FengYun-3H/WAI-II Prelaunch Test Results and The Calibration Approach In-orbit

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CONTENT

一、Introduce

Wide-field Auroral Imager (WAI)

- a new instrument on the Fengyun-3D (FY-3D) satellite which was launched on November 15, 2017.
- It produces the far ultraviolet (FUV) images of the aurora and the ionosphere in wide field of view (FOV) and high spatial resolution, by imaging the N_2 Lyman-Birge-Hopfiled (LBH) bands emissions.
- WAI is the first optical remote sensor for space weather and space physics in China.

WAI-II

- The same as WAI on FY-3D, except that it will image the emissions in two LBH bands (140-160nm, 160-180nm).
- will be launched this year.

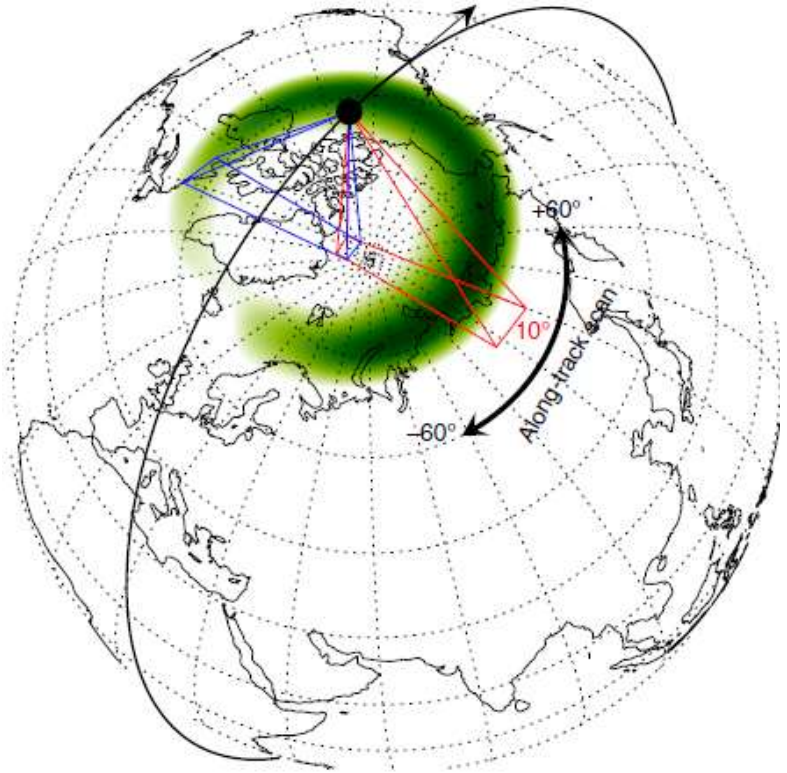


Illustration of the operation of WAI. The auroral oval is represented in green. The thick black represents the orbit of FY-3D. The red and blue lines represent the FOVs of the two cameras.

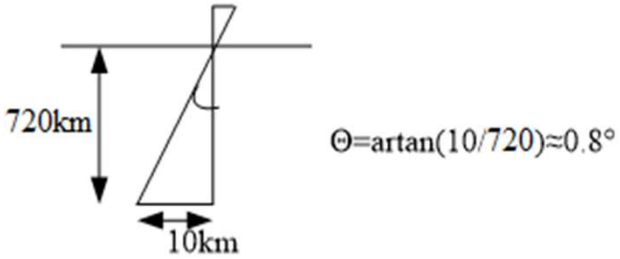
FY WAI requirement summary

Parameter	Value
Wavelength	140-180 nm (**WAI**)
	140-160 nm, 160-180 nm (**WAI-II**)
Field of view (FOV)	130° (cross-track) ×10° (along-track) (instantaneous) 130° ×130° (total)
Nadir Spatial Resolution	≤ 10 km (at 110km altitude)
Time Resolution	≤ 2 min for scanning mode ~100 min for nadir mode
Overall Sensitivity	≥ 6.0 counts/(Rayleigh·s)
Dynamic Range	200-8000 Rayleigh

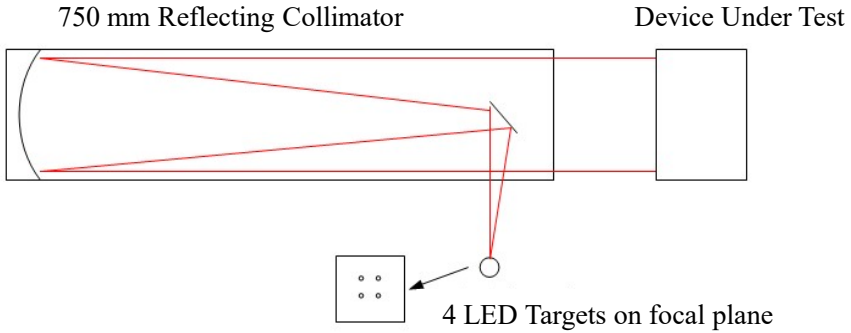
WAI-II main Prelaunch test parameters

Number	Parameter	Number	Parameter
1	Angular Resolution	7	FOV Uniformity (Flat Field Calibration)
2	FOV	8	Pointing Accuracy
3	Detection Sensitivity	9	Geometric Calibration (Detector Distortion Correction, and Optical Distortion Correction)
4	Operating Wavelength Range	10	Detector Response Linearity Calibration
5	Dynamic Range	11	Dark Field Calibration
6	Temporal Resolution		

1. Angular Resolution



WAI-II Angular Resolution Requirement



Angular Resolution Test Diagram

The Rayleigh criterion:

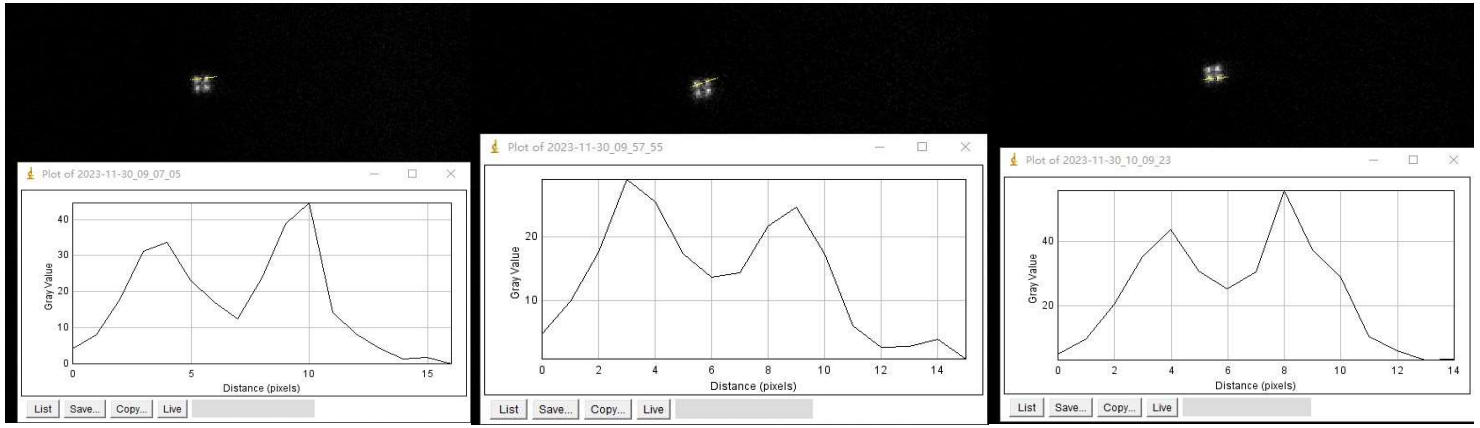
when the imaging contrast ratio of two adjacent image points is not less than 15%, these two points can be resolved.

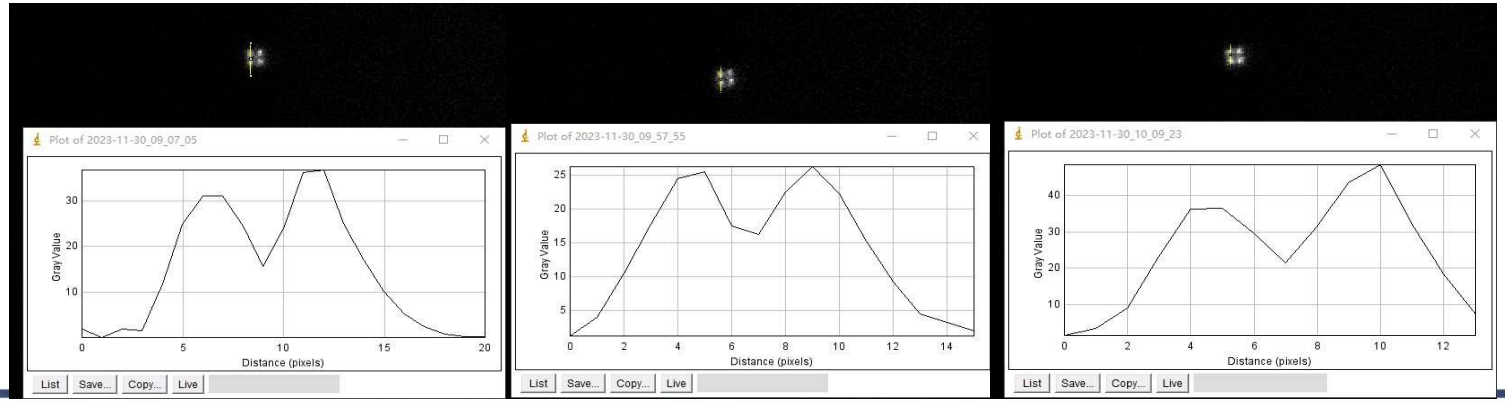
The contrast ratio calculation formula is: $C = \frac{I_{max} - I_{min}}{I_{max} + I_{min}} \times 100\%$

