

# Quality Report



Generated with Pix4Ddiscovery version 4.5.2 Preview



**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	termico zenmuse XT2
Processed	2019-10-29 16:41:45
Camera Model Name(s)	XT2_13.0_640x512 (Grayscale)
Average Ground Sampling Distance (GSD)	5.88 cm / 2.31 in
Area Covered	0.012 km <sup>2</sup> / 1.2188 ha / 0.00 sq. mi. / 3.0134 acres
Time for Initial Processing (without report)	04m:14s

## Quality Check



Images	median of 9749 keypoints per image	
Dataset	96 out of 96 images calibrated (100%), all images enabled	
Camera Optimization	452.09% relative difference between initial and optimized internal camera parameters	
Matching	median of 5784.77 matches per calibrated image	
Georeferencing	yes, 10 GCPs (10 3D), mean RMS error = 0.031 m	

## Preview

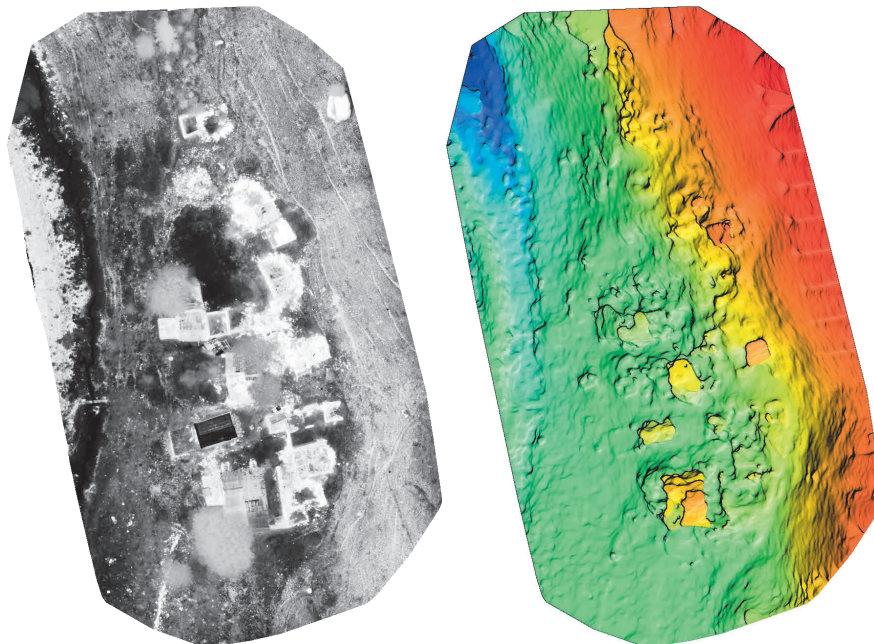


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

# Calibration Details



Number of Calibrated Images	96 out of 96
Number of Geolocated Images	96 out of 96

