934	5.000	10.000
☑	IMG_1148.JPG	group1	46.65609420	6.54155796	781.793	5.000	10.000
☑	IMG_1149.JPG	group1	46.65608730	6.54070200	780.951	5.000	10.000
☑	IMG_1150.JPG	group1	46.65613880	6.53983380	780.771	5.000	10.000
☑	IMG_1151.JPG	group1	46.65617870	6.53898330	779.702	5.000	10.000
☑	IMG_1152.JPG	group1	46.65620580	6.53813780	781.091	5.000	10.000
☑	IMG_1153.JPG	group1	46.65624120	6.53729250	781.454	5.000	10.000
☑	IMG_1154.JPG	group1	46.65627930	6.53641060	780.826	5.000	10.000
☑	IMG_1155.JPG	group1	46.65633030	6.53554940	778.801	5.000	10.000

There are 3 optional steps to follow before clicking Next:

a. (optional) Select Image Coordinate System

On *Coordinate System*, click Edit... if the image geolocation is given in a coordinate system other than WGS84 (default).

For more information and step by step instructions about how to select/change the Image Coordinate System: 202560029.

b. (optional, recommended) Import Image Geolocation and Orientation

If the image geolocation (position) information is stored in the EXIF of the images, it will be loaded automatically.

For more information and step by step instructions about how to select/change the Image Geolocation and Orientation: 202560019.

> Note:
> The software considers the Date Taken field of the EXIF to set up the order in which the images are taken.
> Step *1. Initial Processing* is faster for projects with image geolocation. In the case of not sufficient overlap, image geolocation helps calibrating the images.

c. (optional) Edit Selected Camera Model

A camera model needs to be defined in order to run a project in Pix4Dmapper. The parameters of this model depend on the camera that was used to capture the image. Most cameras save their name in the metadata of the image in EXIF format. This field is used to associate a given camera model to all the images captured with this camera.

The *Selected Camera Model* section, on the *Image Properties window* displays the selected camera model. The camera model can be:

Valid: A green check is displayed if the camera model is valid. A camera model is valid if it already exists in the camera model database of Pix4Dmapper or if there is sufficient information in the EXIF data of the images to create a new camera model that will be saved into the user camera model database. If the camera model is retrieved from the EXIF data, it is recommended to check the camera model parameters and, if needed, to edit them.
Invalid: A red cross is displayed if the camera model is not valid. A camera model is invalid if it is not in the camera model database of Pix4Dmapper and if there is not enough information in the EXIF data of the images. In this case the camera model needs to be defined manually.

For more information and step by step instructions about how to edit the camera model: 202560169.

> Note: Grouping the images:
> When the project contains images with different spectral signatures (RGB, NIRGB, etc) usually the images are grouped automatically. In case that they are not grouped by default, group them manually following: 202560509.
> In this case one orthomosaic is generated per group.

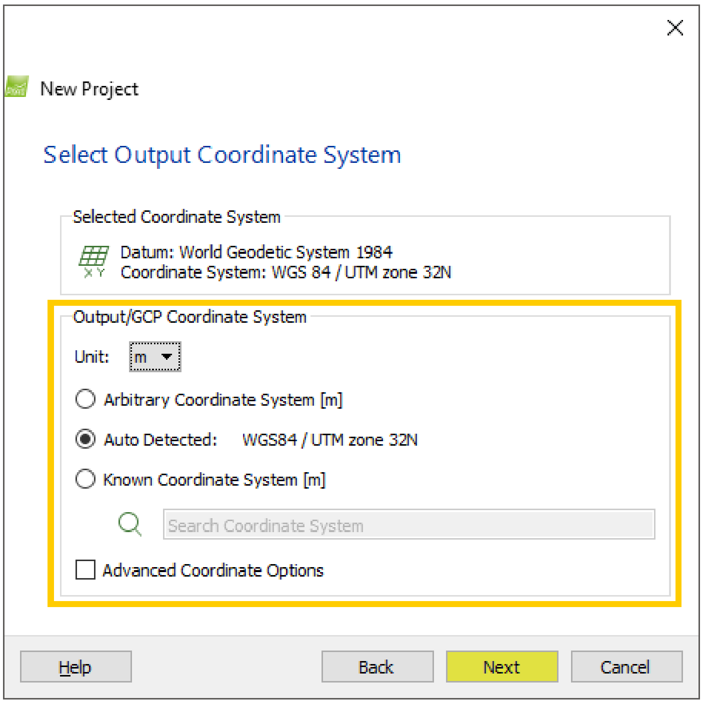
In the *Select Output Coordinate System* window:

1. (optional) Change the output / GCP coordinate system: 202560029.

Note: For more information about the Output/GCP coordinate System section: 202558239.

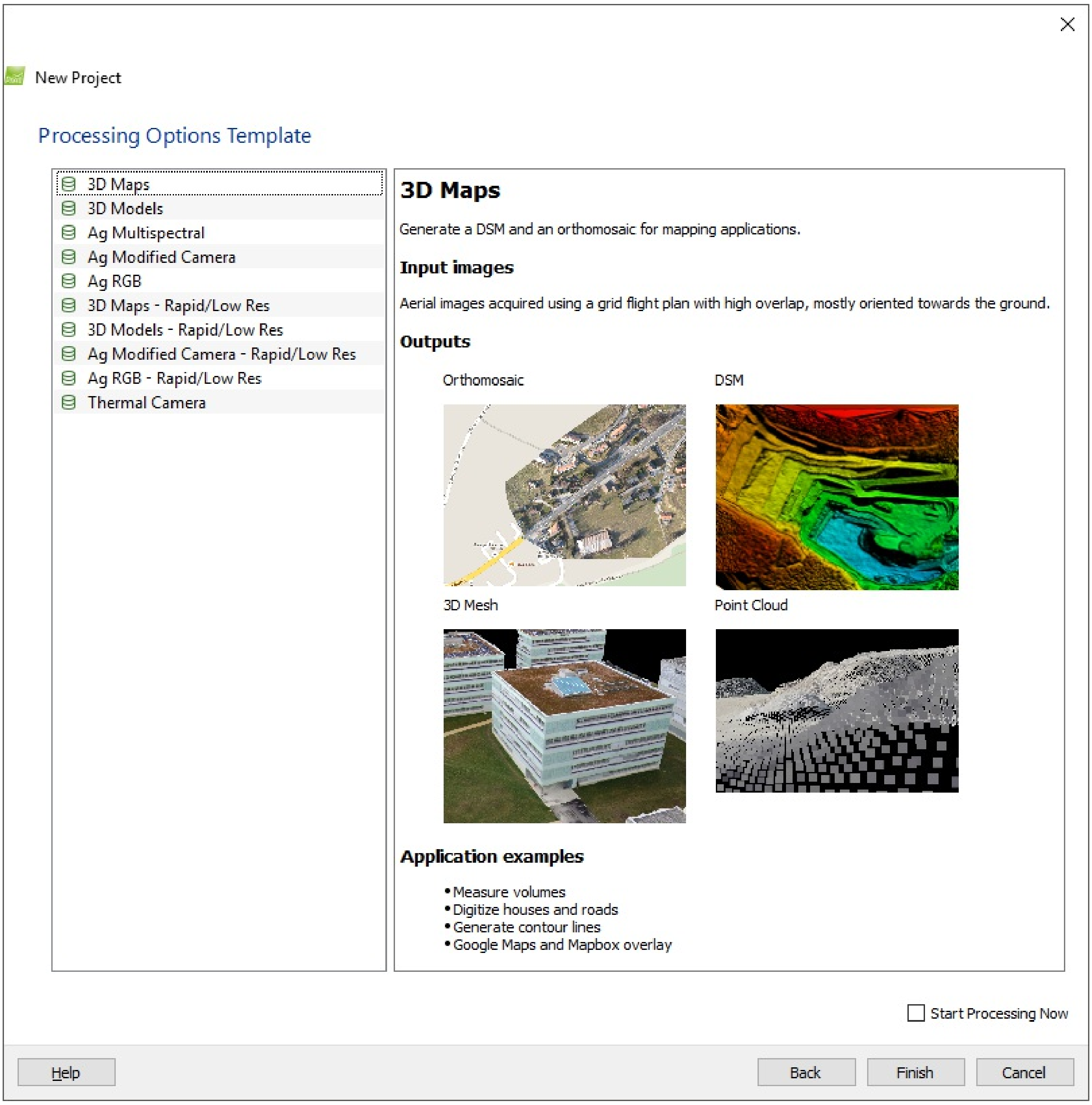
Note:
By default, the output and GCP coordinates system will be the same. To select a different coordinate system for the outputs: 202558099. To select different coordinate system for the GCPs: 202557749.
By default, the *Unit* is *m* (meters).
If the images have geolocation, by default, *Auto detected* is selected, displaying the corresponding UTM or Nad83 zone of the images.
If the images do not have geoloacation, by default, *Arbitrary Coordinate System* is selected.

2. Click Next.



In the *Processing Options Template* window:

1. Select the desired template (which can be modified or changed before processing).



By default, *3D Maps* is selected, and the following *Processing Options Templates* appear:

Processing Options Template	Characteristics
3D Maps	Generates a 3D model (point cloud, 3D textured mesh) as well as a DSM and an orthomosaic. Typical input: aerial images acquired using a grid flight plan. Applications examples: quarries, cadaster, etc.
3D Models	Generates a 3D model (point cloud, 3D texture mesh). Typical input: any images with high overlap. Application examples: 3D models of buildings, objects, ground imagery, indoor imagery, inspection, etc.
Ag Multispectral	Generates reflectance, index (such as NDVI), classification and application maps. Typical input: images from multispectral cameras (Sequoia, Micasense RedEdge, Multispec 4C, etc). Application examples: precision agriculture.
Ag Modified Camera	Generates reflectance, index (such as NDVI), classification and application maps. Typical input: images taken with modified RGB cameras. Application examples: precision agriculture.
Ag RGB	Generates an orthomosaic. Typical input: images taken with RGB cameras for agriculture (Sequoia RGB). Application examples: digital scouting, report claiming for precision agriculture.
3D Maps - Rapid/Low Res	Faster processing of the *3D Maps* template generating lower accuracy as well as lower resolution outputs.
3D Models - Rapid/Low Res	Faster processing of the *3D Models* template generating lower accuracy as well as lower resolution outputs.
Ag Modified Camera - Rapid/Low Res	Faster processing of the *Ag Modified Camera* template generating lower accuracy as well as lower resolution outputs.

Ag RGB - Rapid/Low Res	Faster processing of the *Ag RGB* template generating lower accuracy as well as lower resolution outputs.
Thermal Camera	Generates a thermal reflectance map. Typical input: images taken with thermal cameras (such as Tau 2 based cameras: FLIR Vue Pro, thermoMAP, etc.). Application examples: irrigation, solar panels, etc.

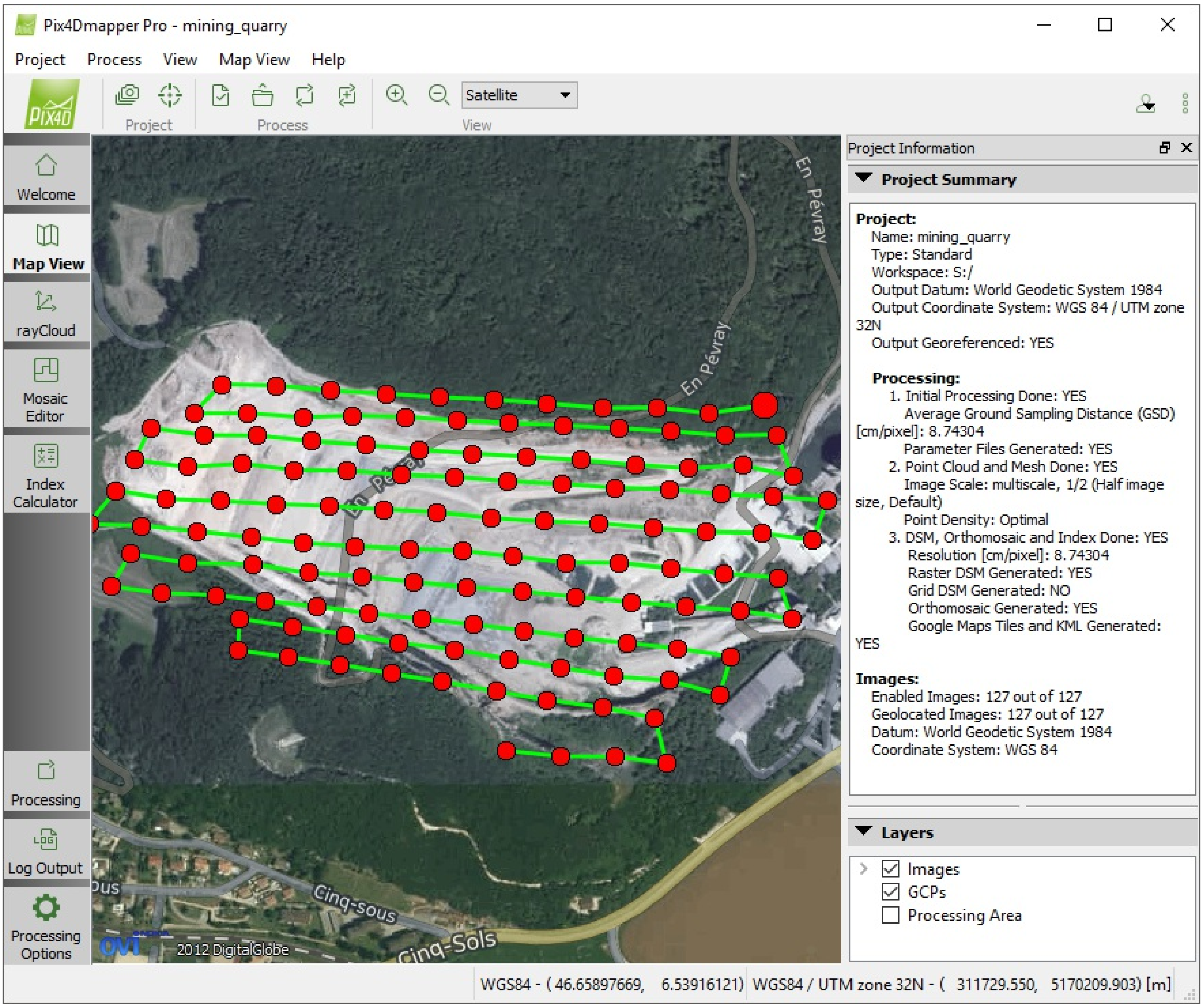
Note: For more information about the *Processing Options Templates*, their outputs and their selected processing options: 205319155.

Note:

- Refers to *Processing Options Templates* existing by default.
- Refers to *Processing Options Templates* created by the user.
- Refers to *Processing Options Templates* (existing by default or created by the user) that have been edited but are not saved.

2. (optional) Select the *Start processing now!* box to start automatically the processing.
3. Click Finish to finish the wizard and start the project.

Once the project is created, the *Map View* is displayed.



There are some optional steps that can be done before processing:

1. (optional) Selecting the Processing Area

By default, the area selected for processing corresponds to the entire area covered by all the images that are calibrated. It is possible to restrict the processing area to the area of interest, but it is not compulsory. This option can be useful to generate the outputs only for an area of interest instead of the entire area.

For step by step instructions about creating a Processing Area: 202560179.

2. (optional) Changing the Processing Options Template and / or the Process Options

Change the output results files (types and format), change some processing options to improve the quality of the results when needed, or change some processing options for advanced use. For more information: 202560009.

> Note: For more information about the *Processing Options Templates*, the outputs they generate and their selected processing options: 205319155.

3. (optional) Adding GCPs

Add Ground Control Points (GCPs) to improve the global accuracy of the project (georeference). GCPs can be measured in the field using topographic methods, taken from existing geospatial data or Web Map Service (WMS).

Warning: Using GCPs is HIGHLY RECOMMENDED when processing images without image geolocation.

If no Ground Control Points are used:

The final results are not scaled, oriented or georeferenced. Therefore they cannot be used for measurements, overlay, and comparison with previous results.
They may produce an inverted 3D model in the rayCloud.
The final 3D model may be shifted (this problem can be corrected using Manual Tie Points: 202560349).

For step by step instructions about how to include GCPs in the project: 202560239.

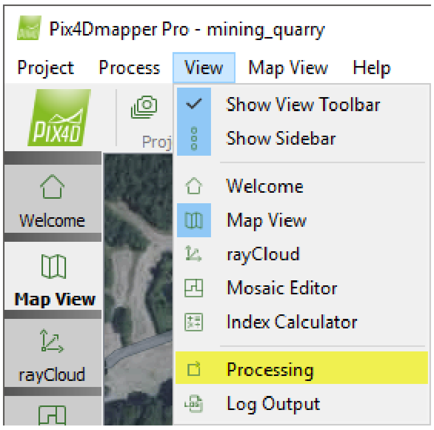
When processing a project it is recommended to go through the following steps:

1. Initial Processing
2. Analyzing the Quality Report
3. Point Cloud and Mesh
4. DSM, Orthomosaic and Index

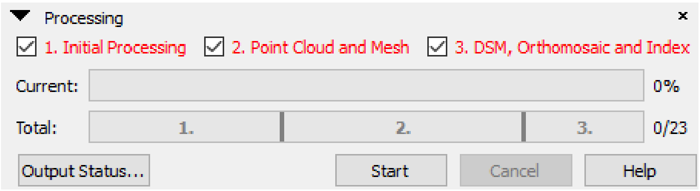
Index
Previous | Next

To start processing the project:

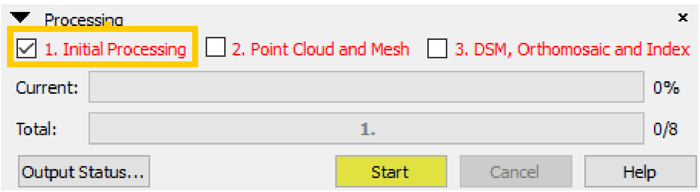
1. On the Menu bar, click View > Processing.



2. The *Processing* bar opens on the bottom of the main window.



3. Ensure that *1. Initial Processing* is selected and that 2. *Point cloud and Mesh* and 3. *DSM, Orthomosaic and Index* are unselected:



4. Click Start.

For more information about the outputs resulting from *1. Initial Processing*: 202558519.

Important:
For a detailed description about how to analyze the Quality Report: 202558689.
For a detailed description about any parameter described in the Quality Report: 202558679.
Example of a Quality Report available at the following link: Quality Report.

Once step *1. Initial Processing* is completed, the Quality Report is automatically displayed. To not be displayed automatically, unselect the *Display Automatically after Processing* box at the bottom of the Quality Report.

It is recommended to verify the following information in the Quality Report:

1. Quality Check

Verify that:

All the checks are green.
All or almost all the images are calibrated in one block.
The relative difference between initial and optimized internal camera parameters is below 5%.
(optional) If using GCPs, the GCP error is below 3×GSD.

Quality Check

Images	median of 35858 keypoints per image	✓
Dataset	127 out of 127 images calibrated (100%), all images enabled	✓
Camera Optimization	0.44% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 13945.5 matches per calibrated image	✓
Georeferencing	yes, 7 GCPs (7 3D), mean error = 0.046 m	✓

2. Preview

For projects with nadir images and for which the orthomosaic preview has been generated, verify that the orthomosaic:

Does not contain holes.
Does not have distortions.
(optional) If GCPs or image geolocation has been used, it has the correct orientation.

Preview

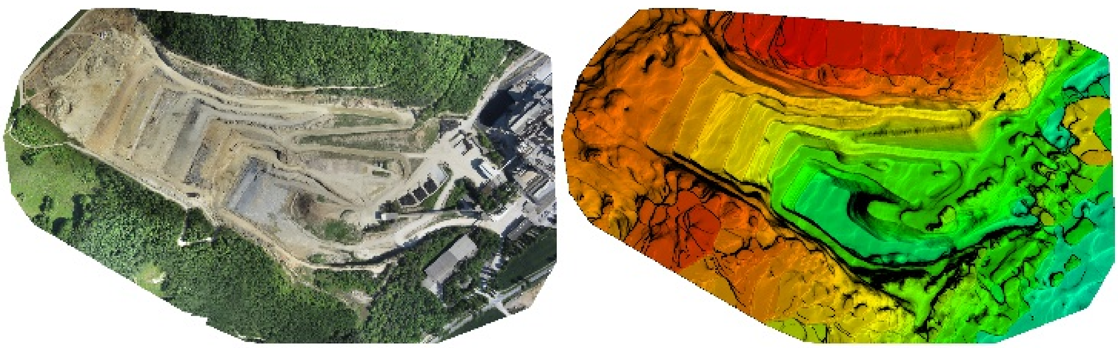
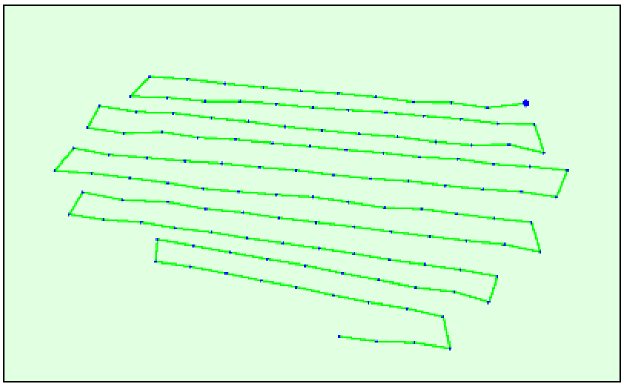


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

3. Initial Image Positions

(optional) If the images have geolocation, verify that the *Initial Image Positions* figure corresponds to the flight plan.

Initial Image Positions

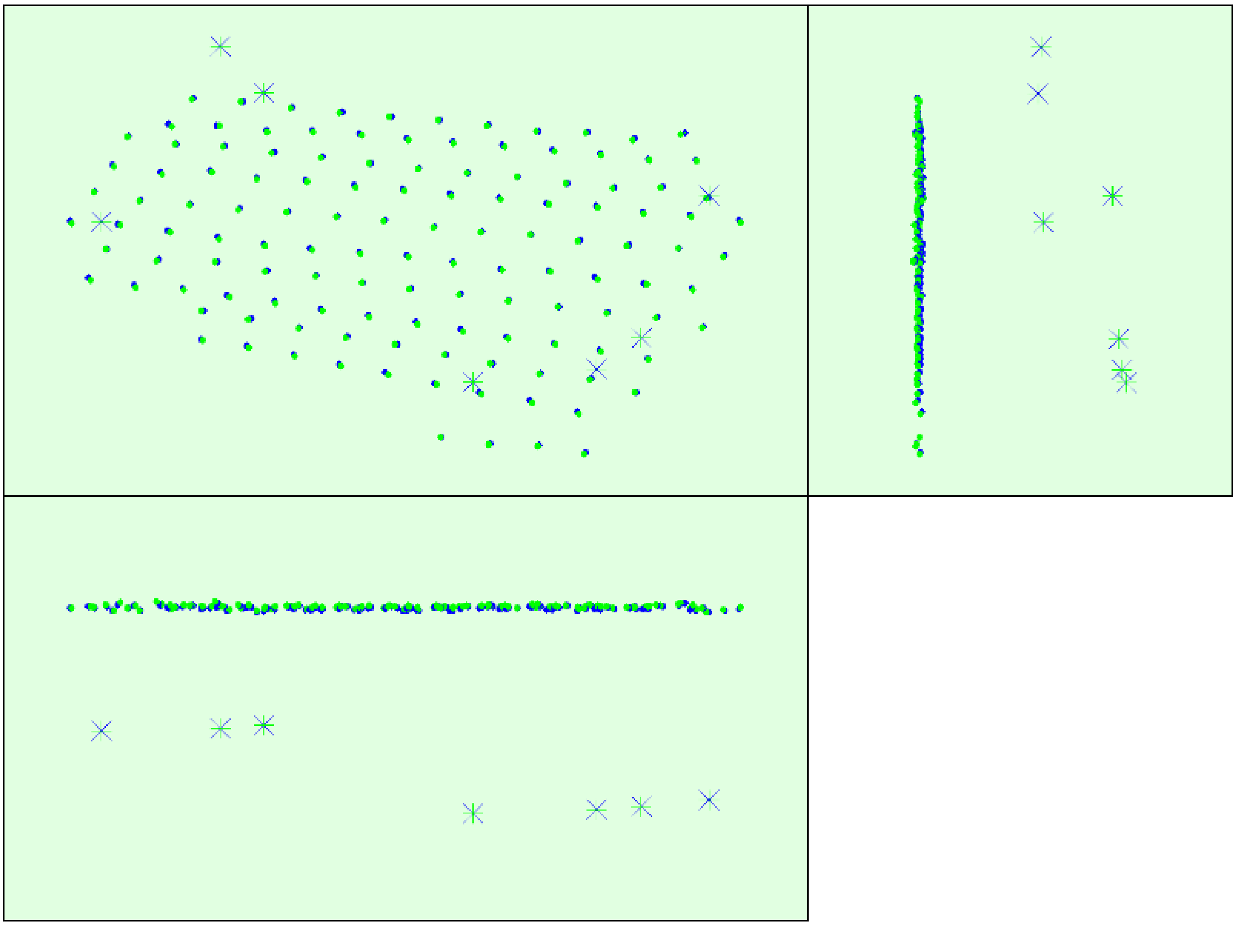


4. Computed Image/GCPs/Manual Tie Points Positions

Verify that :

(optional) If using images with geolocation, the computed image geolocation is good.
(optional) If using GCPs, the GCPs' error is low (the difference between input and computed GCPs is small).

Computed Image/GCPs/Manual Tie Points Positions

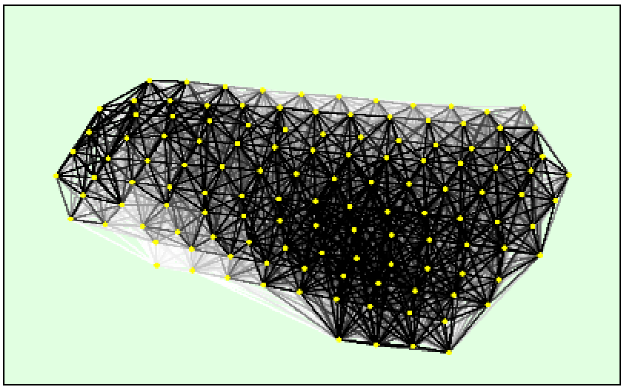


5. 3D Points from 2D Keypoints Matches

Verify that:

Enough matches have been computed between the images.
The graph consists of one block. If multiple blocks exist, each block will have a different color. For more information: 207932643.

2D Keypoint Matches



Number of matches 25 222 444 666 888 1111 1333 1555 1777 2000

6. Geolocation Details

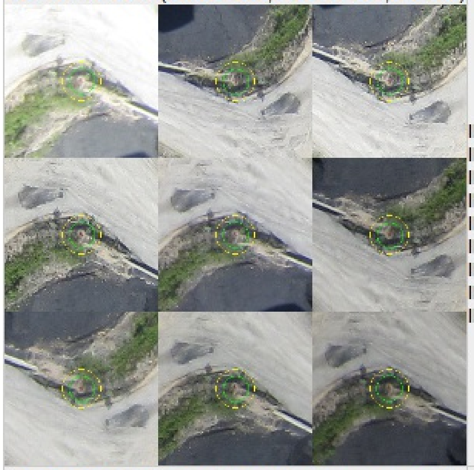
(optional) If using GCPs, verify that:

All GCPs are taken into account (not displayed with red color on the *Geolocation and Ground Control Points* table).
All marked GCPs have been verified.
The green circle representing the reprojected GCP 3D point is inside the yellow circle representing the marked GCP.

Ground Control Points

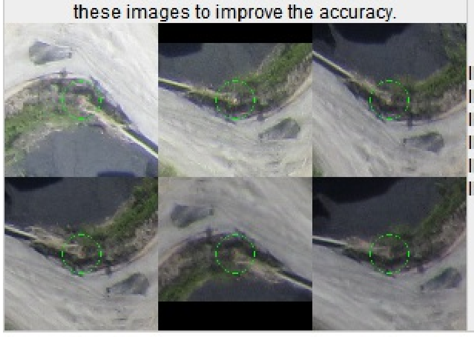
GCP Name	Accuracy XY/Z [m]	Error X [m]	Error Y [m]	Error Z [m]	Projection Error [pixel]	Verified/Marked
9001 (3D)	0.020/ 0.020	-0.010	-0.011	-0.004	0.647	7 / 7
9002 (3D)	0.020/ 0.020	0.021	-0.019	0.041	0.592	4 / 4
9004 (3D)	0.020/ 0.020	-0.009	0.005	0.007	1.210	8 / 8
9011 (3D)	0.020/ 0.020	-0.008	-0.035	-0.114	0.948	9 / 9
9016 (3D)	0.020/ 0.020	-0.031	0.022	-0.098	0.936	10 / 10
9017 (3D)	0.020/ 0.020	0.024	0.016	-0.113	0.922	10 / 10
9012 (3D)	0.020/ 0.020	0.030	0.013	0.180	1.051	14 / 14
Mean [m]		0.002547	-0.001266	-0.014592		
Sigma [m]		0.021055	0.019540	0.098809		
RMS Error [m]		0.021208	0.019581	0.099881		

GCP Name: 9011 (312064.388,5169799.361,523.326)



IMG_1146.JPG
IMG_1167.JPG
IMG_1168.JPG
IMG_1169.JPG
IMG_1170.JPG
IMG_1194.JPG
IMG_1195.JPG
IMG_1196.JPG
IMG_1197.JPG

GCP 9011 was not marked on the following images (only up to 6 images shown). If the circle is too far away from the initial GCP position, also measure the GCP in these images to improve the accuracy.



IMG_1147.JPG
IMG_1166.JPG
IMG_1192.JPG
IMG_1193.JPG
IMG_1198.JPG
IMG_1221.JPG

7. Processing Options

Verify that:

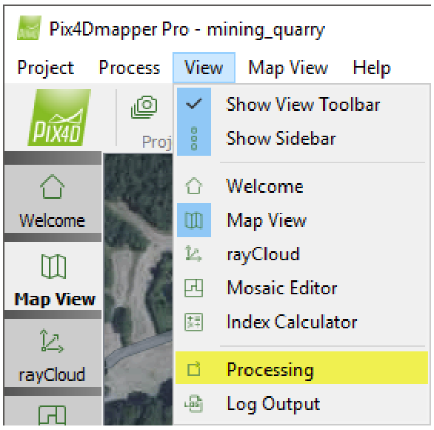
(optional) If using GCPs, the *Ground Control Point (GCP) Coordinate System* is correct.
(optional) If using images with geolocation, the *Image Coordinate System* is correct.

Processing Options

Hardware	CPU: Intel(R) Core(TM) i7-4710HQ CPU @ 2.50GHz RAM: 16GB GPU: Intel(R) HD Graphics 4600 (Driver: 20.19.15.4331)
Operating System	Windows 10 Home, 64-bit
Camera Model Name	CanonIXUS220HS_4.3_4000x3000 (RGB)
Image Coordinate System	WGS84
Ground Control Point (GCP) Coordinate System	WGS84
Output Coordinate System	WGS84 / UTM zone 32N
Detected template:	No template available
Keypoints Image Scale	Full, Image Scale: 1
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Standard, Internal Parameters Optimization: All, External Parameters Optimization: All, Rematch: Auto yes

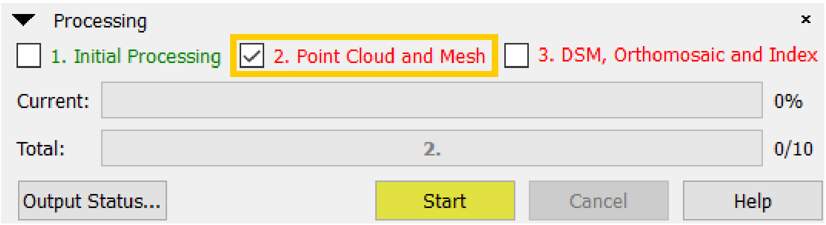
To process step *2. Point Cloud and Mesh*:

1. On the Menu bar, click View > Processing.



2. The *Processing* bar opens on the bottom of the main window.

3. Ensure that *2. Point Cloud and Mesh* is selected, and that *1. Initial Processing* and *3. DSM, Orthomosaic and Index* are unselected.

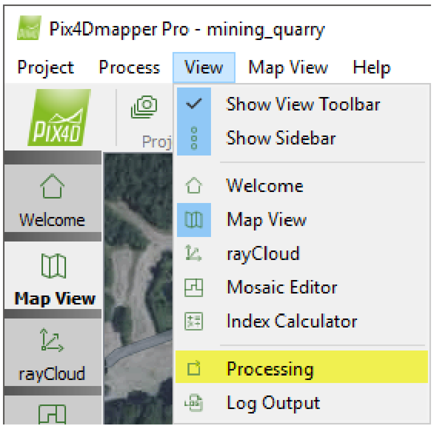


4. Click Start.

For more information about the outputs resulting from *2. Point Cloud and Mesh*: 202558549.

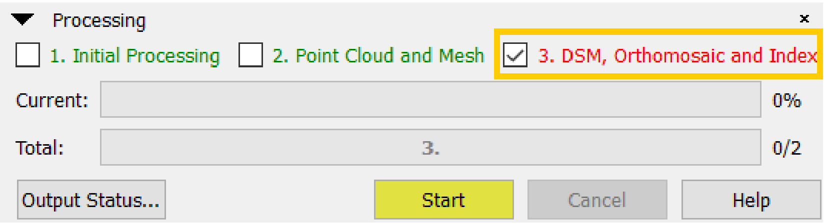
To process step *3. DSM, Orthomosaic and Index*:

1. On the Menu bar, click View > Processing.



2. The *Processing* bar appears in the bottom of the main window.

3. Ensure that *3. DSM, Orthomosaic and Index* is selected, and that *1. Initial Processing*, and *2. Point Cloud and Mesh* are unselected.



4. Click Start.

For more information about the outputs resulting from *3. DSM, Orthomosaic and Index*: 202558559.

Once the project has been processed, it is possible to use the results:

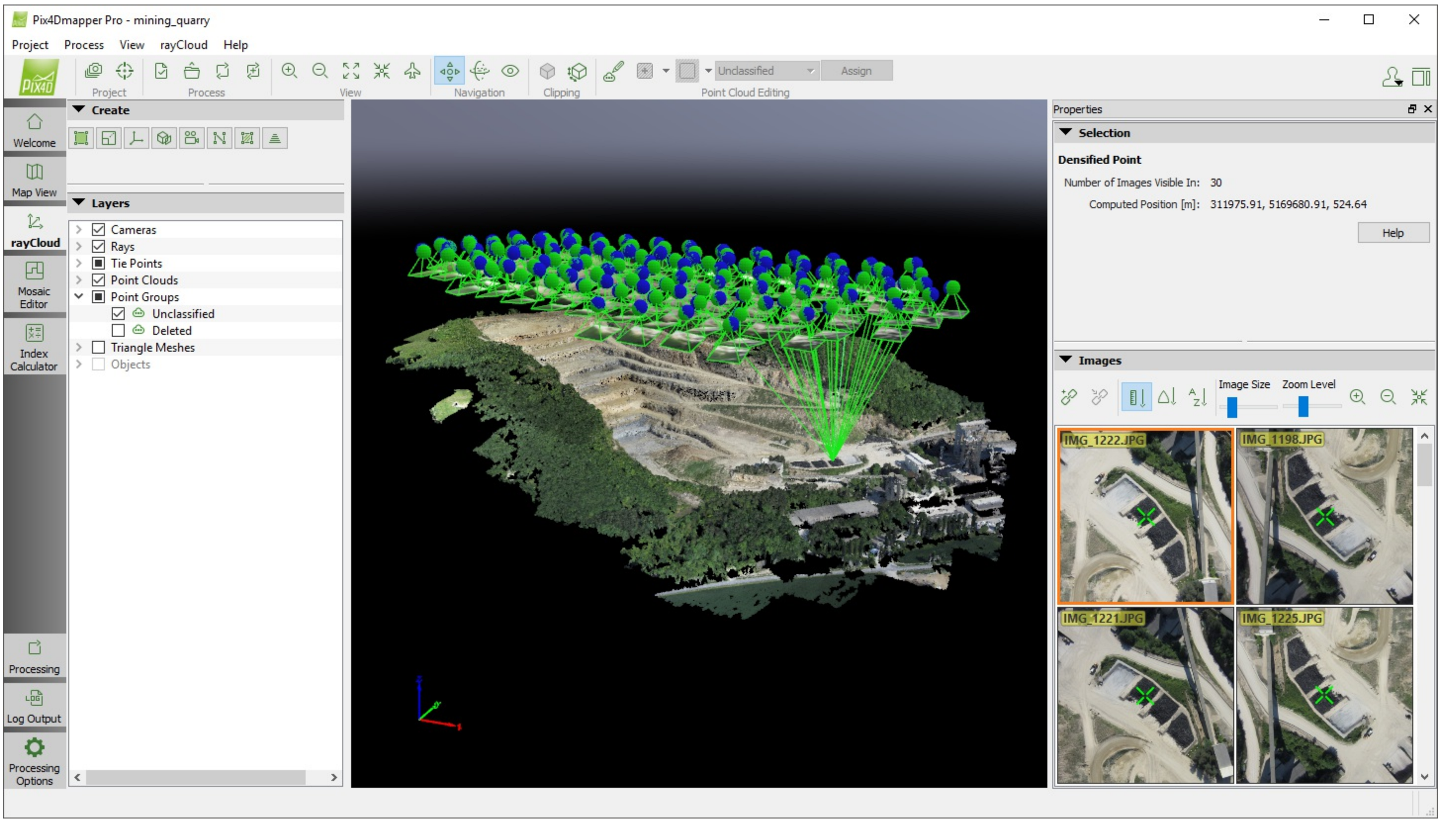
Using the rayCloud
Using the Mosaic Editor
Using the Index Calculator
Uploading Project Files
Using output files in other software

Using the rayCloud

The use of the *rayCloud* is optional and it can be used to:

Visualize the different elements of the reconstruction (Camera Positions, Reprojections (rays), GCPs, Manual / Automatic Tie Points, Processing Area, Clipping Box, Densified Point Cloud, Terrain / Objects / other Point Groups, 3D Textured Mesh, Video Animation Trajectories) and their properties.
Visualize point clouds / triangle meshes created in other projects or with other software.
Georeference a project using GCPs and /or Scale and Orientation constraints.
Create Orthoplanes to obtain mosaics of any selected plane (for example, building facades).
Verify / improve the accuracy of the reconstruction.
Assign points of the point cloud to different point groups.
Improve the visual aspect.
Create objects and measure distances (polylines), surfaces, and volumes (stockpiles).
Create 3D fly-through animations (Video Animation Trajectories).
Export different elements (GCPs, Manual / Automatic Tie Points, Objects, Video Animation Trajectories).
Export point cloud files using points belonging to one or several classes.

For more information: 202558639.

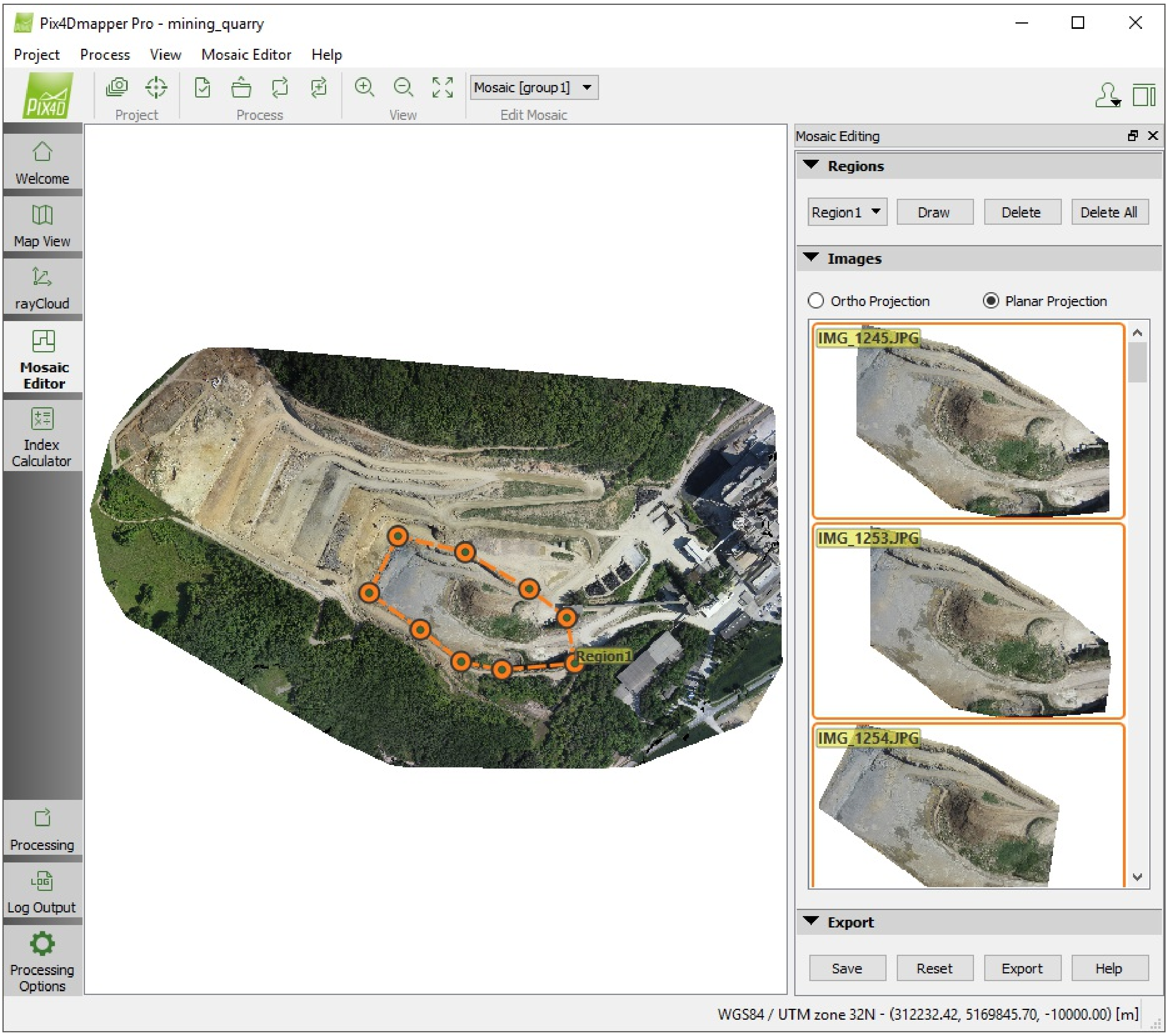


Using the Mosaic Editor

The use of the *Mosaic Editor* is optional and it can be used to:

Visualize the DSM (raster GeoTIFF Digital Surface Model).
Visualize the Orthomosaic.
Improve the visual aspect of the Orthomosaic.

For more information: 202558709.

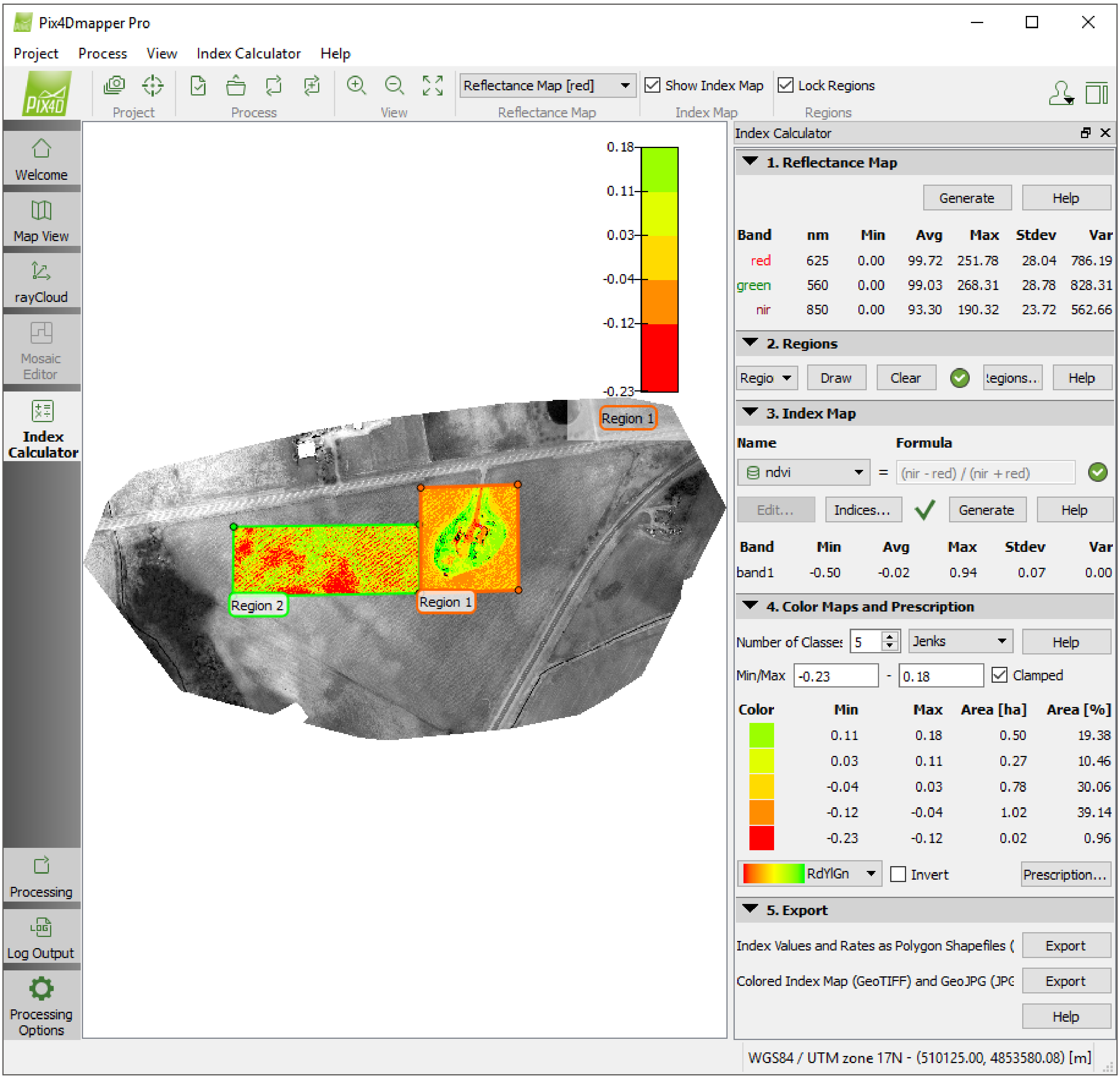


Using the Index Calculator

The use of the *Index Calculator* is optional and it can be used to:

Generate an Index Map / Index Grid where the color of each pixel is computed using a formula that combines different bands of the Reflectance Map(s).
Provide information about the bands of the Reflectance Map(s) and Index Map.
Visualize the Index Map as a Colored Index Map by applying a color mapping to it.
Export a georeferenced Colored Index Map.
Annotate the classes of the Index Map to generate an Application Map.
Export an Application Map as a shape file to be imported in any Tractors Consoles.

For more information: 202558729.



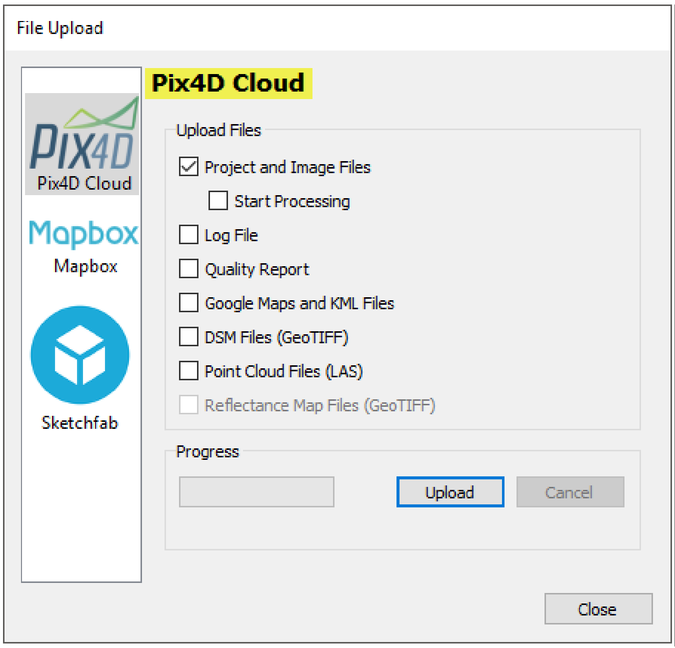
Uploading Project Files

The use of the *Upload Project Files* feature is optional and it can be used to:

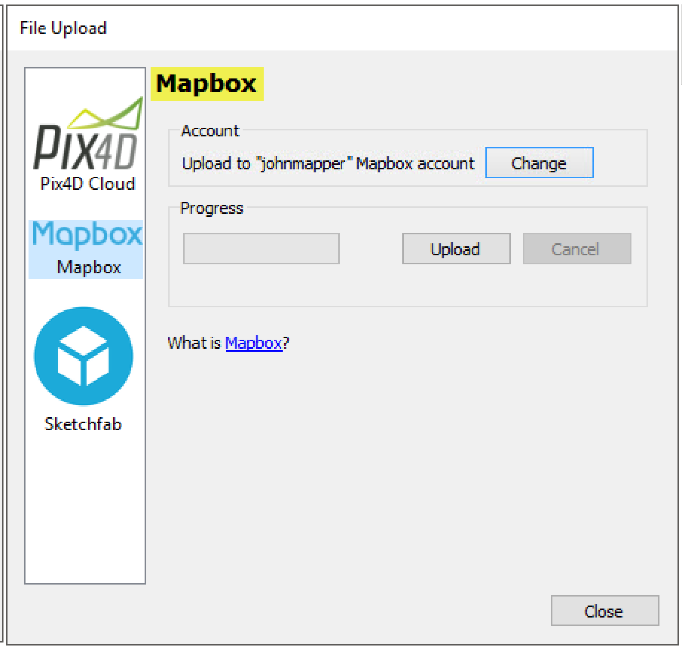
Upload Files to the Pix4D Cloud, in order to:
Store files in the Pix4D online account.
Process projects online.
Provide project information to the support team.
Upload files to Mapbox.
Upload 3D Textured Mesh to Sketchfab, for viewing, interacting and sharing.

For a full description about the *File Upload* pop-up: 202557689.

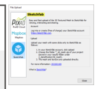
For step by step instructions about how to Upload project files into Pix4D Cloud: 202558589.



Upload Files to the Pix4D Cloud



Upload Files to Mapbox



Upload Files to Sketchfab

Using output files in other software

Pix4Dmapper outputs are compatible with many software (GIS, CAD, etc.) and can be used for many different applications. For more information about how to use Pix4Dmapper output files in other software: 202558499.

The software manual describes all the options that can be found in the Pix4Dmapper software. Offline version: pdf. The following links contain a detailed description of these options:

Table View	Blocks View	Index View

Interface			
Menu bar	Toolbar	View toolbar	Main view
Floating License Shortcuts			

Menu Bar		
Menu Project	**Menu Process**	**Menu View**
New Project... Open Project... Recent Projects Close Project Download Project Files... Upload Project Files... Image Properties Editor... Image Geolocation Selected Camera Model Edit Camera Model Images Table GCP/MTP Manager... GCP Coordinate System GCP/MTP Table Import GCPs... Export GCPs... Add Point Remove Points Import Marks... Export Marks... GCP/MTP Editor rayCloud Basic GCP/MTP Editor GCP/MTP Table Images Preview Select Output Coordinate System... Save Project Save Project As... Split into Subprojects... Exit	Reoptimize Rematch and Optimize Quality Report... Open Results Folder... Outputs Status... Generate Quality Report Save Undistorted Images Run Terrain/Object Point Cloud Classification (beta) Generate 3D Textured Mesh Generate DTM (beta) Import Point Cloud for DSM Generation... Generate Google Maps Tiles, KML and Mapbox Tiles Generate Contour Lines Send Elevation Data (DSM) to eMotion Send Map to eMotion Processing Options... Initial Processing Point Cloud and Mesh DSM, Orthomosaic and Index Resources and Notifications Templates	Show View Toolbar Show Sidebar Welcome Projects Help Demo Project Map View rayCloud Mosaic Editor Index Calculator Processing Log Output **Menu Help** Help Contents Online Support Forum Personal Support Settings... About...

Views			
Map View	**rayCloud**	**Mosaic Editor**	**Index Calculator**

Menu bar entry Processing Area Toolbar 2D View Project Information sidebar Project Summary Layers Status bar	Menu bar entry Viewpoint Navigation Modes Perspective/ Orthographic Change Background... Display Sky New Scale Constraint New Orientation Constraint New Orthoplane New Polyline New Surface New Volume New Video Animation Trajectory... Toolbar Left sidebar Create Layers Cameras Rays Tie Points Processing Area Point Clouds Point Groups Triangle Meshes Objects 3D View Right sidebar Clipping Box Cameras GCPs and Manual Tie Points Automatic Tie Points Processing Area Point Clouds Objects Status bar	Menu bar entry View Mosaic Editing Visualization Toolbar Mosaic View Sidebar Status bar	Menu bar entry Toolbar Index View Sidebar 1. Reflectance Map 2. Regions 3. Index Map Formula Editor Index List 4. Color Maps and Prescription 5. Export Status bar

Next

When Pix4Dmapper opens, 4 sections appear:

Menu bar
Toolbar
View toolbar
Main view

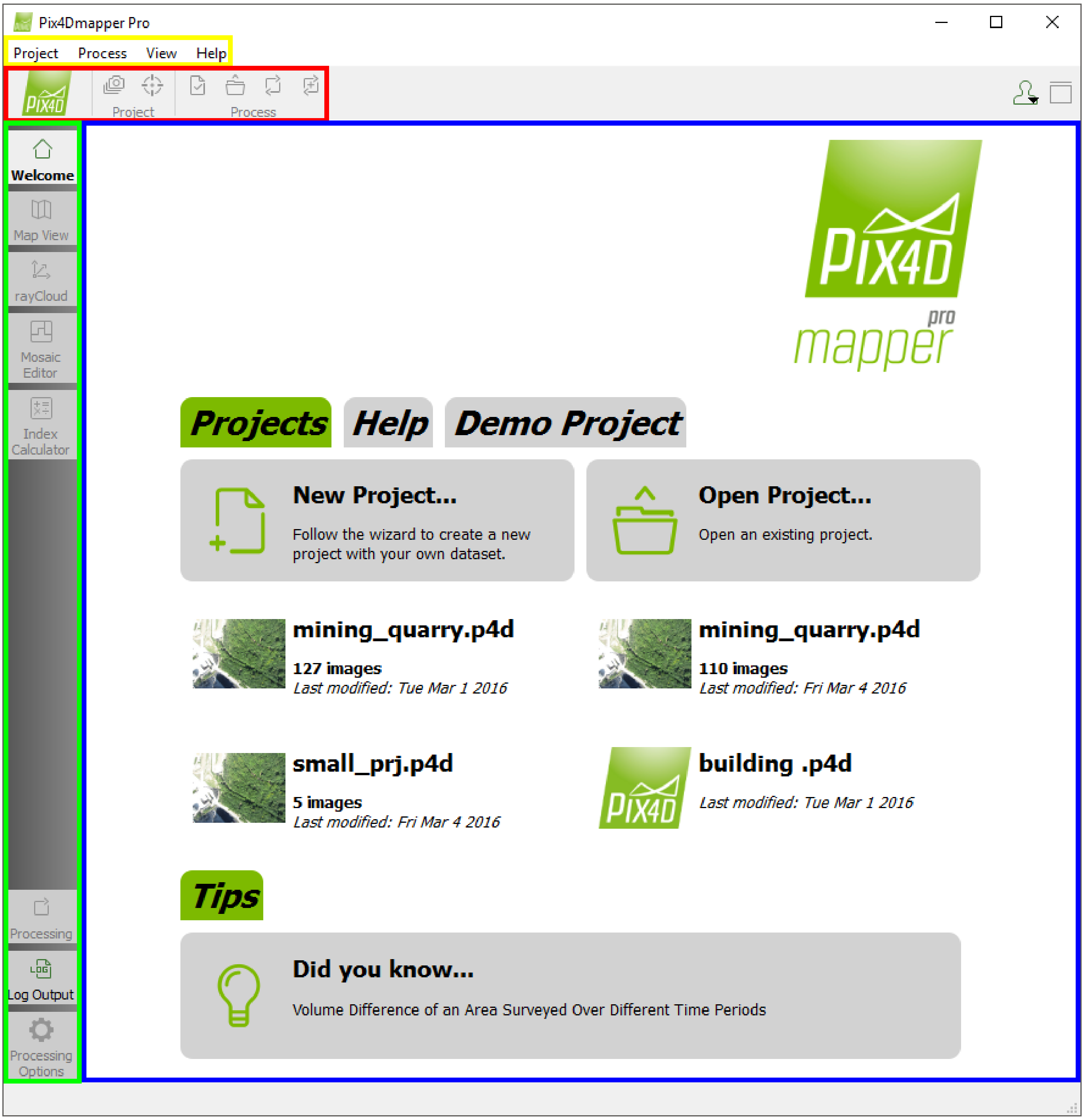


Figure 1. Menu bar (yellow), toolbar (red), view toolbar (green) and main view (blue).

Menu bar

There are 4 items:

Project: This menu allows the user to create, open, close, save or split a project. It also allows the user to view and define the properties of the images, GCPs, and output coordinate system.

Process: This menu gives access to all processing options and actions.
View: This menu gives access to the different views of the software. Depending on the selected view, a new item will appear on the Menu bar: *Map, rayCloud, Mosaic Editor* or *Index Calculator*. This extra menu bar item contains options specific for the selected view.
Help: This menu:
Gives access to the Manual, Support Site and Forum.
Allows the user to set some settings (proxy, camera model database, language)
Gives information about the installed release.

The different options within the menu bar items may be active or grayed out depending on the status of the project and the selected options.

Toolbar

The different buttons within the toolbar may be active or grayed out depending on the status of the project and the selected options. Each button's action can also be accessed through the Menu bar and is explained in more details in the next articles.

The toolbar buttons are:

On the left:

Project

Image Properties Editor...

GCP/Manual Tie Point Manager...

Process

Quality Report...

Open Results Folder...

Reoptimize

Rematch and Optimize

On the right:

User Options: There are 4 items that can be selected:

Logged In as USERNAME: Displays the username.
Cloud Projects: Opens the user website account, displaying the *Projects* page, where the user can access the uploaded projects (https://mapper.pix4d.com/projects/).
Manage Licenses: Opens the user website account, displaying the *Licenses* page, where the user can access the Licenses and Devices information (https://mapper.pix4d.com/licenses/).
Log Out...: Option to deactivate the license in the installed computer.

Show / Hide the Sidebar: Shows /hides the sidebar relative to the selected view. The Welcome view does not have a sidebar.

When activating the different views using the View Menu bar item (*Map View, rayCloud, Mosaic Editor* and *Index Calculator*) some extra buttons appear. These extra buttons are specific for the selected view (see *Figures 2-5* below).

View toolbar

Appears on the left and allows to select the view, bars (*Processing* and/or *Log Output* bar) and the Processing Options window. Depending on the status of the project and the selected options, the different options may be active or grayed out. When starting the software, only the Welcome View and the *Log Output* bar are active.

The following views are available:

Welcome

Map View

rayCloud

Mosaic Editor

Index Calculator

The following bars are available:

Processing

Log Output

The following windows are available:

Processing Options...

In order to show / hide the view toolbar, on the Menu bar click View > Show View Toolbar.

Main view

When Pix4Dmapper opens, the Welcome View appears.

When opening a project the Map View is selected by default and the 2D View appears. When the rayCloud is selected, the 3D View appears. When the Mosaic Editor is selected, the Mosaic View appears and when the Index Calculator is selected, the Index View appears.

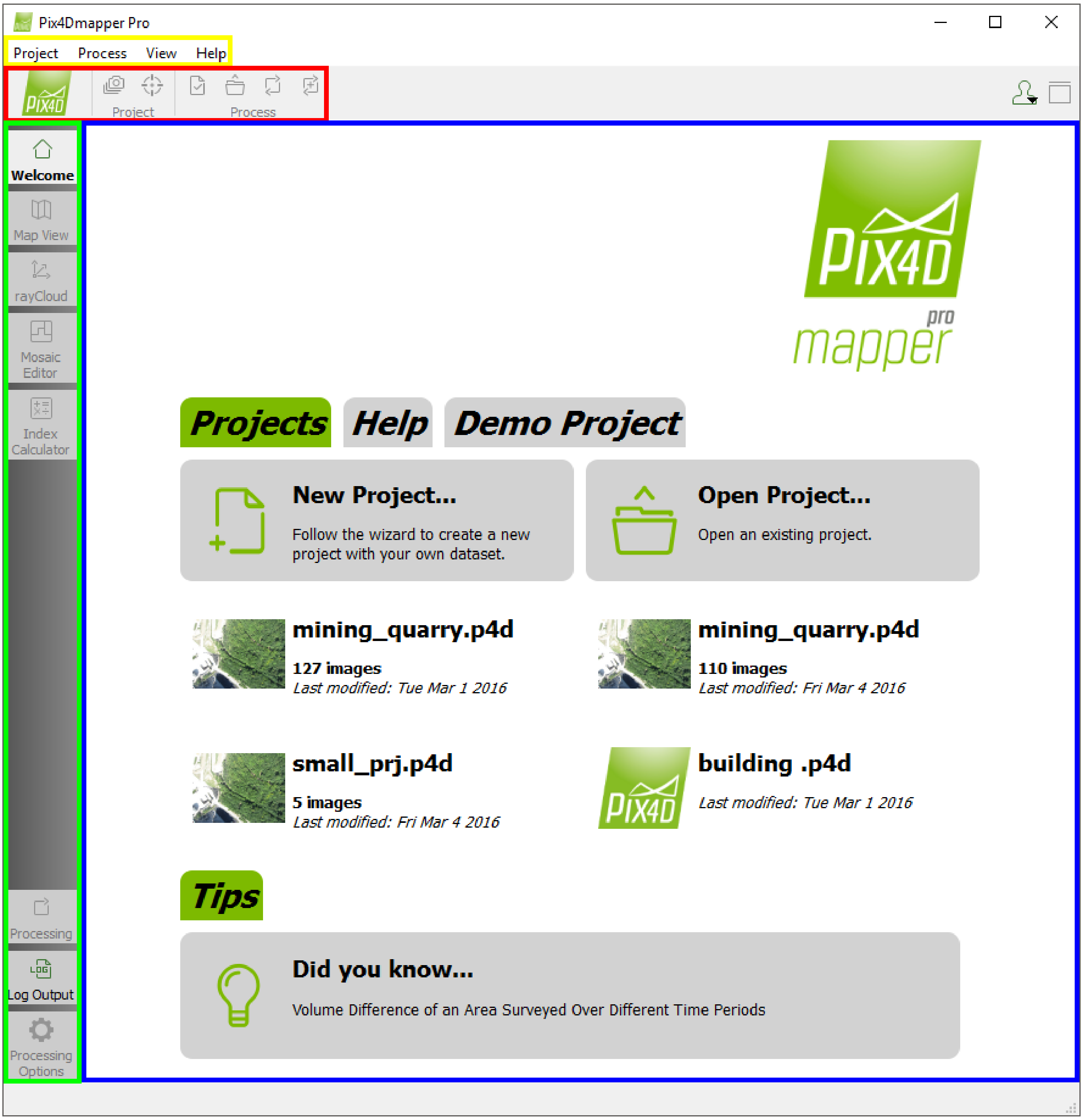


Figure 1. Menu bar, toolbar buttons, view toolbar and main view when starting the software.

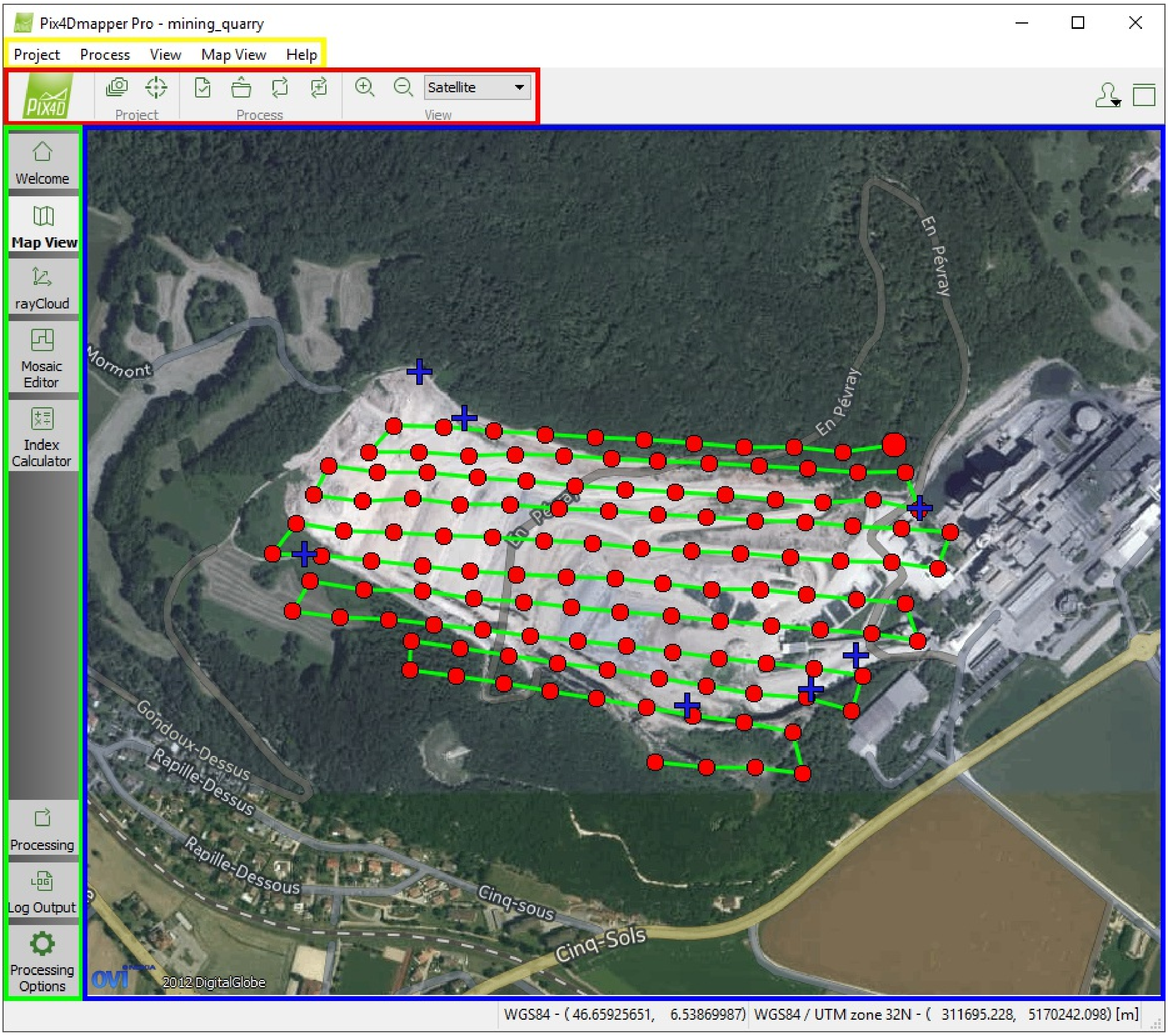


Figure 2. Menu bar, toolbar buttons, view toolbar and main view when the Map View is selected.

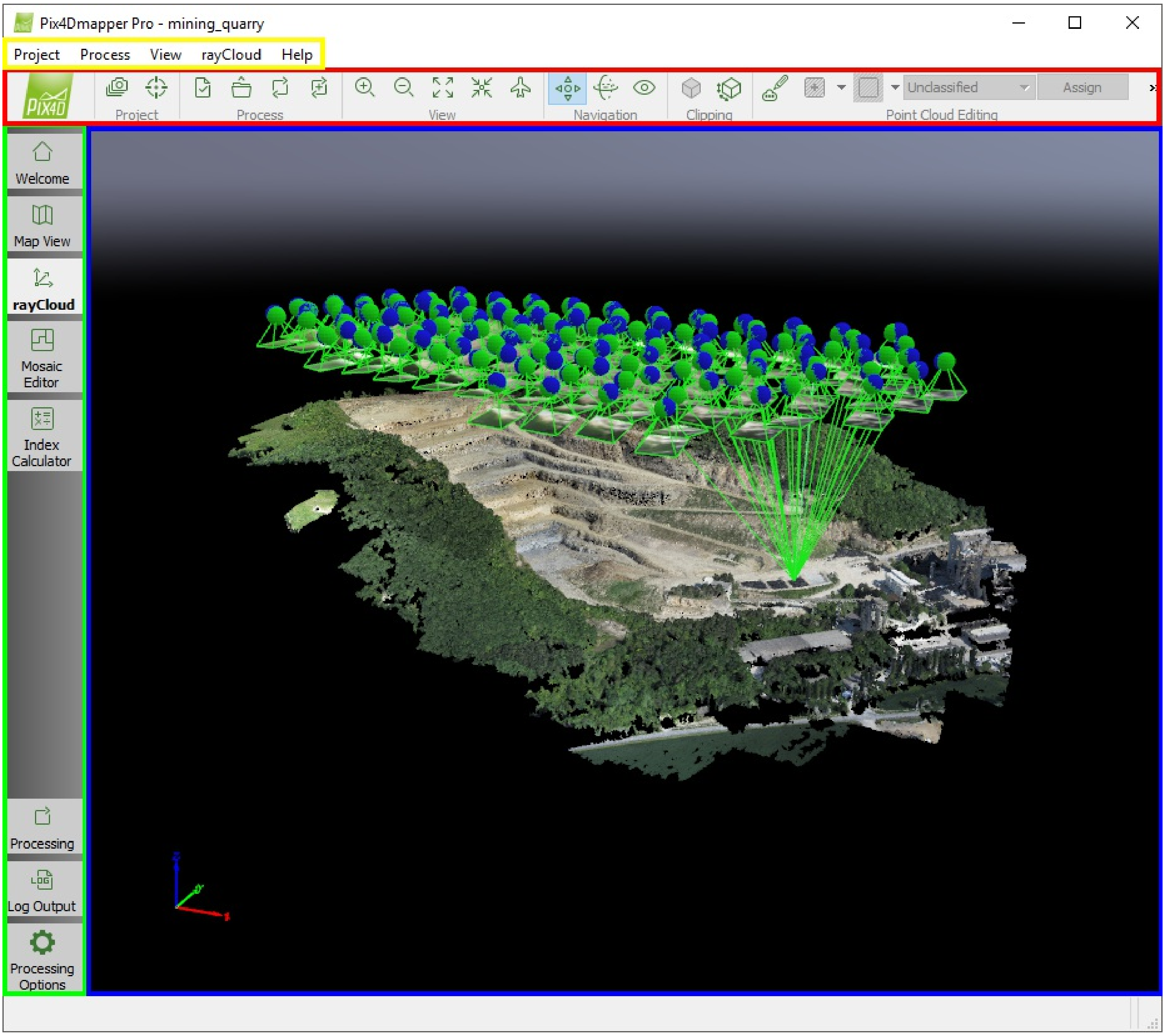


Figure 3. Menu bar, toolbar buttons, view toolbar and main view when the rayCloud is selected.

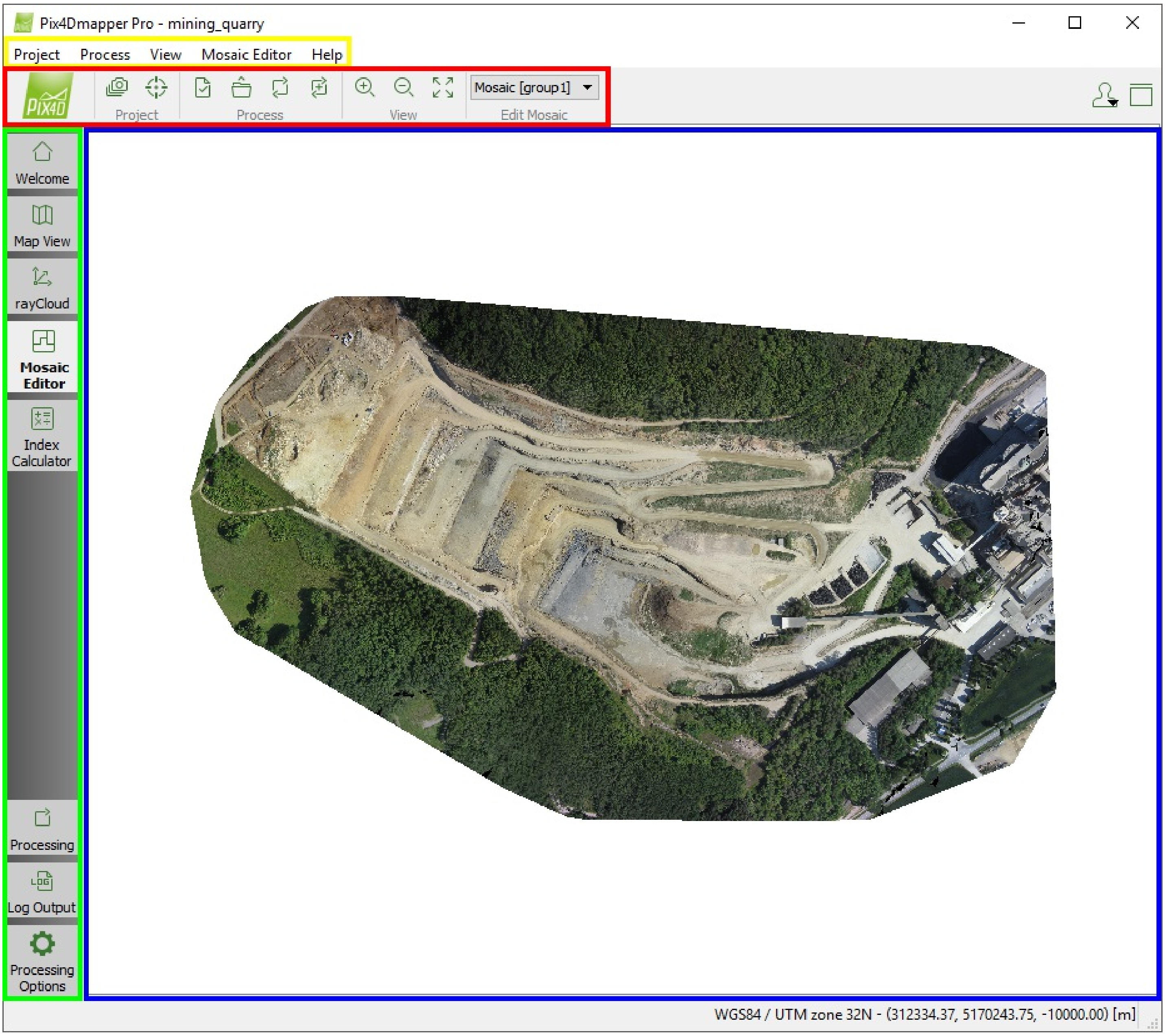


Figure 4. Menu bar, toolbar buttons, view toolbar and main view when the Mosaic Editor is selected.

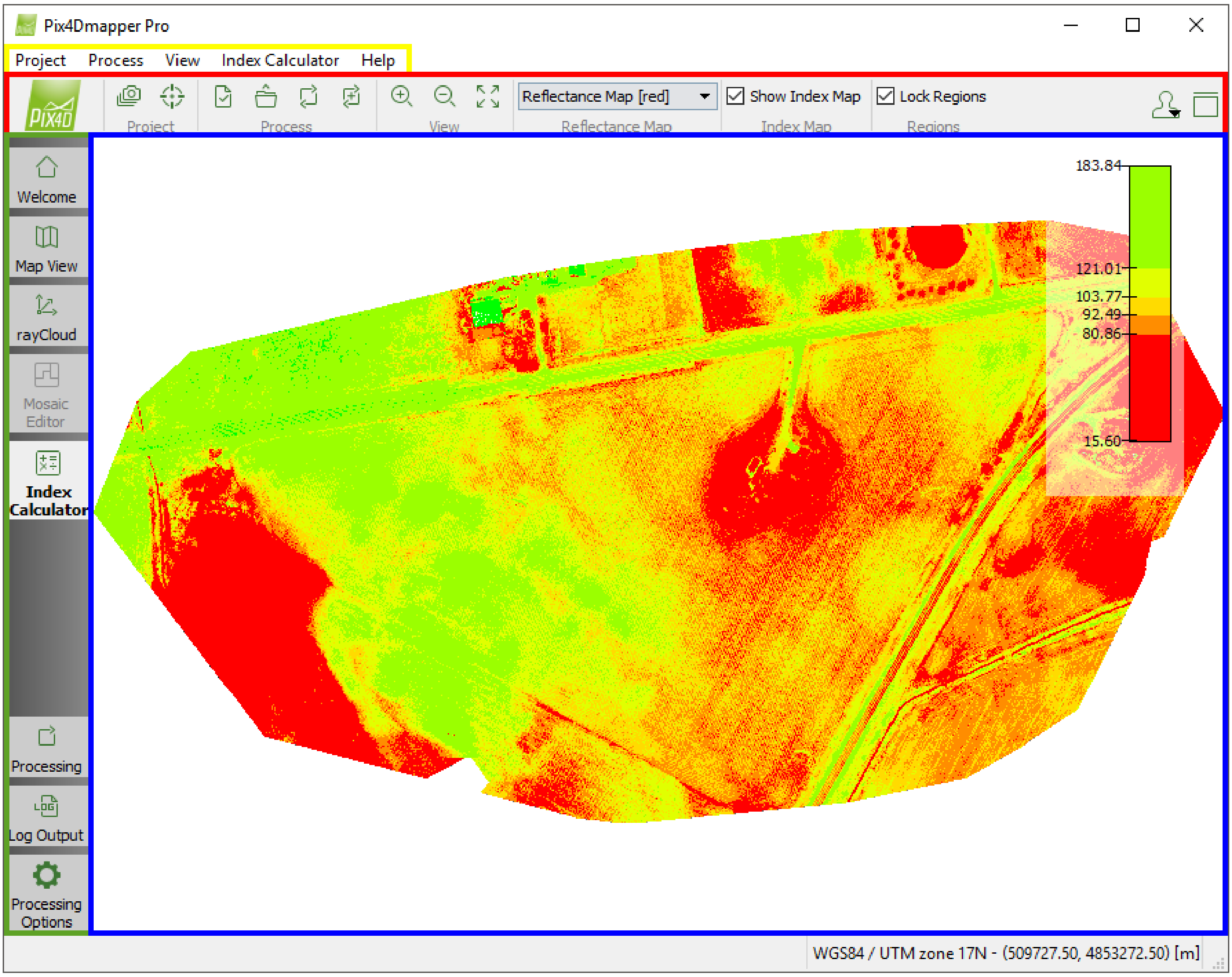


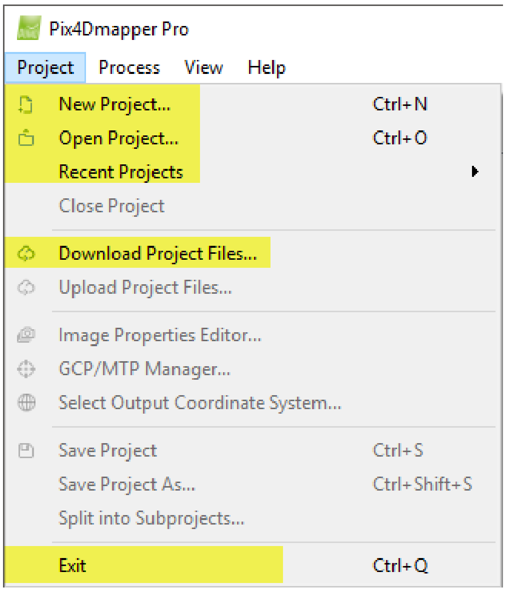
Figure 5. Menu bar, toolbar buttons, view toolbar and main view when the Index Calculator is selected.

Access: On the Menu bar, click Project.

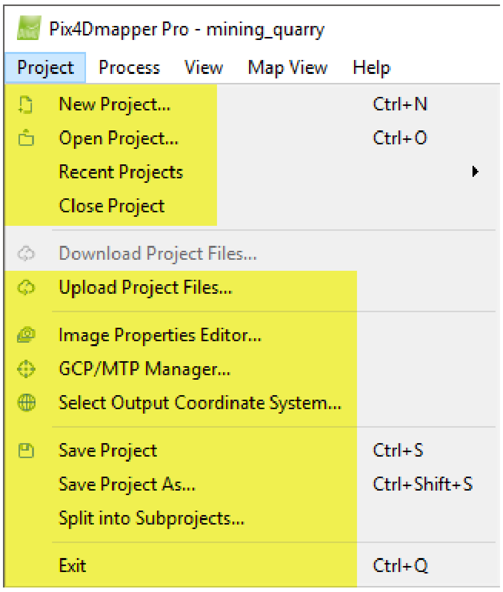
There are 13 items that can be selected:

New Project...
Open Project...
Recent Projects
Close Project
Download Project Files...
Upload Project Files...
Image Properties Editor...
GCP/MTP Manager...
Select Output Coordinate System...
Save Project
Save Project As...
Split into Subprojects...
Exit

Depending on whether there is a project loaded/created, different options will be enabled or grayed out:



Available options before a project is loaded or created.



Available options once a project is loaded or created.

New Project...

Opens the wizard to create a new project.

For step by step instructions about how to create a new project: 202557309.

Open Project...

Opens an existing project. By clicking Open Project, a pop-up will appear to navigate and select a *.p4d* project file (Pix4Dmapper project file format).

Recent Projects

Displays a menu with the 10 last projects that have been opened. By clicking on one of them, the project will open.

Close Project

Closes the current project.

Download Project Files...

Allows the user to download and load a Pix4Dmapper project previously uploaded to Pix4D Cloud. This option is enabled when the software is opened and disabled once a project is loaded or created.

For step by step instructions: 205751415.

Upload Project Files...

Allows the user to:

Upload and process a project to Pix4D Cloud Server.
Upload Files to Mapbox.
Upload Files to Sketchfab.

For more information: 202557689.

Image Properties Editor...

Allows the user to change the properties of the project's images such as: coordinate system, geolocation, orientation and the associated camera model. For more information: 202557849.

GCP/MTP Manager...

Allows the user to set up and edit the properties of the GCPs / Manual Tie Points / Check Points such as: Select the GCP coordinate system, import GCPs, add / remove points, import / export the marks, open the rayCloud or Basic Editor for marking. For more information: 202558329.

Select Output Coordinate System...

Allows the user to select the coordinate system of the results. For more information: 202558099.

Save Project

Saves the status/properties and configuration of the current project.

> Important: This option saves any change made since the project was opened and saved for the last time. The *.p4d* project file will be updated with the current state of the project. This has no impact on other files such as input files or output files. Output files will be modified/created only when processing.

Save Project As...

Save the status/properties, configuration, and results of the current project into another location and/or with a different name.

> Important: If a different project name or path is selected, this option will save a copy of the project in the new location using the new project name.
>
> A new *.p4d* project file will be created and saved with the same information as the current project. Once this new project is created, any changes made and saved with the option *Save Project* will not be saved in the original project. Only the new project will include all the changes.

Split into Subprojects...

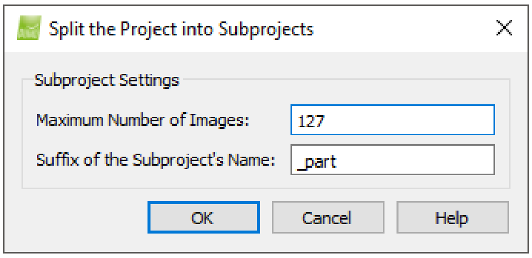
Allows the user to automatically split the project into subprojects by creating different .p4d files.

Each .p4d file contains the images for the created subproject.

The different subprojects overlap, therefore, some images will appear in more than one subproject.

> Important: Only aerial projects with geolocated images can be split.

By clicking Split into Subprojects... the *Split the Project into Subprojects* pop-up will open:



It contains the following options:

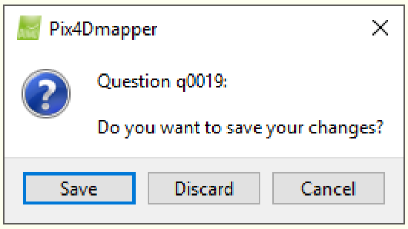
Maximum Number of Images: Defines the area to be used to split the terrain into subprojects. When selecting for example 100, a subproject will cover the area from 100 images plus some area and images from neighboring subprojects so as to ensure there will be overlap between them.
Suffix of the Subproject's Name: Text to use as suffix for the subprojects. Each subproject will be named as *projectname + Suffix + Number*.

Important: All the Manual Tie Points, GCPs, Check Points and Objects created in the original project will be copied into all the generated subprojects.

Exit

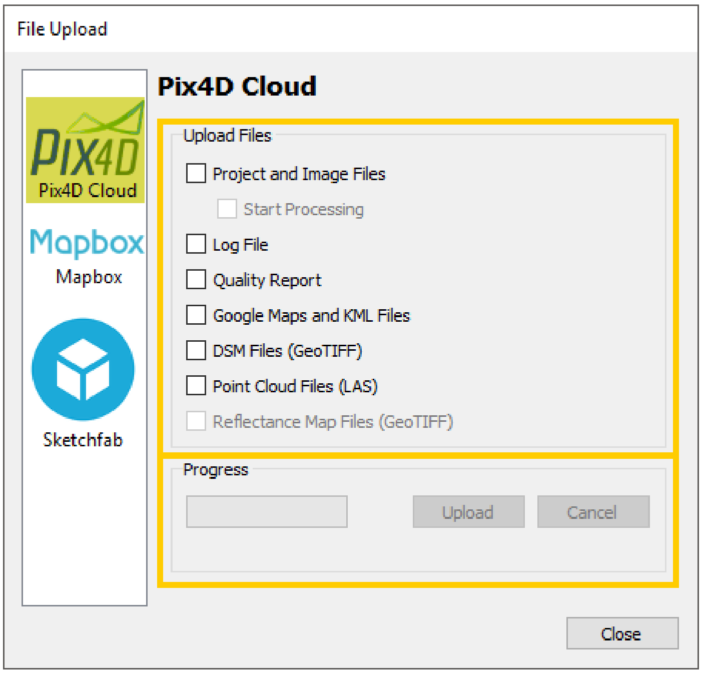
Closes the project and exits the software.

Important: If changes have been made and the project was not saved, the following pop-up appears:



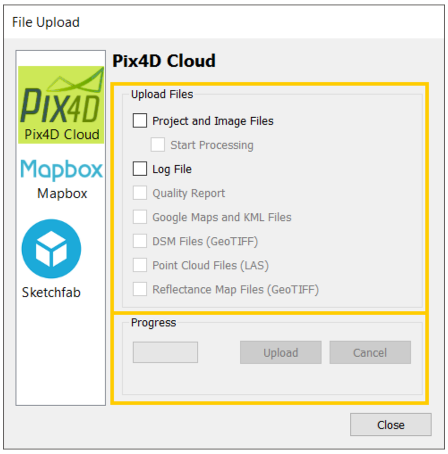
Click Save to save the changes and exit, Discard to exit without saving, and Cancel to keep the software open.

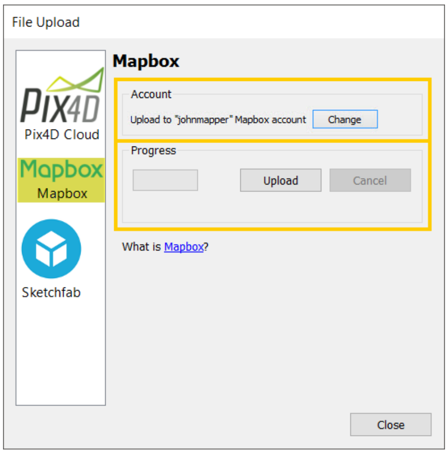
Access: On the Menu bar, click Process > Upload Project Files... (active once a project has been loaded or created).

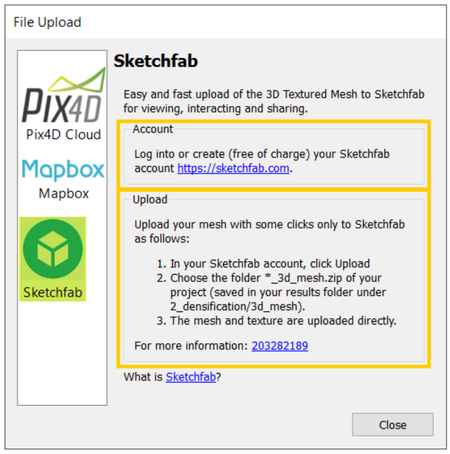


The *File Upload* pop-up appears, which allows the user to:

Upload and process a project to Pix4D Cloud Server.
Upload Files to Mapbox.
Upload Files to Sketchfab







Upload and process a project to Pix4D Cloud Sever

The *Upload Project* window contains 2 sections:

Upload Files
Progress

and the action buttons:

Close: Closes the window.

Upload Files

The *Upload Files* section contains the following boxes:

Project and Image Files: To upload the .p4d file and the images of the project.
Start Processing: To start processing on Pix4D Cloud Server. It is enabled when *Project and Image Files* has been selected. For more information and step by step instructions: 202558589.

Note: When sending a project to Pix4Dmapper Support Team, there is no need to select *Start Processing*.

Log File (.log): To upload the log file of the project.
Quality Report (.pdf): To upload the quality report of the project.
Google Maps and KML Files: To upload the Google Maps and .kml files of the project.
DSM Files (GEOTIFF): To upload the DSM files of the project.
Point Cloud Files (LAS): To upload the point cloud files of the project.
Reflectance Map Files (GEOTIFF): To upload the reflectance map file of the project.

Note: The boxes are enabled if the corresponding files have been generated.

Progress

The *Progress* section contains:

Progress bar: Displays the upload status in percentage.
Upload: Allows the user to upload the selected files to the cloud.
Cancel: Cancels the upload.

Note: When the project is uploading, the following information is displayed:
MB already uploaded.
Size of files to be uploaded for the project.
Estimated time remaining.
Upload speed.

Upload Files to Mapbox

The *Upload Project* window contains 2 sections:
Account
Progress

and the action button:

Close: Closes the window.

Account

It displays:

"A new authorization will be requested" if no Mapbox account is logged in.
Upload to "USER" Mapbox account: If a Mapbox account is already logged in Pix4Dmapper .
The button **Change**: Allows the user to log out of the associated Mapbox account in Pix4Dmapper.

Progress

The *Progress* section contains:

Progress bar: Displays the upload status in percentage.
Upload: Allows the user to upload the selected files to the cloud.
Cancel: Cancels the upload.

Note: When the project is uploading, the following information is displayed:
MB already uploaded.
Size of files to be uploaded for the project.
Estimated time remaining.
Upload speed.

Upload Files to Sketchfab

Note: In order to use the 3D Textured Mesh in Sketchfab: 203282189.

The *Upload Project* window contains 2 sections:

Account
Upload

and the action button:

Close: Closes the window.

Account

It displays the URL to log in or create (free of charge) a Sketchfab account.

> **Note:** There is a limit on the size of the files that can be imported:
> Basic (free account): 50MB per model.
> Pro: 200MB per model.
> Business: 500MB per model.

Upload

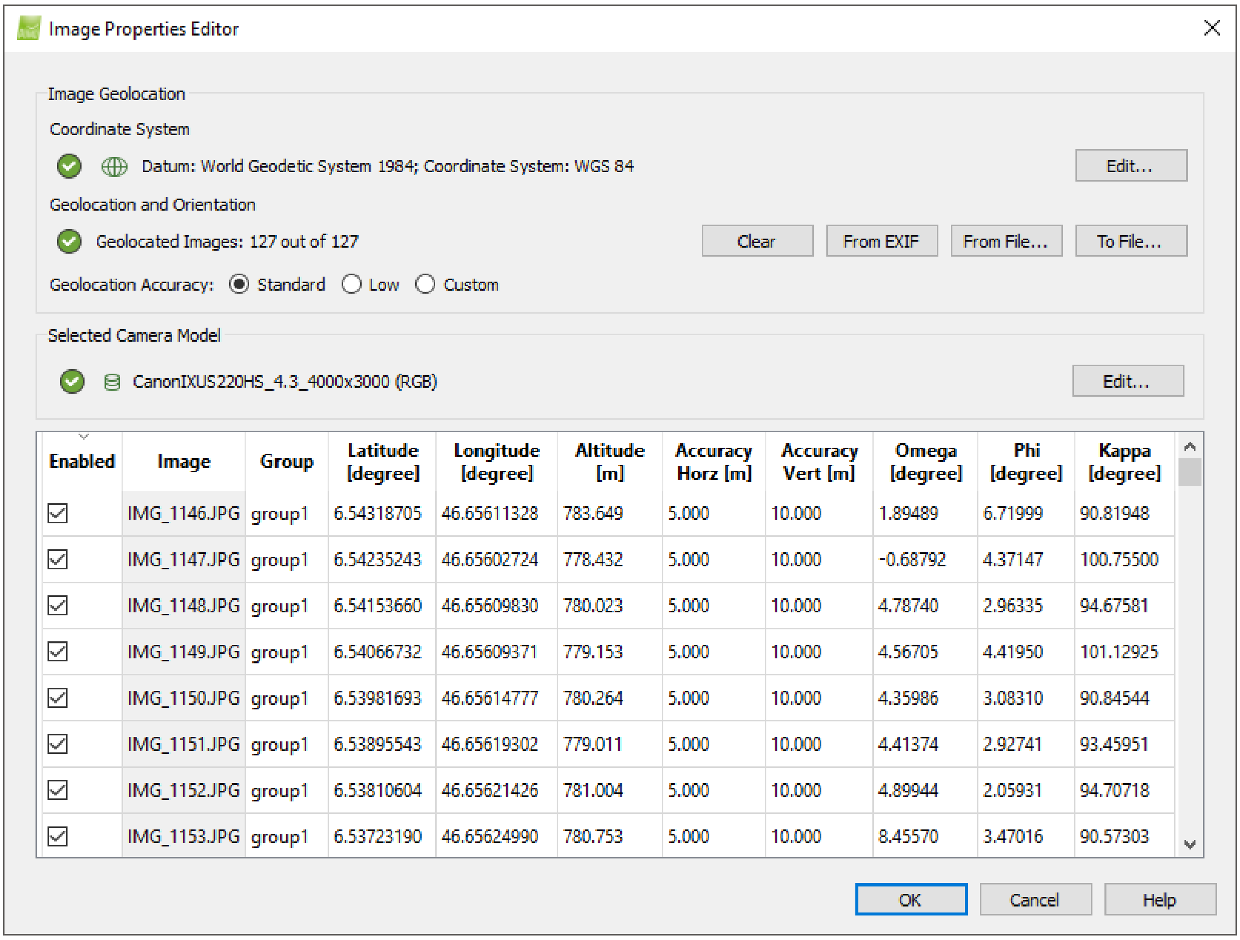
It displays the instructions to upload files to Sketchfab: 204963595.

Access: On the Menu bar, click Project > Image Properties Editor...

Access via the New Project wizard: When creating a new project, after loading the images.

The *Image Properties Editor* window contains 3 sections:

Image Geolocation:
Selects the coordinate system used for the images' geolocation.
Imports/exports the coordinates and, optionally, the orientation of the images and/or the accuracy of the coordinates.
Selects the accuracy of the geolocation.
Selected Camera Model: Selects and configures the camera model associated to the images.
Images Table: Displays the selected images, as well as each image's group, position, position accuracy, orientation, and if the image is enabled or not (an enabled image will be taken into account for processing).



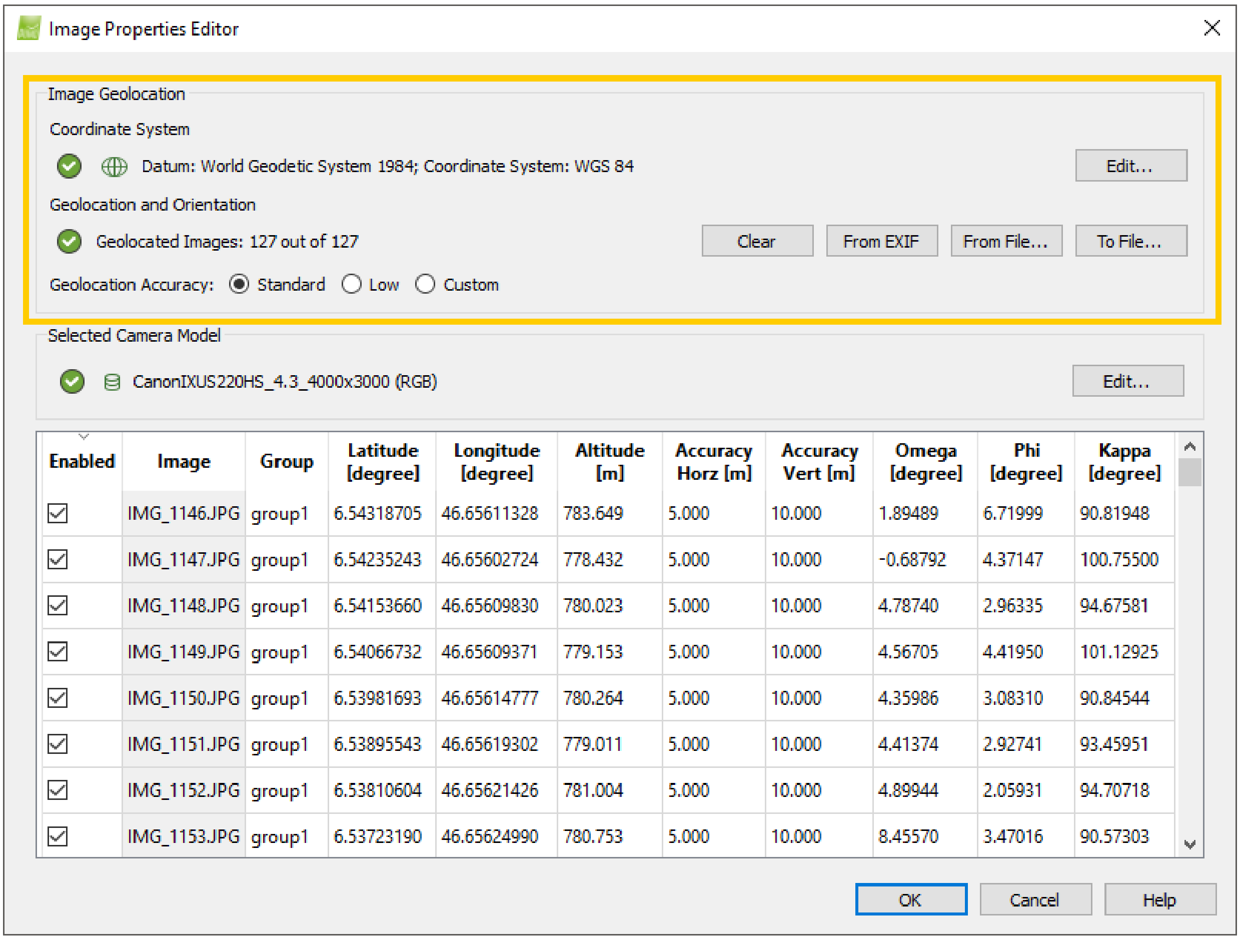
Enabled	Image	Group	Latitude [degree]	Longitude [degree]	Altitude [m]	Accuracy Horz [m]	Accuracy Vert [m]	Omega [degree]	Phi [degree]	Kappa [degree]
☑	IMG_1146.JPG	group1	6.54318705	46.65611328	783.649	5.000	10.000	1.89489	6.71999	90.81948
☑	IMG_1147.JPG	group1	6.54235243	46.65602724	778.432	5.000	10.000	-0.68792	4.37147	100.75500
☑	IMG_1148.JPG	group1	6.54153660	46.65609830	780.023	5.000	10.000	4.78740	2.96335	94.67581
☑	IMG_1149.JPG	group1	6.54066732	46.65609371	779.153	5.000	10.000	4.56705	4.41950	101.12925
☑	IMG_1150.JPG	group1	6.53981693	46.65614777	780.264	5.000	10.000	4.35986	3.08310	90.84544
☑	IMG_1151.JPG	group1	6.53895543	46.65619302	779.011	5.000	10.000	4.41374	2.92741	93.45951
☑	IMG_1152.JPG	group1	6.53810604	46.65621426	781.004	5.000	10.000	4.89944	2.05931	94.70718
☑	IMG_1153.JPG	group1	6.53723190	46.65624990	780.753	5.000	10.000	8.45570	3.47016	90.57303

Access: On the Menu bar, click Project > Image Properties Editor...

Access via the New Project wizard: When creating a new project, after loading the images.

The *Image Geolocation* section contains:

Coordinate System: Selects the coordinate system used for the images' geolocation.
Geolocation and Orientation: Imports/exports the coordinates and, optionally, the orientation of the images and/or the accuracy of the coordinates.
Geolocation Accuracy: Selects the accuracy of the geolocation.



Coordinate System

Datum: Displays the selected image datum. By default the selected datum is *World Geodetic System 1984*.
Coordinate System: Represents the selected image coordinate system. By default the selected coordinate system is *WGS 84*.
Vertical coordinate system or Geoid Height Above the Ellipsoid: It is displayed in parenthesis. It represents the vertical coordinate system / Geoid Height Above the Ellipsoid that will be used to convert image height from geoidal to ellipsoidal. For more information about when to use this function: 202559459.
Edit...: Opens the *Select Image Coordinate System* pop-up that allows the user to change the selected coordinate system.
For more information: 202558239.

Geolocation and Orientation

Important: Pix4Dmapper can process images with or without geolocation. If less than 3 images are geolocated, lower precision results are expected.

The left icon indicates the status:

- : If less than 3 images are geolocated, lower precision results are expected.
- : More than 3 images are geolocated.

The number of geolocated images is displayed next to the status indicator icon.

There are 4 options available for this section:

Clear: Deletes the images' coordinates that are already loaded.
From EXIF: Imports the image geolocation (coordinates) written in the EXIF data of the images if they are available.
From File...: Imports from a file the coordinates of the images and, optionally, the orientation of the images and/or the accuracy of the coordinates using the Select Geolocation File pop-up.
To file: Exports to a file the coordinates of the images and, optionally, the orientation of the images and/or the accuracy of the coordinates using the Export Image Geolocation pop-up.

Geolocation Accuracy

Defines the horizontal and vertical accuracy values (*Accuracy Horz, Accuracy Vert*).

The horizontal accuracy (*Accuracy Horz)* refers to the first and second coordinates (latitude and longitude or X and Y) of the images.
The vertical accuracy (*Accuracy Vert)* refers to the third coordinate (altitude or Z) of the images.

There are 3 options:

Standard: Useful when having very accurate image geolocation. Sets the values to:
Accuracy Horz: 5 (m or ft).
Accuracy Vert: 10 (m or ft).
Low: Useful when having non accurate image geolocation. Sets the values to:
Accuracy Horz: 50 (m or ft).
Accuracy Vert: 100 (m or ft).
Custom: Allows the user to set other values or edit the accuracy of each individual image or of a group of images.

The higher the accuracy numerical value (m or ft), the less influence the image's coordinates will have in the *Initial Processing* when compared to other images or GCPs with lower accuracy numerical values (m or ft). The accuracy is a value between 0.001 and 10'000.

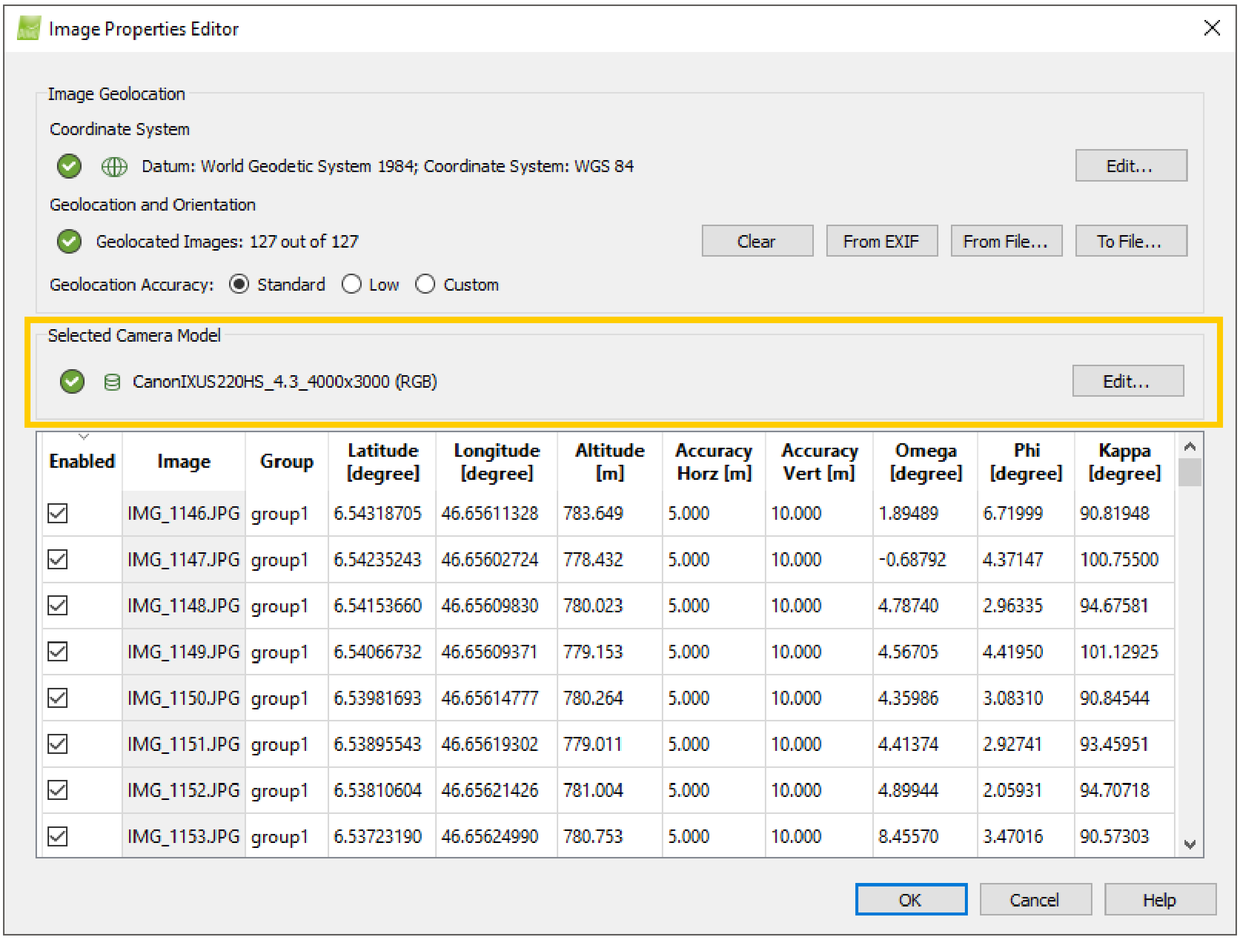
Warning: The accuracy must be given in meters or feet according to the selected coordinate system.

To edit the accuracy of one image, double click on the corresponding cell and enter the new value. For more information about editing the accuracy of multiple images, see Actions on the table.

Access: On the Menu bar, click Project > Image Properties Editor...

Access via the New Project wizard: When creating a new project, the *Image Properties* window appears after loading the images.

The *Selected Camera Model* section is used to describe the selected camera model(s) associated with the images.



Enabled	Image	Group	Latitude [degree]	Longitude [degree]	Altitude [m]	Accuracy Horz [m]	Accuracy Vert [m]	Omega [degree]	Phi [degree]	Kappa [degree]
☑	IMG_1146.JPG	group1	6.54318705	46.65611328	783.649	5.000	10.000	1.89489	6.71999	90.81948
☑	IMG_1147.JPG	group1	6.54235243	46.65602724	778.432	5.000	10.000	-0.68792	4.37147	100.75500
☑	IMG_1148.JPG	group1	6.54153660	46.65609830	780.023	5.000	10.000	4.78740	2.96335	94.67581
☑	IMG_1149.JPG	group1	6.54066732	46.65609371	779.153	5.000	10.000	4.56705	4.41950	101.12925
☑	IMG_1150.JPG	group1	6.53981693	46.65614777	780.264	5.000	10.000	4.35986	3.08310	90.84544
☑	IMG_1151.JPG	group1	6.53895543	46.65619302	779.011	5.000	10.000	4.41374	2.92741	93.45951
☑	IMG_1152.JPG	group1	6.53810604	46.65621426	781.004	5.000	10.000	4.89944	2.05931	94.70718
☑	IMG_1153.JPG	group1	6.53723190	46.65624990	780.753	5.000	10.000	8.45570	3.47016	90.57303

The status indicator is represented with the left icon:

- : The camera model is valid, if it is retrieved from Pix4Dmapper's camera model database, from the user's camera model database, from a project file, or from the image EXIF data if enough information exists in the data.
- : The camera model is invalid if the camera model does not correspond to any model of the camera model databases and if the EXIF data of the images does not have sufficient information about the camera model.

On the right of the status indicator, there is an icon that describes the source of the camera model:

: Camera model taken from the Pix4Dmapper's camera model database.
: Camera model taken from the Pix4Dmapper's camera model database with some user-edited values.
: Camera model taken from the user's camera model database.
: Camera model taken from the image EXIF data when the camera model does not exist in the Pix4Dmapper's or the user's database and there is valid information in the EXIF data.
: Camera model taken from the .p4d project file when a .p4d file is opened and its camera model does not exist in the Pix4Dmapper's or the user's database.

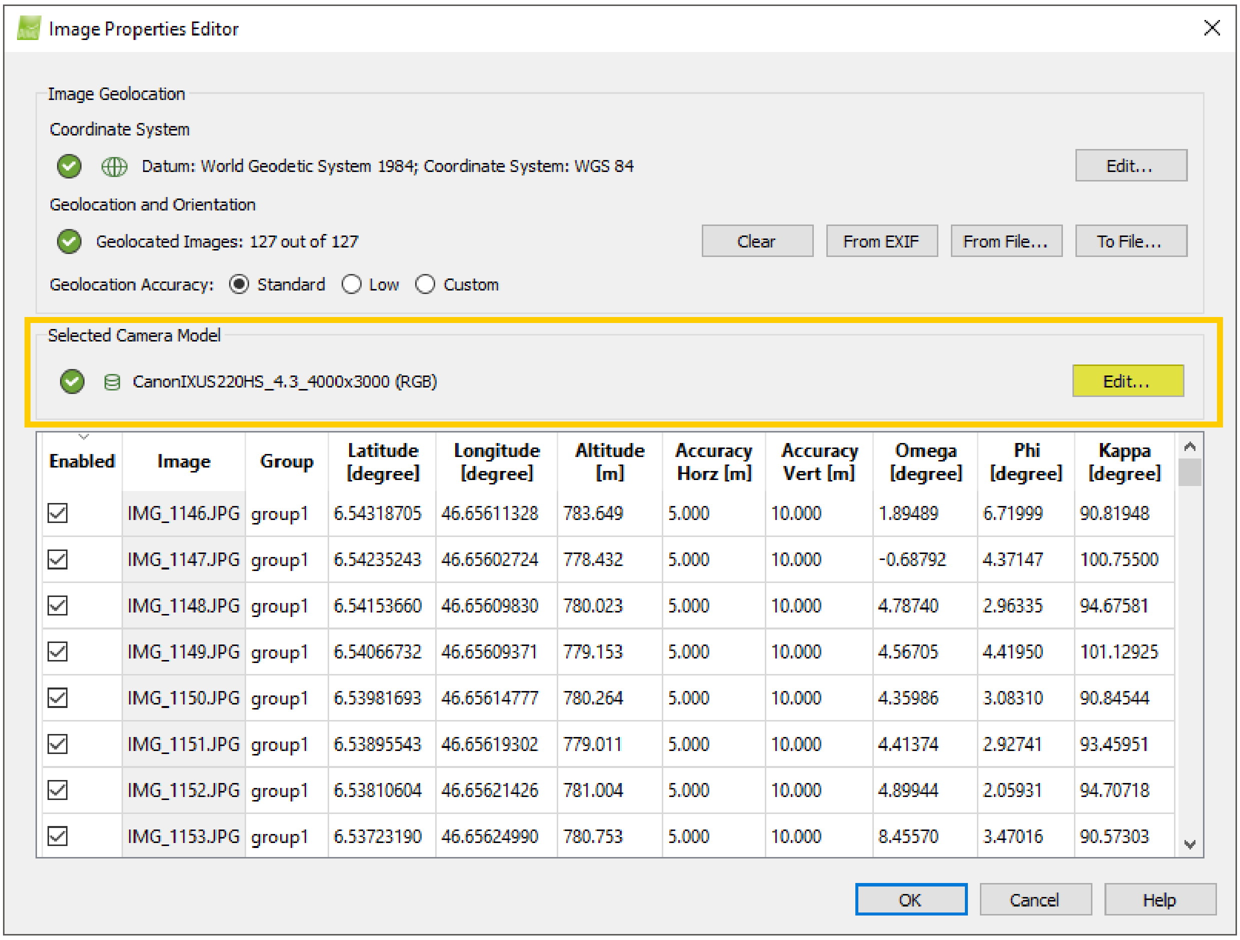
Beside the status indicator appears the Exif ID (*CameraModel_ FocalLength_ResolutionWidthxResolutionHeight*) and the band configuration.

On the right of the *Selected Camera Model section* there are the following buttons:

Edit...: Opens the *Edit Camera Model* pop-up which allows the user to edit the corresponding camera model. For more information about the *Edit Camera Model* window: 202558159.
Assign (optional): Appears if more than one camera models are detected (e.g. multiple flights with different cameras or merged projects). By clicking it, the corresponding camera model is assigned to other detected camera models that have the same image width and height.

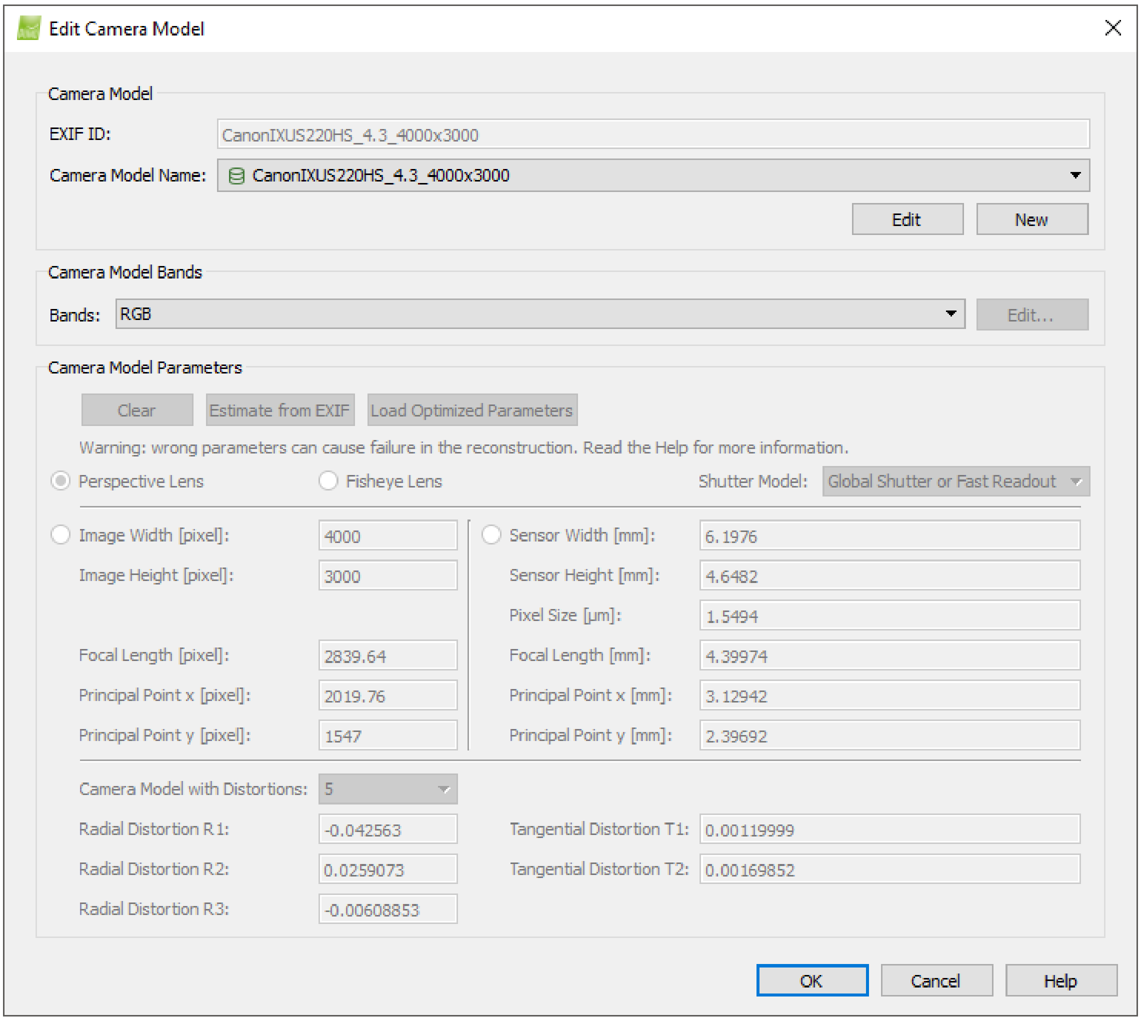
Access: On the Menu bar, click on Project > Image Properties Editor..., the *Image Properties Editor* window appears, in the *Selected Camera Model* section, click Edit...

Access via the New Project wizard: When creating a new project, the *Image Properties* window appears after loading the images, in the *Selected Camera Model* section, click Edit...



The *Edit Camera Model* window is used to define or edit the camera model.

The camera model can be set to a perspective or fisheye lens.



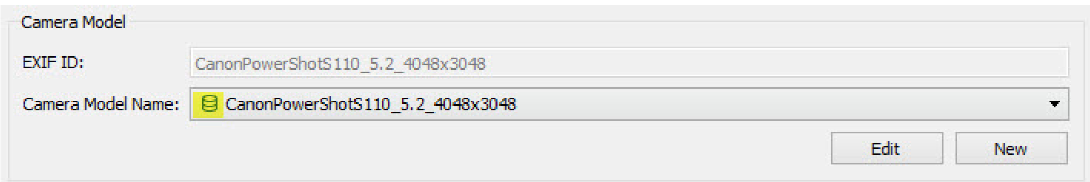
There are 3 sections:

Camera Model: Displays the current EXIF ID and the associated camera model.
Camera Model Bands: Displays the configuration band selected for the camera model.
Camera Model Parameters: Describes the camera parameters for the selected camera model.

and 3 action buttons:

OK: Confirms/applies the changes:
Uses the camera model selected in the *Camera Model* section if saved into the camera model database.
Uses the camera model name and parameters displayed in the *Camera Model Parameters* section if pressed while editing or creating a new camera model. The currently displayed camera parameters are not saved into the camera model database but they are saved only in the project .p4d file.
Cancel: Does not save the changes.
Help: Opens the Pix4Dmapper help.

Camera Model



The following items are displayed:

EXIF ID: Displays the current EXIF ID (*CameraModel_ FocalLength_ResolutionWidthxResolutionHeight*) of the camera. No user intervention is possible.

Camera Model Name: Displays the currently selected camera model. The corresponding drop-down list allows the user to select another known camera model with the same image width and height.

Beside on the left of the selected camera model name, an icon appears that describes the source of the camera model:

- : Camera model taken from the internal camera model database.
- : Camera model taken from the internal camera model database with some user-edited values.
- : Camera model taken from the user camera model database.
- : Camera model taken from the image EXIF data when the camera model does not exist in the internal or the user database and there is valid

information in the EXIF data.
: Camera model taken from the .p4d file when a .p4d file is created and its camera model does not exist in the internal or the user camera database.

Note: There are 2 camera databases: internal camera database (with the cameras and values from Pix4Dmapper), and user camera database (with the cameras added or modified by the user).
The internal camera database cannot be edited, modified or deleted.
The user camera database can be:
Edited Menu Project > Image Properties Editor... > Selected Camera Model > Edit Camera Model.
Cleared, imported or exported from Help > Settings..., under the tab Camera database.

Click the drop-down list to display the available camera models. The drop-down list only displays camera models with the same image width and height as the one detected in the EXIF ID. The drop-down list displays camera models using perspective lenses if Perspective lens (*Camera Model Parameters* section) is selected and it displays camera models using fisheye lenses if Fisheye lens (*Camera Model Parameters* section) is selected.

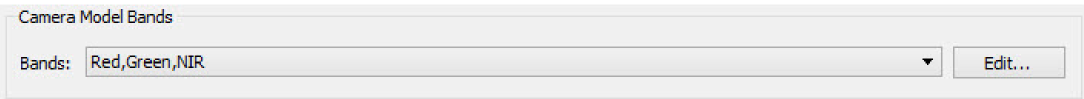
Note: No information is displayed if no camera model exists with the same image width and height.

The following buttons are displayed:

Edit: Edit the *Camera Model Bands* and/or the *Camera Model Parameters* for the selected camera model. To edit the camera parameters: 202560169.
New: Create a new camera model. To create a new camera model: 202560169.
Restore: It is displayed only for camera models that exist in the internal camera database and have been edited by the user and stored in the user camera database. It removes the camera model from the user database and restores the parameters from the internal database.
Save to DB: Visible when clicking on Edit or New. Save the camera model in the user camera model database.

Note:
When editing , and saving to DB, it changes to
When editing , and saving to DB, it creates
When editing , and saving to DB, it creates
When editing , and saving to DB, it creates
When editing or or or , and clicking in OK without saving to DB, it creates
When creating new and Saving to DB, it creates
When creating new and clicking in OK without saving to DB, it creates
Cancel edit: Visible when clicking on Edit or New. Cancel the editing or creating of a new camera model.

