

Autel Mapper

Quick Start Guide

V1.1.1 2023.05



AUTEL
ROBOTICS



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Recommendations

Autel Robotics provide users with the following materials for best use practices of Autel Mapper:

1. "Autel Mapper Installation Guide"
2. "Autel Mapper Quick Start Guide"
3. "Autel Mapper User Manual"

4. It is recommended that users first use the "**Autel Mapper Installation Guide**" to understand how to install the software and check hardware compatibility; browse the "**Autel Mapper Quick Start Guide**" to facilitate users to quickly understand how to use the software and perform 2D and 3D reconstruction tasks, and finally utilize the "**Autel Mapper User Manual**" for a detailed explanation of both beginner and advanced techniques for using the software, and explanations of technical terms within the software.

Documentation

※The following guide is subject to update without prior notice. It is recommended to visit the official website of Autel Robotics to confirm you are using the latest version of this documentation.



Or



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This manual is written based on Autel Mapper V1.1.0. If it is inconsistent with the version of the software you are actually running, please update the software to the latest version as soon as possible. If some operations are inconsistent with the manual description due to the software version upgrade, please refer to the actual software you are using. This manual is for reference only.

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3D Reconstruction

1. 3D Reconstruction Introduction

3D reconstruction refers to the use of algorithms to combine and stitch images to generate a 3D mode.

In Autel Mapper, 3D Reconstruction can be completed in two ways, which will be outlined in this guide, through the use of images only or optimizing through the use of Ground control points (GCPs) and utilizing the “Mark” feature.

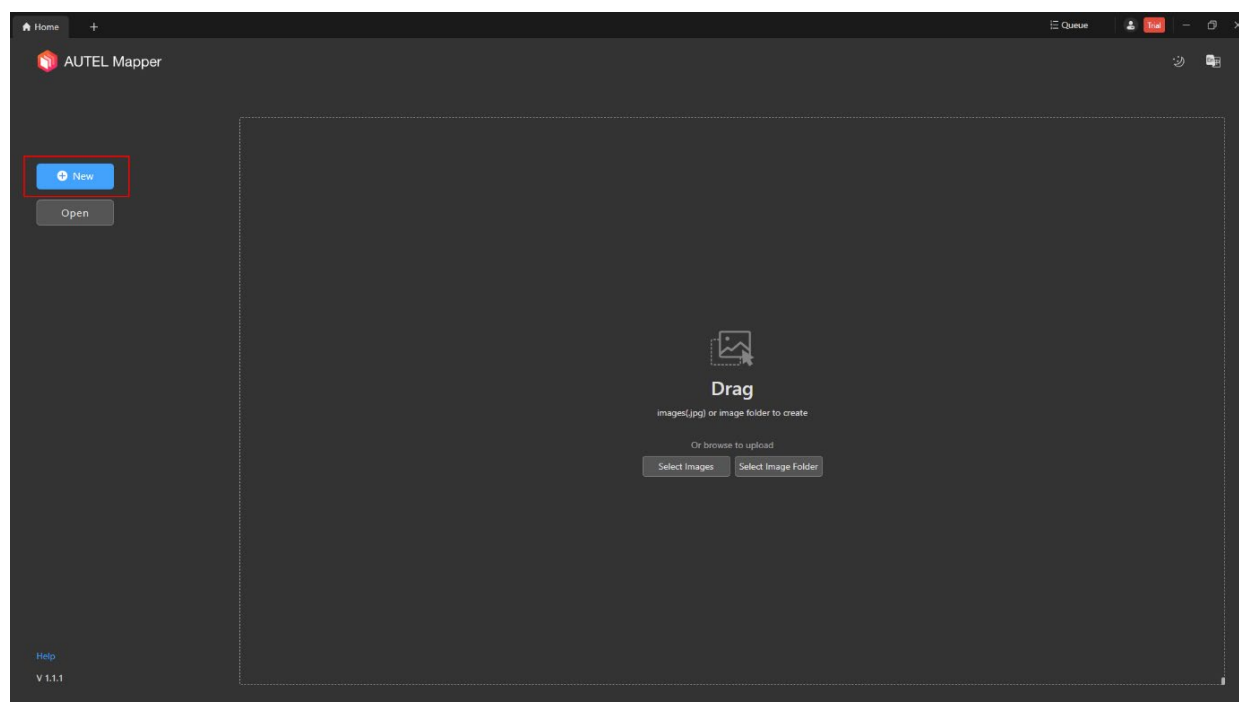
2. 3D Reconstruction With Images

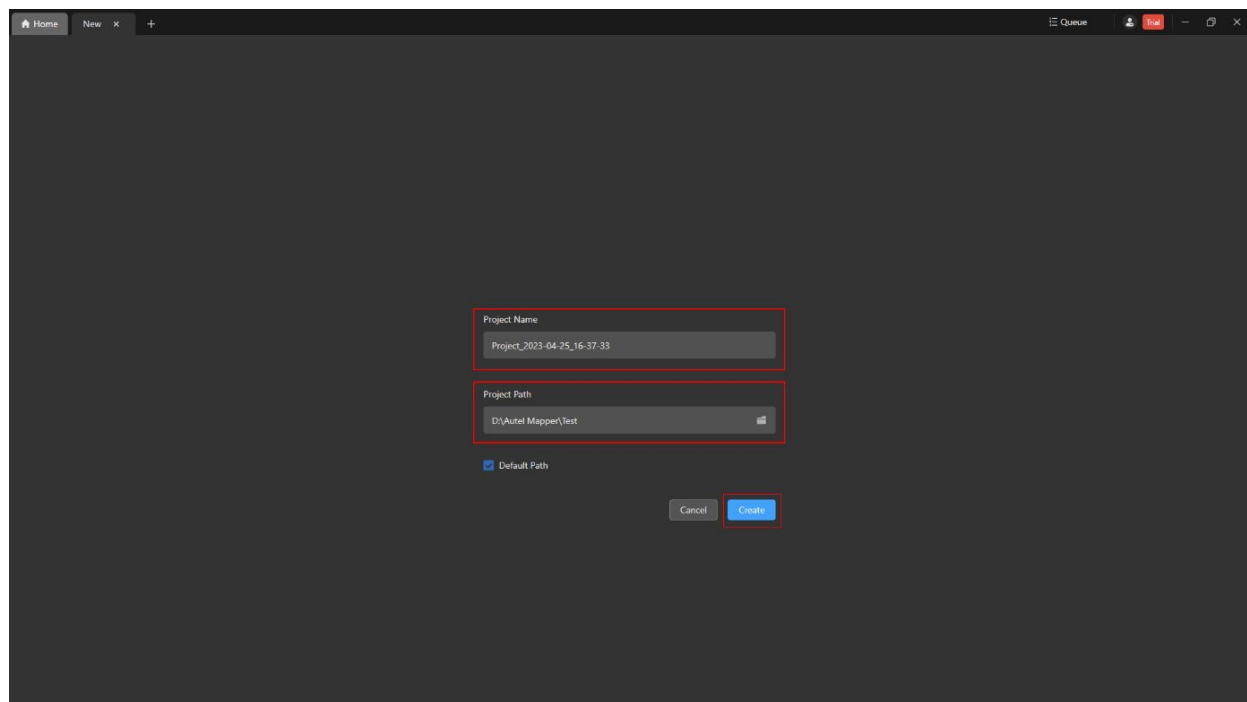
The process is as follows:

New Project → Import Images → Aerial Triangulation → 3D Reconstruction

2.1 New Project

After starting Autel Mapper, click the [New] button on the home page, enter the project name and path, then click the [Create] button to create a new project.



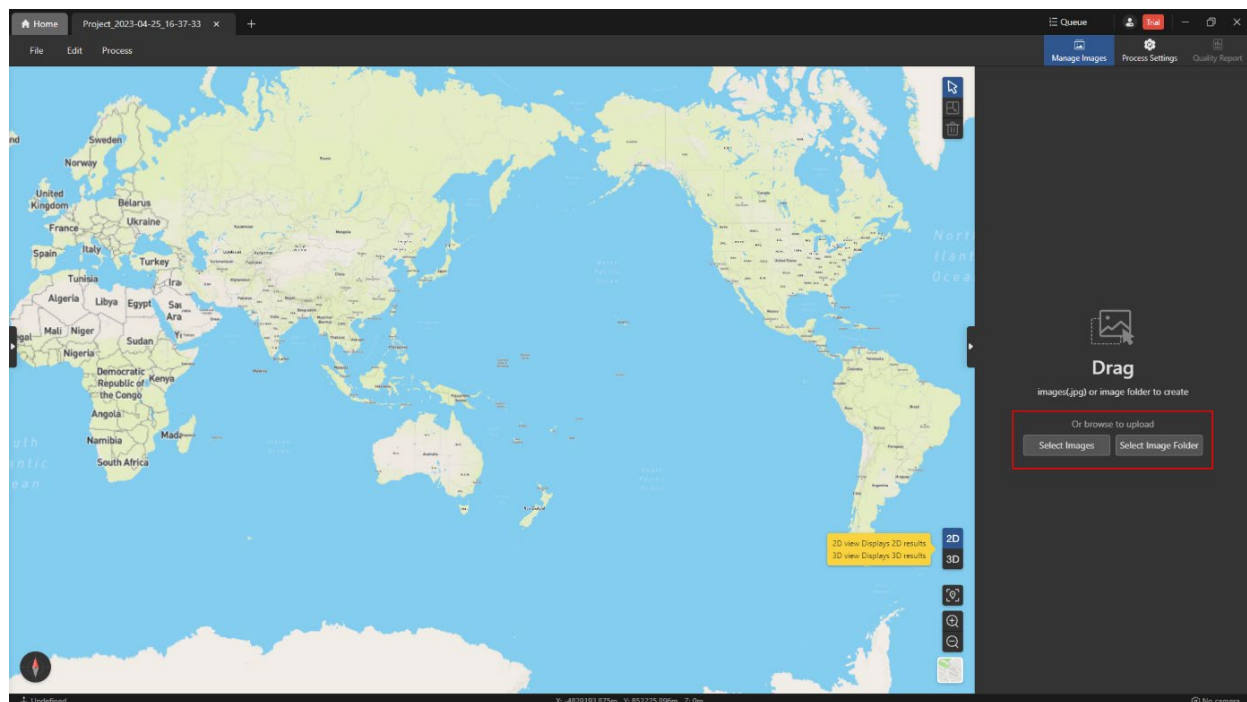


2.2 Import Images

Click the [Select Images] or [Select Image Folder] button on the [Manage Images] page under the project page and select the image file (.jpg) on the local disk of the computer to import.

Note:

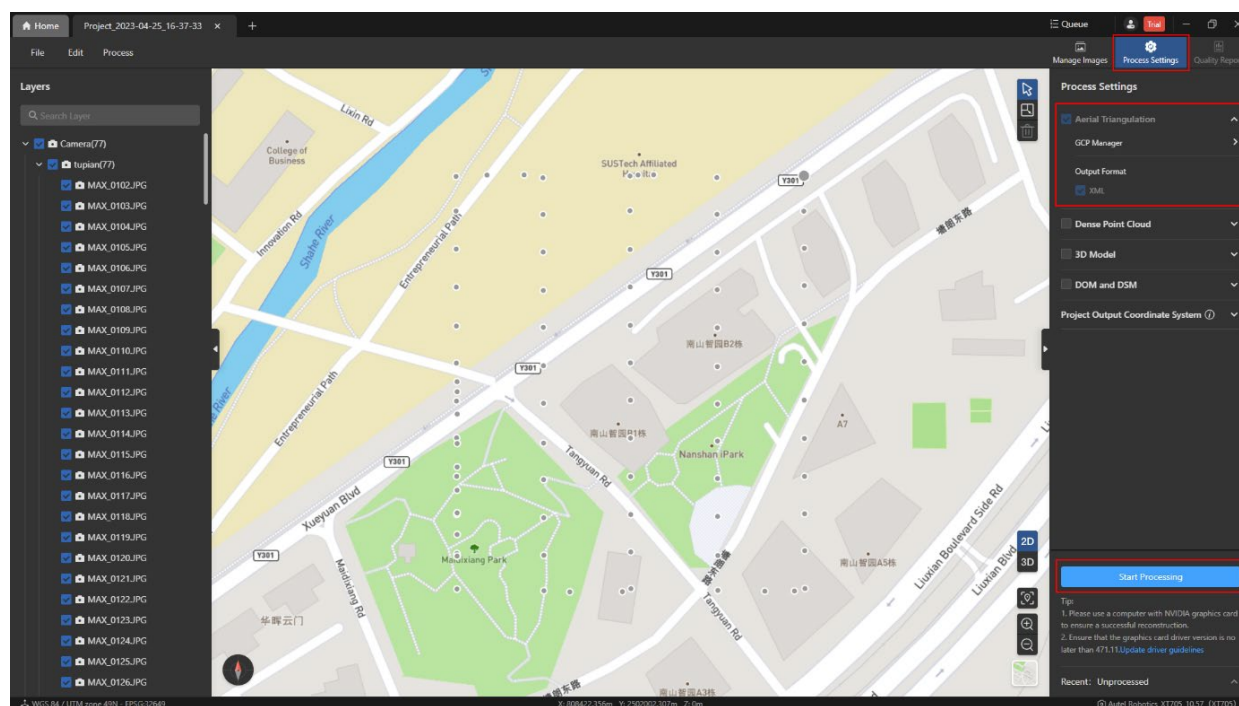
When performing 3D reconstruction, the quality and quantity of the imported images will affect the quality of the final reconstruction results, this is not due to software algorithms.