## ? Initial Image Positions

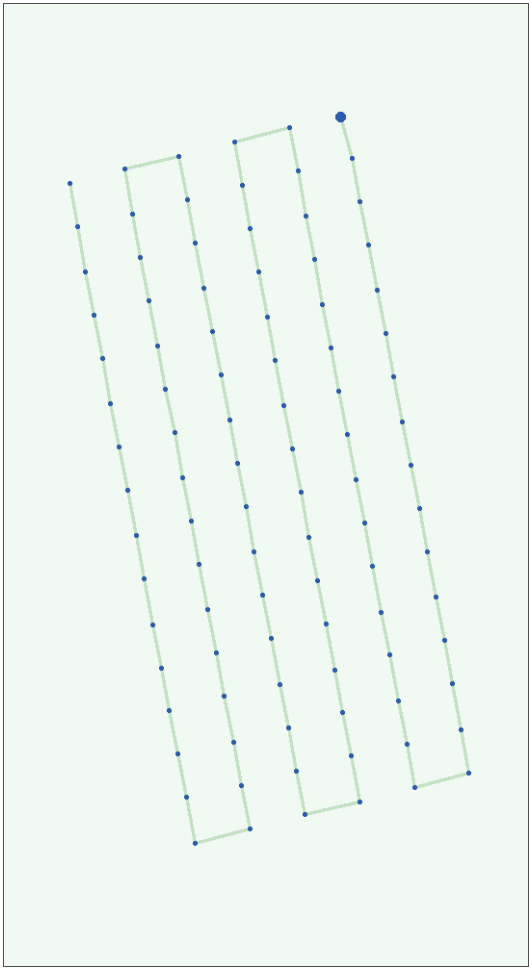
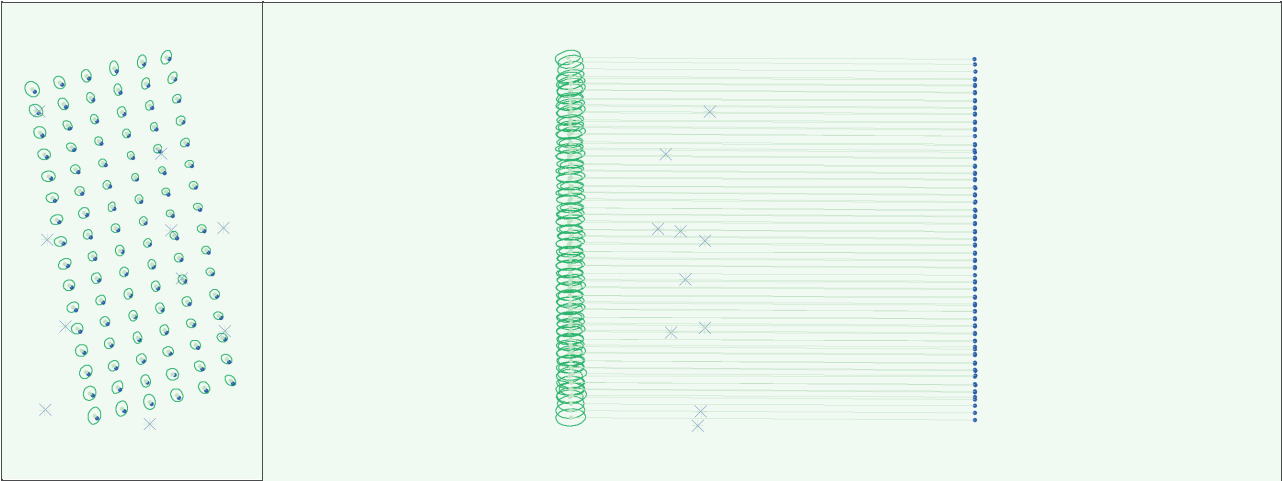
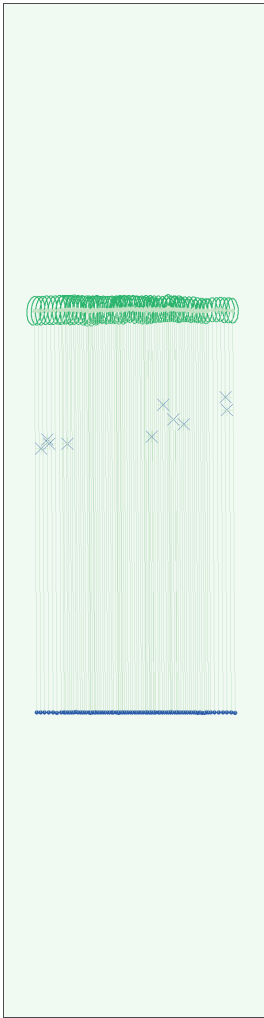


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

## ? 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). 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	0.019	0.020	0.050	0.023	0.025	0.007
Sigma	0.003	0.004	0.003	0.005	0.003	0.002

