The new Total Solar Irradiance observations from FY-3C Solar Irradiance Monitor

Jin Qi[1], Hong Qiu[1], Wei Fang[2], Peng Zhang[1],

Yupeng Wang[2], Xin Ye[2]

1. National Satellite Meteorological Center, Chinese Meteorological Administration
2. Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences

Email: qijin@cma.gov.cn
Tel: 86-10-68406947

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FengYun 3 Satellite

FengYun 3 (FY-3) satellite series is the second generation polar-orbiting meteorological satellite.

The mission contains sounding, imaging, ozone and earth radiation budget .

Earth radiance Measurement
Solar Irradiance Monitor

FY-3A: morning orbit, launched May, 27, 2008
FY-3B: afternoon orbit, launched Nov., 5, 2010
FY-3C: morning orbit, launched Sep., 23, 2013

FY-3D: afternoon orbit, will launch in 2016

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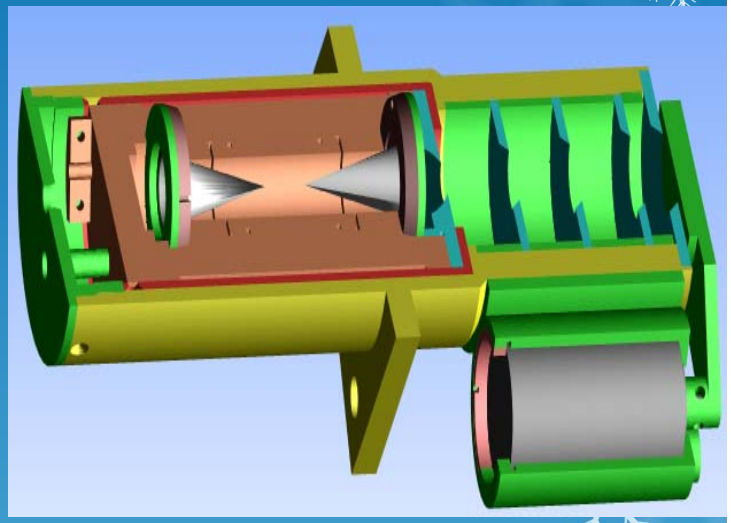
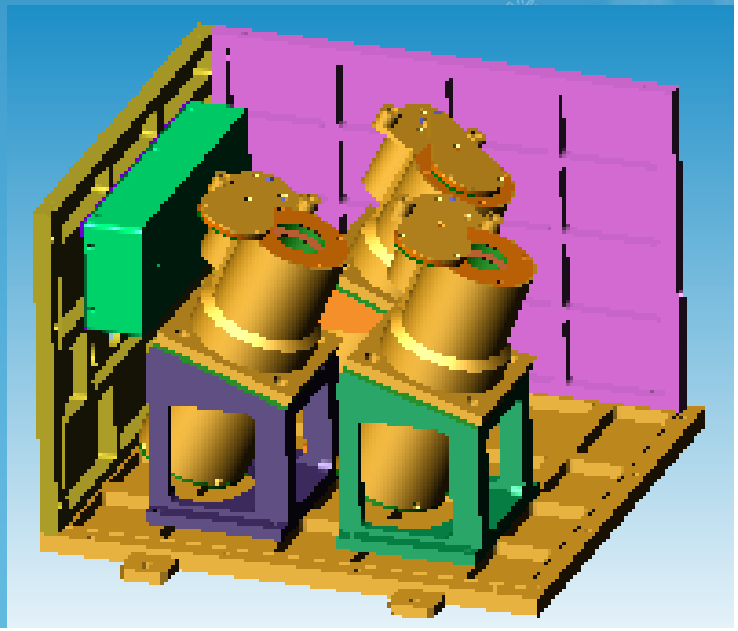
Solar Irradiance Monitor (SIM)

Main goal: get accurate observation of solar incident radiation, assess climate effects



