



Important: Click on the different icons for:



Help to analyze the results in the Quality Report



Additional information about the sections



Click [here](#) for additional tips to analyze the Quality Report

Summary



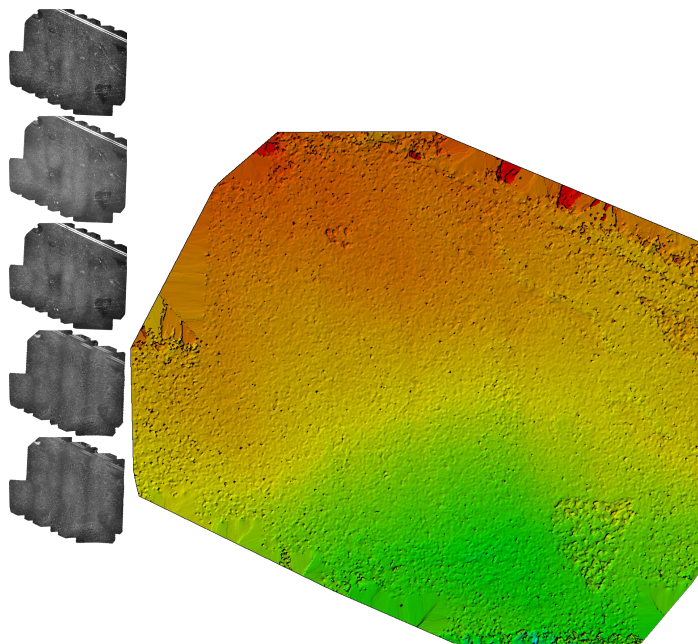
Project	40m_radcal
Processed	2020-11-06 20:26:14
Camera Model Name(s)	FC6360_5.7_1600x1300 (Blue), FC6360_5.7_1600x1300 (Green), FC6360_5.7_1600x1300 (Red), FC6360_5.7_1600x1300 (Red edge), FC6360_5.7_1600x1300 (NIR), FC6360_5.7_1600x1300 (RGB)
Rig name(s)	«FC6360»
Average Ground Sampling Distance (GSD)	2.32 cm / 0.92 in
Area Covered	0.000 km ² / 0.0000 ha / 0.00 sq. mi. / 0.0000 acres
Time for Initial Processing (without report)	45m:46s