2.3 Aerial Triangulation

Aerial triangulation, sometimes known as aerotriangulation, generates dense point clouds for use in mapping.

If the project has not been processed, check **[Aerial Triangulation]** by default on the **[Process Settings]** page under the project page, and click the **[Start Processing]** button to perform aerial triangulation. This is a necessary step in order to correctly and effectively render the model.



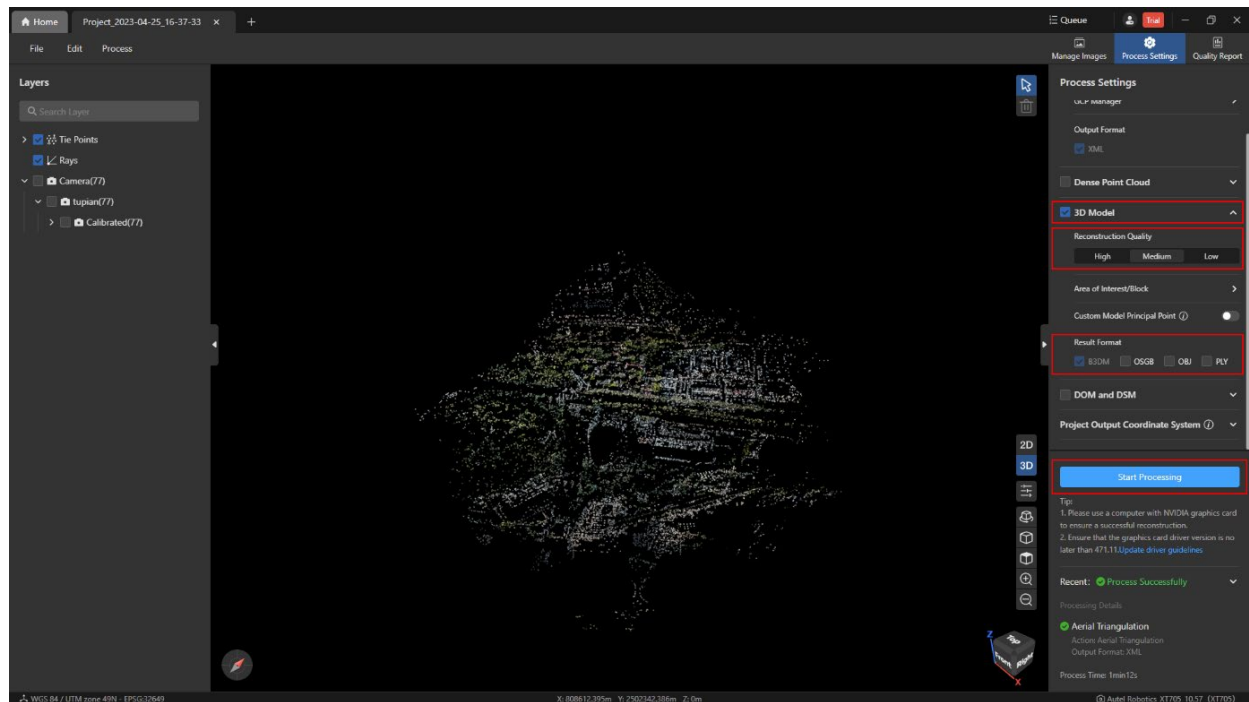
2.4 3D Reconstruction

3D reconstruction will create a 3D model, and the 3D model relies on the results of Dense Point Clouds.

If you only check **[3D Model]** for processing, the background will also process **[Dense Point Cloud]** before processing the 3D model, but the dense point cloud will not be generated.

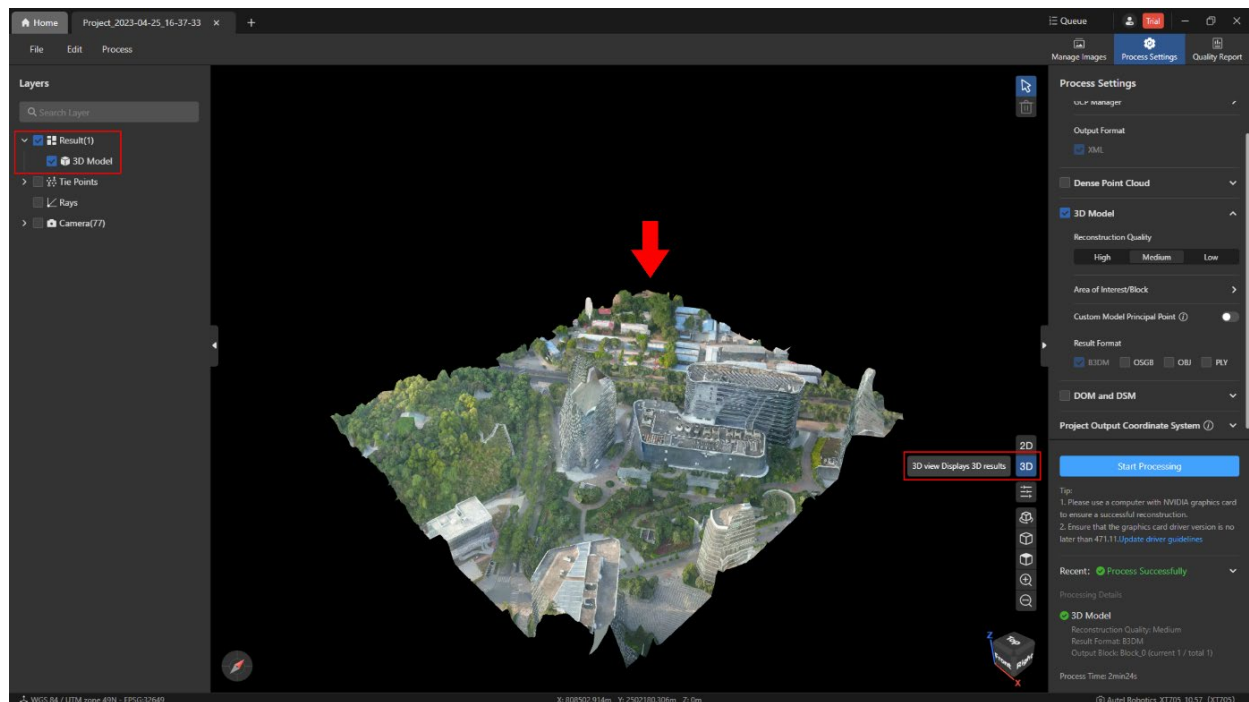
3D reconstruction settings:

- On the **[Process Settings]** page, check **[3D Model]**.
- Select the reconstruction quality, with the default being "medium", the higher the quality, the longer the reconstruction processing time.
- Select the output format, the default is .B3DM, and you can additionally choose three formats: .OSGB, .OBJ, and .PLY.
- Click the **[Start Processing]** button to start the 3D reconstruction process. This process will take some time, please be patient.



View 3D reconstruction results:

- Check [3D Model] in the [Result] column under the [Layers] page.
- Click the [3D] icon to switch to the 3D view to display the results.



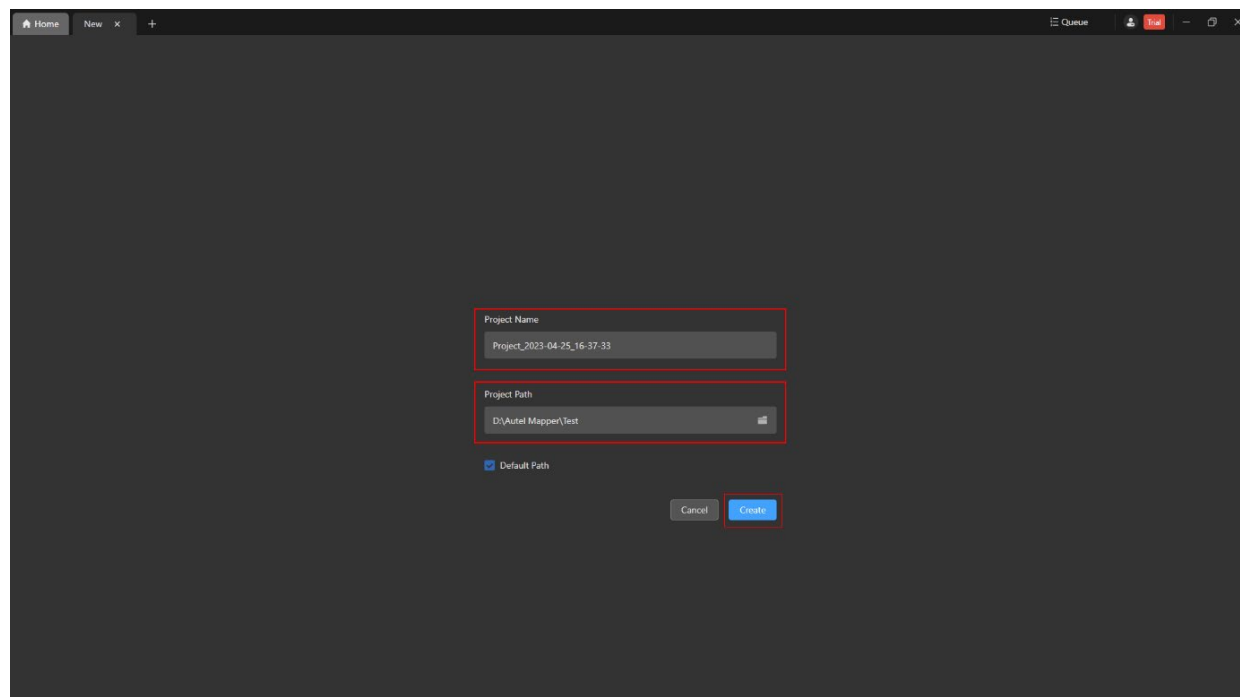
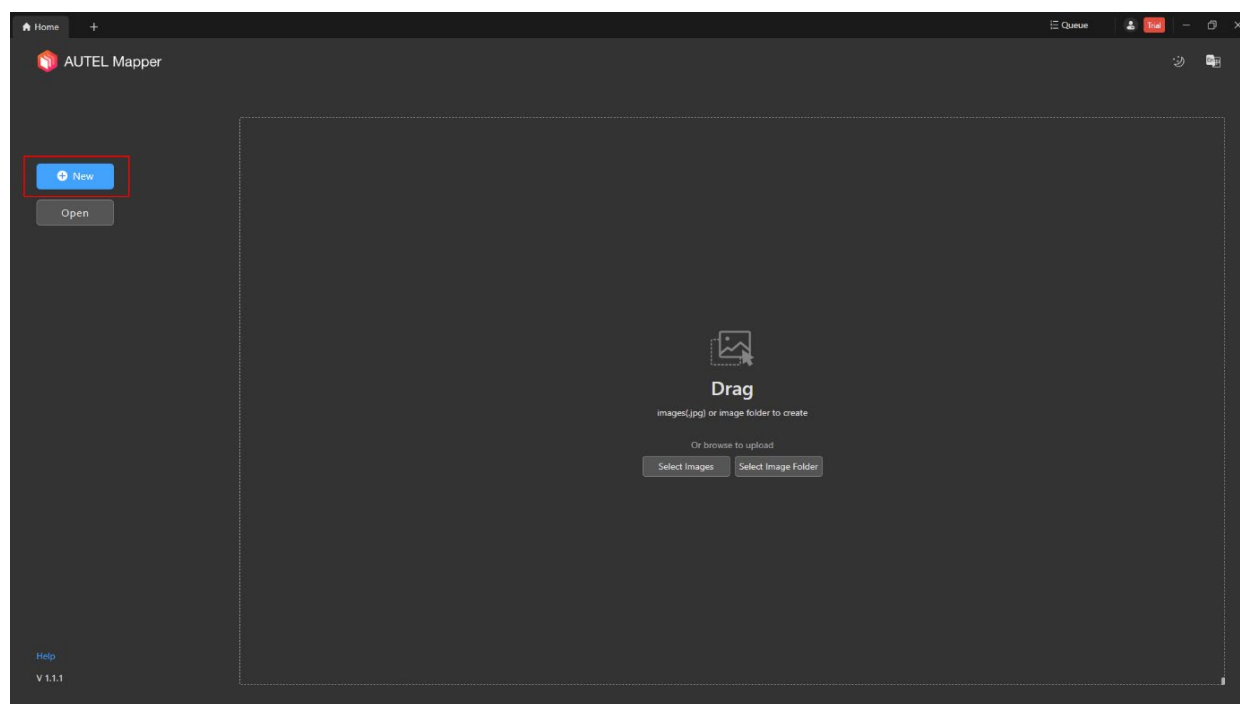
3. Optimized 3D Reconstruction With GCPs, Marks

The process is as follows:

New Project → Import Images → Aerial Triangulation → Import GCPs File → Mark → Reoptimize → 3D Reconstruction

3.1 New Project

After starting Autel Mapper, click the [New] button on the home page, enter the project name and path, and click the [Create] button to create a new project.

