



SORCE Team Attending Freiberg EUV-IR Validation Workshop –

The *ESA (European Space Agency) Solar EUV-IR Validation Workshop* is April 15-17, in Freiberg, Germany. This gathering is an important part of all solar irradiance programs because it provides validation of our measurements made in 2008 from the TIMED and *SORCE* satellites and from a rocket flight with the prototype SDO EVE instrument. If all goes as planned, attending on behalf of *SORCE* will be PI Tom Woods (XPS), Jerry Harder and Margit Haberleiter (SIM), Marty Snow and Bill McClintock (SOLSTICE), and Greg Kopp (TIM). The workshop attendees will discuss solar science results in the EUV, UV, Visible, NIR, and TSI.



Workshop topics include:

- Calibration discussion on space instrumentation and validation
- WHI Solar Irradiance Spectra (SIRS) from the April 2008 campaign and development of an irradiance data base for solar minimum conditions
- Development of an irradiance data base for solar active minimum conditions
- TSI measurements and analysis
- Modeling of the solar spectral irradiance
- Irradiance indices for solar and solar-terrestrial relation modeling and their applications
- Solar variability in the transition region as a function of temperature to be derived by intercomparisons of data

Following the workshop, some of the science team will continue on to Vienna, Austria, to attend the European Geosciences Union (EGU) General Assembly, April 19-24. This meeting provides an opportunity for the *SORCE* team

to communicate their research results to a broader international community. It is also a chance to promote collaborations with the other solar, climate, and space weather communities. The meeting website is:

<http://meetings.copernicus.org/egu2009/>



On-Board Computer Anomaly –

Starting on January 4, the *SORCE* On-Board Computer (OBC) experienced two resets within the week. The first OBC reset (January 4) appears to be identical in nature as the OBC reset in May 2007. The second OBC reset (January 9) behaved differently, and this reset appears to be related to an undesired software feature in doing real-time dumping of the event messages during a ground contact.

There was a complete recovery from these two anomalies. The *SORCE* spacecraft and instruments are safe and in good health, and there does not appear to be any significant degradation. Since the instruments were off during the majority of the week, there is a gap in solar irradiance measurements. The gap in the science data is from approximately 16 UT on Jan. 3 to Jan. 13, when mission operations started to power-up the instruments. Fortunately, the Sun was very quiet that week. Due to the recovery process (instrument warm up time), many of the immediate data are not of sufficient quality for scientific purposes (though they are useful for calibration). TSI level 3 products were resumed on Jan. 13 and SSI products a day later. SIM is an exception, since it requires a small and manageable wavelength shift correction.

The following is a day-by-day summary of the events:

Sunday, Jan 4

On the first pass on Sunday, Jan. 4, *SORCE* came up in safe-mode. Most of Sunday was spent looking at telemetry and verifying observatory state of health. The safe-mode entry appears to be due to an OBC reset, and Orbital reports that it looks almost identical to the OBC reset that occurred in May 2007 (see May 2007 *SNS SORCE Newsletter* for details). The procedure to recover from safe-mode is to (1) reset (soft or hard reset) the OBC and reload its patches, tables and RTSs, (2) exit safe-hold in contingency solar pointing mode, turn on the star tracker, (3) transition to normal solar pointing mode and turn on operational heaters, and (4) turn on instruments and resume science operations. With extra TDRS and ground contacts, this was expected to take about 3 days.

Monday, Jan 5

Step 1 (soft reset of OBC and loading patches) of the recovery was performed, but Step 2 (switch to contingency point mode) was not successful.

Tuesday, Jan 6

From examining data, the problem in performing Step 2 was found to be related to the ephemeris generated on the

ground. A second attempt with corrected ephemeris for Step 2 (switch to contingency pointing mode) was tried later on Tuesday, but this also failed.

Wednesday, Jan 7

From examining data and working with Orbital engineers, it was determined that a flag set from the first failure has to first be cleared before attempting Step 2 again. With this flag cleared, Step 2 was successful in switching to the contingency solar pointing mode, followed by transition to normal solar pointing (Step 3).

Thursday, Jan 8

All the instruments, TIM, SIM, SOLSTICE, and then XPS, were powered on successfully. All of the instruments were cold (below -10 C) and had their heaters activated (except for SIM B that uses SIM A heater and XPS that does not have a heater). During the last TRDS monitor of the day, it was found that there was a power shed event during the orbit eclipse after the last instrument was powered on. Consequently, all the instruments were off again. The power shed event was triggered by under-voltage limit on the battery and occurred 94 seconds prior to sunrise. The cause for the power shed was found to be related to extra power draw with all instrument heaters being on at full power to warm up the instruments, longer than normal eclipse period (35 min instead of more typical 25 min). The plan for recovery from this event was to power up a few instruments on one day and then the rest of the instruments on a second day. Most instruments reach normal operating temperature in about 12 hours.

Friday, Jan 9

Recovery from the under-voltage event was in progress when the OBC reset occurred during a ground contact. This OBC reset was not like the Sunday or May 2007 OBC reset. The rest of the day was spent examining data and verifying observatory state of health.

Saturday, Jan 10

Orbital reported that this OBC reset appeared to be caused by an undesired software feature in doing real-time dumping of the event messages during a ground contact. The solution is not to do any real-time dumping of the event messages during future ground contacts. The rest of the day was spent working up the recovery plans / procedures to include a hard reset (power cycle) of the OBC.