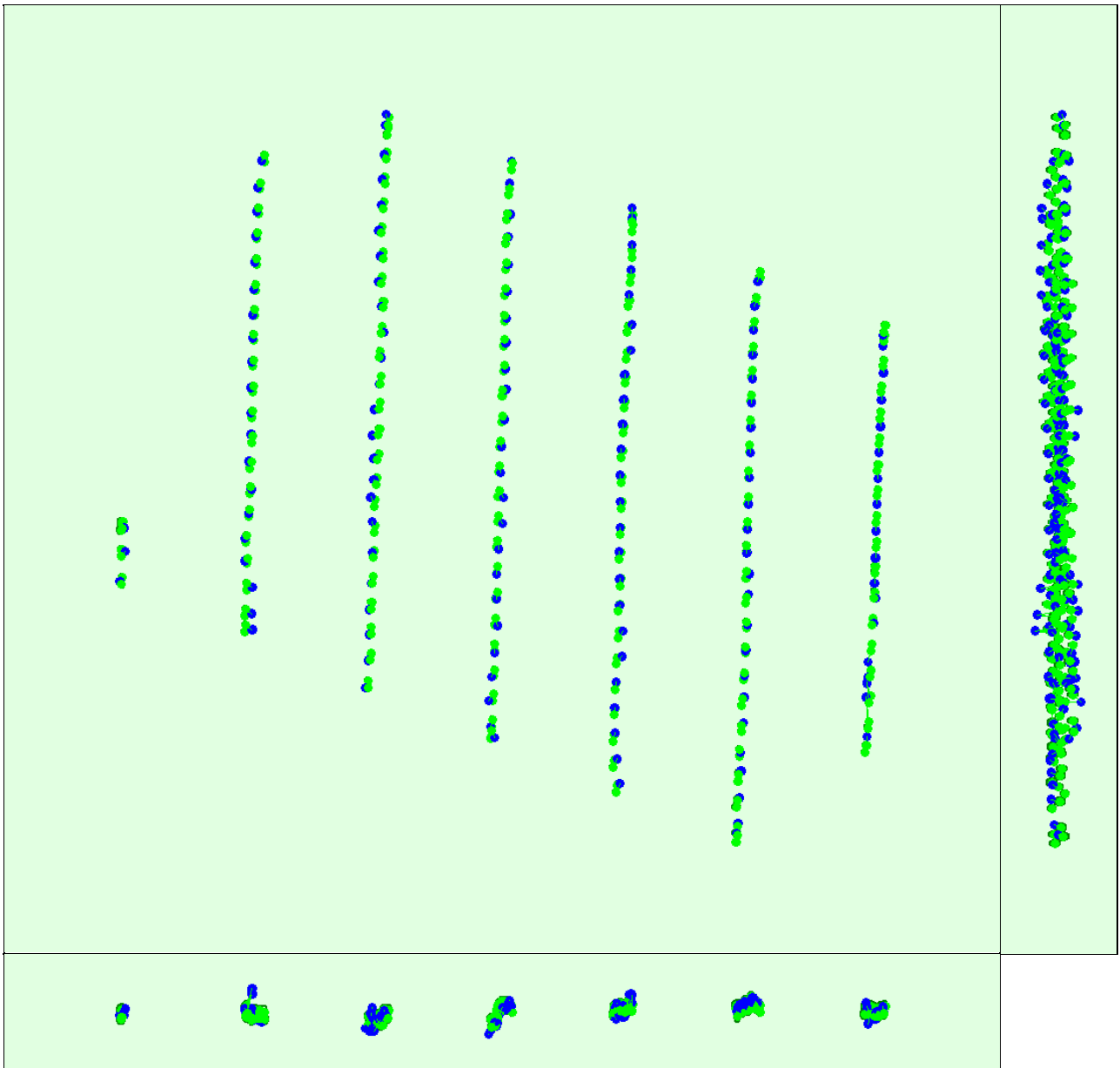
Quality Check



Images	median of 10000 keypoints per image	
Dataset	828 out of 828 images calibrated (100%), all images enabled	
Camera Optimization	34.3% relative difference between initial and optimized internal camera parameters	
Matching	median of 6831.89 matches per calibrated image	
Georeferencing	yes, no 3D GCP	

Preview





Uncertainty ellipses 10x magnified

Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Dark green ellipses indicate the absolute position uncertainty of the bundle block adjustment result.

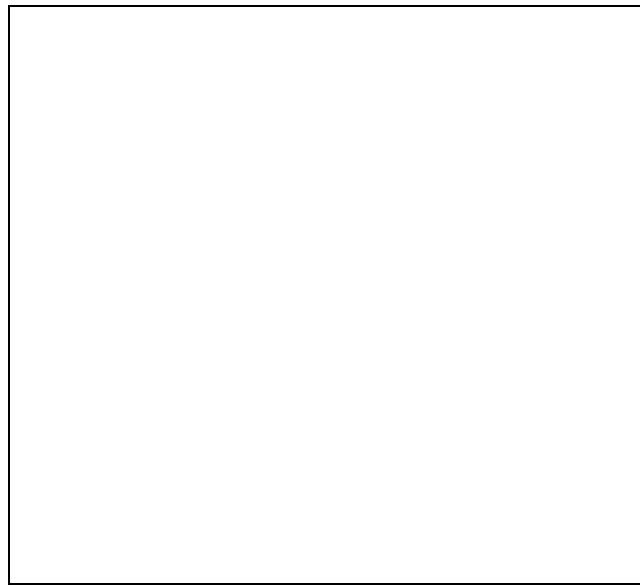
? Absolute camera position and orientation uncertainties



	X[m]	Y[m]	Z[m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.028	0.029	0.047	0.052	0.053	0.032
Sigma	0.004	0.004	0.003	0.007	0.010	0.000

? Overlap





Number of overlapping images: 1 2 3 4 5+

Figure 4: Number of overlapping images computed for each pixel of the orthomosaic. Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint matches is also sufficient for these areas (see Figure 5 for keypoint matches).

Bundle Block Adjustment Details



Number of 2D Keypoint Observations for Bundle Block Adjustment	2227667
Number of 3D Points for Bundle Block Adjustment	289914
Mean Reprojection Error [pixels]	0.169

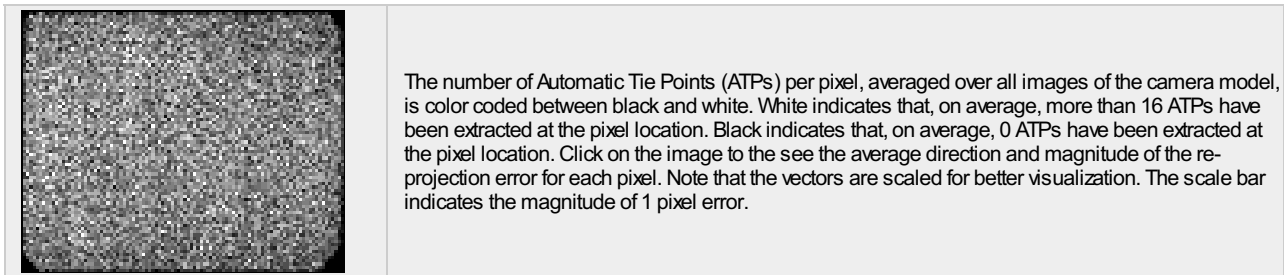
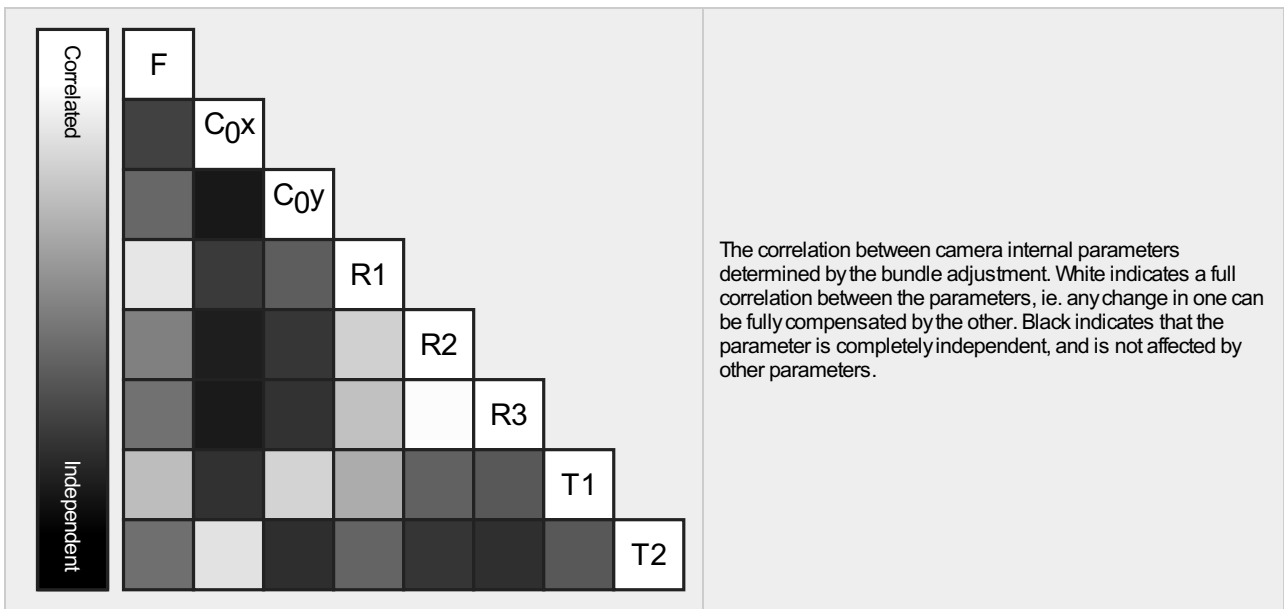
Internal Camera Parameters