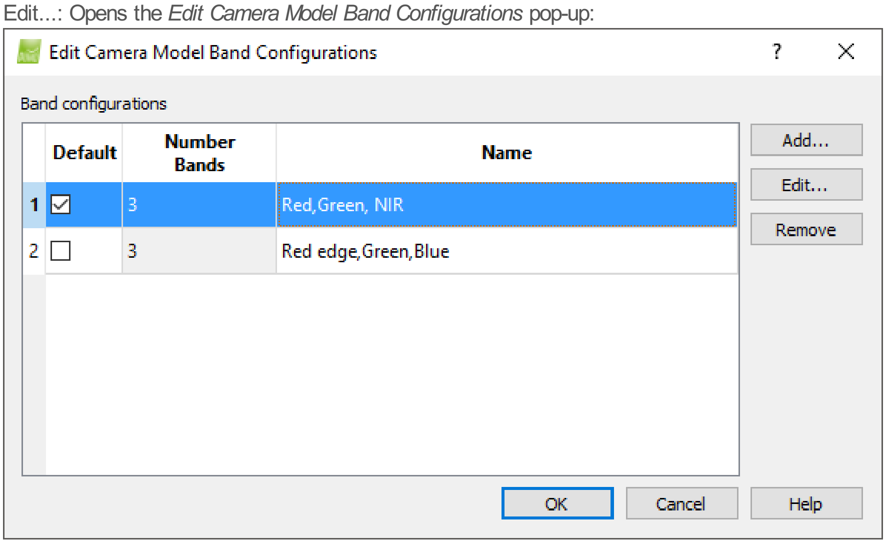
Camera Model Bands



The section contains 2 items:

Bands: Displays the band configuration selected for the project. If the band configuration is in the EXIF, and it is one of the bands listed below, it is selected automatically. It allows the user to change the band configuration when more bands have been added to the camera model.

Edit...: Opens the *Edit Camera Model Band Configurations* pop-up:



Access: It is enabled if Edit or New has been clicked in the *Camera Model* section.

Allows to add/edit/remove Band configurations.

There is one section:

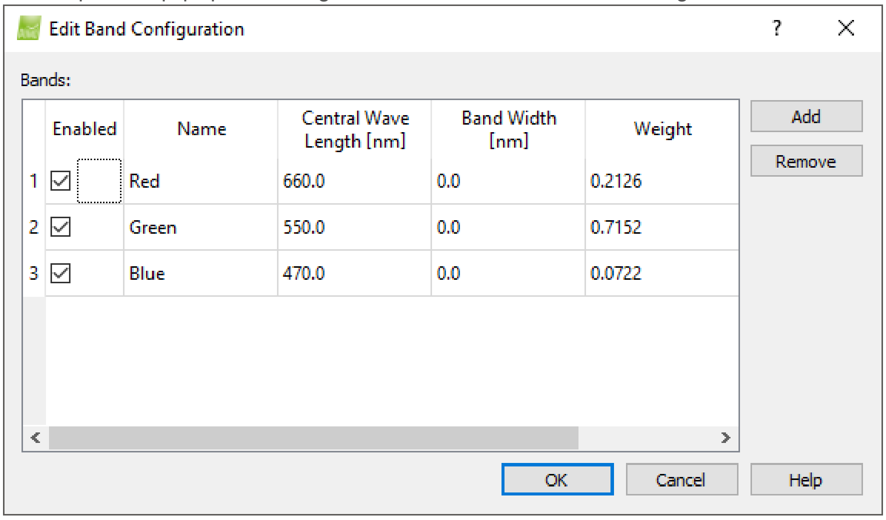
Band configurations table:

Each row displays information for one band configuration:

Default: Displays which band configuration is selected by default when using the selected Camera Model.
Bands Number: Number of bands for the Camera Model.
Name: Name of the band configuration, double click on the cell to edit the name.

and the action buttons:

Add..: Opens the pop-up band configuration window to add a new band configuration.



By default the values of the RGB band configuration appear :

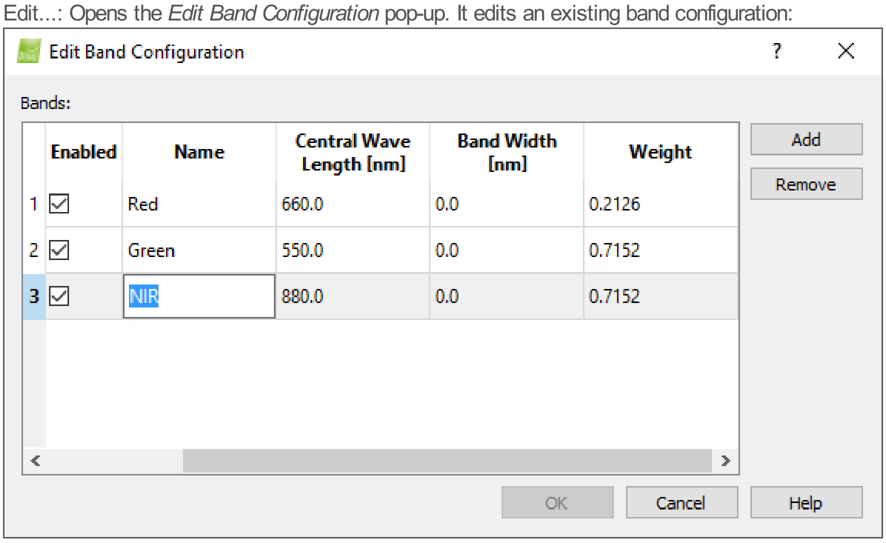
Each row displays information for one band and by double clicking on them, it is possible to edit the value:

Enabled: Displays if the band is enabled or not for the selected band configuration.
Name: Name of the band for the band configuration.
Central Wave Length [mm]: Representative (most influential) wave length for the band.
Band Width [mm]: Width of the distribution related the central wave length of the band.
Weight: How much value Pix4Dmapper gives to the selected band compared to other bands of the band configuration. These values only affect step *1. Initial Processing.* The sum of all weights should be 1.

And the action buttons:

Add...: Add one more band. The number of bands should match the number of channels present in the image.
Remove: Deletes the selected row.
OK: Saves the new band configuration.
Cancel: Does not save the band configuration.
Help: Opens the Pix4Dmapper help.

Edit...: Opens the *Edit Band Configuration* pop-up. It edits an existing band configuration:



By default the values of the RGB band configuration appear :

Each row displays information for one band and by double clicking on them, it is possible to edit the value:

Enabled: Displays if the band is enabled or not for the selected Band configuration.
Name: Name of the band for the Band configuration.
Central Wave Length [mm]: Representative (most influential) wave length for the band.
Band Width [mm]: Width of the distribution related the central wave length of the band.
Weight: How much value Pix4Dmapper gives to the selected band compare to other bands of the band configuration. These values only affect step *1. Initial Processing.* All the weights should sum to 1.

And the action buttons:

Add...: Add one more band. The number of bands should match the number of channels present in the image.
Remove: Deletes the selected row.
OK: Saves the new band configuration.
Cancel: Does not save the band configuration.
Help: Opens the Pix4Dmapper help.

Remove: Delete the selected band from the *Band configurations* table.
OK: Confirms/applies the changes.
Cancel: Does not save the changes.
Help: Opens the Pix4Dmapper help.

> Example: Examples of band configurations:
> RGB: For images with 3 bands. The first band corresponds to Red, the second band corresponds to Green, and the third band corresponds to Blue.
> Blue, Green, NIR: For images with 3 bands. The first band corresponds to Blue, the second band corresponds to Green, and the third band corresponds to Near Infrared.
> NIR, Green, Blue: For images with 3 bands. The first band corresponds to Near Infrared, the second band corresponds to Green, and the third band corresponds to Blue.
> NIR, Red, Green: For images with 3 bands. The first band corresponds to Near Infrared (or Infrared), the second band corresponds to Red, and the third band corresponds to Green.
> Red edge, Green, Blue: For images with 3 bands. The first band corresponds to Red edge, the second band corresponds to Green, and the third band corresponds to Blue.
> Red, Green, NIR: For images with 3 bands. The first band corresponds to Red, the second band corresponds to Green, and the third band corresponds to Near Infrared.

Camera Model Parameters

The *Camera Model Parameters* section includes all camera parameters and is enabled for editing if the Edit or New button has been clicked in the *Camera Model* section. It displays the camera parameters of the selected *Camera Model Name* in the *Camera Model* section.

The *Camera Model Parameters* section has 3 action buttons (enabled if Edit or New has been clicked in the *Camera Model* section):

Clear: It clears all the fields except image width (pixel) and height (pixel).
Estimate from EXIF: Estimates the parameters from the EXIF data if enough information about the camera model is found there.
Load Optimized Parameters: Enabled once at least step 1 has been completed, it changes the camera initial values to the optimized values.

It also has the *Shutter Model* dropdown list with the following options:

Global Shutter or Fast Readout
Linear Rolling Shutter

Global Shutter or Fast Readout

To be used if the camera has a global shutter: all light information is read at the same time for the whole sensor.

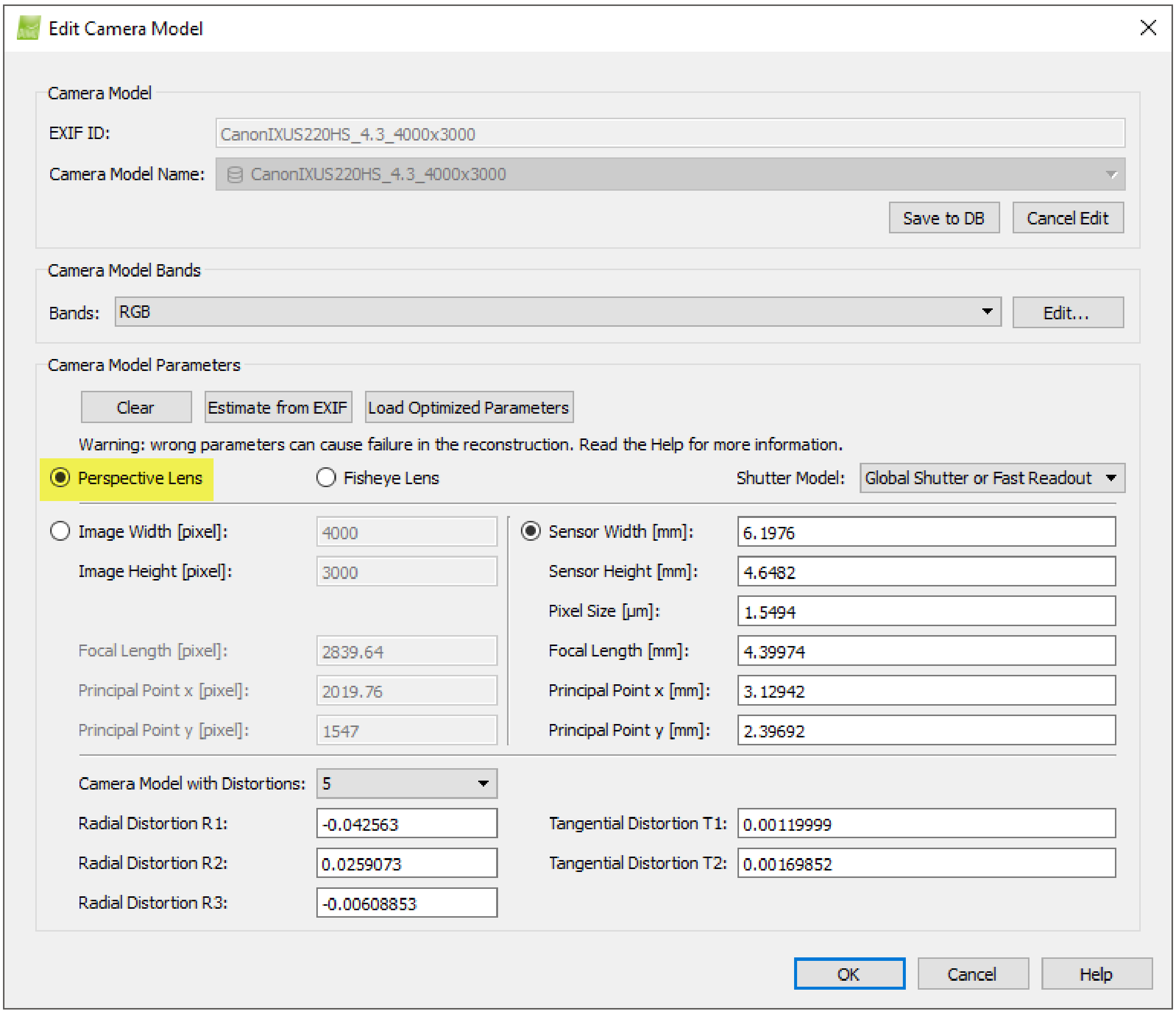
Linear Rolling Shutter

This option models the rolling shutter (the image is scanned line by line) of some cameras such as the GoPro or the standard DJI cameras. This can be enabled if the camera's shutter is a rolling shutter and, the flight plan is linear: grid mission, building facade, etc...

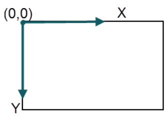
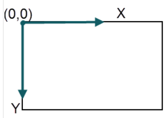
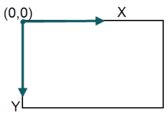
The parameters can be defined or edited for a:

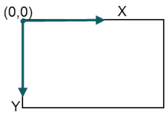
Perspective lens: When the camera model uses a perspective lens.
Fisheye lens: When the camera model uses a fisheye lens (ultra wide angle lens).

Perspective lens



To edit values in pixels, select the radio button on the left of the *Image width [pixels]* text box. To edit values in millimeters, select the radio button on the left of the *Sensor width [mm]* text box.

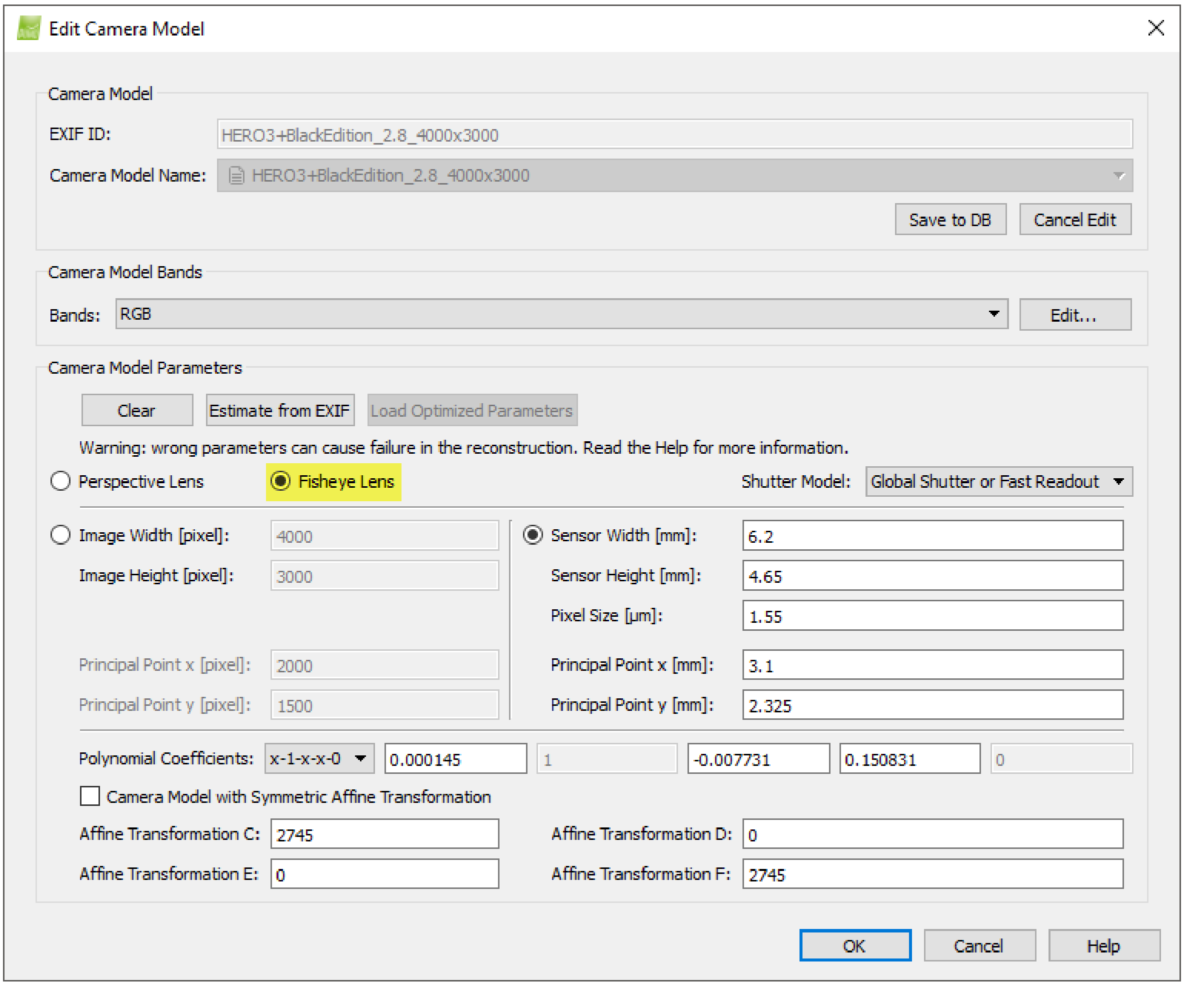
Internal Camera Parameters for Perspective lens	
Camera Model Name	Name for the camera model.
Image Width [pixel]	The image width in pixels. This value cannot be edited. It is read from the image file information.
Image Height [pixel]	The image height in pixels. This value cannot be edited. It is read from the image file information.
Focal Length [pixel]	The focal length in pixels.
Principal Point x [pixel]	The x image coordinate of the principal point in pixels. The principal point is located around the center of the image. The coordinate system has its origin as displayed here: 
Principal Point y [pixel]	The y image coordinate of the principal point in pixels. The principal point is located around the center of the image. The coordinate system has its origin as displayed here: 
Sensor Width [mm]	The sensor width in millimeters. If the sensor width is estimated from the EXIF and no information is in the image EXIF data, the sensor width is set to 36[mm].
Sensor Height [mm]	The sensor height in millimeters. If the sensor height is estimated from the EXIF and no information is in the image EXIF data, the sensor width is set to 36 [mm] and the sensor height is computed in such a way that the ratio sensor width / sensor height in millimeters equals the ratio image width / image height in pixels.
Pixel Size [µm]	The size of the pixel is read from the EXIF data if the information is available. If there is no information related to the pixel size, then it is calculated in order to correspond to 36 x 24 mm sensor size.
Focal Length [mm]	The focal length in millimeters.
Principal Point x [mm]	The x image coordinate of the principal point in millimeters. The principal point is located around the center of the sensor. The coordinate system has its origin as displayed here: 

Principal Point y [mm]	The y image coordinate of the principal point in millimeters. The principal point is located around the center of the sensor. The coordinate system has its origin as displayed here: 
Radial Distortion K1:	Radial distortion of the K1 lens.
Radial Distortion K2:	Radial distortion of the K2 lens.
Radial Distortion K3:	Radial distortion of the K3 lens.
Tangential Distortion T1:	Tangential distortion of the T1 lens.
Tangential Distortion T2:	Tangential distortion of the T2 lens.

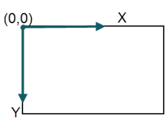
Tip: If the radial and tangential distortions of the lens are not known, it is recommended to set the values for K1, K2, K3, T1, T2 to 0. For more information about how to calibrate a perspective camera: 206065716.

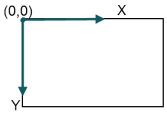
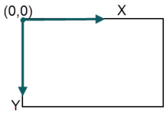
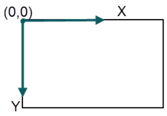
Note: For more information about how the internal parameters for a perspective lens are defined: 202559089.

Fisheye lens



To edit values in pixels, select the radio button on the left of the *Image width [pixels]* text box. To edit values in millimeters, select the radio button on the left of the *Sensor width [mm]* text box.

Internal Camera Parameters for Fisheye lens	
Camera Model Name	Name for the camera model.
Image Width [pixel]	The image width in pixels. This value cannot be edited. It is read from the image file information.
Image Height [pixel]	The image height in pixels. This value cannot be edited. It is read from the image file information.
Principal Point x [pixel]	The x image coordinate of the principal point in pixels. The principal point is located around the center of the image. The coordinate system has its origin as displayed here: 

Principal Point y [pixel]	The y image coordinate of the principal point in pixels. The principal point is located around the center of the image. The coordinate system has its origin as displayed here: 
Sensor Width [mm]	The sensor width in millimeters. If the sensor width is estimated from the EXIF and no information is in the image EXIF data, the sensor width is set to 36[mm].
Sensor Height [mm]	The sensor height in millimeters. If the sensor height is estimated from the EXIF and no information is in the image EXIF data, the sensor width is set to 36 [mm] and the sensor height is computed in such a way that the ratio sensor width / sensor height in millimeters equals the ratio image width / image height in pixels.
Pixel Size [μm]	The size of the pixel is read from the EXIF data if the information is available. If there is no information related to the pixel size, then it is calculated in order to correspond to 36 x 24 mm sensor size.
Principal Point x [mm]	The x image coordinate of the principal point in millimeters. The principal point is located around the center of the sensor. The coordinate system has its origin as displayed here: 
Principal Point y [mm]	The y image coordinate of the principal point in millimeters. The principal point is located around the center of the sensor. The coordinate system has its origin as displayed here: 
Polynomial Coefficients	4 different type of polynomials can be selected from a drop-down list, where 1,2 or 3 values are already pre-defined and cannot be changed: 0-1-x-x-0 x-1-x-x-0 0-1-x-x-x: recommended x-1-x-x-x: ignores an area around the image center. This is useful when the center is blurry or contains a lot of noise
Camera Model with Symmetric Affine Transformation	If selected, the model is symmetric and C=D and E=F=0. This is useful when the circular image cannot be modeled by a sphere.
Affine Transformation C	Affine transformation C value.
Affine Transformation D	Affine transformation D value.
Affine Transformation E	Affine transformation E value.
Affine Transformation F	Affine transformation F value.

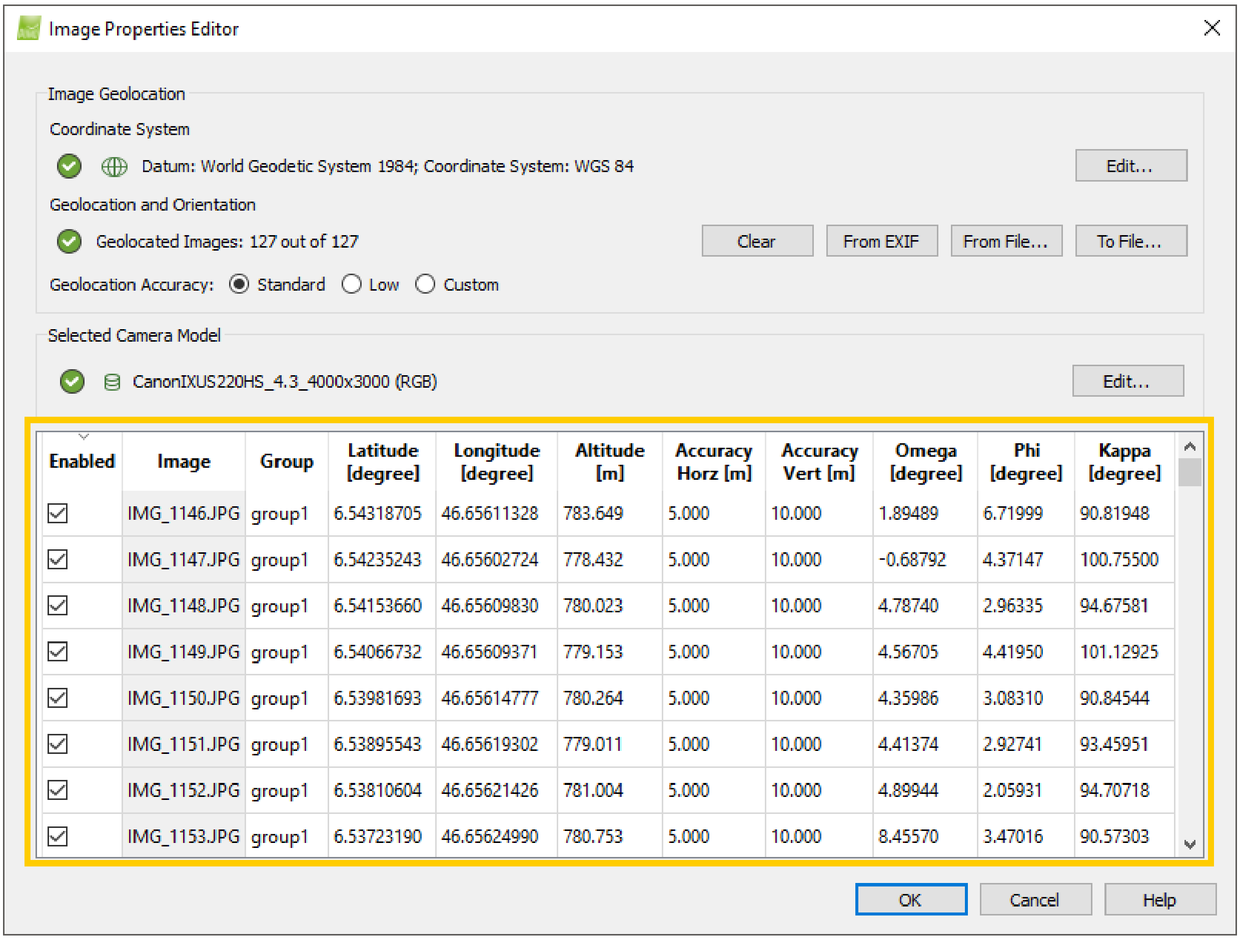
Note: For more information about how the internal parameters for a fisheye lens are defined: 202559089.

Tip: For more information about how to calibrate a fisheye camera: 202557009.

Access: On the Menu bar, click Project > Image Properties Editor...

Access via the New Project wizard: When creating a new project, the *Image Properties* window appears after loading the images.

This table is used to describe and edit the information and the status of the images used for the project.



The following actions can be performed on the table:

Sorting the table
Selecting Images
Editing Values

The table has as many rows as the amount of images in the project. Each row displays information for one image:

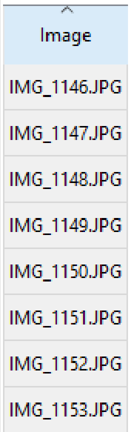
Status of the image (Enabled)
Image
Group
Camera model (Multi-camera model projects)
First coordinate
Second coordinate
Third coordinate
Accuracy Horz
Accuracy Vert
Omega
Phi
Kappa

Actions on the table

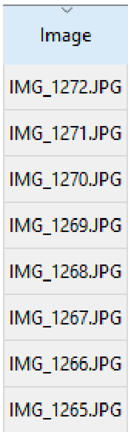
Sorting the table

By clicking the column title used to sort the table, it will be ordered from the *smallest to the highest value*. By clicking again the column title already used for sorting, the sorting will switch from *smallest to highest* to *higest to smaller* and vice versa.

A triangle indicates which column title is used for sorting and the type of sorting:



Smallest to highest values.



Highest to smallest values.

Selecting images

Selecting an image

Left click any of the image´s cells. The row corresponding to the selected image is displayed in blue.

Selecting multiple images

For images that are displayed one after the other: Press the **Shift** key and left click the first and last images to be selected. The rows corresponding to the selected images are displayed in blue. Alternatively, left click one image and while keeping the left button clicked, move the mouse up or down.

For images that are not displayed one after the other: Press the **Control** key and left click all the images to be selected. The rows corresponding to the selected images are displayed in blue.

Editing values

Editing one image

For the Enabled column:

1. Click the box (the status switch between selected / unselected).

For the Group column:

1. Double click the cell.
2. Type the new value or click the left arrow to select among the existing values.
3. Click Enter or click outside the cell.

For the Latitude, Longitude, Altitude, Accuracy Horz or Accuracy Vert columns:

1. Double click the cell.
2. Type the new value.
3. Click Enter or click outside the cell.

Editing all the values for one column

For the Enabled column:

1. Right click one cell of the column.
2. Click **Enabled All Images** or **Disable All Images**.

For the Group column:

1. Right click one cell of the column.
2. Click **Edit All Groups**.
3. Type the new value or click the left arrow to select among the existing values.
4. Click Enter or click outside the cell.

For the Latitude, Longitude, Altitude, Accuracy Horz or Accuracy Vert columns:

1. Right click one cell of the column.
2. Click **Edit All Altitudes / Horz. Accuracies / Vert. Accuracies**.
2. Type the new value.
3. Click Enter or click outside the cell.

Editing the selected rows values for one colum

Select multiple images and:

For the Enabled column:

1. Right click one of the selected cells of the column.
2. Click **Enabled Selected Images** or **Disable Selected Images**.

For the Group column:

1. Right click one of the selected cells of the column.
2. Click **Edit Groups in Selected Rows**.
3. Type the new value or click the left arrow to select among the existing values.
4. Click Enter or click outside the cell.

For the Latitude, Longitude, Altitude, Accuracy Horz or Accuracy Vert columns:

1. Right click one of the selected cells of the column.
2. Click **Edit Altitudes / Horz. Accuracies / Vert. Accuracies in Selected Rows.**
2. Type the new value.
3. Click Enter or click outside the cell.

Status of the image (Enabled)

The status of the image is displayed in the *Enabled* column. It is defined by a box that indicates if the image is used for the processing or not. If the box is selected, the image is enabled and is used for the processing.

To select or unselect an image: Left click on the box.

Note: The disabled images are not deleted from the project in case of further need to use them.

Image

This column displays the name of the images. It cannot be edited.

Group

When processing images that belong to different groups, all images are processed together, generating:

One point cloud of automatic tie points for the whole project. The color of the automatic tie points will be mixed: some points will take color from the RGB images and others from the NIRGB images.
One densified point cloud per group.
One DSM for the whole project.
One orthomosaic per group.

Important: Images taken by the same camera during different flights should not be grouped into different groups, unless there is need to generate different orthomosaics for each data.

Tip: Use the groups to group images with different spectral signatures (RGB, NIRGB, etc). In this case different reflectance maps are generated that can be used for index calculations. For more information about index calculations: 202558289.

By default the images that have the same number and type of bands as well as the images with the same pixel type (byte, float) will be grouped as group1. Images with different bands and pixel type will be grouped as group2, group3, etc. To change the group of one image, double click on the corresponding cell and edit the group. For more information about editing the group of multiple images: 202557949.

Important: When having more than one group, the Google files (Google Maps tiles and .kml) will only be generated if one of the groups is named *RGB* (capital letters). Then the Google files will be generated only for this group. For more information about how to generate Google files: 202558149.

Camera model (Multi-camera model projects)

For projects with more than one camera model, this column displays the camera model assigned to the corresponding images.

To change the camera model of one image, double click on the corresponding cell. Click on the arrow that appears and, from the drop-down list, choose the desired camera model.

Note: The camera model can only be chosen among a list of detected camera models for the project.

First Coordinate

The first coordinate is:

Latitude [degree]: If the coordinate system of the images is a geographic coordinate system.
X [m]: If the coordinate system of the images is a projected coordinate system. The unit is given in meters.
X [feet]: If the coordinate system of the images is a projected coordinate system. The unit is given in feet.
Local X [m]: If the coordinate system is defined by the user (local coordinate system). The unit is given in meters.

The coordinate columns are filled:

When importing the coordinates from the image EXIF data if the information exists.
When importing the coordinates from the image geolocation file.
When manually editing the table: double click on the corresponding cell and enter the coordinate.

Note: If no image geolocation has been imported then the value of the cells is zero (0.000).

Second coordinate

The second coordinate is:

Longitude [degree]: If the coordinate system of the images a geographic coordinate system.
Y [m]: If the coordinate system of the images is a projected coordinate system. The unit is given in meters.
Y [feet]: If the coordinate system of the images is a projected coordinate system. The unit is given in feet.
Local Y [m]: If the coordinate system is defined by the user (local coordinate system). The unit is given in meters.

The coordinate columns are filled:

When importing the coordinates from the image EXIF data if the information exists.
When importing the coordinates from the image geolocation file.
When manually editing the table: Double click on the corresponding cell and enter the coordinate.

Note: If no image geolocation has been imported then the value of the cells is zero (0.000).

Third Coordinate

The third coordinate is:

Altitude [m]: If the coordinate system of the images is a geographic coordinate system.
Z [m]: If the coordinate system of the images is a projected coordinate system. The unit is given in meters.
Z [feet]: If the coordinate system of the images is a projected coordinate system. The unit is given in feet.
Local Z [m]: If the coordinate system is defined by the user (local coordinate system). The unit is given in meters.

The coordinate columns are filled:

When importing the coordinates from the image EXIF data if the information exists.
When importing the coordinates from the image geolocation file.
When manually editing the table: Double click on the corresponding cell and enter the coordinate.

Note: If no image geolocation has been imported then the value for the cells is zero (0.000).

Warning:
The Z coordinate must be given in the same unit as the (X,Y) coordinates (meters or feet).
All image geolocation coordinates have to be given in the same coordinate system.

Accuracy Horz

Defines the horizontal accuracy value (*Accuracy Horz*). The horizontal accuracy refers to the first and second coordinates (latitude, longitude, or X,Y) of the images.

Very accurate image geolocation (latitude, longitude, or X,Y) coordinates: Low accuracy value.
Non accurate image geolocation (latitude, longitude, or X,Y) coordinates: High accuracy value.

The higher the accuracy value, the less impact the image´s coordinates will have on the *Initial Processing,* compared to other images or GCPs with lower accuracy values. The accuracy is a value between 0.001 and 10'000.

Warning: The horizontal accuracy must be given in meters or feet according to the selected coordinate system.

To edit the horizontal accuracy of one image, double click on the corresponding cell and enter the new value. For more information about editing the horizontal accuracy of multiple images, see Actions on the table.

Accuracy Vert

Defines the vertical accuracy value (*Accuracy Vert*). The vertical accuracy refers to the third coordinate (altitude or Z) of the images.

Very accurate image geolocation (altitude or Z) coordinate: Low accuracy value.
Non accurate image geolocation (altitude or Z) coordinate: High accuracy value.

The higher the accuracy value, the less impact the image´s coordinate will have on the *Initial Processing,* compared to other images or GCPs with lower accuracy values. The accuracy is a value between 0.001 and 10'000.

Warning: The vertical accuracy must be given in meters or feet according to the selected coordinate system.

To edit the vertical accuracy of one image, double click on the corresponding cell and enter the new value. For more information about editing the vertical accuracy of multiple images, see Actions on the table.

Omega

Omega (ω) is the rotation around the X-axis. It is given in degrees.

The rotation columns are filled:

When importing the angles from the image geolocation file.
When manually editing the table: Double click on the corresponding cell and enter the angle.

This value is optional as Pix4Dmapper does NOT require the orientation of the camera in order to process the projects.
For more information about how Pix4Dmapper defines the Omega - Phi - Kappa angles: 202558969.

Phi

Phi (φ) is the rotation around the Y-axis. It is given in degrees.

The rotation columns are filled:

When importing the angles from the image geolocation file.
When manually editing the table: Double click on the corresponding cell and enter the angle.

This value is optional as Pix4Dmapper does NOT require the orientation of the camera in order to process the projects.
For more information about how Pix4Dmapper defines the Omega - Phi - Kappa angles: 202558969.

Kappa

Kappa (κ) is the rotation around the Z-axis. It is given in degrees.

The rotation columns are filled:

When importing the angles from the image geolocation file.
When manually editing the table: Double click on the corresponding cell and enter the angle.

This value is optional as Pix4Dmapper does NOT require the orientation of the camera in order to process the projects.
For more information about how Pix4Dmapper defines the Omega - Phi - Kappa angles: 202558969.

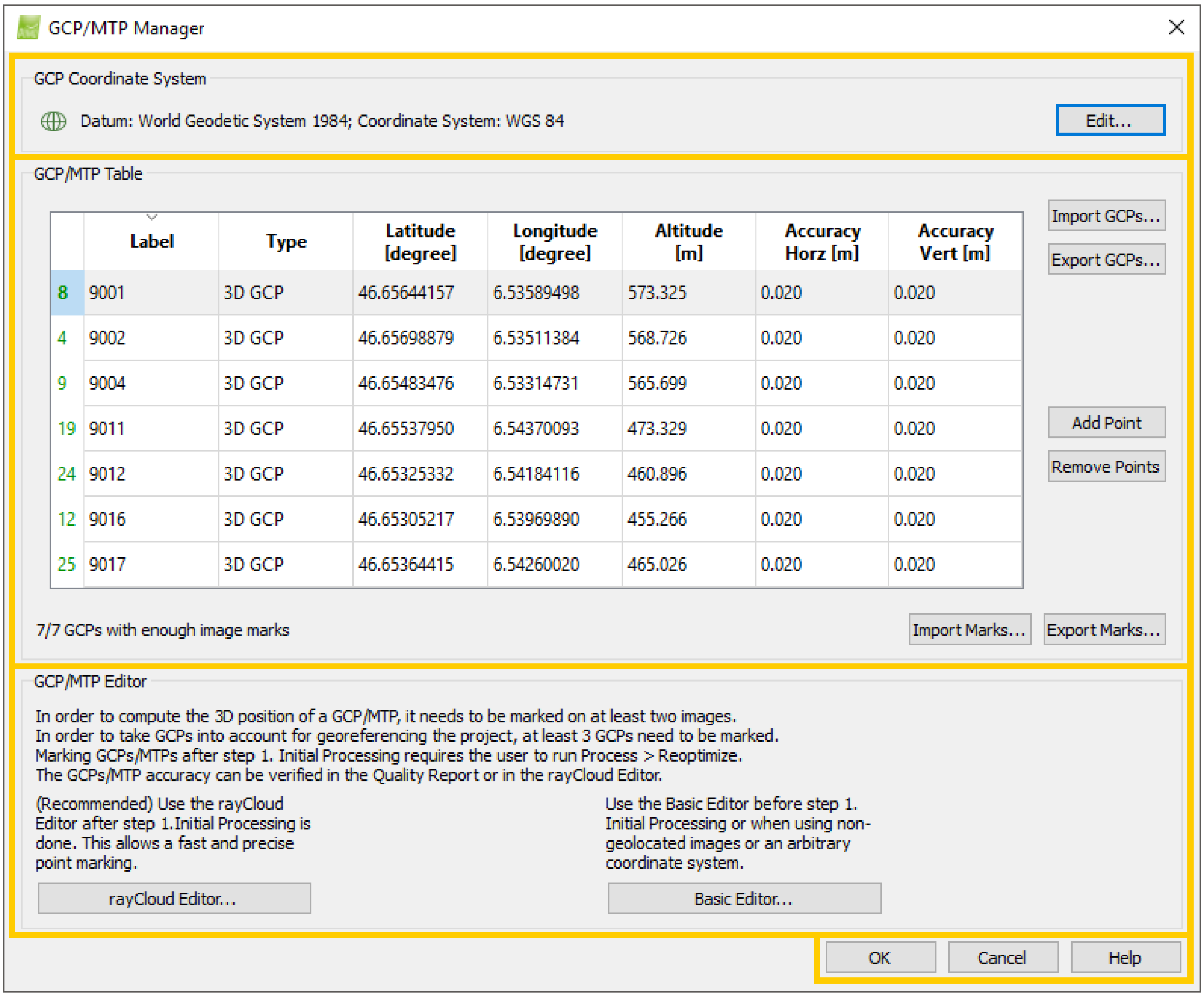
Access: On the Menu bar, click Project > GCP/MTP Manager...

The *GCP/MTP Manager* pop up window has the following 3 sections:

GCP Coordinate System: Section to select the coordinate system on which the GCPs/MTPs/Check Points position are based.
GCP/MTP Table: Section to:
Import, edit, add and remove GCPs/MTPs/Check Points
Export GCPs/Check Points coordinates and, optionally for GCPs, the accuracy of the coordinates.
Import or export a file with the image coordinates of the GCPs/MTPs/Check Points and on which images have been marked, in which position and at which zoom level.
GCP/MTP Editor: Section to mark the GCPs/MTPs/Check Points on images.

And the action buttons:

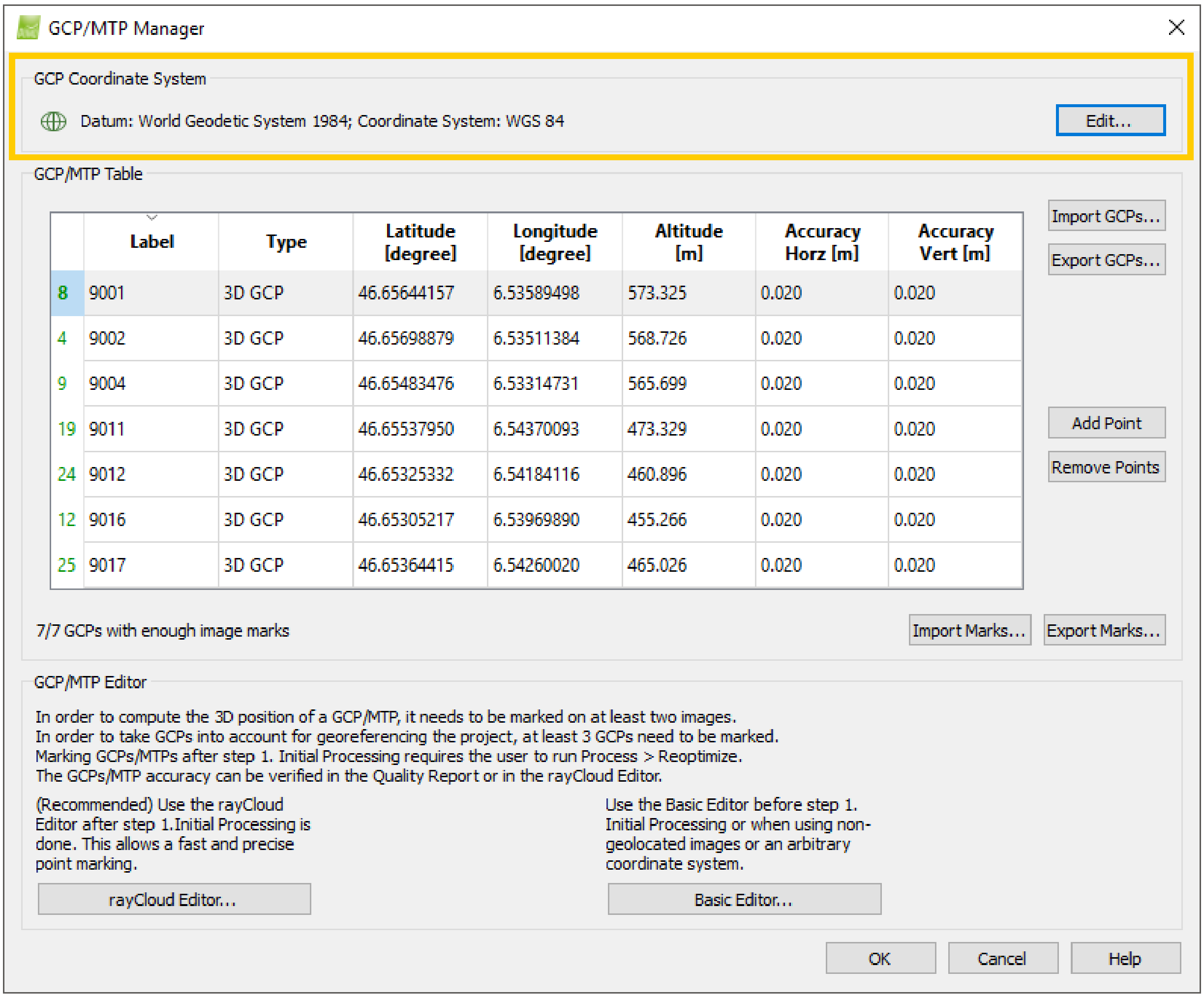
OK: Confirms the changes.
Cancel: Does not save the changes.
Help: Opens the Pix4Dmapper help.



Access: On the Menu bar, click Project > GCP/MTP Manager...

The *GCP Coordinate System* section is used to define the coordinate system on which the GCPs/MTPs/Check Points position are based.

Datum: Represents the selected images' datum. By default the selected *Datum* is World Geodetic System 1984.
Coordinate system: Represents the selected images' coordinate system.
When the selected coordinate system is a Geographic Coordinate System.
When the selected coordinate system is Projected Coordinate System.
Vertical coordinate system or Geoid Height Above the Ellipsoid: It is displayed in parenthesis. It represents the vertical coordinate system / Geoid Height Above the used ellipsoid that will be used to convert the GCPs height from geoid to ellipsoidal. For more information about when to use this function: 202559459.
Edit...: Opens the *Select GCP Coordinate System* pop-up that allows the user to change the selected coordinate system.
For more information: 202558239.

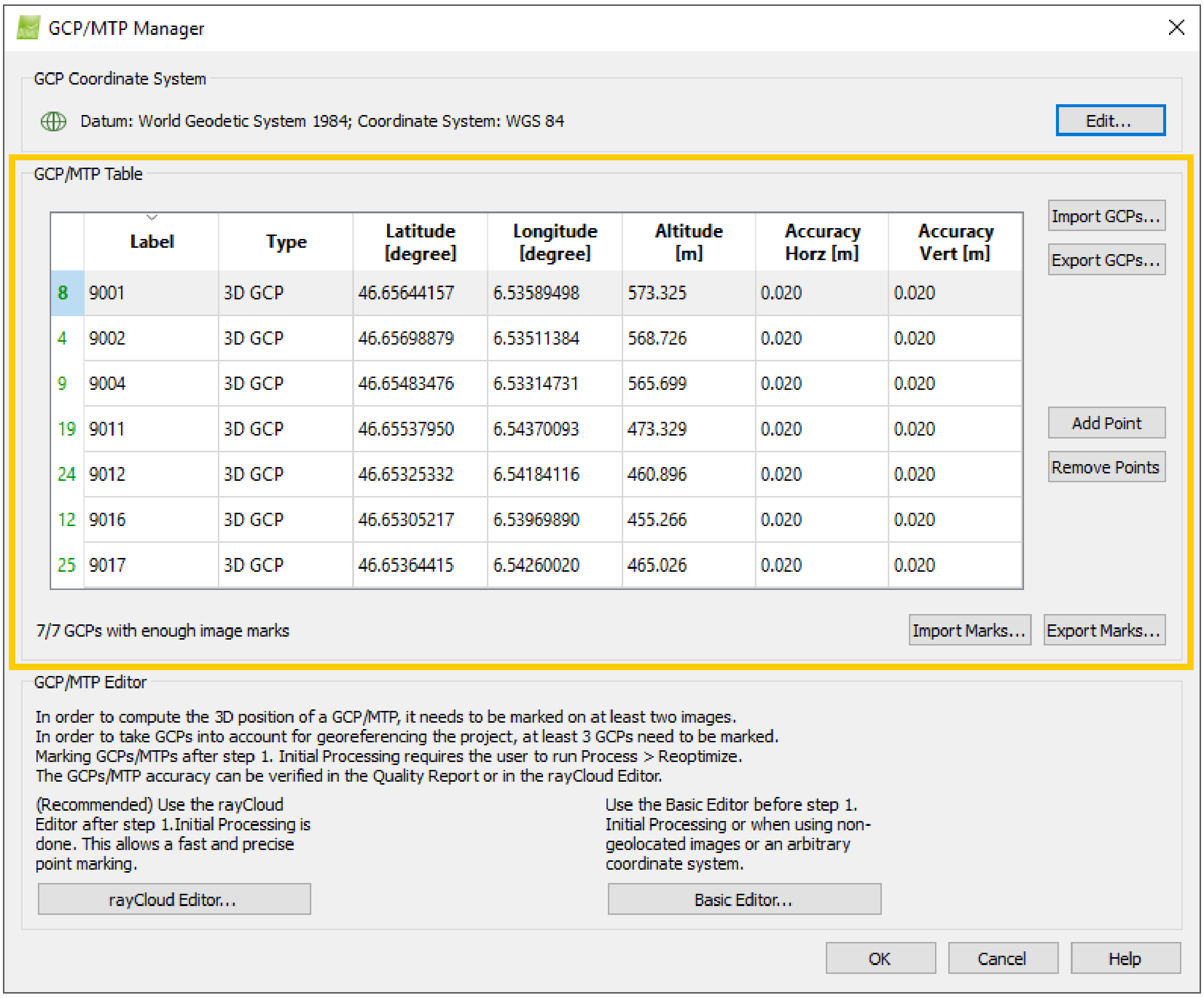


Access: On the Menu bar, click Project > GCP/MTP Manager...

This section contains a *GCP/MTP Table* which displays all the GCPs/Manual Tie Points/Check Points of the projects together with their properties, and 6 action buttons:

Import GCPs...: Allows the user to import a file with GCPs/Check points.
Export GCPs...: Allows the user to export GCPs/Check Points coordinates and, optionally for GCPs, the accuracy of the coordinates.
Add Point : Allows the user to manually add one by one GCPs/Manual Tie Points/Check Points.
Remove Points : Allows the user to remove the selected GCPs/Manual Tie Points/Check Points.
Import Marks...: Allows the user to import a file which contains, for each GCPs/Manual Tie Points/Check Points list of the marked images and, for each image, the coordinates and zoom level.
Export Marks...: Allows the user to export a file which contains, for each GCPs/Manual Tie Points/Check Points list of the marked images and, for each image, the coordinates and zoom level.

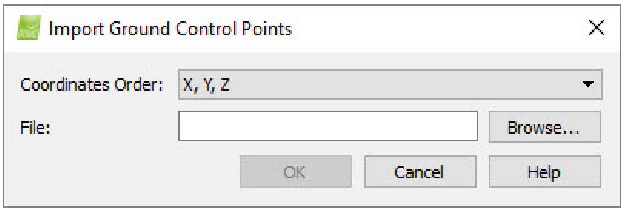
In the bottom left side, a status text appears indicating how many GCPs are implemented in the project and marked in at least 2 images.



Access: On the Menu bar, click Project > GCP/MTP Manager..., on the *GCP/MTP Table* section, click Import GCPs...

Pix4Dmapper can import a file with the coordinates of the GCPs. For more information about the file format: 202558539.

When clicking Import GCPs..., the *Import Ground Control Points* pop-up appears:

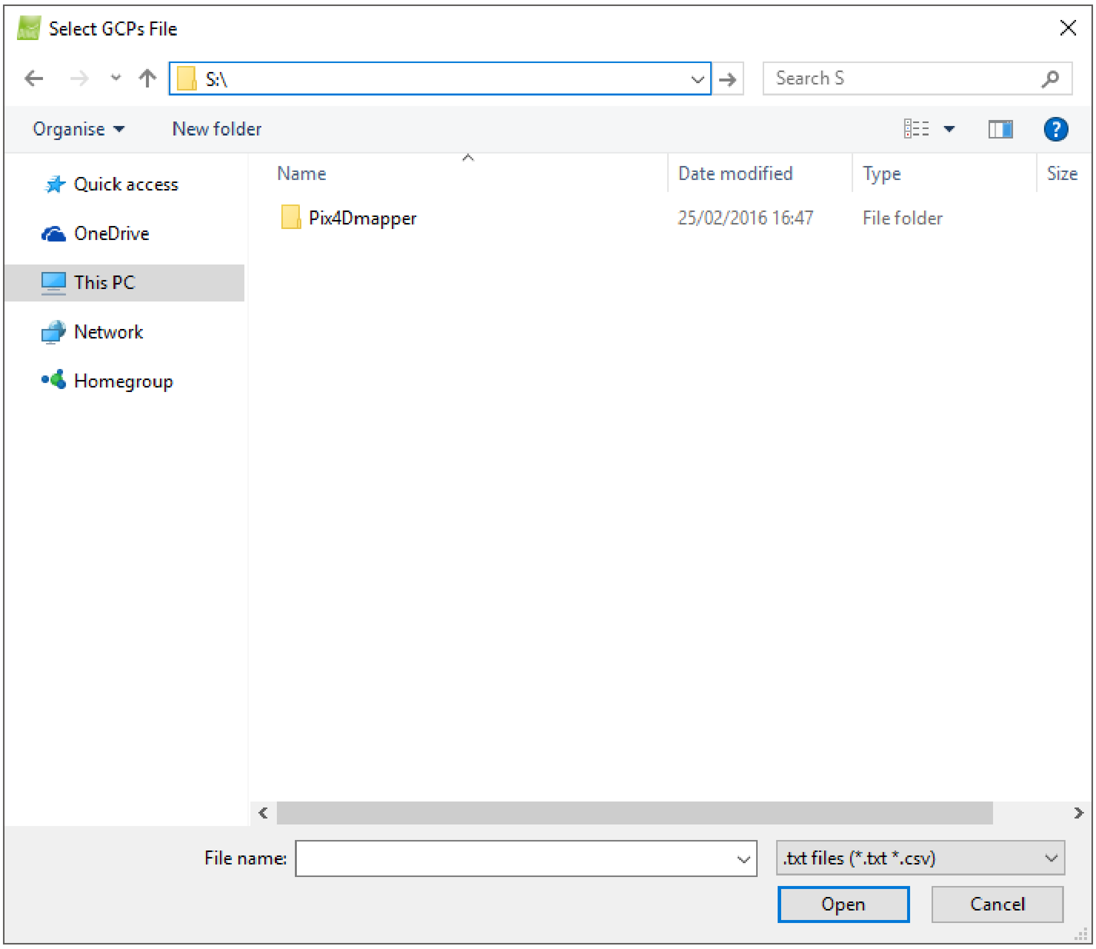


It contains the following sections:

Coordinates Order: Allows the user to select the order of the coordinates of the file to be imported. Depending the coordinate system, there are the following possibilities:
Latitude, Longitude, Altitude or Longitude, Latitude, Altitude (only if a geographic coordinate system is selected).
X, Y, Z, or Y, X, Z
File: Displays the name of the selected file to be imported.

And the action buttons:

Browse...: Opens the *Select GCPs File*, a navigation window used to search for and select the file to be imported.



Ok: Imports the selected file.
Cancel: Does not save the changes and exits the pop-up.
Help: Opens the Pix4Dmapper help.

Access: On the Menu bar, click Project > GCP/MTP Manager..., on *GCP/MTP Table*, click Add Point.

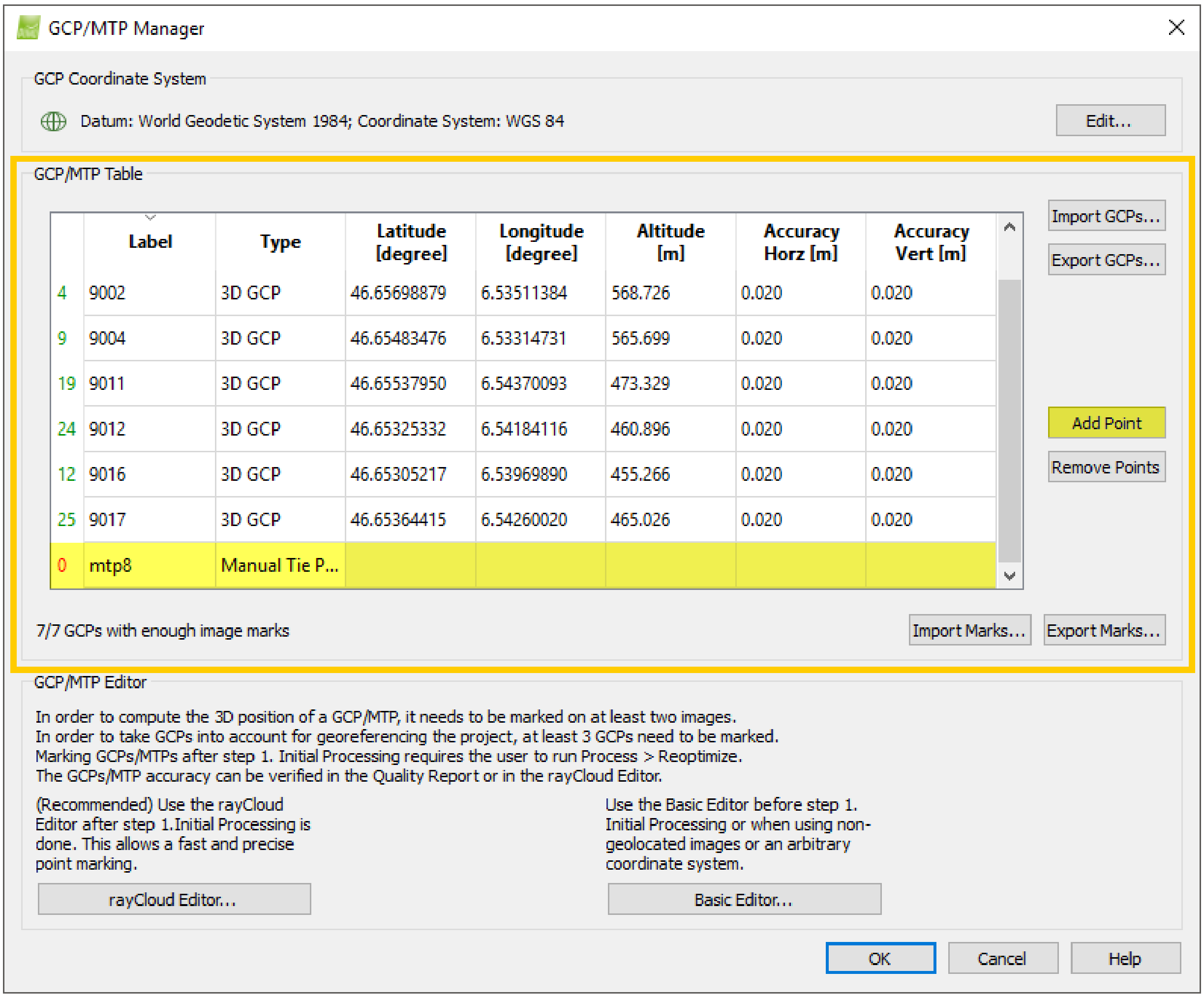
This button is used to manually add GCPs/MTPs/Check Points one by one.

Note: Before adding the points, their coordinate system needs to be defined. For more information: 202557749.

Warning: All GCPs/MTPs/Check Points need to be defined in the same coordinate system.

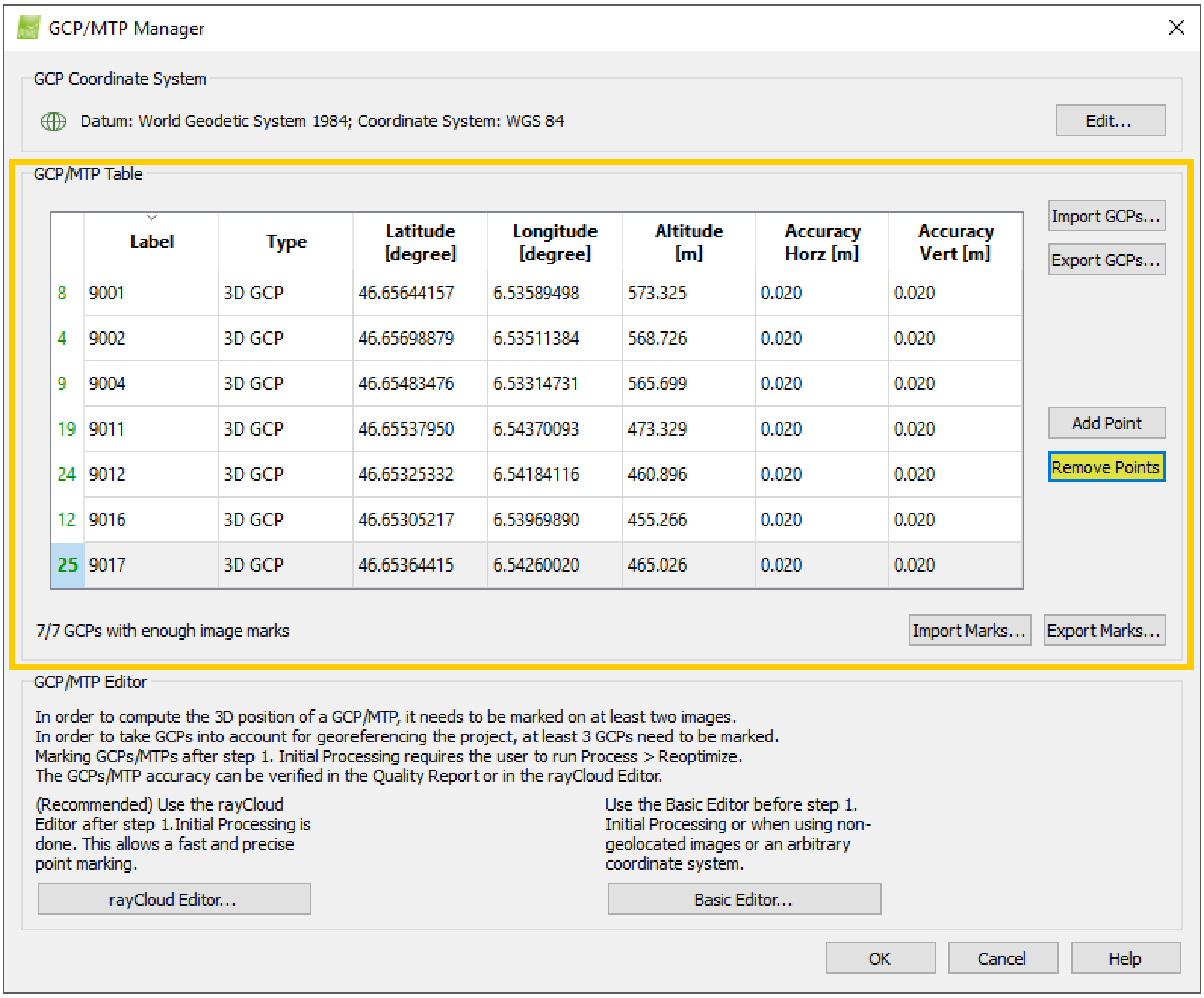
The Add Point button allows the user to add a new point in the *GCP/MTP Table*. The *Type* is by default set to *Manual Tie Point*. The label is automatically generated and starts by "mtp" followed by a number that increases with the number of points added (e.g. mtp1, mtp2, mtp3, etc.). The labels are automatically generated when adding a point in the *GCP/MTP Manager* by pressing the Add Point button or when adding a point or an object in the rayCloud. The point type can be changed by double clicking on the *Type* cell and selecting the desired type.

For more information about the *GCP/MTP Table* properties: 202557919.

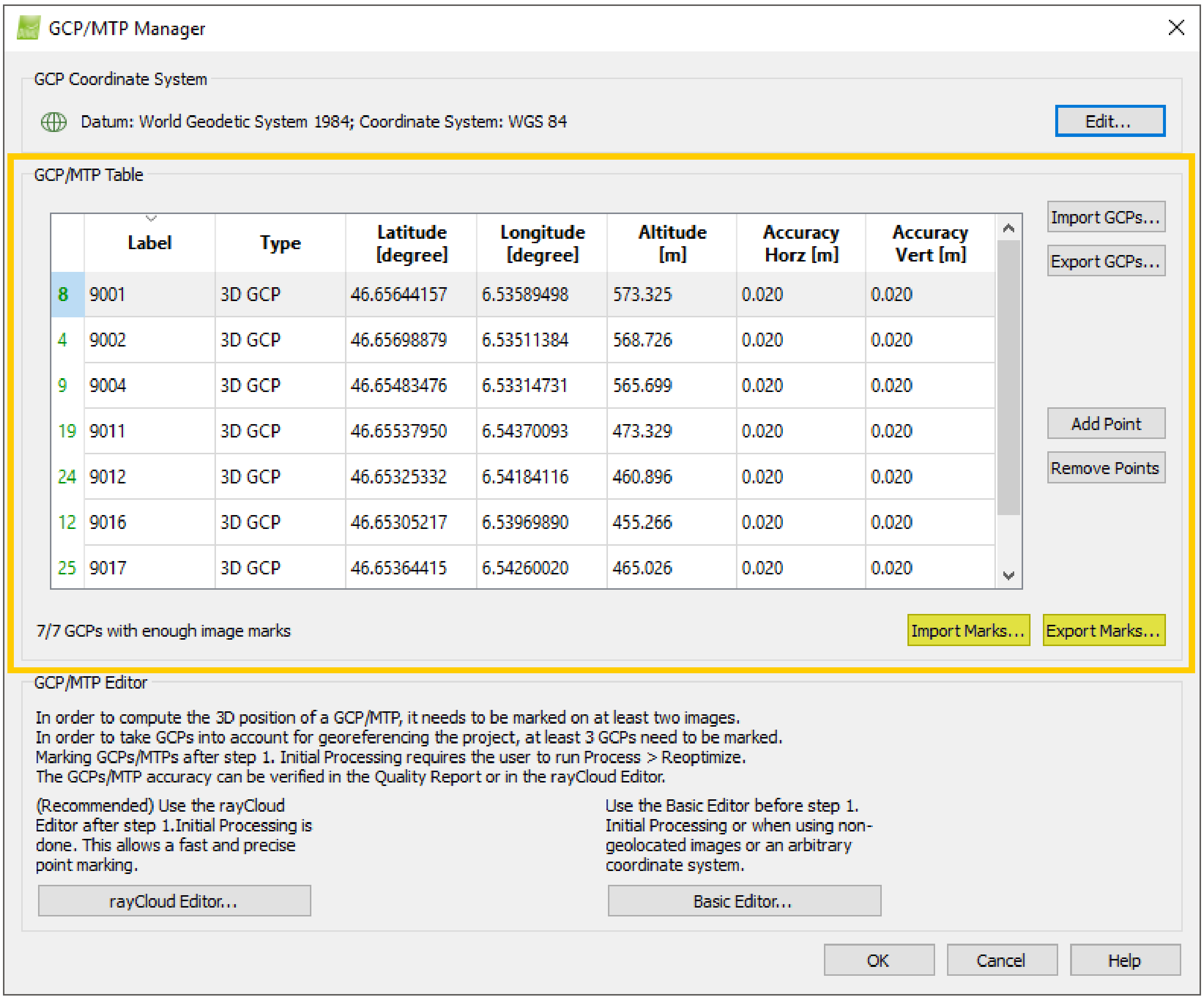


Access: On the Menu bar, click Project > GCP/MTP Manager..., on *GCP/MTP Table*, click Remove Points.

When clicking Remove Points the *GCPs/MTPs/Check Points* that are displayed on the *GCP/MTP Table* can be removed. One or multiple points can be selected from the *GCP/MTP Table* and be removed by clicking Remove Points. For more information about how to select a point on the *GCP/MTP Table*: 202557919.



Access: On the Menu bar, click Project > GCP/Manual Tie Point Manager..., on *GCP/Manual Tie Point Table*, click Import / Export Marks...

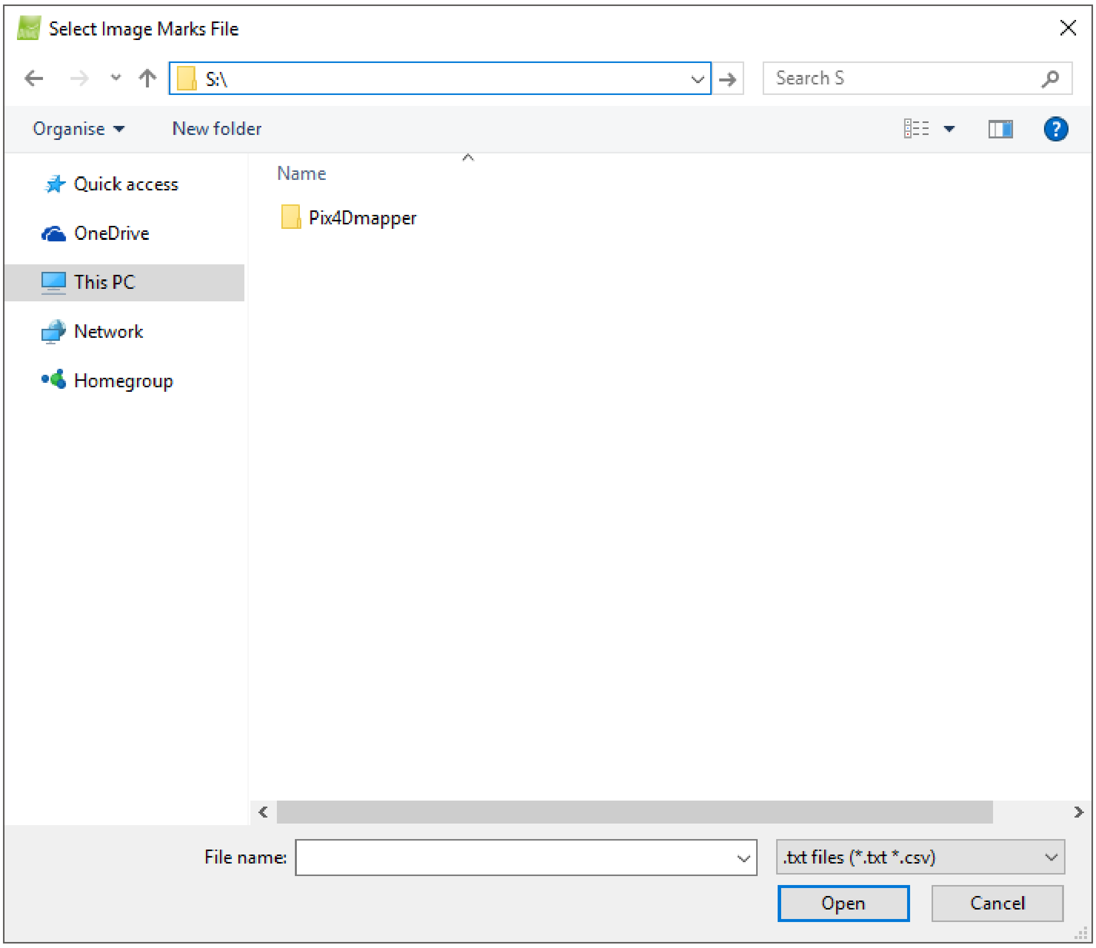


Import Marks...

Pix4Dmapper can import a file with the image coordinates of the GCPs / Manual Tie Points. For more information about the file format: 202558539.

Warning: The zoom level at which GCPs / Manual Tie Points are marked has an impact on the GCP / Manual Tie Point error obtained in the *Quality Report*. Usually the higher the zoom level, the more precisely the GCP / Manual Tie Point is marked. These GCPs / Manual Tie Points will have a bigger impact on the reconstructed model than GCPs / Manual Tie Points marked on a lower zoom level; lower error values are also expected for these GCPs / Manual Tie Points. For example, when GCPs / Manual Tie Points are marked without zooming into the images, the GCP / Manual Tie Point error can be 10 times higher than when the GCPs / Manual Tie Points are marked by zooming into the images.

When clicking Import Marks..., the *Select Import Image Marks File* pop-up appears:



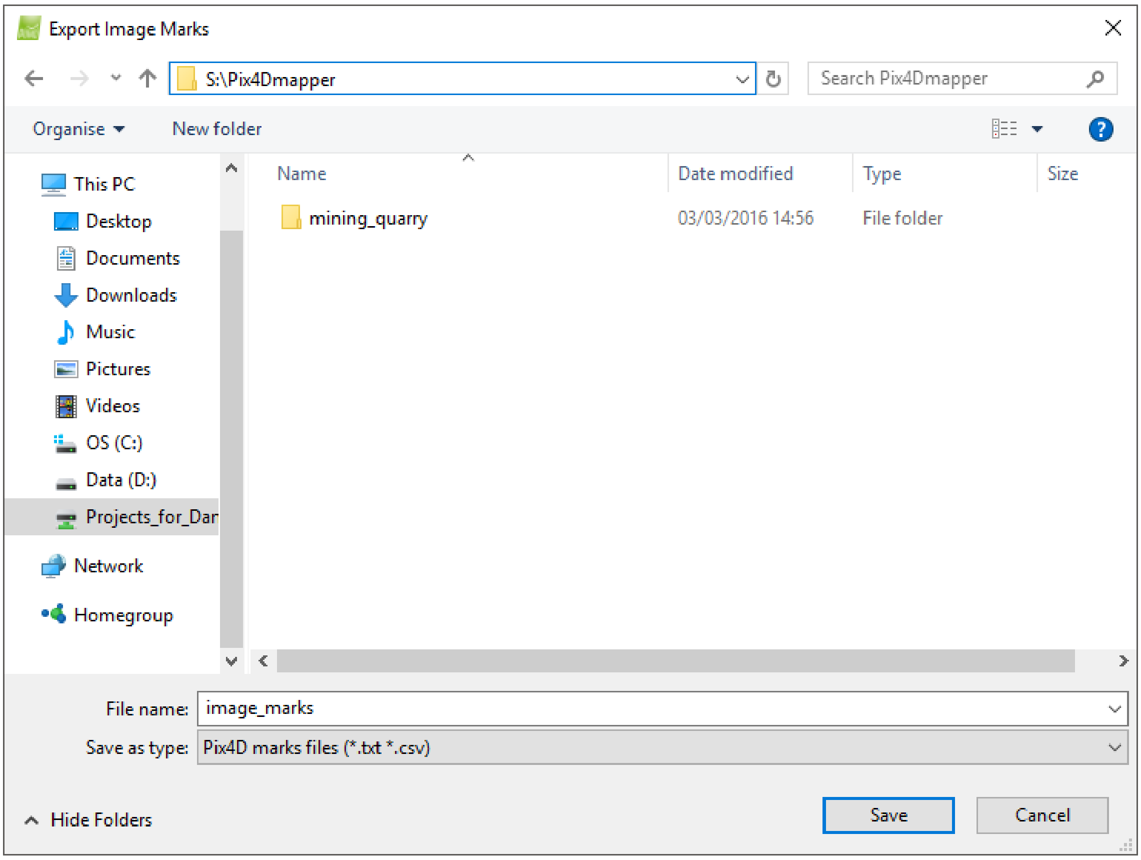
Navigation menu, to select the location to store the file.
On *File name*, type the name of the file.
The *Save as type* displays the file format used to save the file:
Pix4D marks files (.txt, *.csv)*: 202558539.
Bingo text file (.txt)*: 202558539.
XML structure (.xml)*: 202558539.
Save: Saves the file.
Cancel: Does not save the file and exits the pop-up.

Export Marks

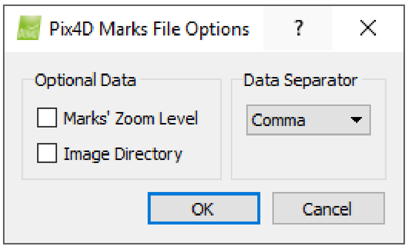
Once the GCPs / Manual Tie Points are marked on the images, Pix4Dmapper can export the image coordinates of the GCPs / Manual Tie Points. This option allows the user to use the same GCPs / Manual Tie Points with the same images the next time the project has to be processed (e.g. merging with another project, adding new images to the current project) without having to manually mark the GCPs / Manual Tie Points again.

Warning: The zoom level at which GCPs / Manual Tie Points are marked has an impact on the GCP / Manual Tie Point error obtained in the *Quality Report*. Usually the higher the zoom level, the more precisely the GCP / Manual Tie Point is marked. These GCPs / Manual Tie Points will have a bigger impact on the reconstructed model than GCPs marked on a lower zoom level; lower error values are also expected for these GCPs / Manual Tie Points. For example, when GCPs / Manual Tie Points are marked without zooming into the images, the GCP / Manual Tie Point error can be 10 times higher than when the GCPs / Manual Tie Points are marked by zooming into the images.

When clicking Export Marks..., the *Export Image Marks* pop-up appears:



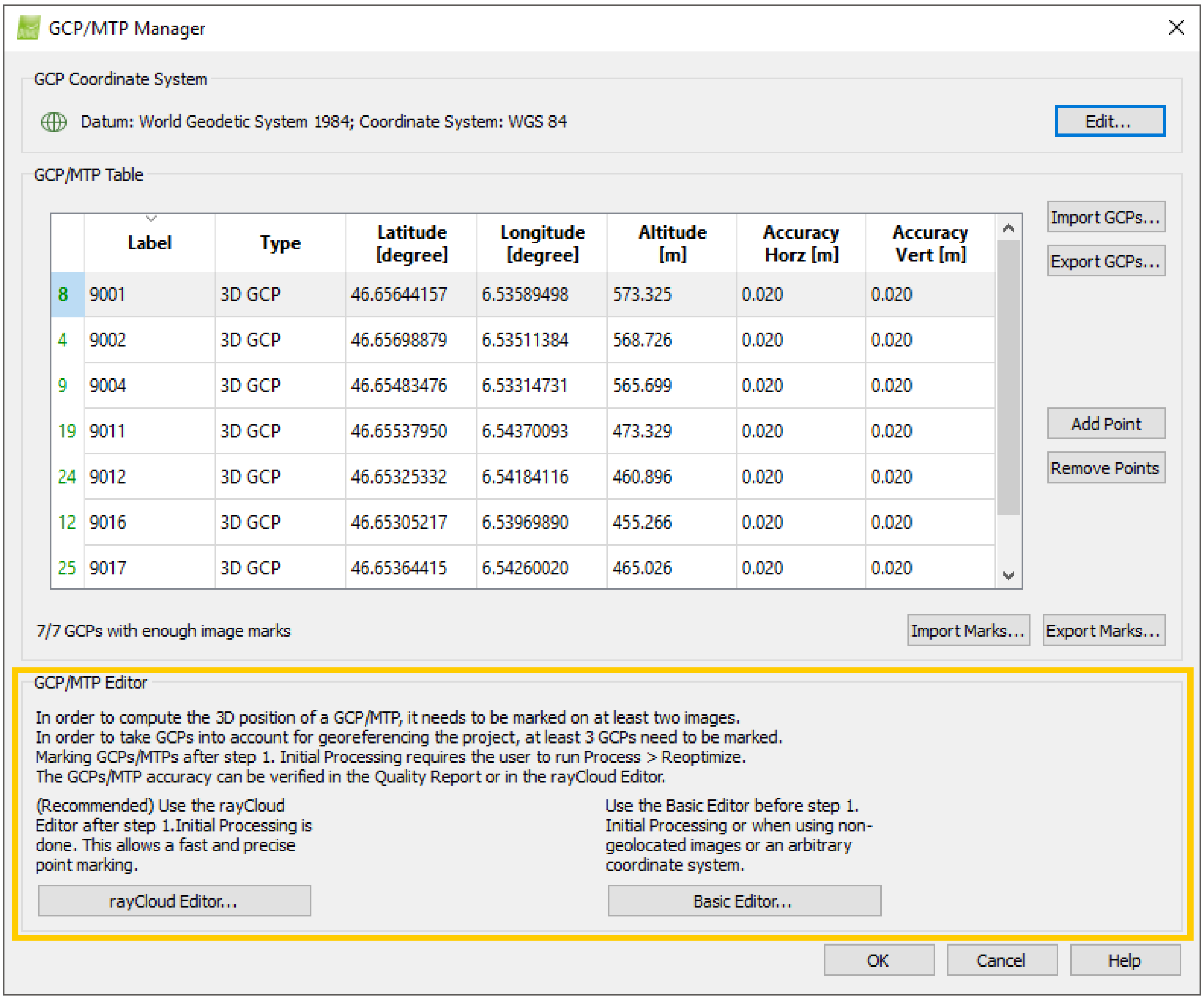
Navigation menu, to select the location to store the file.
On *File name*, type the name of the file.
The *Save as type* displays the file format used to save the file:
Pix4D marks files (.txt, *.csv)*: 202558539.
Bingo text file (.txt)*: 202558539.
XML structure (.xml)*: 202558539.
When *Pix4D marks files is selected,* the *Pix4D Marks File Options* pop-up appears:



Marks's Zoom Level check box: Exports the zoom level at which the GCPs / Manual Tie Points are marked on the images.
Image Directory check box: Exports the directory of the images.
Data Seperator: Sets the character used to separate the values in the file. The drop down list has the following options:
Comma (default)
Semicolon
Tab
Space
Save: Saves the file.
Cancel: Does not save the file and exits the pop-up.

For step by step instructions about how to export the marks of the GCPs / Manual Tie Points: 204924709.

Access: On the Menu bar, click Project > GCP/MTP Manager...



Allows the user to mark/edit the GCPs/Manual Tie Points/Check Points in the initial images. There are 2 options:

rayCloud Editor...: Available only if step *1. Initial Processing* has been completed. It opens the left sidebar of the rayCloud.
Basic Editor...: Available even if no processing step has been completed. It opens the Basic GCP/Manual Tie Points Editor.

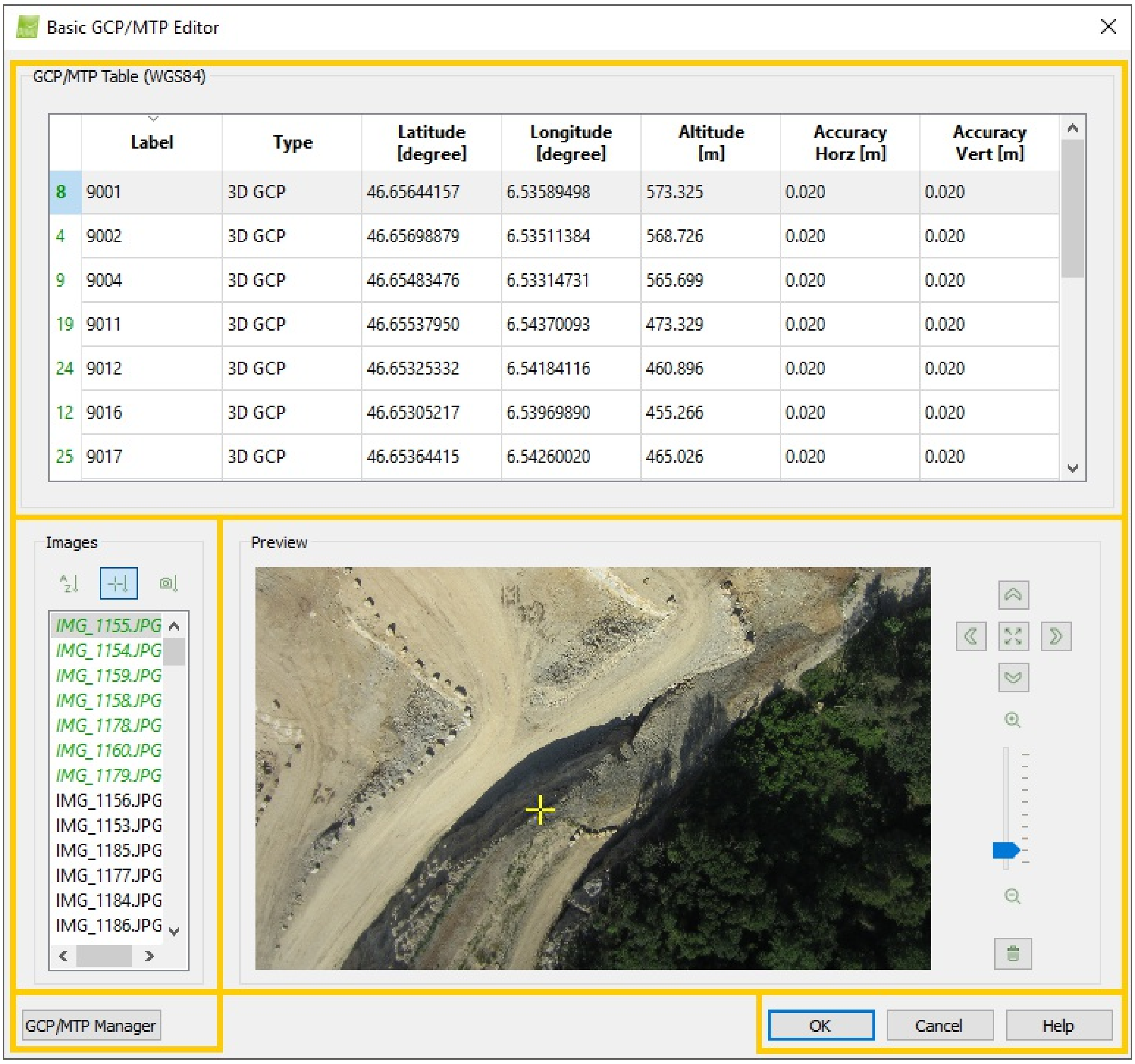
Access: On the Menu bar, click Project > GCP/MTP Manager... The *GCP/MTP Manager* window opens. In the *GCP/MTP Editor* section, click Basic Editor...

The *Basic GCP/MTP Editor* pop-up has the following 3 sections:

GCP/MTP Table: Section that allows the user to edit the GCPs/Manual Tie Points/Check Points values and status.
Images: A list with all the images.
Preview: Section where the GCPs / Manual Tie Points / Check Points are marked on the image.

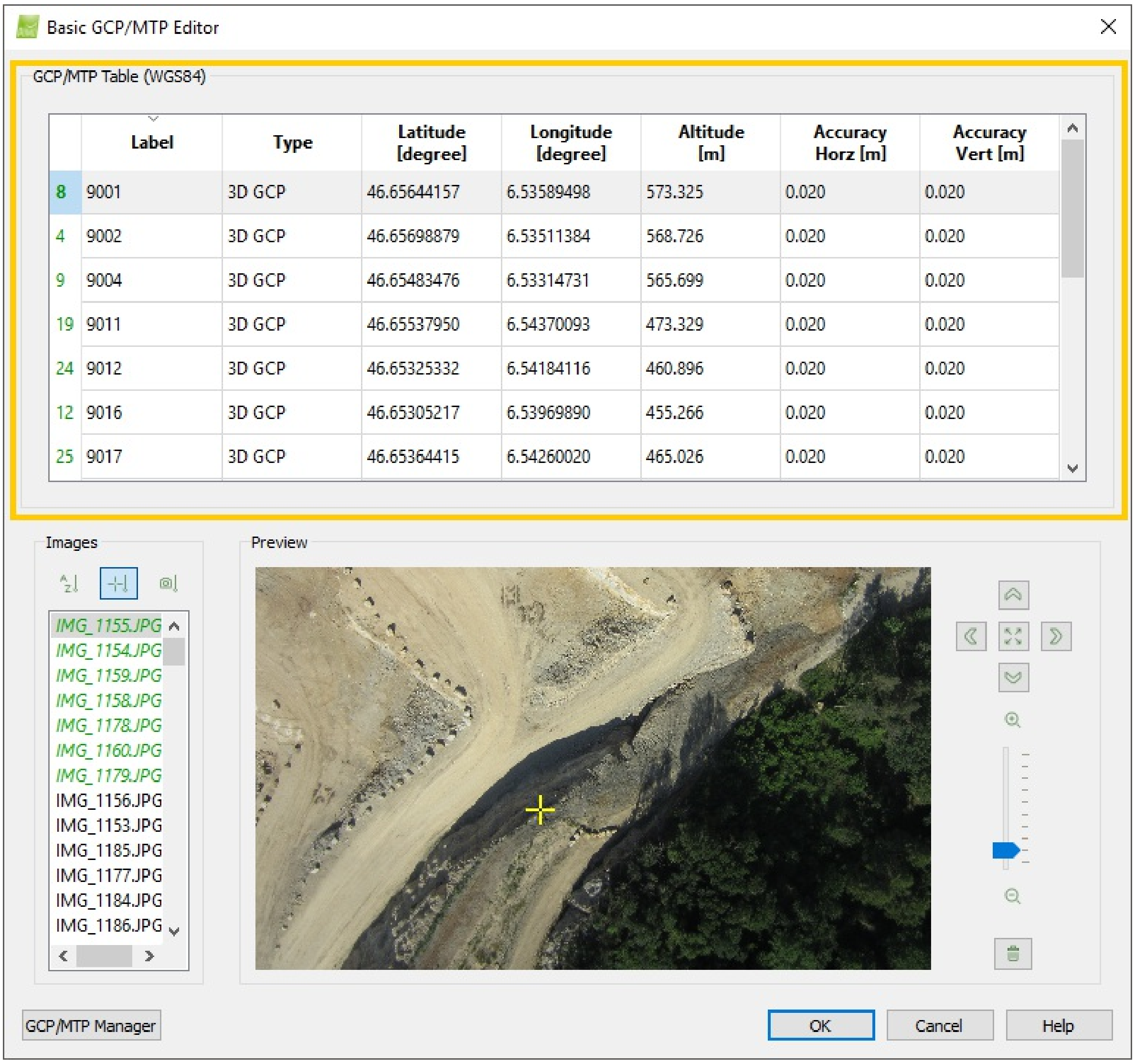
And the action buttons:

GCP/MTP Manager: Closes the Basic GCP / Manual Tie Point Editor and goes back to the GCP/Manual Tie Point Manager.
OK: Confirms the changes.
Cancel: Does not save the changes and exits the pop-up.
Help: Opens the Pix4Dmapper help.



Access: On the Menu bar, click Project > GCP/MTP Manager... The *GCP/MTP Manager* window opens. In the *GCP/MTP Editor* section, click Basic Editor...

This section allows the user to view the GCPs/Manual Tie Points/Check Points, values and status.



Next to the section title *GCP/MTP Table*, the coordinate system of the GCPs is displayed.

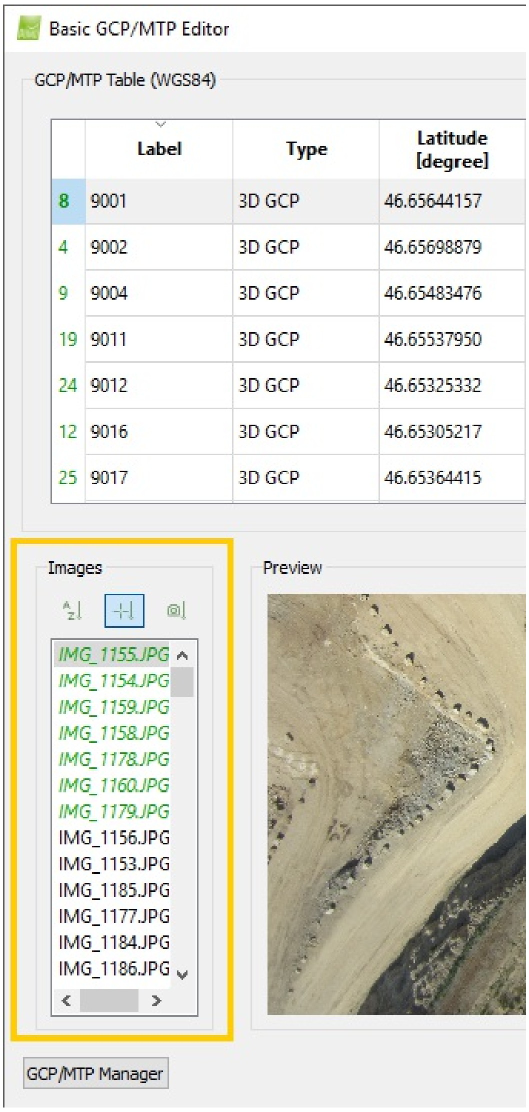
This section contains a *Ground Control Points Table* which displays all the GCPs of the projects together with their properties.

Access: On the Menu bar, click Project > GCP/MTP Manager... The *GCP/MTP Manager* window opens. In the *GCP/MTP Editor* section, click Basic Editor...

This section displays a list of all the project images.

For each selected point on the GCP/MTP *Table* section, the *Images* section shows with:

Green color: The images on which the point has been marked.
Black color: The images on which the point has not been marked.



The images can be sorted according to three different criteria by clicking on the corresponding buttons:

- Sort Images by Name.
- Sort Images by the Distance to GCP.
- Sort Images by the Distance to the Marked Images.

There is one context menu for the *Images* section that can be accessed by right clicking on one image. The context menu gives access to the following action:

Remove Mark: Deletes the marked point that appears on this image.

Sort Images by Name

The images are sorted alphabetically by name.

Sort Images by the Distance to GCP

The images are sorted by distance to the GCP (closest image to the GCP is displayed first). This sorting is selected by default when 2D GCPs, 3D GCPs or

Check points have been imported into the project. This sorting is recommended to easily find images on which GCPs or Check points may appear.

Note: Non geolocated images are displayed at the bottom of the list.

Sort Images by the Distance to the Marked Images

The images are sorted by distance to the marked images (closest image to the marked images is displayed first). This sorting is recommended to easily find images on which *Manual Tie Points* appear. It can be used after having marked the Manual Tie Point on at least one image.

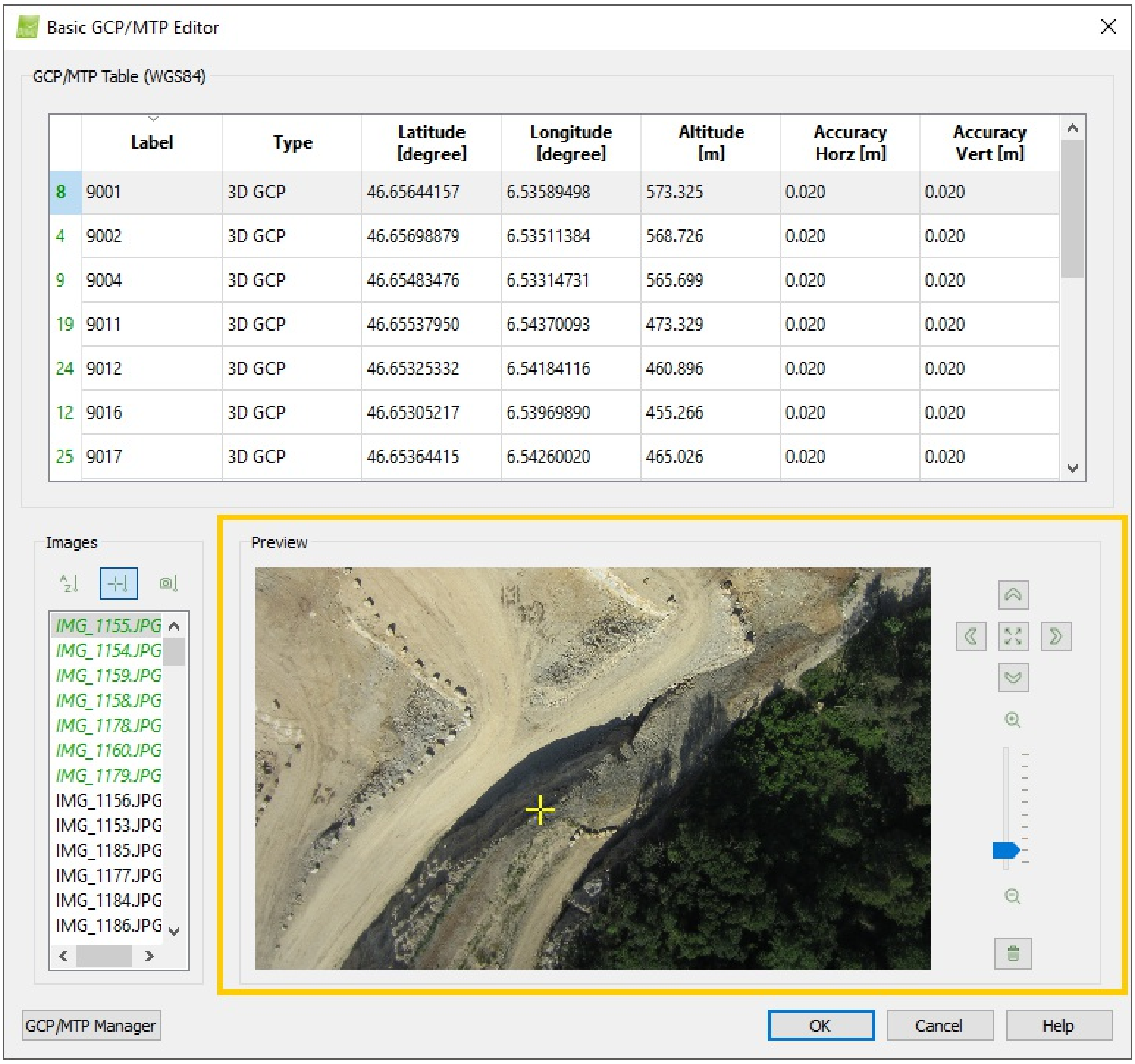
Note: Non geolocated images are displayed at the bottom of the list.

Access: On the Menu bar, click Project > GCP/MTP Manager... The *GCP/MTP Manager* window opens. In the *GCP/MTP Editor* section, click Basic Editor...

This section is used to mark the GCPs/Manual Tie Points/Check Points on the images.

Important: Each point needs to be marked on at least 2 images to be taken into account in processing. It is recommended to mark each point in at least 4-5 images.

Important: The zoom level at which GCPs are marked has an impact on the GCP error obtained in the Quality Report. Usually the higher the zoom level, the more precisely the GCP is marked. These GCPs will have more impact on the reconstructed model than GCPs marked in a lower zoom level and lower error values are expected for those GCPs. For example, when GCPs are marked without zooming into the images, the GCP error can be 10 times higher than when GCPs are marked by zooming into the images.



When the *Basic GCP/MTP Editor* is opened the first time, no image is displayed in the *Preview* section. Once points are imported from a file or once a new point has been added, the first image is displayed in the *Preview* section.

The following actions are available:

Zoom in: Move the mouse scroll wheel forwards.
Zoom out: Move the mouse scroll wheel backwards.
Pan: Press the left mouse button and move the mouse.
Zoom in quickly to a specific point: With the mouse click on the point of interest and press the Alt key.
Zoom out instantly to zero zoom level: Press the Shift key.
Mark a point: Left click on the point on the image.

In the right part of the *Preview* section there is a control panel to navigate in the image:

Left arrow button: Moves to the left part of the image (when the image is zoomed in).

Right arrow button: Moves to the right part of the image (when the image is zoomed in).

Up arrow button: Moves to the top part of the image (when the image is zoomed in).

Down arrow button: Moves to the bottom part of the image (when the image is zoomed in).

Reset view button: Zooms out to zero zoom level.

Zoom in button: Zooms in.

Zoom slider: Zooms in or out.
In: Move the slider up.
Out: Move the slider down.

Zoom out button: Zooms out.

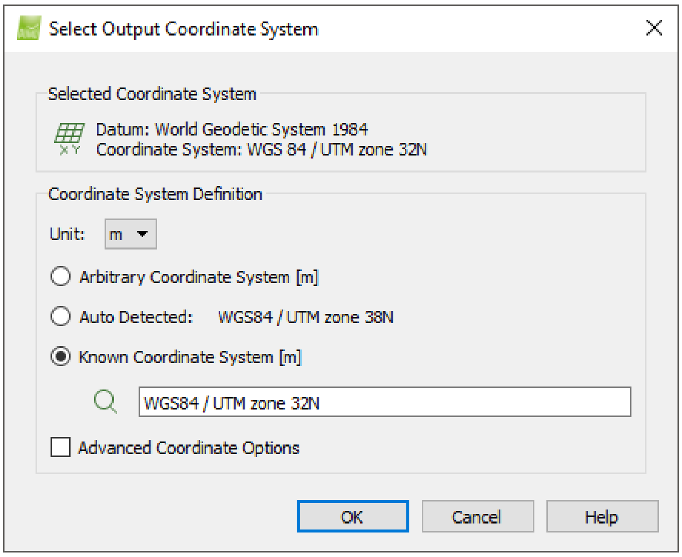
Remove button: Removes the marked point (if any) from the image displayed in the *Preview* section. If there is no mark in the image displayed in the *Preview* section, the Remove button is grayed out.

Access: On the Menu bar, click Project > Select Output Coordinate System...

Important: The output coordinate system does not need to be the same as the image geolocation coordinate system or the GCPs coordinate system. By default, the output coordinate system is the same as the GCPs coordinate system if GCPs are used, otherwise it is the same as the image geolocation coordinate system. If the coordinates system is WGS84, the output is given in the corresponding UTM zone.

If less than 3 images are geolocated and less than 3 GCPs are defined, then the output coordinates system is set to "Arbitrary".

The *Select Output Coordinate System* pop-up allows the user to choose the coordinate system of the outputs.

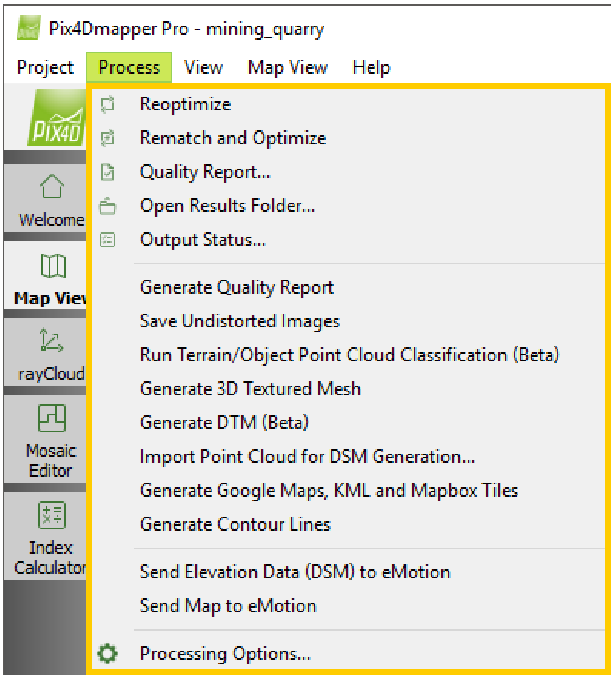


For a full description of the *Select Output Coordinate System* pop-up: 202558239.

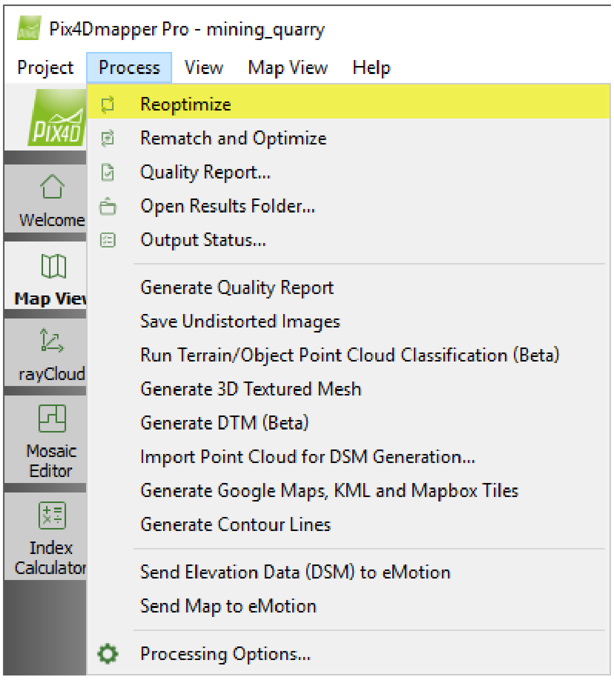
Access: On the Menu bar, click Process.

There are 16 items that can be selected:

Reoptimize: Reoptimizes the camera positions using information from GCPs/ Manual tie points that are added after step.1 *Initial Processing*.
Rematch and Optimize: Computes more matches between the images (and therefore more Automatic Tie Points) and reoptimizes the internal and external camera parameters.
Quality Report...: Opens the *Quality Report* in a new window.
Open Results Folder...: Opens an explorer window with the path where the project outputs are stored.
Show Output Status...: Shows the status of the output files generated.
Generate Quality Report: Generates a new *Quality Report* that refers to the new reconstruction obtained after applying changes to the project after step.1 *Initial Processing*.
Save Undistorted Images: Generates and saves an undistorted copy of each original image using the optimized distortion camera parameters.
Run Terrain/Object Point Cloud Classification (beta): Generates a Terrain point cloud and an Objects Point Cloud.
Generate 3D Textured Mesh: Generates a 3D Textured Mesh based on triangles using a a simplified Densified Point Cloud.
Generate DTM (beta): Generates a DTM using the points from the *Terrain* point group.
Import Point Cloud for DSM Generation...: Allows the user to import a point cloud that will be used to generate the DSM and orthomosaic.
Generate Google Maps, KML and Mapbox Tiles: Generates Google Maps tiles, Google Earth KML file and Mapbox tiles for the orthomosaic.
Generate Contour Lines: Generates the contour lines specified in the *Processing Options* using the raster DSM.
Send Elevation Data (DSM) to eMotion: (only if senseFly eMotion is installed) Sends a DSM generated in Pix4Dmapper to eMotion.
Send Map to eMotion: (only if senseFly eMotion is installed) Sends an Orthomosaic generated in Pix4Dmapper to eMotion.
Processing Options...: Opens a pop-up that allows the user to select the processing options and/or the processing options template.



Access: On the Menu bar, click Process > Reoptimize (enabled once step *1. Initial Processing* has been completed).



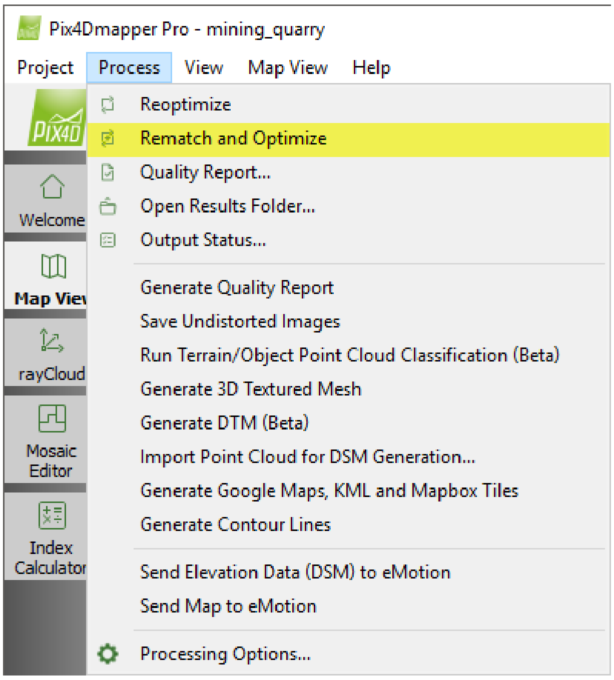
This process reoptimizes the internal and external camera parameters. It should be used when changes have been applied to the project after step *1. Initial Processing* has been completed. Such changes can be:

Adding GCPs.
Adding Manual Tie points.
Adding Check points.
Changing coordinate systems.
Disable images.

Important: Disabled or uncalibrated ameras will not be taken into account. In order to calibrate uncalibrated cameras: 202560189.

Warning:
Results generated during step *1. Initial Processing* are overwritten.
The *Quality Report* is deleted. To generate a new *Quality Report*: 202558319.
If step *2. Point Cloud and Mesh* and step *3. DSM, Orthomosaic and Index* have been done as well, their results are removed. These results need to be saved by the user in order not to lose them.

Access: On the Menu bar, click Process > Rematch and Optimize (enabled once step *1. Initial Processing* has been completed).



This process computes more matches between the images (and therefore more Automatic Tie Points) and reoptimizes the internal and external camera parameters. It is recommend to use it:

After manually calibrating cameras that were not initially calibrated.
For difficult projects where few matches were initially found.
To merge individual projects that do not share common images.
To optimize the step *1. Initial Processing* by re-matching images. For projects with more than 500 images, this process is unselected and disabled in the processing options.

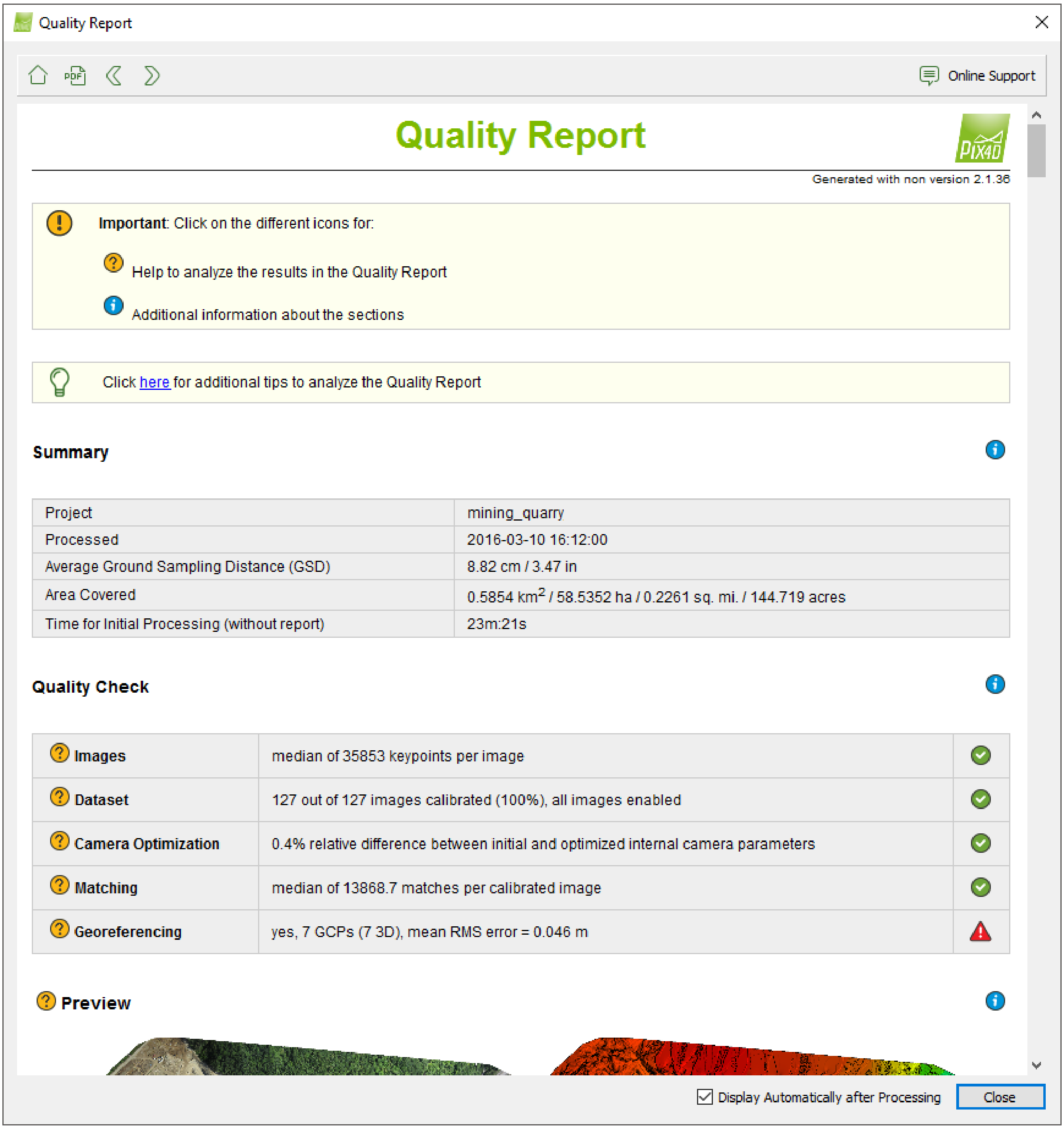
Note: For large projects (more than 500 images), the *Rematch and Optimize* feature significantly increases processing time.

Important: Disabled or uncalibrated ameras will not be taken into account. In order to calibrate uncalibrated cameras: 202560189.

Warning:
Results generated during step *1. Initial Processing* are overwritten.
The *Quality Report* is deleted. To generate a new *Quality Report*: 202558319.
If step *2. Point Cloud and Mesh* and step *3. DSM, Orthomosaic and Index* have been done as well, their results are removed. These results need to be saved by the user in order not to lose them.

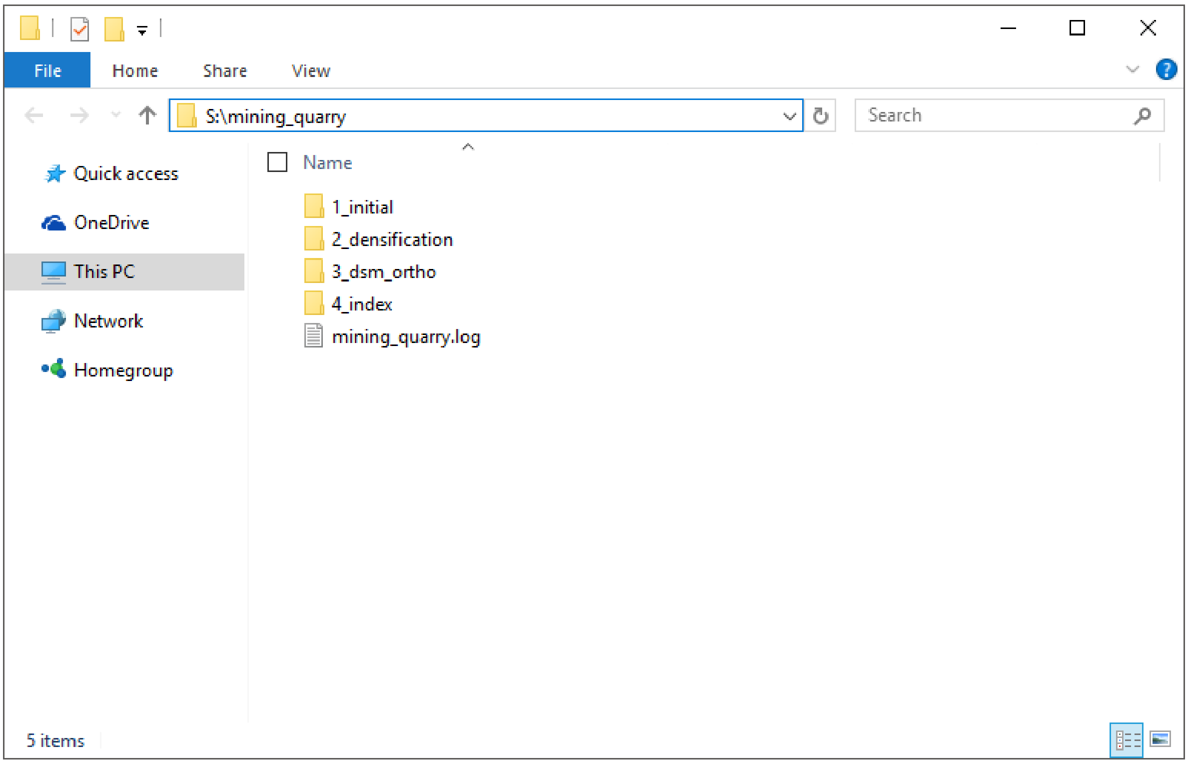
Access: On the Menu bar, click Process > Quality Report... (active once step *1. Initial Processing* has been completed). The *Quality Report* opens in a pop-up window.

Important:
For a detailed description about how to analyze the Quality Report: 202558689.
For a detailed description about the parameters described in the Quality Report: 202558679.
For a description about how to analyze the Quality Report: 202557339.
Example of a Quality Report available at the following link: Quality Report.

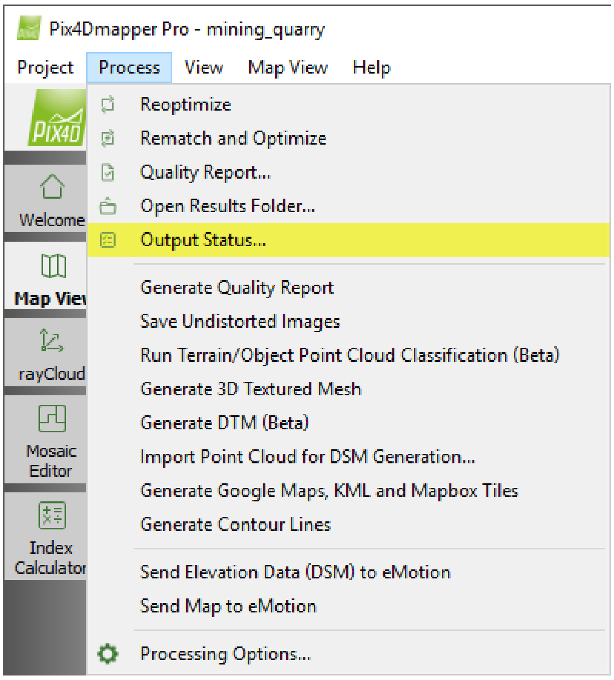


Access: On the Menu bar, click Process > Open Results Folder... The Results Folder in a new window.

Important:
For a detailed description of the folder structure: 20255864.
For more information about the output files: 202558509.



Access: On the Menu bar, click Process > Output Status.... The *Output Status* pop-up appears.



The *Output Status* pop-up displays:

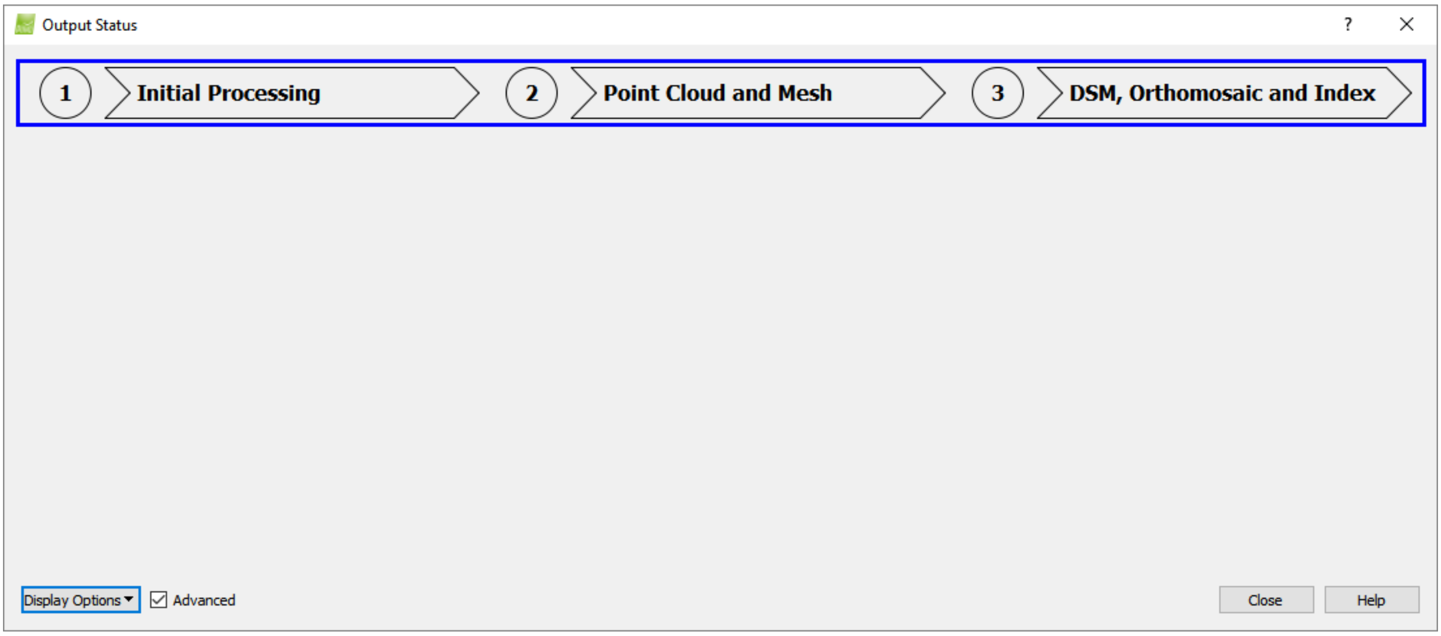
The Processing Step that is being processed.
The Processing Steps that have already been processed.
The Processing Steps that cannot be processed with the current version of Pix4Dmapper. For more information: 204162839.
The Output Files that are selected to be generated.
The Output File that is being generated.
The Output Files that have already been generated.
The Output Files that can be generated with the current version of Pix4Dmapper. For more information: 204162839.
The formats of the Output Files selected to be generated.
The dependencies between the Output Files.
Information and links to the Processing Options and the Results Folders about the Output Files.

The *Output Status* pop-up consists of:

Processing Steps
Output Files
Display Options

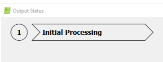
Processing steps

The three Processing Steps, *1. Initial Processing*, *2. Point Cloud and Mesh* and *3. DSM, Orthomosaic and Index* appear in the *Output Status* pop-up.

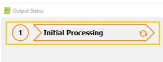


The Processing Steps can be:

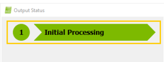
Transparent: If the Processing Step is not processed yet.
Orange: If the Processing Step is being processed.
Green: If the Processing Step is already processed.
Grayed out: If the Processing Step is not available in the current version of Pix4Dmapper. For more information: 204162839.



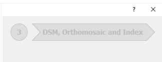
Processing Step not processed yet.



Processing Step being processed.



Processing Step processed.



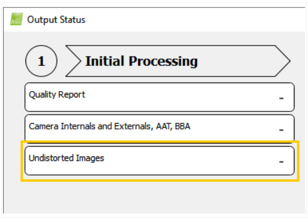
Processing Step grayed out.

Important: When no Output Files are selected for step *3. DSM, Orthomosaic and Index*, step *3. DSM, Orthomosaic and Index* is grayed out and cannot be processed.

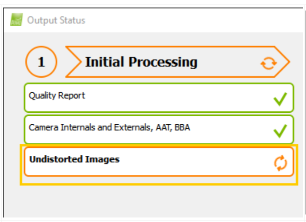
Output Files

The Output Files can be:

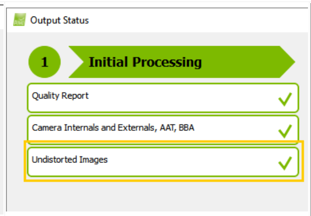
White: If the Output File is not generated yet.
Orange: If the Output File is being generated.
Green: If the Output File is already generated.
Grayed out: If the Output File is not selected to be generated or the Output File is not available in the current version of Pix4Dmapper. For more information: 204162839.



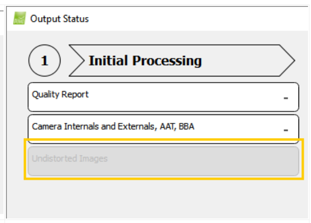
Output File selected to be generated.



Output File being generated.



Output File being generated.



Output File not selected to be generated.

