

Quality Report



Generated with Pix4Denterprise version 4.3.31



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Additional information about the sections



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

Summary



Project	eldo_3k_1_re
Processed	2019-01-23 06:39:08
Camera Model Name(s)	RedEdge_5.5_1280x960 (Blue), RedEdge_5.5_1280x960 (Green), RedEdge_5.5_1280x960 (Red), RedEdge_5.5_1280x960 (NIR), RedEdge_5.5_1280x960 (Red edge)
Rig name(s)	«MicaSense 5 band»
Average Ground Sampling Distance (GSD)	8.26 cm / 3.25 in
Area Covered	0.609 km ² / 60.9434 ha / 0.24 sq. mi. / 150.6723 acres
Time for Initial Processing (without report)	04h:21m:41s

Quality Check



Images	median of 34433 keypoints per image	
Dataset	10085 out of 10460 images calibrated (96%), 5 images disabled	
Camera Optimization	1.13% relative difference between initial and optimized internal camera parameters	
Matching	median of 4273.41 matches per calibrated image	
Georeferencing	yes, no 3D GCP	

Preview

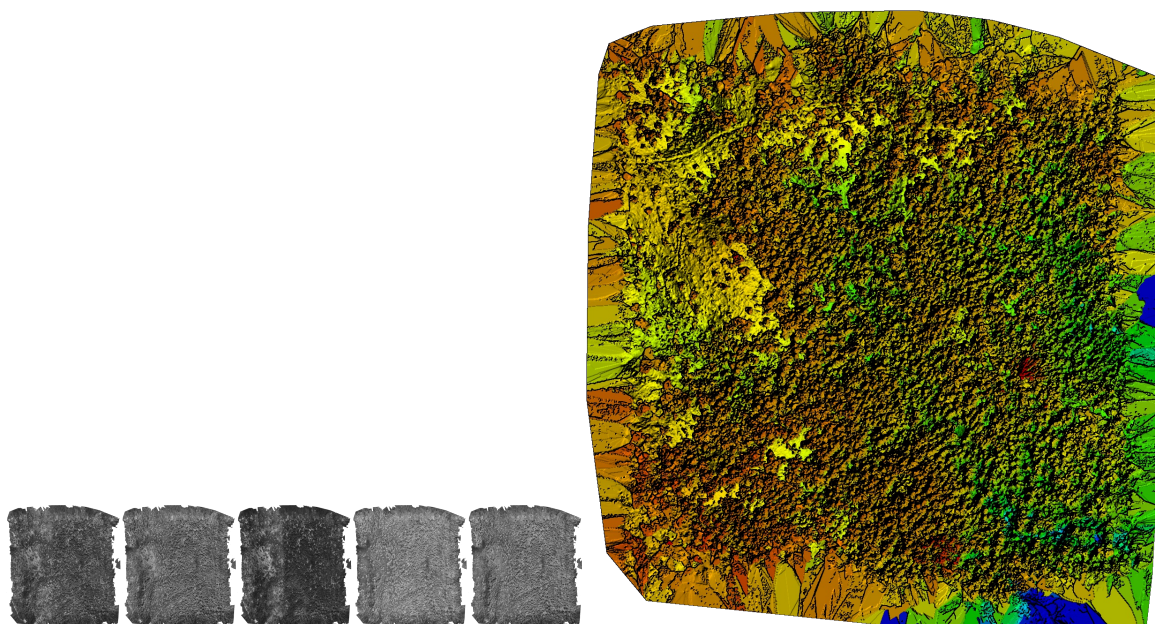


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details



Number of Calibrated Images	10085 out of 10465
Number of Geolocated Images	10465 out of 10465

