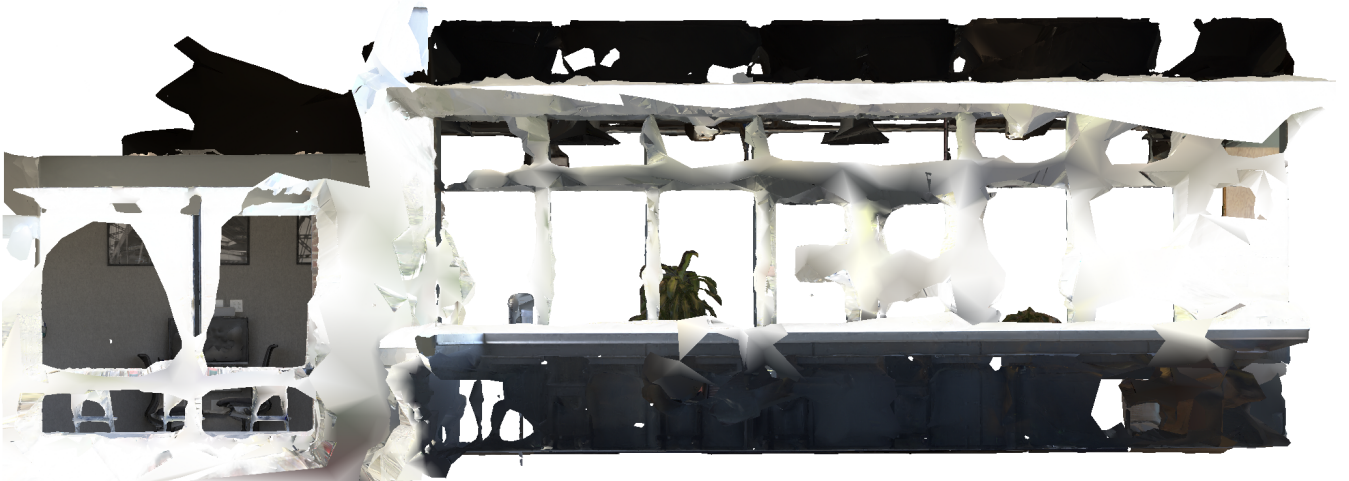


# Agisoft Metashape

Processing Report

24 August 2023



# Survey Data

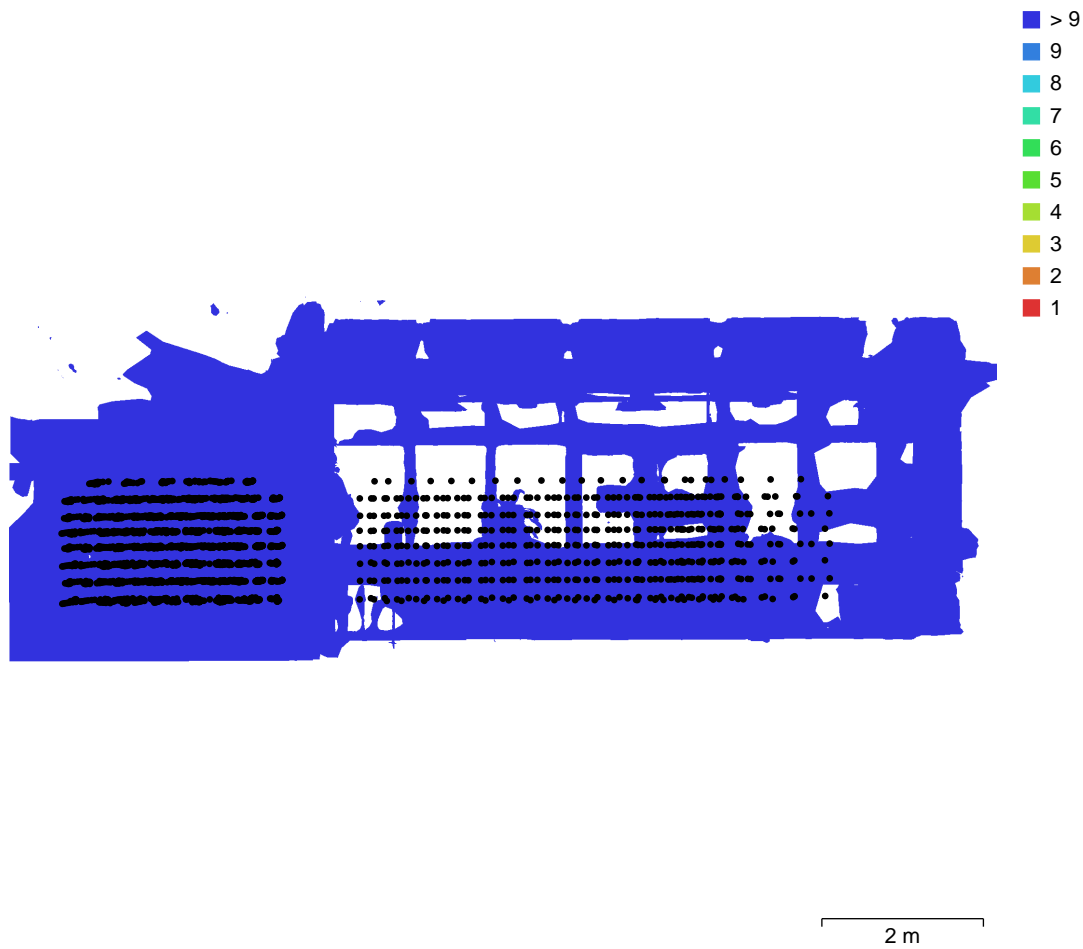


Fig. 1. Camera locations and image overlap.

Number of images:	2,772	Camera stations:	2,772
Flying altitude:	82.5 cm	Tie points:	3,489,696
Ground resolution:	0.408 mm/pix	Projections:	9,994,962
Coverage area:	38.7 m <sup>2</sup>	Reprojection error:	1.01 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
Camera 0	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 1	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 2	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 3	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 4	5784 x 8660	12 mm	4.17 x 4.17 um	No

<b>Camera Model</b>	<b>Resolution</b>	<b>Focal Length</b>	<b>Pixel Size</b>	<b>Precalibrated</b>
Camera 5	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 6	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 7	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 8	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 9	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 10	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 11	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 12	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 13	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 14	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 15	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 16	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 17	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 18	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 19	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 20	5784 x 8660	12 mm	4.17 x 4.17 um	No
Camera 21	5784 x 8660	12 mm	4.17 x 4.17 um	No

Table 1. Cameras.

# Camera Calibration

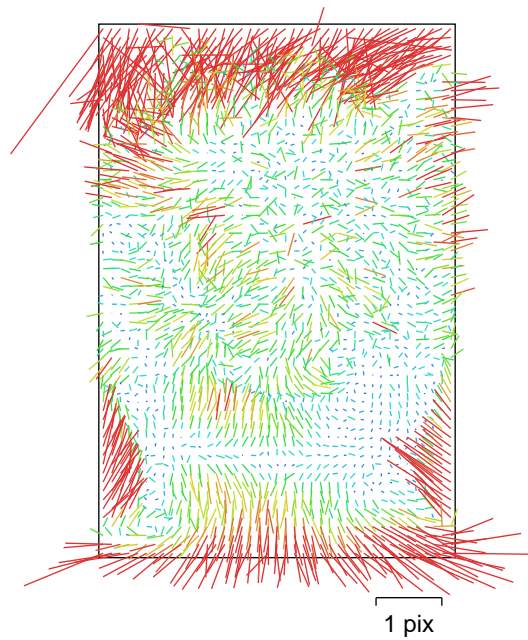


Fig. 2. Image residuals for Camera 0.

