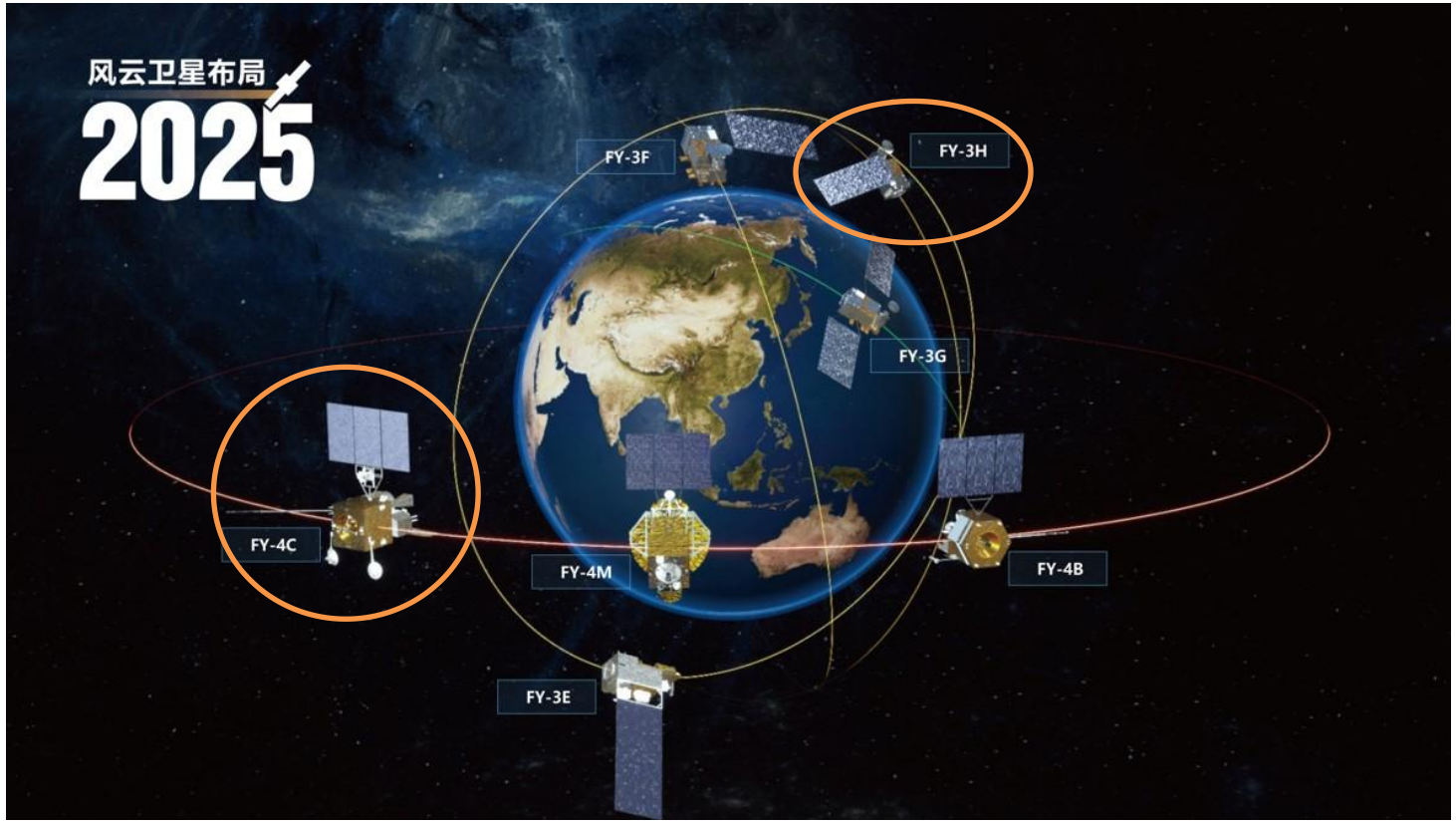
2025年风云气象卫星
新型遥感与探测技术研讨会

The New-Coming Capabilities of FengYun Satellites for Space Weather Observations in 2025

Report Author : HUANG Cong

- In 2025, CMA/NSMC will launch two FengYun (FY) satellites - **FY-4C** in **geostationary** orbit and **FY-3H** in **Sun-synchronous** orbit (830 km, in afternoon orbit of 14:00 to replace FY-3D).
- There will be solar Extreme UltraViolet Imager (**EUVI**)、solar X-ray and EUV Spectrometer (**XEUVS**) and Multiband Ultraviolet Spectrum Imager (**MUSI**) onboard FY-4C; Ionospheric Photo-Meter (**IPM**) and Wide-angle Aurora Imager-II (**WAI-II**) onboard FY-3H.
- These space weather payloads will improve the **solar/ionospheric/auroral** observation capabilities of CMA/NSMC.