? Initial Image Positions

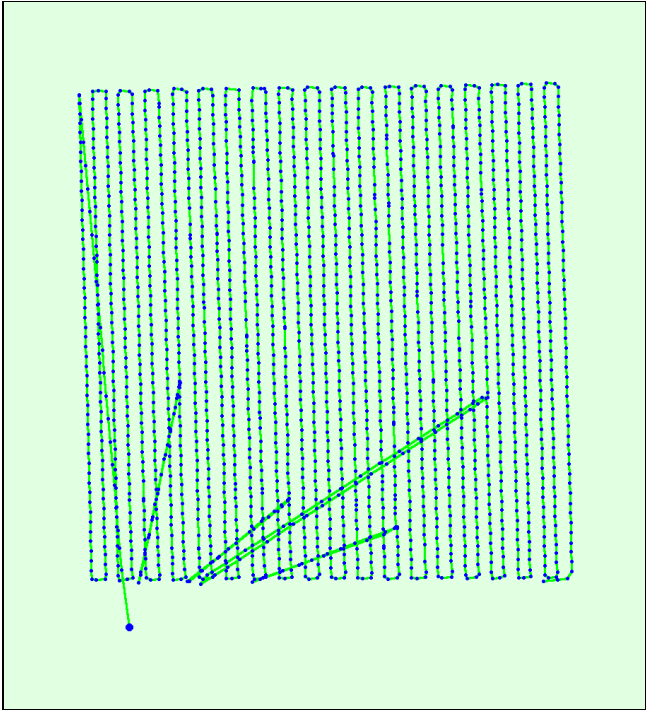
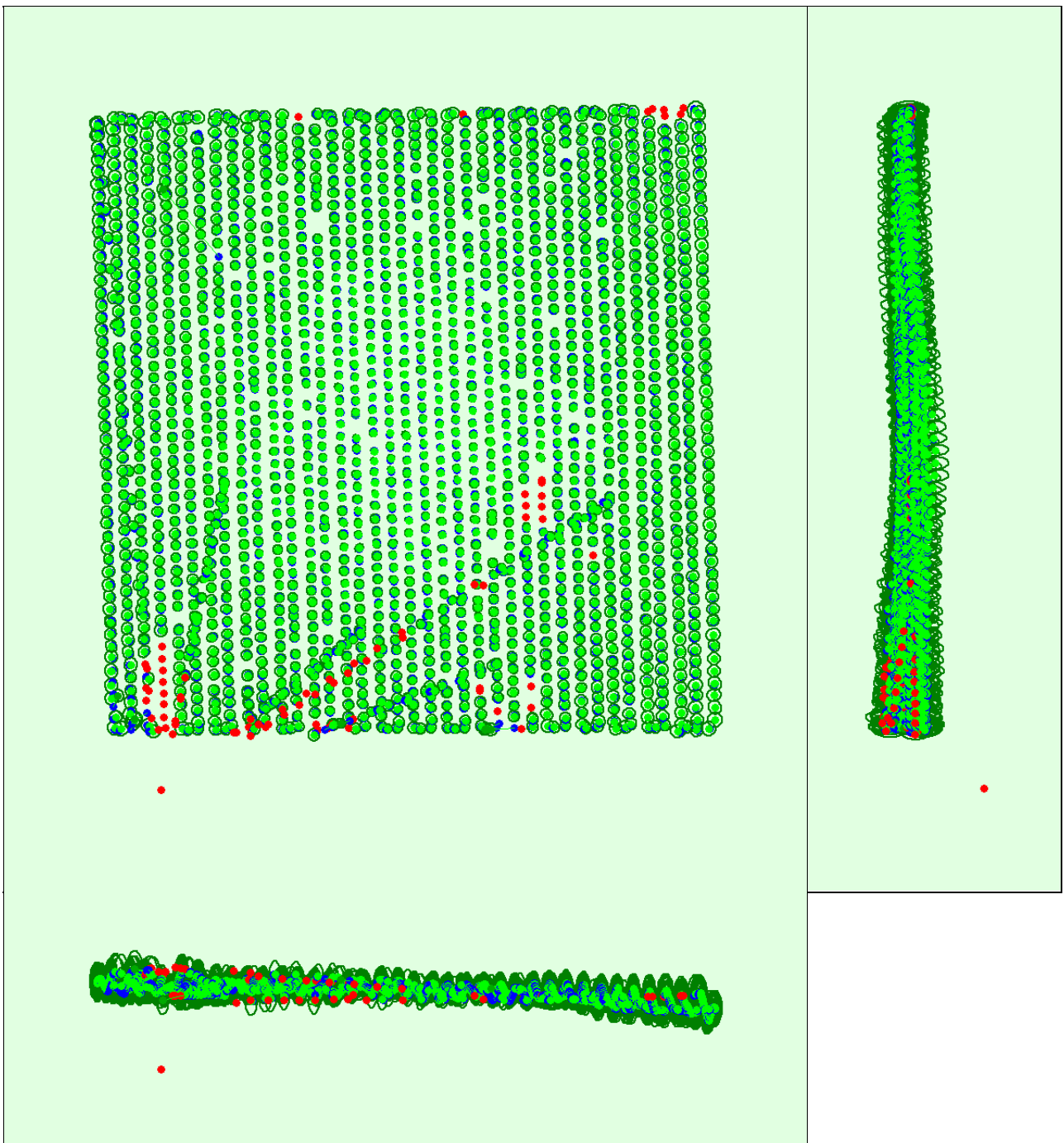


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

? Computed Image/GCPs/Manual Tie Points Positions





Uncertainty ellipses 50x 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	0.102	0.102	0.238	0.048	0.048	0.019
Sigma	0.016	0.016	0.050	0.003	0.003	0.004

