

Cup-marked stone, Zermatt-Hubelwäng, Switzerland

Image-based modeling report automatically generated by Agisoft Photoscan 1.4.1, the software package used for 3D modeling the Hubelwäng cup-marked stone.

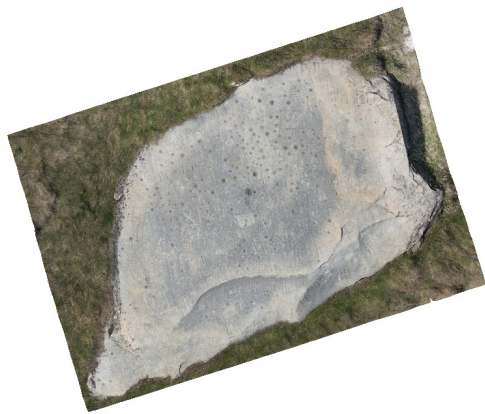
See <https://skfb.ly/6sxJT> for an online accessible model hosted on Sketchfab.

References:

J. Reinhard, Was in den Rucksack passt... In: Chr. Rinne et al. (ed.), Vom Bodenfund zum Buch - Archäologie durch die Zeiten. Festschrift für Andreas Heege. Historische Archäologie Sonderband 1 (Bonn 2017), 503-520. URL: <http://www.histarch.uni-kiel.de/sonderband01.htm>, supplemental material can be accessed via <https://doi.org/10.5281/zenodo.3373713>.

**archaeobotics
Jochen Reinhard M.A.
Ägeristrasse 65a
CH-6300 Zug
+41 79 70 50 389
jochen.reinhard@archaeobotics.ch
<http://archaeobotics.ch/>**