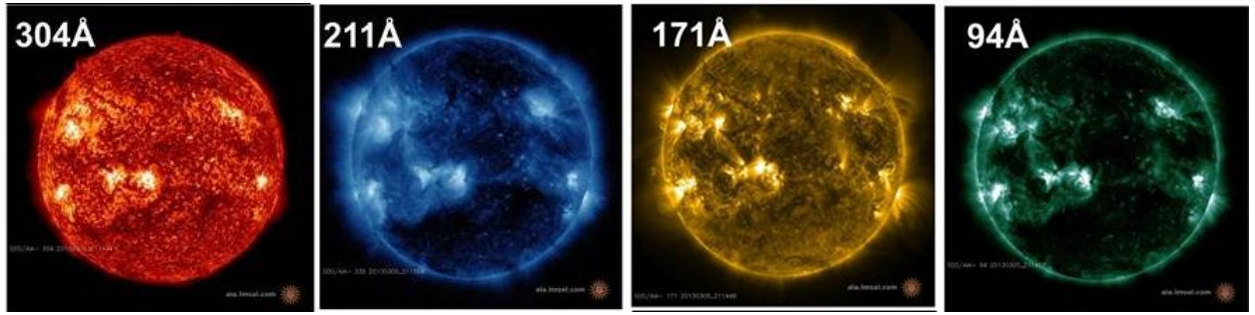
Overview – Space Weather Payloads onboard FYSAT in 2025



FY-4C/EUVI, the solar Extreme UltraViolet Imager

- The Extreme Ultraviolet imager (EUVI) onboard FY-4C is a normal-incidence reflecting telescopes that images the Sun in four EUV wavelength channels (examples from SDO).

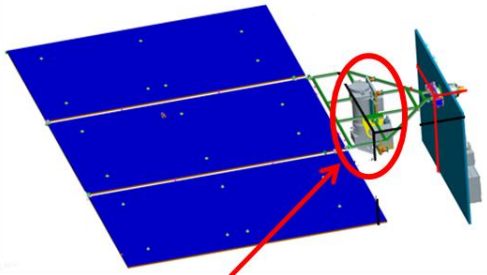
Wavelength Log(Te)	94 Å	171 Å	211 Å	304 Å
Filaments				■
Coronal Holes			■	
Active region complexity		■	■	
CMEs(e.g. dimming)		■		
Flare Location and Morphology	■			
Quiet Regions		■		■

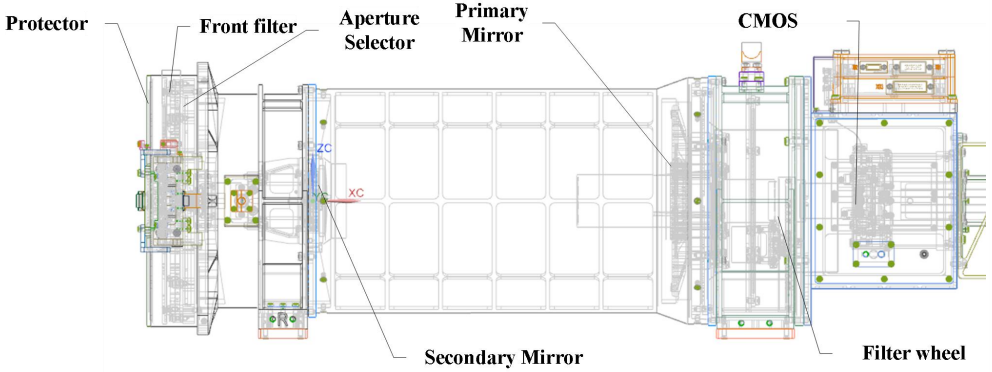


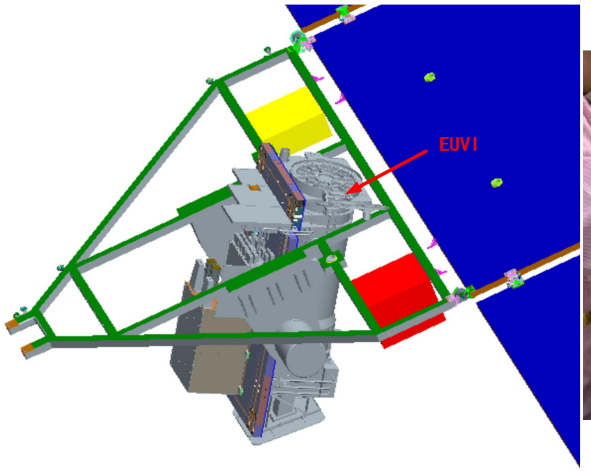
Title	Index
Bandpass	Fe_XVIII 9.4nm Fe IX 17.1nm Fe_XIV 21.1nm、 He II 30.4nm
Mirrors	Multilayer-coated Zerodur
Field of view	42×42 arcmin(along detector axes)
Resolution	3.5 arcsec
CMOS detector	2048×2048
Time interval	5s

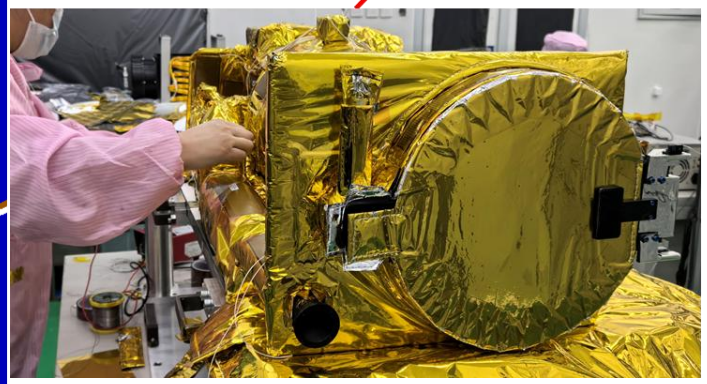
FY-4C/EUVI, the solar Extreme UltraViolet Imager