For each Processing Step, the following Output Files are displayed:

1. Initial Processing:

Quality Report

Camera Internals and Externals, AAT, BBA
Undistorted Images

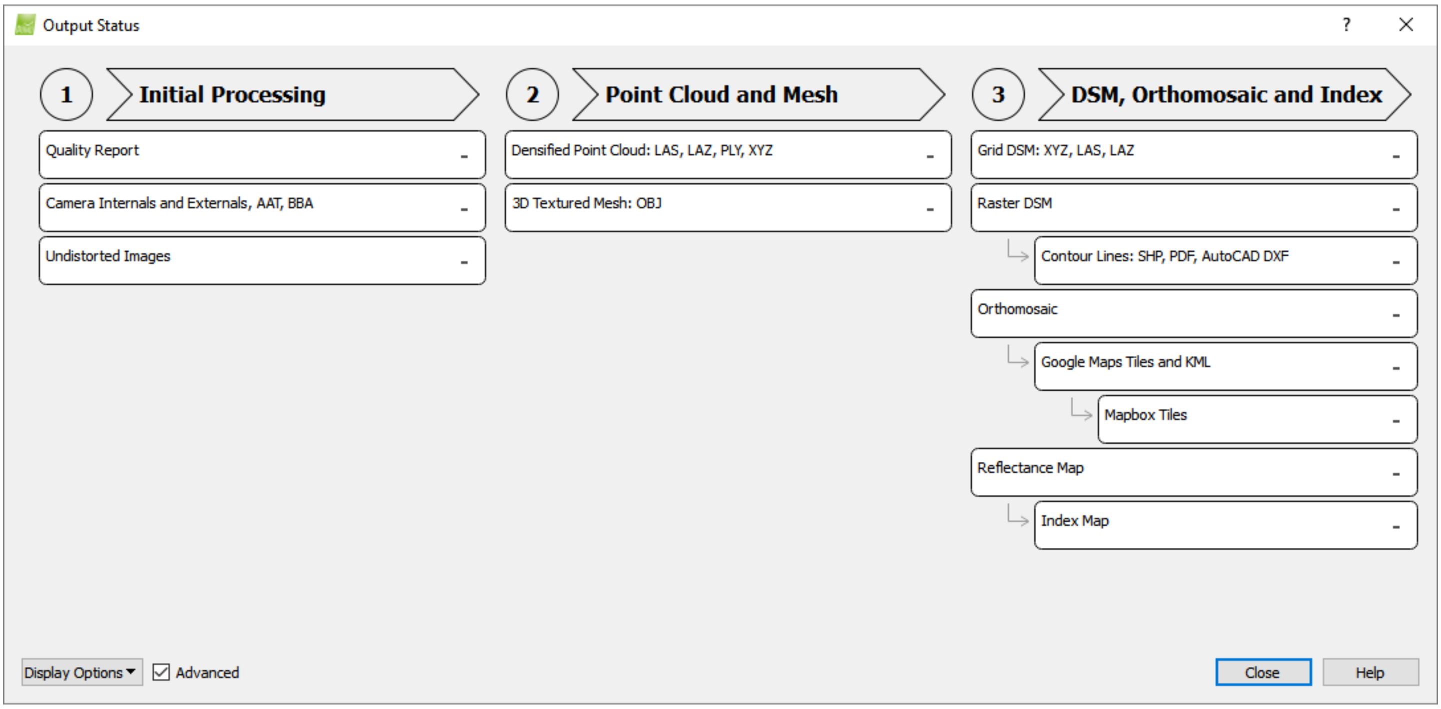
Note: The *Camera Internals and Externals, AAT and BBA* and the *Undistorted Images* are displayed only when the *Advanced* box is selected.

2. Point Cloud and Mesh:

Densified Point Cloud
3D Textured Mesh

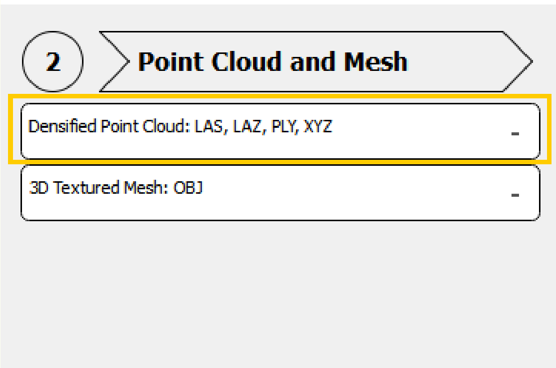
3. DSM, Orthomosaic and Index:

Grid DSM
Raster DSM
Contour Lines
Orthomosaic
Google Maps Tiles and KML
Mapbox Tiles
Reflectance Map
Index Map



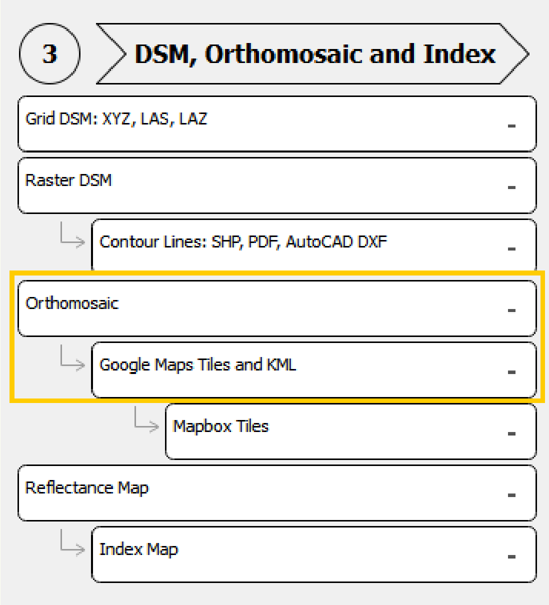
In each Output File box, the different output file formats selected for the Output File are displayed.

Example: For the *Densified Point Cloud*, the *las, laz, ply* and *xyz* file formats are selected.



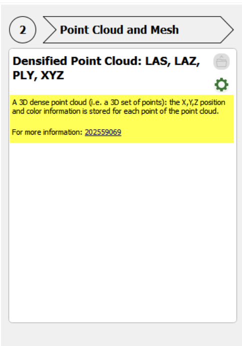
Some Output Files are indented and connected to other Output Files with arrows. These arrows represent the dependencies between the different Output Files. If the initial Output File is not selected, the depended one cannot be generated and it is grayed out.

Example: The *Google Maps Tiles and KML* depends on the *Orthomosaic* to be generated.

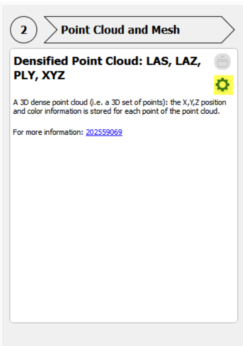


Clicking an Output File box, the box is extended. The extended box contains:

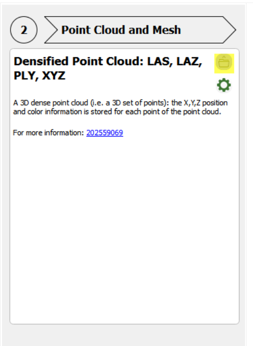
A description of the Output File.
A link to the Processing Options of this Output File.
A link to the Results Folder directory of the Output File.



Description of the Output File.



Open the Processing Options for this Output File.



Open the Results Folder for this Output File.

Display Options

The Display Options drop down list selects the Output Files to be displayed. The Display Option can be:

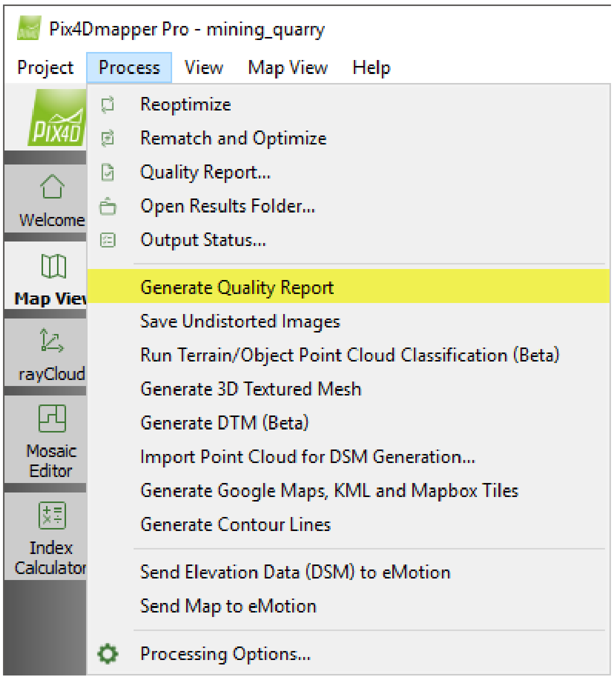
Disabled: The Output Files not selected or not available in the current version of Pix4Dmapper are displayed.
To do: The Output Files selected to be generated are displayed.
In Progress: The Output Files being generated are displayed.
Done: The Output Files already generated are displayed.

If the *Advanced* box is selected, the Advanced Output Files are visualized. If the *Advanced* box is not selected, the Advanced Output Files are not visualized.

And the action buttons:

Close: Closes the Output Status pop-up.
Help: Opens the Pix4Dmapper help.

Access: On the Menu bar, click Process > Generate Quality Report (enabled once step *1. Initial Processing* has been completed).

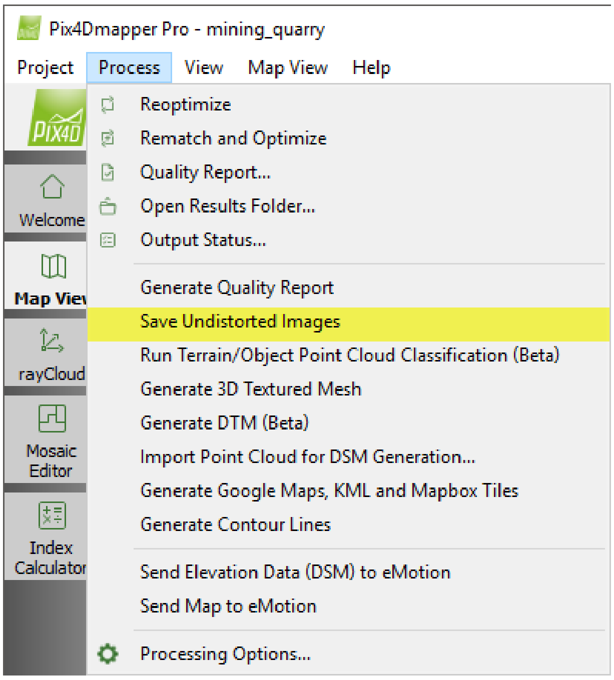


This process generates a new *Quality Report* that refers to the new reconstruction obtained after applying changes to the project once step *1. Initial Processing* has been completed. Such changes can be:

Adding GCPs.
Adding Manual Tie points.
Adding Check points.
Changing coordinate systems.
Enabling/disabling images.
Running the *Rematch and Optimize* option.

Important: When adding GCPs, Manual Tie points, Check points, changing coordinate systems or enabling/disabling images, the *Reoptimize* option has to be applied before generating the new *Quality Report*.

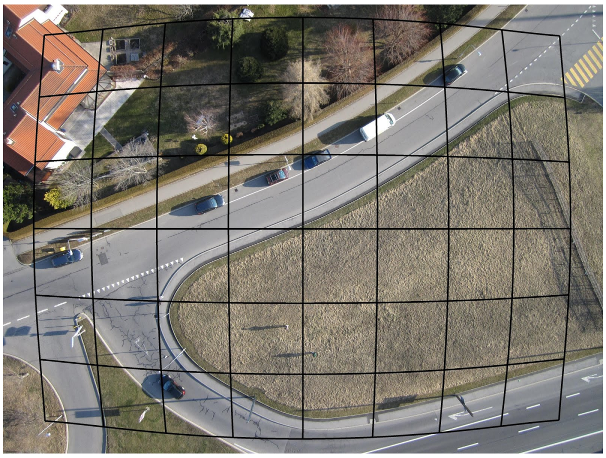
Access: On the Menu bar, click Process > Save Undistorted Images (active once step *1. Initial Processing* has been completed).



This process generates an undistorted copy of each original image using the optimized distortion parameters of the selected camera model.

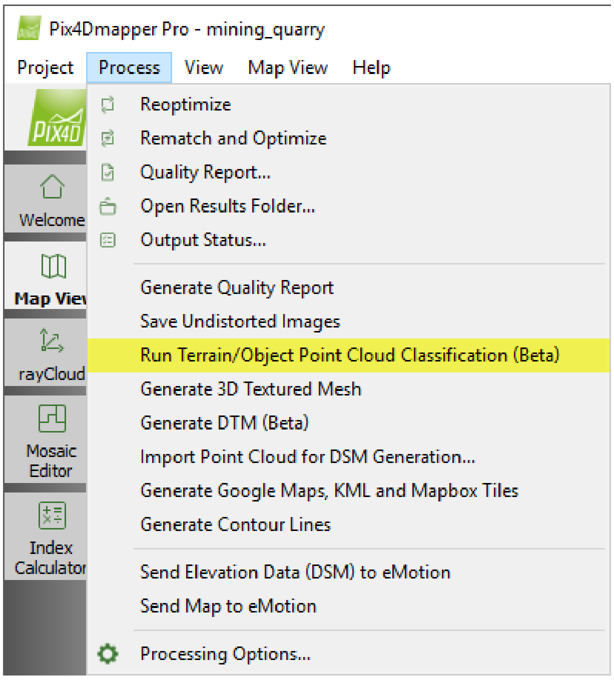
Important:
This process is available only when processing images using a perspective lens camera model.
The undistorted images will only be generated for the calibrated images.

Information: For more information about the camera distortion: 202559069.


Original image: ***The square grid is distorted because of the lens of the camera.***


Undistorted image: ***The square grid is now perfectly aligned.***

Access: On the Menu bar, click Process > Run Terrain /Object Point Cloud Classification (beta) (active once step *2. Point Cloud and Mesh* has been completed).



Important: By default, the *Terrain / Object Point Cloud Classification* is not computed during processing step *2. Point Cloud and Mesh.* It is possible to compute the classification while processing step *2. Point Cloud and Mesh.* For step by step instructions: 203186589.

This process computes a Point Cloud Classification using the densified point cloud generated during step *2. Point Cloud and Mesh.* The deleted points are not taken into account. This process classifies each point into *Terrain* / *Objects* groups:

Terrain: It consists of terrain points.
Objects: It consists of object points.

It is possible to set up the classification parameters, available on the processing options: 204644369.

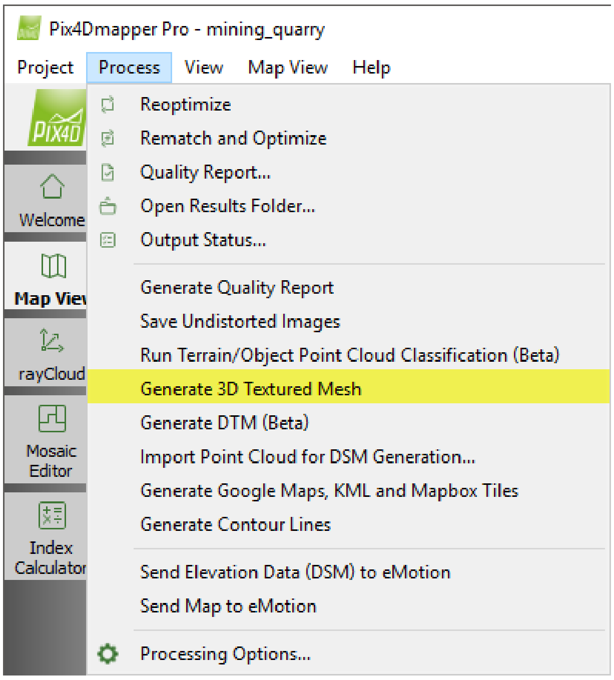
For step by step instructions about how to compute the Point cloud Classification: 203186589.

Important: It is possible to edit the computed *Terrain* / *Objects* classification and move points from one group to another, delete them, move them into a new group, etc. For step by step instructions: 202560499.

Note: Once a *Terrain* point group exist, it is possible to generate a DTM (beta). For step by step instructions: 203204259.

Access: On the Menu bar, click Process > Generate 3D Textured Mesh (active once step *2. Point Cloud and Mesh* has been completed).

Important: The *3D Textured Mesh* cannot be generated when selecting *Use Semi-Global Global Matching* (beta). This option is available on the Menu bar, by clicking Process > Processing Options..., selecting Processing step *2. Point Cloud and Mesh*, and selecting the tab Add-ons. For more information: 205443205.



This process generates a *3D Textured Mesh* based on triangles using the *Densified Point Cloud*.

Important: By default, by clicking Process > Generate 3D Textured Mesh, the 3D Textured Mesh will be generated:
In .p4b format, only readable in the rayCloud:
project_name\2_densification\project_data\project_name_3d_mesh.p4b
In .obj format:
project_name\2_densification\3d_mesh\project_name_simplified_3d_mesh.obj

In order not to generate the .obj file and/or generate other outputs (.ply, .fbx, .dxf, .obj, zipped .obj, .pdf) before clicking Process > Generate 3D Textured Mesh, change the processing options and click OK. For more information: 202557799.

For step by step instructions about how to generate the 3D Textured Mesh: 202560669.

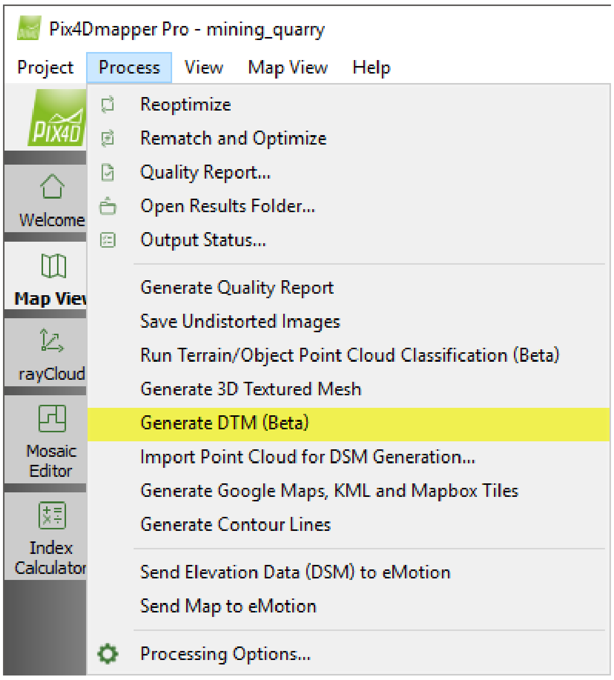
Important: The *3D Textured Mesh* will be generated using the *Densified Point Cloud*. If any *Processing Area* and/or image annotation is defined, and if the corresponding options are selected in the *Point Cloud Filters* options, they will also be used for the *3D Textured Mesh* generation.

These options are available on the Menu bar, by clicking Process > Processing Options... and selecting 2. Point Cloud and Mesh. For more information: 202557799.

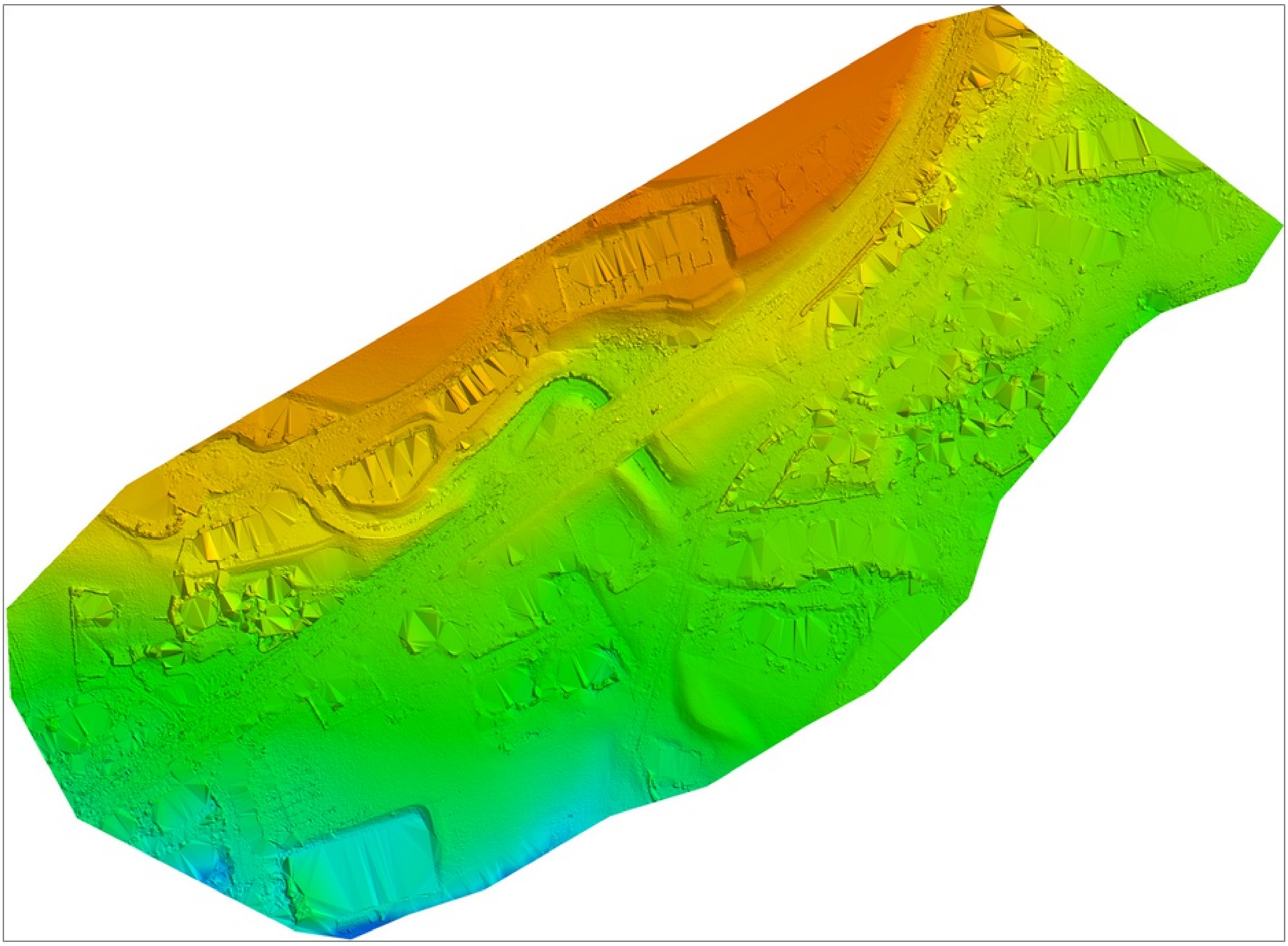
3D Textured Mesh

Access: On the Menu bar, click Process > Generate DTM (beta) (active once step *2. Point Cloud and Mesh* has been completed and the point group *Terrain* exists and contains points).

Note: The point group *Terrain* can be generated automatically by running *Run Terrain/Object Point Cloud Classification (beta)*. For step by step instructions: 203186589.

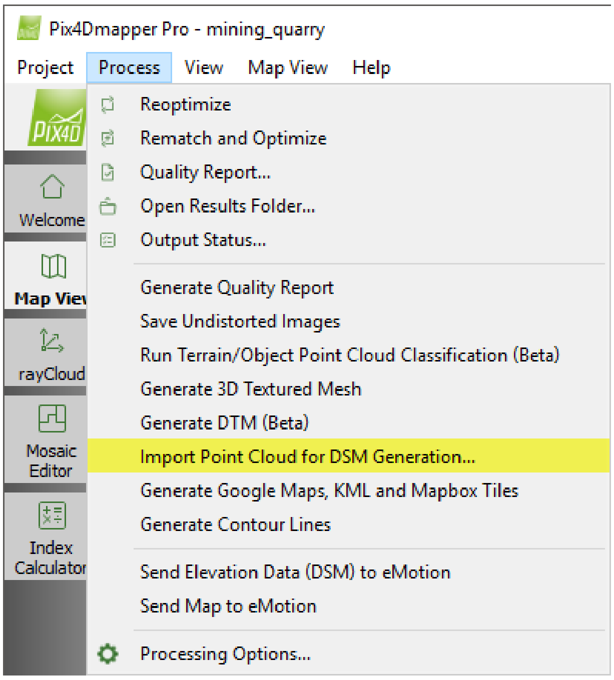


This process generates a DTM using the points from the *Terrain* point group.



DTM

Access: On the Menu bar, click Process > Import Point Cloud for DSM Generation... (active once step *1. Initial Processing* has been completed).



This process allows the user to import a point cloud to generate the DSM and the orthomosaic.
Once the point cloud has been imported, step *3. DSM, Orthomosaic and Index* has to be started to generate the DSM and the orthomosaic.

It opens the *Select Point Cloud* pop-up, which allows to navigate to the path where the point cloud to be imported is stored and select it.

The accepted formats are:

.xyz
.las
.laz

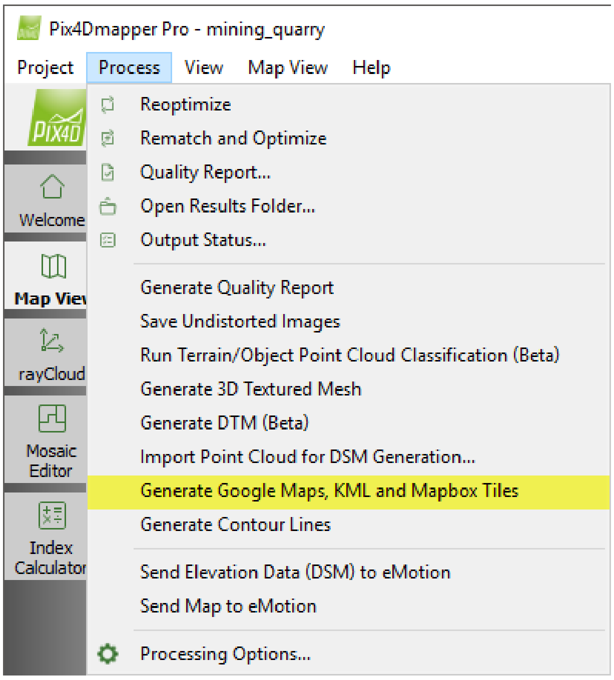
It contains the action buttons:

Open: Confirms the importation of the selected file.
Cancel: Does not import any file and close the pop-up.

Warning:
The external point cloud needs to be in the same coordinate system as the output coordinate system.
If step *3. DSM, Orthomosaic and Index* has already been completed for this project, existing results are overwritten when running the step again. The existing results need to be saved by the user in order not to lose them.

Important:
The imported Point Cloud is not visualized in the rayCloud.
If step *2. Point Cloud and Mesh* has been completed, its results are not used for the DSM and Orthomosaic generation.
The imported Point Cloud will be used to generate the DSM.
The original images are projected to the DSM in order to obtain the Orthomosaic.

Access: On the Menu bar, click Process > Generate Google Maps, KML and Mapbox Tiles (active once step *3. DSM, Orthomosaic and Index* has been completed and if the outputs are selected in the processing options: 206860936).



This process generates the Google Maps tiles, KML files and Mapbox tiles for the orthomosaic.

Important:
When images are grouped in more than one group, the *Google Maps, KML* and *Mapbox Tiles* will only be generated if one of the groups is named *RGB* (in capital letters). Then the *Google Maps, KML* and *Mapbox tiles* will be generated only for this group. For more information about the image groups: 202557949.
The *Google Maps, KML* and *Mapbox tiles* are only generated for 3 bands with 8 bit per band images.
The *Google Maps, KML and Mapbox tiles* will only be generated for projects with georeference (image geolocation and/or GCPs).

For more information about the Google Maps tiles, the KML files and the Mapbox tiles files and how to use them: 202558499.

Figure 1: Google Maps tiles

Figure 2: KML

Index > Interface > Menu Process

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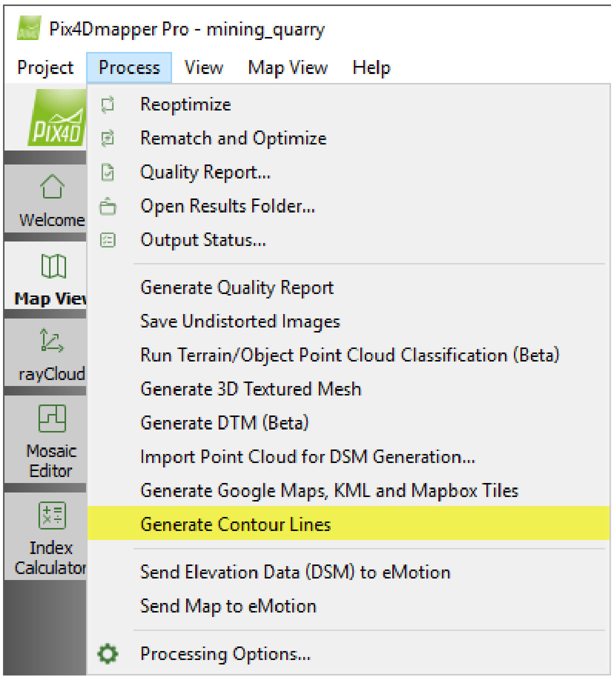
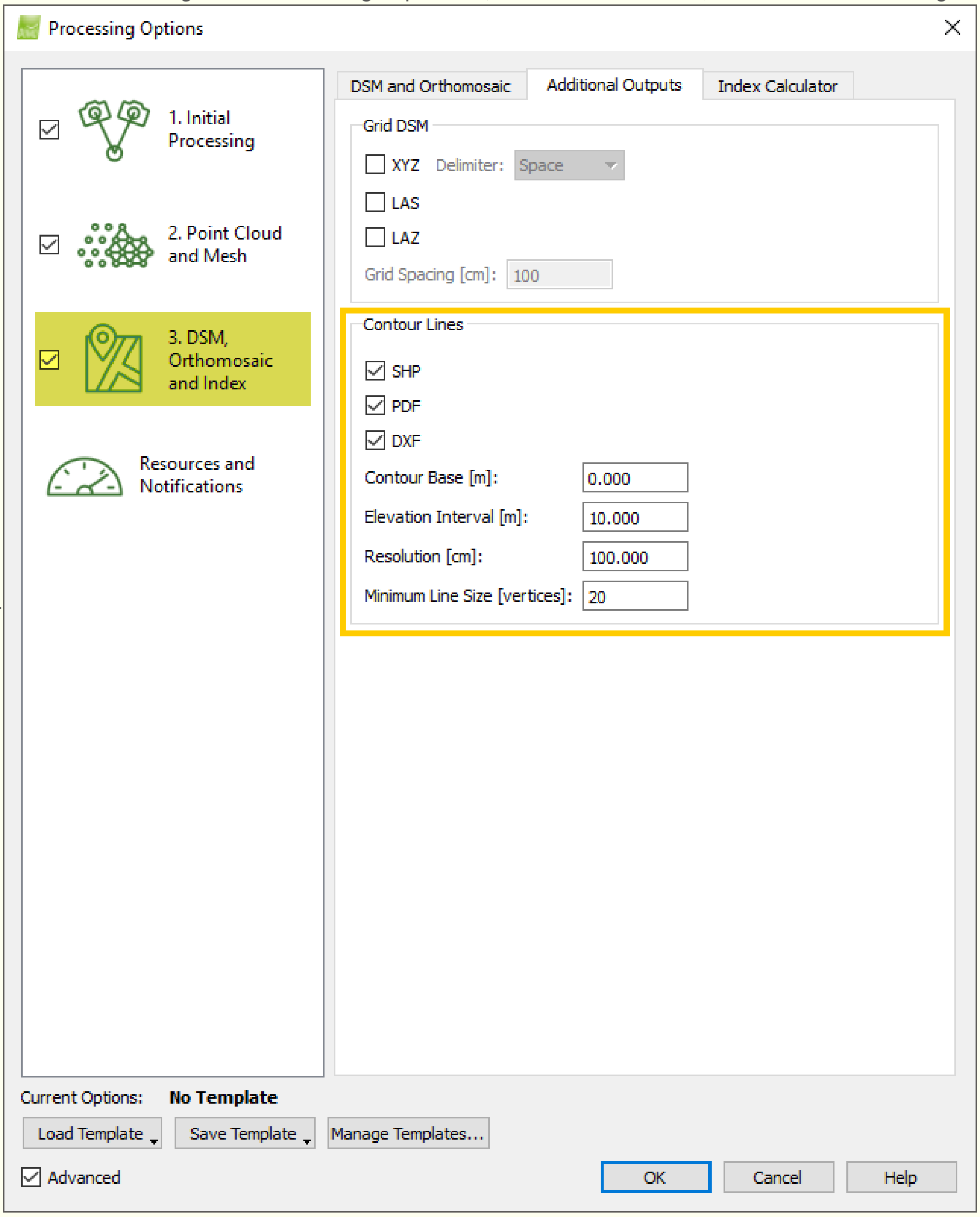
Access: On the Menu bar, click Process > Generate Contour Lines (active once step *3. DSM, Orthomosaic and Index* has been completed and if any Contour Lines format is selected in the processing options). For step by step instructions: 202560639.



This process generates the contour lines using the Raster DSM. For more information about contour lines: 202559879.

Important: The option to generate the *Contour Lines* is grayed out if the option to merge the tiles of Raster DSM is disabled. For more information about the options of the Raster DSM: 202557769.

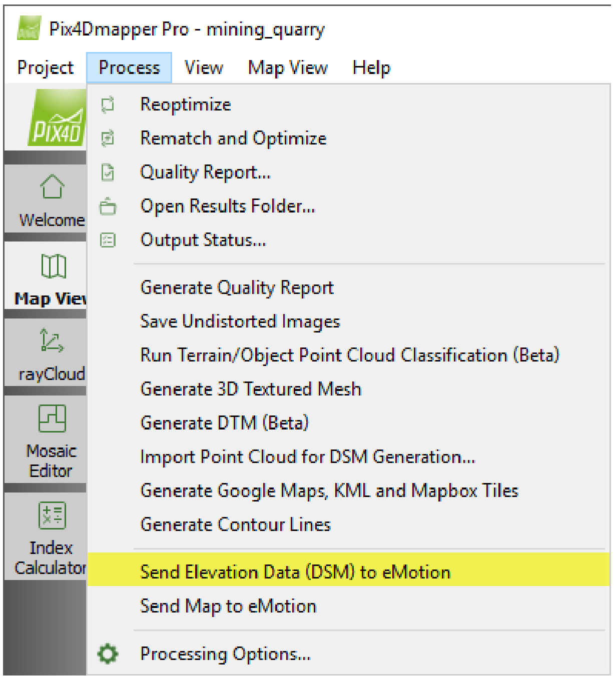
Note:
If contour lines with the same *Elevation Interval* are already generated, they will be overwritten.
If the *Contour Lines* processing options have been configured when executing step *3. DSM, Orthomosaic and Index*, the *Contour Lines* will be generated automatically when running step 3.



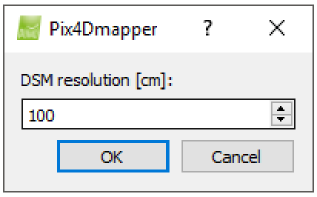
Contour lines

Access: On the Menu bar, click Process > Send Elevation Data (DSM) to eMotion. Only available when senseFly eMotion is installed on the same device and step *2. Point Cloud and Mesh* is completed.

Important:
The DSM sent to eMotion is not the same as the DSM generated during step *3. DSM, Orthomosaic and Index*. The resolution of the DSM sent to eMotion is set to 100 cm.
It is possible to generate the DSM that will be sent to eMotion only if the output coordinate system is not set to arbitrary.
The altitude of the DSM that will be sent to eMotion will refer to the ellipsoid. If the vertical coordinate system is set to a geoid model, a conversion will take place.



When clicking Process > Send Elevation Data (DSM) to eMotion, a pop-up appears:



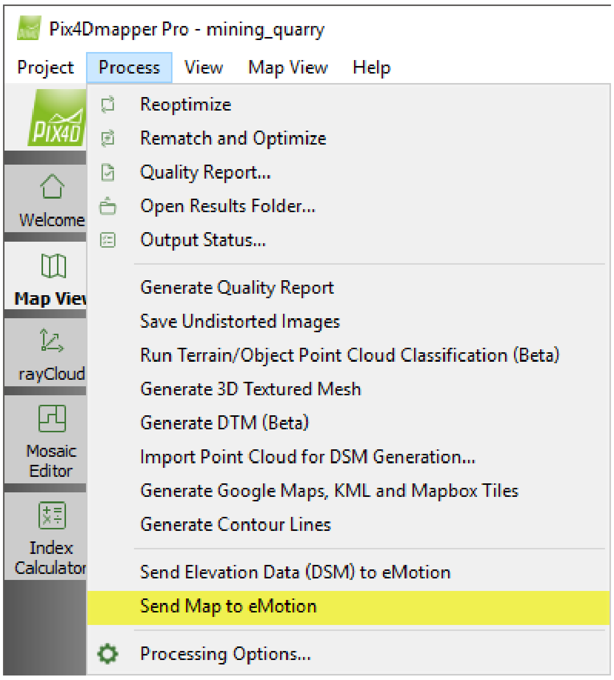
The pop-up sets the DSM resolution for the DSM that is sent to eMotion.

The action buttons:

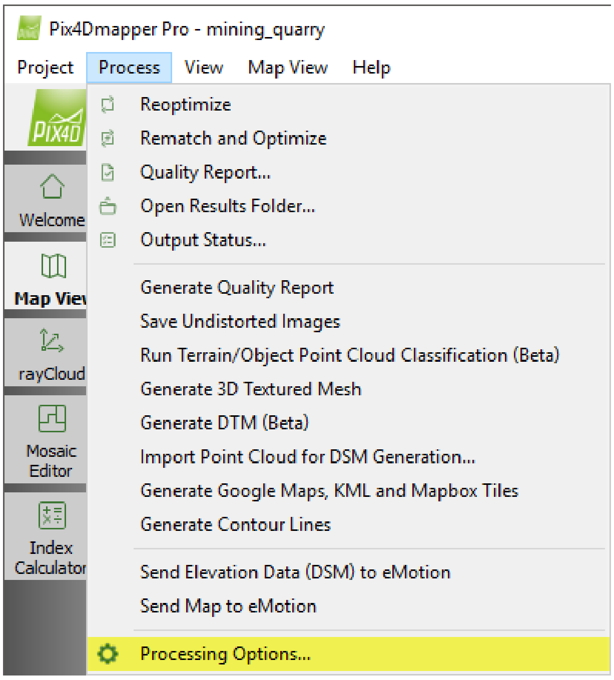
OK: Generates the DSM that will be sent to eMotion.
Cancel: Cancels the generation of the DSM.

Access: On the Menu bar, click Process > Send Map to eMotion. Only available when Sensefly eMotion is installed on the same device, step 2. *Point Cloud and Mesh* is completed and the Orthomosaic of step 3. DSM, Orthomosaic and Index is generated.

Important: It is possible to generate the Map that will be sent to eMotion only if the output coordinate system is not set to arbitrary.



Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears.



This feature allows to:

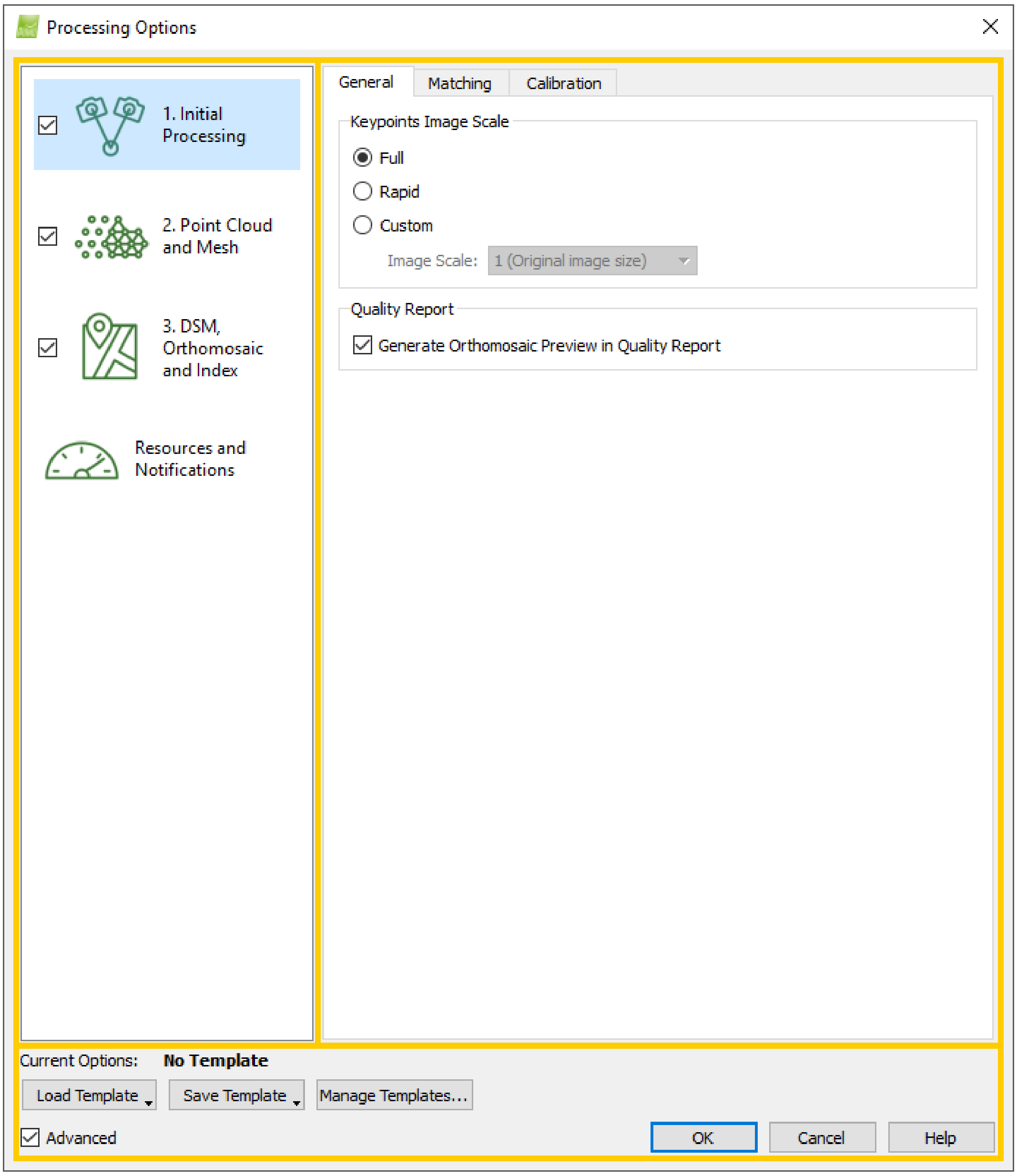
View/edit the processing options:
Selecting which outputs are generated and in which format.
Assigning hardware resources to the processing.
Select a Processing Options Template.
Create a new Processing Options Template.
Manage Processing Options Templates.

It contains three sections:

Processing steps and resources: Allows the user to select a step or the resources in order to visualize/edit options.
Tabs associated to the selected step or resources: Allows the user to visualize/edit the processing options, outputs and/or resources for the selected step/resources.
Processing Options Template: Allows the user to select a template, save a custom template and manage templates.

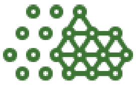
And four actions:

OK: Confirms the changes.
Cancel: Does not save the changes.
Help: Opens the Pix4Dmapper help.
Advanced options: Displays/hides the advanced options tabs, available for *1. Initial Processing* and *2. Point Cloud and Mesh*.


Processing Options
1. Initial Processing
2. Point Cloud and Mesh
3. DSM, Orthomosaic and Index
Resources and Notifications
General
Matching
Calibration
Keypoints Image Scale
Full
Rapid
Custom
Image Scale: 1 (Original image size)
Quality Report
Generate Orthomosaic Preview in Quality Report
Current Options: No Template
Load Template
Save Template
Manage Templates...
Advanced
OK
Cancel
Help

Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 1. Initial Processing. By default, only the *General* tab appears. On the bottom left, select the *Advanced* box to display other tabs.


1. Initial Processing


2. Point Cloud and Mesh

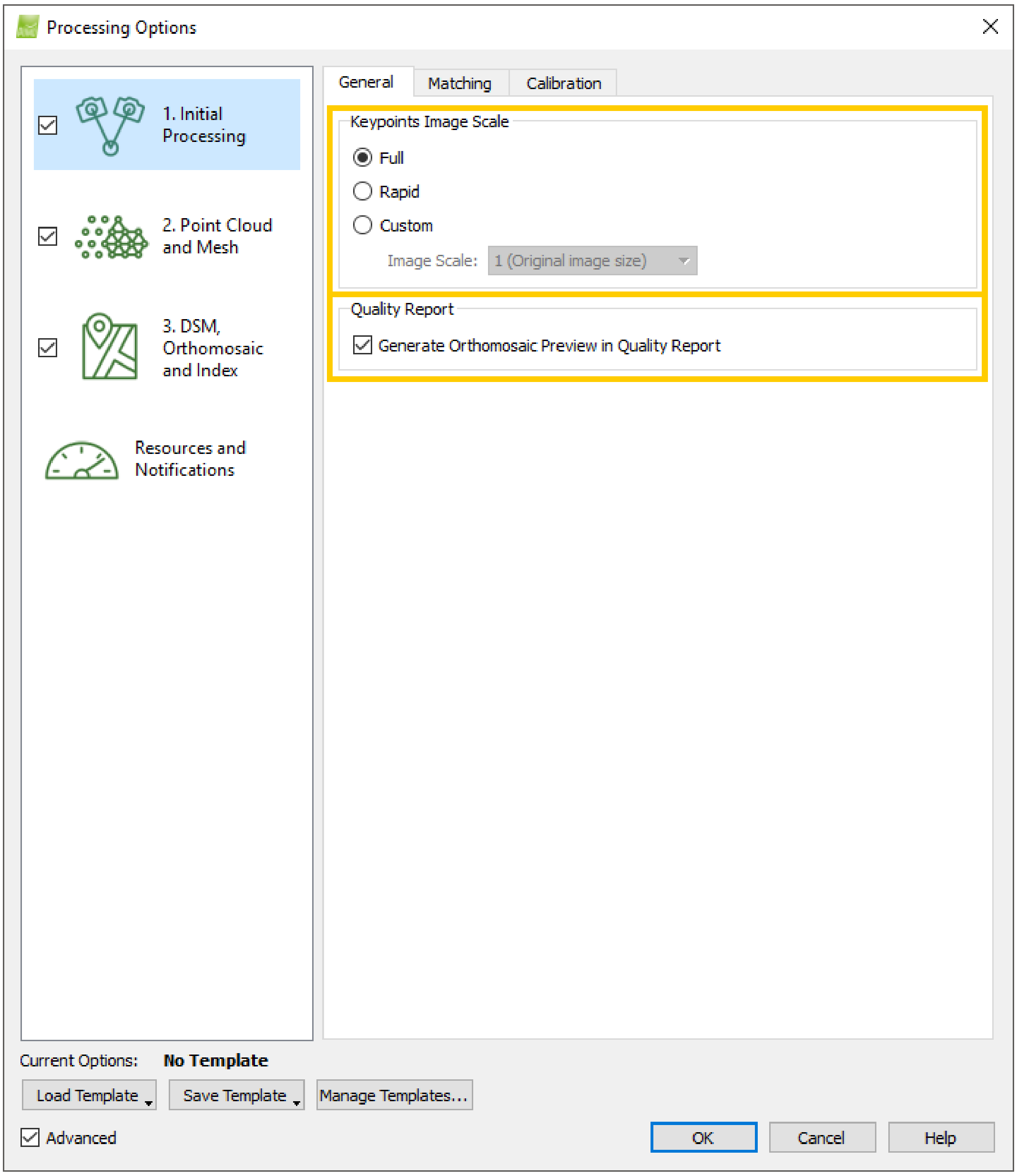

3. DSM, Orthomosaic and Index

Resources and Notifications

General | Matching | Calibration

Allows the user to change the processing options and to select what the Quality Report will display. It contains 2 sections:

Keypoints Image Scale: Allows the user to define the image size used to extract the keypoints.
Quality Report: Allows the user to select what the Quality Report will display.



Keypoints Image Scale

Allows the user to define the image size used to extract the keypoints. It is possible to select:

Full: It sets full *Image Scale* for precise results.
Rapid: It sets a lower *Image Scale* for fast results.
Custom: Allows the user to select the *Image Scale*. There are the following options:
Image Scale:

- 1 (Original image size): This is the recommended *Image Scale*.
- 2 (Double image size): For small images (e.g. 640x320 pixels), a scale of 2 (double image size) should be used. More features will be extracted and it will have a positive impact on the accuracy of the results.
- 1/2 (Half image size): For large projects with high overlap, a scale of 1/2 (half image size) can be used to speed up processing. This will, usually, result in a slightly reduced accuracy as less features will be extracted. This scale is also recommended for blurry or low textured images, as it usually results in better outputs than the full scale for such images.
- 1/4 (Quarter image size): For very large projects with high overlap, a scale of 1/4 (quarter image size) can be used to speed up processing. This will, usually, result in a slightly reduced accuracy as less features will be extracted. This scale is also recommended for very blurry or very low textured images, as it usually results in better outputs than the full scale for such images.
- 1/8 (Eighth image size): For very large projects with high overlap, a scale of 1/8 (eighth image size) can be used to speed up processing. This will, usually, result in a slightly reduced accuracy as less features will be extracted.

Quality Report

Allows the user to select what the Quality Report will display.

Generate Orthomosaic Preview in Quality Report: The Quality Report will display a low resolution DSM and Orthomosaic. To display these elements, the Quality Report generation takes longer. Disabling this option, the Quality Report generation is faster.

> Important: The low resolution DSM is generated using the Automatic Tie Points. The low resolution Orthomosaic is generated based on this DSM. Both outputs are expected to be of low quality and should not be used for further analysis.

> Note: When processing images that belong to different groups, all images are processed together, generating only one DSM for the whole project, but generating one Orthomosaic per group using the images associated to that group. For more information about the image groups: 202557949.

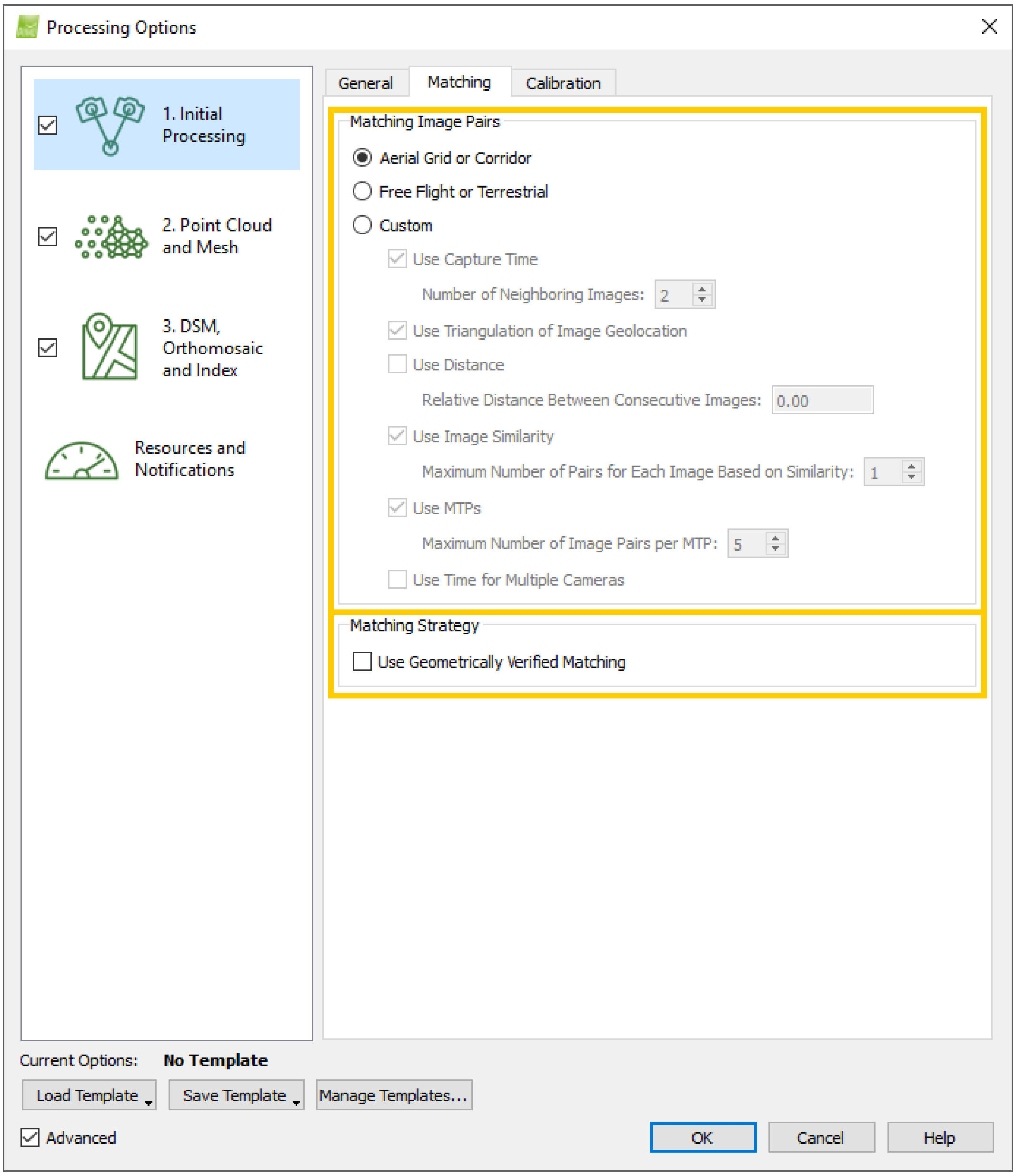
Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 1. Initial Processing. By default, only the *General* tab appears. On the bottom left, select the *Advanced* box to display the *Matching* tab.

1. Initial Processing | 2. Point Cloud and Mesh | 3. DSM, Orthomosaic and Index | Resources and Notifications

General | **Matching** | Calibration

Allows the user to change the processing options related to the keypoints matching for step *1. Initial Processing*. It contains 2 sections:

Matching Image Pairs: Allows the user to select which pairs of images are matched.
Matching Strategy: Allows the user to determine how the images are matched.



Matching Image Pairs

Allows the user to select which pairs of images are matched:

Aerial Grid or Corridor: Optimizes the pair matching for Aerial Grid or Corridor flight paths.
Free flight or Terrestrial: Optimizes the pair matching for Free-flight paths or Terrestrial images (for example, taking images around a house or a statue).
Custom (for advanced users): Specific pair matching parameters useful in specific projects. Suggested if one of the above options does not provide the desired results. It contains the different pair matching parameters:

> Important: Higher number of matches will increase the processing time and the quality of the results and may generate results in case of low quality datasets that failed with the default matching options.

Use Capture Time: Matches images considering the time on which they were taken.
Number of Neighboring Images: It allows the user to set how many images (before and after in time) are used for the pair matching.
Use Triangulation of Image Geolocation: Only available if the images have geolocation. It is only useful for aerial flights. The geolocation position of the images is triangulated. Each image is matched with images with which it is connected by a triangle.
Use Distance: Only available if the images have geolocation. It is useful for oblique or terrestrial projects. Each image is matched with images within a relative distance.
Relative Distance Between Consecutive Images: It allows the user to set the relative distance.

> Example: For *Relative Distance Between Consecutive Images* = 5 and average distance between consecutive images = 2 m: Pix4Dmapper will multiple the average distance by 5 (2*5 = 10 m). It will create a sphere with center the image and radius 10 m and will match this image with all other images included in the sphere.

Use Image Similarity: Uses the image content for pairs matching. Matches the *n* images with most similar content.
Maximum Number of Pairs for Each Image Based on Similarity: Maximum number of image pairs with similar image content to be matched.
Use MTPs: Images connected via a shared Manual Tie Point will be matched.
Maximum Number of Image Pairs per MTP: Maximum number of image pairs connected by a given MTP.
Use Time for Multiple Cameras: When having multiple flights without geolocation using the same flight plan over the same area, and having different camera models for each flight, it matches the images from one flight with the ones from the other flight using the time information.

Matching Strategy

Allows the user to determine how the images are matched:

Use Geometrically Verified Matching: Slower but more robust. If not selected, matches are established using only the image content. If selected, the relative camera positions are also taken into account to discard geometrically unrealistic matches. Useful when many similar features are present throughout the project: rows of plants in a farming field, window corners on a building's facade, etc.

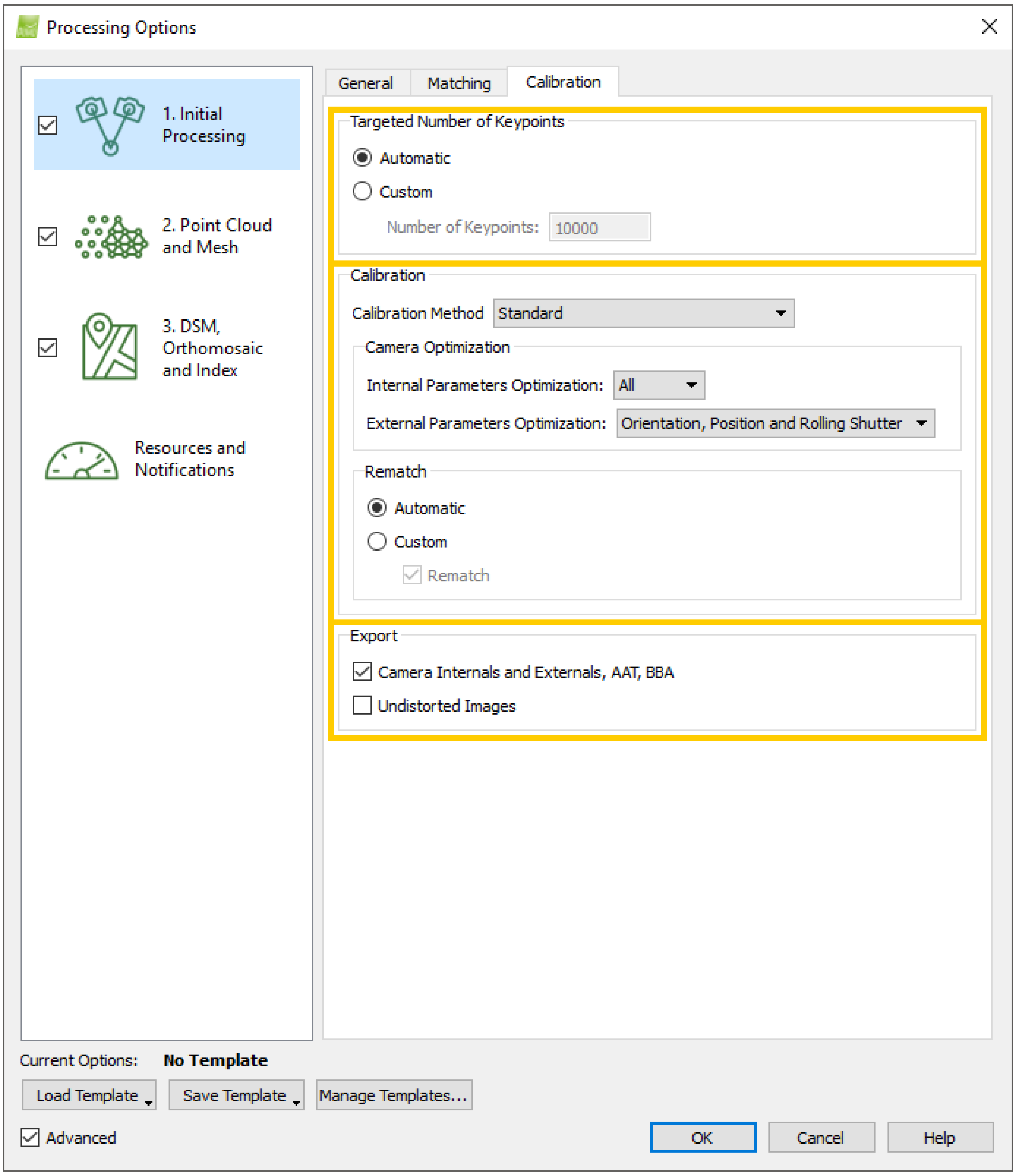
Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 1. Initial Processing. By default, only the *General* tab appears. On the bottom left, select Advanced to display other tabs.

1. Initial Processing | 2. Point Cloud and Mesh | 3. DSM, Orthomosaic and Index | Resources and Notifications

General | Matching | **Calibration**

Allows the user to change the processing options and desired outputs for step *1. Initial Processing*. It contains 4 sections:

Targeted Number of Keypoints: Allows the user to set up the number of keypoints that is extracted.
Calibration: Allows the user to select how the camera internal and external parameters are optimized.
Rematch: Allows the user to add more matches after the first part of the initial processing.
Export: Allows the user to select outputs.



Targeted Number of Keypoints

Allows the user to set up the number of keypoints to be extracted.

Automatic (Default): Automatic way to select which keypoints are extracted.
Custom: Allows the user to restrict the number of keypoints.
Number of Keypoints: Maximum number of keypoints to be extracted per image.

Calibration

Allows the user to select how the camera internal and external parameters are optimized.

The optimization step consists of running the Automatic Aerial Triangulation (AAT), Bundle Block Adjustment (BBA), and camera self-calibration steps multiple times, till an optimal reconstruction is achieved:

Calibration Method
Standard (default)
Alternative: Optimized for aerial nadir images with accurate geolocation and low texture content and for relatively flat terrain, for example, fields.
Accurate Geolocation and Orientation: Optimized for project with very accurate image geolocation and orientation. This calibration method requires all images to be geolocated and oriented.
Camera Optimization: This option defines which camera parameters are optimized.
Internal Parameters Optimization: Defines which internal camera parameters of the camera model are optimized.
All (default): Optimizes all the internal camera parameters. Small cameras such as those used with UAVs, are much more sensitive to temperature or vibrations, which affects the camera calibration. Therefore, it is recommended to select this option when processing images taken with such cameras.
None: Does not optimize any of the internal camera parameters. It is recommended when using large cameras that are already calibrated and when these calibration parameters are used for processing.
Leading: Optimizes the most important internal camera parameters. This option is useful to process certain cameras such as cameras with a slow rolling shutter speed.
Perspective lens camera models: The focal length and the first two radial distortion parameters.
Fisheye lens camera models: The polynomial coefficients.
All Prior: Forces the optimal internal parameters to be close to the initial values. This option is useful for the rare cases in which two different optimal focal length values are found.
External Parameters Optimization: The position and orientation of the cameras. Defines how the external camera parameters are optimized.
All (default): Optimizes the rotation and position of the camera as well as the linear rolling shutter in case the camera model follows the linear rolling shutter model.In this case the camera model should be defined accordingly: 202558159.
None: Does not optimize any of the external camera parameters. Only enabled when *Accurate Geolocation and Orientation* has been selected as *Calibration Method.* Only recommended when the camera orientation and position are known and very accurate.
Orientation: Optimizes only the orientation of the cameras. Only enabled when *Accurate Geolocation and Orientation* has been selected as *Calibration Method.* Only recommended when the camera position is known and very accurate but the orientation is not as accurate as the camera position.

> Note:
>
> The *Camera Optimization* processing options define which camera parameter are optimized. There are 2 types of camera parameters:
>
> Internal camera parameters: The parameters of the camera model.
> External camera parameters: The position and orientation of the cameras.
>
> The optimization procedure starts with some initial values in order to compute the optimized values. The following initial values are used:
>
> Internal camera parameters: The initial values are extracted from the camera model that has been chosen.
> External camera parameters: The initial values are extracted from the Automatic Aerial Triangulation (AAT) during Step *1. Initial Processing* or using the geolocation and IMU when *Accurate Geolocation and Orientation* has been selected as *Calibration Method.*
>
> After step *1. Initial Processing* has been done, the optimized values for the internal and external parameters are saved to file. For more information about the output files generated during step *1. Initial Processing*: 202558519.
>
> The initial and optimized values for the internal camera parameters are also displayed in the *Quality Report*.

Rematch

Allows the user to add more matches after the first part of the initial processing, which usually improves the quality of the reconstruction:

Automatic (Default): Enables rematching only for projects with less than 500 images.
Custom: Allows the user to select if rematch is done or not for the project.
Rematch: Enables the rematch option.

Export

Allows the user to select outputs:

Camera Internals and Externals, AAT, BBA: When this option is selected, the results of the AAT, BBA, and optimized internal and external camera parameters are exported.
Undistorted Images: When this option is selected, an undistorted copy of each original image is generated using the optimized distortion parameters of the selected camera model.

Important: This feature is only available when processing images using a perspective lens camera model.

If step *1. Initial Processing* has already been done, it is possible to generate undistorted images without running step 1 again. For more information: 202557929.

Information: For more information about the camera distortion: 202559069.

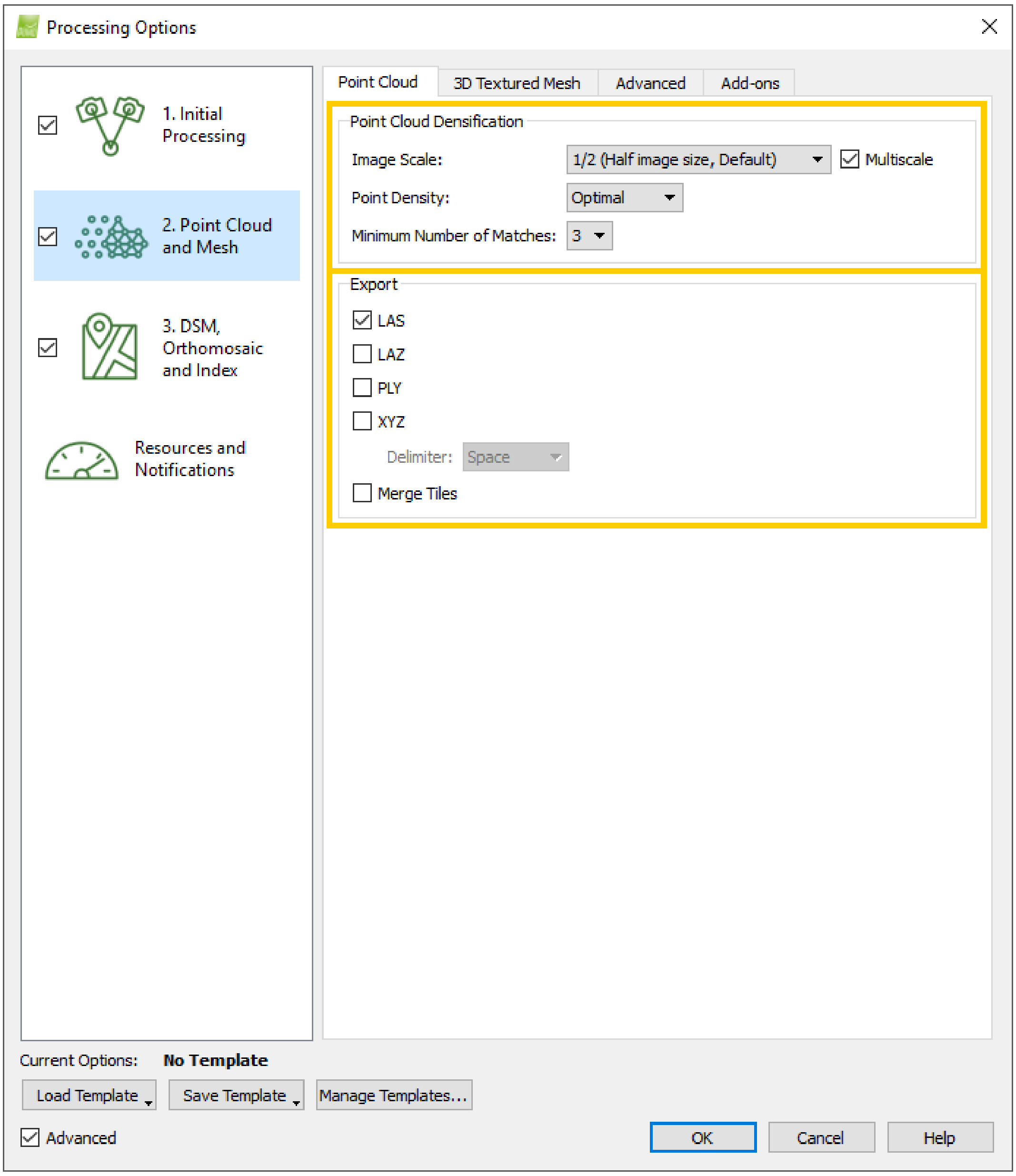
Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 2. Point Cloud and Mesh. By default, only the *Point Cloud* and the *3D Textured Mesh* tabs appear. On the bottom left, select the Advanced box to display other tabs.

1. Initial Processing | **2. Point Cloud and Mesh** | 3. DSM, Orthomosaic and Index | Resources and Notifications

Point Cloud | 3D Textured Mesh | Advanced | Add-ons

Allows the user to change the processing options and desired outputs for the Point Cloud that is generated during step 2. *Point Cloud and Mesh*. This step increases the density of 3D points of the 3D model computed in step *1. Initial Processing*, which leads to higher accuracy both for the DSM and the Orthomosaic. This tab contains 2 sections:

Point Cloud Densification: Allows the user to define parameters for the point cloud densification.
Export: Allows the user to select the desired output formats for the densified point cloud.



Point Cloud Densification

Allows the user to set parameters for the point cloud densification. It contains the following options:

Image Scale: The *image scale* defines the scale of the image at which additional 3D points are computed. From the drop-down list, it is possible to select:
1/2 (Half image size, Default): Half size images are used to compute additional 3D points. It is the recommended image scale.
1 (Original image size, Slow): The original image size is used to compute additional 3D points. More points are computed than with half image scale, especially in areas where features can be easily matched (e.g. cities, rocks, etc.). This option may require four times more RAM and processing time than when choosing the default value *1/2 (half image size)*, and usually it does not significantly improve the results.
1/4 (Quarter image size, Fast): Quarter size images are used to compute additional 3D points. Less points are computed than with the half image scale. However, more points are computed in areas with features that cannot easily be matched such as vegetation areas. This scale is recommended for projects with vegetation.
1/8 (Eighth image size, Tolerant): Eighth size images are used to compute additional 3D points. Less points are computed than with the half or quarter image scale. However, more points are computed in areas with features that cannot easily be matched such as vegetation areas. This scale is recommended for projects with vegetation.

> Multiscale (default): When this option is activated, additional 3D points are computed on multiple image scales, starting with the chosen scale from the *Image scale* drop down list and going to the *1/8* scale *(eighth image size, tolerant)*. For example, if *1/2 (half image size, default)* is selected, the additional 3D points are computed on images with half, quarter, and eighth image size. This is useful for computing additional 3D points in vegetation areas as well as keeping details in areas without vegetation.

> Note: The Image Scale has an impact on the number of 3D points generated. For more information: 203269885.

Point Density: This parameter defines the density of the densified point cloud. The point density can be chosen from the following options:
Optimal (Default): A 3D point is computed for every (4/ *Image Scale)* pixel. For example, if the *Image Scale* is set to *1/2 (half image size)*, one 3D point is computed every 4/(0.5) = 8 pixels of the original image. This is the recommended point cloud density.
High (Slow): A 3D point is computed for every *Image Scale* pixel. The result will be an oversampled Point cloud that requires up to 4 times more processing time and RAM than optimal density. Usually, this point cloud option does not significantly improve the results.
Low (Fast): A 3D point is computed for every (16/*Image Scale)* pixel . For example, if the *Image Scale* is set to *1/2 (half image size)*, one 3D point is computed every 16/(0.5) = 32 pixels of the original image. The final point cloud is computed up to 4 times faster and uses up to 4 times less RAM than optimal density.

> Note: The Point Density has an impact on the number of 3D points generated. For more information: 203269885.

Minimum Number of Matches: The minimum number of matches per 3D point represents the minimum number of valid re-projections of this 3D point to the images. The minimum number of matches per 3D point can be:
3 (default): Each 3D point has to be correctly re-projected in at least 3 images.
2: Each 3D point has to be correctly re-projected in at least 2 images. This option is recommended for projects with small overlap, but it produces a point cloud with more noise and artifacts.
4: Each 3D point has to be correctly re-projected in at least 4 images. This option reduces the noise and improves the quality of the point cloud, but it might compute less 3D points in the final point cloud.
5: Each 3D point has to be correctly re-projected in at least 5 images. This option reduces the noise and improves the quality of the point cloud, but it might compute less 3D points in the final point cloud. It is recommended for oblique imagery projects that have high overlap.
6: Each 3D point has to be correctly re-projected in at least 6 images. This option reduces the noise and improves the quality of the point cloud, but it might compute less 3D points in the final point cloud. It is recommended for oblique imagery projects that have very high overlap.

Export

Allows the user to select the desired output formats for the Point Cloud.

The following formats can be chosen:

> Note: It is possible to select more than one format in order to save the Point Cloud in multiple formats. When no output is selected, only a .p4b file is generated. It is always generated, but can only be opened in the rayCloud of the Pix4Dmapper.

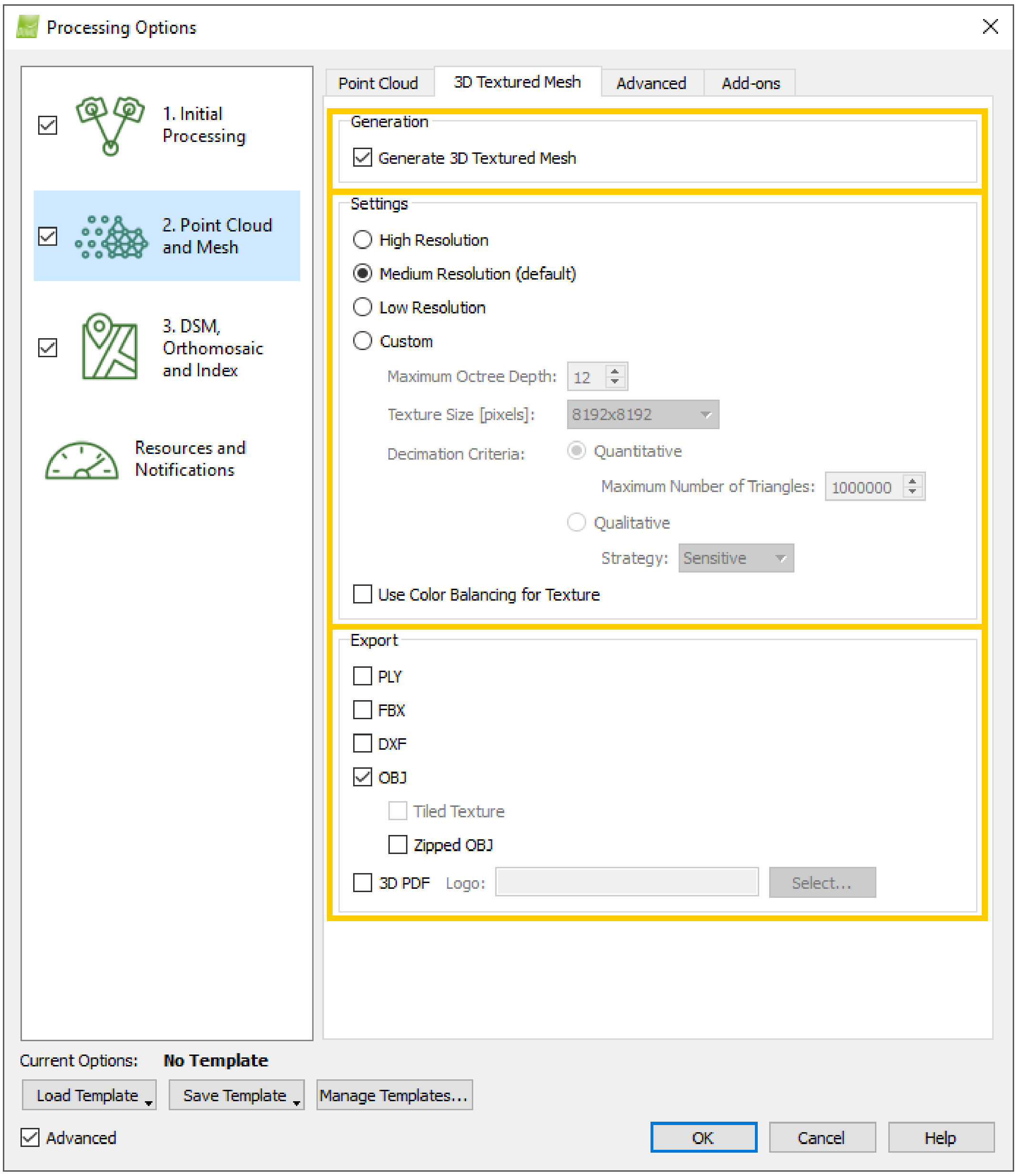
LAS (default): LiDAR LAS file with X,Y,Z position and color information for each point of the Point Cloud.
LAZ: Compressed LiDAR LAS file with X,Y,Z position and color information for each point of the Point Cloud.
PLY: PLY file with X,Y,Z position and color information for each point of the Point Cloud.
XYZ: ASCII text file with the X,Y,Z and color information for each point of the Point Cloud.
Delimiter: Defines the delimiter character of the file, used to separate the values. The drop down list has the following options:
Space
Tab
Comma
Semicolon
Merge Tiles: If several tiles have been generated, produces a single file with all the points.

For more information about the file formats and the software with which these files can be opened: 202558499.

Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 2. Point Cloud and Mesh. By default, only the *Point Cloud* and the *3D Textured Mesh* tabs appear. On the bottom left, select the Advanced box to display other tabs.

Allows the user to change the processing options and desired outputs for the 3D Textured Mesh of step 2. *Point Cloud and Mesh*. This tab contains 3 sections:

Generation: Allows the user to select the generation of the 3D Textured Mesh.
Settings: Allows the user to select parameters concerning the generation of the 3D Textured Mesh.
Export: Allows the user to select the desired output formats for the 3D Textured Mesh.



Generation

Generate 3D Textured Mesh: Allows the user to the select whether the 3D textured mesh should be generated.

Settings

Allows the user to select the resolution for the 3D Textured Mesh generation.

> Important:
> The Point Cloud is used to generate a surface composed of triangles. The distance between the mesh and the points of the Point Cloud is optimized to be minimal, but this means that points of the mesh do not necessarily correspond to points of the point cloud.
> Since the mesh is 3D, it is unfolded onto a 2D plane in order to define the resolution (pixel size). Then the 3D position of the pixel is reprojected into the original images to obtain the color. Blending is used instead of stitching to generate the texture of the 3D Textured Mesh.
> The 3D Textured Mesh will be generated using the Point Cloud. If a Processing Area and/or Image Annotations are defined, and if the corresponding options are selected in the *Point Cloud Filters* options, they will also be used for the generation of the 3D Textured Mesh.

The available parameters are:

High Resolution: High level of detail. Recommended to maximize the visual aspect of the 3D Textured Mesh. Computing time and size will increase significantly.
Medium Resolution (default): Default option. Recommended setting for most project. Strikes a good balance between size, computing time and level of detail for the 3D Textured Mesh.
Low Resolution: Lower level of detail leading to faster computing time and lower size. Good compromise for sharing the 3DTextured Mesh.
Custom: Allows the user to select the options for the 3D Textured Mesh generation:
Maximum Octree Depth: To create the 3D Textured Mesh, the project is iteratively subdivided into 8 subregions. These are organized in a tree structure, and this parameter indicates how many subdivisions should be created. Higher values mean that more regions will be created, hence each region will be small, leading to higher resolution and higher computing times.
Texture Size [pixels]: Parameter used to define the resolution of the texture of the 3D Textured Mesh, affecting the pixel size.
Decimation Criteria: After the first step in the mesh creation, too many triangles are created and this parameter indicates how the spurious triangles should be discarded.
Quantitative: Some triangles will be discarded till they reach the desired number:
Maximum Number of Triangles: Number of triangles in the final 3D Textured Mesh.
Qualitative: Some triangles will be discarded trying to maintain the original geometry.
Strategy: Indicates the strategy employed to discard the triangles:
Sensitive: The triangles selected have as priority to maintain the original geometry of the 3D Textured Mesh.
Aggressive: The triangles selected have as priority to maintain a lower number of triangles.
Use Color Balancing for Texture: The Color Balancing algorithm will be used for the generation of the texture of the 3D Texture Mesh. The Color Balancing algorithm ensures that the texture will be homogeneous.

> Note: For projects that are not very large, it may be that the resulting number of triangles is lower than the maximum set up in the options. The maximum will only be reached if the project is large and could create a model with more triangles.

> Important: The higher the parameters selected the longer the processing time. Using high definition parameters have more visual impact when zooming in and visualizing the model from close. This allows to better identify details in the model.

For step by step instructions about how to generate the 3D Textured Mesh: 202560669.

Export

Allows the user to select the desired output formats for the 3D Textured Mesh.

The following formats can be chosen:

> Note: It is possible to select more than one format in order to save the 3D Textured Mesh in multiple formats. When no output is selected, only a .p4b file is generated. It is always generated but can only be opened in the rayCloud of Pix4Dmapper.

PLY: PLY file with:
X,Y,Z position for each vertex of the 3D Textured Mesh
Texture information (using a .jpg texture file).
FBX: FBX file with:
X,Y,Z position for each vertex of the 3D Textured Mesh.
Texture information.
AutoCAD DXF: DXF file with:
X,Y,Z position for each vertex of the 3D Textured Mesh.
OBJ (default): OBJ file with:
X,Y,Z position for each vertex of the 3D Textured Mesh.
Texture information (using a .jpg and .mtl texture files).
Tiled Texture: Allows the user to tile the texture file to reduce the size of each individual file.
Zipped OBJ: ZIP file containing the OBJ, .jpg and .mtl files.
3D PDF: PDF file containing a 3D model of the 3D Textured Mesh. The texture size of the 3D Textured Mesh that is displayed in the 3D PDF is 2000*2000 pixels.
Logo: Selects a logo (.jpg or .tif) that will be displayed on the 3D pdf.

Important: The *3D Textured Mesh* file is not georeferenced. It has coordinates on a local coordinate system centered around the project.
To visualize the *3D Textured Mesh* with georeference: 204606535.

Warning:
For .ply and .obj format, the texture is generated in a .jpg file, which contains a 2D planar RGB image of the values for each pixel of the triangles that forms the 3D Textured Mesh.
In order to use the 3D Textured Mesh in other software, use both files, having them in the same folder and without renaming the texture .jpg file.
The .jpg texture file is associated to the .ply / .obj / .p4b generated while generating the attached .jpg file.
If new .ply / .obj / .p4b files are generated, they cannot use a .jpg file generated previously even if it is for the same project and same parameter values.
If having problems visualizing the 3D textured Mesh in the rayCloud or external software due to lack of hardware resources, it is possible to resize the .jpg file (reducing the same percentage for the width and hight) using any image editor. This requires less memory.

For step by step instructions about how to generate the 3D Textured Mesh: 202560669.

For more information about the file formats and the software with which these files can be opened: 202558499.

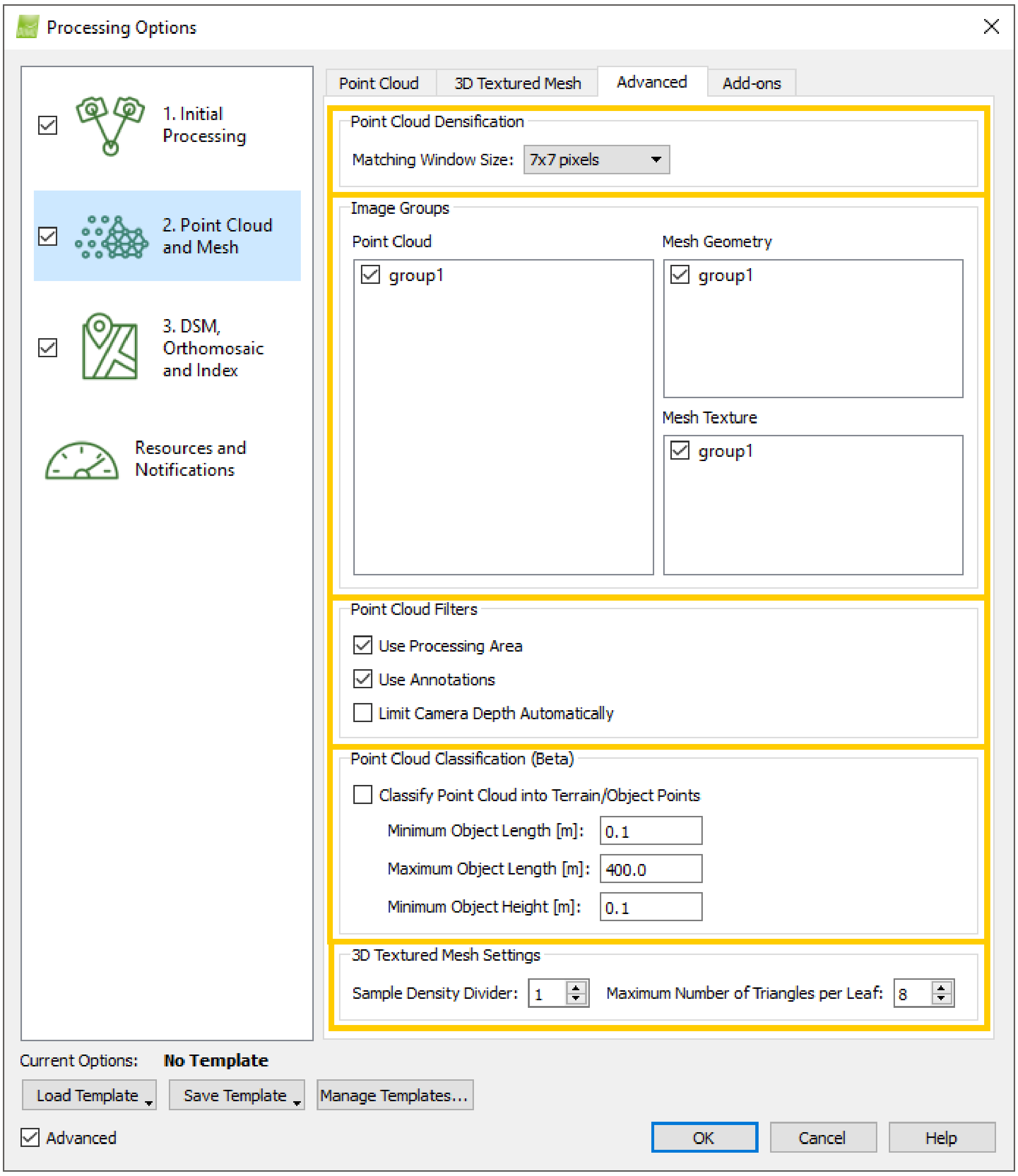
Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 2. Point Cloud and Mesh. By default, only the *Point Cloud* and the *3D Textured Mesh* tabs appear. On the bottom left, select the Advanced box to display other tabs.

1. Initial Processing | **2. Point Cloud and Mesh** | 3. DSM, Orthomosaic and Index | Resources and Notifications

Point Cloud | 3D Textured Mesh | **Advanced** | Add-ons

Allows the user to change the advanced processing options for the Point Cloud and the 3D Textured Mesh of step *2. Point Cloud and Mesh*. This tab contains 4 sections:

Point Cloud Densification: Allows the user to define parameters for the point cloud densification.
Image Groups: Allows the user to select which image groups are used for different outputs.
Point Cloud Filters: Allows the user to change options concerning the filtering of the point cloud.
Point Cloud Classification (beta): Allows the user to run the Terrain/Object Point Cloud Classification while processing the *2. Point Cloud and Mesh* and to set up the parameters used when computing the Point Cloud Classification. The Point Cloud Classification assigns each point to either the Terrain Point Group or the Object Point Group. The Terrain Point Group can be used to generate a DTM.
3D Textured Mesh Settings: Allows the user to change options concerning the mesh generation.



Point Cloud Densification

Allows the user to set parameters for the point cloud densification. It contains the following options:

Matching Windows Size: Size of the grid used to match the densified points in the original images.
7x7 pixels: Faster processing. Suggested when using aerial nadir images.
9x9 pixels: Finds a more accurate position for the densified points in the original images. Suggested when using oblique and / or terrestrial images.

Image Groups

Allows the user to define which image groups are used to generate each of three different outputs: the Point Cloud, the Mesh Geometry and the Mesh Texture. Useful for projects that consist of images of different band configuration.

> Example: For a project that consists of both RGB and NIR images, the point cloud can be generated based on both the RGB and the NIR images, the geometry of the Mesh can be computed using only the RGB images and the texture of the Mesh using only the NIR images.

This section consists of 3 fields:

Point Cloud: Image groups used for the Point Cloud generation.
Mesh Geometry: Image groups used for the computation of the geometry of the Mesh.
Mesh Texture: Image groups used for the texture of the Mesh.

Point Cloud Filters

Allows the user to select filters that will be taken into account for the Point Cloud and the 3D Textured Mesh generation. The following options are available:

Use Processing Area: If a Processing Area has been drawn, it will be used to filter the Point Cloud and the 3D Textured Mesh. For more information: 202558439.

Use Annotations: If Image Annotations have been created, they will be used to filter the Point Cloud and the 3D Textured Mesh. For more information and step by step instructions: 202560549.
Limit Camera Depth Automatically: Prevents the reconstruction of background objects. Useful for oblique/terrestrial projects around objects.

Point Cloud Classification (beta)

Allows the user to run the Terrain/Object Point Cloud Classification and to set up the parameters used when computing the Point Cloud Classification.

The Point Cloud Classification classifies each point into either the Terrain or Objects point group. It uses all the points of the Point Cloud but not the points assigned to the Deleted point group.

Terrain point group: It consists of points considered to be terrain points. It can be used to generate a DTM.
Objects point group: It consists of points considered to be object points.

> Note:
> During Point Cloud Classification a first process classifies the Point Cloud, generating a Terrain point group and an Objects point group.
> During a second step, the Point Cloud Classification uses the user defined geometric constraints (parameters) to validate if the points of the Objects point group can still be considered as belonging to an object, or if they should be moved to the Terrain point group.
> Once a Terrain point group exists, it is possible to generate a DTM (beta). For step by step instructions: 202560579.

> Important:
>
> At the end of the classification, points might not be classified correctly. Points might have been classified as belonging to the Objects point group whereas they belong to the Terrain point group and vice versa.
>
> It is possible to edit the computed Terrain / Objects classification and move points from one point group to another, delete them, move them into a new point group, etc. For step by step instructions about how to edit the Point Cloud: 202560499.

If the Classify Point Cloud into Terrain/Object Points box is selected, the Point Cloud Classification will be computed during step *2. Point Cloud and Mesh.*

The available parameters are:

Minimum Object Length [units]: Minimum expected length for the objects.
Maximum Object Length [units]: Maximum expected length for the objects.
Minimum Object Height [units]: Minimum expected height for the objects.

These parameters define geometric constraints that a group of points of the Objects point group should have in order to be verified as being an object.

> Example:
>
> *Minimum Object Length* = 0.1 [m]
> *Maximum Object Length* = 100 [m]
> *Minimum Object Height* = 0.1 [m]
>
> The Objects point group will contain only objects with length between 0.1 and 100 meters and higher than 0.1 meter.

For step by step instructions about how to compute the Point Cloud Classification and generate a DTM: 202560579.

3D Textured Mesh Settings

Advanced options influencing the generation of the 3D Textured Mesh:

Sample Density Divider: The value goes from 1 (default) to 5. Increasing this value will create more triangles in regions with a lower density of points. However, this might also create more unwanted triangles in noisy regions. To be used when there are holes in the mesh and the model is not too noisy.
Maximum Number of Triangles per Leaf: Value between 8 and 128. Higher values will lead to less detailed results (and faster computing times) since regions will be subdivided less often.

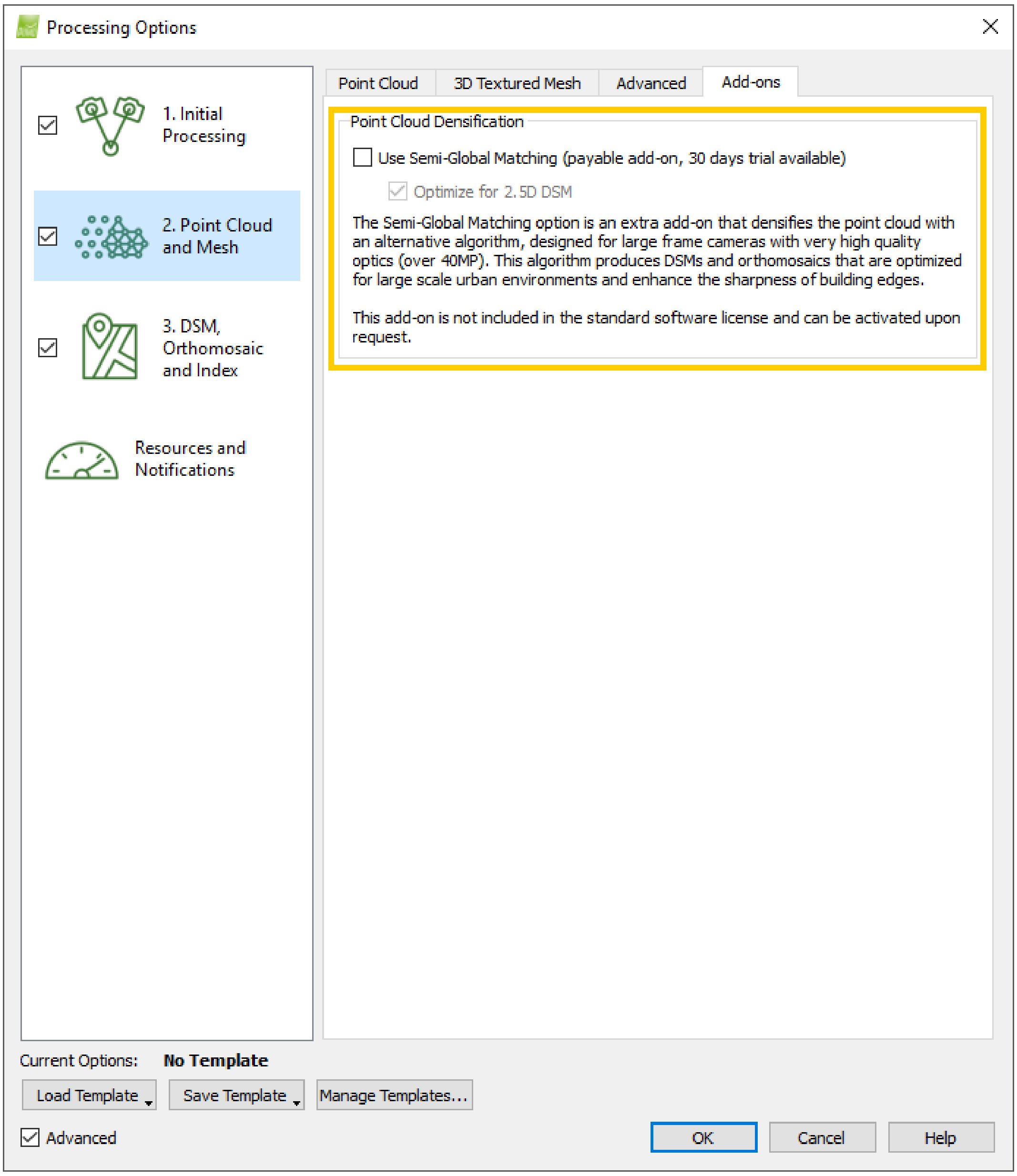
Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 2. Point Cloud and Mesh. By default, only the *Point Cloud* and the *3D Textured Mesh* tabs appear. On the bottom left, select the Advanced box to display other tabs.

1. Initial Processing | **2. Point Cloud and Mesh** | 3. DSM, Orthomosaic and Index | Resources and Notifications

Point Cloud | 3D Textured Mesh | Advanced | **Add-ons**

Allows the user to select an add-on for the Point Cloud Densification. This tab contains 1 section:

Point Cloud Densification: Allows the user to select an add-on for the Point Cloud Densification.



Point Cloud Densification

Allows the user to select an add-on for the point cloud densification. It contains the following options:

Use Semi-Global Matching (payable add-on): This option uses the Semi-Global Matching algorithm for the point cloud densification. It is a payable add-on feature. It may give better results for projects with low / uniform texture images (roads, walls, roofs). Another possible use is when the expected output is a good Orthomosaic of an urban area. In this last case, the *Optimize for 2.5D DSM* option (see below) should be selected. The Semi-Global Matching is optimized for large frames images (larger than 40MP).

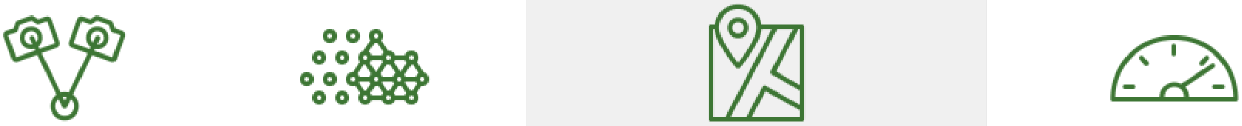
> Important:
> The *Use Semi-Global Matching (payable add-on)* option DOES NOT allow the user to generate the 3D Textured Mesh.
> The *Use Semi-Global Matching (payable add-on)* option is grayed out when a *Fisheye Lens* camera has been used. For more information: 202558159.

Optimize for 2.5D DSM: It generates a 2.5D Point Cloud instead of a full 3D Point Cloud. It should be used when the expected output is a good Orthomosaic.
Overlap Scenario: Only visible for projects with images larger than 40MP. Allows to select the *forward overlap* (frontal overlap) and the *sideward overlap* (side overlap) of the project, to optimize the *Semi-Global Matching* algorithm to the selected overlap.

> Important:
> When the *Optimize for 2.5D DSM* option is selected a 2.5D Point Cloud is generated.
> The *Optimize for 2.5D DSM* option is not recommended for oblique projects because the result will be a 2.5D Point Cloud.

> Note: The *Semi-Global Matching* option will use the selected options of the *Point Cloud Densification* section (*Image Scale, Point Density, Minimum Number of Matches*). The *Multiscale* option is always used when *Semi-Global Matching* has been selected.

Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 3. DSM, Orthomosaic and Index.

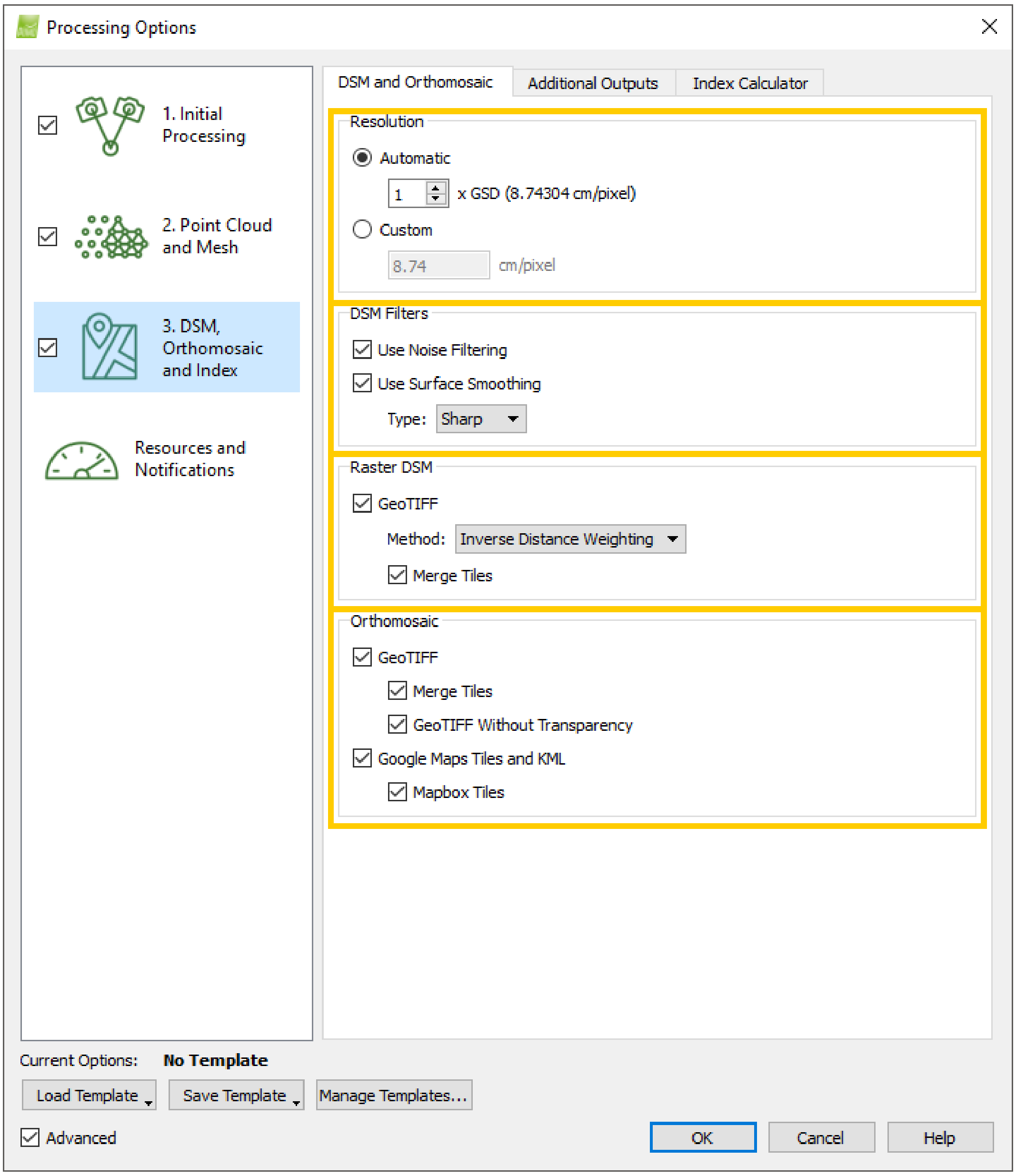


1. Initial Processing | 2. Point Cloud and Mesh | **3. DSM, Orthomosaic and Index** | Resources and Notifications

DSM and Orthomosaic | Additional Outputs | Index Calculator

Allows the user to change the processing options and desired outputs for DSM and Orthomosaic generation of step *3. DSM, Orthomosaic and Index*. It contains 4 sections:

Resolution: Allows the user to define the spatial resolution used to generate the DSM and Orthomosaic.
DSM Filters: Allows the user to define parameters to filter and smooth the points of the Point Cloud used to obtain the DSM.
Raster DSM: Allows the user to select the output file format and options for the raster DSM.
Orthomosaic: Allows the user to select the output file format for the Orthomosaic as well as different options related to the Orthomosaic generation.



Resolution

Allows the user to define the spatial resolution used to generate the DSM and Orthomosaic.

Automatic (default): By default one GSD is selected. One can also easily change the resolution to multiples of the GSD.
Custom: Allows to select any value for the resolution of the Raster DSM and the Orthomosaic generation.

DSM Filters

Allows the user to define parameters to filter and smooth the points of the Point Cloud used to obtain the DSM.

Important: The filtering and smoothing will not have any impact in the Point Cloud.

The following options are available:

Use Noise Filtering: The generation of the Point Cloud can lead to noisy and erroneous points. The noise filtering corrects the altitude of these points with the median altitude of the neighboring points.
Use Surface Smoothing: Once the noise filter has been applied, a surface is generated using the points. This surface can contain areas with erroneous small bumps. The surface smoothing corrects these areas by flattening them. This section allows the user to set the following parameter:
Type: Three smoothing types can be selected:
Sharp (default): Tries to preserve the orientation of the surface and to keep sharp features such as corners and edges of buildings. Only quasi-planar areas are flattened.
Smooth: Tries to smooth areas, assuming that sharp features exist because of noise and that they should be removed. Areas that are not very planar are smoothed and become planar.
Medium: This is a compromise between the two other options. It tries to preserve sharp features while flattening roughly planar areas.

Raster DSM

Allows the user to select whether the raster DSM is generated and to select the method with which the DSM will be generated:

GeoTIFF (activated by default): Saves the DSM as a GeoTIFF file. For most projects the DSM is split into several tiles and one GeoTIFF file is generated per tile.
Method: The method that is used for the Raster DSM generation. The method will affect the processing time and the quality of the results.
Inverse Distance Weighting: The inverse distance weighting algorithm is used to interpolate between points. This method is recommended for buildings.
Triangulation: The triangulation algorithm based on Delauney triangulation is used. This method is recommended for flat areas (agriculture fields) and stockpiles.

Important: The triangulation method can be up to 10 times faster than the Inverse Distance Weight Method, but the results may be worse especially for buildings.

Merge Tiles (activated by default): Generates a single DSM GeoTIFF file by merging the individual tiles. When this option is not selected, the merged DSM file is not generated.

Orthomosaic

Allows the user to select the output file format for the Orthomosaic as well as different parameters related to the Orthomosaic generation:

GeoTIFF (activated by default): Saves the Orthomosaic into a GeoTIFF file. For most projects, the Orthomosaic is split into several tiles and one GeoTIFF file is generated per tile.
Merge Tiles (activated by default): Generates a single Orthomosaic GeoTIFF file by merging the individual tiles. When this option is deactivated, the merged Orthomosaic file is not generated.
GeoTIFF Without Transparency: Generates a GeoTIFF file without transparency. For more information: 202558809.

Information: For more information about the Orthomosaic algorithms: 202559429.

Google Maps Tiles and KML: This option allows the user to generate the Google Maps and Google Earth files for the Orthomosaic.
Mapbox Tiles: This option allows the user to generate the Mapbox Tiles for the Orthomosaic.

If step *3. DSM, Orthomosaic and Index* has already been processed, it is possible to generate the Google Maps, KML and Mapbox Tiles without running step 3 again. For more information: 202558149.

Important:
When having images grouped in more than one group, the *Google Maps Tiles* and *KML* and the *Mapbox Tiles* will only be generated if one of the groups is named *RGB* (capital letters). For more information about the image groups: 202557949.
The *Google Maps Tiles* and *KML and the Mapbox Tiles* are only generated for 3 band images with 8 bit per band.

Important: When having images grouped in more than one group, one Orthomosaic per group is generated. For more information about image groups: 202557949.

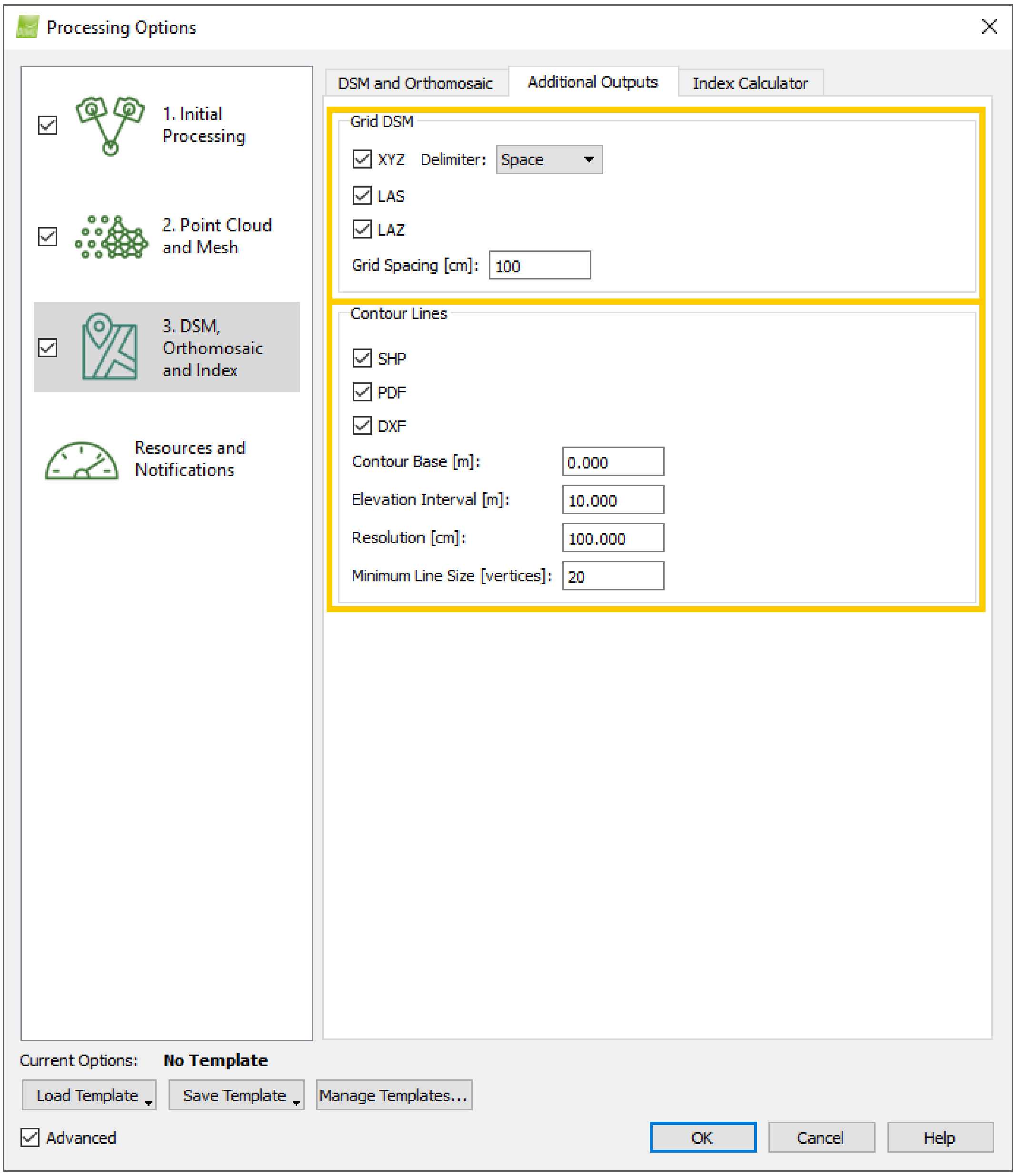
Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 3. DSM, Orthomosaic and Index.

1. Initial Processing | 2. Point Cloud and Mesh | **3. DSM, Orthomosaic and Index** | Resources and Notifications

DSM and Orthomosaic | **Additional Outputs** | Index Calculator

Allows the user to change the selected processing options and output files for the additional outputs to be generated during step *3. DSM, Orthomosaic and Index*. It contains 2 sections:

Grid DSM: Allows the user to select the output file format for the Grid DSM.
Contour Lines: Allows the user to generate the contour lLines using the Raster DSM and to select the processing options for the contour lines.



Grid DSM

Allows the user to select the desired file format for the DSM:

XYZ: ASCII text file with the X,Y,Z position and color information for each point of the Point Cloud.
Delimiter: It defines the delimiter character of the file, used to separate the values. The drop down list has the following options:
Space
Tab
Comma
Semicolon
LAS: LiDAR LAS file with X,Y,Z position and color information for each point of the Point Cloud.
LAZ: Compressed LiDAR LAS file with X,Y,Z position and color information for each point of the Point Cloud.
Grid Spacing [cm]: The spacing defines the distance between two 3D points in the DSM and is given in centimeters. For example: a grid spacing of 100 centimeters will generate one 3D point every 100 centimeters. The default value is 100 centimeters. One DSM with the selected spacing is generated in addition to a DSM generated using the resolution selected in the *DSM and Orthomosaic* tab.

For more information about the file formats and the software with which these files can be opened: 202558499.

Note: It is possible to select more than one format in order to save the Grid DSM in more than one format.

Note: The Grid DSM is restricted to 256 million points. If the chosen grid spacing or resolution generates more than 256 million points, then the grid sampling or resolution distance is doubled until the number of generated points does not exceed 256 million.

Contour Lines

Allows the user to generate contour lines using the Raster DSM. For more information about the concept of contour lines: 202559879.

Important: The option to generate the contour lines is grayed out if the option to merge the tiles of Raster DSM is disabled. For more information about the options of the Raster DSM: 202557769.

SHP: When this option is selected, the contour lines file is generated in .shp format.
PDF: When this option is selected, the contour lines are saved in a .pdf format.
DXF: When this option is selected, the contour lines file is generated in .dxf format.
Contour Base [units]: It defines the relative altitude which is used as a contour line base. It can be in meters or in feet according to the coordinate system used.

Example: For a project with minimum altitude 315 meters, *Contour Base* = 30 meters means that the first contour line (the base) will be at 345 meters (315+30).

Elevation Interval [units]: It defines the contour lines elevation interval. It can be in meters or in feet according to the coordinate system used. It can be any positive value.

Warning: The *Elevation Interval* must be smaller than (Maximum - Minimum) altitude of the DSM. For more information about the DSM altitudes: 202557619.

Example: For a project with Minimum altitude 400 meters and Maximum altitude 650 meters and *Contour Base* = 0 meters, *Elevation Interval* = 50 meters means that that contour lines will be generated at 400, 450, 500, 550, 600, and 650 meters.

Note: The smaller the *Interval* value, the larger the size of the contour lines file and the more processing time will be needed for its generation.

Resolution [units]: It defines the horizontal distance for which an altitude value is registered. The higher the *Resolution* value, the smoother the contour lines.

Example: If the *Resolution* is set to 100 cm, an altitude value will be registered every 100 cm (horizontally).

Minimum Line Size [points]: It defines the minimum number of vertices that a contour line can have. Lines with less vertices will be deleted and less noise will be produced.

Example: If the *Minimum Line Size* [points] is set to 20, all contour lines that have less than 20 vertices will be deleted.

Note:
It is possible to select more than one format in order to save the contour lines in multiple formats.
If the step *3. DSM, Orthomosaic and Index* has already been processed, it is possible to generate the *Contour Lines* without running step 3 again. For more information: 202558469.
For step by step instructions about how to generate contour lines: 202560639.

Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click 3. DSM, Orthomosaic and Index.

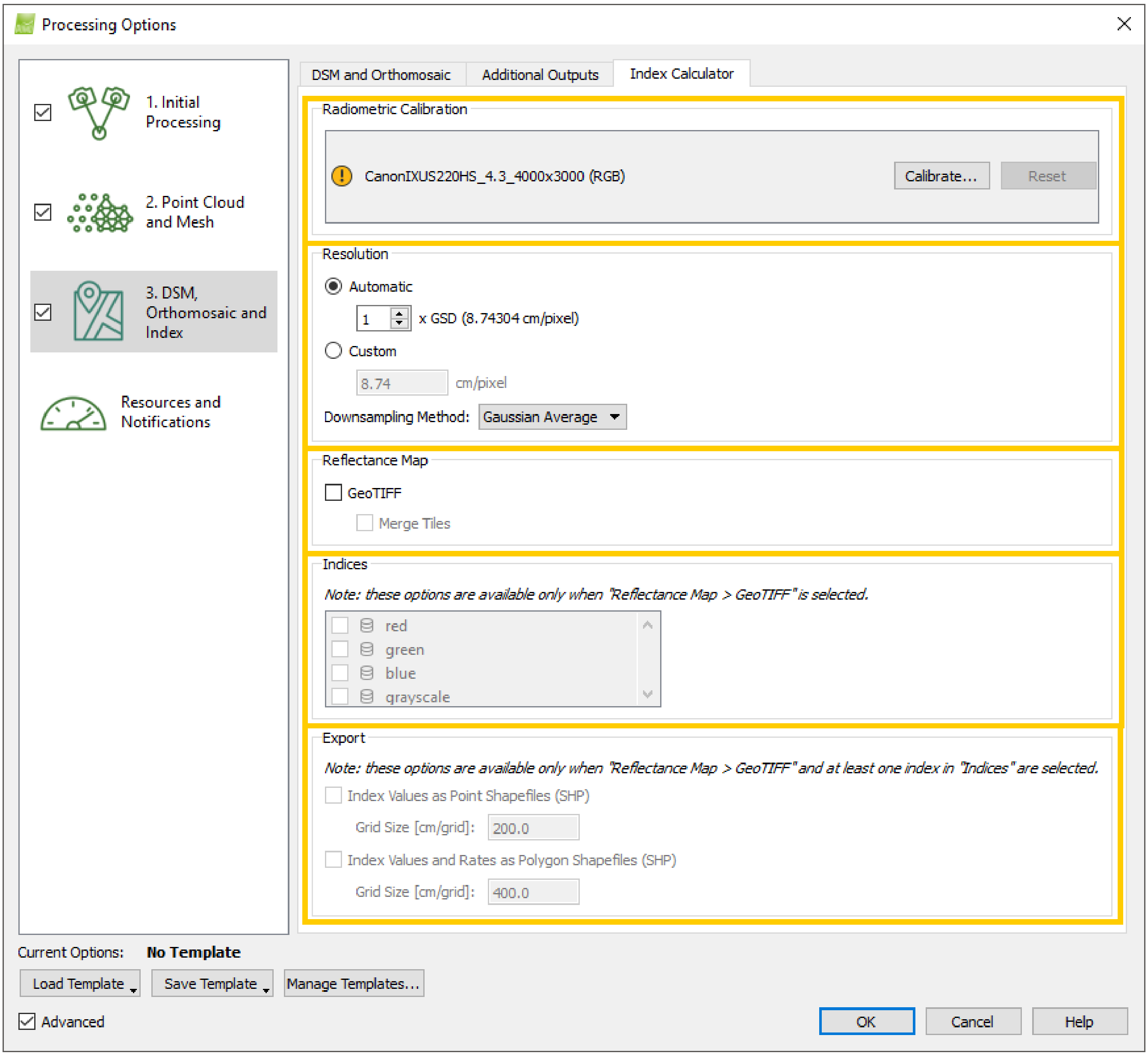
1. Initial Processing	2. Point Cloud and Mesh	**3. DSM, Orthomosaic and Index**	Resources and Notifications

DSM and Orthomosaic	Additional Outputs	**Index Calculator**

Allows the user to change the processing options and outputs related to the Index Calculator. These are processed during step *3. DSM, Orthomosaic and Index.*

These settings come in 4 sections:

Radiometric Calibration: Allows the users to calibrate and correct the image reflectance, taking the illumination and sensor influence into consideration.
Resolution: Allows the user to set the resolution as well as the downsampling method (if needed).
Reflectance Map: Allows the user to decide if the Reflectance Map(s) will be generated while processing step *3. DSM, Orthomosaic and Index,* and if the Tiles will be merged.
Indices: Shows the list of indices either from the database or created by the user. Allows the user to select which indices are generated while processing step *3. DSM, Orthomosaic and Index.* For the selected indices, the Index Map is saved as a GeoTIFF, the Index Map Grid as a .shp file, the Classes as a .shp file and the Classes with color representation as a .jpg file.
Export: Allows the user to select some desired outputs.

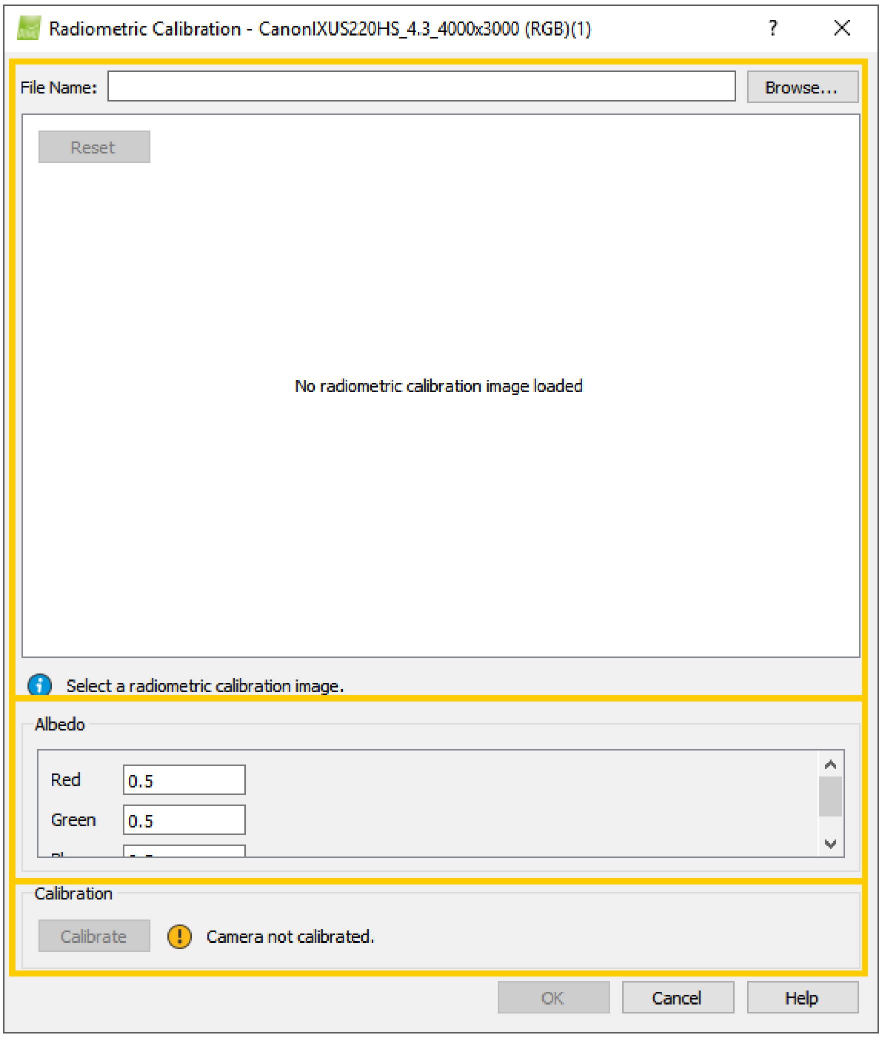


Radiometric Calibration

Allows the users to calibrate and correct the image reflectance, taking the illumination and sensor influence into consideration.

The camera used is displayed. Users can calibrate the sensor to perform an illumination adjustment in order to obtain more accurate reflectance values. If there are more than one camera models in the project, all the cameras will be listed in the Radiometric Calibration section.