? Overlap



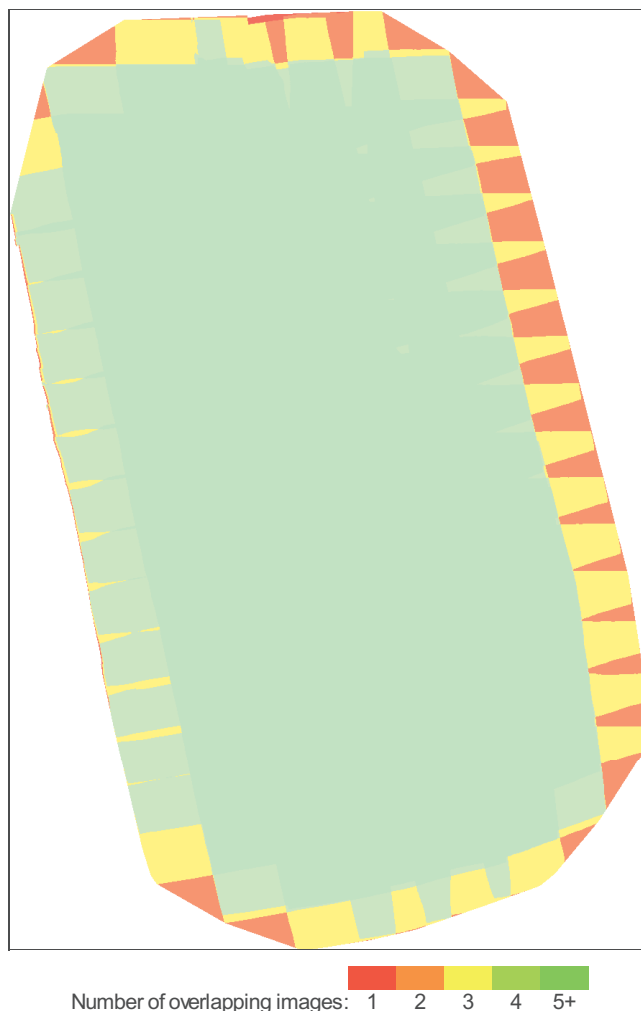


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic. Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	539722
Number of 3D Points for Bundle Block Adjustment	165327
Mean Reprojection Error [pixels]	0.251

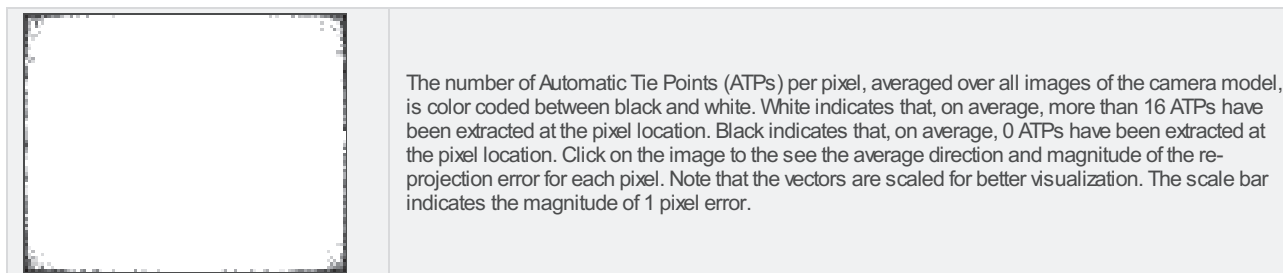
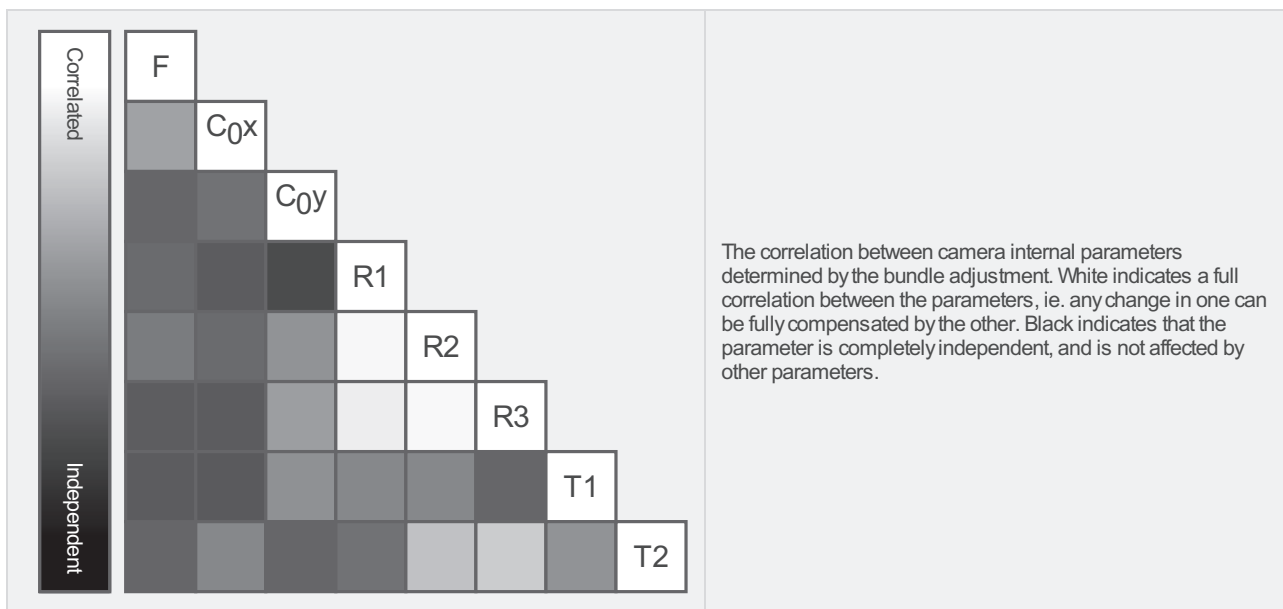
### ? Internal Camera Parameters