- Four EUV Wavelength Channels：
  - 9.4nm ---Flare；
  - 17.1nm、21.1nm ---Corona and Active region and CMEs
  - 30.4nm ---Filaments



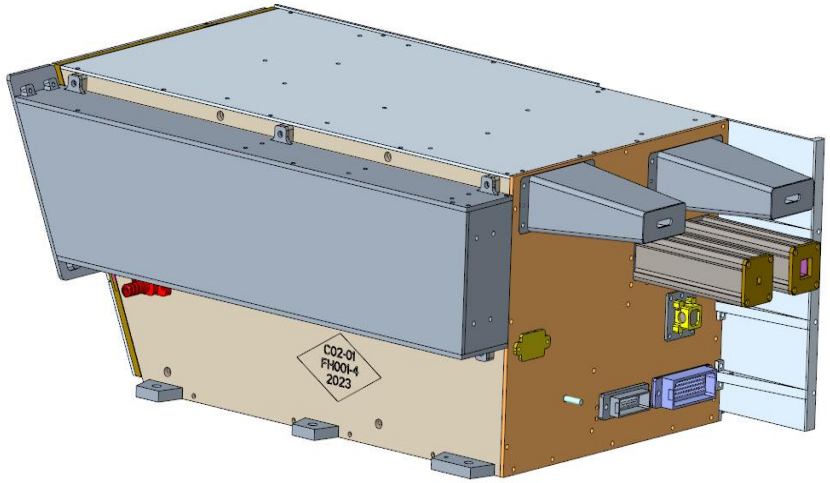






FY-4C/XEUVS, the solar X-ray and EUV Spectrometer

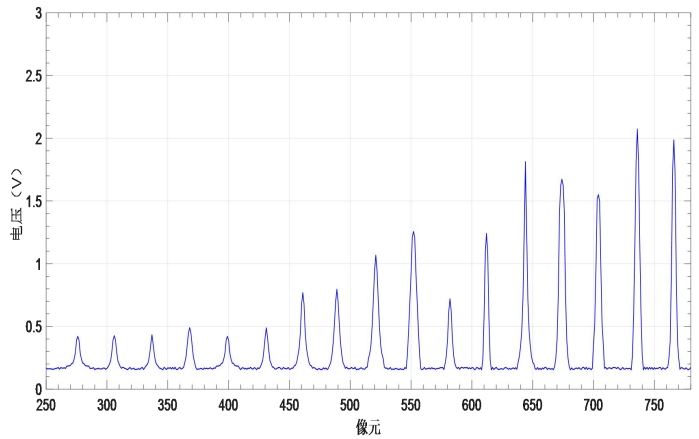
- Scientific Goals: Making full- disk observations of the solar X- ray and Ultra-Violet flux and spectra, to provide critical information about solar activity for space weather operations;
- Instrumentation: 1 X-ray channel for the quiet Sun and 1 X-ray channel for solar flares observation, continuous spectra measurement for 5-35nm, 110-145nm, with 0.5nm spectral resolution.



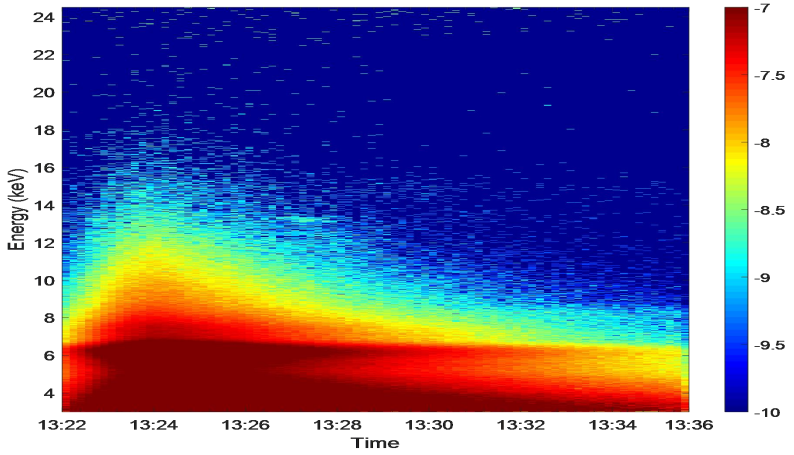
Characteristics	Parameters	
Channels(Wavelength Bands)	X-ray	0.05nm-0.4nm
		0.1nm-0.8nm
	EUV	5nm-35nm
	FUV	110nm-145nm
	FUV	275nm-285nm
Spectral Resolution	X-ray	Better than 5%
	EUV	≤0.5nm
	FUV	≤0.1nm
Field of View	Full disk of the Sun≥55 arcmin	
Cadence	X-ray	1s
	EUV/FUV	5s

