

# Quality Report



Generated with PIX4Dmapper version 4.7.5



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## Summary



Project	22628 Higgins KapitiRd-Otaihangia 20230322
Processed	2023-03-24 08:48:50
Camera Model Name(s)	ZenmuseP1_35.0_8192x5460 (RGB)
Average Ground Sampling Distance (GSD)	0.71 cm / 0.28 in

## Quality Check



⚠️ <b>Images</b>	median of 21830 keypoints per image	✓
⚠️ <b>Dataset</b>	1361 out of 1481 images calibrated (91%), all images enabled, 2 blocks	⚠️
⚠️ <b>Camera Optimization</b>	0.11% relative difference between initial and optimized internal camera parameters	✓
⚠️ <b>Matching</b>	median of 7866.36 matches per calibrated image	✓
⚠️ <b>Georeferencing</b>	yes, 17 GCPs (17 3D), mean RMS error = 0.003 m	✓

## Calibration Details



Number of Calibrated Images	1361 out of 1481
Number of Geolocated Images	1481 out of 1481

### ⚠️ 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 500x 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	0.005	0.005	0.010	0.006	0.006	0.003
Sigma	0.001	0.001	0.000	0.001	0.001	0.001

## Bundle Block Adjustment Details



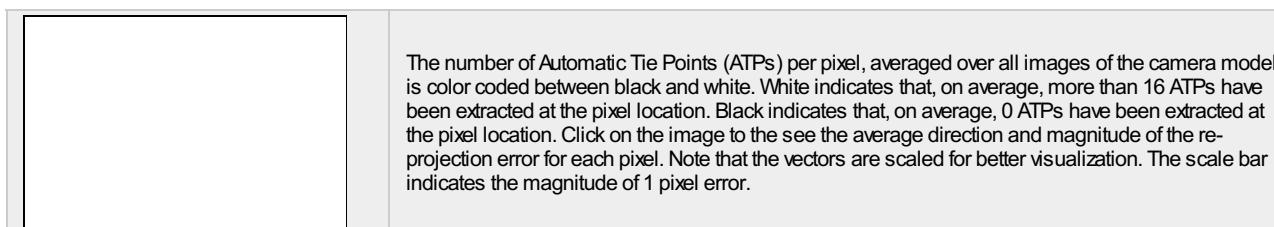
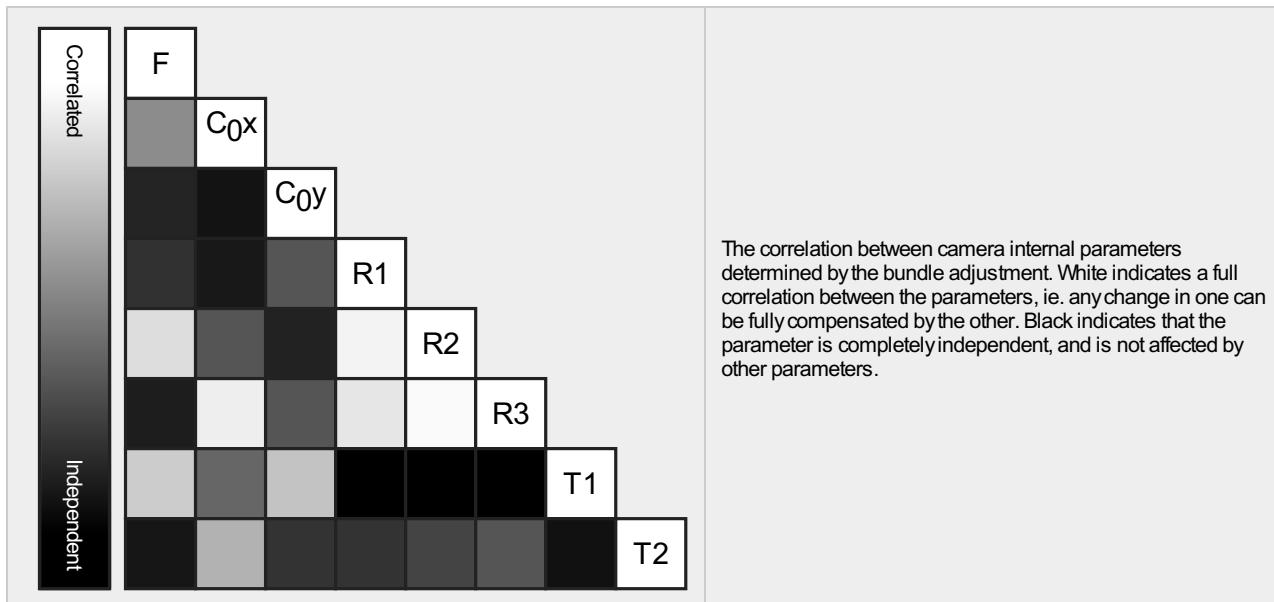
Number of 2D Keypoint Observations for Bundle Block Adjustment	11187696
Number of 3D Points for Bundle Block Adjustment	3113354
Mean Reprojection Error [pixels]	0.144