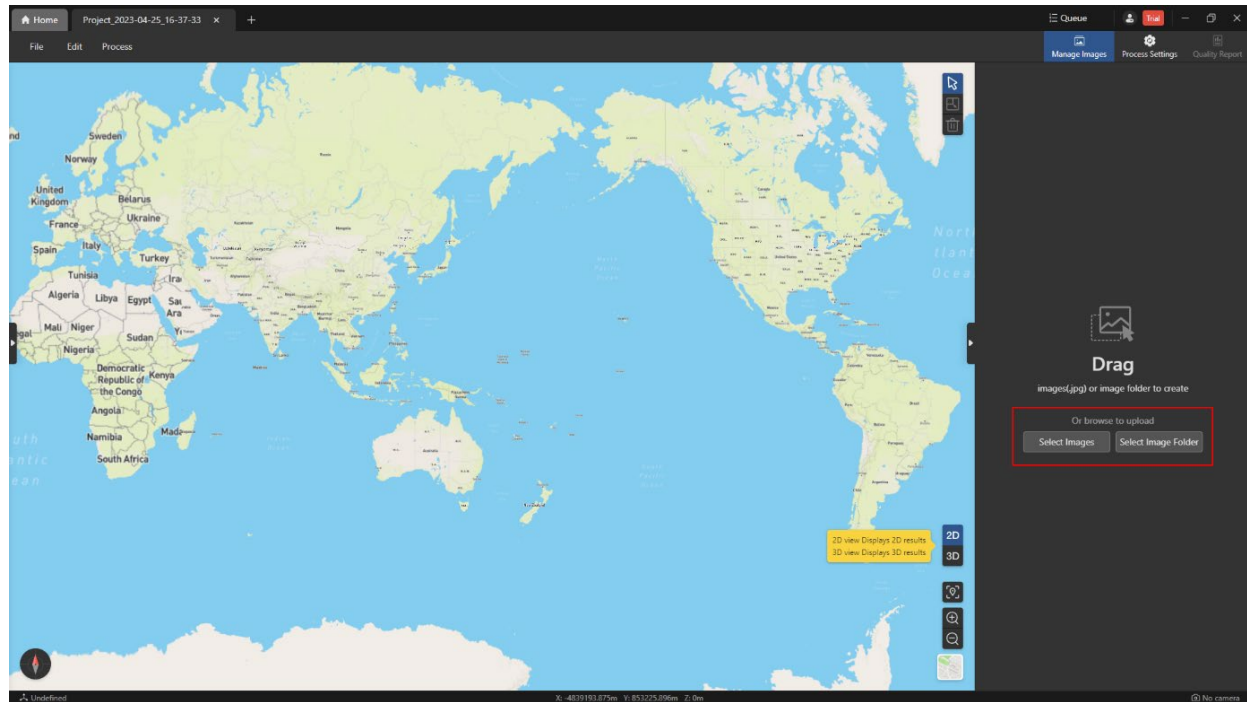


3.2 Import Images

Click the [Select Images] or [Select Image Folder] button on the [Manage Images] page under the project page and select the image file (.jpg) on the local disk of the computer to import.

Note:

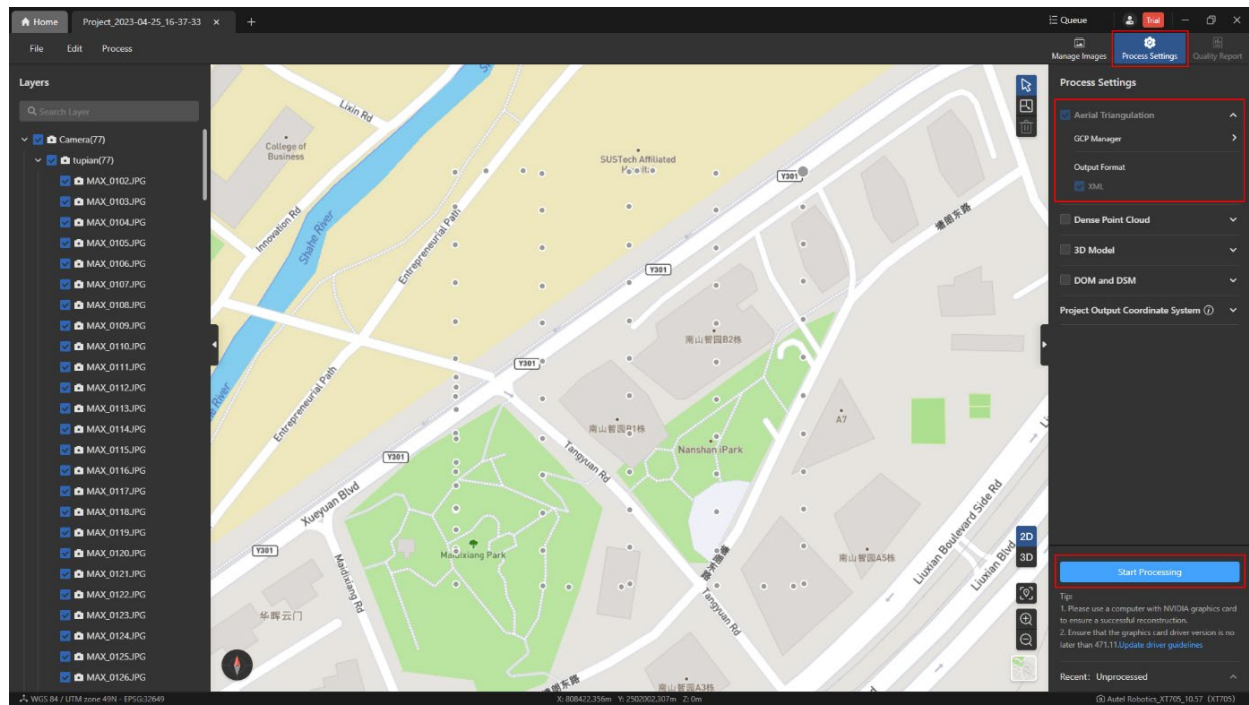
When performing 3D reconstruction, the quality and quantity of the imported images will affect the quality of the final reconstruction results, this is not due to software algorithms.



3.3 Aerial Triangulation

Aerial triangulation, sometimes known as aerotriangulation, generates dense point clouds for use in mapping.

If the project has not been processed, check [Aerial Triangulation] by default on the [Process Settings] page under the project page, and click the [Start Processing] button to perform aerial triangulation. This is a necessary step in order to correctly and effectively render the model.

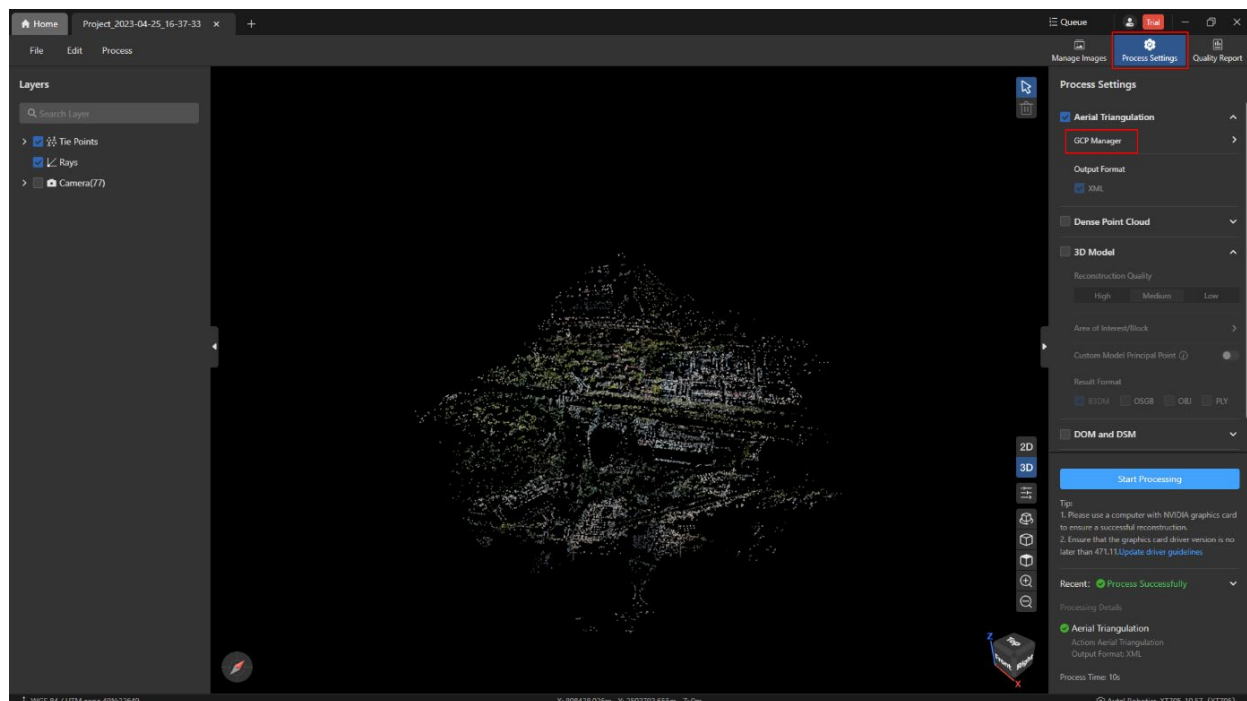


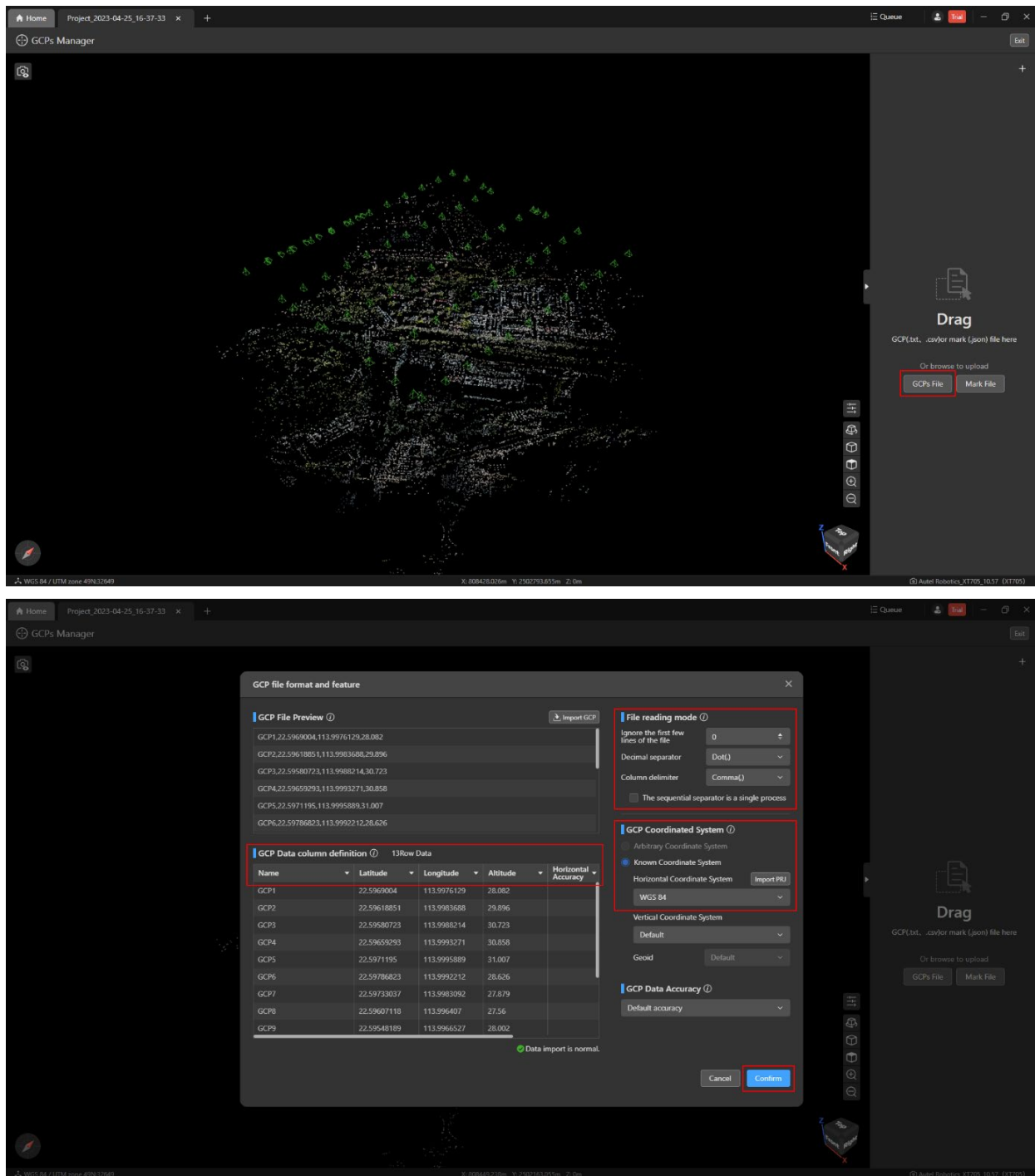
3.4 Import GCPs File

Ground control points (GCPs) are used to improve the accuracy of photogrammetric products generated through aerial triangulation.