FY-4C/XEUVS, the solar X-ray and EUV Spectrometer

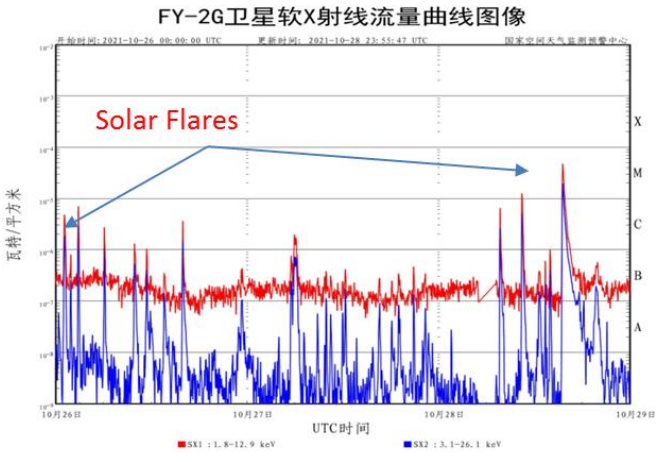
- Provide accurate data of the X-ray flux and spectra during solar flare explosions, continue to the FY-2 series satellites (see the right panel below);
- Provide solar X-EUV-FUV spectra from short-term in minute to long-term in over 5-year, for forecasting disturbance of the ionospheric electron, upper atmosphere's density, etc.



The FY-4C/XEUVS responded to the 3-35nm EUV beam-light provided by the NSRL (HeFei) in the pre-launch test.



The X-ray spectra evolved during the X1 solar flare happened on 2022-05-03

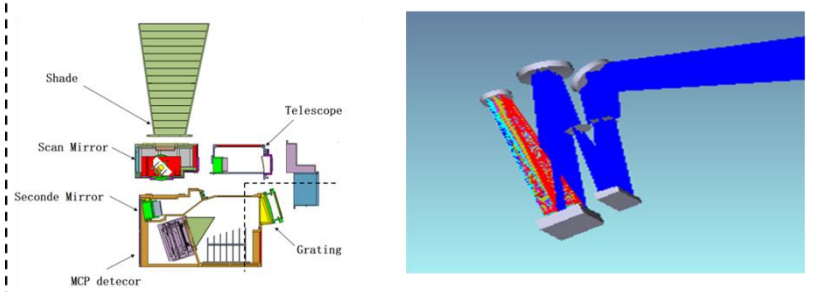


FY-4C/MUSI, the Multiband Ultraviolet Spectrum Imager

- Hyperspectral imager designed to observe the FUV airglow emissions between ~ 120 and 160 nm, which include the prominent HI 121.6 nm, OI 130.4 nm, OI 135.6 nm, and the N2 Lyman-Birge-Hopfield (LBH) emission.

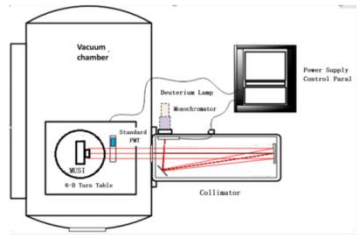
Channel	Wavelength (nm)	Dynamic Range(R)	Responsivility(counts·s-1·R-1·pixel-1)
1	121.6	10-20000	≥2.85E-3
2	130.4	10-20000	≥5.7E-3
3	135.6	10-10000	≥5.7E-3
4	140-160	10-10000	≥4.3E-3

- FOV: 14°×16°
- Spatial Resolution: ＜50km
- Spectral Resolution: ＜0.4nm
- Disk scans： ≤60min。

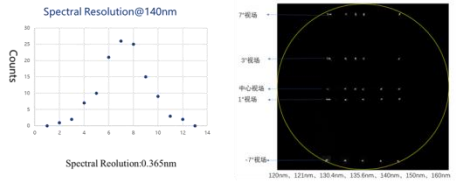


System Design

Detector: MCP+WSA

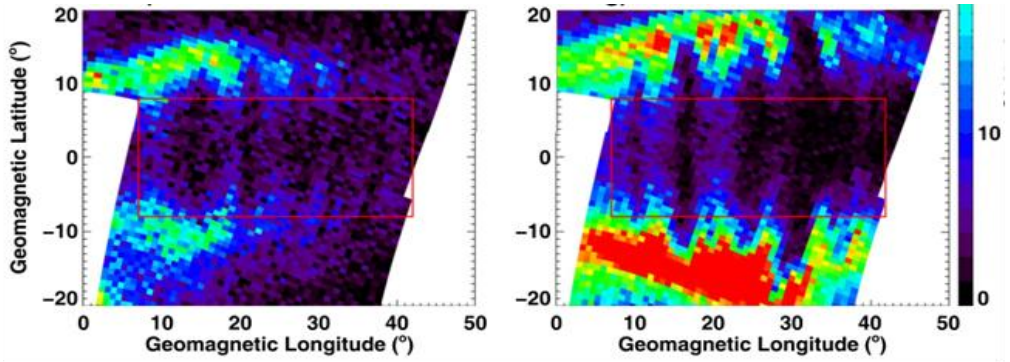


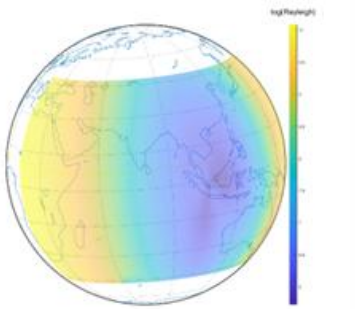
Calibration System



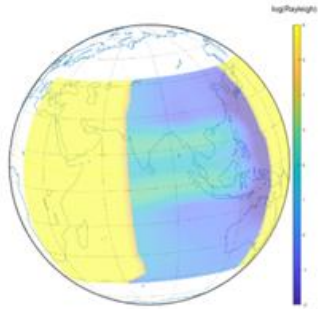
FY-4C/MUSI, the Multiband Ultraviolet Spectrum Imager