Detector is based on ESR, 0.2 ~ 50um, there observation mode:

self-test,
solar,
background



FY-3A/3B SIM:

- ✓ **has three same ESRs;**
- ✓ **no tracing system;**
- ✓ **FOV ±13.3°**

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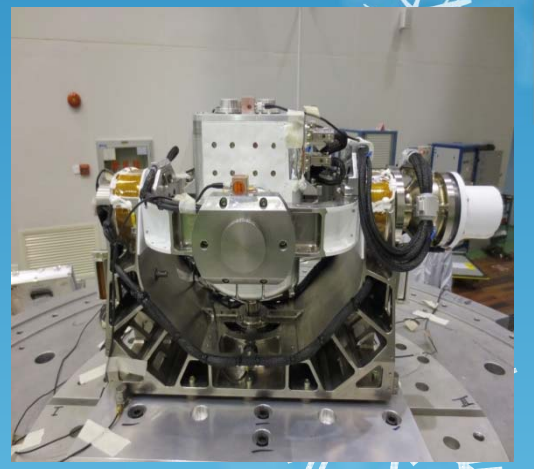
Solar Irradiance Monitor (SIM)

FY-3C/SIM:

- ✓ **Sun sensor;**
- ✓ **Two-axis rotating device;**
- ✓ **Precise temperature control system;**
- ✓ **Two same ESRs, one operates continuously, other one observes one day a month for monitoring aging effects**

Parameter	FY-3A/B	FY-3C
Spectral range	0.2~50um	0.2~50um
Absolute accuracy	0.5%	0.1%
Relative accuracy	0.03%/3 years	0.02%/4 years
FOV	±13.3°	±2°
Tracing accuracy	--	±0.1°
Temperature control accuracy	--	0.3K



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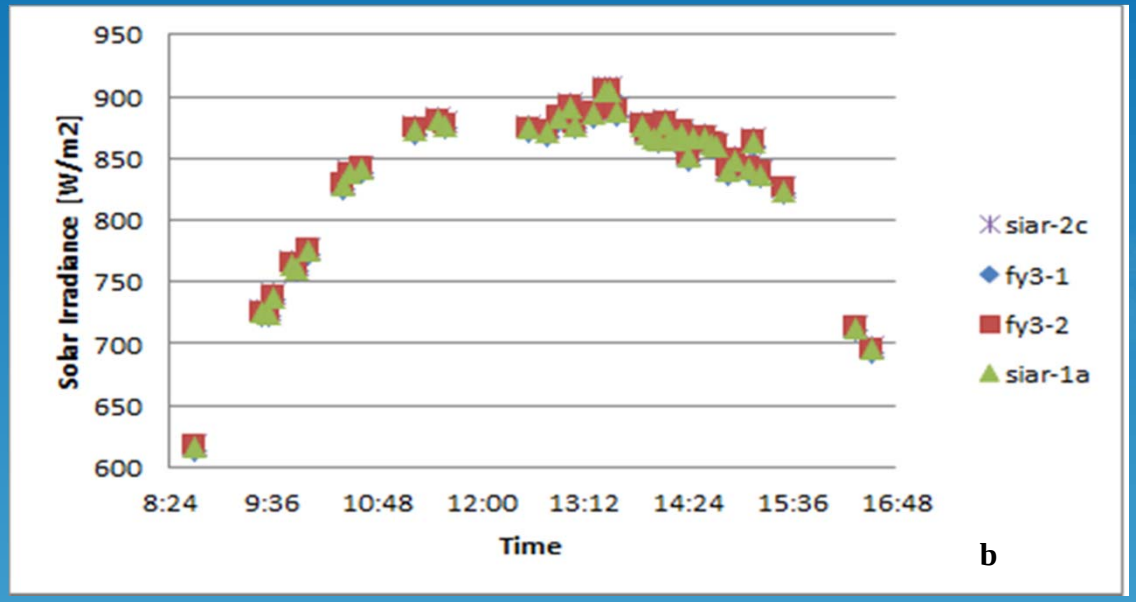
Calibration-before launch

