

## Summary

Project	Veedol Substation
Processed	2018-07-19 14:09:53
Camera Model Name(s)	FC6310_8.8_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	1.75 cm / 0.69 in
Area Covered	0.029 km <sup>2</sup> / 2.9011 ha / 0.01 sq. mi. / 7.1725 acres
Time for Initial Processing (without report)	14m:22s

## Quality Check

<b>Images</b>	median of 59805 keypoints per image	✓
<b>Dataset</b>	63 out of 63 images calibrated (100%), all images enabled	✓
<b>Camera Optimization</b>	159.06% relative difference between initial and optimized internal camera parameters	⚠
<b>Matching</b>	median of 25330.1 matches per calibrated image	✓
<b>Georeferencing</b>	yes, no 3D GCP	⚠

## Preview

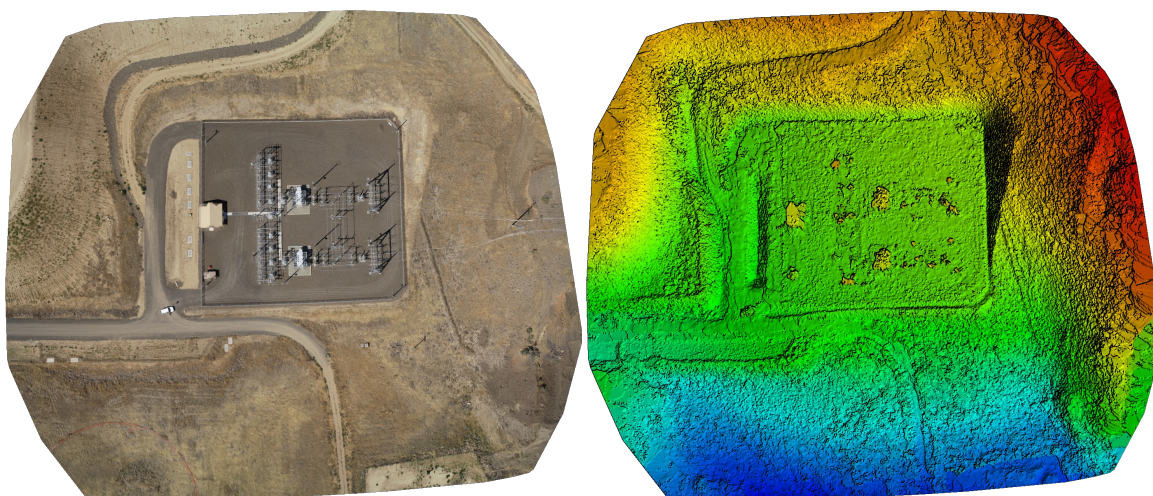


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

## Calibration Details

Number of Calibrated Images	63 out of 63
Number of Geolocated Images	63 out of 63

