GRWG Web Meeting

**Topic:** Planning a GSICS/CEOS-WGCV Workshop on SI-traceable reference instruments

Development of Chinese SI-traceable reference instruments and retrospective recalibration of historical satellite data

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Joint Project

- National High Technology Research & Development Program of China (863 program) before 2018
- National Key R&D Program of China after 2018
- FY Polar Satellite Program

National Satellite Meteorological Center (NSMC), CMA

Academy of OPTO-Electronics (AOE), CAS

Shanghai Institute of Technical Physics (SITP), CAS

Anhui Institute of Optics and Fine Mechanics (AIOFM), CAS
• Climate Change Detection, Calibration Reference Satellite

EOS
• Solar total irradiance 0.01%
• Solar spectral irradiance 0.1%
• Earth reflected solar radiance 0.3%
• Earth outgoing longwave radiance 0.1K

Long-term Chinese EOS data

Instrument Development

Data Reprocessing

Short-term goal (2014–2018)

Medium-term goal (2018–2022)

Long-term goal (2022–2025)

IR
Blackbody and emissivity measurement on-board

SRB
Coherent photon Tech for optical path reuse

Solar Spectrum traceable
Cryogenic radiometer

Engineering Model for reference instrument

Satellite Data Reprocessing
Lunar, DCC, PICS

Space-based CDR

Flight Model for reference satellite
This system consists of 7 components: Earth/moon imaging spectrometer (EMIS), Solar irradiance spectroradiometer (SIS), Total solar irradiance radiometer (TSIR), Spaceborne absolute cryogenic radiometer (SACR), Comparison transfer module (CTM), information processing module, and drive control module.

- **Overall design technology of space-borne reference load in solar band**
- **Solar-earth-moon hyperspectral observation technique based on space cryogenic radiometer Correlation**
- **Photon self-calibrated solar absolute spectral irradiance observation technology Performance test and precision verification technology of the load principle prototype**
SI-traceable demo instrument development on FY-3RM rainfall mission (2020)

LeSIRB - Lunar and Earth Spectral Imager Radiometry Benchmark

Mission Goal: Demonstration of SI traceability instrument and experiment for inter-calibration between current Fengyun satellite optical imagers to improve calibration accuracy

<table>
<thead>
<tr>
<th>Parameter items</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Ground spatial resolution</td>
<td>250m</td>
</tr>
<tr>
<td>Spectral resolution</td>
<td>4nm</td>
</tr>
<tr>
<td>Spectral range</td>
<td>400nm~1060nm</td>
</tr>
<tr>
<td>Ground Swath width</td>
<td>50Km</td>
</tr>
<tr>
<td>S/N Ratio</td>
<td>&gt;150</td>
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<tr>
<td>Radiance Dynamic</td>
<td>Similar to MERSI-3</td>
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<tr>
<td>MTF</td>
<td>&gt;0.2@f/f_nyq=1.0</td>
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<tr>
<td>Radiometric uncertainty</td>
<td>2%</td>
</tr>
<tr>
<td>Spectral calibration</td>
<td>2nm</td>
</tr>
<tr>
<td>Polarization sensitivity</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Observation Model</td>
<td>Earth/Lunar/Sun/Calibrator</td>
</tr>
</tbody>
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2. SI tracable IR Instrument

- Fourier interferometer
- IR telescope system
- Cooled MCT detector
- Absolute Radiance blackbody

SI-traceable Blackbody:
- ITS-90 standard
- Standard Pt thermometers
- Thermal isolated Cavity
- Phase Change Cells
- Emissivity measured
- Heat pipe
- TEC controlled
On-orbit FTS instruments

FY-3/HIRAS 0.2-0.7K

FY-4/GIIRS 0.5-1K
of 30 years’
Chinese historical Satellite data (2018-2022)
Components for EO

- Space-Ground Communication
- Data format for storage and delivery

Space Segment
Ground Segment

- Satellite
- Instrument

NRT Calibration

- SDR
- EDR

Inter Calibration & Re-calibration
Validation
Re-analysis

- FCDR
- TCDR

Sensor-dependent, weather and environmental usage
Sensor-dependent or sensor-independent, climate usage

2018/3/24
WIGOS Space 2040 Workshop
Geneva, Switzerland, 18-20 Nov. 2015
GRWG Web Meeting
The role of GSICS in Retrospective Recalibration
Second Joint GSICS/IVOS Lunar Calibration Workshop – China 2017
Summarization

- To improve the quality and accuracy of Chinese remote sensing satellites, Related projects in China have been initiated since 2015 and move into the second phase for the SI-traceable instruments development and retrospective recalibration of history satellite data.

- Requirement and traceability chain of Space-based Benchmark, technical possibility, Risk/Cost are evaluated by the remote sensing scientists, space mission maker, instrument vendors and data users.

- International SI-traceable hyperspectral reference instrument workshop may be very useful to push this concept into quicker implementation within WMO/GSICS and CEOS/WGCV members.
Together For Better

谢谢！