? Overlap



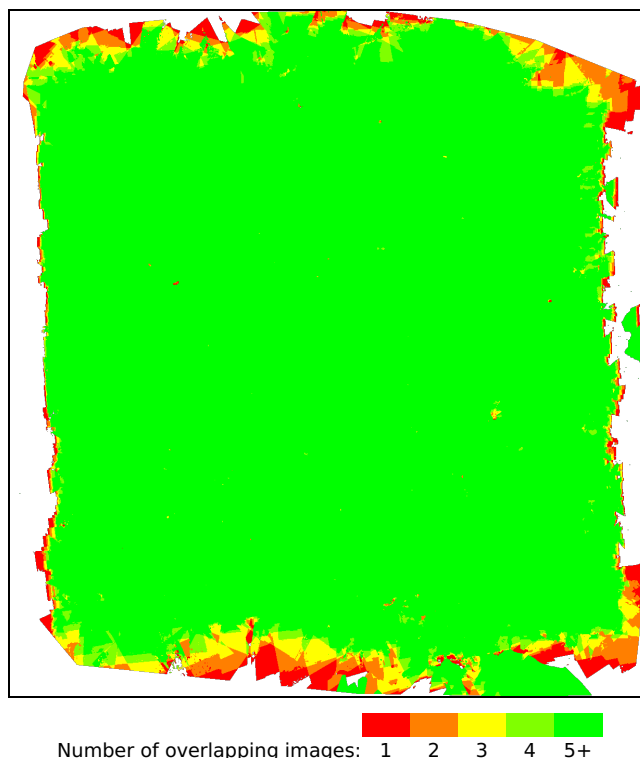


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	12367527
Number of 3D Points for Bundle Block Adjustment	4995481
Mean Reprojection Error [pixels]	0.215

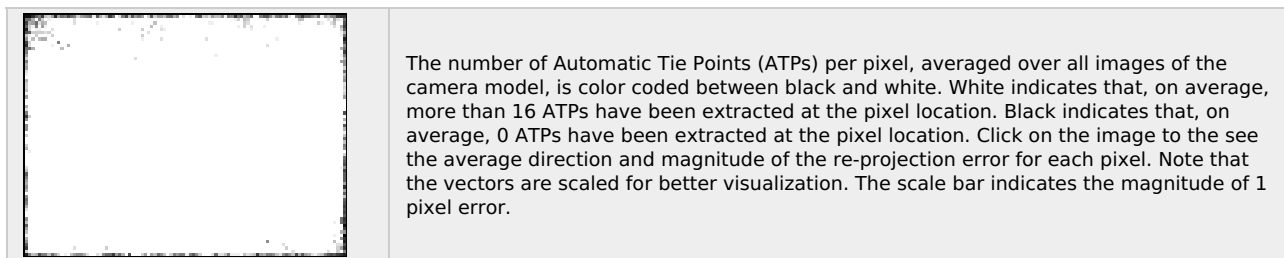
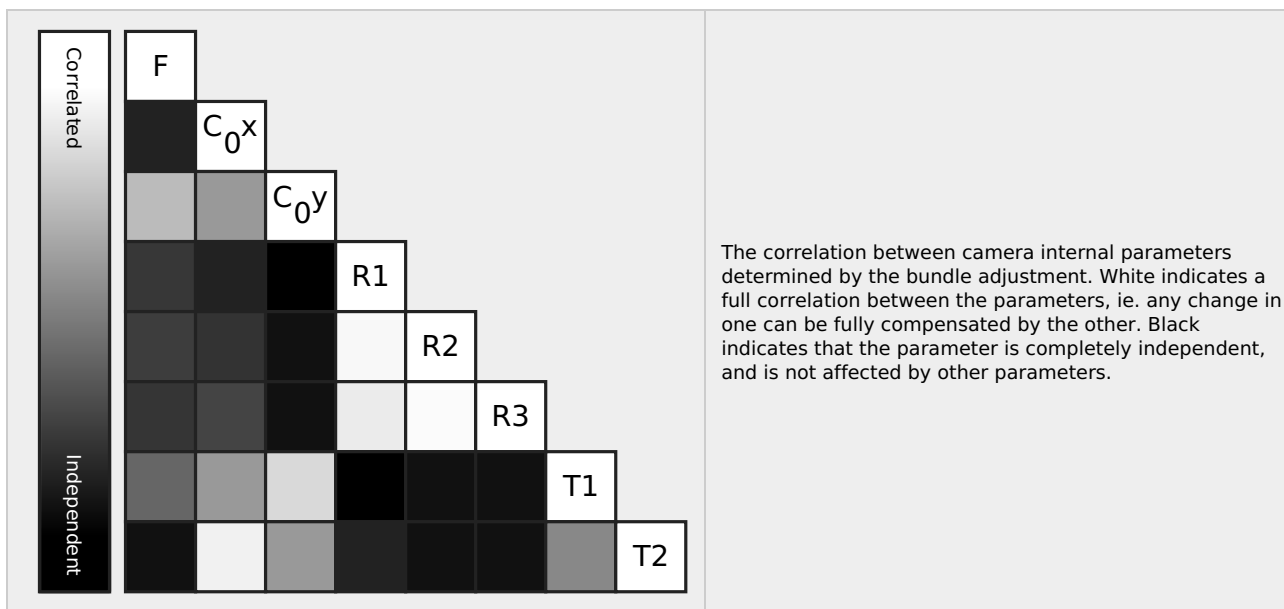
? Internal Camera Parameters

RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]



EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.605 [pixel] 2.466 [mm]	495.123 [pixel] 1.857 [mm]	-0.097	0.149	-0.017	0.000	0.000
Optimized Values	1449.697 [pixel] 5.436 [mm]	654.676 [pixel] 2.455 [mm]	494.817 [pixel] 1.856 [mm]	-0.098	0.163	-0.057	0.000	-0.000
Uncertainties (Sigma)	0.212 [pixel] 0.001 [mm]	0.160 [pixel] 0.001 [mm]	0.120 [pixel] 0.000 [mm]	0.001	0.008	0.017	0.000	0.000