二、Prelaunch test results

Camera #1

Central field | 50% field | 70% field





Transverse

	Contrast Ratio
Central	51.1%
50%	32.1%
70%	32.9%

Longitudinal

	Contrast Ratio
Central	37.0%
50%	22.9%
70%	32.5%

二、Prelaunch test results

Camera #2

Transverse

	Contrast Ratio
Central	56.4%
50%	28.0%
70%	

Longitudinal

	Contrast Ratio
Central	34.8%
50%	32.7%
70%	31.7%

Camera #3

Transverse

	Contrast Ratio
Central	36.8%
50%	63.6%

Longitudinal

	Contrast Ratio
Central	38.5%
50%	35.4%
70%	19.2%

Camera #4

Transverse

	Contrast Ratio
Central	37.0%
50%	49.1%
	30.7%

Longitudinal

	Contrast Ratio
Central	20.0%
50%	22.3%
70%	24.1%

The angular resolutions of 4 cameras meet the 0.8° angular resolution requirement.

2. Field of View

- WAI uses two sub-optical systems with a sub-FOV of 68°×10° to form a 130°×10° FOV, and obtains a total FOV of 130°×130° by scanning in the 10° FOV direction.
- FOV test includes 3 items:

  (1) The sub-optical system FOV meets the 68°×10° requirement.

  (2) The sub-optical system FOV stitching meets the requirement.

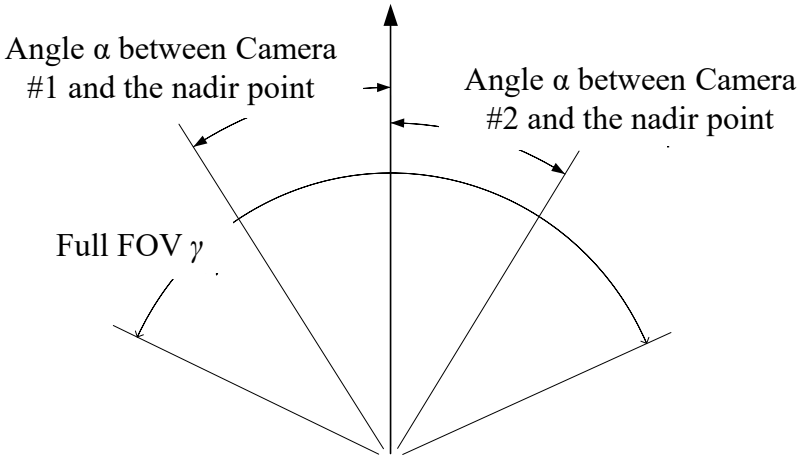
  (3) The scanning component enables the imager to scan 120° along the optical axis in the 10° FOV direction.

二、Prelaunch test results

(1) The Sub-optical System FOV Meets the 68° ×10° Requirement

Test Item		Test Data
FOV of Camera #1	10° Direction	11.75°
	68° Direction	71.5°
FOV of Camera #2	10° Direction	11.25°
	68° Direction	70.75°
FOV of Camera #3	10° Direction	10.875°
	68° Direction	70.375°
FOV of Camera #4	10° Direction	11.5°
	68° Direction	71.25°

(2) The Sub-optical System FOV Stitching Meets the Requirement



Single channel full field-of-view angle γ:

$$\gamma = \frac{\omega_1}{2} + \frac{\omega_2}{2} + \alpha + \beta$$

ω1： FOV of Camera #1， ω2： FOV of Camera #2

Test Data

Channel	ω_1	ω_2	α	β	γ
LBHS	71.5°	70.75°	32.43°	32.62°	136.175°
LBHL	70.375°	71.25°	31.85°	32.54°	135.202°

(3) The Scanning Component Enables the Imager to Scan 120° along the Optical Axis in the 10° FOV Direction

The FOV angle in the scanning direction is determined by the 10° direction FOV angle and the scanning angles *α1* and *α2* between the Hall limit and the sub-satellite point optical axis:

γ2 = 10° direction FOV angle+*α1* + *α2*

FOV angle in the scanning direction test data

Channel	FOV angle in 10° direction	α_1	α_2	γ_2
LBHS	11.25°	62.898°	62.358°	136.506°
LBHL	10.875°	62.898°	62.358°	136.131°

Total FOV of two channels test data

Channel	Total FOV
LBHS	136.175°×136.506°
LBHL	135.202°×136.131°

The total FOV of two channels Meet the 130° ×130° total FOV requirement.

3. Detection Sensitivity

The calculation formula for the overall sensitivity of WAI is:

$$S(\lambda) = N \cdot A \cdot \omega \cdot \rho(\lambda) \cdot \tau(\lambda) \cdot \varepsilon(\lambda) \cdot \frac{10^6}{4\pi}$$

$S(\lambda)$: pixel sensitivity of instrument

N: total number of pixels of detector, N=1062

A: entrance pupil area

ω: pixel solid angle, $\omega = 1.95 \times 10^{-4}$sr

$\rho(\lambda)$: reflectivity of a mirror

$\tau(\lambda)$: transmittance of a filter

$\varepsilon(\lambda)$: quantum efficiency of a detector

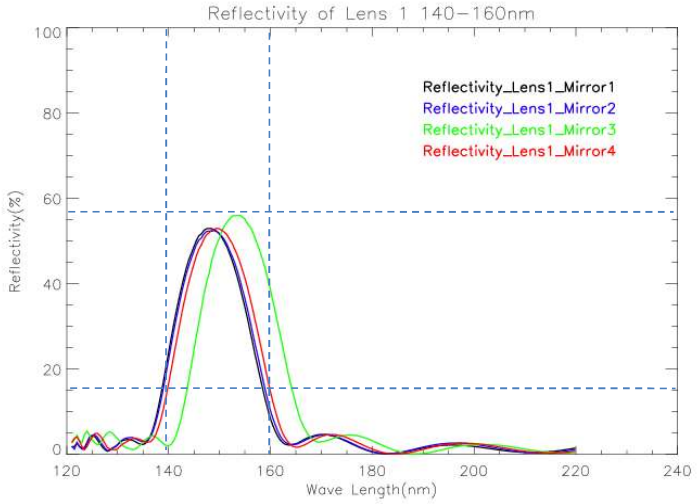
Reflectivity of 4 mirrors of 4 cameras

Testing the reflectivity of the accompanying films yields:

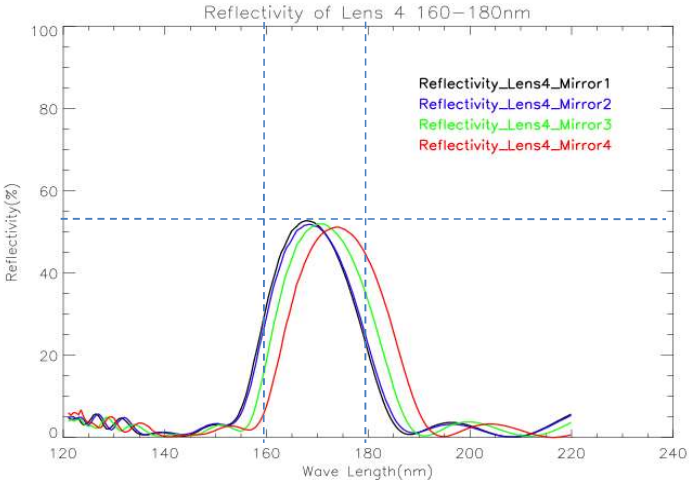
The reflectivity of the 4 mirrors M1, M2, M3, and M4 of Camera #1 and Camera #2 is the same.

The reflectivity of Camera #3 and Camera #4 is the same.