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Survey Data

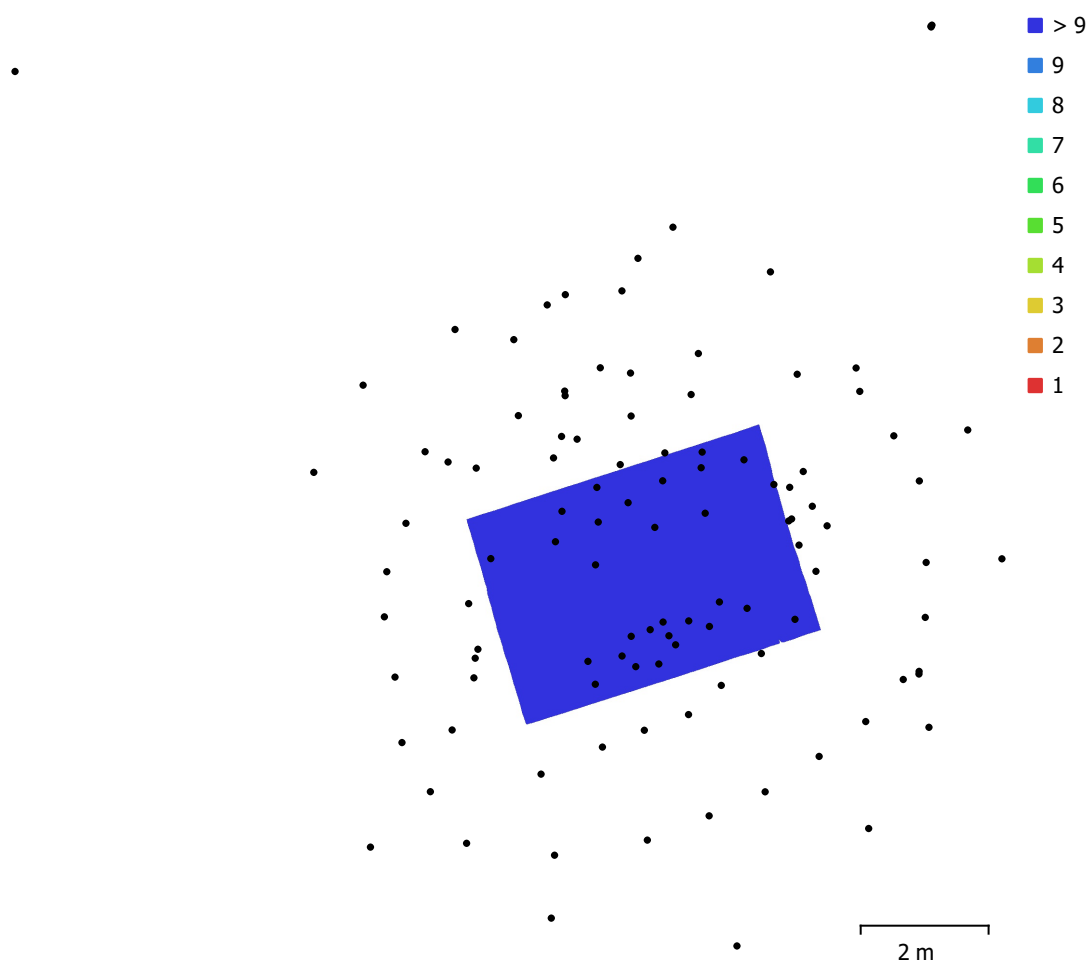


Fig. 1. Camera locations and image overlap.

Number of images:	108	Camera stations:	108
Flying altitude:	37.9 m	Tie points:	72,490
Ground resolution:	1.04 cm/pix	Projections:	176,915
Coverage area:	16.1 m ²	Reprojection error:	0.55 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
NEX-6 (16 mm)	4912 x 3264	16 mm	4.89 x 4.89 μm	No
NEX-6 (30 mm)	4912 x 3264	30 mm	4.89 x 4.89 μm	No
NEX-6 (25 mm)	4912 x 3264	25 mm	4.96 x 4.96 μm	No
Lumia 640 LTE (2.97 mm)	3264 x 1840	2.97 mm	1.11 x 1.11 μm	No

Table 1. Cameras.

Camera Calibration

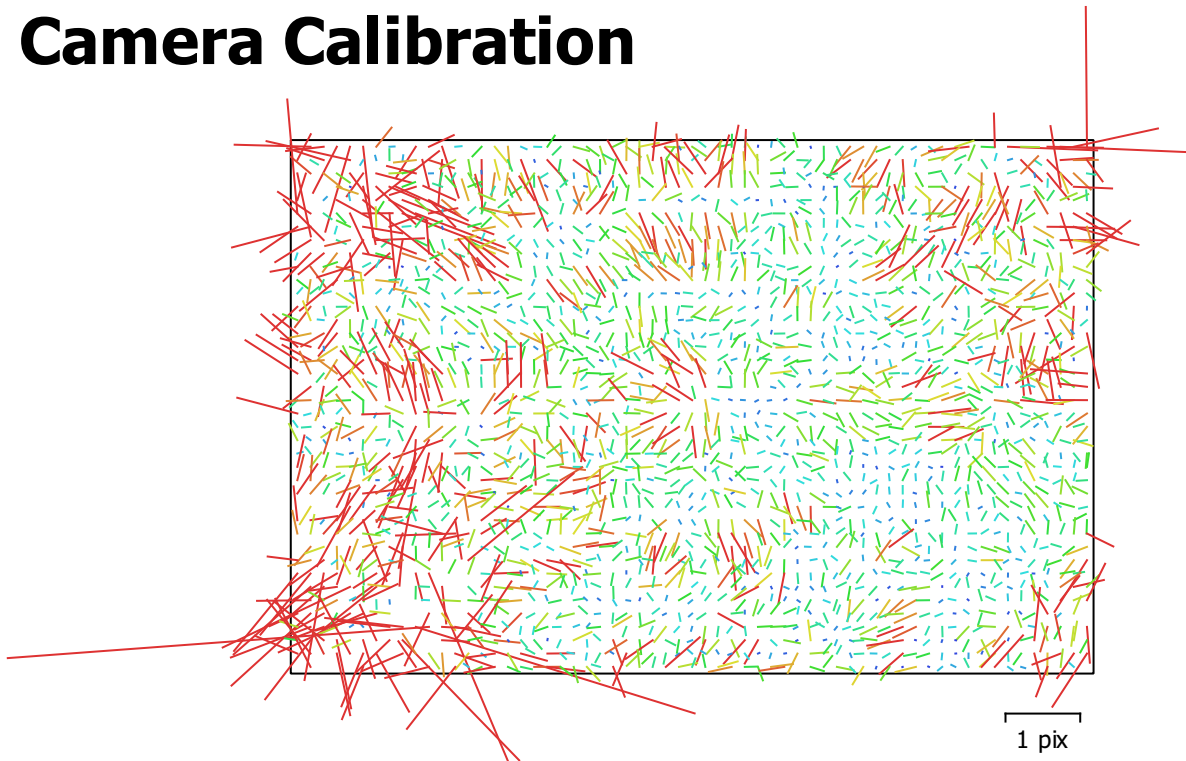


Fig. 2. Image residuals for NEX-6 (16 mm).

