VEXCEL
IMAGING

ULTRACAM

Calibration Report

Bahia, Brasil 2013

Photo on page 1 courtesy of Hiparc Geotecnologia, Brasil

www.hiparc.com

UltraCam Lp, GSD25 cm, RGB

ULTRACAM

Geometric Calibration

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-62411397-f80**
Panchromatic Camera:	**ck = 79.800 mm**
Multispectral Camera:	**ck = 79.800 mm**
PPA Information:	**X: 0.000 mm**
	Y: -0.080 mm

Panchromatic Camera

Large Format Panchromatic Output Image

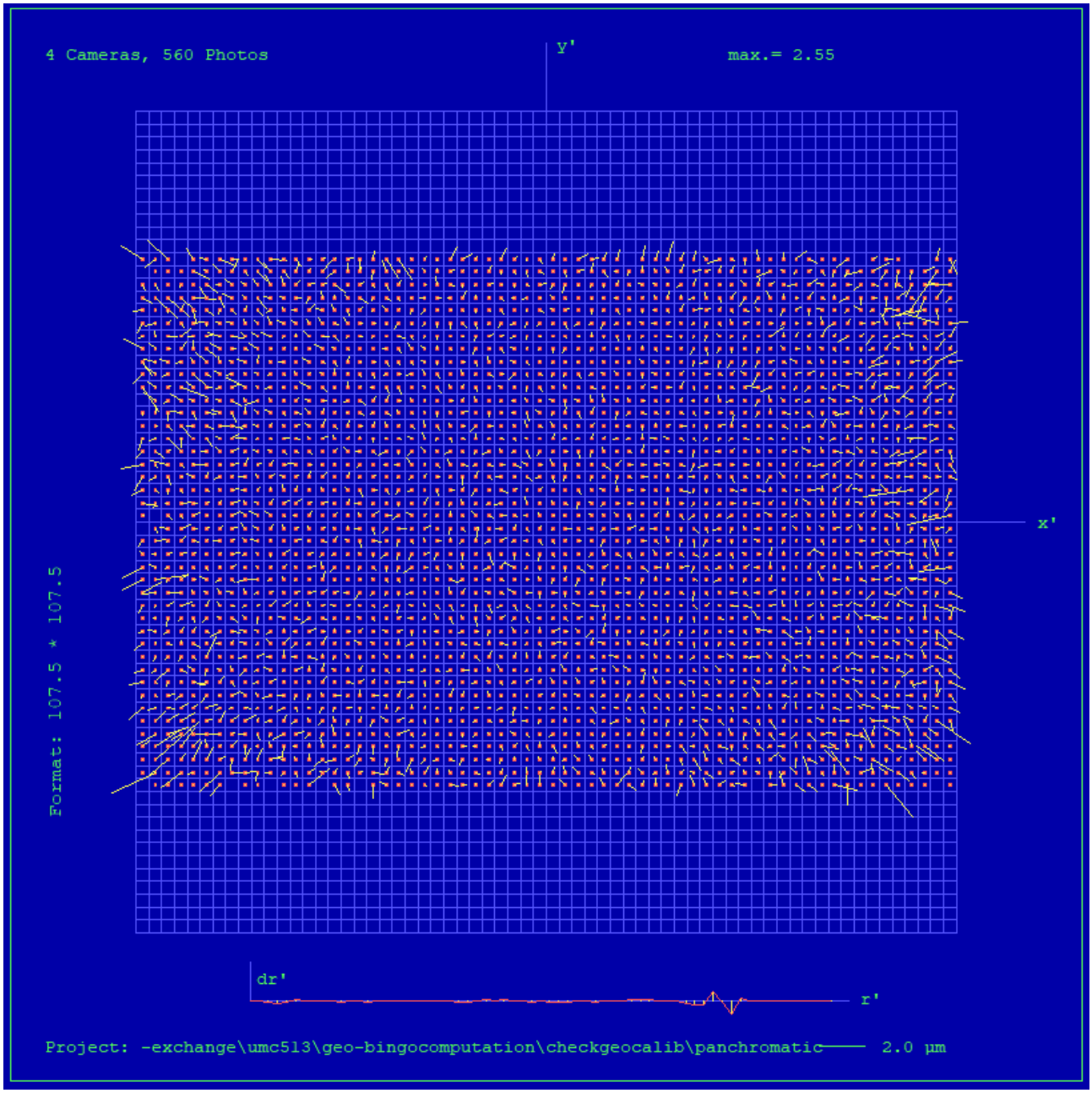
Image Format	long track cross track	68.016mm 105.840mm	17004pixel 26460pixel
Image Extent		(-34.008, -52.920)mm	(34.008, 52.920)mm
Pixel Size		4.000µm*4.000µm	
Focal Length	ck	79.800mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	-0.080mm	± 0.002mm
Lens Distortion	Remaining Distortion less than 0.002mm		

Multispectral Camera

Medium Format Multispectral Output Image (Upscaled to panchromatic image format)

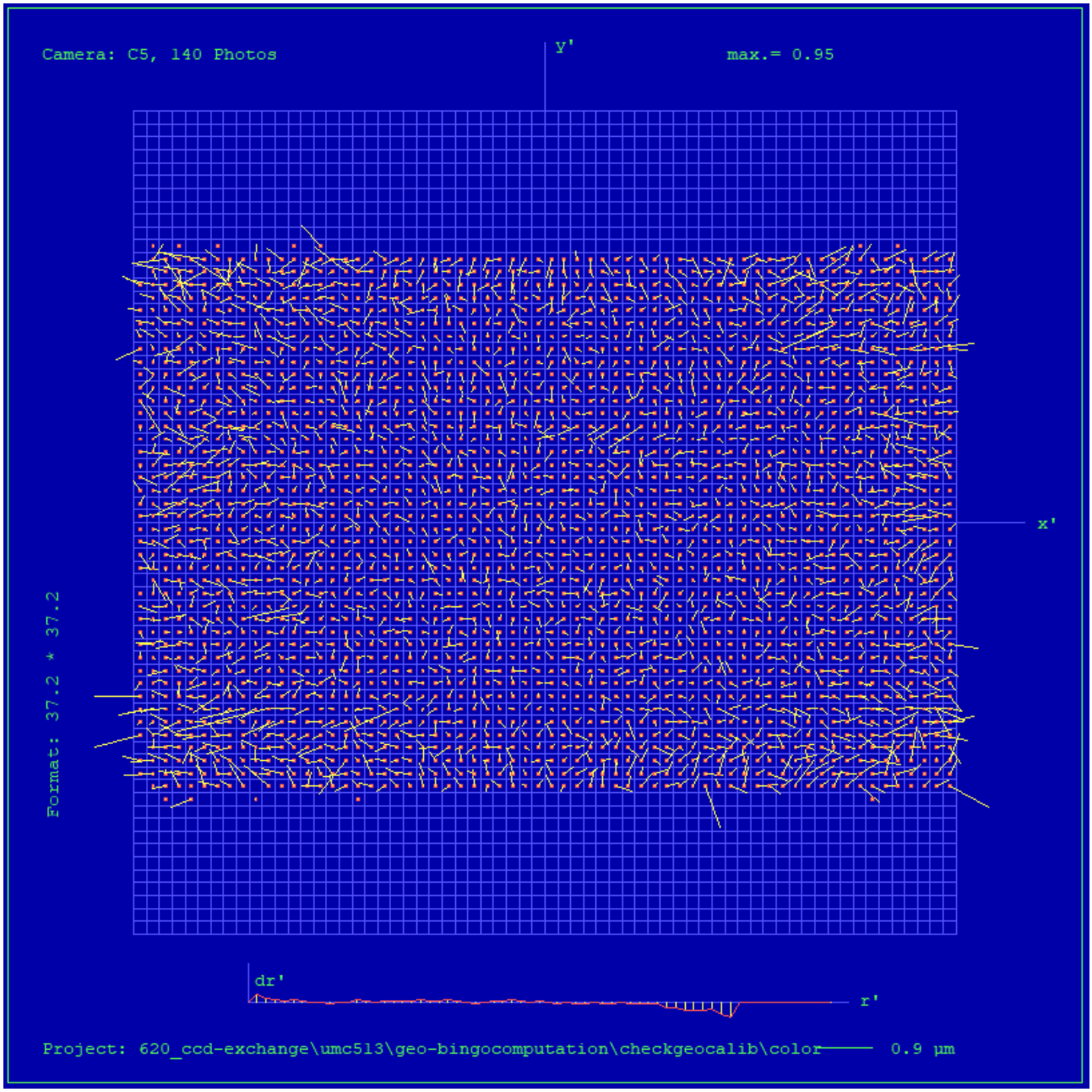
Image Format	long track cross track	68.016mm 105.840mm	5668pixel 8820pixel
Image Extent		(-34.008, -52.920)mm	(34.008, 52.920)mm
Pixel Size		12.000µm*12.000µm	
Focal Length	ck	79.800mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	-0.080mm	± 0.002mm
Lens Distortion	Remaining Distortion less than 0.002mm		