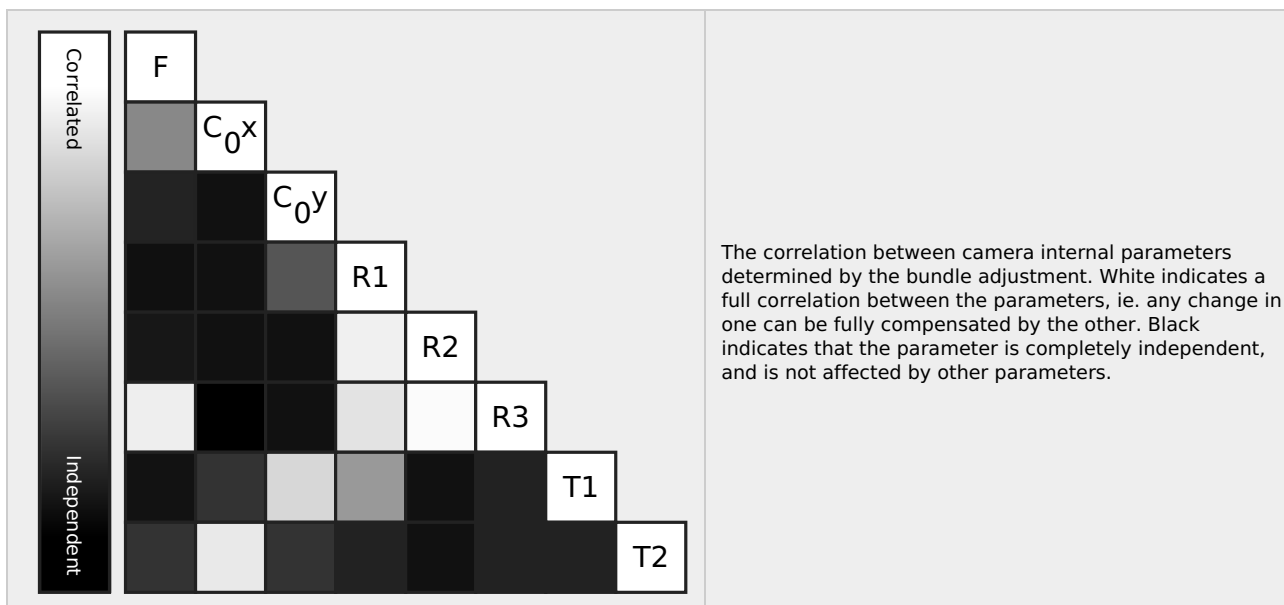
Internal Camera Parameters

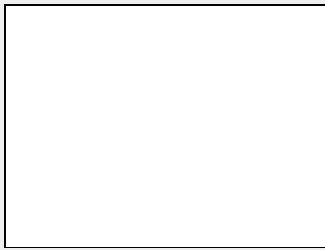
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]



EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.835 [pixel] 2.467 [mm]	481.299 [pixel] 1.805 [mm]	-0.099	0.143	-0.021	0.000	0.001
Optimized Values	1446.390 [pixel] 5.424 [mm]	655.691 [pixel] 2.459 [mm]	481.351 [pixel] 1.805 [mm]	-0.099	0.153	-0.038	0.000	0.000
Uncertainties (Sigma)	0.204 [pixel] 0.001 [mm]	0.047 [pixel] 0.000 [mm]	0.039 [pixel] 0.000 [mm]	0.000	0.002	0.005	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.

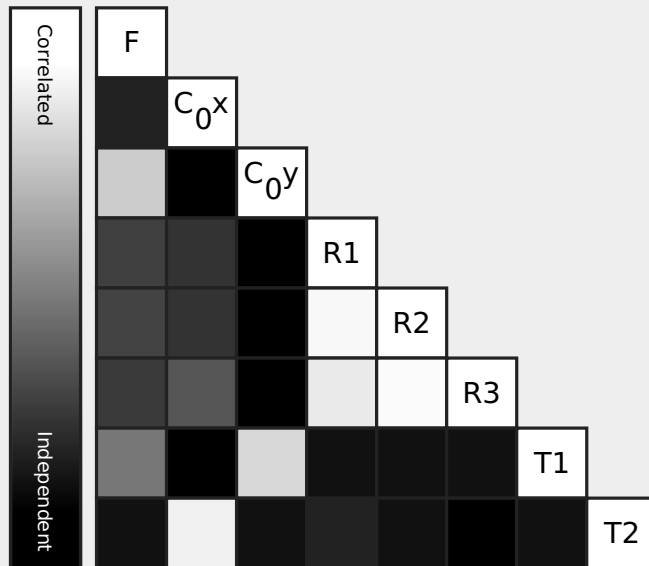
? Internal Camera Parameters

 **RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]**

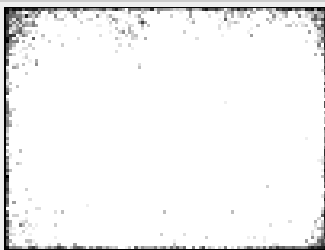


EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.200 [pixel] 2.465 [mm]	493.864 [pixel] 1.852 [mm]	-0.100	0.131	-0.003	-0.000	0.000
Optimized Values	1451.748 [pixel] 5.444 [mm]	653.552 [pixel] 2.451 [mm]	493.479 [pixel] 1.851 [mm]	-0.098	0.122	0.015	-0.000	-0.000
Uncertainties (Sigma)	0.214 [pixel] 0.001 [mm]	0.183 [pixel] 0.001 [mm]	0.138 [pixel] 0.001 [mm]	0.001	0.009	0.020	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.