The field comparison experiment was held from March 27 to April 5, 2013 at Yunnan province, China. It was a synchronous observation with one rotating platform under clear sky;

The reference results are from SIAR-1A and SIAR-2C, which had already completed the 11th International Pyrheliometer Comparison（IPC-XI）;
With the WRR standard, the observations from SIM will be traceable;

a

Calibration-before launch



Simultaneous observation result on Apr. 3 after quality control

World Radiometric Reference (WRR) factor

instrument	SIAR-1a	SIAR-2c	FY3-1	FY3-2
WRR	1.0024	0.999839	1.005927	1.000448
σ	0.000997	0.001125	0.000785	0.000769

On orbit

FY-3C was launched on Sep. 23,2013

FY-3C/SIM began to operate from Oct. 1, 2013

$$E_s = (E_{Sun} - E_{Space}) \times f_{fov} \times f_{Doppler} \times f_{AU} \times f_{WRR} \times f_{re}$$

Comparing to FY-3A/3B, the equation is adding Doppler influence factor and changing the distance correction from empirical formula to using satellite gps data

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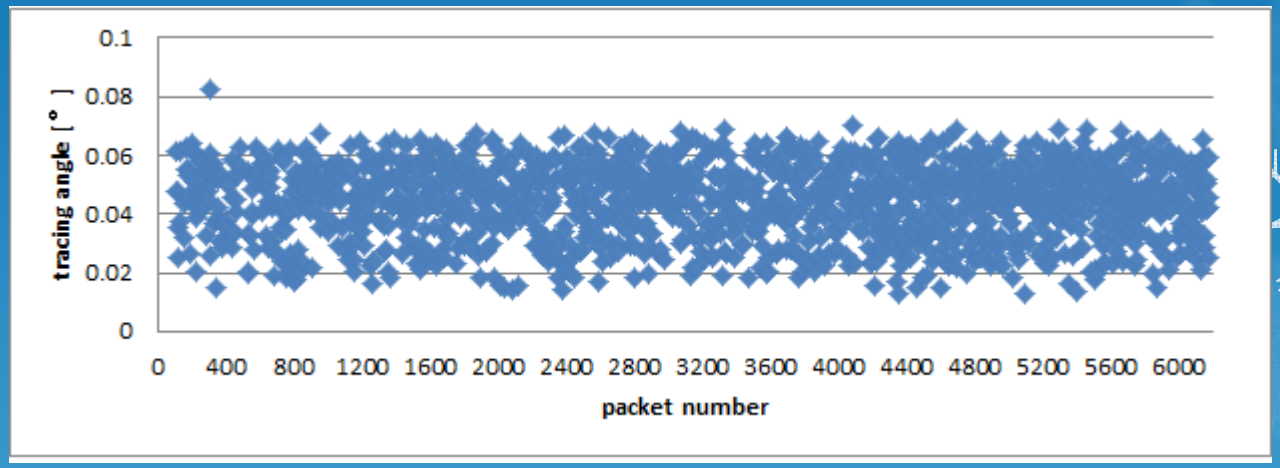
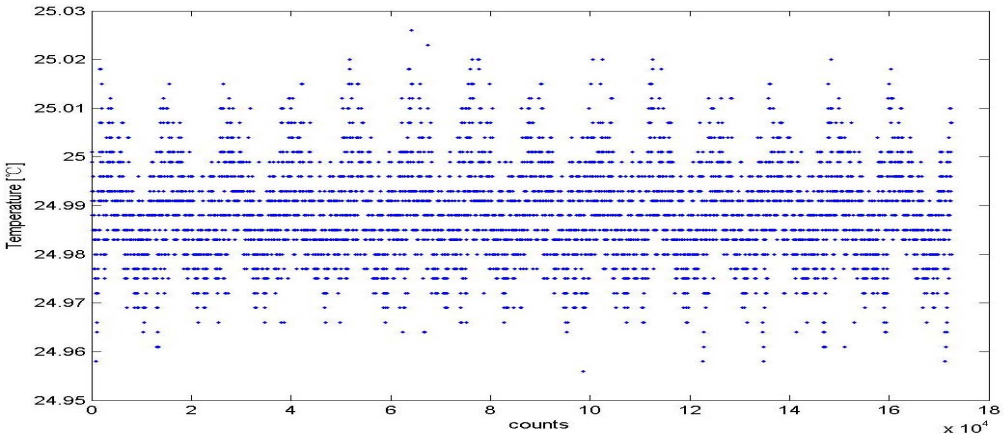
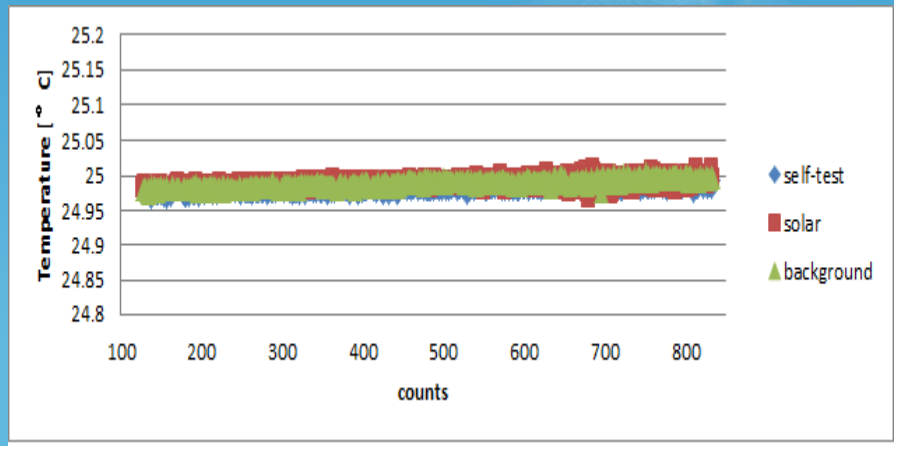
On orbit