Full Panchromatic Image, Residual Error Diagram



Residual Error (RMS): **0.62 µm**

Green Cone (Cone 5), Residual Error Diagram



Residual Error (RMS): **0.45 µm**

Explanations

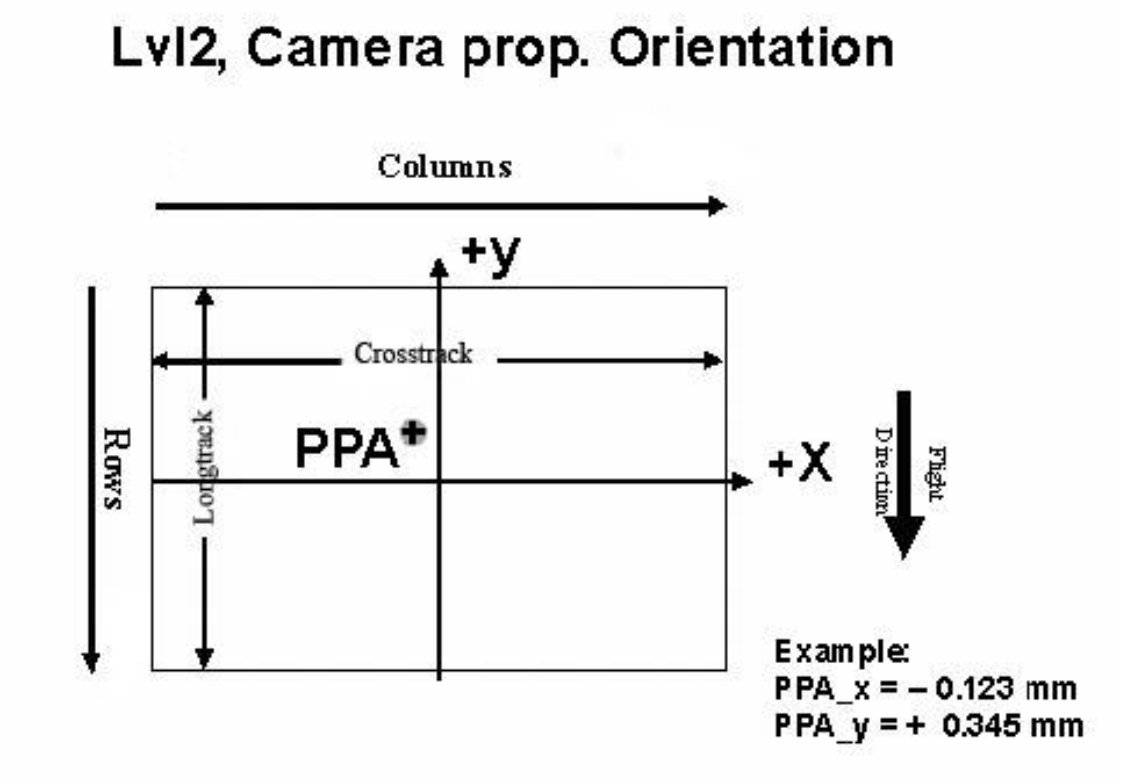
Calibration Method:

The geometric calibration is based on a set of 140 images of a defined geometry target with 394 GCPs.

Number of point measurements for the panchromatic camera : >16000
Number of point measurements for the multispectral camera : >60000

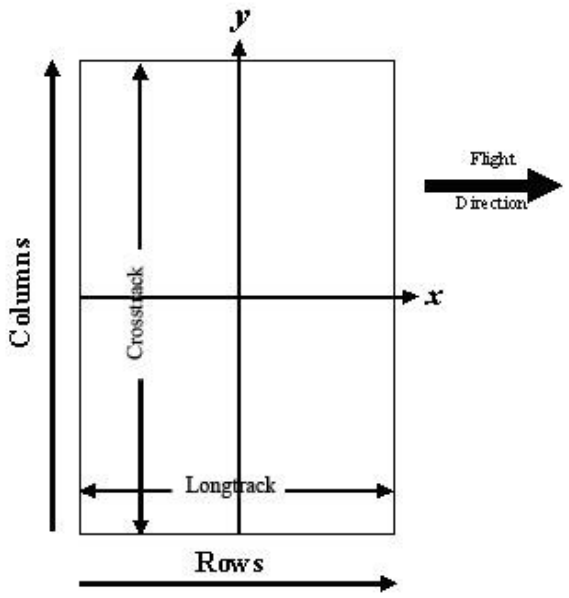
Determination of the image parameters by Least Squares Adjustment.
Software used for the adjustment: BINGO (GIP Eng. Aalen, Germany)

Level 2 Image Coordinate System:

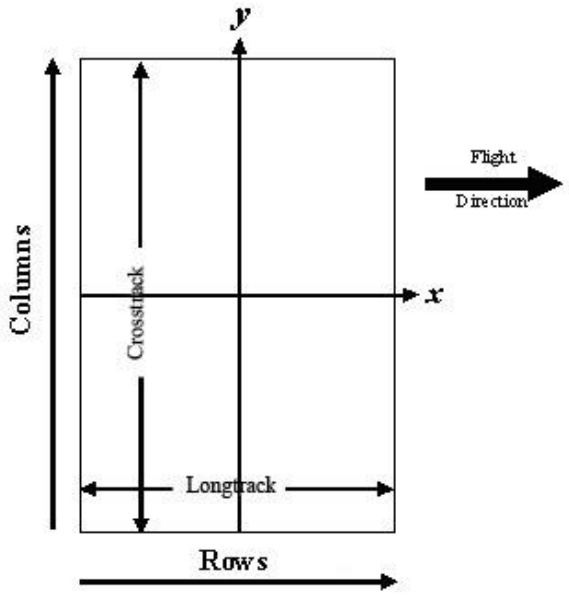


The image coordinate system of the Level 2 images is shown in the above figure. The basic image format and coordinate of the principal point in the level 2 image is given on page 4 of this report. The above figure shows the position of an example principal point at the coordinate (-0.123 / 0.345).