### Initial Image Positions

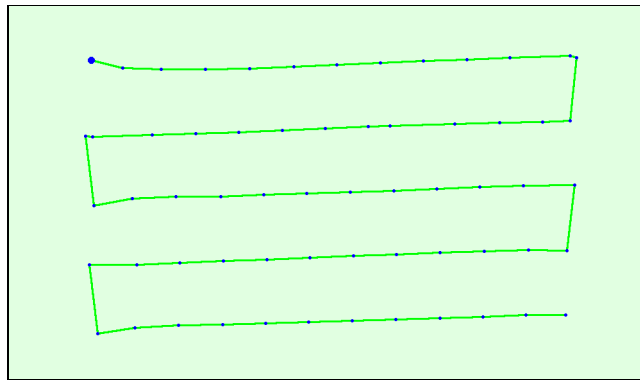
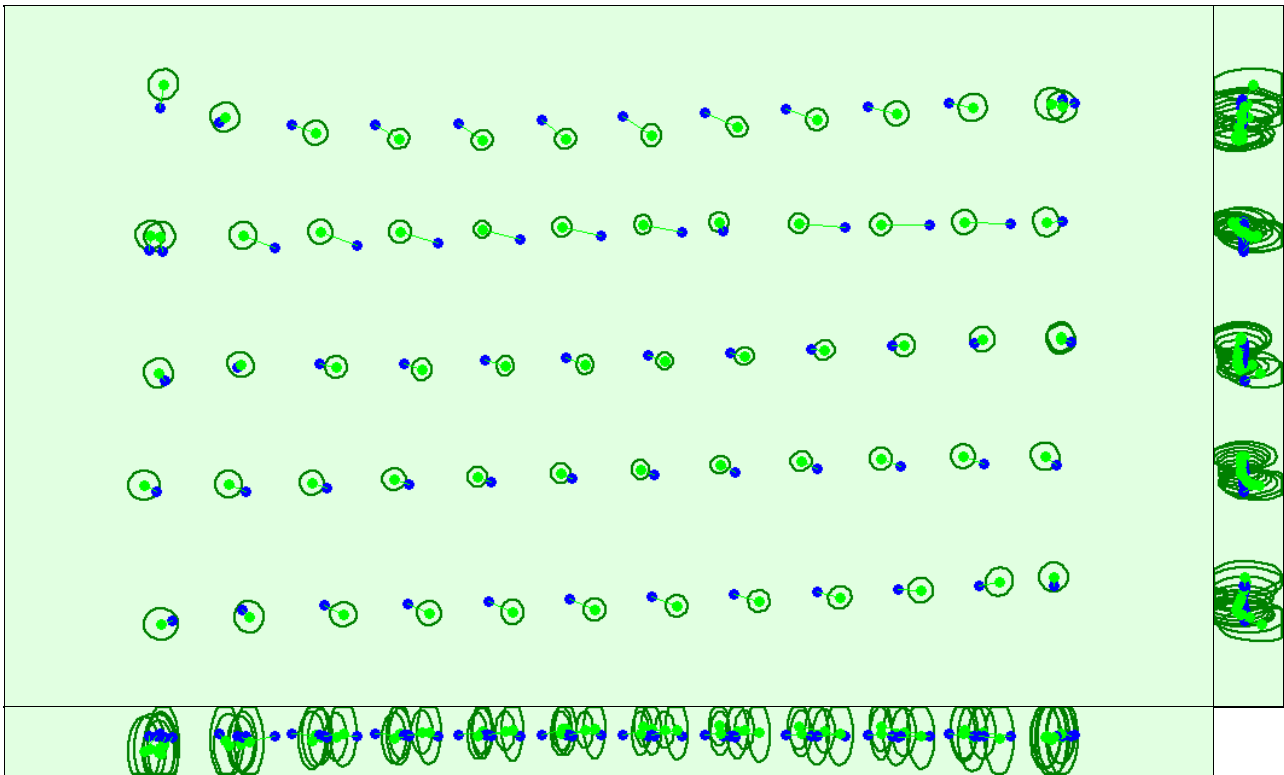


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

### Computed Image/GCPs/Manual Tie Points Positions



Uncertainty ellipses 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	0.208	0.208	0.502	0.571	0.361	0.160
Sigma	0.036	0.036	0.107	0.017	0.026	0.006