The import process is as follows:

- Click [GCP Manager] in the [Aerial Triangulation] column on the [Process Settings] page to enter the the [GCPs Manager] page.
- Click the [GCPs File] button on the [GCPs Manager] page and select the GCPs file on the local disk of the computer to import.
- In the [GCP file format and feature] page, set the [File reading mode] and [GCP Coordinated System] of the control point files, and make appropriate adjustments to the header of the [GCP Data column definition] as needed, then finally click the [Confirm] button to import the handle data.





3.5 Mark

After the aerial triangulation is completed, imported GCP files will automatically calculate the coordinate position of the relevant control points on the image, but there will be a certain deviation between the automatically calculated position and the actual offline acquisition position. The “mark” is to then mark the real geographic coordinates of the image control point to the corresponding position in the image associated with the image control point, so as to obtain the highest accuracy possible of the model.

Marking process is as follows:

- Select any image control point in the **[GCPs]** column in the **[GCPs Manager]** page, and the image associated with the image control point will be automatically displayed in the **[Image Gallery]** column in the lower left corner.
- Randomly select an image in **[Image Gallery]**, and mark the actual position in the **[Image Marks]** column.

Note:

- For any GCP, after marking two points (that is, two images), you can click the **[Auto mark other images]** button to automatically mark the actual position of the GCPs in the remaining associated images, although it is recommended to check this process has effectively and correctly marked each point.
- For any GCP, the Reprojection Error Value and 3D Point Error will be automatically calculated after marking two points.
- The **[Blue ×]** in the image is the coordinate position of the control point of the image automatically calculated after aerial triangulation; the **[Green +]** is the coordinate position actually collected by the user, click the point with the mouse to create your “marked” point.
- After marking, you can check the number of marks for the image control point in the **[Mark]** column of the **[GCPs]** column.

The screenshots illustrate the workflow for marking Ground Control Points (GCPs) in Autel Mapper. The top screenshot shows the initial state where GCP1 is marked with a value of 1. The bottom screenshot shows GCP2 marked with a value of 2, resulting in improved accuracy metrics.

Top Screenshot (GCP1 marked):

- Image Marks:** MAX_0149.JPG is displayed with a red box and a green crosshair indicating the marked point.
- Image Gallery (1/18):** A grid of images showing various ground features. The first image (MAX_0149.JPG) is highlighted with a red border.
- GCPs (13):** A table listing 13 GCPs. GCP1 is selected and marked with a value of 1.
- Properties Panel:** Shows details for GCP1, including Name (GCP1), Type (Control Points), Horizontal Accuracy (0.005), Vertical Accuracy (0.005), Longitude (113.9976129), Latitude (22.5969004), and Altitude (28.082).
- 3D View:** A 3D point cloud visualization showing the marked GCP1 as a blue point on the ground.
- Instructions:**
 - Please mark in the images:
 - mark at least two images to calculate the error.
 - high accuracy will be obtained if marked in images with similar GCP distribution
 - The GCP list at top right:
 - Press Ctrl to select multiple GCPs.
 - Press Shift to select the GCP between 2 clicks.
 - Multiple GCPs can be selected for batch editing.

Bottom Screenshot (GCP2 marked):

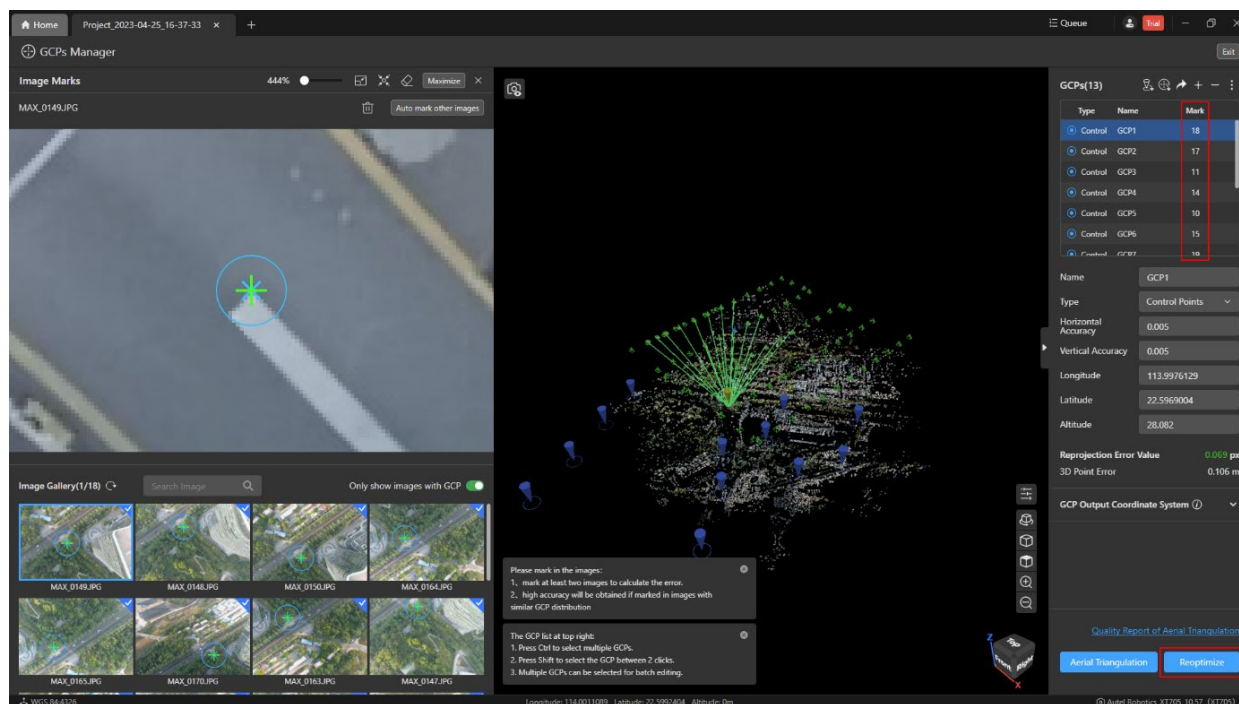
- Image Marks:** MAX_0148.JPG is displayed with a red box and a green crosshair indicating the marked point.
- Image Gallery (2/18):** The second image (MAX_0148.JPG) is highlighted with a red border.
- GCPs (13):** GCP2 is selected and marked with a value of 2.
- Properties Panel:** Shows details for GCP2, including Name (GCP2), Type (Control Points), Horizontal Accuracy (0.005), Vertical Accuracy (0.005), Longitude (113.9976129), Latitude (22.5969004), and Altitude (28.082).
- 3D View:** A 3D point cloud visualization showing the marked GCP2 as a blue point on the ground.
- Instructions:**
 - Please mark in the images:
 - mark at least two images to calculate the error.
 - high accuracy will be obtained if marked in images with similar GCP distribution
 - The GCP list at top right:
 - Press Ctrl to select multiple GCPs.
 - Press Shift to select the GCP between 2 clicks.
 - Multiple GCPs can be selected for batch editing.

Accuracy Metrics (Bottom Screenshot):

- Reprojection Error Value:** 0.069 px
- 3D Point Error:** 0.106 m

3.6 Reoptimization

Click the [Reoptimize] button in the lower right corner of the [GCPs Manager] page to optimize the marked points, correct the positions where needed, and view the optimization results after the process is completed.

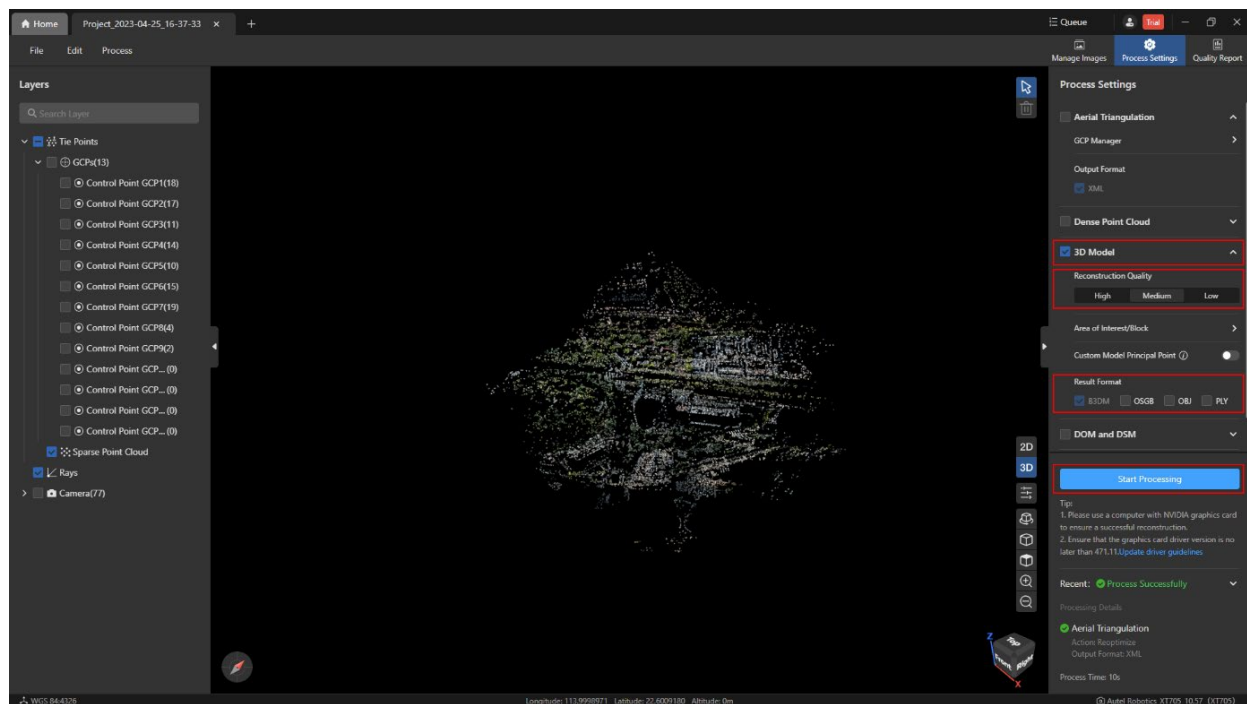


3.7 3D Reconstruction

3D reconstruction will create a 3D Model. Once reoptimization is completed, 3D reconstruction will be carried out, and the obtained model results are more accurate.

3D reconstruction settings:

- On the [Process Settings] page, check [3D Model].
- Select the reconstruction quality, with the default being "medium", the higher the quality, the longer the reconstruction processing time.
- Select the output format, the default is .B3DM, and you can additionally choose three formats: .OSGB, .OBJ, and .PLY.
- Click the [Start Processing] button to start the 3D reconstruction process. This process will take some time, please be patient.



View 3D reconstruction results:

- Check [3D Model] in the [Result] column under the [Layers] page.
- Click the [3D] icon to switch to the 3D view to display the results.



2D Reconstruction

1. 2D Reconstruction Introduction

2D reconstruction is to generate a digital surface model (DSM) and digital orthophoto (DOM) of the captured area using images collected by drone.

In Autel Mapper, 2D Reconstruction can be completed in two ways, which will be outlined in this guide, through the use of images only or optimizing through the use of Ground control points (GCPs) and utilizing the “Mark” feature.