Level 3 Image Coordinate System:
(after rotation of 270° CW)



Panchromatic Image Format



Multispectral Image Format

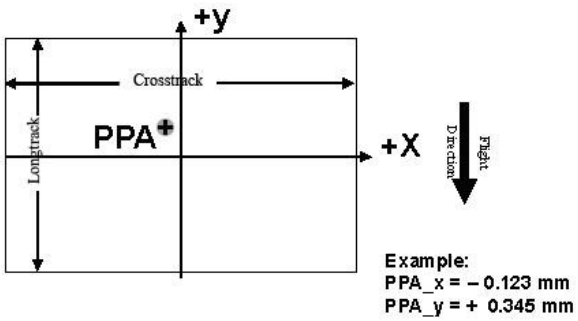
Position of Principal Point in Level 3 Image

The position of the principal point in the level 3 image depends on the “rotation” setting used in UltraMap during the pan-sharpening step. The exact position relative to the image center is given in the table below as a function of the rotation setting used in UltraMap. The coordinates are specified for clockwise (CW) rotation in steps of 90 degrees, according to the principal point coordinate given on page 4 for high- and low resolution images.

Image Format	Clockwise Rotation (Degree)	PPA	
		X	Y
Level 2	-	0.000	-0.080
Level 3	0	0.000	0.000
Level 3	90	-0.080	0.000
Level 3	180	0.000	0.080
Level 3	270	0.080	0.000

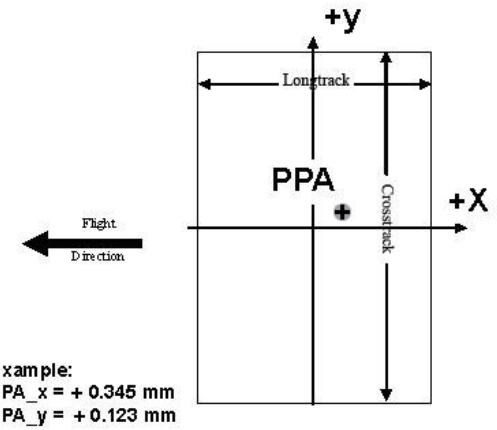
The coordinates in the figure below are only example values to illustrate the effect of image rotation on the principal point position, and do **not** correspond to the camera described in this report.

Lvl3, Rotation 0 deg clockwise



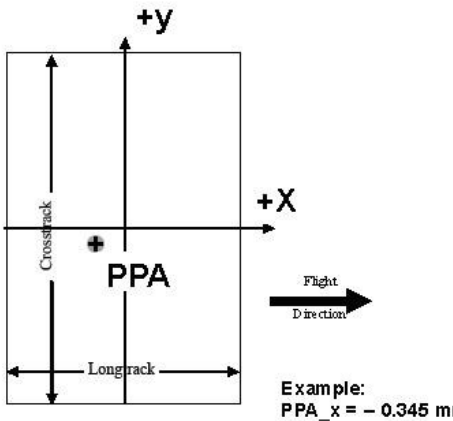
Example:
PPA_x = – 0.123 mm
PPA_y = + 0.345 mm

Lvl3, Rotation 90 deg clockwise



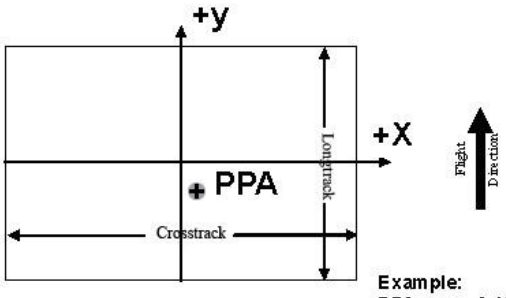
Example:
PPA_x = + 0.345 mm
PPA_y = + 0.123 mm

Lvl3, Rotation 270 deg clockwise



Example:
PPA_x = – 0.345 mm
PPA_y = – 0.123 mm

Lvl3, Rotation 180 deg clockwise



Example:
PPA_x = + 0.123 mm
PPA_y = – 0.345 mm

Lens Resolving Power

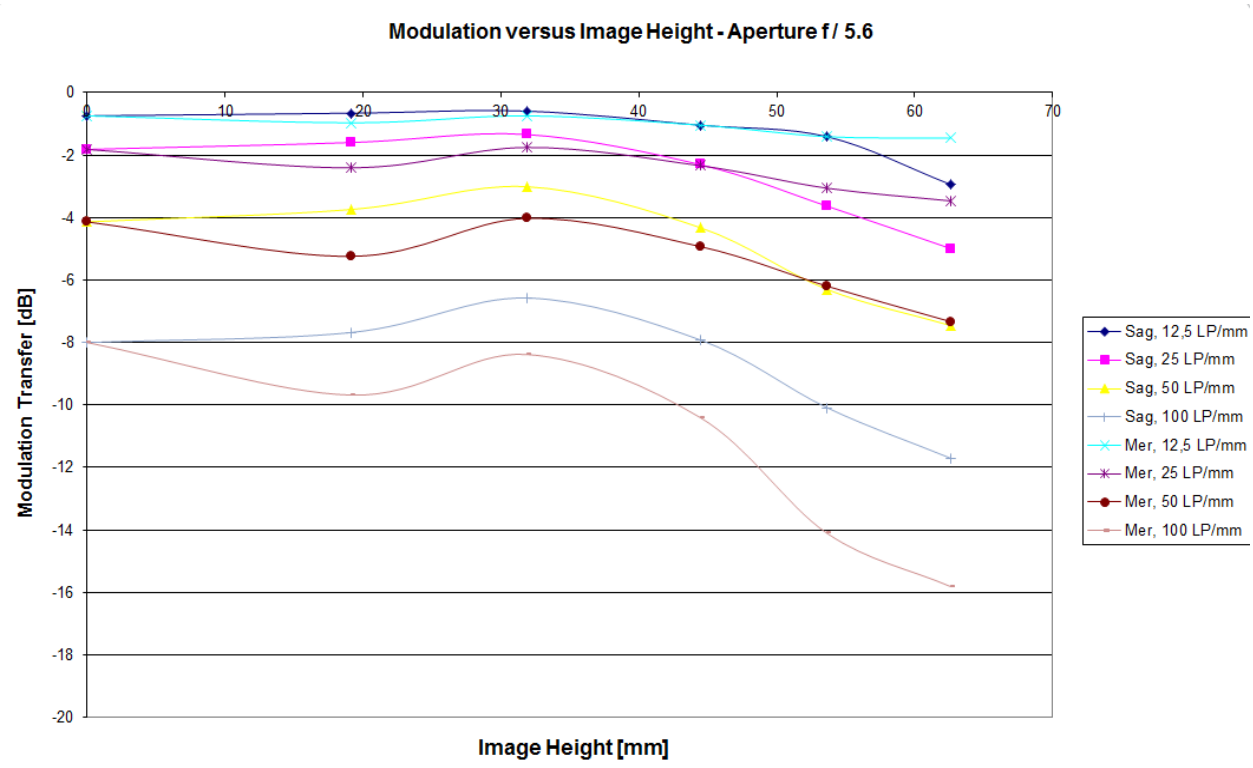
The following curves show the development of the modulation transfer function across different image heights of the panchromatic cones.
Please note that these values have been calculated and can vary up to 10% with optics from production (especially at high LP's).

