

# Stonex X120GO

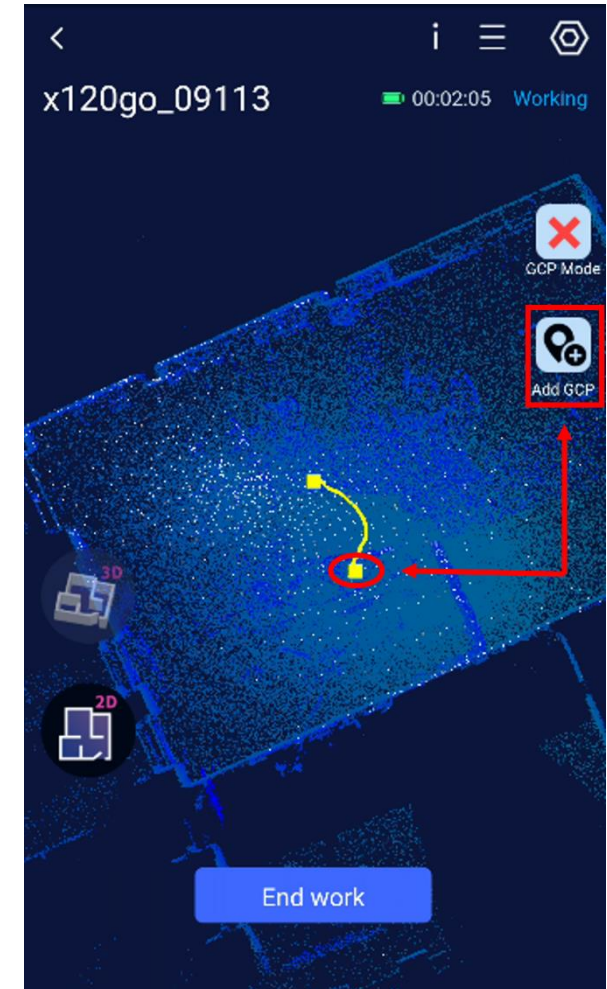
## *How to register point clouds with GCPs*

Tutorial v.1

# GCPs acquisition

To acquire GCPs with 120GO there are two possible ways:

1. Stand still about 10 seconds on a point.
2. In the GOapp, click on the *GCP Mode* icon. While scanning, as you pass above a GCP, stop on it and click the icon *Add GCP*. The software will acquire the position and a message of successful acquisition will be displayed. A yellow square will identify the GCP.

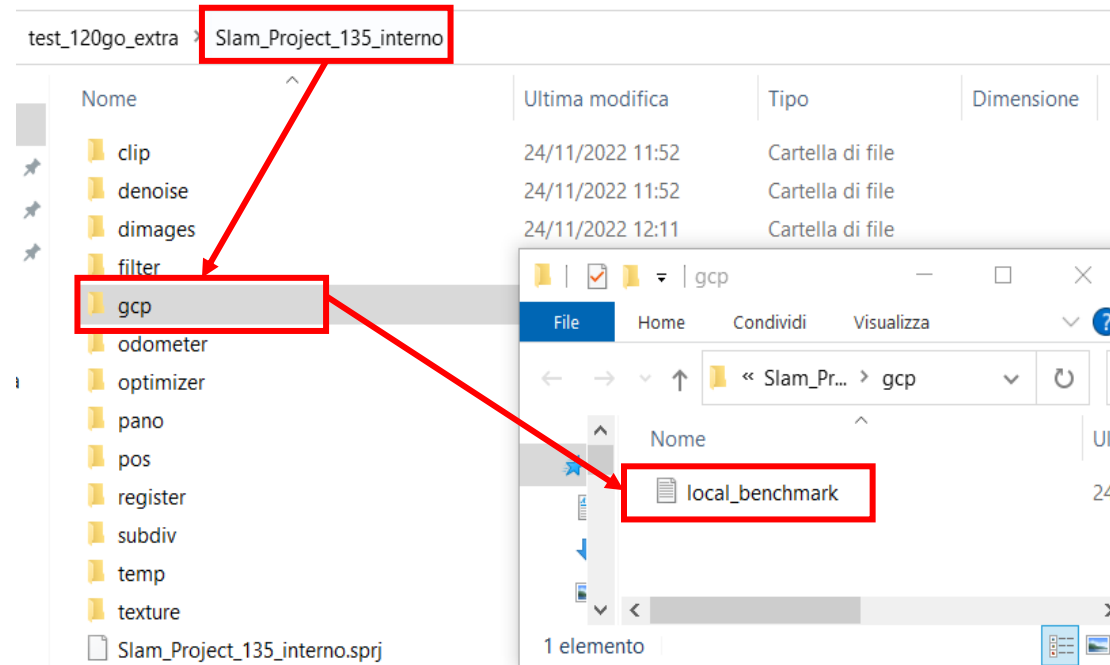


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# GOpst registration

If GCPs were acquired standing still, the information about them will be obtained automatically during the processing of point cloud creation.

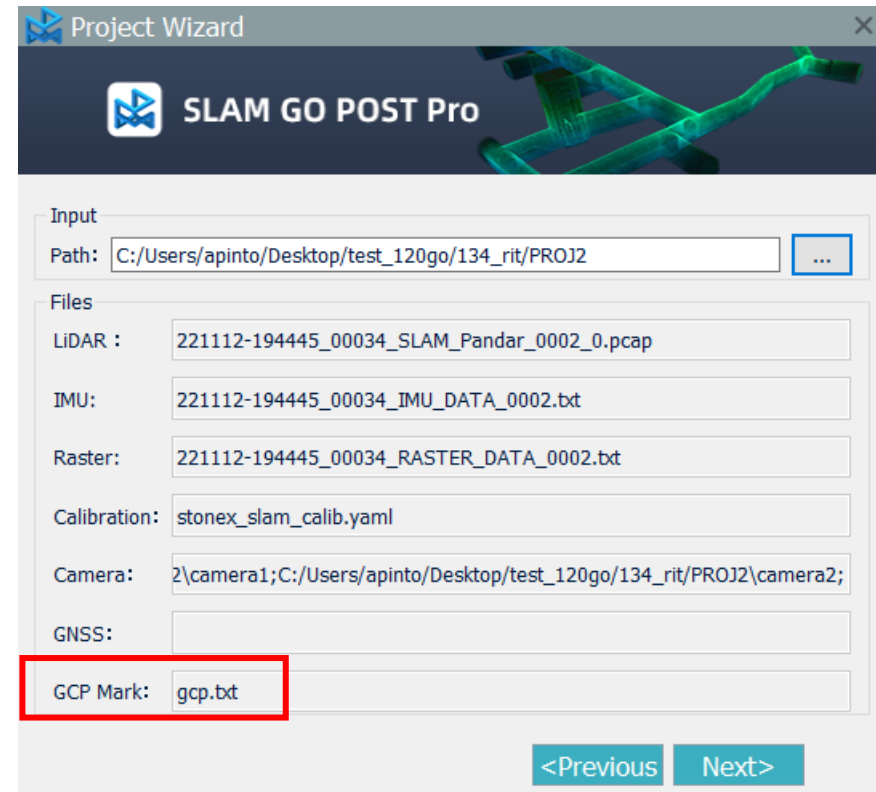
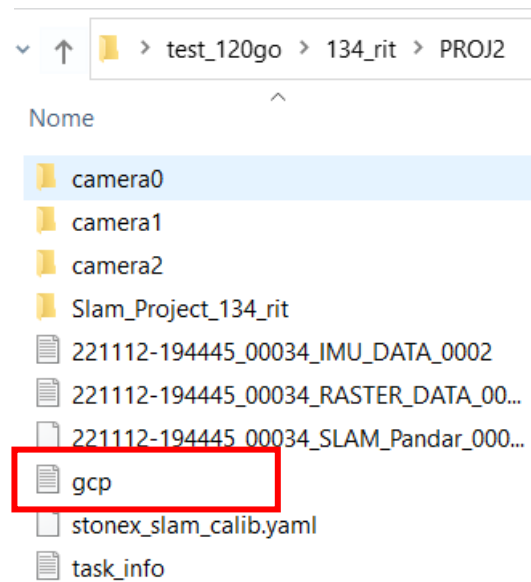
In the project folder, there will be a subfolder called *gcp*. Inside there will be a file called *local\_benchmark.txt*, with the coordinates in a local coordinate system.