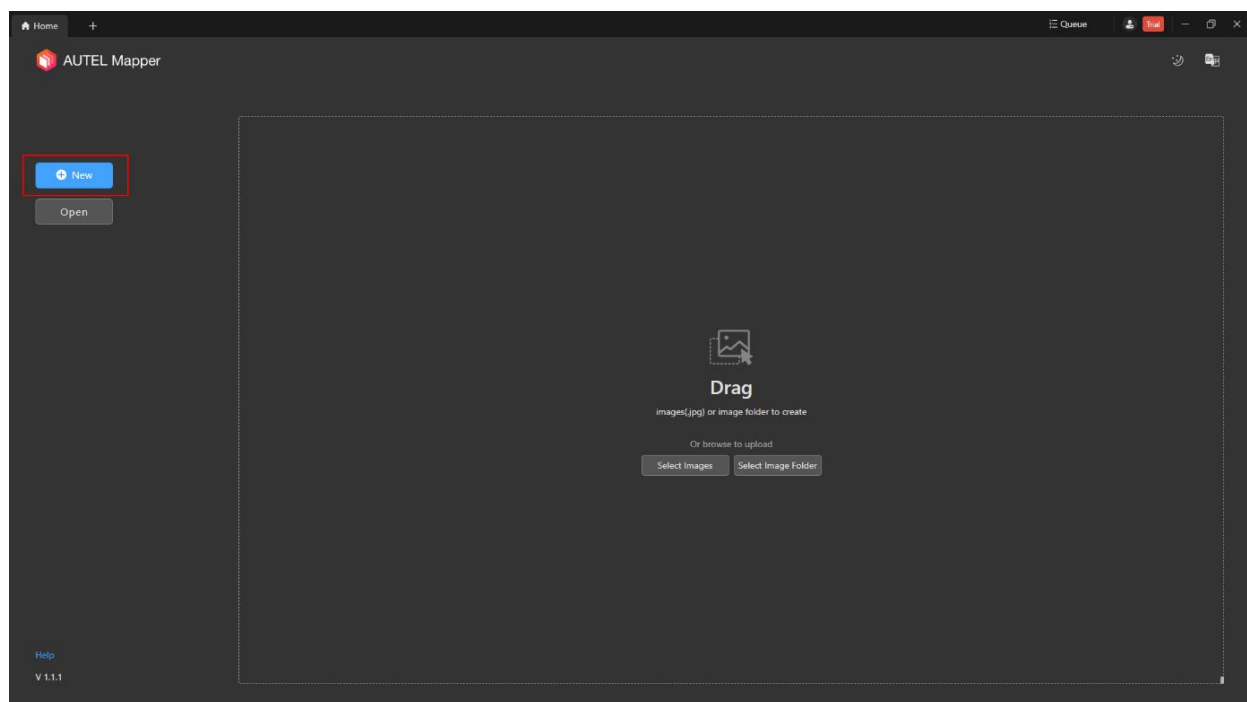
2. 2D Reconstruction With Images

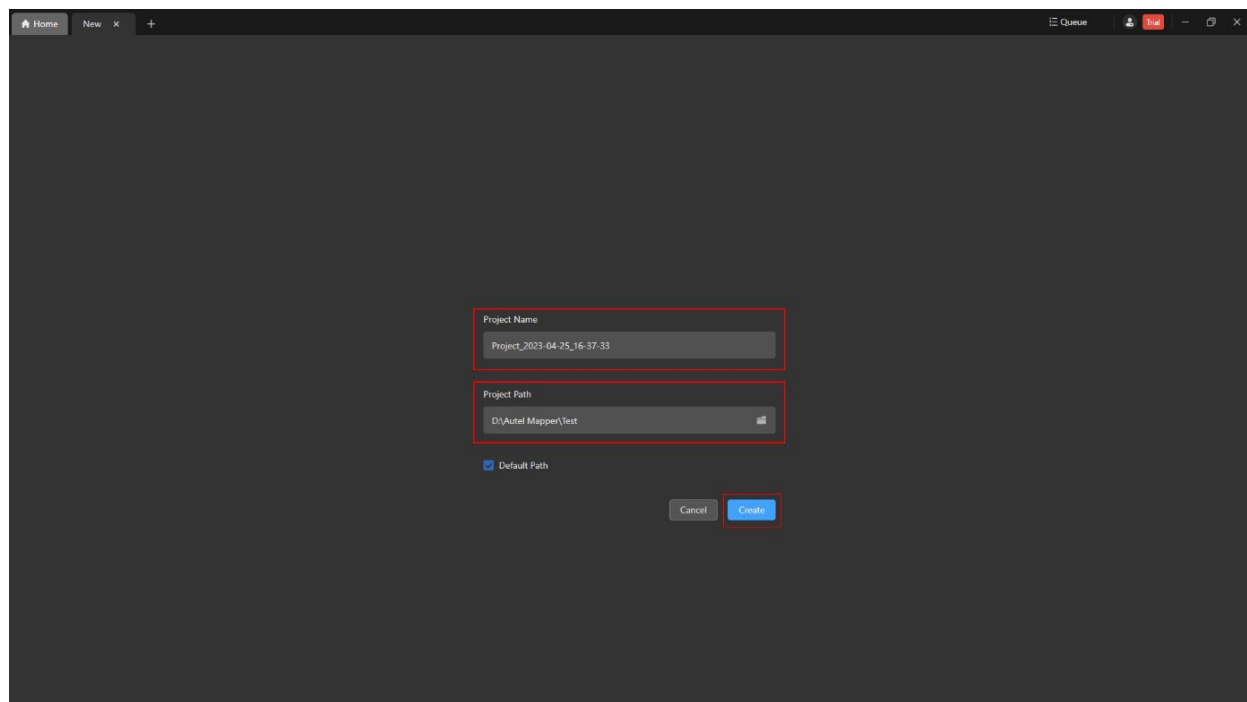
The process is as follows:

New Project → Import Images → Aerial Triangulation → 2D Reconstruction

2.1 New Project

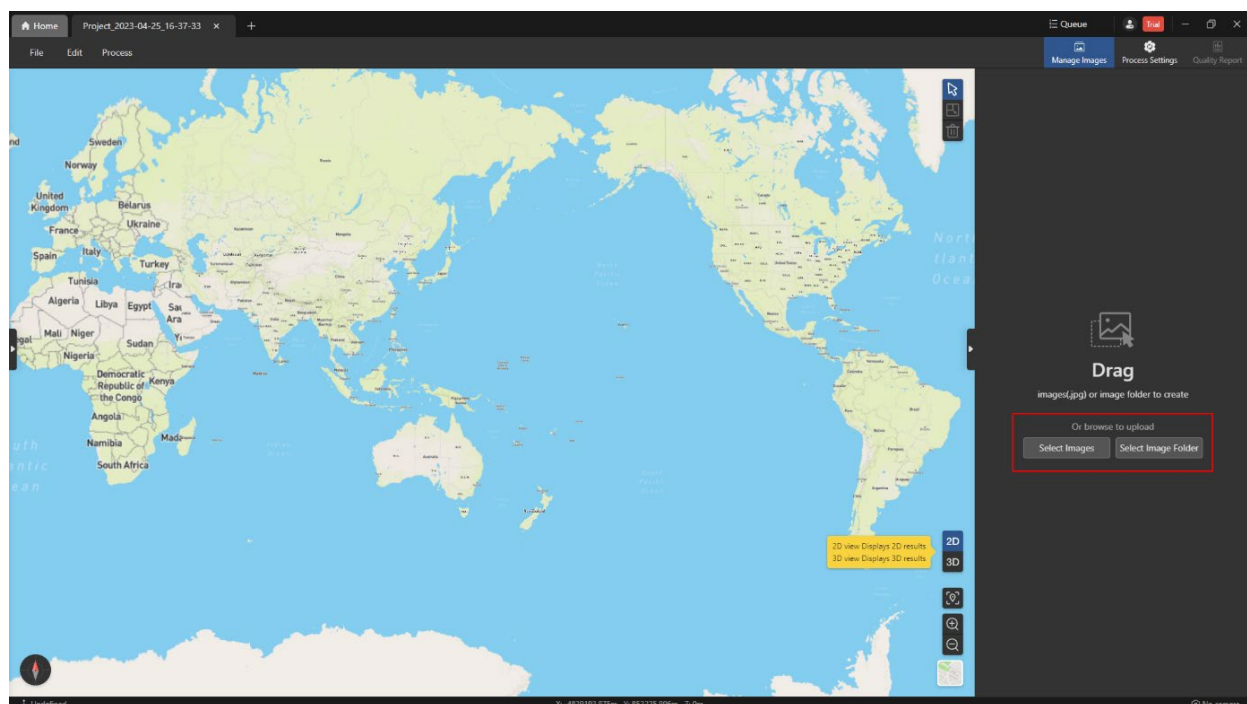
After starting Autel Mapper, click the [New] button on the home page, enter the project name and path, then click the [Create] button to create a new project.





2.2 Import Images

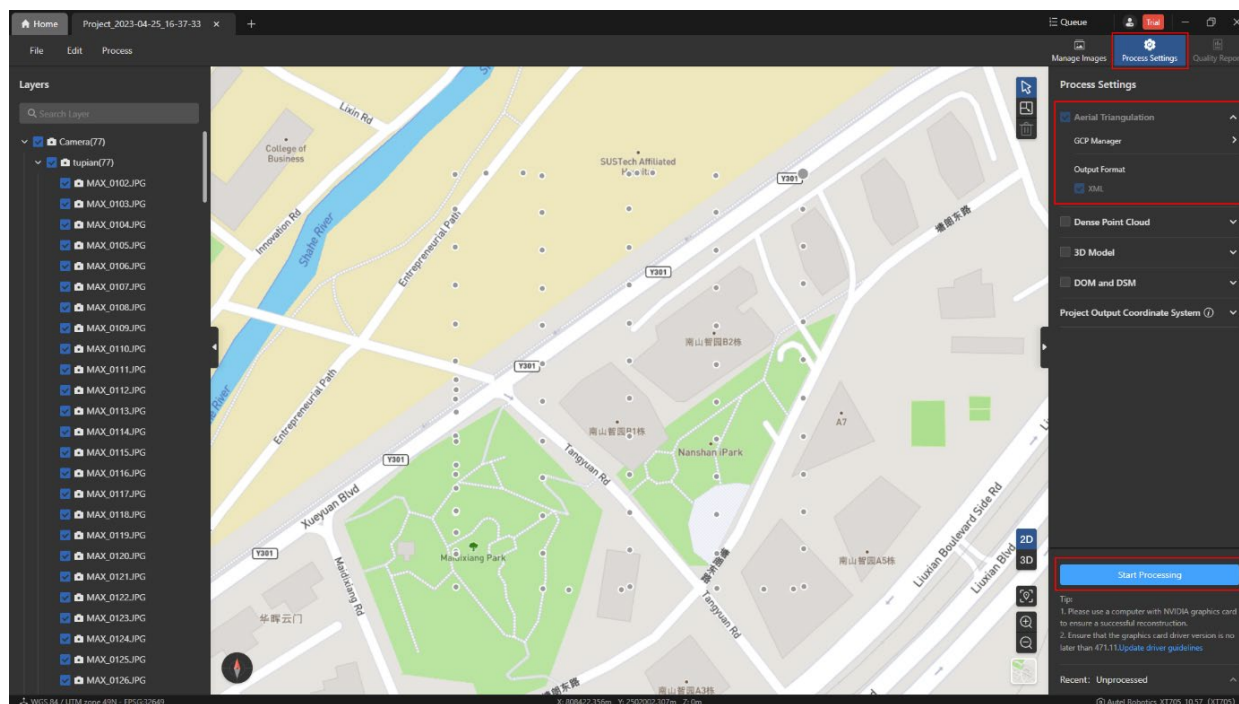
Click the [Select Images] or [Select Image Folder] button on the [Manage Images] page under the project page and select the image file (.jpg) on the local disk of the computer to import.



2.3 Aerial Triangulation

Aerial triangulation, sometimes known as aerotriangulation, generates dense point clouds for use in mapping.

If the project has not been processed, check **[Aerial Triangulation]** by default on the **[Process Settings]** page under the project page, and click the **[Start Processing]** button to perform aerial triangulation. This is a necessary step in order to correctly and effectively render the model.

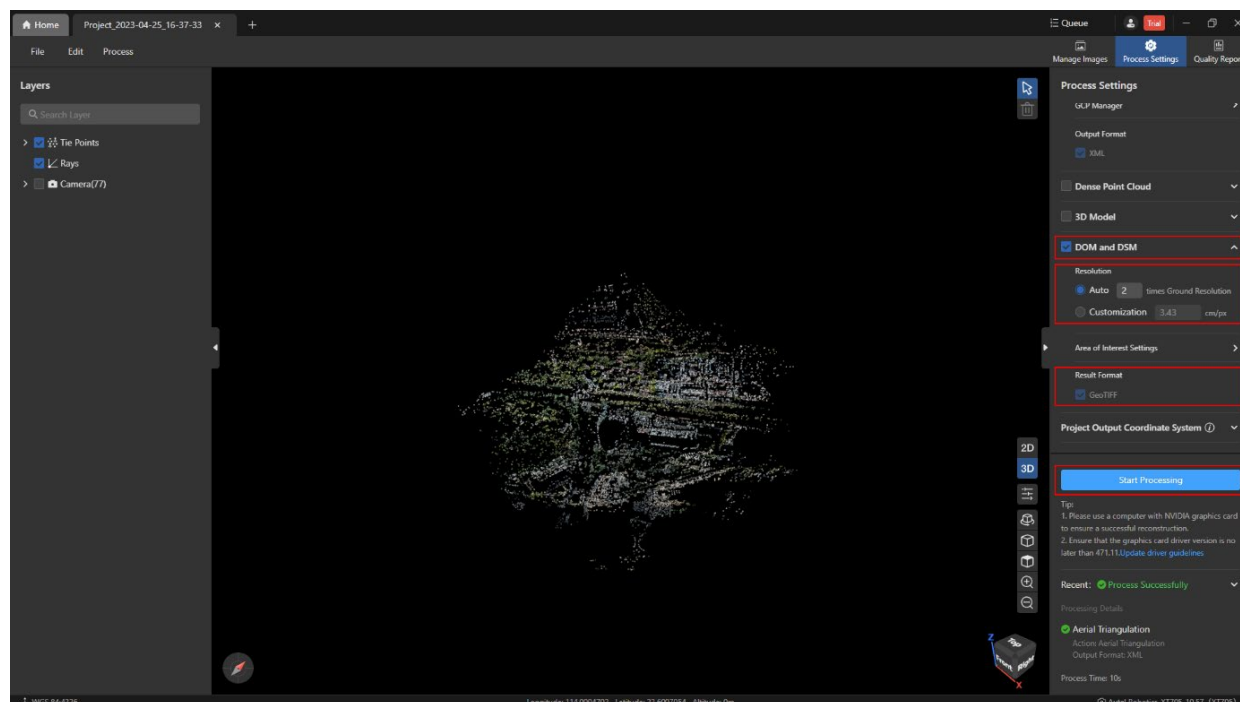


2.4 2D Reconstruction

2D reconstruction utilizes both DOM and DSM.