After clicking Calibrate for a camera model, the *Radiometric Calibration* pop-up appears:



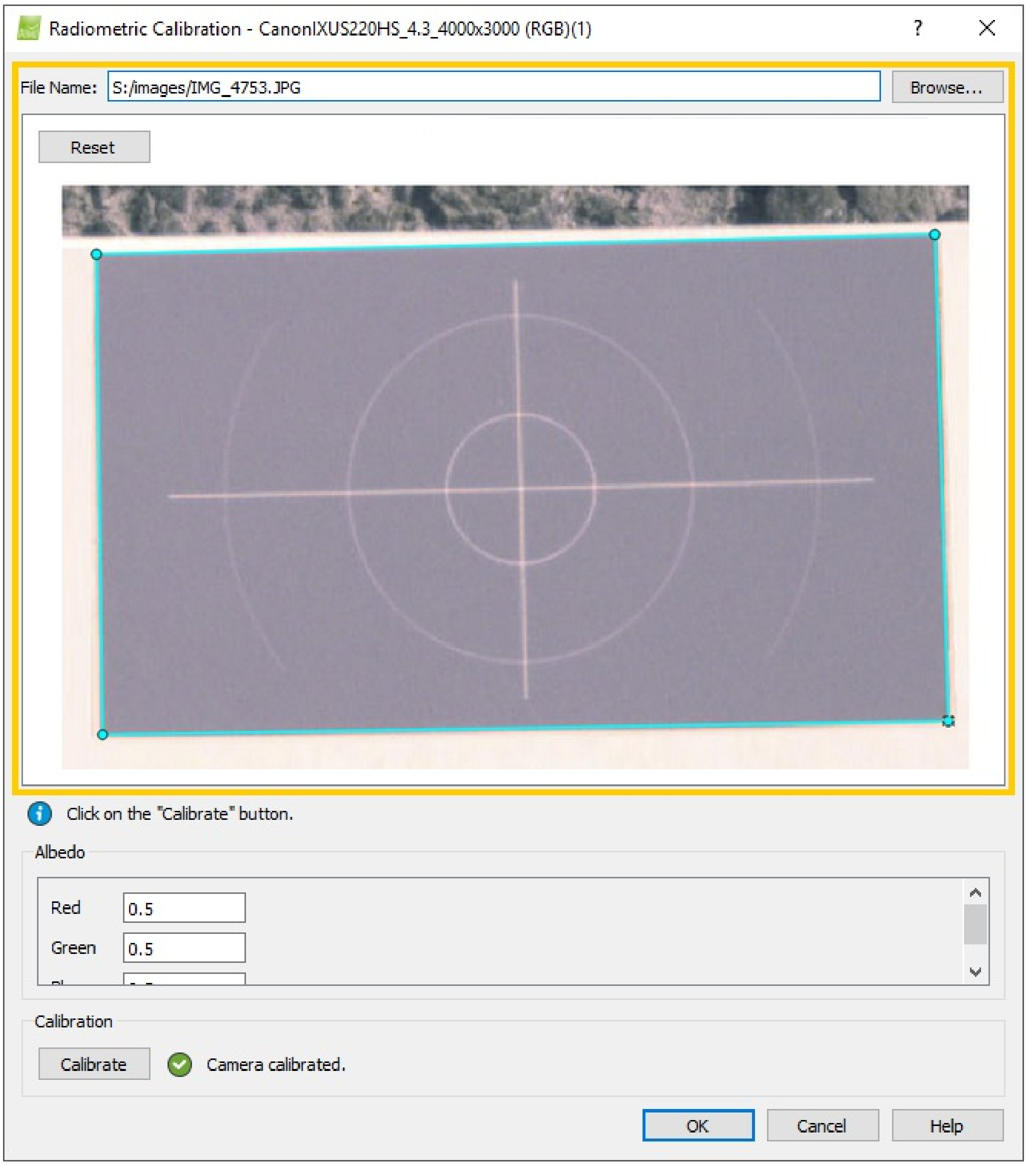
The *Radiometric Calibration* pop-up has the 3 sections:

Image: The image section allows the user to browse the image that will be used for the radiometric calibration.
Albedo: The Albedo section allows the user to set the albedo values for the calibration target.
Calibration: The calibration section allows the user to perform the radiometric calibration based on the selected calibration target and the Albedo values selected.

Image

In *File Name*, the Browse button, opens the *Select a radiometric calibration image* pop-up. This pop-up allows the user to select the image in which the radiometric calibration target appears.

When an image is browsed, the user can draw a region on the image that will define the radiometric calibration. The Reset button, resets the area drawn by the user.

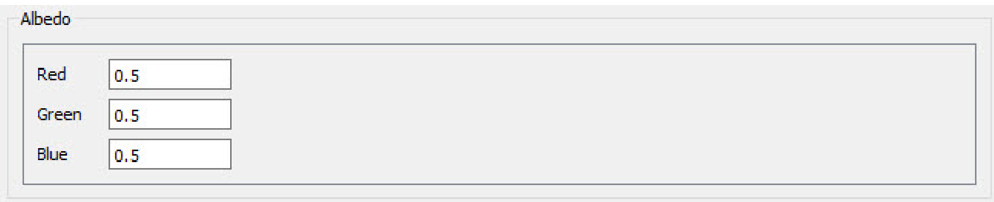


Albedo

In the Albedo section the detected bands of the camera model appear. This section allows the user to type the albedo values for the calibration target for the bands of the camera model selected.

> Important: The albedo values can be between 0.0 and 1.0.

For more information about the radiometric calibration target: 206494883.



Calibration

In the Calibration section, there is an action button:

Calibrate: When a region is drawn and the albedo values are correctly set, the Calibrate button is enabled. It performs the radiometric calibration.

and the action buttons:

OK: Confirms the radiometric calibration.
Cancel: Does not save the radiometric calibration.
Help: Opens the Pix4Dmapper help.

Resolution

Allows the user to set the resolution for the reflectance map. If a resolution lower than 1 GSD is chosen, the downsampling method can be chosen among the following options. Note that the window size will depend on the downsampling rate:

Gaussian Average: Apply a Gaussian filter to the image.
Average: The pixel takes the average value of the window around it.
Median: The pixel takes the median value of the window around it.
75% Quantile: The pixel takes the value of the 75% quantile of the window around it.
Minimum pixel: The pixel takes the minimal pixel value of the window around it.
Maximum pixel: The pixel takes the maximal pixel value of the window around it.
Warp: The pixels are downsampled using a cubic spline interpolation method.

Reflectance Map

Allows users to generate and save the Reflectance Map in GeoTIFF format.

GeoTIFF: The Reflectance Map is generated and saved in GeoTIFF format during the step 3. *DSM, Orthomosaic and Index*.
Merge Tiles: For most projects, the Reflectance Map is split into tiles where every tile is in GeoTIFF format. This option generates a single Reflectance Map file by merging all the individual tiles.

When this box is deselected, the merged Reflectance Map file is not generated, and users will only find smaller tiles in the result folder.

Indices

Allows the user to select which indices are generated while processing step *3. DSM, Orthomosaic and Index* (If in the section *Reflectance Map, Geotiff* is selected), and generates the Index Map Grid and the Classes for the selected indices. The resolution of the Index Map generated is the same as the Reflectance Map.

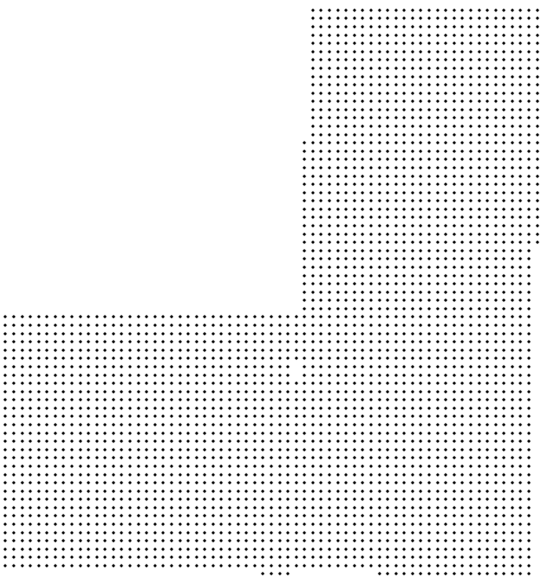
Indices Box: All indices are displayed in the gray box with icons:
: The index exists in the Pix4Dmapper index database. For more information about the Pix4Dmapper Index Database List: 202558379.
: The index was created / edited by the user in another project (on the same computer) that was closed and saved. :202560489.
: The index was created / edited by the user in this project: 202560489.

Export

Allows the user to select some desired outputs:

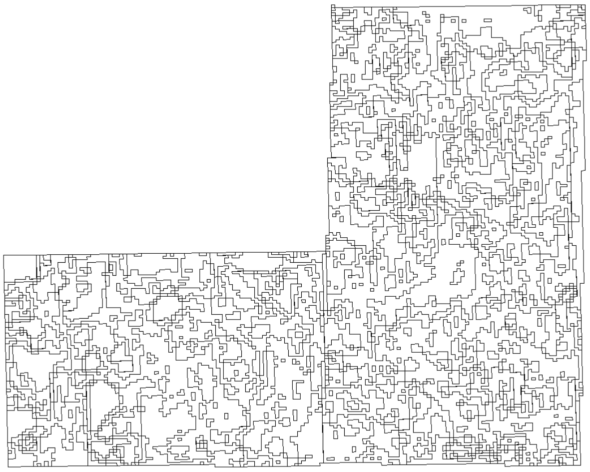
Index Values as Point Shapefiles (.shp): This map is generated while generating the Index Map. The Index Map Grid is generated by placing a grid in the Index Map. If a grid point lays on exactly 1 pixel, it takes the value of the pixel of the Index Map. If a point lays on several pixels, its value is interpolated with the values of the neighboring cells of the Index Map.
Grid Size [unit/grid]: Defines the grid size. The default value is 200 cm/grid.

Note: The maximum value that can be entered is 10000.



Index Values and Rates as Polygon Shapefiles (.shp): Allows the user to export the index vales and rate regions as a .shp file.
Grid Size [unit/grid]: Defines the grid size. The default value is 400 cm/grid.

Note: The maximal value that can be entered is 10000.



Access: On the Menu bar, click Process > Processing Options..., the *Processing Options* pop-up appears. Click Resources and Notifications.

1. Initial Processing | 2. Point Cloud and Mesh | 3. DSM, Orthomosaic and Index | **Resources and Notifications**

Resources and Notifications

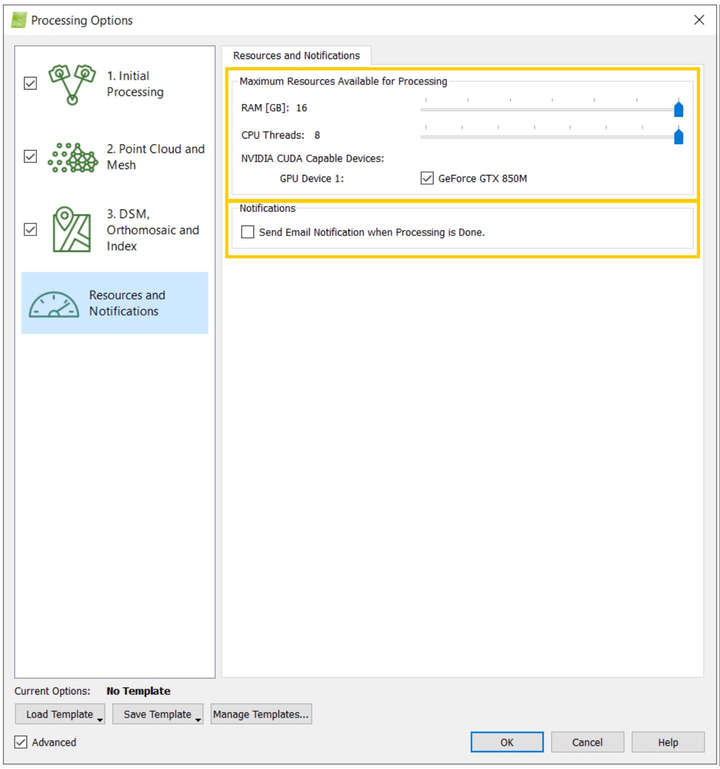
Allows the user to select the usage of the hardware resources and to select a notification for when processing is done. This can be useful when running multiple projects on the same computer or when the computer is needed for tasks other than processing:

This tab contains two sections:

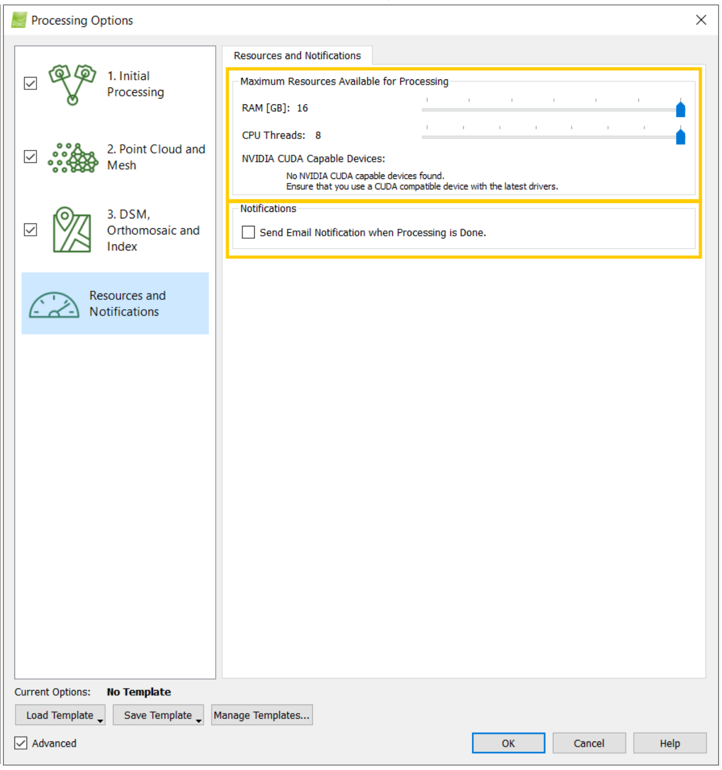
Maximum Resources Available for Processing: Allows to throttle the resources dedicated to the software
Notifications: Allows to trigger a notification when processing is completed.

Maximum Resources Available for Processing

RAM [GB]: By default all the available RAM memory is used. It is possible to reduce the amount of RAM assigned to the processing of the project by moving the slider to a lower value.
CPU Threads: By default all the CPU threads are used. It is possible to reduce the amount of CPU threads assigned to the processing of the project by moving the slider to a lower value.
NVIDIA CUDA Capable Devices:
ONLY when using NVIDIA Graphic card(s) compatible with CUDA, it is possible to activate / deactivate the use of the Graphic card(s) by selecting/deselecting the box.
When using Cuda processing, the processing speed is increased and the impact is more significant for large projects.
Under *NVIDIA CUDA capable devices list,* the list of GPUs appears . The cards that have at least 2 GB RAM are selected by default.



NVIDIA CUDA Capable Devices available.



NVIDIA CUDA Capable Devices not available.

Tip: When processing several projects of a given size at the same time, the first project starting step *2. Point Cloud and Mesh* will use as much RAM as possible. When another project starts processing step *2. Point Cloud and Mesh* as well, less RAM will be available and processing might be slower.

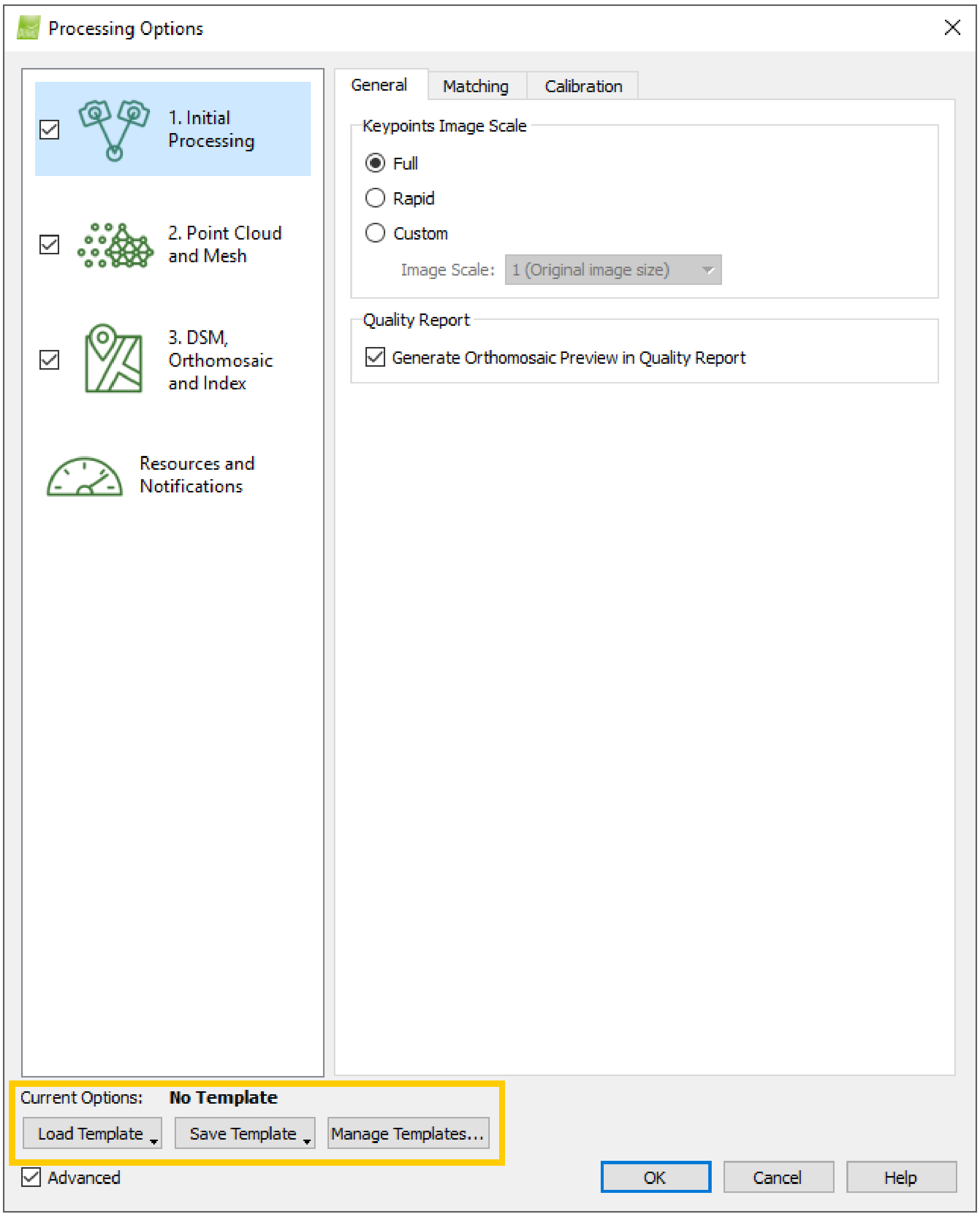
Therefore, reducing the amount of RAM to be used so that the resources are shared between the projects running at the same time helps to reduce the overall processing time.

For example on a 64GB RAM computer, when running 2 projects, set the amount of RAM to 32GB for each project.

Notifications

If the notification box is selected, an email notification will be sent to the email address used to log in Pix4Dmapper when processing is done.

Access: On the Menu bar, click Process > Processing Options..., a pop-up appears.



The *Templates* section allows to:

Load (select) a template.
Save a custom template.
Visualize the description of a template (*Manage Templates*).
Edit the name and description of a custom template (*Manage Templates*).
Delete a custom template (*Manage Templates*).
Import templates from the support site (*Manage Templates*).

It contains:

Current Options: Displays the selected *Processing Options Template.*
Load Template: Allows to select a *Processing Options Template.*

Note:

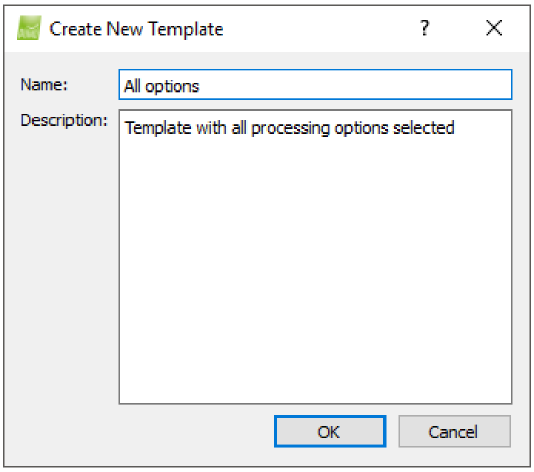
Refers to *Processing Options Templates* existing by default.

Refers to *Processing Options Templates* created by the user.

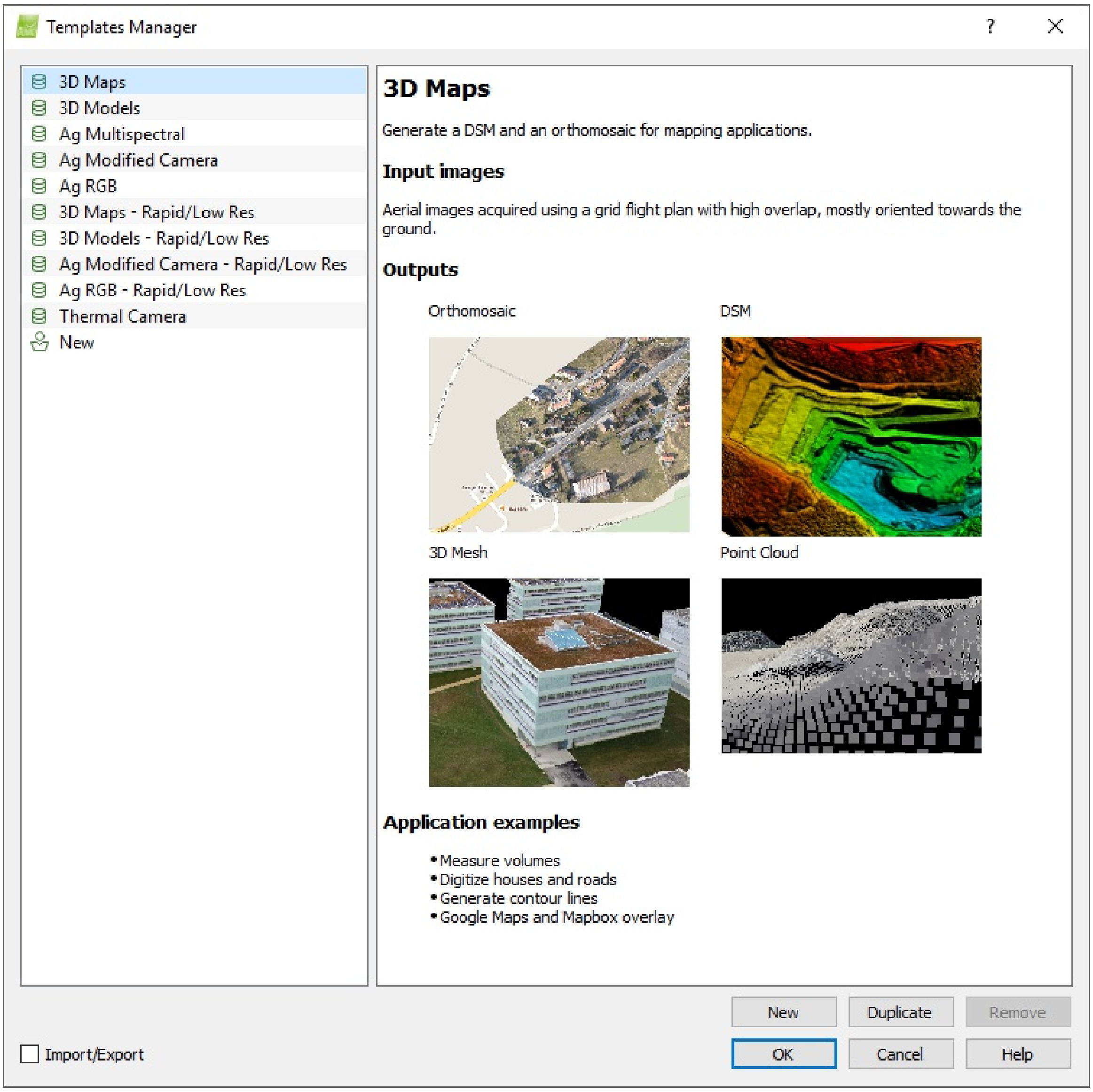
Refers to Processing Options Templates (existing by default or created by the user) that have been edited but are not saved.

Save Template: Displays 2 options:

Update "Template" with Current Options: Available when a *Processing Options Template* created by the user is selected and some options have changed, allows to overwrite the *Processing Options Template* with the new selected options.
Create New Template with Current Options: Allows to save the selected processing options as new *Processing Options Template.* Opens the *Create New Template* pop-up which allows to enter a *Name* and a *Description* for the new template:



Manage Templates...: Opens the *Templates Manager* pop-up:



It contains 2 sections:

List of existing *Processing Options Templates*:

Note:

- Refers to *Processing Options Templates* existing by default.
- Refers to *Processing Options Templates* created by the user.
- Refers to Processing Options Templates (existing by default or created by the user) that have been edited but are not saved.

Description of the selected *Processing Options Template:*

And the buttons:

New: Creates a new *Processing Options Template* with the selected processing options.
Duplicate: Duplicates an existing *Processing Options Template* with another name.
Remove: Deletes a *Processing Options Template.*
Import/Export check box: Displays the buttons:
Import...: Allows to import a template (.tmpl files created with Pix4Dmapper).
Export: Allows to export a template as .tmpl.
Folder...: Opens the folder where the user *Processing Options Template* are saved.

Note: More processing options templates (.tmpl) available here.

OK: Confirms the changes.
Cancel: Does not save the changes.
Help: Opens the Pix4Dmapper help.

Note: For more information about the *Processing Options Templates*, their outputs and their selected processing options: 205319155.

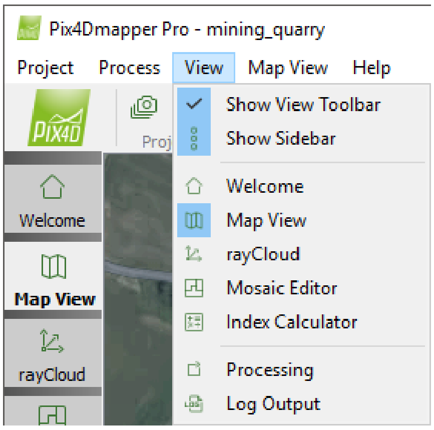
Access: On the Menu bar, click View.

There are 2 items that can be selected / unselected:

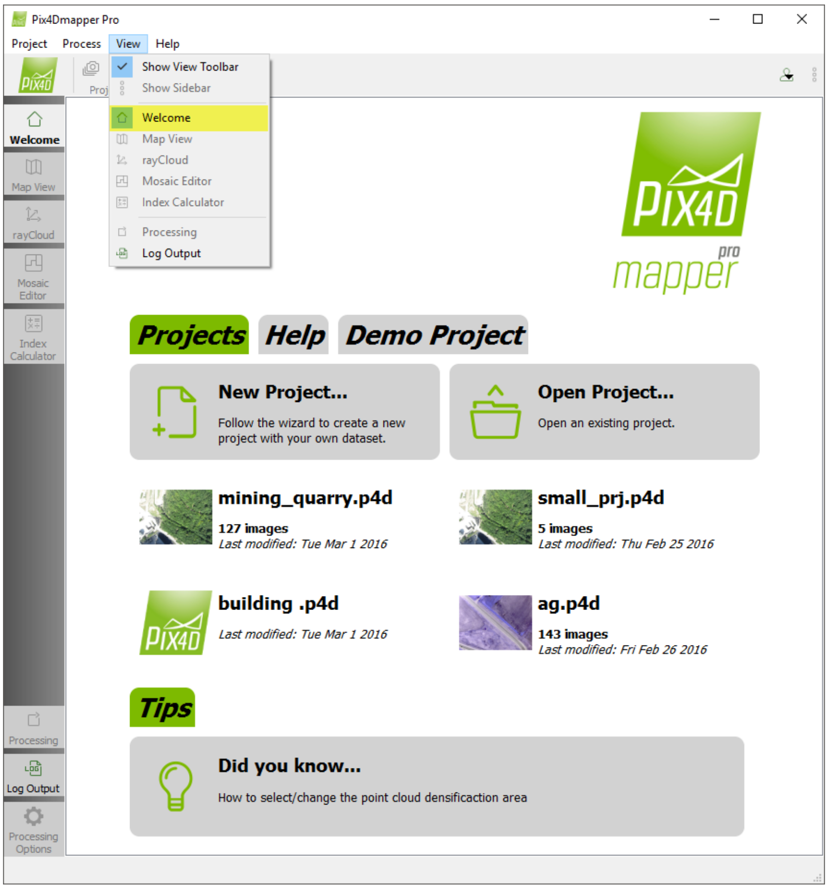
Show View Toolbar: Show / hide the View toolbar. For more information: 202557839.
Show Sidebar: Show / hide the Sidebar. For more information: 202558389.

And 7 items that can be selected:

Welcome: Opens the Welcome View interface.
Map View: Opens the Map View, available when a project is created/opened.
rayCloud: Opens the rayCloud View, available when a project is created/opened.
Mosaic Editor: Opens the Mosaic Editor View, available once step *3. DSM, Orthomosaic and Index* has been completed.
Index Calculator: Opens the Index Calculator View, available once step *1. Initial Processing* has been completed.
Processing: Opens the *Processing* bar, available when a project is created/opened.
Log Output: Opens the *Log Output* bar, available when a project is created/opened.



Access: On the Menu bar, click View > Welcome.



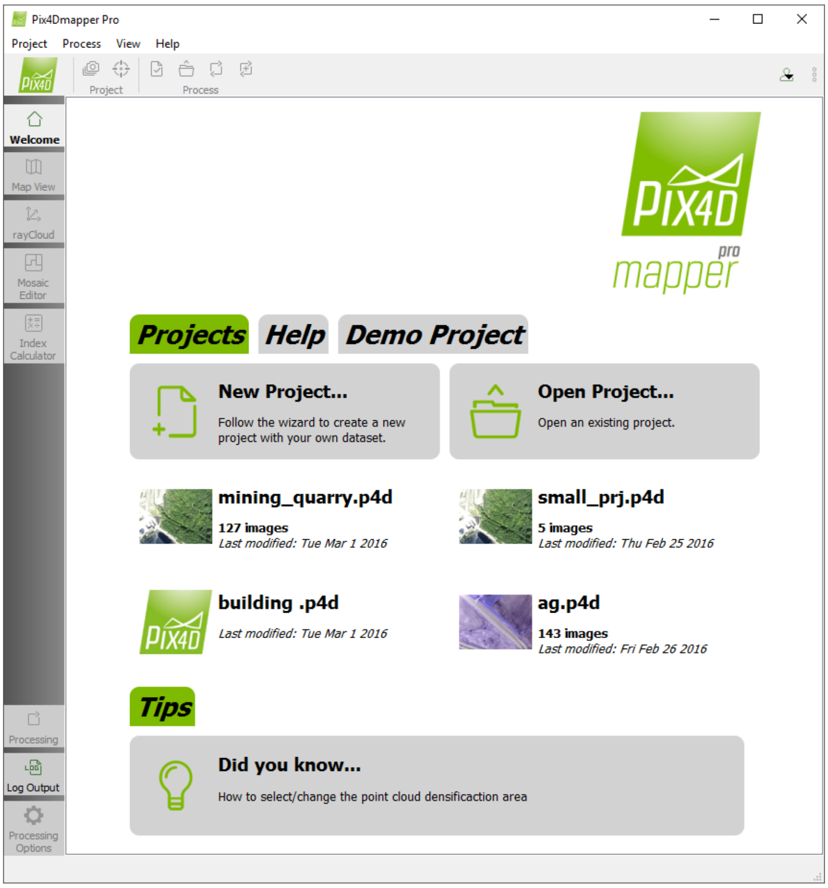
The Welcome View has 3 sections:

Projects
Help
Demo Project

Projects

Contains the items:

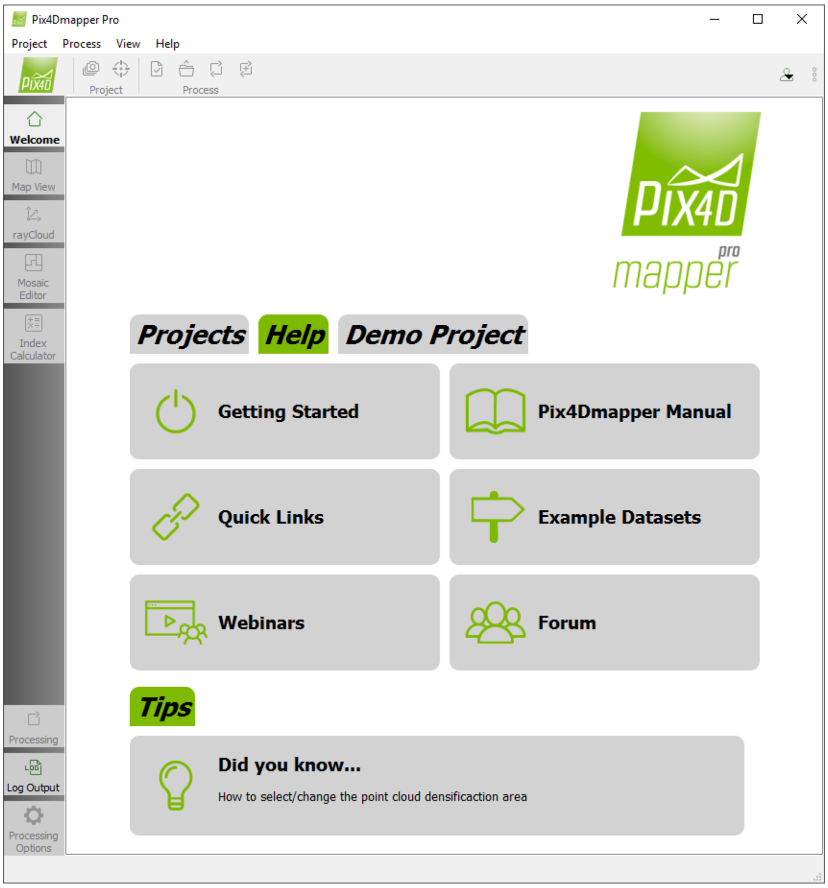
New Project...
Opens the wizard that guides the user to create a new project.
For step by step instructions about how to create a new project:202557309.
Open Project...
Opens an existing project. Opens a pop-up to navigate and select a .p4d project file (Pix4Dmapper project file format).
Recent Projects
Displays a menu with the 4 last projects that have been opened. By clicking on one of them, the project will open.
Tips
Displays information about the use of Pix4Dmapper. It opens the Knowledge Base articles containing a detailed description.



Help

Contains the items:

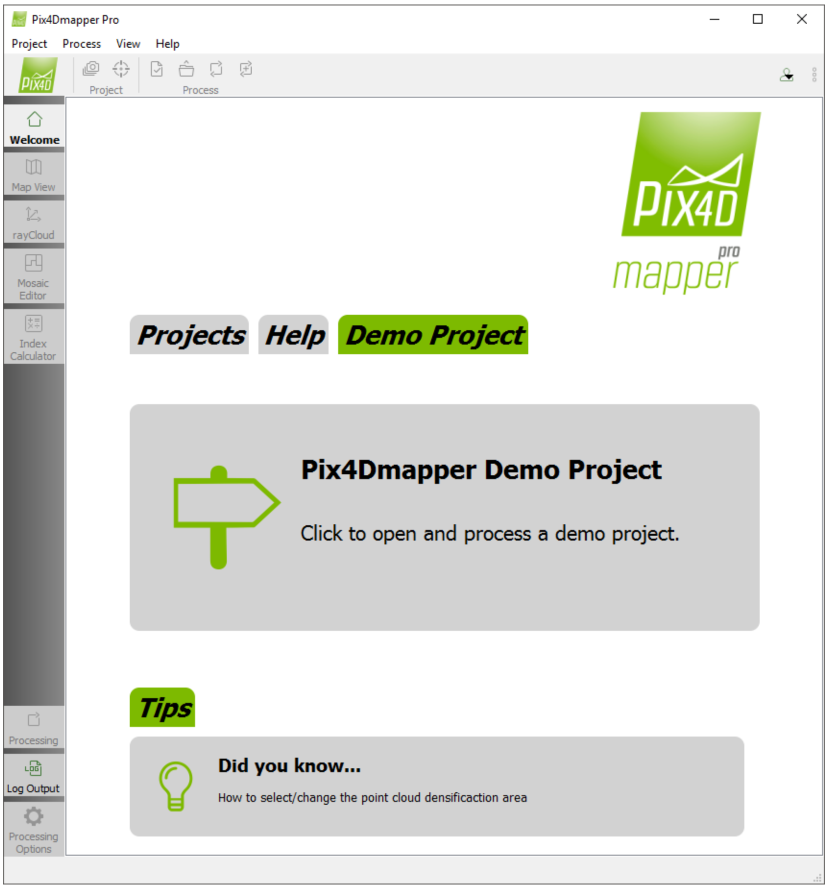
Getting Started
Opens the Support site, displaying the Getting Started index. This guide explains how to get started with Pix4Dmapper. It shows the needed steps before using Pix4D to obtain a good dataset, how to create a project and how to start processing. It also shows how to get started with advanced features such as Ground Control Points.
Pix4Dmapper Manual
Opens the Support site, displaying the Manual index.
Quick Links
Opens the Support site, displaying the Quick Links index.
Example Datasets
Opens the Support site, displaying the example datasets index.
Webinars
Opens the Support site, displaying the Webinars index.
Forum
Opens the Support site, displaying the Forum index page.
Tips
Displays information about the use of Pix4Dmapper. It opens the Knowledge Base articles containing a detailed description.



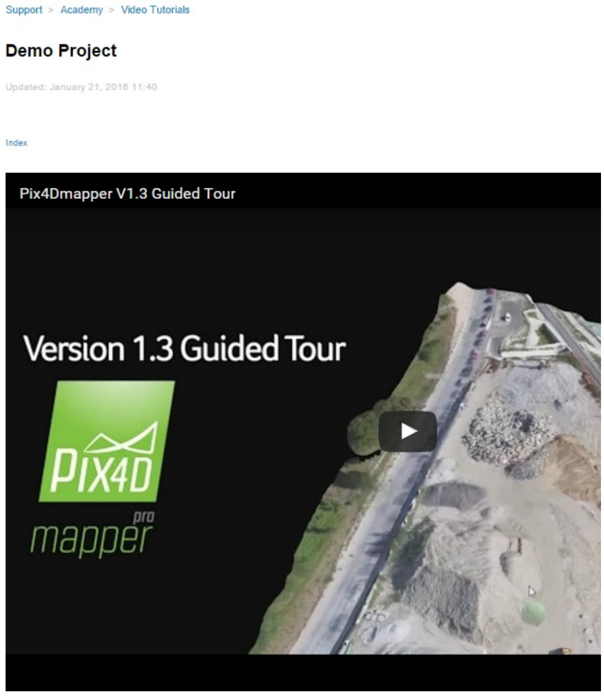
Demo Project

Contains the items:

Pix4Dmapper Demo Project
Automatically loads a demo project, ready to be processed and opens in a browser window the demo project video that highlights the possibilities of Pix4Dmapper.
Tips
Displays information about the use of Pix4Dmapper. It opens the Knowledge Base articles containing a detailed description.

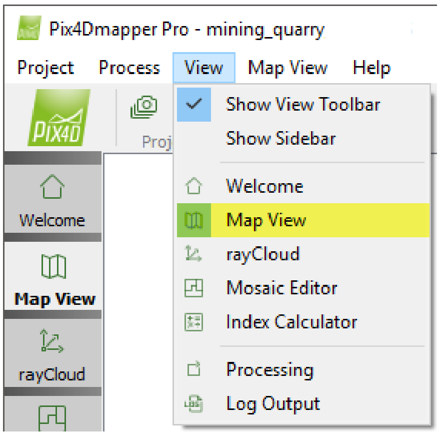


Map View with the demo project loaded



Demo project video in Pix4D Support site

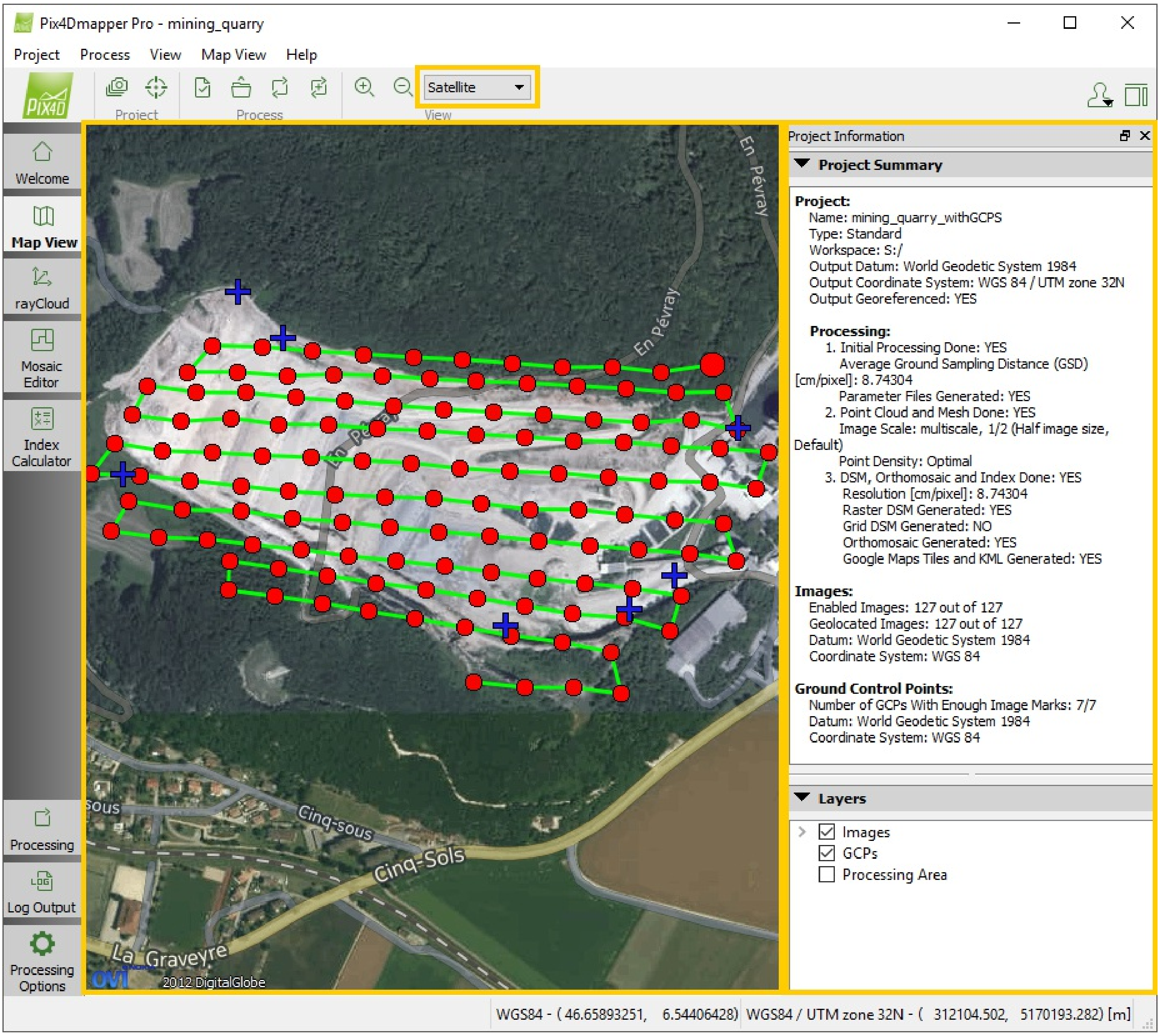
Access: On the Menu bar, click View > Map View.



By selecting the Map View the following elements are displayed on the main window:

Menu bar entry: Displayed on the Menu bar.
Toolbar: The standard toolbar and some extra buttons related to the Map View.
2D View: Displayed in the main window. By default the Satellite view is displayed.
Project Information sidebar: Displayed on the right of the 2D Map. It contains two sections: *Project Summary* and *Layers*.
Status bar: Displayed at the bottom right of the Map View. Displays the coordinates when passing the mouse over the 2D View.

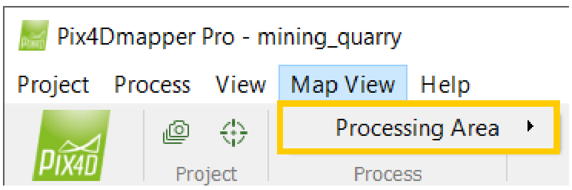
Important: The 2D Map displays the earth if the images are not geotagged.



Menu bar entry

On the Menu bar, when clicking Map View, the following option is displayed:

Processing Area: Indicates the area of the project for which the different steps of processing will be applied.



Toolbar

The following toolbar buttons are displayed:

Standard toolbar buttons: For more information: 202557839.
Toolbar extra buttons:

Toolbar extra buttons

View
Zoom In: Zooms in the selected view.
Zoom Out: Zooms out the selected view.

Change Background Map: A drop-down list that changes the 2D View background displayed on the main window. It has the following options:
Satellite (default): Displays a satellite view of the project's location. If none of the images are geolocated, the whole earth is displayed.
Maps: Displays a map view of the project's location. If none of the images are geolocated, the whole earth is displayed. The background map displays the standard OpenStreetMap map.
Orthomosaic: This option is available only if the Google Maps tiles and KML have been generated. It displays the orthomosaic that Pix4Dmapper generates in step 3.*DSM, Orthomosaic and Index.*

Note: To generate the Google Maps tiles and KML: 202558149.

Information: The data displayed by OpenStreetMap is available under the Open Database License, the cartography is licensed as CC BY-SA.

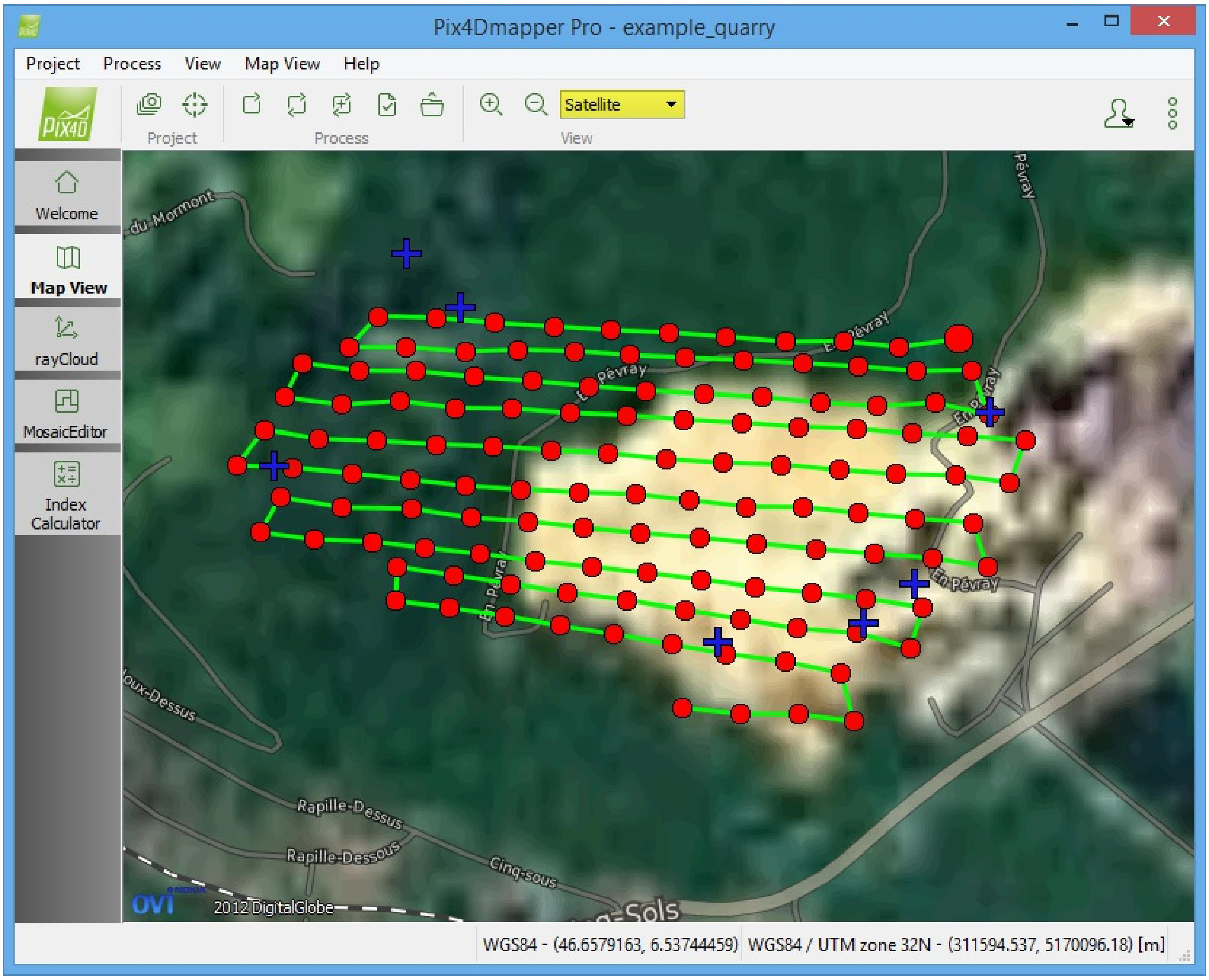


Figure 1. Satellite view

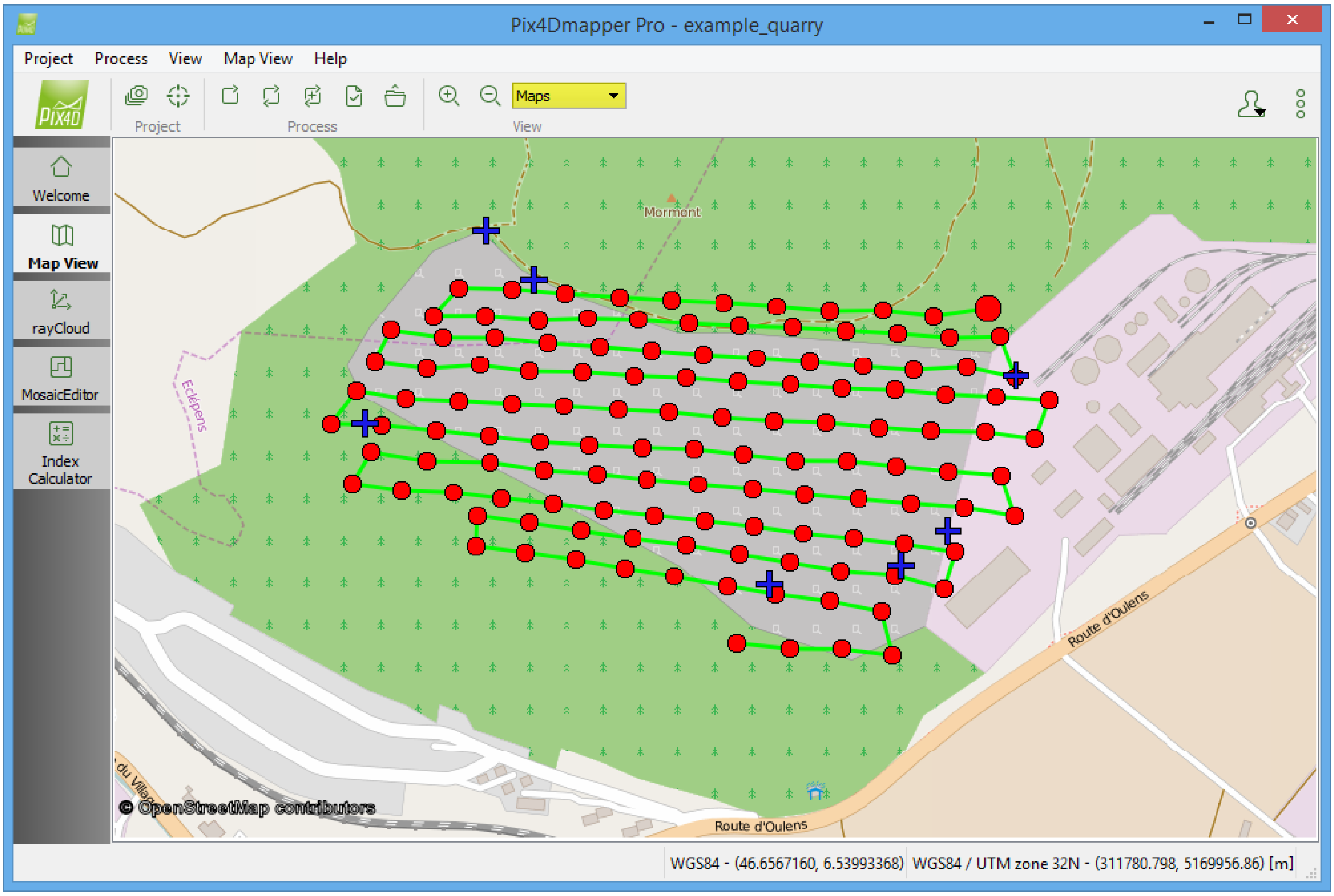


Figure 2. Maps view

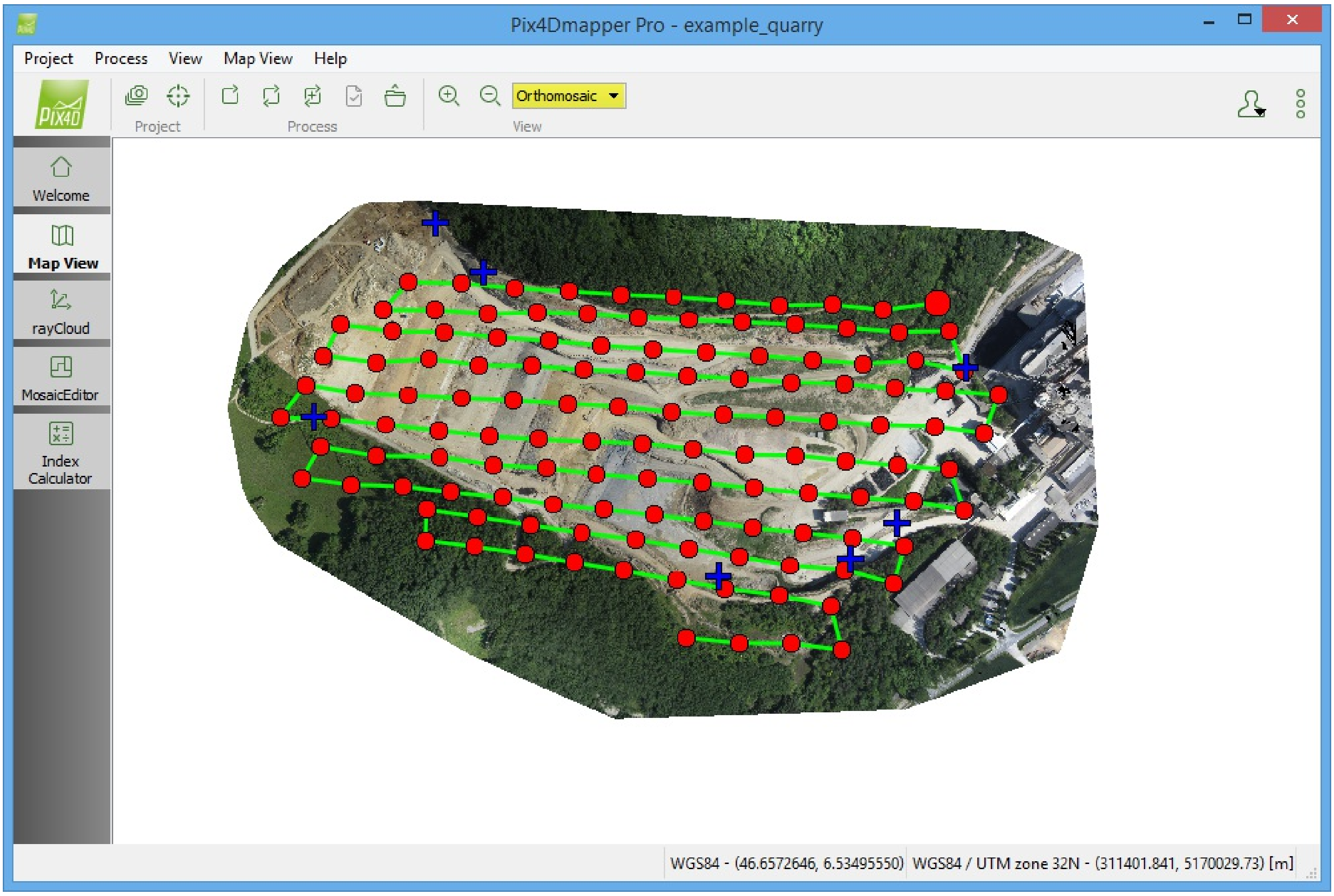


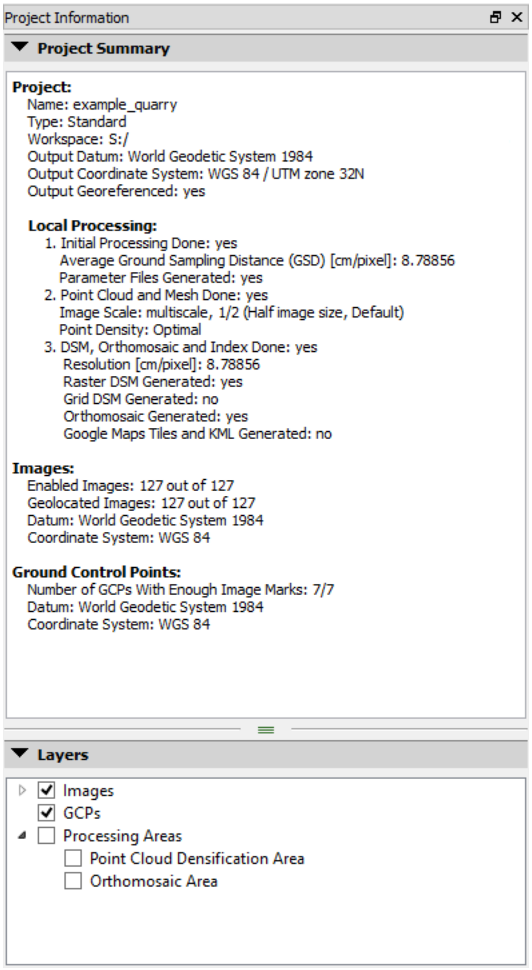
Figure 3. Orthomosaic view

Section which displays the location of the project on earth and the project elements (images, GCPs, etc.). For more information: 202557979.

Project Information sidebar

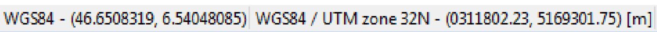
Project Summary: Section with a summary of the project parameters and the processing progress.
Layers: Section with the project elements (images, GCPs, etc.) that are visible in the 2D View.

For more information about the sidebar's display possibilities: 202558389.



Status bar

The coordinates of the current mouse position on the 2D View are displayed at the bottom right of the Map View. Two types of coordinates are displayed:



Geographical WGS84 coordinates
Latitude and longitude coordinates are displayed.
Selected Coordinate System
The X and Y coordinates of the selected output coordinate system (202558239) are displayed .

Note: If the project has no georeference or it is georeferenced in an arbitrary coordinate system, only the geographical WGS84 coordinates are displayed.

Access: On the Menu bar, click View > Map View and then, on the Menu bar, click View > Processing Area.

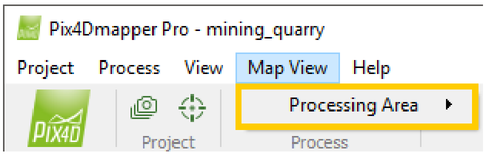
Note: Only one *Processing Area* can been used.

Warning:
It is recommended to include areas covered by images in the *Processing Area,* so as to exclude areas of low overlap that can affect the results.
The *Processing Area* affects only the visualization of the Automatic Tie Points in the 3D View of the rayCloud. It does not affect the results of step *1. Initial Processing*.
When the *Processing Area* is defined before step *2. Point Cloud and Mesh* is processed, it affects the Point Cloud visualized in the 3D View of the rayCloud and the results saved on disk. This *Processing Area* will also affect the results of step *3. DSM, Orthomosaic and Index.*
When the *Processing Area* is defined after step *2. Point Cloud and Mesh* is completed, it only affects the Point Cloud visualized in the 3D View of the rayCloud but not the results saved on disk. This *Processing Area* will also affect the results of step *3. DSM, Orthomosaic and Index.*
When exporting the Point Cloud, it is possible to take into account the Processing Area, even if it is drawn after step 2 is processed. For more information about how to export the Point Cloud: 203890769.
When the *Processing Area* is defined before step *3. DSM, Orthomosaic and Index* is completed, only the results of step 3 will be affected.

Warning:
In order to take the *Processing Area* into account for the visualization of the Point Cloud and / or the generation of the outputs of step *2. Point Cloud and Mesh*, the corresponding filter should be selected in the *Processing Options*. For more information: 204644369.

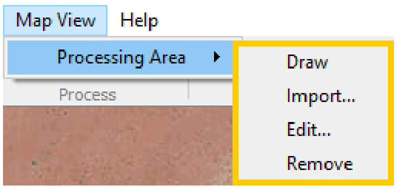
The *Processing Area* will be taken into account for the results of step *3. DSM, Orthomosaic and Index* even if the *Processing Areas* box is not selected in the *Point Cloud Filters.*

The *Processing Area* indicates the area of the project for which the different steps of processing will be applied. The area can only be defined in the Map View if the project is georeferenced in a known coordinate system.



It contains 4 options:

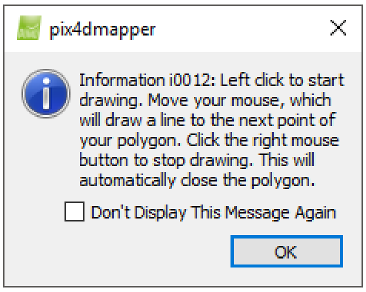
Draw
Import...
Edit...
Remove



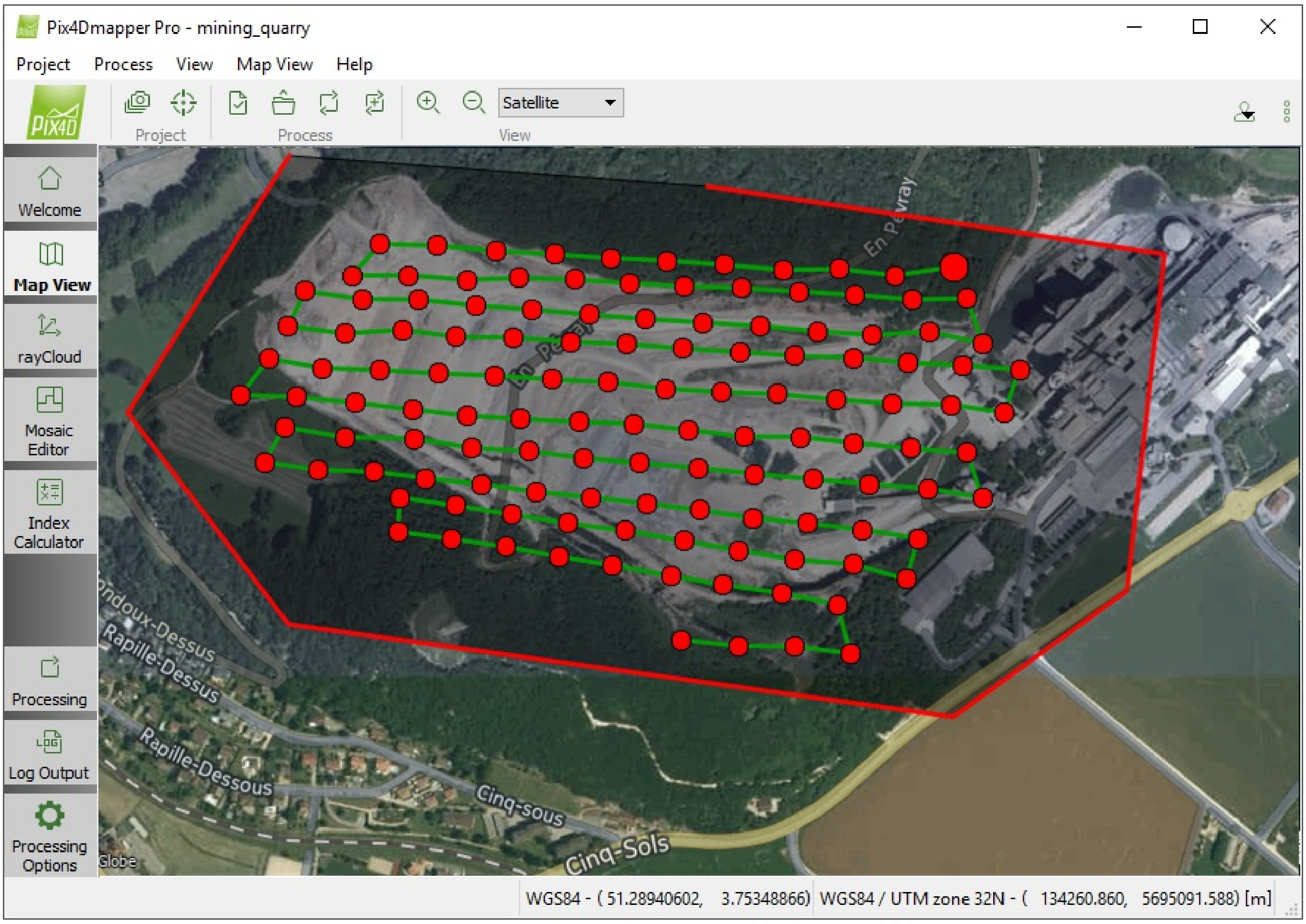
For step by step instructions about how to select / draw the *Processing Area*: 202560179.

Draw

By clicking *Draw,* the information i0012 pop-up appears with instructions about how to draw the area:

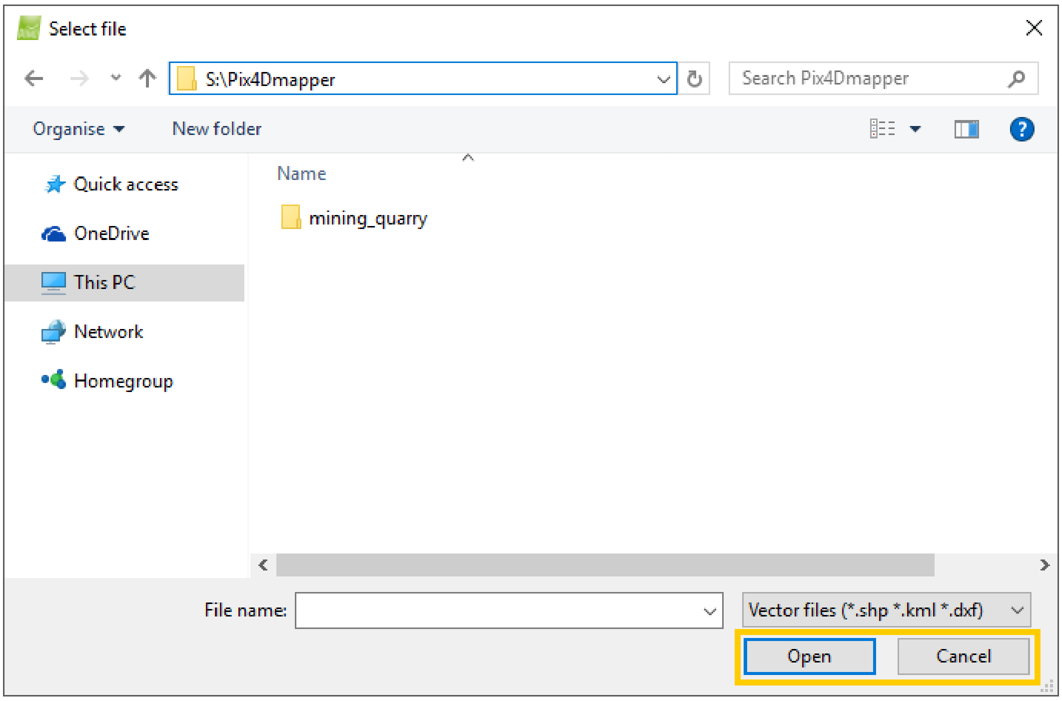


Right click inserts the last vertex of the *Processing Area* and stops the drawing.



Import...

By clicking *Import...*, the *Select file* pop-up appears which allows the user to load the area from a vector file (.shp, .kml or .dxf):



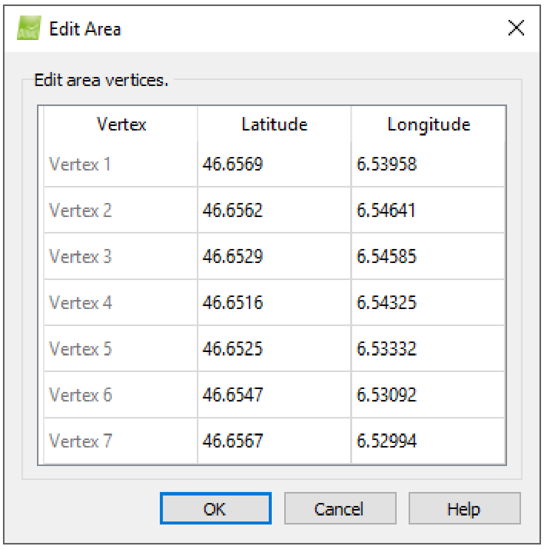
Navigation window: Used to search for and select the vector file.
Open: Loads the file.
Cancel: Does not save the changes and closes the pop-up.

Note: The Vector file (.shp, .kml or .dxf) has to be a polygon file (not lines) and can be given in any coordinate system from Pix4Dmapper's coordinate system database.

Edit...

Available only if a *Processing Area* has already been drawn / imported. By clicking *Edit...*, the *Edit Area* pop-up appears. It contains a table with the following columns:

Vertex: Each vertex of the area drawn or imported.
Latitude: The latitude of each vertex.
Longitude: The longitude of each vertex.



To edit the area, by changing the *Latitude* and/or *Longitude* values, double-click on the corresponding cells in the table.

The *Edit Area* pop-up also has 3 action buttons:

OK: Confirms the changes.
Cancel: Does not save the changes and closes the pop-up.
Help: Opens the Pix4Dmapper help.

Remove

Available only if a *Processing Area* has already been drawn / imported. By clicking *Remove*, the previously drawn or imported area is deleted.

Access: On the Menu bar, click View > Map View. The 2D View is displayed on the Main window.

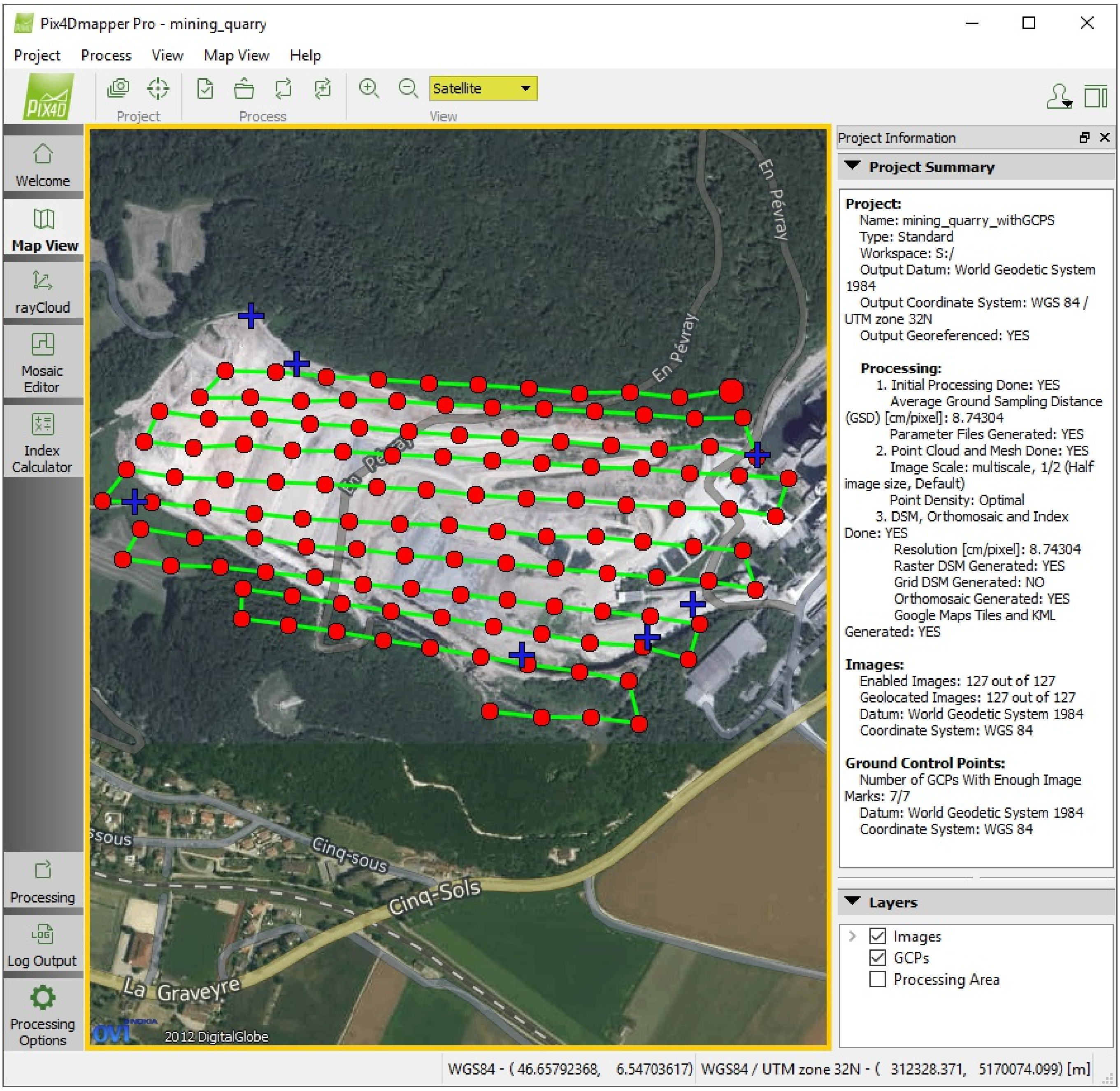
The 2D View has 2 components:

Background map
Displayed elements

Background map

On the top of the 2D View there is a drop-down list indicating the type of the background map that has been selected.

Note: While loading a map, the drop-down list with the available maps is disabled.



By default when a project is loaded, the *Satellite* type is selected. To navigate the map:

Zoom in: Move the mouse scroll wheel forwards.
Zoom out: Use the mouse scroll wheel backwards.
Pan: Left click and move the mouse.

Click on the background drop down list to select a different type of map. The following background maps are available:

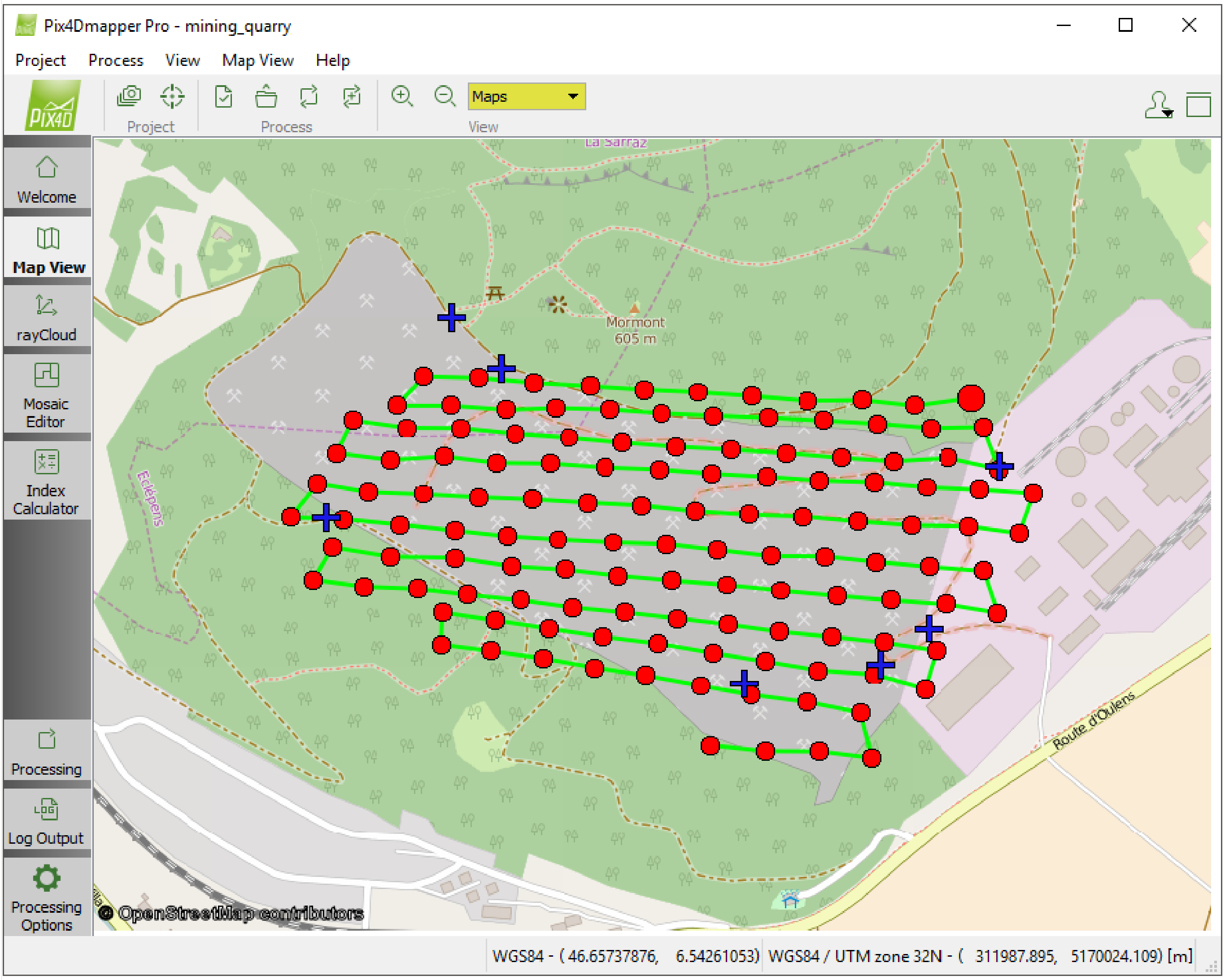
Maps
Satellite
Orthomosaic

Maps

The background map displays the standard OpenStreetMap map.

Note: The *Maps* background is loaded only if there is Internet connection.

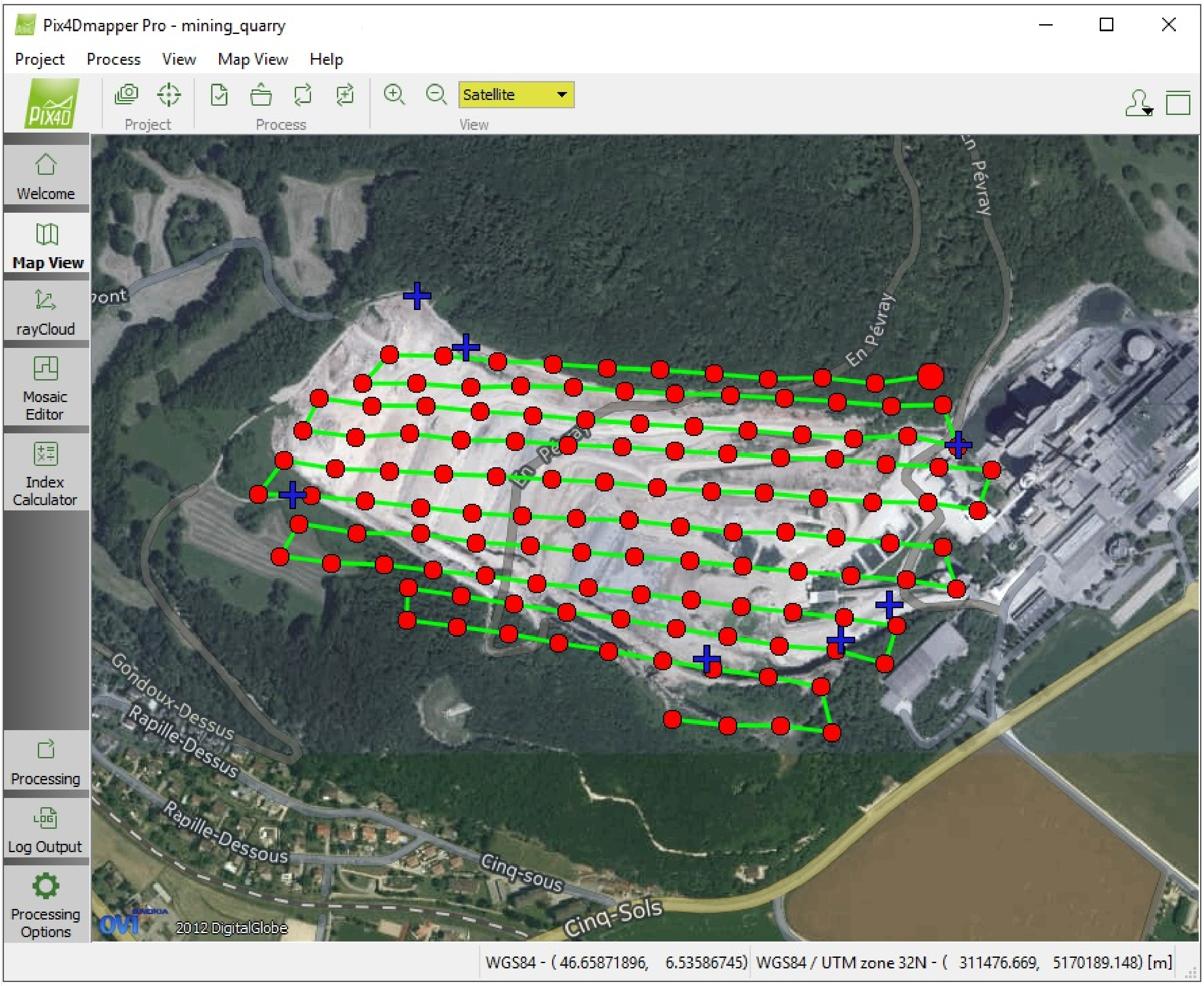
Information: The data displayed by OpenStreetMap is available under the Open Database License, the cartography is licensed as CC BY-SA.



Satellite

The background map displays a satellite map.

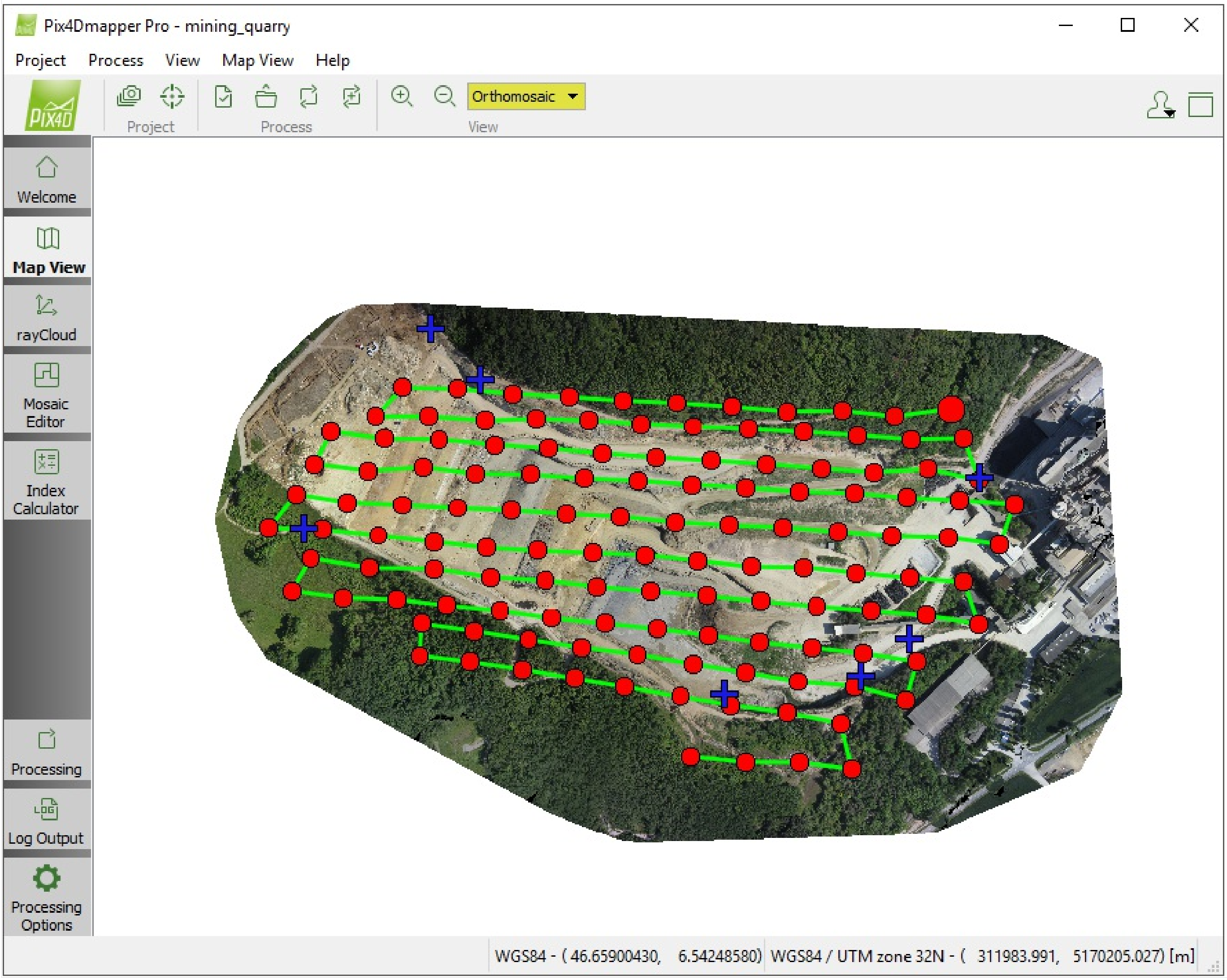
Note: The *Satellite* background is loaded only if there is Internet connection.



Orthomosaic

The background map displays the Orthomosaic that is generated in step 3. *DSM, Orthomosaic and Index.*

Note: This background map is available only if the *Google Maps tiles and KML* have been generated. To generate the *Google Maps tiles* and *KML*: 202558149.



Displayed elements

The elements that are displayed are the following:

Images
Flight plan
GCPs
Processing Area

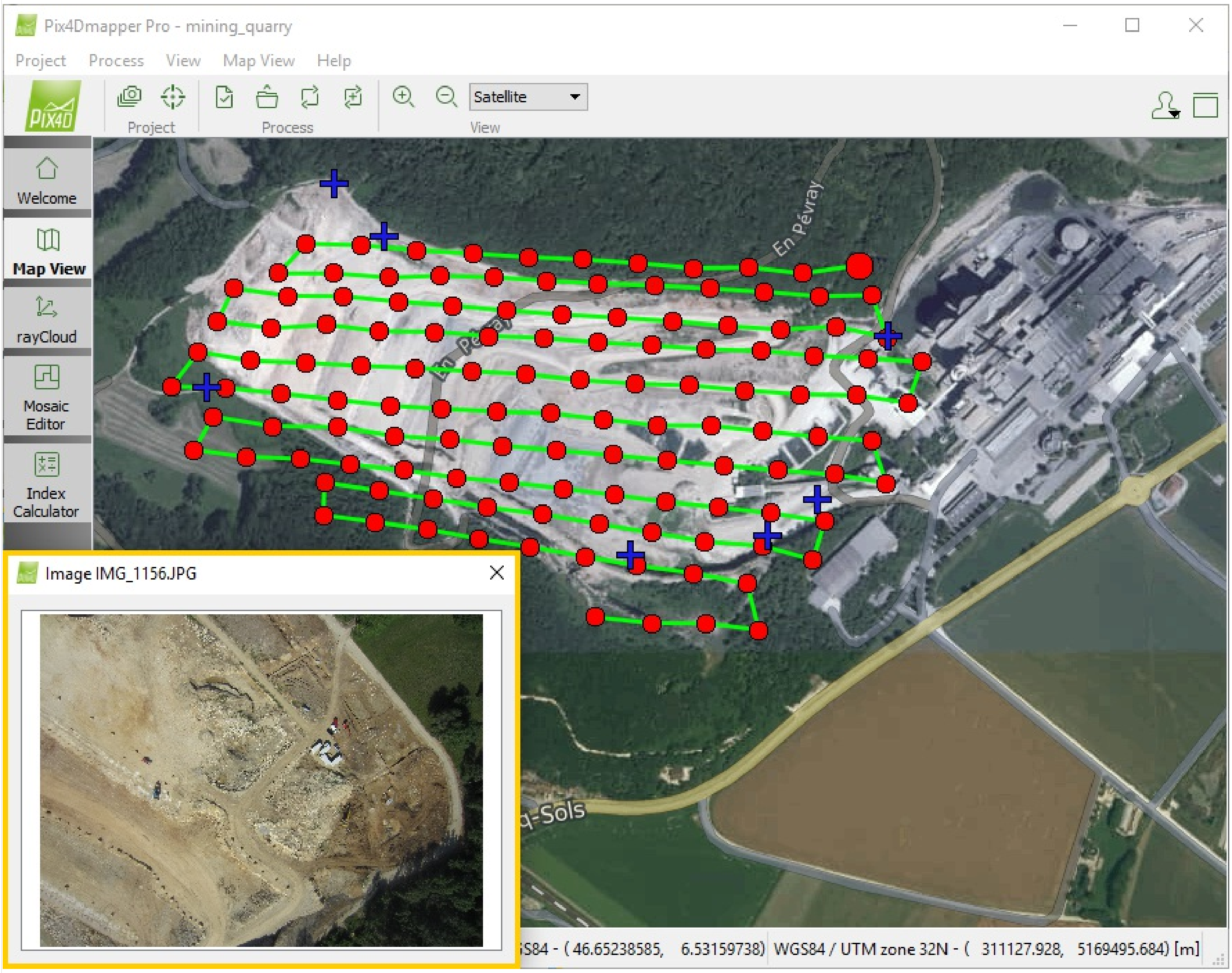
Images

The images of the project that are geolocated with a known coordinate system are displayed as dots on the 2D View. The first image is displayed as a larger dot. The color of the dot indicates the phase of the processing:

Red: When a project is loaded before processing has started.
Gridded red: For the images that are disabled (not taken into account for processing).
Dark green: For images that have been calibrated after step *1. Initial Processing*.
Blue: During step 2. *Point Cloud and Mesh* for the loaded images.
Luminous green: After step 2. *Point Cloud and Mesh*.

When hovering over the image dots, the image name is displayed at the bottom part of the 2D View. When double clicking on an image dot, a pop-up appears that displays the corresponding image.

Important: If the project has no georeference or it is georeferenced in an arbitrary coordinate system, the images are not displayed on the 2D View. The 2D View displays the whole earth.



The Images layer has a sub-layer:

Flight plan: It displays the flight plan that was used to take the images as a green line starting from the larger dot (first image).

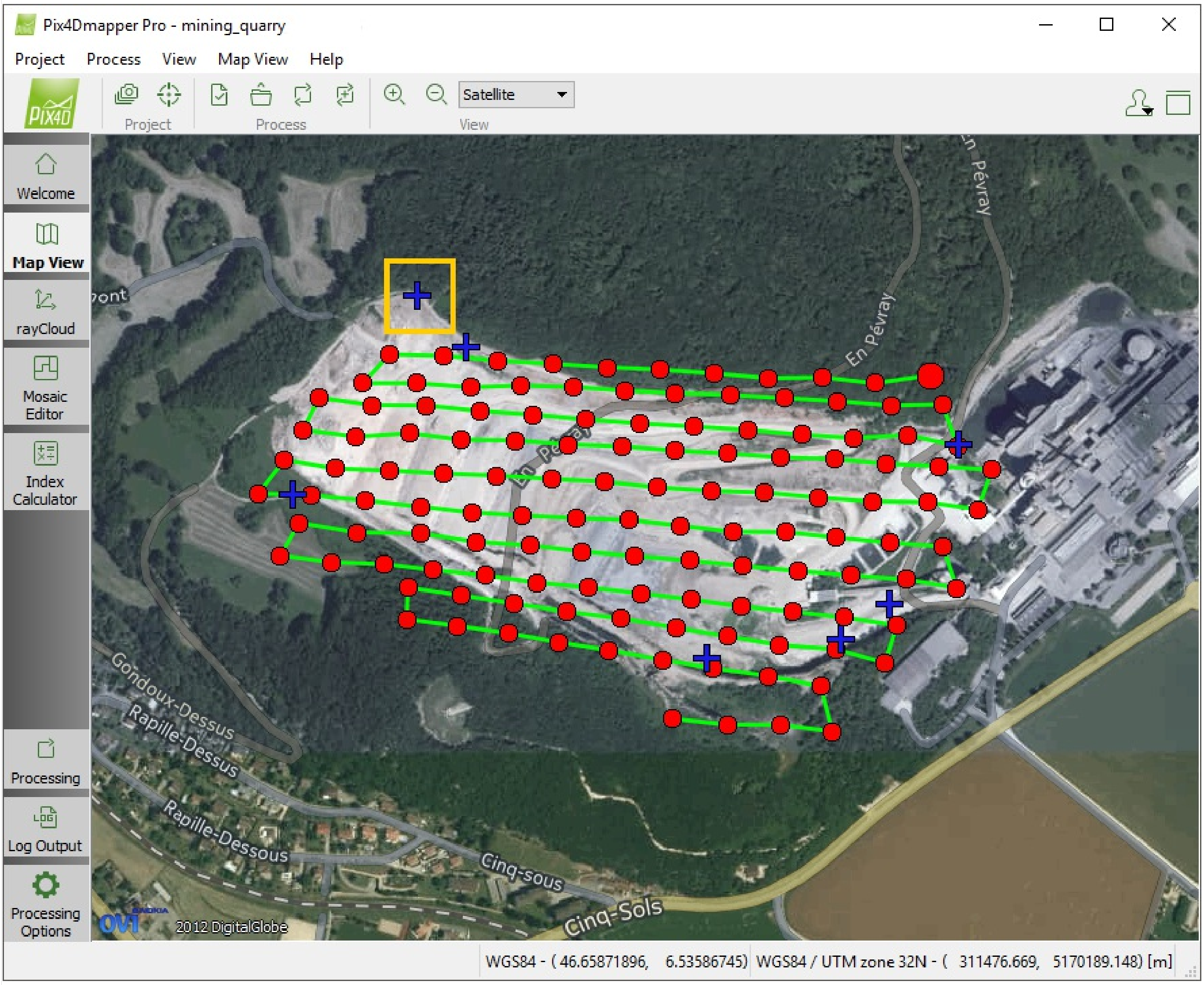
GCPs

The GCPs of the project, if there are any, are displayed as crosses on the map:

Blue cross: GCPs that are marked on at least 2 images.
Red cross: GCPs that are marked on less than 2 images.

When hovering over the GCP cross, the GCP name is displayed at the bottom of the 2D View. When double-clicking on a GCP cross, the *GCP/MTP Manager* window opens and the corresponding GCP is selected.

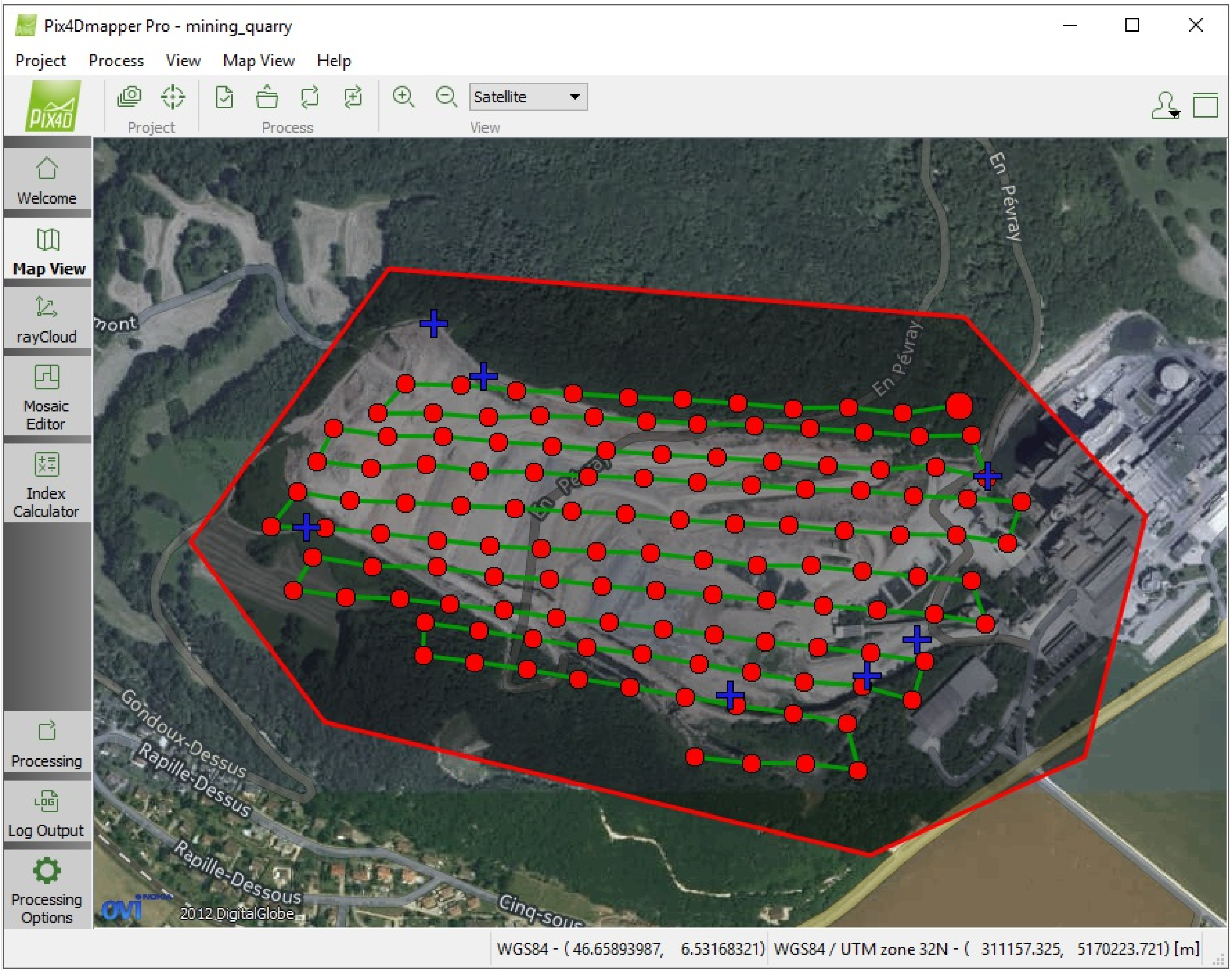
Important: If the project has no georeference or it is georeferenced in an arbitrary coordinate system, the GCPs are not displayed on the 2D View. The 2D View displays the whole earth.



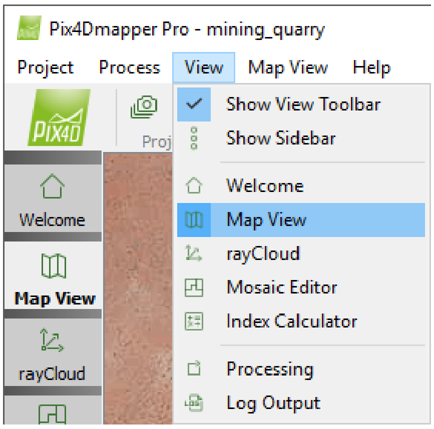
Processing Area

The *Processing Area*, if defined, is displayed on the 2D View as transparent polygon with a red border.

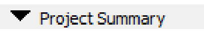
Important: If the project has no georeference or it is georeferenced in an arbitrary coordinate system, the *Processing Area* is not displayed on the 2D View. The 2D View displays the whole earth.



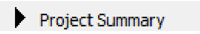
Access: On the Menu bar, click View > Map View to open the Map View. The Project Summary is displayed on the right of the main window. For information about the sidebar's display possibilities: 202558389.



On the left part of the *Project Summary*, there is an arrow that allows the user to show/hide the summary by clicking on it.



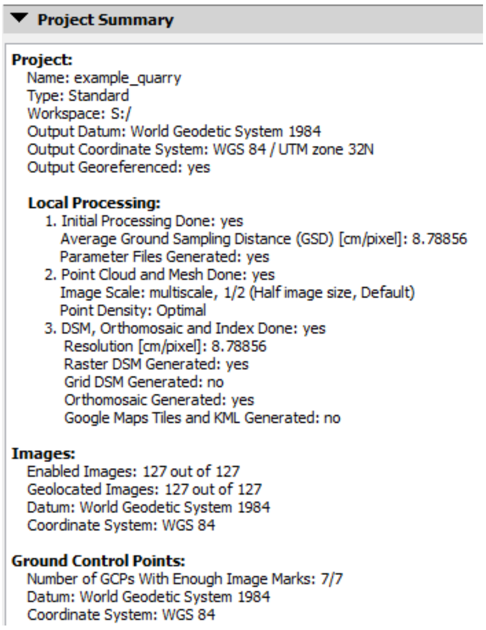
: By default the *Project Summary* is visible.



: The *Project Summary* is not visible.

There are 4 sections in the *Project Summary:*

Project
Processing
Images
Ground Control Points



Project

This section displays general information about the project:

Name: The name of the project.
Type: The type of the project (Aerial nadir, Alternative processing mode, Aerial oblique or terrestrial).
Workspace: The path to the folder where the .p4d project file is located and where the output folder is saved.
Output Datum: The datum of the outputs.
Output Coordinate System: The coordinate system of the outputs.
Output Georeferenced: Indicates whether the output is georeferenced.

Note: If no georeference is given to the project (non geolocated images and no GCPs, or non geolocated images and GCPs in Local coordinate system), then the output coordinate system is set to Local and no datum is displayed:
Output coordinate system: Local

Processing

This section describes the progress of each of the 3 steps of the local processing:

Step (1): Initial Processing
Initial Processing Done: *NO:* If the initial processing has not been done. *YES:* If step 1. *Initial Processing* has been processed. *Average Ground Sampling Distance [cm/pixel]:* - : If Initial Processing has not been done. "GSD": Where "GSD" is the average Ground Sampling Distance. *Parameter Files Generated:* The parameter files contain the results of the AAT, BBA, and optimized internal and external camera parameters: *NO:* If if the parameter files have not been generated. *YES:* If the parameter files have been generated.
Step (2): Point Cloud and Mesh
Point Cloud and Mesh Done: NO: If the step 2. *Point Cloud and Mesh* has not been processed. *YES*: If the step 2. *Point Cloud and Mesh* has been processed. *Image Scale:* Scale of the image with which additional 3D points are computed: - : If the *Point Cloud and Mesh* has not been generated. *1/2 (half image size, default)*: Half size images are used to compute additional 3D points. *1 (original image size, slow)*: The original image size is used to compute additional 3D points. *1/4 (quarter image size, fast)*: Quarter size images are used to compute additional 3D points. *1/8 (eighth image size, tolerant)*: Eighth size images are used to compute additional 3D points. *Point Density:* *Optimal:* Computed with an optimal point density. *High:* Computed with a high point density. Processing time will increase. *Low:* Computed with a low point density. Processing time will decrease.
Step (3): DSM, Orthomosaic and Index
DSM and Orthomosaic Generation Done: *NO:* If step 3. *DSM, Orthomosaic and Index* has not been processed. *YES:* If step 3. *DSM, Orthomosaic and Index* has been processed. *Resolution [cm/pixel]:* -: If step 3. *DSM, Orthomosaic and Index* has not been processed. "Resolution": Where "Resolution" is the resolution of the DSM and of the Orthomosaic if step 3. *DSM, Orthomosaic and Index* has been processed. *Raster DSM Generated:* *NO:* If the Raster DSM GeoTIFF file has not been generated. *YES:* If the Raster DSM GeoTIFF file has been generated. *Grid DSM Generated:* *NO:* If the Grid DSM GeoTIFF file has not been generated. *YES:* If the Grid DSM GeoTIFF file has been generated. *Orthomosaic Generated:* *NO:* If the orthomosaic GeoTIFF file has not been generated. *YES:* If the orthomosaic GeoTIFF file has been generated. *Google Maps Tiles and KML generated:* *NO:* If the Google Maps tiles and KML files for the orthomosaic have not been generated. *YES:* If the Google Maps tiles and KML files for the orthomosaic have been generated.

Images

This section displays information about the images of the project:

Enabled Images: The number of images that are going to be used for initial processing.
Geolocated Images: The number of images that have geolocation data.
Datum: The datum of the images' geolocation.
Coordinate System: The coordinate system of the image' geolocation.

> Note: If the images are not geolocated or are given in a Local coordinate system, then the coordinate system is set to Local and no datum is displayed:
> *Coordinate System:* Local

Ground Control Points

This section displays information about the GCPs of the project and is shown only if GCPs are defined.

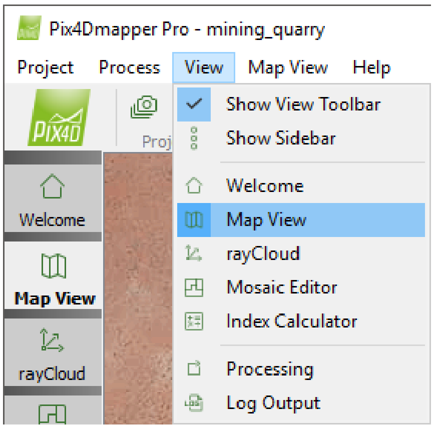
Number of GCPs With Enough Image Marks: The number of GCPs that are marked on at least 2 images and the total number of GCPs.
Datum: The datum of the GCPs.
Coordinate System: The coordinate system of the GCPs.

> Note: If the images are not geolocated or are given in a Local coordinate system, then the coordinate system is set to Local and no datum is displayed:
> *Coordinate System:* Local

Important: If there are less than 3 GCPs with enough image points, the following warning message appears in red color:

"At least 3 GCPs must have enough image marks to be taken into account during processing."

Access: On the Menu bar, click View > Map View to open the Map View. The *Layers* section is displayed on the Map View Project Information sidebar. For information about the sidebar's display possibilities: 202558389.



On the left part of the *Layers*, there is an arrow that allows the user to show/hide the layers by clicking on it.

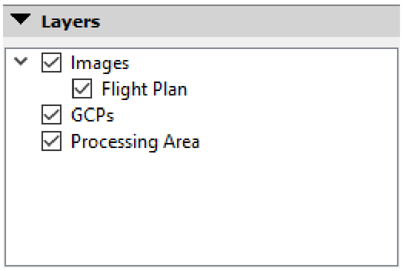
(default): The *Layers* section is visible.

: The *Layers* section is not visible.

Each layer corresponds to one element type that appears on the 2D Map in the main window. There are 3 main layers:

Images
GCPs
Processing Area

Note: Each layer object can be shown/hidden on the 2D Map by selecting / unselceting the box next to the layer name.



Images

Displays the images of the project on the 2D Map as dots. The first image is displayed as a larger dot. By default, the images are displayed. Unselect the *Images* box to hide the images.

A context menu is available when right clicking on the *Images* layer. The following option is available:

Image Properties Editor: Opens the *Image Properties Editor* that allows the user to edit the image properties. For more information about the *Image Properties Editor*: 202557849.

The Images layer has a sub-layer:

Flight plan: Displays the flight plan that was used to take the images as a green line starting from the larger dot (first image) and then following the images in time. By default the flight plan is displayed. Unselect the *Images* box or the *Flight plan* box to hide the flight plan.

GCPs

Displays the Ground Control Points (GCPs) of the project on the 2D Map. By default, if the project has GCPs, the GCPs are displayed. Unselect the *GCPs* box to hide the GCPs.

A context menu is available when right clicking on the *GCPs* layer. The following option is available:

GCP/MTP Manager: Opens the *GCP/MTP Manager* that allows the user to add or edit GCPs. For more information about the *GCP/MTP Manager* : 202558329.

Processing Area

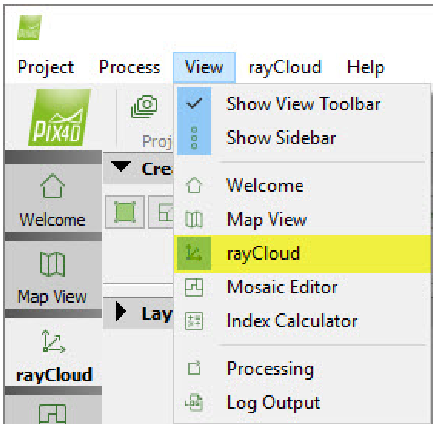
Displays the *Processing Area* of the project on the 2D Map. By default, if an area is defined, it is displayed. Unselect the *Processing Area* box to hide the area.

A context menu is available when right clicking on the *Processing Area* layer. The following options are available:

Draw
Import...
Edit...
Remove

For more information about the *Processing Area*: 202557659.

Access: On the Menu bar, click View > rayCloud.

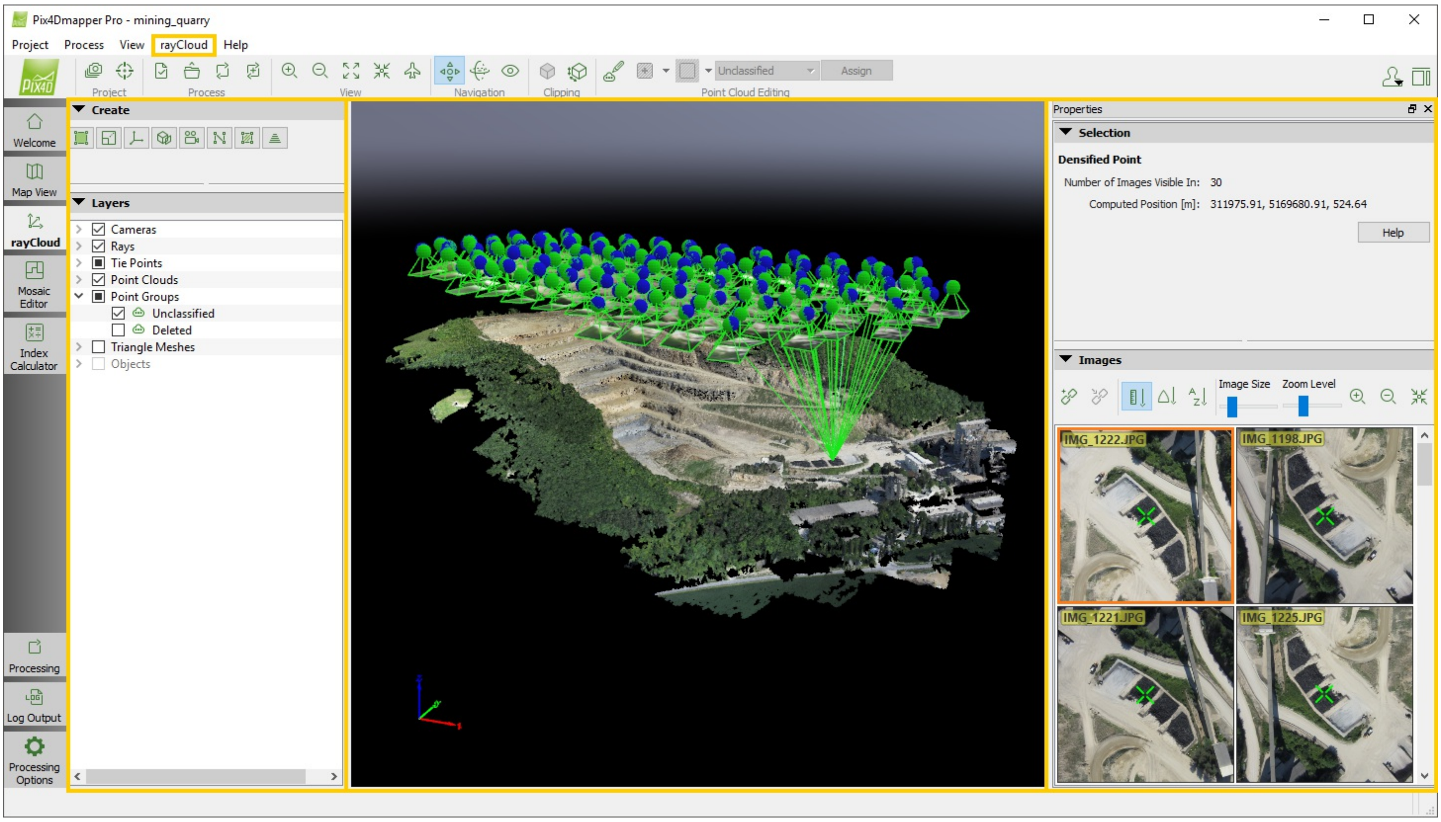


The use of the *rayCloud* is optional and it can be used to:

Visualize the different elements of the reconstruction (Camera Positions, Reprojections (rays), GCPs, Manual / Automatic Tie Points, Processing Area, Clipping Box, Densified Point Cloud, Terrain / Objects / other classes of points, 3D Textured Mesh, Objects, Video Animation Trajectories) and their properties.
Visualize point clouds / Triangle Meshes using point clouds created in other projects or with other software.
Georeference a project using GCPs and /or Scale and Orientation constraints.
Create Orthoplanes to obtain mosaics of any selected plane (for example, building facades).
Verify / improve the accuracy of the reconstruction.
Assign points of the point cloud to different classes.
Improve the visual aspect.
Create objects and measure distances (Polylines), surfaces, and volumes.
Create 3D Fly-trought animations (Video Animation Trajectories).
Export different elements (GCPs, Manual / Automatic Tie Points, Objects, Video Animation Trajectories).
Create point cloud files using points belonging to one or several classes.

When selecting the *rayCloud* the following elements are displayed on the Main window:

Menu bar entry: The standard Menu bar items and an extra item.
Toolbar: The standard toolbar and some extra buttons specific to the rayCloud.
Left Sidebar: Displayed on the left of the 3D View. It consists of two sections: the *Create* section and the *Layers* section. The Create section allows the user to create a *Processing Area, Objects, Scale and Orientation Constraints* and *Orthoplanes*. The *Layers* section displays the list of layers and sub layers (elements) which are displayed on the 3D View. It allows the user to edit the display options of existing elements as well as to insert or import elements on the 3D View, and export elements to file.
3D View: Displayed in the Main view. Displays in 3D the different elements.
Right sidebar: Displayed on the right of the 3D View. Displays different information depending the selected element.
Status bar: Displayed on the bottom right of the rayCloud view. Displays the coordinates when passing the mouse over any element displayed in the 3D View.



More information:

Video Tutorial: Introducing the rayCloud: 202561469.
Video Tutorial: rayCloud Tutorial: 202561479.
Webinar: Using the rayCloud: 202561629.

Status bar

On the bottom right part of the 3D View, the following is displayed:

WGS84 / UTM zone 32N - (311684.29, 5169774.29, 496.97) [m]

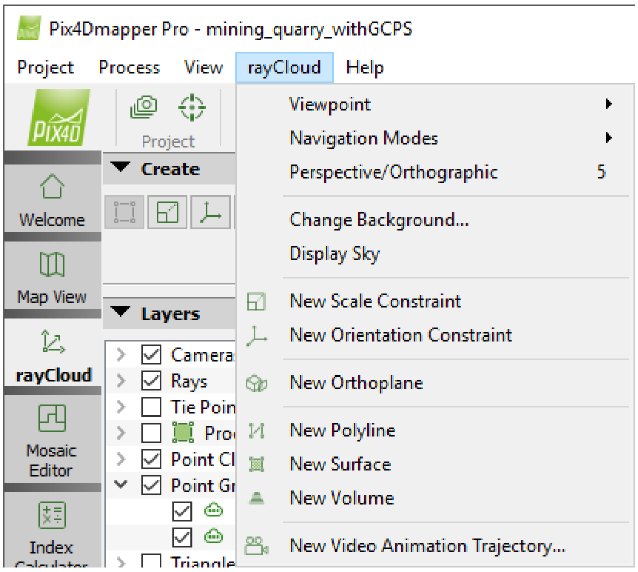
Selected Coordinate System: Displays the selected coordinate system of the point.
Position: Displays the (X,Y, Z) coordinates in meters / feet of each point of the 3D View when passing the mouse over any element. When passing the mouse over the displayed elements, the coordinates change.

> Important: In the rayCloud, the coordinate system is the output coordinate system.
>
> By default the output coordinate system is the same as the GCPs coordinate system, if GCPs are used, otherwise it is the same as the image geolocation coordinate system. If the coordinates system is WGS84, the output is given in UTM. If less than 3 images are geolocated and less than 3 GCPs are defined, then the output coordinates system is set to "Arbitrary".

Access: On the Menu bar, click View > rayCloud, and then click rayCloud.

The following options are displayed:

Viewpoint
Navigation Mode
Perspective/Orthographic
Change Background
Enable Realistic Sky
New Scale Constraint
New Orientation Constraint
New Orthoplane
New Polyline
New Surface
New Volume
New Video Animation Trajectory

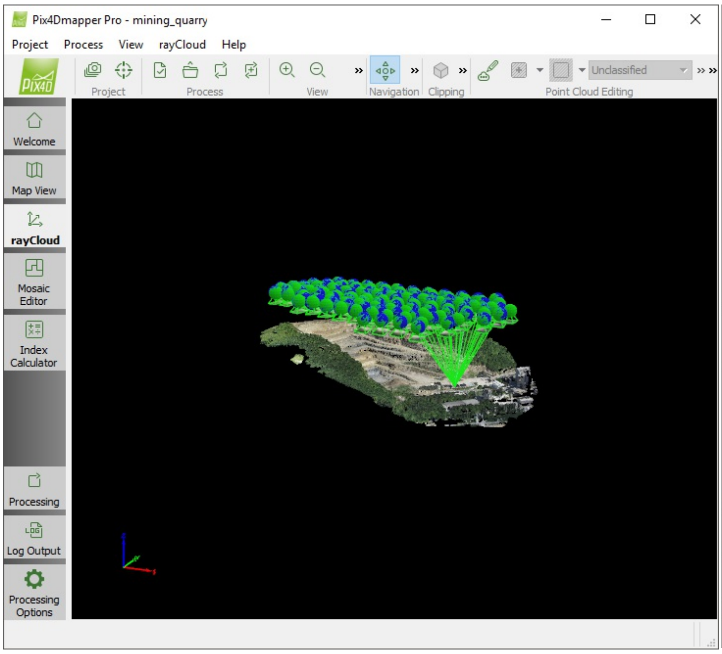


Viewpoint

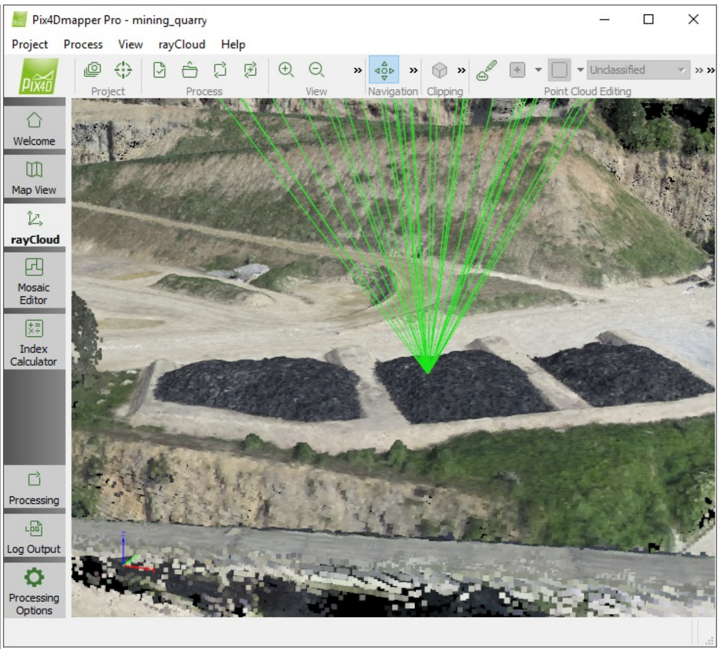
Allows the user to select pre-defined viewpoints for the 3D View. These predefined viewpoints are accessible:

Using the Menu bar rayCloud > Viewpoint.
Using the keyboard.

