

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-TOS-OF
No. 057
Week 43
27.10.03
Routine Phase

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		J. Green	1

1 General

The Flight Control Team at MOC has compiled this report with some input provided by the Flight Dynamics Team, ISOC and ISDC.

It addresses the activities from 18.10.03 until 24.10.03 (both dates inclusive) and covers the revolutions 124 & 125.

2 Summary of Activities

The operations were performed according to the planning inputs from ISOC combined with some manual commanding by MOC.

The target of these revolutions was IC443 (RA 06:17:39.50; DEC +22:23:41.0). The activities performed consisted of a hexagonal dithering observation.

Note: Some further information concerning the activities is provided in the Appendix.

3 Satellite Status

3.1 Platform

The performance of the platform was good. No new unexpected behaviour / malfunction was identified.

3.1.1 AOCS

The AOCS operations were performed from the timeline during this period.

Six slews/pointings were missed due to different problems at the station and also due to a known IMCS problem.

There was an OTF flicker caused by an undetected SEU on the Star Tracker. This was not seen at Broadcast Packet level and therefore had no effect on the observation.

The fuel consumption over the period between 17/10/2003 and 24/10/2003 was 0.103Kg. The remaining propellant is in the order of 174.31 Kg on the 24th of October.

Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix.

3.1.2 Power

The power subsystem is working as specified. The available power from the arrays is in the order of **2250W**. This means that there is no noticeable degradation of the solar arrays since launch.

3.1.3 Thermal

The thermal control of the satellite is working well. The temperatures are currently all within the specified operational limits.

3.1.4 OBDH

The OBDH subsystem is working flawlessly. No on-board communications problem identified.

3.1.5 RF

The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

3.2.1 SPI

The overall status of the instrument is nominal.

During the reporting period the instrument was in photon-by-photon mode with spectra TM enabled and an assigned TM bandwidth in the science windows of 98 pkts/cycle.

The cryocooler is working well, keeping the Ge detector cold plate temperature within 85+/-1K.

The 3rd Ge detectors annealing cycle is planned to take place from rev.129 to 133 (starting on 3rd November).

Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

The Status of the unit is Nominal. The TM bandwidth assigned to IBIS is 134 pkts/8sec. The observation period was characterized by moderate solar activity (see IREM report)

Note: Some more information concerning the IBIS operations is provided in the Appendix.

3.2.3 JEM-X

The status of both JEM-X units is nominal.

During this period JEM-X2 operations were performed by the automatic Timeline, with a TM allocation of 8 packets/cycle during science operations, and JEM-X1 was dormant with a TM allocation of 1 packet/cycle.

On 2003-10-19 (DOY 292) at 17:41 JEM-X2 went to Safe mode due to high background radiation, recorded in the IREM Electron Counters, as a result of enhanced solar activity. JEM-X2 was put back in Data Taking mode at 19:58, once the background radiation levels had returned to nominal.

3.2.4 OMC

The status of OMC is nominal.

During this period OMC operations were performed by the automatic Timeline, with the TM allocation to OMC of 5 packets/cycle during normal science operations. A total of 147 images were captured during this period, with 5 being missed due to various problems.

Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The status of the unit is Nominal. The observation period was characterized by a moderate solar activity with reporting of three possible solar flares in the DOY 292 and 296. The maximum X-ray flux reached was class X5.5 and with a moderate proton activity on DOY 296.

Note: Some more information concerning the IREM operations is provided in the Appendix.

4 Ground Facilities

The main problems this week, as previous weeks, concern the consolidator, the link to the ISDC was again quieter this week, with only one mention.

4.1 Mission Operations Centre

On DoY 291, the imca crashed, and had to be rebooted.

4.2 Ground Stations & Network

See anomalies below.

4.3 Science Ground Segment

4.3.1 ISOC

This report covers to end of week 43.

1. Planning.

Short term PSF: up to rev. 139 received from MOC

Long term PSF: up to rev. 146

POS and POD generated: up to rev 132 and sent to MOC and ISDC

TSF: Up to rev 128.

Revs 128 - 132 were replanned, at the request of MOC, following the redelivery of all PSF's. The reason for this being the discovery of an unusually large deviation in the times of the orbital events between when these PSFs were generated and now. In rev 131 was also introduced a window for the on-board time wrap-around.