NEX-6 (16 mm)

21 images

Type
Frame

Resolution
4912 x 3264

Focal Length
16 mm

Pixel Size
4.89 x 4.89 μm

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	P1	P2
F	3280.85	0.25	1.00	-0.04	-0.22	-0.09	-0.07	-0.06	0.19	0.04	-0.03
Cx	-21.9604	0.34		1.00	0.00	-0.14	0.35	-0.04	0.02	0.88	-0.11
Cy	-6.24487	0.28			1.00	-0.24	-0.19	-0.09	0.06	-0.01	0.70
B1	3.30041	0.075				1.00	0.03	-0.13	0.06	-0.25	-0.15
B2	2.33427	0.085					1.00	0.06	-0.03	0.24	-0.26
K1	-0.0520034	0.00013						1.00	-0.89	-0.03	0.02
K2	0.0381073	0.00018							1.00	-0.01	-0.02
P1	-0.000831283	3.1e-005								1.00	-0.09
P2	-0.0013072	2.2e-005									1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Calibration

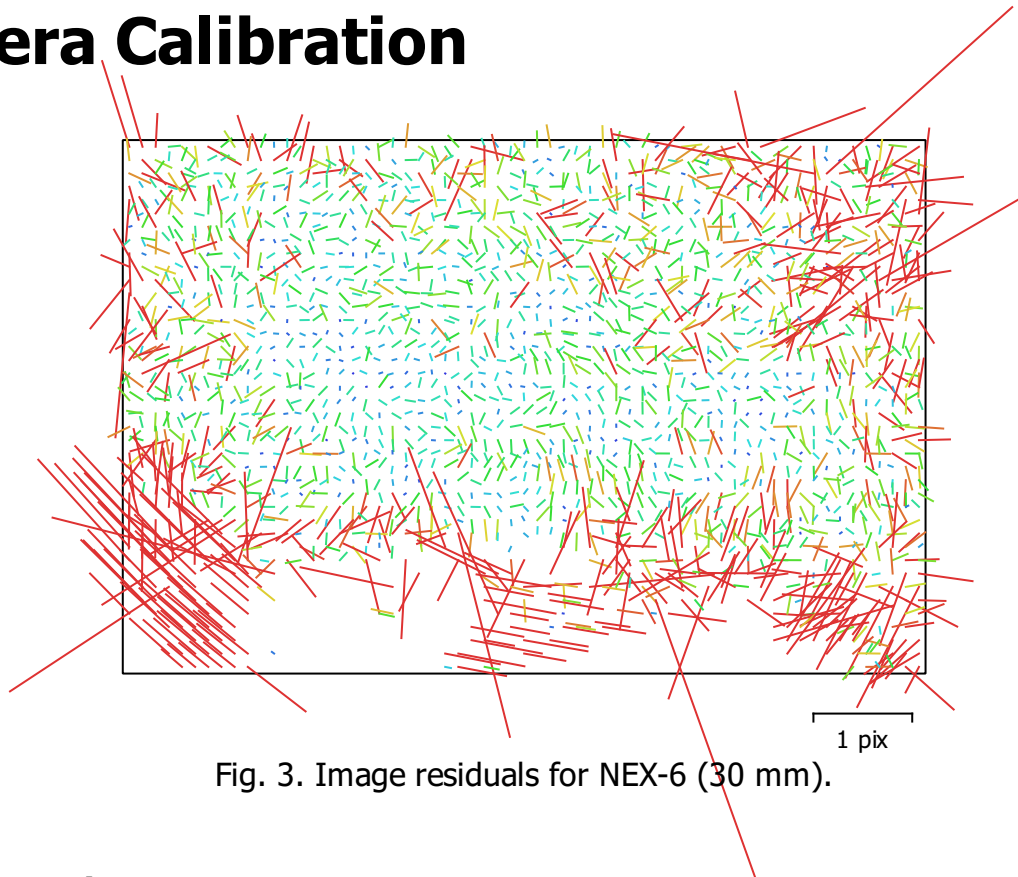


Fig. 3. Image residuals for NEX-6 (30 mm).