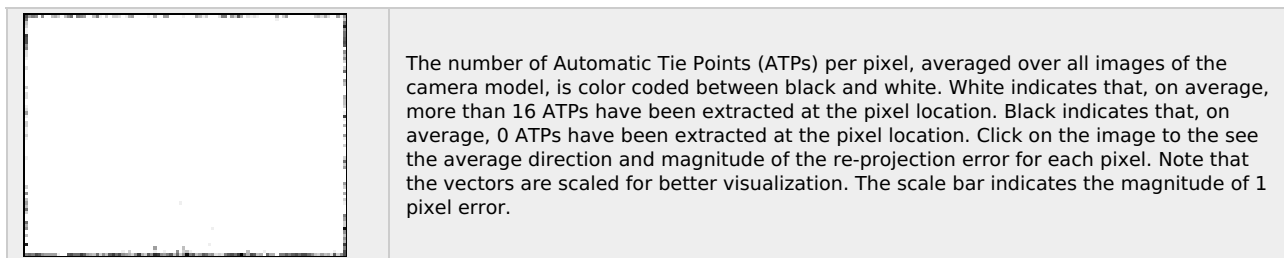
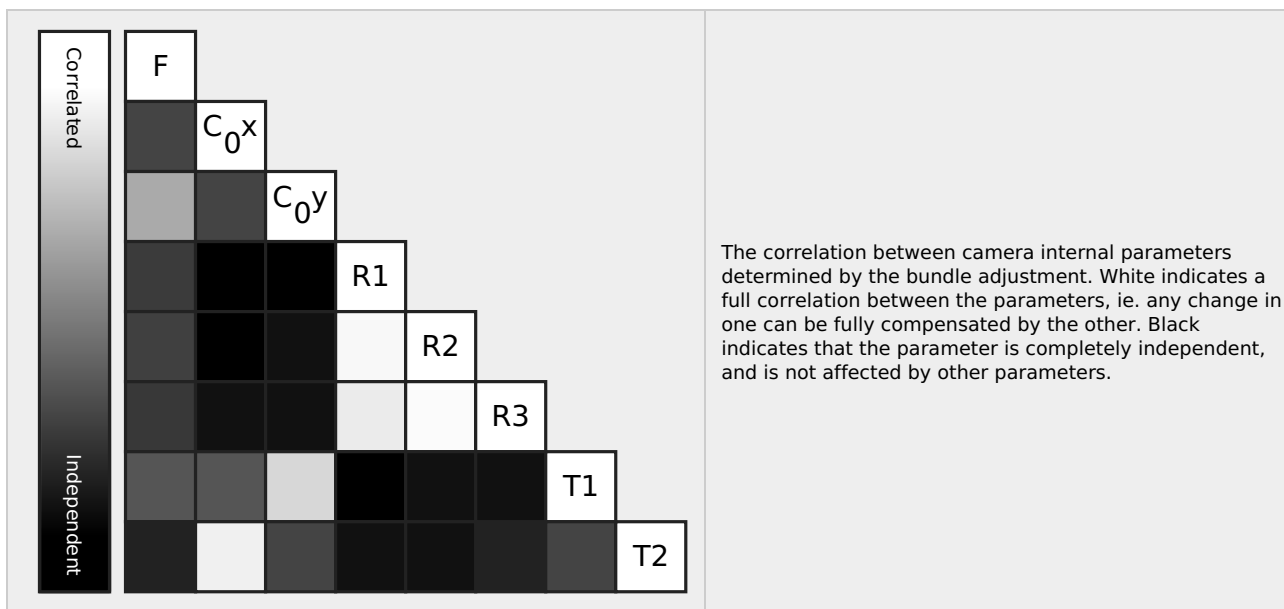
? Internal Camera Parameters

 **RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]**



EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	666.605 [pixel] 2.500 [mm]	482.221 [pixel] 1.808 [mm]	-0.105	0.153	-0.045	0.000	0.000
Optimized Values	1452.526 [pixel] 5.447 [mm]	663.073 [pixel] 2.487 [mm]	482.412 [pixel] 1.809 [mm]	-0.106	0.164	-0.070	0.000	-0.000
Uncertainties (Sigma)	0.213 [pixel] 0.001 [mm]	0.160 [pixel] 0.001 [mm]	0.119 [pixel] 0.000 [mm]	0.001	0.008	0.017	0.000	0.000