FC6360_5.7_1600x1300 (Blue). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]



EXIF ID: FC6360_5.7_1600x1300

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1828.571 [pixel] 5.740 [mm]	755.798 [pixel] 2.372 [mm]	617.107 [pixel] 1.937 [mm]	-0.410	0.348	-0.365	0.001	0.001
Optimized Values	2517.123 [pixel] 7.901 [mm]	781.627 [pixel] 2.454 [mm]	614.439 [pixel] 1.929 [mm]	-0.689	1.074	-2.066	0.008	0.001
Uncertainties (Sigma)	12.514 [pixel] 0.039 [mm]	0.701 [pixel] 0.002 [mm]	0.638 [pixel] 0.002 [mm]	0.008	0.044	0.147	0.000	0.000



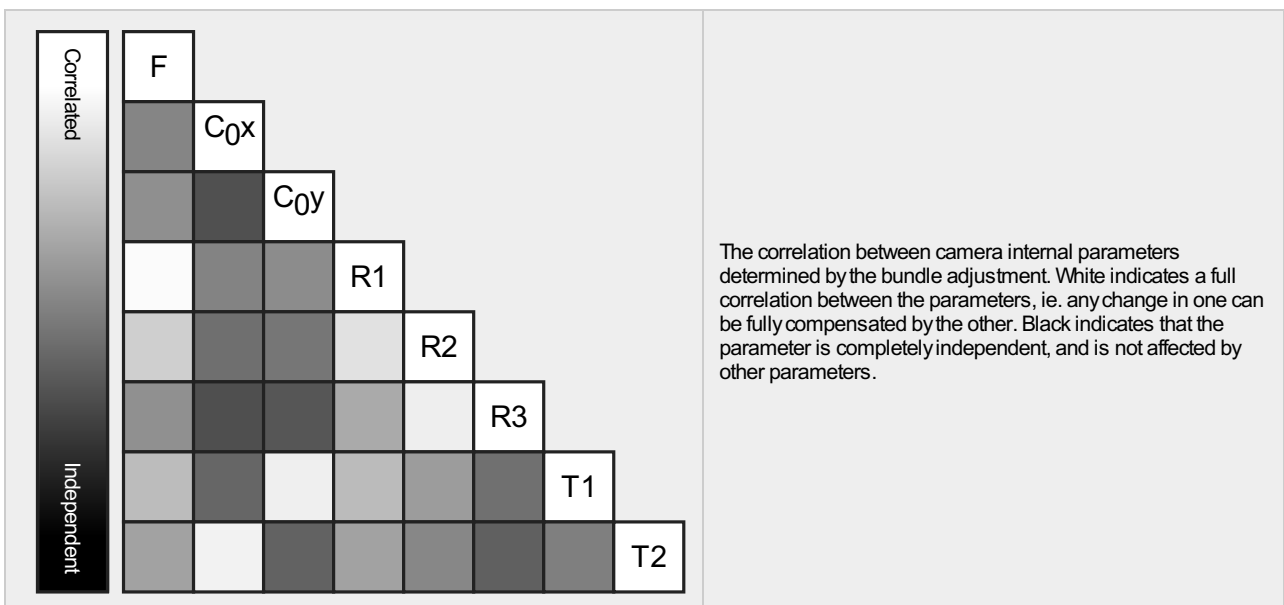
Internal Camera Parameters

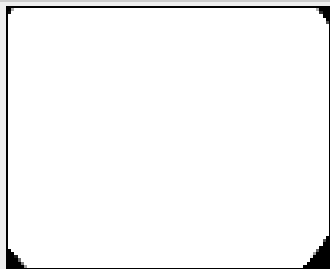
FC6360_5.7_1600x1300 (Green). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]



