Quality Report

Generated with Pix4Denterprise version 4.5.6

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	Lote_105_14-10-23
Processed	2023-10-27 18:30:04
Camera Model Name(s)	FC6360_5.7_1600x1300 (Green), FC6360_5.7_1600x1300 (Red), FC6360_5.7_1600x1300 (Red edge), FC6360_5.7_1600x1300 (NIR)
Rig name(s)	«FC6360»
Average Ground Sampling Distance (GSD)	3.01 cm / 1.18 in
Area Covered	0.307 km^2 / 30.6693 ha / 0.12 sq. mi. / 75.8248 acres
Time for Initial Processing (without report)	03h:51m:44s

Quality Check

Images	median of 9432 keypoints per image	⚠
Dataset	7960 out of 8076 images calibrated (98%), all images enabled, 2 blocks	⚠
Camera Optimization	7.82% relative difference between initial and optimized internal camera parameters	⚠
Matching	median of 4566.2 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

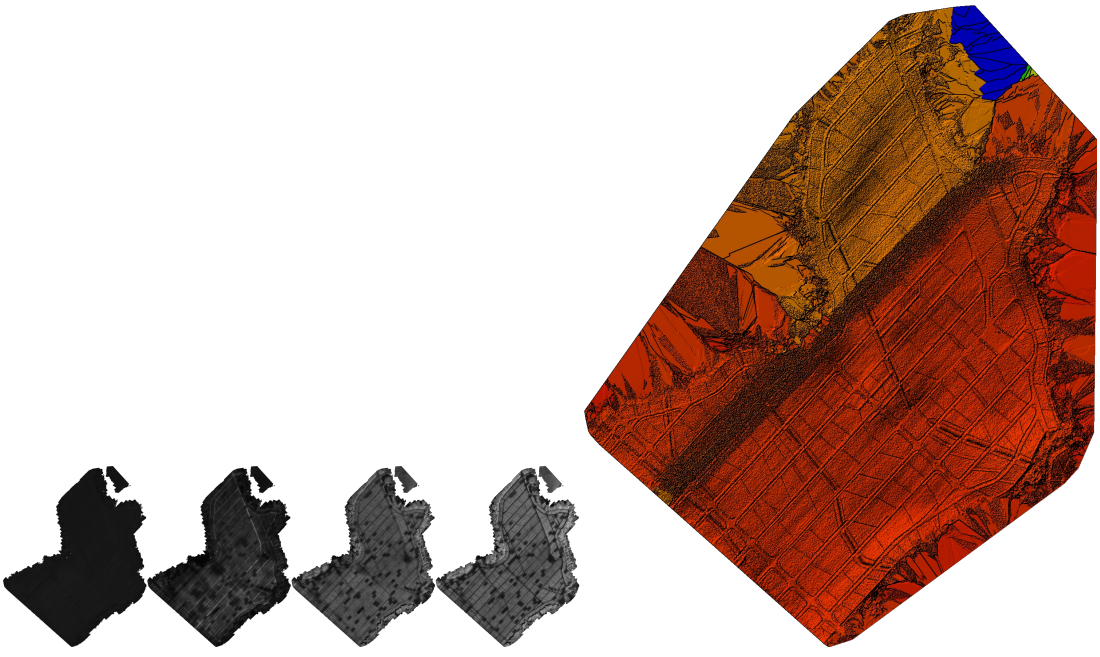


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	7960 out of 8076
Number of Geolocated Images	8076 out of 8076

