

Supplementary Materials

File S1: final report generated by *Agisoft Metashape* with all the processing parameters adopted during the creation of the R2 three-dimensional model

R2

Ring bracelet fragment from Travo archaeological site (Piacenza).

14 February 2024



Survey Data

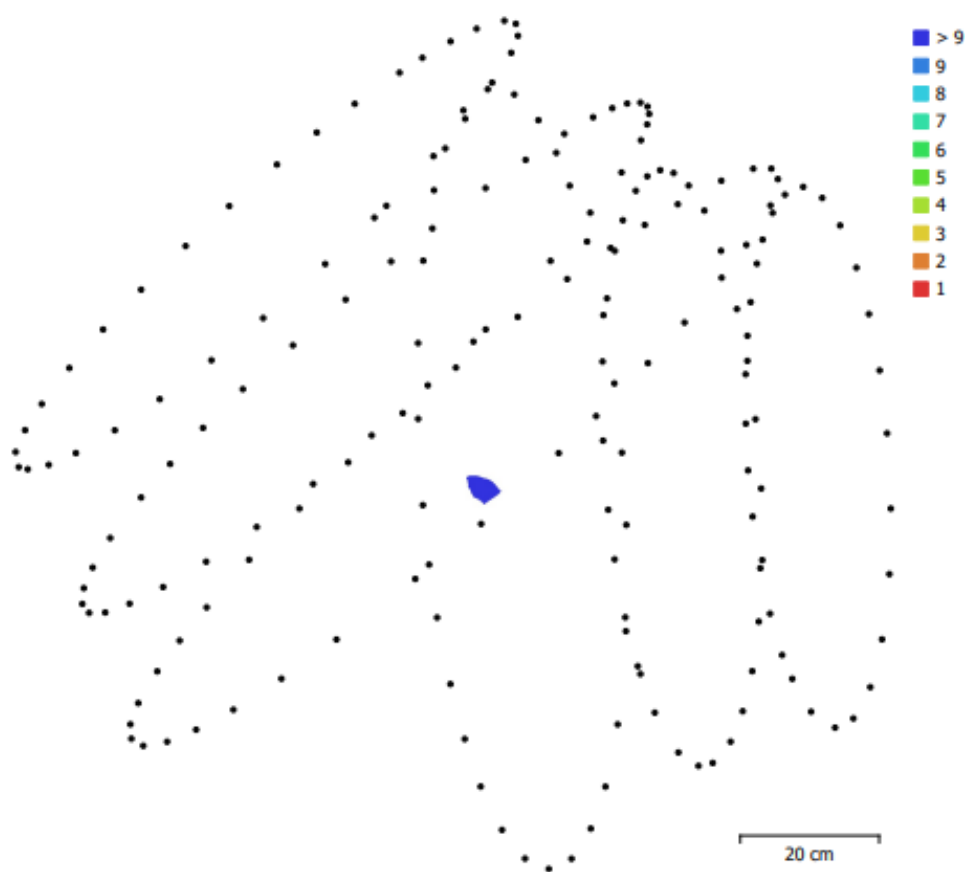


Fig. 1. Camera locations and image overlap.

Number of images:	193	Camera stations:	193
Flying altitude:	58.8 cm	Tie points:	108,283
Ground resolution:	0.0316 mm/pix	Projections:	335,859
Coverage area:	12.4 cm ²	Reprojection error:	3.51 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
Canon EOS RP, RF24-105...	6240 x 4160	105 mm	5.76 x 5.76 μm	No
Canon EOS RP, RF24-105...	6240 x 4160	105 mm	5.76 x 5.76 μm	No

Table 1. Cameras.