2. Observation status

ECS's for rev's 106, 109, 111, 113 and 114 received from ISDC. Processing in ISOC pending.

3. ISOC science archive

No processing in ISOC but a new tape is announced by ISDC to be in the mail to ISOC.

4. System

The system performance is very stable. OMC delta catalogue received from the OMC PI. Has been used operationally from rev 128. The ISOC system version 10 has now completed the development and is undergoing testing. For this reason MOC is also delivering PSF's compatible with the new system in parallel to the operational PSF's. This will allow the generation of POS's for the same revolution in parallel on the new system for test purposes.

5. Problems

none

6. Miscellaneous

The TAC process is completed resulting in a recommended observation program. This has been submitted to ESA management for approval.

Delta qualification of the Flight Spare SPI cryo-cooler to check the impact of the SPI annealing cycles is started however with some delay. Some preliminary results are expected during next week to allow a final decision to go ahead with the next annealing planned for early November.

4.3.2 ISDC

On 28/10/2003, the status of ISDC observation processing is:

- Latest Standard Analysis completed: observation 01202360002 (Sco X-1/JEMXdiagnost, Revolution 97) on 23/10/2003
- Latest products archived: observation 01201020004 (Cygnus X-1, Revolution 79-80) on 17/10/2003
- Latest observation products sent to the observer: observation 01201020004 (Cygnus X-1, Revolution 79-80) on 17/10/2003

5 Special Events

Nothing to report

6 Anomalies

New anomalies raised during the past week are listed below:

Later at 01:55, there was a drop in TLM from DSS-16, which was also seen in the AGC levels. This was probably caused by Radio Frequency Interference. The impact was a failed sun steering law command, and a failed STR mapping, which caused pointing 01230076 to be lost, 01230077 was recovered.

On DoY 291 at 22:46, the imca crashed, all the workstations disconnected, at 22:57, operations were moved to the B-chain. Only the TC and VC0 TLM were moved. At 23:37 the A-chain was recovered, and operations returned to the prime system.

On DoY 294 from 05:01 to 06:03, there were several brief drops in VC0 TLM from Redu, due to the on-going playback, there was no impact.

Later at 13:00 there was a drop in Redu TLM due to a “hit on the line”, and from 15:02 to 15:15 TM & TC dropped due to a “short break failure”, again no impact.

On Doy 295 at 15:19, there was one message indicating an error sending data to the ISDS.

On DoY 296 at 05:15 there were Reed-Solomon alarms from Redu, no impact.

Also on DoY 296 at 23:37, command A3192 failed release due to a PTV error, which caused the Timeline to be stopped. The impact was the loss of pointing 01250038, which was later executed manually.

On DoY 297 between 00:37 and 01:32, the TM from DSS-16 was very poor, with commands unverified and lost packets. The cause was RFI, which had been expected.

Later between 02:40 and 02:43, the TM & TC from DSS-16 dropped causing slew 01250041 to be missed, which was later executed manually.

At 07:15 there were Reed-Solomon alarms, also from Redu.

Arid	Date Occurrence	Subject	Segment	Status
INT - 002492	20/10/2003	Lost TC and TM link via REDU	Ground	COMMS
INT - 002493	20/10/2003	Telemetry loss from DSS-16 due to RFI	Ground	NASA Sta.
INT - 002495	21/10/2003	Double telemetry rate received from DSS-24	Ground	NASA Sta.
INT - 002496	23/10/2003	Telemetry and Tele-command link was lost to REDU	Ground	COMMS
INT - 002497	23/10/2003	Loss of TC and TM link via REDU	Ground	ESA Sta.
INT - 002499	27/10/2003	Telemetry loss from DSS-16 due to RFI DR: G103560	Ground	NASA Sta.
INT - 002500	27/10/2003	Telemetry loss from DSS-16 DR G103558	Ground	NASA Sta.
INT - 002501	27/10/2003	Telemetry loss from DSS-16 DR G103577	Ground	NASA Sta.
INT - 002502	28/10/2003	Loss of TC and TM link due to X-25 link	Ground	COMMS