- Products：Nightside TEC and NmF2；Plasma Bubble；O/N2 (examples from GOLD)

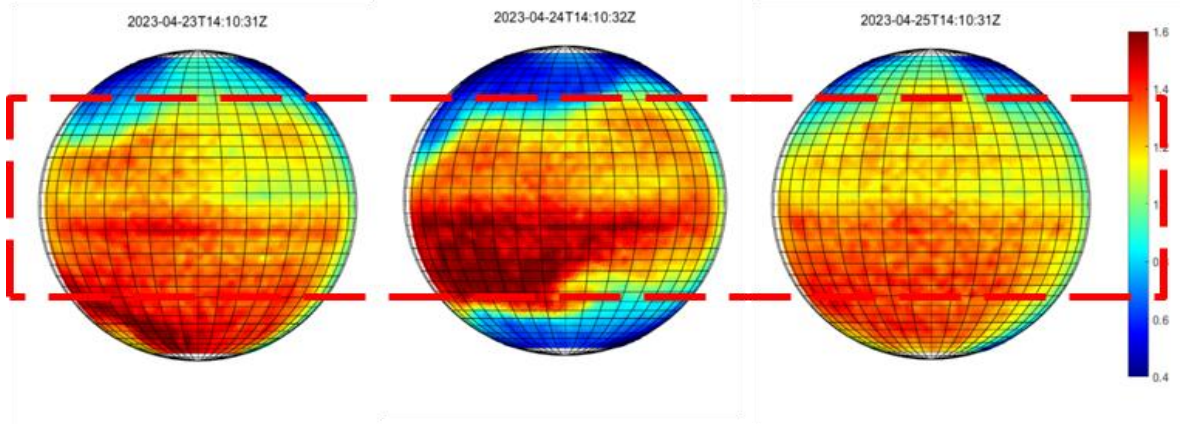


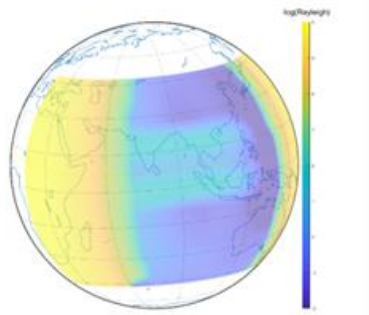


121.6nm

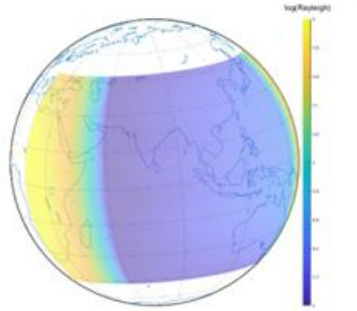


130.4nm





135.6nm



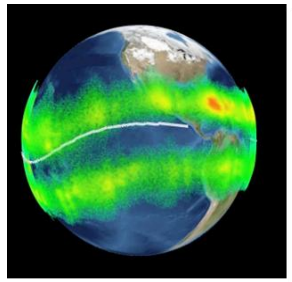
LBHS

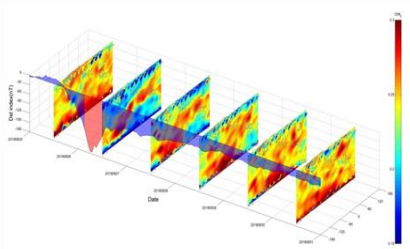
FY-3H/IPM, the Ionospheric Photo-Meter

- FY-3H/IPM is similar to the FY3D IPM instrument (Jiang et al., 2020; Wang et al., 2022). This instrument monitors the OI 135.6 nm and N2 LBH (140-180 nm) emissions in daytime and the OI 135.6 nm emission in nighttime by employing a filter wheel (examples below are from FY-3D/IPM and FY-3E/TriIPM).