Camera #1 & 2

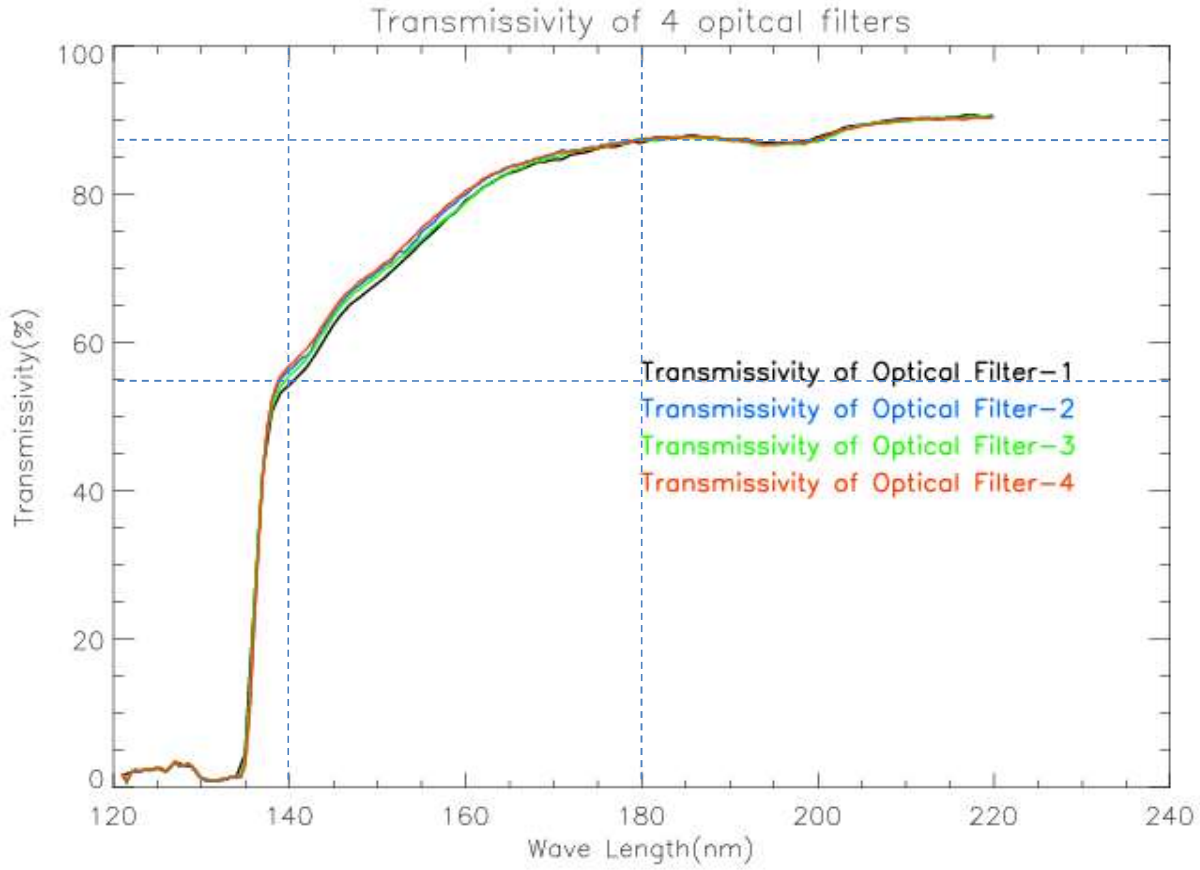


Camera #3 & 4



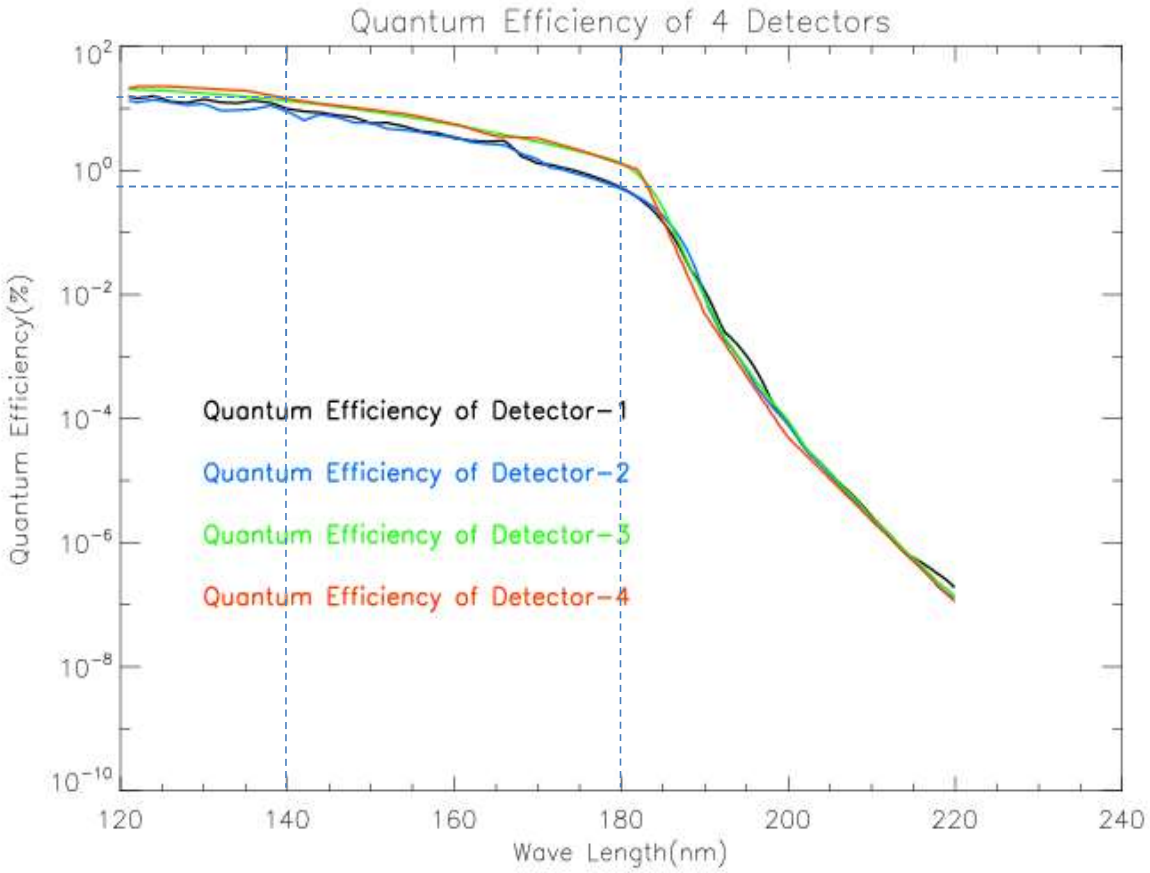
二、Prelaunch test results

Transmittance of filters of 4 cameras



二、Prelaunch test results

Quantum efficiency of 4 detectors



二、Prelaunch test results

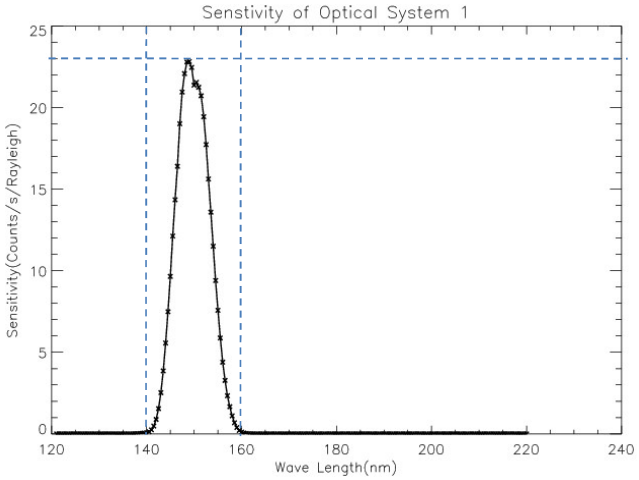
Entrance pupil areas of 4 cameras

Camera	Aperture length（mm）	Aperture width（mm）	Aperture area（mm^2）	Coefficient	Entrance pupil area（mm^2）
1	28.49	13.21	376.35	8.16	46.12
2	28.51	13.19	376.05	8.16	46.08
3	28.52	13.22	377.03	8.16	46.20
4	28.51	13.22	376.90	8.16	46.19

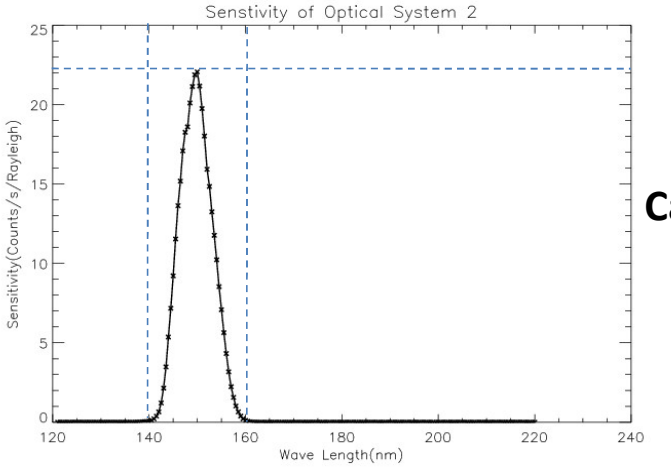
二、Prelaunch test results

The overall sensitivity of 4 cameras at various wavelengths

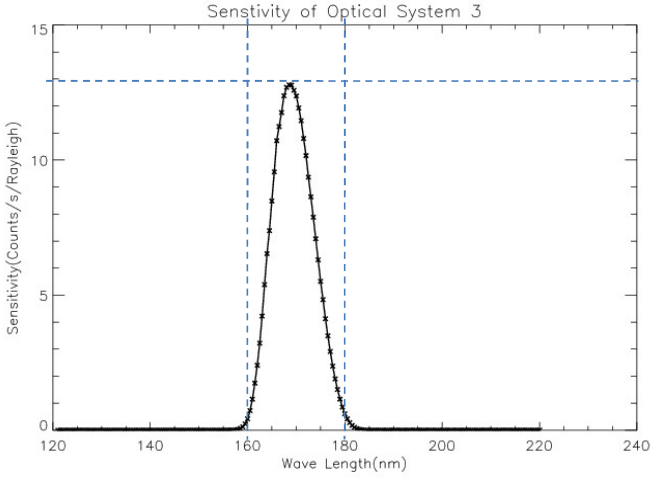
Camera #1



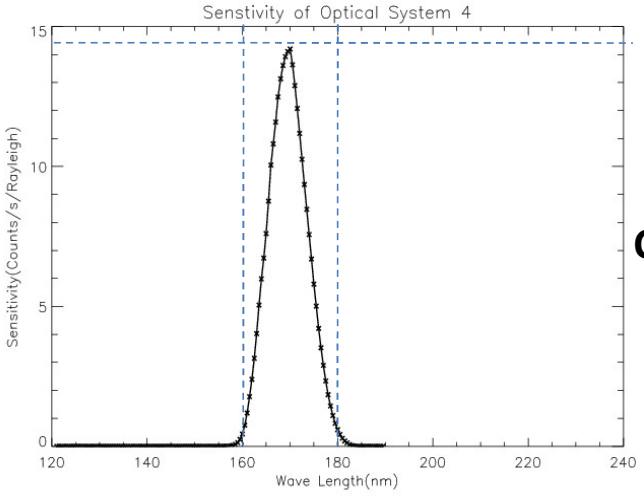
Camera #2



Camera #3



Camera #4



二、Prelaunch test results

Overall Average Sensitivity of 4 cameras

Channel	Camera	Arithmetic Average Sensitivity （Units：counts/s/Rayleigh）
LBHS	1	9.8870952
	2	9.0127480
LBHL	3	6.8247120
	4	7.0754260

The overall average sensitivity of 4 cameras meet the 6.0 counts/s/Rayleigh requirement.