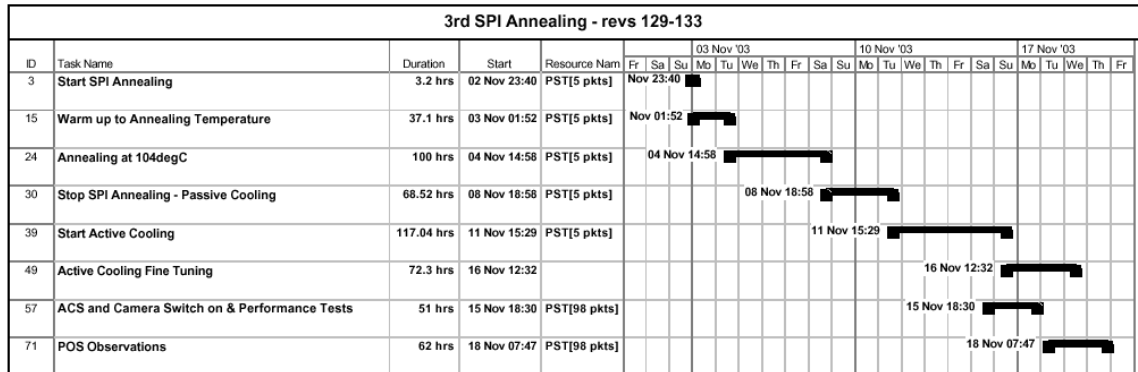
7 Future Milestones

Solar flares are predicted for week 43.

It is currently planned to install the next release of the OMCAS (Version 2.9) on Friday 31st October.

The 3rd SPI annealing is going to take place between rev129 and rev133. A detailed annealing timeline has been agreed with the SPI PI and ISOC. The timeline includes a minimum 100hrs annealing time, the patch and in-flight validation of the IASW 4.3.0 and a few additional tests to investigate the FEE#57 anomaly. The new constraint to switch on the camera below 105K is still under discussion and pending confirmation from the PS.

Here follows the summary view of the schedule:



8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 124 & 125

In revolutions 124 & 125 a hexagonal dithering observation of the supernova remnant IC443 (RA 06:17:39.50; DEC +22:23:41.0) was performed for the entire duration of observation time (~131 hours).

Throughout these revolutions all instruments were in their nominal science modes, except for JEM-X1, which remained in Safe mode, and the TM allocation was 134 IBIS, 98 SPI, 1 JEM-X1, 8 JEM-X2, 5 OMC.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

The latest entries in the history file for INTEGRAL

```

2003-10-02T19:36:59.000Z    174.6053    F    Automatic TM processing.
2003-10-04T08:41:58.000Z    174.5895    F    Automatic TM processing.
2003-10-05T19:08:42.000Z    174.5730    F    Automatic TM processing.
2003-10-07T08:31:01.000Z    174.5628    F    Automatic TM processing.
2003-10-08T19:12:57.000Z    174.5340    F    Automatic TM processing.
2003-10-10T08:21:57.000Z    174.5147    F    Automatic TM processing.
2003-10-11T18:47:04.000Z    174.4793    F    Automatic TM processing.
2003-10-13T08:14:28.000Z    174.4496    F    Automatic TM processing.
2003-10-14T18:50:48.000Z    174.4231    F    Automatic TM processing.
2003-10-16T08:03:00.000Z    174.4129    F    Automatic TM processing.
2003-10-17T18:23:11.000Z    174.3960    F    Automatic TM processing.
2003-10-19T01:07:54.000Z    174.3741    F    Automatic TM processing.
2003-10-19T07:54:03.000Z    174.3418    F    Automatic TM processing.
2003-10-22T00:57:46.000Z    174.3263    F    Automatic TM processing.
2003-10-22T07:41:23.000Z    174.3097    F    Automatic TM processing.

```

8.3 Detailed Satellite Information

This section contains some detailed information concerning the various subsystems of the satellite and instruments.

8.3.1 AOCS Operations

AOCS operations were executed from the Automatic Timeline.

During this period, 42 Open Loop Slews, 121 Closed Loop Slews and 4 Momentum Bias were executed. 6 slews were missed or executed manually. This is equivalent to a 3.7%.

18/10/03 (Day of Year 291, Revolution 123)

Slew lost due to Ground Station problem (Goldstone DSS-16): Drops in TM (as well in the AGC level), which were apparently caused by RFI at the station, caused failure of AOCS commands and therefore missing of slew 01230076. After the TM link was stabilised, the Timeline Recovery tool was used to manually slew to the attitude of pointing 01230077 and then the parameters of the next slew were updated.