NOTE: remember to delete the first GCP, since the scanner will save the position of the initialization as a GCP, unless the initialization isn't itself a control point!

# GOpst registration

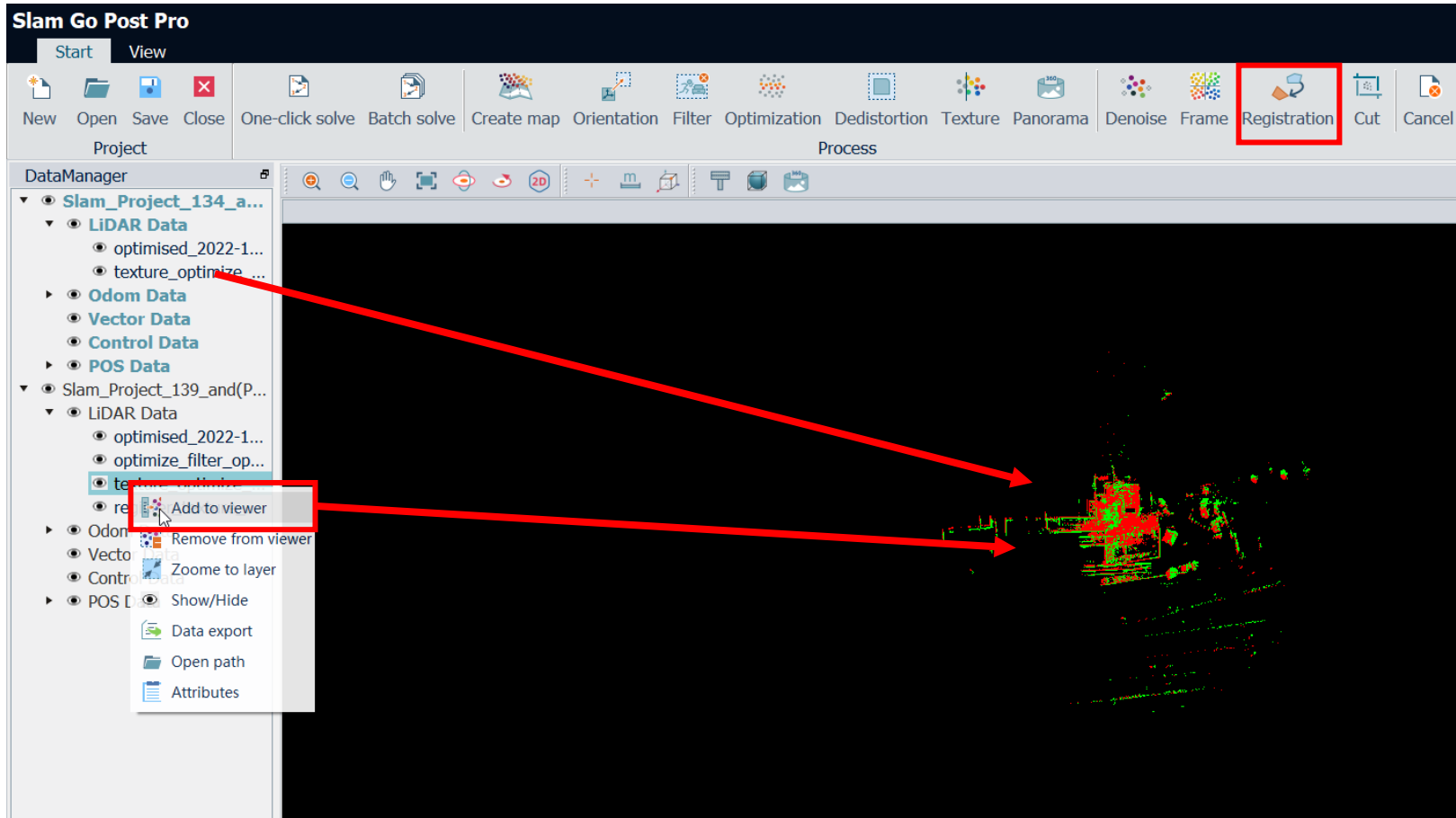
If GCPs were acquired through the app, when you download the data in your PC, in the project folder there will be a .txt file called *gcp*. When you import the data in the GOpst software, check if the *gcp.txt* file is called as an input file. When the point cloud is created, in the subfolder *gcp* there will be a file with coordinates of GCPs called *local\_benchmark.txt*.



# GOpst registration

When you have processed the two point clouds that you want to register, add to the view both the point clouds.

Now click on *Registration*.



# GOpst registration

In the registration window, click on the *folder icon* to import the *local\_benchmark.txt* file for both the point clouds. In the lower left corner you will see the RMS of the registration on the GCPs.

The screenshot shows the 'Registor' window with two data tables and registration parameters. The 'Base' table has a red header, and the 'Registration data' table has a green header. Both tables have columns for ID, X, Y, Z, and ERROR. The 'RMS:0.017' value is highlighted in a red box at the bottom left. The 'Pick', 'Convert', and 'Cancel' buttons are at the bottom right.

