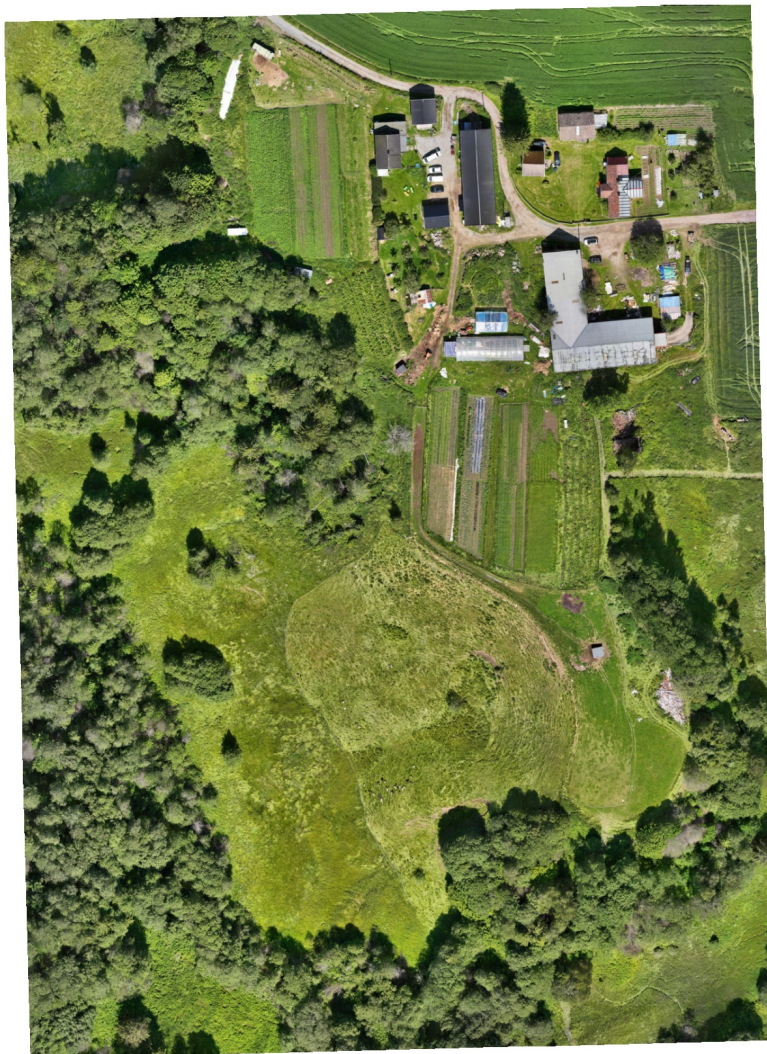


2025-06-25_Sander_M4E_SO

DJI Matrice 4E in Smart Oblique mode
Flown by Luc Girod
Georeferencing through RPK with 16 CPs.
Processing by Luc Girod - 2025-06-25
30 June 2025



