

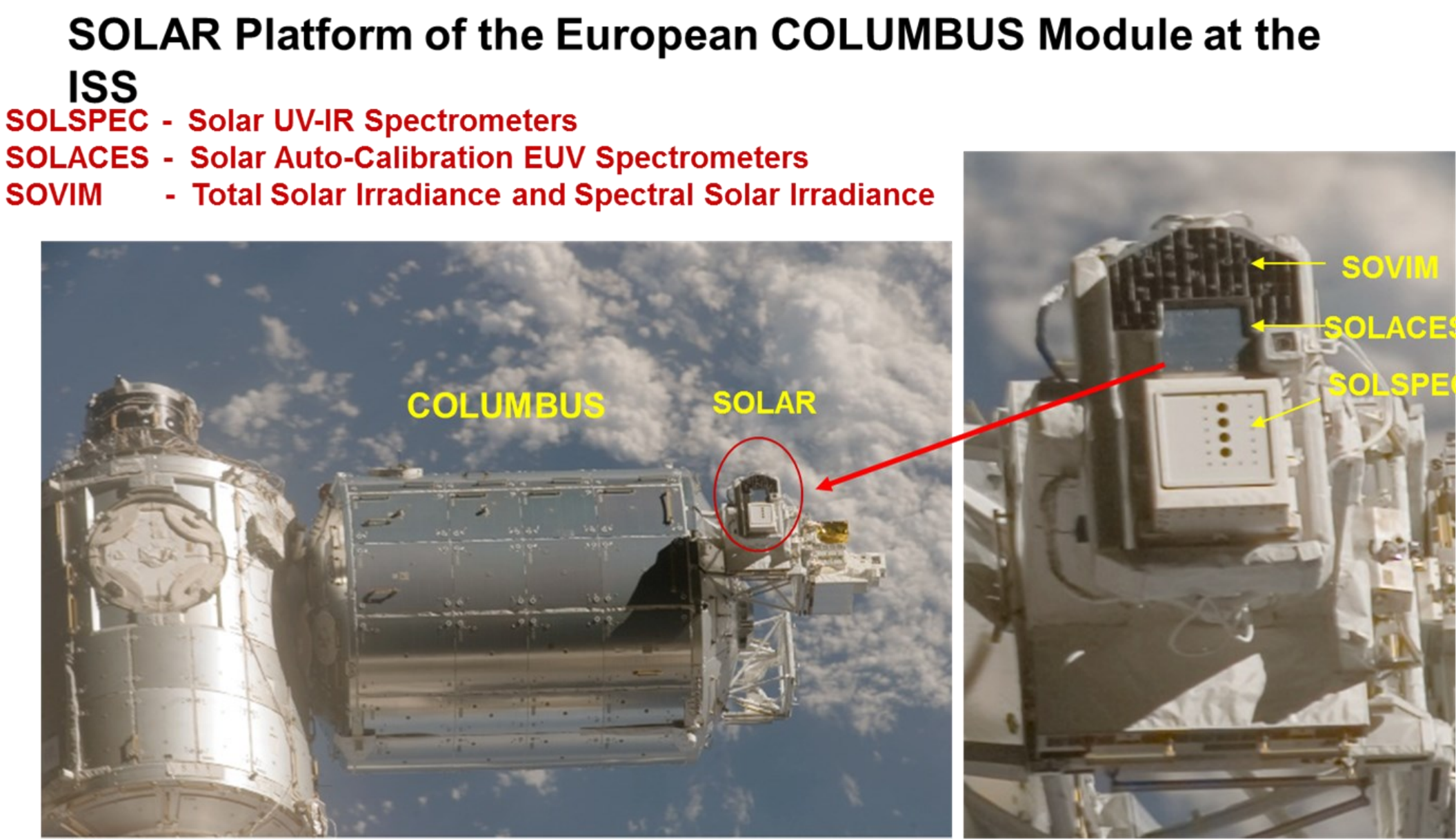
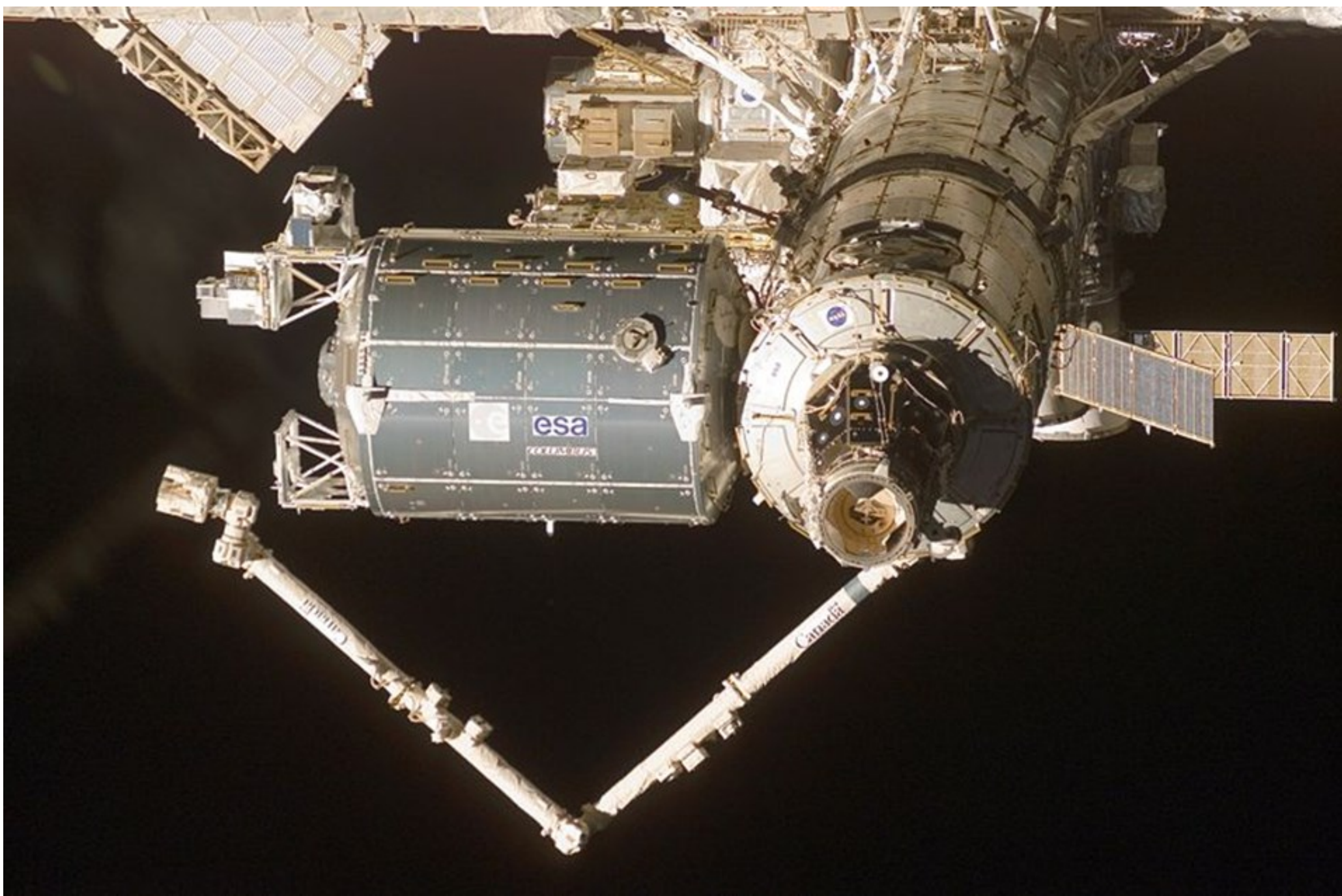
Science of the midnight sun from the ISS: a full solar rotation observed by the SOLAR payload