ID	X	Y	Z	ERROR
1	-0.691	-5.095	-0.155	0.000
2	4.697	-9.473	0.213	0.000
3	4.734	0.841	-0.147	0.000

ID	X	Y	Z	ERROR
1	-0.580	-5.131	-0.160	0.024
2	4.923	-9.365	0.210	0.021
3	4.705	0.939	-0.186	0.015

Registration parameters:  
Grid size: 0,50 m Distance threshold: 2,0 m  
Number of iterations: 20 Iteration distance: 0,0010 m

**RMS:0.017**  ICP Pick Convert Cancel

Tip: hold down the Ctrl key when picking points

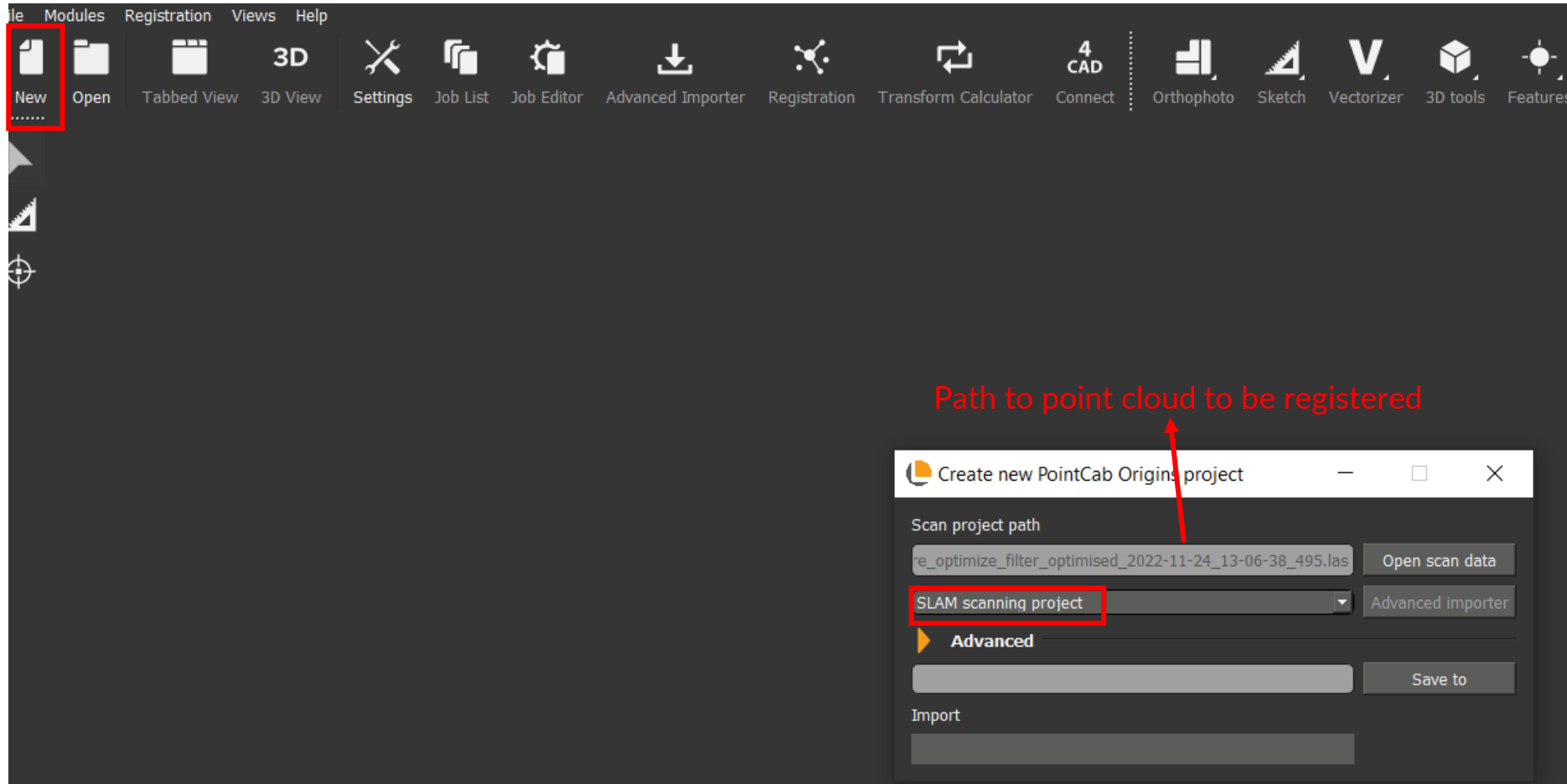
# GOpst registration

Click convert to generate the registered point cloud. The registered point cloud will be saved in the GOpst project folder, in the subfolder register. The name of the new point cloud will start with *register*.

clip	23/11/2022 10:50	Cartella di file	
denoise	23/11/2022 10:50	Cartella di file	
dimages	23/11/2022 11:18	Cartella di file	
filter	23/11/2022 11:09	Cartella di file	
gcp	23/11/2022 11:09	Cartella di file	
odometer	23/11/2022 11:09	Cartella di file	
optimizer	23/11/2022 11:17	Cartella di file	
pano	23/11/2022 11:26	Cartella di file	
pos	23/11/2022 11:09	Cartella di file	
register	24/11/2022 09:30	Cartella di file	
subdiv	23/11/2022 10:50	Cartella di file	
temp	23/11/2022 11:09	Cartella di file	
texture	23/11/2022 11:30	Cartella di file	
Slam_Project_139_and.sprj	24/11/2022 16:52	File SPRJ	104 KB

# PointCab registration

Import the point cloud, in *.las* format, you want to register in PointCab. Click on *New* when PointCab start, than choose the path to the point cloud. Select “SLAM scanning project”, than choose the save path.