NEX-6 (30 mm)

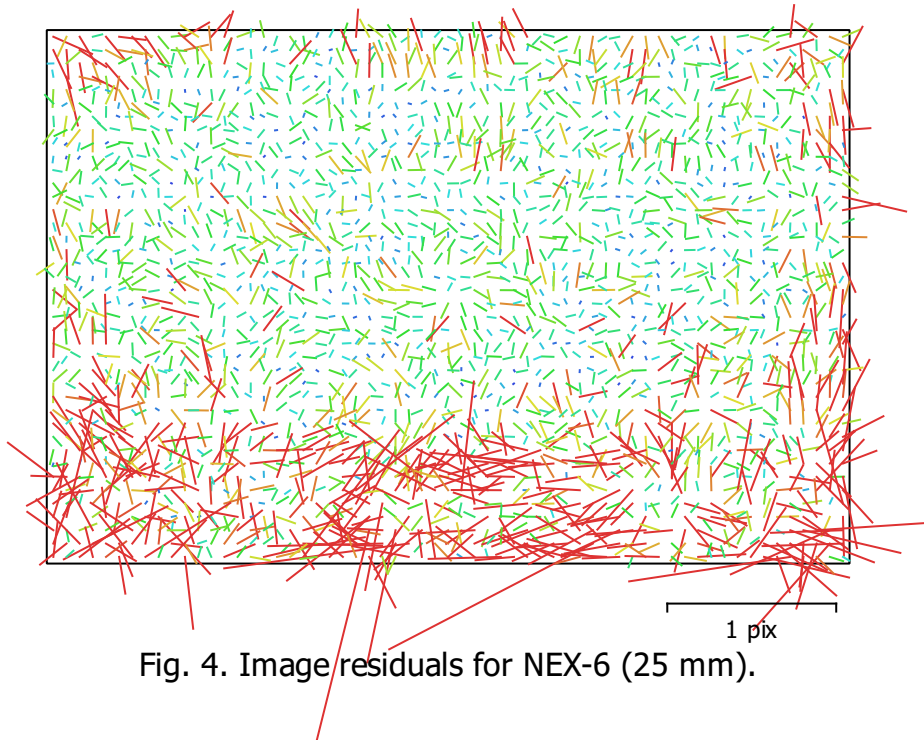
27 images

Type	Resolution	Focal Length	Pixel Size
Frame	4912 x 3264	30 mm	4.89 x 4.89 μm

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	P1	P2
F	6396.32	1	1.00	-0.08	-0.47	-0.55	0.05	-0.14	0.11	-0.12	-0.23
Cx	-11.5338	1.6		1.00	0.09	0.03	0.12	0.01	-0.04	0.96	0.11
Cy	10.6072	1.6			1.00	-0.31	0.04	-0.02	0.02	0.11	0.43
B1	2.85258	0.67				1.00	-0.10	-0.02	0.02	0.06	0.07
B2	-3.39768	0.55					1.00	0.02	0.00	-0.08	0.01
K1	0.00196168	0.00044						1.00	-0.94	0.01	-0.10
K2	-0.00108712	0.0023							1.00	-0.04	0.12
P1	-0.000861096	8.8e-005								1.00	0.10
P2	-0.000584841	4.4e-005									1.00

Table 3. Calibration coefficients and correlation matrix.

Camera Calibration



NEX-6 (25 mm)

59 images

Type	Resolution	Focal Length	Pixel Size
Frame	4912 x 3264	25 mm	4.96 x 4.96 μm

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	P1	P2
F	5228.57	0.41	1.00	-0.03	-0.38	-0.16	-0.07	0.02	0.11	-0.01	-0.16
Cx	-47.8923	0.61		1.00	0.02	-0.04	0.35	0.01	-0.02	0.91	-0.07
Cy	-10.9664	0.63			1.00	-0.60	0.00	-0.07	0.02	0.01	0.45
B1	5.07162	0.21				1.00	0.05	-0.00	0.00	-0.03	-0.06
B2	-1.84281	0.2					1.00	0.03	-0.03	0.11	-0.04
K1	-0.0102734	0.00017						1.00	-0.93	0.00	-0.02
K2	0.0263763	0.00054							1.00	-0.02	0.00
P1	-0.00308584	3.6e-005								1.00	-0.08
P2	-0.00130222	2e-005									1.00

Table 4. Calibration coefficients and correlation matrix.