EXIF ID: FC6360_5.7_1600x1300

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1828.571 [pixel] 5.740 [mm]	756.658 [pixel] 2.375 [mm]	617.126 [pixel] 1.937 [mm]	-0.409	0.333	-0.309	0.001	0.001
Optimized Values	2508.995 [pixel] 7.876 [mm]	782.188 [pixel] 2.455 [mm]	605.421 [pixel] 1.900 [mm]	-0.677	0.757	-0.796	0.004	0.002
Uncertainties (Sigma)	12.477 [pixel] 0.039 [mm]	0.407 [pixel] 0.001 [mm]	0.395 [pixel] 0.001 [mm]	0.007	0.019	0.046	0.000	0.000





The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

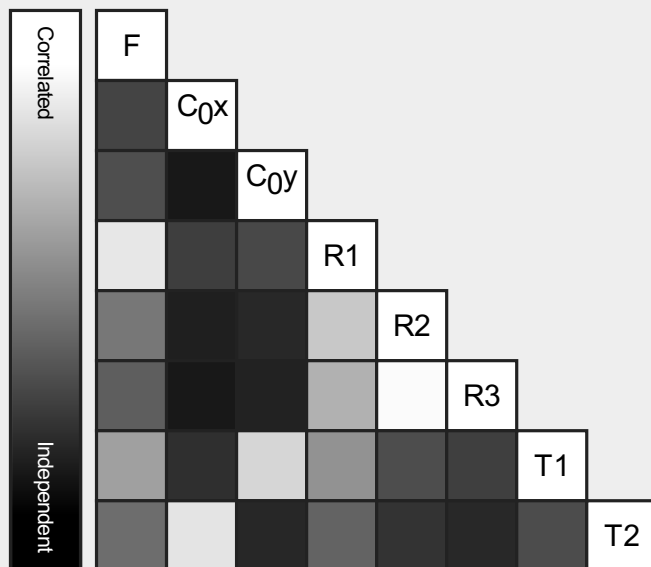
Internal Camera Parameters

FC6360_5.7_1600x1300 (Red). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]

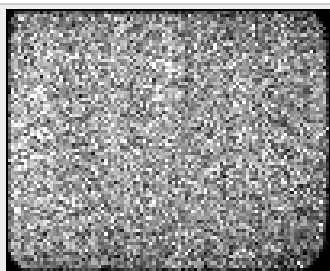


EXIF ID: FC6360_5.7_1600x1300

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1828.571 [pixel] 5.740 [mm]	756.323 [pixel] 2.374 [mm]	617.463 [pixel] 1.938 [mm]	-0.412	0.372	-0.425	0.001	0.001
Optimized Values	2514.025 [pixel] 7.892 [mm]	782.836 [pixel] 2.457 [mm]	626.615 [pixel] 1.967 [mm]	-0.678	0.941	-1.569	0.006	0.001
Uncertainties (Sigma)	12.504 [pixel] 0.039 [mm]	0.704 [pixel] 0.002 [mm]	0.611 [pixel] 0.002 [mm]	0.007	0.041	0.135	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

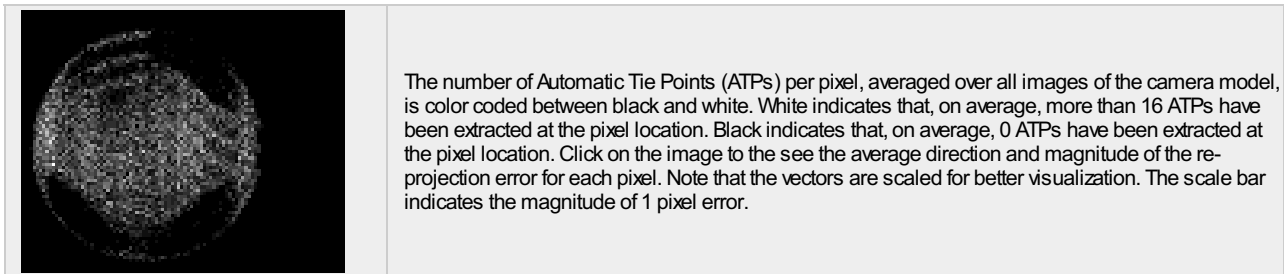
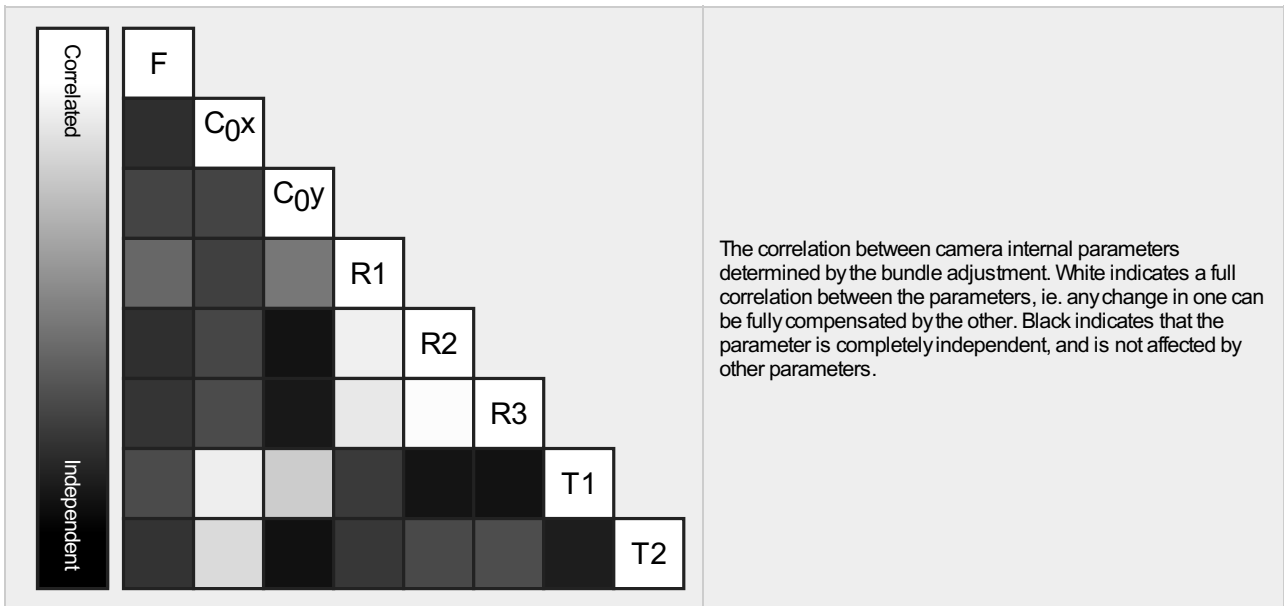
FC6360_5.7_1600x1300 (Red edge). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]