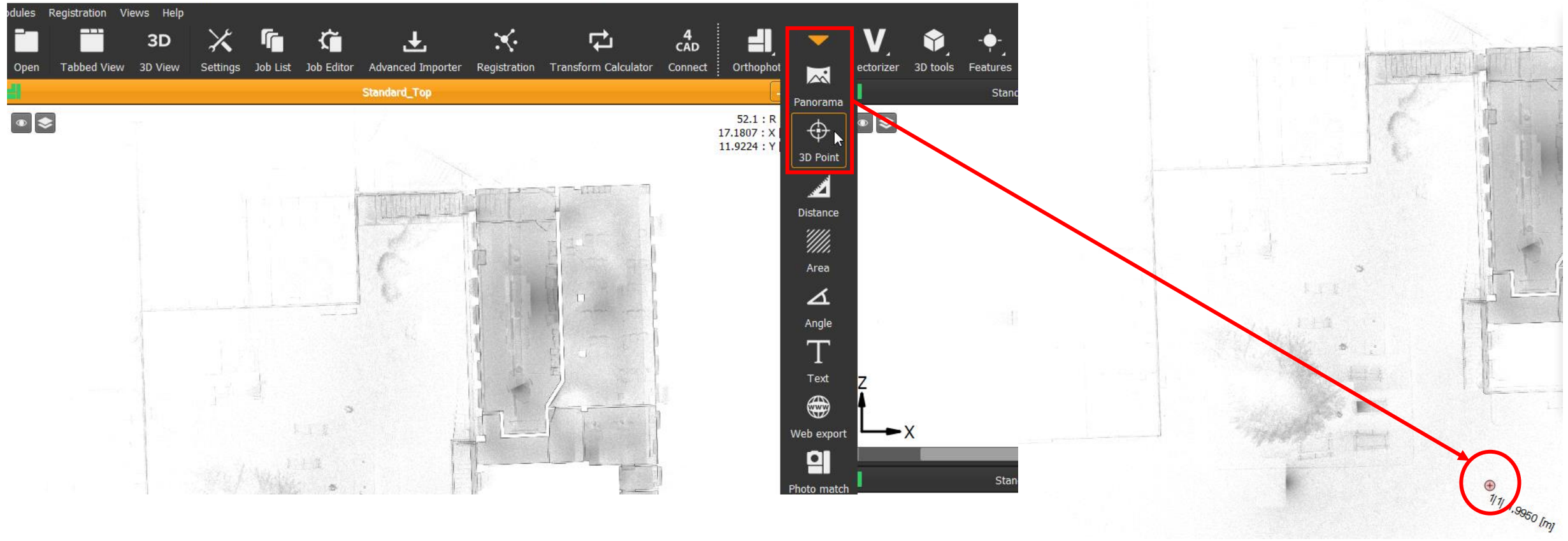




# PointCab registration

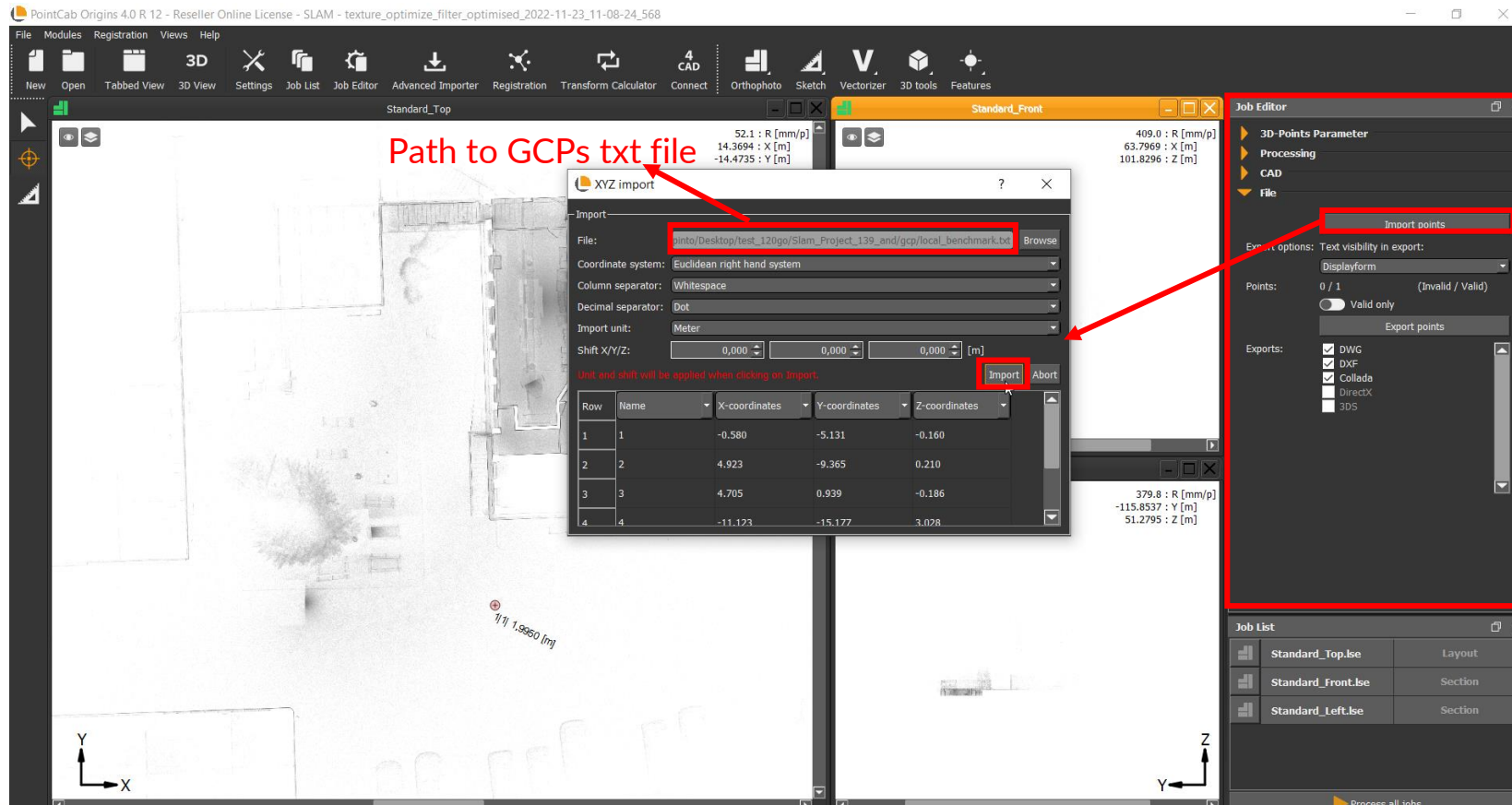
To import GCPs of the point cloud you want to register, first create a point. Click on *Sketch* and choose *3D Point*. Create a random point in the view by clicking in the standard\_top view.

PointCab Origins 4.0 R 12 - Reseller Online License - SLAM - texture\_optimize\_filter\_optimised\_2022-11-23\_11-08-24\_568