**XT2\_13.0\_640x512 (Grayscale). Sensor Dimensions: 58.824 [mm] x 47.059 [mm]**



EXIF ID: XT2\_13.0\_640x512

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	141.440 [pixel] 13.000 [mm]	320.000 [pixel] 29.412 [mm]	256.000 [pixel] 23.529 [mm]	0.000	0.000	0.000	0.000	0.000
Optimized Values	780.879 [pixel] 71.772 [mm]	317.085 [pixel] 29.144 [mm]	257.942 [pixel] 23.708 [mm]	-0.048	0.465	-0.058	-0.001	-0.001
Uncertainties (Sigma)	0.891 [pixel] 0.082 [mm]	0.203 [pixel] 0.019 [mm]	0.179 [pixel] 0.016 [mm]	0.001	0.011	0.030	0.000	0.000



## ? 2D Keypoints Table



	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	9749	5785
Min	8185	3324
Max	12252	8302
Mean	9728	5622

## ? 3D Points from 2D Keypoint Matches



	Number of 3D Points Observed
In 2 Images	86828
In 3 Images	31787
In 4 Images	16652
In 5 Images	9250
In 6 Images	7922
In 7 Images	3973
In 8 Images	3601
In 9 Images	2541
In 10 Images	1065
In 11 Images	777
In 12 Images	692
In 13 Images	103
In 14 Images	70
In 15 Images	49
In 16 Images	17