Initial Image Positions

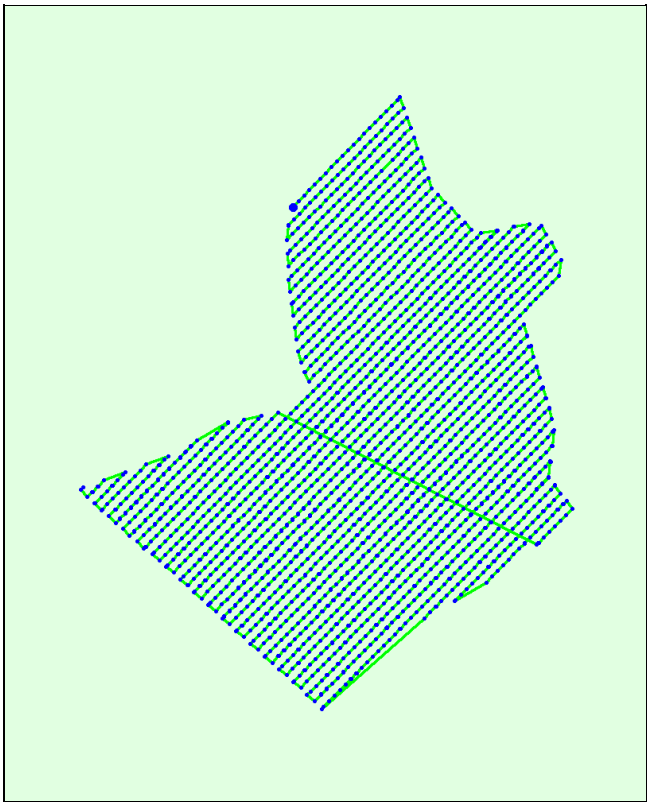
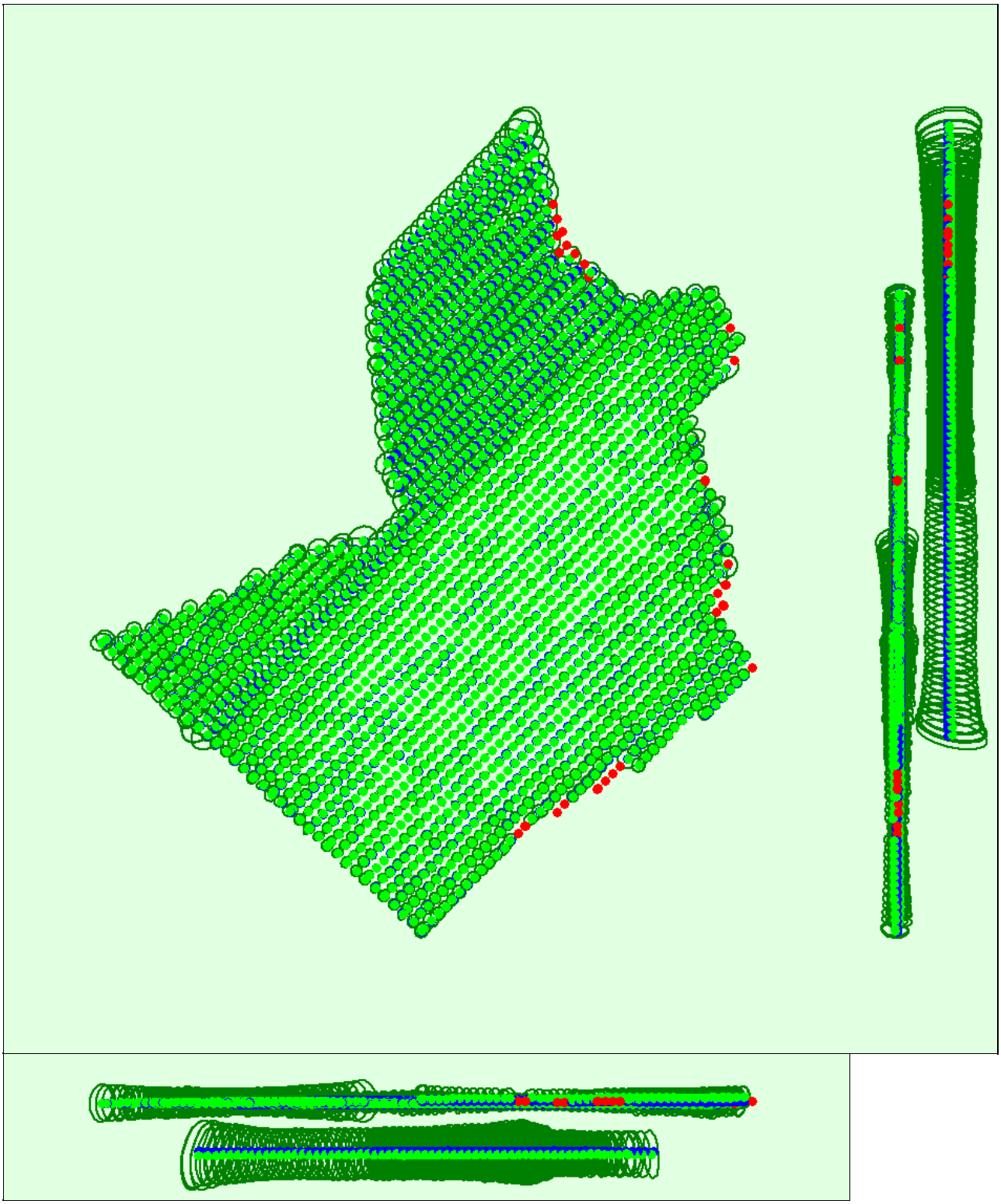