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Since March 2008, an optical package measuring the sun spectral irradiance operates in space from the ESA COLUMBUS module of the International Space Station. Three instruments compose this package: a total solar irradiance instrument SOVIM, a UV-visible-infrared spectrometer: SOLSPEC and a far UV instrument: SOL-ACES. SOVIM stopped operations due to an electrical problem six months after launch but the two other instruments are still operating and ESA plans on supporting them until 2017. However, the life of the ISS has now been extended to 2020 and if the instruments stay in the current condition, a further extension would be possible.

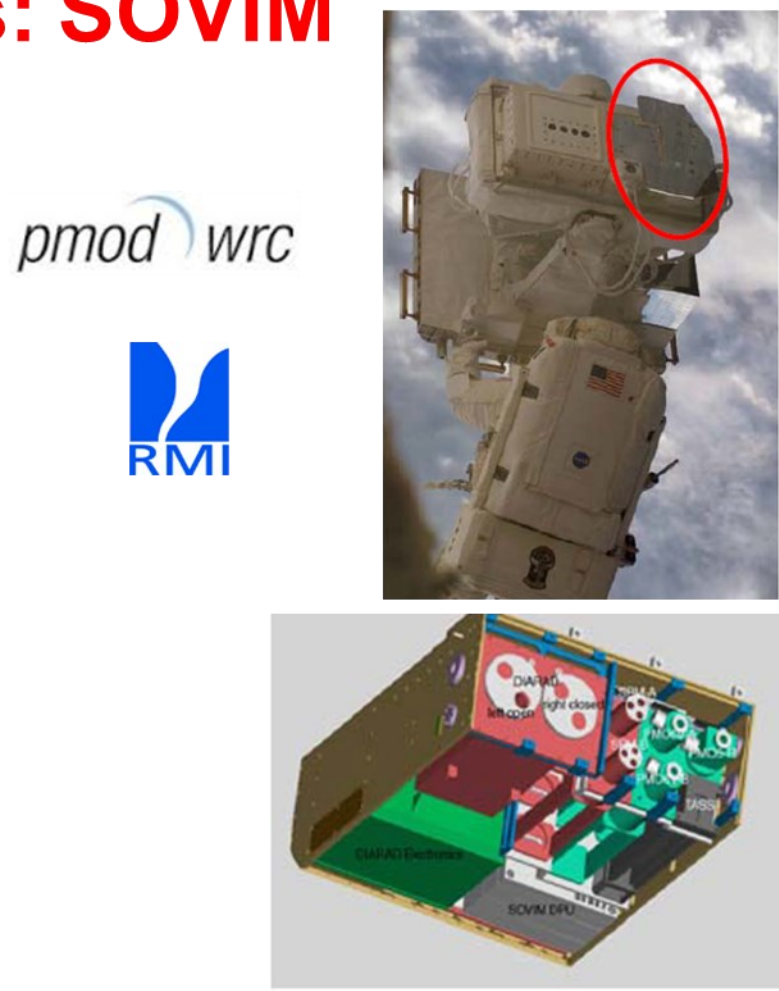
Due to the specificities of the ISS and mechanical limitation of the SOLAR moving platform, continuous operations is not possible and is made in intervals guaranteeing both solar visibility and minimum of contamination. This excludes arrivals of vehicles at the ISS and manoeuvres using chemical propulsion. In December 2012, NASA and the ISS partners approved a specific attitude, called the "SOLAR Attitude", allowing the bridging of two solar viewing opportunities and thus providing quasi-continuous observations during a full solar rotation.



SOLAR was launched in February 2008

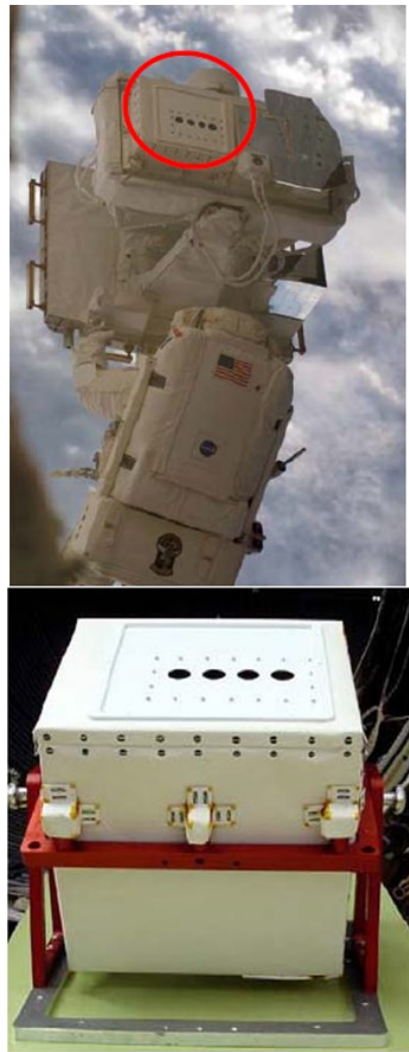
SOLAR instruments: SOVIM

- Total sun irradiance measurement
- Precision measurement of irradiance variability
- Instrument stopped functioning (power supply board failure)