Camera Calibration

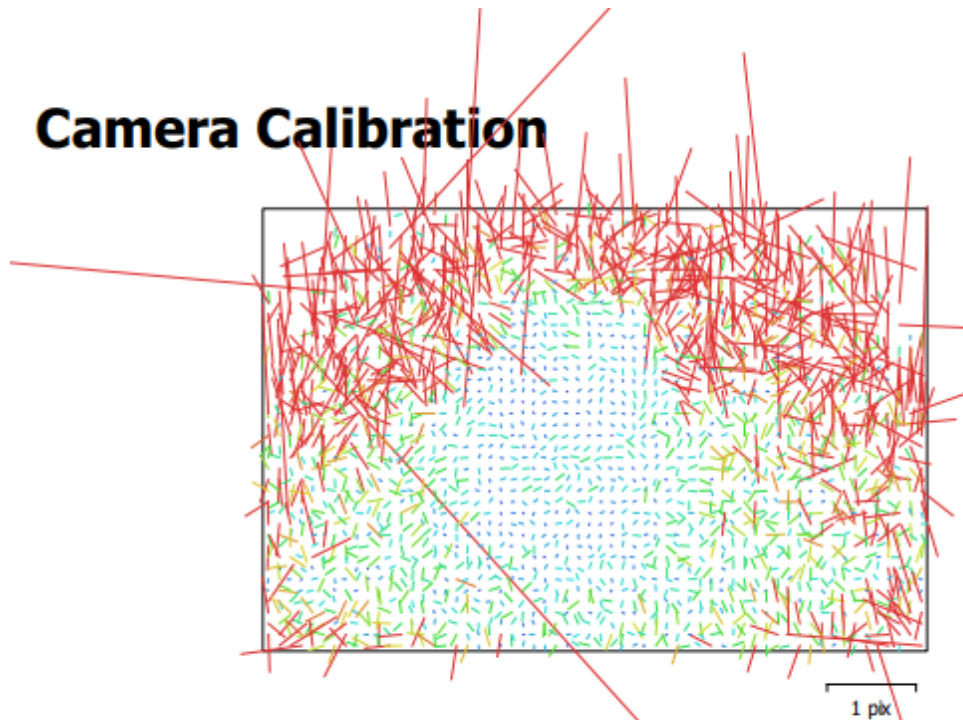


Fig. 2. Image residuals for Canon EOS RP, RF24-105mm F4-7.1 IS STM (105mm).

Canon EOS RP, RF24-105mm F4-7.1 IS STM (105mm)

88 images

Type	Resolution	Focal Length	Pixel Size
Frame	6240 x 4160	105 mm	5.76 x 5.76 μm

	Value	Error	F	Cx	Cy	B2	K1	K2	K3	P1	P2
F	18789.6	5.2	1.00	-0.05	-0.57	0.32	-0.18	0.08	0.01	-0.05	0.10
Cx	-44.2789	5.1		1.00	0.02	-0.03	0.03	-0.05	0.06	0.92	0.02
Cy	-158.839	8.1			1.00	-0.38	0.02	0.14	-0.27	0.05	0.64
B2	9.72133	0.26				1.00	0.01	-0.07	0.10	-0.26	-0.10
K1	-0.23014	0.005					1.00	-0.91	0.81	0.10	-0.18
K2	9.36728	0.27						1.00	-0.97	-0.08	0.21
K3	-169.464	5							1.00	0.09	-0.25
P1	-0.00323252	7.1e-05								1.00	0.03
P2	0.000591272	0.00014									1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Calibration

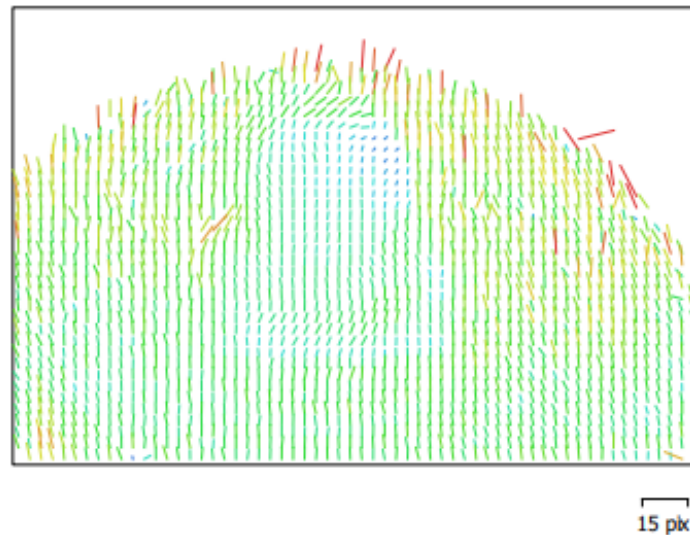


Fig. 3. Image residuals for Canon EOS RP, RF24-105mm F4-7.1 IS STM (105mm).

Canon EOS RP, RF24-105mm F4-7.1 IS STM (105mm)

105 images

Type	Resolution	Focal Length	Pixel Size
Frame	6240 x 4160	105 mm	5.76 x 5.76 μm

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
F	18756.5	60	1.00	-0.04	-0.71	0.24	-0.06	0.05	-0.39	0.65
Cx	-2879.43	1.1e+02		1.00	0.08	0.19	0.43	-0.51	-0.66	-0.29
Cy	171.958	94			1.00	-0.13	0.12	-0.14	0.19	-0.92
K1	-0.602078	0.028				1.00	-0.67	0.53	-0.69	-0.10
K2	2.87838	0.43					1.00	-0.97	-0.03	-0.10
K3	-10.6491	2.8						1.00	0.16	0.17
P1	0.00823554	0.0022							1.00	0.08
P2	-0.00424057	0.00097								1.00

Table 3. Calibration coefficients and correlation matrix.