Survey Data

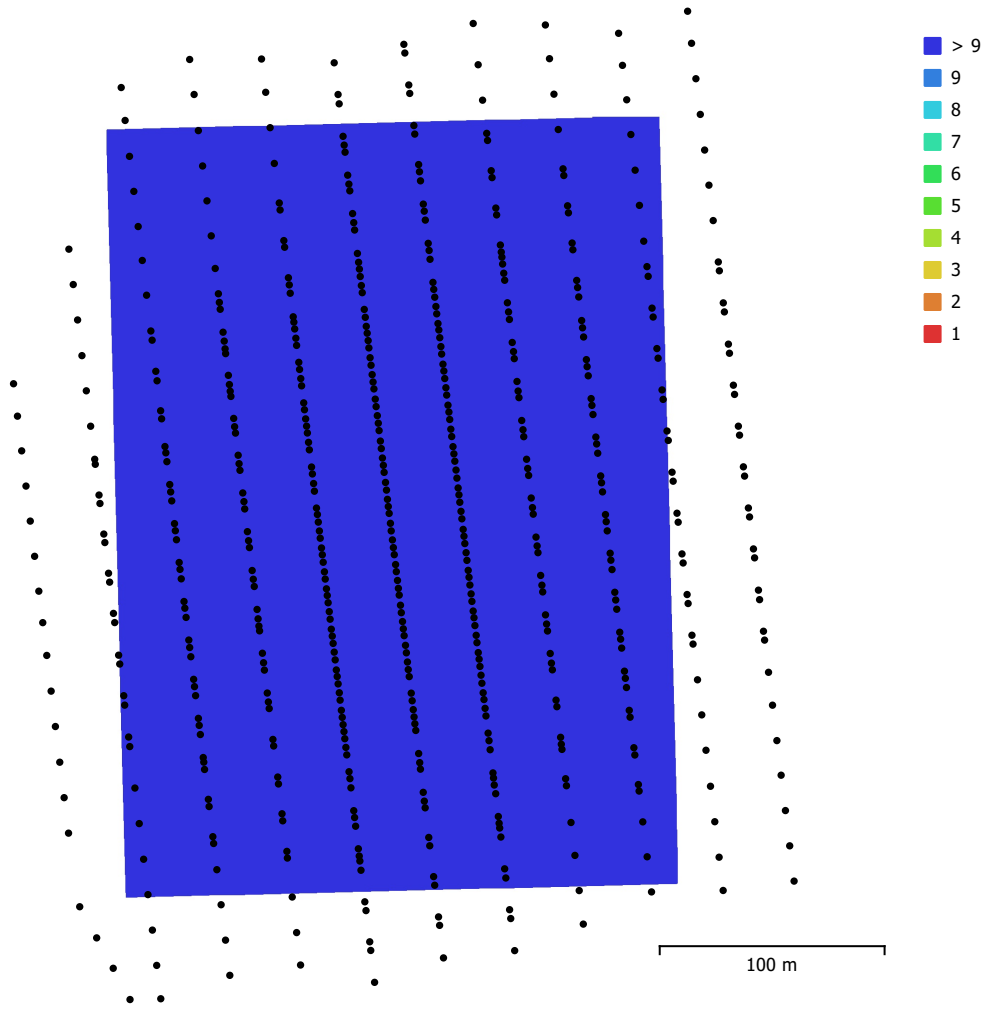


Fig. 1. Camera locations and image overlap.

Number of images:	571	Camera stations:	571
Flying altitude:	90.1 m	Tie points:	474,650
Ground resolution:	2.42 cm/pix	Projections:	1,888,706
Coverage area:	0.0839 km ²	Reprojection error:	1.16 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
M4E (12.29mm)	5280 x 3956	12.29 mm	3.36 x 3.36 μ m	Yes

Table 1. Cameras.

Camera Calibration

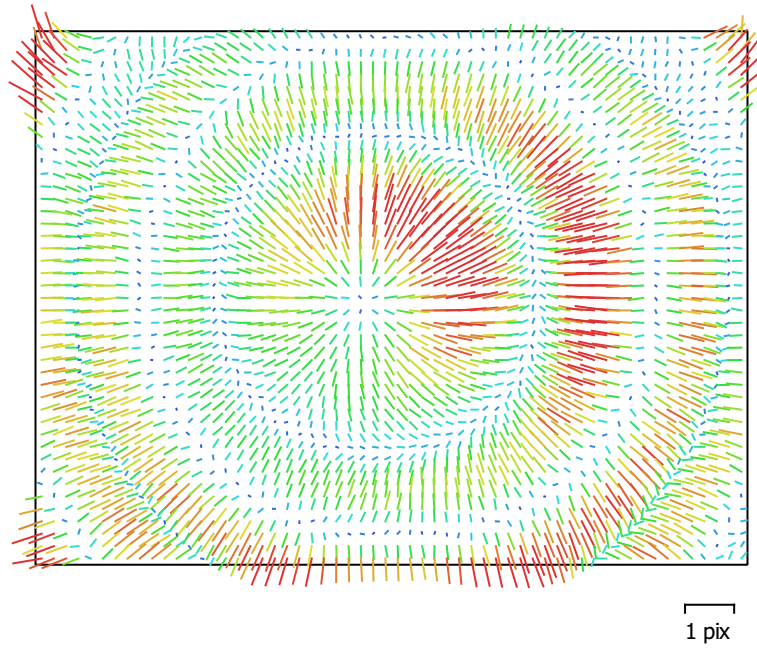


Fig. 2. Image residuals for M4E (12.29mm).