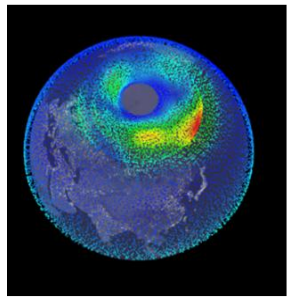
IPM Performance

Parameter		Value
Wavelength		135.6 nm and 145–180 nm
Field of view	Scientific Channel	~3.5° (along orbit) ~1.6° (cross orbit)
	Calibration Channel	~3.5° (along orbit) ~1.6° (cross orbit)
Responsivity (counts/s/Rayleigh)		day mode: 3.52@135.6nm, 4.07@157nm) night mode: 200.99(@135.6nm)
Time resolution		
Calibration accuracy		12.52%

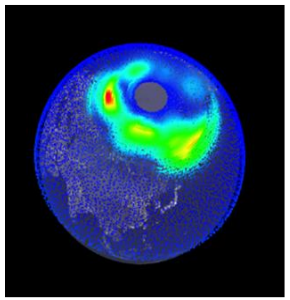




TEC、NmF2



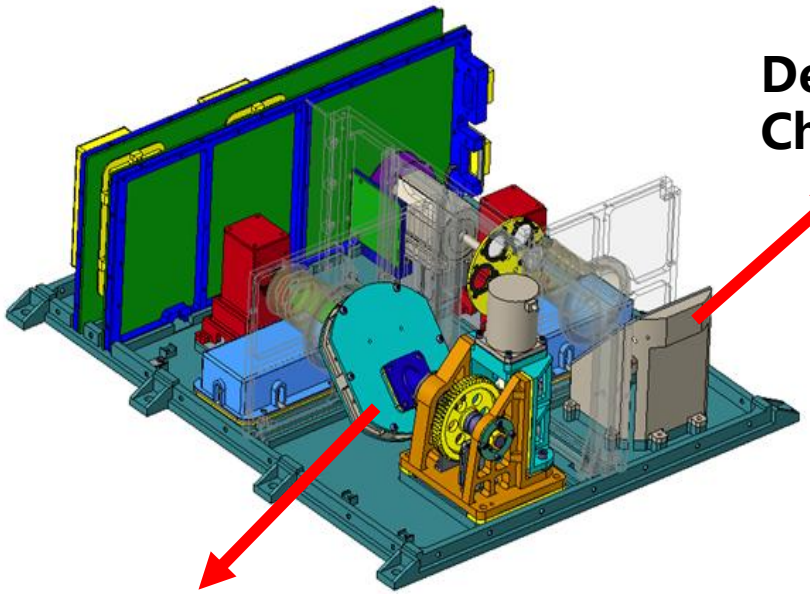
O/N2

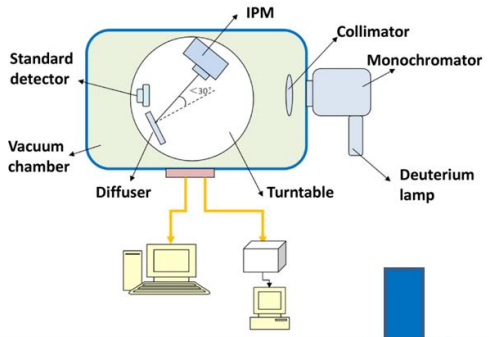


Aurora Features

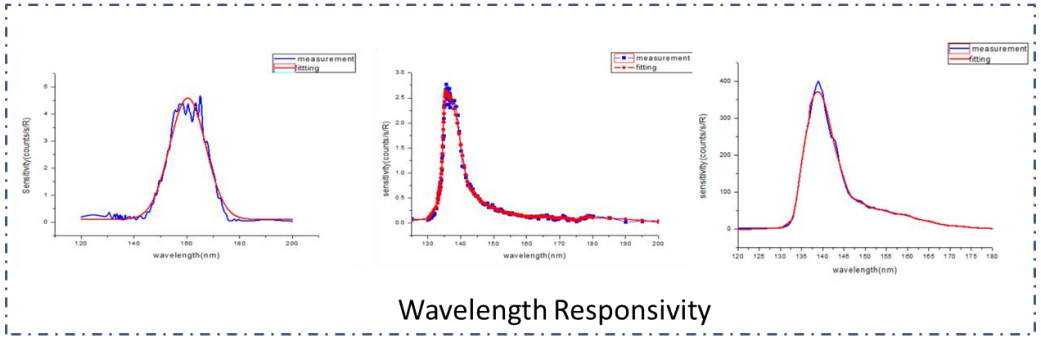
FY-3H/IPM, the Ionospheric Photo-Meter

- Advantage：“Smart” sensor；Topside airglow sounder；High sensitivity；In-orbit calibration，etc.





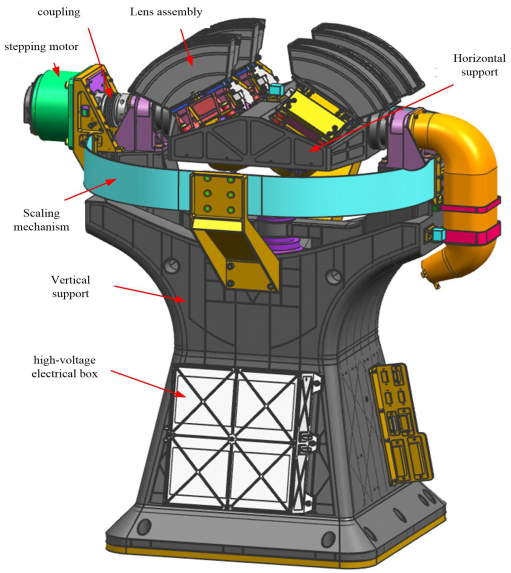
Calibration System



Wavelength Responsivity

FY-3H/WAI-II, the Wide-angle Aurora Imager-II

- WAI-II is imaging th aurora in the solar polar orbit through 130°×130° large field of view, the N2 molecular radiation LBH band (140nm~180nm) of the Earth's northern and southern auroras are imaged and observed, and aurora radiation intensity information with the spatial resolution of 10km in the auroral oval is obtained. Then the products can be used to forecast geomagnetic storm, magnetospheric substorm and ionospheric weather in polar region.