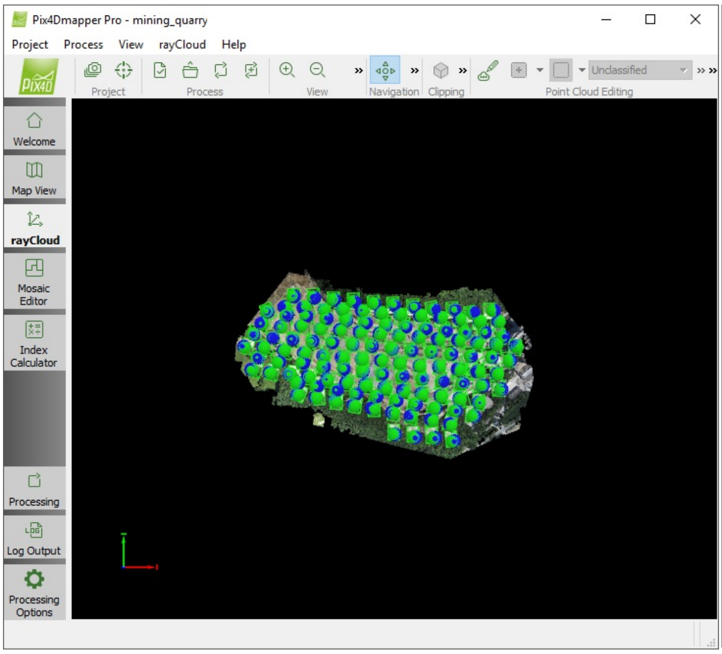
Using the Menu bar rayCloud > Viewpoint.
View All: Moves the viewpoint in order to fit all the layers in the 3D View. **Focus on Selection:** Moves the viewpoint in order to display in detail the selected element (point, camera). **Top:** Moves the viewpoint in such a way that the layers are viewed from the top and fits all the layers in the 3D View. **Front:** Moves the viewpoint in such a way that the layers are viewed from the front and fits all the layers in the 3D View. **Back:** Moves the viewpoint in such a way that the layers are viewed from the back and fits all the layers in the 3D View. **Left:** Moves the viewpoint in such a way that the view looks towards the left part of the layers and fits all the layers in the 3D View. **Right:** Moves the viewpoint in such a way that the view looks towards the right of the layers and fits all the layers in the 3D View. **Home:** Moves the viewpoint to the default viewpoint when opening the rayCloud and fits all the layers in the 3D View.
Using the keyboard
View All: Press **"C"** to move the viewpoint in order to fit all the layers in the *3D View*. **Focus on Selection**: Press **"F"** to move the viewpoint in order to display in detail the selected element (point, camera) **Top**: Press **"7"** to move the viewpoint in such a way that the layers are viewed from the top and fit in the *3D View*. **Front**: Press **"1"** to move the viewpoint in such a way that the layers are viewed from the front and fit in the *3D View*. **Back**: Press **"Ctrl" + "1"** to move the viewpoint in such a way that the layers are viewed from the back and fit in the *3D View*. **Left**: Press **"3"** to move the viewpoint in such a way that the layers are viewed from the left and fit in the *3D View*. **Right**: Press **"Ctrl" + "3"** to move the viewpoint in such a way that the layers are viewed from the right and fit in the *3D View*. **Home**: Press **"0"** to move the viewpoint to the default viewpoint when opening the rayCloud and fits all the layers in the *3D View*.



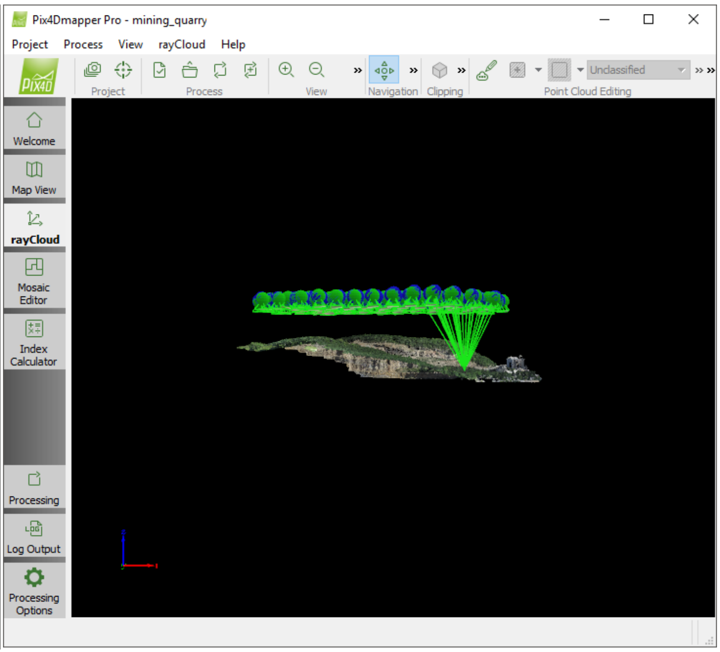
View All



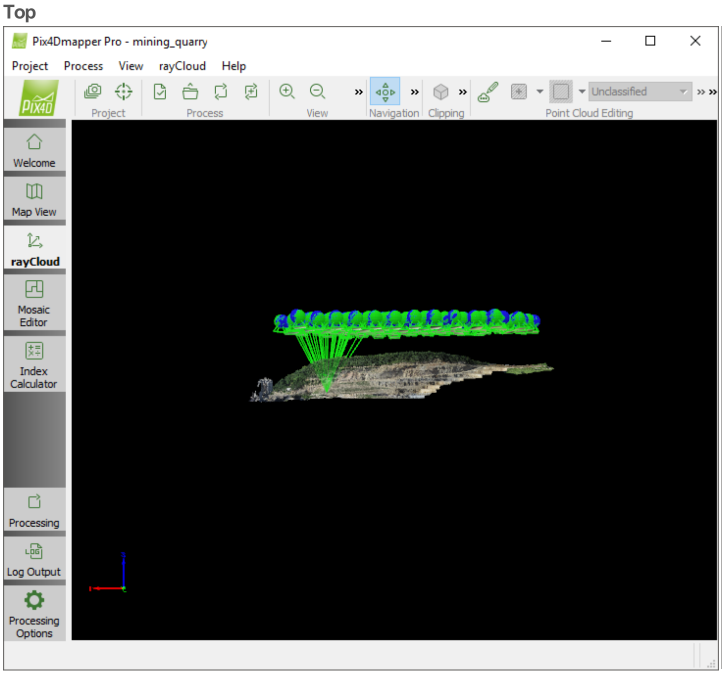
Focus on Selection



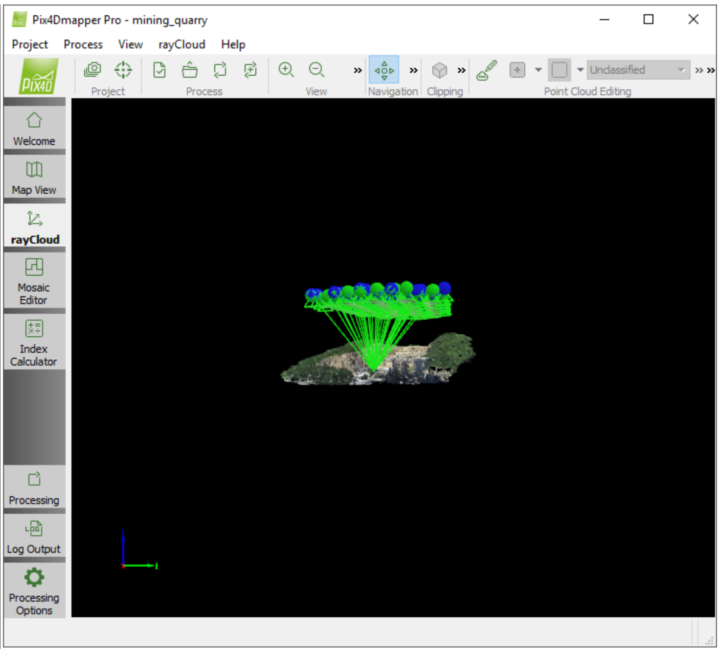
Top



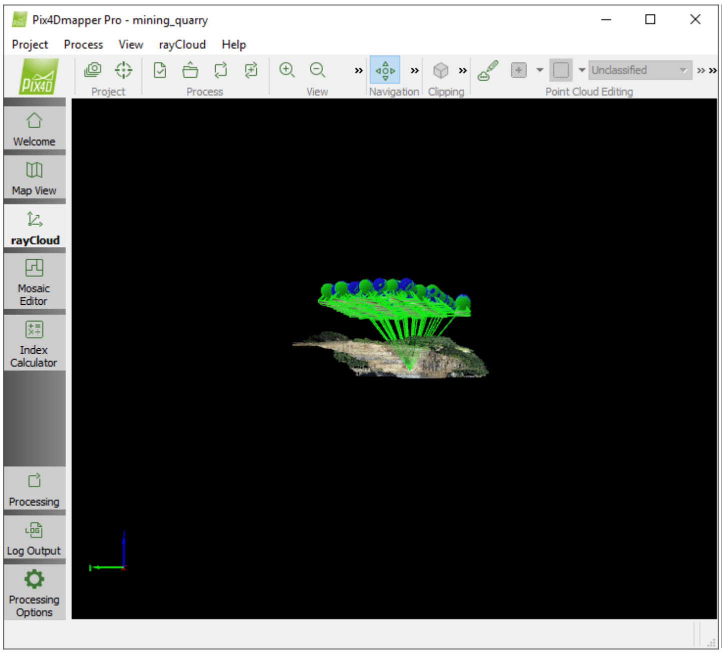
Front



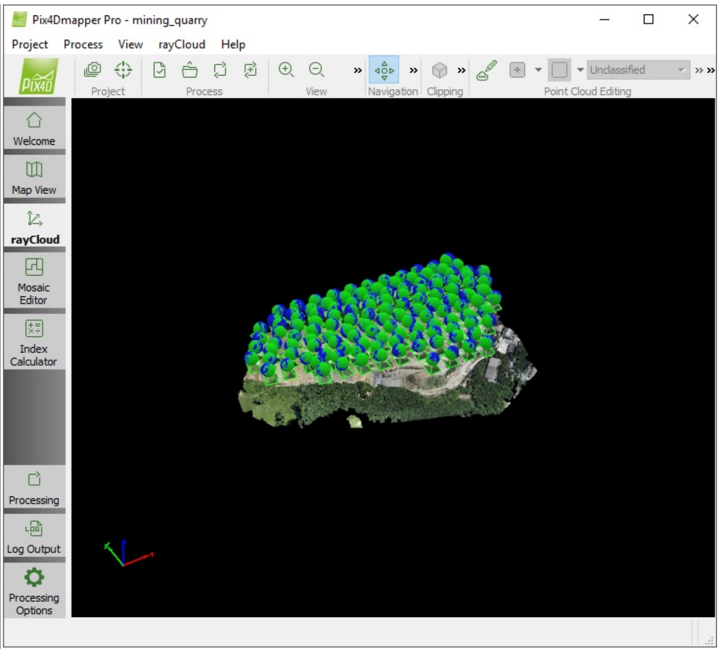
Back



Left



Right



Home

Navigation Mode

Allows the user to change the way to navigate in the 3D View, which defines how the 3D view reacts when using the mouse or keyboard:

Standard: Pix4D standard navigation mode.
Trackball: The camera movements are defined relatively to a ball placed at the center of the view. Recommended to efficiently navigate around a single centered object.
First Person: Allows the user to interact with the view by simulating piloting the camera rather than manipulating the model. Recommended for close inspection and complex models requiring more degrees of freedom.

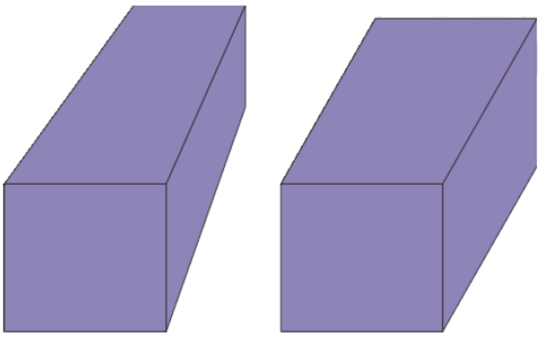
For more information and full description of all the possible actions to navigate in the 3D View using the mouse or keyboard: 205360675.

Perspective/Orthographic

Defines the projection used to display the layers in the 3D View. By default the perspective projection is used. It is possible to switch between perspective and orthographic projection by clicking on the Perspective/Orthographic option of the rayCloud Menu bar.

It is also possible to change the view type from perspective to orthographic using the keyboard by pressing "5".

Perspective projection: Parallel lines don't look parallel and further objects appear smaller. This is what human eyes see.
Orthographic projection: Parallel lines stay parallel. Therefore the size of objects does not depend on the distance. This view mode is recommended for technical drawing.



Perspective projection vs Orthographic projection

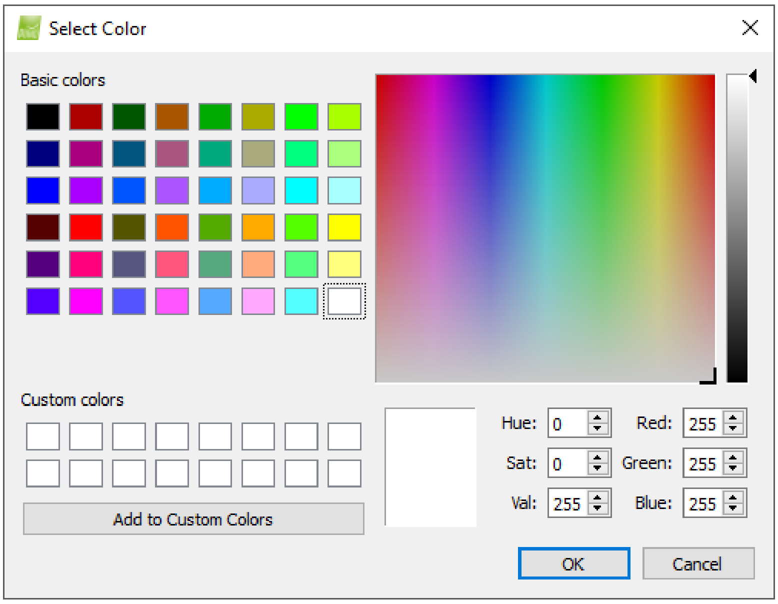
For more information about Perspective/Orthographic projections:

Wiki Orthographic projection
Wiki Perspective projection

Change Background

Allows the user to change the color of the background in the 3D View.

The *Select Color* pop up appears:



The *Select Color* pop-up has the following sections:

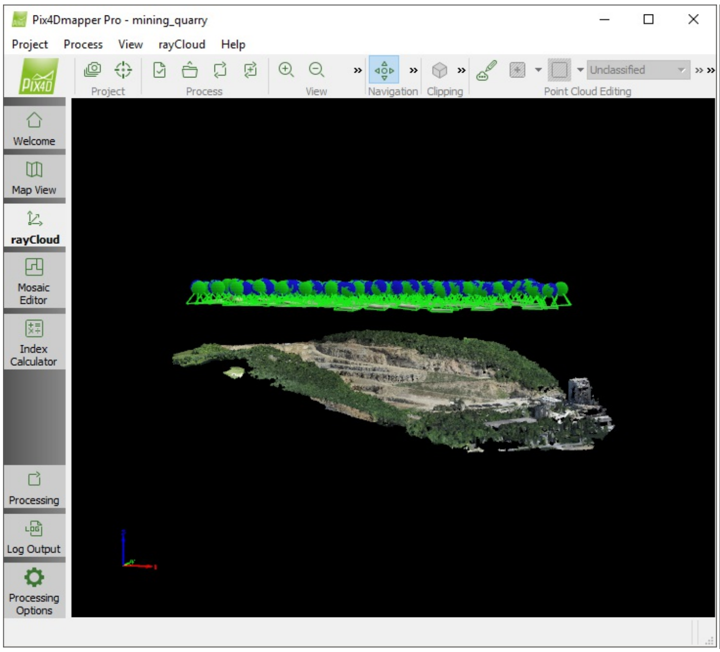
Basic colors: Selects a basic color.
Palette: Selects / modifies a color using the palette.
Color Properties Values: Modifies a color typing the color properties values (Hue, Sat, Val, Red, Green, Blue).
Display of the selected color.
Add color to custom colors: Adds the selected color to custom colors, available for other projects.

And the action buttons:

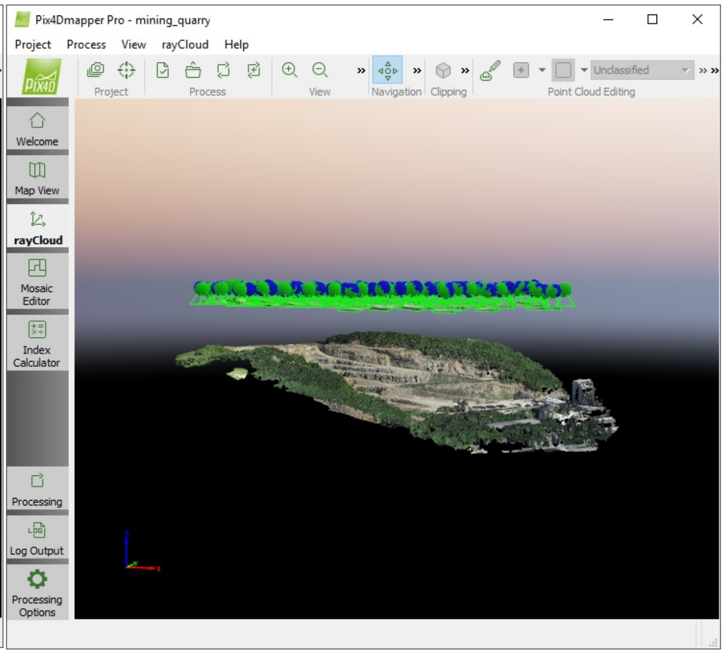
OK: Confirms the changes.
Cancel: Does not save the changes.

Enable Realistic Sky

Allows the user to display a realistic sky gradient in the horizon of the plane where the project is based.



Realistic Sky Disable



Realistic Sky Enable

New Scale Constraint

A Scale Constraint is a an line with known real Cartesian distance between 2 points, allowing to set up a local scale of the model.

It is a mathematical constraint over the geometry of the project.

It is used when:

No GCPs are not being used.

No good image geolocation is used for the images.

It is used to improve the relative accuracy (202556259) by adding a local scale to the project, by defining the real distance between 2 known points.

Important:
It is recommended to use the several Scale Constraint and distribute them along the project.
Once the Scale Constraints objects are added, it is needed to repotimize.

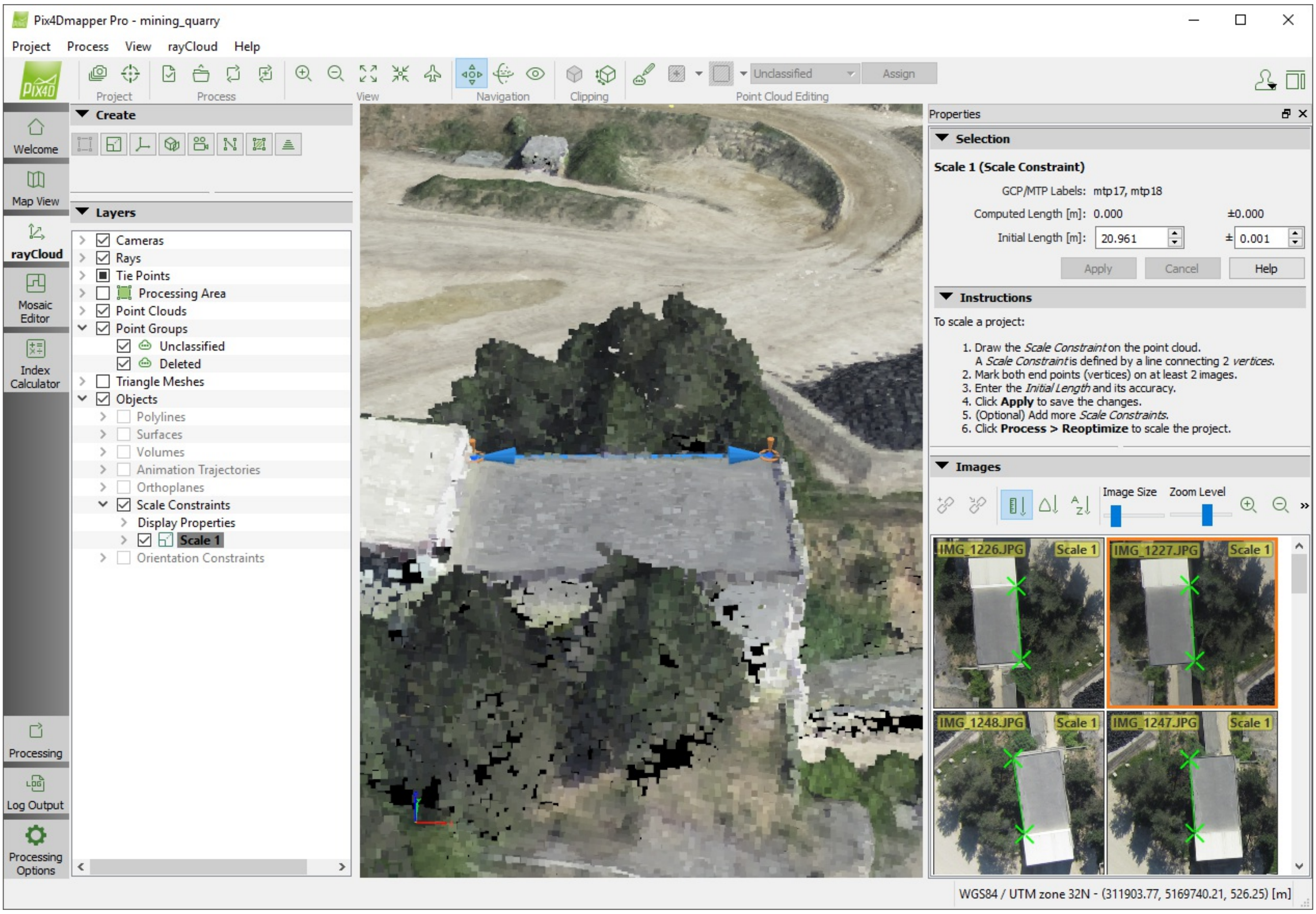
Warning: When creating Scale Constraints, if the project does not have image geolocation, it is suggested as well to create Orientation Constraints to set up an local orientation for the model.

Example: In the real model, the user knows that the Cartesian distance between point 1 and point 2 is 5 meters, then, it is possible to create a scale constraint (line) having as vertices the Points A and B and setting up the distance between the points to 5 meters.

Right click on *Objects* and clicking *New Scale Constraint* allows the user to create a new 3D Scale Constraint.

For step by step instructions about how to draw a new Scale Constraint: 205360375.

Once a new Scale Constraint is created, the right sidebar displays the following information: 202558219.



New Orientation Constraint

A Orientation Constraint is a line that represents a known axis, allowing to set up an local orientation of the model.

It is a mathematical constraint over the geometry of the project.

It is used when:

No GCPs are not being used.
No good image geolocation is used for the images.

It is used to avoid a rotated model or to force a certain orientation for the model, by defining one or more desired axes (X and /or Y and / or Z).

Important:
In case of using several Orientation Constraint, if they represent a different axis (X, Y, Z), they must be placed with 90º between each other to avoid a deformed model.
It is possible to create more than one Orientation Constraint for one axis (for example, X), then, the average value will be used.
Once the Orientation Constraints objects are added, it is needed to repotimize.

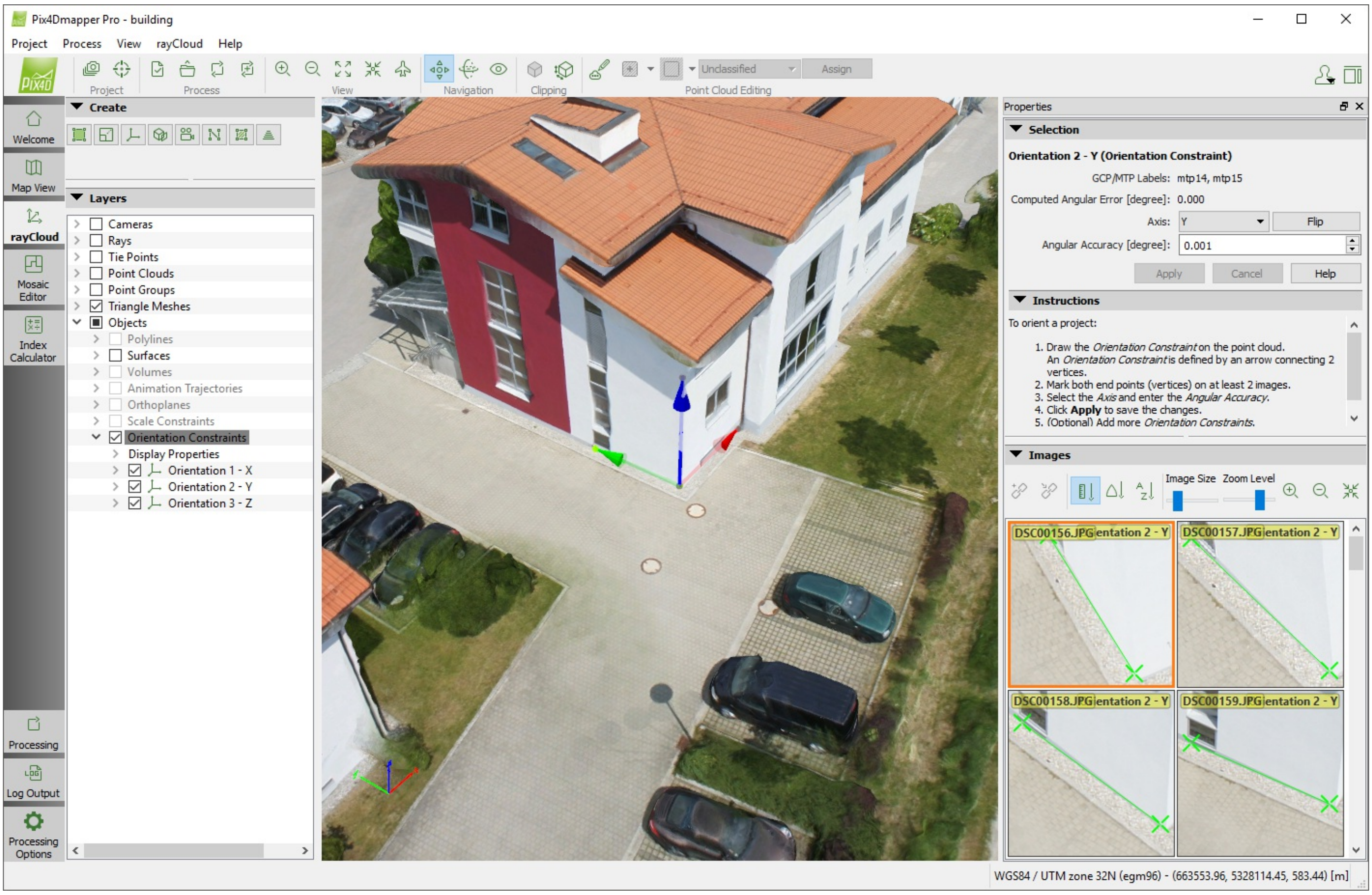
Warning: When creating Orientation Constraints, if the project does not have image geolocation, it is suggested as well to create Scale Constraints to set up a local scale of the model.

Example: In the real model, the user knows that the desired orientation regarding the axis X, Y, and Z, then, it is possible to create 3 Orientation constraint having 90º with each other and selecting which object represents which axis, defining a 3 dimensions coordinate system basis.

Right click on *Objects* and clicking *New Orientation Constraint* allows the user to create a new 3D Orientation Constraint.

For step by step instructions on how to draw a new Scale Constraint: 205360385.

Once a new Scale Constraint is created, the right sidebar displays the following information: 202558219.



New Orthoplane

An Orthoplane is a tool to create one or several orthophotos of arbitrary areas of the model without having any impact / modifications in the model.

It is created by defining orthoprojection areas that allows to set up:

Area of interest (surface and depth).
Location.
Orientation and direction of the projection.

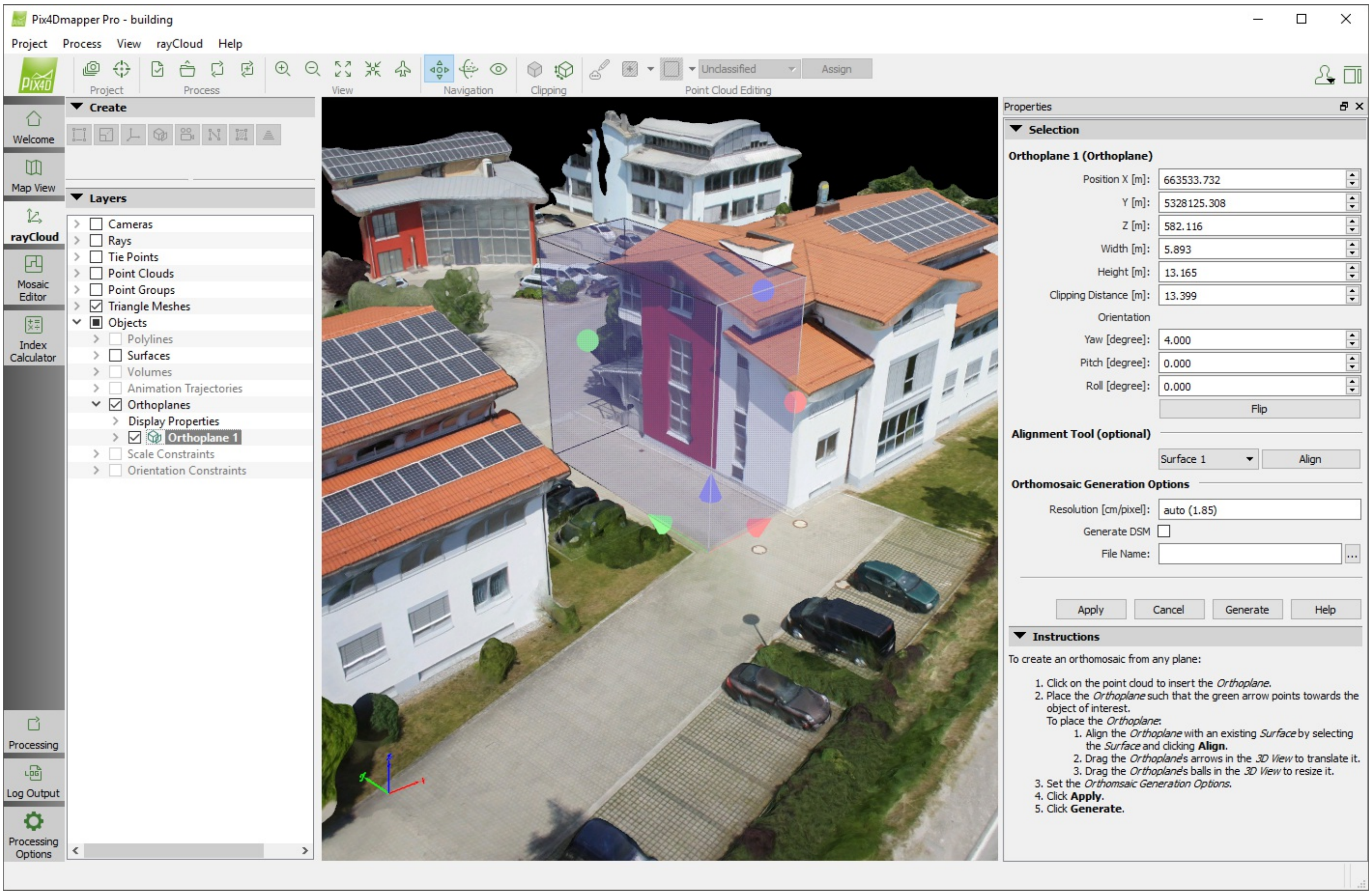
Important: It is important to define properly the box (orthoprojection area):
Area of interest (surface and depth).
Location.
Orientation and direction of the projection.

Only the geometry inside the box (points of the densified point cloud) will be used to find the projection surface.

Right click on *Objects* and clicking *New Orthoplane* allows the user to create a new 3D Orthoplane.

For step by step instructions about how to draw a new Scale Constraint: 204664359.

Once a new Scale Constraint is created, the right sidebar displays the following information: 202558219.



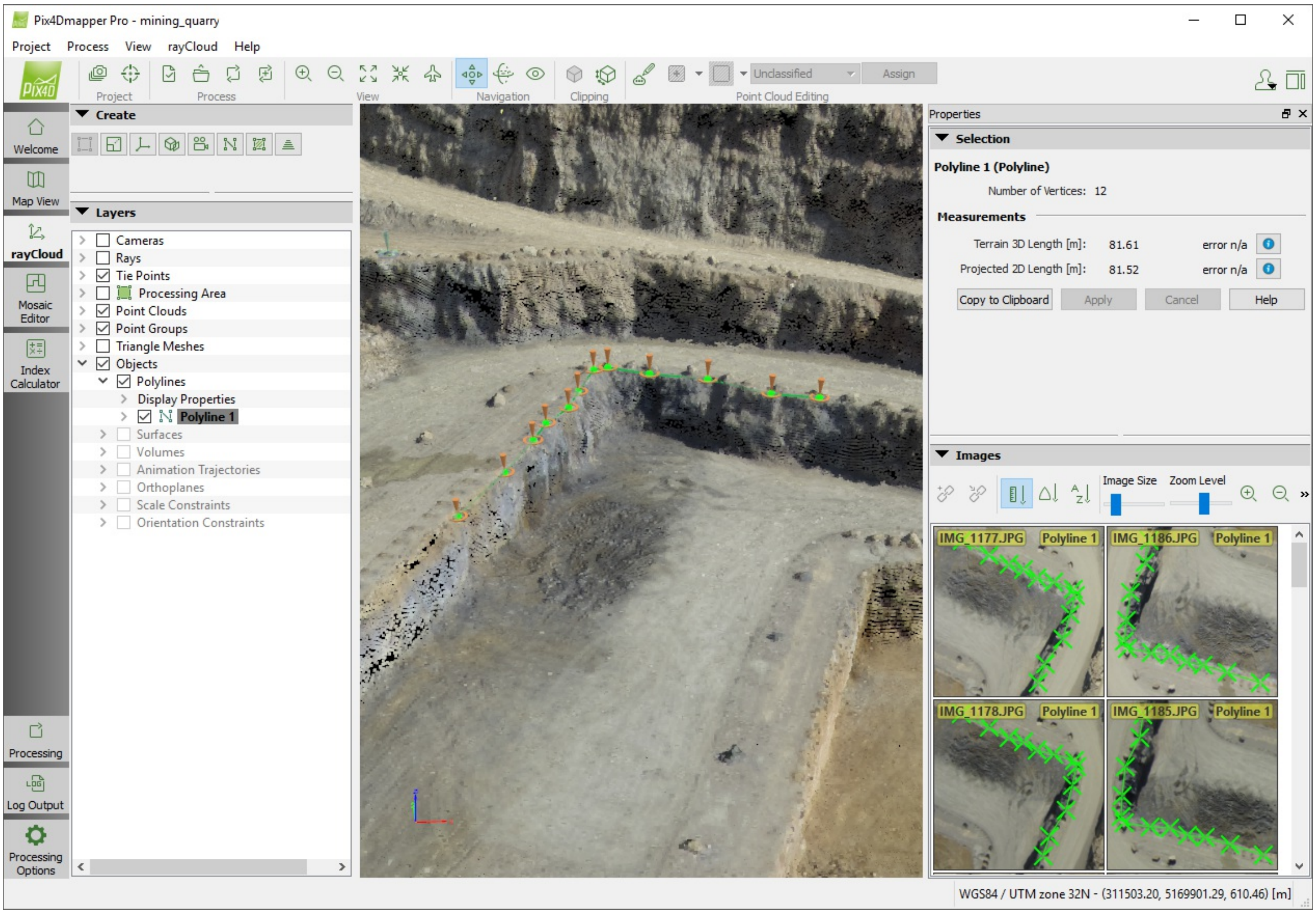
New Polyline

A Polyline Object is a continuous line composed of one or more sub-lines. It is created by specifying the vertices of each line. For more information about the concept of Polyline: 202559829.

Right click on *Objects* and clicking *New Polyline* allows the user to create a new 3D Polyline, i.e. a polyline where each vertex has 3 coordinates.

For step by step instructions about how to draw a new Polyline: 202560309.

Once a new Polyline is created, the right sidebar displays the following information: 202558219.



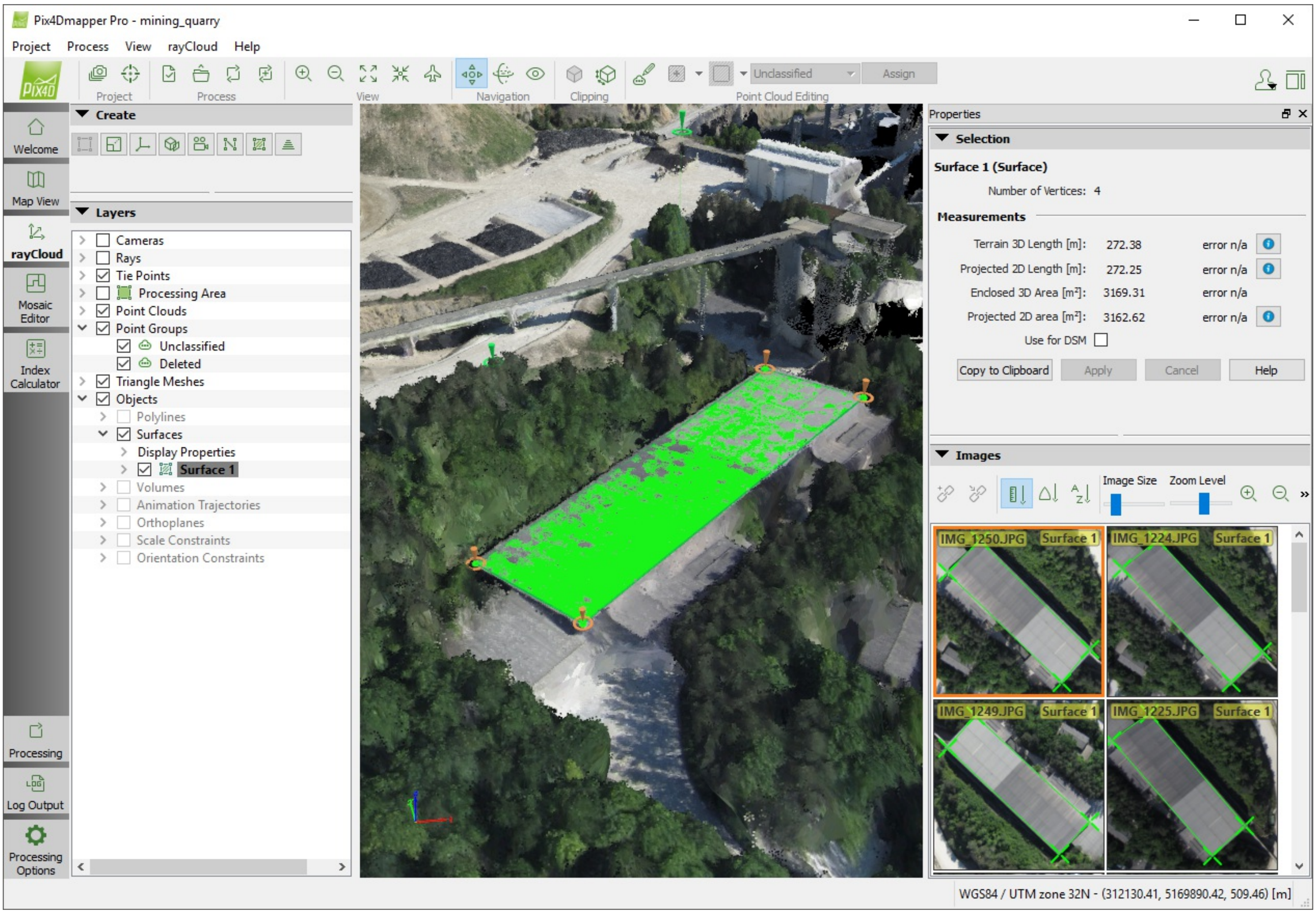
New Surface

A Surface is an object that can be used to define planar areas such as a road, the roof of a building, etc. It can also be used to correct the DSM and generate a better orthomosaic on these surfaces.

Right click on *Objects* and clicking *New Surface* allows the user to create a new 3D planar Surface, i.e. a surface where each vertex has 3 coordinates.

For step by step instructions about how to draw a new Surface: 202560269.

Once a new Surface is created, the *Sidebar* displays following information: 202558219.



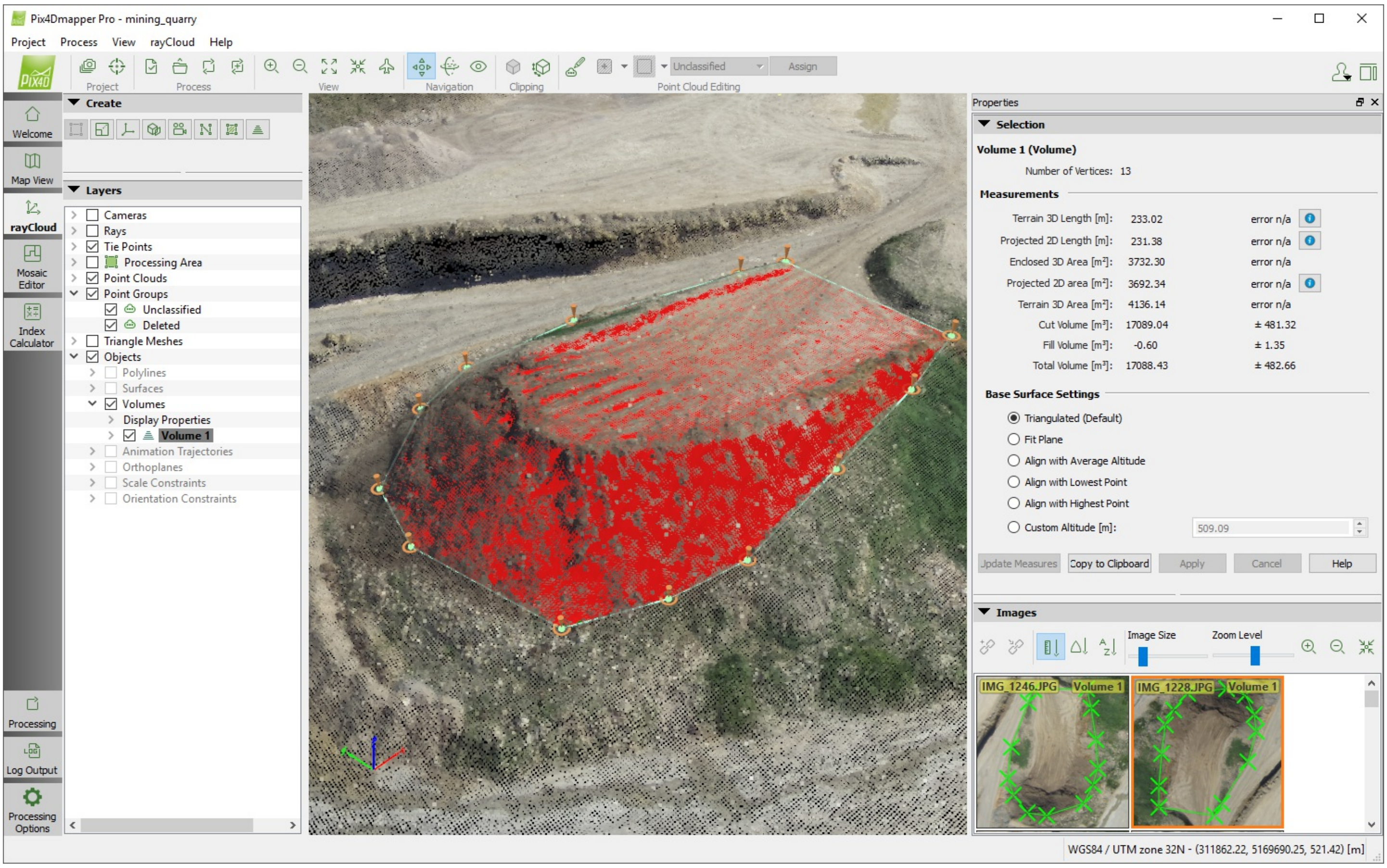
New Volume

A Volume is an object that can be used for volume calculations. It is defined by a 3D Surface called base. The volume is computed between the base and the terrain surface.

Right click on *Objects* and clicking *New Volume* allows the user to create a new volume by defining the base.

For step by step instructions about how to draw a new volume: 202560319.

Once a *New Volume* is created, the *Sidebar* displays the following information: 202558219.



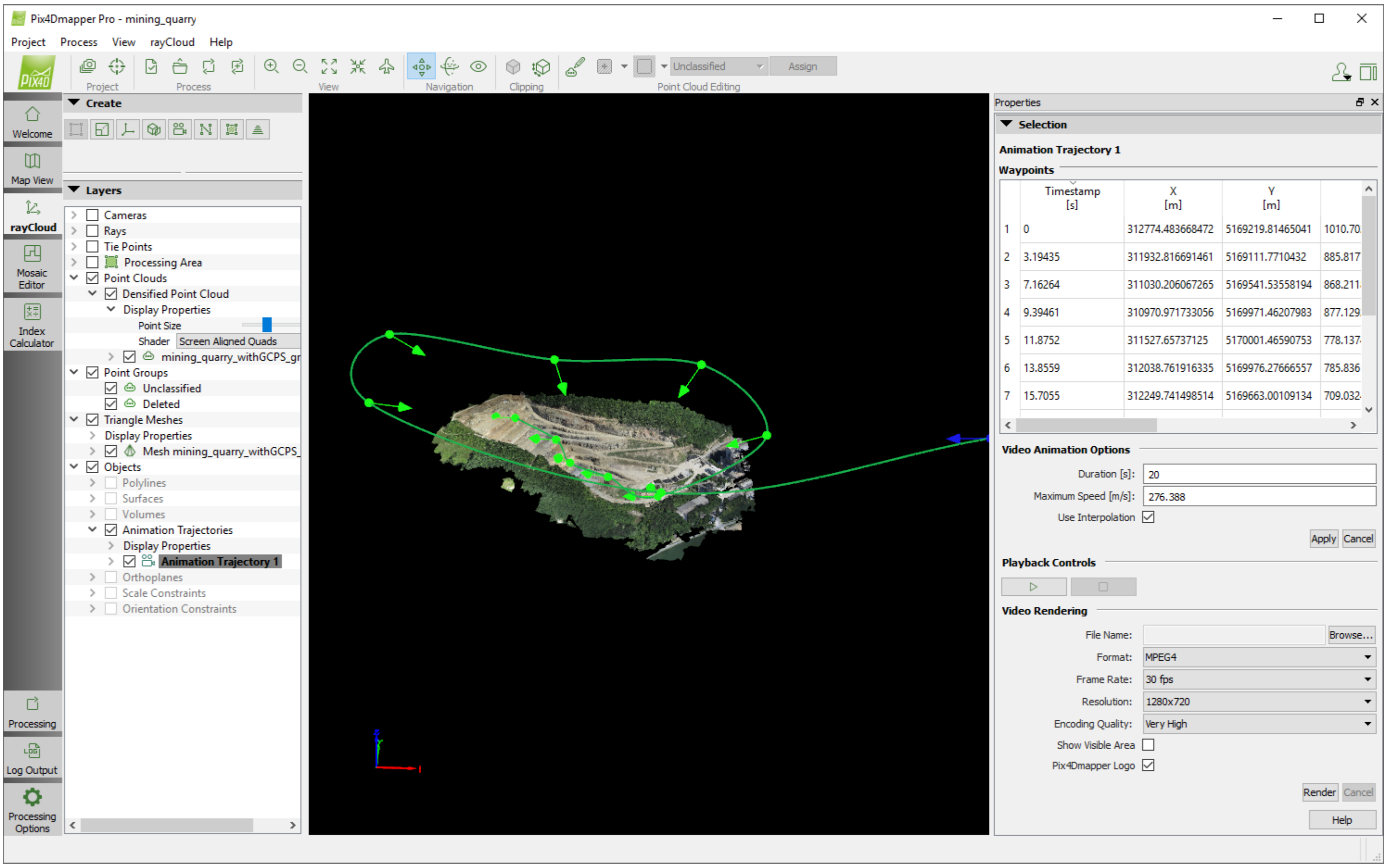
New Video Animation Trajectory

An Animation trajectory is a 3D Fly-trough Animation created as a video.

Right click on *Objects* and clicking *New Video Animation Trajectory* allows the user to create a new Video Animation Trajectory by defining the path of the recording by creating waypoints.

For step by step instructions about how to create a 3D Fly-trough Animation: 202560299.

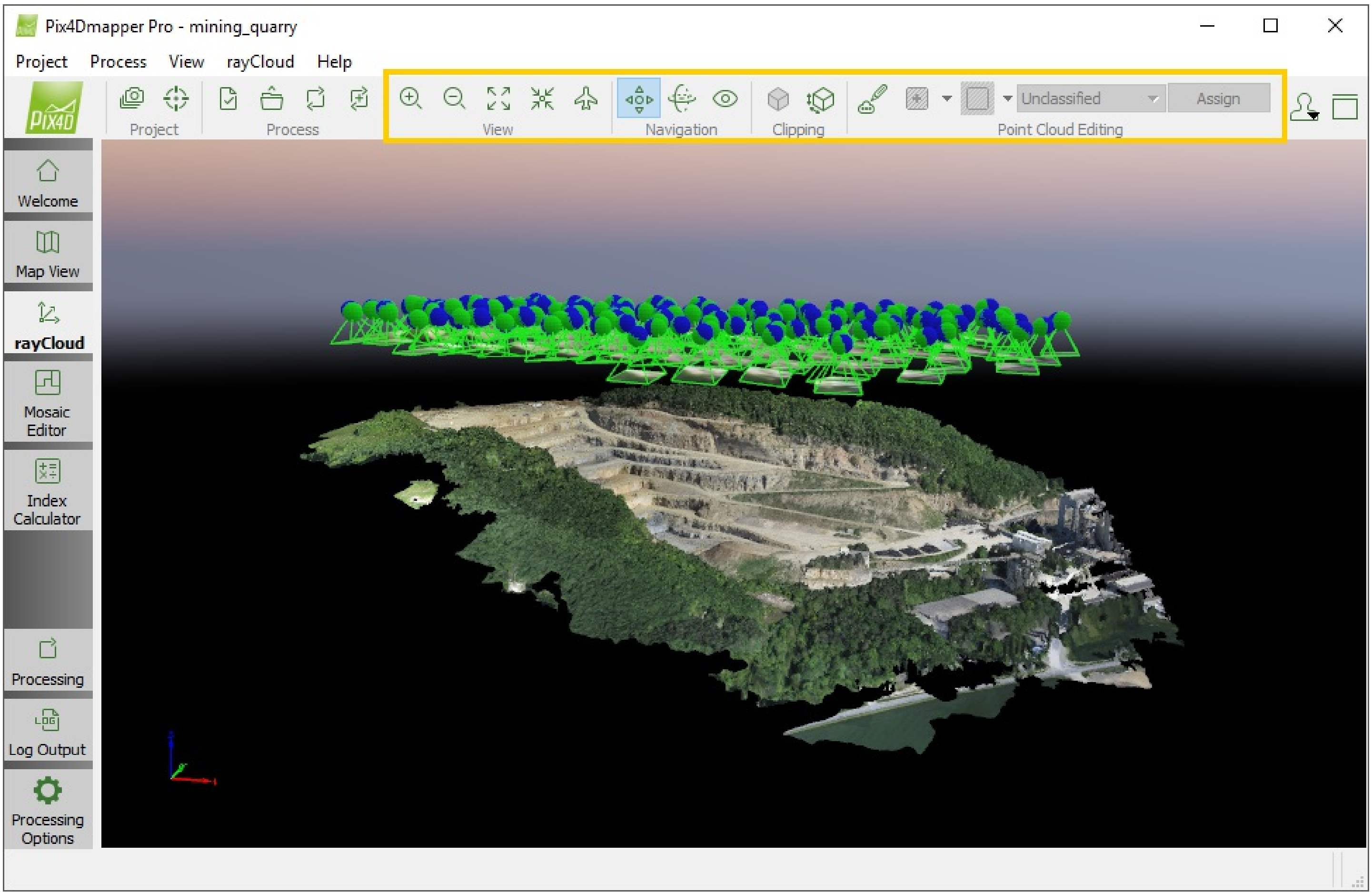
Once a new Animation Trajectory is created, the right sidebar displays the following information: 202558219.



Index > Interface > Menu View > rayCloud

Previous | Next

Access: On the Menu bar, click View > rayCloud.



The following Toolbar buttons are displayed:

Standard Toolbar: For more information: 202557839.
Toolbar extra buttons:

Toolbar extra buttons

View

- Zoom In: Zooms in the selected view.
- Zoom Out: Zooms out the selected view.
- View All: Moves the viewpoint in order to fit all the layers in the 3D View.
- Focus on Selection: Moves the viewpoint in order to display in detail the selected element (point, camera).
- View from Top: Moves the viewpoint in such a way that the layers are viewed from the top and fits all the layers in the 3D View.

Navigation

- Set standard camera
- Set trackball camera
- Set first person camera

Clipping

Note: For step by step instructions about how use the clipping box in the rayCloud: 204048035.

- Clip Point Cloud: Applies the *Clipping Box* in the 3D View and visualizes only the area contained in the Clipping Box.
- Edit Cliping Box: Visualizes the *Clipping Box* in the 3D View, visualize the *Clipping Box* properties in the right sidebar and allows the user to edit it in the 3D View and / or the right sidebar.

Point Cloud Editing

Note: The points of the Point Cloud can be edited by assigning them into a different point group. For step by step instructions about how to edit the point cloud points in the rayCloud: 202560499.

Edit Densified Point Cloud: Enters / exits the Edit Point Cloud Densification mode, enabling / graying out the editing toolbar buttons below.

Add Points to Selection: Allows the user to select the points to be edited.

Remove Points from Selection: Allows the user to unselect the points to be edited.

Select All: Allows the user to select all the visible points to be edited.

Clear Selection: Allows the user to clear all the points selected to be edited.

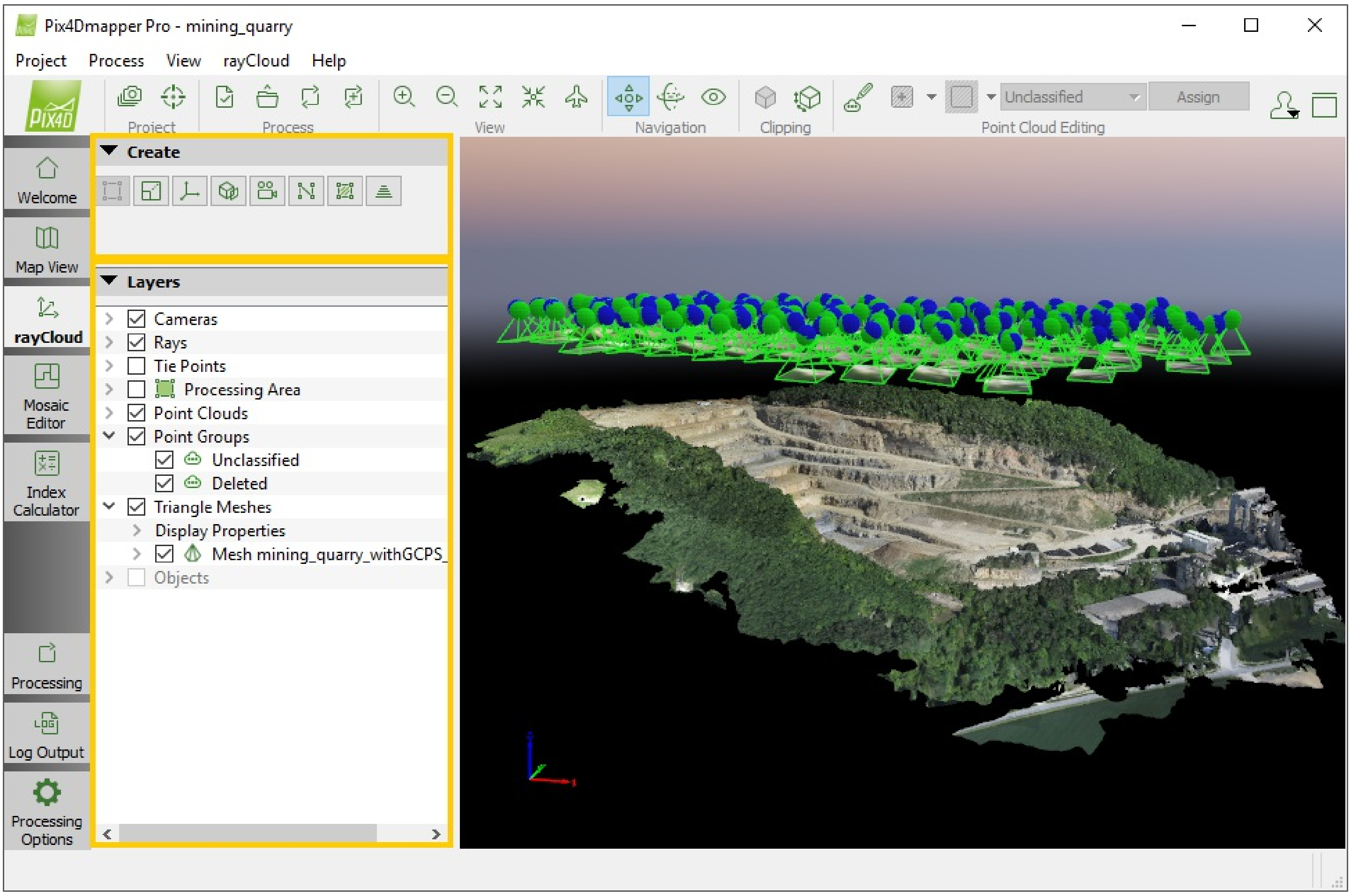
Invert Selection: Converts the selected points to be edited into unselected and vice versa.

Unclassified Allows the user to select the Point Group to which the selected points will be assigned. The options are:

Unclassified: Selected by default. It contains points that do not belong to any other point group. By default, all the points are Unclassified.
Deleted: Points that will not be used for the step *3. DSM, Orthomosaic and Index*. When processing step *3. DSM, Orthomosaic and Index*, only the points belonging to the point group *Deleted* will not be used.
(optional) Terrain: Generated automatically when running the *Run Terrain/Object Point Cloud Classification* or when step *2. Point Cloud and Mesh* has been completed while the processing option *Classify Point Cloud into Terrain/Object Points* is selected. It can also be created manually. When using the option *Generate DTM (beta)*, only the points belonging to the group *Terrain* will be used.
(optional) Objects: Generated automatically when running the *Run Terrain/Object Point Cloud Classification* or when the step *2. Point Cloud and Mesh* has been completed while the processing option *Classify Point Cloud into Terrain/Object Points* is selected. It can also be created manually.
(optional) Others: Any other Group created manually by the user.
New Point Group: Option to create new Point Groups. By clicking *New Point Group*, a pop-up appears, type the new point group name and click OK. The created group is selected.

Assign Assigns the selected points to the selected Point Group.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The left sidebar is displayed on the left of the main window.



The left sidebar consists of the sections :

Create: This section allows the user to create a Processing Area, Orientation Constraints, Scale Constraints, Orthoplanes, Video Animations, Lines, Surfaces and Volumes.
Layers: This section groups all the group of objects that can be displayed on the 3D View.

The left sidebar can be shown / hidden by dragging and dropping the left side border of the 3D View.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Create* section in the left sidebar is displayed on the left of the main window.

The *Create* section consists of icons that allow the user to create a Processing Area, Scale Constraints, Orientation Constraints, Orthoplanes, Polylines, Surfaces and Volumes.

The *Create* section consists of the following icons:

Create Processing Area: Allows the user to create a Processing Area. This icon is grayed our once a Processing Area is created. For step by step instructions: 202560179.
Create a New Scale Constraint: Allows the user to create a new 3D Scale Constraint. For step by step instructions: 205360375.
Create a New Orientation Constraint: Allows the user to create a new 3D Orientation Constraint. For step by step instructions: 205360385.
Create a New Orthoplane Constraint: Allows the user to create a new 3D Orthoplane. For step by step instructions: 204664359.
Create a New Video Animation Trajectory: Starts the New Video Animation Trajectory wizard. For step by step instructions: 202560299
Create a New Polyline Object: Allows the user to create a new 3D Polyline. For step by step instructions: 202560309.
Create a New Surface Object: Allows the user to create a new 3D planar Surface. For step by step instructions: 202560269.
Create a New Volume Object: Allows the user to create a new Stockpile. For step by step instructions: 202560319.

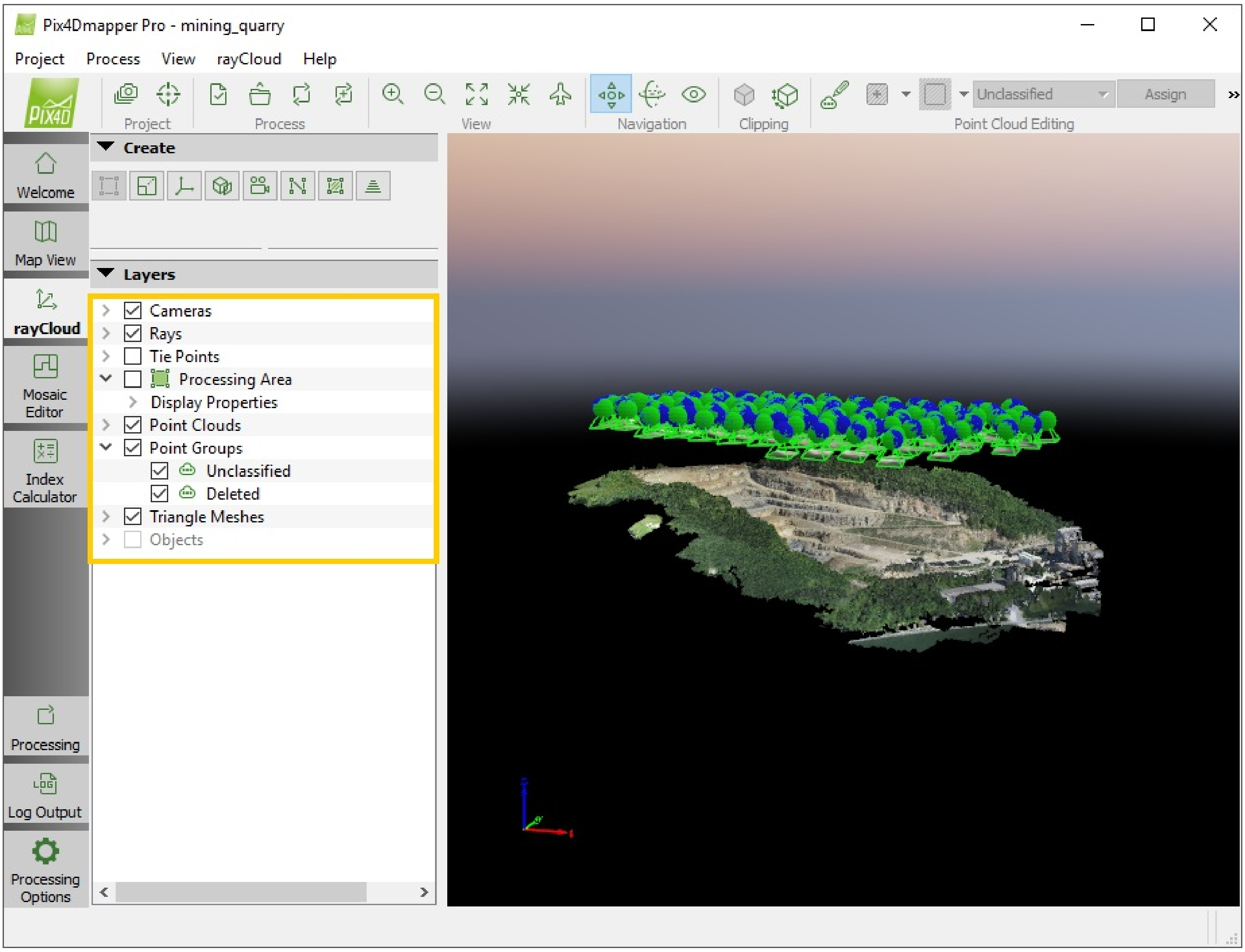
Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.

A layer is a group of objects that can be displayed on the 3D View. The Layers section of the left sidebar contains the following layers:

Cameras: Contains all the cameras of the project. One camera is associated to each image.
Rays: Allows the user to show / hide the rays between selected points in the model and the cameras where the point has been found. Contains the rays display properties.
Tie Points: Contains the Manual Tie Points, GCPs, Check Points and Automatic Tie Points.
Processing Area: Contains the Processing Area.
Point Clouds: Contains point clouds (Densified Point Cloud and loaded external point clouds).
Point Groups: Contains the different groups of points (each point of the densified point cloud is assigned to one group).
Triangle Meshes: Contains Triangle Meshes (generated in Pix4D or imported).
Objects: Contains any drawn object: Polylines, Surfaces, Volumes, Video Animation Trajectories, Orthoplanes, Scale Constraints and Orientation Constraints.

Characteristics:

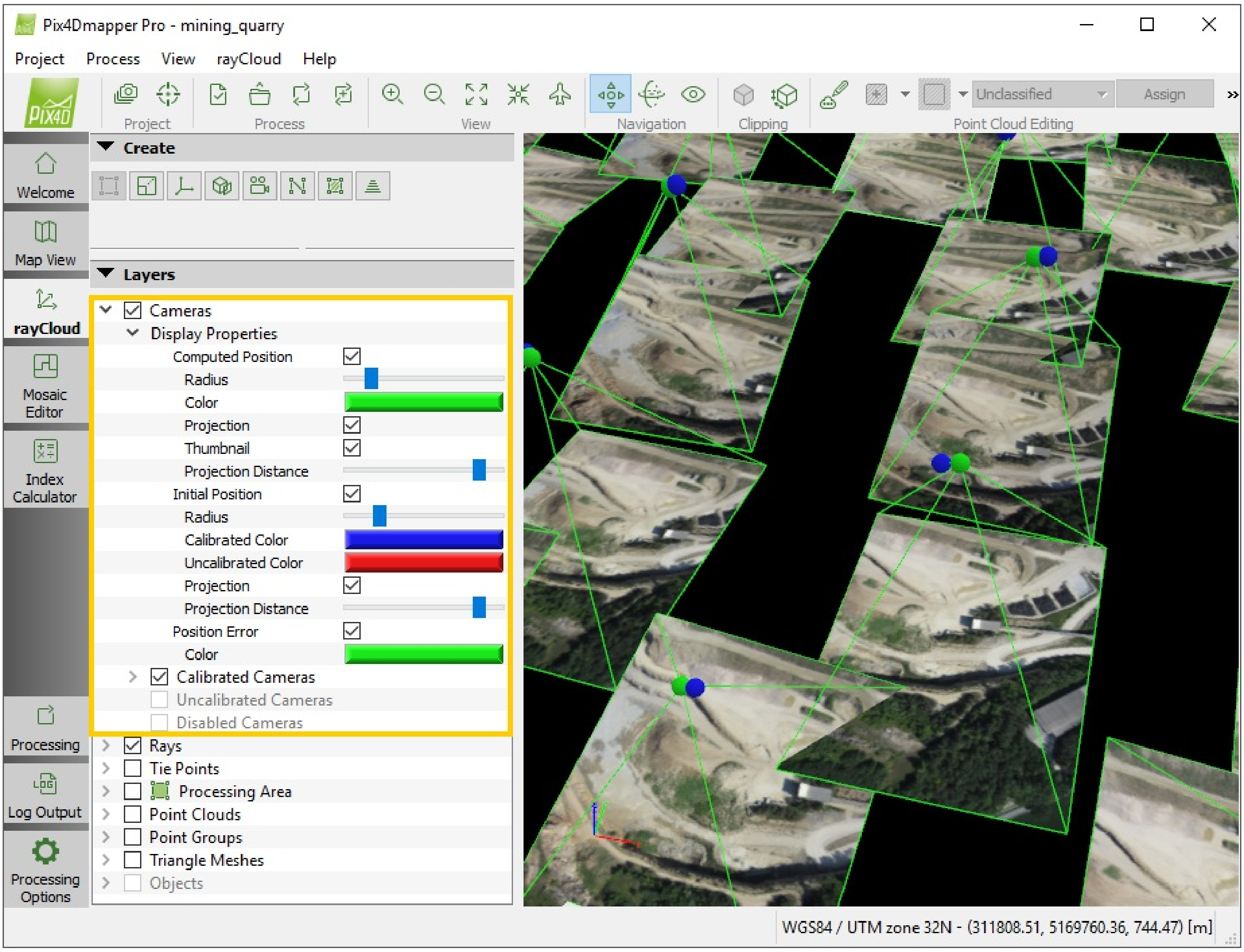
By clicking on the left arrow of a layer, the sub-layers and layer properties are shown or hidden.
By clicking on the a layer's check box, the corresponding layer is shown or hidden in the 3D View.
The different layer properties can be edited.
Some layers have a context menu that can be accessed by right clicking on the corresponding layer.



Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.

The *Cameras* layer contains the following sub-layers:

Display Properties: Displays properties for all the cameras.
Calibrated Cameras: The cameras that have been used for the reconstruction of the model.
Uncalibrated Cameras: The cameras that have not been used for the reconstruction. These cameras are cameras for which the optimized position could not be computed during initial processing and that have been discarded from the reconstruction.
Disabled Cameras: The cameras that have been disabled by the user.



Display Properties

The Display Properties layer allows to edit the display properties for all the cameras. The following properties can be edited:

Computed position: View/hide the calibrated (optimized) camera position sphere (this property affects only the *Calibrated cameras).*
Radius: Increases/decreases the computed camera positions' sphere radius (this property affects only the *Calibrated cameras).*
Color: Selects the computed camera positions' sphere color, the color for the projection lines (between the computed position and the corners of the thumbnails), and the color for the thumbnails borders(this property affects only the *Calibrated cameras).*
Projection: View/hide projection lines between the computed camera positions and the thumbnails (this property affects only the *Calibrated cameras).*
Thumbnail: View/hide a thumbnail of the original images (this property affects only the *Calibrated cameras).*
Projection Distance: Increases/decreases the distance between the computed camera positions and the thumbnails (this property affects only the *Calibrated cameras).*
Initial Position: View/hide the initial camera position sphere.
Radius: Increases/decreases the initial camera positions sphere radius.
Calibrated Color: Selects the initial camera positions' sphere color for the *Calibrated Cameras* (cameras used for the reconstruction).
Uncalibrated color: Selects the initial camera positions' sphere color for the *Uncalibrated Cameras* (cameras not used for the reconstruction).
Projection: View/hide projection lines between the computed camera positions and an hypothetical thumbnails (the thumbnail box appears but empty).

Projection Distance: Increases/decreases the distance between the computed camera positions and the hypothetical thumbnails.
Position Error: View/hide a line between initial and computed camera positions (this property affects only the *Calibrated cameras).*
Color: Color for the line between initial and computed camera positions (this property affects only the *Calibrated cameras).*

Calibrated Cameras

The Calibrated Cameras layer contains the list of Calibrated Cameras.

On the left of each camera name, the icon is displayed to indicate that the camera is calibrated.

Uncalibrated Cameras

The Uncalibrated Cameras layer contains a list of Uncalibrated Cameras.

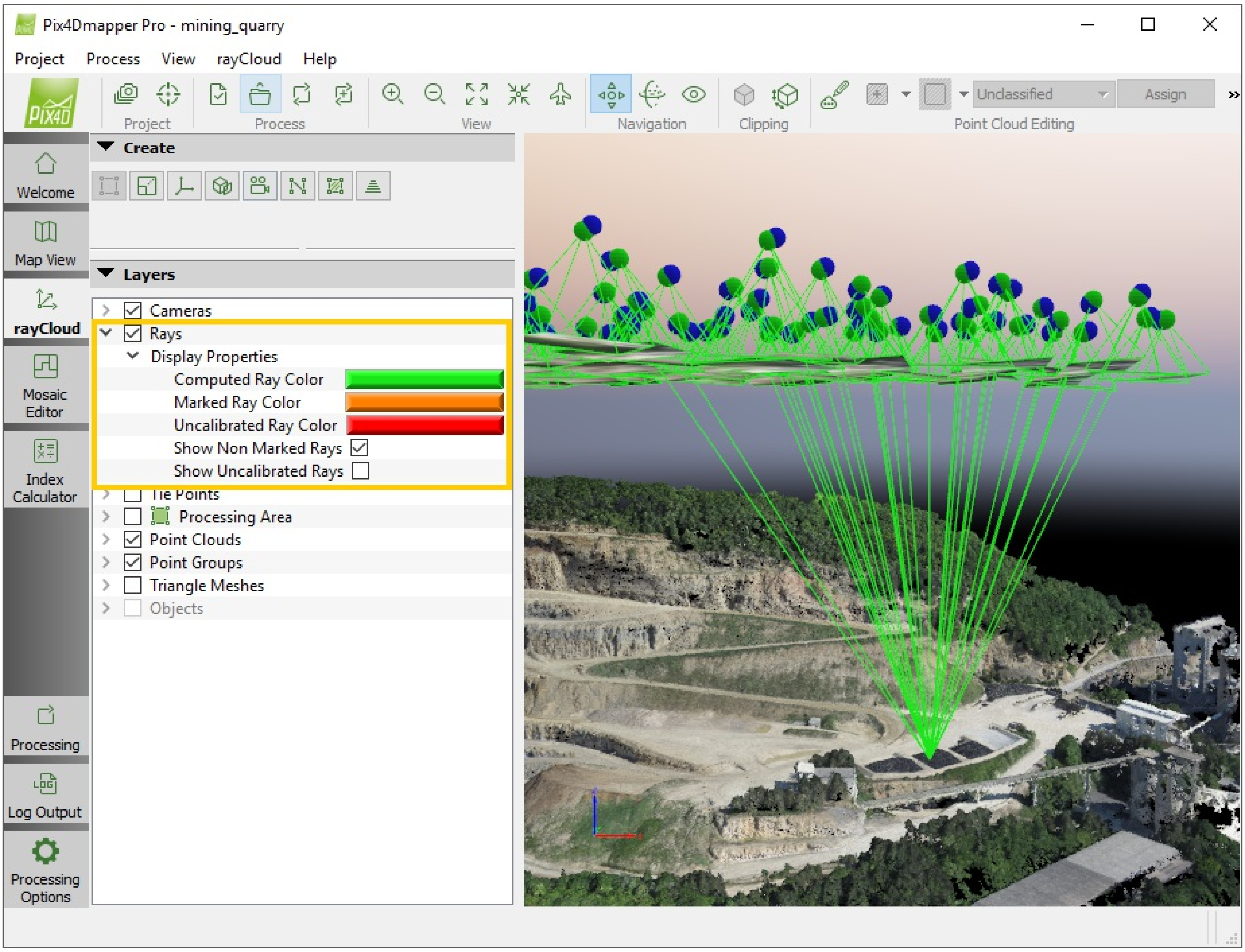
On the left of each camera name, the icon is displayed to indicate that the camera is uncalibrated.

Disabled Images

The Disabled images layes contains a list of the images disabled by the user.

On the left of each camera name, the icon is displayed to indicate that the camera is disabled.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.



Note: Even if the layer *Rays* is selected, if the layer *Cameras* is not selected, the rays will not be visible.

The *Cameras* layer contains the following sub-layer:

Display Properties: Displays properties for all the rays.

Display Properties

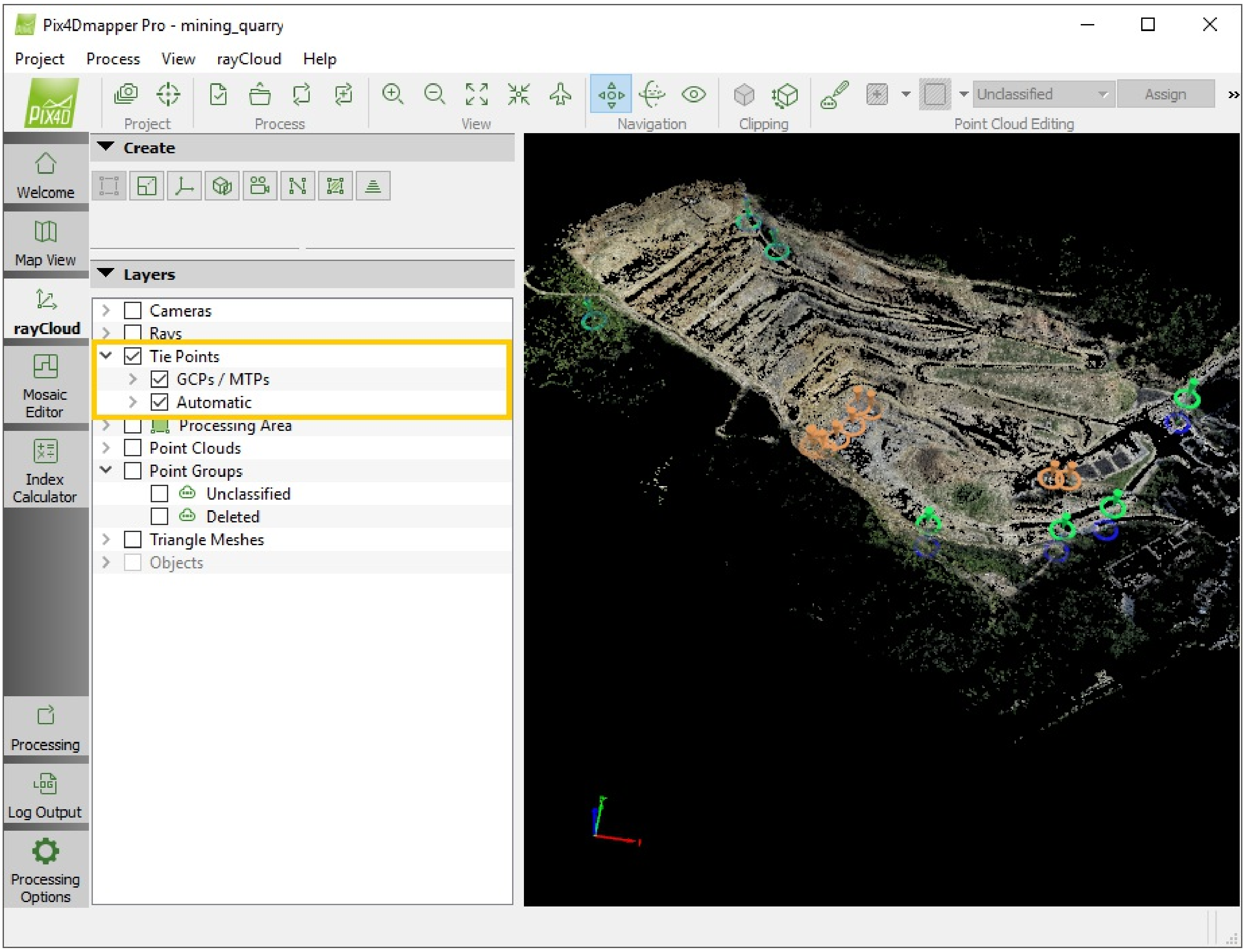
The following properties can be edited:

Computed Ray Color: Selects the ray color for the projection lines between the selected 3D point and the calibrated cameras where the 3D point was visible but not marked, crossing the thumbnail in the 3D point where the point is found in the original image.
Marked Ray Color: Selects the ray color for the projection lines between the selected 3D point and the calibrated cameras where the 3D point was marked, crossing the thumbnail in the point where the 3D point is found in the original image.
Uncalibrated Ray Color: Selects the ray color for the projection lines between the selected 3D point and the not calibrated cameras.
Show Non Marked Rays: View/hide the rays for calibrated cameras where the 3D point was visible but not marked.
Show Uncalibrated Rays: View/hide the rays for uncalibrated cameras.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.

The Tie Points layer contains the following sub-layers:

Manual / GCPs: All the Manual Tie Points, 2D GCPs, 3D GCPs, and Check Points of the project.
Automatic: The Automatic Tie Points computed during initial processing. Only Tie Points visible in at least 3 images are displayed.



Manual / GCPs

The Manual / GCPs layer has the following structure:

Display Properties: Displays properties of all Manual Tie Points and GCPs.
Computed Position: View/hide the points optimized position.
Minimum Pixel Size: Defines the size of the points' computed positions on the screen (not the real size of the points with respect to the model). This property allows the points to be visible both when visualizing the model from very close and from very far. When the zoom level is above the given zoom level defined by the Minimum size property, the points keep the same size on the screen independently from the zoom level. When zooming in closer to the model, below the zoom level defined by the Minimum size property, the size of the points on the screen will increase each time the user zooms in so that the points remain visible even if the view is close to the model.
Minimum Physical Size: Defines the minimum physical size of the points on the 3D View. This defines the zoom level below which the points need to be displayed with their real size with respect to the model so that the points remain visible even when zooming in very close to the model.
Marked Color: Cross color of the points' computed positions for points marked on at least 2 images.
Non marked color: Cross color of the points' computed positions for points marked in less than 2 images.
Initial Position: View/hide the points' initial positions (this property affects only the GCPs and Check points).
Minimum Pixel Size: Defines the size of the points' initial positions on the screen (not the real size of the points with respect to the model). This property allows the points to be visible both when visualizing the model from very close and from very far. When the zoom level is above the given zoom level defined by the Minimum size property, the points keep the same size on the screen independently from the zoom level. When zooming in closer to the model, below the zoom level defined by the Minimum size property, the size of the points on the screen will increase each time zooming in so that the closer to the model the view gets, the points remain visible.
Minimum Physical Size: Defines the physical minimum size of the points on the 3D View. This defines the zoom level below which the points need to be

displayed with its real size with respect to the model so that the points remain visible even when zooming in very close to the model.
Color: Cross color of the points' initial positions for GCPs.
Checkpoint Color: Cross color of the points' initial positions for Check Points.
Position error: View/hide the line between the points' initial and computed positions (this property affects only the GCPs and Check points).
Color: Color for the line between the points' initial and computed positions (this property affects only the GCPs and Check points).
Show Error Ellipsoid: View/hide the ellipsoid formed by the theoretical error. For more information: 202559139.
Color: Color for the error ellipsoid.
Physical Size Scale: Defines the minimum physical size of the ellipsoid on the 3D View. This defines the zoom level below which the ellipsoid need to be displayed with their real size with respect to the model so that the ellipsoid remain visible even when zooming in very close to the model.
List of Manual Tie Points, 2D GCPs, 3D GCPs and Check points: Each point has the following sub-element:
Display Properties: This layer allows the user to edit the display properties for the corresponding point. The properties that can be edited are the same than the properties for all the points.

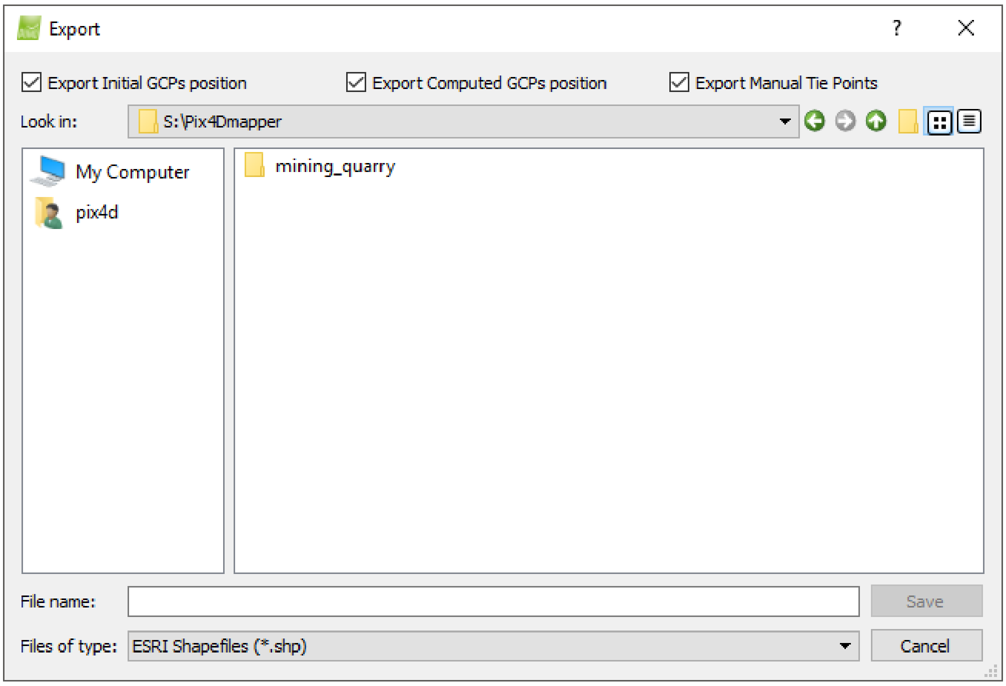
On the left of each point's name, an icon is displayed that indicates the type of the point. The type can be:

Manual Tie Point
2D GCP
3D GCP
Check Point

By right clicking on the Manual / GCPs layer, a context menu with the following action appears:

Export Points: Opens the *Export* pop-up, allowing the user to export Manual Tie Points and/or, export initial and/or computed GCPs position.

Note: If the model does not have GCPs or Manual Tie Points, the option Export Points will be grayed out.



The available formats are:
AutoCad DFX (*.dfx)
ESRI Shapefiles (*.shp)
Keyhole Markup Language (*.kml)
Microstation DGN (*.dgn)

On the top of the *Export* pop-up there are 3 check-boxes that allow the user to select what kind of points to export:

Export Initial GCPs position : Exports the initial position of the GCPs.
Export Computed GCPs position: Exports the computed position of the GCPs.
Export Manual Tie Points: Export the Manual Tie Points.

By right clicking on a point layer, a context menu with the following actions appears:

Rename: Rename the point.
Remove: Removes the point.

Automatic

This layer displays the Automatic Tie Points that are computed during initial processing. Each Tie Point is visible in at least 3 images. The Automatic layer has the following sub-element:

Display Properties: Displays properties of the Automatic Tie Points.
Point Size: Size for each point in the 3D View .

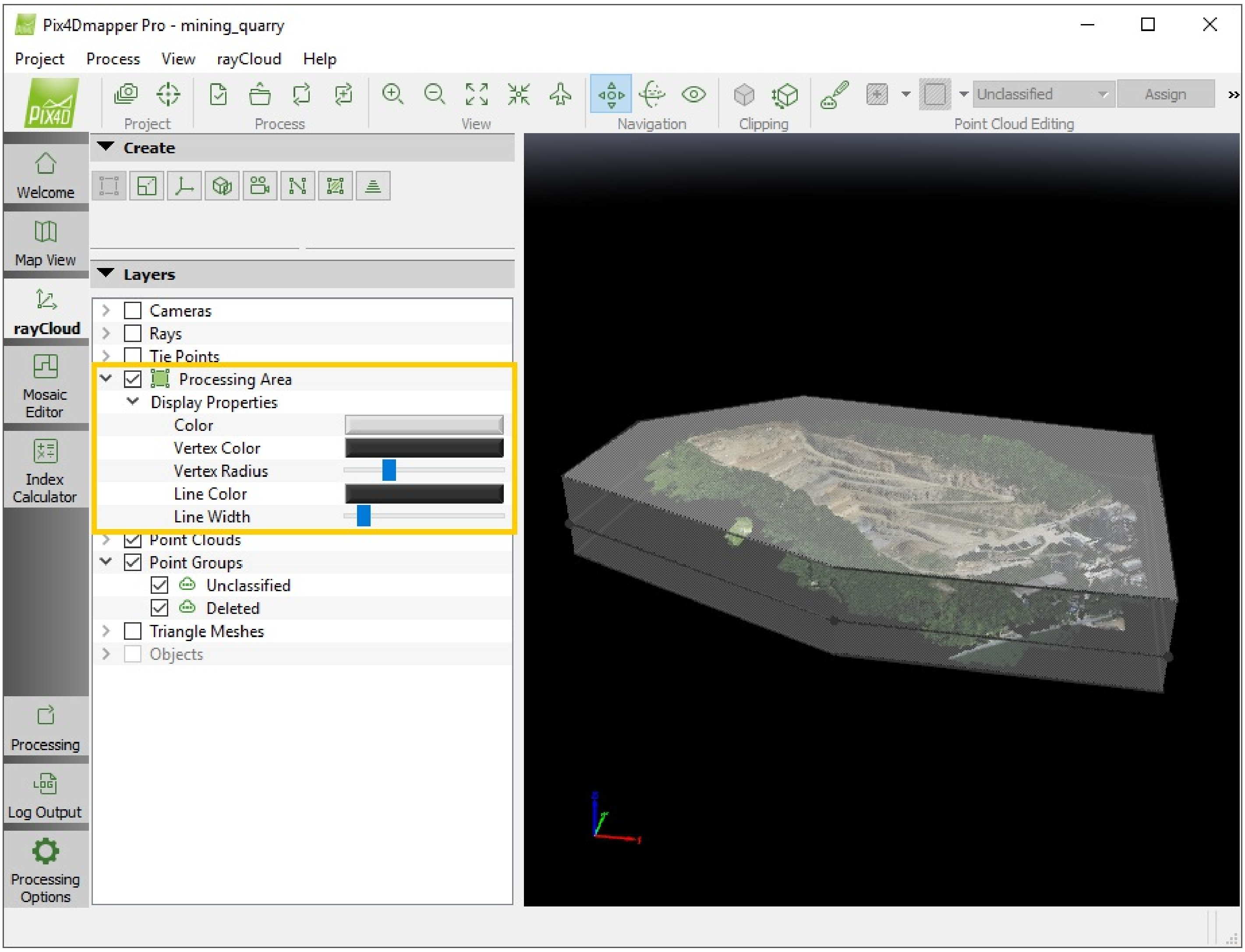
Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.
The *Processing Area* layer appears on the *Layers* section of the left sidebar once a *Processing* Area is drawn.

Warning:
It is recommended to include areas covered by images in the *Processing Area,* so as to exclude areas of low overlap that can affect the results.
The *Processing Area* affects only the visualization of the Automatic Tie Points in the 3D View of the rayCloud. It does not affect the results of step *1. Initial Processing*.
When the *Processing Area* is defined before step *2. Point Cloud and Mesh* is processed, it affects the Point Cloud visualized in the 3D View of the rayCloud and the results saved on disk. This *Processing Area* will also affect the results of step *3. DSM, Orthomosaic and Index*.
When the *Processing Area* is defined after step *2. Point Cloud and Mesh* is completed, it only affects the Point Cloud visualized in the 3D View of the rayCloud but not the results saved on disk. This *Processing Area* will also affect the results of step *3. DSM, Orthomosaic and Index*.
When exporting the Point Cloud, it is possible to take into account the Processing Area, even if it is drawn after step 2 is processed. For more information about how to export the Point Cloud: 203890769.
When the *Processing Area* is defined before step *3. DSM, Orthomosaic and Index* is completed, only the results of step 3 will be affected.

Warning:
In order to take the *Processing Area* into account for the visualization of the Point Cloud and / or the generation of the outputs of step *2. Point Cloud and Mesh*, the corresponding filter should be selected in the *Processing Options*. For more information: 204644369.

The *Processing Area* will be taken into account for the results of step *3. DSM, Orthomosaic and Index* even if the *Processing Areas* box is not selected in the *Point Cloud Filters*.

Note: For step by step instructions about how to select a *Processing Area*: 202560179.



By right clicking on the *Processing Area* layer a context menu with the following option appears:

Remove: Allows the user to remove the Processing Area. The *Create Processing Area* icon in the *Create* section of the left sidebar can be used again to create a new Processing Area. The *Processing Area* layer of the *Layers* section of the left sidebar is removed.

The Processing Area has the following sub-element:

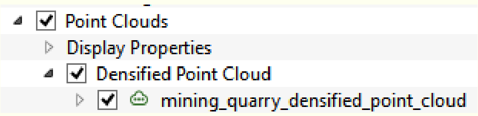
Display Properties: Allows the user to edit the display properties for the Processing Area. The following properties can be edited:
Color: Color of the top, bottom, and side planes that define the area.
Vertex Color: Color of the spheres that represent the vertices of the middle plane of the area.
Vertex Radius: Radius of the spheres that represent the vertices of the middle plane of the area.
Line Color: Color of the lines between the vertices of the planes (bottom, middle, and top planes) of the area.
Line Width: Width of the lines between the vertices of the planes (bottom, middle, and top planes) of the area.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.

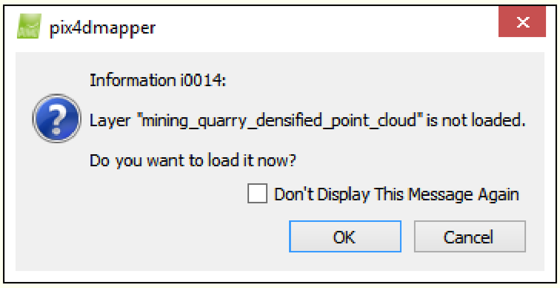
The Point Cloud layer contains the following sub-layers:

Densified Point Cloud: The point cloud that is generated after step 2. *Point Cloud and Mesh.*
External Point Clouds: Any other external point cloud(s) loaded into the project by dragging and dropping a point cloud file.

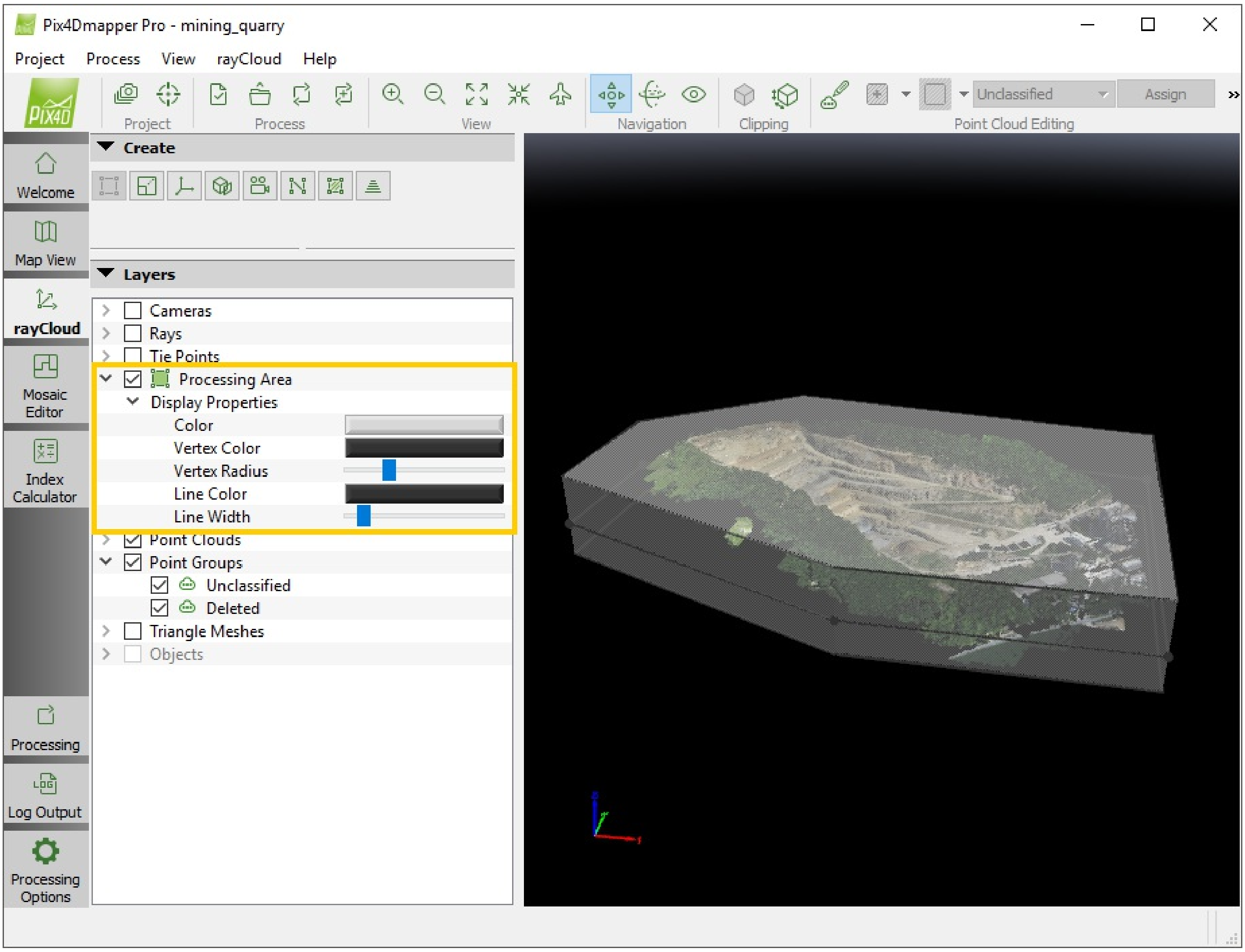
Note: By default, the different point clouds are not loaded or displayed:
The name of a loaded point cloud is displayed standard format, while the name of point clouds that are not loaded are displayed in italics.



By clicking on the point cloud's check box, the corresponding point cloud's visibility is toggled in the 3D View.
Once step 2 is completed, when reopening a project, or when a point cloud has been unloaded:
The point clouds are not loaded in the rayCloud. The next time that the point cloud's check box is selected, the *Information i0014* pop-up message appears:



OK: Loads and displays the mentioned layer in the rayCloud.
Cancel: Closes the pop-up message and does not perform any action.



Densified Point Cloud

The Densified Point Cloud layer has a sub-layer that displays the name of the available point cloud(s). If the point cloud has been generated by splitting it into multiple parts, each part is displayed as one layer. On the left of the point cloud name there is an icon indicating that the layer is a point cloud: .

The loaded point cloud layer has the following sub-elements:

Display Properties: Allows to the user edit the display properties for the densified point cloud. The following property can be edited:
Point Size: Size of each point for the densified point cloud in the 3D View.
Shader: Defines the points shape and color in the 3D View. The different options are:
Screen Aligned Quads (default): Each point is drawn as a flat square where the point is located. It is the fastest to render but produces many artifacts when changing the viewpoint. The color for each point comes from the reconstruction.
Spherical Points: Each point is drawn as a non-perspective corrected sphere, for example, an approximated ball. It reduces the artifacts when moving the view but is not correct when the points are very close to the viewpoint. It gives the best compromise between rendering speed and image quality. The color for each point comes from the reconstruction
Spherical Points (HD): Each point is drawn as a perspective corrected sphere. This gives the highest image quality but it is very slow to render. The color for each point comes from the reconstruction.
Screen aligned quads, Altitude (Red,Green,Blue): The same as *Screen Aligned Quads* but the color for each point is given by the altitude.
Spherical Points, Altitude (Red,Green,Blue): The same as *Spherical Points* but the color for each point is given by the altitude.
Spherical Points (HD), Altitude (Red,Green,Blue): The same as *Spherical Points (HD)* but the color for each point is given by the altitude.
Screen aligned quads, Thermal: Useful for thermal project. The same as *Screen Aligned Quads* but the color for each point is given by the value of the channel in the Ironbow palette.
Spherical Points, Thermal: Useful for thermal project. The same as *Spherical Points* but the color for each point is given by the value of the channel in the Ironbow palette.

By clicking on an specific densified point cloud's check box, the corresponding point cloud is shown or hidden in the 3D View.

By right clicking on an specific densified point cloud's name, a context menu with the following action appears:

Load Layer: Visible if the point cloud is not loaded, loads the point cloud in the rayCloud.
Unload Layer: Visible if the point cloud is loaded, unloads the point cloud from the rayCloud.

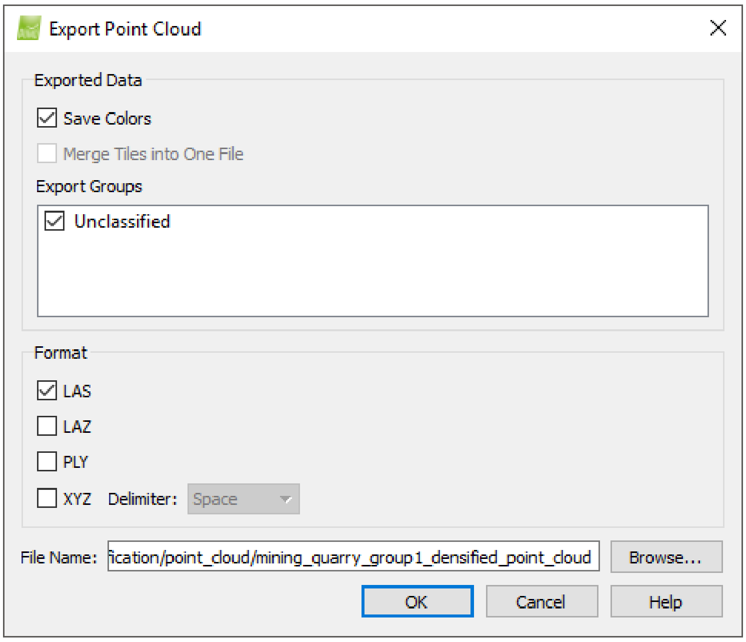
Tip: Loaded layers consume RAM and GPU memory. Unloading layers that are not needed increases the speed using the rayCloud.

Export Point Cloud: Allows the user to export a Densified Point Cloud of all the selected Point Groups, with the selected properties, in the selected formats and with the desired path / file name.

Important: If a Processing Area exists, only points withing the processing area are exported.

Useful in cases where:
The Point Cloud has been modified using the rayCloud (deleted points, changed or created the Processing area).
The intent is to export only one/some Point Groups.
Some point cloud format files were not generated (not selected in the processing options).
Change output options: Save/discard colors.

By clicking Export Point Cloud, the *Export Point Cloud* pop-up appears:



It contains 2 sections:
Exported Data: Allows the user to configure some parameters for the exporting and allows to select the *Point Groups* to export.
Save Colors: Selected by default, this saves the color values for each point of the Point Cloud of the .PLY file.

Note: .las and .laz files always have color information. .xyz files do not have color.

Merge Tiles Into One File: Not selected by default. In case the Point Cloud output files were divided in parts, this forces to export all parts within the same file by merging the parts.

Warning: When generating the Point Cloud, if the file is too large and the computer memory cannot process the full file, it is divided in parts.

When exporting a point cloud and selecting Merge Tiles Into One file, the software requires less memory than when generating them. However, if the computer resources are not sufficient, it may fail.

Export Groups: Allows the user to select which Point Groups will be exported for the Densified Point Cloud. By default, all the Point Groups are selected. When a classification has been created (by creating Point Groups and assigning points to the groups or by using *Terrain/Objects Point Cloud Classification (beta)*, more point groups appear in the *Export Groups* section. By selecting the box next to the point group name, the point group will be exported.

Warning: The exported Densified Point Cloud will contain all the Point Groups selected. By default all the Point Groups are selected. The Deleted Point Group cannot be exported.

Format: Allows the user to select the different formats in which the Point Cloud is exported. It is possible to select:
LAS
LAZ
PLY
XYZ (it is possible to use as delimiter: Space, Tab, Comma and Semicolon).

And:

File Name: Displays the path and name where the Point Cloud will be stored. By default, this is the project folder where the Point Cloud is stored after step 2. *Point Cloud and Mesh*.

Browse...: Allows the user to select the path/name where the the exported Point Cloud will be stored.

Warning: If the exported Point Cloud file is saved with the same name in the same folder where an existing file exists, it will replace the existing Point Cloud.

OK : Saves the project and exports the selected formats with the selected parameters.
Cancel: Closes the pop-up message and does not perform any action.

External Point Clouds

It is possible to visualize other point clouds by selecting the point cloud file and dragging and dropping it onto the *Point Clouds* layer. A new sub-layer is added to the Point Clouds layer with the path to the loaded file as name. The loaded point cloud has the following sub-element:

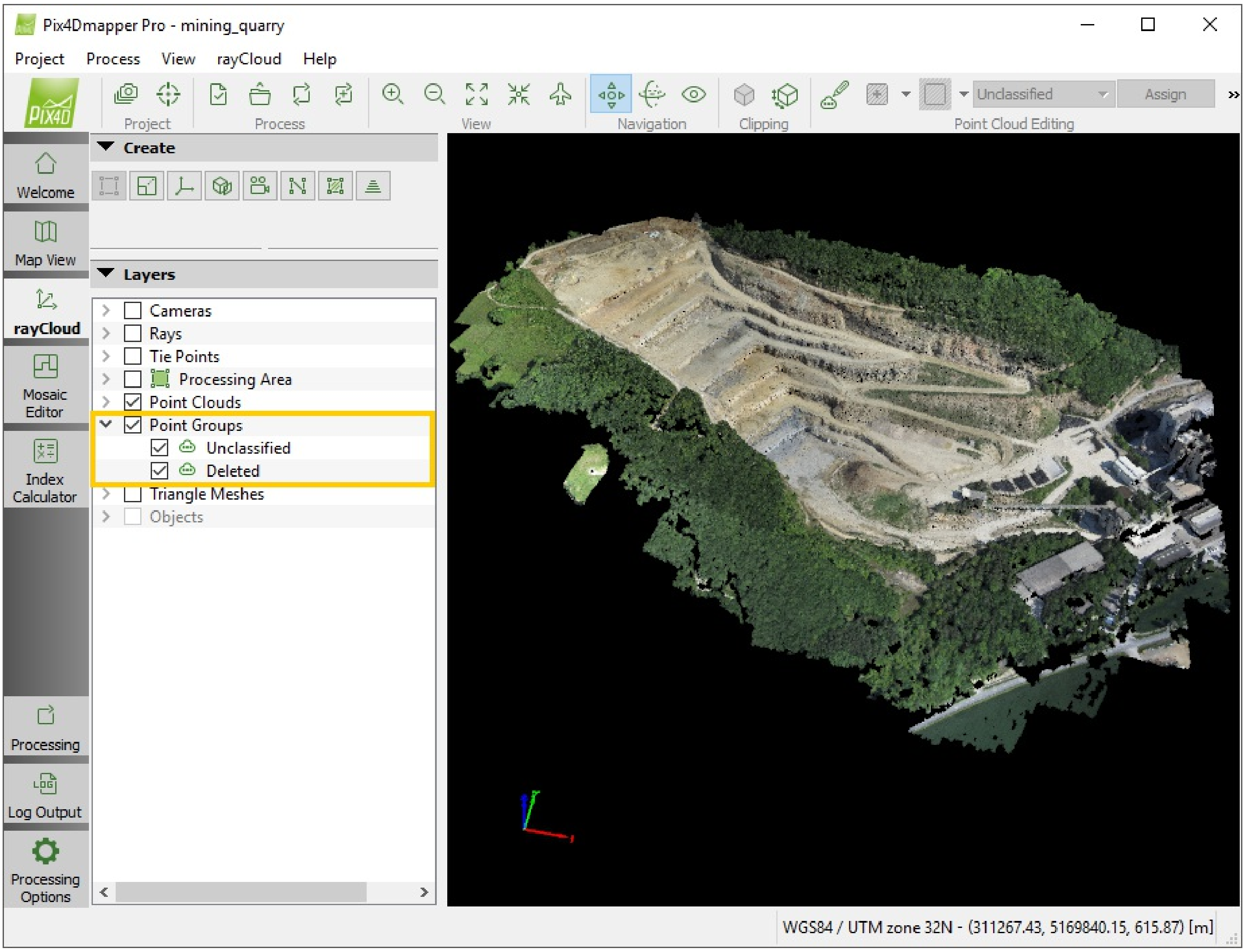
Properties: Displays properties for the corresponding point cloud.
Point Size: Size of each point for the corresponding point cloud in the 3D View.
Shader: Defines the points shape and color in the 3D View. The different options are:
Screen Aligned Quads (default): Each point is drawn as a flat square where the point is located. It is the fastest to render but produces many artifacts when changing the viewpoint. The color for each point comes from the reconstruction.
Spherical Points: Each point is drawn as a non-perspective corrected sphere, for example, an approximated ball. It reduces the artifacts when moving the view but is not correct when the points are very close to the viewpoint. It gives the best compromise between rendering speed and image quality. The color for each point comes from the reconstruction
Spherical Points (HD): Each point is drawn as a perspective corrected sphere. This gives the highest image quality but it is very slow to render. The color for each point comes from the reconstruction.
Screen aligned quads, Altitude (Red,Green,Blue): The same as *Screen Aligned Quads* but the color for each point is given by the altitude.
Spherical Points, Altitude (Red,Green,Blue): The same as *Spherical Points* but the color for each point is given by the altitude.
Spherical Points (HD), Altitude (Red,Green,Blue): The same as *Spherical Points (HD)* but the color for each point is given by the altitude.

The following formats can be loaded:

.las
.laz

Loaded point clouds are displayed in the right position if it is a Pix4Dmapper file or an external file using the same coordinate system as the output coordinate system selected in Pix4Dmapper.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.



The Point Groups layer contains the following sub-layers:

Unclassified: Selected by default. It contains points that do not belong to any other point group. By default, all the points are Unclassified.
Deleted: Points that will not be used for the step *3. DSM, Orthomosaic and Index.* When processing step *3. DSM, Orthomosaic and Index*, only the points belonging to the point group *Deleted* will not be used.
(optional) Terrain: Generated automatically when running the *Run Terrain/Object Point Cloud Classification* or when step *2. Point Cloud and Mesh* has been completed while the processing option *Classify Point Cloud into Terrain/Object Points* is selected. It can also be created manually. When using the option *Generate DTM (beta)*, only the points belonging to the group *Terrain* will be used.
(optional) Objects: Generated automatically when running the *Run Terrain/Object Point Cloud Classification* or when the step *2. Point Cloud and Mesh* has been completed while the processing option *Classify Point Cloud into Terrain/Object Points* is selected. It can also be created manually.
(optional) Others: Any other Group created manually by the user.

By clicking on an specific Point Group check box, the corresponding Point Group is shown or hidden in the 3D View.

By right clicking on an specific Point Group, a context menu with the following action appears:

Rename: Allows to change the Point Group name.
Remove: Deletes the selected Point Group.

For:

Unclassified: Rename and Remove are grayed out.
Deleted: Rename and Remove are grayed out.
(optional) Terrain: Rename is grayed out.
(optional) Objects: Rename and Remove are available.
(optional) Others: Rename and Remove are available.

By right clicking on the Point Groups layer, a context menu with the following action appears:

New Point Group: Option to create new Point Groups. By clicking *New Point Group*, a new point group named *Group1* will be created in the Point Groups sub-layer.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.

The Triangle Meshes layer can display a 3D Textured Mesh.

By default, the 3D Textured Mesh (if generated) is not loaded in the rayCloud. If it has been generated, by selecting it, it will be loaded and displayed in the rayCloud.
By clicking the triangle mesh's check box, the corresponding triangle mesh is shown or hidden in the 3D View.

The Triange Meshes layer can also display a 2.5D Triangle Mesh of any point cloud file that has been loaded by dragging and dropping it on the *Triangle Meshes* layer. The following formats can be dragged and dropped:

.las
.laz

It displays a 2.5D triangle mesh. Displayed in the right position if it is a Pix4Dmapper file or external file using the same coordinate system than the output coordinate system selected in Pix4Dmapper.

Warning: DO NOT drag and drop a point cloud to generate the Triangle Mesh while a project is processing: the processing may stop.

Once step *2. Point Cloud and Mesh* is completed, when reopening a project, or when a triangle mesh has been unloaded:

The Triangle Meshes are not loaded in the rayCloud. Next time that the triangle mesh's check box is clicked, the triangle mesh is loaded again.

The *Triangle Meshes* layer contains the following sub-layers:

Display Properties: Displays properties for all the triangle meshes.
List of triangle meshes: All the triangle meshes loaded in the project.

Display Properties

Displays properties for all the triangle meshes.

Allows the user to edit the display properties for all the triangle meshes. The following properties can be edited:

Color: The color of all the triangles of the triangle meshes. The color is only applied to the monochrome shader. The default color is gray.
Shader: Specifies the way each triangle of the mesh is colored. The color is related to the 3D position of each triangle. The mesh can be colored in different ways:
Textured: Selected by default for the 3D textured Mesh generated for the project. Not available for dragged and dropped triangle meshes. The triangles are colored with the texture file generated when generating the 3D Textured Mesh.
Monochrome: The triangles are colored with a color-to-black scale that depends on an angle measured with respect to a virtual sun positioned 45 degrees from the north-east horizon. It uses the color selected above.
Color: The triangles are colored with an RGB scale. The color of a triangle depends on an angle measured with respect to 3 virtual suns that have Red, Green, and Blue illumination. The color of each triangle is the combination of the light received by the three virtual suns. This shader displays a slope map if the model is viewed from above. It gives information about the orientation of each surface.
Altitude (Red, Green, Blue): The triangles are colored with an RGB scale. The color of a triangle depends on the altitude of the triangle.
Altitude (Topography): The triangles are colored with a default scale. The color of a triangle depends on the altitude of the triangle.
Thermal: Useful for thermal project. The triangles are colored according to the channel value in the Ironbow palette.