## ? 2D Keypoint Matches



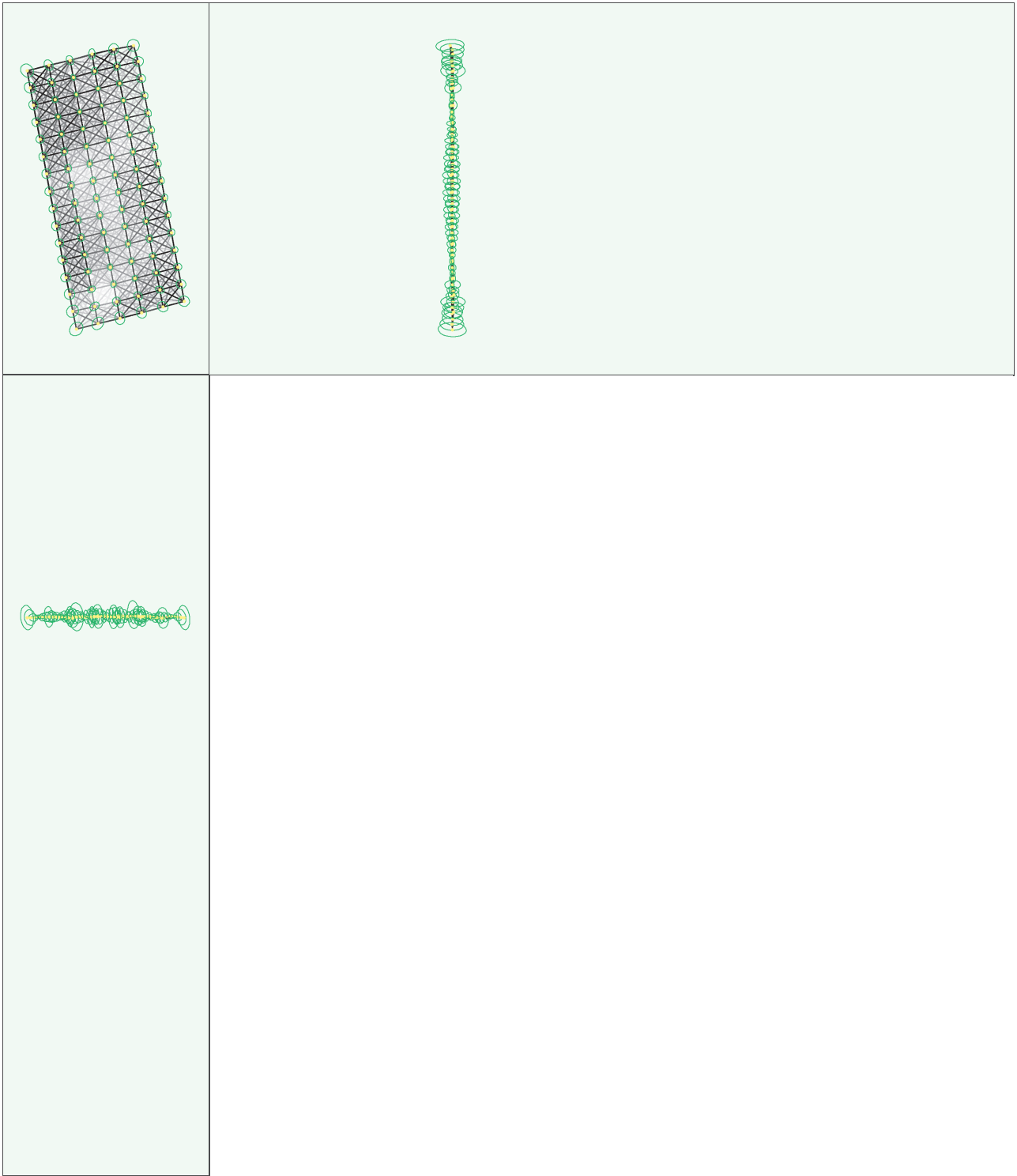


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.017	0.019	0.027	0.096	0.055	0.028
Sigma	0.005	0.005	0.015	0.043	0.019	0.011

# 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
MA202 (3D)	0.020/ 0.020	0.005	0.001	0.020	0.245	8 / 8
MA204 (3D)	0.020/ 0.020	0.071	0.018	0.152	0.640	3 / 3
MA205 (3D)	0.020/ 0.020	0.000	0.001	0.062	0.217	3 / 3
MA206 (3D)	0.020/ 0.020	-0.006	-0.010	0.045	0.307	5 / 5
MA210 (3D)	0.020/ 0.020	-0.008	0.003	-0.012	0.258	9 / 9
MB207 (3D)	0.020/ 0.020	0.020	0.006	-0.029	0.087	3 / 3
MG201 (3D)	0.020/ 0.020	-0.012	-0.006	-0.022	0.413	7 / 7
MG203 (3D)	0.020/ 0.020	-0.017	0.017	-0.052	0.197	6 / 6
MG208 (3D)	0.020/ 0.020	-0.006	-0.014	-0.036	0.306	7 / 7
MG209 (3D)	0.020/ 0.020	0.018	0.017	-0.037	0.265	4 / 4
Mean [m]		0.006419	0.003300	0.009073		
Sigma [m]		0.024521	0.010883	0.059396		
RMS Error [m]		0.025347	0.011372	0.060085		

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 v.s. manually marked.

## 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	0.00
-3.00	0.00	41.67	45.83	50.00
0.00	3.00	58.33	54.17	50.00
3.00	6.00	0.00	0.00	0.00
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]		0.855271	-0.816829	-152.166815
Sigma [m]		0.110484	0.174395	0.247259
RMS Error [m]		0.862378	0.835238	152.167016

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]	0.855271	-0.816829	-152.166815

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]	100.00	100.00	100.00
[-2.00, 2.00]	100.00	100.00	100.00

[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	5.000000	5.000000	10.000000
Sigma of Geolocation Accuracy [m]	0.000000	0.000000	0.000000

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

## Initial Processing Details


### System Information

Hardware	CPU: Intel(R) Core(TM) i7-4700HQ CPU @ 2.40GHz RAM: 16GB GPU: Intel(R) HD Graphics 4600 (Driver: 20.19.15.4549)
Operating System	Windows 10 Home, 64-bit

### Coordinate Systems

Image Coordinate System	WGS 84 (EGM96 Geoid)
Ground Control Point (GCP) Coordinate System	WGS 84 / UTM zone 32N (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 32N (EGM96 Geoid)

### Processing Options

Detected Template	 Thermal Camera
Keypoints Image Scale	Full, Image Scale: 2
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: yes
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Alternative Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, yes

## Point Cloud Densification details

### Processing Options

Image Scale	multiscale, 1 (Original image size, Slow)
Point Density	Optimal
Minimum Number of Matches	3
3D Textured Mesh Generation	no
LOD	Generated: no
Advanced: Image Groups	Grayscale
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	01m:43s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	NA

### Results

Number of Generated Tiles	1
Number of 3D Densified Points	1015029
Average Density (per m <sup>3</sup> )	56.93



# DSM, Orthomosaic and Index Details



## Processing Options



DSM and Orthomosaic Resolution	1 x GSD (5.88 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Inverse Distance Weighting Merge Tiles: no
Orthomosaic	Generated: yes Merge Tiles: no GeoTIFF Without Transparency: no Google Maps Tiles and KML: no
Index Calculator: Reflectance Map	Generated: yes Resolution: 1 x GSD (5.88 [cm/pixel]) Merge Tiles: no
Index Calculator: Indices	grayscale
Time for DSM Generation	48s
Time for Orthomosaic Generation	32s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01m:11s
Time for Index Map Generation	03s