2D reconstruction settings:

- Check [DOM and DSM] on the [Process Settings] page.
- Set the ground resolution; the only result format, .GeoTIFF, is checked by default.
- Click the [Start Processing] button to start the 2D reconstruction process. This process will take some time, please be patient.

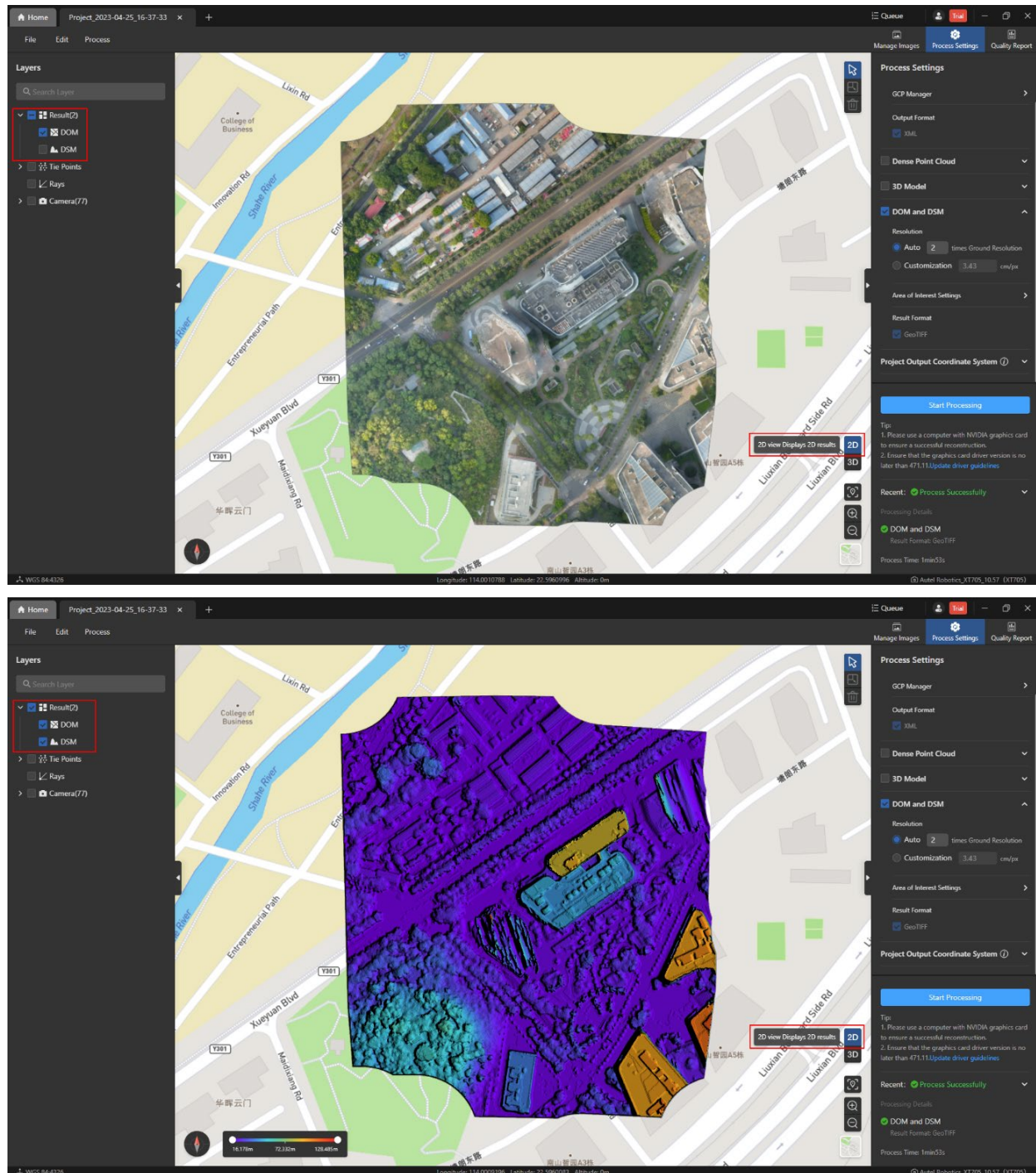


View 2D reconstruction results:

- Check [DOM] or [DSM] in the [Result] column under the [Layers] page.
- Click the [2D] icon to switch to the 2D view to display the 2D reconstruction results.

Note:

- When [DOM] and [DSM] are checked at the same time, only DSM will be displayed in the 2D view.



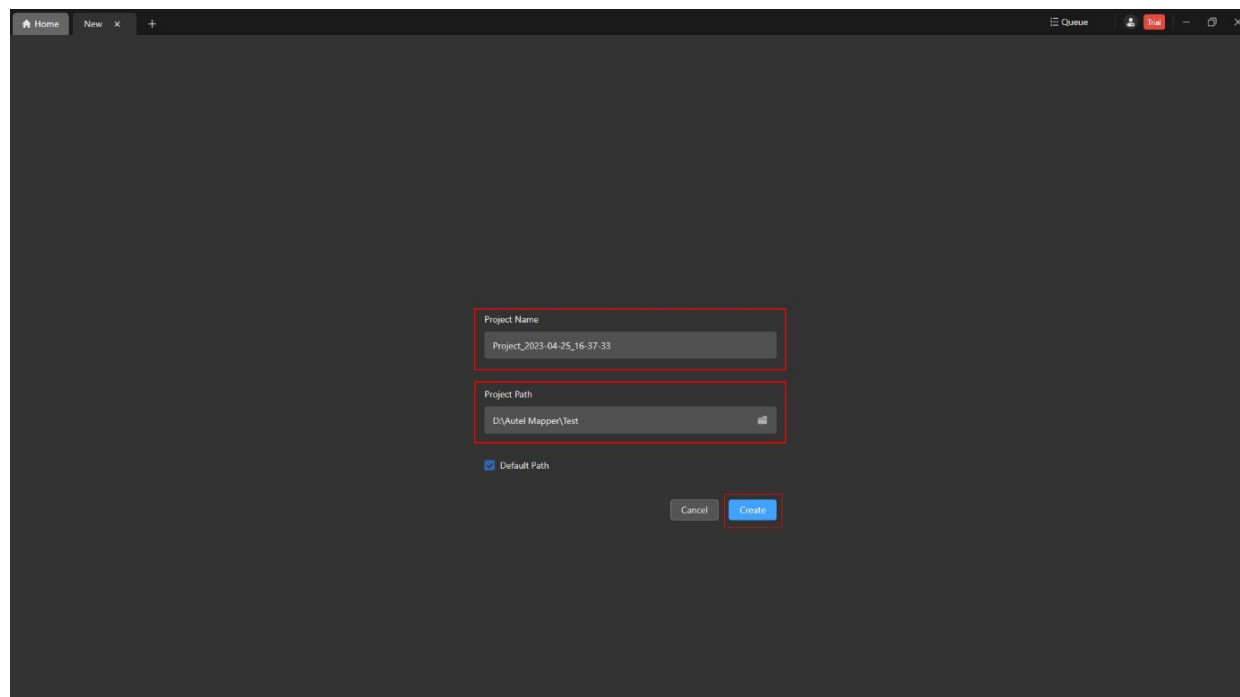
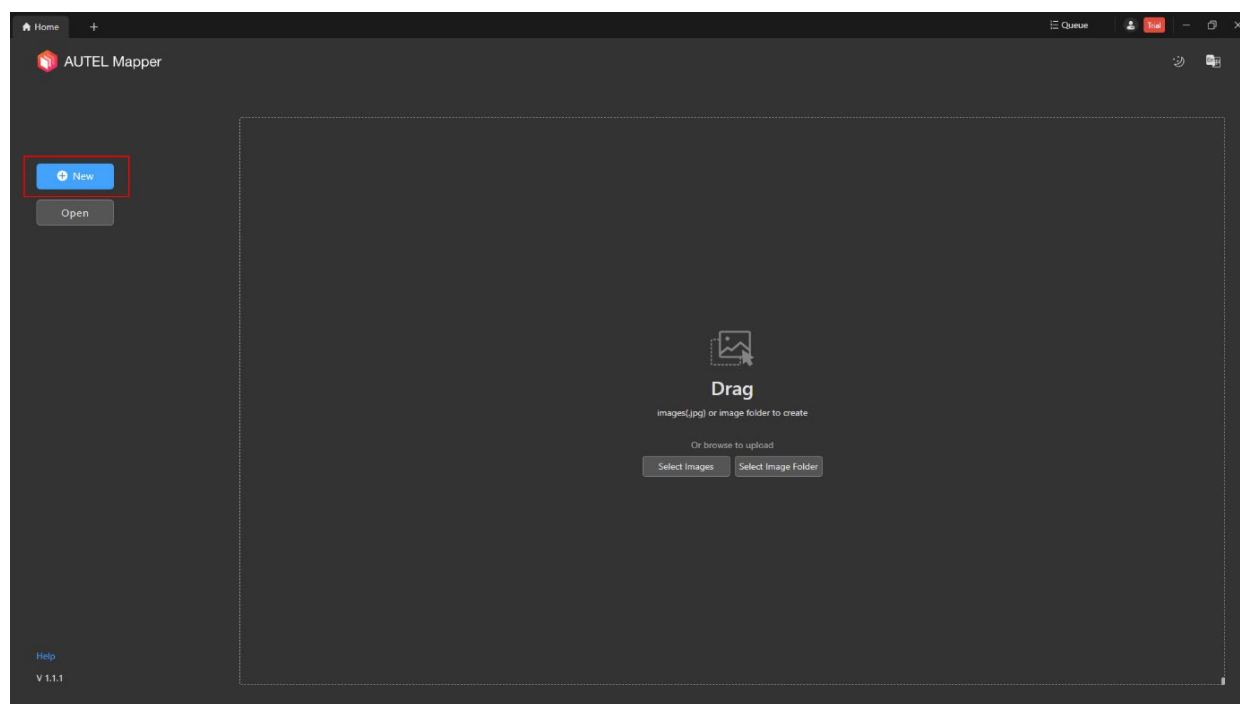
3. Optimized 2D Reconstruction With GCPs, Marks

The process is as follows:

New Project → Import Images → Aerial Triangulation → Import GCPs File → Mark → Reoptimize → 2D Reconstruction

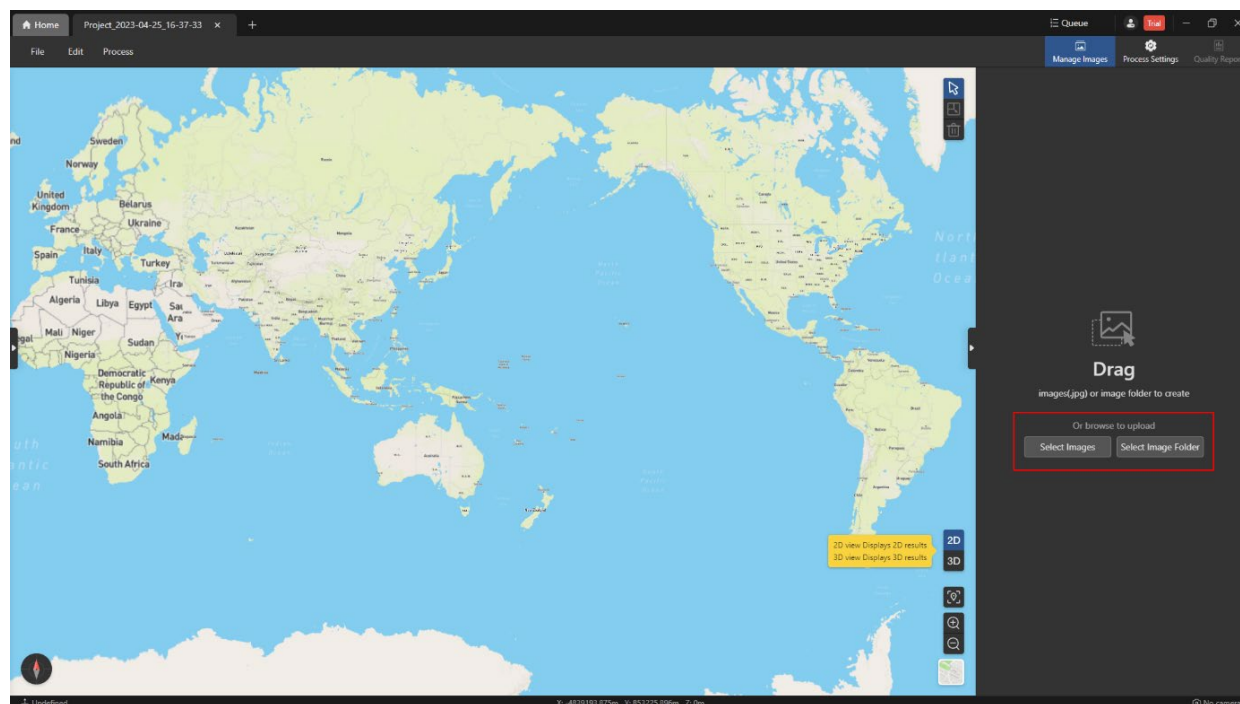
3.1 New Project

After starting Autel Mapper, click the [New] button on the home page, enter the project name and path, and click the [Create] button to create a new project.