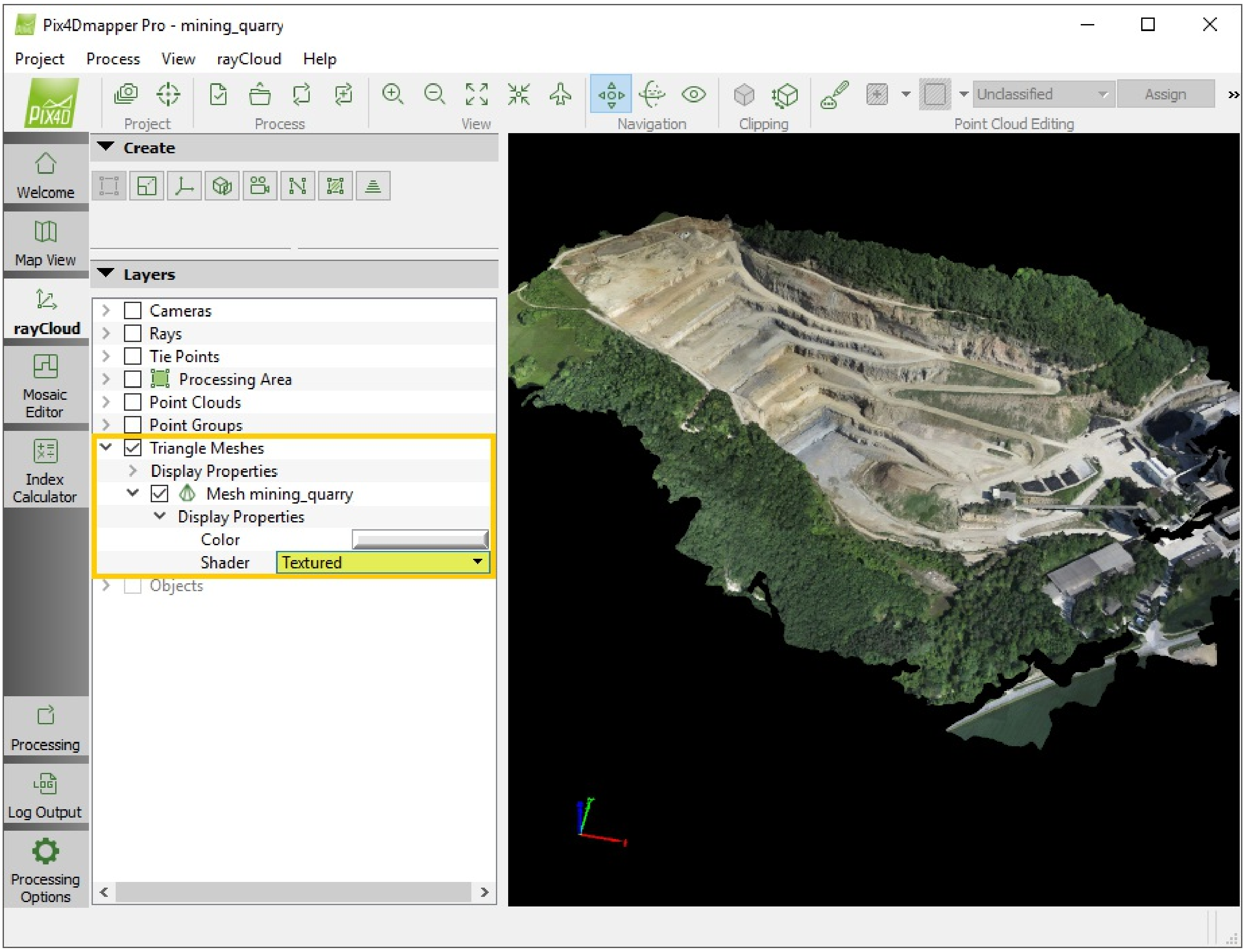


Figure 1. Texture

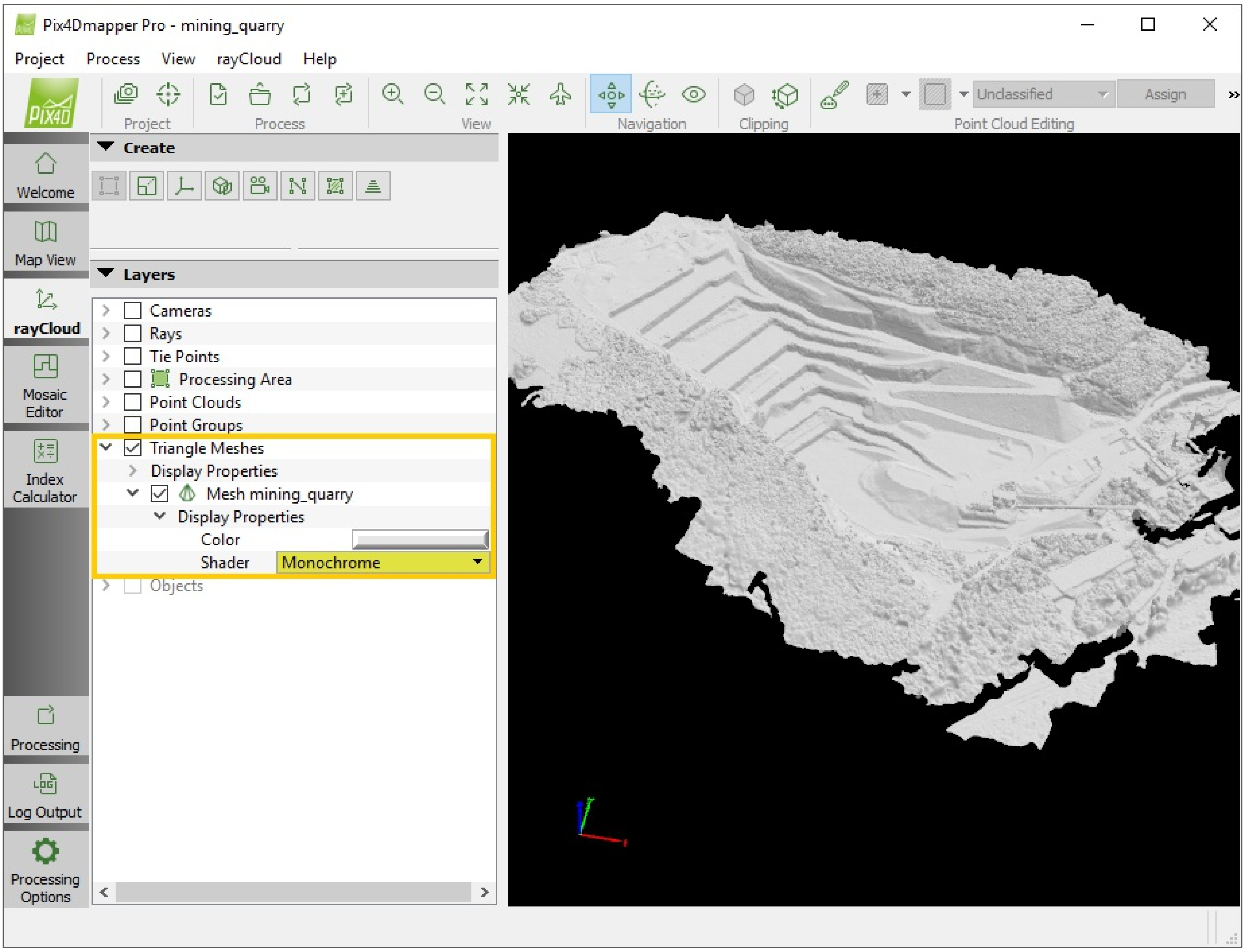


Figure 2. Monochrome

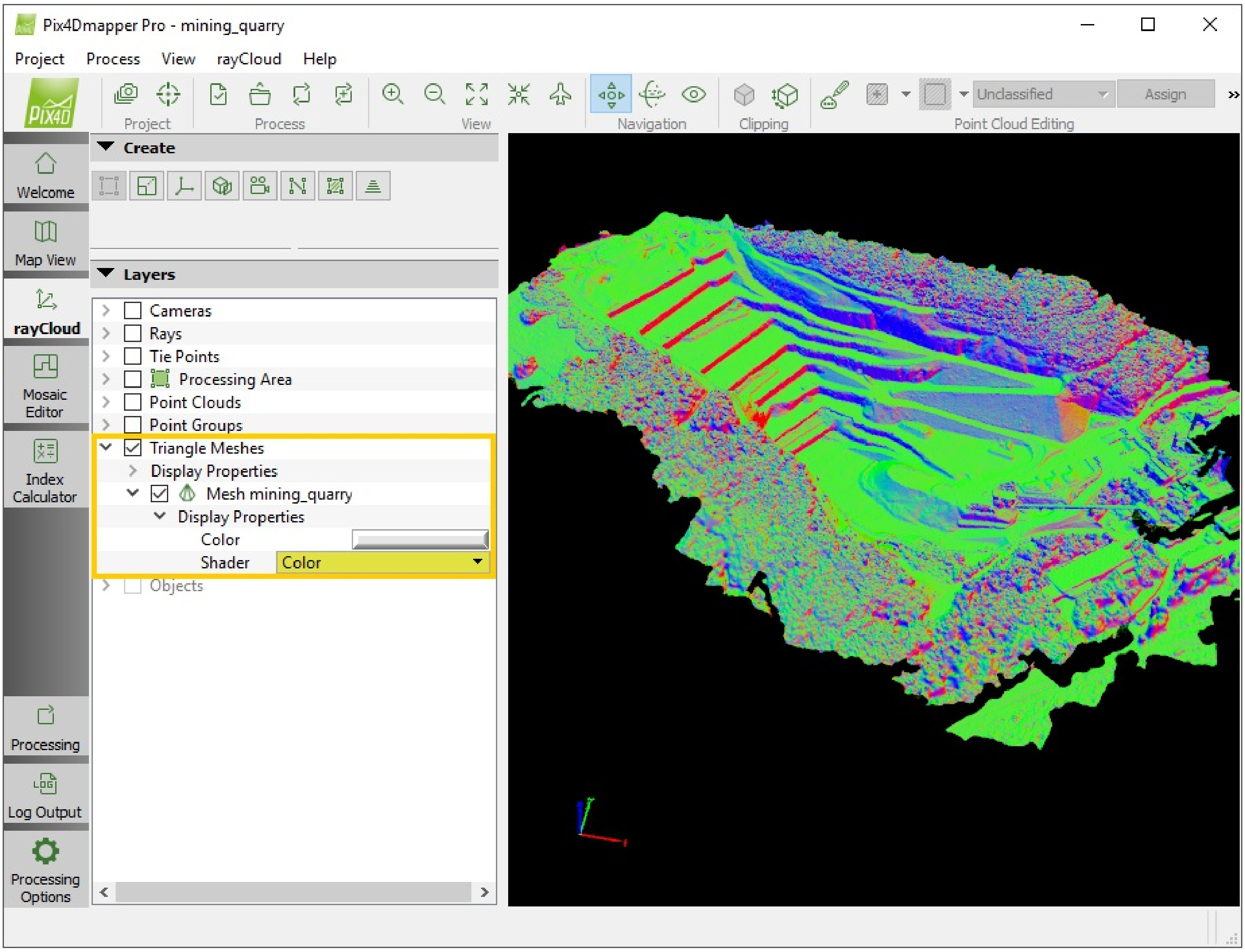


Figure 3. Color

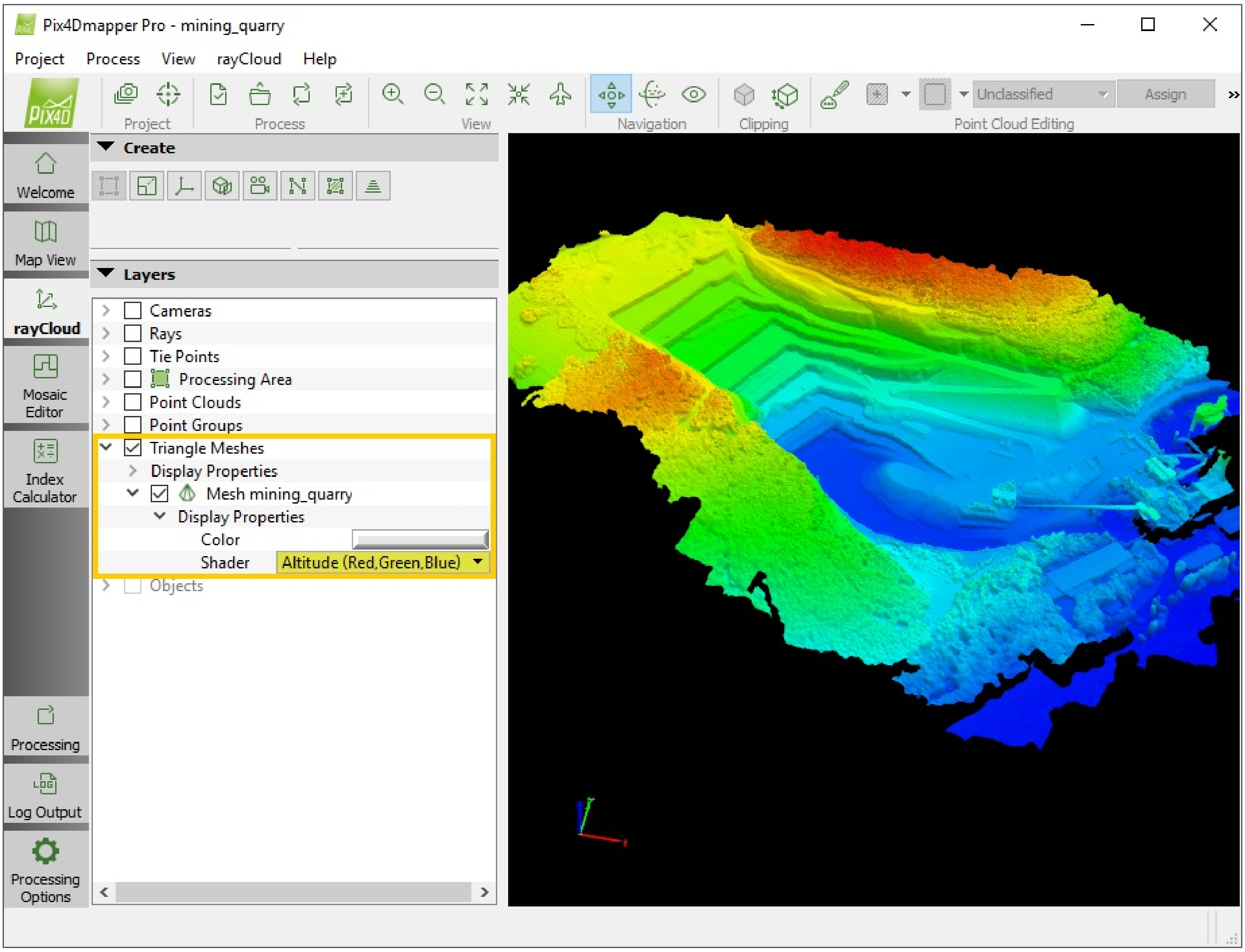


Figure 4. Altitude (Red, Green, Blue)

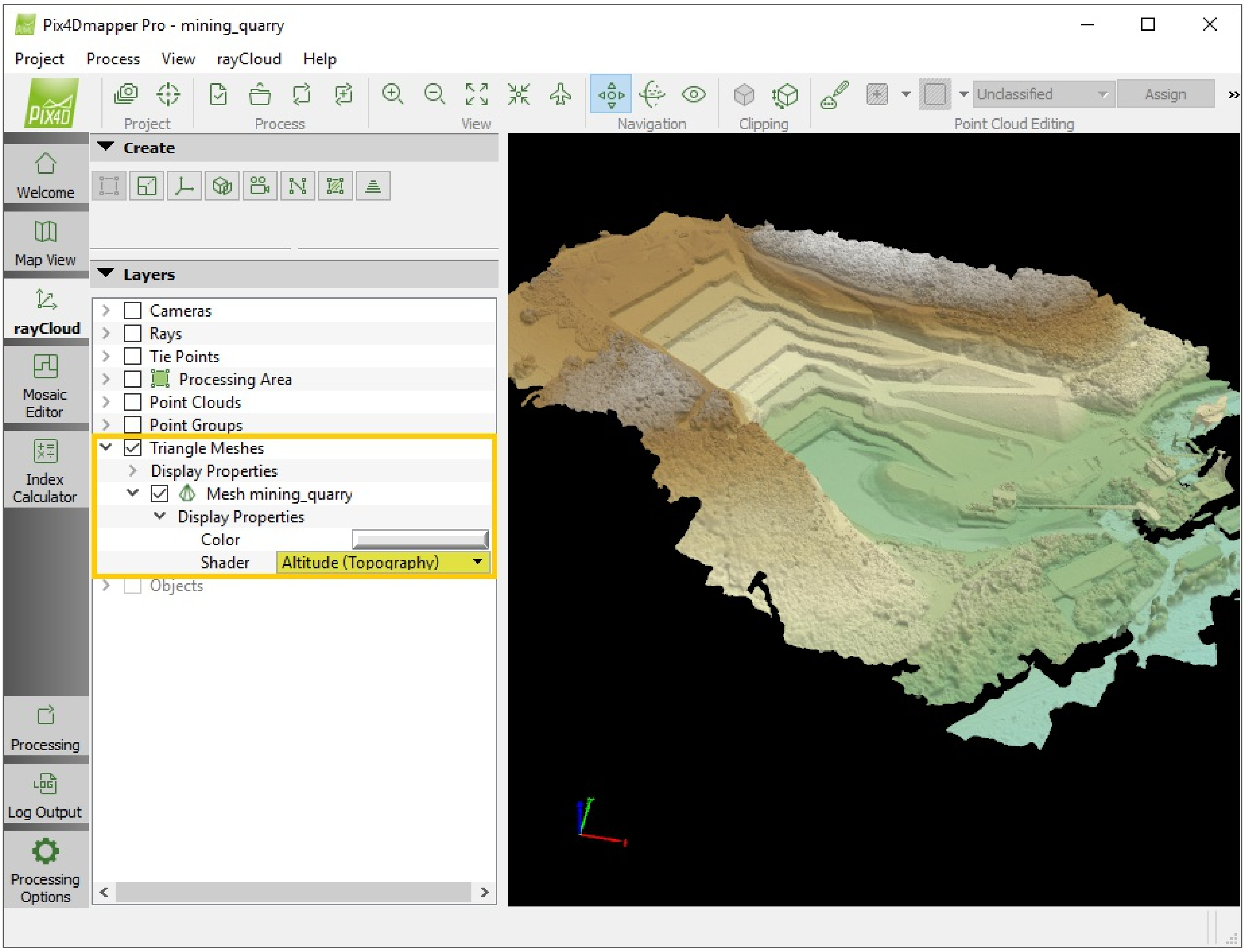


Figure 5. Altitude (Topography)

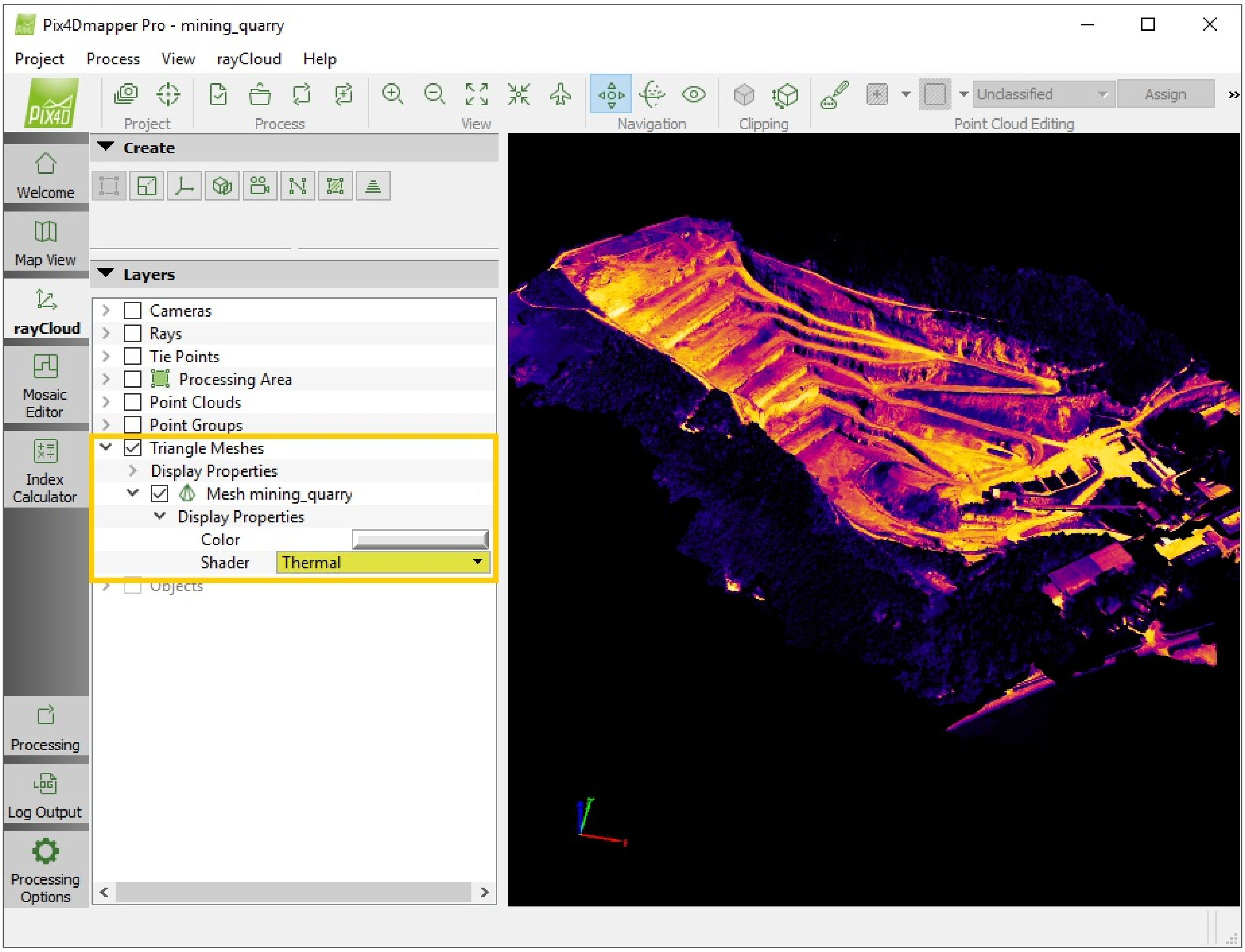


Figure 6. Thermal

List of triangle meshes

By default, the 3D Textured Mesh (if generated) is not loaded in the rayCloud. If it has been generated, by selecting it, it will be loaded and displayed in the rayCloud. By clicking the triangle mesh's check box, the corresponding triangle mesh is shown or hidden in the 3D View.

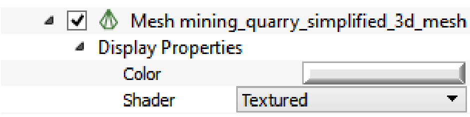
By right clicking on an specific triangle mesh's name, a context menu with the following action appears:

Load Layer: Visible if the triangle mesh is not loaded, load the triangle mesh in the rayCloud.
Unload Layer: Visible if the triangle mesh is loaded, unload the triangle mesh from the rayCloud.

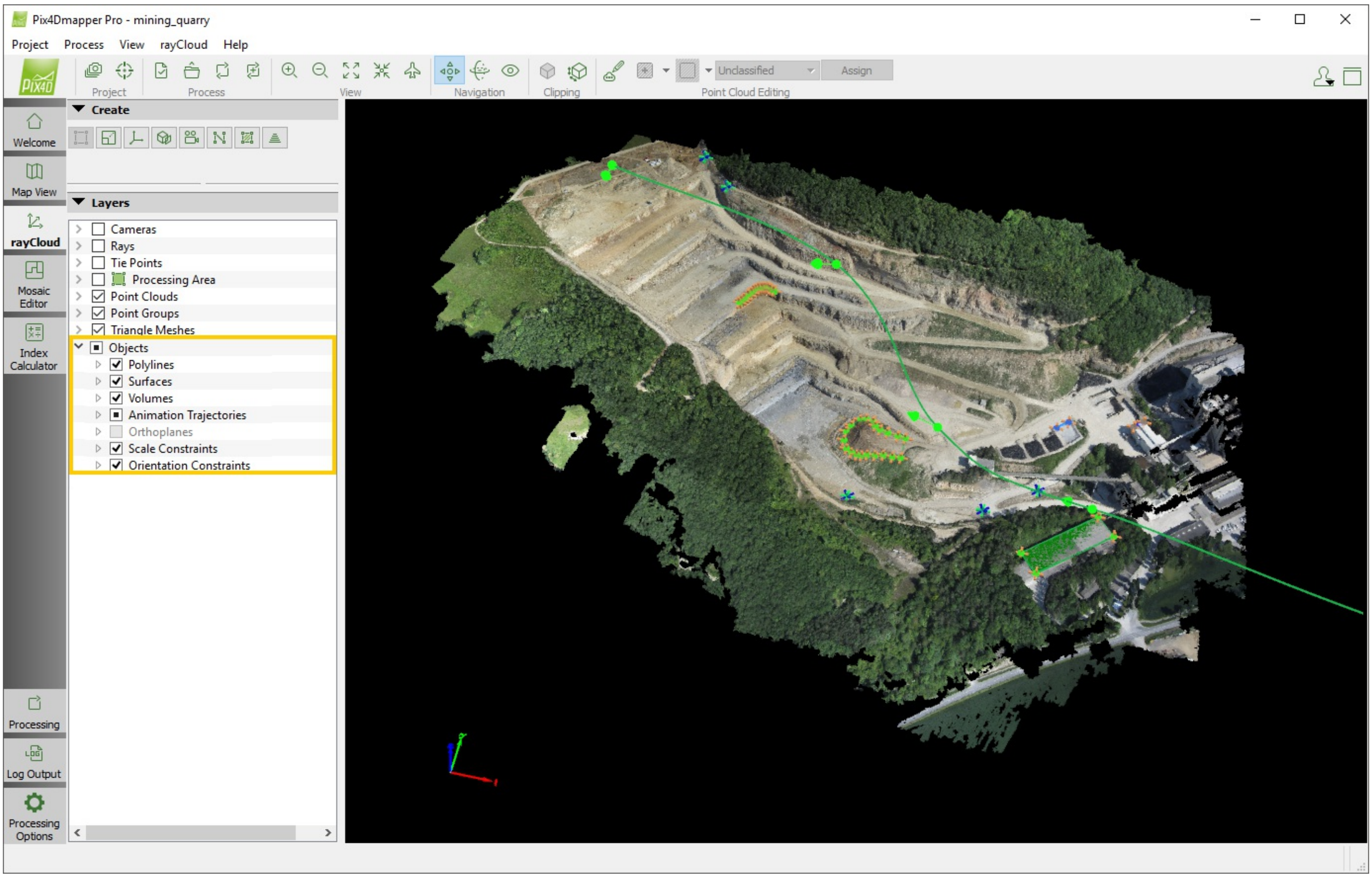
Each triangle mesh layer has the following sub-element:

Displays Properties: Displays properties for the corresponding triangle mesh and only apply to the corresponding triangle mesh. The same properties are available for all triangle meshes.

On the left of the triangle mesh name, there is an icon indicating that the layer is a triangle mesh: .



Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Layers* section in the left sidebar is displayed on the left of the main window.



The Objects layer contains the following sub-layers:

Polylines: Contains the list of polylines added to the project. A *Polyline* object is a continuous line composed of one or more sub-lines. It is created by specifying the vertices of each line. For more information about the concept of polyline: 202559829.
Surfaces: Contains the list of surfaces added to the project. A *Surface* object can be used to define planar areas such as a road, the roof of a building, etc. It can also be used to correct the DSM and generate a better orthomosaic on these surfaces.
Volumes: Contains the list of volumes added to the project. It can be used for volume calculation. It is defined by a 3D surface called a base. The volume is computed between the base and the terrain surface.
Animation Trajectories: Contains the list of Animation Trajectories added to the project. The animation Trajectories consist of waypoints that define the path for an imaginary camera that records the scene.
Orthoplanes: Contains the list of Orthoplanes added to the project. The Orthoplane is a tool to create one or several orthophotos of arbitrary areas of the model without having any impact / modifications in the model.
Scale Constraints: Contains the list of Scale Constraints added to the project. The Scale Constraint is a line with known real Cartesian distance between 2 points, allowing to set up a local scale of the model.
Orientation Constraints: Contains the list of Orientation Constraints added to the project. The Orientation Constraints is a line that represents a known axis, allowing to set up an local orientation of the model.

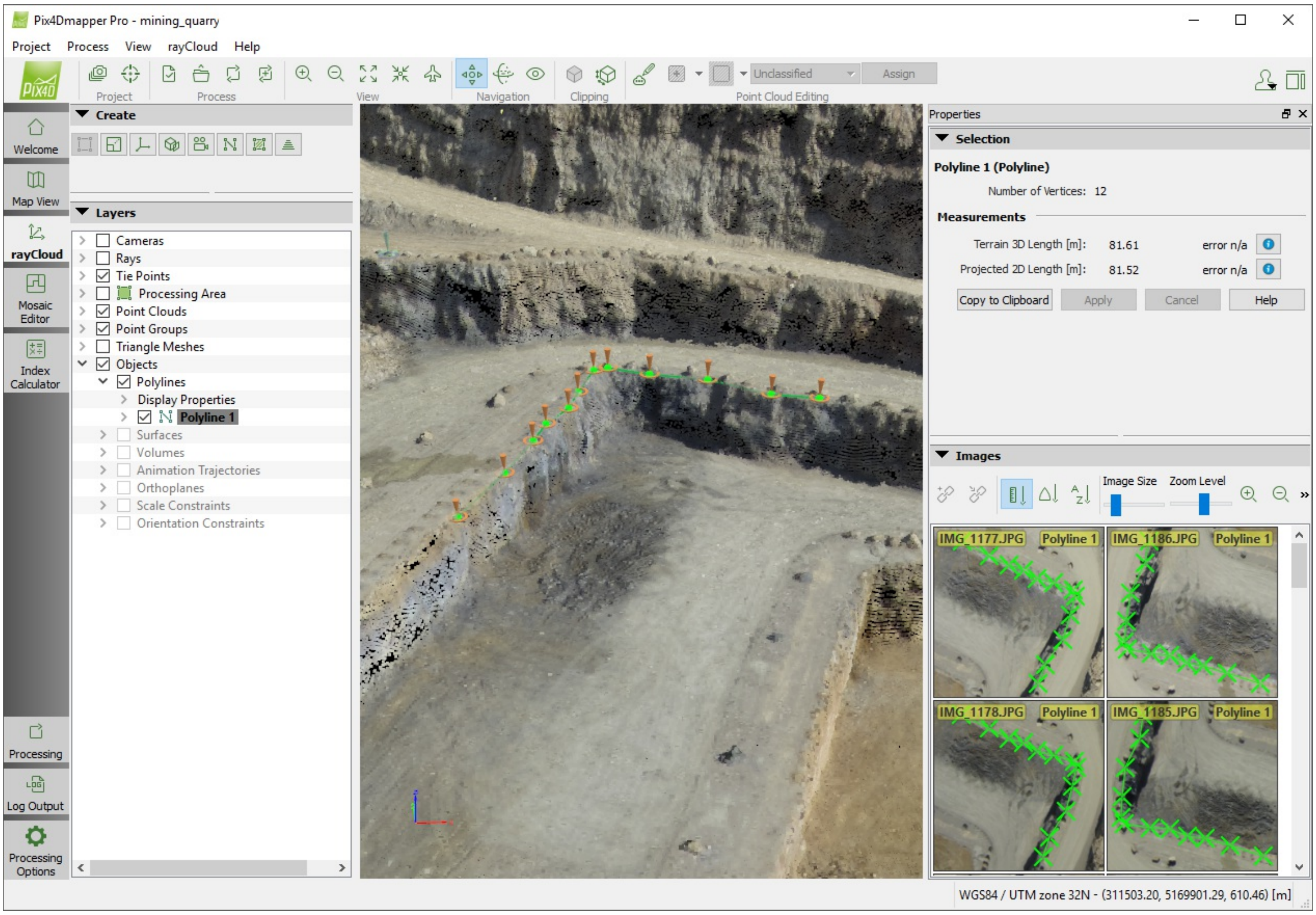


Figure 1. Polyline object

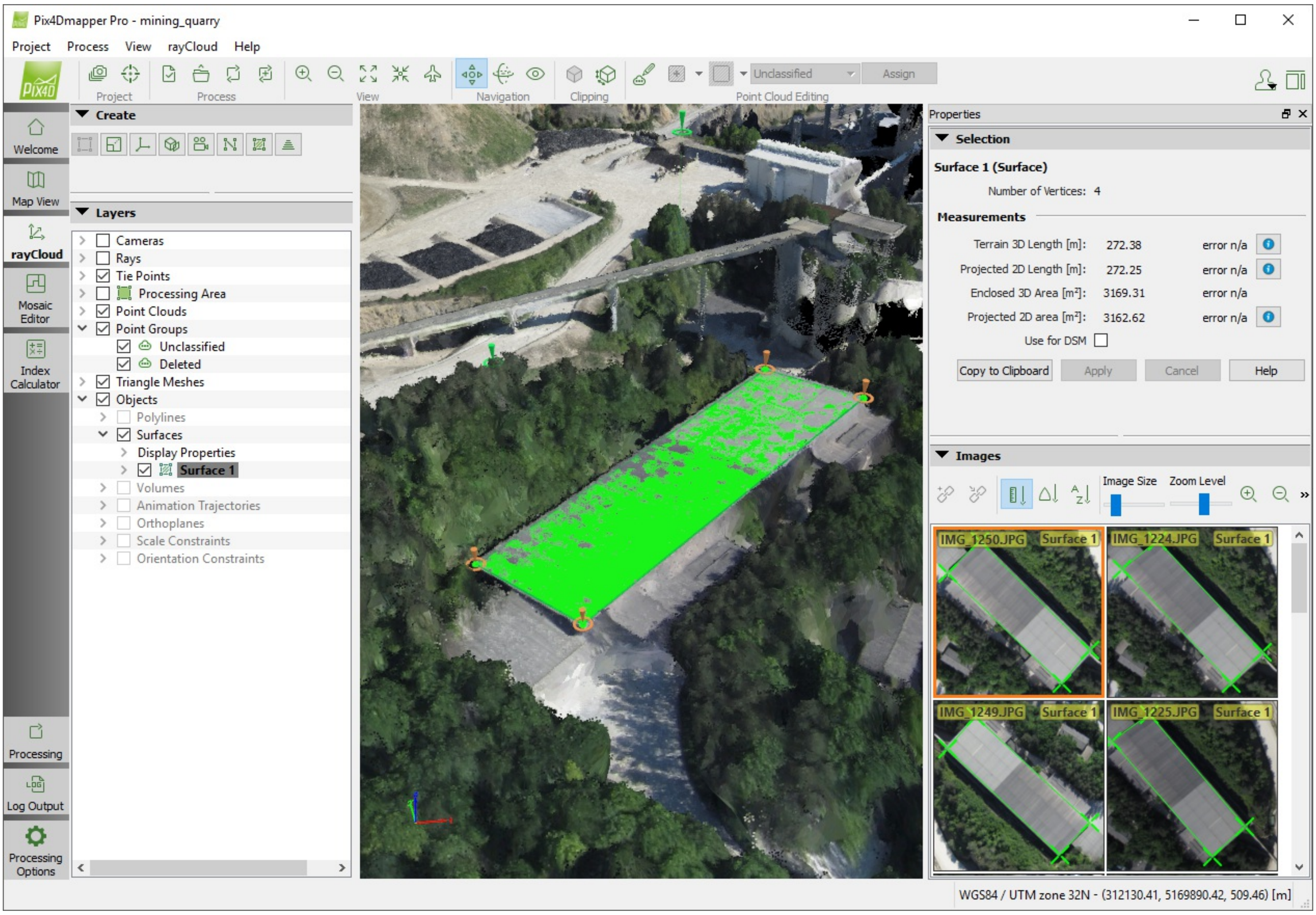


Figure 2. Surface object

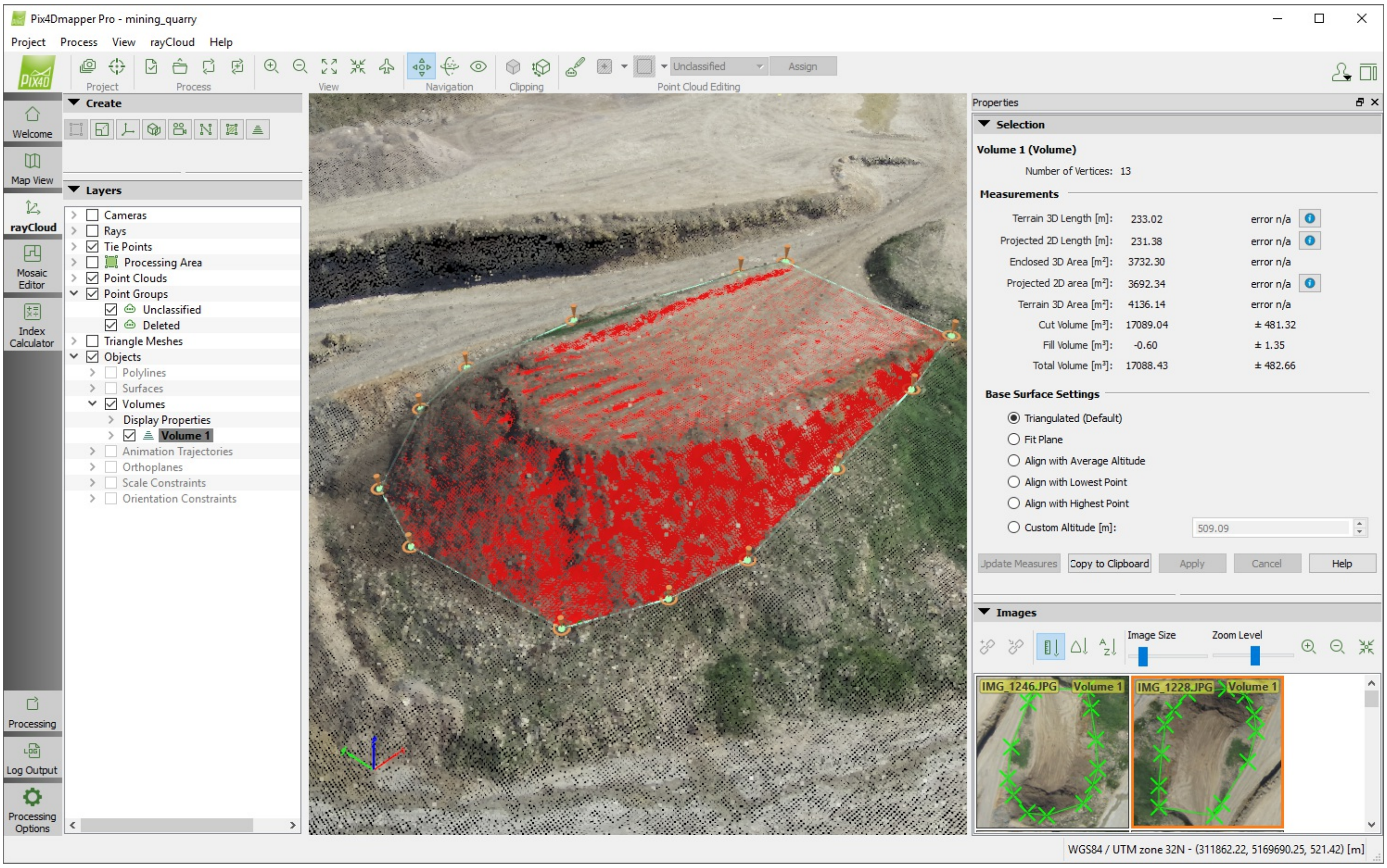


Figure 3. Volume object

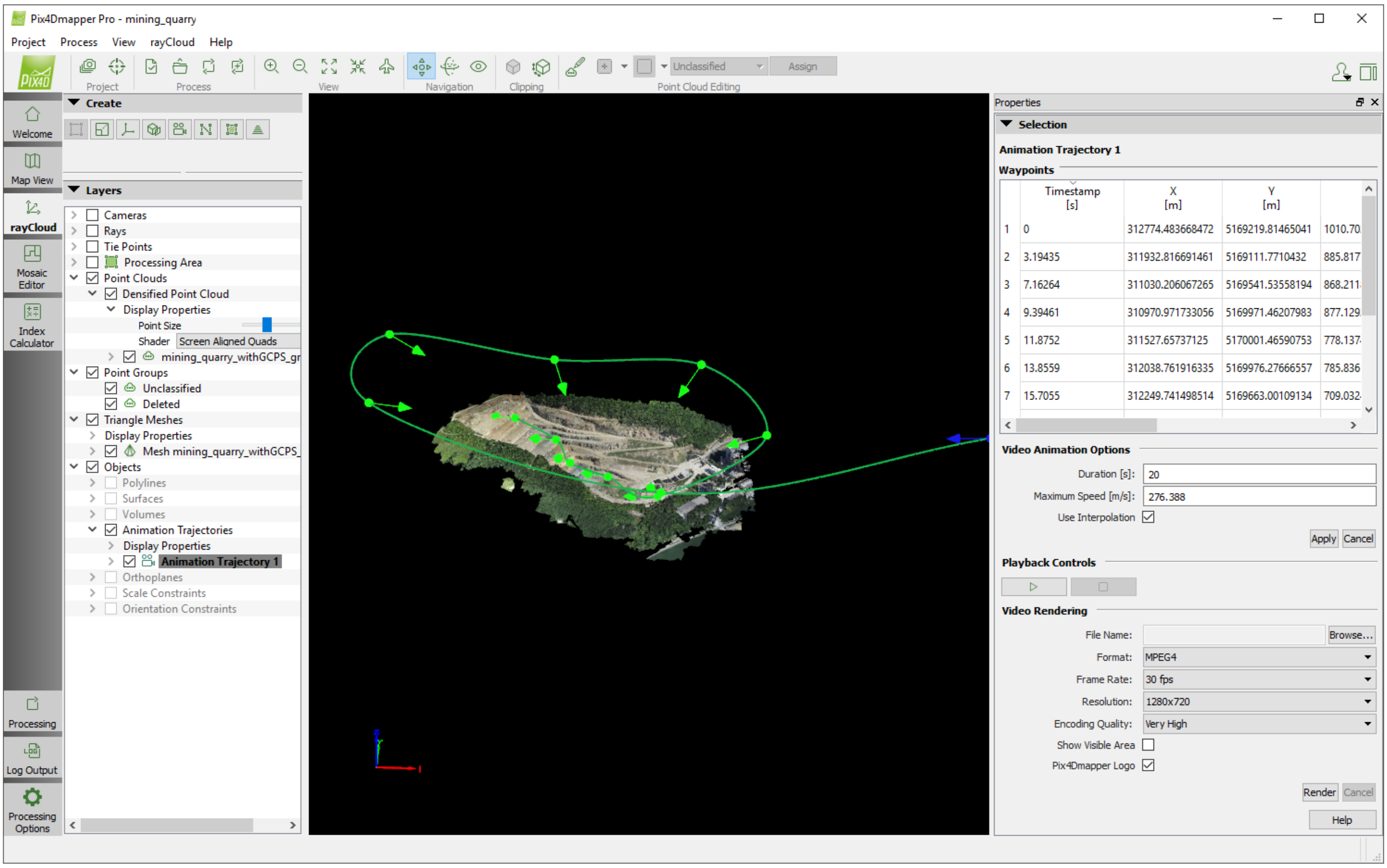


Figure 4. Animation Trajectory

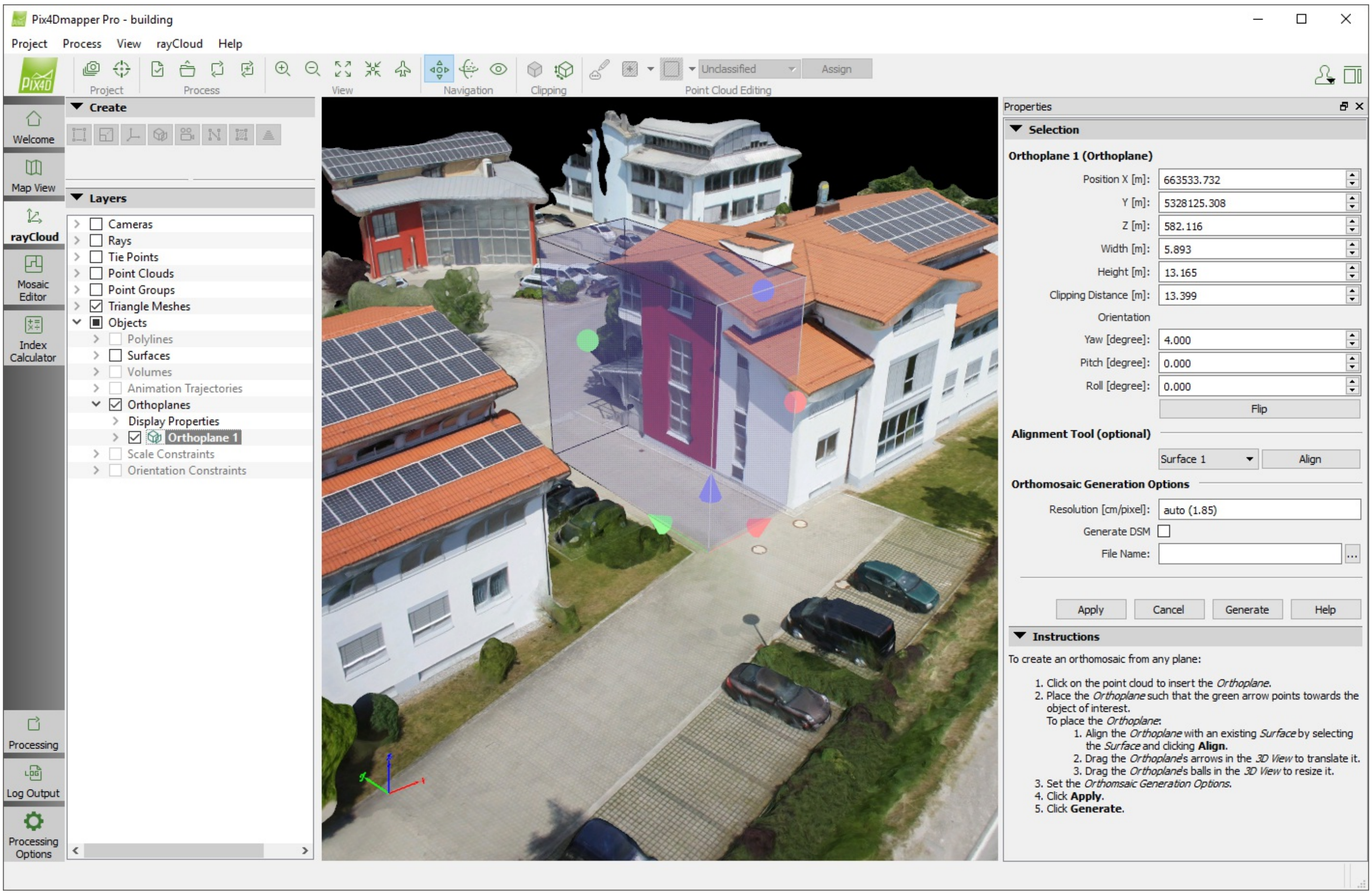


Figure 5. Orthoplane

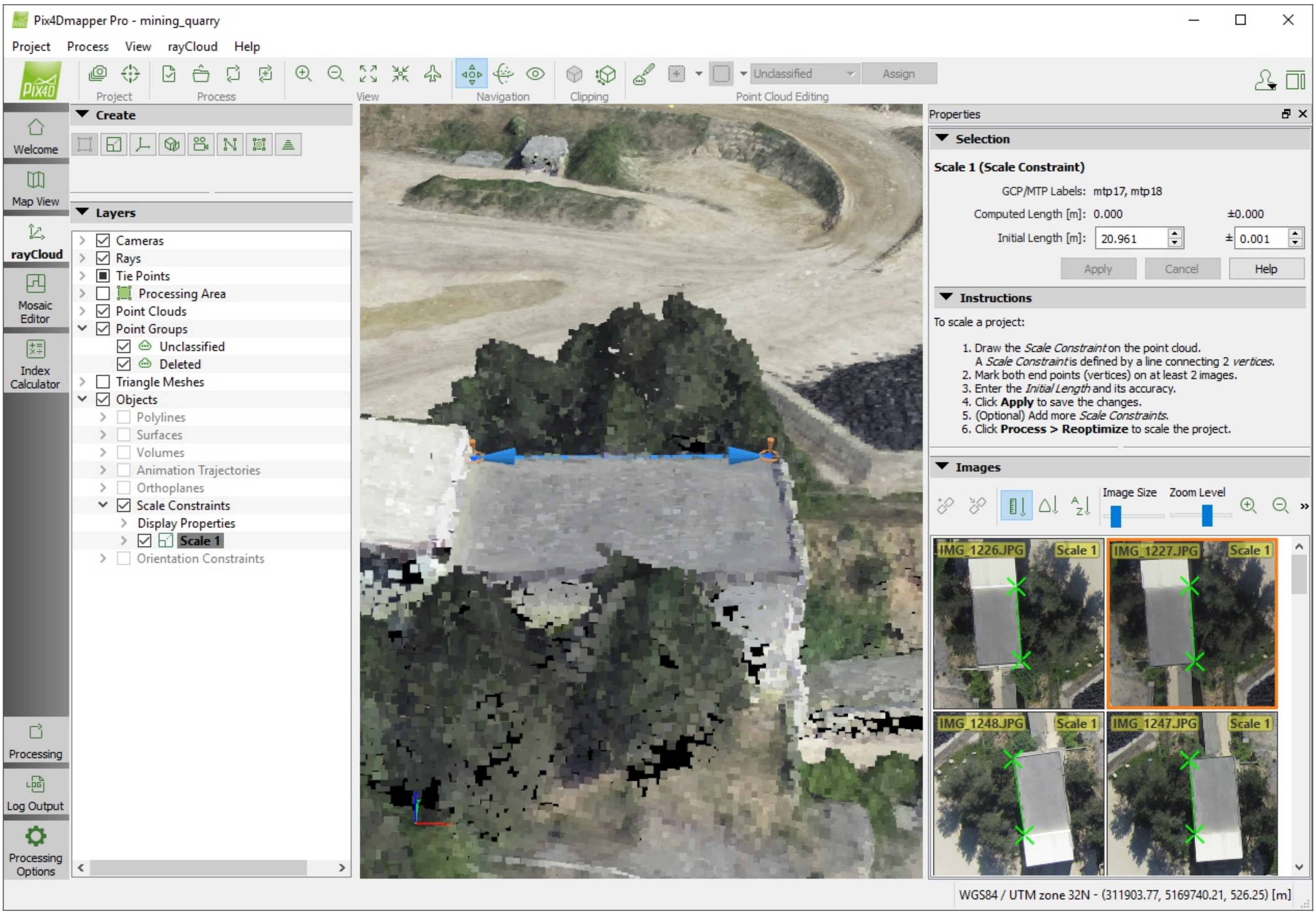


Figure 6. Scale Constraint

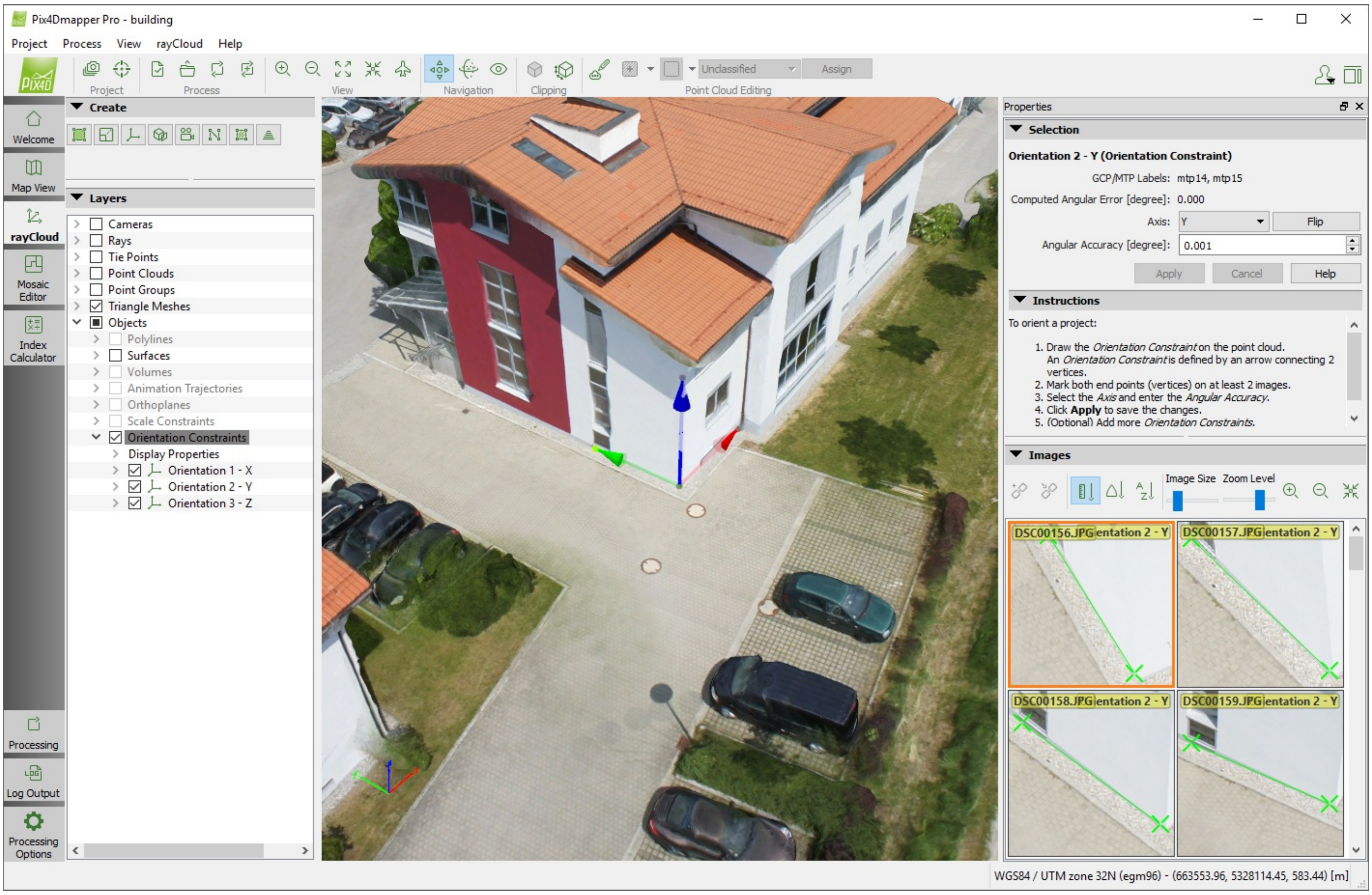


Figure 7. Orientation Constraints

Polylines

Contains the list of polylines added to the project. A *Polyline* object is a continuous line composed of one or more sub-lines. It is created by specifying the vertices of each line. For more information about the concept of Polyline: 202559829.

The *Polylines* layer has the following structure:

Display Properties: This layer allows the user to edit the display properties all the polylines.
Vertex Color: Color of the spheres that represent the vertices of the polylines.
Vertex Radius: Radius of the spheres that represent the vertices of the polylines.
Line Color: Color of the lines between the vertices of the polylines.
Line Width: Width of the lines defining the polylines.
List of Polylines: Each Polyline has the following sub-element:
Display Properties: This layer allows the user to edit the display properties of the line. The properties that can be edited are the same than the Display properties of the Polylines listed above.

By right clicking on the *Polylines* sub-layer, a context menu with the following options appears:

New Polyline: Allows the user to draw a new polyline. For step by step instructions: 202560309.
Export All Polylines: Opens the *Export* pop-up that allows the user to export the corresponding components from the polyline into a file.

> Important: A Polyline is composed of lines and vertices to which Manual Tie Points are associated.

The following file formats can be selected for export:
AutoCad DFX (.dfx).
ESRI Shapefiles (.shp).
Keyhole Markup Language (.kml).
Microstation DGN (.dgn).

The type of components to export can be selected. The following components can be exported:

Export Vertices: Exports the vertices of the the Polylines.
Export Lines: Exports the lines of the the Polylines.

> Important:
> The option *Export All Polylines* is enabled only if at least one Polyline has been drawn.

Surfaces

Contains the list of surfaces added to the project. A *Surface* object can be used to define planar areas such as a road, the roof of a building, etc. It can also be used to correct the DSM and generate a better Orthomosaic on these surfaces.

The *Surfaces* layer has the following structure:

Display Properties: This layer allows the user to edit the display properties for all the surfaces.
Vertex Color: Color of the spheres that represent the vertices of the surfaces.
Vertex Radius: Radius of the spheres that represent the vertices of the surfaces.
Line Color: Color of the lines between the vertices of the surfaces.
Line Width: Width of the line defining the surface areas.
Base: View/hide the base of the surfaces.
Color: Color of the base of the surfaces.
Shader: Specifies the way each triangle of the base surfaces is colored. The color is related to the 3D position of each triangle. 2 ways of coloring the triangles are available:
Monochrome: Selected by default. The triangles are colored with a color-to-black scale depending on the angle with respect to a virtual sun positioned in the north-east at 45 degrees from the horizon. It uses the color selected above.
Color: The triangles are colored with a RGB scale. The color of a triangle depends on the angle with respect to 3 virtual suns with Red, Green, and Blue illumination. The color of each triangle is the combination of the light received by the 3 virtual suns. This shader gives a slope map if the model is looked at from top. It gives information about the orientation of each surface.
List of Surfaces: Each Surface has the following sub-element:
Display Properties: This layer allows the user to edit the display properties of a surface. The properties that can be edited are the same than the Display Properties of the Surfaces listed above.

By right clicking on the *Surfaces* sub-layer, a context menu with the following options appears:

New Surface: Allows the user to draw a new surface. For step by step instructions: 202560269.
Export All Surfaces: Opens the *Export* pop-up that allows the user to export the corresponding components from the surface into a file.

> Important: A Surface is composed of surfaces, lines and vertices to which Manual Tie Points are associated.

The following file formats can be selected for export:
AutoCad DFX (.dfx).
ESRI Shapefiles (.shp).
Keyhole Markup Language (.kml).
Microstation DGN (.dgn).

The type of components to export can be selected. The following components can be exported:

Export Vertices: Exports the vertices of the Surfaces.
Export Lines: Exports the lines of the Surfaces.
Export Surfaces: Exports the surface meshes of the Surfaces.

> Important:
> The options *Export All Surfaces is* enabled only if at least one Surface has been drawn.

Volumes

Contains the list of volumes added to the project. It can be used for volume calculation. It is defined by a 3D surface called a base. The volume is computed between the base and the terrain surface.

The *Volumes* layer has the following structure:

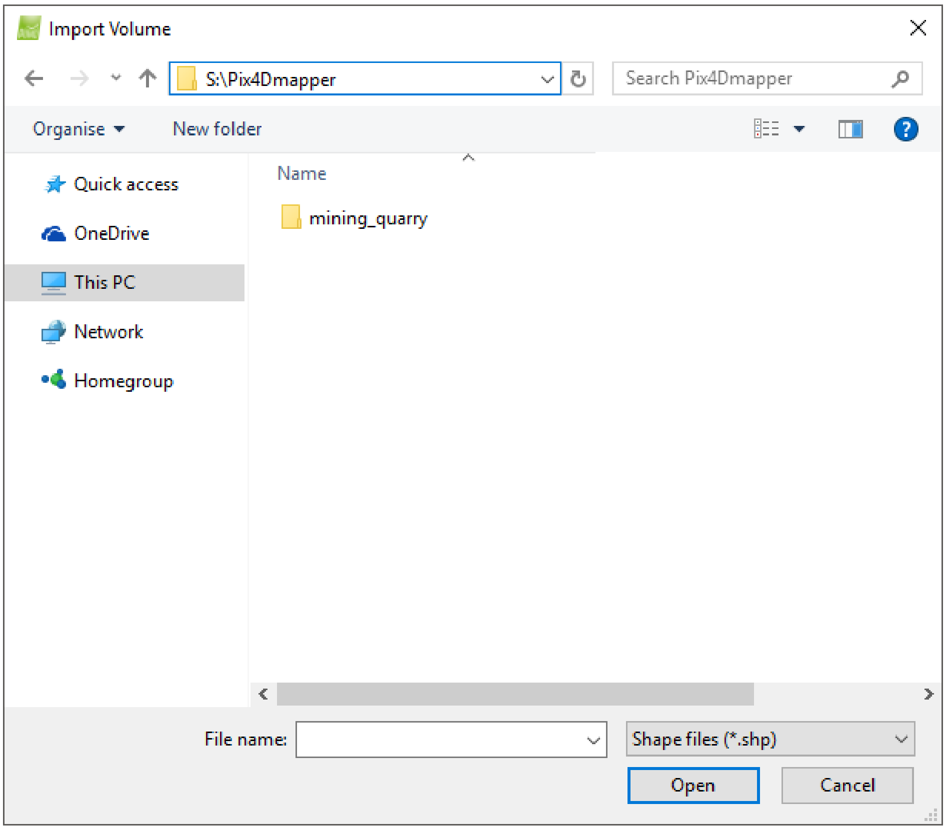
Display Properties: This layer allows the user to edit the display properties for all the volumes.
Vertex Color: Color of the spheres that represent the vertices of the bases of the volumes.
Vertex Radius: Radius of the spheres that represent the vertices of the bases of the volumes.
Line Color: Color of the lines between the vertices of the bases of the volumes.
Line Width: Width of the lines defining the bases of the volumes.
Base: View/hide the basex of the volumes.
Color: Color of the bases of the volumes.
Shader: Specifies the way each triangle of the bases of the volumes is colored. The color is related to the 3D position of each triangle. There are 2 ways of coloring the triangles available:
Monochrome: Selected by default. The triangles are colored with a color-to-black scale depending on the angle with respect to a virtual sun positioned in the north-east at 45 degrees from the horizon. It uses the color selected above.
Color: The triangles are colored with an RGB scale. The color of a triangle depends on the angle with respect to 3 virtual suns with Red, Green, and Blue illumination. The color of each triangle is the combination of the light received by the 3 virtual suns. This shader gives a slope map if the model is looked at from top. It gives information about the orientation of each surface.
Terrain: View/hide the triangles defining the terrain. These triangles are generated using the base of the volume and the points above and below that surface.
Color: Color of the triangles defining the terrain. These triangles are generated using the base surface and the points above and below that surface (this property only affects Volume objects).
Shader: Specifies the way each triangle defining the terrain is colored. The color is related to the 3D position of each triangle. 2 ways of coloring the triangles are available:

Monochrome: Selected by default. The triangles are colored with a color-to-black scale depending on the angle with respect to a virtual sun positioned in the north-east at 45 degrees from the horizon. It uses the color selected above.
Color: The triangles are colored with a RGB scale. The color of a triangle depends on the angle with respect to 3 virtual suns with Red, Green, and Blue illumination. The color of each triangle is the combination of the light received by the 3 virtual suns. This shader gives a slope map if the model is looked at from top. It gives information about the orientation of each surface.
List of Volumes: Each object has the following sub-element:
Display Properties: This layer allows the user to edit the Display Properties of a Volume. The properties that can be edited are the same as the Display Properties of the Volumes listed above.

By right clicking on the *Volumes* sub-layer, a context menu with the following options appears:

New Volume: Allows the user to draw a new volume. For step by step instructions: 202560319.
Import Volume: Opens the *Import Volume* pop-up that allows the user to import Volumes created previously with Pix4Dmapper for the same area of study or created manually.

> Important:
> To import a volume created previously with Pix4Dmapper, it has to be a .shp file that contains surfaces (*name_surfaces.shp*) or vertices (*name_vertices.shp*).
> To import a volume created with an external software, it has to be a .shp file that contains a 3D polygon (surface) or 3D vertices.



Contains the sections:

Navigation window: Used to search for and select the file to be imported.
File name: Displays the name of the selected file to be imported.
Files of type: Displays the possible formats accepted for the input file: Shape files (.shp) are accepted.

And the action buttons:

Open: Imports the selected file.
Cancel: Does not import the Volume and exits the pop-up.
Help: Opens the Pix4Dmapper help.
Export All Volumes: Opens the *Export* pop-up that allows the user to export the corresponding components from the volume into a file.

> Important: A Volume is composed of volume meshes, lines, and vertices to which Manual Tie Points are associated.

The following file formats can be selected for export:
AutoCad DFX (.dfx).
ESRI Shapefiles (.shp).
Keyhole Markup Language (.kml).
Microstation DGN (.dgn).

The type of components to export can be selected. The following components can be exported:

Export Vertices: Exports the vertices of the Volumes.
Export Surfaces: Exports the surface meshes of the Volumes.
Export Meshes: Exports the volume meshes of the Volumes.

> Important:
> The options *Export All Volumes* is enabled only if at least one Volume has been drawn.

List of objects

Each object layer has the following sub-element:

Display Properties: Displays properties of the corresponding objects. The properties that can be edited are not the same for all the objects.

> Note: Changing the *Display Properties* of the selected object, affects only to the selected object.

On the left of the object name, there is an icon indicating the type of the object:

- Polyline
- Surface
- Volume

By right clicking on a specific object's layer, a context menu with the following options appears:

Insert Vertices: Insert vertices on the line between existing vertices of the object.
Append Vertices: Insert vertices after the last vertex inserted for the object.
Rename: Rename the object.
Export: Opens the *Save objects* pop-up that allows the user to export the corresponding components from the selected object into a file.

> Important:
> A Polyline is composed of lines and vertices to which Manual Tie Points are associated.
> A Surface is composed of a surface mesh and vertices to which Manual Tie Points are associated.
> A Volume is composed of a surface mesh, volume meshes and vertices to which Manual Tie Points are associated.

The following file formats can be selected for export:
AutoCad DFX (.dfx).
ESRI Shapefiles (.shp).
Keyhole Markup Language (.kml).
Microstation DGN (.dgn).

The type of components to export can be selected. Depending on the object types, not all type of components are available. The following components can be exported:

For a Polyline it is possible to:

Export Vertices: Exports the vertices of the the Polyline.
Export Lines: Exports the lines of the the Polyline.

For a Surface it is possible to:
Export Vertices: Exports the vertices of the Surface.
Export Surfaces: Exports the surface mesh of the Surface.

For a Volume it is possible to:

Export Vertices: Exports the vertices of the Volume.
Export Surfaces: Exports the surface mesh of the Volume.
Export Meshes: Exports the volume mesh of the Volume.
Remove: Removes the selected object.

> Important:
> The option *Remove* do not delete the Manual Tie Points generated when drawing the object (when drawing an object Polyline, Surface or Volume, the vertices create Manual Tie Points).

Animation Trajectories

Contains the list of Animation Trajectories added to the project. The Animation Trajectories consist of waypoints that define the path for an imaginary camera that records the scene.

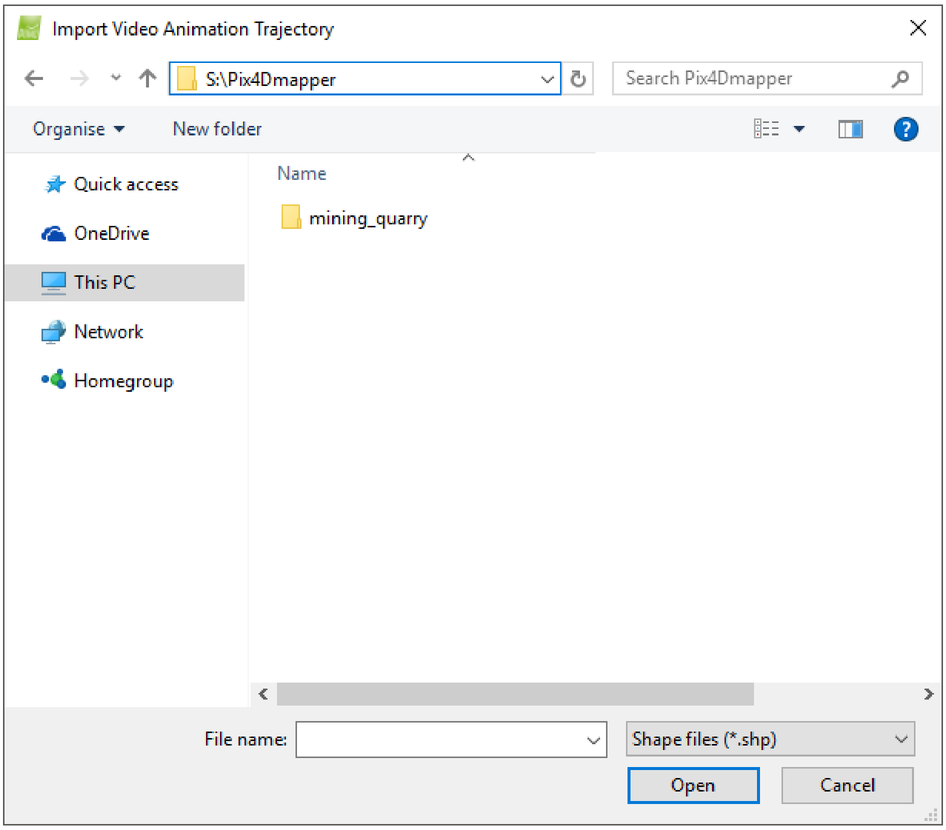
The *Animation Trajectories* layer has the following structure:

Display Properties: Displays properties of the corresponding objects. The properties that can be edited are:
Start Vertex Color: Color of the spheres that represent the first waypoints.
Vertex Color: Color of the spheres that represent the waypoints.
Vertex Radius: Radius of the spheres that represent the waypoints.
Line Color: Color of the lines between waypoints.
Line Width: Width of the line defining the path between waypoints.
List of Animation Trajectories: Each Animation Trajectory has the following sub-element:
Display Properties: This layer allows the user to edit the display properties of the Animation Trajectories. The properties that can be edited are the same than the Display properties of the Animation Trajectories listed above.

By right clicking on the *Animation Trajectories* sub-layer, a context menu with the following options appears:

New Video Animation Trajectory: Allows the user to create a new Animation Trajectory. For step by step instructions: 202560299.
Import...: Opens the *Import Video Animation Trajectory* pop-up that allows the user to import Animation Trajectories created previously with Pix4Dmapper for the same area of study or created manually.

For step by step instructions about how to import an Animation Trajectory with the rayCloud: 202560569.



Contains the sections:

Navigation window: Used to search for and select the file to be imported.
File name: Displays the name of the selected file to be imported.
Files of type: Displays the possible formats accepted for the input file: .csv and .txt are accepted.

And contains the action buttons:

Open: Imports the selected file.
Cancel: Does not import the animation and exits the pop-up.
Help: Opens the Pix4Dmapper help.

Important: Manually created Animation Trajectories must have the same format and extension than files generated when exporting an Animation Trajectory with Pix4D.

List of Animation Trajectories

On the left of the object name, there is an icon indicating the type of the object:

Animation Trajectory

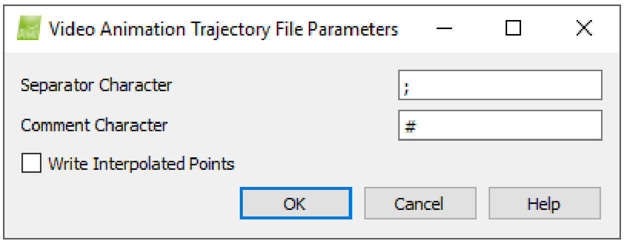
By right clicking on a specific object's layer, a context menu with the following options appears:

Rename: Rename the object.
Remove: Removes the selected object.
Export...: Opens the *Export Video Animation Trajectory* pop-up that allows the user to export the selected Animation Trajectory.

For step by step instructions about how to export an Animation Trajectory with the rayCloud: 203123429.

Contains the action buttons:

Save: Confirms the path and name to export the animation and opens the *Video Animation Trajectory File Parameters* pop-up:



Contains the option:
Separator Character: Character to be used as separator for the different information for each waypoint / interpolated Point:
Time [s], Position X, Position Y, Position Z, Rotation X, Rotation Y, Rotation Z.

Note: The default value for separator ";" in Microsoft Excel is read as Tab and will place each separated text on one column.

Comment Character: Character to be used as first character for the comment lines which include information about the video animation options:
Name, Time computation, Interpolation, Max speed, Duration, Number of points, Distance unit of measure, Angle unit of measure.
Write Interpolated Points [m]: By default it is not selected. Only the video animation options, the created waypoints and its coordinates are stored. Select *Write Interpolated Points [m]* to store as well intermediate points between consecutive waypoints.

By default, the value is 1, and it will crate one intermediate point every each meter.

Cancel: Does not export the animation and exits the pop-up.
Help: Opens the Pix4Dmapper help.

Important: It is possible to export Animation Trajectories as CSV files which can be opened with any text editor or spreadsheets editor.

Orthoplanes

Contains the list of orthoplanes added to the project. An *Orthoplane* is a tool to create one or several orthophotos of arbitrary areas of the model without having any impact / modifications in the model.

The *Orthoplanes* layer has the following structure:

Display properties: This layer allows the user to edit the display properties for all the orthoplanes.
Color: Color of the top, bottom, and side planes that define the area.
X Handle Color: Color of the X location arrow and X dimension sphere.
Y Handle Color: Color of the Y location arrow and Y dimension sphere.
Z Handle Color: Color of the Z location arrow and Z dimension sphere.
Near Plane Edge Color: Color of the lines that define the surface that represents the origin of the projection.
Far Plane Edge Color: Color of the lines that define the surface that represents the limit of the projection.
List of Orthoplanes: Each object has the following sub-element:
Display Properties: This layer allows the user to edit the display properties for the orthoplane. The Display Properties that can be edited are the same as the Display Properties of the Orthoplanes listed above.

By right clicking on the *Orthoplanes* sub-layer, a context menu with the following options appears:

New Orthoplane: Allows the user to create a new 3D Orthoplane. For step by step instructions: 204664359.

By right clicking on a specific object's layer, a context menu with the following options appears:

Rename: Rename the object.
Remove: Removes the selected object.

Scale Constraints

Contains the list of Scale Constraints added to the project. A *Scale Constraints* object is a line with known real Cartesian distance between 2 points, allowing to set up a local scale for the model.

The *Scale Constraints* layer has the following structure:

Display Properties: This layer allows the user to edit the display properties for all the Scale Constraints.
Vertex Color: Color of the spheres that represent the vertices of the Scale Constraints.
Vertex Radius: Radius of the spheres that represent the vertices of the Scale Constraints.
Line Color: Color of the lines between the vertices of the Scale Constraints.
Line Width: Width of the line defining the distance between vertices of the Scale Constraints.
List of Scale Constraints: Each object has the following sub-element:
Display Properties: This layer allows the user to edit the Display Properties of the Scale Constraint. The properties that can be edited are the same as the Display Properties for the Scale Constraint listed above.

By right clicking on the *Scale Constraints* sub-layer, a context menu with the following options appears:

New Scale Constraint: Allows the user to create a new 3D Scale Constraint. For step by step instructions: 205360375.

By right clicking on a specific object's layer, a context menu with the following options appears:

Remove: Removes the selected object.

Orientation Constraints

Contains the list of Orientation Constraints added to the project. An *Orientation Constraints* object is a line that represents a known axis, allowing to set up an local orientation for the model.

The *Orientation Constraints* layer has the following structure:

Display properties: This layer allows the user to edit the display properties for all the Scale Constraints.
Vertex Color: Color of the spheres that represent the vertices of the Orientation Constraints.
Vertex Radius: Radius of the spheres that represent the vertices of the Orientation Constraints.
Line Width: Width of the line defining the Orientation Constraints.
List of Orientation Constraints: Each object has the following sub-element:
Display Properties: This layer allows the user to edit the Display Properties of the Orientation Constraint. The Display Properties that can be edited are the same as the Display Properties for the Orientation Constraints listed above.

By right clicking on the *Orientation Constraints* sub-layer, a context menu with the following options appears:

New Orientation Constraint: Allows the user to create a new 3D Orientation Constraint. For step by step instructions: 205360385.

By right clicking on a specific object's layer, a context menu with the following options appears:

Remove: Removes the selected object.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The 3D View is displayed in the center of the main window.

The 3D View displays the different objects defined in a project, such as the cameras, the GCPs, etc.The different layers that are displayed in the 3D View and that are also visible in the Layers section of the left sidebar are:

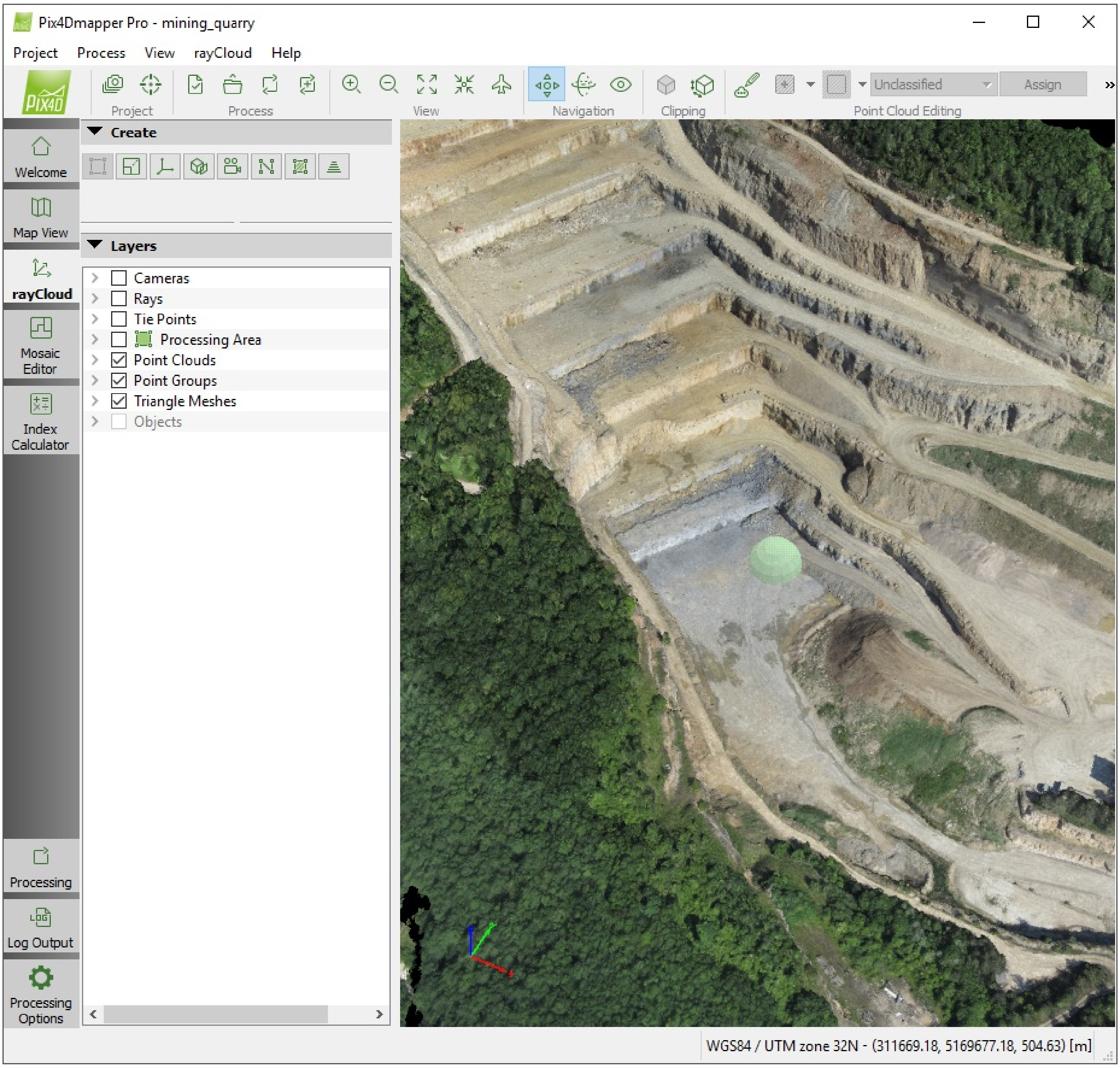
Cameras: This layer groups all the cameras of the project (calibrated, uncalibrated and disabled). One camera is associated to each image of the project. It is defined by its initial position (if known), the optimized position and orientation.
Rays: They are displayed when clicking on a 3D point on the 3D View if the Cameras and the Rays layers are shown. The 3D point is projected to all the calibrated cameras in which the point is visible. The rays cut the thumbnails of the cameras at the location where the point is visible in the original images.
Tie Points: This layer groups all the Manual Tie Points, GPCs, Check Points, and Automatic Tie Points. The Automatic Tie Points are computed during initial processing.
Processing Area: This layer display the Processing Area defined in the Map View or the rayCloud.
Point Clouds: This layer groups all the point clouds. It contains the Densified Point Cloud and the dragged-and-dropped point clouds.
Triangle Meshes: This layer groups the 3D Textured Mesh and triangle meshes generated by triangulating a point cloud that is loaded as a triangle mesh.
Objects: This layer groups all the objects defined by the user. These objects can be Polylines, Surfaces, Volumes, Animation Trajectories, Orthoplanes, Scale Constraints and Orientation Constraints.
Clipping Box: This tool allows to visualize only the points included in the Clipping Box. This tool is not visible in the Layers section of the left sidebar.

The layers can be shown/hidden using the Layers sections of the left sidebar, which can also be used to change the display properties (color, size, etc.) of each layer. For more information about the Layers section of the left sidebar: 202558089.

Important: It is possible to change the *Points Density* by Press "Alt" + "+" or "AltGr" + "- " in order to increase or decrease the density, "Alt" + "0" reset the *Points Density* to default values.

Important: The navigation in the 3D View (how the 3D view reacts when using the mouse or keyboard) depends on the *Navigation Mode* selected. For more information and full description of all the possible actions to navigate in the 3D View using the mouse or keyboard: 205360675.

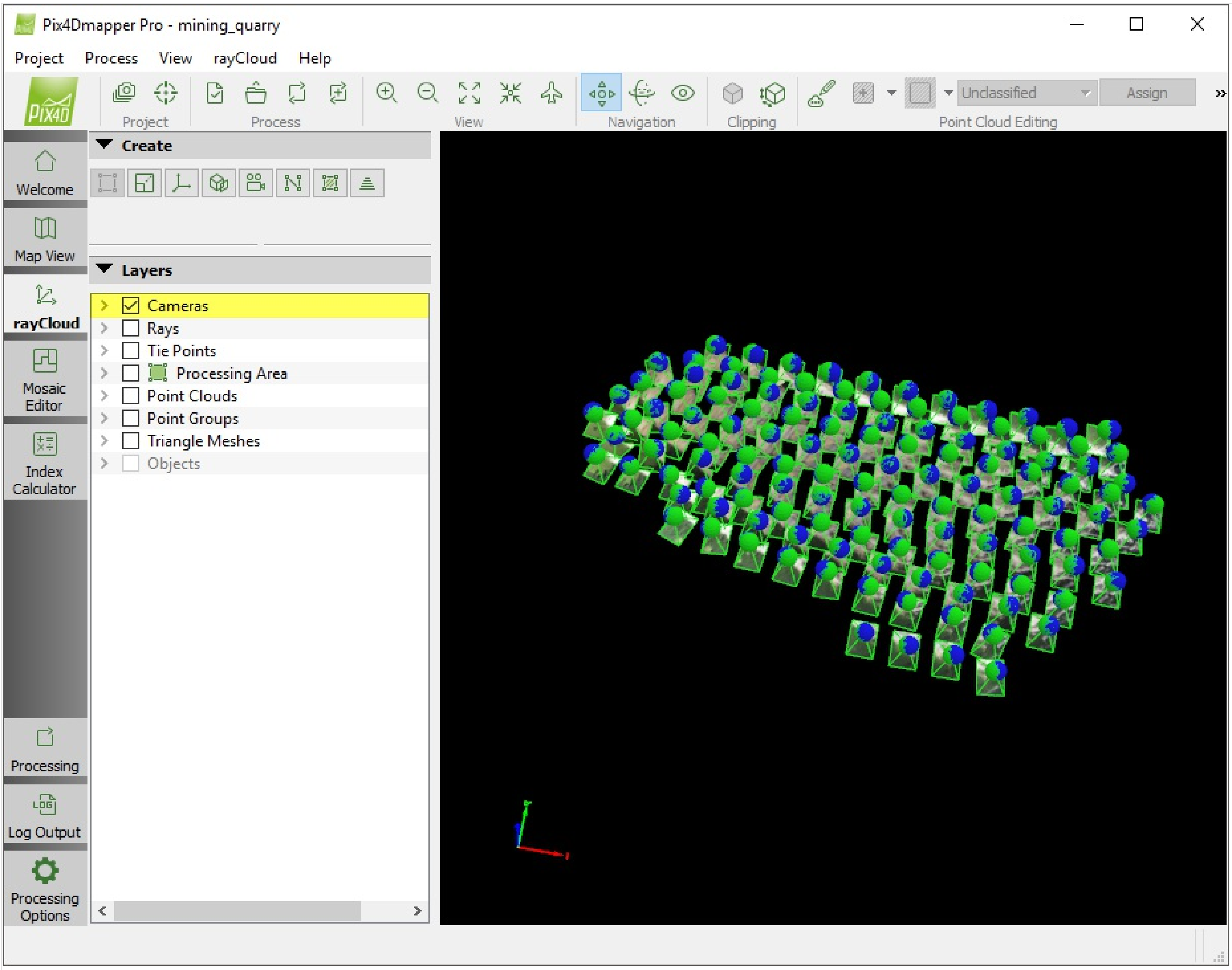
Important: Several predefined viewpoints exist such as top view, front view, etc. These predefined viewpoints are accessible using the keyboard and are using the Menu bar rayCloud > Viewpoint. For more information about the available viewpoints: 202558069.



Layers

Cameras

By default, the Camera layers are displayed on the 3D View as:
Blue sphere: Initial camera positions (GPS coordinates).
Green sphere: Optimized camera positions.
Red sphere: Initial camera positions (GPS coordinates) for Uncalibrated Cameras for which Pix4Dmapper could not find optimized positions and therefore were not used for the reconstruction.
Pale Red sphere: Initial camera positions (GPS coordinates) for Uncalibrated Cameras that were disabled by the user and were not used for the reconstruction.
Green line: Distance between initial and optimized positions.
Green lines: Projection lines between the optimized camera positions and the original image thumbnails.
Green squares: Borders of the original image thumbnails.



Cameras

Rays

By default, the rays can have the following colors:

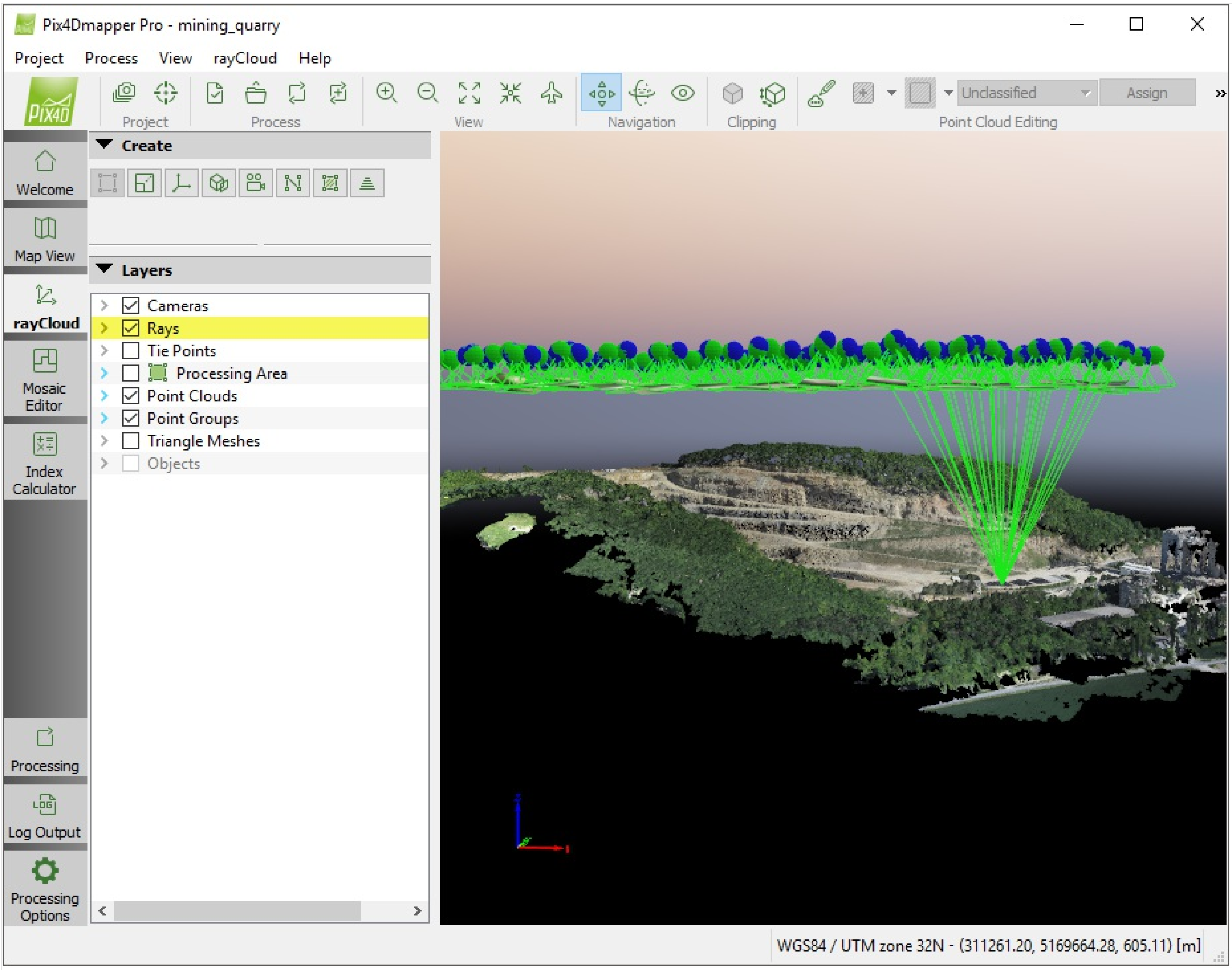
Green rays: The rays that connect the selected 3D point and the calibrated cameras in which the 3D point was visible but not marked.

Orange rays: The rays that connect the selected 3D point and the calibrated cameras in which the 3D point was marked.

Red ray: The rays that connect the selected 3D point and the not calibrated cameras.

Light Blue ray: The ray that connects the selected 3D point with the image that is currently selected in the *Image View*, and on which the point is visible but not marked.

Light Purple ray: The ray that connects the selected 3D point with the image that is currently selected in the *Image View*, and on which the point has not been marked.



Rays

Tie Points

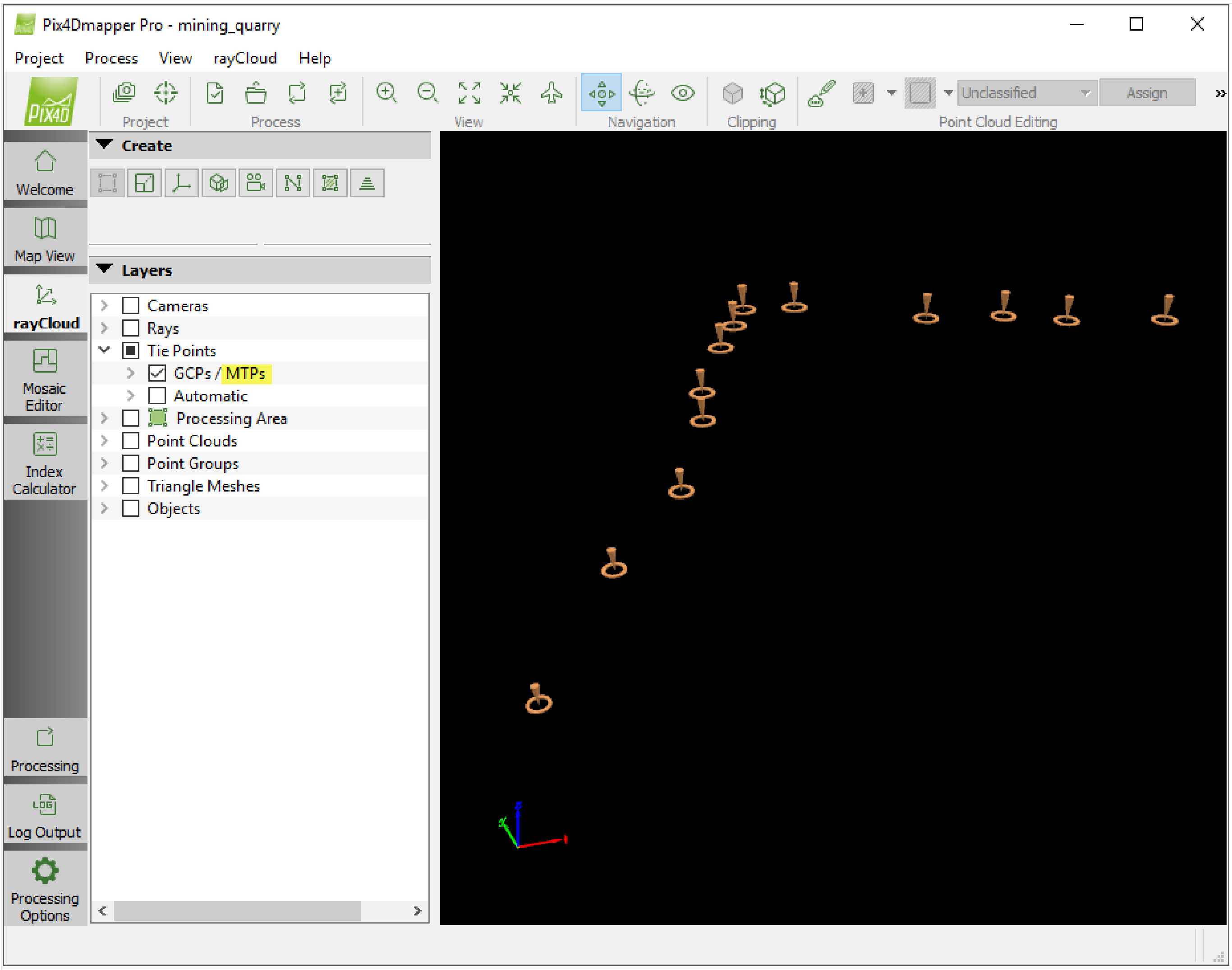
By default, the Tie Points are displayed on the 3D View as:

Green cone: Optimized position of Manual Tie Points, GCPs, Check Points, and vertices of the *Objects* drawn in the 3D View that are marked in at least 2 images.

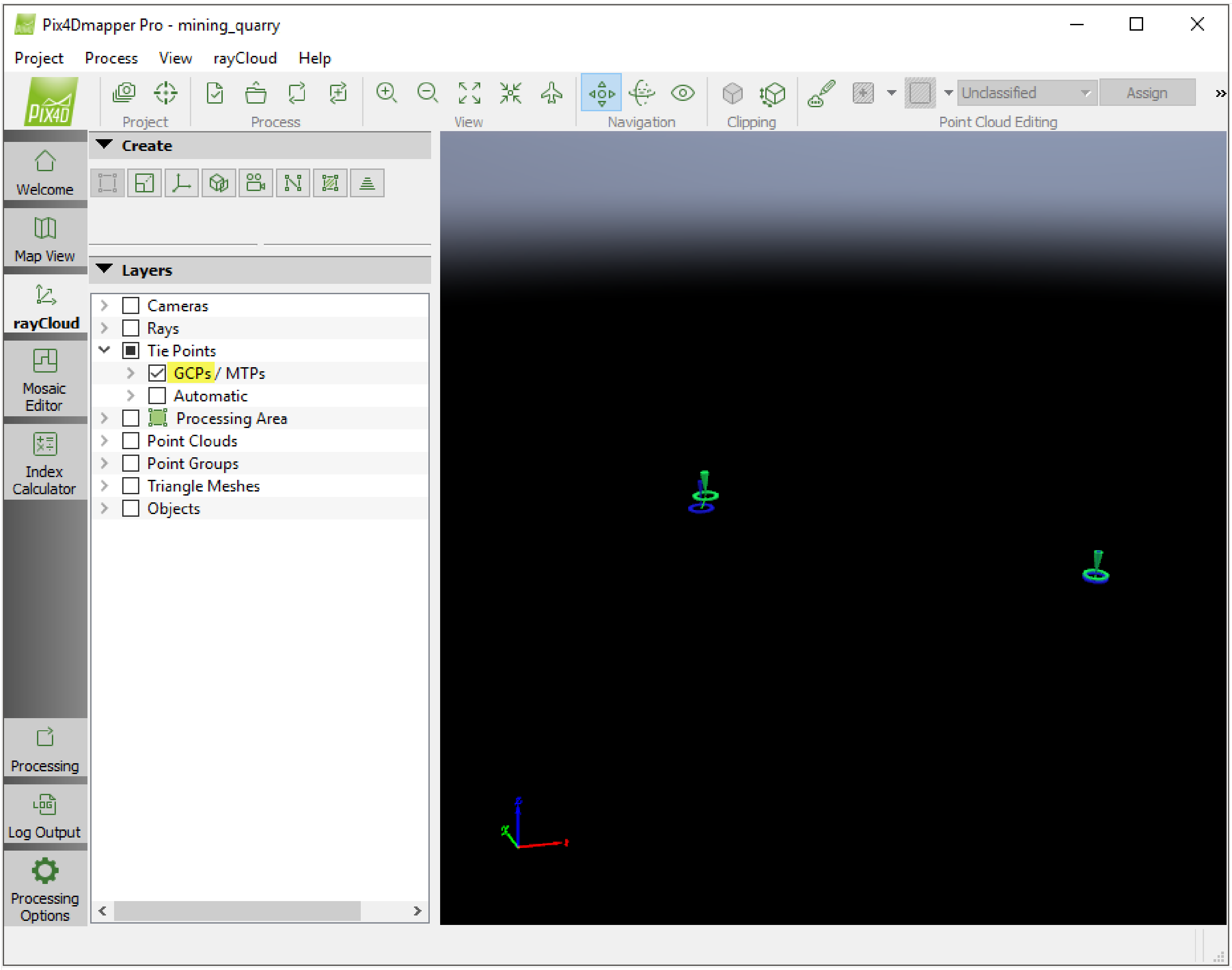
Orange cone: Vertices of the *Objects* drawn in the 3D View that are marked in less than 2 images.

Blue cone: Original position of GCPs and Check Points.

Colored point: Automatic tie point computed at step *1. Initial Processing* colored using the original images.



Manual Tie Points



Pix4Dmapper Pro - mining_quarry
Project
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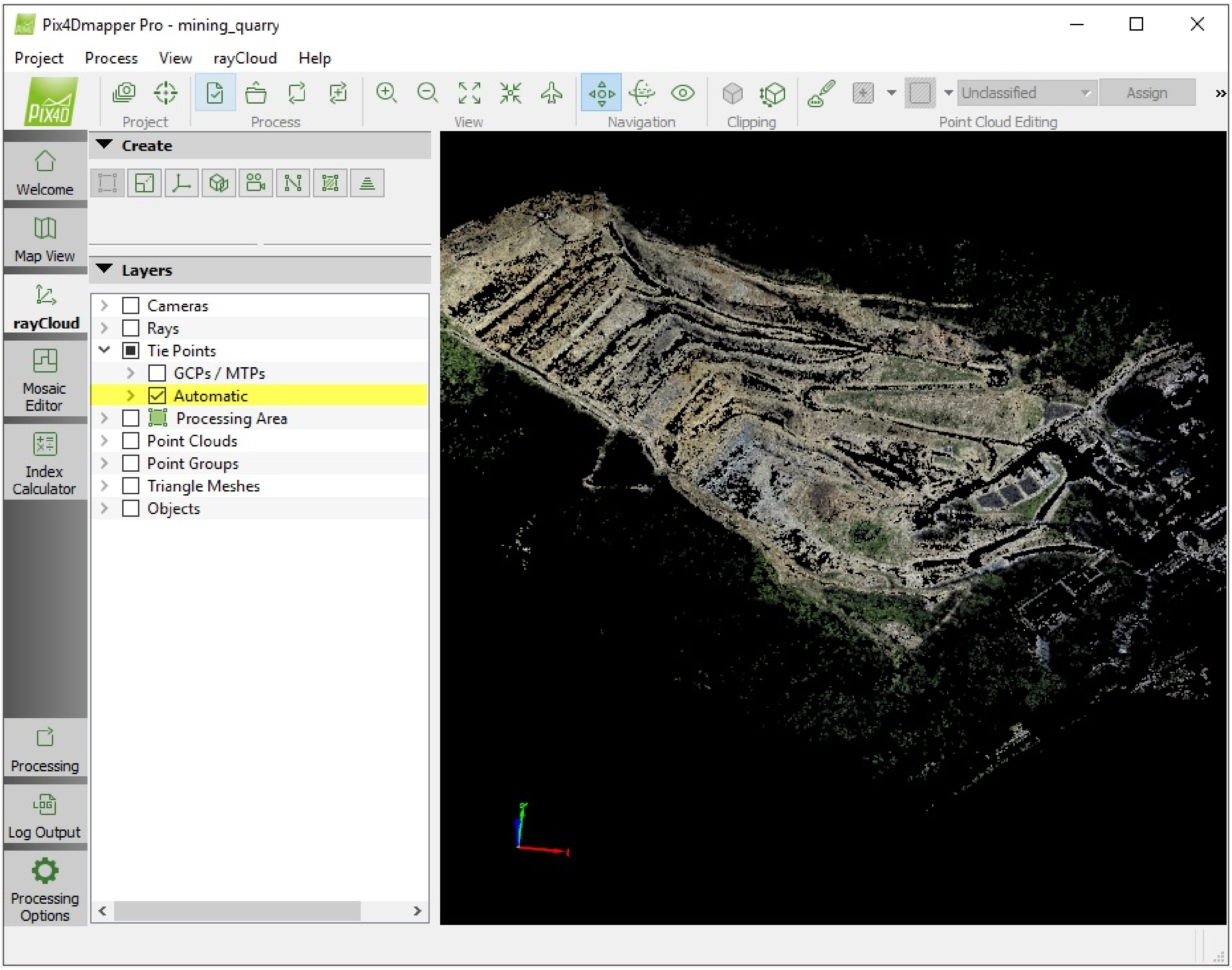
View
rayCloud
Help
Project
Process
View
Navigation
Clipping
Unclassified
Assign
Point Cloud Editing
Welcome
Map View
rayCloud
Mosaic Editor
Index Calculator
Processing
Log Output
Processing Options
Create
Layers
Cameras
Rays
Tie Points
GCPs / MTPs
Automatic
Processing Area
Point Clouds
Point Groups
Triangle Meshes
Objects

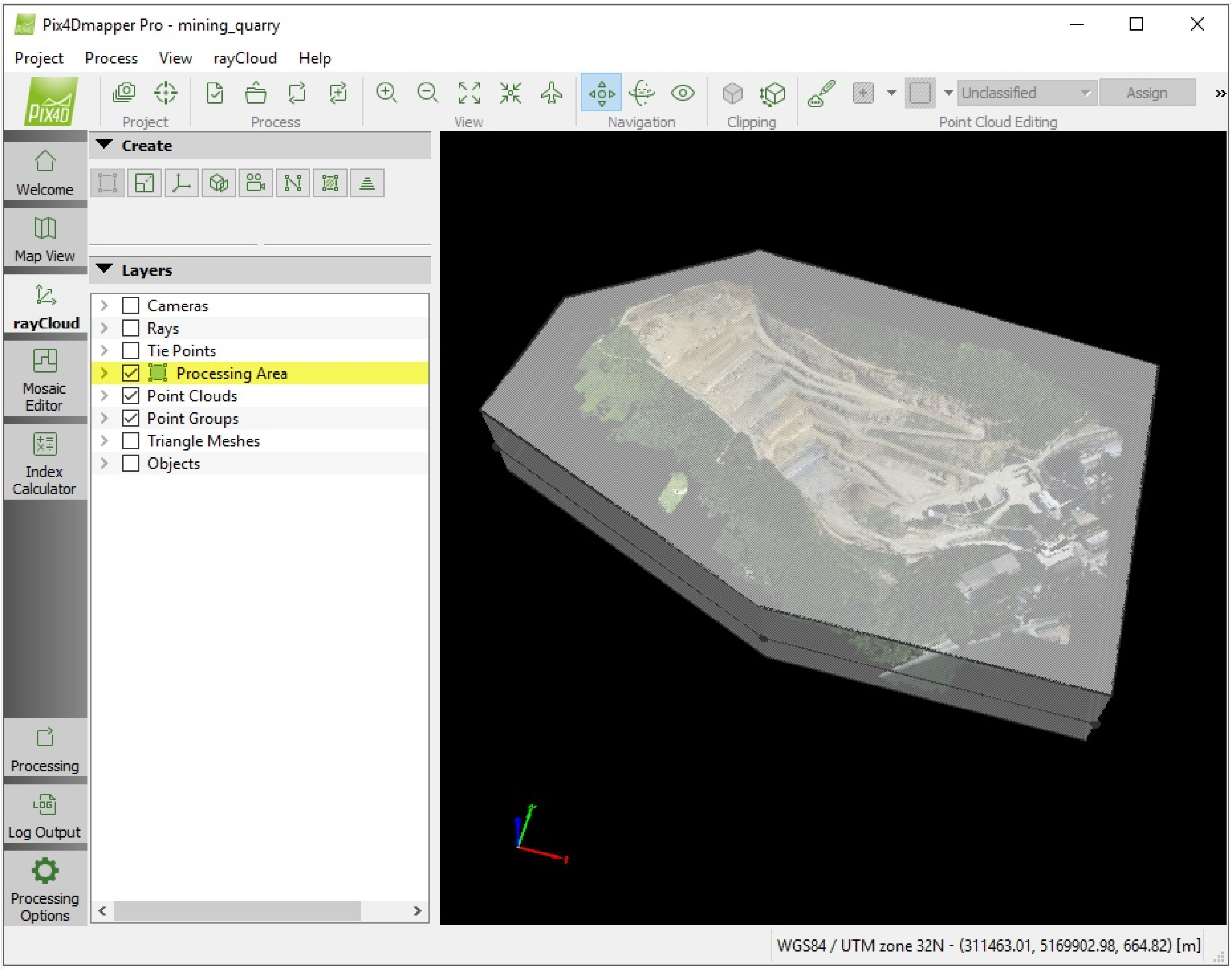
GCPs



Automatic Tie Points

Processing Areas

By default, a Processing Area is displayed on the 3D View as:
Gray spheres: Vertices of the middle plane of the 3D Processing Area.
Gray lines: Lines between the vertices of the planes (bottom, middle, and top planes) of the 3D Processing Area.
Transparent gray planes: Top, bottom, and side planes that form the 3D Processing Area.
Transparent light gray planes: Top, bottom, and side planes that form the 3D Processing Area when hovering over the area in the 3D View.
White lines: Lines between the vertices of the planes (bottom, middle, and top planes) of the 3D Processing Area when selecting the area in the 3D View.

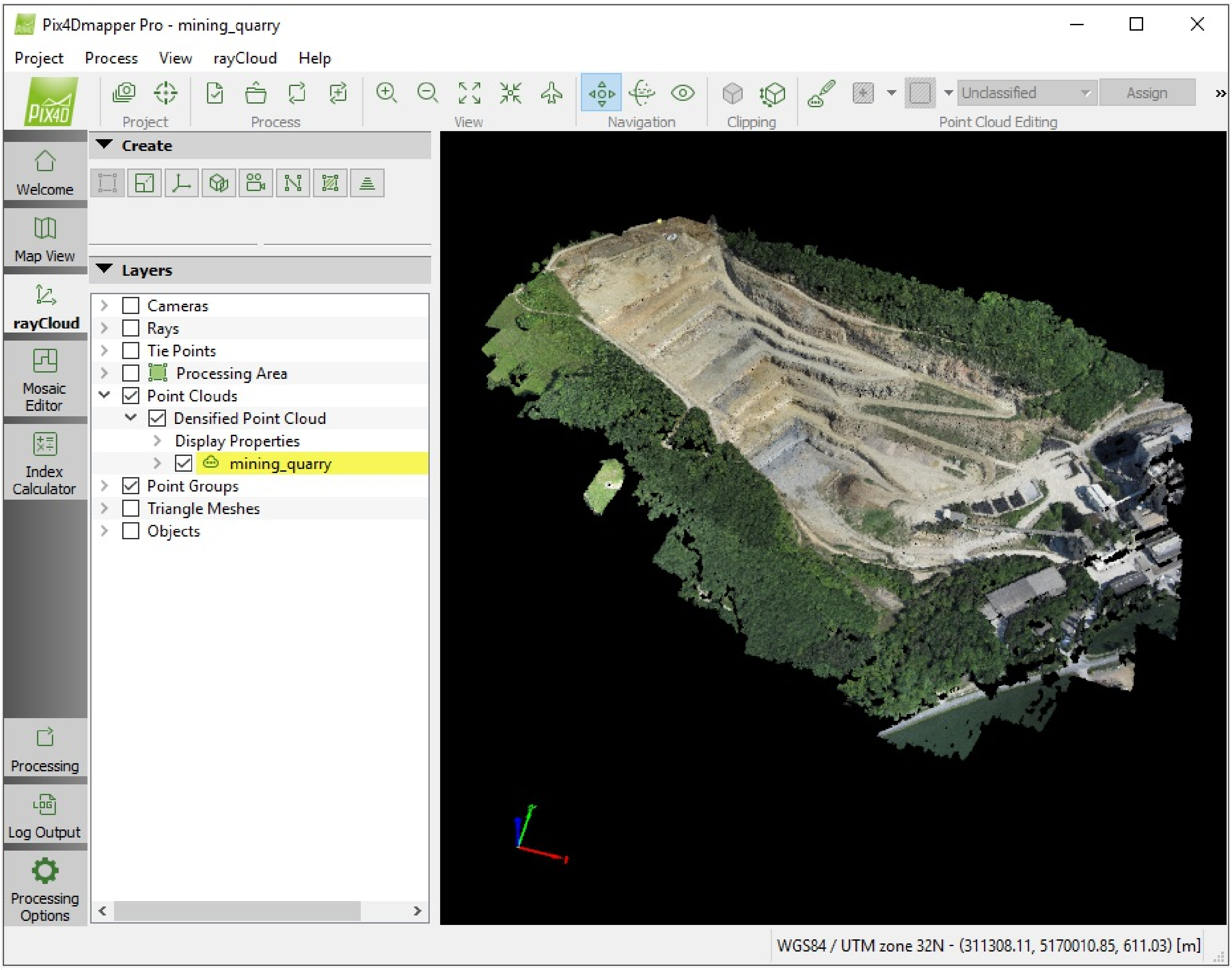


Processing Area: Point Cloud Densification Area

Point Clouds

By default, the Point Clouds are displayed on the 3D View using the 3D coordinates of their points as computed by Pix4Dmapper.

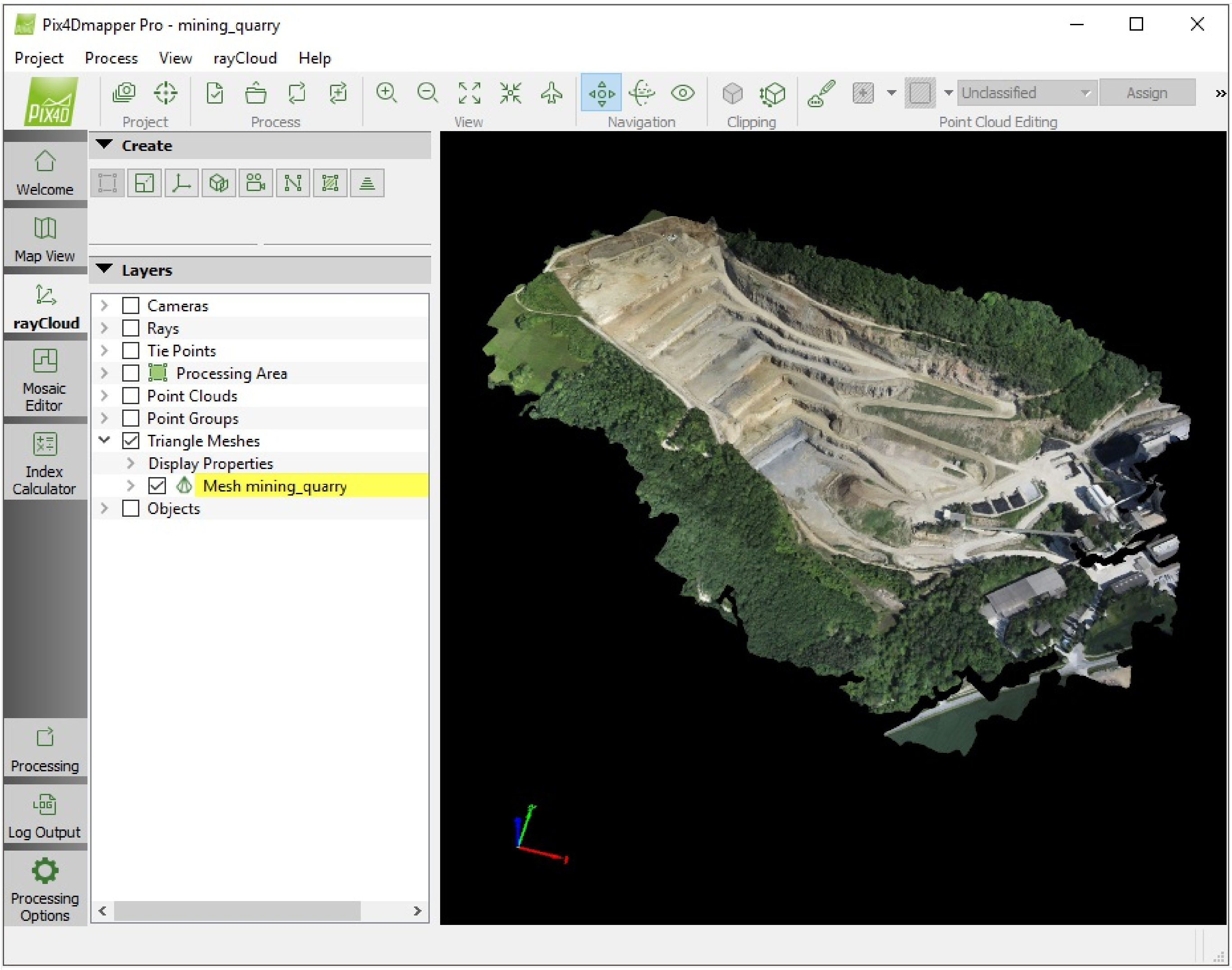
The coordinates of a given point are displayed on the bottom right part of the main window when the point is selected in the 3D View.



Densified Point Cloud

Triangle Meshes

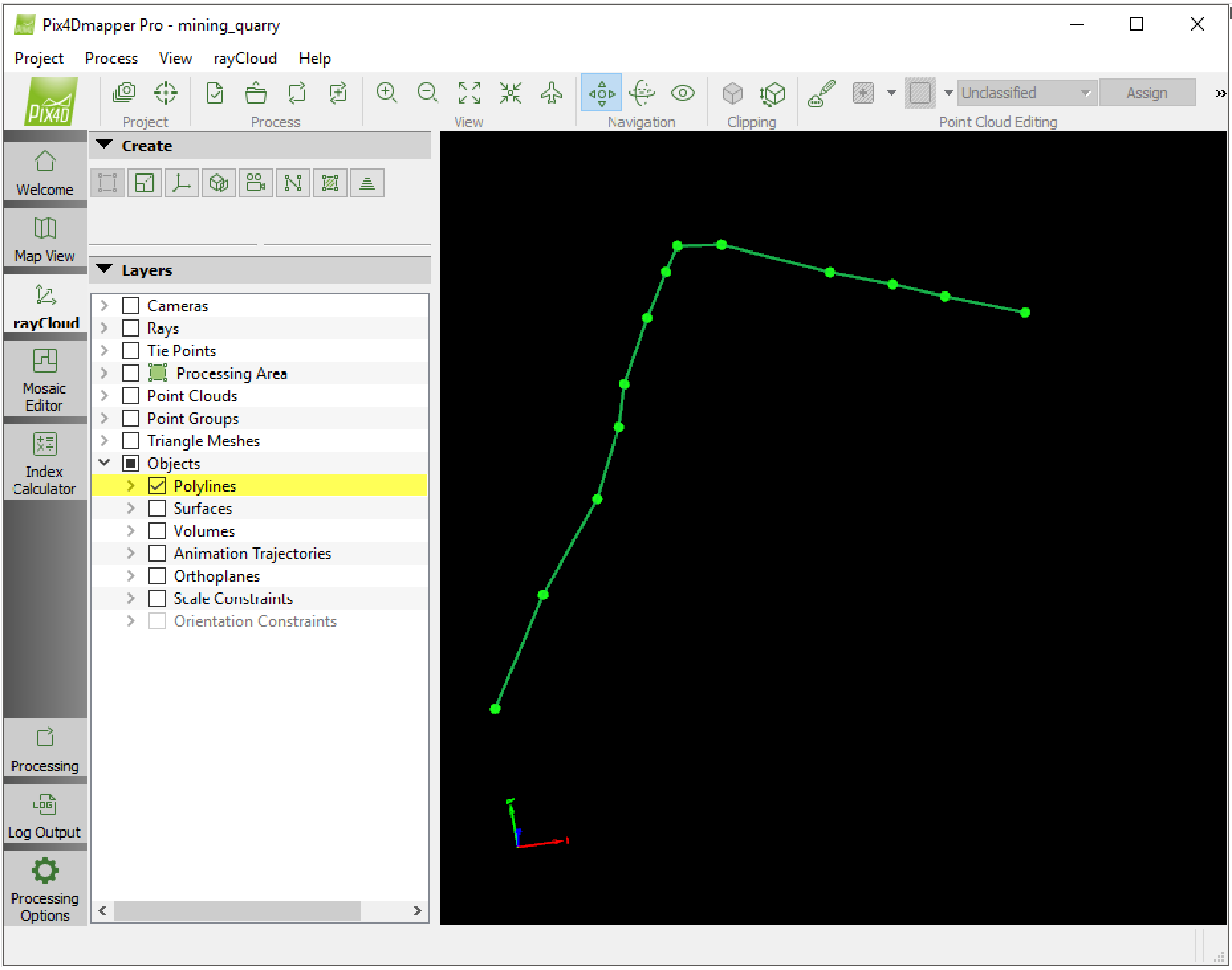
By default, the 3D Textured Mesh is displayed using the Texture shader and other triangle meshes are displayed using the Monochrome shader with gray color. For more information about the Display Options of the Triangle Meshes: 202558079.



Triangle Meshes

Objects

By default, the Objects are displayed on the 3D View as:
For Polylines, Surfaces, Volumes and Video AnimationTrajectories:
Green sphere: Object vertices for Polylines, Surfaces and Volumes. Waypoints for Animation Trajectories.
Green Arrow: Orientation of the camera in the waypoint (only for Animation Trajectories).
Blue sphere: First Waypoint in Animation Trajectories (only for Animation Trajectories).
Blue Arrow: Orientation of the camera in the first waypoint (only for Animation Trajectories).
Green surface: Base surface for Surfaces and Volumes.
Green lines: Lines between vertices/waypoints from the same object. For Polylines, Surfaces, Volumes and Animation Trajectories.
Red Terrain: Triangles below and above the base surface and the terrain defined by the Point Cloud (only for Volumes).
For Scale Constraints:
Light Blue double arrow: Scale Constraints.
For Orientation Constraints:
Dark Blue single arrow: Orientation Constraints.
For Orthoplanes:
Red sphere: Allows to increase the 3D orthoplane in the X Dimension.
Blue sphere: Allows to increase the 3D orthoplane in the Y Dimension.
Green sphere: Allows to increase the 3D orthoplane in the Z Dimension.
Red cone: Allows to move the 3D orthoplane in the X Dimension.
Blue cone: Allows to move the 3D orthoplane in the Y Dimension.
Green cone: Allows to move the 3D orthoplane in the Z Dimension.
Gray lines: Lines between the vertices of the planes of the 3D orthoplane.
Light gray lines: Defines the frontal surface of the 3D orthoplane (face that will be mapped).
Transparent light blue planes: Side planes that form the 3D orthoplane.