Main technical index requirements

Serial number	Parameter	Main technical index
1	Working waveband	route1：140 ~160nm；route2：160 ~180nm
2	Accuracy of on-board radiometric calibration	≤15%
3	Sensitivity	better than 6.0 counts/Rayleigh/s
4	Uniformity of field of view	≤15%
5	Detect total field of view	≥130°×130°
6	Spatial resolution	Substellar point resolution：≤10km（110km）
7	pointing accuracy	≤0.2°
8	Out-of-band response	Less than 5% of the in-band response in 120-220nm

FY-3H/WAI-II, the Wide-angle Aurora Imager-II

- WAI-II acquires the Earth aurora oval image data in orbit. Based on the auroral oval radiation intensity distribution and the extraction algorithm of auroral oval boundary position, the geomagnetic sub-storm forecasting is made according to the auroral intensity and boundary variation trend of the continuous-observation data.

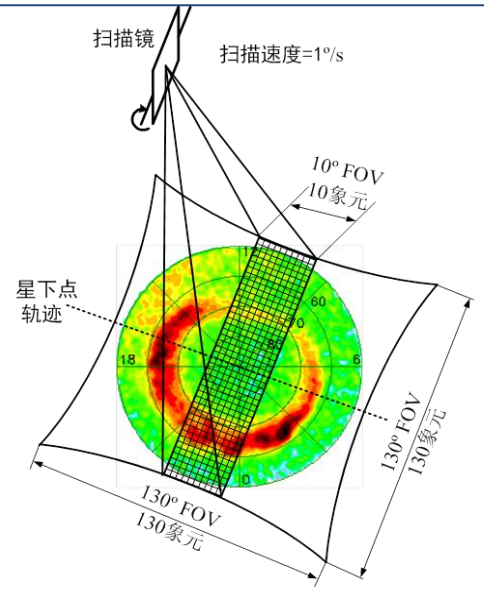
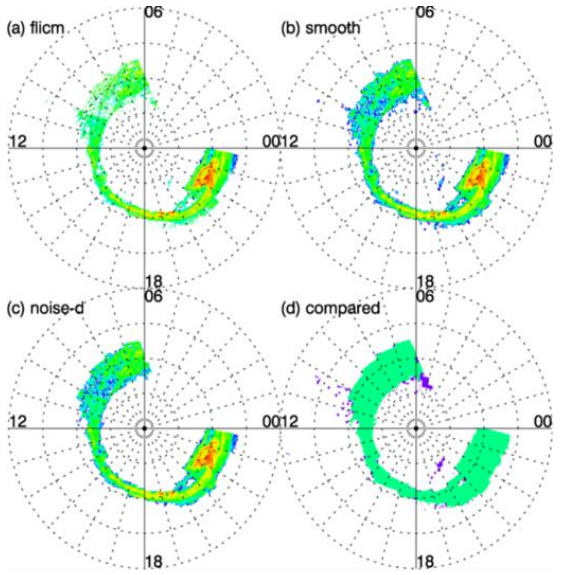
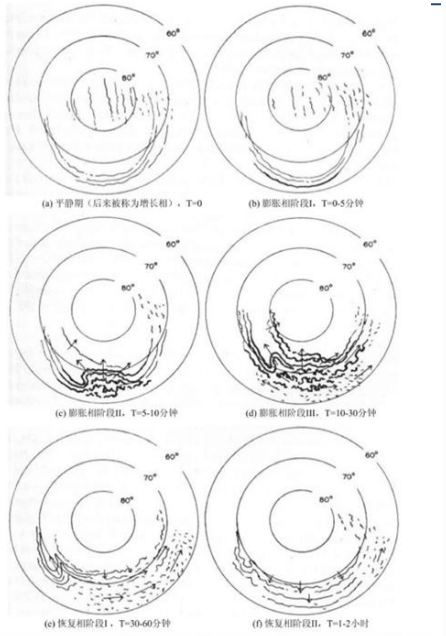


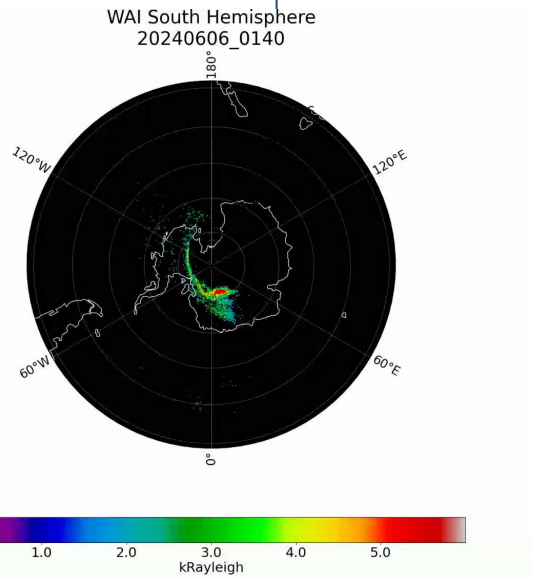
Diagram of in-orbit scanning observation