## Internal Camera Parameters

ZenmuseP1\_35.0\_8192x5460 (RGB). Sensor Dimensions: 35.000 [mm] x 23.328 [mm]

EXIF ID: ZenmuseP1\_35.0\_8192x5460

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	8194.340 [pixel] 35.010 [mm]	4096.001 [pixel] 17.500 [mm]	2729.996 [pixel] 11.664 [mm]	-0.048	0.021	-0.097	0.002	-0.001
Optimized Values	8203.984 [pixel] 35.051 [mm]	4102.641 [pixel] 17.528 [mm]	2758.545 [pixel] 11.786 [mm]	-0.050	0.018	-0.096	0.001	-0.001
Uncertainties (Sigma)	1.384 [pixel] 0.006 [mm]	0.118 [pixel] 0.001 [mm]	0.075 [pixel] 0.000 [mm]	0.000	0.001	0.001	0.000	0.000



## 2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	21830	7866
Mn	14328	1207
Max	46574	20765
Mean	22527	8220

## 3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	1616442
In 3 Images	570932
In 4 Images	296522
In 5 Images	177484
In 6 Images	111479

In 7 Images	79314
In 8 Images	60638
In 9 Images	46947
In 10 Images	36318
In 11 Images	26807
In 12 Images	21595
In 13 Images	17526
In 14 Images	14479
In 15 Images	12578
In 16 Images	5867
In 17 Images	3667
In 18 Images	2665
In 19 Images	1929
In 20 Images	1491
In 21 Images	1240
In 22 Images	1015
In 23 Images	886
In 24 Images	784
In 25 Images	651
In 26 Images	543
In 27 Images	566
In 28 Images	420
In 29 Images	340
In 30 Images	350
In 31 Images	344
In 32 Images	312
In 33 Images	249
In 34 Images	227
In 35 Images	193
In 36 Images	164
In 37 Images	131
In 38 Images	80
In 39 Images	55
In 40 Images	38
In 41 Images	45
In 42 Images	27
In 43 Images	5
In 44 Images	6
In 45 Images	3