M4E (12.29mm)

571 images, precalibrated

Type	Resolution	Focal Length	Pixel Size
Frame	5280 x 3956	12.29 mm	3.36 x 3.36 μm

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
F	3715.9	0.019	1.00	0.00	-0.09	-0.37	0.32	-0.30	-0.01	-0.00
Cx	19.1642	0.017		1.00	-0.01	-0.00	0.00	-0.00	0.64	0.00
Cy	-19.2228	0.014			1.00	0.00	0.02	-0.03	0.00	0.44
K1	-0.106369	1.9e-05				1.00	-0.97	0.90	-0.00	-0.04
K2	-0.00101746	4.7e-05					1.00	-0.98	0.01	0.05
K3	-0.0169282	3.6e-05						1.00	-0.00	-0.07
P1	-0.000248134	7.6e-07							1.00	-0.01
P2	-0.00027648	7.9e-07								1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Locations

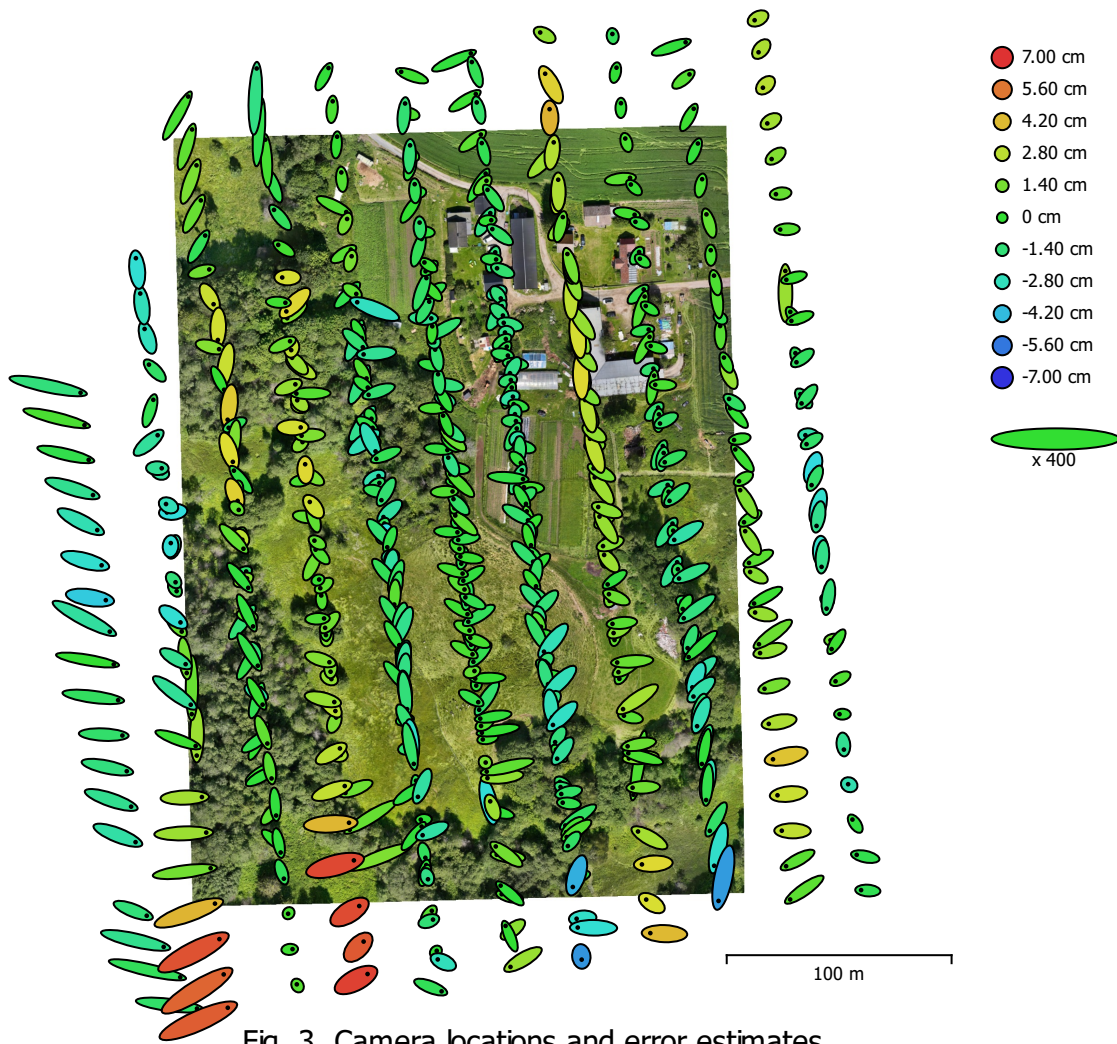