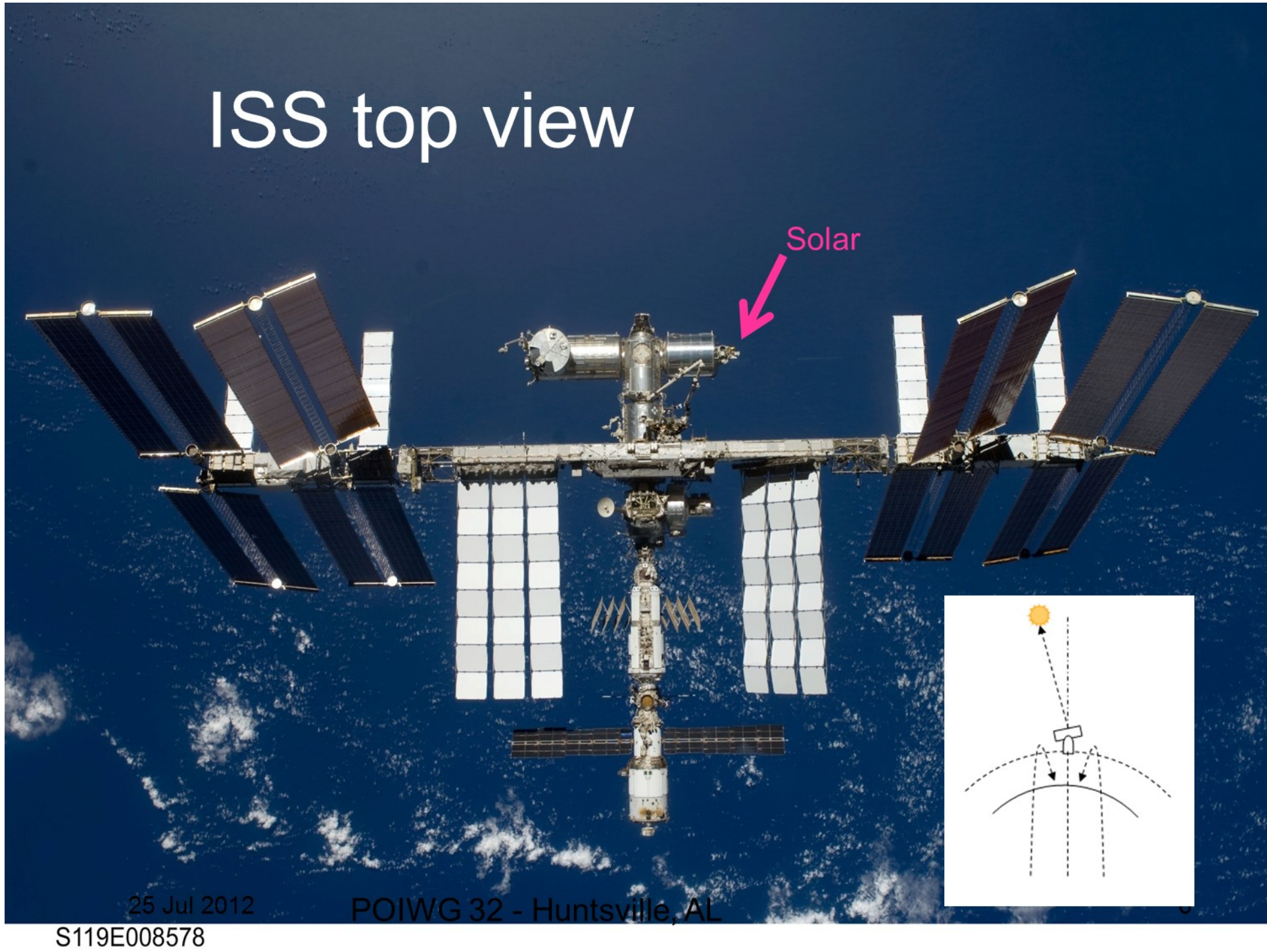
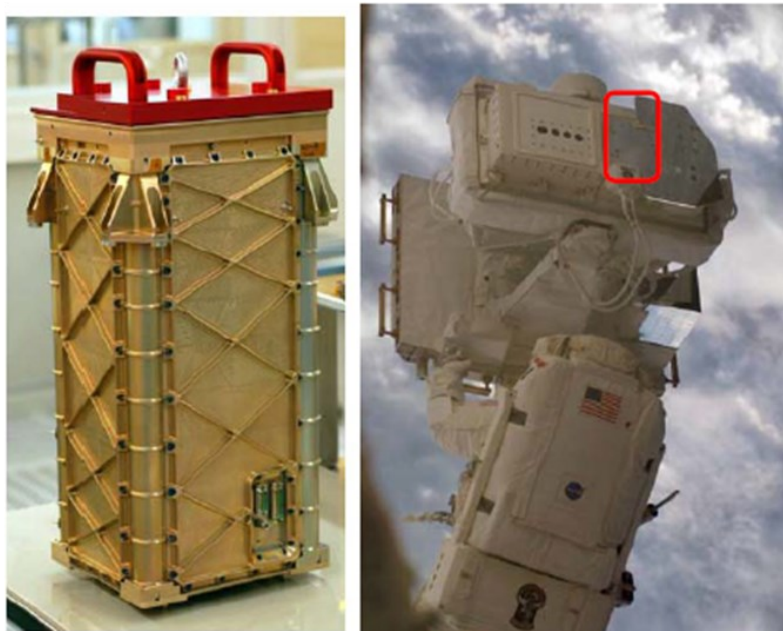
SOLAR instruments: SOLSPEC

- Measure the solar spectrum irradiance from 180 nm to 3000 nm
- Precision measurement of irradiance variability
- Study of solar variability at short and long term
- Absolute measurements (2% in UV and 1% above)