4. Operating Wavelength Range

Spectral radiation responsivity Q of cameras:

$$Q = \rho(\lambda) \cdot \tau(\lambda) \cdot \eta(\lambda)$$

$\rho(\lambda)$: reflectivity of a mirror, $\tau(\lambda)$: transmittance of a filter, $\eta(\lambda)$: quantum efficiency of a detector

Test includes 3 items:

(1) The imager operates in the wide bands of 140nm-160nm and 160nm-180nm. It is necessary to measure the wavelength distribution of the responsivity of the imager in the band of 130nm-200nm.

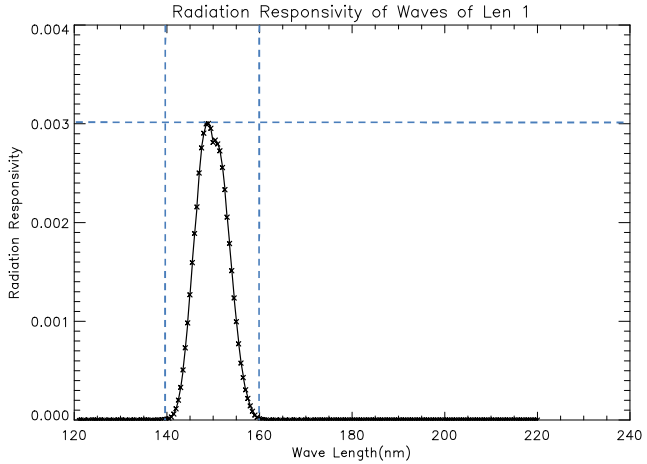
(2) Calculate the average responsivity in the 140nm - 160nm and 160nm - 180nm bands respectively, and the average responsivity in the band of 130nm - 200nm except for the operating bands.

(3) Calculate the ratio of the average responsivity outside the operating band to the average response efficiency within the band.

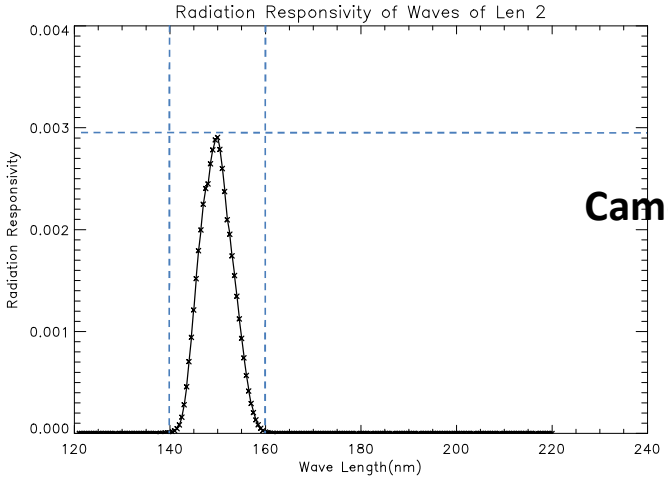
二、Prelaunch test results

(1) Measure wavelength distribution of spectral radiation responsivity of imager in the band of 130nm-200nm

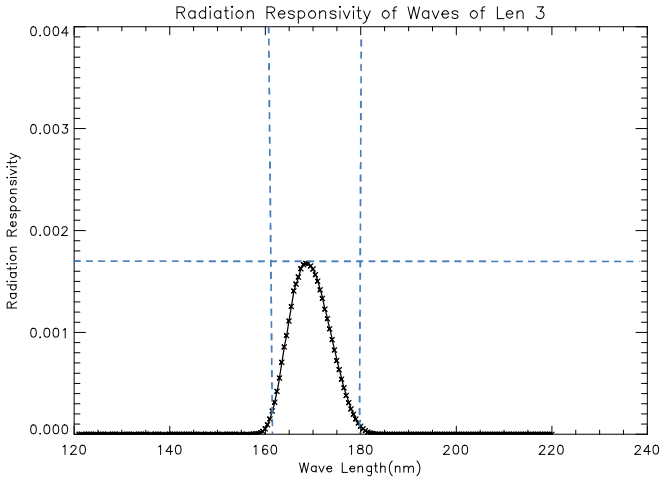
Camera #1



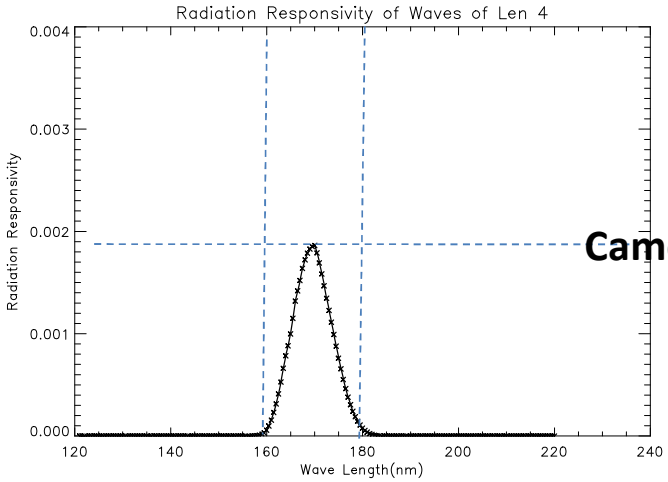
Camera #2



Camera #3



Camera #4



(2) Calculate the average responsivity in the 140nm-160nm and 160nm-180nm bands respectively, and the average responsivity in the band of 130nm-200nm except for the operating bands

Bands	Average Spectral Responsivity
Camera #1（140nm-160nm）	0.0013008588
130nm-200nm except for the operating bands of Camera #1	1.8890281e-007
Camera #2（140nm-160nm）	0.0011868490
130nm-200nm except for the operating bands of Camera #2	1.8321733e-007
Camera #3（160nm-180nm）	0.00089638192
130nm-200nm except for the operating bands of Camera #3	1.6400313e-006
Camera #4（140nm-160nm）	0.00092951282
130nm-200nm except for the operating bands of Camera #4	1.7301979e-006

(3) Calculate the ratio of the average responsivity outside the operating band to the average responsivity within the band

Channel inhibition ratio of Camera #1 (Operatinging band: 140nm-160nm)

Wavelength（nm）	Average Spectral Responsivity（ASR）	Target Strength	Response Signal	Test value of inhibition ratio
140-160	0.0013008588	3578	4.6544727	---
135.6	1.5266848e-008	7000	0.00010686794	2.2960267e-005
130.4	8.1154430e-010	10000	8.1154430e-006	1.7435795e-006
121.6	8.5991110e-010	10000	8.5991110e-006	1.8474941e-006
160-180	3.4578905e-007	2385	0.00082470688	0.00017718589
180-220	1.1501050e-012	2545	2.9270171e-009	6.2886116e-010
Comprehensive inhibition ratio				0.00020373786

Channel inhibition ratio of Camera #2 (Operatinging band: 140nm-160nm)

Wavelength（nm）	Average Spectral Responsivity（ASR）	Target Strength	Response Signal	Test value of inhibition ratio
140-160	0.0011868490	3578	4.2465456	---
135.6	8.2048961e-009	7000	5.7434273e-005	1.3524940e-005
130.4	5.2482097e-010	10000	5.2482097e-006	1.2358774e-006
121.6	2.8180585e-010	10000	2.8180585e-006	6.6361199e-007
160-180	3.5144171e-007	2385	0.00083818848	0.00019738125
180-220	1.0610386e-012	2545	2.7003433e-009	6.3589176e-010
Comprehensive inhibition ratio				0.00021280632

二、Prelaunch test results

Channel inhibition ratio of Camera #3 (Operatinging band: 160nm-180nm)

Wavelength（nm）	Average Spectral Responsivity（ASR）	Target Strength	Response Signal	Test value of inhibition ratio
160-180	0.00089638192	2385	2.1378709	---
135.6	8.6256232e-010	7000	6.0379362e-006	2.8242754e-006
130.4	2.2820375e-009	10000	2.2820375e-005	1.0674347e-005
121.6	8.2974550e-009	10000	8.2974550e-005	3.8811768e-005
140-160	2.8754288e-006	3578	0.010288284	0.0048123974
180-220	1.8052880e-006	2545	0.0045944580	0.0021490811
Comprehensive inhibition ratio				0.0070137889

Channel inhibition ratio of Camera #4 (Operatinging band: 160nm-180nm)

Wavelength（nm）	Average Spectral Responsivity（ASR）	Target Strength	Response Signal	Test value of inhibition ratio
160-180	0.00092951282	2385	2.2168881	---
135.6	8.5587517e-010	7000	5.9911262e-006	2.7024938e-006
130.4	2.6020587e-009	10000	2.6020587e-005	1.1737439e-005
121.6	8.3548636e-009	10000	8.3548636e-005	3.7687350e-005
140-160	3.0596741e-006	3578	0.010947514	0.0049382349
180-220	1.8907139e-006	2545	0.0048118668	0.0021705502
Comprehensive inhibition ratio				0.0071609123

The test values of channel inhibition ratio of 4 cameras meet the inhibition ratio requirement (<5%).