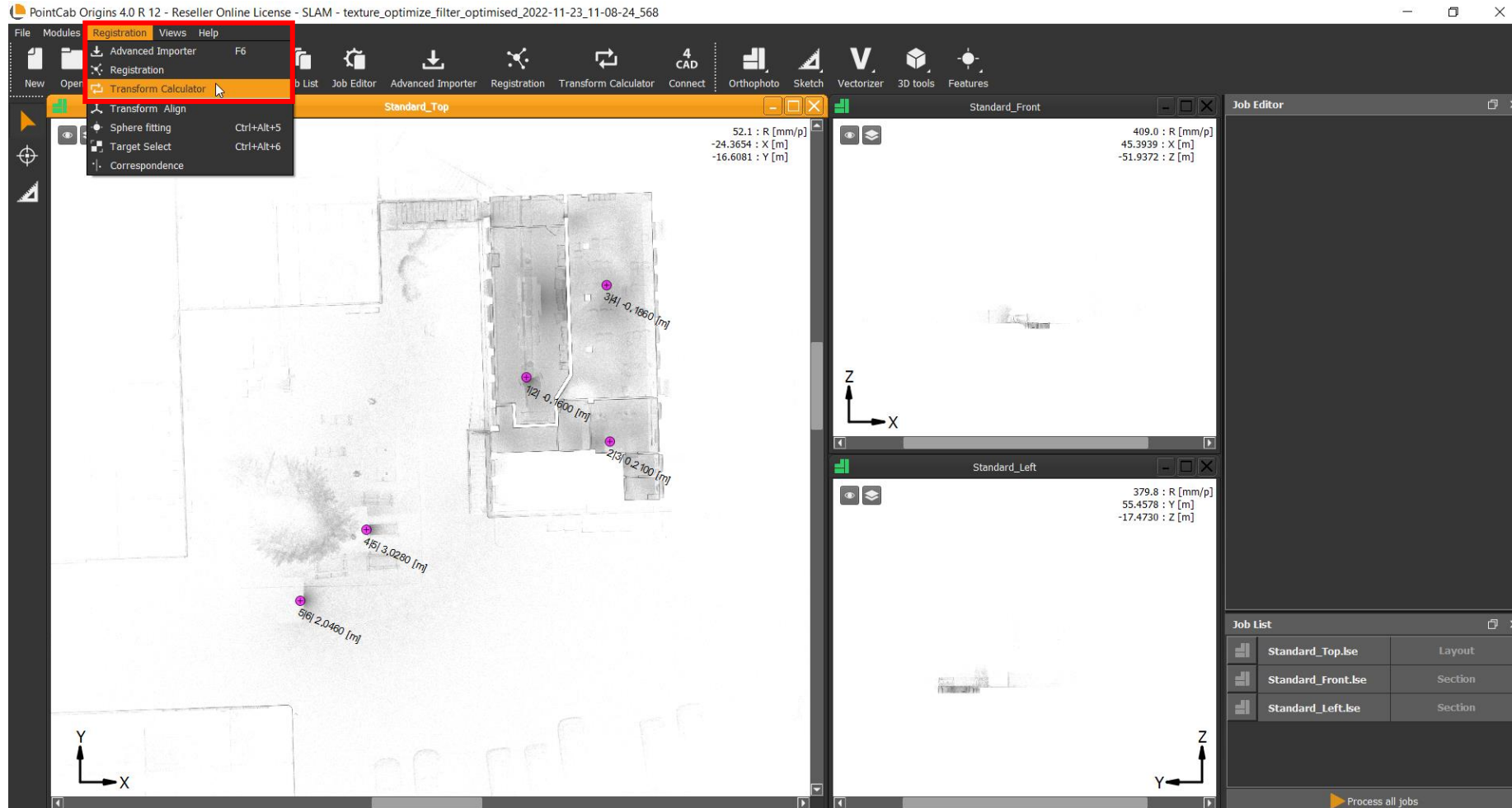
# PointCab registration

Select the point just created. In the *Job Editor* select the *File* category, and click *Import points*. Insert the path to the textual file with the GPCs coordinates. Set the parameters, then click *Import*. After this, you have to delete the point you created at first by right-click on it and click *delete*.



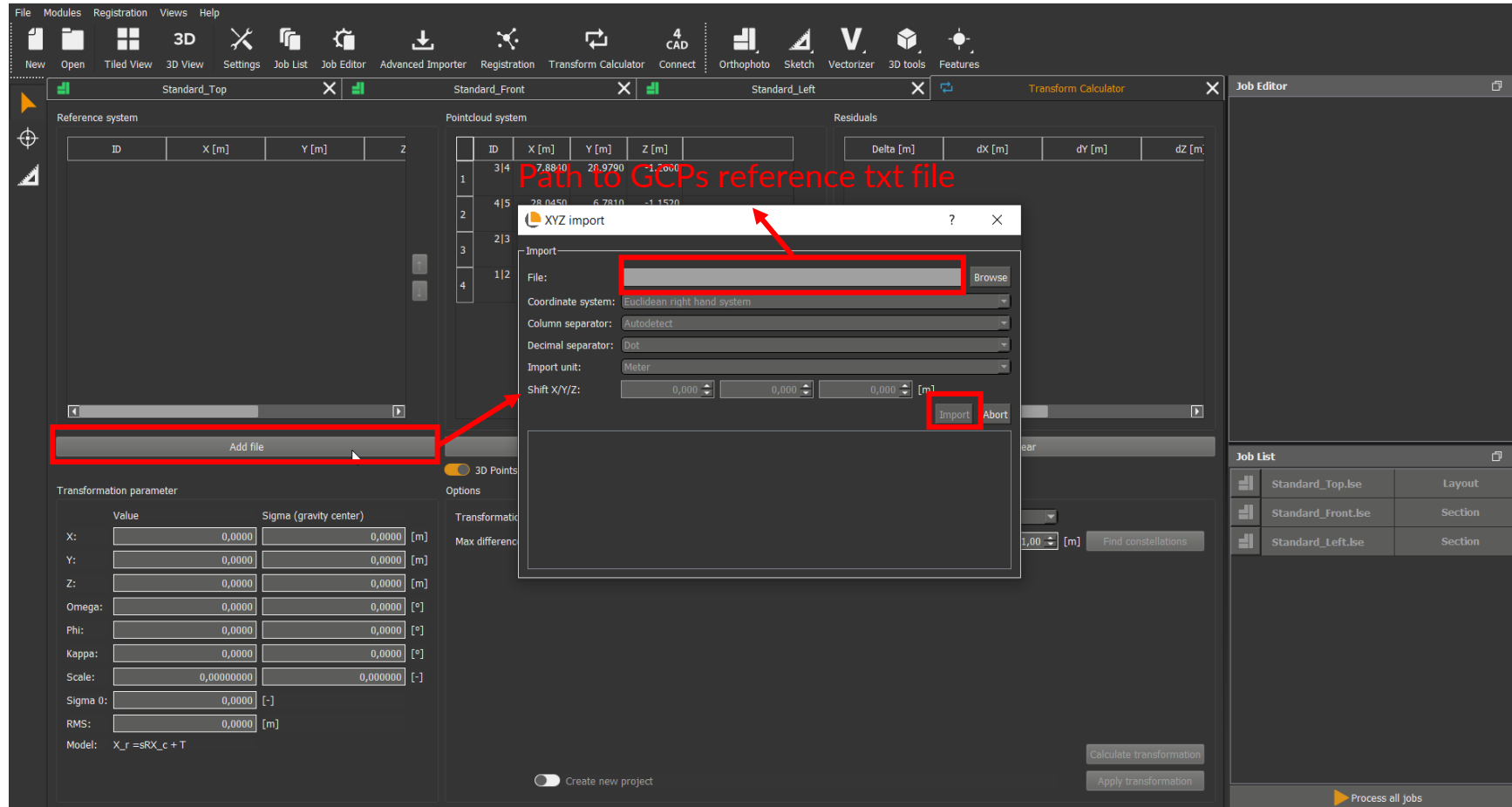
# PointCab registration

Once you imported the GCPs, in the upper part click *Registration*, then click *Transform Calculator*.