## Camera 0

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2956.13</b>	0.026	1.00	0.02	-0.06	-0.85	0.77	-0.68	-0.03	0.16
<b>Cx</b>	<b>-16.2691</b>	0.028		1.00	-0.19	0.06	-0.04	0.03	0.84	-0.11
<b>Cy</b>	<b>-21.6455</b>	0.032			1.00	-0.04	0.01	-0.00	-0.18	0.78
<b>K1</b>	<b>-0.0343346</b>	1.9e-05				1.00	-0.96	0.90	0.09	-0.14
<b>K2</b>	<b>0.00811438</b>	1.4e-05					1.00	-0.98	-0.07	0.05
<b>K3</b>	<b>-0.000558108</b>	3.2e-06						1.00	0.07	-0.01
<b>P1</b>	<b>0.000365184</b>	2.7e-06							1.00	-0.11
<b>P2</b>	<b>-0.000584115</b>	3.3e-06								1.00

Table 2. Calibration coefficients and correlation matrix.

# Camera Calibration

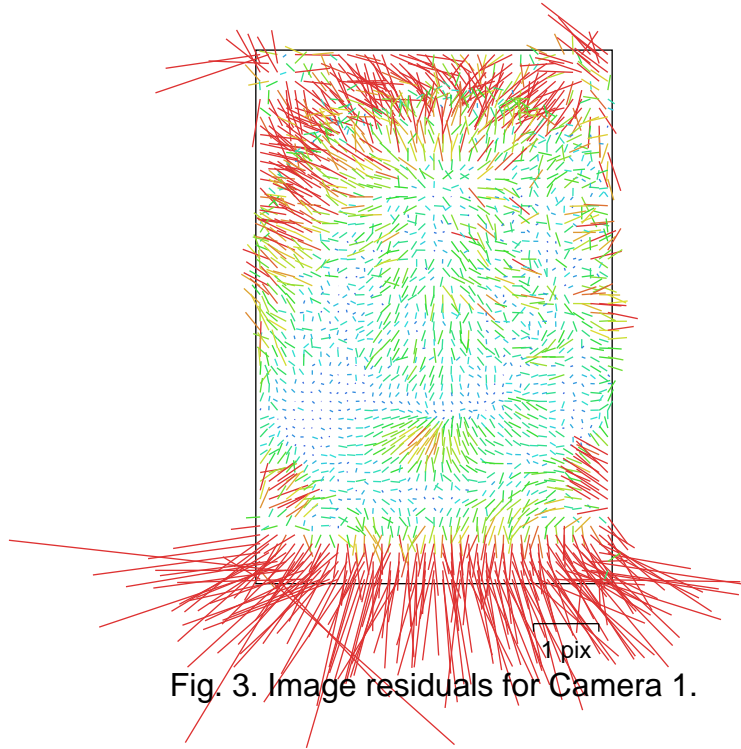


Fig. 3. Image residuals for Camera 1.

## Camera 1

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2956.69</b>	0.025	1.00	-0.01	-0.04	-0.80	0.76	-0.67	-0.07	0.16
<b>Cx</b>	<b>9.50062</b>	0.028		1.00	0.05	0.01	0.01	-0.02	0.83	0.08
<b>Cy</b>	<b>28.1571</b>	0.037			1.00	-0.12	0.08	-0.08	0.04	0.84
<b>K1</b>	<b>-0.0290951</b>	2.2e-05				1.00	-0.95	0.89	0.05	-0.13
<b>K2</b>	<b>0.00355283</b>	1.9e-05					1.00	-0.98	-0.03	0.11
<b>K3</b>	<b>0.000679091</b>	4.6e-06						1.00	0.00	-0.09
<b>P1</b>	<b>-0.000527744</b>	2.8e-06							1.00	0.05
<b>P2</b>	<b>-0.000410054</b>	3.8e-06								1.00

Table 3. Calibration coefficients and correlation matrix.

# Camera Calibration

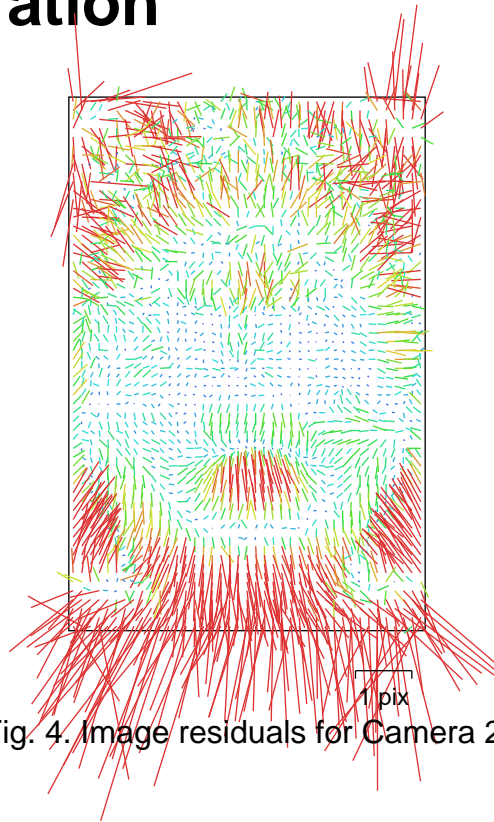


Fig. 4. Image residuals for Camera 2.

## Camera 2

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2958.46</b>	0.02	1.00	-0.00	-0.20	-0.70	0.66	-0.56	0.01	0.07
<b>Cx</b>	<b>-17.021</b>	0.024		1.00	0.03	0.01	-0.01	0.02	0.84	0.04
<b>Cy</b>	<b>51.6256</b>	0.028			1.00	-0.02	-0.04	0.04	0.02	0.78
<b>K1</b>	<b>-0.031417</b>	1.5e-05				1.00	-0.95	0.87	-0.02	-0.07
<b>K2</b>	<b>0.00439263</b>	1.4e-05					1.00	-0.97	0.01	-0.01
<b>K3</b>	<b>0.000432818</b>	3.6e-06						1.00	0.00	0.03
<b>P1</b>	<b>-0.00100031</b>	2.3e-06							1.00	0.03
<b>P2</b>	<b>-0.000106309</b>	2.6e-06								1.00

Table 4. Calibration coefficients and correlation matrix.

# Camera Calibration

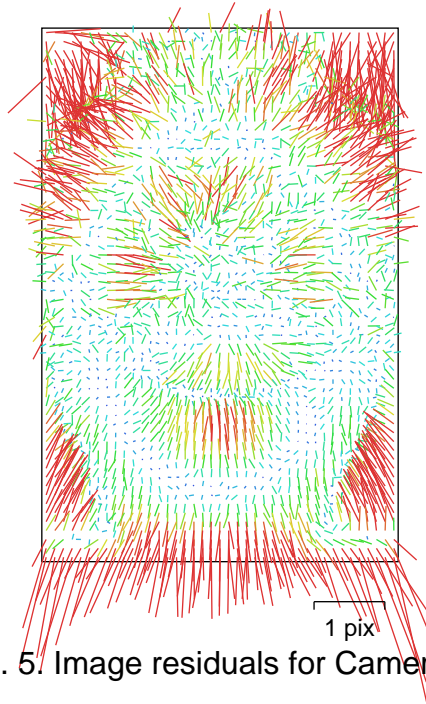


Fig. 5. Image residuals for Camera 3.