### Overlap

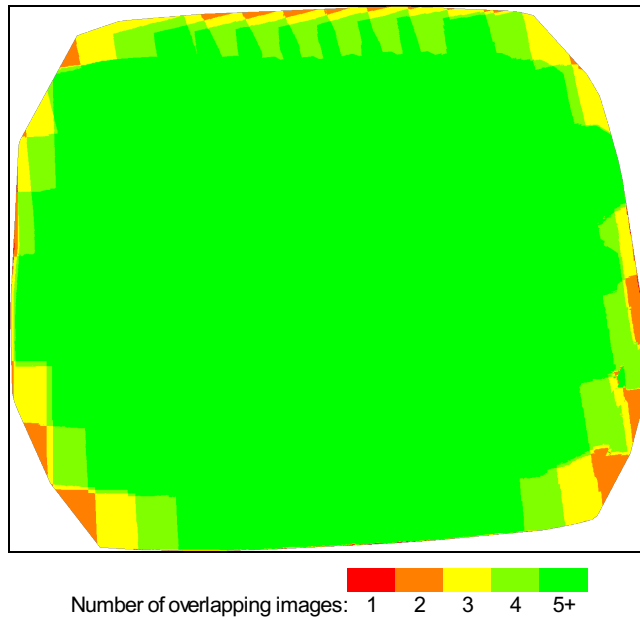


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic. Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

## Bundle Block Adjustment Details

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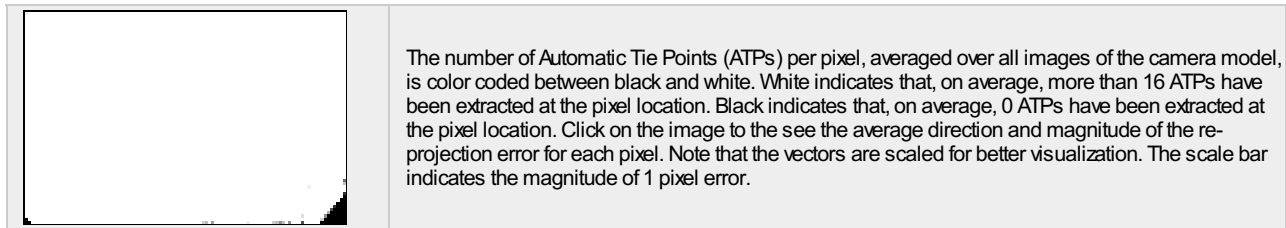
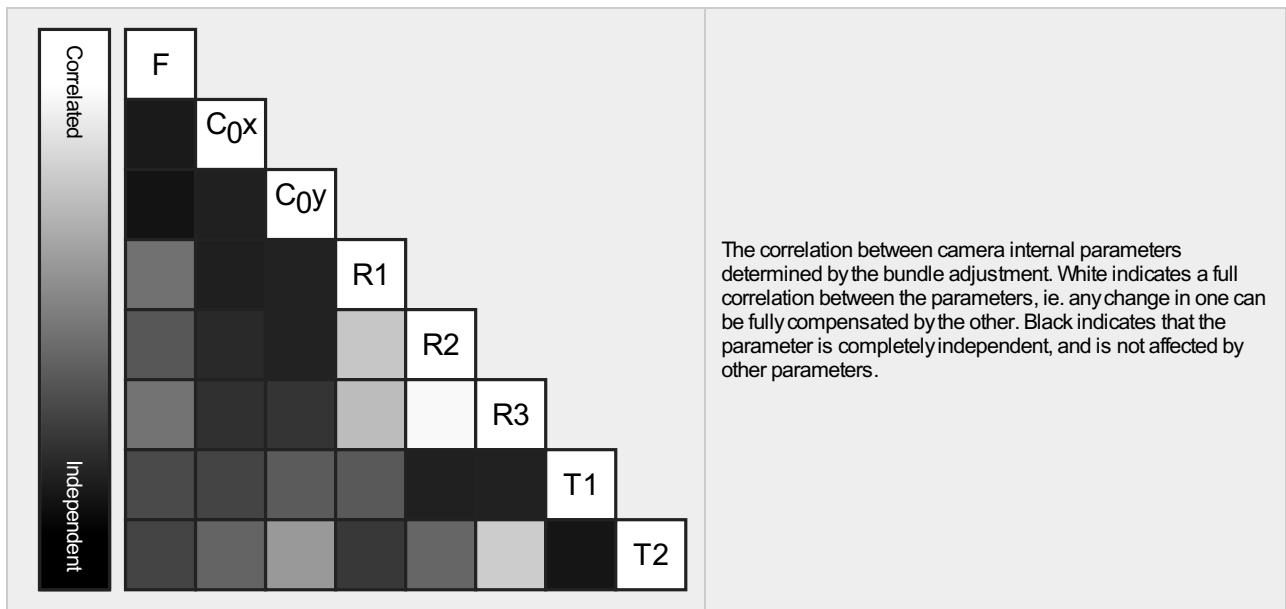
Number of 2D Keypoint Observations for Bundle Block Adjustment	1697685
Number of 3D Points for Bundle Block Adjustment	617810
Mean Reprojection Error [pixels]	0.281