Camera Calibration

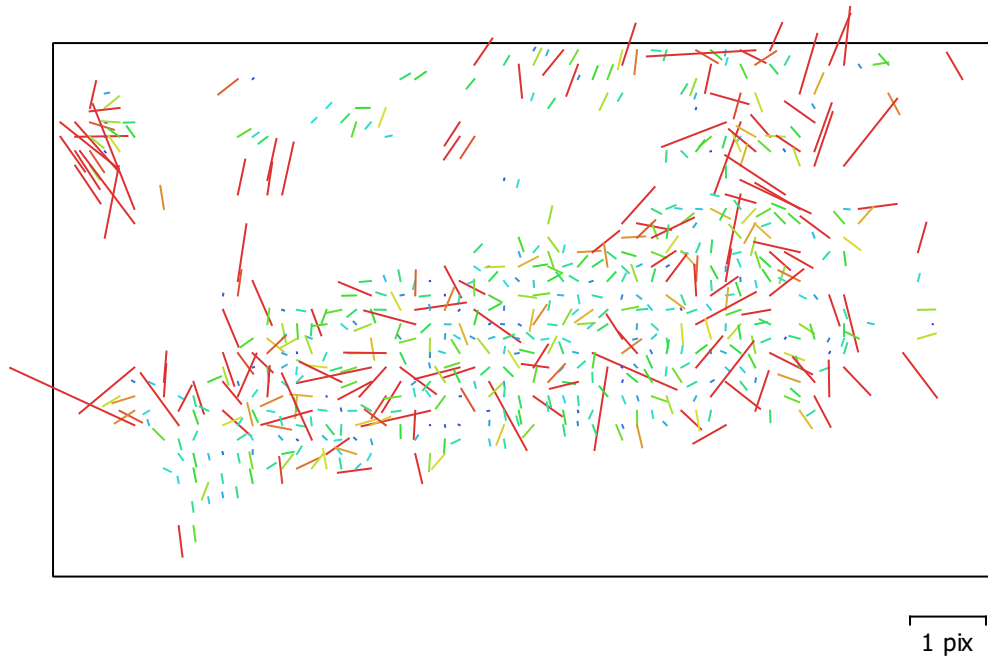


Fig. 5. Image residuals for Lumia 640 LTE (2.97 mm).

Lumia 640 LTE (2.97 mm)

1 images

Type
Frame

Resolution
3264 x 1840

Focal Length
2.97 mm

Pixel Size
1.11 x 1.11 μm

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	P1	P2
F	2655.79	2.7	1.00	0.19	-0.77	-0.74	0.48	0.24	-0.33	-0.05	-0.60
Cx	5.96116	2		1.00	0.17	-0.48	-0.06	0.07	0.01	0.88	-0.30
Cy	13.5668	4.3			1.00	0.19	-0.49	-0.30	0.45	0.35	0.51
B1	-6.80794	1.6				1.00	-0.11	-0.24	0.18	-0.35	0.56
B2	-8.93754	2.3					1.00	-0.14	0.10	-0.49	-0.08
K1	0.100982	0.0017						1.00	-0.94	0.07	-0.33
K2	-0.163683	0.0057							1.00	0.02	0.38
P1	0.000391528	0.00035								1.00	-0.19
P2	-0.000482082	0.00018									1.00

Table 5. Calibration coefficients and correlation matrix.

Scale Bars

Label	Distance (m)	Error (m)
point 1_point 2	0.121174	-0.00282601
point 2_point 3	0.0580396	-0.0034604
point 3_point 4	0.120787	-0.00321258
point 1_point 4	0.058283	-0.00321697
point 6_point 7	0.565976	0.00197645
Total		0.00298451

Table 6. Check scale bars.