## Camera 3

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2973.66</b>	0.019	1.00	-0.03	-0.12	-0.78	0.72	-0.65	0.00	0.12
<b>Cx</b>	<b>-11.3892</b>	0.018		1.00	0.03	-0.01	0.00	-0.01	0.78	0.01
<b>Cy</b>	<b>-20.5501</b>	0.022			1.00	-0.00	-0.02	0.02	0.04	0.76
<b>K1</b>	<b>-0.0355049</b>	1.2e-05				1.00	-0.96	0.90	-0.02	-0.11
<b>K2</b>	<b>0.00918811</b>	8.9e-06					1.00	-0.98	0.02	0.03
<b>K3</b>	<b>-0.000665193</b>	2e-06						1.00	-0.01	-0.01
<b>P1</b>	<b>0.000465407</b>	1.6e-06							1.00	0.02
<b>P2</b>	<b>-0.000156852</b>	2.1e-06								1.00

Table 5. Calibration coefficients and correlation matrix.

# Camera Calibration

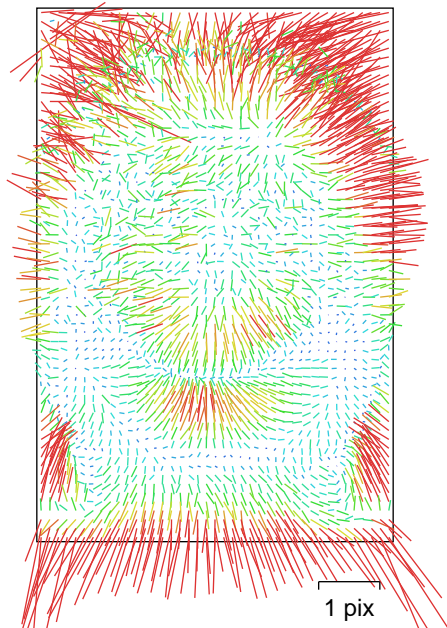


Fig. 6. Image residuals for Camera 4.

## Camera 4

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2971.47</b>	0.02	1.00	-0.01	-0.13	-0.78	0.75	-0.68	0.03	0.08
<b>Cx</b>	<b>-7.83632</b>	0.021		1.00	-0.06	-0.00	-0.01	0.01	0.83	-0.07
<b>Cy</b>	<b>-5.62458</b>	0.029			1.00	-0.04	-0.01	0.01	-0.06	0.85
<b>K1</b>	<b>-0.0326343</b>	1.4e-05				1.00	-0.96	0.91	-0.03	-0.11
<b>K2</b>	<b>0.00778881</b>	1e-05					1.00	-0.98	0.01	0.05
<b>K3</b>	<b>-0.000415862</b>	2.3e-06						1.00	-0.01	-0.03
<b>P1</b>	<b>0.00071641</b>	2e-06							1.00	-0.04
<b>P2</b>	<b>-0.000365399</b>	2.9e-06								1.00

Table 6. Calibration coefficients and correlation matrix.



# Camera Calibration

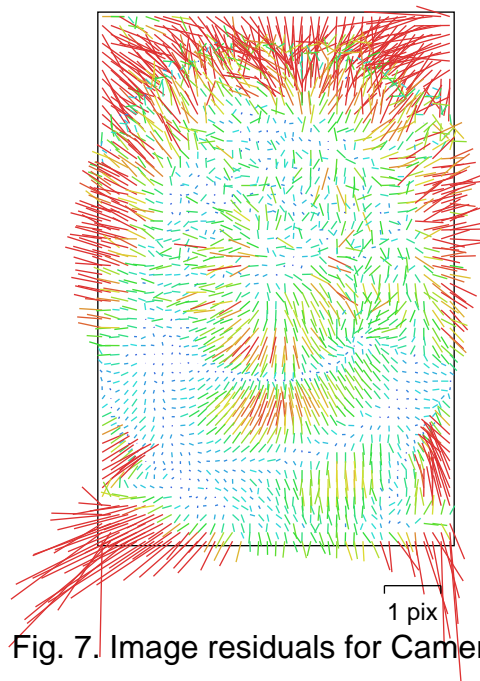


Fig. 7. Image residuals for Camera 5.

## Camera 5

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2957.36</b>	0.02	1.00	0.02	-0.05	-0.82	0.75	-0.67	0.07	0.22
<b>Cx</b>	<b>29.3175</b>	0.02		1.00	0.08	-0.07	0.05	-0.03	0.79	0.07
<b>Cy</b>	<b>50.0906</b>	0.026			1.00	-0.07	0.03	-0.03	0.10	0.83
<b>K1</b>	<b>-0.0332756</b>	1.4e-05				1.00	-0.96	0.90	-0.09	-0.20
<b>K2</b>	<b>0.00776056</b>	1e-05					1.00	-0.98	0.07	0.12
<b>K3</b>	<b>-0.000393804</b>	2.3e-06						1.00	-0.06	-0.08
<b>P1</b>	<b>-0.00078314</b>	1.9e-06							1.00	0.09
<b>P2</b>	<b>0.000162261</b>	2.6e-06								1.00

Table 7. Calibration coefficients and correlation matrix.

# Camera Calibration

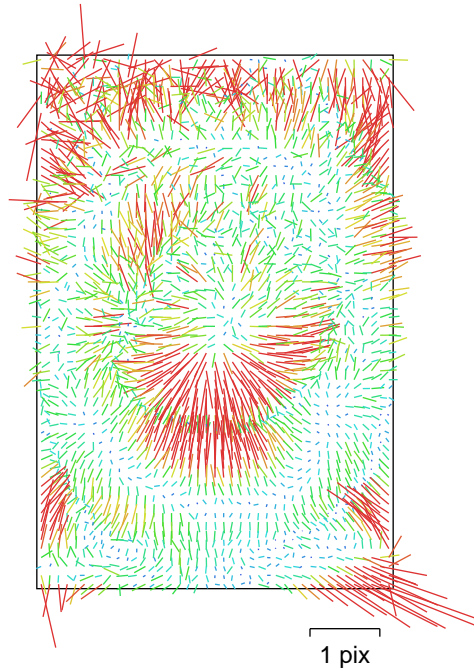


Fig. 8. Image residuals for Camera 6.

## Camera 6

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2958.73</b>	0.022	1.00	0.04	-0.12	-0.79	0.73	-0.64	0.00	0.14
<b>Cx</b>	<b>-24.2852</b>	0.021		1.00	-0.12	0.05	-0.03	0.02	0.77	-0.10
<b>Cy</b>	<b>-15.8013</b>	0.026			1.00	-0.02	-0.01	0.02	-0.15	0.80
<b>K1</b>	<b>-0.0364182</b>	1.4e-05				1.00	-0.96	0.90	0.05	-0.15
<b>K2</b>	<b>0.00962746</b>	9.8e-06					1.00	-0.98	-0.04	0.06
<b>K3</b>	<b>-0.000759044</b>	2.1e-06						1.00	0.02	-0.03
<b>P1</b>	<b>0.000339946</b>	2e-06							1.00	-0.13
<b>P2</b>	<b>0.000343318</b>	2.5e-06								1.00

Table 8. Calibration coefficients and correlation matrix.