# PointCab registration

In the *Transform Calculator* window you will need to import the GCPs text file of the reference point cloud. In *Reference system*, click *Add file*, insert the file path and click *Import*.



# PointCab registration

Once imported reference GCPs, click *Find constellations* to let the software find the best solutions with the smaller errors (*Residuals*). Click *Apply transformation* to perform the registration.

The screenshot displays the PointCab software interface during a registration process. The 'Transform Calculator' window is active, showing the 'Residuals' table, which is highlighted with a red box. The 'Find constellations' button is also highlighted with a red box. The 'Apply transformation' button is highlighted with a red box. The 'Transformation parameter' section shows the following values:

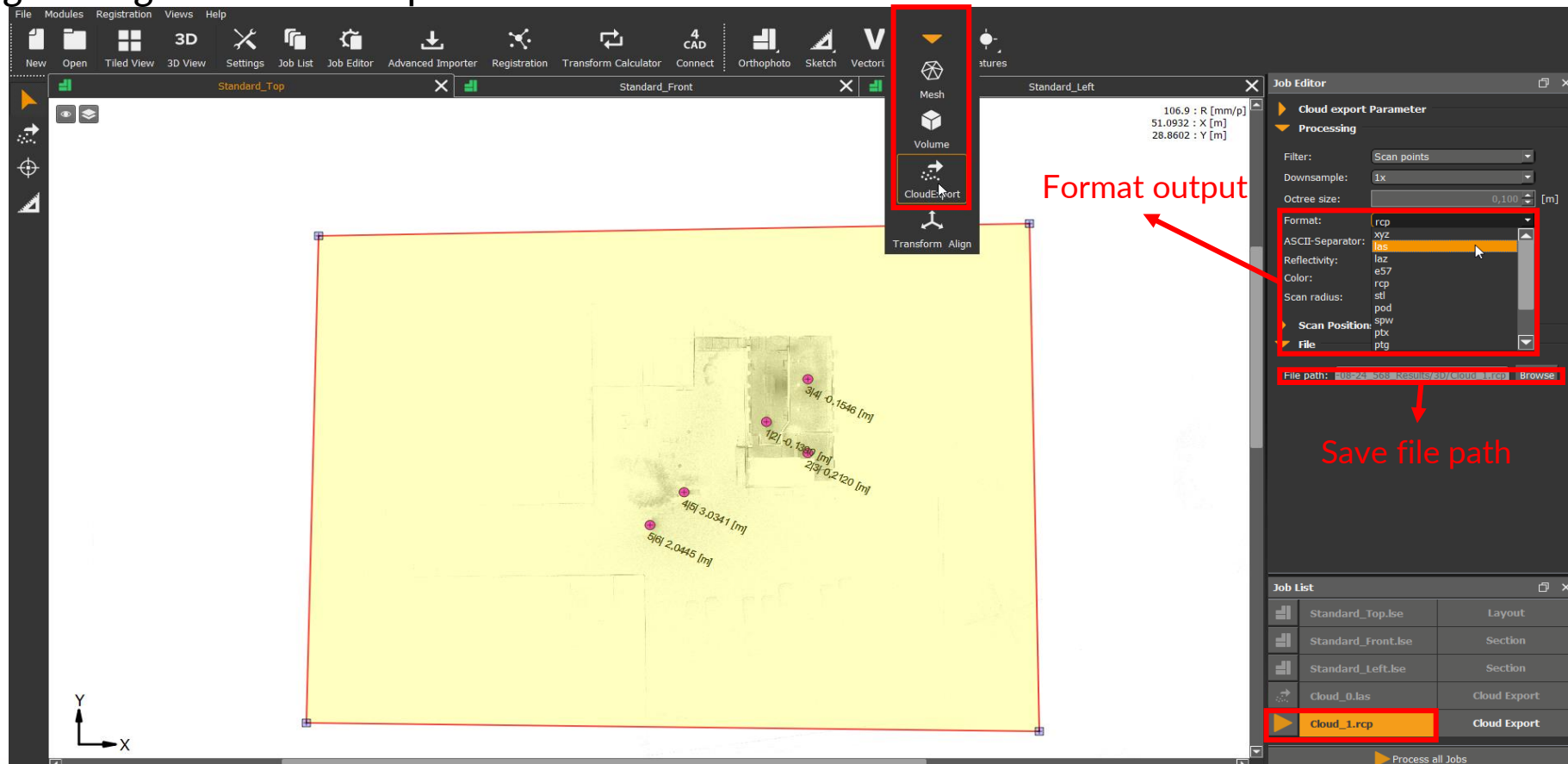
Parameter	Value	Sigma (gravity center)
X:	-0,0097	0,0071 [m]
Y:	-0,0004	0,0071 [m]
Z:	0,0348	0,0071 [m]
Omega:	0,1620	0,1108 [°]
Phi:	0,0735	0,0972 [°]
Kappa:	-1,2517	0,0390 [°]
Scale:	1,00000000	1,000000 [-]
Sigma 0:	0,0112 [-]	
RMS:	0,0212 [m]	

The 'Residuals' table is as follows:

ID	Delta [m]	dX [m]	dY [m]	dZ [m]
1	0.0113	0.0111	0.0016	-0.0019
2	0.0215	-0.0195	-0.0049	-0.0076
3	0.0258	0.0086	0.0237	-0.0055
4	0.0109	0.0108	0.0017	-0.0010
5	0.0294	-0.0109	-0.0221	0.0160