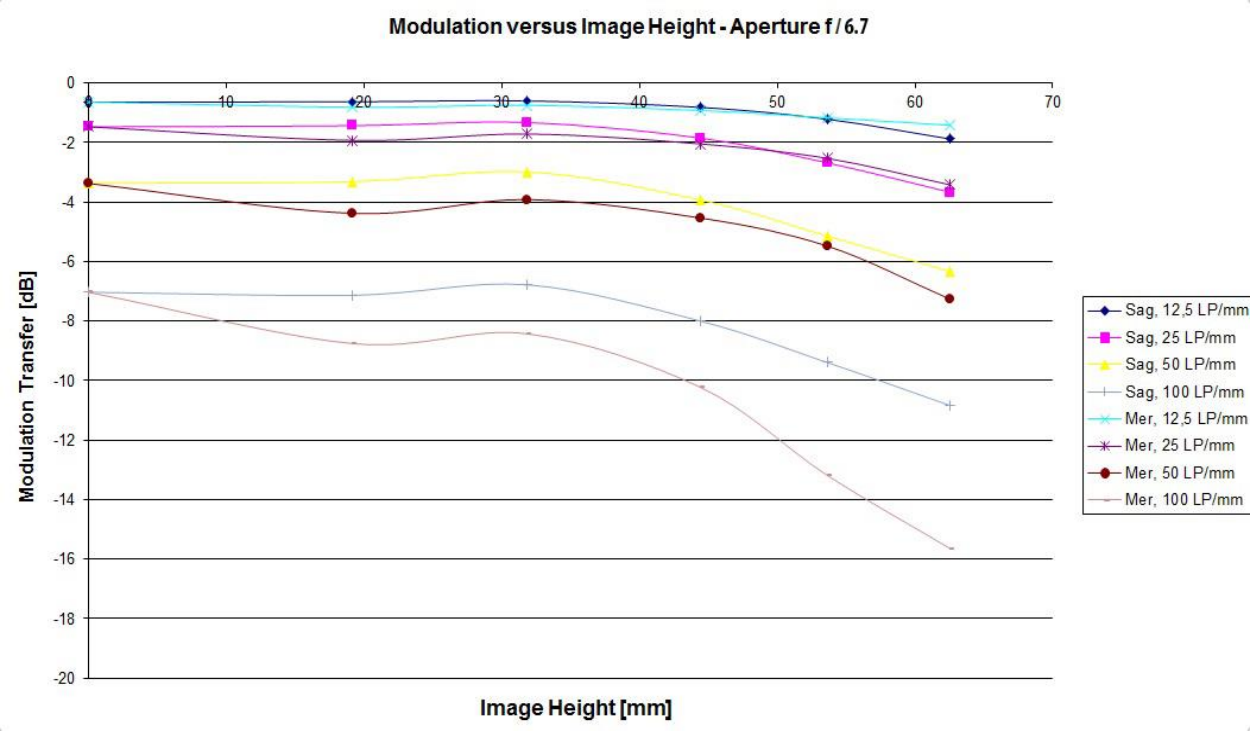
The curves are given for the meridonial (tangential) and sagital (radial) component of signals at frequencies of 12.5, 25, 50 and 100 line pairs per millimeter.

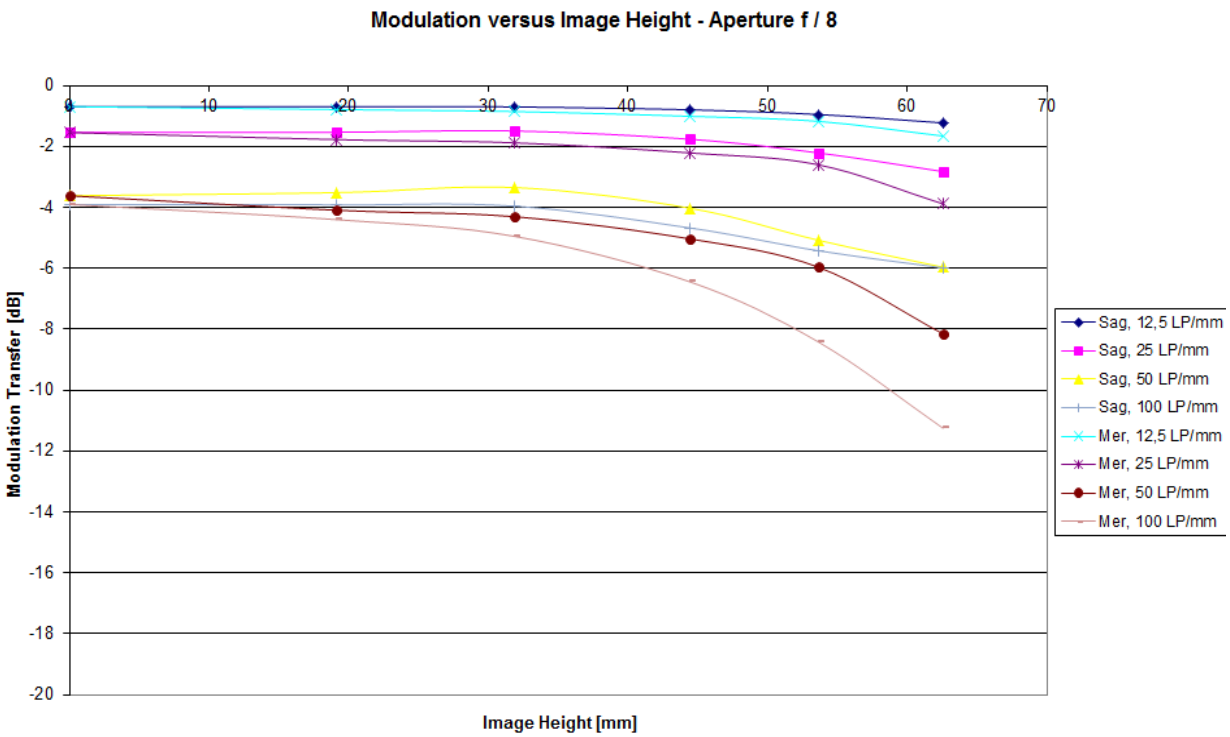
As the MTF is a function of the specific aperture size used, one set of curves is given for each aperture size.