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



Uncertainty ellipses 100x 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). Red dots indicate disabled or uncalibrated images. 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	0.058	0.060	0.117	0.052	0.053	0.015
Sigma	0.025	0.027	0.070	0.016	0.016	0.008

Overlap

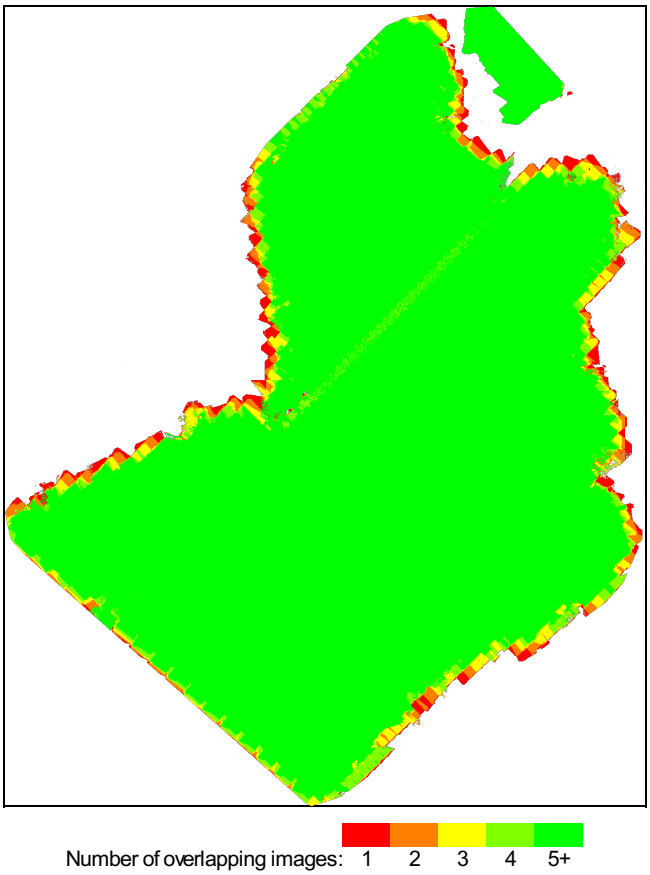


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

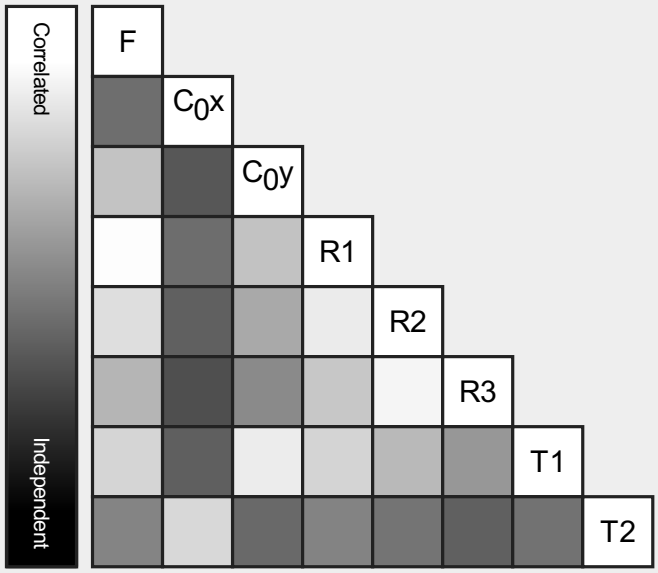
Number of 2D Keypoint Observations for Bundle Block Adjustment	11328702
Number of 3D Points for Bundle Block Adjustment	3719843
Mean Reprojection Error [pixels]	0.219