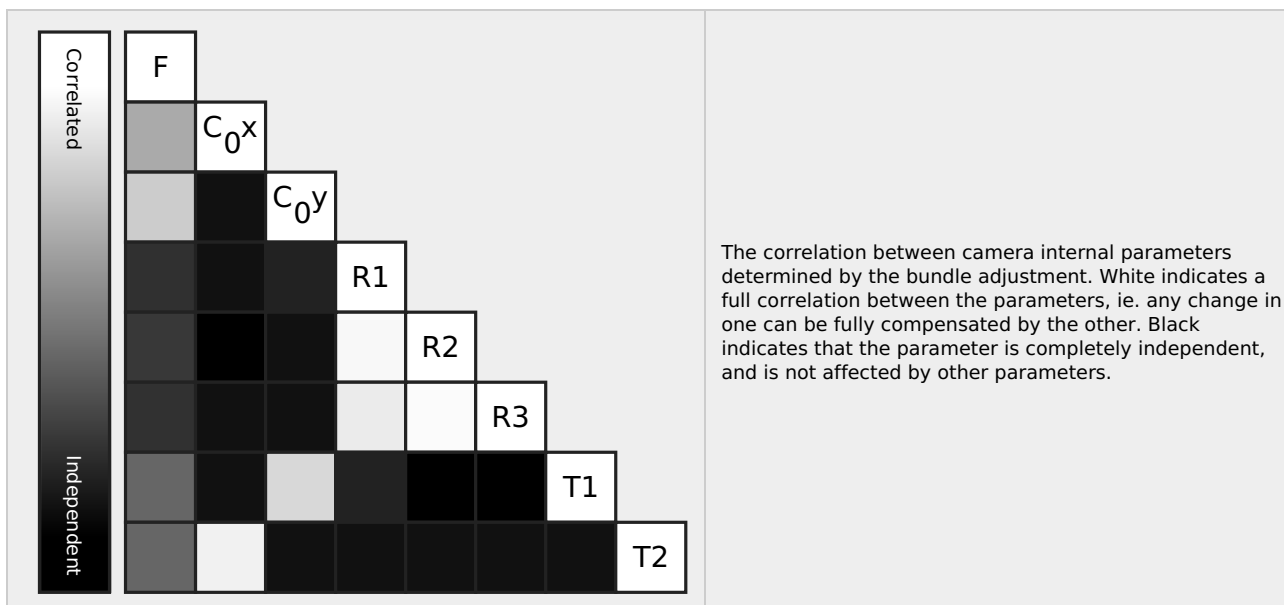


Internal Camera Parameters

RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	661.440 [pixel] 2.480 [mm]	495.379 [pixel] 1.858 [mm]	-0.103	0.155	-0.049	0.000	0.001
Optimized Values	1450.007 [pixel] 5.438 [mm]	658.190 [pixel] 2.468 [mm]	493.960 [pixel] 1.852 [mm]	-0.102	0.152	-0.043	0.000	0.000
Uncertainties (Sigma)	0.210 [pixel] 0.001 [mm]	0.140 [pixel] 0.001 [mm]	0.104 [pixel] 0.000 [mm]	0.001	0.007	0.015	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.

🔍 Camera Rig «MicaSense 5 band» Relatives. Images: 10460



	Transl X [m]	Transl Y [m]	Transl Z [m]	Rot X [degree]	Rot Y [degree]	Rot Z [degree]
RedEdge_5.5_1280x960 (Green)	Reference Camera					
RedEdge_5.5_1280x960 (Blue)						
Initial Values	0.030	0.000	0.000	0.000	0.000	0.000
Optimized values	0.030	0.000	0.000	-0.105	0.128	-0.371
Uncertainties (sigma)				0.005	0.007	0.000
RedEdge_5.5_1280x960 (Red)						
Initial Values	0.000	0.022	0.000	0.000	0.000	0.000
Optimized values	0.000	0.022	0.000	0.054	0.075	-0.061
Uncertainties (sigma)				0.006	0.007	0.000
RedEdge_5.5_1280x960 (NIR)						
Initial Values	0.030	0.022	0.000	0.000	0.000	0.000
Optimized values	0.030	0.022	0.000	-0.155	-0.106	0.118
Uncertainties (sigma)				0.005	0.007	0.000
RedEdge_5.5_1280x960 (Red edge)						
Initial Values	0.015	0.011	0.000	0.000	0.000	0.000
Optimized values	0.015	0.011	0.000	-0.064	-0.552	-0.322
Uncertainties (sigma)				0.004	0.006	0.000

🔍 2D Keypoints Table



	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34433	4273
Min	16855	0
Max	46530	27558
Mean	33248	4403

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Blue)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	29399	2548
Min	18177	0
Max	41020	7809
Mean	28816	2726

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Green)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	35402	4548
Min	19898	226
Max	46530	27558
Mean	34575	4862

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Red)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	21756	1842

Min	16855	0
Max	35696	6321
Mean	23572	2208

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (NIR)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34401	3744
Min	18392	0
Max	42134	9502
Mean	32898	3814

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Red edge)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	35483	4108
Min	19214	0
Max	43843	9700
Mean	34190	4182