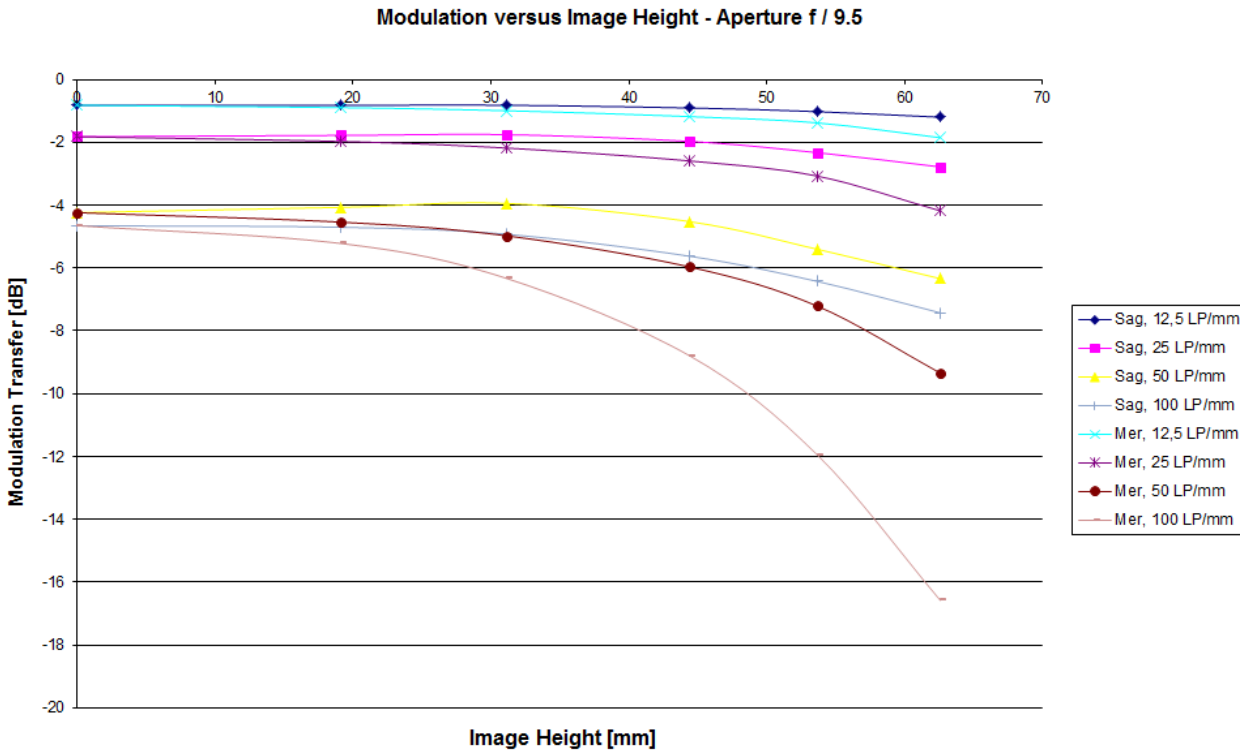
Lens types

Cone	Lens
C0 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/80mm, Qioptic GmbH, Germany
C1 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/80mm, Qioptic GmbH, Germany
C2 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/80mm, Qioptic GmbH, Germany
C3 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/80mm, Qioptic GmbH, Germany
C4 (RED)	Qioptic Vexcel HR Digaron 1:4/27mm, Qioptic GmbH, Germany
C5 (GREEN)	Qioptic Vexcel HR Digaron 1:4/27mm, Qioptic GmbH, Germany
C6 (BLUE)	Qioptic Vexcel HR Digaron 1:4/27mm, Qioptic GmbH, Germany
C7 (NIR)	Qioptic Vexcel HR Digaron 1:4/27mm, Qioptic GmbH, Germany

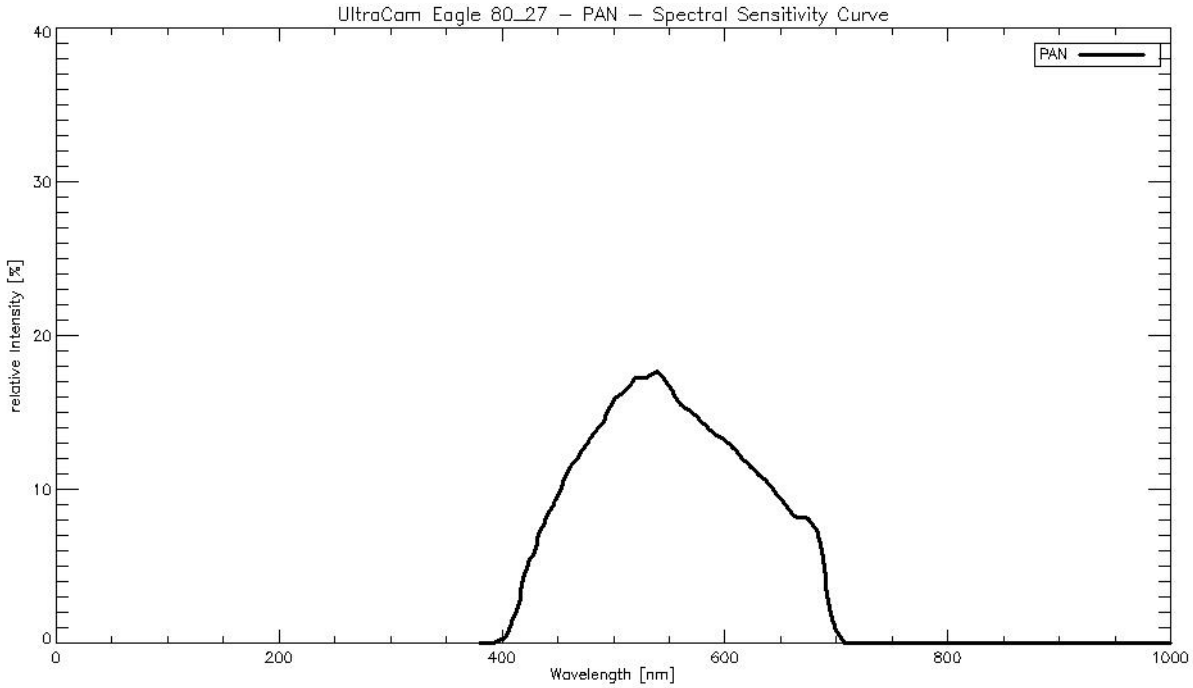

Modulation versus Image Height - Aperture f / 5.6
Modulation Transfer [dB]
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
60
70
Image Height [mm]
Sag, 12,5 LP/mm
Sag, 25 LP/mm
Sag, 50 LP/mm
Sag, 100 LP/mm
Mer, 12,5 LP/mm
Mer, 25 LP/mm
Mer, 50 LP/mm
Mer, 100 LP/mm

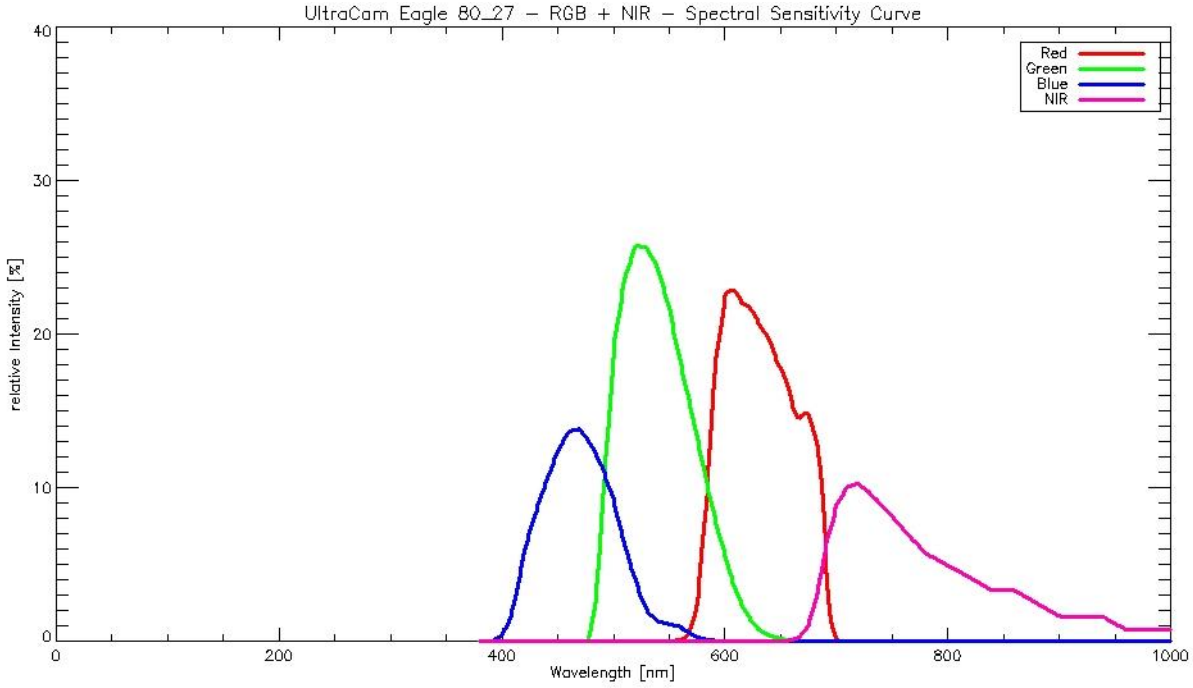

Modulation versus Image Height - Aperture f / 6.7
Modulation Transfer [dB]
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
60
70
Image Height [mm]
Sag, 12,5 LP/mm
Sag, 25 LP/mm
Sag, 50 LP/mm
Sag, 100 LP/mm
Mer, 12,5 LP/mm
Mer, 25 LP/mm
Mer, 50 LP/mm
Mer, 100 LP/mm