Fig. 3. Camera locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated camera locations are marked with a black dot.

X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total error (cm)
1.79238	1.66731	1.74027	2.44797	3.00352

Table 3. Average camera location error.

X - Easting, Y - Northing, Z - Altitude.

Ground Control Points

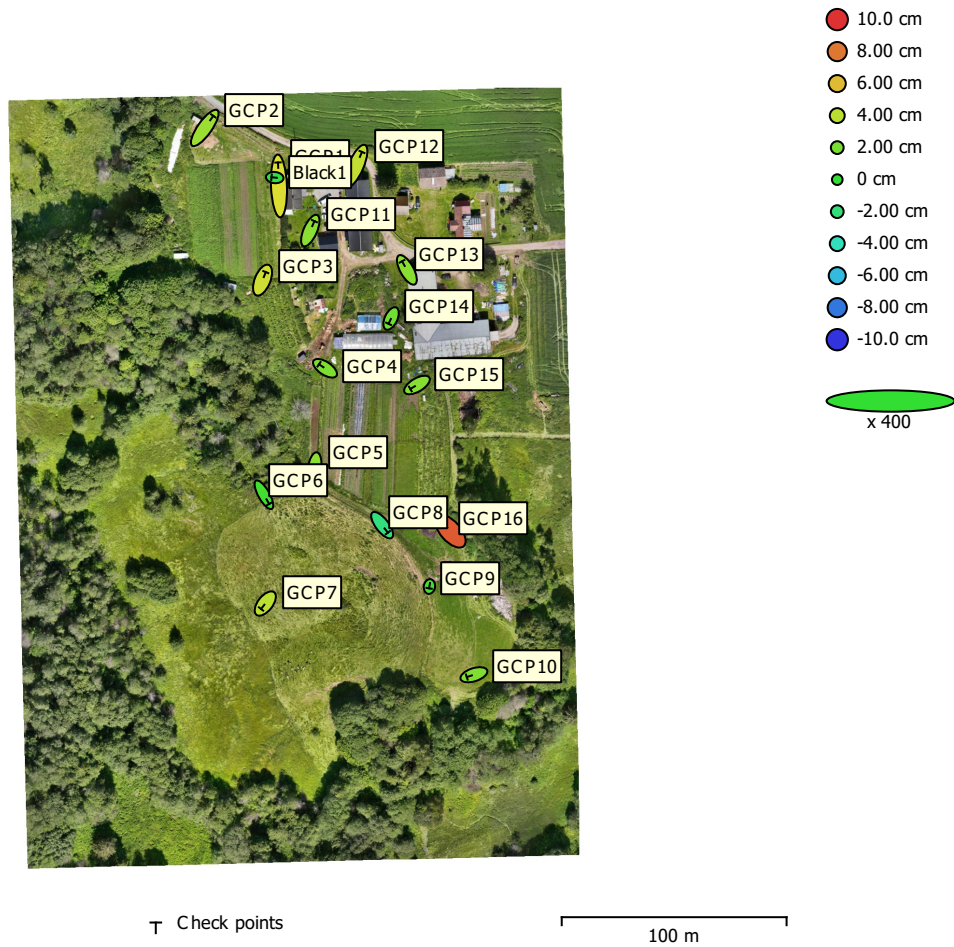


Fig. 4. GCP locations and error estimates.
 Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
 Estimated GCP locations are marked with a dot or crossing.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
17	1.12109	2.09541	3.52421	2.37647	4.2506

Table 4. Check points RMSE.
 X - Easting, Y - Northing, Z - Altitude.