EXIF ID: FC6360_5.7_1600x1300

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1828.571 [pixel] 5.740 [mm]	755.613 [pixel] 2.372 [mm]	617.364 [pixel] 1.938 [mm]	-0.406	0.310	-0.258	0.001	0.001
Optimized Values	2554.583 [pixel] 8.019 [mm]	778.422 [pixel] 2.444 [mm]	554.302 [pixel] 1.740 [mm]	-0.768	2.590	-11.790	0.017	-0.002

Uncertainties (Sigma)	12.627 [pixel] 0.040 [mm]	4.330 [pixel] 0.014 [mm]	5.110 [pixel] 0.016 [mm]	0.022	0.413	2.453	0.001	0.001
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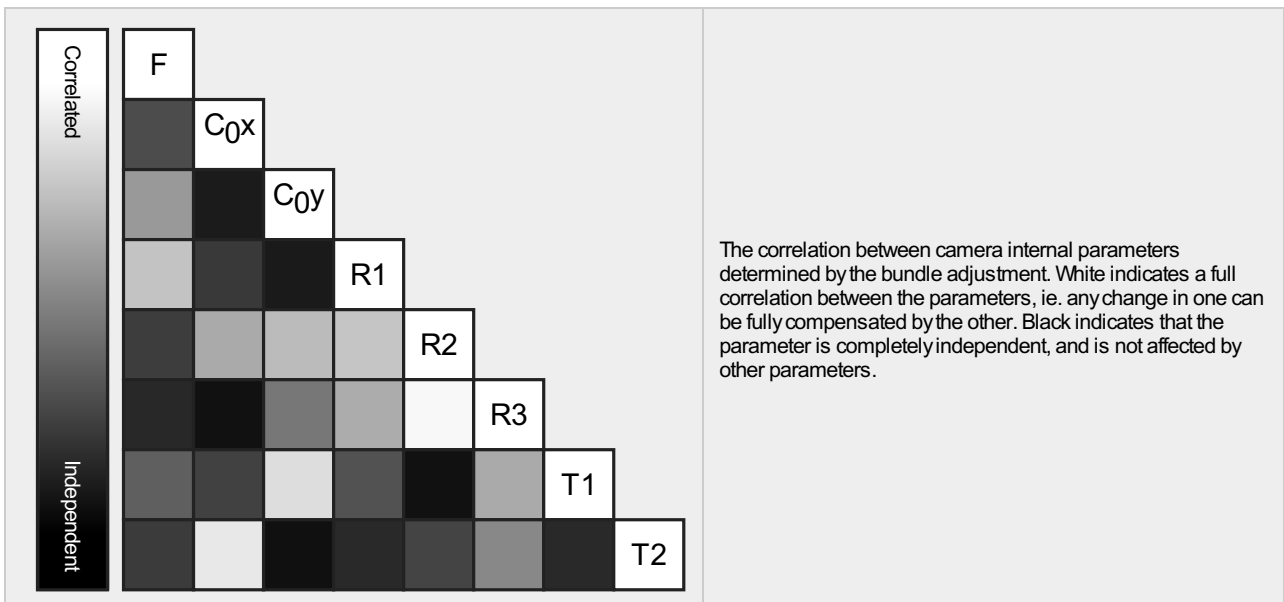
Internal Camera Parameters

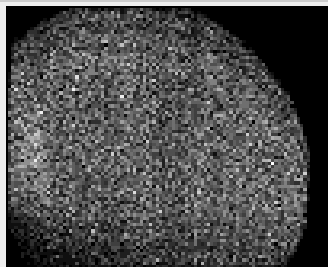
FC6360_5.7_1600x1300 (NIR). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]



EXIF ID: FC6360_5.7_1600x1300

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1828.571 [pixel] 5.740 [mm]	755.238 [pixel] 2.371 [mm]	618.263 [pixel] 1.941 [mm]	-0.406	0.326	-0.312	0.001	0.001
Optimized Values	2559.019 [pixel] 8.033 [mm]	821.376 [pixel] 2.578 [mm]	583.733 [pixel] 1.832 [mm]	-0.695	0.851	-1.396	0.018	-0.008
Uncertainties (Sigma)	12.679 [pixel] 0.040 [mm]	2.165 [pixel] 0.007 [mm]	3.450 [pixel] 0.011 [mm]	0.009	0.078	0.300	0.000	0.000