Modulation versus Image Height - Aperture f / 8
Modulation Transfer [dB]
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
60
70
Image Height [mm]
Sag, 12,5 LP/mm
Sag, 25 LP/mm
Sag, 50 LP/mm
Sag, 100 LP/mm
Mer, 12,5 LP/mm
Mer, 25 LP/mm
Mer, 50 LP/mm
Mer, 100 LP/mm


Modulation versus Image Height - Aperture f / 9.5
Modulation Transfer [dB]
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
60
70
Image Height [mm]
Sag, 12,5 LP/mm
Sag, 25 LP/mm
Sag, 50 LP/mm
Sag, 100 LP/mm
Mer, 12,5 LP/mm
Mer, 25 LP/mm
Mer, 50 LP/mm
Mer, 100 LP/mm

Spectral Sensitivity





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Radiometric Calibration

Camera: **UltraCam Eagle M3**
Serial: **UC-EpII-1-62411397-f80**

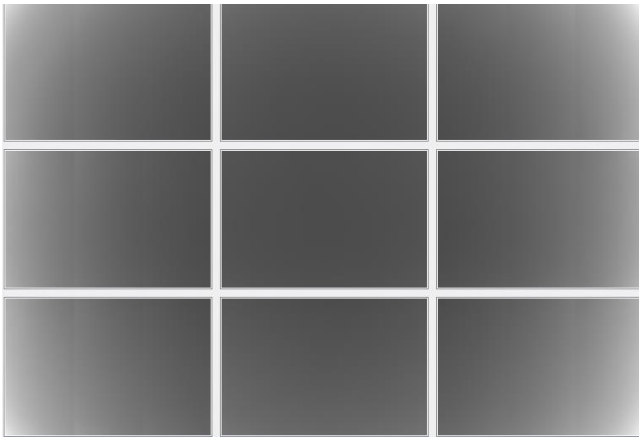
	PAN	R, G, NIR	B
Used Apertures	F5.6	F4.8	F4.8
	F6.7	F5.4	F4.8
	F8	F6.7	F4.8
	F9.5	F8	F5.6
	F11	F9.5	F6.7
	F13	F11	F8
	F16	F13	F9.5
	F22	F19	F13

Dead Pixel Report: see Appendix I

Calibration of Vignetting for working Aperture F6.7

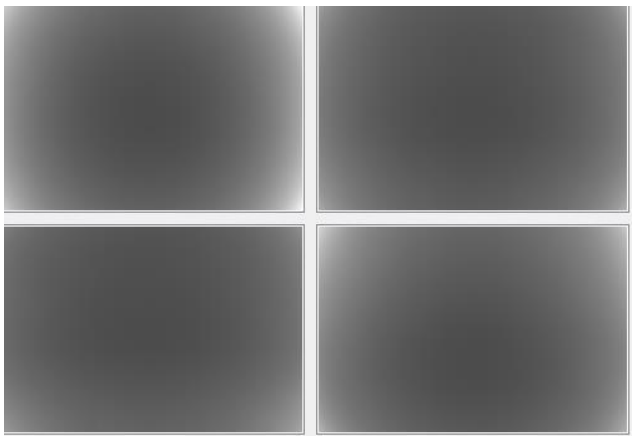
	PAN	R, G, NIR	B
Aperture	F6.7	F5.4	F4.8

Graphical Overview of Pan Sensors:



00_00	01_00	00_01
02_00	03_00	02_01
00_02	01_01	00_03

Graphical Overview of Multispectral Sensors:



04_00 (RED)	06_00 (BLUE)
05_00 (GREEN)	07_00 (NIR)

Explanations

Calibration Method:

The radiometric calibration is based on a series of 50 flat field images for each aperture size and sensor. The flat field is illuminated by eight normal light lamps with known spectral illumination curves.

These images are used to calculate the specific sensitivity of each pixel to compensate local as well as global variations in sensitivity. Sensitivity tables are calculated for each sensor and aperture setting, and applied during post processing from level 0 to level 1.

Outlier Pixels that do not have a linear behavior as described in the CCD specifications are marked as defective during the calibration procedure. These pixels are not used or only partially used during post processing and the information is restored by interpolation between the neighborhood pixels surrounding the defective pixels.

Certain pixels that are named Qmax pixels due to the fact that they can only store and transfer charge up to a certain maximum amount are detected in an additional calibration step. These pixels are treated differently during post processing, since their behavior can affect not only single pixel values but whole columns.

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Shutter Calibration

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-62411397-f80**
Panchromatic Camera:	**4 * Prontor Magnetic 0 HS** **Prontor-Werk Alfred Gauthier GmbH, Germany**
Multispectral Camera:	**4 * Prontor Magnetic 0 HS** **Prontor-Werk Alfred Gauthier GmbH, Germany**

Calibration of Shutter Release Times:

The shutter release times measured during the calibration describe the time from the moment when the electrical current through the shutter is turned off by the electronics, until the shutter is mechanically closed.

This time is relevant for the exposure control and needs to be known before image recording can take place.

Currently used SRT values (operation values):

Cone Number	Lens Serial Number	SRT F5.6 [ms]	SRT F6.7 [ms]	SRT F8 [ms]	SRT F9.5 [ms]	SRT F11 [ms]	SRT F13 [ms]	SRT F16 [ms]	SRT F22 [ms]	Measurement Tolerance [ms]
C0 (Pan)	12 16 05 78	6.36	6.55	6.89	7.06	7.22	7.32	7.52	7.77	+/- 0.2
C1 (Pan)	12 16 05 84	6.69	6.88	7.17	7.40	7.59	7.68	7.85	8.19	+/- 0.2
C2 (Pan)	12 15 42 91	6.95	7.17	7.48	7.67	7.84	7.96	8.13	8.42	+/- 0.2
C3 (Pan)	12 16 05 88	6.45	6.68	6.99	7.20	7.33	7.49	7.73	8.08	+/- 0.2
C4 (Red)	12 11 00 37	6.97	7.09	7.20	7.28	7.35	7.48	7.57	7.70	+/- 0.2
C5 (Green)	12 11 00 62	7.22	7.30	7.49	7.59	7.64	7.78	7.95	8.10	+/- 0.2
C6 (Blue)	12 12 06 28	7.35	7.36	7.36	7.41	7.58	7.66	7.75	8.02	+/- 0.2
C7 (NIR)	12 15 32 05	7.55	7.62	7.86	8.01	8.09	8.18	8.36	8.53	+/- 0.2

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Electronics and Sensor Calibration

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-62411397-f80**
Panchromatic Camera:	**9 * FTF9060-M Area CCD Sensor by DALSA**
Multispectral Camera:	**4 * FTF9060-M Area CCD Sensor by DALSA**

Calibration of Negative Substrate Voltage (VNS):

For optimum performance of the DALSA CCD sensors, the negative substrate voltage is adjusted to a value specified by DALSA.

This voltage value is measured to achieve the best anti-blooming performance possible for each particular sensor.

Currently used VNS and VOG values (operation values):

Cone_Sensor	Sensor Type	Sensor Serial Number	VNS Voltage [V]	VOG Voltage [V]
00_00	FTF9060-M	192209/001	22.20	6.58
00_01	FTF9060-M	192209/003	21.60	7.04
00_02	FTF9060-M	192209/086	22.20	6.53
00_03	FTF9060-M	192209/077	22.00	6.78
01_00	FTF9060-M	192209/085	21.60	6.62
01_01	FTF9060-M	192209/073	21.80	6.52
02_00	FTF9060-M	192209/080	22.00	6.26
02_01	FTF9060-M	192209/068	21.80	6.58
03_00	FTF9060-M	197663/070	21.80	6.37
04_00 (red)	FTF9060-M	192209/075	21.80	7.24
05_00 (green)	FTF9060-M	192209/050	22.00	6.53
06_00 (blue)	FTF9060-M	192209/084	22.00	6.22
07_00 (NIR)	FTF9060-M	192209/060	22.00	6.38

Calibration of Intensity Threshold for Exposure Control:

Each CCD sensor and electronics module varies slightly in global sensitivity and intensity scale.