5. Dynamic Range

The dynamic range is determined by the lowest and highest intensities that the imager can respond to.

Highest response intensity: $L_{MX} = \frac{C_{MX}}{S}$

L_{MX}: highest detection target brightness, C_{MX}: the average maximum count rate of a pixel, S: detection sensitivity of a pixel

Lowest response intensity: $L_{MN} = \frac{1}{S \cdot t}$

L_{MN}: lowest detection brightness, S: detection sensitivity of a pixel , t: exposure time

二、Prelaunch test results

Highest and Lowest detection target brightness of 4 cameras

Camera	Detection Sensitivity（counts/s/Rayleigh）	Maximum Count Rate（kcps）	Highest Detection target Brightness（Rayleigh）	Exposure Time (s)	Lowest Detection Target Brightness（Rayleigh）
1	9.8870952	302	30544.865	7.48	14.3599
2	9.0127480	301	33397.141	7.48	15.7531
3	6.8247120	302	44250.953	7.48	20.8036
4	7.0754260	302	42682.941	7.48	20.0665

The highest and lowest detection brightness meet the maximum (8000 Rayleigh) and minimum (200 Rayleigh) dynamic range requirement, respectively.

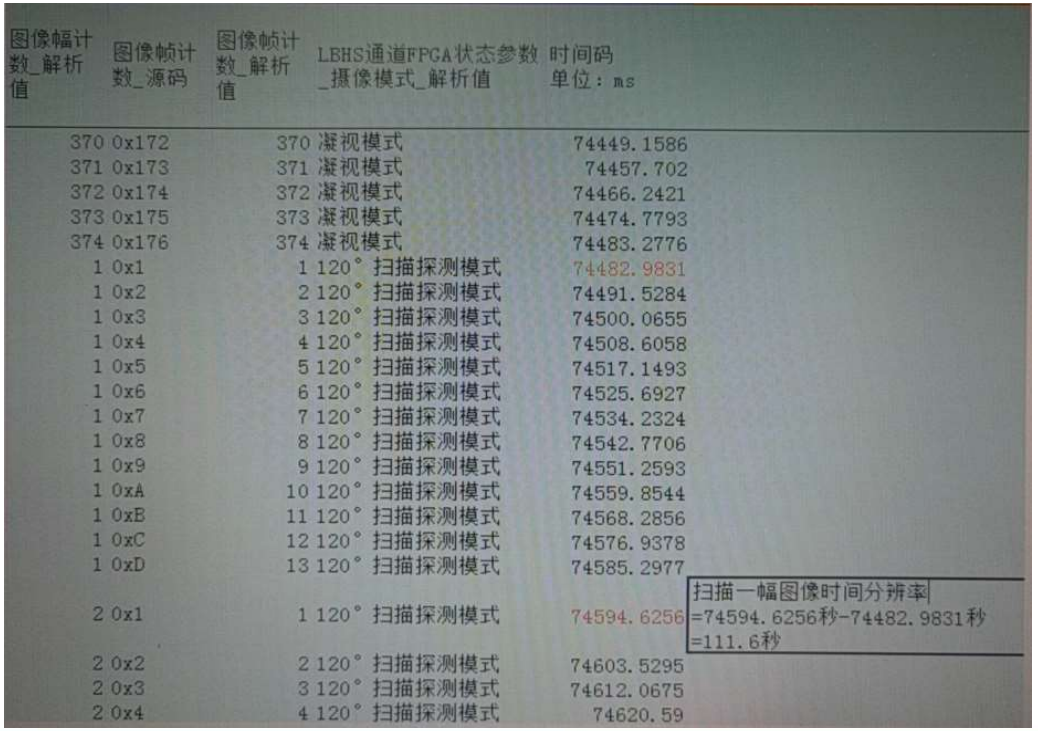
6. Temporal Resolution

The temporal resolution requirement of the imager is 2 minutes, that is, it is required to collect a 130°×130° image within 2 minutes.

The software evaluation results show that the temporal resolution for scanning an image is:

74594.6256s - 74482.9831s = 111.6425s

The temporal resolution meets the requirement.



图像幅计数_解析值	图像帧计数_源码	图像帧计数_解析值	LBHS通道FPGA状态参数_摄像模式_解析值	时间码 单位：ms
370	0x172	370	凝视模式	74449.1586
371	0x173	371	凝视模式	74457.702
372	0x174	372	凝视模式	74466.2421
373	0x175	373	凝视模式	74474.7793
374	0x176	374	凝视模式	74483.2776
1	0x1	1	120° 扫描探测模式	74482.9831
1	0x2	2	120° 扫描探测模式	74491.5284
1	0x3	3	120° 扫描探测模式	74500.0655
1	0x4	4	120° 扫描探测模式	74508.6058
1	0x5	5	120° 扫描探测模式	74517.1493
1	0x6	6	120° 扫描探测模式	74525.6927
1	0x7	7	120° 扫描探测模式	74534.2324
1	0x8	8	120° 扫描探测模式	74542.7706
1	0x9	9	120° 扫描探测模式	74551.2593
1	0xA	10	120° 扫描探测模式	74559.8544
1	0xB	11	120° 扫描探测模式	74568.2856
1	0xC	12	120° 扫描探测模式	74576.9378
1	0xD	13	120° 扫描探测模式	74585.2977
2	0x1	1	120° 扫描探测模式	74594.6256
2	0x2	2	120° 扫描探测模式	74603.5295
2	0x3	3	120° 扫描探测模式	74612.0675
2	0x4	4	120° 扫描探测模式	74620.59

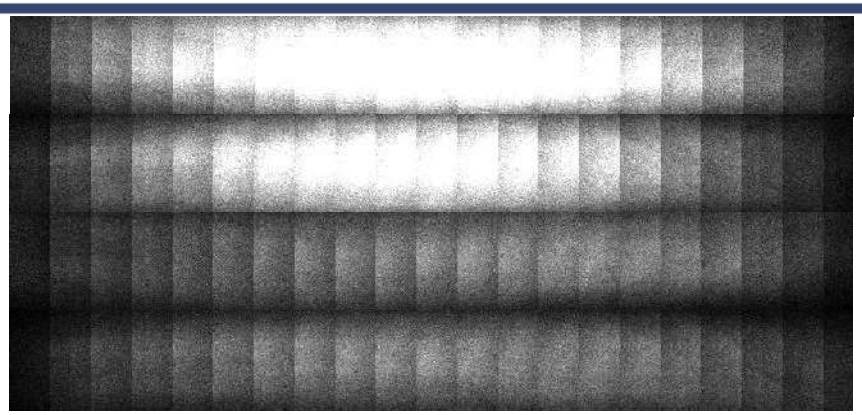
扫描一幅图像时间分辨率
=74594.6256秒-74482.9831秒
=111.6秒

7. FOV Uniformity (Flat Field Calibration)

The purpose of image-plane flat-field calibration is to calibrate the non uniformity of the response at different positions on the image plane.

During the calibration test, the diffuse emission plate illuminated by a far ultraviolet deuterium lamp is imaged using a vacuum condition imaging instrument, and a local flat field calibration image of the image plane is captured; Then rotate the turntable to allow the imaging device to capture images of the diffuse beam from different fields of view; Extract flat field images from different fields of view and stitch them together to obtain a full-scale flat field calibration image; Normalize the center response of the image plane to obtain calibration data for flat field calibration.