Digital Elevation Model

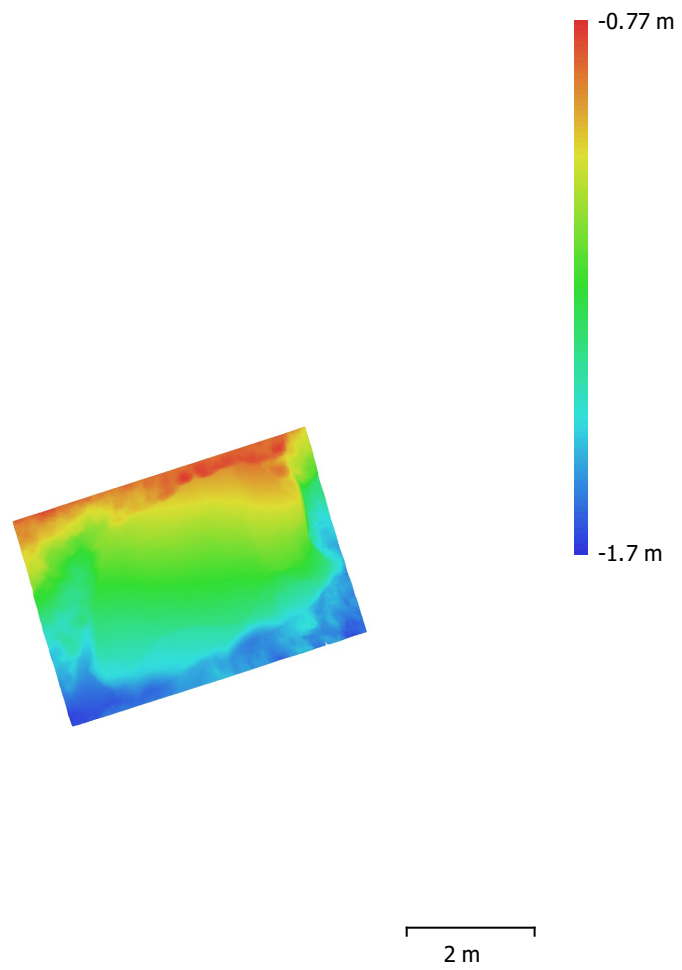


Fig. 6. Reconstructed digital elevation model.

Resolution: unknown
Point density: unknown

Processing Parameters

General

Cameras	108
Aligned cameras	108
Markers	7
Scale bars	5

Shapes

Polylines	835
Polygons	66100
Coordinate system	Local Coordinates (m)
Rotation angles	Yaw, Pitch, Roll

Point Cloud

Points	72,490 of 83,514
RMS reprojection error	0.226491 (0.549572 pix)
Max reprojection error	1.48574 (16.2155 pix)
Mean key point size	2.3696 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	2.52576

Alignment parameters

Accuracy	Highest
Generic preselection	Yes
Key point limit	40,000
Tie point limit	4,000
Filter points by mask	Yes
Adaptive camera model fitting	Yes
Matching time	8 minutes 52 seconds
Alignment time	53 seconds

Optimization parameters

Parameters	f, b1, b2, cx, cy, k1, k2, p1, p2
Optimization time	1 seconds

Dense Point Cloud

Points	30,743,150
Point colors	3 bands, uint8

Depth maps generation parameters

Quality	High
Filtering mode	Aggressive
Processing time	46 minutes 41 seconds

Dense cloud generation parameters

Processing time	1 hours 56 minutes
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Model

Faces	4,777,721
Vertices	2,393,272
Vertex colors	3 bands, uint8
Texture	5,000 x 5,000, 4 bands, uint8

Depth maps generation parameters

Quality	High
Filtering mode	Aggressive

Reconstruction parameters

Surface type	Arbitrary
Source data	Dense cloud

General

Interpolation	Enabled
Processing time	12 minutes 7 seconds

Texturing parameters

Blending mode	Average
Texture size	5,000
Enable color correction	No
Enable hole filling	No
UV mapping time	1 minutes 11 seconds
Blending time	1 minutes 32 seconds

DEM

Size	6,173 x 5,031
Coordinate system	Local Coordinates (m)

Reconstruction parameters

Source data	Dense cloud
Interpolation	Enabled
Processing time	9 seconds

Orthomosaic

Size	11,774 x 9,982
Coordinate system	Local Coordinates (m)
Colors	3 bands, uint8

Reconstruction parameters

Blending mode	Mosaic
Surface	DEM
Enable color correction	No
Enable hole filling	Yes
Processing time	6 minutes 5 seconds

Software

Version	1.5.4 build 8885
Platform	Windows 64