19/10/03 (Day of Year 292, Revolution 123-124)

Slew lost due to IMCS problem: At 13:10 the command to swap the guide star prior to a Closed Loop Slew failed static PTV. All the conditions were actually OK; the command should not have failed. This is a known occasional IMCS problem. The impact of the problem was that slew 01240005 was lost. A manual slew was performed to the attitude of pointing 01240005. The same problem happened again at 14:12, which resulted in the missing of slew 01240006. This time also, a manual slew was done to the attitude of pointing 01240006. At the end, the Automatic Timeline was aborted and the application restarted. This is known to solve the reoccurrence of the static PTV problem in the short term.

20/10/03 (Day of Year 293, Revolution 124)

OTF flicker due to Pitch and Yaw error: At 09:34:47, and undetected SEU on the Star Tracker caused a large jump of 140 seconds-of-arc (517 CCD units) in the position of the Guide Star in one tracking cycle:

2003.293.09.34.46.415	65535	G	VALID/FULL	VALID MAG	8.45	-8636	3192
2003.293.09.34.46.915	65535	G	VALID/FULL	VALID MAG	8.50	-8129	3454
2003.293.09.34.47.415	65535	G	VALID/FULL	VALID MAG	8.45	-8629	3197

The rather dim variable star, TYCHO# 1323-00781-1 (V963), was picked as Guide by the ACC after an Open-Loop Slew. The OTF flicker was not seen at BCP level and had no impact on observation.

21/10/03 (Day of Year 294, Revolution 124-125)

Nothing to report.

22/10/03 (Day of Year 295, Revolution 125)

Nothing to report.

23/10/03 (Day of Year 296, Revolution 125)

Slew missed due to delay in TC verification (Goldstone DSS16): At 23:37, the command to report the current guide star failed release. The reason was late AD verification of the previous interlocked command due to a delay in reception of the TM frames. The effect was that the timeline was stopped and close-loop slew 01250038 was missed. Manual slew was done to the attitude of pointing 01250038.

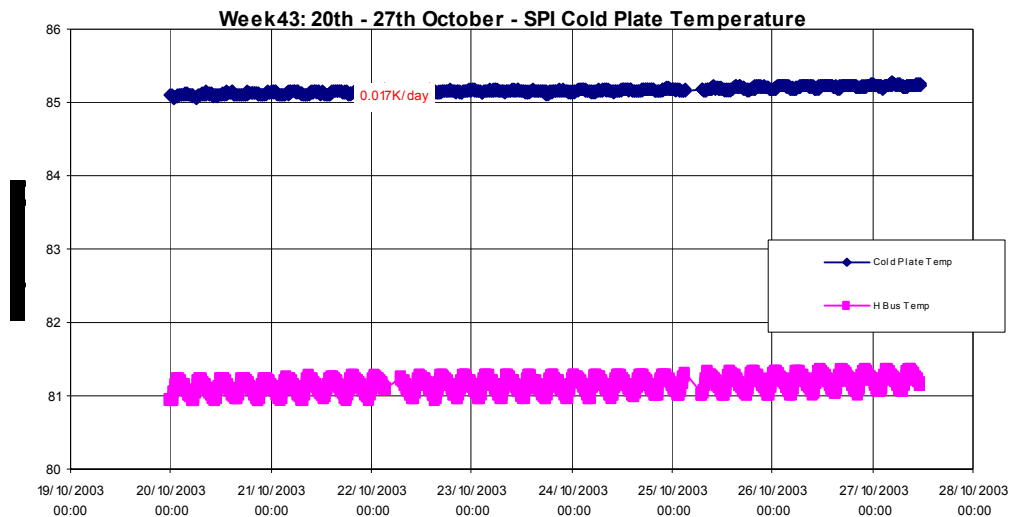
24/10/03 (Day of Year 297, Revolution 125)

Slew missed due to drop in TM/TC link from the G/S (Goldstone DSS16): At 02:40, the TM/TC links from the G/S dropped out. We had been warned of possible RFI during the pass. The timeline was stopped and slew 01250041 was lost. After re-establishment of the links, a manual slew was done to the attitude of pointing 01250041.