# Camera Calibration

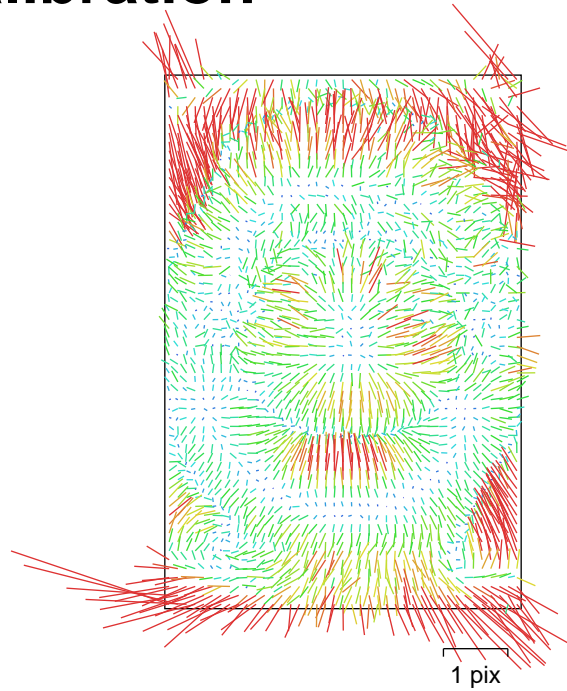


Fig. 9. Image residuals for Camera 7.

## Camera 7

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2962.16</b>	0.018	1.00	0.03	-0.17	-0.65	0.64	-0.56	0.01	0.05
<b>Cx</b>	<b>21.547</b>	0.022		1.00	0.04	-0.01	0.03	-0.04	0.84	0.08
<b>Cy</b>	<b>19.5563</b>	0.026			1.00	-0.11	0.03	-0.01	0.04	0.86
<b>K1</b>	<b>-0.0324574</b>	1.3e-05				1.00	-0.95	0.89	-0.00	-0.20
<b>K2</b>	<b>0.00683568</b>	1e-05					1.00	-0.98	0.02	0.09
<b>K3</b>	<b>-9.48886e-05</b>	2.4e-06						1.00	-0.02	-0.05
<b>P1</b>	<b>-0.000156619</b>	1.9e-06							1.00	0.05
<b>P2</b>	<b>0.00022705</b>	2.4e-06								1.00

Table 9. Calibration coefficients and correlation matrix.

# Camera Calibration

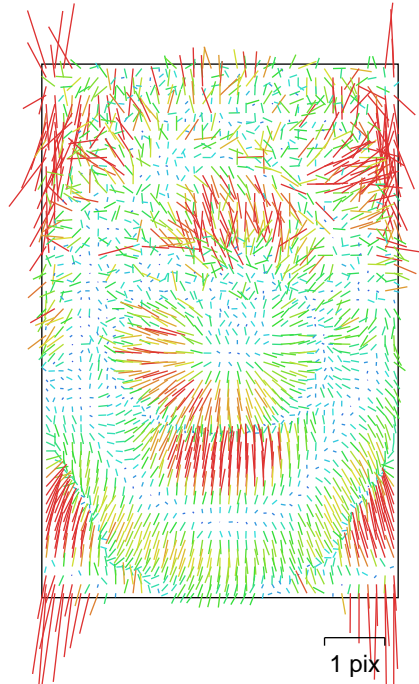


Fig. 10. Image residuals for Camera 8.

## Camera 8

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2959.69</b>	0.016	1.00	0.01	-0.18	-0.67	0.65	-0.58	0.00	0.08
<b>Cx</b>	<b>19.3801</b>	0.019		1.00	-0.02	-0.01	0.00	-0.00	0.82	-0.01
<b>Cy</b>	<b>23.5269</b>	0.02			1.00	0.00	-0.02	0.02	-0.04	0.71
<b>K1</b>	<b>-0.0357135</b>	9.8e-06				1.00	-0.95	0.88	-0.01	-0.19
<b>K2</b>	<b>0.0092082</b>	6.8e-06					1.00	-0.98	0.01	0.07
<b>K3</b>	<b>-0.000628304</b>	1.5e-06						1.00	-0.01	-0.04
<b>P1</b>	<b>-0.000687054</b>	1.7e-06							1.00	-0.03
<b>P2</b>	<b>2.48103e-05</b>	1.8e-06								1.00

Table 10. Calibration coefficients and correlation matrix.

# Camera Calibration

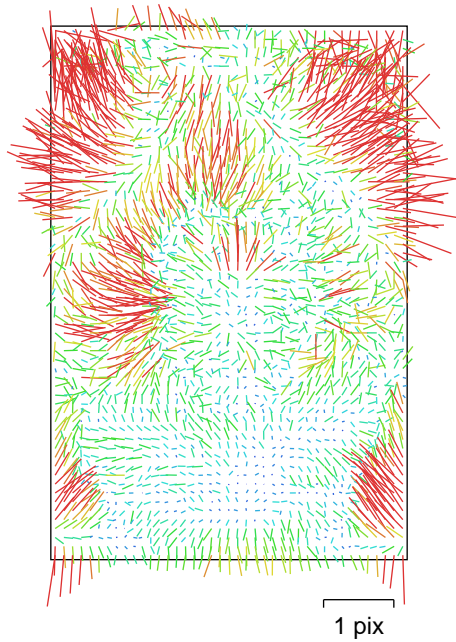


Fig. 11. Image residuals for Camera 9.

## Camera 9

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2957.33</b>	0.022	1.00	-0.03	-0.07	-0.82	0.74	-0.67	0.00	0.10
<b>Cx</b>	<b>-21.338</b>	0.015		1.00	0.03	0.01	-0.01	0.01	0.65	0.01
<b>Cy</b>	<b>-13.3648</b>	0.021			1.00	-0.01	0.04	-0.05	0.02	0.64
<b>K1</b>	<b>-0.041107</b>	1.3e-05				1.00	-0.97	0.91	-0.00	-0.05
<b>K2</b>	<b>0.0126653</b>	8.1e-06					1.00	-0.99	0.00	-0.00
<b>K3</b>	<b>-0.00129271</b>	1.6e-06						1.00	-0.00	0.01
<b>P1</b>	<b>0.00032618</b>	1.4e-06							1.00	0.01
<b>P2</b>	<b>6.5751e-05</b>	1.9e-06								1.00

Table 11. Calibration coefficients and correlation matrix.

# Camera Calibration

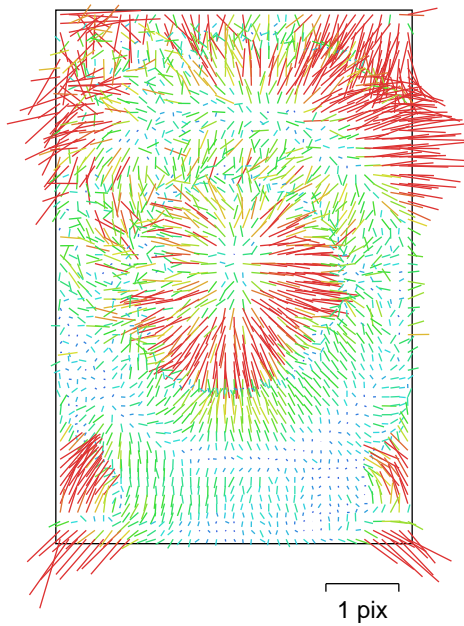


Fig. 12. Image residuals for Camera 10.