3.2 Import Images

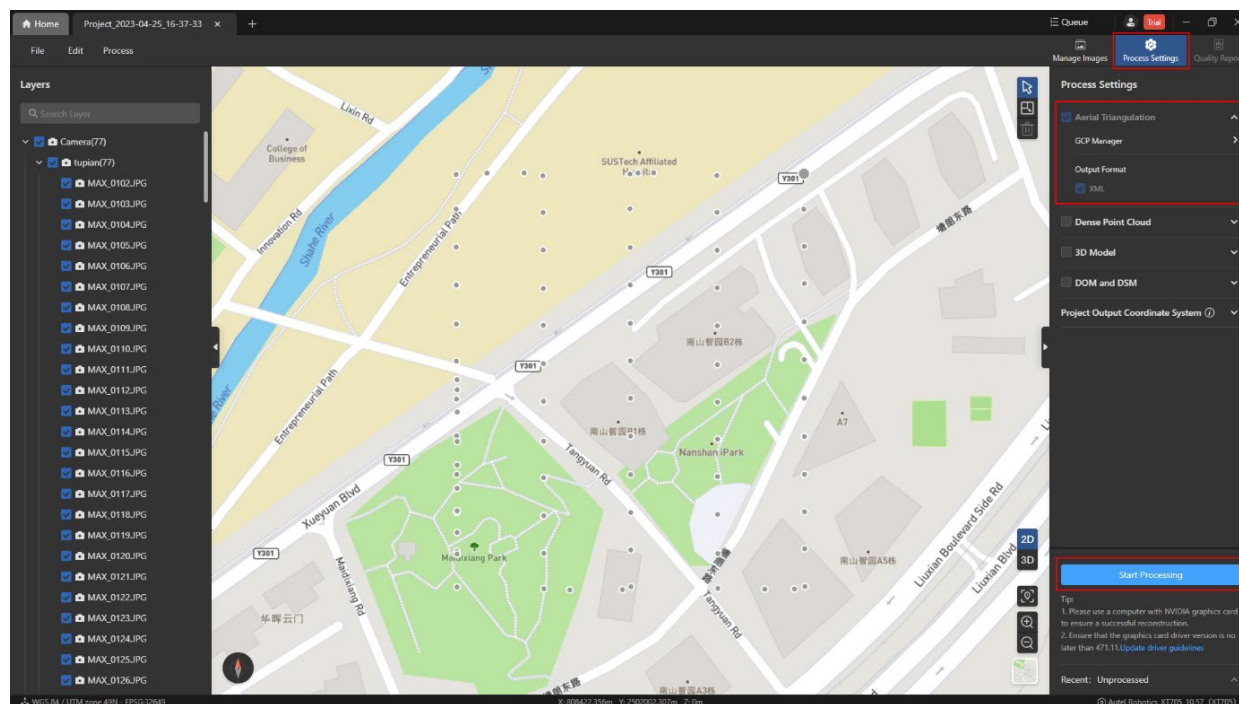
Click the [Select Images] or [Select Image Folder] button on the [Manage Images] page under the project page and select the image file (.jpg) on the local disk of the computer to import.



3.3 Aerial Triangulation

Aerial triangulation, sometimes known as aerotriangulation, generates dense point clouds for use in mapping.

If the project has not been processed, check **[Aerial Triangulation]** by default on the **[Process Settings]** page under the project page, and click the **[Start Processing]** button to perform aerial triangulation. This is a necessary step in order to correctly and effectively render the model.

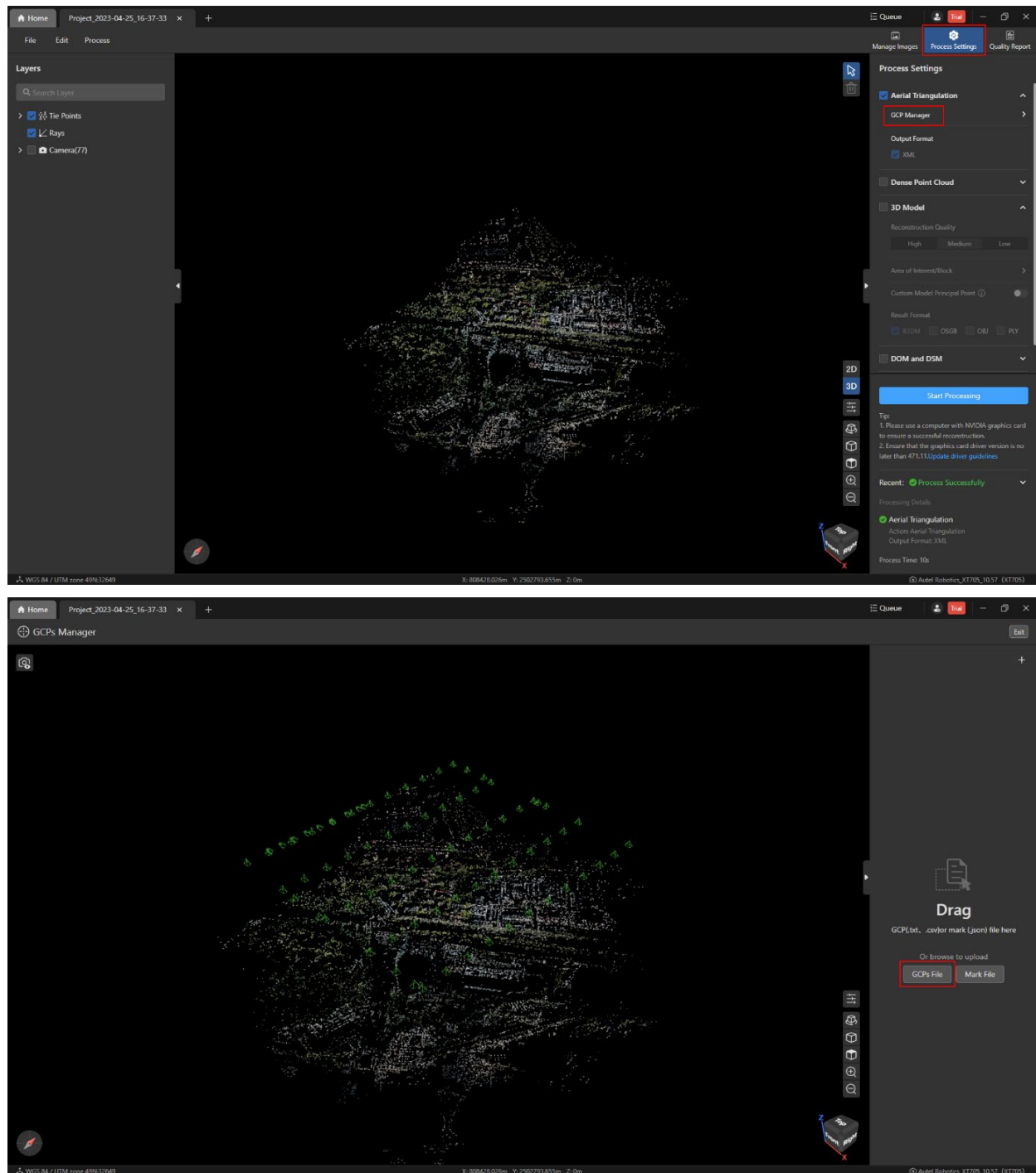


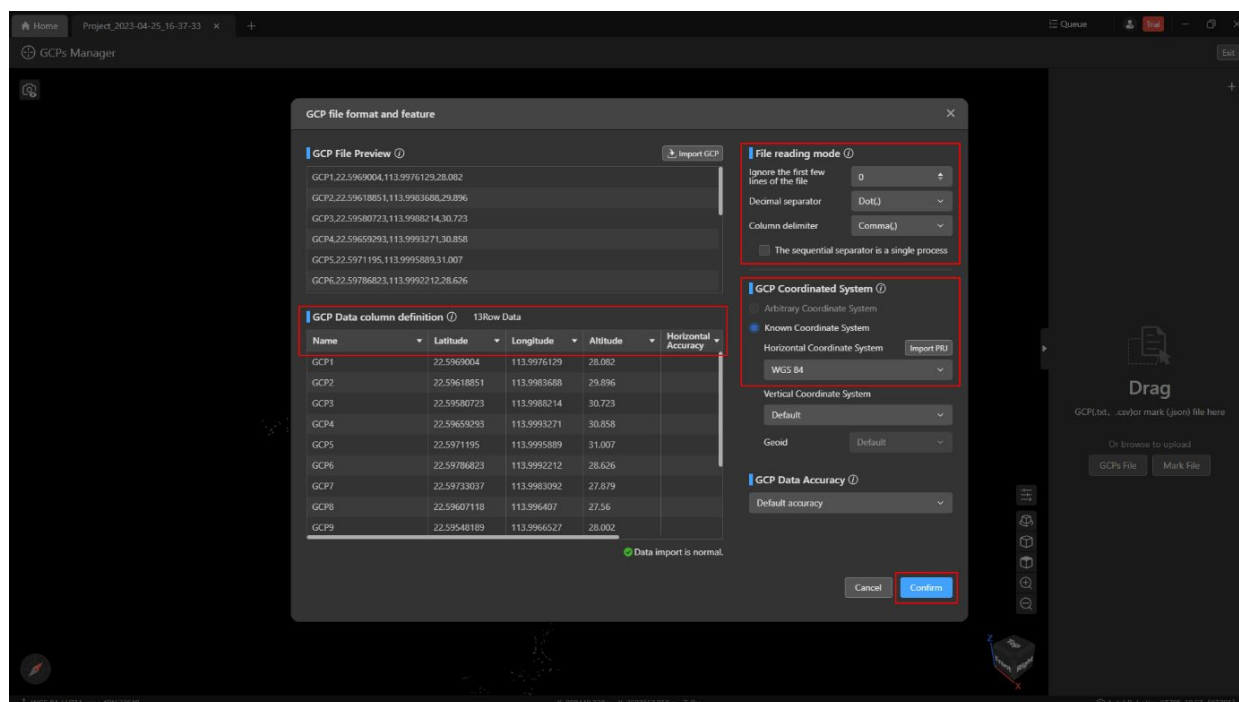
3.4 Import GCPs File

Ground control points (GCPs) are used to improve the accuracy of photogrammetric products generated through aerial triangulation.

The import process is as follows:

- Click **[GCP Manager]** in the **[Aerial Triangulation]** column on the **[Process Settings]** page to enter the **[GCPs Manager]** page.
- Click the **[GCPs File]** button on the **[GCPs Manager]** page and select the GCPs file on the local disk of the computer to import.
- In the **[GCP file format and feature]** page, set the **[File reading mode]** and **[GCP Coordinated System]** of the control point files, and make appropriate adjustments to the header of the **[GCP Data column definition]** as needed, then finally click the **[Confirm]** button to import the handle data.





3.5 Mark

After the aerial triangulation is completed, imported GCP files will automatically calculate the coordinate position of the relevant control points on the image, but there will be a certain deviation between the automatically calculated position and the actual offline acquisition position. The “mark” is to then mark the real geographic coordinates of the image control point to the corresponding position in the image associated with the image control point, so as to obtain the highest accuracy possible of the model.