Pix4Dmapper Pro - mining_quarry
Project
Process
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Project
Process
View
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Clipping
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Assign
Point Cloud Editing
Create
Layers
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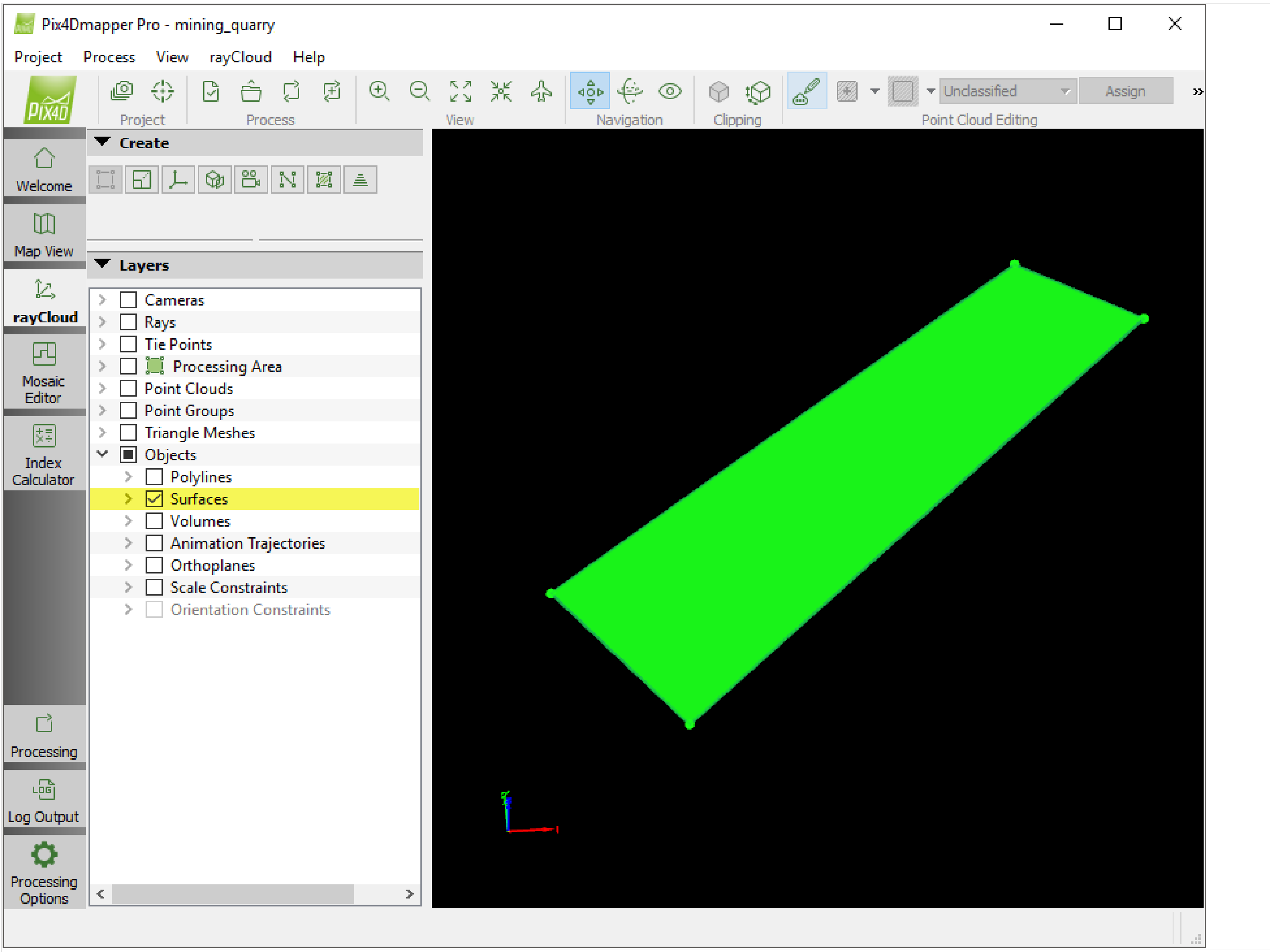
Triangle Meshes
Objects
Polylines
Surfaces
Volumes
Animation Trajectories
Orthoplanes
Scale Constraints
Orientation Constraints

Polylines


Pix4Dmapper Pro - mining_quarry
Project
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Clipping
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Point Cloud Editing
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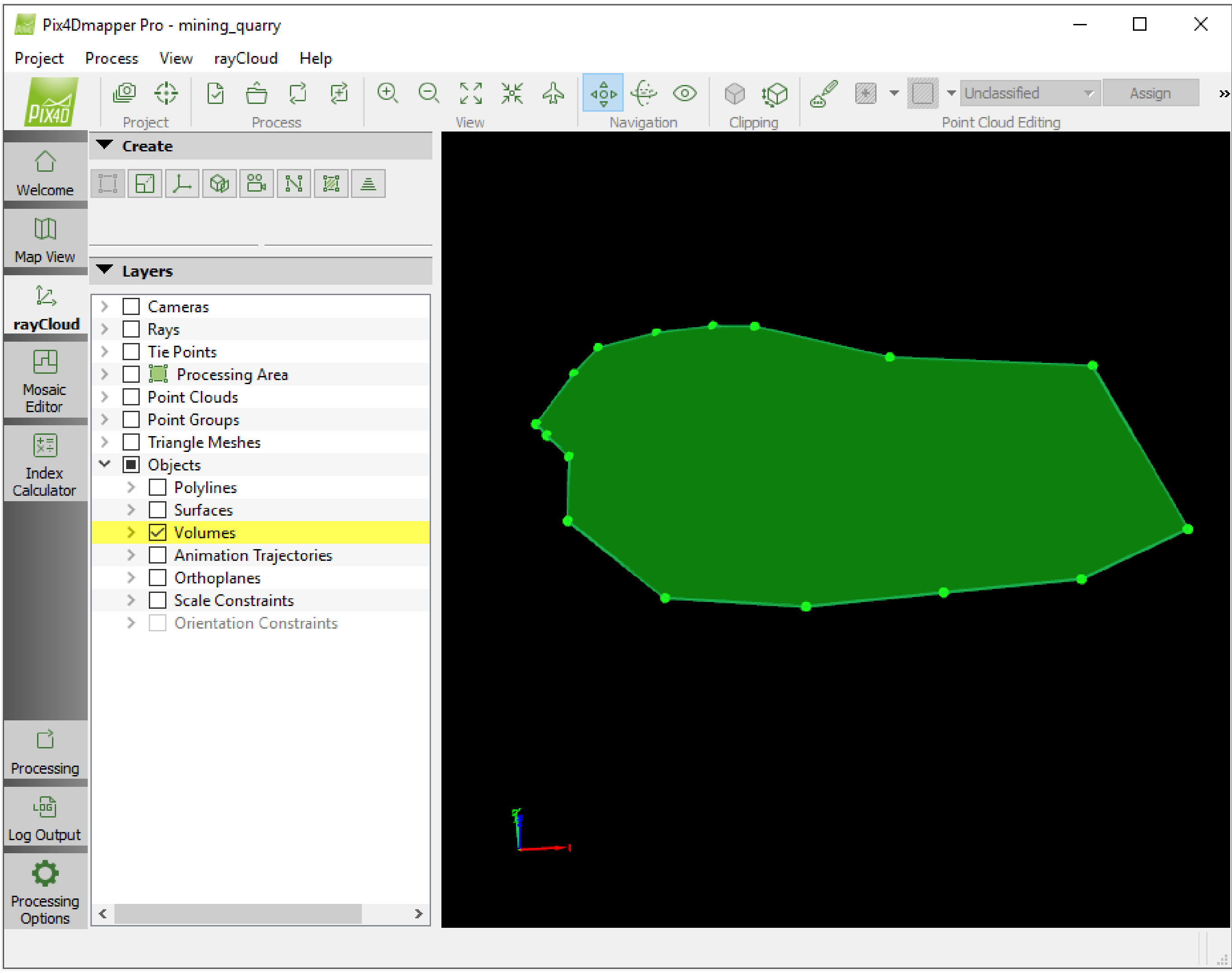
Animation Trajectories
Orthoplanes
Scale Constraints
Orientation Constraints

Surfaces

Volumes


Pix4Dmapper Pro - mining_quarry
Project
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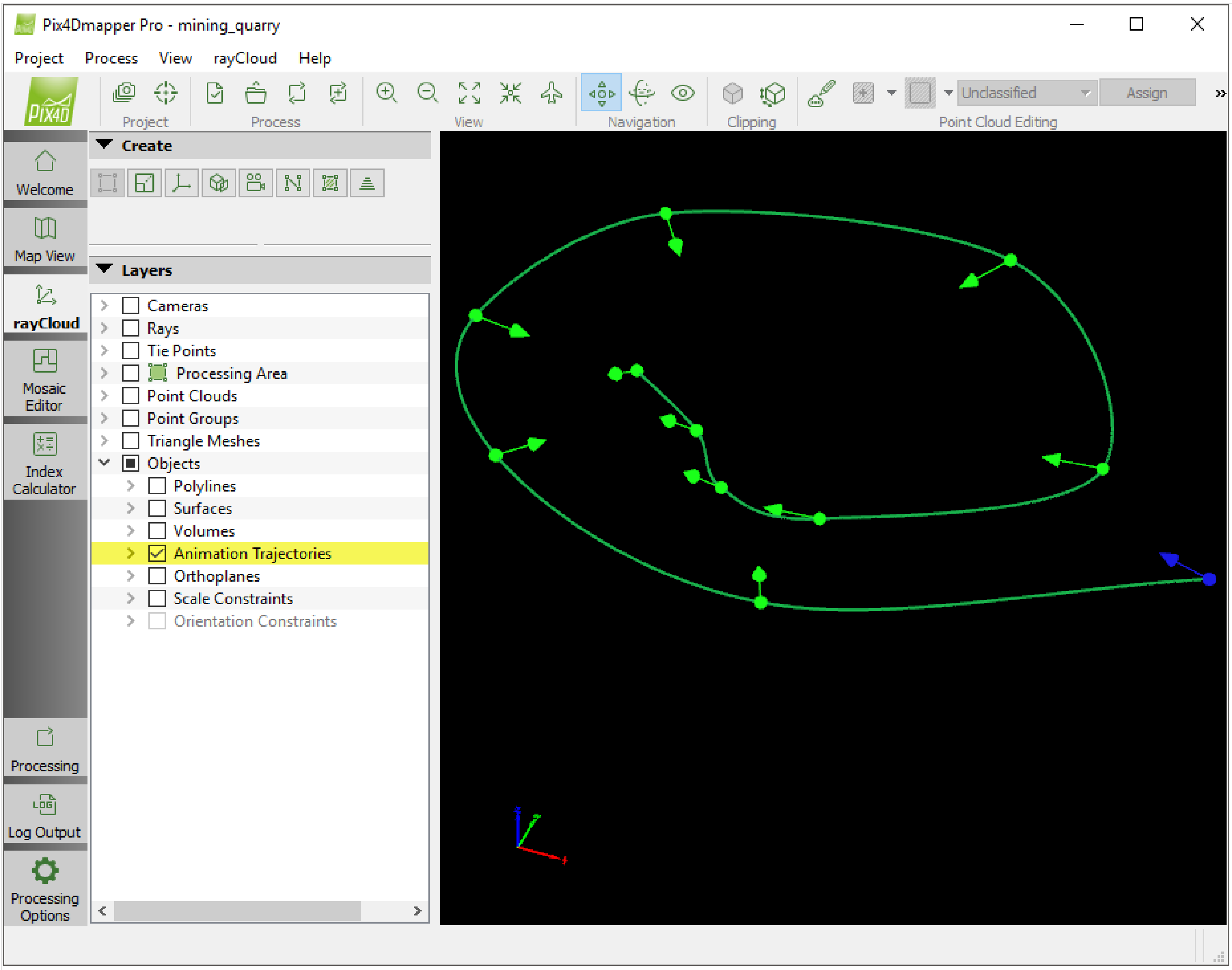
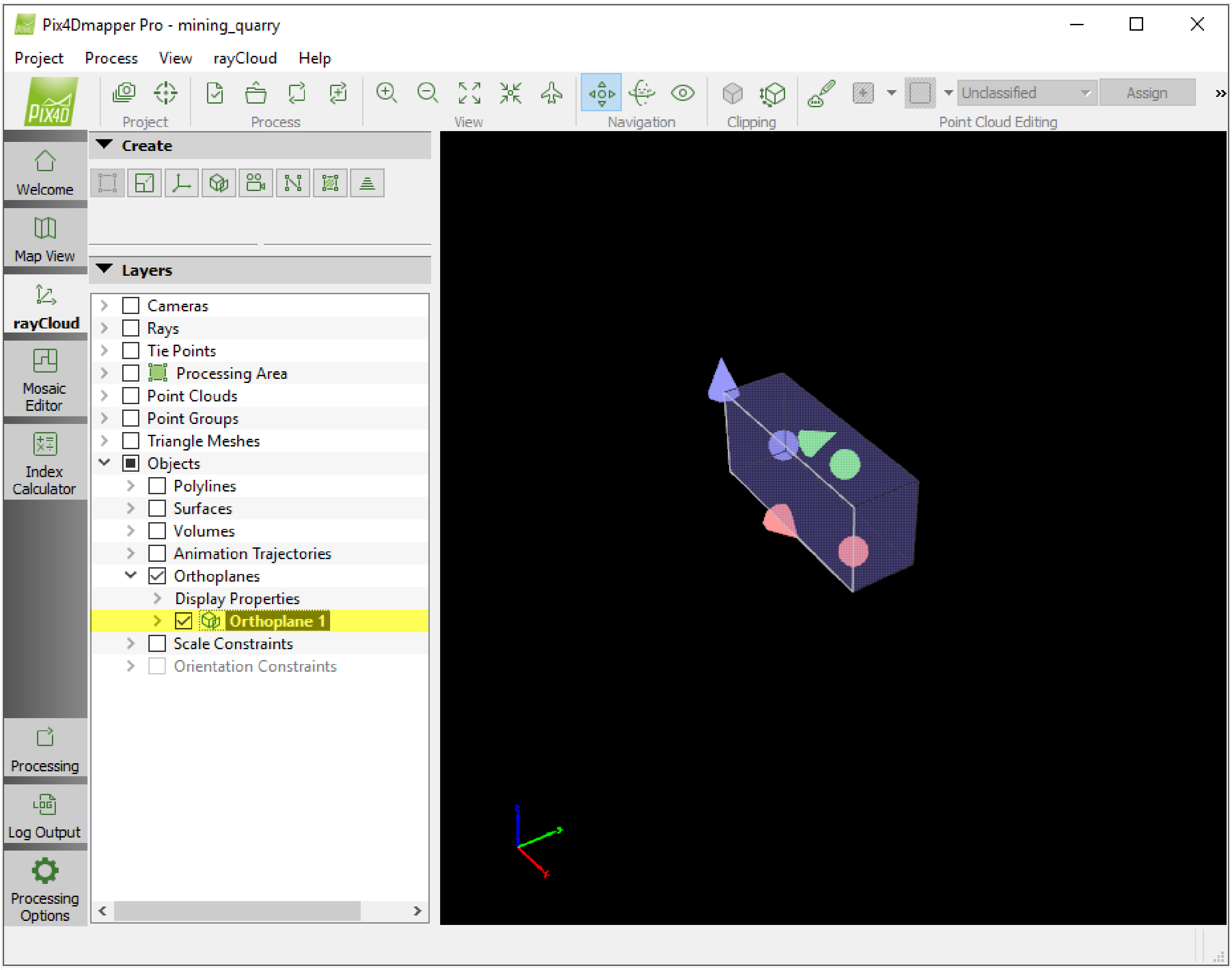
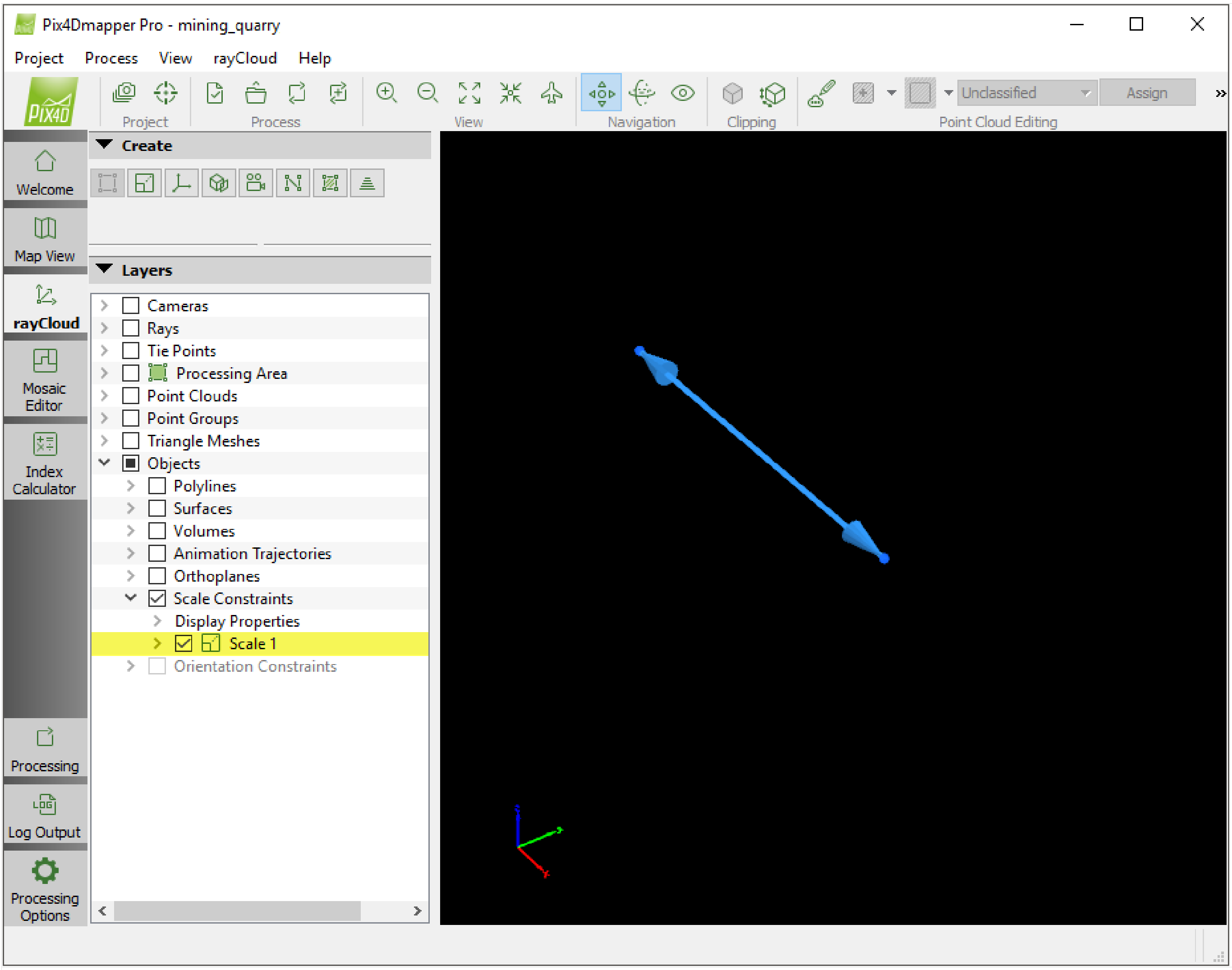
Orthoplanes
Scale Constraints
Orientation Constraints



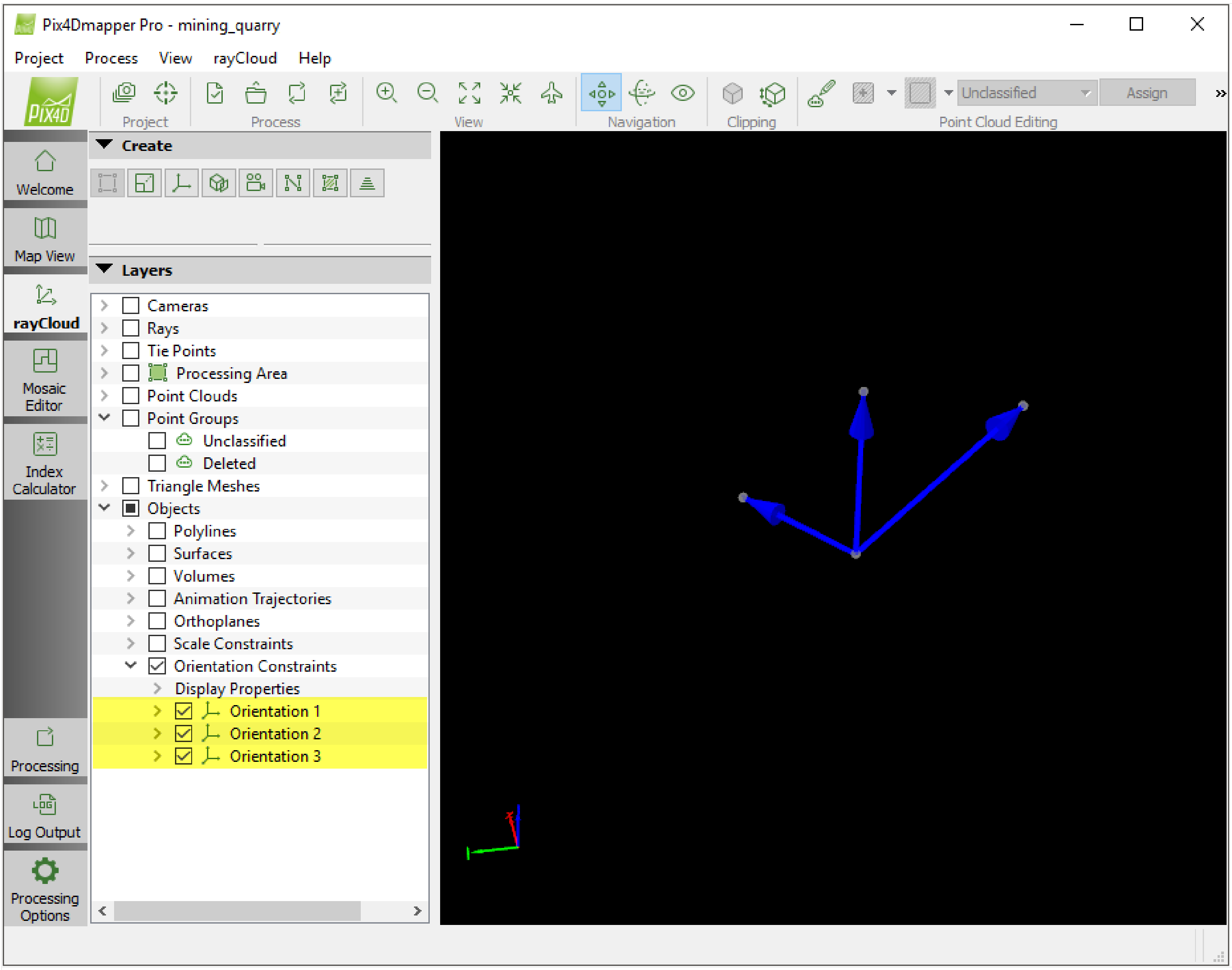
Animation Trajectory



Orthoplanes



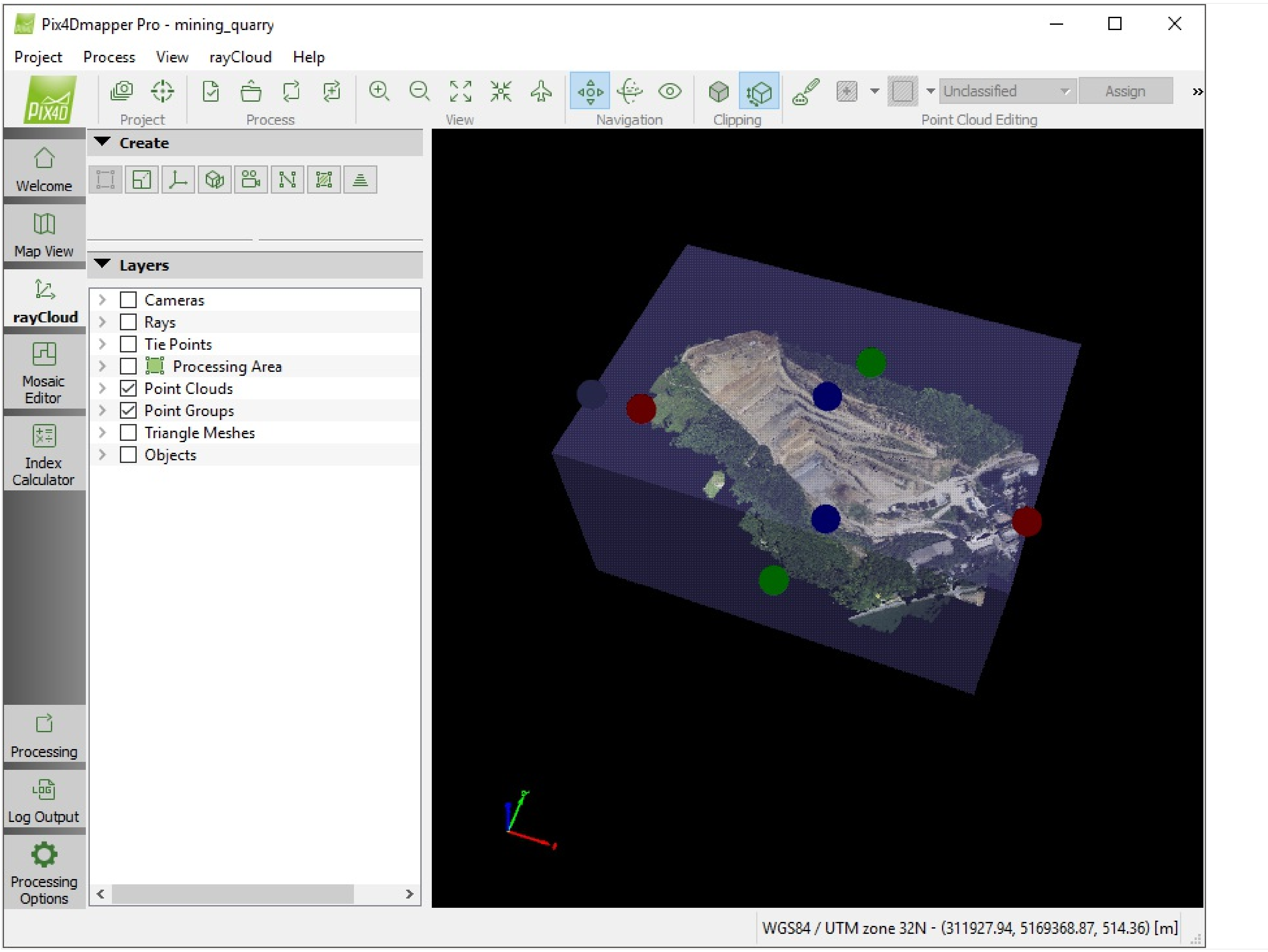
Scale Constraint



Orientation Constraint

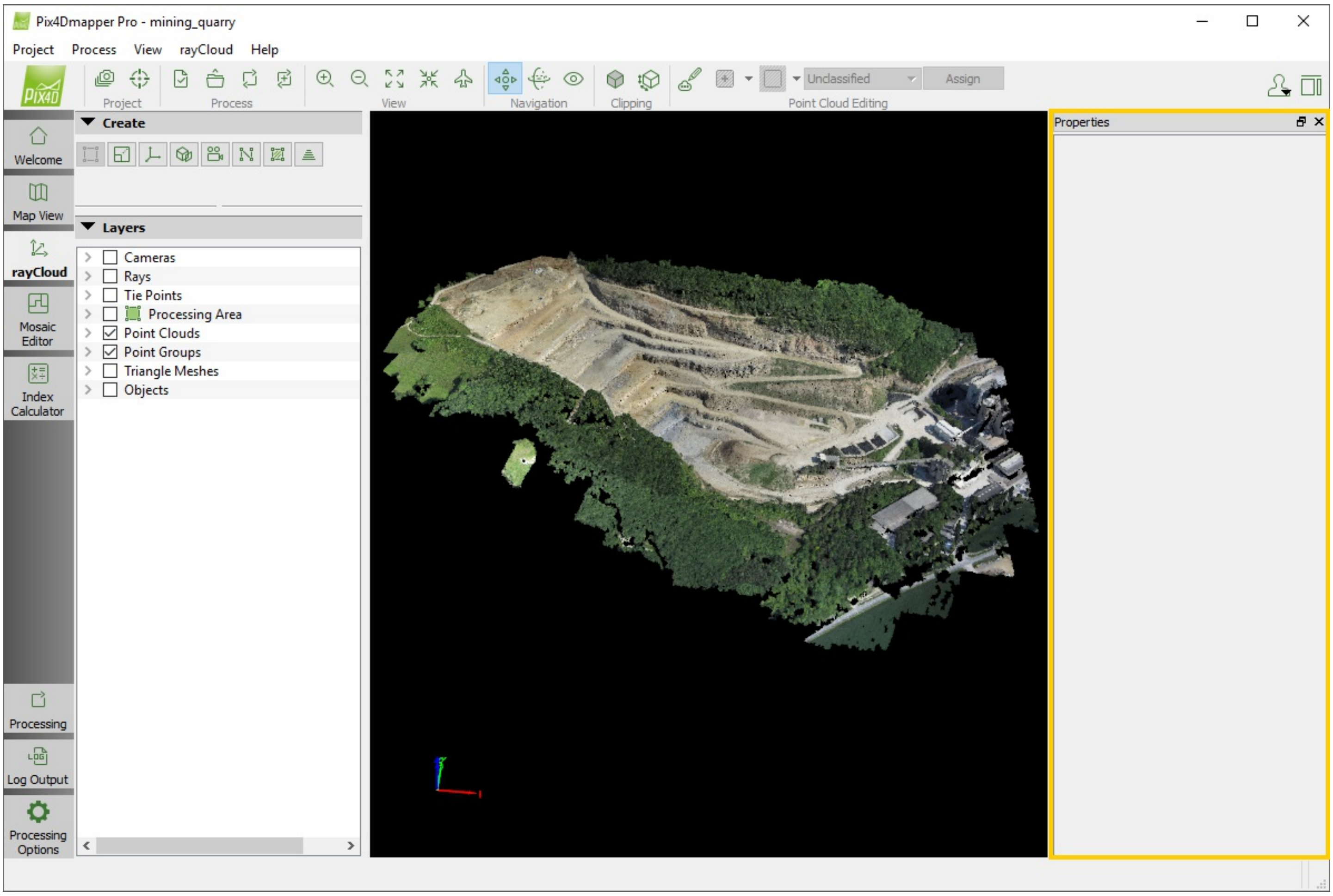
Clipping Box

Pink spheres: Allows to increase the 3D area in the X dimension.
Light blue spheres: Allows to increase the 3D area in the Z dimension.
Light green spheres: Allows to increase the 3D area in the Y dimension.
Light purple sphere: Allows to rotate the 3D area.
Transparent light blue planes: Side planes that form the 3D area.



Index > Interface > Menu View > rayCloud
Previous | Next

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The right sidebar is displayed on the right of the main window.
For information about the sidebar's display possibilities: 202558389.



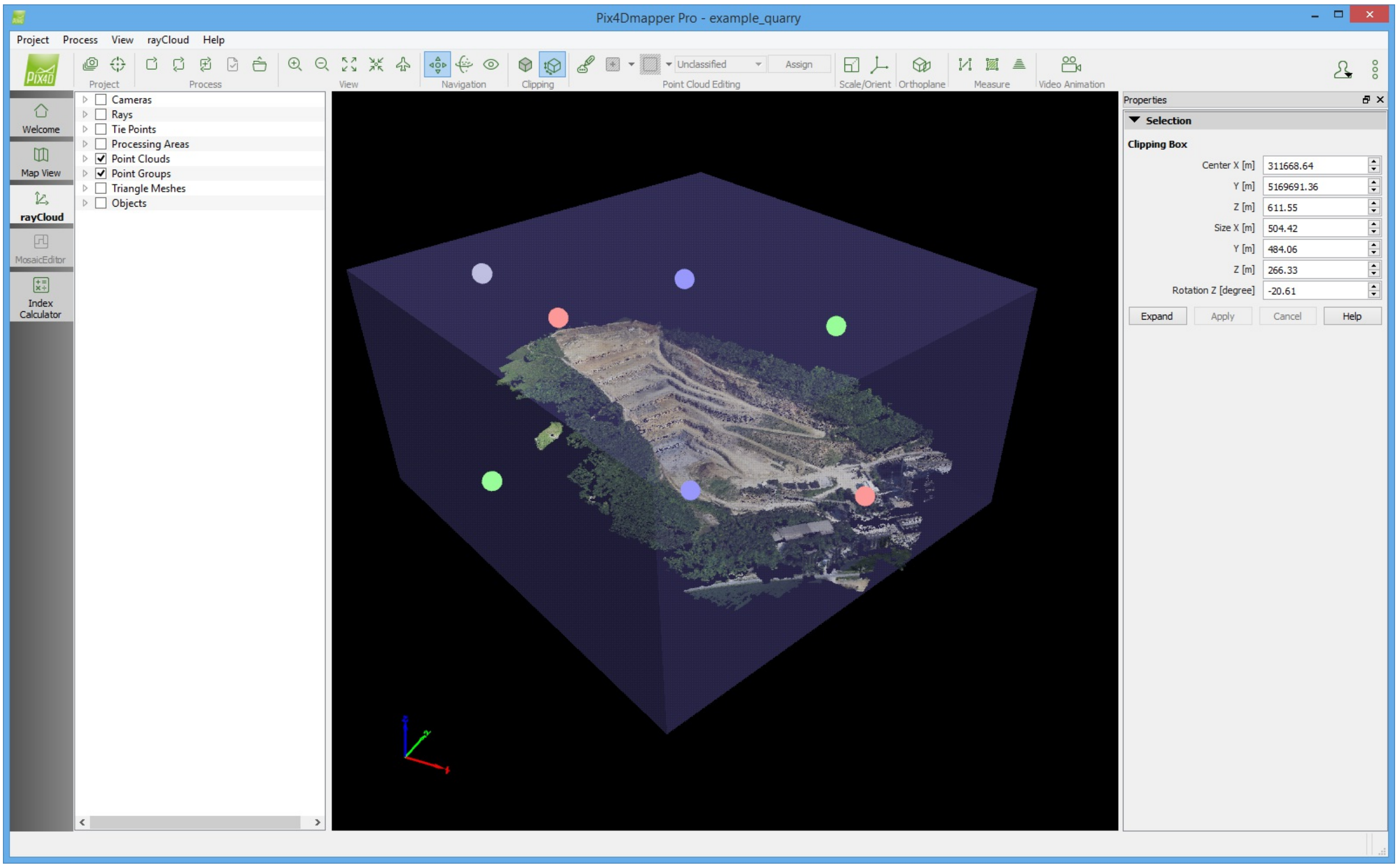
The *rayCloud* right sidebar displays different information for the element that is currently selected in the 3D View. The elements that can be selected in the 3D View are:

Clipping box
Cameras
GCPs and Manual Tie Points
Automatic Tie Points
Processing Area
Point Clouds
Objects: Polylines, Surfaces, Volumes, Animation Trajectories, Orthoplanes, Scale constraints and Orientation Constraints

Access: On the Menu bar, click View > rayCloud to open the rayCloud. In the toolbar, click the button . The right sidebar is displayed on the right of the main Window.
The *Clipping Box is displayed in the 3D View and the Clipping Box* Properties are displayed in the right sidebar.

Note: The *Clipping Box* only affects the display, not the results of any outputs of step *1. Initial Processing*, the *Densified Point Cloud* or step *3. DSM, Orthomosaic and Index.*

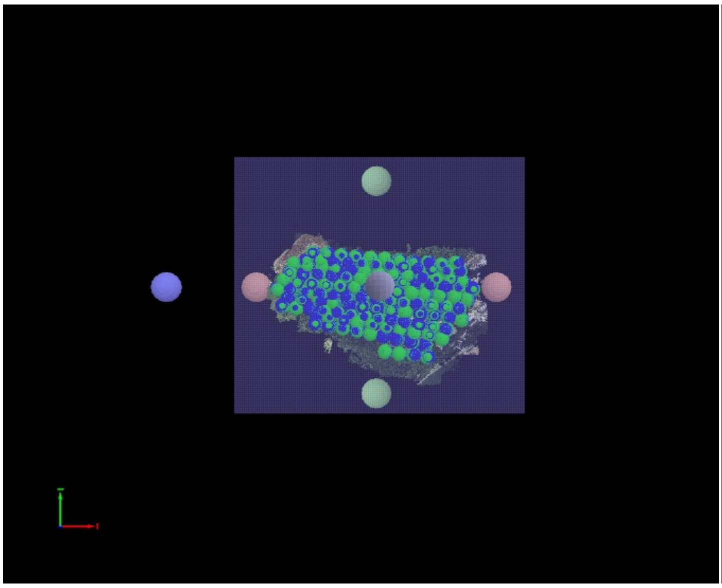
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX



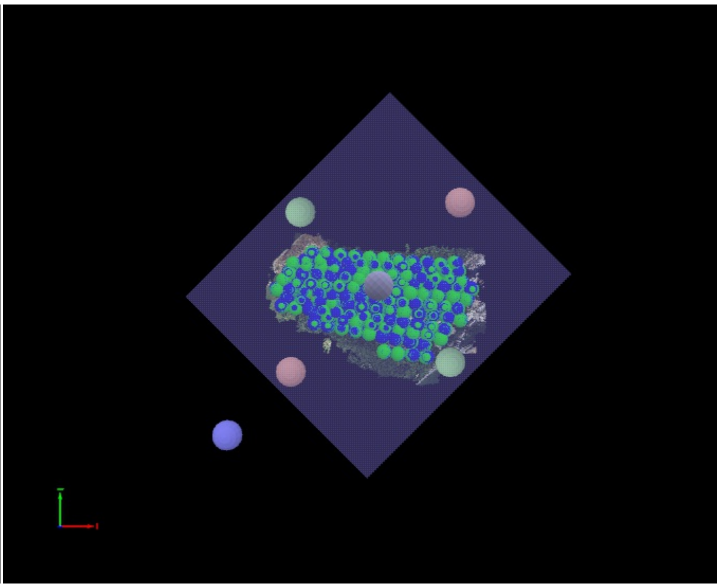
The following information is displayed:

Center X [m]: Relative X coordinate of the center of the Clipping Box.
Y [m]: Relative Y coordinate of the center of the Clipping Box.
Z [m]: Relative Z coordinate of the center of the Clipping Box.
Size X [m]: Size in meters of the X side of the Clipping Box.
Y [m]: Size in meters of the Y side of the Clipping Box.
Z [m]: Size in meters of the Z side of the Clipping Box.
Rotation Z [degree]: Represents the angle between:
The X axis of the model and the X axis of the Clipping Box.
The Y axis of the model and the Y axis of the Clipping Box.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX If we have time it would be nice to change this screenshot. It is not very sharp.



Rotation 0º



Rotation 45º

Below that information there are four buttons:

Expand: Creates a new Clipping Box which covers the full model.
Apply: Applies the changed in the values of the properties of the C;ipping Box.
Cancel: Cancels the changes in the values of the properties of the Clipping Box.
Help: Opens the Pix4Dmapper help.

Note: On the toolbar, click to apply the *Clipping Box* in the 3D View and visualize only the area contained in the Clipping Box.

For step by step instructions about how to use the Clipping Box: 204048035.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The *Sidebar* is displayed on the right of the main window.

The camera information is displayed on the right sidebar when clicking in the 3D View:

Initial camera position (for calibrated and uncalibrated cameras for which the initial position is known).
Calibrated camera position (for calibrated images).
Camera associated image thumbnail (for calibrated images).
The camera information is also displayed when selecting a given camera in the *Layers* section of the left sidebar.

The displayed camera information is different for:

Calibrated images
Uncalibrated images

Calibrated images

The following information is displayed in the *Selection* section:

Camera: Name of the image associated to the selected camera.
Camera Model: Camera model associated to the selected camera, including Image size in pixels (widthxheight) and band configuration.
Number of Marked MTPs and GCPs: Number of Manual Te Points / GCPs marked on the image.
Number of Automatic Tie Points: Total number of matched keypoints found on the image.
Computed Position [units]: X, Y, Z computed position of the camera.

Buttons:

Disable: Disables the image. In order to remove the camera from the reconstruction, the project needs to be reoptimized. This button is shown for enabled cameras.
Enable: Enables the image. In order to include the camera in the reconstruction, the project needs to be reoptimized. This button is shown for disabled cameras.
Uncalibrate: In order to recalibrate a camera it is necessary to uncalibrate it first. This option should be chosen if the user is not confident about the calibration of the camera.
Help: Opens the Pix4Dmapper help.
Apply Annotation: (available when the *Image Annotation* tool is used): Applies the image annotation to the Densified Point Cloud.

Note:
The *Image Annotation* tool does not affect the results obtained when running:
Step *1. Initial Processing*
Process > *Reoptimize*
Process > *Rematch and Optimize*
If step *2. Point Cloud and Mesh* has been completed:
By running again Step *2. Point Cloud and Mesh*: A new *Densified Point Cloud* including the annotations is generated.

Note:
For step by step instructions about how to calibrate a camera: 202560189.
For step by step instructions about how to annotate images: 202560549.

Image preview: Displays the image associated to the calibrated camera.

Orange cross: Represents the position of an automatic keypoint that has been matched with a keypoints from other images.
Yellow cross: Represents a Manual tie point or a GCP marked on the image.
Right slider: Allows the user to select the minimum number of images with which a keypoint has been matched.
Zoom in: Zoom in on the image.
Zoom out: Zoom out of the image.
Image Annotation: Activates the *Image Annotation* mode. For step by step instructions about how to annotate images: 202560549.

Tip: For the selected image:
In order to zoom in/out: Place the mouse over the location on which to zoom, and move the mouse scroll button forwards/backwards.
In order to pan: Place the mouse over the location on which to pan, and press the left mouse button while dragging the mouse.
By placing the mouse over an image and typing space, the image is displayed in full screen, where is possible to zoom, pan, click, etc.
When using the full screen mode, by typing:
Space: Minimizes the image and keeps the full screen zoom and panning level.
Esc: Minimizes the image and keeps the previous zoom and panning.

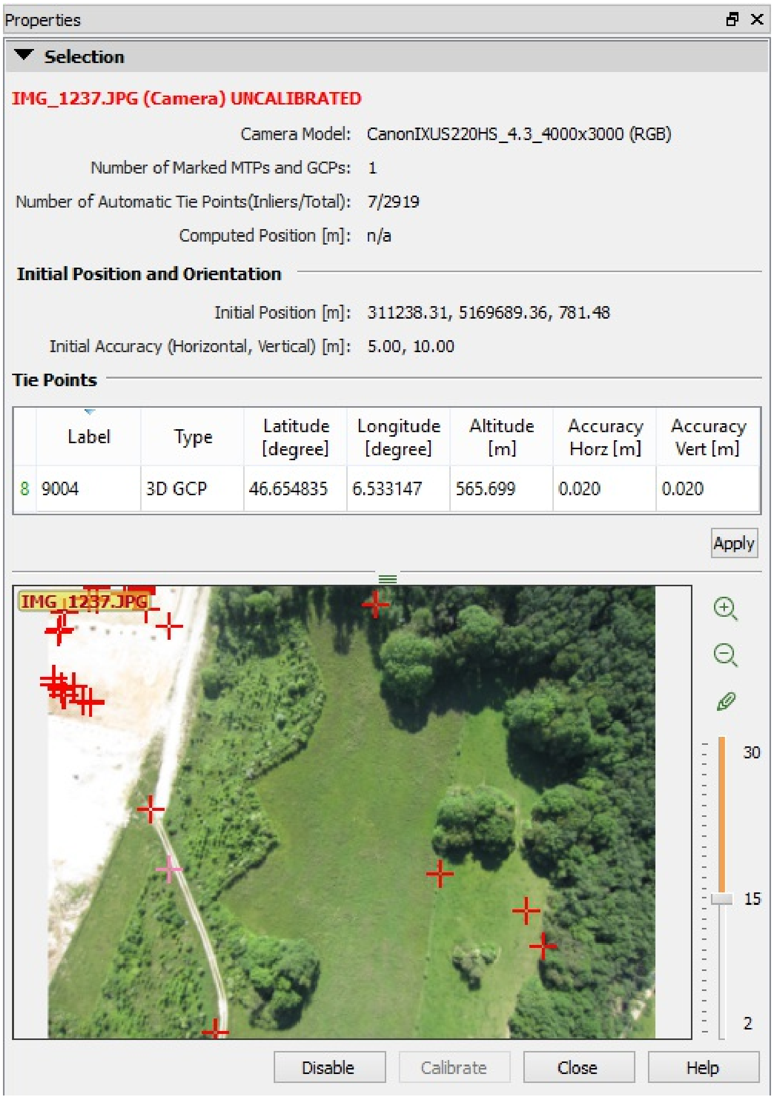
Images section

When double clicking on a cross in the Image preview (Automatic/Manual Tie Point or GCP), the *Images* section displays the images where the point can be found (including the currently selected image). For more information: 202558459.

Uncalibrated images

When selecting an uncalibrated camera, it can be manually calibrated.

The following information is displayed in the *Selection* section:



Camera: Name of the image associated to the selected camera.
Camera Model: Camera model associated to the selected camera, including Image size in pixels (widthxheight) and band configuration.
Number of Marked MTPs and GCPs: Number of Manual Te Points / GCPs marked on the image.
Number of Automatic Tie Points (Inliers/Total): Inlier points and total number of matching keypoints found on the image.
Computed Position [units]: X, Y, Z position of the computed camera. Since there is no computed position, it appears as *n/a*.

Buttons:

Disable: Disables the image. In order to remove the camera from the reconstruction, the project needs to be reoptimized. This button is shown for enabled cameras.
Calibrate: Allows the user to calibrate an uncalibrated camera. This button is enabled only if more than 20 Manual Tie Points and Automatic Tie Points are considered as being inliers.
Close: Exits the manual calibration mode.
Help: Opens the Pix4Dmapper help.
Apply Annotation: (available when the *Image Annotation* tool is used): Applies the image annotation to the Densified Point Cloud.

Note:
The *Image Annotation* tool does not affect the results obtained when running:
Step *1. Initial Processing*
Process > *Reoptimize*
Process > *Rematch and Optimize*
If step *2. Point Cloud and Mesh* has been completed:
By running again Step *2. Point Cloud and Mesh*: A new *Densified Point Cloud* including the annotations is generated.

Note:
For step by step instructions about how to calibrate a camera: 202560189.
For step by step instructions about how to annotate images: 202560549.

Image preview: Displays the image associated to the uncalibrated camera.

Red cross: Represents the position of an automatic keypoint that was not matched with keypoints from other images.
Orange crosses: Represents the position of an automatic keypoint which has a high probability of being accurately matched with keypoints of other images.
Yellow crosses: Represents a Manual tie point or a GCP marked on the image.
Right slider: Allows the user to select the minimum number of images with which a keypoint could be matched.
Zoom in: Zoom in on the image.
Zoom out: Zoom out of the image.
Image Annotation: Activates the *Image Annotation* mode. For step by step instructions about how to annotate images: 202560549.

Tip: For the selected image:
In order to zoom in/out: Place the mouse over the location on which to zoom, and move the mouse scroll button forwards/backwards.
In order to pan: Place the mouse over the location on which to pan, and press the left button while dragging the mouse.
By placing the mouse over an image and typing space, the image is displayed in full screen, where is possible to zoom, pan, click, etc.
When using the full screen mode, by typing:
Space: Minimizes the image and keeps the full screen zoom and panning level.
Esc: Minimizes the image and keeps the previous zoom and panning.

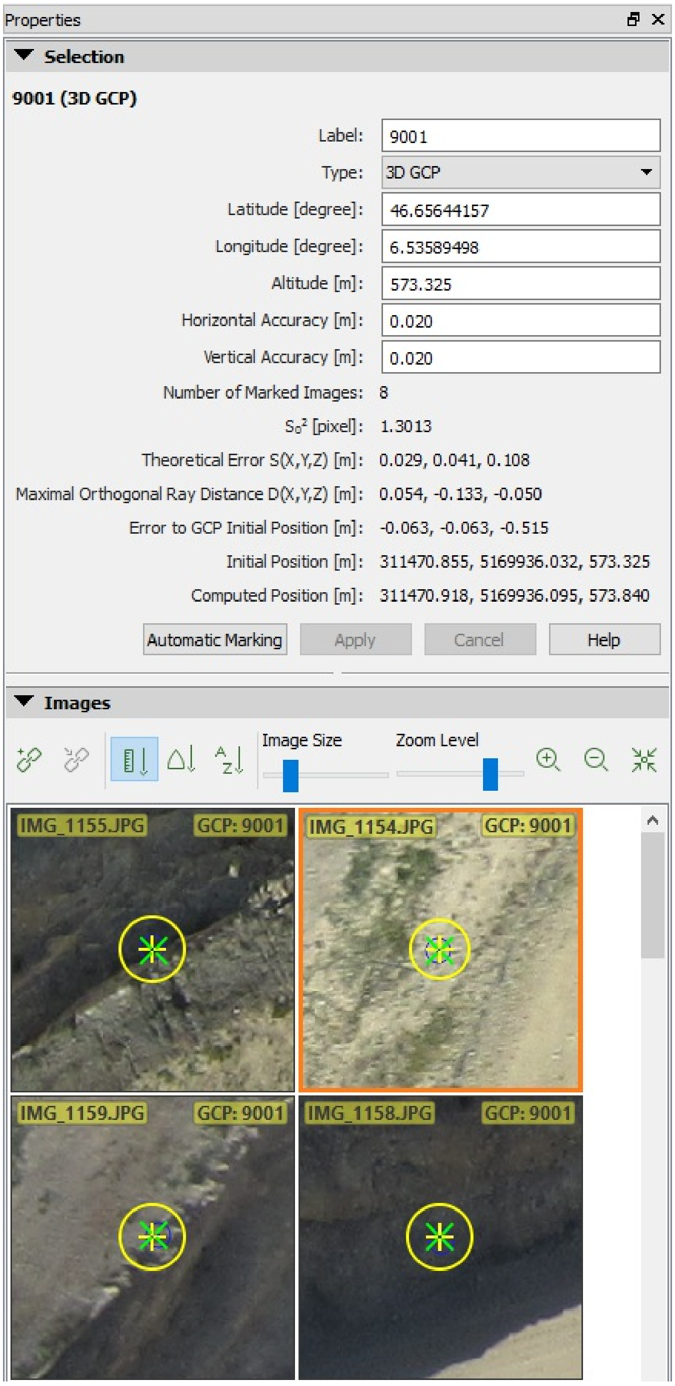
Tie Points section: Displays in a table information about the Manual Tie Points and GCPs that are marked on the selected image. The table allows the user to edit the information about the *Tie Points* by double clicking on the corresponding cell. For detailed information: 202557919.

Apply: When clicking on this button, the new marks or changes for the displayed Manual Tie Points and GCPs are added to the project.

Images section

When double clicking on a cross in the Image preview (Automatic / Manual Tie Point or GCP), the *Images* section displays the images where the point can be found (including the currently selected image). For more information: 202558459.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The right sidebar is displayed on the right of the main window.
The GCP or Manual Tie Point information is displayed when selecting a given 2D GCP, 3D GCP, Check point or Manual Tie Point in the 3D View or in the *Layers* section of the left sidebar.



The following information is displayed:

Name (type): The name and the type of the point (3D GCP, 2D GCP, Check point, Manual Tie Point).
Label: The name of the point.
Type: The type of the point (3D GCP, 2D GCP, Check point, Manual Tie Point).
First Coordinate:
Latitude [degree]: If the coordinate system of the GCPs is a geographic coordinate system.
X [m]: If the coordinate system of the GCPs is a projected coordinate system. The unit is given in meters.
X [feet]: If the coordinate system of the GCPs is a projected coordinate system. The unit is given in feet.
Arbitrary X [m]: If the coordinate system of the GCPs is defined by the user (local coordinate system). The unit is given in meters.
Arbitrary X [feet]: If the coordinate system of the GCPs is defined by the user (local coordinate system). The unit is given in feet.
Second Coordinate:
Longitude [degree]: If the coordinate system of the GCPs is a geographic coordinate system.
Y [m]: If the coordinate system of the GCPs is a projected coordinate system. The unit is given in meters.

Y [feet]: If the coordinate system of the GCPs is a projected coordinate system. The unit is given in feet.
Arbitrary Y [m]: If the coordinate system of the GCPs is defined by the user (local coordinate system). The unit is given in meters.
Arbitrary Y [feet]: If the coordinate system of the GCPs is defined by the user (local coordinate system). The unit is given in feet.
Third coordinate:
Altitude [m]: If the coordinate system of the GCPs is a geographic coordinate system.
Z [m]: If the coordinate system of the GCPs is a projected coordinate system. The unit is given in meters.
Z [feet]: If the coordinate system of the GCPs is a projected coordinate system. The unit is given in feet.
Arbitrary Z [m]: If the coordinate system of the GCPs is defined by the user (local coordinate system). The unit is given in meters.
Arbitrary Z [feet]: If the coordinate system of the GCPs is defined by the user (local coordinate system). The unit is given in feet.
Horizontal Accuracy [units]: The horizontal accuracy defined for the 2D and 3D GCPs. For more information: 202557919.
Vertical Accuracy [units]: The vertical accuracy defined for the 3D GCPs. For more information: 202557919.
Marks in images: The number images on which the point is marked.
So^2 [pixel]: A posteriori variance component of all the marked points for a given 3D point. For more information: 202559199.
Theoretical Error S(X,Y,Z)[units]: Theoretical error estimation. For more information: 202559139.
Maximal Orthogonal Ray Distance D (x,y,z)[units]: Maximal distance from the estimated 3D point and all the rays used to compute that 3D point. The distance is measured between the 3D point and the point defined by the line perpendicular to the ray passing through the 3D point. For more information: 202559179.
Error to GCP Initial Position [units]: Error in X, Y, Z between the original 3D position and the estimated 3D position. This information does not appear for Manual Tie Points.
Initial Position [units]: The initial X,Y,Z position of the 3D GCP, Manual Tie Point or Check point. The initial X, Y position of the 2D GCP.
Computed Position [units]: The computed X, Y, Z position of the 3D GCP, Manual Tie Point or Check point. The computed X, Y position of the 2D GCP.

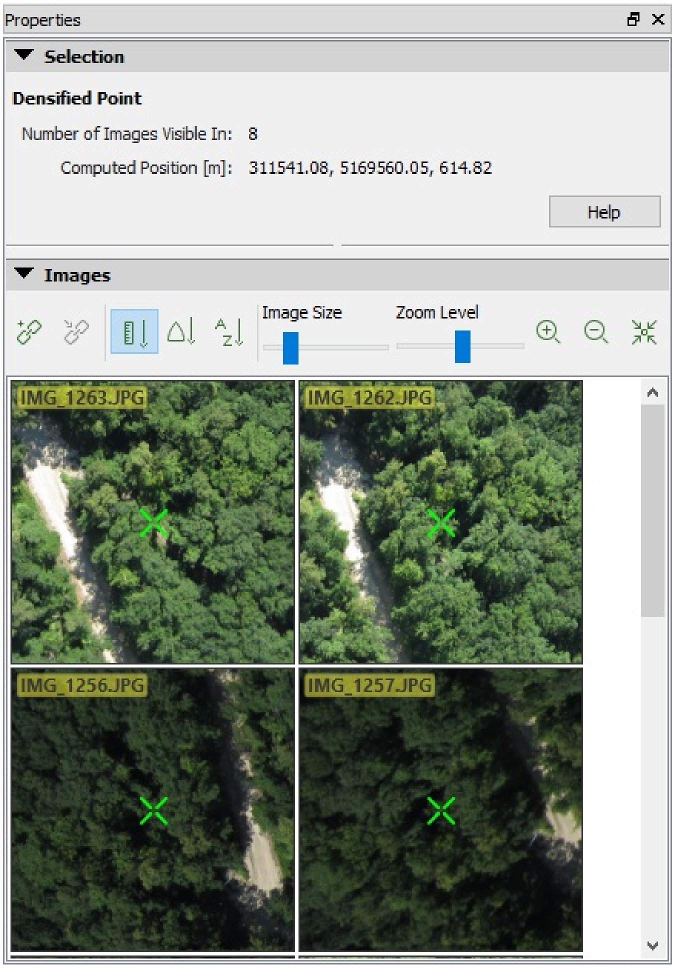
Below the table there are four buttons:

Automatic Marking: Allows the user to automatically mark the 3D point in the images that have not been marked. This button is activated when the 3D point has been marked in at least two images.
Apply: This button is active when the image marks have been modified, i.e. when a new image has been marked or when an existing mark has been updated or removed. When clicking this button, the new marks are taken into account and the 3D position of the corresponding point is recomputed. This button is also active when a change is done in the information regarding the point.
Cancel: Does not save the changes made to the marks of the point in the images or the information of the point.
Help: Opens the Pix4Dmapper help.

The *Images* section: Displays the selected image and the other images where the point can be found. For more information: 202558459.

Important: The zoom level at which GCPs / Manual Tie Points are marked has an impact on the GCP / Manual Tie Point error obtained in the *Quality Report*. Usually the higher the zoom level, the more precisely the GCP / Manual Tie Point is marked. These GCPs / Manual Tie Points will have a bigger impact on the reconstructed model than GCPs / Manual Tie Points marked on a lower zoom level; lower error values are also expected for these GCPs / Manual Tie Points. For example, when GCPs / Manual Tie Points are marked without zooming into the images, the GCP / Manual Tie Point error can be 10 times higher than when the GCPs / Manual Tie Points are marked by zooming into the images.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The right sidebar is displayed on the right of the main window.
The Automatic tie points information is displayed when an Automatic tie point is selected in the 3D View.



The following information is displayed:

Automatic Tie Point name (Automatic Tie Point): A unique name that identifies the Automatic Tie Point: ATP *[number],* where number is unique.
Number of Images Marked On: Number of calibrated images on which the point has been automatically marked (identified as the same 2D keypoint).
Number of Images Visible In: Number of calibrated images on which the 3D automatic tie point has been reprojected (number of calibrated images where the computed 3D point is visible).
So^2[pixel]: A posteriori variance component of all the marked points for a given 3D point. For more information: 202559199.
Theoretical Error S(X,Y,Z)[units]: Theoretical error estimation. For more information: 202559139.
Maximal Orthogonal Ray Distance D(X,Y,Z)[units]: Maximal distance from the estimated 3D point and all the rays used to compute that 3D point. The distance is measured between the 3D point and the point defined by the line perpendicular to the ray passing through the 3D point. For more information: 202559179.
Computed Position [units]: X, Y, Z position of the selected point.

Below this information there is one button:

Help: Opens the Pix4Dmapper help.

The *Images* section: Displays the images where the point is marked on and visible in. For more information: 202558459.

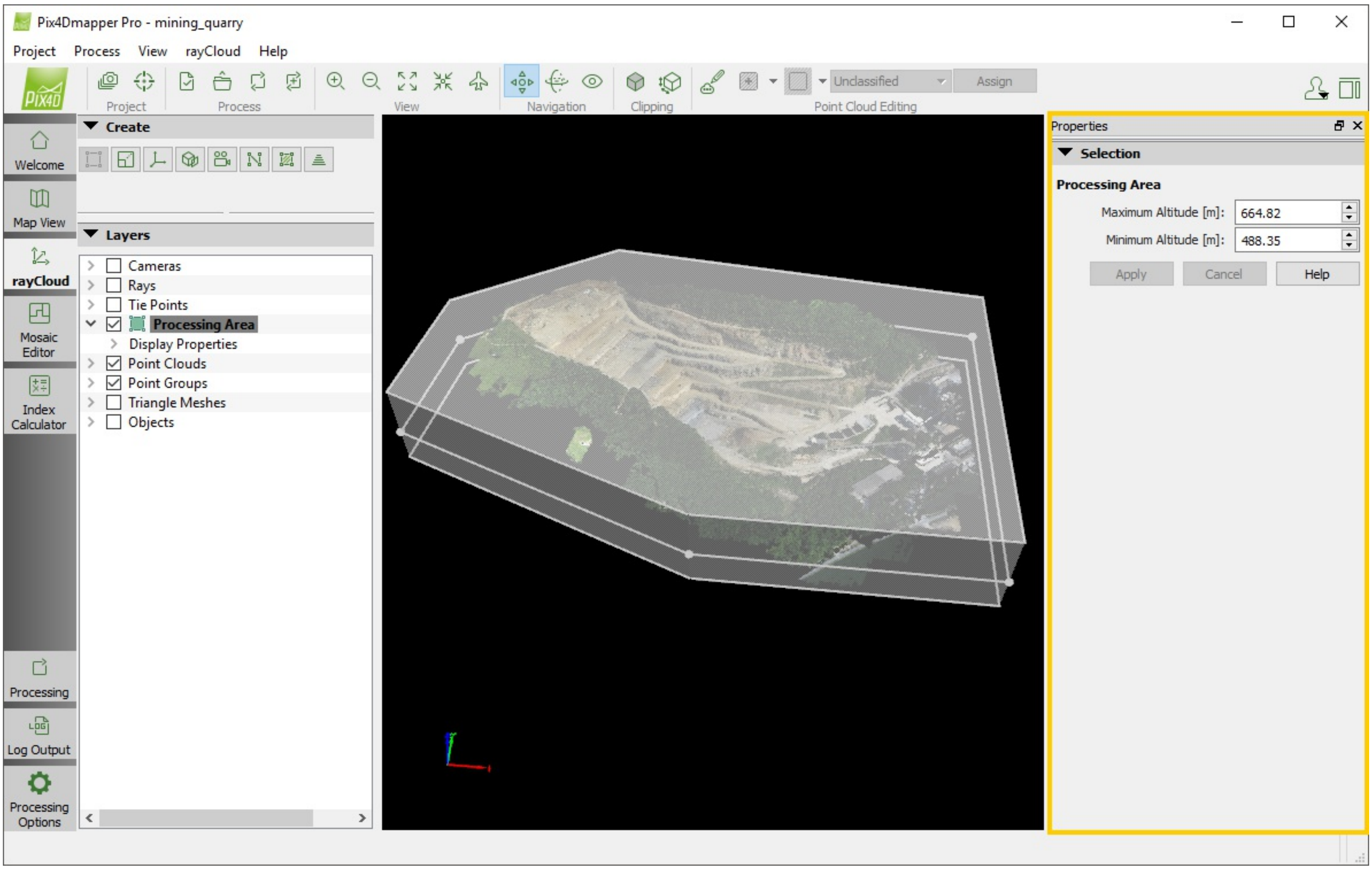
Access: On the Menu bar, click View > rayCloud to open the rayCloud. The right sidebar is displayed on the right of the main window.
The *Processing Area* information is displayed when the *Processing Area* is selected in the *3D View*.

Warning:
It is recommended to include areas covered by images in the *Processing Area,* so as to exclude areas of low overlap that can affect the results.
The *Processing Area* affects only the visualization of the Automatic Tie Points in the 3D View of the rayCloud. It does not affect the results of step *1. Initial Processing*.
When the *Processing Area* is defined before step *2. Point Cloud and Mesh* is processed, it affects the Point Cloud visualized in the 3D View of the rayCloud and the results saved on disk. This *Processing Area* will also affect the results of step *3. DSM, Orthomosaic and Index*.
When the *Processing Area* is defined after step *2. Point Cloud and Mesh* is completed, it only affects the Point Cloud visualized in the 3D View of the rayCloud but not the results saved on disk. This *Processing Area* will also affect the results of step *3. DSM, Orthomosaic and Index*.
When exporting the Point Cloud, it is possible to take into account the Processing Area, even if it is drawn after step 2 is processed. For more information about how to export the Point Cloud: 203890769.
When the *Processing Area* is defined before step *3. DSM, Orthomosaic and Index* is completed, only the results of step 3 will be affected.

Warning:
In order to take the *Processing Area* into account for the visualization of the Point Cloud and / or the generation of the outputs of step *2. Point Cloud and Mesh*, the corresponding filter should be selected in the *Processing Options*. For more information: 204644369.

The *Processing Area* will be taken into account for the results of step *3. DSM, Orthomosaic and Index* even if the *Processing Areas* box is not selected in the *Point Cloud Filters*.

Note: For step by step instructions about how to select a *Processing Area*: 202560179.



The section *Selection* displays the following information:

Maximum Altitude[units]: Altitude of the top plane of the *Processing Area*.
Minimum Altitude[units]: Altitude of the bottom plane of the *Processing Area*.

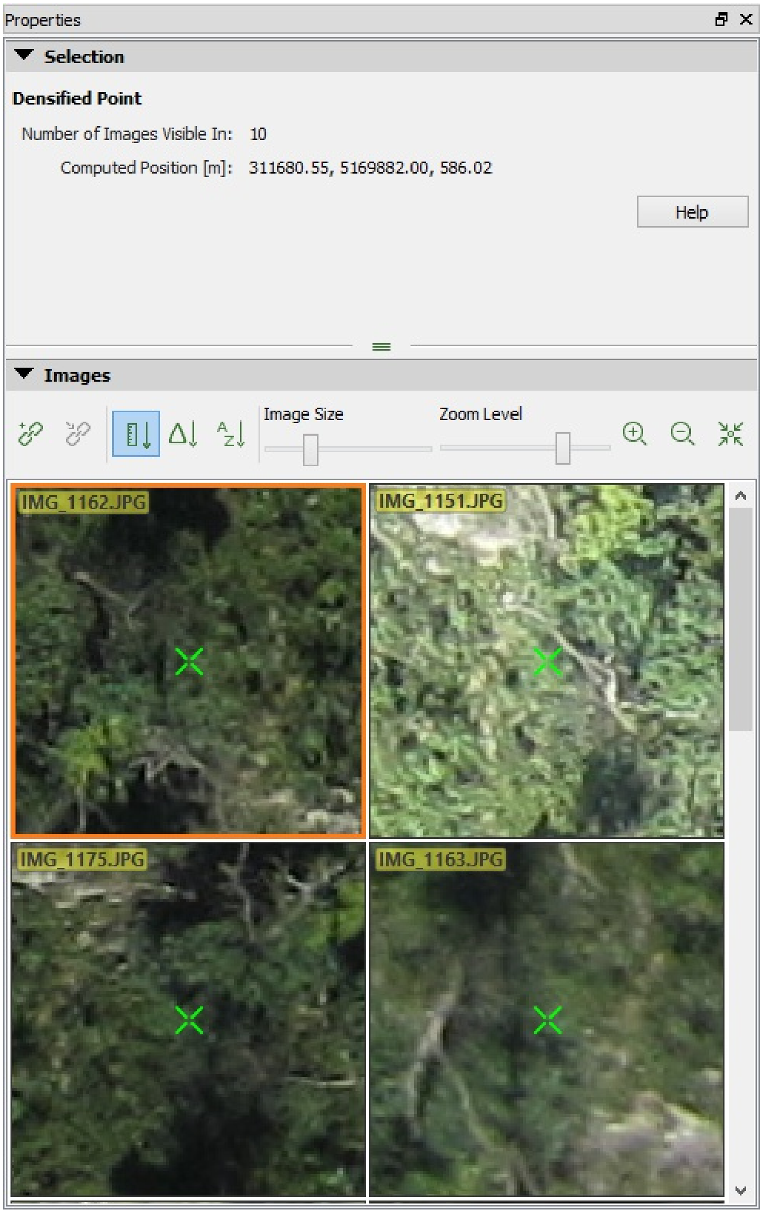
Important: *Maximum Altitude* should be higher than *Minimum Altitude*.

Note: The *Maximum Altitude* and *Minimum Altitude* can be edited by:
Selecting the text box and:
Clicking Page Up/Page Down keys: Increase/Decrease the value by 10 units.
Clicking Up Arrow/Down Arrow keys: Increase/Decrease the value by 1 unit.
Clicking Up Arrow/Down Arrow text box buttons: Increase/Decrease the value by 1 unit.
Typing a new number in the text box.

Below that information there are 2 buttons, grayed out by default, enabled once the values for Minimum or Maximum Altitude are modified.

Apply: Saves the new values for the Minimum/Maximum Altitude and applies the new filters.
Cancel: Does not save the new values for the Minimum/Maximum Altitude.
Help: Opens the Pix4Dmapper help.

Access: On the Menu bar, click View > rayCloud to open the rayCloud. The right sidebar is displayed on the right of the main window.
The Point Clouds information is displayed when a point of a point cloud is selected in the 3D View.



The following information is displayed:

Number of Images Visible In: Number of calibrated images on which the selected point has been reprojected (number of calibrated images where the computed 3D point is visible).
Computed Position [units]: X, Y, Z position of the selected point in the *3D View.*

Below this information there is one button:

Help: Opens the Pix4Dmapper help.

The *Images* section: Displays the selected image and the other images where the point can be found. For more information: 202558459.

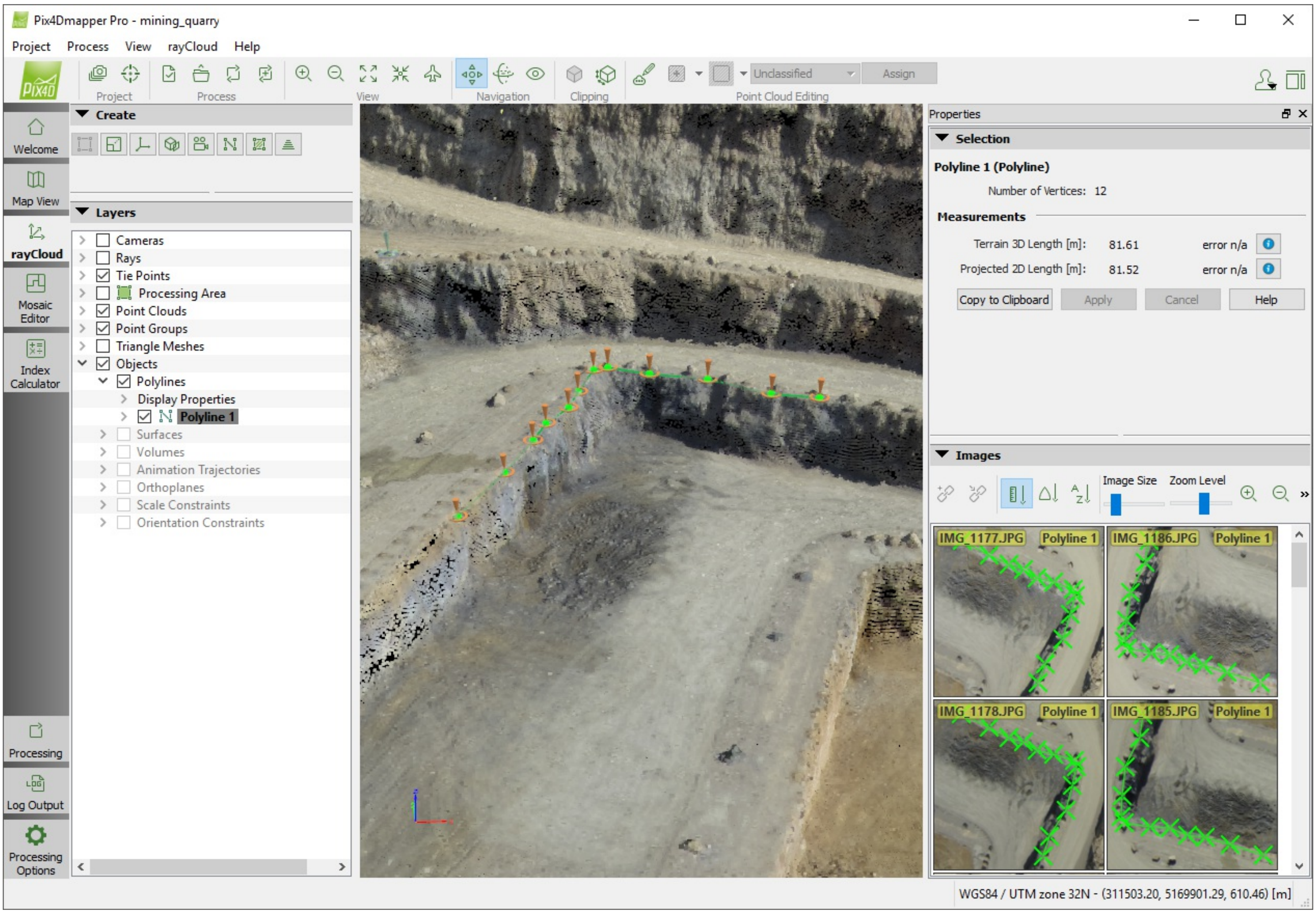
Access: On the Menu bar, click View > rayCloud to open the rayCloud. The right sidebar is displayed on the right of the main window.
The object information is displayed when an object is selected in the 3D View, or when an object is selected in the *Layers* section of the left sidebar.

There are 7 type of objects:

Polylines
Surfaces
Volumes
Animation Trajectories
Orthoplanes
Scale Constraints
Orientation Constraints

Note: A Manual Tie Point is associated to each vertex of the objects. The *Sidebar* allows the user to mark these Manual Tie Points on the images. Each vertex that is marked in a least 2 images is taken into account in step *1. Initial Processing* if it is started from scratch or if the reconstruction is re-optimized.

Polylines



The following information is displayed:

Object name (object type): The name of the Polyline and its type (Polyline).
Number of Vertices: Number of vertices used to draw the Polyline.
Measurements
Terrain 3D length[units]: 3D length of the Polyline, taking into account the three coordinates of the vertices. For more information: 202559819.
Projected 2D length[units]: 2D length of the Polyline, taking into account the (X,Y) coordinates of the vertices. For more information: 202559839.

Note: When the polyline is created, next to the measurements, "error n/a " appears indicating that the measurement accuracy cannot be calculated till all the vertices of the polyline are marked on at least 2 images. For step by step instructions: 202560609.

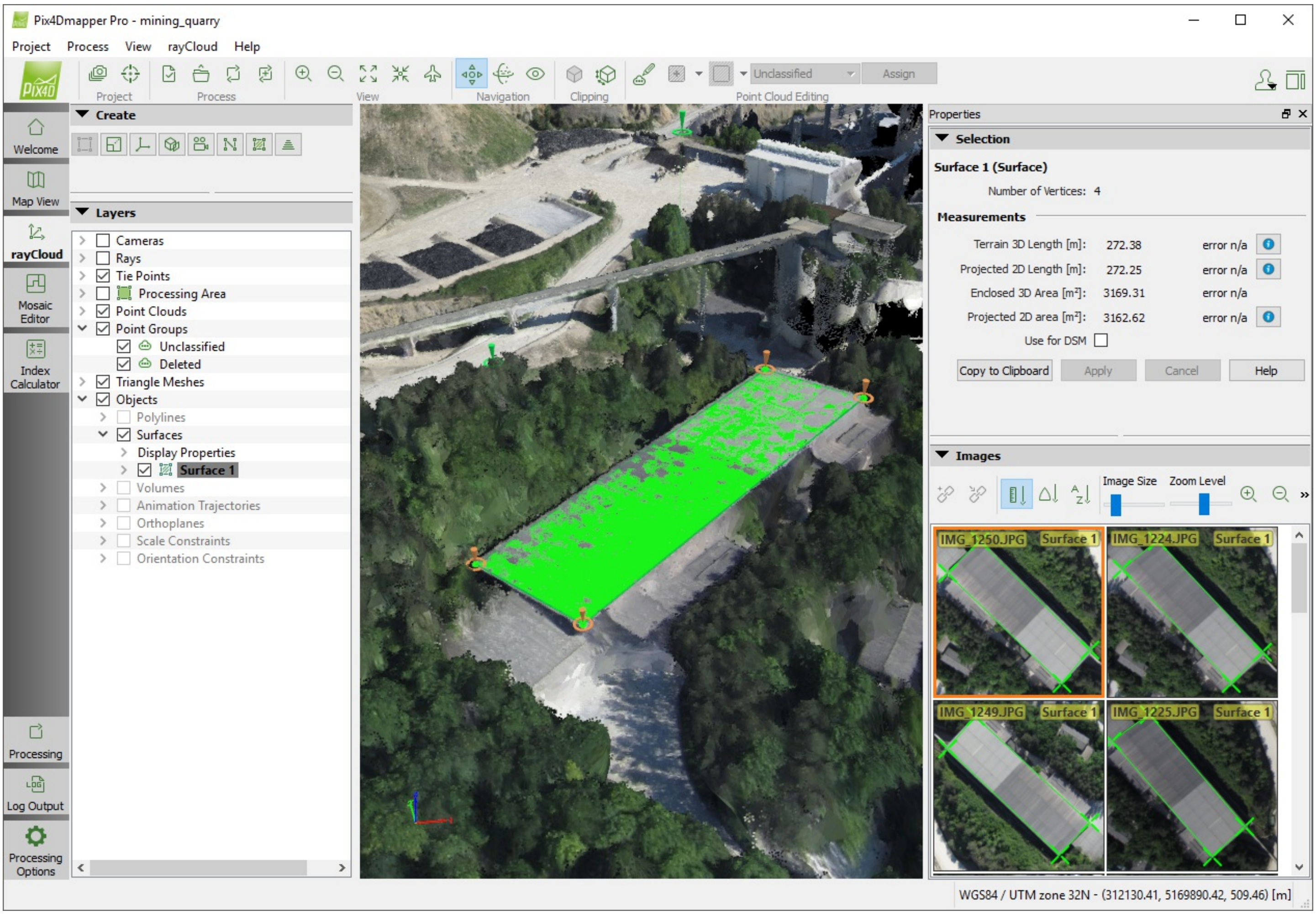
The buttons:

Copy to Clipboard: Copy the selected information to the clipboard that can be pasted into a text editor or spreadsheet by opening the destination file and pasting.
Apply: This button is active when the image marks for the Manual Tie Points associated to the Polyline vertices have been modified, i.e. when a new image has been marked or when an existing mark has been updated or removed. When clicking this button, the new marks are taken into account and the 3D position of the corresponding vertices is recomputed.
Cancel: This button is active when the image marks for the Manual Tie Points associated to the polyline vertices have been modified, i.e. when a new image has been marked or when an existing mark has been updated or removed. It cancels the modifications of the image marks.
Help: Opens the Pix4Dmapper help.

The *Images* section: Displays the images where the object can be found. For more information: 202558459.

For step by step instructions about how to draw a new Polyline: 202560309.

Surfaces



The following information is displayed:

Object name (object type): The name of the Surface and its type (Surface).
Number of Vertices: Number of vertices used to draw the object.
Measurements
Terrain 3D Length[units]: 3D length of the line that has been used to draw the Surface taking into account the three coordinates of the vertices. For more information: 202559819.
Projected 2D Length[units]: 2D length of the line that has been used to draw the Surface taking into account the (X,Y) coordinates of the vertices. For more information: 202559839.
Enclosed 3D Area[units^2]: 3D area that is enclosed by this surface, taking into account the three coordinates of the vertices.
Projected 2D Area[units^2]: 2D area that is enclosed by this surface, taking into account the (X,Y) coordinates of the vertices.

> Note: When the surface is created, next to the measurements, "error n/a " appears indicating that the measurement accuracy cannot be calculated till all the vertices of the surface are marked on at least 2 images. For step by step instructions: 202560609.

Used for DSM: When this box is selected, the surface is used to improve the DSM model.

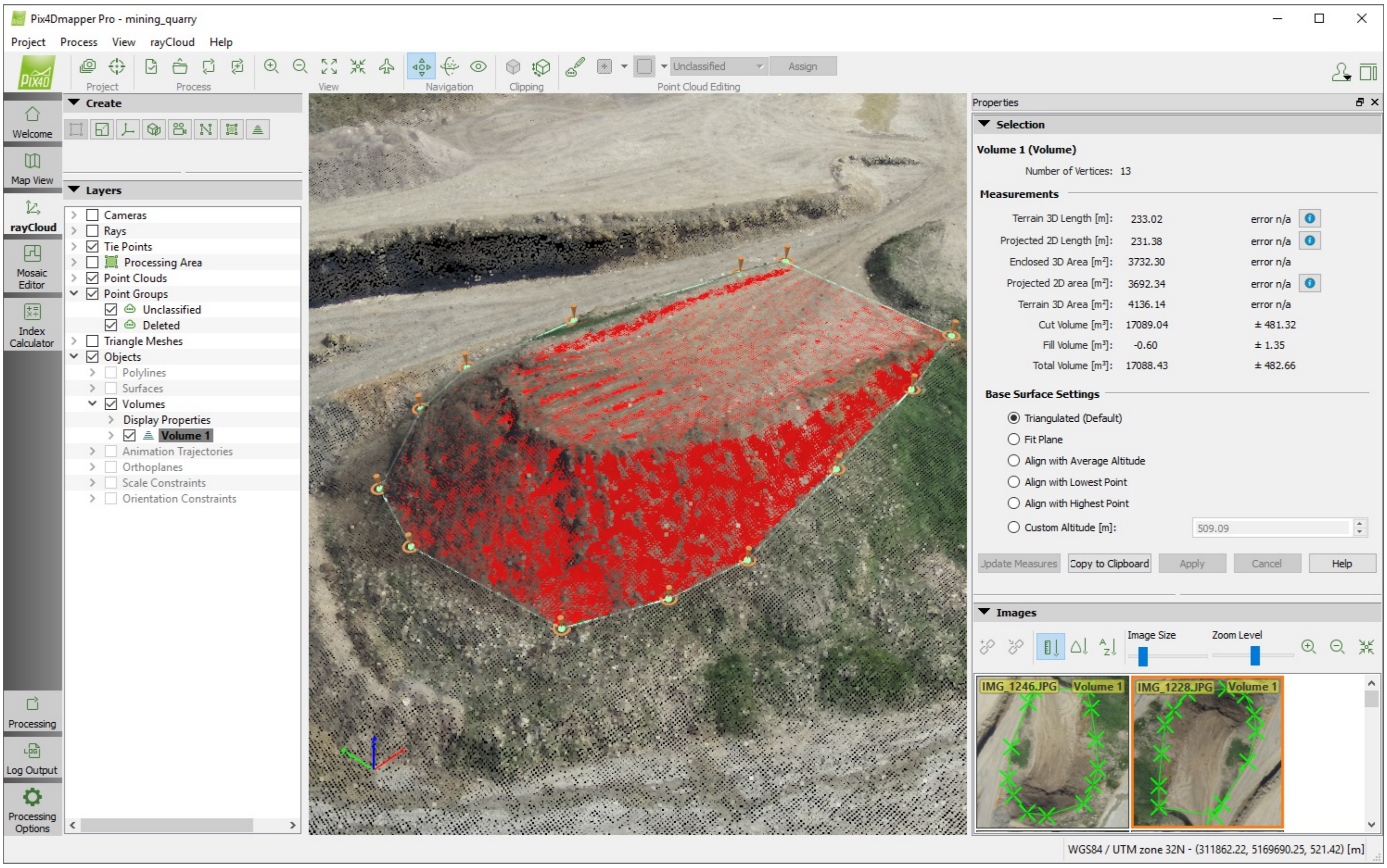
And the buttons:

Copy to Clipboard: Copy the selected information to the clipboard that can be pasted into a text editor or spreadsheet by opening the destination file and pasting.
Apply: This button is active when the image marks for the Manual Tie Points associated to the surface vertices have been modified, i.e. when a new image has been marked or when an existing mark has been updated or removed. When clicking on this button, the new marks are taken into account and the 3D position of the corresponding vertices is recomputed.
Cancel: This button is active when the image marks for the Manual Tie Points associated to the surface vertices have been modified, i.e. when a new image has been marked or when an existing mark has been updated or removed. It cancels the modifications of the image marks.
Help: Opens the Pix4Dmapper help.

The *Images* section: Displays the images where the object can be found. For more information: 202558459.

For step by step instructions about how to draw a new Surface: 202560269.

Volumes



The following information is displayed:

Object name (object type): The name of the Volume and its type (Volume).
Number of Vertices: Number of vertices used to draw the Volume.
Measurements
Terrain 3D Length[units]: 3D length of the line that has been used to draw the Volume's base surface taking into account the three coordinates of the vertices. For more information: 202559819.
Projected 2D Lenght[units]: 2D length of the line that has been used to draw the volume's base surface taking into account the (X,Y) coordinates of the vertices. For more information: 202559839.
Enclosed 3D Area[units^2]: 3D area that is enclosed by the volume's base surface, taking into account the 3 coordinates of the vertices.
Projected 2D Area[units^2]: 2D area that is enclosed by the volume's base surface, taking into account the (X,Y) coordinates of the vertices.
Terrain 3D Area[units^2]: Area that is defined by all the triangles of the volume's surface. These triangles are computed with respect to the densified point cloud.
Cut Volume[units^3]: Volume that is above the volume base. The volume is measured between the volume's base and the surface defined by the densified point cloud.
Fill Volume[units^3]: Volume that is below the volume base. The volume is measured between the volume base and the surface defined by the densified point cloud.
Total Volume[units^3]: Total volume, Total Volume = Cut volume + Fill volume.

> Note: When the volume is created, next to the measurements (except Cut, Fill, and Total volume), "error n/a " appears indicating that the measurement accuracy cannot be calculated till all the vertices of the volume are marked on at least 2 images. For step by step instructions: 202560609.
>
> If step 2. *Point Cloud and Mesh* has not been done, next the Cut, Fill, and Total volume, it appears "error n/a " indicating that the densified point cloud is required and step 2. has to be run.

Base surface settings: Sets the base plane for the volume calculation. There are six different options:
Triangulated: Selected by default. Connects all the vertices and triangulates the volume above and below the base surface.
Fit plane: Fits a plane to the vertices, so that all vertices are at the minimum distance from the base surface.
Align with average altitude: The base surface is parallel to the XY plane with altitude at the average altitude of all vertices.
Align with lowest point: The base surface is parallel to the XY plane with altitude at the lowest altitude of all vertices.
Align with highest point: The base surface is parallel to the XY plane with altitude at the highest altitude of all vertices.
Custom altitude [units]: The base surface is parallel to the XY plane with altitude at a custom altitude.

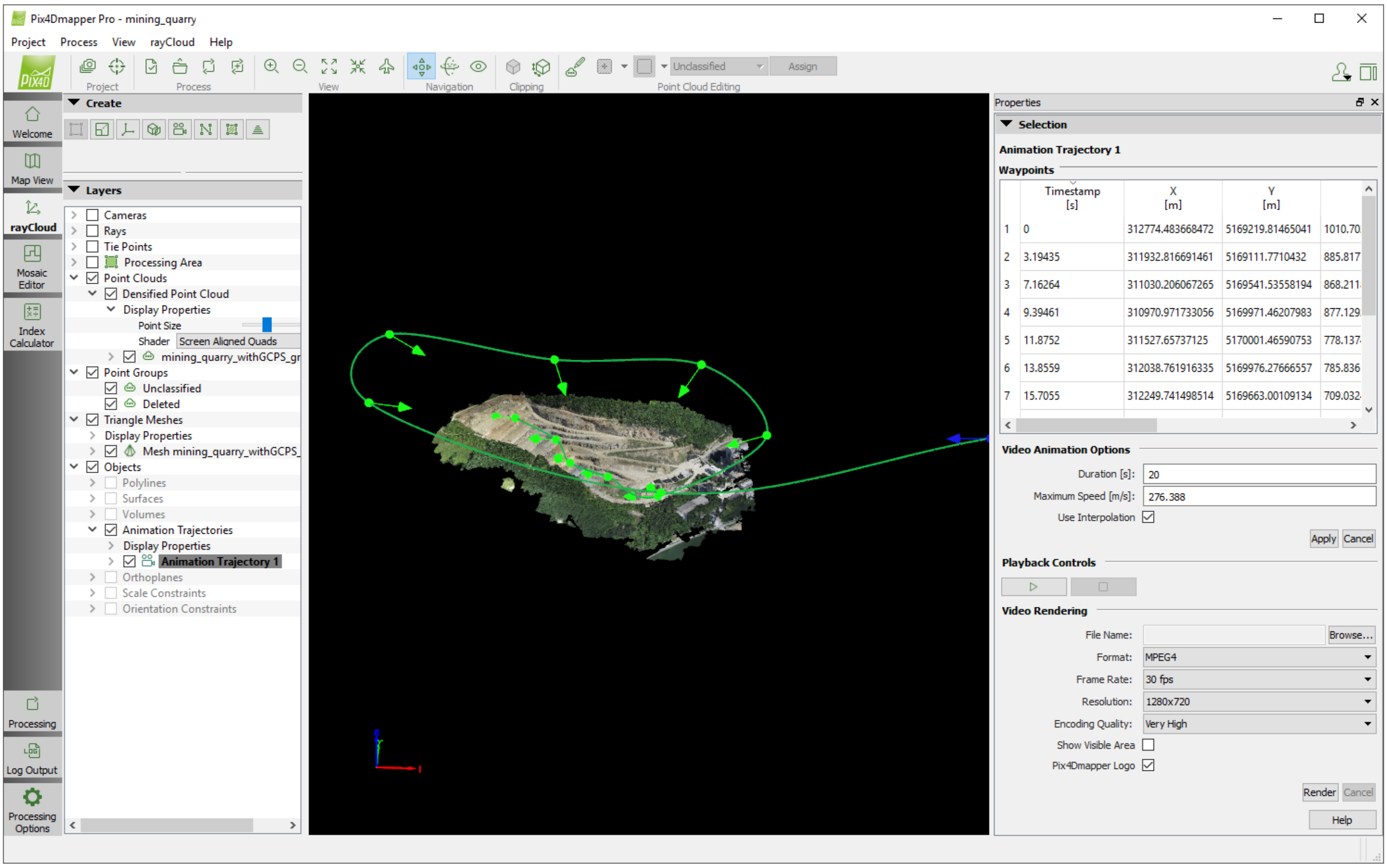
And the buttons:

Update Measurements: Computes and displays the measurements of the object in the *Sidebar* and in the *3D view.*
Copy to Clipboard: Copy the selected information to the clipboard that can be pasted into a text editor or spreadsheet by opening the destination file and pasting.
Apply: This button is active when the image marks for the Manual Tie Points associated to the volume vertices have been modified, i.e. when a new image has been marked or when an existing mark has been updated or removed. When clicking on this button, the new marks are taken into account and the 3D position of the corresponding vertices is recomputed, *but* the measurements are not calculated and displayed in the *Sidebar* and in the *3D view* only when clicking on *Update Measurements*.
Cancel: This button is active when the image marks for the Manual Tie Points associated to the volume vertices have been modified, i.e. when a new image has been marked or when an existing mark has been updated or removed. It cancels the modifications of the image marks.
Help: Opens the Pix4Dmapper help.

The *Images* section: Displays the images where the object can be found. For more information: 202558459.

For step by step instructions about how to draw a new Volume: 202560319.

Animation Trajectories



Under Selection in the main frame the name of the Animation trajectory and 4 sections appear:

Waypoints
Video Animation Options
Playback Controls
Video Rendering

And the button:

Help: Opens the Pix4Dmapper help.

Waypoints

The following actions can be performed on the table:

Inserting Waypoints: Right click on any cell and click on one of the followings:
Insert Current Viewpoint as Waypoint Before Selection: Inserts the actual viewpoint in the 3D View as waypoint before the selected row (selected waypoint).
Insert Current Viewpoint as Waypoint After Selection: Inserts the actual viewpoint in the 3D View as waypoint after the selected row (selected waypoint).
Insert Displayed Computed Cameras Position as Waypoint Before Selection: Inserts ALL the cameras that are actually visible in the 3D View as waypoints before the selected row (selected waypoint) by placing them (if more than one camera is inserted, the order is defined considering the exif information from the cameras).
Insert Displayed Computed Cameras Position as Waypoint After Selection: Inserts ALL the cameras that are actually visible in the 3D View as waypoints after the selected row (selected waypoint) by placing them (if more than one camera is inserted, the order is defined considering the exif information from the cameras).
Deleting Waypoints: Right click on any cell, and click on Remove Selected Waypoints.
Editing Values: Double click on the cell and edit the value. Timestamp cannot be edited manually, the values can be changed by changing the Duration, Maximum Speed or selecting/unselecting the Use Interpolation checkbox.

The table has as many rows as there are waypoints in the Animation Trajectory. Each row displays information for one waypoint.

Label: Name of the waypoint.
Timestamp [s]. Time at which the animation passes through the waypoint.
X coordinate [units]
Y coordinate [units]
Z coordinate [units]
Rotation in X Axis [degrees]
Rotation in Y Axis [degrees]
Rotation in Z Axis [degrees]

Video Animation Options

This section allows the user to change the time of the animation and use or not use interpolation between waypoints:

Duration [s]: Total length in seconds for the animation.
Maximum Speed [m/s]: Maximum speed of the movement of the fly-trough camera in meters/second. The speed is not constant since the software recognizes changes in direction and orientation and reduces the speed in that sectors to allow smother camera movements.
Use Interpolation: Ensure a smooth transitions between waypoints.

> Note:
> If the *Use Interpolation* checkbox is NOT selected, the path between waypoints will be straight lines.
> If the *Use Interpolation* checkbox is selected, the path between waypoints will be curved lines. The angle of the curve is related to the angle between consecutive lines.

This section contains 2 action buttons:

Apply: Saves the changes done in the sections *Waypoints* or *Video Animation Options*.
Cancel: Reverts the changes to restore the saved Animation Trajectory.

Playback Controls

This sections allows the user to display the animation in the 3D View.

▷ Play animation
□ Stop animation

Video Rendering

This sections allows the user to create a video file and set up different video rendering properties:

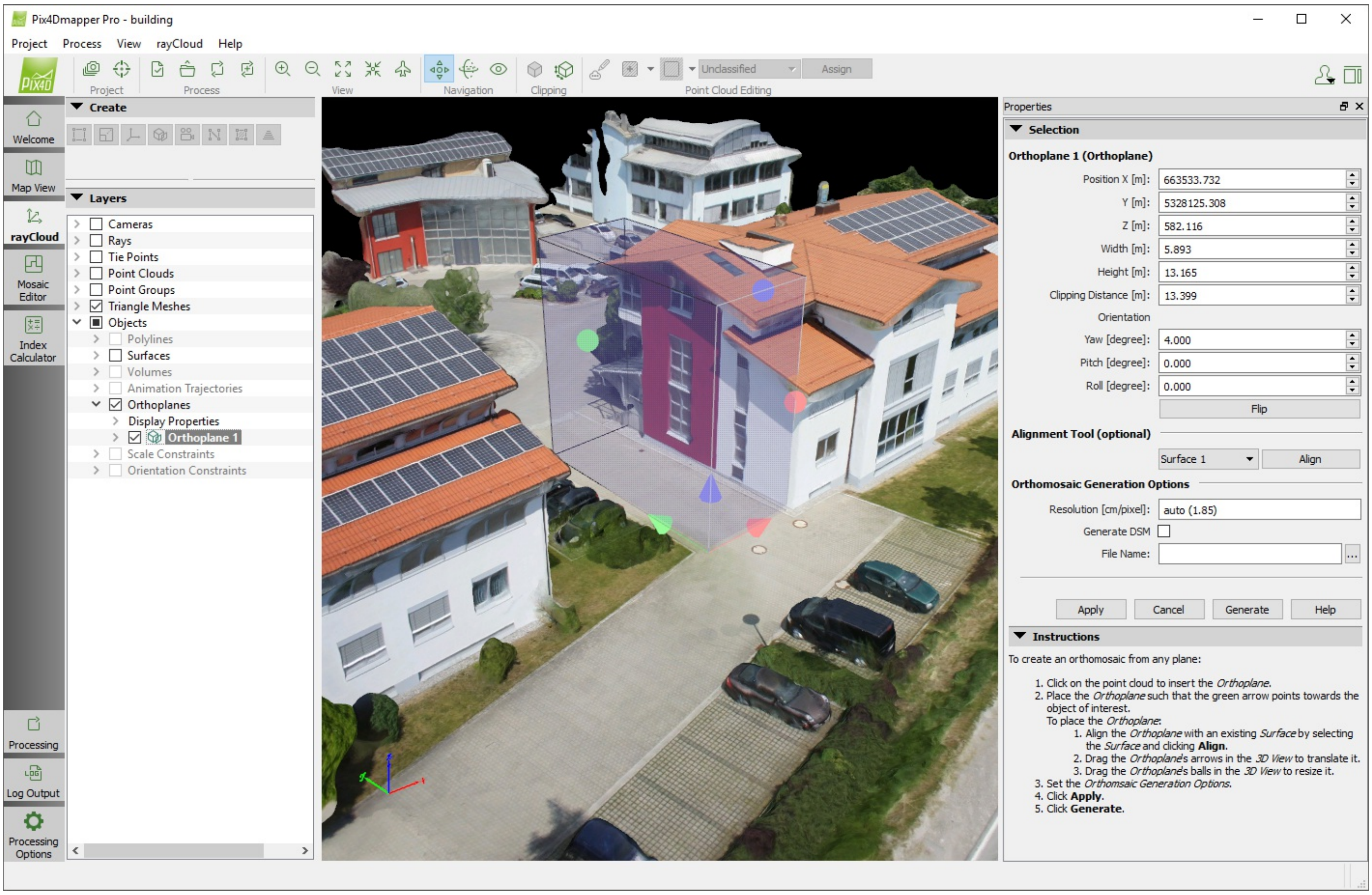
File Name: Displays the path and the name where the video will be rendered and saved.
Format: Video file format. The available options are: MPEG4 and MPEG2.
Frame Rate: Frames per second to be stored in the video. The available options are: 24, 30 and 60 fps.
Resolution: Total width and height of the video in pixels. The available options are: 800x600, 1024x768, 1280x720 and 1920x1080.
Encoding Quality: Defines the pixel size within the video, the higher the encoding quality the higher definition
Show Visible Area: Displays / does not display in the 3D View a frame allowing to see which part of the 3D View fits in the scene to be recorded according to the resolution. Elements outside the visible area do not appear in the recorded video
Pix4Dmapper Logo: When rendering and creating the video, it displays/ does not display the Pix4Dmapper logo in the bottom right of the video.

This section contains 4 action buttons:

Browse... : Opens the *Save Video As* window which allows to choose the video's folder.
Render: Converts the animation Trajectory into a video, saved in the selected path and using the video properties selected.
Cancel: Enabled while Rendering is in progress, allows to cancel the rendering of an Animation Trajectory into Video.
Help: Opens the Pix4Dmapper help.

For step by step instructions about how to create an Animation Trajectory: 202560299.

Orthoplanes



Under *Selection* in the main frame appears 3 sections:

Object name (object type): The name of the Orthoplane and its type (Orthoplane).
Position X [units]: Position in X of the reference corner with respect to the origin of the output coordinate system.
Y [units]: Position in Y of the reference corner with respect to the origin of the output coordinate system.
Z [units]: Position in Z of the reference corner with respect to the origin of the output coordinate system.
Width [units]: Size in X of the orthoplane area in output coordinate system units.
Height [units]: Size in Y of the orthoplane area in output coordinate system units.
Clipping Distance [units]: Size in Z of the orthoplane area in output coordinate system units.
Orientation: Defines the rotation of the orthoplane area with respect to the axes of the coordinate system.
Yaw [degrees]: Rotation around the Y axis.
Pitch [degrees]: Rotation around the X axis.
Roll [degrees]: Rotation around the Z axis.
Flip: Changes the orientation and direction of the projection.
Alignment tool (optional): Allows the user to align the orthoplane with a Surface Object.
Surface1: Allows the user to select the surface object to use for alignment.
Align: Aligns the Orthoplane to the selected surface by using the perpendicular vector to the surface as direction of the projection and using the base of the surface as middle point of the Z of the Orthoplane.
Orthomosaic Generation Options: Options related to the output files.
Resolution [cm/pixel]: This value can be modified before generating the new Orthoplane mosaic and indicates the spatial resolution of the Orthomosaic.
Generate DSM: When the checkbox is selected, a DSM file is generated with the Orthoplane Mosaic. Processing options are optimized for facades (sharp *Surface Smoothing* and *Noise Filtering* for the DSM filters, Raster DSM method set to *Inverse Distance Weighting*).
Output File: Path where the Orthoplane and optionally the DSM will be stored.
...: Selects the path where the Orthoplane and optionally the DSM will be stored.

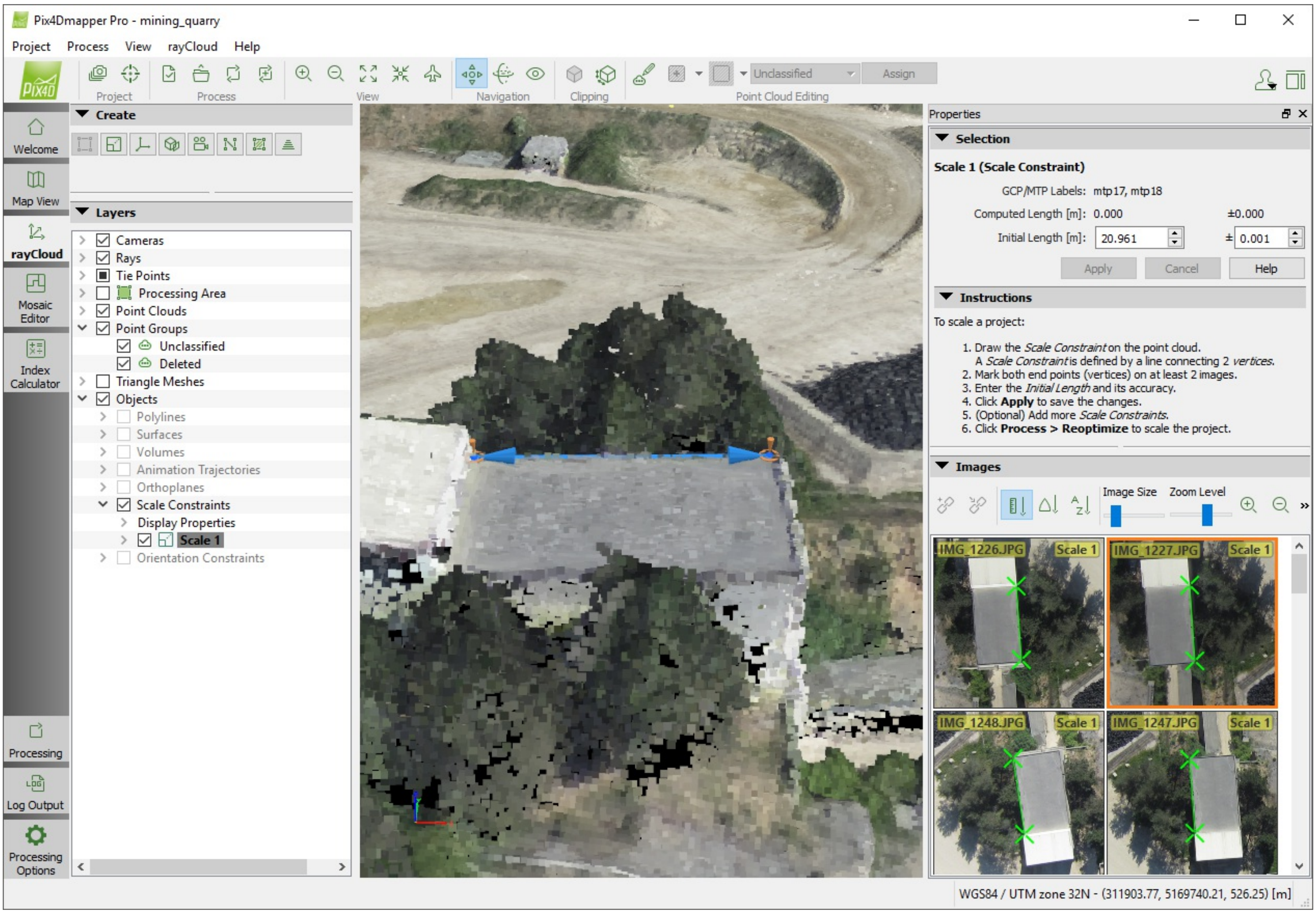
And the buttons:

Apply: Enabled when there has been any change in the properties of the object. It applies the changes.
Cancel: Cancels the changes in the properties since the last time that apply has been clicked.
Generate: Generates the Orthomosaic and optionally the DSM for the selected orthoplane in the selected path.
Help: Opens the Pix4Dmapper help.

The *Instructions* section displays instructions about how to draw a new orthoplane.

For step by step instructions about how to draw a new orthoplane: 204664359.

Scale Constraints



Contains 3 sections:

Selection
Instructions
Images

Under *Selection* in the main frame appears:

Object name (object type): The name of the Scale and its type (Scale Constraint).
GCP/MTP Labels: When creating a *Scale Constraint*, the vertices of the line representing the scale constraint are associated to Manual Tie Points. This label displays the names of the Manual Tie Points associated to the object.
Computed Length [units]: Length measured in the 3D model. The *Computed Length Error* is given by the difference between the *Computed Length* and the *Initial Length*.
Initial Length [units]: Length measured in the field representing the real length of the scale constraint. The accuracy of the *Initial Length* is the accuracy of the measurements in the field.

And the buttons:

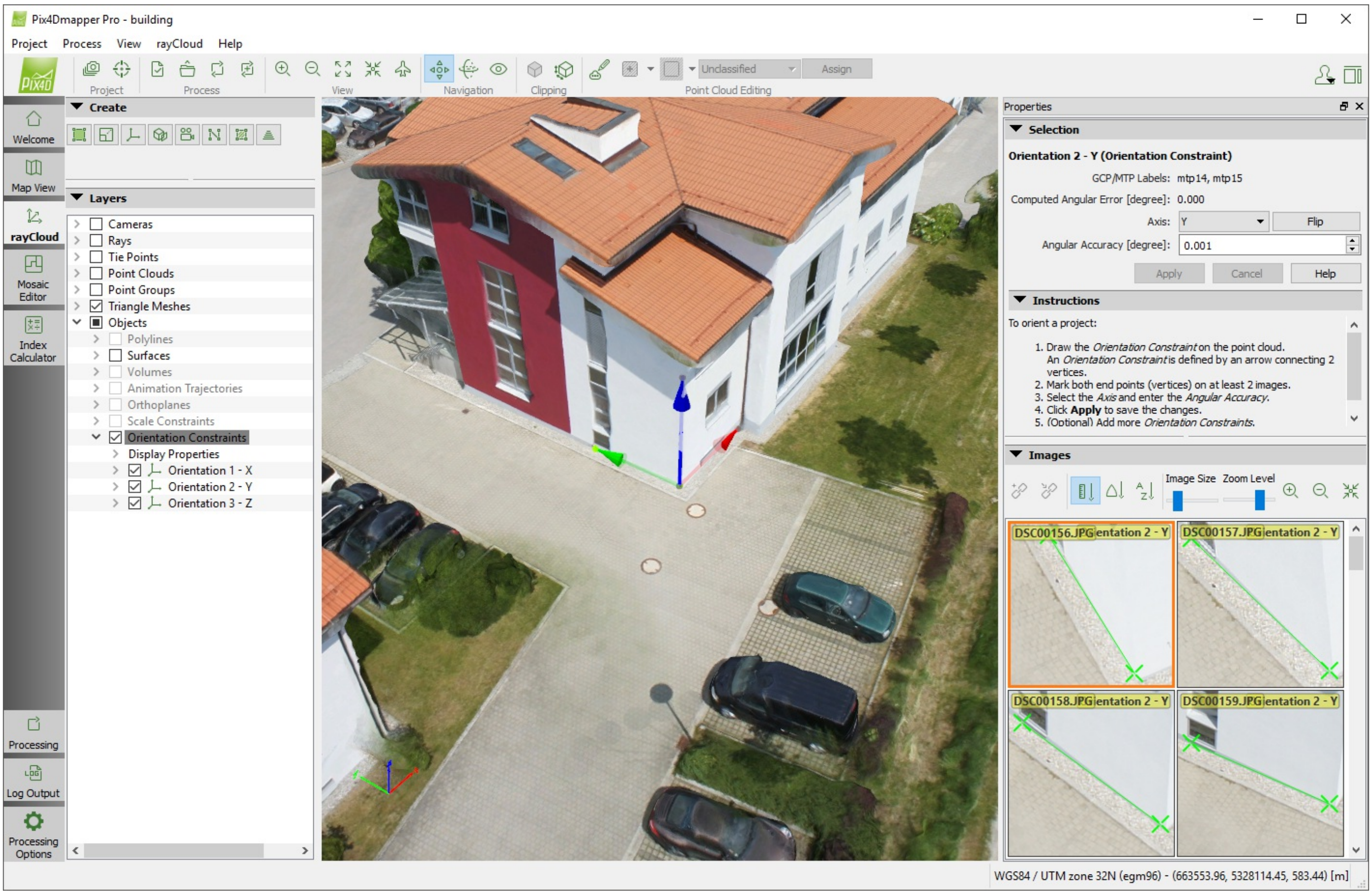
Apply: Enabled when there has been any change in the properties of the object or a new marking in the images. It applies the changes.
Cancel: Cancel the changes in the properties or in the marking since the last time that apply has been clicked.
Help: Opens the Pix4Dmapper help.

The Instructions section: Displays instructions about how to draw a new Scale Constraint.

The *Images* section: Displays the images in which the object is visible. For more information: 202558459.

For step by step instructions about how to draw a new Scale Constraint: 205360375.

Orientation Constaints



Contains 3 sections:

Selection
Instructions
Images

Under *Selection* in the main frame appears:

Object name (object type): The name of the Orientation and its type (Orientation Constraint).
GCP/MTP Labels: When creating an *Orientation Constraint*, the vertices of the arrow representing the scale constraint are associated to Manual Tie Points. This label displays the names of the Manual Tie Points associated to the object.
Computed Angular Error [degree]: Angular difference between the computed axis and the axis that was drawn.
Axis: Name of the axis that the Orientation Constraint represents.
Flip: Changes the direction of the Orientation by rotating it by 180°.
Angular Accuracy [degree]: Angular accuracy of the measurements in the field.

And the buttons:

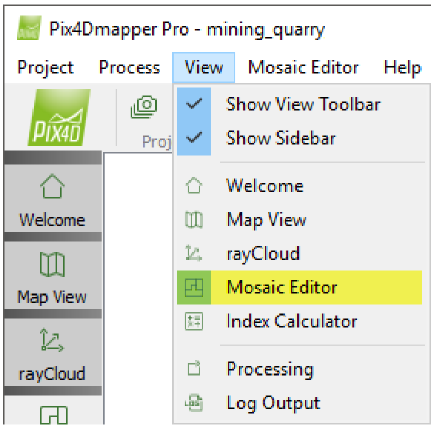
Apply: Enabled when there has been any change in the properties of the object or a new marking in the images has been done. It applies the changes.
Cancel: Cancels the changes in the properties or in the marking since the last time that apply has been clicked.
Help: Opens the Pix4Dmapper help.

The Instructions section: Displays instructions to draw a new Orientation Constraint.

The *Images* section: Displays the images where the object can be found. For more information: 202558459.

For step by step instructions about how to draw a new Orientation Constraint: 205360385.

Access: On the Menu bar, click View > Mosaic Editor (available only if step *3. DSM, Orthomosaic and Index* has been completed).



Warning:
The *Mosaic Editor* may be used to manually correct artifacts in the Orthomosaic resulting from Step *3. DSM, Orthomosaic and Index* and in order to improve its visual aspect.
The changes applied in the Mosaic Editor affect a local copy, not the mosaic resulting from Step *3. DSM, Orthomosaic and Index.*
In order to obtain the edited mosaic, the mosaic needs to be exported: 202560079. The orthomosaic resulting from Step *3. DSM, Orthomosaic and Index* will then be overwritten. The Grid DSM as well as the different orthomosaic formats (GeoTIFF, Google Maps Tiles, etc.) will be generated if selected in the processing options.
For more information about the Mosaic Editor processes workflow: 204829349.

For step by step instructions about how to improve the visual aspect of the orthomosaic: 202559939 (for buildings), 202559959 (for bridges).

The use of the *Mosaic Editor* is optional and it can be used to:

Visualize the DSM (raster GeoTIFF Digital Surface Model).
Visualize the Mosaic.
Improve the visual aspect of the orthomosaic.

When selecting the *Mosaic Editor* view the following elements are displayed on the Main window:

Menu Bar Entry: Extra entry displayed on the Menu bar.
Toolbar: The standard toolbar and some extra buttons specific to the Mosaic Editor.
Mosaic View: Displayed in the main window. By default the *Orthomosaic* is displayed. The Mosaic Editor can also be used to visualize the DSM (Elevation).
Sidebars: Displayed on the right of the Mosaic View. By default the *Mosaic editing* sidebar is displayed.
Status bar: Displayed on the bottom right of the Mosaic View. Display the coordinates when passing the mouse over the orthomosaic / DSM.

For step by step instructions related to the use of the Mosaic Editor: 202558709.

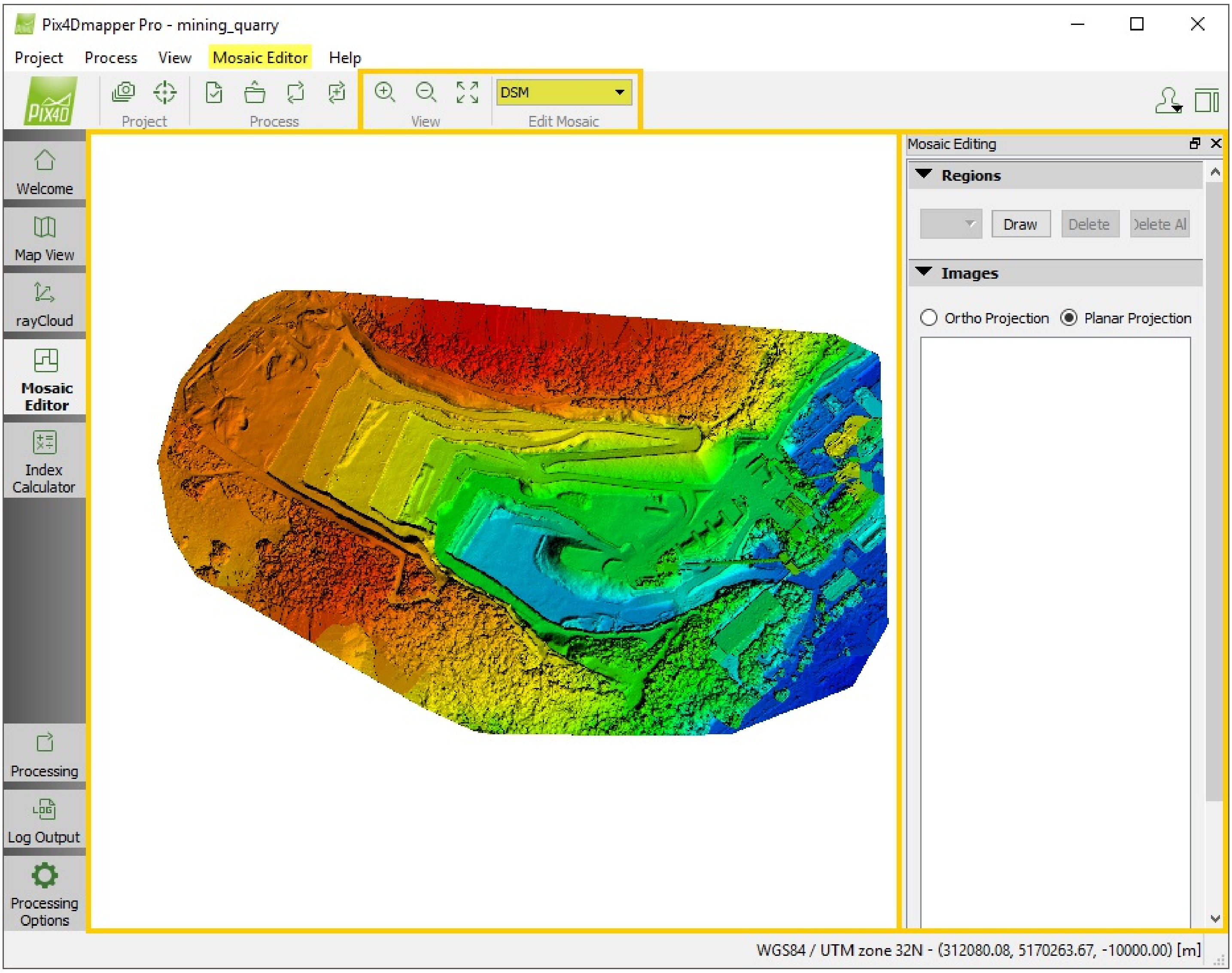


Figure 1. Mosaic Editor with DSM view

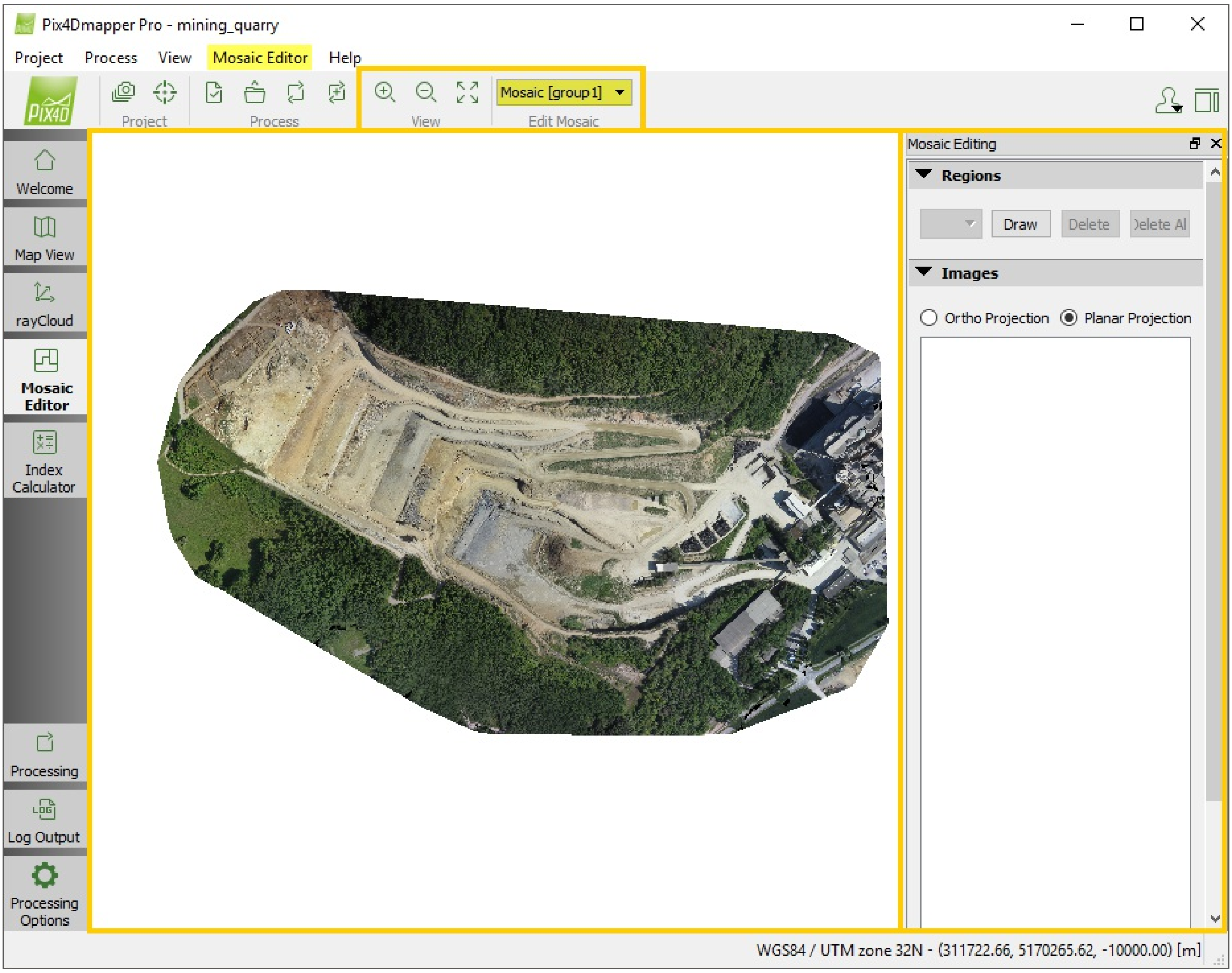
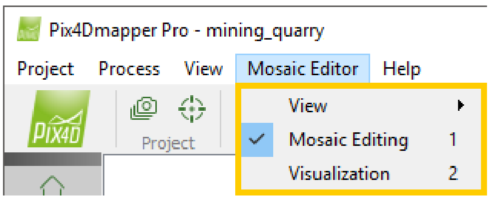


Figure 2. Mosaic Editor with Orthoimage view

Menu bar entry

On the Menu bar, by clicking Mosaic Editor the following options are displayed:



View: Shows the view options of the Mosaic View.
Mosaic Editing: Opens the *Mosaic Editing* sidebar.
Visualization: Opens the *Visualization* sidebar.

Toolbar

The following Toolbar buttons are displayed:

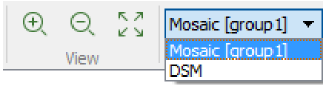
Standard Toolbar: For more information: 202557839.
Toolbar extra buttons:
View

Zoom In: Zooms in the selected view.

Zoom Out: Zooms out the selected view.

View All: Moves the viewpoint in order to fit the model in the Mosaic View.

Edit Mosaic



Element to be displayed in the Mosaic View, by default the Mosaic [group1] is displayed. If there are more than one groups of images, one Mosaic is generated per group of images. It is possible to display the different generated mosaics as well as the DSM.

Mosaic View

By default the *Mosaic* view is selected and the mosaic is displayed. If the *DSM* view is selected, the DSM is displayed.

When passing the mouse over the orthomosaic / DSM, the Mosaic Status bar displays the coordinates of the hovered point.

The following mouse interactions are available:

Left click on the mosaic and move the mouse: Pan the mosaic.
Left click on a Region vertex while moving the mouse: Allows to move the vertex of the region.
Moving the mouse scroll forwards: Zoom in on the mosaic.
Moving the mouse scroll backwards: Zoom out of the mosaic.

Sidebar

There are two sidebars:

Mosaic editing sidebar : Allows the user to edit the mosaic.
Visualization sidebar: Allows the user to visualize the mosaic or the DSM.

Status bar

On the bottom right part of the Mosaic View, the following is displayed:

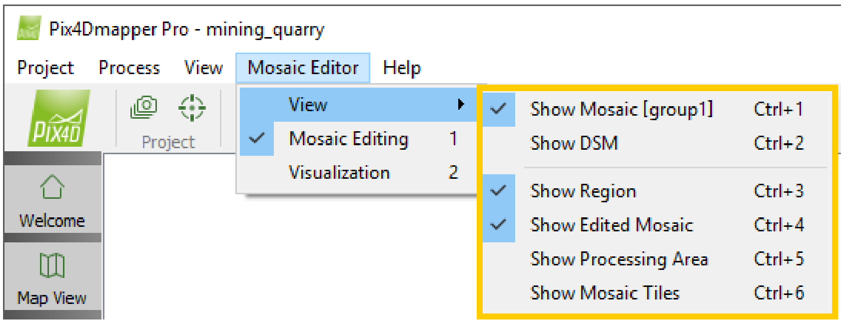
WGS84 / UTM zone 32N - (311684.29, 5169774.29, 496.97) [m]

Selected Coordinate System: Displays the selected coordinate system of the point.
Position: Displays the (X,Y) coordinates in meters / feet of each point of the orthomosaic / DSM. When passing the mouse over the orthomosaic / DSM the coordinates change.

> Important: The geographic (ellipsoid) projection coordinates are used in meters / feet, instead of geographic (ellipsoid) coordinates in degrees, considering the output coordinate system selected.
>
> By default the output coordinate system is the same as the one of the GCPs if GCPs are used. Otherwise it is the same as the one of the images. If the coordinates system is WGS84, the output is given in UTM.
>
> If less than 3 images are geolocated and less than 3 GCPs are defined, then the output coordinates system is "Arbitrary".

> Note: The Status Bar displays the position for the whole area covered by the Orthomosaic / DSM and the area without data. When passing the mouse over areas where there is no data, the no data altitude value -10000 is displayed.

Access: On the Menu bar, click View > Mosaic Editor, in the Mosaic Editor, on the Menu bar click Mosaic Editor and select the menu option View (available only if step *3. DSM, Orthomosaic and Index* has been completed).



The View options affect the Mosaic View. The following options are available:

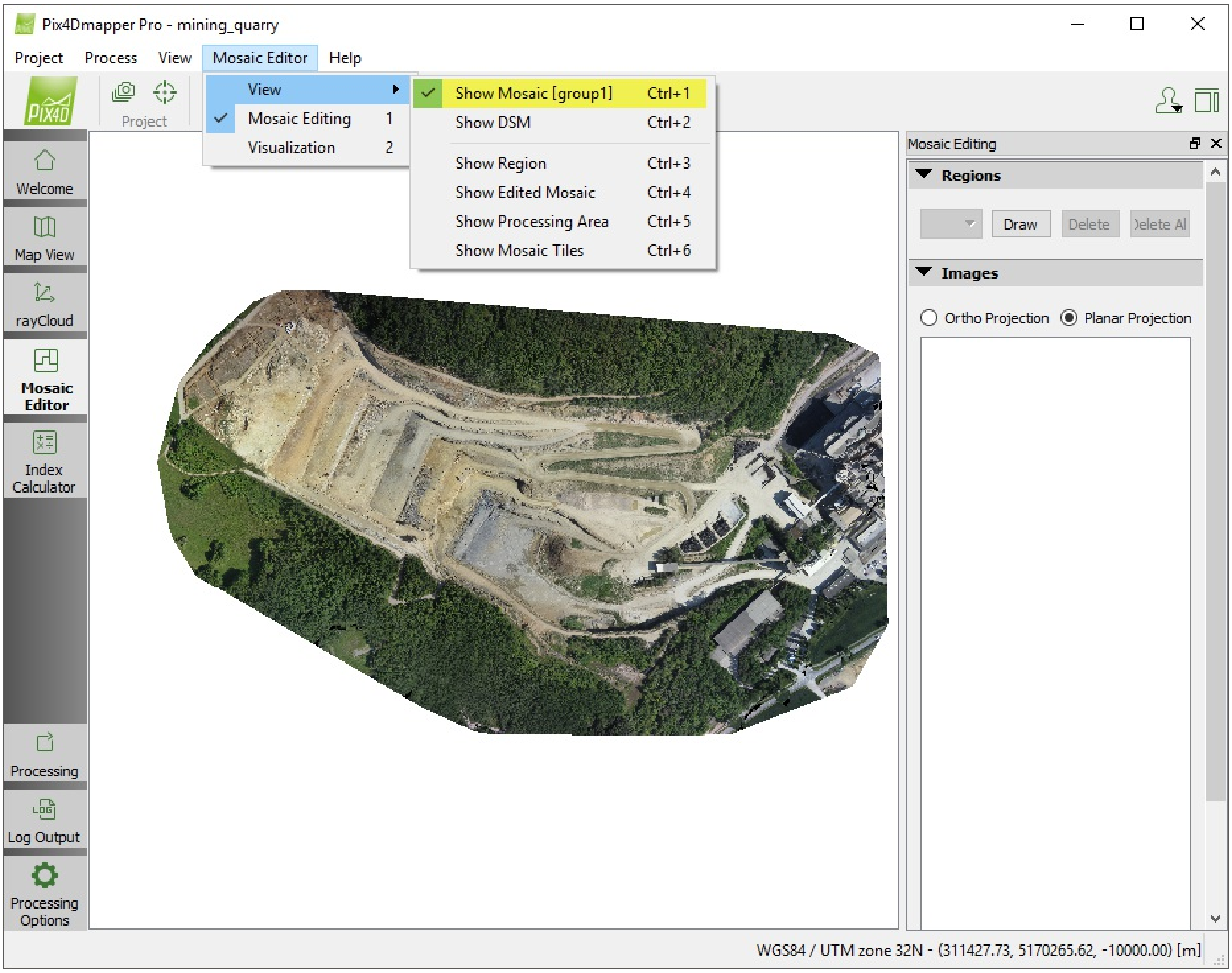
Show Mosaic [Group]
Show DSM
Show Region
Show Edited Mosaic
Show Processing Area
Show Mosaic Tiles

Show Mosaic [Group]

This option is selected by default.

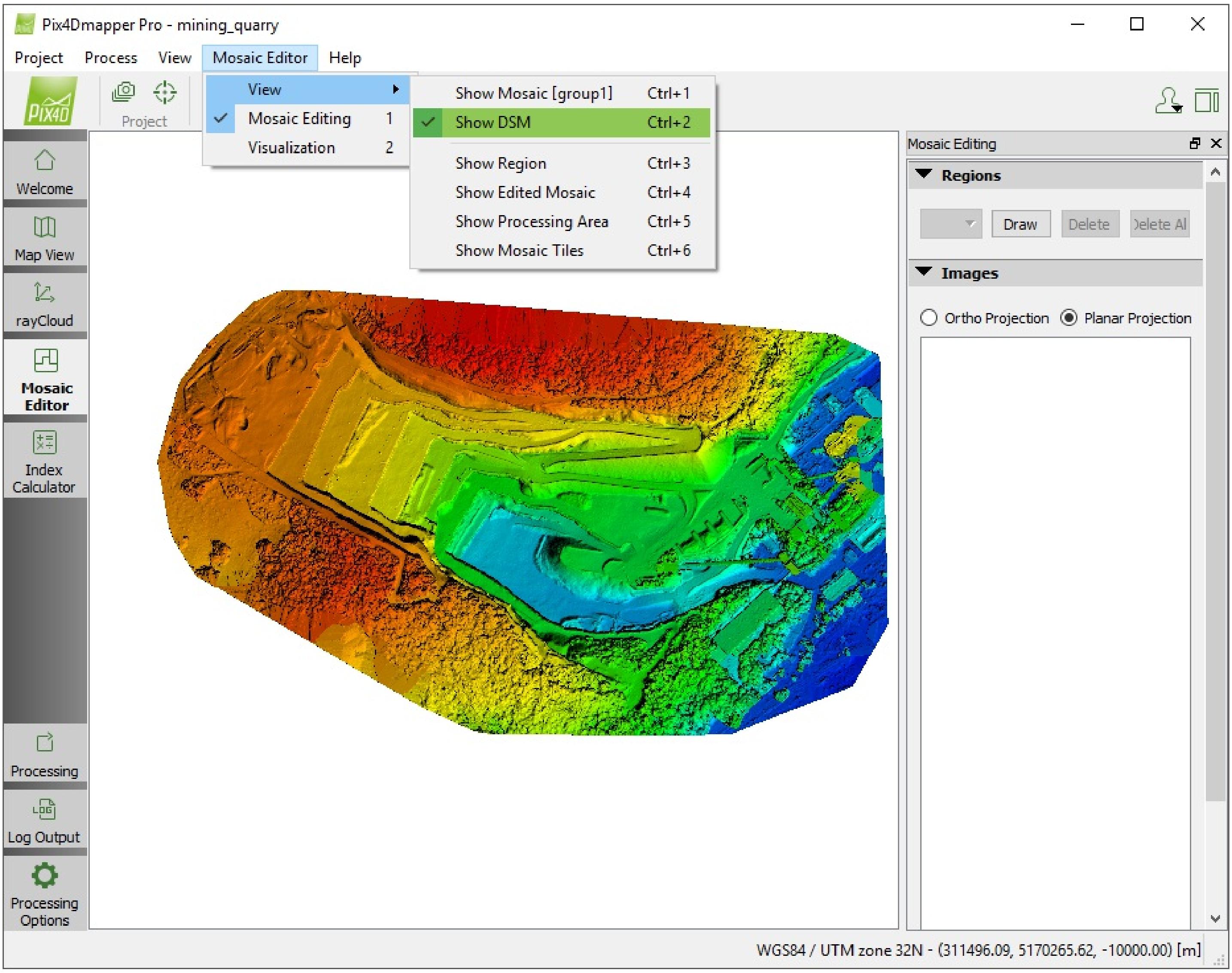
It displays the mosaic generated using the images that belong to the corresponding group. The default group is group1. For more information about the image groups: 202557949.

The mosaic can be edited by creating regions and by assigning another image to them or selecting another projection for each region. The edited mosaic will be edited and visualized in real time. Once the editing has been completed, the mosaic needs to be exported in order to generate the new output files for the mosaic.