 **2D Keypoint Matches**



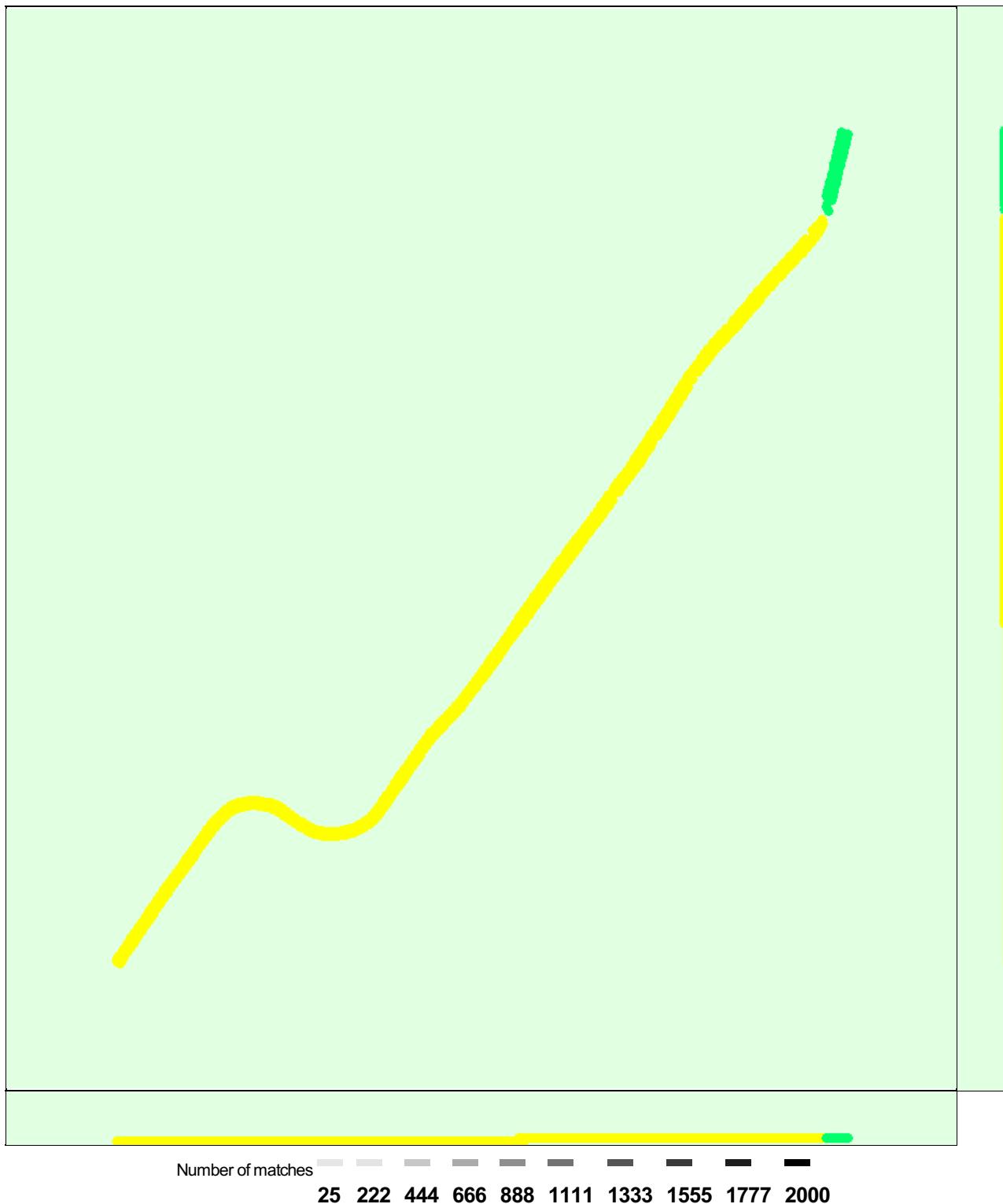


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

## Geolocation Details

### Ground Control Points

GCP Name	Accuracy XY/Z [m]	Error X [m]	Error Y [m]	Error Z [m]	Projection Error [pixel]	Verified/Marked
28 (3D)	0.020/ 0.020	-0.001	0.001	-0.005	0.343	15 / 15
30 (3D)	0.020/ 0.020	0.001	0.002	-0.000	0.307	14 / 14
32 (3D)	0.020/ 0.020	-0.000	-0.002	0.002	0.254	14 / 14