### Internal Camera Parameters

**FC6310\_8.8\_5472x3648 (RGB). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]**

EXIF ID: FC6310\_8.8\_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3668.759 [pixel] 8.604 [mm]	2736.001 [pixel] 6.417 [mm]	1823.999 [pixel] 4.278 [mm]	0.003	-0.008	0.008	-0.000	0.000
Optimized Values	9504.312 [pixel] 22.290 [mm]	2640.107 [pixel] 6.192 [mm]	1425.275 [pixel] 3.343 [mm]	0.070	-0.611	3.488	-0.030	-0.042
Uncertainties (Sigma)	20.203 [pixel] 0.047 [mm]	3.755 [pixel] 0.009 [mm]	4.464 [pixel] 0.010 [mm]	0.001	0.018	0.103	0.000	0.000



## 2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	59805	25330
Mn	44414	14786
Max	71893	41163
Mean	59470	26947

## 3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	429108
In 3 Images	99029
In 4 Images	37227
In 5 Images	17813
In 6 Images	10111
In 7 Images	6110
In 8 Images	4543
In 9 Images	3499
In 10 Images	2563
In 11 Images	1748
In 12 Images	1590
In 13 Images	1121
In 14 Images	895
In 15 Images	777
In 16 Images	493
In 17 Images	343
In 18 Images	228
In 19 Images	191
In 20 Images	159
In 21 Images	107
In 22 Images	62
In 23 Images	43