## Camera 10

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2964.91</b>	0.02	1.00	-0.03	-0.13	-0.79	0.75	-0.68	0.02	0.04
<b>Cx</b>	<b>-11.4063</b>	0.018		1.00	-0.02	0.01	-0.01	0.01	0.76	-0.05
<b>Cy</b>	<b>-16.0038</b>	0.025			1.00	-0.01	0.02	-0.01	-0.04	0.81
<b>K1</b>	<b>-0.0359526</b>	1.2e-05				1.00	-0.96	0.91	-0.03	-0.08
<b>K2</b>	<b>0.0101762</b>	8.1e-06					1.00	-0.98	0.02	0.03
<b>K3</b>	<b>-0.000834318</b>	1.7e-06						1.00	-0.01	-0.01
<b>P1</b>	<b>-7.02073e-05</b>	1.5e-06							1.00	-0.04
<b>P2</b>	<b>-0.000509836</b>	2.2e-06								1.00

Table 12. Calibration coefficients and correlation matrix.

# Camera Calibration

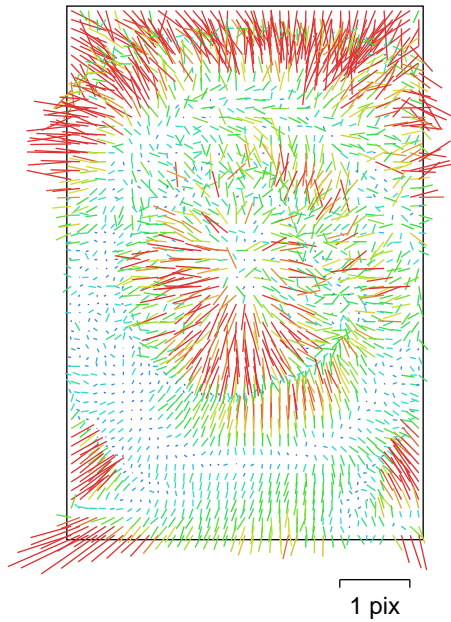


Fig. 13. Image residuals for Camera 11.

## Camera 11

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2965.67</b>	0.02	1.00	0.00	-0.05	-0.85	0.79	-0.71	0.01	0.17
<b>Cx</b>	<b>21.4512</b>	0.017		1.00	0.02	-0.04	0.03	-0.03	0.72	0.01
<b>Cy</b>	<b>25.458</b>	0.023			1.00	-0.01	0.01	0.00	0.05	0.77
<b>K1</b>	<b>-0.0370664</b>	1.3e-05				1.00	-0.97	0.92	-0.04	-0.12
<b>K2</b>	<b>0.0105135</b>	8.3e-06					1.00	-0.98	0.03	0.06
<b>K3</b>	<b>-0.000896669</b>	1.7e-06						1.00	-0.03	-0.03
<b>P1</b>	<b>-0.00047334</b>	1.5e-06							1.00	0.03
<b>P2</b>	<b>-0.000267896</b>	2.1e-06								1.00

Table 13. Calibration coefficients and correlation matrix.

# Camera Calibration

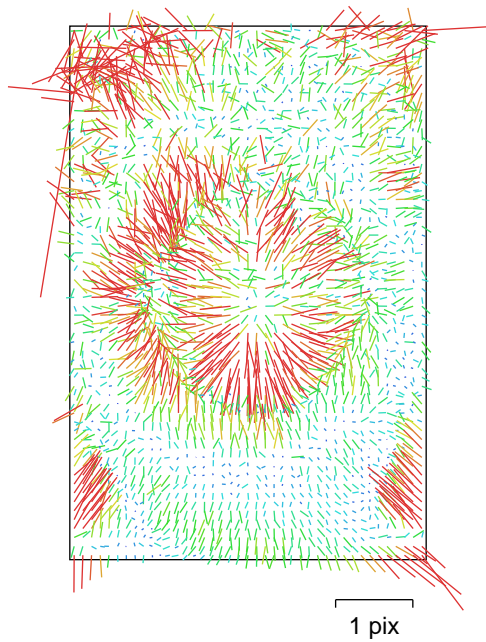


Fig. 14. Image residuals for Camera 12.

## Camera 12

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2958.63</b>	0.024	1.00	0.07	-0.06	-0.83	0.77	-0.69	0.05	0.10
<b>Cx</b>	<b>-17.3905</b>	0.019		1.00	-0.06	0.01	-0.00	0.01	0.70	-0.03
<b>Cy</b>	<b>-11.9953</b>	0.024			1.00	0.00	0.01	-0.01	-0.08	0.73
<b>K1</b>	<b>-0.0382137</b>	1.4e-05				1.00	-0.97	0.92	-0.01	-0.06
<b>K2</b>	<b>0.0113412</b>	9.1e-06					1.00	-0.99	0.01	0.01
<b>K3</b>	<b>-0.00107379</b>	1.8e-06						1.00	-0.01	0.01
<b>P1</b>	<b>0.000243997</b>	1.7e-06							1.00	-0.04
<b>P2</b>	<b>-0.000115513</b>	2.2e-06								1.00

Table 14. Calibration coefficients and correlation matrix.



# Camera Calibration

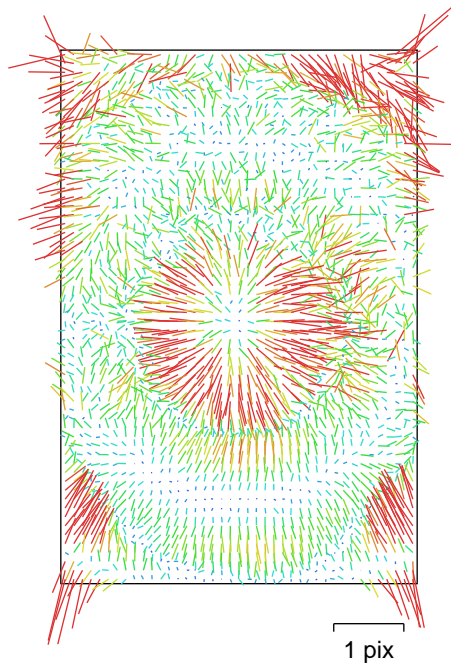


Fig. 15. Image residuals for Camera 13.

## Camera 13

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2948.73</b>	0.02	1.00	-0.00	-0.06	-0.80	0.74	-0.67	-0.05	0.09
<b>Cx</b>	<b>10.4866</b>	0.017		1.00	-0.01	-0.00	0.01	-0.01	0.73	0.00
<b>Cy</b>	<b>21.123</b>	0.025			1.00	-0.01	0.02	-0.01	0.01	0.81
<b>K1</b>	<b>-0.0372097</b>	1.3e-05				1.00	-0.96	0.91	0.03	-0.06
<b>K2</b>	<b>0.0103174</b>	8.8e-06					1.00	-0.98	-0.02	0.02
<b>K3</b>	<b>-0.000828114</b>	1.8e-06						1.00	0.01	-0.00
<b>P1</b>	<b>-0.000132722</b>	1.5e-06							1.00	-0.01
<b>P2</b>	<b>0.000103221</b>	2.2e-06								1.00

Table 15. Calibration coefficients and correlation matrix.