Internal Camera Parameters

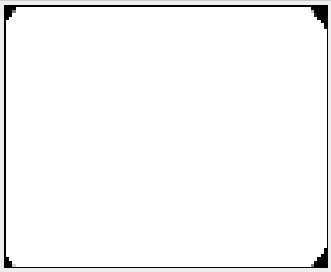
FC6360_5.7_1600x1300 (Green). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]

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]	755.958 [pixel] 2.373 [mm]	627.225 [pixel] 1.969 [mm]	-0.409	0.326	-0.294	0.001	0.001
Optimized Values	1965.725 [pixel] 6.171 [mm]	784.214 [pixel] 2.462 [mm]	656.281 [pixel] 2.060 [mm]	-0.421	0.327	-0.271	0.000	0.000
Uncertainties (Sigma)	6.790 [pixel] 0.021 [mm]	0.129 [pixel] 0.000 [mm]	0.155 [pixel] 0.000 [mm]	0.003	0.005	0.008	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.



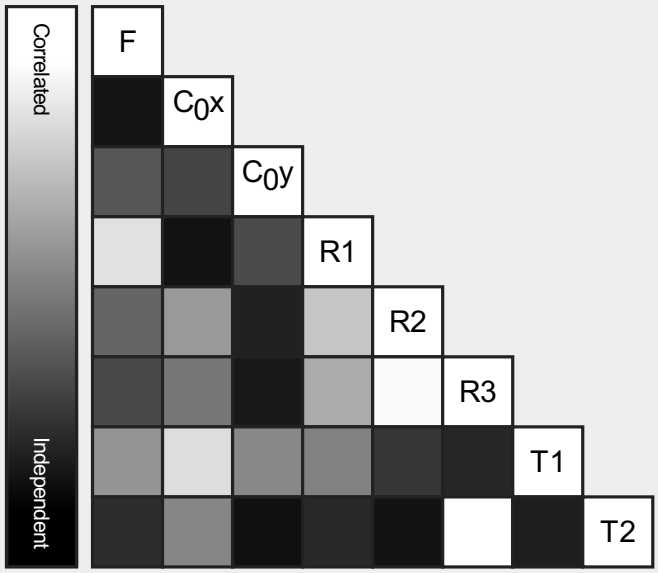
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the 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

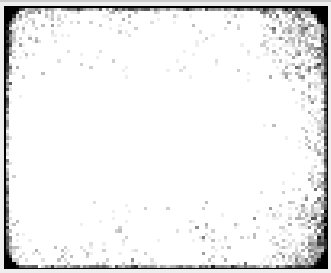
FC6360_5.7_1600x1300 (Red). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]

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]	756.431 [pixel] 2.374 [mm]	626.816 [pixel] 1.968 [mm]	-0.407	0.305	-0.225	0.001	0.001
Optimized Values	1971.240 [pixel] 6.188 [mm]	793.719 [pixel] 2.492 [mm]	656.049 [pixel] 2.059 [mm]	-0.422	0.360	-0.359	-0.000	-0.000
Uncertainties (Sigma)	6.810 [pixel] 0.021 [mm]	0.373 [pixel] 0.001 [mm]	0.332 [pixel] 0.001 [mm]	0.003	0.013	0.027	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.



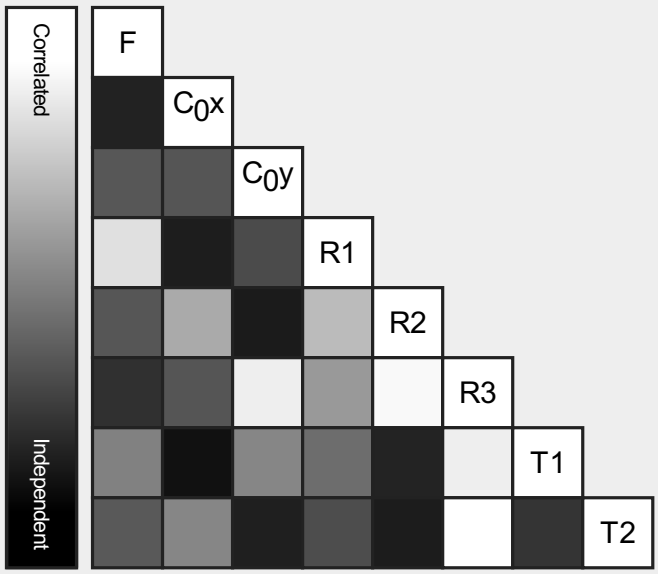
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the 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