Sunday, Jan 11

The hard reset (power cycle) of the OBC and loading patches (Step 1) were completed, and Steps 2 and 3 went smoothly.

Monday, Jan. 12

The MU was turned on and configured, and then the TIM instrument was turned on. The XPS and SIM A instruments followed on consecutive orbits. Instrument turn-on was deliberately slow to allow the instruments to warm up and demand less power. The instruments were configured

and the sequence started to resume successful science operations.

Tuesday, Jan. 13

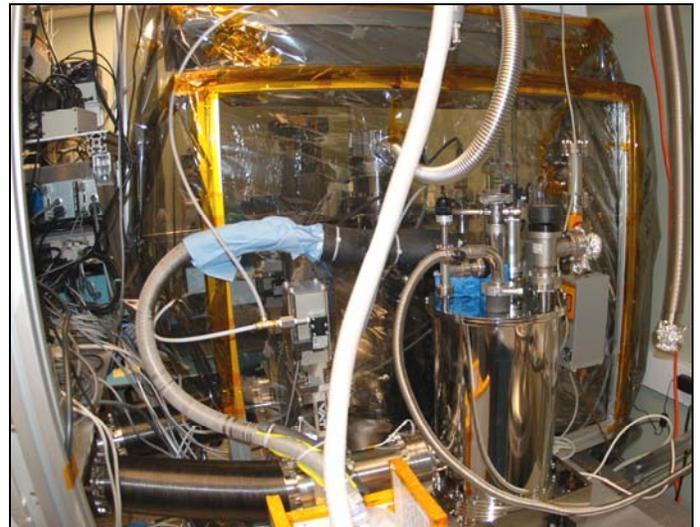
SOLSTICE A, SIM B, and SOLSTICE B were turned on nominally. The recovery efforts were complete.

After the spacecraft was recovered and instruments turned back on, additional instrument in-flight calibrations were performed to access any degradation effects. As mentioned earlier, there was a small wavelength shift in the SIM solar spectra, and this wavelength shift can be corrected by updating the data processing algorithms.

The SORCE operations team, both at LASP and Orbital Sciences Corporation, did an excellent job efficiently working at solving the SORCE anomalies as quickly as possible. Of special note is one tremendous effort by LASP's Mission Operations Manager, Sean Ryan, who not only fought all of the SORCE fires but also was up all night Jan 7 fighting a real fire in North Boulder that burned over 3000 acres. We feel very fortunate to have such a dedicated team!

LASP's New TSI Radiometer Facility –

In December 2008, LASP completed the new TSI Radiometer Facility (TRF). The TRF is the only calibration facility in the world that is able to characterize total solar irradiance (TSI) instruments at the desired accuracy for full incident solar power levels under flight-like vacuum conditions, providing the first end-to-end pre-launch validations of TSI instruments.



A NIST-calibrated cryogenic radiometer (foreground) accurately measures input light at solar power levels in the TSI Radiometer Facility. The Glory/TIM instrument under test is housed in the vacuum chamber enclosed by the clean tent toward the rear.

The Glory/TIM instrument, scheduled to launch in November 2009, recently returned to LASP from Orbital Sci-

ences Corporation for a month. Using the TRF, the TIM team ran tests to check the space-flight Glory/TIM calibrations against the TRF's NIST-calibrated reference cryogenic radiometer, and found very good agreement. This makes the Glory/TIM the first ground-validated TSI instrument in the 30-years these instruments have been flying.

Tests are currently underway in the TRF using the two ground-based versions of the SORCE/TIM to help validate, albeit indirectly, that the SORCE flight instrument is indeed producing an accurate TSI value. Further validation will come once Glory launches and the Glory and SORCE TIM instruments can be directly compared on-orbit. This on-orbit comparison essentially transfers the TRF validation of the Glory/TIM to the flight SORCE/TIM. Results to date give us no reason to doubt the SORCE/TIM's measured TSI values, which are slightly lower than other current flight instruments.

Extended Mission Proposal –

The entire SORCE team has been busy preparing the SORCE Extended Mission Proposal for 2010-2013. The NASA Earth Science Division (ESD) of the Science Mission Directorate (SMD) is supporting 13 Earth observing missions that are, or soon will be, operating beyond their prime mission lifetimes. Since extended operations and associated data production activities require a significant fraction of the ESD annual budget, NASA periodically evaluates the allocation of funds with the aim of maximizing the missions' contributions. All NASA Earth Science Missions are expected to submit a proposal that includes scientific productivity, contribution to national objectives, technical status, and budget efficiency. This evaluation process is known as the "Senior Review". Proposals are due March 24, and an in-person presentation will follow in April or May.

Upcoming Meetings / Talks –

SORCE scientists plan to present papers or attend the following 2009 meetings:

Boulder Solar Day, March 20, Boulder, Colorado
ESA Solar EUV-IR Validation Workshop, April 15-17,
Freiberg, Germany
EGU General Assembly, April 19-24,
Vienna, Austria
Space Weather Workshop, April 28-May 1,
Boulder, Colorado
ISSI Working Group – Cross-calibration of past FUV
Experiments, May 25-28, Bern Switzerland
AAS/Solar Physics Division Meeting, June 14-18,
Boulder, Colorado
IAMAS/APSO – SORCE Meeting, July 19-29,
Montreal, Canada

933,617

Hits to the SORCE Website

(Since 4/21/03, As of 2/20/09)

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