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
GCP1	-0.211025	5.2121	4.93827	7.1831	0.515 (5)
GCP2	1.90093	2.68036	3.08758	4.509	0.352 (6)
GCP3	0.72381	1.77876	4.58522	4.97113	0.794 (7)
GCP4	-1.33865	0.88936	2.18814	2.71494	0.540 (5)
GCP5	-0.305369	-2.24064	2.66437	3.49465	0.648 (8)
GCP6	1.15749	-2.04753	0.495051	2.40359	0.717 (5)
GCP7	-0.943957	-1.20202	3.97106	4.25502	0.733 (6)
GCP8	1.27823	-1.66232	-2.17025	3.01781	0.516 (7)
GCP9	-0.0681558	-0.399985	0.540271	0.675667	0.680 (6)
GCP10	-1.57675	-0.509242	2.27923	2.81787	0.635 (6)
GCP11	0.924686	2.09522	2.57686	3.44749	0.542 (6)
GCP12	1.32434	3.08844	4.21692	5.3921	0.411 (6)
GCP13	-1.06759	1.9115	2.54016	3.3535	0.428 (8)
GCP14	-0.557885	-1.17389	1.78518	2.2082	0.347 (6)
GCP15	-1.48418	-0.875828	2.46169	3.00496	0.719 (6)
GCP16	-1.47183	1.66298	8.81541	9.09083	0.615 (6)
Black1	-0.717288	0.0669792	-0.515451	0.885821	0.558 (7)
Total	1.12109	2.09541	3.52421	4.2506	0.588

Table 5. Check points.
X - Easting, Y - Northing, Z - Altitude.

Digital Elevation Model

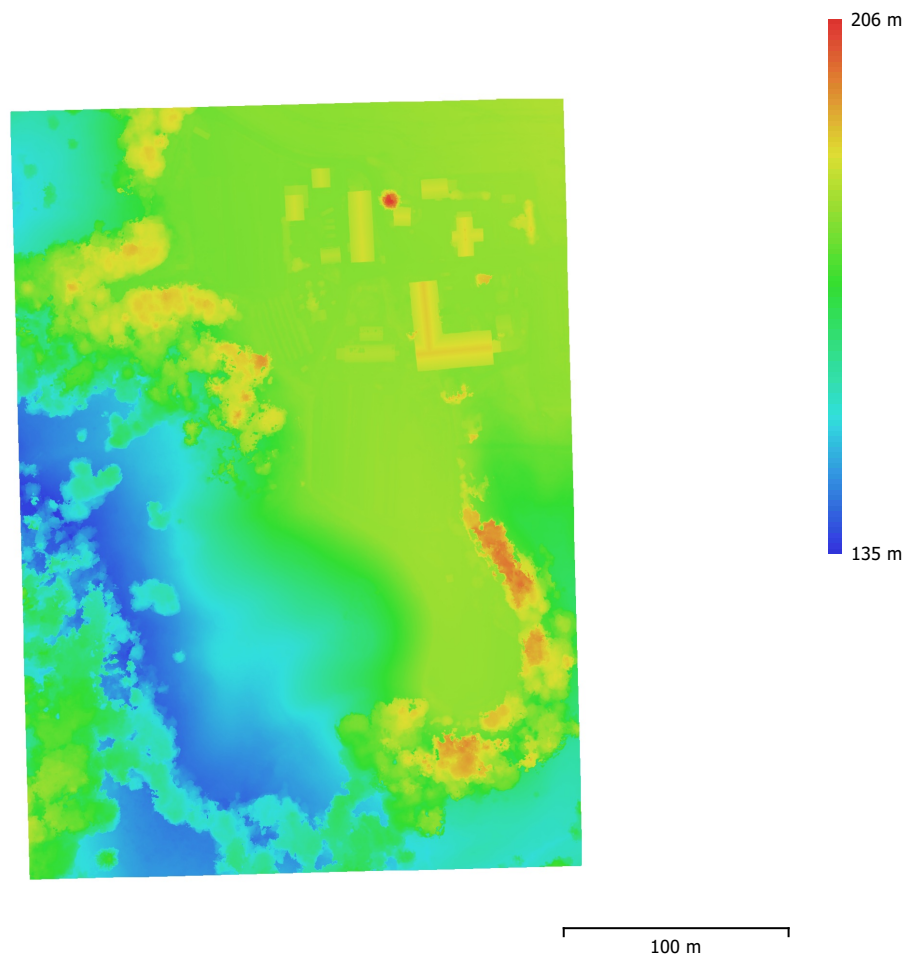


Fig. 5. Reconstructed digital elevation model.