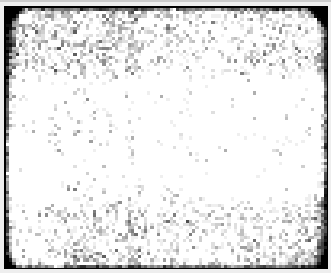
FC6360_5.7_1600x1300 (Red edge). Sensor Dimensions: 5.022 [mm] x 4.081 [mm]

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]	756.021 [pixel] 2.373 [mm]	627.705 [pixel] 1.970 [mm]	-0.406	0.300	-0.214	0.001	0.001
Optimized Values	1973.490 [pixel] 6.195 [mm]	796.431 [pixel] 2.500 [mm]	668.000 [pixel] 2.097 [mm]	-0.412	0.297	-0.228	-0.001	0.000
Uncertainties (Sigma)	6.818 [pixel] 0.021 [mm]	0.366 [pixel] 0.001 [mm]	0.320 [pixel] 0.001 [mm]	0.003	0.013	0.026	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 the 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.

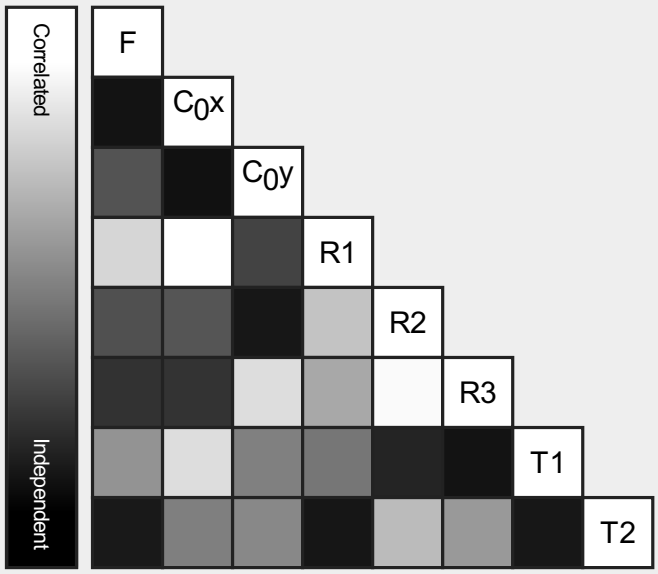
Internal Camera Parameters

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

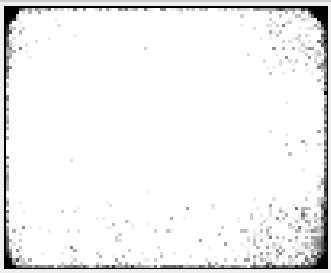
EXIF ID: FC6360_5.7_1600x1300

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1828.571 [pixel] 5.740 [mm]	756.042 [pixel] 2.373 [mm]	627.050 [pixel] 1.968 [mm]	-0.408	0.317	-0.264	0.001	0.001
Optimized Values	1975.943 [pixel] 6.203 [mm]	792.455 [pixel] 2.488 [mm]	662.795 [pixel] 2.081 [mm]	-0.416	0.322	-0.276	-0.000	-0.001

Uncertainties (Sigma)	6.827 [pixel] 0.021 [mm]	0.443 [pixel] 0.001 [mm]	0.402 [pixel] 0.001 [mm]	0.003	0.015	0.032	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 the 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: 8076

	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 (Red)						
Initial Values	0.016	0.016	0.000	0.000	0.000	0.000
Optimized values	0.016	0.016	0.000	-0.032	0.118	0.008
Uncertainties (sigma)				0.009	0.011	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	-0.046	0.036	0.005
Uncertainties (sigma)				0.009	0.011	0.001
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	0.046	0.106	-0.000
Uncertainties (sigma)				0.011	0.013	0.001

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	9432	4566
Min	7226	12
Max	10000	7404
Mean	9320	4384

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	9284	4776

Min	7226	352
Max	10000	6780
Mean	9241	4570

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	3823
Min	8030	22
Max	10000	7100
Mean	9668	3882

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	3525
Min	8026	20
Max	10000	6843
Mean	9857	3538

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	9101	3743
Min	7928	12
Max	10000	7404
Mean	9234	3861