8.3.2 SPI Operations

Cryo-cooler:

The temperature is leveled at around 85.2K with a small positive drift of 0.017K/day, well within the expected range.



IASW/DPE:

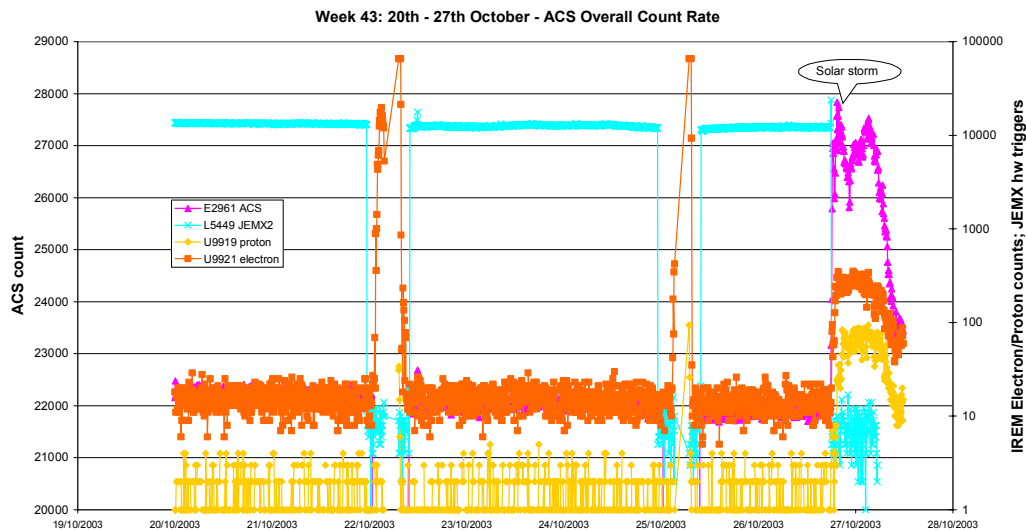
The new IASW 4.3.0 produced by CNES Toulouse is undergoing a reduced set of independent acceptance tests at MOC. The database and procedure changes to control the added functionalities have been implemented and exported into the Mission Control System.

The DPE will be patched with the new IASW during the 3rd annealing cycle planned in November.

ACS:

The next figure reports the plot of the ACS, IREM and JEMX2 count rate. The unusual count rate value on the 26-27th October was due to a solar storm, which was also detected by IREM electron counter and JEMX2 event trigger counter (JEMX2 turned itself off as a consequence of this flux peak).

The following plot shows the ACS count rate during the last week.



AFEE :

Nothing to report.

DFEE:

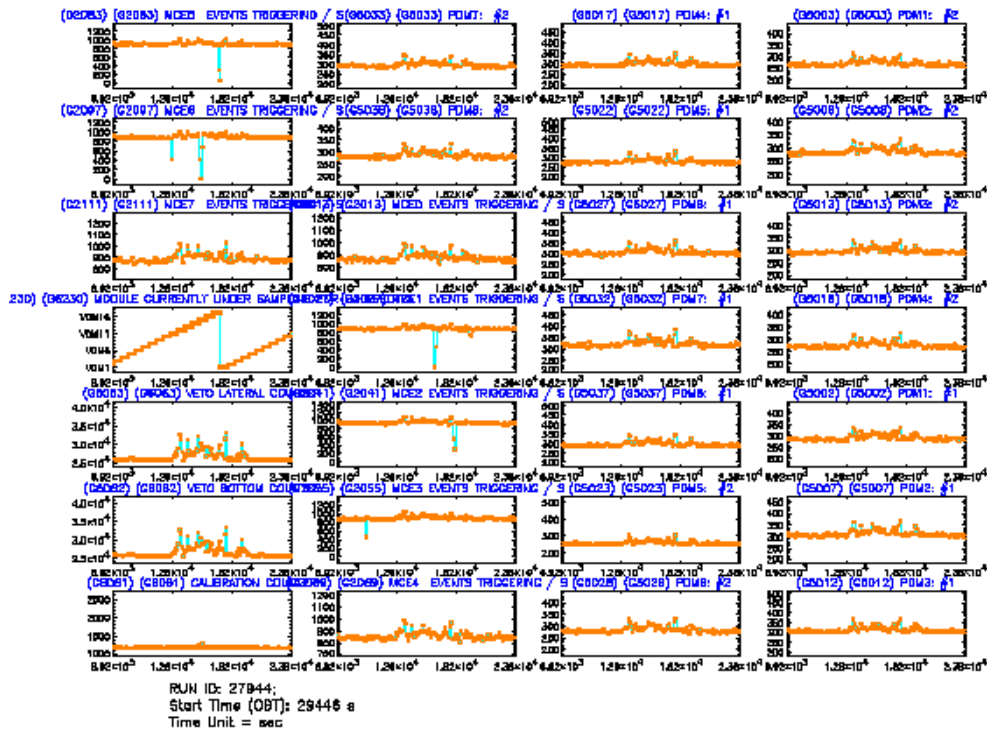
Nothing to report.