Resolution: 5.00 cm/pix
Point density: 400 points/m²

Processing Parameters

General

Images	571
Aligned images	571
Markers	17
Coordinate system	ETRS89 / UTM zone 32N + NN2000 height (EPSG::5972)
Rotation angles	Yaw, Pitch, Roll

Tie Points

Points	474,650 of 515,044
RMS reprojection error	0.252852 (1.16026 pix)
Max reprojection error	0.762155 (76.5527 pix)
Mean key point size	3.60049 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	4.68792

Alignment parameters

Accuracy	High
Generic preselection	Yes
Reference preselection	Source
Key point limit	40,000
Key point limit per Mpx	1,000
Tie point limit	4,000
Exclude stationary tie points	Yes
Guided image matching	No
Adaptive camera model fitting	No
Matching time	3 minutes 18 seconds
Matching memory usage	579.29 MB
Alignment time	1 minutes 56 seconds
Alignment memory usage	1.00 GB
Date created	2025:06:25 16:39:11
Software version	2.2.1.20641
File size	141.28 MB

Depth Maps

Count	571
Depth maps generation parameters	
Quality	High
Filtering mode	Moderate
Max neighbors	16
Processing time	23 minutes 28 seconds
Memory usage	7.25 GB
Date created	2025:06:25 17:17:47
Software version	2.2.1.20641
File size	3.73 GB

Model

Faces	14,472,622
Vertices	7,248,617
Vertex colors	3 bands, uint8
Texture	8,192 x 8,192 x 11, 3 bands, uint8

Depth maps generation parameters

Quality	High
Filtering mode	Moderate
Max neighbors	16
Processing time	23 minutes 28 seconds
Memory usage	7.25 GB

Reconstruction parameters

Surface type	Arbitrary
Source data	Depth maps
Interpolation	Enabled
Strict volumetric masks	No
Processing time	8 minutes 10 seconds
Memory usage	9.77 GB
Texturing parameters	
Mapping mode	Generic
Blending mode	Mosaic
Texture size	8,192
Pixel size (m)	0.02
Enable hole filling	Yes
Enable ghosting filter	Yes
UV mapping time	1 minutes 33 seconds
UV mapping memory usage	2.71 GB
Blending time	21 minutes 36 seconds
Blending memory usage	62.88 GB
Date created	2025:06:25 17:26:01
Software version	2.2.1.20641
File size	1.72 GB
DEM	
Size	5,081 x 6,941
Resolution	5.00 cm/pix
Coordinate system	ETRS89 / UTM zone 32N + NN2000 height (EPSG::5972)
Depth maps generation parameters	
Quality	High
Filtering mode	Moderate
Max neighbors	16
Processing time	23 minutes 28 seconds
Memory usage	7.25 GB
Reconstruction parameters	
Source data	Depth maps
Interpolation	Enabled
Processing time	4 minutes 18 seconds
Memory usage	26.68 GB
Date created	2025:06:25 22:18:55
Software version	2.2.1.20641
File size	146.12 MB
Orthomosaic	
Size	10,160 x 13,880
Resolution	2.50 cm/pix
Coordinate system	ETRS89 / UTM zone 32N + NN2000 height (EPSG::5972)
Colors	3 bands, uint8
Orthophotos	6.83 GB
Reconstruction parameters	
Blending mode	Mosaic
Surface	DEM
Enable hole filling	Yes
Enable ghosting filter	No
Processing time	8 minutes 45 seconds
Memory usage	1.95 GB
Date created	2025:06:27 14:03:54
Software version	2.2.1.20641
File size	7.07 GB
System	
Software name	Agisoft Metashape Professional
Software version	2.2.1 build 20641
OS	Windows 64 bit
RAM	127.15 GB
CPU	AMD Ryzen 9 7950X 16-Core Processor

GPU(s)

NVIDIA GeForce RTX 4080 SUPER