Therefore the maximum possible intensity of each sensor needs to be measured to evaluate the sensitivity behavior of the CCD and electronics.

This value is used as a threshold for the exposure control dialogue shown in the in-flight user interface of the Eagle.

Currently used Threshold values (operation values):

Cone_Sensor	Sensor Type	Sensor Serial Number	Intensity Threshold [DN]	
			Tap 1	Tap2
00_00	FTF9060-M	192209/001	13800	13100
00_01	FTF9060-M	192209/003	13370	12730
00_02	FTF9060-M	192209/086	13560	12910
00_03	FTF9060-M	192209/077	13580	12870
01_00	FTF9060-M	192209/085	14700	13390
01_01	FTF9060-M	192209/073	14040	13200
02_00	FTF9060-M	192209/080	13870	13100
02_01	FTF9060-M	192209/068	14080	13140
03_00	FTF9060-M	197663/070	13690	12840
04_00 (red)	FTF9060-M	192209/075	13040	12610
05_00 (green)	FTF9060-M	192209/050	14120	13080
06_00 (blue)	FTF9060-M	192209/084	13760	13010
07_00 (NIR)	FTF9060-M	192209/060	13660	12770

ULTRACAM

Summary

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-62411397-f80**
Laboratory Calibration Date:	**Jun-29-2020**
Camera Revision:	**Rev02.00**
Date of Report:	**Jun-29-2020**
Version of Report:	**V01**

The following calibrations have been performed for the above mentioned digital aerial mapping camera:

- Geometric Calibration
- Radiometric Calibration
- Shutter Calibration
- Sensor and Electronics Calibration

This equipment is operating fully within specification as defined by Vexcel Imaging GmbH.

Dr. Michael Gruber
Chief Scientist, Photogrammetry
Vexcel Imaging GmbH

Dipl. Ing. (FH) Helmut Jauk
Senior Project Engineer R&D
Vexcel Imaging GmbH

Appendix I

Dead Pixel Report:

Sensor number		
Anomaly type	X-Coordinate	Y-Coordinate

C00-00

PIXEL: 89/5276
PIXEL: 1117/4448
PIXEL: 1583/ 951
PIXEL: 1661/1748
PIXEL: 2072/4864
PIXEL: 2710/5443
PIXEL: 2873/5318
PIXEL: 2913/2886
PIXEL: 2913/6017
PIXEL: 2914/1001
PIXEL: 3468/4144
PIXEL: 3514/ 220
PIXEL: 3625/1955
PIXEL: 3646/3062
PIXEL: 3758/1925
PIXEL: 4519/5999
PIXEL: 4554/2848
PIXEL: 4645/3256
PIXEL: 4846/3099
PIXEL: 5109/5920
PIXEL: 5460/1912
PIXEL: 5728/4075
PIXEL: 5742/ 626
PIXEL: 6003/3409
PIXEL: 6012/3189
PIXEL: 6180/3500
PIXEL: 6345/6011
PIXEL: 6455/5687
PIXEL: 6580/3901
PIXEL: 6662/2833
PIXEL: 6719/4869
PIXEL: 6890/4819
PIXEL: 7155/5509
PIXEL: 7171/5808
PIXEL: 7361/5190

PIXEL: 7380/3283
PIXEL: 7591/5964
PIXEL: 7741/3541
PIXEL: 7756/4771
PIXEL: 7873/5420
PIXEL: 8132/ 104
PIXEL: 8470/1013
PIXEL: 8925/5208
PIXEL: 38/4737
PIXEL: 305/ 33
PIXEL: 388/5345
PIXEL: 388/5346
PIXEL: 967/1056
PIXEL: 1070/1902
PIXEL: 1315/ 851
PIXEL: 1704/5061
PIXEL: 5784/2981

C00-01

PIXEL: 170/4937
PIXEL: 469/4418
PIXEL: 473/5228
PIXEL: 960/1081
PIXEL: 1282/5965
PIXEL: 1400/4652
PIXEL: 1645/3432
PIXEL: 1753/3221
PIXEL: 2248/3075
PIXEL: 2481/4944
PIXEL: 2824/4204
PIXEL: 3844/3929
PIXEL: 4628/1732
PIXEL: 4802/1516
PIXEL: 4972/2499
PIXEL: 5528/5771
PIXEL: 6870/5773
PIXEL: 7089/2342
PIXEL: 153/5626
PIXEL: 196/4647
PIXEL: 220/5775
PIXEL: 617/5196
PIXEL: 861/5622
PIXEL: 1686/5546
PIXEL: 4658/5979
PIXEL: 8071/2346
PIXEL: 8662/ 655
PIXEL: 8847/ 372
PIXEL: 8912/ 18
PIXEL: 8072/2346

C00-02

PIXEL: 62/3490
PIXEL: 574/4962
PIXEL: 1092/2276
PIXEL: 1460/1009
PIXEL: 1960/3763
PIXEL: 2113/1666
PIXEL: 2601/5748
PIXEL: 3326/3276
PIXEL: 4030/4420
PIXEL: 4130/2876
PIXEL: 4258/1495
PIXEL: 5186/3158
PIXEL: 5288/5921
PIXEL: 5336/3828
PIXEL: 5599/1608
PIXEL: 5816/4835
PIXEL: 6077/2799
PIXEL: 7135/3477
PIXEL: 7150/4477
PIXEL: 7690/3202
PIXEL: 7784/2408
PIXEL: 8814/3339
PIXEL: 163/1688
PIXEL: 214/ 99
PIXEL: 7365/1861
PIXEL: 8429/ 98
PIXEL: 8430/ 99
PIXEL: 8431/ 98
PIXEL: 8565/ 30
PIXEL: 8782/5536
PIXEL: 8782/5537
PIXEL: 8428/ 98

C00-03

PIXEL: 175/3724
PIXEL: 284/4702
PIXEL: 305/2260
PIXEL: 1015/4493
PIXEL: 1058/5937
PIXEL: 1088/3598
PIXEL: 1435/2845
PIXEL: 1435/2846
PIXEL: 2346/3443
PIXEL: 3324/4171
PIXEL: 4355/2748
PIXEL: 4394/2312
PIXEL: 4423/3680
PIXEL: 4777/4080
PIXEL: 4801/1183

PIXEL: 4866/4989
PIXEL: 5236/4190
PIXEL: 5293/5272
PIXEL: 5338/5732
PIXEL: 5671/5261
PIXEL: 6166/4466
PIXEL: 6234/4719
PIXEL: 6303/4856
PIXEL: 6465/4260
PIXEL: 6765/2759
PIXEL: 6792/4869
PIXEL: 6928/4007
PIXEL: 7512/ 65
PIXEL: 7905/2117
PIXEL: 8219/ 334
PIXEL: 8339/2199
PIXEL: 8518/2142
PIXEL: 8633/ 212
PIXEL: 8793/5676
PIXEL: 88/5712
PIXEL: 456/5987
PIXEL: 592/5320
PIXEL: 1577/4942
PIXEL: 1578/4942
PIXEL: 1984/2162
PIXEL: 2641/4432
PIXEL: 2641/4433
PIXEL: 2642/4432
PIXEL: 3757/3442
PIXEL: 3758/3442
PIXEL: 3758/3443
PIXEL: 3759/3442
PIXEL: 3760/3443
PIXEL: 7047/5938
PIXEL: 8677/5526
PIXEL: 8975/2708
PIXEL: 9034/ 284
COLUMN: 8368/1039