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

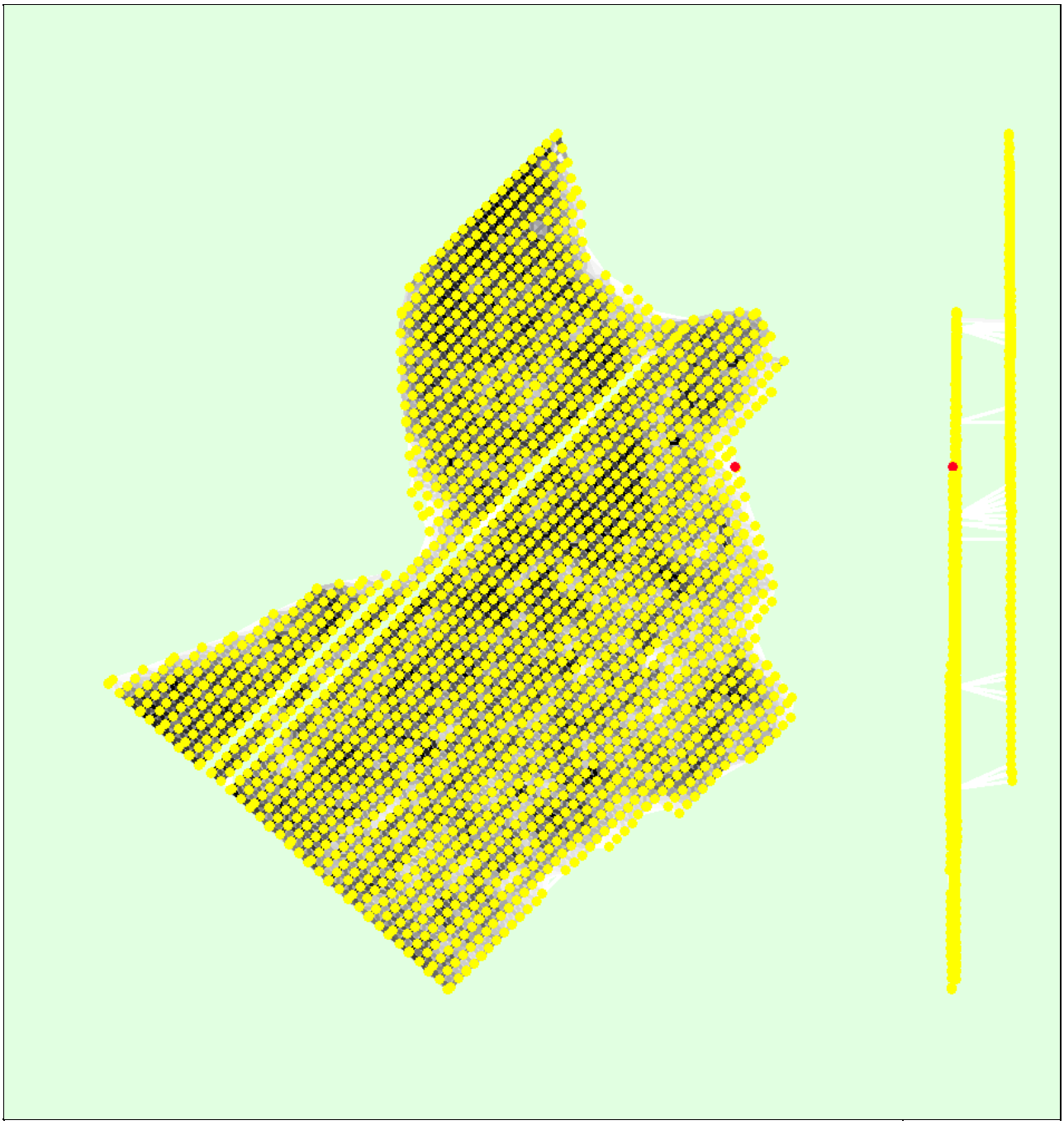
	FC6360_5.7_16... (Green)	FC6360_5.7_1600... (Red)	FC6360_5.7...(Red edge)	FC6360_5.7_1600... (NIR)
FC6360_5.7_1600x1300 (Green)	144 / 465 / 4960	29 / 81 / 1390	24 / 72 / 1034	9 / 25 / 525
FC6360_5.7_1600x1300 (Red)		157 / 1755 / 4378	18 / 52 / 771	10 / 25 / 540
FC6360_5.7_1600x1300 (Red edge)			56 / 1044 / 4366	19 / 62 / 1175
FC6360_5.7_1600x1300 (NIR)				395 / 1947 / 5029