# Camera Calibration

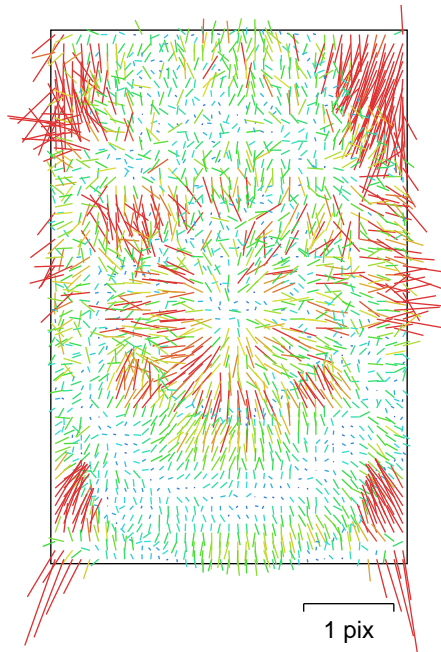


Fig. 16. Image residuals for Camera 14.

## Camera 14

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2965.64</b>	0.021	1.00	0.01	-0.03	-0.82	0.75	-0.68	0.01	0.19
<b>Cx</b>	<b>10.6275</b>	0.014		1.00	0.00	0.00	0.00	-0.01	0.60	-0.02
<b>Cy</b>	<b>44.713</b>	0.021			1.00	-0.02	0.03	-0.03	-0.00	0.69
<b>K1</b>	<b>-0.0393555</b>	1.2e-05				1.00	-0.97	0.92	-0.01	-0.11
<b>K2</b>	<b>0.0120018</b>	7.8e-06					1.00	-0.99	0.01	0.06
<b>K3</b>	<b>-0.00113278</b>	1.5e-06						1.00	-0.00	-0.04
<b>P1</b>	<b>-0.000301121</b>	1.3e-06							1.00	-0.02
<b>P2</b>	<b>0.000268341</b>	1.9e-06								1.00

Table 16. Calibration coefficients and correlation matrix.

# Camera Calibration

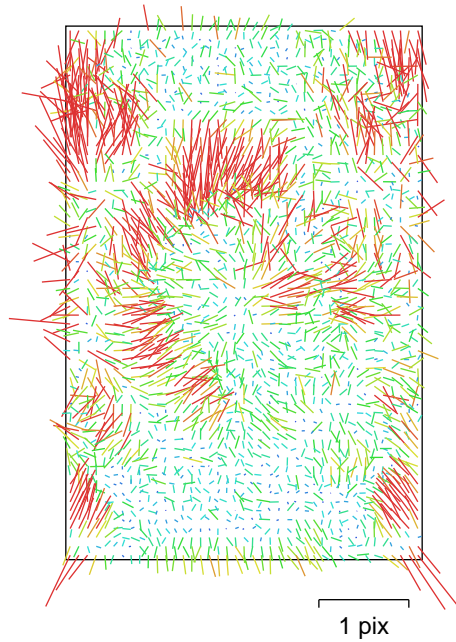


Fig. 17. Image residuals for Camera 15.

## Camera 15

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2967.02</b>	0.025	1.00	-0.01	-0.03	-0.82	0.74	-0.67	0.02	0.09
<b>Cx</b>	<b>-7.41724</b>	0.015		1.00	0.01	0.00	0.00	-0.00	0.55	-0.01
<b>Cy</b>	<b>-23.778</b>	0.022			1.00	-0.02	0.04	-0.03	-0.00	0.67
<b>K1</b>	<b>-0.040364</b>	1.4e-05				1.00	-0.97	0.92	-0.01	-0.04
<b>K2</b>	<b>0.0126939</b>	9.1e-06					1.00	-0.99	0.01	0.01
<b>K3</b>	<b>-0.00128065</b>	1.8e-06						1.00	-0.00	0.01
<b>P1</b>	<b>0.000578566</b>	1.4e-06							1.00	0.00
<b>P2</b>	<b>-0.000168748</b>	2.1e-06								1.00

Table 17. Calibration coefficients and correlation matrix.

# Camera Calibration

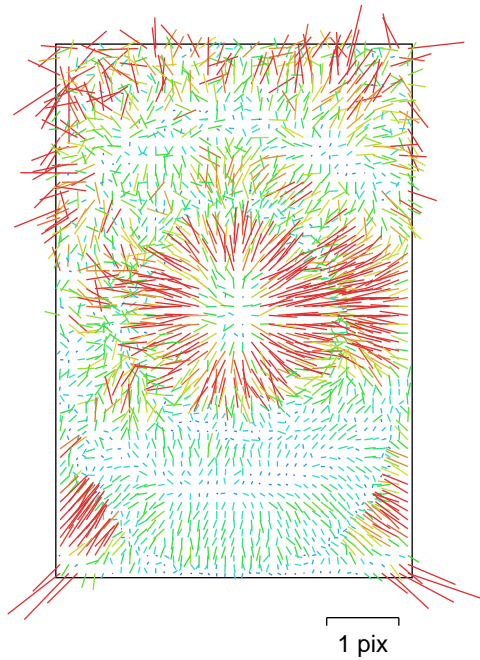


Fig. 18. Image residuals for Camera 16.

## Camera 16

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2952.2</b>	0.026	1.00	-0.05	-0.04	-0.82	0.77	-0.70	0.03	0.03
<b>Cx</b>	<b>-8.4105</b>	0.02		1.00	0.02	0.01	-0.01	0.01	0.71	0.01
<b>Cy</b>	<b>-14.8424</b>	0.027			1.00	0.01	0.02	-0.01	0.00	0.73
<b>K1</b>	<b>-0.0383076</b>	1.5e-05				1.00	-0.97	0.92	-0.04	-0.01
<b>K2</b>	<b>0.0108191</b>	9.8e-06					1.00	-0.99	0.02	-0.03
<b>K3</b>	<b>-0.00096471</b>	1.9e-06						1.00	-0.01	0.05
<b>P1</b>	<b>0.000213836</b>	1.7e-06							1.00	0.05
<b>P2</b>	<b>-0.000214236</b>	2.4e-06								1.00

Table 18. Calibration coefficients and correlation matrix.

# Camera Calibration

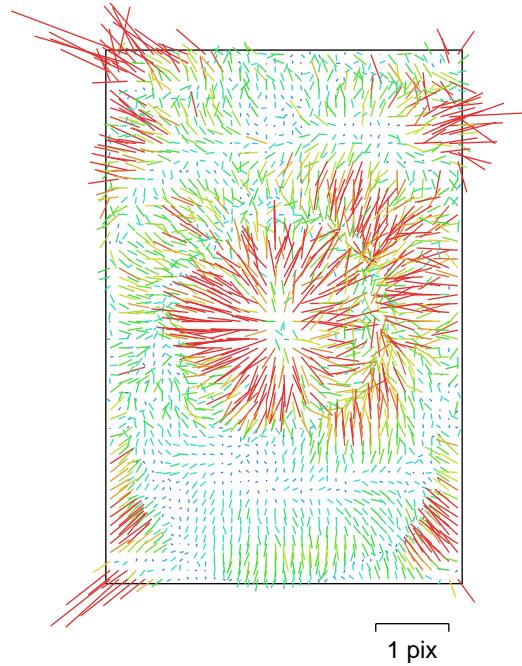


Fig. 19. Image residuals for Camera 17.