Tracing

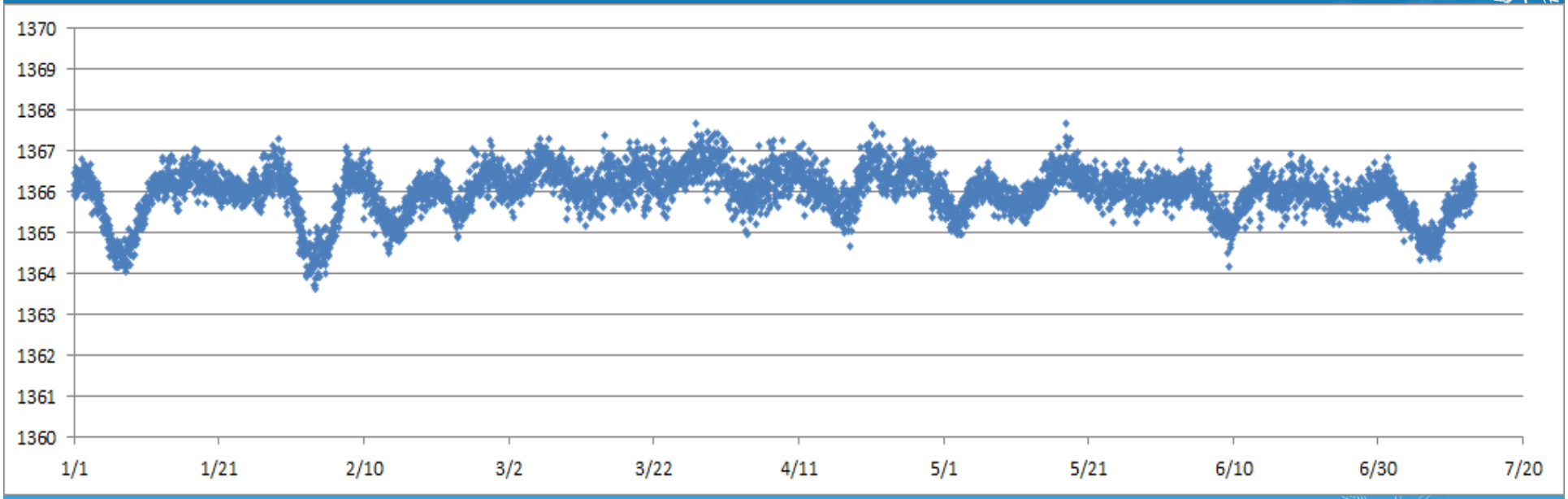


Temperature control





On orbit - TSI



TSI is around 1366W/m2, the reason may be:

- ✓ **WRR scale and transfer**
- ✓ **Aperture size**

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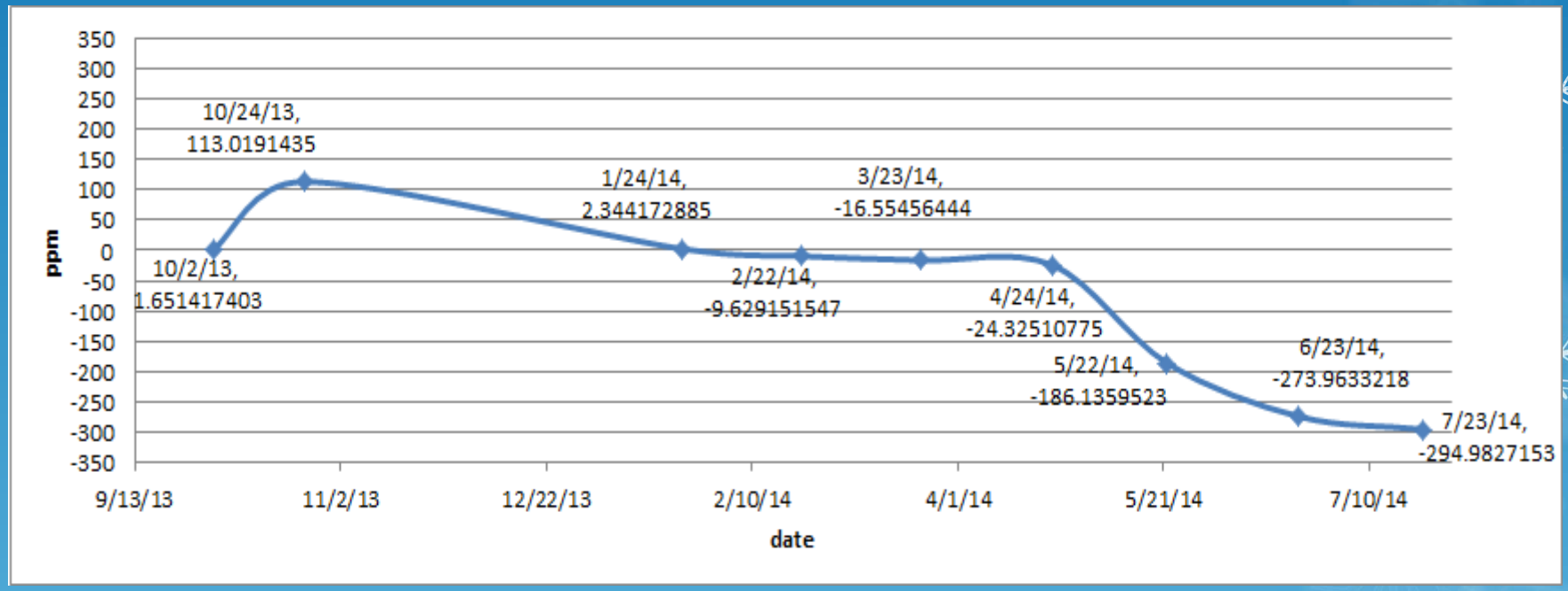
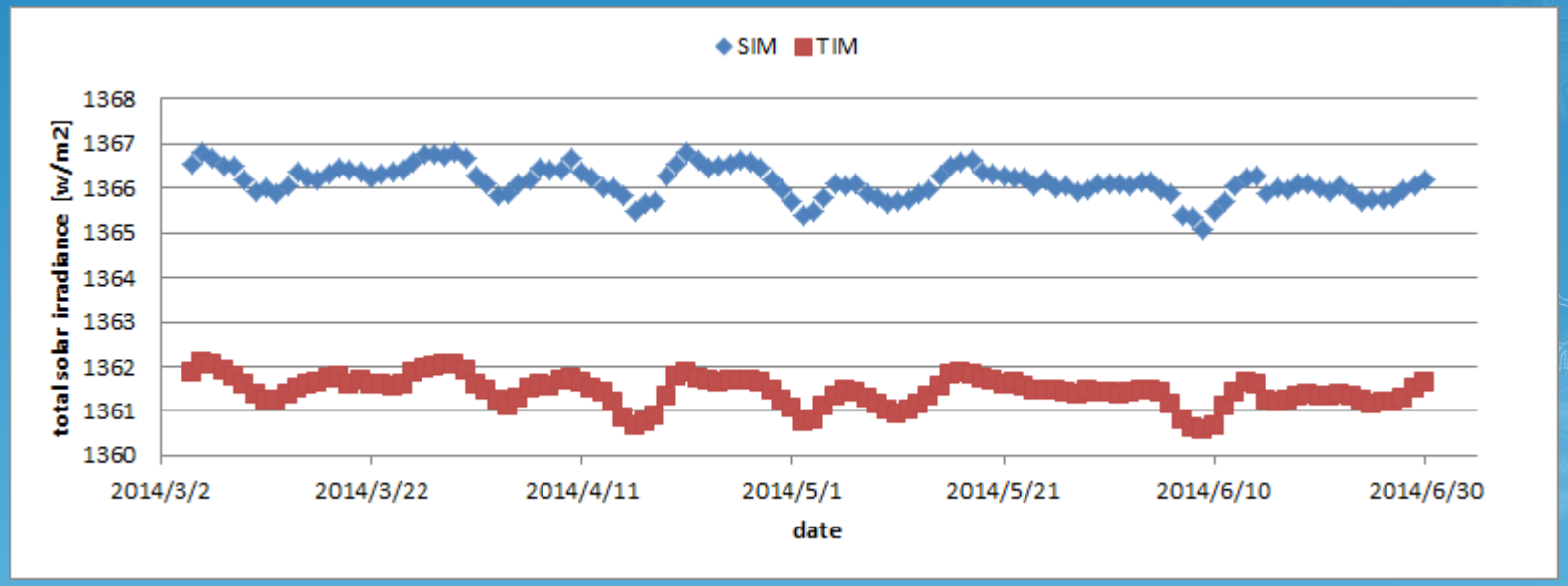
On orbit - aging



On orbit – inter-comparison

The difference between the two data is about 4.7±0.1W/m² (1σ) during Mar 5~Jun 30, 2014.



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Future plan

We plan to have an inter-calibration between FY-3B/SIM and FY-3C/SIM, try to get more precision long time-series TSI data

In recent days, we have a discussion about FY-3E\F\G payloads and instruments properties;

FY-3E will be an early-morning orbit, launched about 2018(just maybe). It is designed to have solar total and spectral irradiance observation. The SSI instrument is mainly for accurate spectral data and applied to retrieval of trace gas, such as ozone, CO2;

For the TSI, instrument will improve the aperture design and some points we learn from FY-3C/SIM;

For the spectral irradiance, it's still under discussion.
SORCE/SIM? Or SOLAR/SOLSPEC?

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