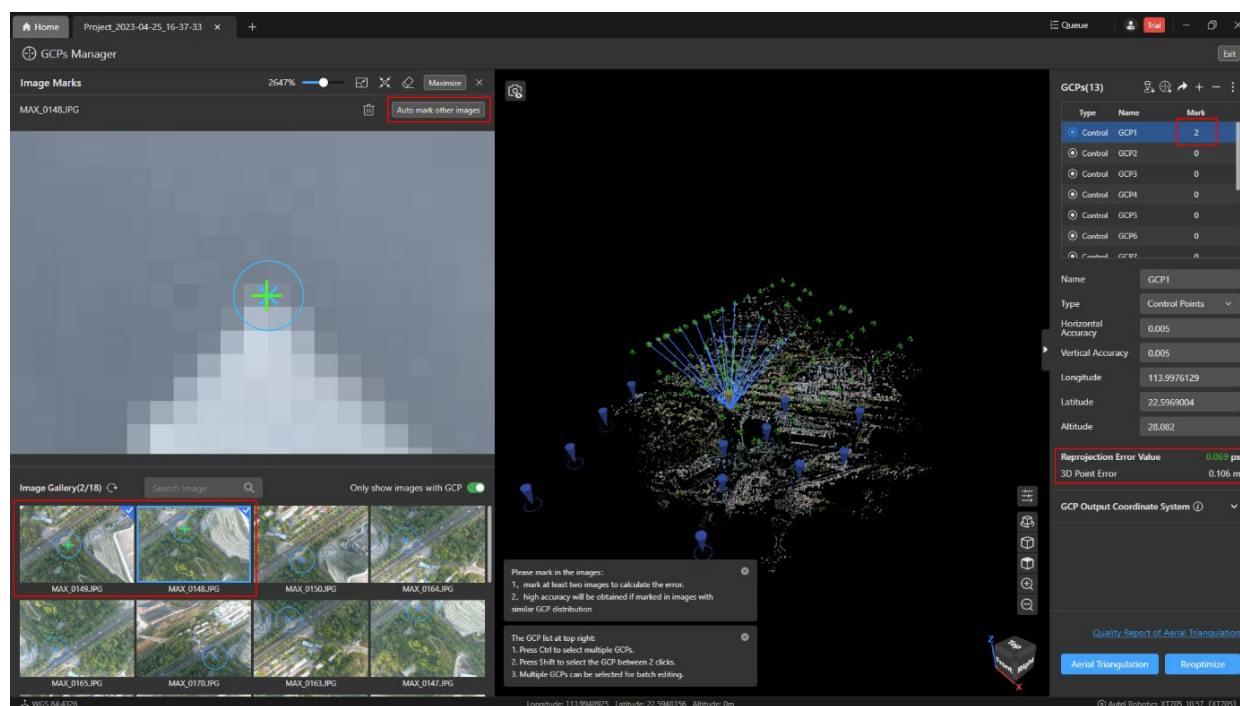
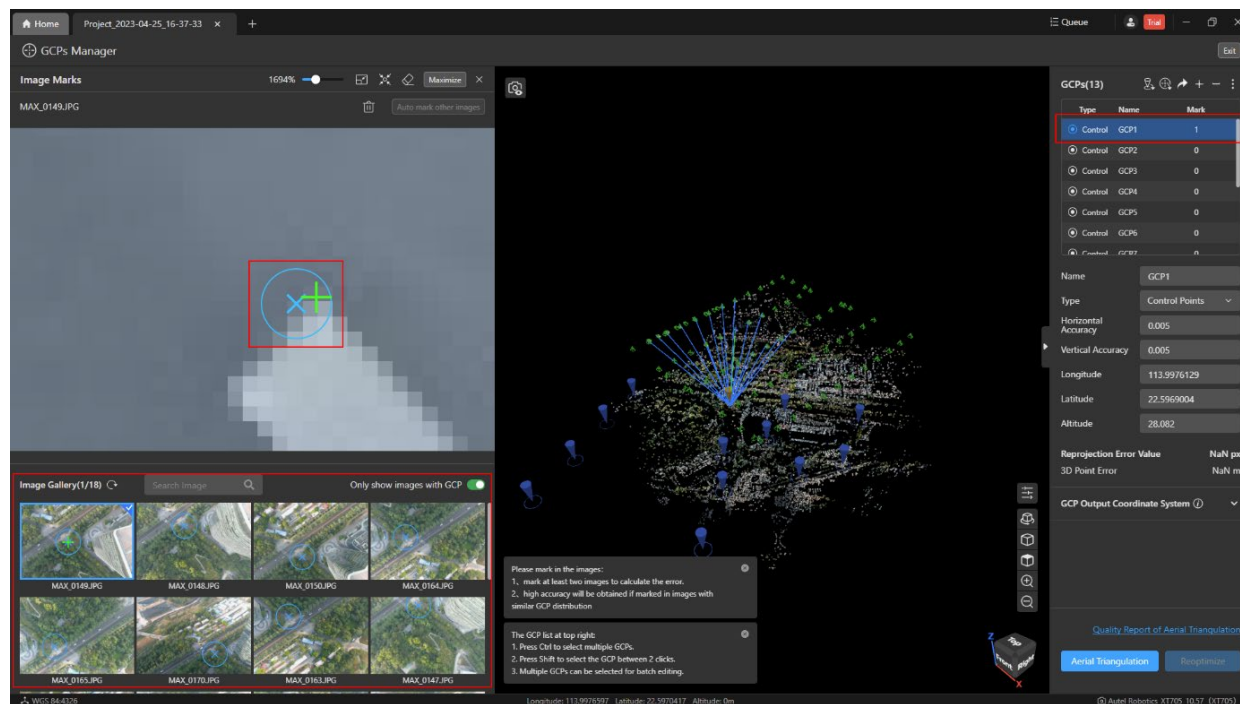
Marking process is as follows:

- Select any image control point in the [GCPs] column in the [GCPs Manager] page, and the image associated with the image control point will be automatically displayed in the [Image Gallery] column in the lower left corner.
- Randomly select an image in [Image Gallery], and mark the actual position in the [Image Marks] column.

Note:

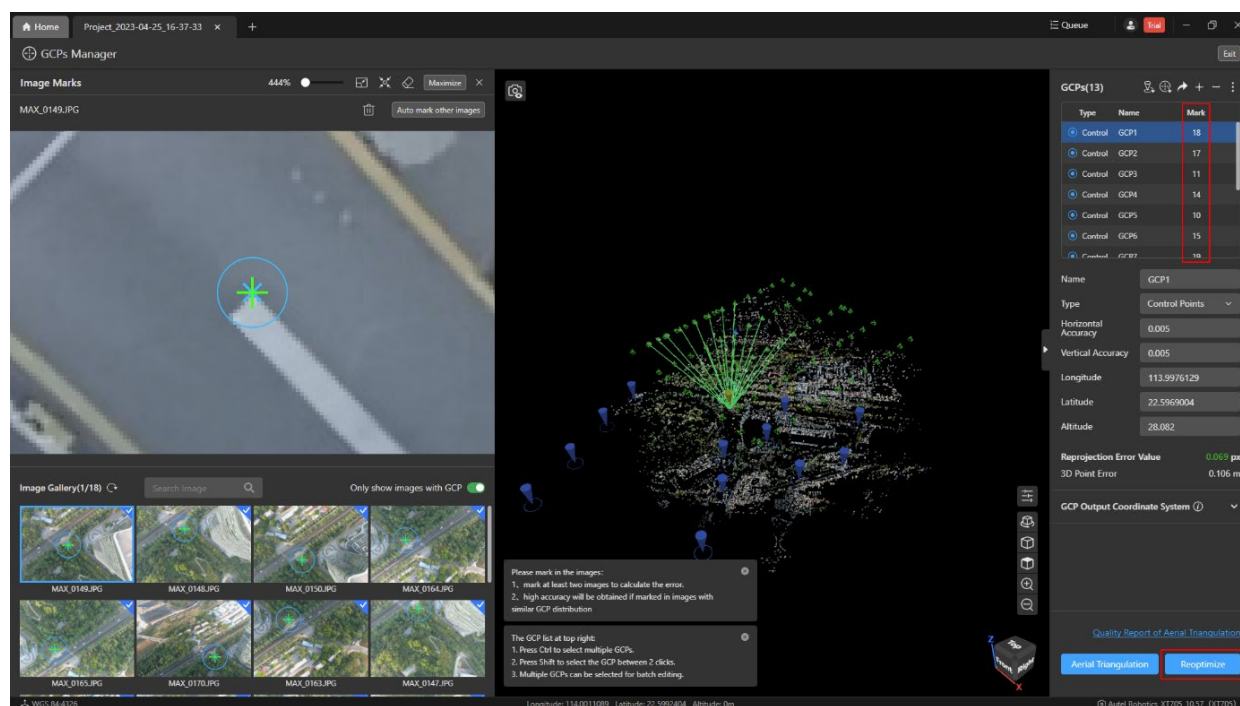
- For any GCP, after marking two points (that is, two images), you can click the [Auto mark other images] button to automatically mark the actual position of the GCPs in the remaining associated images, although it is recommended to check this process has effectively and correctly marked each point.
- For any GCP, the Reprojection Error Value and 3D Point Error will be automatically calculated after marking two points.
- The [Blue x] in the image is the coordinate position of the control point of the image automatically calculated after aerial triangulation; the [Green +] is the coordinate position actually collected by the user, click the point with the mouse to create your “marked” point.

- After marking, you can check the number of marks for the image control point in the [Mark] column of the [GCPs] column.



3.6 Reoptimization

Click the [Reoptimize] button in the lower right corner of the [GCPs Manager] page to optimize the marked points, correct the positions where needed, and view the optimization results after the process is completed.

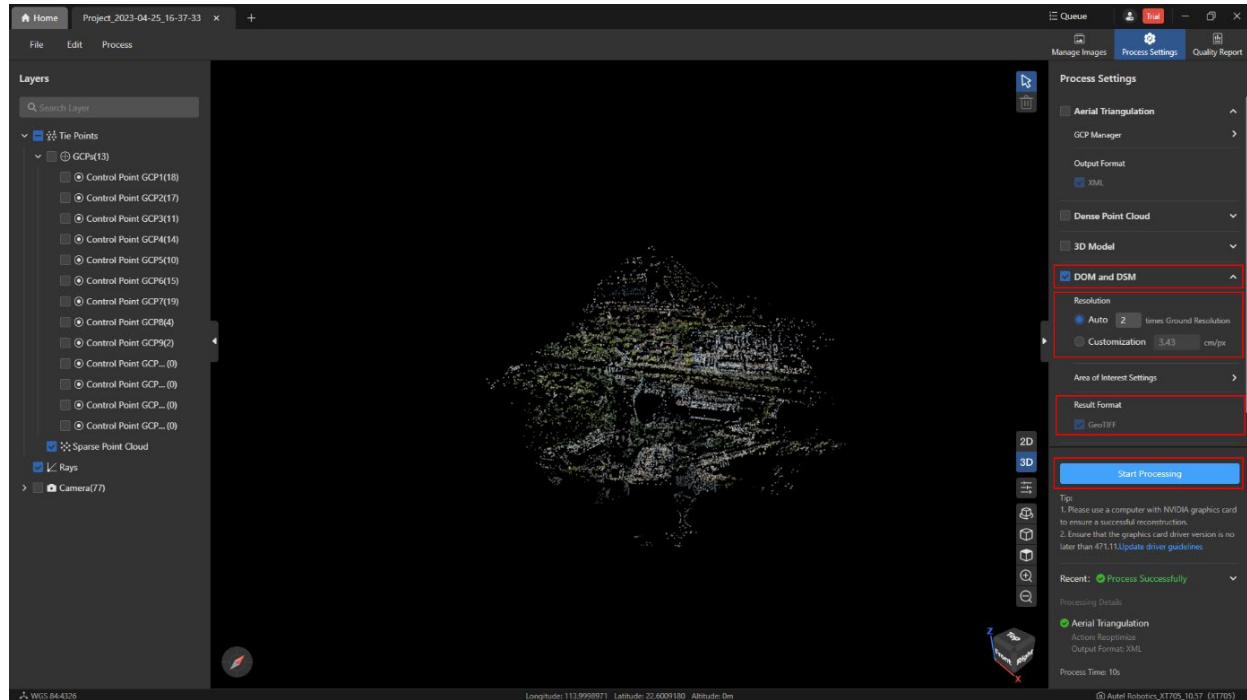


3.7 2D Reconstruction

2D reconstruction utilizes both DOM and DSM. After reoptimization, 2D reconstruction is performed, and the obtained model results are more accurate.

2D reconstruction settings:

- Check [DOM and DSM] on the [Process Settings] page.
- Set the ground resolution; the only result format, .GeoTIFF, is checked by default.
- Click the [Start Processing] button to start the 2D reconstruction process. This process will take some time, please be patient.



View 2D reconstruction results:

- Check [DOM] or [DSM] in the [Result] column under the [Layers] page.
- Click the [2D] icon to switch to the 2D view to display the 2D reconstruction results.

Note:

- When [DOM] and [DSM] are checked at the same time, only DSM will be displayed in the 2D view.