In 24 Images	41
In 25 Images	8
In 26 Images	1

## 2D Keypoint Matches

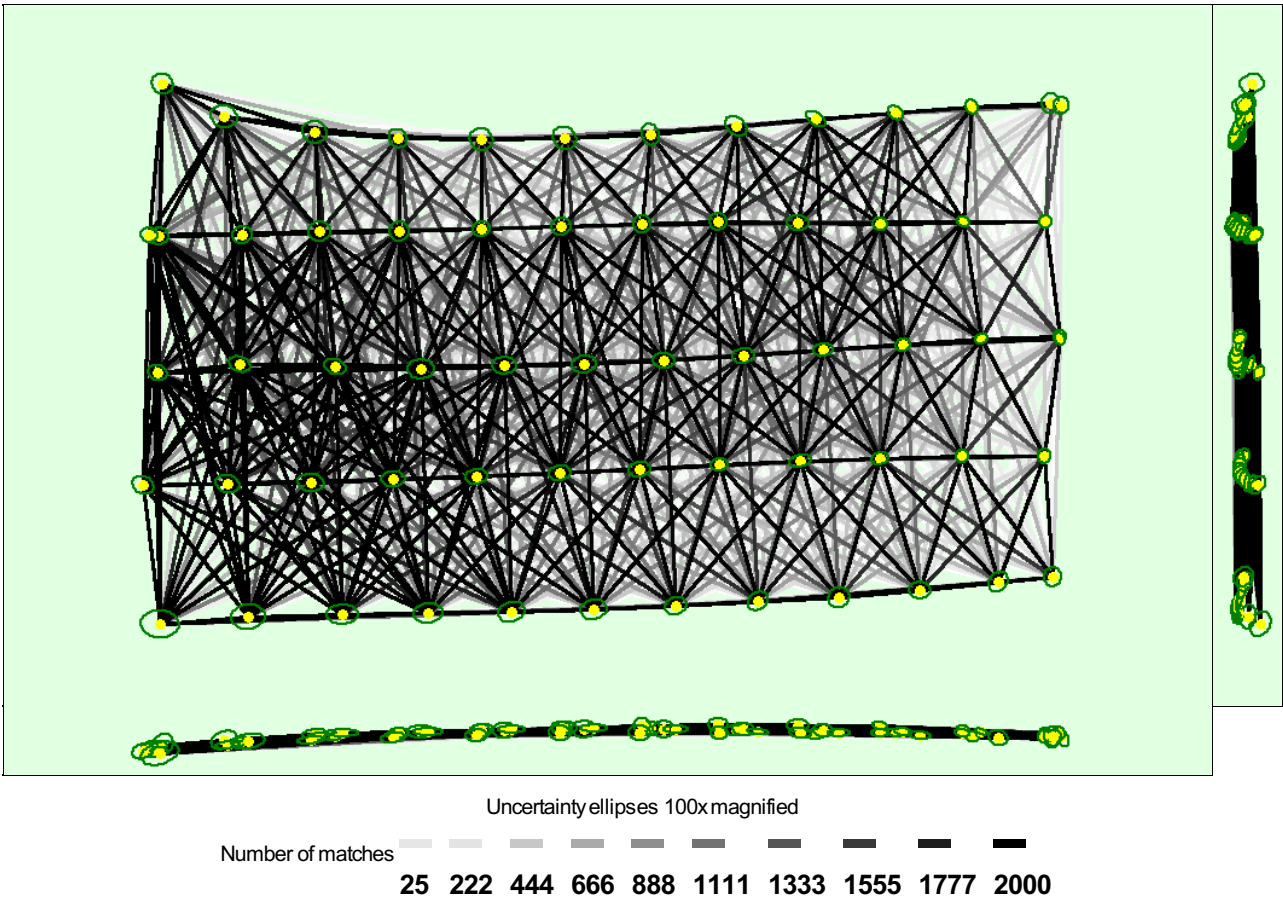


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.018	0.015	0.010	0.021	0.025	0.008
Sigma	0.004	0.003	0.004	0.005	0.008	0.002

## Geolocation Details

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### Absolute Geolocation Variance

Mn Error [m]	MaxError [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	34.92	1.59	0.00
-3.00	0.00	17.46	52.38	61.90
0.00	3.00	30.16	42.86	38.10

3.00	6.00	4.76	3.17	0.00
6.00	9.00	12.70	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
<b>Mean [m]</b>		-0.000001	-0.000009	-0.000001
<b>Sigma [m]</b>		3.872106	1.528468	1.081882
<b>RMS Error [m]</b>		3.872106	1.528468	1.081882

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]	82.54	100.00	100.00
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
<b>Mean of Geolocation Accuracy [m]</b>	5.000000	5.000000	10.000000
<b>Sigma of Geolocation Accuracy [m]</b>	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) Xeon(R) CPU X5672 @ 3.20GHz RAM: 144GB GPU: NVIDIA Quadro P4000 (Driver: 23.21.13.9133)
Operating System	Windows 10 Enterprise, 64-bit

### Coordinate Systems

Image Coordinate System	GCS_WGS_1984 (EGM96 Geoid)
Output Coordinate System	WGS_1984_UTM_Zone_10N (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: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Standard Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, yes

## 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	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	09m:21s
Time for Point Cloud Classification	01m:29s
Time for 3D Textured Mesh Generation	NA

## Results

Number of Generated Tiles	1
Number of 3D Densified Points	8569134
Average Density (per m <sup>3</sup> )	420.27

## DSM, Orthomosaic and Index Details

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### Processing Options

DSM and Orthomosaic Resolution	1 x GSD (1.75 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Inverse Distance Weighting Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: yes
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	5 x GSD (1.75 [cm/pixel])
Time for DSM Generation	07m:32s
Time for Orthomosaic Generation	08m:09s
Time for DTM Generation	03m:43s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s