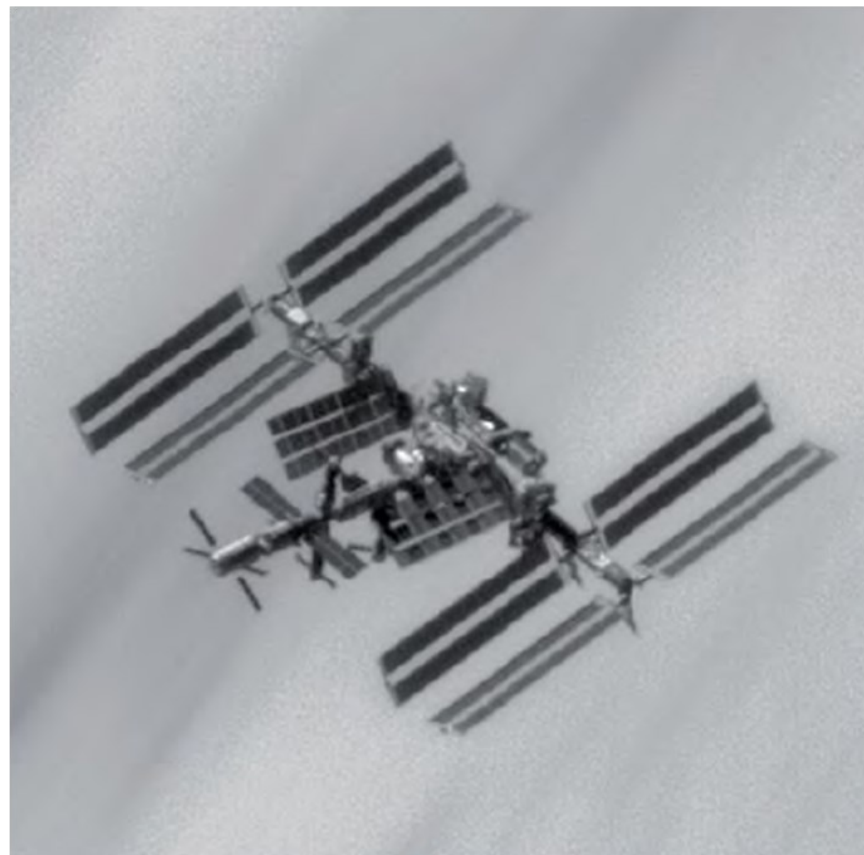


SOLAR instruments: SOLACES

- Solar spectral irradiance of the full disk from 17 to 220 nm at 0.5 to 2 nm spectral resolution (4 EUV spectrometers)
- Auto-calibration capability: high absolute resolution
- Absolute calibration with ionization chambers as secondary instruments



Operation restrictions on the ISS

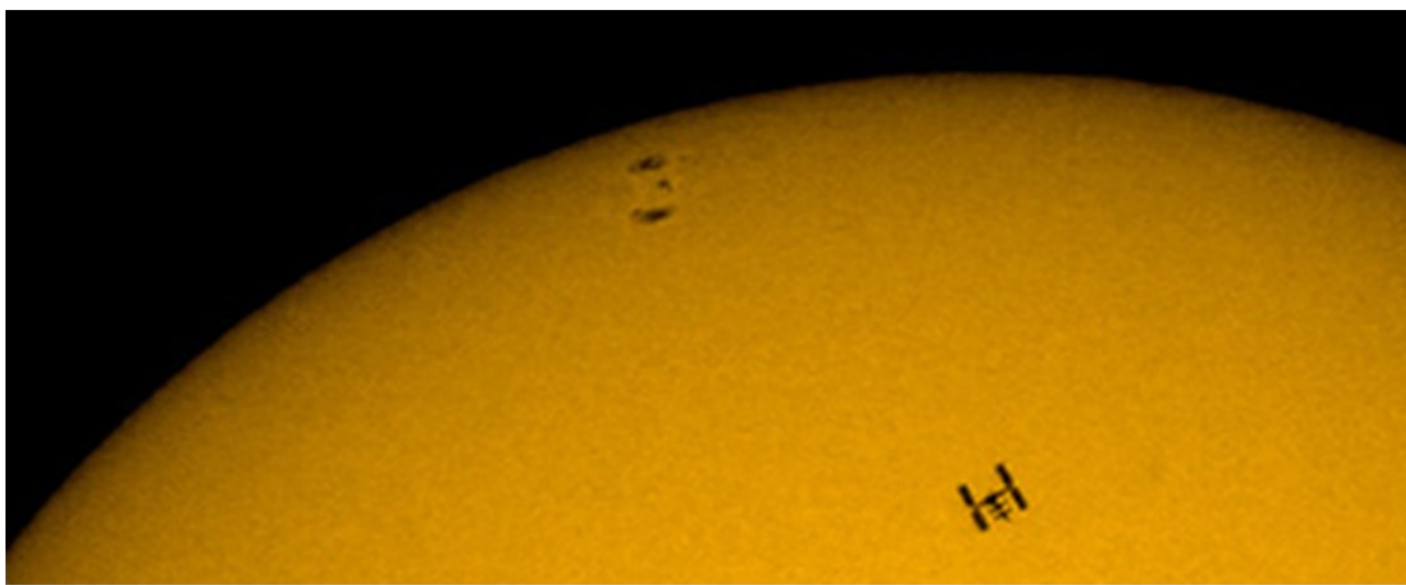


- ISS cannot give full target access to a pointing payload.
- SOLAR has thus successions of solar viewing opportunities of several earth days in a row.
- Close to solstices, a small change of attitude allows for a longer sequence combining two periods and thus covering a full solar rotation.
- NASA and the other ISS agencies approved a bridging of two periods in December 2012.
- Chemical propulsion, vehicle activities and space weather limit also the use of the payload.