二、Prelaunch test results



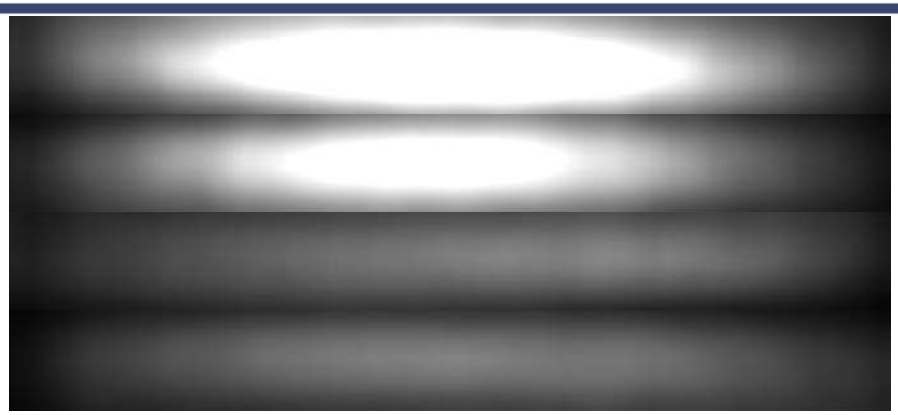
21 position stitched images

Camera #1

Camera #2

Camera #3

Camera #4



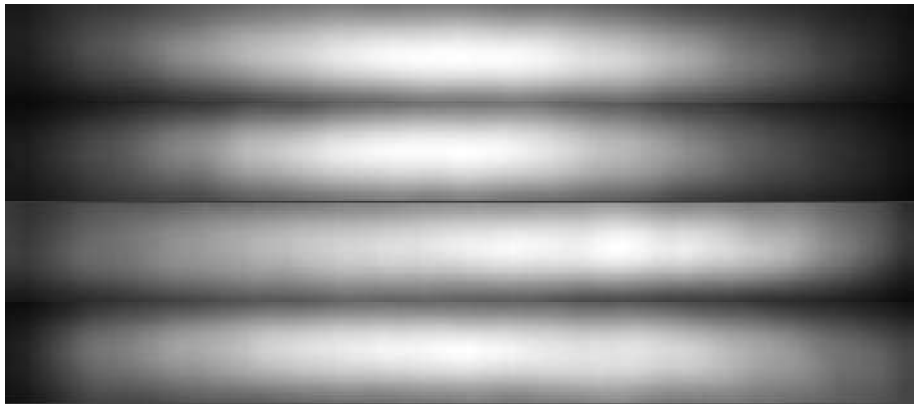
Smoothed images

Camera #1

Camera #2

Camera #3

Camera #4



Flat Field Matrix

Normalized images

8. Pointing Accuracy

WAI has one-dimensional pointing ability. The pointing accuracy index characterizes the difference between the actual pointing angle and the command pointing angle.

Serial Number	Parameter	Record		Remarks
1	0 Pointing Deviation	2′28″	2′54″ (0.048°)	Return after turning 30° towards Hall B
		2′19″		Return after turning 30° towards Hall B
		3′25″		Return after turning 30° towards Hall A
		3′24″		Return after turning 30° towards Hall A
2	30° Pointing Deviation	2′59″	3′2″ (0.051°)	From sub - satellite point to Hall B
		3′4″		
		3′2″		

二、Prelaunch test results

Continued

Serial Number	Parameter	Record		Remarks
3	-30° Pointing Deviation	1′59″ 2′3″ 2′0″	2′1″ (0.034°)	From sub - satellite point to Hall A
4	60° Pointing Deviation	6′29″ 9′39″ 10′	8′42″ (0.145°)	From sub - satellite point to Hall B
5	-60° Pointing Deviation	1′39″ 2′26″ 2′21″	2′9″ (0.036°)	From sub - satellite point to Hall A
6	Average Pointing Deviation	2′39″(0.044°) 4′57″ (0.0825°)		

The Pointing Deviation meets the pointing accuracy requirement (0.2°).

9. Geometry Calibration

According to the measured dot matrix image, sample and query the table for calibration.

(1) Detector Geometric Distortion Correction Range: $640 \le X \le 950$， $470 \le Y \le 1120$

(2) Optical Geometric Distortion Correction Range:

Correction Formula:

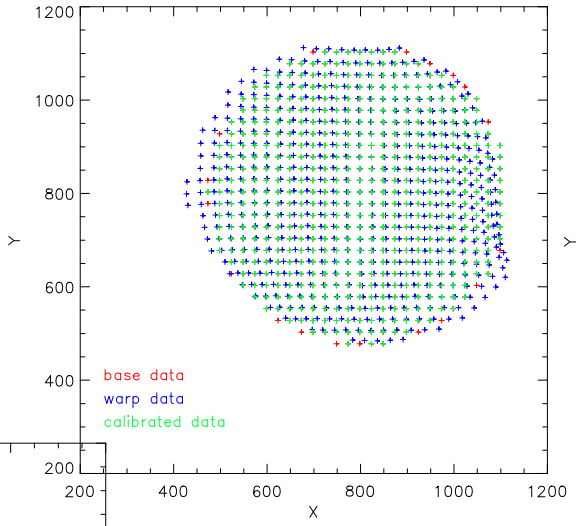
$$X' = X + \Delta X_D([(X - X_{min}) \times 10.0], [(Y - Y_{min}) \times 10.0])$$

$$Y' = Y + \Delta Y_D([(X - X_{min}) \times 10.0], [(Y - Y_{min}) \times 10.0])$$

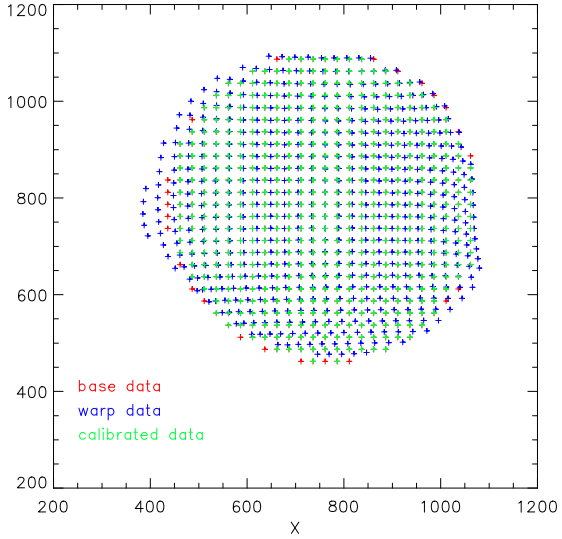
Camera	Optical Distortion Correction Range
1	$730 \le X \le 870$， $500 \le Y \le 1100$
2	$670 \le X \le 810$， $490 \le Y \le 1090$
3	$690 \le X \le 830$， $490 \le Y \le 1090$
4	$650 \le X \le 790$， $490 \le Y \le 1090$