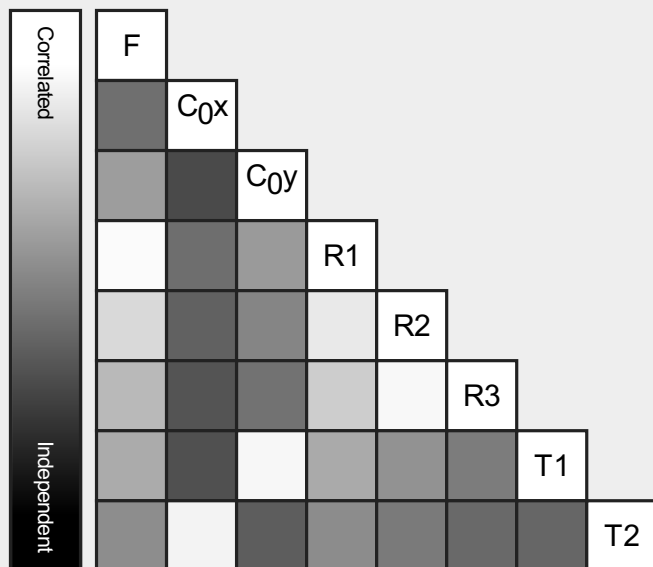
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

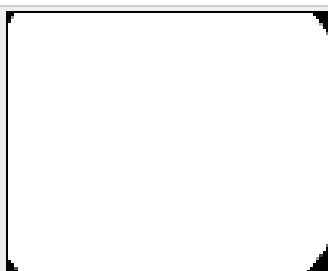
FC6360_5.7_1600x1300 (RGB). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]

EXIF ID: FC6360_5.7_1600x1300

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	2173.920 [pixel] 6.824 [mm]	780.964 [pixel] 2.451 [mm]	639.519 [pixel] 2.007 [mm]	-0.511	0.507	-0.546	0.000	0.000
Optimized Values	2474.725 [pixel] 7.768 [mm]	776.354 [pixel] 2.437 [mm]	641.676 [pixel] 2.014 [mm]	-0.659	0.839	-1.188	0.001	0.002
Uncertainties (Sigma)	12.691 [pixel] 0.040 [mm]	0.451 [pixel] 0.001 [mm]	0.484 [pixel] 0.002 [mm]	0.007	0.020	0.051	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Camera Rig «FC6360» Relatives. Images: 690

	Transl X [m]	Transl Y [m]	Transl Z [m]	Rot X [degree]	Rot Y [degree]	Rot Z [degree]
FC6360_5.7_1600x1300 (Green)	Reference Camera					
FC6360_5.7_1600x1300 (Blue)						
Initial Values	0.000	0.016	0.000	0.000	0.000	0.000
Optimized values	0.000	0.016	0.000	0.080	0.081	0.001
Uncertainties (sigma)				0.013	0.015	0.001
FC6360_5.7_1600x1300 (Red)						
Initial Values	0.016	0.016	0.000	0.000	0.000	0.000

Optimized values	0.016	0.016	0.000	-0.099	0.071	-0.015
Uncertainties (sigma)				0.013	0.015	0.001
FC6360_5.7_1600x1300 (Red edge)						
Initial Values	0.032	0.000	0.000	0.000	0.000	0.000
Optimized values	0.032	0.000	0.000	0.395	-2.416	0.140
Uncertainties (sigma)				0.116	0.095	0.007
FC6360_5.7_1600x1300 (NIR)						
Initial Values	0.016	0.000	0.000	0.000	0.000	0.000
Optimized values	0.016	0.000	0.000	-0.074	-1.771	0.159
Uncertainties (sigma)				0.078	0.046	0.003

2D Keypoints Table



	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	6832
Mn	8288	1875
Max	10000	8425
Mean	9795	6710

2D Keypoints Table for Camera FC6360_5.7_1600x1300 (Blue)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	8827	6012
Mn	8288	5492
Max	8974	6150
Mean	8763	5910

2D Keypoints Table for Camera FC6360_5.7_1600x1300 (Green)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	6876
Mn	8331	4921
Max	10000	8215
Mean	9977	6878

2D Keypoints Table for Camera FC6360_5.7_1600x1300 (Red)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	6921
Mn	10000	6196
Max	10000	7144
Mean	10000	6810

2D Keypoints Table for Camera FC6360_5.7_1600x1300 (Red edge)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	2690
Mn	8419	1875
Max	10000	3655
Mean	9300	2857

2D Keypoints Table for Camera FC6360_5.7_1600x1300 (NIR)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	8861	5911
Mn	8553	4887
Max	10000	6411

Mean	8993	5678
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2D Keypoints Table for Camera FC6360_5.7_1600x1300 (RGB)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	7189
Mn	8364	5379
Max	10000	8425
Mean	9829	7108

Median / 75% / Maximal Number of Matches Between Camera Models

	FC6360_5.7_160... (Blue)	FC6360_5.7_16... (Green)	FC6360_5.7_1600... (Red)	FC6360_5.7... (Red edge)	FC6360_5.7_1600... (NIR)	FC6360_5.7_1600... (RGB)
FC6360_5.7_1600x1300 (Blue)	448 / 2892 / 4986	449 / 1040 / 2587	289 / 1461 / 2158		1 / 1 / 1	461 / 1038 / 2475
FC6360_5.7_1600x1300 (Green)		760 / 1816 / 6791	471 / 1152 / 3321	1 / 1 / 1	1 / 1 / 1	712 / 1592 / 4749
FC6360_5.7_1600x1300 (Red)			354 / 3201 / 5745		1 / 1 / 1	473 / 1093 / 3016
FC6360_5.7_1600x1300 (Red edge)				697 / 1635 / 2697	45 / 84 / 633	(n/a) / (n/a) / 1
FC6360_5.7_1600x1300 (NIR)					1820 / 3232 / 5408	1 / 1 / 1
FC6360_5.7_1600x1300 (RGB)						780 / 1784 / 6255