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

	RedEdge_5.5_12... (Blue)	RedEdge_5.5_1... (Green)	RedEdge_5.5_128... (Red)	RedEdge_5.5_128... (NIR)	RedEdge_5.... (Red edge)
RedEdge_5.5_1280x960 (Blue)	16 / 288 / 4657	10 / 43 / 2646	50 / 397 / 3243	13 / 112 / 1103	10 / 132 / 1585
RedEdge_5.5_1280x960 (Green)		14 / 70 / 25152	9 / 35 / 1972	7 / 37 / 3548	8 / 47 / 7517
RedEdge_5.5_1280x960 (Red)			13 / 346 / 3656	10 / 80 / 946	13 / 98 / 1302
RedEdge_5.5_1280x960 (NIR)				13 / 329 / 7216	26 / 608 / 3843
RedEdge_5.5_1280x960 (Red edge)					11 / 165 / 5904

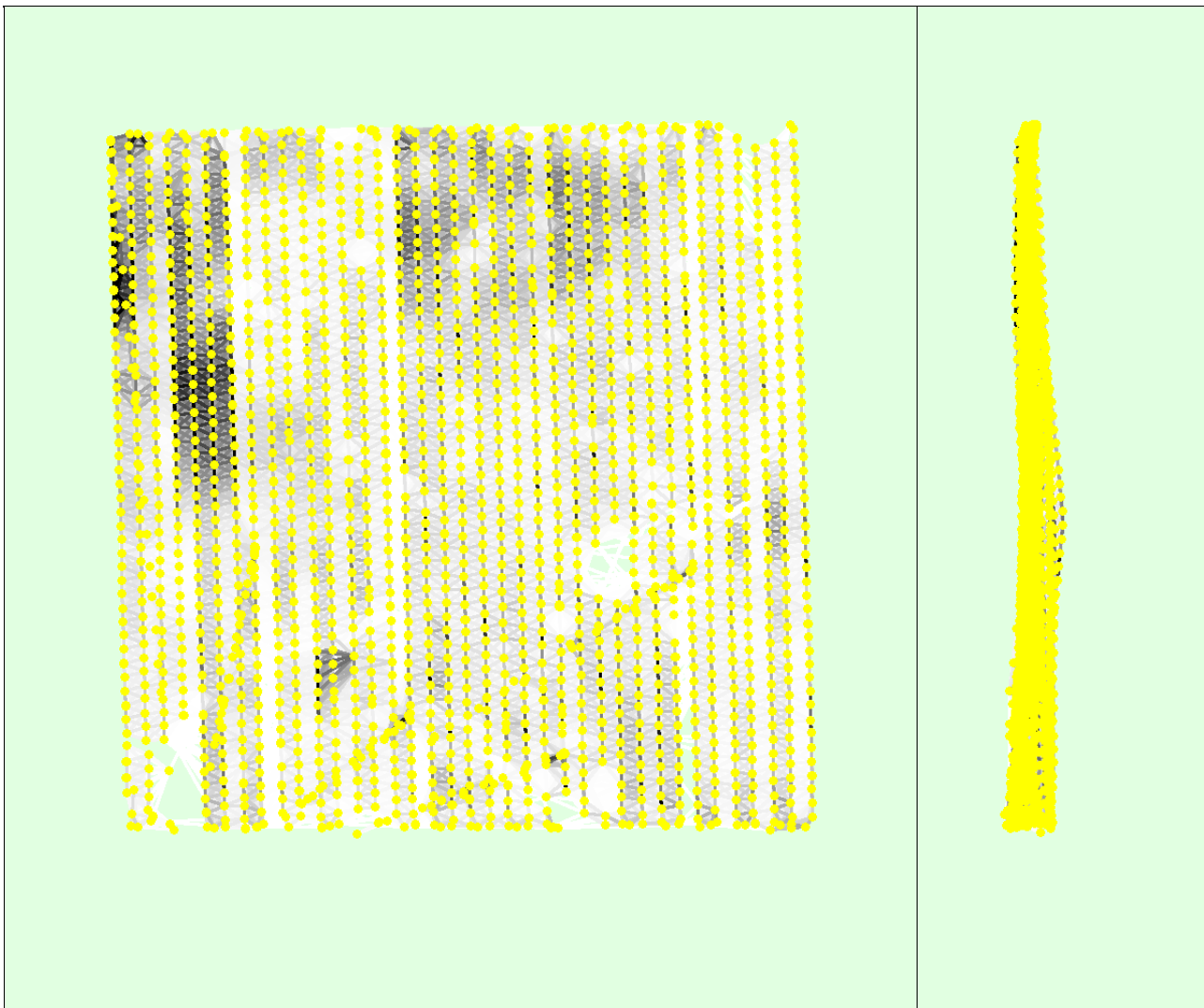
? 3D Points from 2D Keypoint Matches



	Number of 3D Points Observed
In 2 Images	3805689
In 3 Images	697164
In 4 Images	249568
In 5 Images	103685
In 6 Images	52991
In 7 Images	28578
In 8 Images	17293
In 9 Images	11510
In 10 Images	7634
In 11 Images	5178
In 12 Images	3750
In 13 Images	2733
In 14 Images	2011
In 15 Images	1612
In 16 Images	1266
In 17 Images	982
In 18 Images	728
In 19 Images	624
In 20 Images	450
In 21 Images	399
In 22 Images	318
In 23 Images	275
In 24 Images	221