二、Prelaunch test results

Detector Geometric Distortion Correction

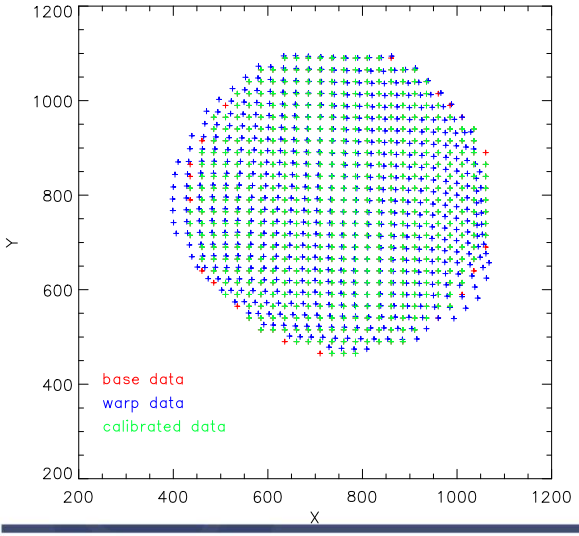


Camera #1

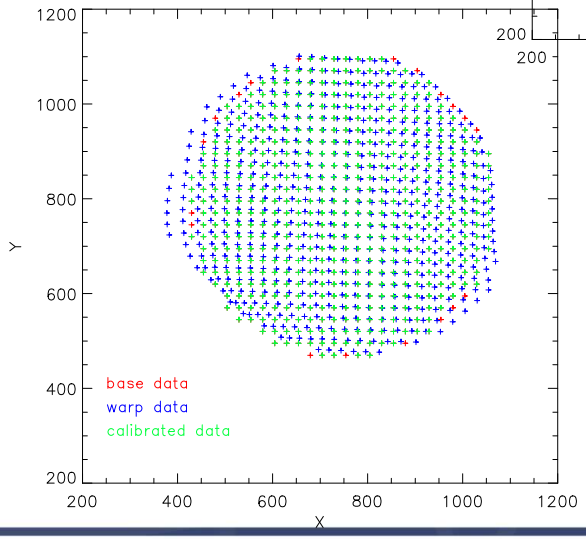


Camera #2

Camera #3

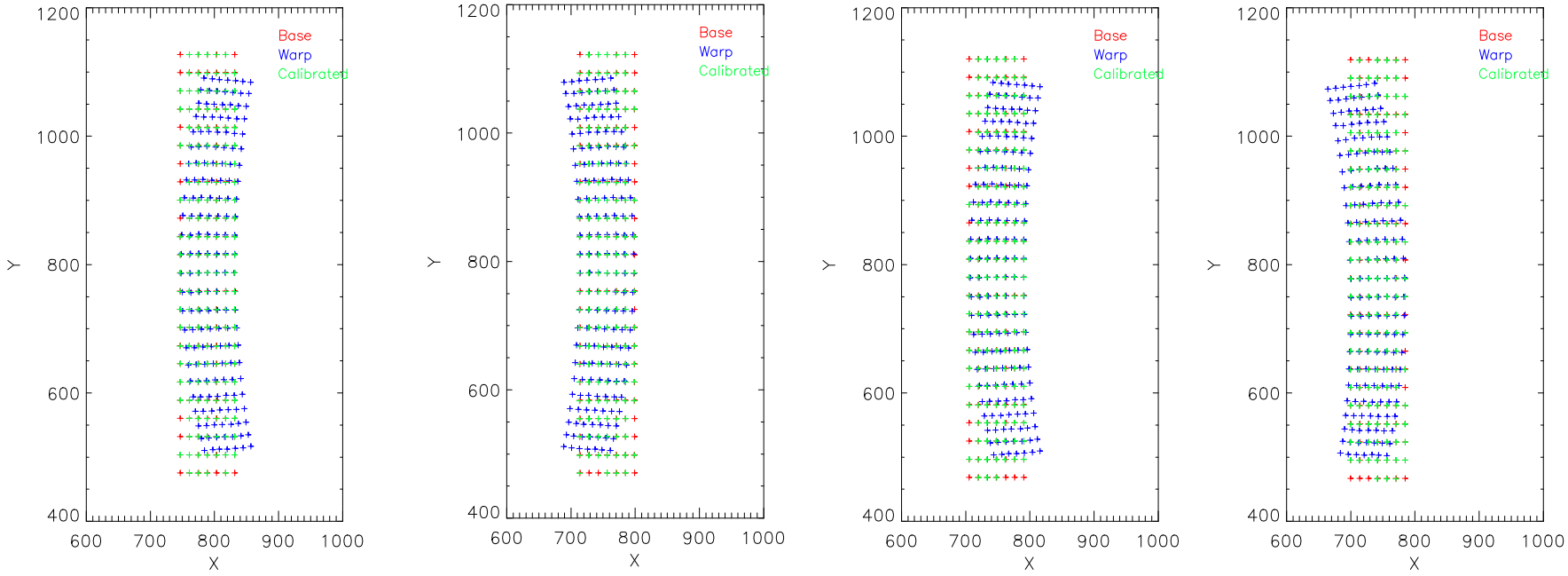


Camera #4



二、Prelaunch test results

Optical Geometric Distortion Correction



Camera #1 **Camera #2** **Camera #3** **Camera #4**

The Geometric Calculation can correct the geometric distortion.

10. Detector Response Linearity Calibration

Since there is a missed-count situation in the counting imaging circuit at high count rates, it is necessary to calibrate the missed-count rate under different count rate conditions and modify the photon count of the image with this data.

Detector 1 response linearity calibration data and results

Number	Area（mm^2）	Front End Count Rate（cps）	Effective Count Rate（cps）	Area Normalization	Normalization of Effective Count Rate	Missing Counting	correction coefficient
1	4	6668	6529	1	1	0	1
2	16	26103	24135	4	3.69658	0.0758539	1.08208
3	36	58224	48727	9	7.46316	0.170759	1.20592
4	64	101162	73780	16	11.3004	0.293728	1.41589
5	100	155149	94723	25	14.5080	0.419680	1.72318
6	144	215799	106566	36	16.3219	0.546613	2.20562
7	256	351105	104275	64	15.9711	0.750452	4.00725

二、Prelaunch test results

Detector 2

Number	Area（mm^2）	Front End Count Rate（cps）	Effective Count Rate（cps）	Area Normalization	Normalization of Effective Count Rate	Missing Counting	correction coefficient
1	4	5386	5308	1	1	0	1
2	16	21226	19922	4	3.75320	0.0616993	1.06576
3	36	47332	40831	9	7.69235	0.145294	1.16999
4	64	82783	63773	16	12.0145	0.249093	1.33172
5	100	127586	84769	25	15.9700	0.361198	1.56543
6	144	180284	100025	36	18.8442	0.476550	1.91040
7	256	302230	107316	64	20.2178	0.684097	3.16553

Response Linearity Calibration Data and Results

Detector 3

Number	Area（mm^2）	Front End Count Rate（cps）	Effective Count Rate（cps）	Area Normalization	Normalization of Effective Count Rate	Missing Counting	correction coefficient
1	4	5900	5798	1	1	0	1
2	16	23818	22107	4	3.81287	0.0467834	1.04908
3	36	53119	45005	9	7.76216	0.137538	1.15947
4	64	93554	69498	16	11.9865	0.250841	1.33483
5	100	140437	89352	25	15.4108	0.383567	1.62224
6	144	203852	103995	36	17.9364	0.501768	2.00710
7	256	340973	103933	64	17.9257	0.719911	3.57030

Detector 4 response linearity calibration data and results

Number	Area（mm^2）	Front End Count Rate（cps）	Effective Count Rate（cps）	Area Normalization	Normalization of Effective Count Rate	Missing Counting	correction coefficient
1	4	5574	5475	1	1	0	1
2	16	21970	20519	4	3.74776	0.0630594	1.06730
3	36	49508	42493	9	7.76128	0.137636	1.15960
4	64	87768	66626	16	12.1691	0.239429	1.31480
5	100	135059	88014	25	16.0756	0.356975	1.55515
6	144	189428	102314	36	18.6875	0.480903	1.92642
7	256	320529	106786	64	19.5043	0.695245	3.28133

11. Dark Field Calibration

Mainly test the dark count of each channel under no light conditions.

Each channel is measured 3 times, with a cumulative time of 600 seconds per measurement.

Dark count rate (counts/s) = (total counts - missed counts) ÷ time

Actual measurement result (counts/s. cm^2) = dark count rate ÷ effective area

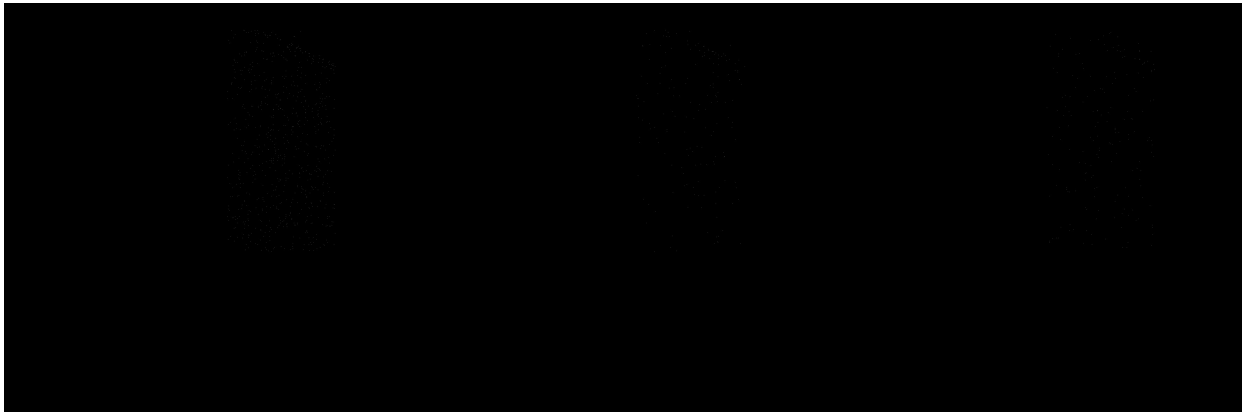
The effective area of the detector is 4.98cm^2

Test Result of Dark Count Rate

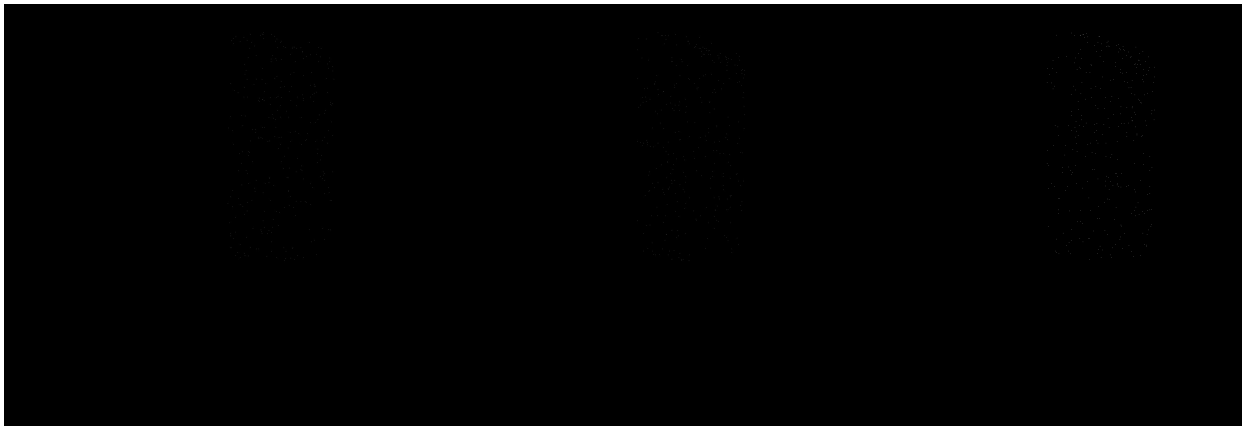
Test Frequency		Test Result of Dark Count Rate（counts/s）	Actual Test Result（counts/s.cm^2）	Remark
通道T01	1	1.19000	0.238956	采集600s
	2	0.415000	0.083333	采集600s
	3	0.401667	0.0806560	采集600s
通道T02	1	0.816667	0.163989	采集600s
	2	0.805000	0.161647	采集600s
	3	0.866667	0.174029	采集600s
通道T03	1	0.390000	0.078132	采集600s
	2	0.388333	0.0779786	采集600s
	3	0.356667	0.0716198	采集600s
通道T04	1	1.49667	0.300535	采集600s
	2	1.50833	0.302878	采集600s
	3	1.51500	0.304217	采集600s

二、Prelaunch test results

The dark field images measured 3 times by Camera #1 have maximum counts of 2, 2, and 2 for each measurement.