ISS seen from the CNES-EU pléiades satellite

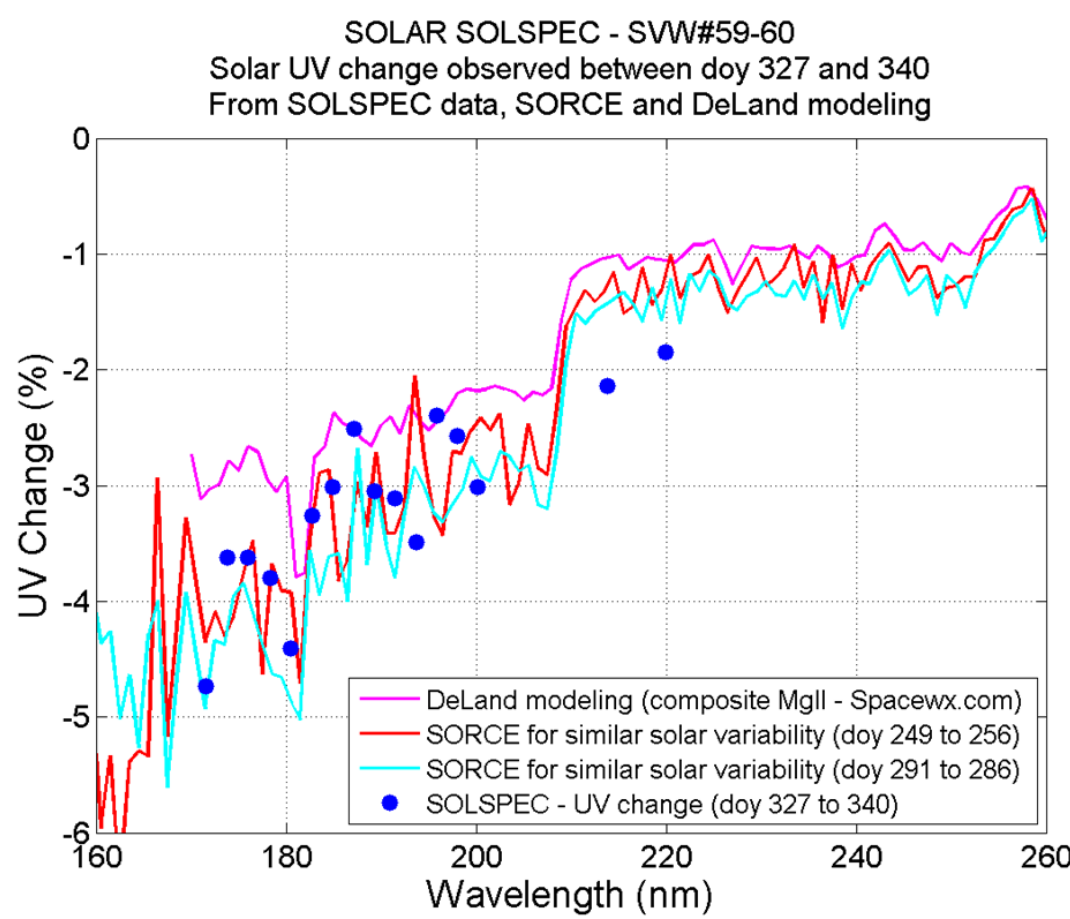
Bridging operations

- The bridging attitude correction was applied between December 1 and December 11, 2012, allowing observations from November 22 to December 24.
- Both SOLACES and SOLSPEC regularly recorded data.