C01-00

PIXEL: 1203/4287
PIXEL: 1479/3554
PIXEL: 2049/5379
PIXEL: 2659/5624
PIXEL: 2827/2678
PIXEL: 2912/5457
PIXEL: 4852/5176
PIXEL: 5830/2586
PIXEL: 6373/3921
PIXEL: 6679/2314

PIXEL: 7305/5788
PIXEL: 8462/5545
PIXEL: 8963/2302
PIXEL: 8993/5466
PIXEL: 403/5700
PIXEL: 419/5801
PIXEL: 2073/2821
PIXEL: 2465/1843
PIXEL: 2465/1842
PIXEL: 2466/1843

C01-01

PIXEL: 2100/ 544
PIXEL: 2670/4885
PIXEL: 3753/4822
PIXEL: 4234/1479
PIXEL: 4312/3112
PIXEL: 5178/2142
PIXEL: 5519/2104
PIXEL: 6417/5568
PIXEL: 7903/5912
PIXEL: 7918/5248
PIXEL: 8087/5651
PIXEL: 8316/6014
PIXEL: 8345/3119
PIXEL: 9002/4248
PIXEL: 3654/5500
PIXEL: 3655/5500
PIXEL: 4421/ 679
PIXEL: 4477/2379
PIXEL: 4484/2047
PIXEL: 4486/2048
PIXEL: 4488/2049
PIXEL: 4489/2048
PIXEL: 4489/2049
PIXEL: 4492/2049
PIXEL: 4490/2049
PIXEL: 4483/2047
COLUMN: 5691/1456

C02-00

PIXEL: 73/3994
PIXEL: 159/1447
PIXEL: 681/3862
PIXEL: 894/ 461
PIXEL: 928/4919
PIXEL: 1658/4555
PIXEL: 2348/4482
PIXEL: 2924/1002

PIXEL: 3021/5760
PIXEL: 3908/1527
PIXEL: 6201/ 65
PIXEL: 6249/5678
PIXEL: 6471/3023
PIXEL: 6662/3743
PIXEL: 7033/5323
PIXEL: 8148/3917
PIXEL: 8297/1759
PIXEL: 8928/5482
PIXEL: 365/6017
PIXEL: 366/6017
PIXEL: 2213/5006

C02-01

PIXEL: 647/1575
PIXEL: 651/1715
PIXEL: 3281/4180
PIXEL: 5463/5185
PIXEL: 5480/4892
PIXEL: 5833/ 828
PIXEL: 7402/ 790
PIXEL: 8105/ 278
PIXEL: 8409/3324
PIXEL: 8953/4674
PIXEL: 1133/3158
PIXEL: 1232/ 42
PIXEL: 1310/ 35
PIXEL: 8413/ 644
PIXEL: 8414/ 644
PIXEL: 8413/ 645
PIXEL: 8414/ 643

C03-00

PIXEL: 1090/3422
PIXEL: 1682/3210
PIXEL: 3188/3775
PIXEL: 4510/5596
PIXEL: 4957/1499
PIXEL: 5260/3946
PIXEL: 5867/3961
PIXEL: 5867/4589
PIXEL: 5867/4693
PIXEL: 5867/5001
PIXEL: 5867/5105
PIXEL: 5867/5674
PIXEL: 7385/5901
PIXEL: 8781/3482
PIXEL: 2763/3797

PIXEL: 5251/ 355
PIXEL: 5251/ 356

C04-00

PIXEL: 876/2057
PIXEL: 1787/5198
PIXEL: 2527/5964
PIXEL: 2689/5427
PIXEL: 3367/5611
PIXEL: 3375/4112
PIXEL: 3404/ 495
PIXEL: 4074/4902
PIXEL: 5591/2854
PIXEL: 6197/2236
PIXEL: 6223/5685
PIXEL: 6285/ 800
PIXEL: 7815/2919
PIXEL: 8321/1549
PIXEL: 964/5858
PIXEL: 4315/4127
PIXEL: 4874/1464
PIXEL: 4874/1465
PIXEL: 4874/1466
PIXEL: 4875/1464
PIXEL: 4875/1465
PIXEL: 8184/ 94
PIXEL: 964/5857
PIXEL: 963/5857

C05-00

PIXEL: 185/ 381
PIXEL: 2838/5523
PIXEL: 3105/ 385
PIXEL: 4385/2785
PIXEL: 5772/3453
PIXEL: 5800/1292
PIXEL: 8237/2113
PIXEL: 8598/2895
PIXEL: 417/4903
PIXEL: 691/3703
PIXEL: 1261/5606
PIXEL: 1918/3721
PIXEL: 2318/ 338
PIXEL: 5812/ 921
PIXEL: 6486/5017
PIXEL: 6827/2713
PIXEL: 6875/1317
PIXEL: 7320/5294
PIXEL: 7321/5294

PIXEL: 7634/5249
PIXEL: 417/4902
PIXEL: 691/3702
PIXEL: 1260/5606
PIXEL: 6487/5017
PIXEL: 6485/5017
PIXEL: 6485/5016
PIXEL: 7321/5295

C06-00

PIXEL: 651/4504
PIXEL: 2622/ 154
PIXEL: 5431/1951
PIXEL: 5451/5913
PIXEL: 6287/1833
PIXEL: 78/5909
PIXEL: 269/5490
PIXEL: 693/1202
PIXEL: 697/5203
PIXEL: 4137/1089
PIXEL: 4602/ 132
PIXEL: 6546/ 606
PIXEL: 8940/4274
PIXEL: 4137/1088
COLUMN: 1992/ 576

C07-00

PIXEL: 208/5557
PIXEL: 1010/5207
PIXEL: 1820/2864
PIXEL: 2278/5884
PIXEL: 2868/2541
PIXEL: 2980/1341
PIXEL: 5162/2446
PIXEL: 6930/4641
PIXEL: 8990/5747
PIXEL: 208/5556
PIXEL: 208/5558
PIXEL: 390/5138
PIXEL: 391/5138
PIXEL: 474/4578
PIXEL: 683/5933
PIXEL: 3377/5395
PIXEL: 4969/5066
PIXEL: 6160/ 322
PIXEL: 6160/ 323
PIXEL: 9027/ 406
PIXEL: 208/5557
PIXEL: 209/5557

Notes

COLUMN anomaly: all pixels below the Qmax detector at location (X,Y) may be affected.
PIXEL anomaly: single detector at location (X,Y) is not functioning within normal range

The Level0 coordinates exclude the two leftmost pixels containing the line index: the corresponding pixel can therefore be located at column (X+2,Y).

Appendix II

Calibration and Modification Dates

Type of Calibration	Laboratory Calibration Date	Modification Date	Modification Reason
Geometric Calibration	**29.Jul.2020**	**29.Jul.2020**	
Radiometric Calibration	**29.Jul.2020**	**29.Jul.2020**	
Shutter Calibration	**29.Jul.2020**	**29.Jul.2020**	
Electronics and Sensor Calibration	**29.Jul.2020**	**29.Jul.2020**	

Note: The above-mentioned Laboratory Calibration Dates represent the dates the camera was calibrated in one of our calibration labs for a full Laboratory Calibration. The Modification date represents a date on which the calibration has been modified due to a calibration enhancement or part exchange. It is an additional information and does not replace the Laboratory Calibration date in any way. With the Modification Reason, always the last modification to the calibration is highlighted