38 (3D)	0.020/ 0.020	-0.005	0.004	0.005	0.321	14 / 14
89 (3D)	0.020/ 0.020	0.006	0.006	-0.003	0.279	11 / 11
91 (3D)	0.020/ 0.020	0.006	0.003	-0.003	0.266	12 / 12
92 (3D)	0.020/ 0.020	-0.004	0.000	-0.006	0.253	10 / 10
94 (3D)	0.020/ 0.020	0.006	0.003	0.007	0.227	12 / 12
400 (3D)	0.020/ 0.020	0.002	0.005	0.002	0.239	11 / 11
402 (3D)	0.020/ 0.020	-0.000	0.002	0.003	0.236	12 / 12
403 (3D)	0.020/ 0.020	0.003	0.002	0.001	0.133	10 / 10
406 (3D)	0.020/ 0.020	-0.004	-0.007	0.002	0.167	8 / 8
408 (3D)	0.020/ 0.020	0.002	-0.007	0.001	0.223	6 / 6
411 (3D)	0.020/ 0.020	-0.006	-0.002	-0.005	0.263	9 / 9
412 (3D)	0.020/ 0.020	-0.004	-0.004	-0.002	0.302	7 / 7
413 (3D)	0.020/ 0.020	-0.002	-0.004	0.003	0.388	17 / 17
415 (3D)	0.020/ 0.020	-0.000	0.001	-0.002	0.278	10 / 10
420 (3D)	0.020/ 0.020	0.000	0.000	0.000	-1.000	1 / 9
<b>Mean [m]</b>		0.000040	0.000086	0.000018		
<b>Sigma [m]</b>		0.003757	0.003867	0.003646		
<b>RMS Error [m]</b>		0.003757	0.003868	0.003646		

Localisation accuracy per GCP and mean errors in the three coordinate directions. The last column counts the number of calibrated images where the GCP has been automatically verified vs. manually marked.

### ⚠ Absolute Geolocation Variance



Mn Error [m]	Max Error [m]	Geolocation Error X[%]	Geolocation Error Y[%]	Geolocation Error Z[%]
-	-0.09	0.00	0.00	0.00
-0.09	-0.07	0.00	0.00	0.07
-0.07	-0.05	0.00	0.07	0.07
-0.05	-0.03	1.03	0.59	2.42
-0.03	-0.02	3.67	4.56	2.72
-0.02	0.00	46.22	43.06	42.17
0.00	0.02	44.31	46.36	46.95
0.02	0.03	3.75	4.56	5.22
0.03	0.05	0.66	0.59	0.37
0.05	0.07	0.22	0.22	0.00
0.07	0.09	0.15	0.00	0.00
0.09	-	0.00	0.00	0.00
<b>Mean [m]</b>		0.063244	-0.007789	-0.181335
<b>Sigma [m]</b>		0.010970	0.010740	0.012036
<b>RMS Error [m]</b>		0.064188	0.013267	0.181734

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.

Geolocation Bias	X	Y	Z
Translation [m]	0.063210	-0.007745	-0.181322

Bias between image initial and computed geolocation given in output coordinate system.

### ⚠ Relative Geolocation Variance



Relative Geolocation Error	Images X[%]	Images Y[%]	Images Z[%]
[-1.00, 1.00]	94.93	94.56	99.49
[-2.00, 2.00]	99.41	99.63	100.00
[-3.00, 3.00]	99.85	100.00	100.00
<b>Mean of Geolocation Accuracy [m]</b>	0.022097	0.022097	0.047110

Sigma of Geolocation Accuracy [m]	0.000921	0.000921	0.001366
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Images X, Y, Z represent the percentage of images with a relative geolocation error in X, Y, Z.

Geolocation Orientational Variance	RMS [degree]
Omega	0.886
Phi	1.168
Kappa	1.001

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) i7-11700K @ 3.60GHz RAM: 128GB GPU: Microsoft Remote Display Adapter (Driver: unknown), Microsoft Remote Display Adapter (Driver: unknown)
Operating System	Windows 10 Pro, 64-bit

### Coordinate Systems



Image Coordinate System	WGS 84
Ground Control Point (GCP) Coordinate System	NZGD2000 / New Zealand Transverse Mercator 2000 (EGM2008 Geoid)
Output Coordinate System	NZGD2000 / New Zealand Transverse Mercator 2000 (EGM2008 Geoid)

### Processing Options



Detected Template	No Template Available
Keypoints Image Scale	Full, Image Scale: 0.5
Advanced: Matching Image Pairs	Custom Use Capture Time: yes, Number of Neighboring Images: 4 Use Triangulation of Image Geolocation: yes Use Distance: no Use Image Similarity: yes, Maximum Number of Pairs for Each Image Based on Similarity: 4 Use MTPs: yes, Maximum Number of Image Pairs per MTP: 50 Use Time for Multiple Cameras: no
Advanced: Matching Strategy	Use Geometrically Verified Matching: yes
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Standard Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, no