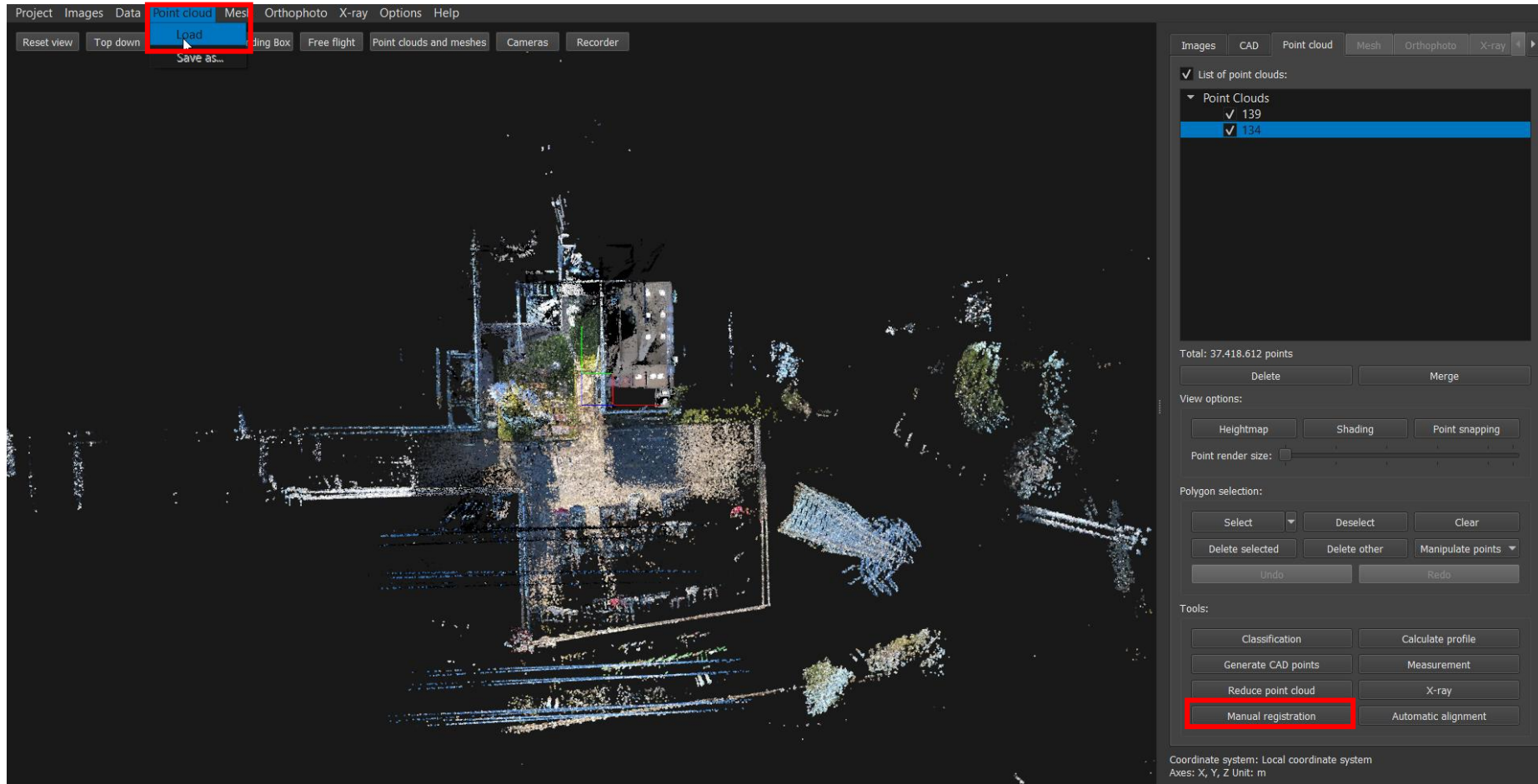
# PointCab registration

Remember to save the registered point cloud. Click *3D tools* and choose *CloudExport*. Select the area of the point cloud to be saved. In *Job Editor* click *Processing* and choose the format output and then the save path in *File*. Then click the *orange triangle* to save the point cloud.



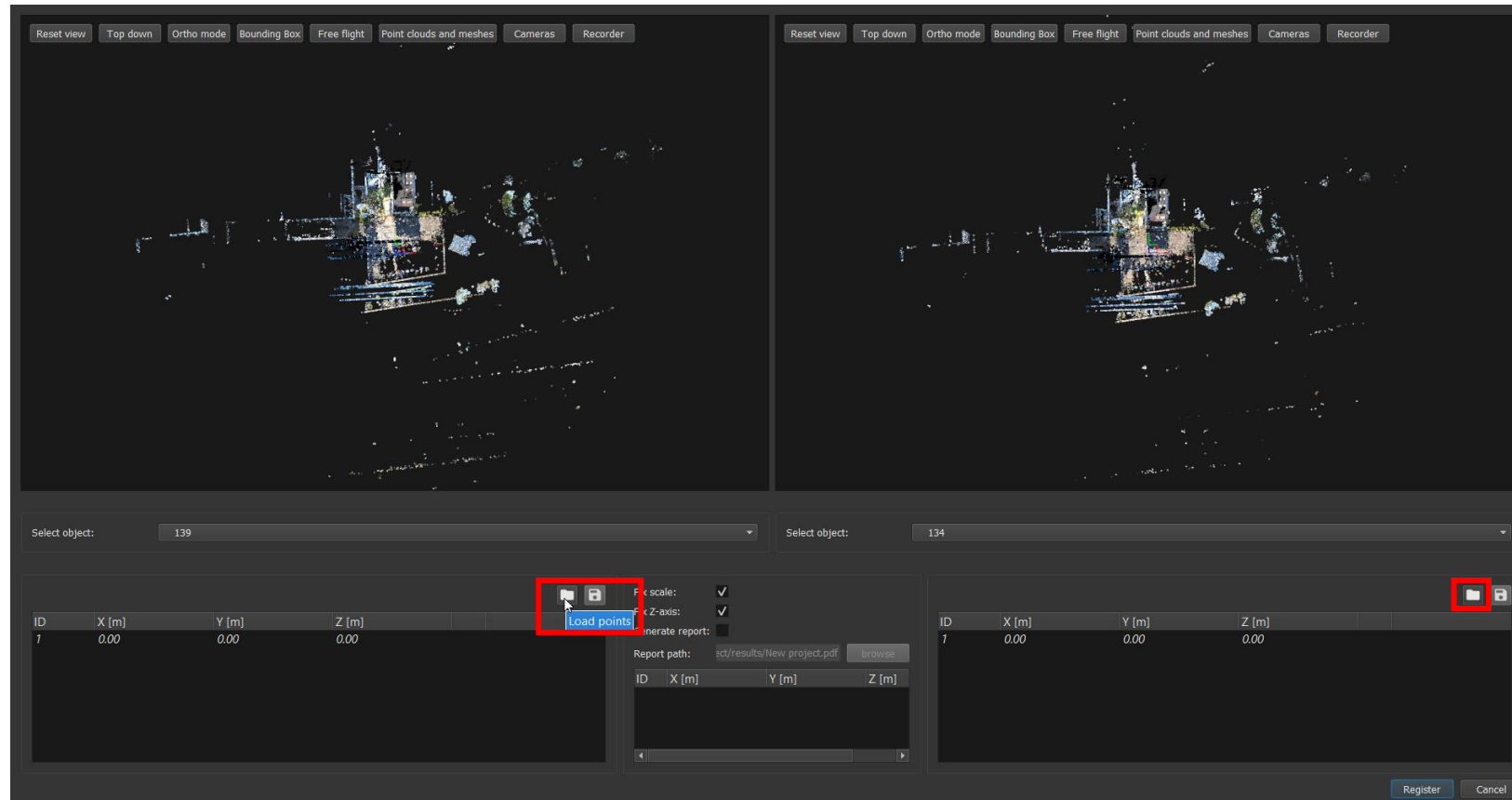
# Cube-3D registration

Import the point clouds you want to register. Click *Point cloud*, then *Load*. You will see both point clouds in the display area. Once loaded, click *Manual registration*.