Scale Bars

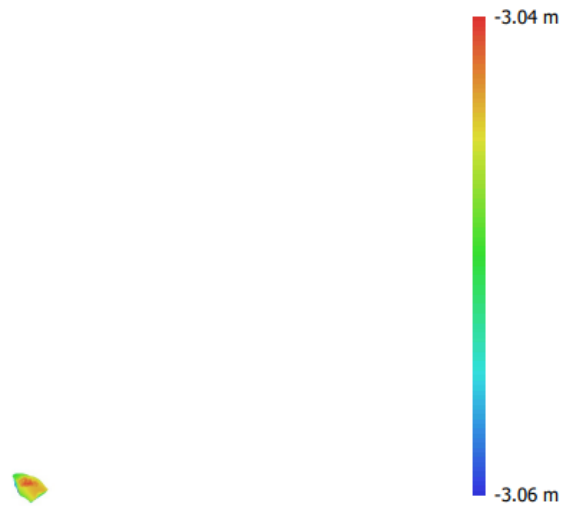
Label	Distance (m)	Error (m)
target 1_target 2	0.126317	-0.000182793
target 1_target 4	0.0697173	0.000217255
target 2_target 4	0.108855	-0.000145448
target 3_target 4	0.127945	-5.4674e-05
target 141_target 142	0.0898862	-0.000113765
target 141_target 144	0.0684997	0.000499656
target 142_target 144	0.13315	0.000149596
target 143_target 144	0.0898537	-0.000146323
Total		0.000226701

Table 6. Control scale bars.

Label	Distance (m)	Error (m)
target 1_target 3	0.106971	-2.88056e-05
target 2_target 3	0.0648153	-0.0051847
target 141_target 143	0.0842661	-0.000733881
target 142_target 143	0.0633815	-0.00561851
Total		0.00384019

Table 7. Check scale bars.

Digital Elevation Model



20 cm

Fig. 5. Reconstructed digital elevation model.

Resolution: 0.148 mm/pix
Point density: 45.7 points/mm²

Processing Parameters

General

Cameras	193
Aligned cameras	193
Markers	14
Scale bars	12
Coordinate system	Local Coordinates (m)
Rotation angles	Yaw, Pitch, Roll

Point Cloud

Points	108,283 of 139,535
RMS reprojection error	1.17028 (3.51407 px)
Max reprojection error	15.2046 (46.8109 px)
Mean key point size	4.85206 px
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	3.53187
File size	10.42 MB

Depth Maps

Count	193
Depth maps generation parameters	
Quality	High
Filtering mode	Mid
Max neighbors	16
Processing time	30 minutes 34 seconds
Memory usage	6.07 GB
Date created	2024:02:12 16:13:29
Software version	1.8.0.13794
File size	484.02 MB

Dense Point Cloud

Points	1,590,636
Point colors	3 bands, uint8
Depth maps generation parameters	
Quality	High
Filtering mode	Mid
File size	19.75 MB

Model

Faces	110,886
Vertices	55,447
Vertex colors	3 bands, uint8
Texture	8,192 x 8,192, 4 bands, uint8
Depth maps generation parameters	
Quality	High
Filtering mode	Mid
Max neighbors	16
Processing time	30 minutes 34 seconds
Memory usage	6.07 GB
Reconstruction parameters	
Surface type	Arbitrary
Source data	Depth maps
Interpolation	Enabled
Strict volumetric masks	No
Processing time	1 minutes 21 seconds

Memory usage	5.15 GB
Texturing parameters	
Mapping mode	Generic
Blending mode	Mosaic
Texture size	8,192
Enable hole filling	Yes
Enable ghosting filter	Yes
UV mapping time	10 seconds
UV mapping memory usage	101.60 MB
Blending time	34 seconds
Blending memory usage	3.54 GB
Blending GPU memory usage	2.28 GB
Date created	2024:02:13 07:26:58
Software version	1.8.0.13794
File size	41.10 MB
System	
Software name	Agisoft Metashape Professional
Software version	1.8.0 build 13794
OS	Windows 64 bit
RAM	15.73 GB
CPU	12th Gen Intel(R) Core(TM) i7-12650H
GPU(s)	NVIDIA GeForce RTX 3060 Laptop GPU