## Camera 17

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2961.27</b>	0.024	1.00	-0.03	-0.00	-0.87	0.81	-0.73	-0.05	0.11
<b>Cx</b>	<b>18.1673</b>	0.017		1.00	-0.02	-0.01	0.01	-0.02	0.68	-0.08
<b>Cy</b>	<b>38.6755</b>	0.024			1.00	0.01	0.02	-0.01	0.01	0.72
<b>K1</b>	<b>-0.0387111</b>	1.4e-05				1.00	-0.97	0.93	0.02	-0.04
<b>K2</b>	<b>0.0115951</b>	9.2e-06					1.00	-0.99	-0.00	-0.00
<b>K3</b>	<b>-0.00106938</b>	1.8e-06						1.00	0.00	0.02
<b>P1</b>	<b>-0.000189448</b>	1.6e-06							1.00	-0.07
<b>P2</b>	<b>0.000303946</b>	2.1e-06								1.00

Table 19. Calibration coefficients and correlation matrix.

# Camera Calibration

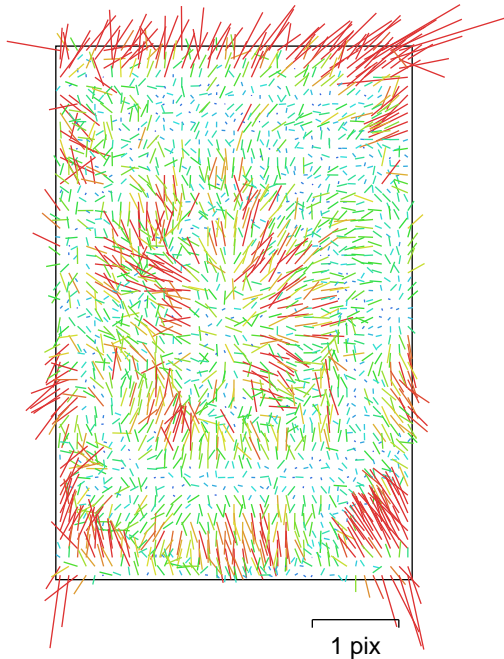


Fig. 20. Image residuals for Camera 18.

## Camera 18

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2960.51</b>	0.031	1.00	0.03	0.10	-0.83	0.77	-0.70	0.00	-0.01
<b>Cx</b>	<b>-19.0385</b>	0.022		1.00	0.00	0.06	-0.06	0.06	0.56	0.08
<b>Cy</b>	<b>-31.2247</b>	0.029			1.00	-0.02	0.06	-0.05	-0.00	0.73
<b>K1</b>	<b>-0.0382072</b>	1.9e-05				1.00	-0.97	0.92	0.04	0.04
<b>K2</b>	<b>0.0111006</b>	1.3e-05					1.00	-0.98	-0.05	-0.05
<b>K3</b>	<b>-0.000981635</b>	2.6e-06						1.00	0.05	0.04
<b>P1</b>	<b>8.92664e-05</b>	2.2e-06							1.00	0.11
<b>P2</b>	<b>-0.000141121</b>	2.9e-06								1.00

Table 20. Calibration coefficients and correlation matrix.

# Camera Calibration

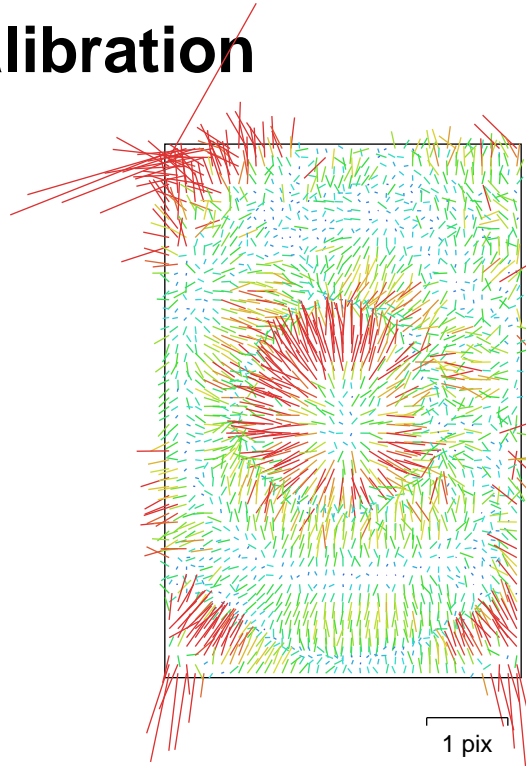


Fig. 21. Image residuals for Camera 19.

## Camera 19

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2958.21</b>	0.023	1.00	0.06	0.13	-0.77	0.73	-0.66	-0.02	0.04
<b>Cx</b>	<b>21.1406</b>	0.017		1.00	0.01	-0.02	0.04	-0.04	0.65	-0.01
<b>Cy</b>	<b>24.449</b>	0.028			1.00	-0.01	0.05	-0.04	0.00	0.80
<b>K1</b>	<b>-0.0370386</b>	1.5e-05				1.00	-0.96	0.91	0.02	0.04
<b>K2</b>	<b>0.0106265</b>	1e-05					1.00	-0.98	0.00	-0.04
<b>K3</b>	<b>-0.000857089</b>	2.2e-06						1.00	-0.01	0.05
<b>P1</b>	<b>-0.000216989</b>	1.5e-06							1.00	-0.02
<b>P2</b>	<b>0.000113463</b>	2.5e-06								1.00

Table 21. Calibration coefficients and correlation matrix.

# Camera Calibration

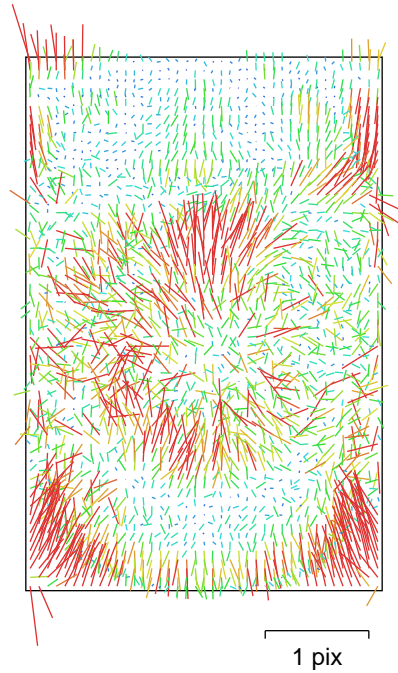


Fig. 22. Image residuals for Camera 20.

## Camera 20

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2957.49</b>	0.027	1.00	0.00	0.07	-0.84	0.78	-0.71	-0.01	-0.02
<b>Cx</b>	<b>18.008</b>	0.015		1.00	0.01	0.01	-0.01	0.01	0.54	0.00
<b>Cy</b>	<b>24.9345</b>	0.028			1.00	0.01	0.03	-0.03	0.02	0.76
<b>K1</b>	<b>-0.0388802</b>	1.6e-05				1.00	-0.97	0.92	0.01	0.05
<b>K2</b>	<b>0.0117332</b>	9.8e-06					1.00	-0.99	-0.01	-0.03
<b>K3</b>	<b>-0.00112615</b>	1.9e-06						1.00	0.01	0.04
<b>P1</b>	<b>0.000144194</b>	2e-06							1.00	0.01
<b>P2</b>	<b>0.000675093</b>	2.6e-06								1.00

Table 22. Calibration coefficients and correlation matrix.