In 25 Images	149
In 26 Images	123
In 27 Images	99
In 28 Images	72
In 29 Images	77
In 30 Images	67
In 31 Images	51
In 32 Images	37
In 33 Images	35
In 34 Images	29
In 35 Images	21
In 36 Images	14
In 37 Images	11
In 38 Images	8
In 39 Images	7
In 40 Images	2
In 41 Images	6
In 42 Images	2
In 43 Images	2
In 45 Images	2
In 46 Images	2
In 47 Images	3
In 48 Images	1
In 53 Images	1
In 55 Images	1

? 2D Keypoint Matches



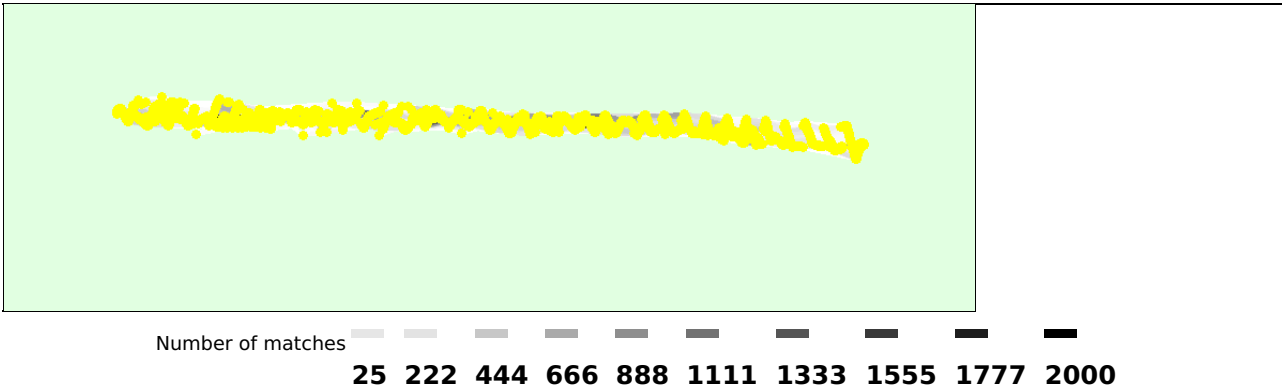


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.01	0.00
-9.00	-6.00	0.05	0.01	0.00
-6.00	-3.00	0.33	0.10	0.00
-3.00	0.00	58.56	51.43	40.12
0.00	3.00	41.02	48.17	59.68
3.00	6.00	0.00	0.27	0.15
6.00	9.00	0.01	0.01	0.05
9.00	12.00	0.01	0.00	0.00
12.00	15.00	0.02	0.00	0.00
15.00	-	0.01	0.00	0.00
Mean [m]		-0.061199	-0.026467	-0.004282
Sigma [m]		0.754918	1.060267	0.758646
RMS Error [m]		0.757395	1.060598	0.758658

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]	99.85	99.96	100.00
[-2.00, 2.00]	99.96	99.99	100.00
[-3.00, 3.00]	99.99	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) Xeon(R) Platinum 8124M CPU @ 3.00GHz RAM: 69GB GPU: no info (Driver: unknown)
Operating System	Linux 4.15.0-1031-aws x86_64

Coordinate Systems



Image Coordinate System	WGS 84 (EGM 96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 10N (EGM 96 Geoid)

Processing Options



Detected Template	No Template Available
Keypoints Image Scale	Custom, Image Scale: 2
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: Custom, yes
Rig «MicaSense 5 band» 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	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: no
LOD	Generated: no
Advanced: 3D Textured Mesh Settings	Sample Density Divider: 1
Advanced: Image Groups	Blue, Green, Red, NIR, Red edge
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	08m:50s
Time for Point Cloud Classification	58s
Time for 3D Textured Mesh Generation	11m:02s

Results



Number of Generated Tiles	1
Number of 3D Densified Points	12092704
Average Density (per m ³)	4.2

DSM, Orthomosaic and Index Details



Processing Options



DSM and Orthomosaic Resolution	1 x GSD (8.26 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Triangulation Merge Tiles: yes
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 (8.26 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	58s
Time for Orthomosaic Generation	55m:43s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:07m:38s
Time for Index Map Generation	39s

Camera Radiometric Correction



Camera Name	Band	Radiometric Correction Type	Reflectance target
RedEdge_5.5_1280x960	Blue	Camera and Sun Irradiance	✓
RedEdge_5.5_1280x960	Green	Camera and Sun Irradiance	✓
RedEdge_5.5_1280x960	Red	Camera and Sun Irradiance	✓
RedEdge_5.5_1280x960	NIR	Camera and Sun Irradiance	✓
RedEdge_5.5_1280x960	Red edge	Camera and Sun Irradiance	✓