3D Points from 2D Keypoint Matches



	Number of 3D Points Observed
In 2 Images	116842
In 3 Images	38730
In 4 Images	24631
In 5 Images	15926
In 6 Images	12071
In 7 Images	9016
In 8 Images	7653
In 9 Images	5496
In 10 Images	4777
In 11 Images	4173
In 12 Images	3586
In 13 Images	3150
In 14 Images	3051
In 15 Images	2573
In 16 Images	2409
In 17 Images	2260
In 18 Images	2058
In 19 Images	1853
In 20 Images	1757
In 21 Images	1678
In 22 Images	1675
In 23 Images	1434
In 24 Images	1358
In 25 Images	1266
In 26 Images	1183
In 27 Images	1026
In 28 Images	1033
In 29 Images	909
In 30 Images	872
In 31 Images	831
In 32 Images	835

In 33 Images	785
In 34 Images	762
In 35 Images	647
In 36 Images	651
In 37 Images	618
In 38 Images	611
In 39 Images	591
In 40 Images	566
In 41 Images	569
In 42 Images	508
In 43 Images	509
In 44 Images	542
In 45 Images	497
In 46 Images	417
In 47 Images	341
In 48 Images	332
In 49 Images	323
In 50 Images	266
In 51 Images	261
In 52 Images	252
In 53 Images	226
In 54 Images	234
In 55 Images	225
In 56 Images	218
In 57 Images	181
In 58 Images	188
In 59 Images	176
In 60 Images	159
In 61 Images	154
In 62 Images	163
In 63 Images	178
In 64 Images	138
In 65 Images	143
In 66 Images	131
In 67 Images	144
In 68 Images	108
In 69 Images	88
In 70 Images	100
In 71 Images	66
In 72 Images	78
In 73 Images	57
In 74 Images	100
In 75 Images	75
In 76 Images	47
In 77 Images	61
In 78 Images	55
In 79 Images	47
In 80 Images	55
In 81 Images	33
In 82 Images	45
In 83 Images	21
In 84 Images	24
In 85 Images	14
In 86 Images	9
In 87 Images	7
In 88 Images	5
In 89 Images	1