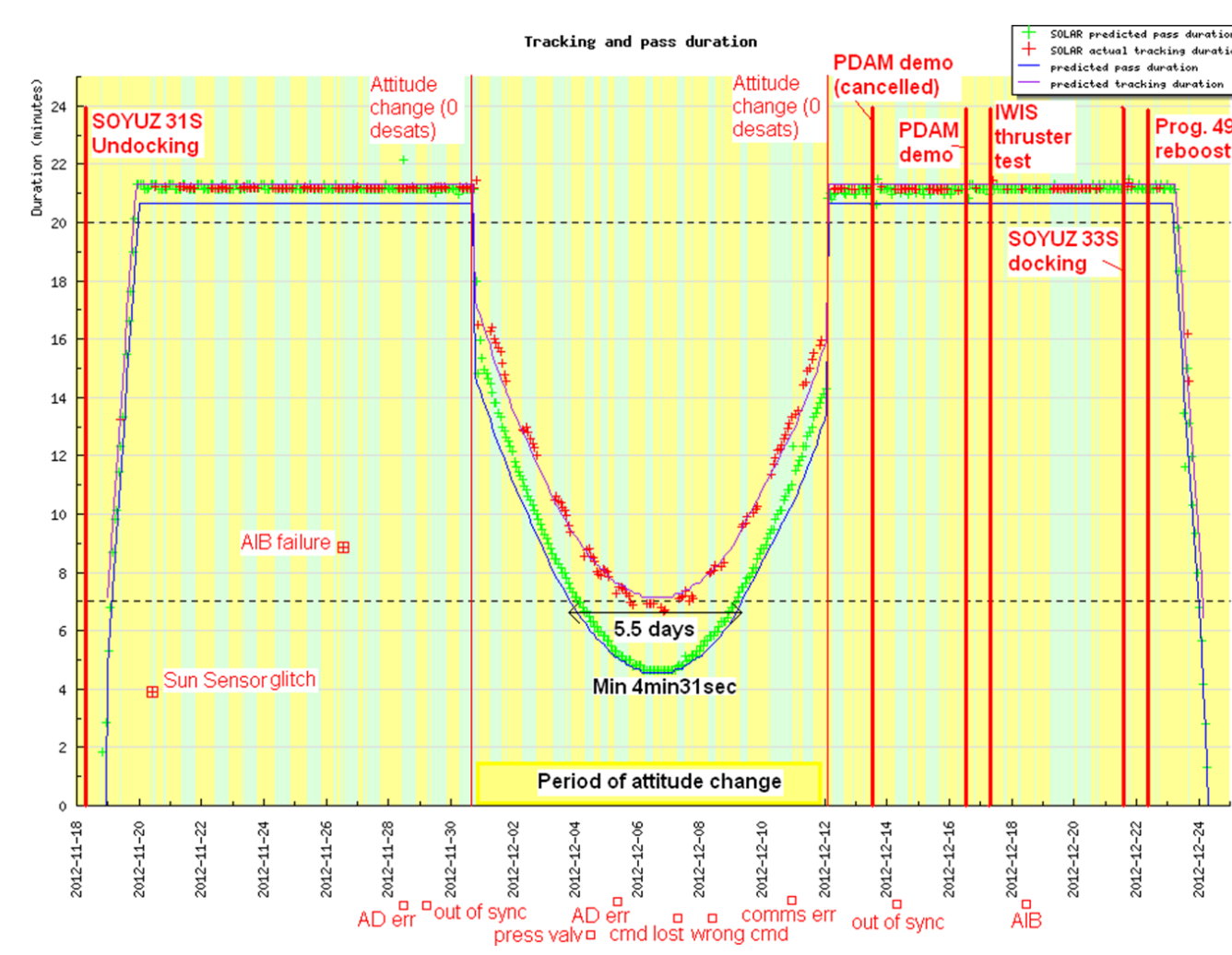


ISS and sunspot group 664 (photograph by Jerry Lodriguss in 2007).

Work still in progress showing the quality of SOLSPEC as a UV short time variation monitor.



Schematics of the bridging



The future: the SOLAR-2 project.

Measurements and observations of SSI variability with high accuracy .

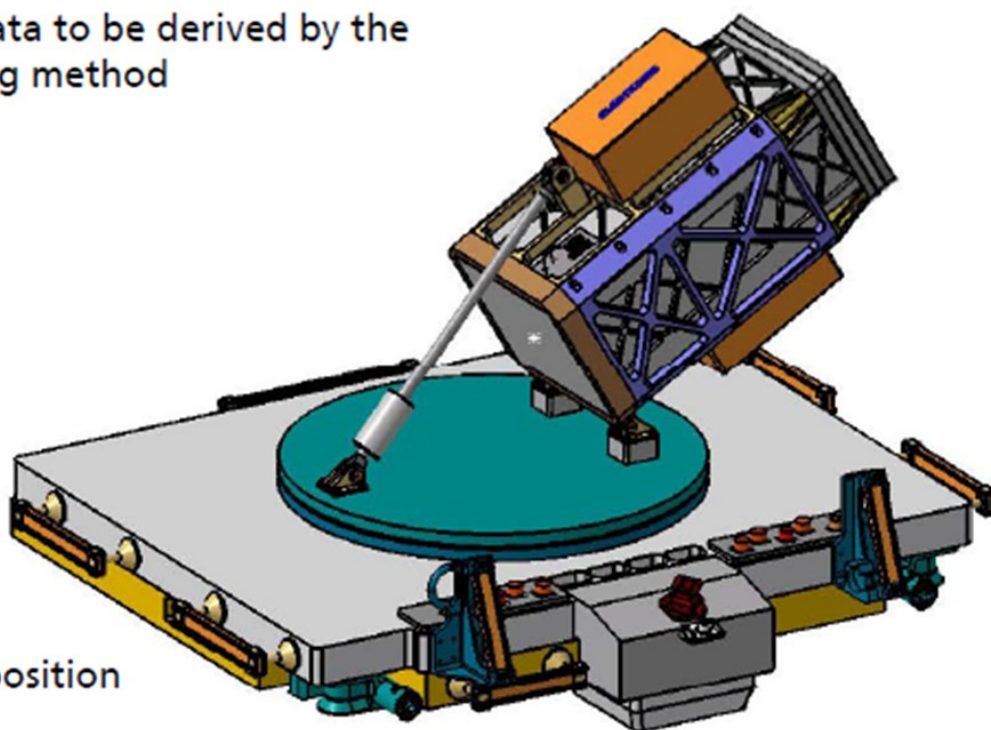
Unique chance to provide SSI data to be derived by the same auto-calibrating measuring method covering a full solar cycle.