# Camera Calibration

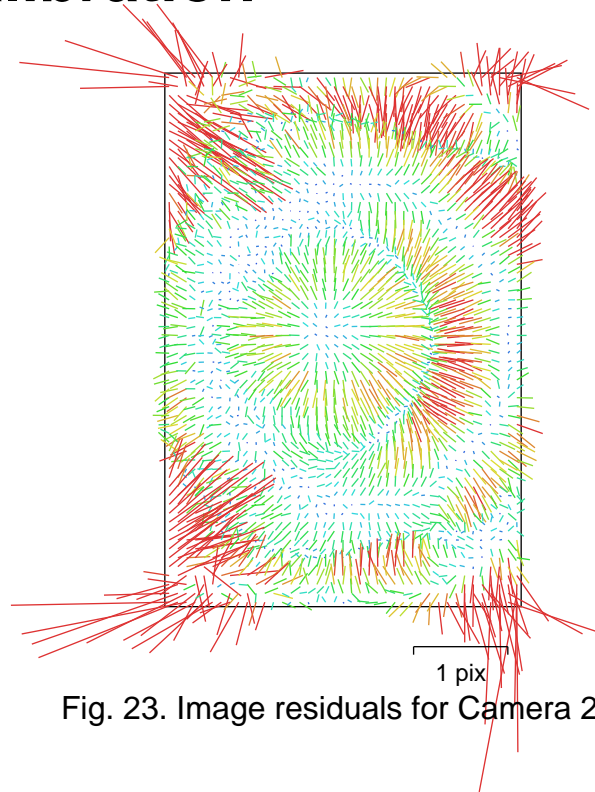


Fig. 23. Image residuals for Camera 21.

## Camera 21

126 images

Type	Resolution	Focal Length	Pixel Size
Frame	<b>5784 x 8660</b>	<b>12 mm</b>	<b>4.17 x 4.17 um</b>

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2962.63</b>	0.039	1.00	-0.57	-0.27	-0.28	0.24	-0.17	-0.02	-0.02
<b>Cx</b>	<b>-14.5499</b>	0.027		1.00	0.18	0.01	-0.01	-0.01	0.10	0.01
<b>Cy</b>	<b>-27.8658</b>	0.024			1.00	0.01	0.01	-0.02	-0.03	0.51
<b>K1</b>	<b>-0.0359484</b>	8.4e-06				1.00	-0.95	0.89	-0.16	-0.00
<b>K2</b>	<b>0.00845297</b>	6.6e-06					1.00	-0.98	0.04	-0.00
<b>K3</b>	<b>-0.000322213</b>	1.6e-06						1.00	-0.02	-0.00
<b>P1</b>	<b>0.00033226</b>	1e-06							1.00	-0.01
<b>P2</b>	<b>-0.000109802</b>	1.5e-06								1.00

Table 23. Calibration coefficients and correlation matrix.

# Scale Bars

<b>Label</b>	<b>Distance (m)</b>	<b>Error (m)</b>
003. 7-8	0.250101	4.11628e-05
006. 15-16	0.250306	0.000275633
009. 23-24	0.250131	1.05126e-05
002a. 4-5	0.24979	-0.000210388
002b. 5-6	0.249773	-0.000126665
005a. 12-13	0.250049	6.94363e-05
005b. 13-14	0.249899	8.85811e-06
008a. 20-21	0.249995	-3.48413e-05
008b. 21-22	0.249838	-4.18006e-05
<b>Total</b>		<b>0.000127343</b>

Table 24. Control scale bars.

# Digital Elevation Model



Fig. 24. Reconstructed digital elevation model.

Resolution: 5.83 mm/pix  
Point density: 2.94 points/cm<sup>2</sup>

# Processing Parameters

## General

Cameras	2772
Aligned cameras	2772
Markers	15
Scale bars	9
Coordinate system	Local Coordinates (m)
Rotation angles	Yaw, Pitch, Roll

## Tie Points

Points	3,489,696 of 5,821,581
RMS reprojection error	0.342296 (1.01494 pix)
Max reprojection error	1.27298 (12.038 pix)
Mean key point size	2.85103 pix
Point colors	3 bands, uint8
Key points	13.14 GB
Average tie point multiplicity	4.62779

## Alignment parameters

Accuracy	Highest
Generic preselection	Yes
Reference preselection	Estimated
Key point limit	60,000
Key point limit per Mpx	1,000
Tie point limit	0
Exclude stationary tie points	Yes
Guided image matching	No
Adaptive camera model fitting	No
Matching time	1 hours 3 minutes
Matching memory usage	4.51 GB
Alignment time	29 minutes 11 seconds
Alignment memory usage	39.75 GB

## Optimization parameters

Parameters	f, cx, cy, k1-k3, p1, p2
Adaptive camera model fitting	No
Optimization time	35 seconds
Date created	2023:08:24 00:57:44
Software version	2.0.2.16404
File size	610.81 MB

## Depth Maps

Count	2771
-------	------

## Depth maps generation parameters

Quality	Medium
Filtering mode	Mild
Max neighbors	16
Processing time	1 hours 5 minutes
Memory usage	5.91 GB
Date created	2023:08:24 03:08:21
Software version	2.0.2.16404
File size	9.26 GB

## Point Cloud

Points	160,089,868
--------	-------------

## Point attributes

Color	3 bands, uint8
-------	----------------

Normal

**Point classes**

Created (never classified) 160,089,868

**Depth maps generation parameters**

Quality Medium  
Filtering mode Mild  
Max neighbors 16  
Processing time 1 hours 5 minutes  
Memory usage 5.91 GB

**Point cloud generation parameters**

Processing time 5 hours 14 minutes  
Memory usage 78.17 GB  
Date created 2023:08:24 08:24:25  
Software version 2.0.2.16404  
File size 2.08 GB

**Model**

Faces 1,797,029  
Vertices 900,470  
Vertex colors 3 bands, uint8  
Texture 16,384 x 16,384, 4 bands, uint8

**Depth maps generation parameters**

Quality Medium  
Filtering mode Mild  
Max neighbors 16  
Processing time 1 hours 5 minutes  
Memory usage 5.91 GB

**Reconstruction parameters**

Surface type Arbitrary  
Source data Depth maps  
Interpolation Enabled  
Strict volumetric masks No  
Processing time 28 minutes 10 seconds  
Memory usage 11.90 GB

**Texturing parameters**

Mapping mode Generic  
Blending mode Mosaic  
Texture size 16,384  
Enable hole filling Yes  
Enable ghosting filter Yes  
UV mapping time 4 minutes 34 seconds  
UV mapping memory usage 1.54 GB  
Blending time 19 minutes 53 seconds  
Blending memory usage 10.80 GB  
Blending GPU memory usage 7.55 GB  
Date created 2023:08:24 08:54:07  
Software version 2.0.2.16404  
File size 300.76 MB

**System**

Software name Agisoft Metashape Professional  
Software version 2.0.2 build 16404  
OS Windows 64 bit  
RAM 255.87 GB  
CPU AMD Ryzen Threadripper 3970X 32-Core Processor  
GPU(s) NVIDIA GeForce RTX 3090  
NVIDIA GeForce RTX 3090  
NVIDIA GeForce RTX 3090