# Cube-3D registration

In the registration window the two point clouds will be displayed side to side in two windows. On the left the reference one, on the right the one to be registered. You can import GCPs coordinates file, by clicking the *folder icon* for both point clouds.





# Cube-3D registration

In the central portion you can see a preview of residuals. By flagging *Generate report* is possible to save a report file with the residuals. You can delete a point by clicking the “x” next to it. When finished click *Register*.

Select object: 139

ID	X [m]	Y [m]	Z [m]	
1	-0.58	-5.13	-0.16	x
2	4.92	-9.37	0.21	x
3	4.70	0.94	-0.19	x
4	-11.12	-15.18	3.03	x
5	-15.48	-19.86	2.05	x
6	0.00	0.00	0.00	

Fix scale:

Fix Z-axis:

Generate report:

Report path: /apinto/Desktop/report.pdf

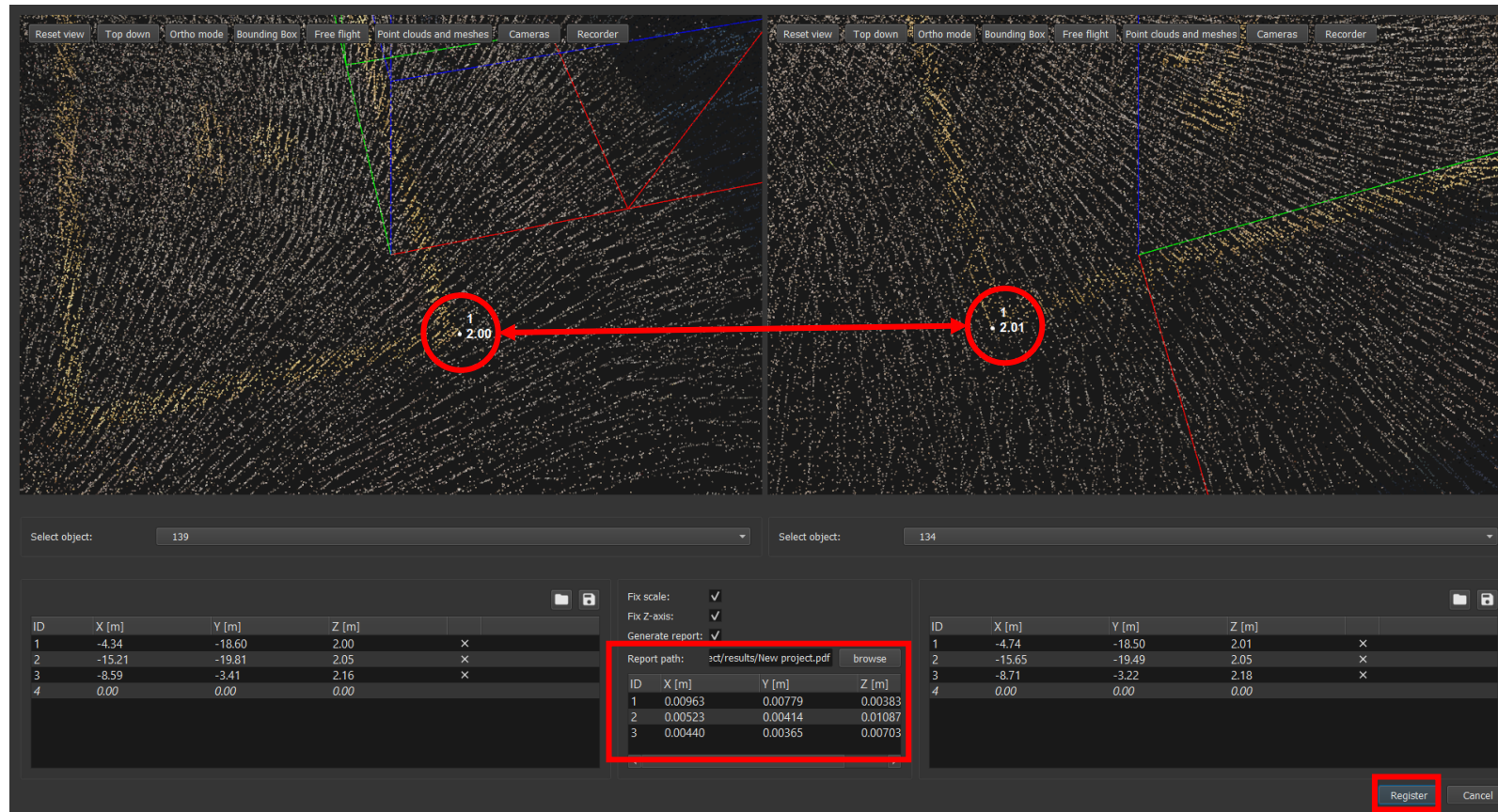
ID	X [m]	Y [m]	Z [m]	
1	0.01030	0.02464	0.006	
2	0.01162	0.00225	0.006	
3	0.02114	0.00615	0.027	
4	0.01006	0.00529	0.003	

Select object: 134

ID	X [m]	Y [m]	Z [m]	
1	-0.69	-5.09	-0.16	x
2	4.70	-9.47	0.21	x
3	4.73	0.84	-0.15	x
4	-11.47	-14.94	3.04	x
5	-15.93	-19.55	2.05	x
6	0.00	0.00	0.00	

# Cube-3D registration

Is possible to create manually correspondences, if no GCPs were collected or if you want to add more. In the registration window, double click on a point cloud to zoom in. Navigate to a recognizable point in both point clouds, than click to create a new correspondence. Click *Register* to end the work.



Here an example of the registration report. There are reported mean errors, and the residuals for each correspondences as a 3D error, and an error for each coordinate.

## Point list registration report

**Project: New project**

**lun novembre 28 2022**

Mean registration error 0.0119m

Mean target registration error components 0.0126m, 0.0123m, 0.0109m

5 correspondences found.

Point ID, 3D error, X error, Y error, Z error

1, 0.0276m, 0.0103m, 0.0246m, 0.0068m

2, 0.0148m, 0.0116m, 0.0023m, 0.0088m

3, 0.0350m, 0.0211m, 0.0062m, 0.0272m

4, 0.0120m, 0.0101m, 0.0053m, 0.0038m

5, 0.0264m, 0.0098m, 0.0233m, 0.0078m

# Cube-3D registration

After the registration, remember to save the registered point cloud. Right-click on it, than click *Save as...*