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	2308016
In 3 Images	604761
In 4 Images	307339
In 5 Images	154135
In 6 Images	102522
In 7 Images	71166
In 8 Images	50768
In 9 Images	33204
In 10 Images	25105
In 11 Images	18655
In 12 Images	13427
In 13 Images	9351
In 14 Images	7079
In 15 Images	5105
In 16 Images	3402
In 17 Images	1886
In 18 Images	1248
In 19 Images	837

In 20 Images	558
In 21 Images	399
In 22 Images	310
In 23 Images	189
In 24 Images	120
In 25 Images	73
In 26 Images	74
In 27 Images	39
In 28 Images	30
In 29 Images	17
In 30 Images	11
In 31 Images	6
In 32 Images	7
In 33 Images	1
In 34 Images	1
In 35 Images	2

2D Keypoint Matches



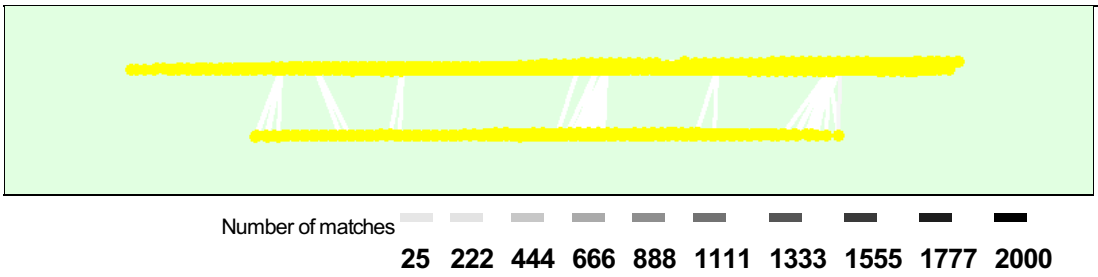


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.00	0.00
-15.00	-12.00	0.00	0.00	0.00
-12.00	-9.00	0.00	0.00	0.00
-9.00	-6.00	0.00	0.00	0.00
-6.00	-3.00	0.00	0.00	4.10
-3.00	0.00	49.01	50.65	29.18
0.00	3.00	50.84	49.30	62.00
3.00	6.00	0.15	0.05	4.72
6.00	9.00	0.00	0.00	0.00
9.00	12.00	0.00	0.00	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		0.112472	0.056480	0.591580
Sigma [m]		0.769002	0.778987	1.505704
RMS Error [m]		0.777184	0.781032	1.617749

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]	99.36	99.77	95.13
[-2.00, 2.00]	99.95	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	1.972839	1.972839	4.367527
Sigma of Geolocation Accuracy [m]	1.760769	1.760769	3.277781

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

Geolocation Orientational Variance	RMS [degree]
Omega	0.708
Phi	0.777
Kappa	2.534

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: 11th Gen Intel(R) Core(TM) i9-11900H @ 2.50GHz RAM: 32GB GPU: Intel(R) UHD Graphics (Driver: 30.0.101.1631), NVIDIA GeForce RTX 3080 Laptop GPU (Driver: 30.0.15.1278)
Operating System	Windows 10 Pro, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84 (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 16N (EGM96 Geoid)

Processing Options

Detected Template	No Template Available
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	Optimal
Minimum Number of Matches	3
3D Textured Mesh Generation	no
LOD	Generated: no
Advanced: Image Groups	Green, Red, Red edge, NIR
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	27m:10s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	NA

Results

Number of Generated Tiles	1
Number of 3D Densified Points	24971535
Average Density (per m^3)	118.56

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (3.01 [cm/pixel])
DSM Filters	Noise Filtering: no Surface Smoothing: no
Orthomosaic	Generated: yes Merge Tiles: yes 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 (3.01 [cm/pixel]) Merge Tiles: yes
Time for DSM Generation	00s
Time for Orthomosaic Generation	02h:00m:56s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	04h:05m:45s
Time for Index Map Generation	00s

Camera Radiometric Correction

Camera Name	Band	Radiometric Correction Type	Reflectance target
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	✓