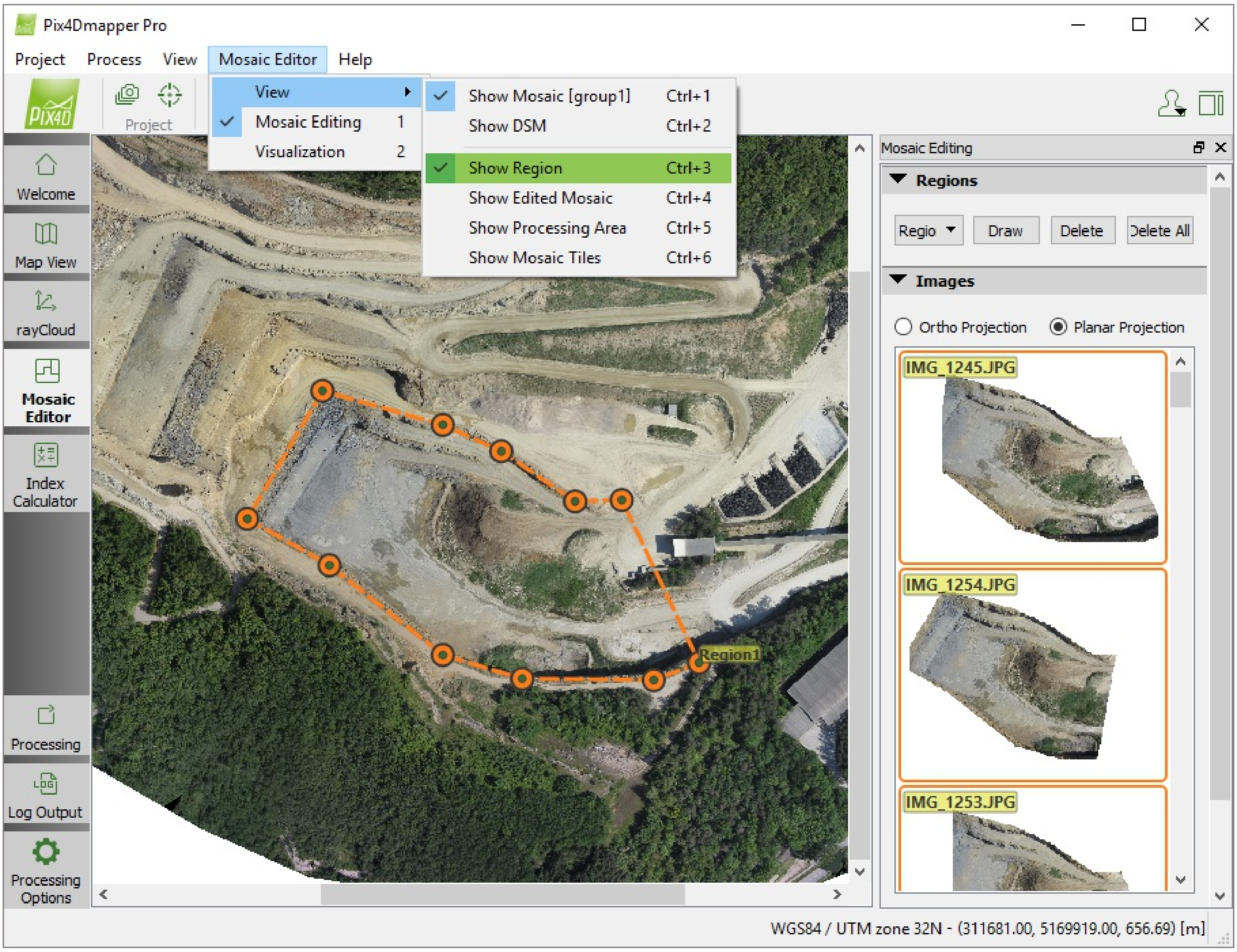
Show DSM

It displays the *DSM* using by default an RGB color map for the altitude values.



Show Region

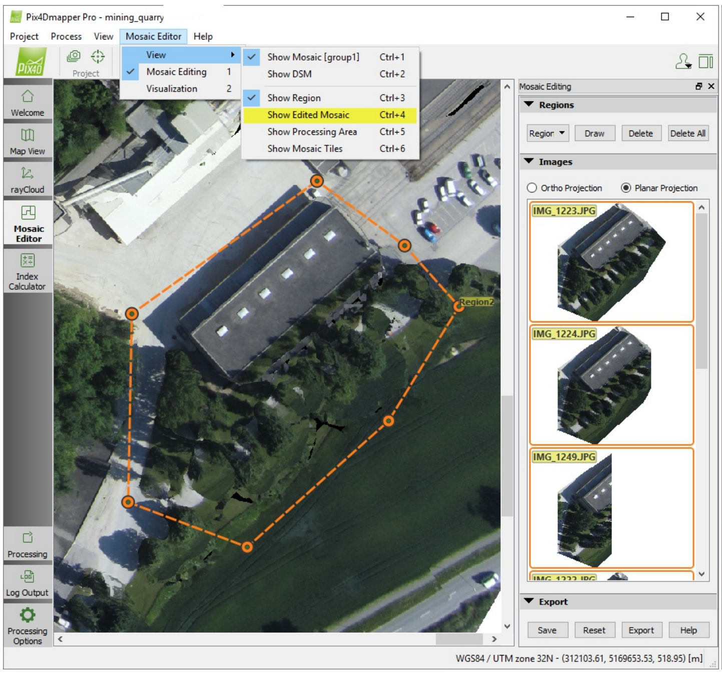
This option is activated by default. It displays the drawn *Regions*.

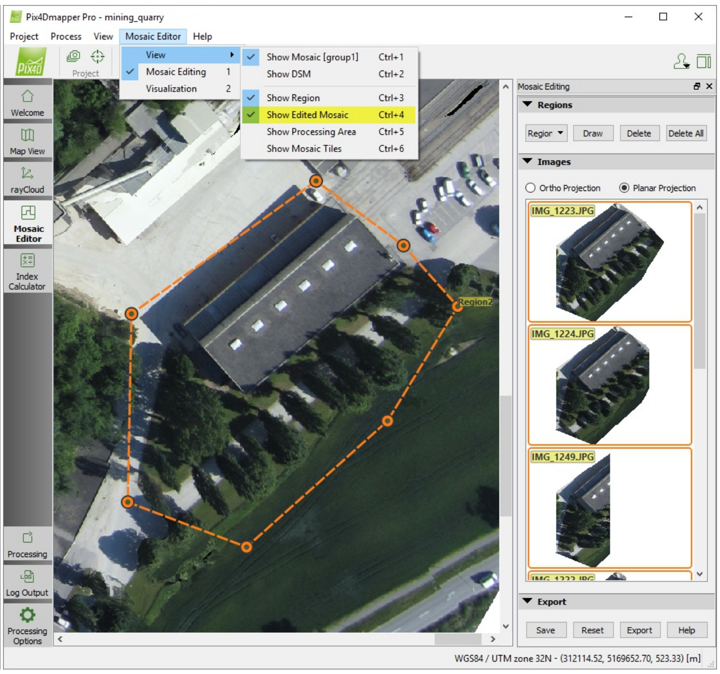


Show Edited Mosaic

This option is activated by default. It displays the edited mosaic.

When it is not activated, the Mosaic View displays the content of the mosaic stored in file.

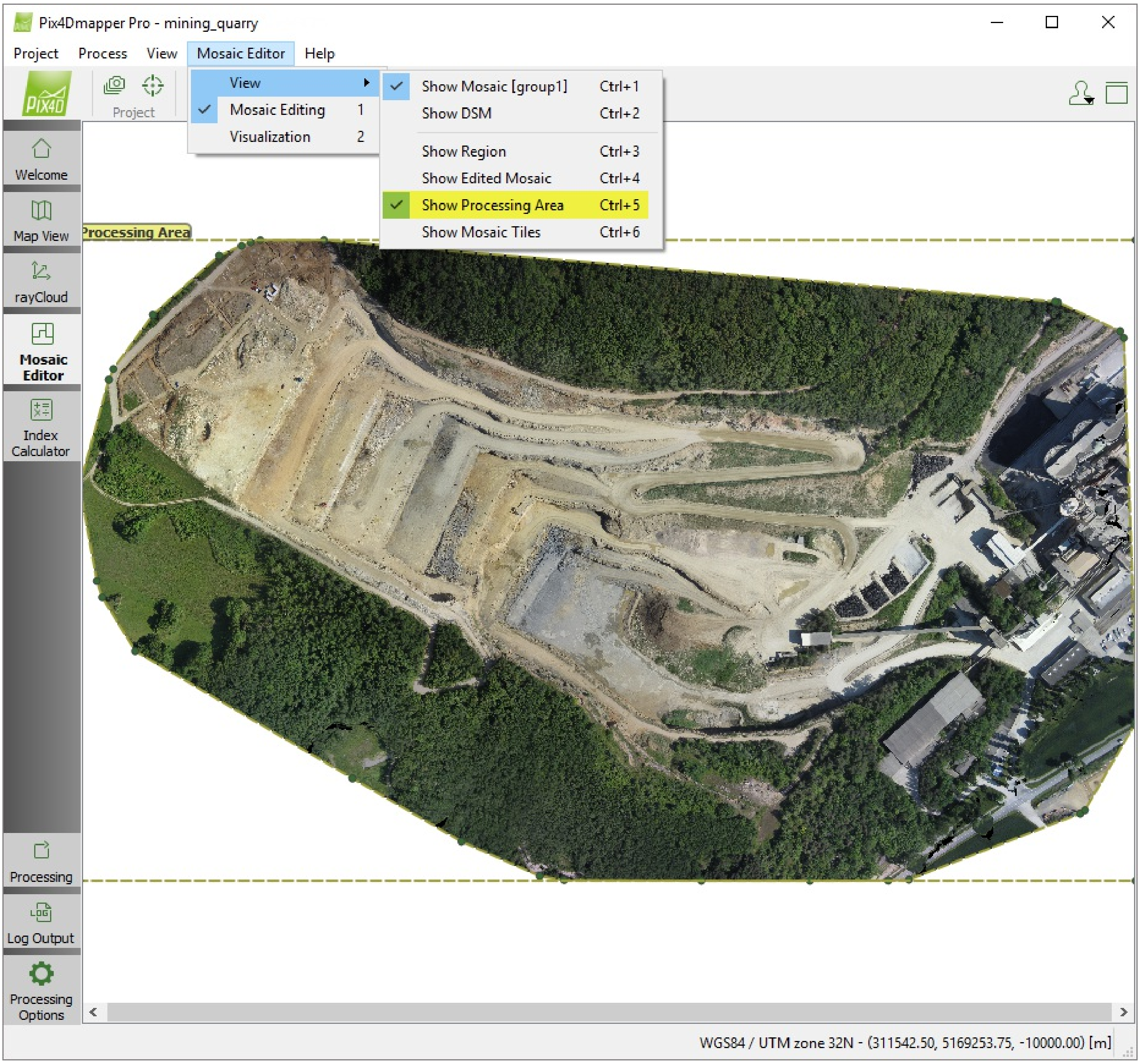

Show Edited Mosaic not activated


Show Edited Mosaic activated

Show Processing Area

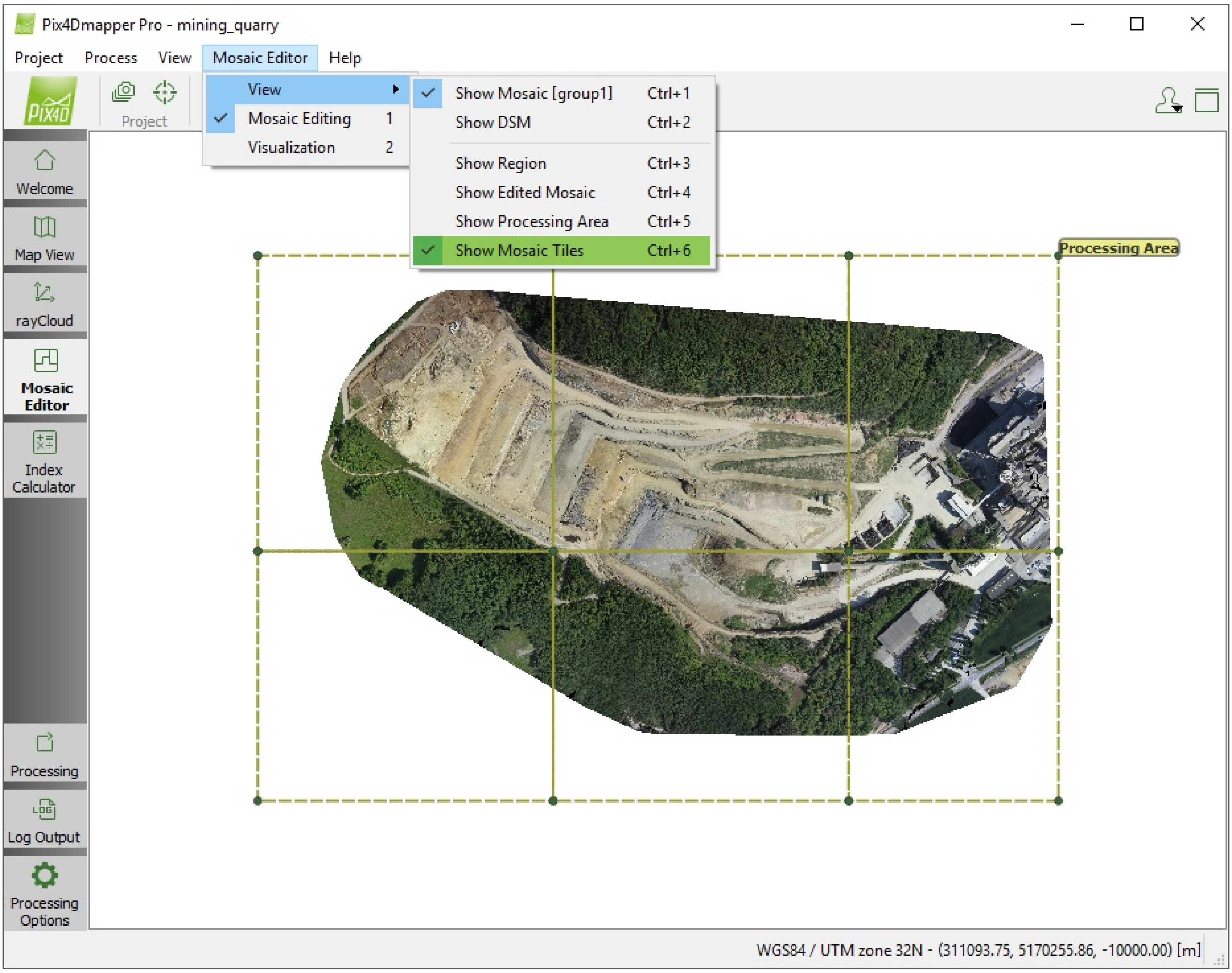
This option is deactivated by default. It displays the Processing Area, which is the area for which the Orthomosaic is generated.

For more information about the Processing Area: 207968273.



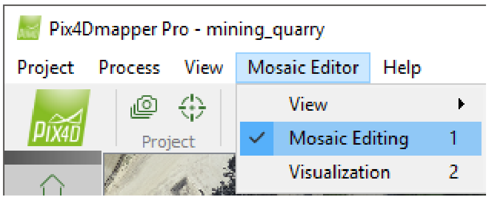
Show Mosaic Tiles

This option is deactivated by default. It displays the GeoTIFF mosaic tiles that will be generated when exporting the mosaic. When the Processing Area is modified, the mosaic tiles are modified as well.


Pix4Dmapper Pro - mining_quarry
Project
Process
View
Mosaic Editor
Help
View
Mosaic Editing 1
Visualization 2
Show Mosaic [group1] Ctrl+1
Show DSM Ctrl+2
Show Region Ctrl+3
Show Edited Mosaic Ctrl+4
Show Processing Area Ctrl+5
Show Mosaic Tiles Ctrl+6
Project
Welcome
Map View
rayCloud
Mosaic Editor
Index Calculator
Processing
Log Output
Processing Options
Processing Area
WGS84 / UTM zone 32N - (311093.75, 5170255.86, -10000.00) [m]

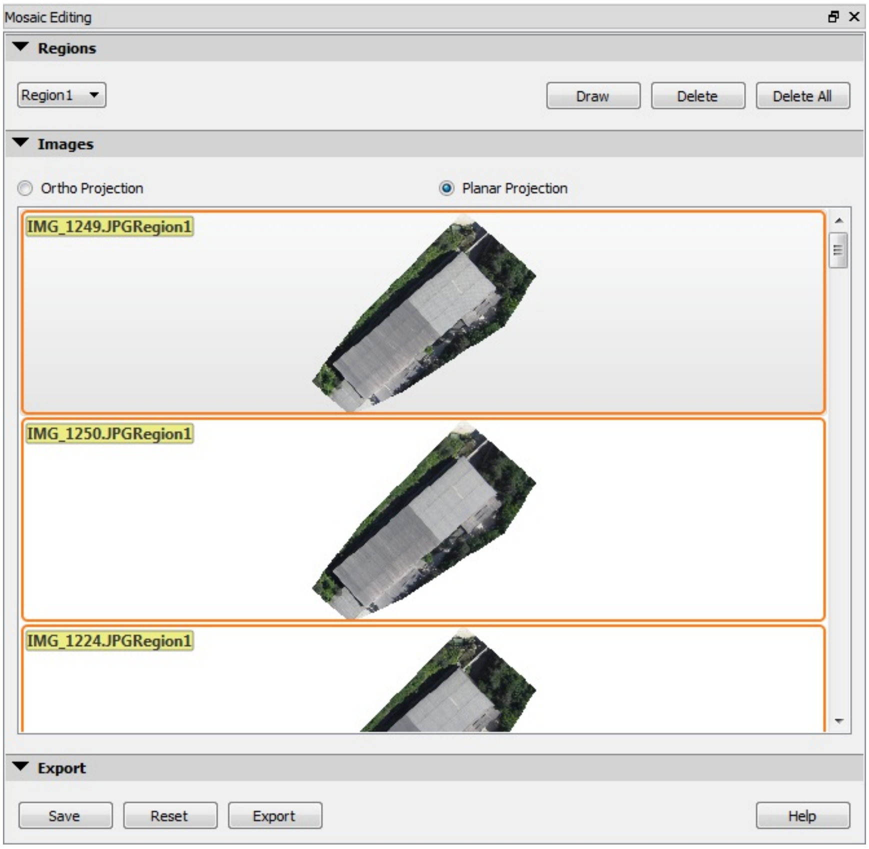
Access: On the Menu bar, click View > Mosaic Editor, on the Menu bar click Mosaic Editor > Mosaic Editing (available only if step *3. DSM, Orthomosaic and Index* has been completed).

For information about the sidebar's display possibilities: 202558389.



The *Mosaic Editing* sidebar contains the following sections:

Regions: Allows the user to select, draw or delete regions.
Images: Allows the user to select which projection and which image can be used for each region.
Export: Allows the user to:
Save locally the changes (saves changes in the *Mosaic View* in internal temporal files).
Reset the displayed mosaic.
Export an edited mosaic by exporting the internal temporal files saved copy).



Regions

Allows the user to select, draw or delete regions.

Contains the following buttons:

Region[number]: Available once one region has been drawn. Allows the user to select a Region.
Draw: Allows the user to draw a region. For step by step instructions: 202560079.
Delete: Allows the user to delete the selected region.
Delete All: Allows the user to delete all the existing regions.

Images

Allows the user to:

Display the different projections available for the selected region.

Display the selected projection type and image for the selected region.
Change the projection type and image to be used for the selected region.

It is possible to select:

Ortho Projection: Displays a list of original images in ortho projection.
Planar Projection: displays a list of original images in planar projection.

> Note:
> Ortho Projection: The ortho projection preserves distances and can be used for mosaics dedicated to measurement applications.
> Planar Projection: The planar projection does not preserve distances, but has less distortions than the ortho projection on sharp transitions such as building edges. Therefore, it is not recommended to use planar images for mosaics dedicated to measurement applications. Its basic use is to improve the visual aspect of the orthomosaic.

Export

> Warning:
> The *Mosaic Editor* may be used to manually correct artifacts in the Orthomosaic resulting from Step *3. DSM, Orthomosaic and Index* and in order to improve its visual aspect.
> The changes applied in the Mosaic Editor affect a local copy, not the mosaic resulting from Step *3. DSM, Orthomosaic and Index*.
> In order to obtain the edited mosaic, the mosaic needs to be exported: 202560079. The orthomosaic resulting from Step *3. DSM, Orthomosaic and Index* will then be overwritten. The Grid DSM as well as the different orthomosaic formats (GeoTIFF, Google Maps Tiles, etc.) will be generated if selected in the processing options.
> For more information about the Mosaic Editor processes workflow: 204829349.

Allows the user to:

Save locally the changes (saves changes in the *Mosaic View* in internal temporal files).
Reset the displayed mosaic.
Export an edited mosaic by exporting the internal temporal files saved copy).

Contains the following buttons:

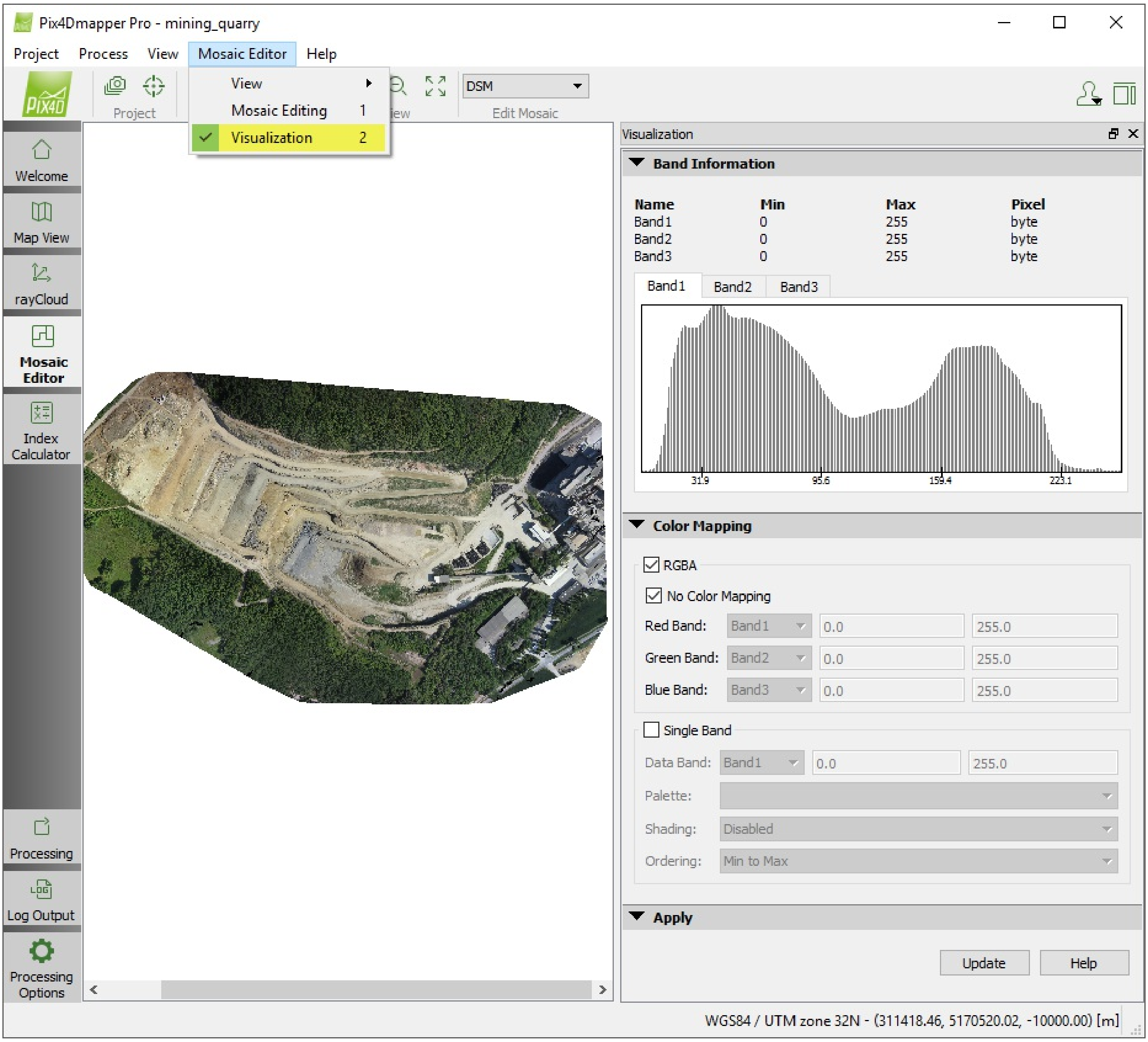
Save: Saves the changes in the mosaic: Overwrites in the *Edited Mosaic* only the areas corresponding to the existing *regions* using the selected projections for them.

The saved *Edited Mosaic* will be used when exporting and when opening the mosaic editor again.

Reset: Resets the *Edited Mosaic* with the *Generated Mosaic* (which is stored as output).
Export: The selected *Edited Mosaic* overwrites the Mosaic generated at step *3. DSM, Orthomosaic and Index.*
Help: Opens Pix4Dmapper help.

Access: On the Menu bar, click View > Mosaic Editor, on the Menu bar click Mosaic Editor > Mosaic Editing (available only if step *3. DSM, Orthomosaic and Index* has been completed).

For information about the sidebar's display possibilities: 202558389.



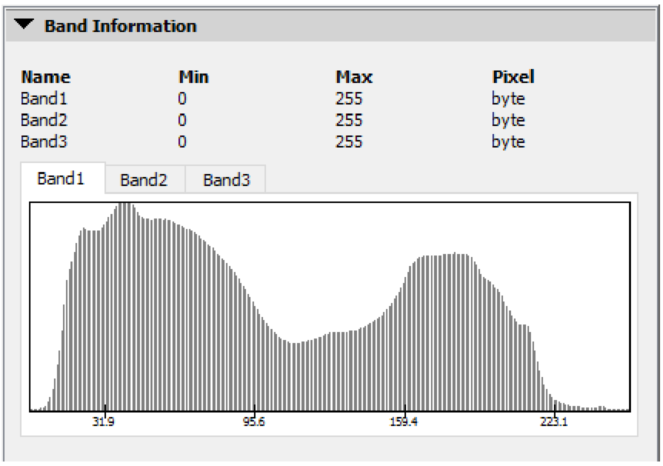
Important: This View is very useful for non standard original images (16 bits per band). It allows the user to specify which band is considered as red, green and / or blue.

The *Mosaic Editing* sidebar contains the following sections:

Band Information: Displays information for the different bands of the mosaic group or DSM.
Color Mapping: Allows the user to change the values to be considered for visualization for each pixel and the visualization rules.
Apply: Allows the user to apply the changes. It considers the visualization parameters to be used in the *Mosaic View.*

Band Information

It displays information for the different bands of the mosaic group or DSM.



The following information is displayed:

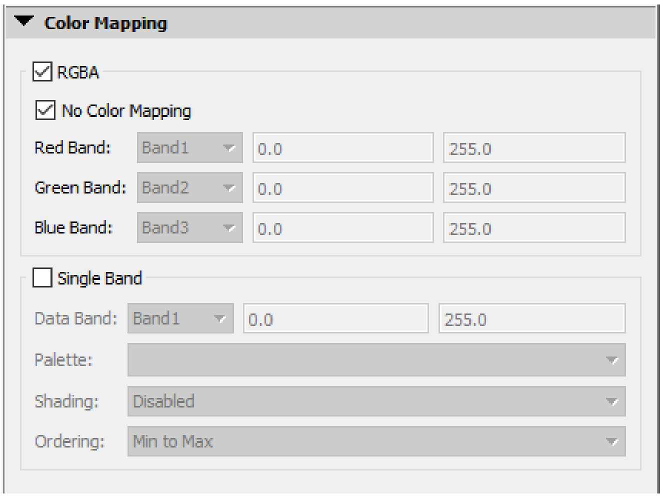
Name: Name of the band.
Min: Minimum pixel value for all the pixels of the band.
Max: Maximum pixel value for all the pixels of the band.
Pixel: Data type, how many bytes are used to store the information of each band.

The band histogram section has one tab per band.

The histogram displays how many pixels in the model have a certain value for each band.

Color Mapping

Allows the user to change the values to be considered for visualization for each pixel and the visualization rules.



It contains 2 sections:

RGBA

Selected by default for Mosaics.

It uses always 3 bands: The final color visualized will be the combination of the values for the 3 bands.

It is possible to select:

No color mapping: Selected by default. It takes the values from the original mosaic file.
Red band: Grayed out unless *No color mapping* is not selected. It allows the user to select which band is considered as the red band for the visualization.
Green band: Grayed out unless *No color mapping* is not selected. It allows the user to select which band is considered as the green band for the visualization.
Blue band: Grayed out unless *No color mapping* is not selected. It allows the user to select which band is considered as the blue band for the visualization.

Single Band

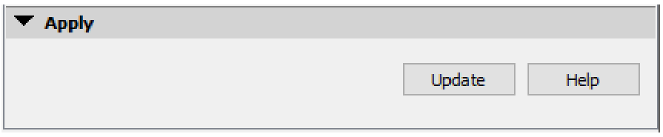
Selected by default for the DSM.

It is possible to use only one band. The final color visualized will consider only the values of one band.

Data band: Allows the user to select which band will be used for visualization.
Palette: Allows the user to select the palette of colors for the visualization of the values of the selected band. The different available options are:
Atlas: It uses the Atlas standard palette. Selected by default for DSM. It uses a palette using blue for low values, yellow for middle values and red for high values.

HSV: It uses the HSV standard palette.
RdYIGn: Low values are red, medium values are yellow and high values are green, used for agriculture.
Thermal: Low values are blue, high values are red. It is used for temperature measurements.
Spectral: It uses all the colors from the visual spectrum. It is used when many different values need to be distinguished.
Grays: It uses a gray scale.
Blues: It uses blue scale.
Red: It uses red scale.
Shading: Allows the user to disable / enable shading using illumination based on the values of each pixel on the model. For more information: How Hillshade works. The different options available are:
Enabled: Selected by default, it uses shading.
Disabled: It does not use shading.
Ordering: Allows the user to invert the selected colors distribution. The different options available are:
Min to Max: Selected by default. It uses the standard colors distribution for the selected palette.
Max to Min: It inverts the selected colors distribution for the selected palette.

Apply

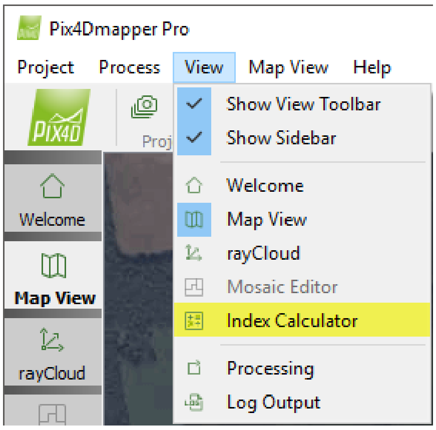


Contains the following buttons:

Update: It applies the changes and considers the visualization parameters to be used in the *Mosaic View*.
Help: It opens Pix4Dmapper help.

Warning:
The *Mosaic Editor* may be used to manually correct artifacts in the Orthomosaic resulting from Step *3. DSM, Orthomosaic and Index* and in order to improve its visual aspect.
The changes applied in the Mosaic Editor affect a local copy, not the mosaic resulting from Step *3. DSM, Orthomosaic and Index*.
In order to obtain the edited mosaic, the mosaic needs to be exported: 202560079. The orthomosaic resulting from Step *3. DSM, Orthomosaic and Index* will then be overwritten. The Grid DSM as well as the different orthomosaic formats (GeoTIFF, Google Maps Tiles, etc.) will be generated if selected in the processing options.
For more information about the Mosaic Editor processes workflow: 204829349.

Access: On the Menu bar, click View > Index Calculator (available once step *1. Initial Processing* has been completed).



Note:
A DSM is used to generate the Reflectance Maps.
One Reflectance Map is generated for each band of each group of images, but only one DSM is generated, regardless the number of images' groups.
The Reflectance Maps contain the reflectance values of each pixel and are used to generate the Index Maps.
The Index Maps are calculated using some specific band(s) from one or more groups of images. Therefore, information from one or more Reflectance Maps may be used.
If a *Region* is drawn, the Index Maps and Colored Index Maps will be generated only for this region.
Colored Index Maps are generated by applying the defined coloring rules to the Index Maps. They are raster files with RGB values.
If a Colored Index Map already exists, creating a new Colored Index Map will overwrite the existing one.

Important:
For more information about the files that are generated, under which action and where they are stored: 202558739.
All the outputs will be stored in: *...\project_name\4_index*
For more information about the project folder structure: 202558649.

Warning: Once the Index Calculator has been used and results are generated, all the outputs from the Index Calculator will be DELETED if any of the following steps / actions is started: step *1. Initial Processing,* step *2. Point Cloud and Mesh,* step *3. DSM, Orthomosaic andIndex, Reoptimize, Rematch and Optimize.*

The existing results need to be backed up to not be overwritten.

The use of the *Index Calculator* is optional and can be used to:

Generate an Index Map / Index Grid where the "color" of each pixel is computed using a formula that combines different bands of the Reflectance Map(s).
Visualize the Index Map as a Colored Index Map by applying a color mapping to it.
Export a georeferenced Colored Index Map.
Annotate the classes of the Index Map to generate an Application Map.
Export an Application Map as a shape file to be imported in any tractors consoles.

When selecting the *Index Calculator* view the following elements are displayed on the main window:

Menu bar entry: Extra entry displayed on the Menu bar.
Toolbar: The standard toolbar and some extra buttons related to the Index Calculator.
Index View: Displayed in the main window. When opening the Index Calculator for a project for the first time, it is blank. Once at least an Index Map has been generated, it displays by default the last index that was displayed before the project was closed.
Index Calculator sidebar: By default, it is displayed on the right of the Index View. Displays information about the Reflectance Map(s), the Index Map, and provides tools to generate and edit the Index Maps.
Status bar: Displayed on the bottom right of the main window. Displays the *Index Value*, the coordinate system and the coordinates when passing the mouse over the Reflectance Map/ Index Map.

For more information:

For step by step instructions about how to use the Index Calculator: 202558729.

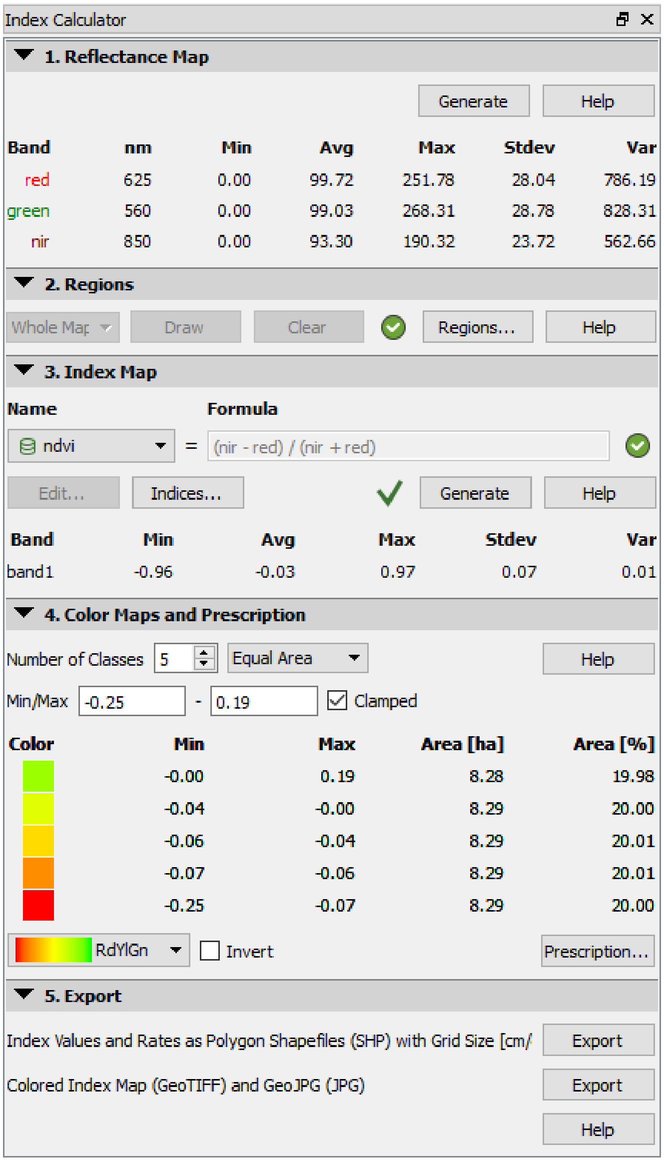
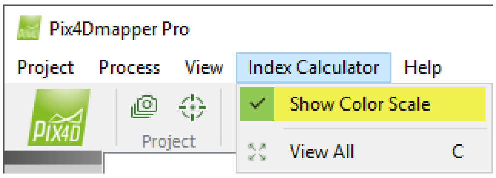


Figure 1. Index Calculator

Menu bar entry

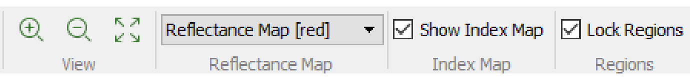
On the Menu bar, by clicking on Index Calculator the following option is displayed:



Show Color Scale: By default it is selected. View/hide the color scale graphic of the Index Map that is displayed on the top right of the Index View.
View All: Zoom in and out, so that the full Reflectance Map or Index Map is displayed in the Index View.

> Note: For information about the files that are generated, under which action and where they are stored: 202558739.

Toolbar



The following Toolbar buttons are displayed:

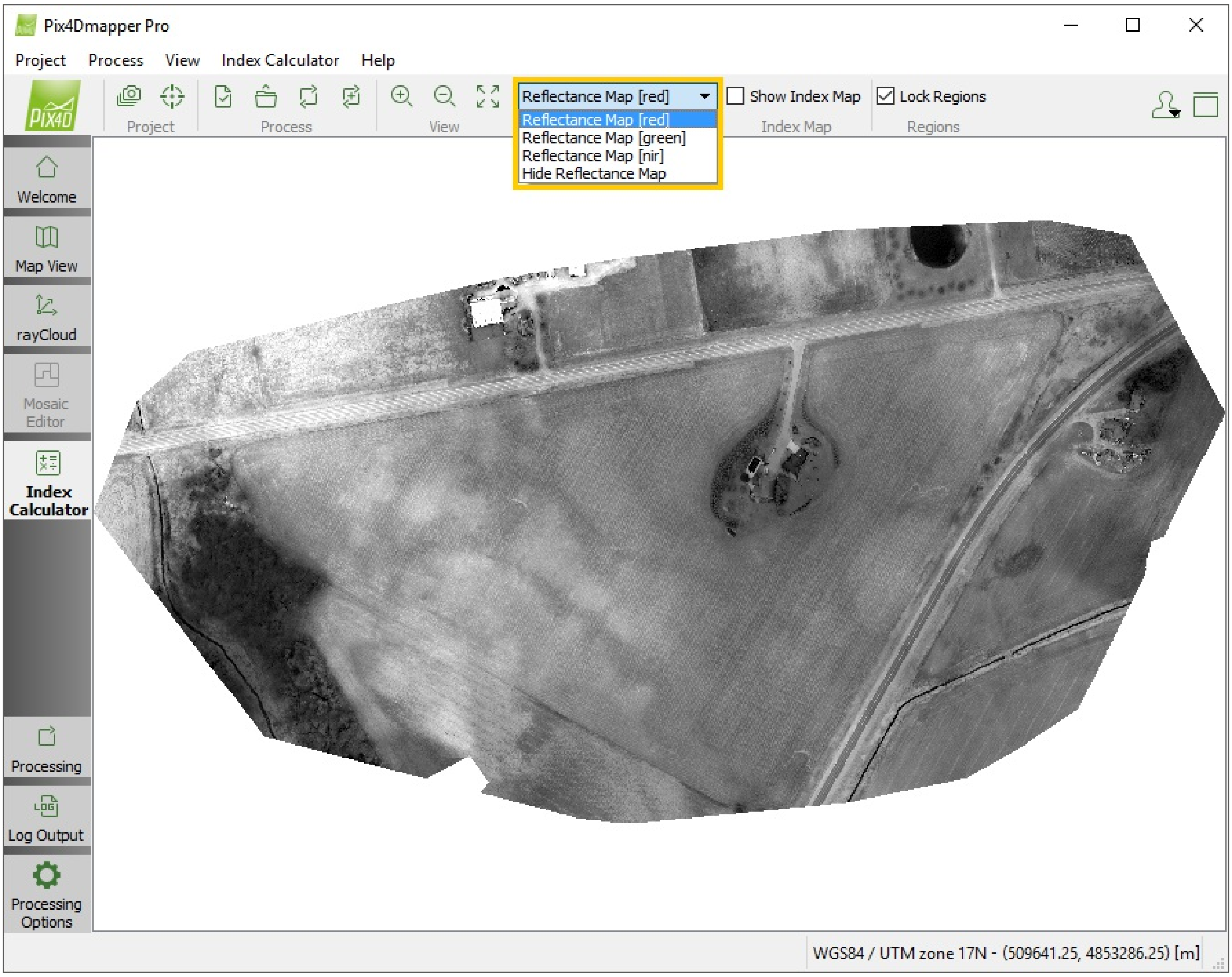
Standard toolbar: For more information: 202557839.
Toolbar extra buttons:
View:

Zoom In: Zooms in the selected view.

Zoom Out: Zooms out the selected view.

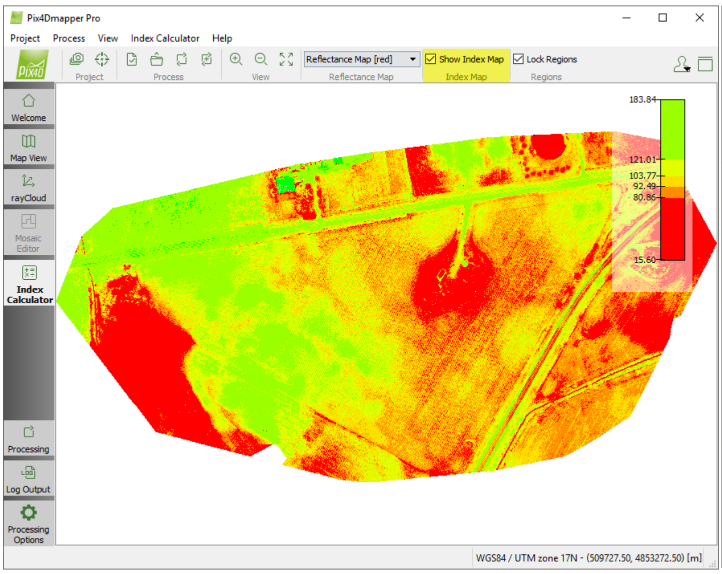
View All: Zooms in and out, so that the full Reflectance Map or Index Map is displayed in the Index View.

Reflectance map:

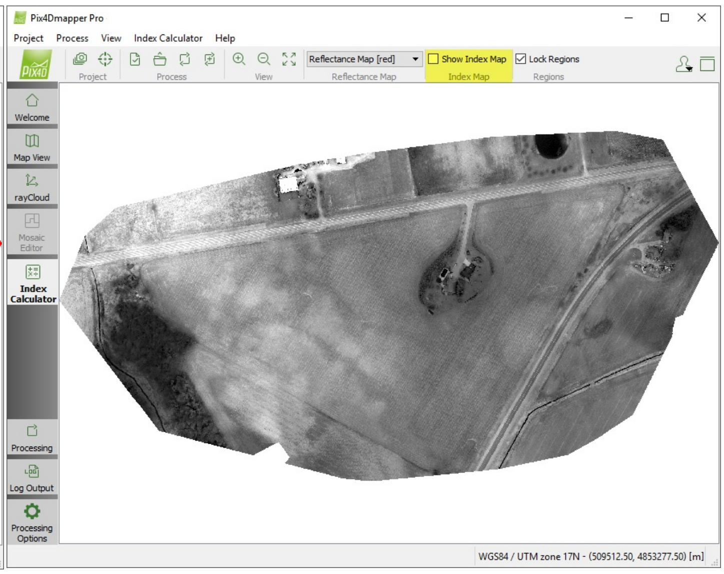


By default the Reflectance Map of the first band is displayed. The drop-down list gives the option to hide the Reflectance Map and select the Reflectance Map of a different band.

Index Map:



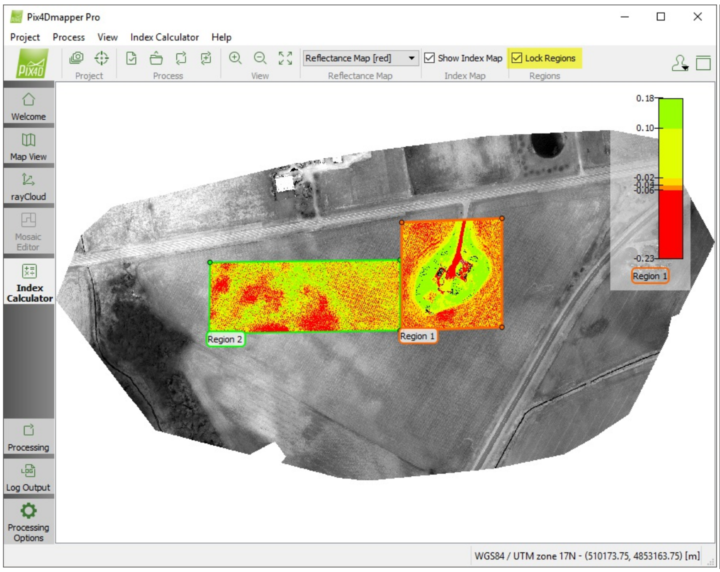
Index Map display



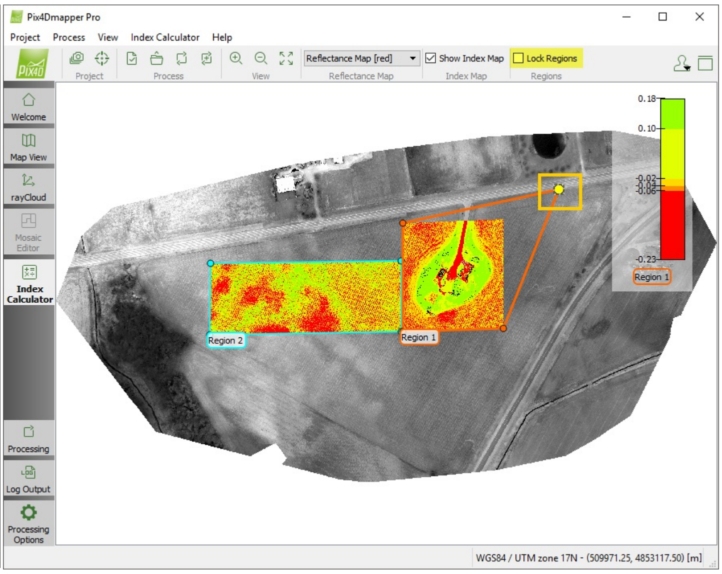
Index Map not display

By default, the *Show Index Map* box is selected. This option controls whether the generated Index Map will be displayed and overlaid on top of the reflectance map.

Regions:



Regions locked



Regions unlocked

By default the *Lock Regions* box is selected. After the regions are drawn: 203937289, they will be displayed in the Index View. If the *Lock Regions* box is selected, the region frame will be locked in the position. Unselect the *Lock Regions* box to enable the editing of previously drawn regions by dragging the whole region or a certain vertex.

Index View

When opening the Index Calculator for a project for the first time, it is blank. Once at least an Index Map has been generated, it displays by default the last index that was displayed before the project was closed.

Navigating on the Index View using the mouse:

Pan: Right/Left click and move the mouse (a hand icon appears representing the focus point for the movement).
Zoom in: Move the scroll wheel forward while positioning the mouse over the Index View.
Zoom out: Move the scroll wheel backwards while positioning the mouse over the Index View.

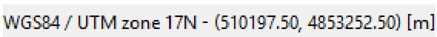
Index Calculator sidebar

The side bar displays the information about the Reflectance Map(s) and the Index Map as well as provides tools to generate and edit the Index Maps.

For details about the Index Calculator Sidebar: 202558249.

Status bar

On the bottom right part of the main window, if a Reflectance Map / Index Map is loaded in the Index View, the following information is displayed:



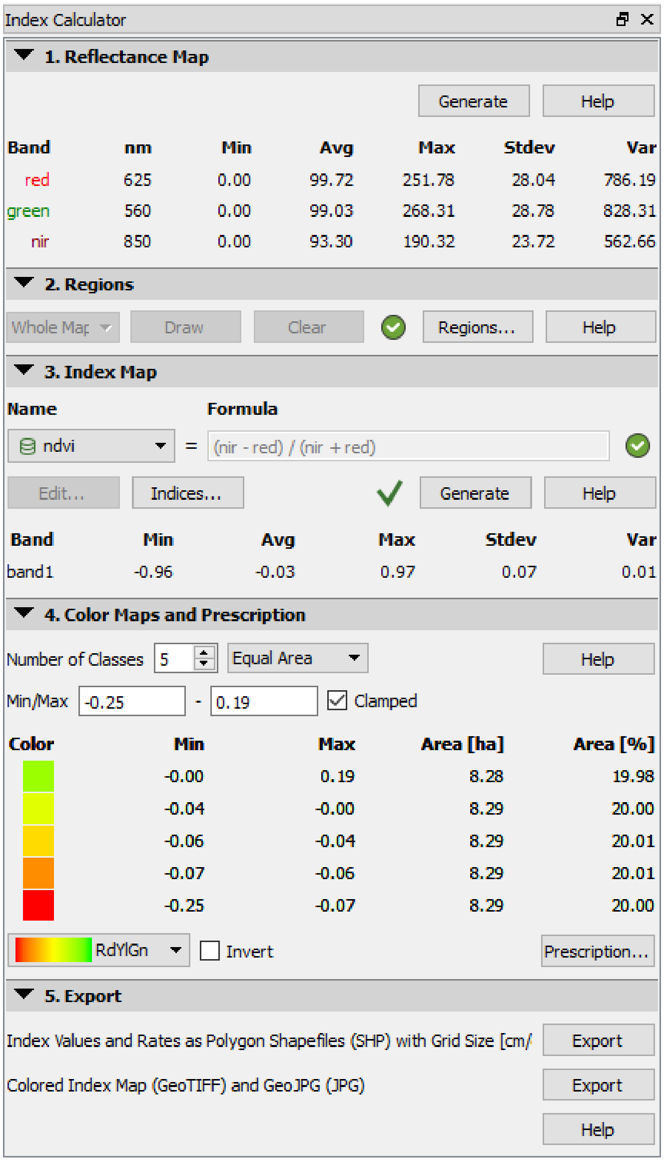
Index Value: Displays the pixel value of the Index under the current mouse location. When passing the mouse over the Index View, the value changes.
Output Coordinate System: Displays the selected output coordinate system.
Coordinates: Displays the (X,Y) coordinates in meters / feet of each point of the Reflectance Map / Index Map. When passing the mouse over the Reflectance Map/ Index Map the coordinates change.

Note: Coordinates of the area covered by the Reflectance Map / Index Map and of the areas without data are displayed.

Access: On the Menu bar, click View > Index Calculator (available once step *1. Initial Processing* has been completed). The *Index Calculator* sidebar is displayed on the right of the main window. For information about the sidebar's display possibilities: 202558389.

The *Index Calculator* Sidebar contains the following sections:

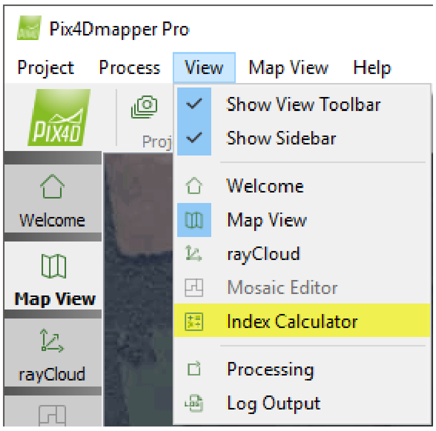
1. Reflectance Map: Used to:
Generate the Reflectance Map(s) used to generate the indices. One Reflectance Map is generated per group of images (RGB, NIR, etc.).
Displays information about the Reflectance Map(s) bands.
2. Regions: Used to:
Define specific areas that the index calculation will be applied to.
3. Index Map: Used to:
Generate, view, edit indices or select the index to be displayed in the Index View.
Displays information about the selected index.
4. Color Maps and Prescription: Used to:
Classify the Index Map, based on the indices values.
5. Export: Used to:
Export the index values and prescription rates as polygon shapefiles.
Export the selected Index Map using the selected classes for the color mapping.



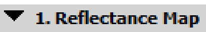
Note:
One Reflectance Map is generated for each band of each group of images.
The Reflectance Maps contain the reflectance values of each pixel are used to generate the Index Maps.
The Index Maps are calculated using some specific band(s) from one or more groups of images. Therefore, information from one or more Reflectance Maps may be used.
If a *Region* is drawn, the Index Maps and Colored Index Maps will be generated only for this region.
Colored Index Maps are generated by applying the defined coloring rules to the Index Maps. They are raster files with RGB values.
If a Colored Index Map already exists, creating a new Colored Index Map will overwrite the existing one.

Important:
For information about the files that are generated, under which action and where they are stored: 202558739.
All the outputs will be stored in: *...\project_name\4_index*
For more information about the project folder structure: 202558649.

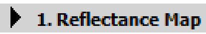
Access: On the Menu bar, click View > Index Calculator (available once step *1. Initial Processing* has been completed). The *Index Calculator* sidebar is displayed on the right of the main window. For information about the sidebar's display possibilities: 202558389.



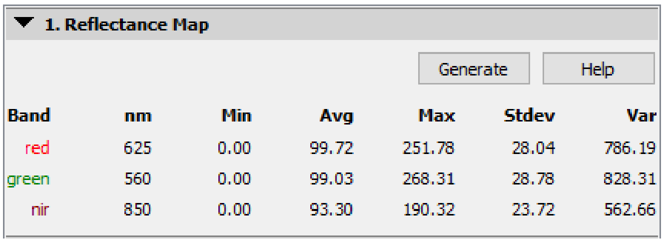
On the left part of section *1. Reflectance Map*, there is an arrow that allows the user to show/hide the section by clicking on it:



By default section *1. Reflectance Map* is visible.



Section *1. Reflectance Map* is not visible.



Band	nm	Min	Avg	Max	Stdev	Var
red	625	0.00	99.72	251.78	28.04	786.19
green	560	0.00	99.03	268.31	28.78	828.31
nir	850	0.00	93.30	190.32	23.72	562.66

And the

Generate: Generates the Reflectance Map if not generated.

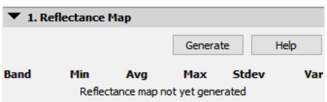
Note: The Reflectance Map is generated based on the selected *Processing Options*: 203891879. For more information about the generated files and where they are stored: 202558739.

Help: Opens the Pix4Dmapper help.

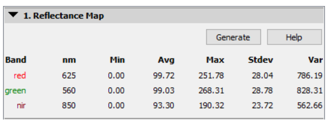
The section *1. Reflectance Map* also displays information for each band of the generated Reflectance Map(s) for each group of images The following information is displayed:

Band: Name of the band. If more than one group exists and the same band name exists in different groups, the bands are displayed as "Groupname_band."
Min: Minimum pixel value per band.
Avg: Average pixel value per band.
Max: Maximum pixel value per band.
Stdev: Standard deviation of pixel values per band.
Var: Variance of pixel values per band.

If the Reflectance Map(s) are not generated, it displays: "Reflectance Map not yet generated."



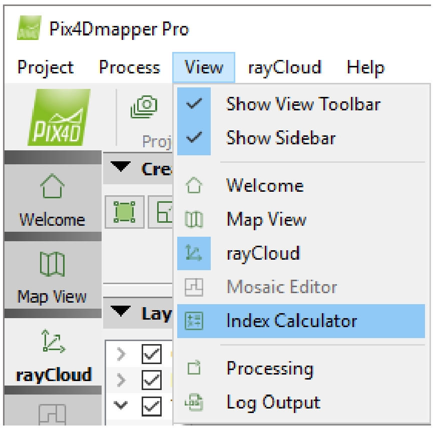
Reflectance Map not generated



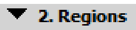
Reflectance Map generated

Note:
One Reflectance Map is generated for each band of each group of images.
The Reflectance Maps contain the reflectance values of each pixel are used to generate the Index Maps.
The Index Maps are calculated using some specific band(s) from one or more groups of images. Therefore, information from one or more Reflectance Maps may be used.
If a *Region* is drawn, the Index Maps and Colored Index Maps will be generated only for this region.
Colored Index Maps are generated by applying the defined coloring rules to the Index Maps. They are raster files with RGB values.
If a Colored Index Map already exists, creating a new Colored Index Map will overwrite the existing one.

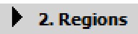
Access: On the Menu bar, click View > Index Calculator (available once step *1. Initial Processing* has been completed). The *Index Calculator* sidebar is displayed on the right of the main window. For information about the sidebar's display possibilities: 202558389.



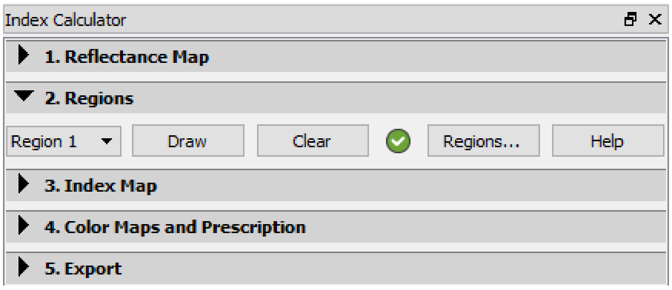
On the left part of section 2. *Regions*, there is an arrow that allows the user to show/hide the section by clicking on it:



By default section 2. *Regions* is expanded and visible.



Section 2. *Regions* is collapsed and hidden.

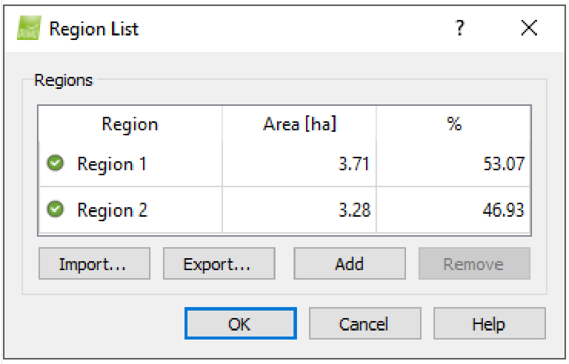


The following information is displayed:

Selected region: Allows the user to select the region to be highlighted with orange color in the Index View and to be used for the index classification.
Draw: Allows the user to draw the selected region in the Index View.
Clear: Allows the user to clear the drawn region in the Index View. Enabled if the selected region is drawn.
Formula Status icon: Next to the button *Clear* appears:
 The region exists and is valid.
 The region has not been drawn or the drawn area is incorrect (its edges intersect).
Regions...: Opens the *Region List* pop-up, which allows the user to manage the regions:
Add a new region.
Delete an existing region.
Edit the name of a region.
Display some properties of the region.
Import / export the regions.
Help: Opens the Pix4Dmapper help.

Regions...

When the button **Region...** is clicked, the following pop-up appears:



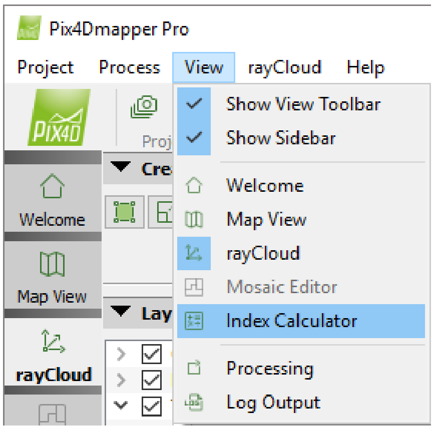
It contains the section *Regions*:

Regions table: Contains the columns:
Region: Name of the region, by double clicking on it, it is possible to edit the name.
Area [units]: Surface covered by the region.
%: Percentage of the total area occupied by the region.
Import...: Allows to import regions from a .shp files.
Export...: Allows to export the regions to a .shp file.
Add: Creates a new region.
Remove: Deletes the selected region.

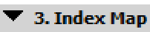
And the buttons:

OK: Confirms the changes.
Cancel: Does not save the changes.
Help: Opens the Pix4Dmapper help.

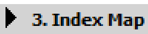
Access: On the Menu bar, click View > Index Calculator (available once step *1. Initial Processing* has been completed). The *Index Calculator* sidebar is displayed on the right of the main window. For information about the sidebar's display possibilities: 202558389.



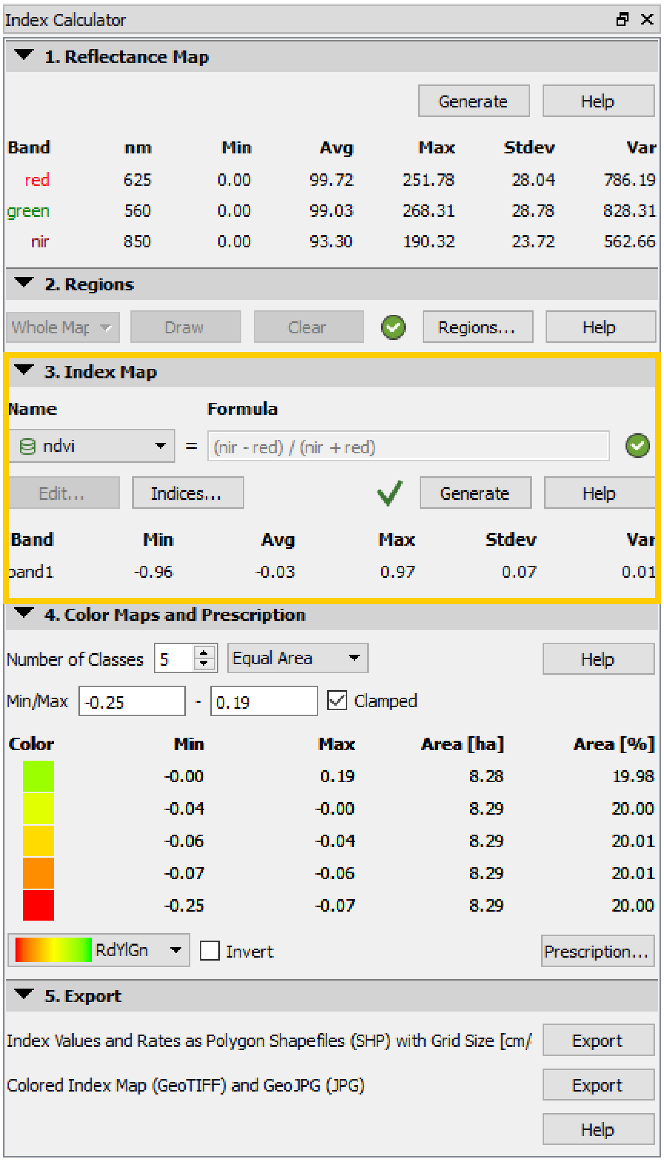
On the left part of section *3. Index Map*, there is an arrow that allows the user to show/hide the section by clicking on it:



By default section *3. Index Map* is visible.



Section *3. Index Map* is not visible.



An Index Map is a single band image where each pixel value is computed using a mathematical formula combining the bands of the Reflectance Map(s). The Index Map gives some information about the captured area.

The following information is displayed:

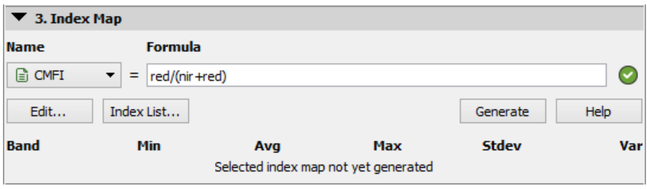
Name: List of available indices. By clicking on the selected index the list of available indices appears. If the icon shown before the index name is:
The index exists in the Pix4Dmapper index database.
For more information about the Pix4Dmapper index database list: 202558379.
The index was created / edited by the user in this project.
The index was created / edited by the user in another project (on the same computer) that was closed and saved.
Formula: Displays the formula associated with the selected index.
Formula Status icon: Next to the *Formula* there is an icon:
The formula is valid.
The formula is incomplete or contains undefined band names.
Index Status icon: If next to the *Generate* button there is
The index has been generated.
Edit...: Grayed out when the selected index belongs to the Pix4Dmapper database. Enabled when the selected index was created by the user. Opens the *Index Maps* window that allows the user to edit the formula that corresponds to the selected index.
For detailed information: 202558279.
Indices...: Opens up the *Index List* window which displays the existing indices and allows the user to add, edit, or remove indices. For detailed information: 202558299.
Generate: Generates a single band GeoTiff image. Each pixel's value is computed by applying the formula to the corresponding pixel of the Reflectance Map(s). It is grayed out if the user defined index formula is not valid.
Help: Opens the Pix4Dmapper help.

Important: For more information about the generated files and where they are stored: 202558739.

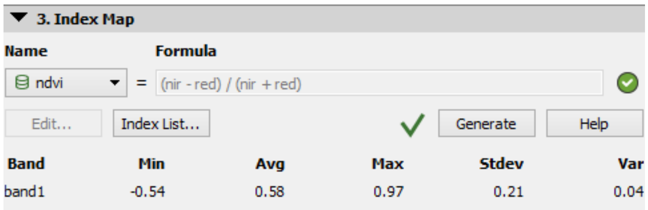
The section *3. Index Map* also displays information about the generated index band. The following information is displayed:

Band: The Index Map has only one band to be displayed (*band1*).
Min: Minimum pixel value.
Avg: Average pixel value.
Max: Maximum pixel value.
Stdev: Standard deviation of pixel values.
Var: Variance of pixel values.

If the selected index has not been generated, it displays: "Selected idex map not yet generated."



Index Map not generated



Index Map generated

Note:
One Reflectance Map is generated for each band of each group of images.
The Reflectance Maps contain the reflectance values of each pixel are used to generate the Index Maps.
The Index Maps are calculated using some specific band(s) from one or more groups of images. Therefore, information from one or more Reflectance Maps may be used.
If a Region is drawn, the Index Maps and Colored Index Maps will be generated only for this region.
Colored Index Maps are generated by applying the defined coloring rules to the Index Maps. They are raster files with RGB values.
If a Colored Index Map already exists, creating a new Colored Index Map will overwrite the existing one.

Access: On the Menu bar, click View > Index Calculator (available once step 1. *Initial Processing* has been completed). The *Index Calculator* sidebar is displayed on the right of the main window. In section *3. Index Map*, click Edit to edit the selected index (available for user defined indices).

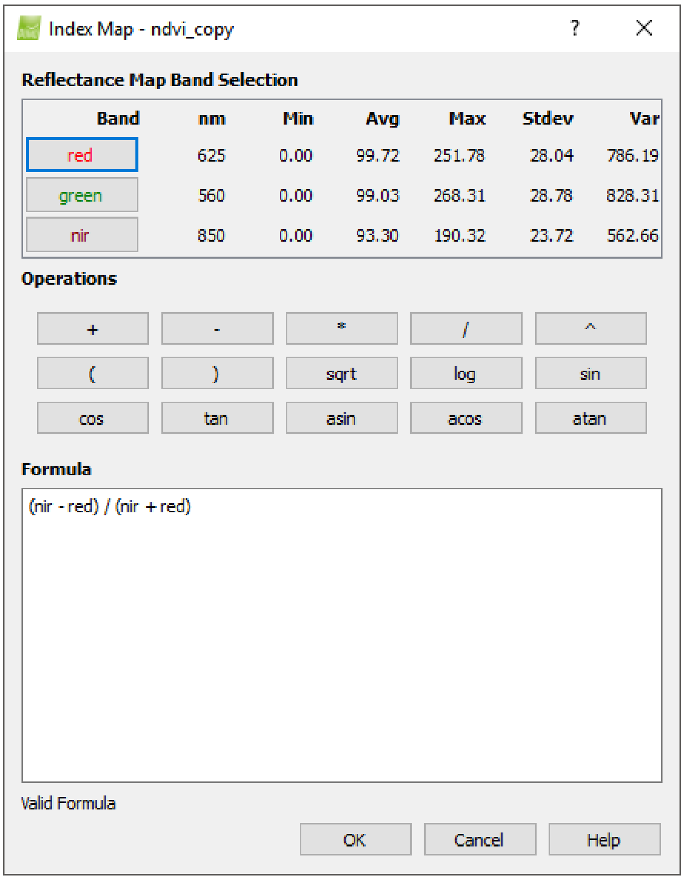
The *Index Map* pop-up is used to easily edit the formula associated to the user defined index. The name of the index that is edited is displayed in the window title.

It contains 3 sections:

Reflectance Map Band Selection
Operations
Formula

And 3 action buttons:

OK: Confirms the changes.
Cancel: Does not save the changes.
Help: Opens the Pix4Dmapper help.



Reflectance Map Band Selection

Displays information for each band of each group of images of the generated Reflectance Map(s).The following information is displayed:

Band: Name of the band . If more than one group exists and the same band name exists in different groups, the bands are displayed as "Groupname_band."
nm: Wavelength of the band in nano-meters.
Min: Minimum pixel value per band.
Avg: Average pixel value per band.
Max: Maximum pixel value per band.
Stdev: Standard deviation of pixel values per band.
Var: Variance of pixel values per band.

By clicking a band button, the band name will be automatically inserted in the *Formula* text box at the current cursor position.

Operations

Buttons that allow the user to automatically insert mathematical operations in the formula text box at the current cursor position.

The available operations are:

Symbol	+	-	*	/	^	(	)
Action	addition	subtraction	multiplication	division	exponentiation	open parenthesis	close parenthesis

Symbol	sqrt	log	sin	cos	tan	asin	acos	atan
Action	square root	natural logarithm	sine	cosine	tangent	arcsine	arcosine	arctangent

Formula

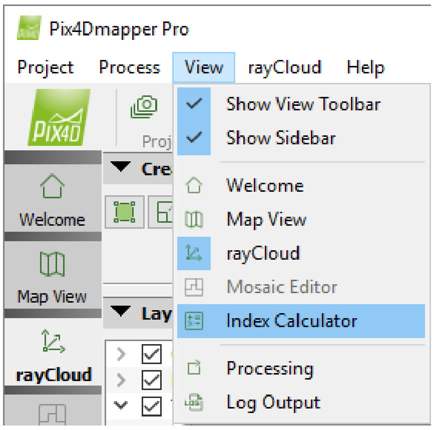
Text box to edit/write the Formula associated to the Index.

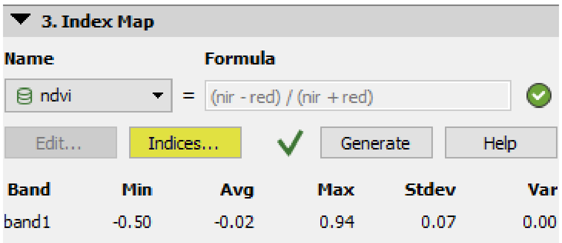
Under the text box appears a message indicating the formula validation status:

Valid formula.
Undefined "band_name" band.
Incomplete formula.
Syntax error.

Important: The formulas' expression is case sensitive: Distinguish between Capital and non-capital letters.

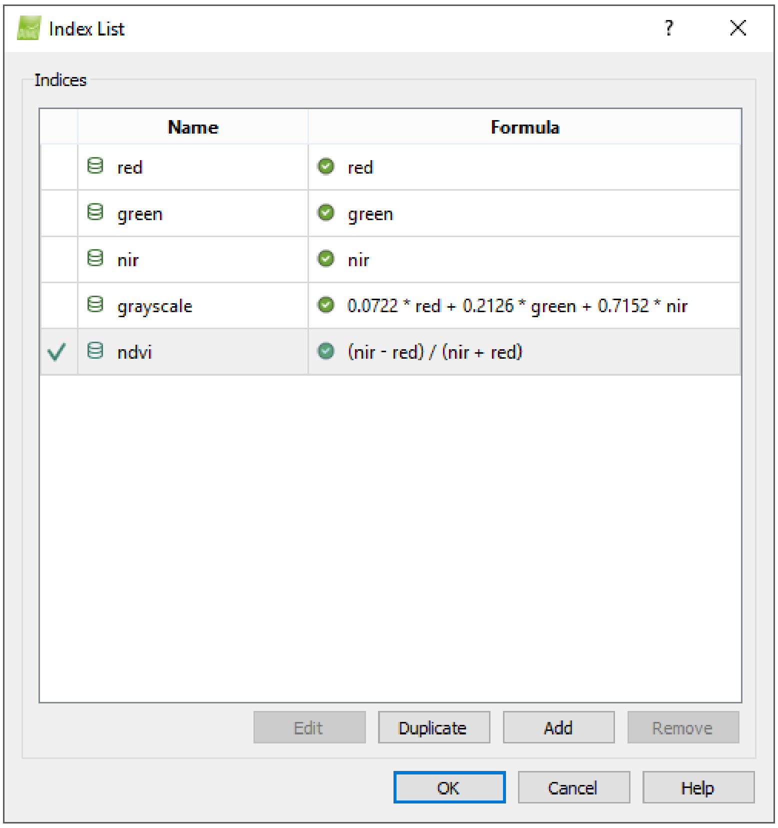
Access: On the Menu bar, click View > Index Calculator (available once step *1. Initial Processing* has been completed). The *Index Calculator* sidebar is displayed on the right of the main window. On section *3. Index Map*, click Indices...





The *Index List* pop-up is used to:

View the indices and their properties.
Edit user defined indices.
Duplicate indices. In order to modify an index from the Pix4Dmapper index database, it has to be duplicated. The copy will be a user defined index and can be edited.
Add new user defined indices.
Remove user defined indices.
Select an index.



The section *Indices* contains the Index table:

Status: The first column displays a green check ✓ if the index has been generated and is empty if the index has not been generated.

Name: Displays:

An icon that shows if:

The index exists in the Pix4Dmapper index database.

For more information about the Pix4Dmapper index database list: 202558379.

The index was created / edited by the user in this project.

The index was created / edited by the user in another project (on the same computer) that was closed and saved.

The index name.

Formula: Displays:

An icon that shows:

If the formula is valid.

If the formula is incomplete or contains undefined band names.

The Formula expression.

And the buttons:

Edit: Enabled for user defined indices. Opens the *Index Map* pop-up allowing the user to edit the currently selected index formula.

Duplicate: Duplicates the selected index with the name: *selectedIndex_copy.* The duplicated index will be user defined even if it is duplicating an index from the Pix4Dmapper index database.

Add: Creates a new user defined index. Opens the *Index Map* pop-up to enter the new formula. By default, it adds it with the name: *unnamed.* If the name already exists, it will be created with the name: *unnamed2*.

Remove: Enabled for user defined indices. Deletes the selected index.

Important: User defined indices created for a project will be available for other projects on the same computer.

Available actions on the table:

Select an Index: By clicking on a cell, the row will be selected and depending on the type of index (from the Pix4Dmapper database or user defined) some buttons will be available or grayed out (see above for more information).

Edit Index name: Available only for user defined indices. Double click on a user defined index name and edit it.

Edit Formula: Available only for user defined indices. Double click on a user defined formula expression and edit it.

Important: The formulas expression is case sensitive: Distinguish Capital and non-capital letters.

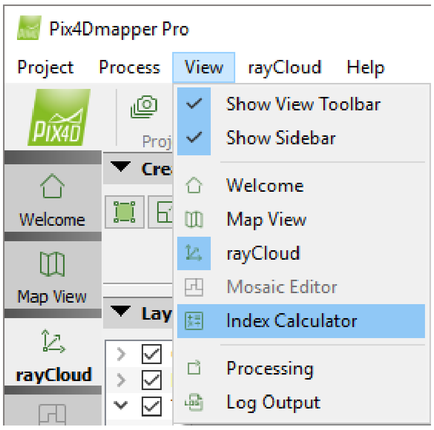
The Index *List* pop-up has as well the following action buttons:

OK: Closes the *Index List* pop-up and the marked index is selected in the *Name* of the *3. Index Map* section of the *Index Calculator Sidebar*.

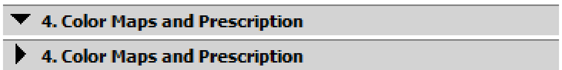
Cancel: Closes the *Index List* pop-up without selecting an index.

Help: Opens the Pix4Dmapper Help.

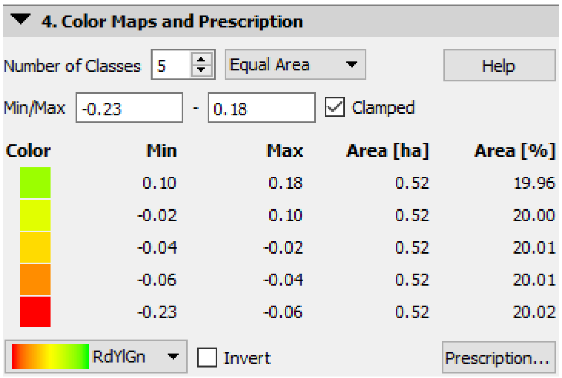
Access: On the Menu bar, click View > Index Calculator (available once step *1. Initial Processing* has been completed). The *Index Calculator* sidebar is displayed on the right of the main window. For information about the sidebar's display possibilities: 202558389.



On the left part of section *4. Color Maps and Prescription*, there is an arrow that allows the user to show/hide the section by clicking on it:

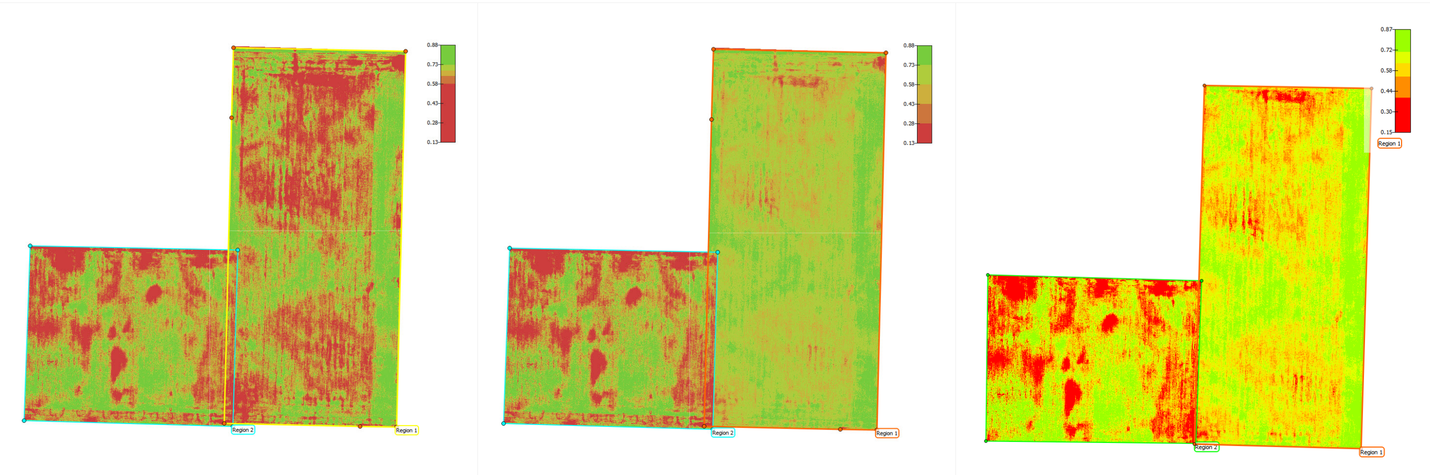


By default section *4. Classes* is expanded and visible.
Section *4. Classes* is collapsed and hidden.



The following information is displayed:

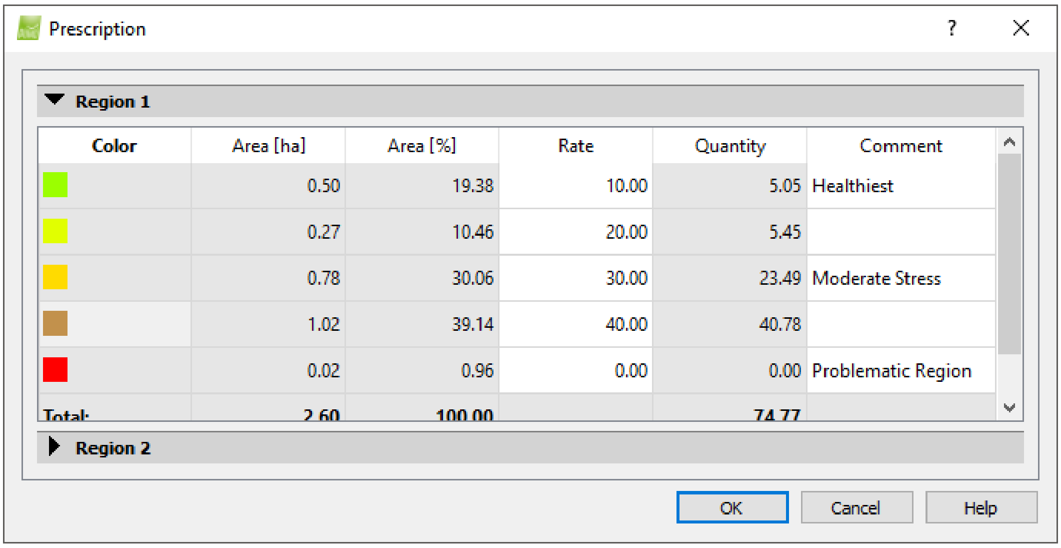
Number of Classes: Number of classes to classify the model. The default value is 5, the minimum value 2 and the maximum value 32.
Method of classification: It is possible to classify the area (classify the pixels in intervals based on their index value and represent each interval using one class and therefore one color) considering:
Equal Spacing: Selected by default, all classes have the same range.
Equal Area: All classes represents the same area in the model.
Jenks: Uses the *Jenks* natural breaks optimization method. For more information: Wikipedia.



Equal Spacing	Equal Area	Jenks

Use Min/Max:
Enter the minimum and maximum index values to ignore the values outside this range. By default it is unselected and the values are the min/max values from the calculated results.
Clamped: Displays the pixels that have an index value outside the selected range (*Min/Max*) with the color of the minimum or maximum selected index values. It

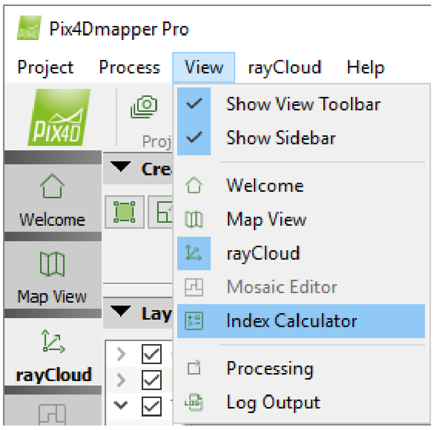
is selected by default. If not selected, the pixels that have an index value outside the selected range (*Min*/*Max*), will be displayed with transparency.
Classes description: It displays the properties of the classes.
Color: Color used in the Index View to represent the class.
Min / Max: Index value range used for each class.
Area [units]:Surface covered by the class.
Area [%]: Percentage of the total area occupied by the region.
Colors Distribution: Contains the palettes that can be used for the colors of the classes.
RdYlGn: Low values are red, medium values are yellow and high values are green, used for agriculture.
Thermal: Low values are blue, high values are red, used for temperature measurements.
Spectral: Uses all the colors of the visual spectrum, used when it is needed to distinguish many different values.
Grays: Uses a gray scale.
Blues: Uses a blue scale.
Reds: Uses a red scale.
Invert: Unselsected by default, it allows to invert the selected colors' distribution.
Prescription...: It displays some classes' parameters and allows to set the application rate and add comments:
Color: Color used in the Index View to represent the class.
Area [units]: Surface covered by the class.
Area [%]: Percentage of the total area occupied by the region.
Rate: It allows to enter the application rate for each class of crops. This rate value should be filled after the on-site scouting is done. The rate units can be whatever the tractor software can read. For chemicals and fertilizer, it could be kg/hectare, grams/hectare, liter/hectare etc. For seeds, it could be seed/hectares.
Quantity: Area[units] x Rate.
Comment: It allows to add comments for each class. These descriptions could be notes from the on-site scouting.



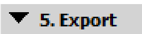
Color	Area [ha]	Area [%]	Rate	Quantity	Comment
	0.50	19.38	10.00	5.05	Healthiest
	0.27	10.46	20.00	5.45	
	0.78	30.06	30.00	23.49	Moderate Stress
	1.02	39.14	40.00	40.78	
	0.02	0.96	0.00	0.00	Problematic Region
Total:	2.60	100.00		74.77	

Help: Opens the Pix4Dmapper help.
Index > Interface > Menu View > Index Calculator > Sidebar
Previous | Next

Access: On the Menu bar, click View > Index Calculator (available once step *1. Initial Processing* has been completed). The *Index Calculator* sidebar is displayed on the right of the main window. For information about the sidebar's display possibilities: 202558389.

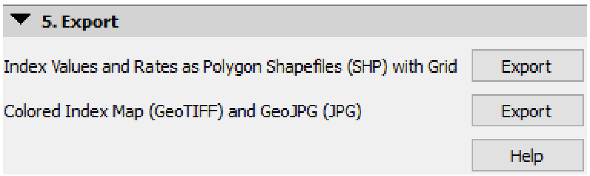


On the left part of section *5. Export*, there is an arrow that allows the user to show/hide the section by clicking on it:



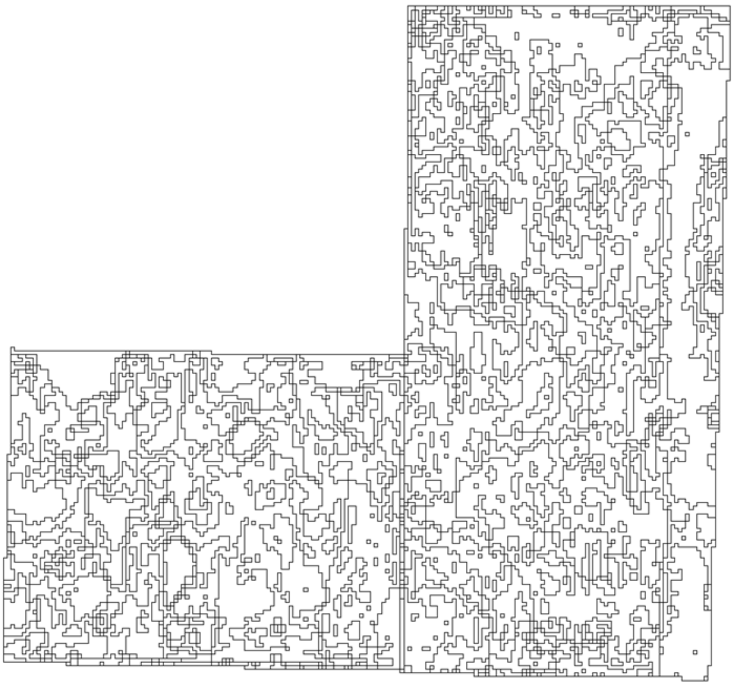
By default the *5. Export* is expanded and visible.

Section *5. Export* is collapsed and hidden.

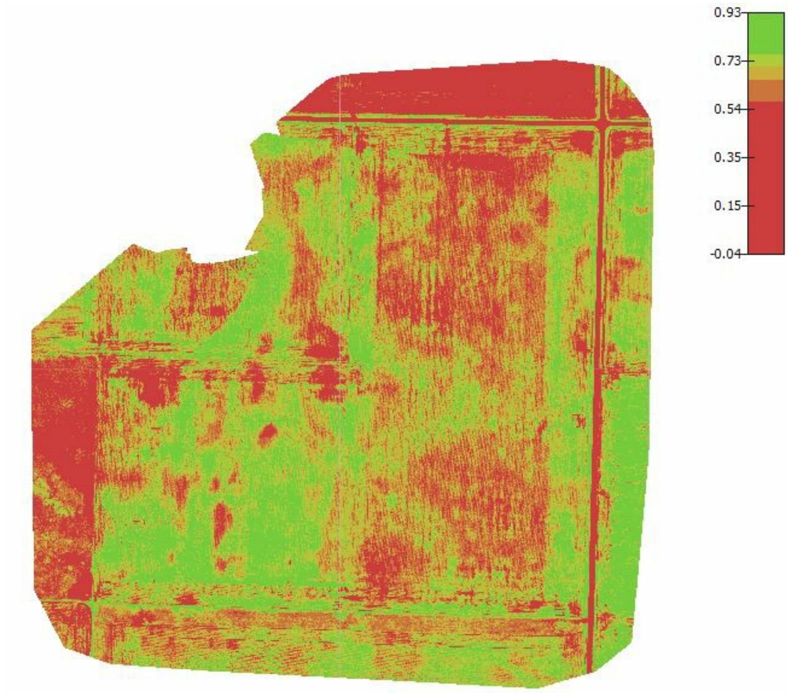


The following information is displayed:

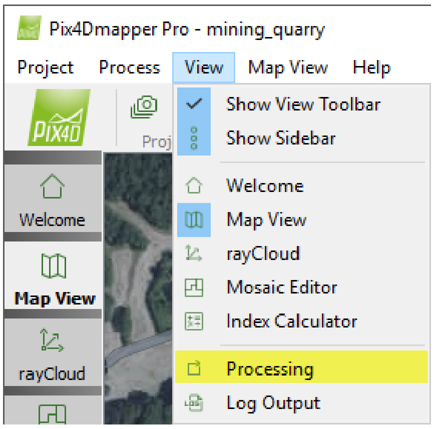
Index Values and Rates as Polygon Shapefiles (.shp) with Grid Size [unit/grid]
Exports the classes as a .shp file (polygon and grid) based on the seletced *Processing Options*: 203891879. One shapefile will be exported for each *Region*. This file can be imported directly into the tractor's displays for field (fertilizer) application.



Colored Index Map GeoTIFF (.tif) and GeoJPG (.jpg)
Exports a Colored Index Map that is generated by applying the defined coloring rules to the Index Map. It is a raster file with RGB values. One Colored Index Map will be exported for all the regions.


0.93
0.73
0.54
0.35
0.15
-0.04

Access: On the Menu bar, click View > Processing (enabled once a project has been loaded or created). The *Processing* bar is displayed at the bottom of the main window. For information about the displayed bars: 202558389.



The *Processing* bar allows the user to process a project.

It contains 1 section:

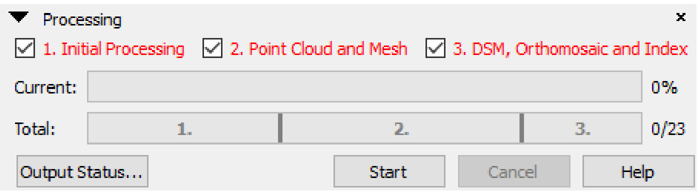
Processing

It also contains 2 Progress bars:

Current
Total

and the buttons:

Output Status: Opens an explorer window with the path where the project outputs are stored.
Start: Starts the processing of the selected processing steps.xxxx
Help: Opens the Pix4Dmapper help.



Processing

The *Processing* section contains 3 subsections:

1. Initial Processing: Automatically extracts keypoints from the images to compute the internal and external camera parameters using the software's advanced Automatic Aerial Triangulation (AAT) and Bundle Block Adjustment (BBA). A sparse 3D point cloud is computed and a low resolution DSM and orthomosaic are generated and displayed in the Quality Report. For more information about the files generated during the *Initial Processing*: 202558519.

Warning: When reprocessing this step for a project, the existing outputs from this step are deleted and overwritten and outputs from steps 2 and 3 (if previously completed) are deleted.

2. Point Cloud and Mesh: Generates a dense 3D point cloud and a 3D textured mesh. For more information about the files generated during the *Point Cloud and Mesh*: 202558549.

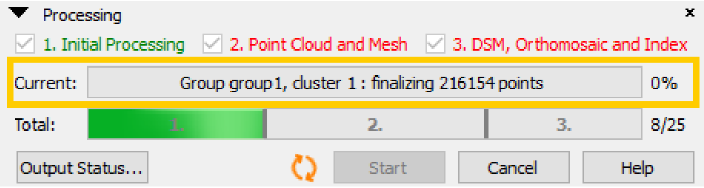
Warning: When reprocessing this step for a project, the existing outputs from this step are deleted and overwritten and outputs from step 3 (if previously completed) are deleted.

3. DSM, Orthomosaic and Index: Generates the DSM, orthomosaic, reflectance map and index map. For more information about the files generated during the *DSM, Orthomosaic and Index*: 202558559.

Warning: When reprocessing this step for a project, the existing outputs from this step are deleted and overwritten.

Current

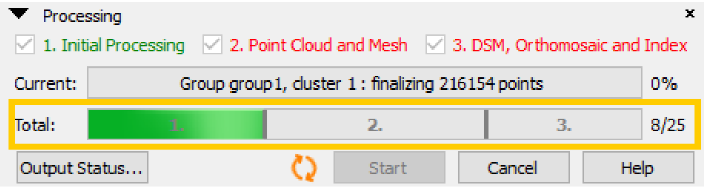
It displays the processing status of each substep as a percentage.



Note: When the project is processing, information about the substep that is currently running is displayed in the *Current* bar.

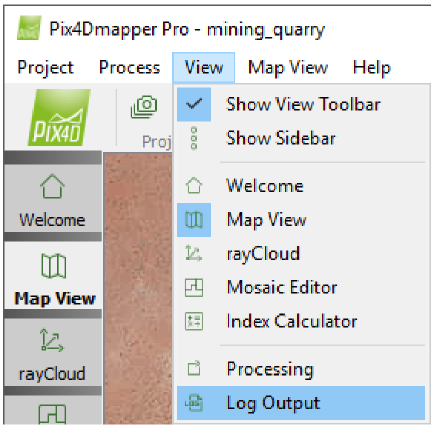
Total

It displays the processing status of all steps of processing that have been selected as the number of completed substeps.



Note: When the project is processing, the processing steps (1, 2, 3) that have been selected are displayed in the *Total* bar.

Access: On the Menu bar, click View > Log Output (enabled once Pix4Dmapper is open). The *Log Output* bar is displayed at the bottom of the main window. For information about the displayed bars: 202558389.



The *Log Output* bar displays useful information about the processing of the project. It describes the steps and substeps of processing, the actions made by the user, warnings and errors during the processing.

Important:
Pix4Dmapper exports the log file (*project_name.log*). It is stored at the output folder *project_name*.
The log file displayed at the *Log Output* bar is cleared each time that Pix4Dmapper closes. The next time that the software will be opened, the log file will start registering the different actions from scratch.

It consists of the:

Levels drop-down list: Allows the user to define the level of details of the log displayed on the main window.
Options drop-down list: Allows the user to set the displaying options for the log on the main window.
Search Engine: Allows the user to search for specific text / numbers in the log displayed on the main window.
Clear Log: Clears (deletes) the log displayed on the main window.
Main window: Displays the log.

Levels

There are the following levels of details:

[Info]: Displays general information that is printed in the log file. The text is displayed in black.

Example: It displays the used version of Pix4Dmapper: *[Info]: Version = <2.1.32>*.

[Warning]: Displays the processing warning messages that are printed in the log file. The text is displayed in yellow.

Example: *[Warning]: Some geotags were invalid and therefore removed.*

[Error]: Displays the error processing messages that are printed in the log file. The text is displayed in red.

Example: [Error]: Failed to open file <file_directory>!.

[Processing]: Displays the processing steps and substeps that are printed in the log file and their status. The text is displayed in green.

Example: *[Processing]: Substep Camera calibration started.*

[UI]: Displays the actions that the user does in the User Interface. The text is displayed in blue.

Example: It displays *[UI]: Open Results Folder clicked,* when the user clicks the button Open Results Folder...

Options

There are the following options:

Full Headers: It displays the full headers (*Date*, *Time*, *% RAM*, *% CPU*).

Wrap Lines: It wraps the lines when the main window is too small.

Search Engine

It allows the user to search for specific keywords, characters of numbers. The results of the searching are displayed in the main window.

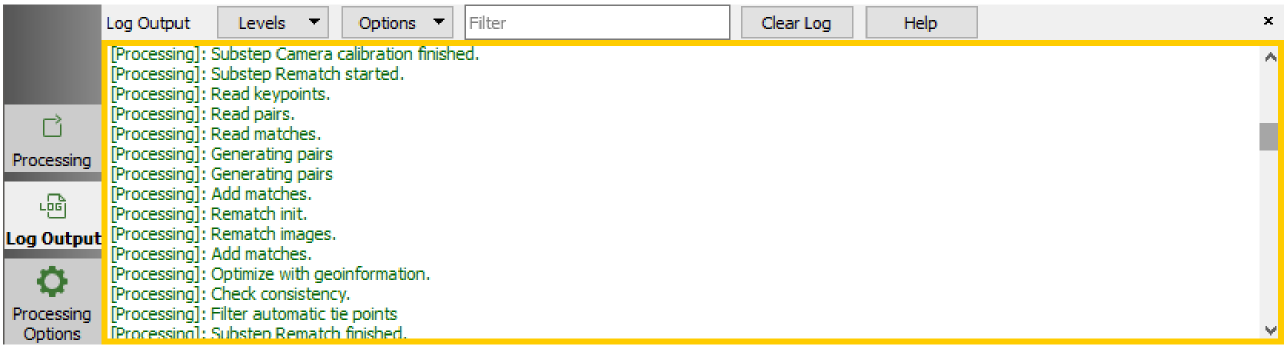
Clear Log

It clears (deletes) the log that is displayed in the main window.

> Important:
> The log file stored at the output folder *project_name* will not be deleted.
> The *Clear Log* action can not be retrieved. Once the log is deleted from the main window, there is no way to bring it back.

Main window

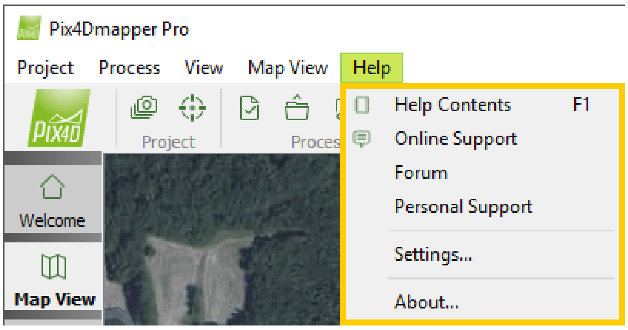
It displays the log. The displayed information depends on the selected *Levels* and *Options*. If a keyword, character or number is used in the *Searching Engine*, the displayed log shows only the strings that contain these elements.



Access: On the Menu bar, click Help.

The Help menu has 6 items that can be selected:

Help Contents: Opens Pix4Dmapper help for the current View.
Online Support: Opens the Online support site in a browser.
Forum: Opens the Support site, displaying the forum index page.
Personal Support: Opens the *Online form* to submit a request to the Support Team in a browser.
Settings...: Opens the Settings window that gives the user access to the proxy and camera database settings.
About...: Provides information about the version, License, *Terms of service*, *Privacy policy* and third party licenses.



Help Contents

The Pix4Dmapper help provides full and detailed information about the current View (*Welcome, Map View, rayCloud, Mosaic Editor, Index Calculator*).

Online Support

Opens a browser pointing to the extensive Knowledge Base which contains numerous articles with step by step instructions and answers to frequently asked questions as well as news, updates, tutorials, user cases, etc.

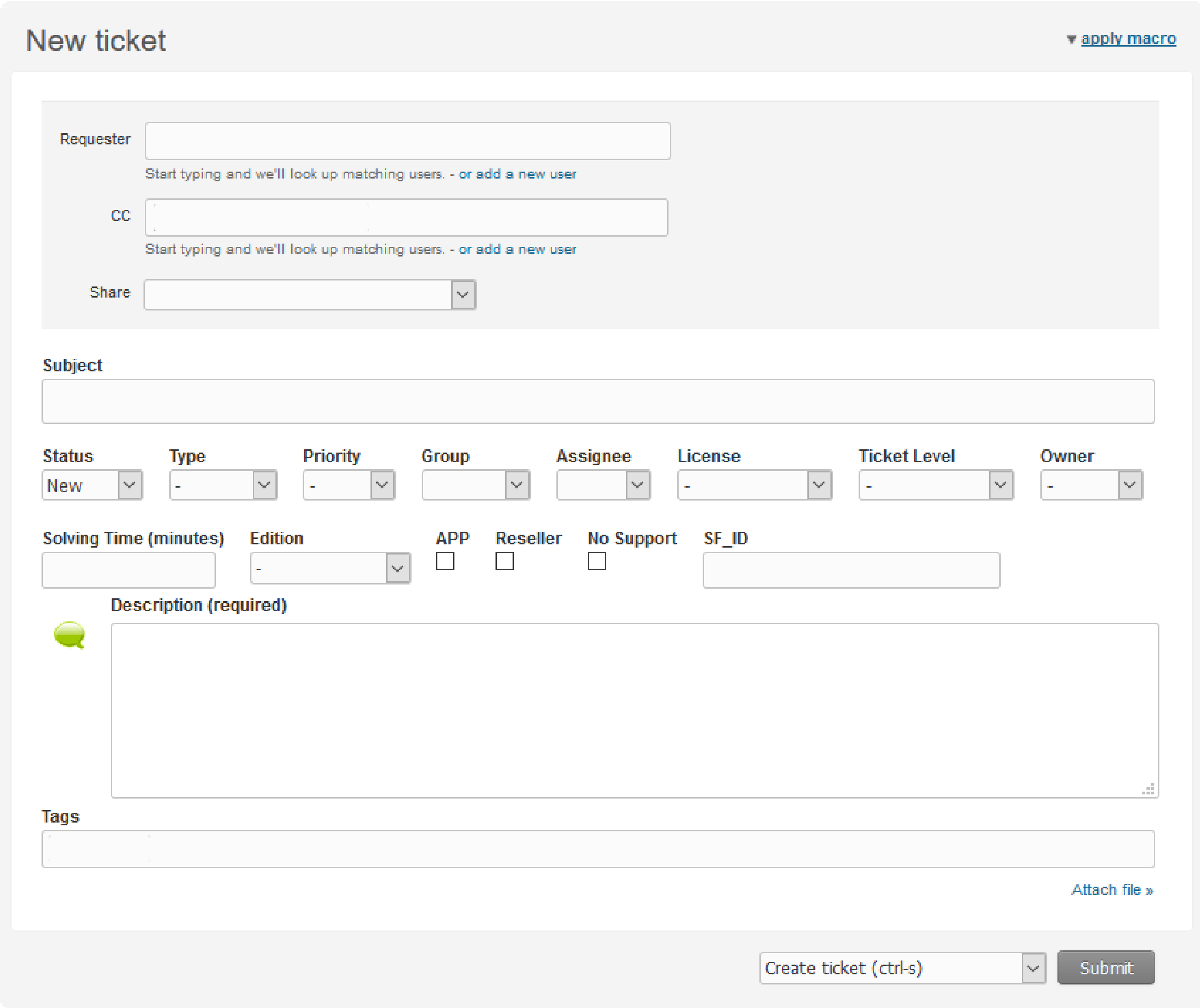
Forum

The forum contains the following topics:

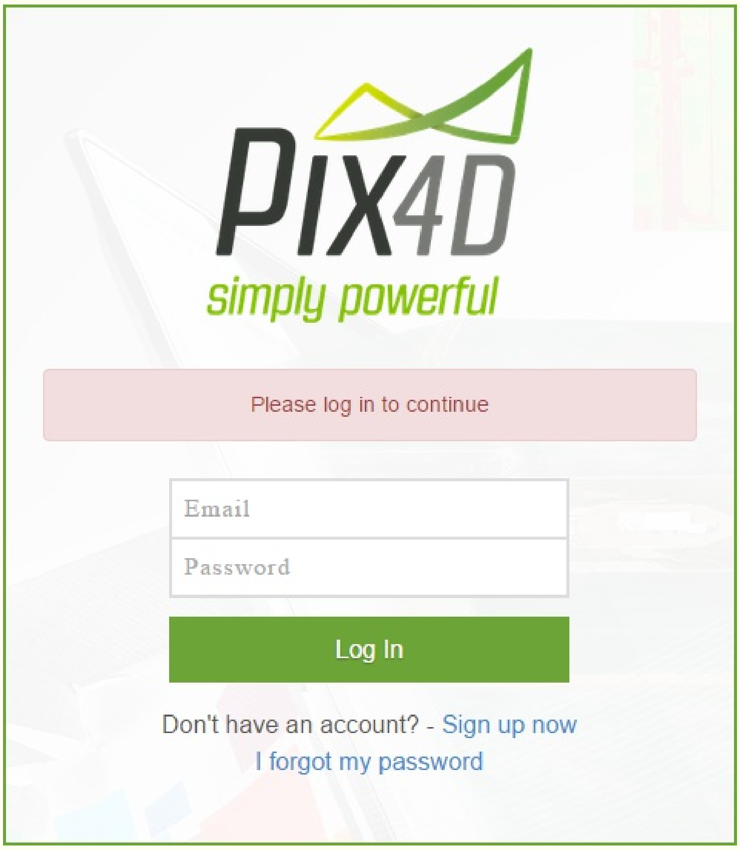
Projects, Experiences and Opinions: Contains posts about user projects, experiences and opinions.
Hardware (Computers, Cameras, Drones): Contains posts about hardware to use for processing, cameras and drones.
Optimized projects and image acquisition: Contains posts related to the inputs in order to obtain the best results.
Georeference (GCPs, Geolocation, Coordinate System): Contains posts regarding the use of GCPs, image geolocation and coordinate systems.
Processing Troubleshooting: Contains posts regarding: quality report, failed quality report, failed processing, processing options and bad / inaccurate results.
Outputs (Editing with Pix4Dmapper or using them in other Software): Contains posts related to the use of the Pix4Dmapper outputs:editing within Pix4Dmapper, using in other software, etc.
Pix4Dcapture: Contains posts related to the use of the Pix4DCapture Application: hardware, tricks, experiences, opinions, troubleshooting, etc.
Pix4Dmapper Mesh: Contains posts related to the use of the Pix4Dmapper Mesh: hardware, tricks, experiences, opinions, troubleshooting, etc.

Personal Support

Contact the dedicated support team for personal support.


New ticket
apply macro
Requester
Start typing and we'll look up matching users. - or add a new user
CC
Start typing and we'll look up matching users. - or add a new user
Share
Subject
Status
New
Type
Priority
Group
Assignee
License
Ticket Level
Owner
Solving Time (minutes)
Edition
APP
Reseller
No Support
SF_ID
Description (required)
Tags
Attach file »
Create ticket (ctrl-s)
Submit

Important: If you are not logged in, the following page appears:



Type the username and password and click Log In.

Settings...

Opens the *Settings* pop-up that gives the user access to the proxy and camera database settings.

It has 4 Tabs:

Proxy
Camera database
Language
Help Improving the Software

And 3 action buttons:

OK: Confirm the changes.
Cancel: Exit without saving.
Help: Open the Pix4Dmapper help.

Proxy

This tab allows the user to configure the Internet connection.

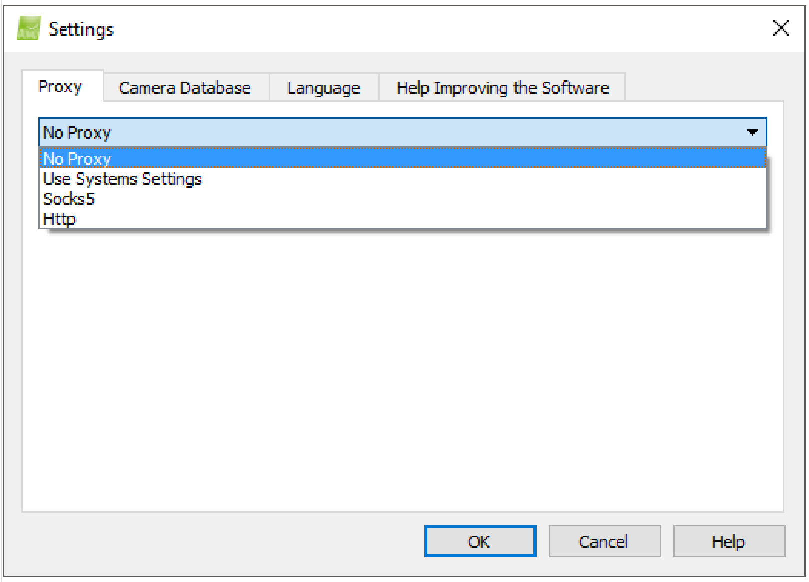
The first drop down list allows the user to select how to connect to the proxy:

No Proxy (default): If no proxy server is used.
Use Systems Settings: Uses the system wide settings.
Socks5
Http

The following fields are displayed:

Host: Proxy host name.
Port: Proxy port number.
Username: Proxy user name.
Password: Proxy password.

In order to enter the proxy settings: 202560089.

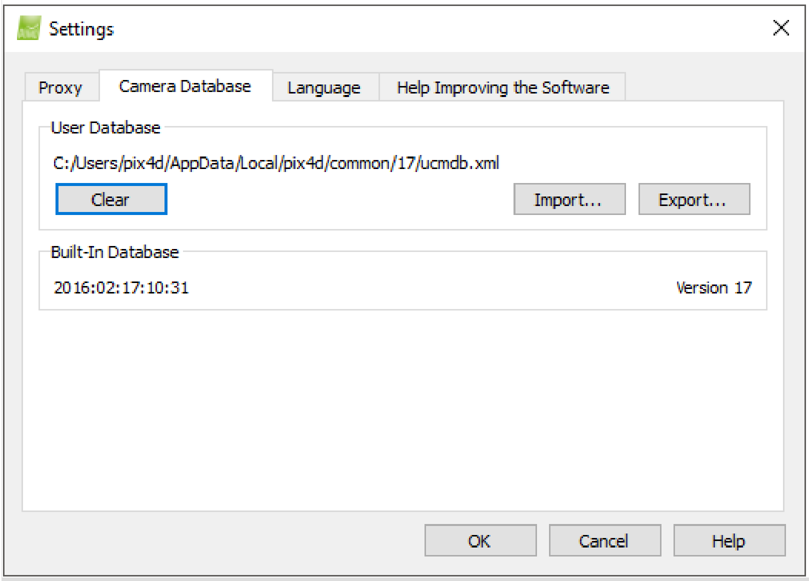


Camera database

This tab allows the user to clear the user camera model database or to import/export it from/to a file. It also displays the built-in database that is used.

The camera database tab has 2 sections:

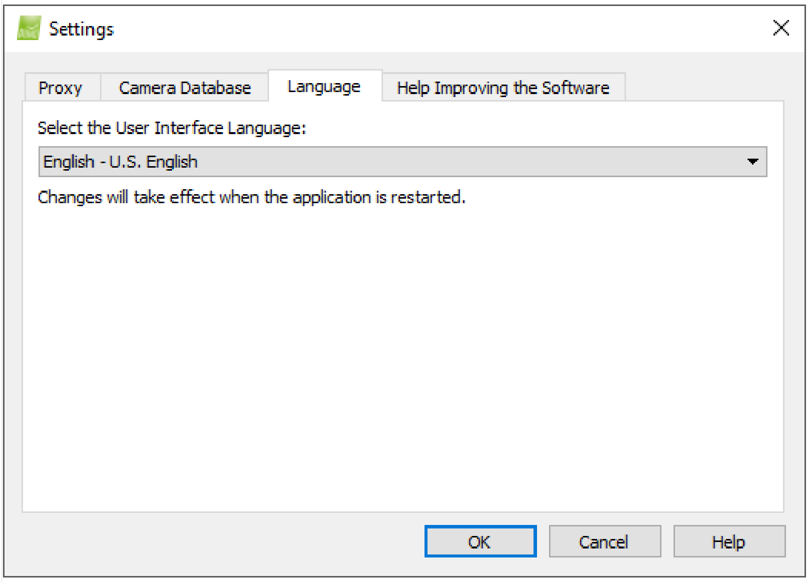
User database: This section has the following action buttons:
Clear: Clears the user camera model database (cameras added or modified by the user).
Import...: Loads a camera database file *.xml with cameras added or modified by the user.
Export...: Exports cameras added or modified by the user to a camera database file *.xml.
Built-in database: Displays the date and the version of the last built-in camera database update.



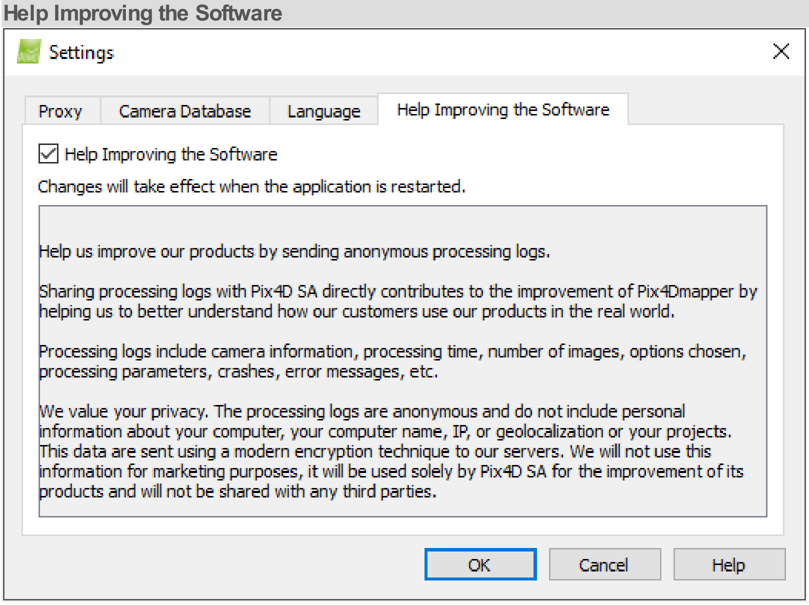
Language

This tab allows the user to set up the language.

The following languages are available:
English - U.S. English (default)
Spanish (Spain) - español de España
Chinese (China)- 中文 (中国)
Chinese (Taiwan)- 中文 (台灣)
German (Germany)- Deutsch
Japannese (Japan)-日本語 (日本)



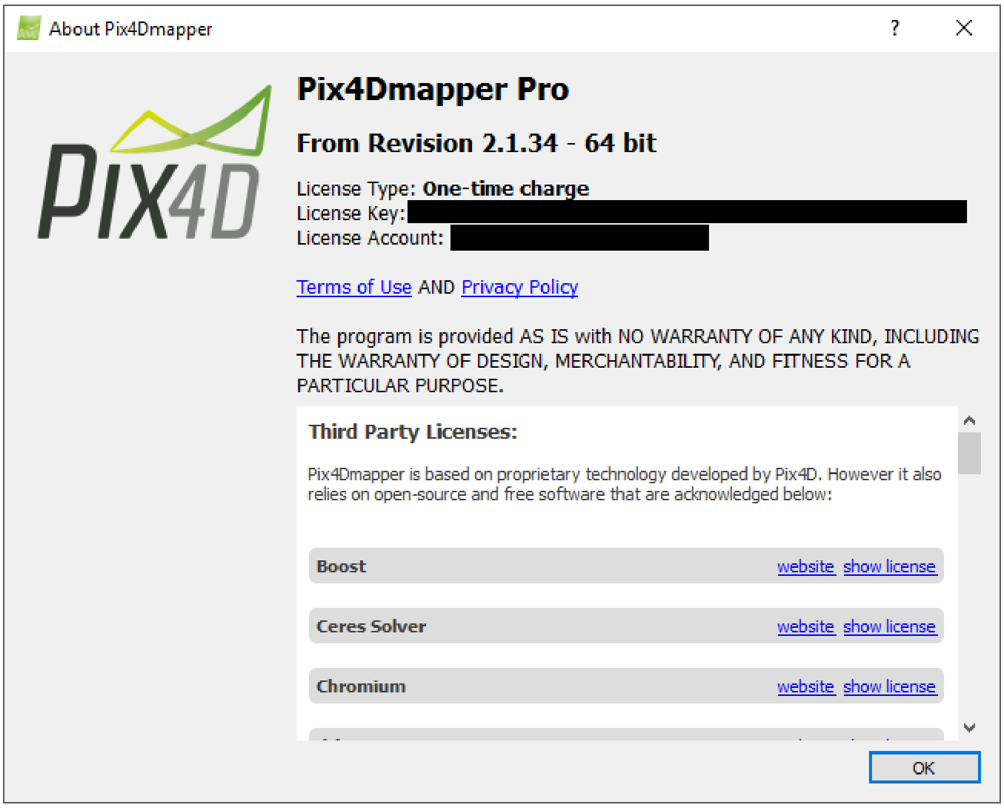
Help Improving the Software



About...

It provides information about the version, license type, license key, license account, *Terms of Use*, *Privacy Policy* and third party licenses.

License Type
License Key
License Account: Pix4D user account to which the license is bound.



The Pix4D Software License is a floating license which allows the user to:

Be logged in one or more computers (devices) at the same time, according to the License type and the authorized device number as specified in the License Certificate. For more information: 204162839.
Have Pix4Dmapper installed in any number of computers.

Pix4Dmapper Pro, is licensed to run at the same time on:

A laptop: It can be used for Rapid/Low Resolution Processing Templates while being still in the field.
A desktop machine: It can be used for higher quality processing.

The license has no limitations in both machines. All features, tools, processing steps can be used by both machines.

For more information about how to download and install the software: 202557299.

With the floating license it is possible to log out the license on one computer in order to log in on another. It is not needed to uninstall Pix4Dmapper:

In order to Log Out a license on a computer (steps 1 to 4): 202559999.
In order to Log In the license to another computer (steps 10 to 14): 202557299.

The following shortcuts are available:

General shortcuts
Basic GCP/Manual Tie Point Editor shortcuts
Log output
rayCloud shortcuts
Layers Sidebar
3D View
Right Sidebar
Mosaic Editor shortcuts
View
Right Sidebar
Index Calculator

General shortcuts

Category	Action	Shortcut	Note
Pix4Dmapper Help	Open the Pix4Dmapper help	F1	
Project	New project	Ctrl + N	
	Open project	Ctrl + 0	
	Save project	Ctrl + S	Does not save the changes done in the Mosaic Editor
	Save project as	Ctrl + Shift + S	
	Exit	Ctrl + Q	

Basic GCP/Manual Tie Point Editor shortcuts

Category	Action	Shortcut	Note
Preview	Remove marked GCP in currently displayed image	Del	The mouse needs to hover over the image
	Zoom out of the image as long as the key is pressed	Shift	The mouse needs to hover over the image
	Zoom in the image as long as the key is pressed	Alt	The mouse needs to hover over the image

Log output

Category	Action	Shortcut	Note
View	Open find bar	Ctrl + F	
	Close find bar	Esc	

rayCloud shortcuts

Category	Action	Shortcut	Note
Layers Sidebar			
Tie Points > Manual/GCPs	Rename point	F2	A point needs to be selected
	Remove point	Del	A point needs to be selected
Processing Areas	Remove area	Del	An area needs to be selected
Objects	Rename object	F2	An object needs to be selected
	Remove object	Del	An object needs to be selected
3D View			
Viewpoints	View All	C	
	Focus on Selection	F	
	Top	7	
	Front	1	
	Back	Ctrl + 1	
	Left	3	
	Right	Ctrl + 3	
	Home	0	
Navidation Modes	Standard	Ctrl + Y	
	Trackball	Ctrl + T	
	First Person	Ctrl + H	
Navigation Modes > Standard	Zoom in	+	
	Zoom in faster	Ctrl + "+"	

	Zoom out	-	
	Zoom out faster	Ctrl + "-"	
	Move forward parallel to the ground plane	Arrow Up	
	Move forward parallel to the ground plane faster	Ctrl + Arrow Up	
	Move backward parallel to the ground plane	Arrow Down	
	Move backward parallel to the ground plane faster	Ctrl + Arrow Down	
	Move up	Page Up	
	Move up faster	Ctrl + Page Up	
	Move down	Page Down	
	Move down faster	Ctrl + Page Down	
	Rotate view down	8	
	Rotate view down faster	Ctrl + 8	
	Rotate view up	2	
	Rotate view up faster	Ctrl + 2	
	Rotate view left	4	
	Rotate view left faster	Ctrl + 4	
	Rotate view right	6	
	Rotate view right faster	Ctrl + 6	
Navigation Modes > Trackball	Zoom in	+	
	Zoom in faster	Ctrl + "+"	
	Zoom out	-	
	Zoom out faster	Ctrl + "-"	
Navigation Modes > First Person	Move forward	W Arrow Up	
	Move backward	S Arrow Down	
	Move left	A Arrow Left	
	Move right	D Arrow Right	
	Move up	Page Up	
	Move down	Page Down	
	Look up	I	
	Look down	K	
	Look left	J	
	Look right	L	
Perspective/Orthographic	Switch between perspective and orthographic projection	5	
Point cloud density	Increase point density	Alt + "+"	Decreases the number of points visible (improves performance on slow computers)
	Decrease point density	Alt + "-"	Increases the number of points visible (requires better computers)
Edit Densified Point Cloud	Delete points	Del	Must be in Edit mode and points must be selected
	Select all	Ctrl + A	Must be in Edit mode
	Clear selection	Ctrl + C	Must be in Edit mode
	Invert selection	Ctrl + I	Must be in Edit mode
Right Sidebar			
Images section	Focus on selection	P	The mouse needs to hover over the image or the image needs to be selected
	Pop up and maximize thumbnail	Space	Maximizes the image under the mouse cursor. Pressing Space again docks the image again keeping the new point of view. Pressing Escape docks the image and keep previous point of view.

Mosaic Editor shortcuts

Insert Cell Insert a new cell after having added the last vertex.InsThe *insert Cell* mode needs to be activated and the vertices need to be created / marked

Category	Action	Shortcut	Note
View			

View	Show Mosaic	Ctrl + 1	If several mosaics are generated because of multiple image labels, the shortcut number is incremented by the number of mosaics - 1. For example, if two mosaics are generated, the shortcut to display the second mosaic is Ctrl + 2
	Show DSM	Ctrl + 2	If several mosaics are generated because of multiple image labels, the shortcut number is incremented by the number of mosaics - 1. For example, if two mosaics are generated, the shortcut to display the DSM is Ctrl + 3
	Show Region	Ctrl + 3	If several mosaics are generated because of multiple image labels, the shortcut number is incremented by the number of mosaics - 1. For example, if two mosaics are generated, the shortcut to display the regions is Ctrl + 4
	Show Edited Mosaic	Ctrl + 4	If several mosaics are generated because of multiple image labels, the shortcut number is incremented by the number of mosaics - 1. For example, if two mosaics are generated, the shortcut to display the edited mosaic is Ctrl + 5
	Show Mosaic Area	Ctrl + 5	If several mosaics are generated because of multiple image labels, the shortcut number is incremented by the number of mosaics - 1. For example, if two mosaics are generated, the shortcut to display the mosaic area is Ctrl + 6
	Show Mosaic Tiles	Ctrl + 6	If several mosaics are generated because of multiple image labels, the shortcut number is incremented by the number of mosaics - 1. For example, if two mosaics are generated, the shortcut to display the mosaic tiles is Ctrl + 7
Right Sidebar			
Right Sidebar	Mosaic Editing	1	
	Visualization	2	
	Draw region	F2	Start drawing a region. Like clicking on the Draw button
	Finish drawing region	Right Click	End drawing a region and insert it in the list
	Cancel region drawing	Esc	

Index Calculator

Category	Action	Shortcut	Note
View	View the whole map	C	
	Delete the selected region or region vertex	Del	The region/region vertex must be selected and the option *Lock Regions* must be deselected