Instrument 1:
SolACES-2, 2 – 270 nm

Instrument 2:
,SOLSPEC-2', 270 – 2600 nm

mounted externally at zenith position

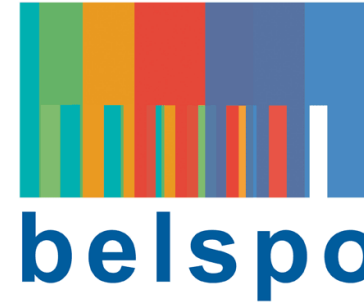
pointing device for movement
within +/- 60° in X- and Y-direction



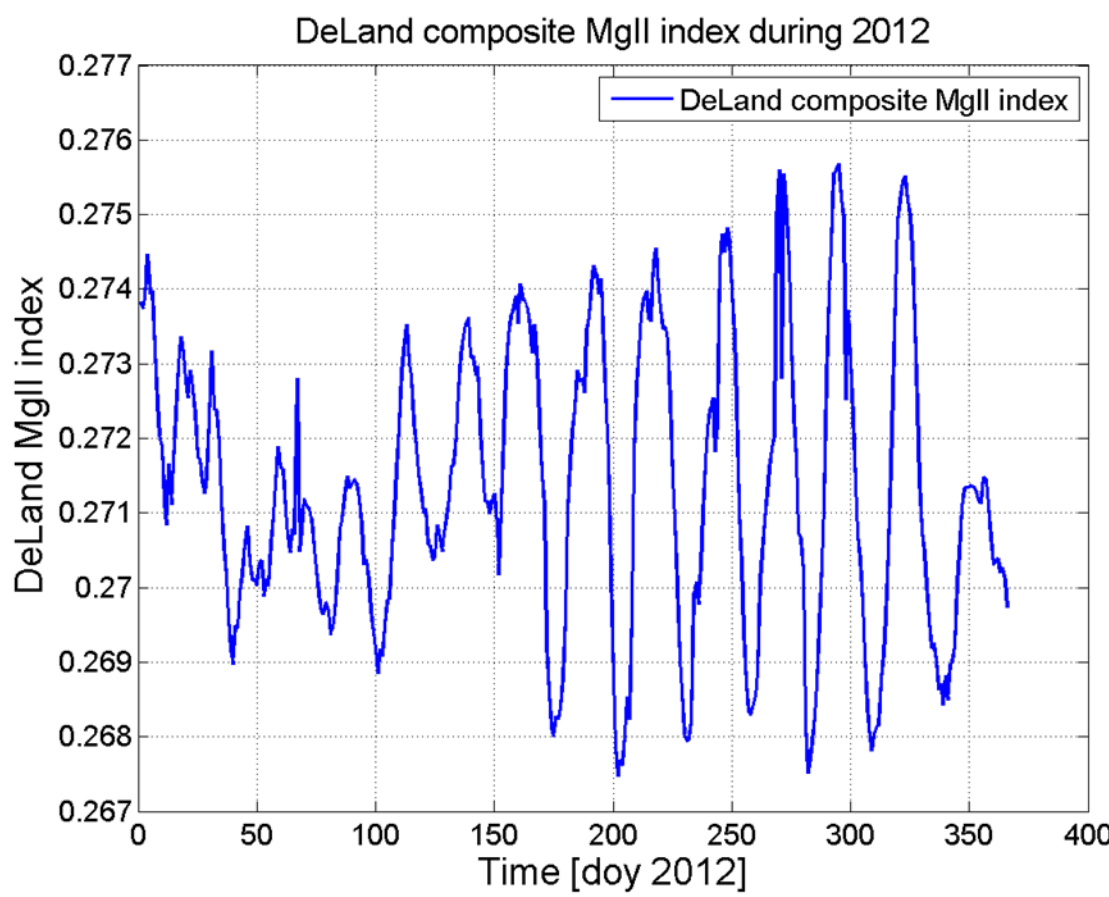
This project is still in the proposal phase.



Several FP-7 European Union and ESA programmes, aim at SOLAR data archiving and preservation, PERICLES is one of them.



SOLAR activity in 2012.



Signature of solar activity during 2012 using the DeLand composite MgII index

Intercomparisons of SOL-ACES and SDO-EVE