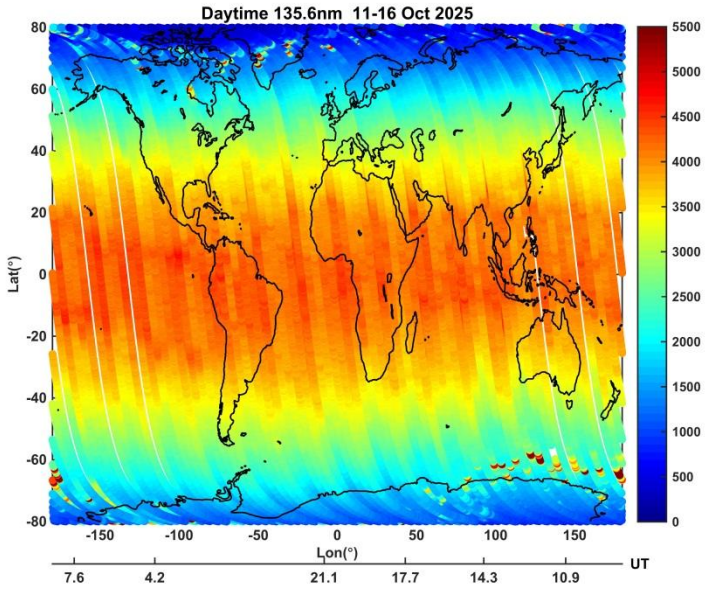
Auroral oval image of expected observation

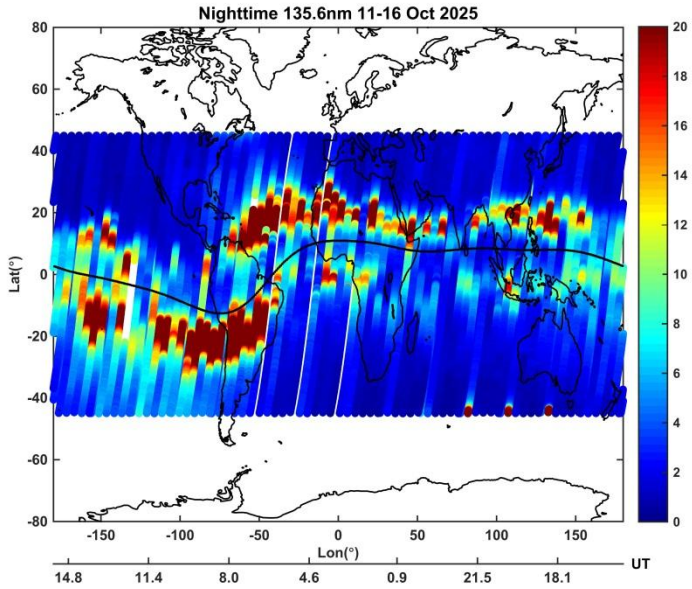


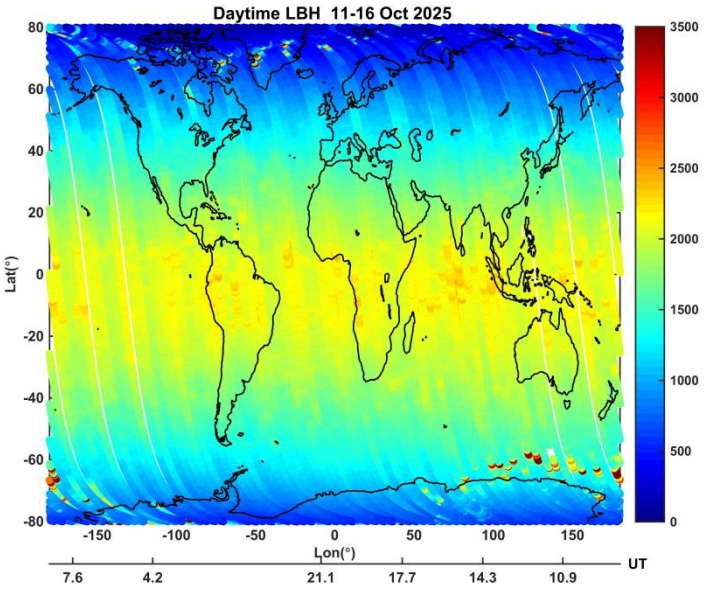
Dynamic process of auroral substorm



“Fresh” Observations from FY-3H/IPM in October, 2025







- CMA/NSMC plans to launch **FY-4C** (geostationary orbit)、**FY-3H** (Sun-synchronous orbit) in **later 2025** (Dec-FY4C, Sep-FY3H).
- The new space weather payloads onboard FY-4C and FY-3H will enhance CMA’s capabilities for **solar EUV imaging**、**solar X-ray flux and EUV spectra**、**ionospheric emission and spectrum**、**aurora monitoring**.
- After **the post-launch test** for approximate **six** months to check the **data validation**, CMA/NSMC will provide these new space weather products to public in 2026, welcome to use these new observations in the **operation** and the **science studies**.

THANK YOU FOR YOUR ATTENTION!