2D Keypoint Matches

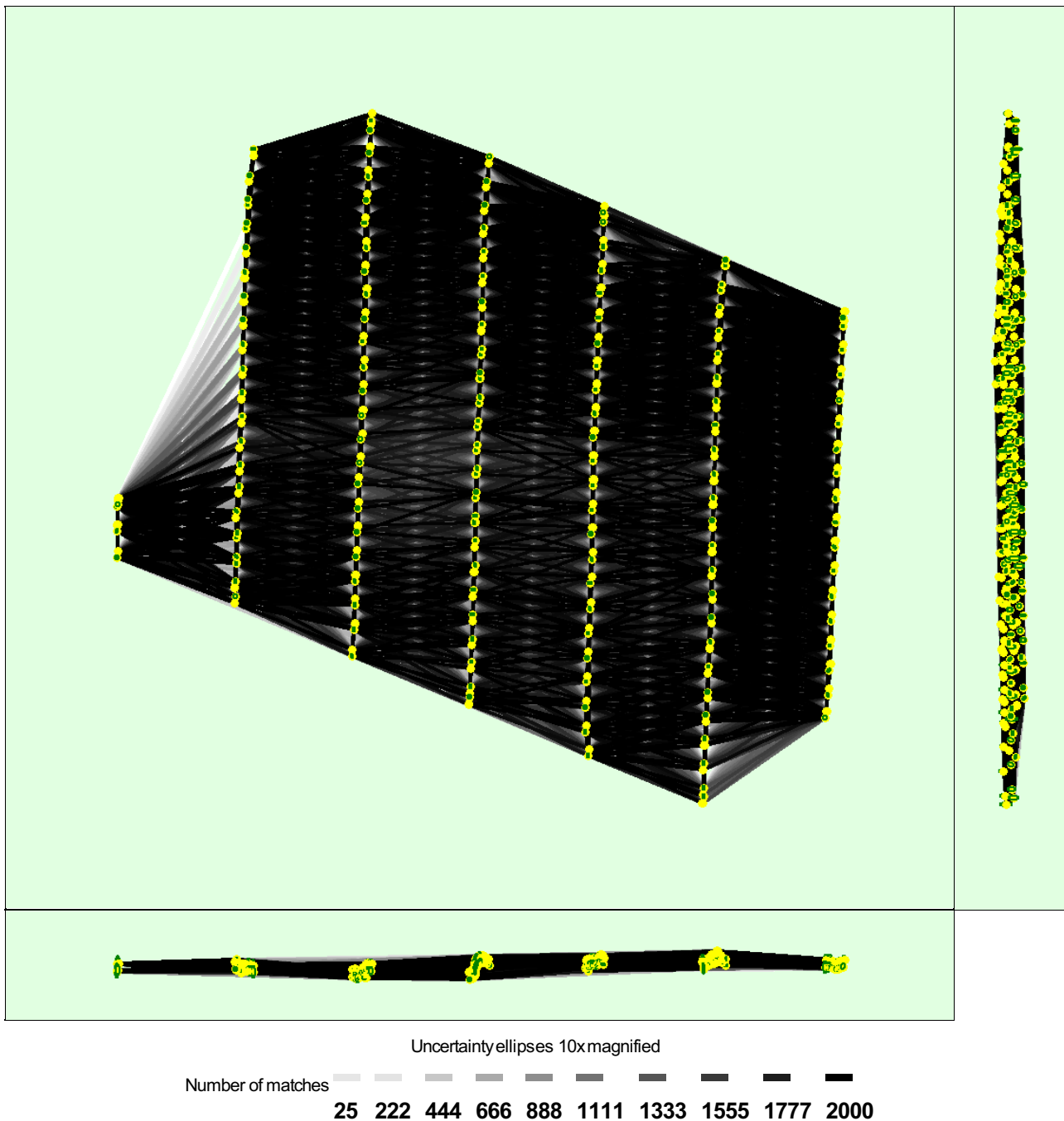


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty of the bundle block adjustment result.

Relative camera position and orientation uncertainties

	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.015	0.017	0.029	0.092	0.115	0.005
Sigma	0.002	0.003	0.014	0.057	0.070	0.001

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X[%]	Geolocation Error Y[%]	Geolocation Error Z[%]
-	-3.49	0.00	0.00	0.00
-3.49	-2.79	0.00	0.00	0.00
-2.79	-2.09	0.00	0.00	0.00
-2.09	-1.39	0.00	5.68	5.43
-1.39	-0.70	1.33	11.59	23.55
-0.70	0.00	50.85	29.47	39.86
0.00	0.70	46.62	39.25	19.44
0.70	1.39	1.21	12.80	9.18
1.39	2.09	0.00	0.36	1.57
2.09	2.79	0.00	0.72	0.85
2.79	3.49	0.00	0.12	0.12
3.49	-	0.00	0.00	0.00
Mean [m]		-0.007798	-0.005722	-0.266623
Sigma [m]		0.268407	0.721314	0.766445
RMS Error [m]		0.268521	0.721337	0.811496

Min Error and Max Error represent geolocation error intervals between -1.5 and 1.5 times the maximum accuracy of all the images. Columns X, Y, Z show the percentage of images with geolocation errors within the predefined error intervals. The geolocation error is the difference between the initial and computed image positions. Note that the image geolocation errors do not correspond to the accuracy of the observed 3D points.

Relative Geolocation Variance

Relative Geolocation Error	Images X[%]	Images Y[%]	Images Z[%]
[-1.00, 1.00]	100.00	91.06	99.76
[-2.00, 2.00]	100.00	99.28	100.00
[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	1.194137	1.194137	2.232923
Sigma of Geolocation Accuracy [m]	0.020737	0.020737	0.032485

Images X, Y, Z represent the percentage of images with a relative geolocation error in X, Y, Z.

Geolocation Orientational Variance	RMS [degree]
Omega	1.002
Phi	1.832
Kappa	1.595

Geolocation RMS error of the orientation angles given by the difference between the initial and computed image orientation angles.

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Core(TM) i7 CPU 870 @2.93GHz RAM: 12GB GPU: Radeon RX580 Series (Driver: 26.20.15019.19000)
Operating System	Windows 10 Pro, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84
Output Coordinate System	WGS 84 / UTMzone 33N

Processing Options

Detected Template	No Template Available
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Keypoints Image Scale	Full, Image Scale: 1
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: yes
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Custom, Number of Keypoints: 10000
Advanced: Calibration	Calibration Method: Alternative Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Custom, yes
Rig «FC6360» processing	optimize relative rotation using a subset of secondary cameras

Point Cloud Densification details



Processing Options



Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Low (Fast)
Minimum Number of Matches	3
3D Textured Mesh Generation	no
LOD	Generated: no
Advanced: Image Groups	Blue, Green, Red, Red edge, NIR, group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	03m:30s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	NA

Results



Number of Processed Clusters	2
Number of Generated Tiles	2
Number of 3D Densified Points	698030
Average Density (per m ³)	88.76

DSM, Orthomosaic and Index Details



Processing Options



DSM and Orthomosaic Resolution	1 x GSD (2.32 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Orthomosaic	Generated: yes Merge Tiles: no GeoTIFF Without Transparency: no Google Maps Tiles and KML: no
Radiometric calibration with reflectance target	yes
Index Calculator: Reflectance Map	Generated: yes Resolution: 1 x GSD (2.32 [cm/pixel]) Merge Tiles: no
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	00s
Time for Orthomosaic Generation	24m:43s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	22m:07s
Time for Index Map Generation	45s

Camera Radiometric Correction



Camera Name	Band	Radiometric Correction Type	Reflectance target
FC6360_5.7_1600x1300	Blue	Camera and Sun Irradiance	✓
FC6360_5.7_1600x1300	Green	Camera and Sun Irradiance	✓
FC6360_5.7_1600x1300	Red	Camera and Sun Irradiance	✓
FC6360_5.7_1600x1300	Red edge	Camera and Sun Irradiance	✓
FC6360_5.7_1600x1300	NIR	Camera and Sun Irradiance	✓
FC6360_5.7_1600x1300	Red Green Blue	No Correction	n/a