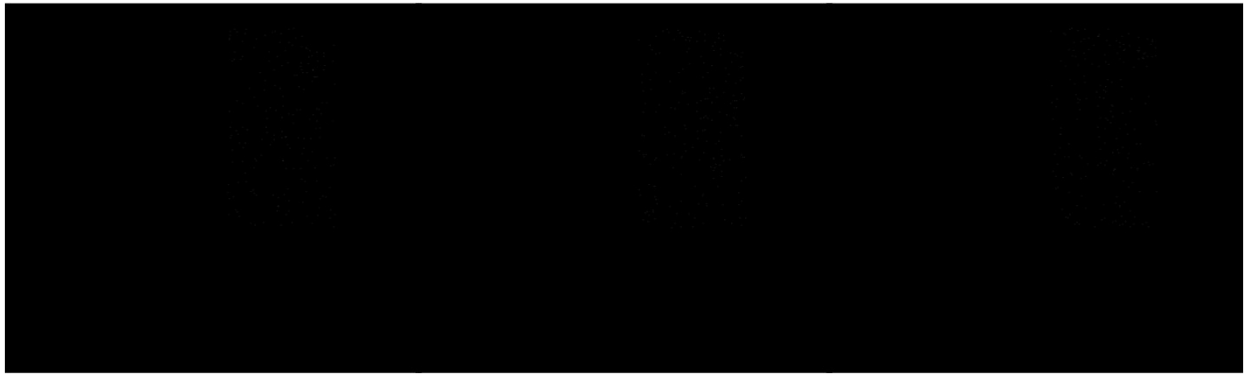


The dark field images measured 3 times by Camera #2 have maximum counts of 2, 2, and 1 for each measurement.

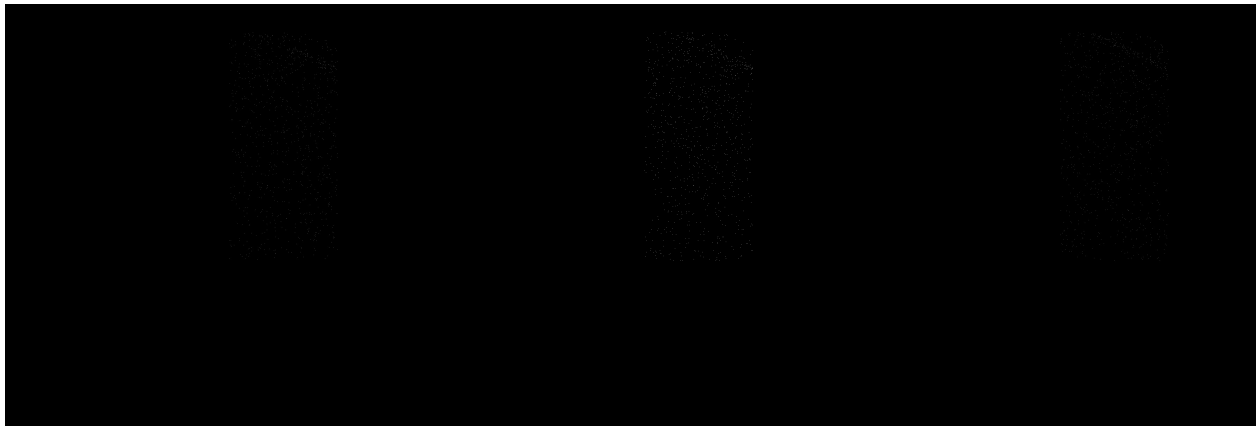


二、Prelaunch test results

The dark field images measured 3 times by Camera #3 have maximum counts of 1, 1, and 1 for each measurement.



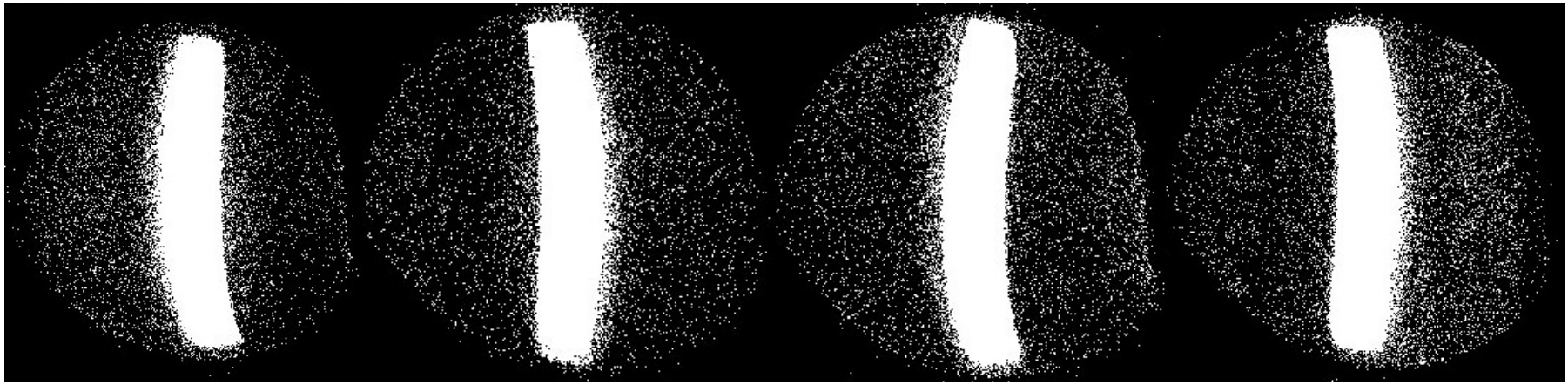
The dark field images measured 3 times by Camera #4 have maximum counts of 2, 1, and 2 for each measurement.



On-board Radiometric Calibration

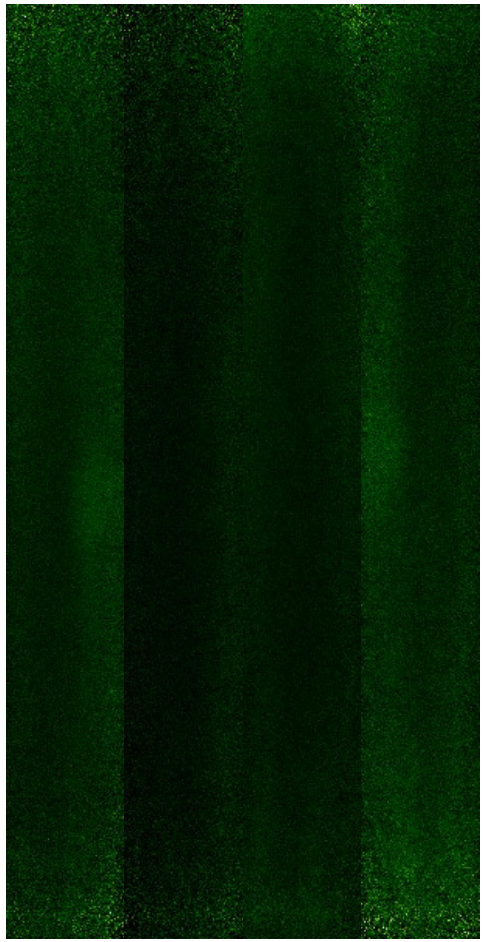
The brightness of the on-board calibration device is calibrated under ground vacuum conditions. When the imager is in orbit, it regularly images the on-board calibration device to calibrate the response change of the instrument.

Imaging of diffuse reflection plate with 4 cameras under ground vacuum



Camera #1 Camera #2 Camera #3 Camera #4

三、Calibration Approach In-orbit



The brightness distribution of on-bard calibration of the imaging of the diffuse reflection plate by 4 cameras after geometric distortion correction and flat-field calibration.

On-board calibration accuracy analysis

Error Source	Error
Ground Calibration Error of On - board Calibration Device	11.8%
Signal - to - Noise Ratio Error of On - orbit Image of Diffuse Reflection Plate	4.5%
Light Source Attenuation Error	2%
Diffuse Reflection Plate Attenuation Error	5%

Comprehensive error of on-board radiometric calibration:

$$e=\sqrt{0.118^2+0.045^2+0.02^2+0.05^2}=13.7\%$$

四、Conclude

Num.	Parameter	Requirement	Test Value
1	Operating Wavelength Range	Channel 1: 140 ~160nm; Channel 2: 160 ~180nm	LBHS: 140-160nm; LBHL: 160-180nm
2	Dynamic Range	200-8000 Rayleigh	Camera #1: 14.3599-30544.965 Rayleigh Camera #2: 15.7531-33397.141 Rayleigh Camera #3: 20.8036-44250.953Rayleigh Camera #4: 20.0665-42682.941 Rayleigh
3	Overall Sensitivity	Better than 6.0 counts/Rayleigh/s	Camera #1: 9.8870952counts/(s·Rayleigh) Camera #2: 9.0127480 counts/(s·Rayleigh) Camera #3: 6.8247120 counts/(s·Rayleigh) Camera #4: 7.0754260counts/(s·Rayleigh)
4	Total FOV	≥ 130°×130°	LBHS: 136.175°×136.506° LBHL: 135.202°×136.131°
5	Temporal Resolution	≤ 2 min（1 frame）	111.6s
6	Spatial Resolution	Subsatellite point resolution: ≤ 10km (110km height)Non Subsatellite point resolution: extrapolated from the resolution projected onto a height of 110km	0.61°
7	Pointing Accuracy	≤0.2°（Minimum Requirement), ≤0.1°（Expected Value)	Average Pointing Deviation 0.0825°

Thank you
for your attention !

NSMC NCSW