PSD:

Nothing to report.

8.3.3 IBIS Operations

On DOY 2003.292 (19/10), at 17:41 high radiation count-rates in all the IBIS detectors were detected. The event was observed by IREM and coincided with a solar flare (see IREM report). The reported ISGRI-PICsIT-VETO count-rates during the event, as recorded by the IBIS ECOE at ESOC are shown below.



The count-rates, as reported by IREM, were not exceeding the IBIS electron-proton-dose thresholds, therefore the unit continued without interruption the nominal observations plan.

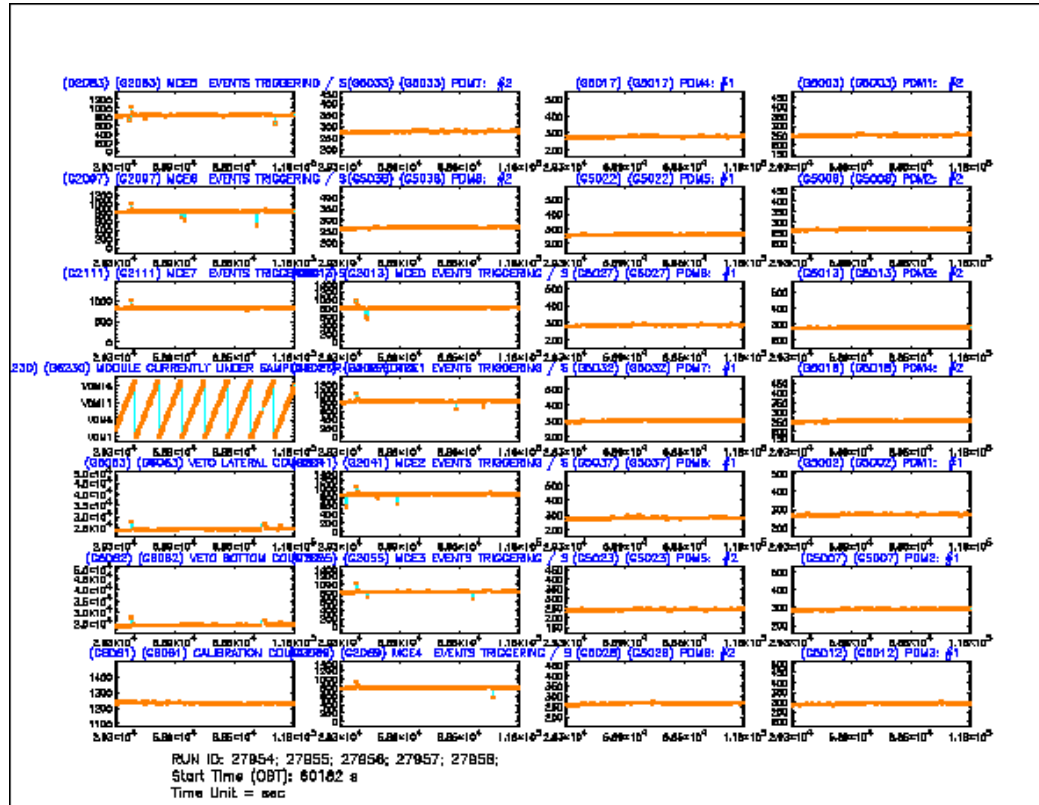
On DOY 2003.294 (21/10) at 11.40Z a problem with IBIS Histogram production was reported. Both Standard Hist and Calibration Hist processes were stopped since the last Ground Station Handover at 04.31Z. ISDC was informed and the recovery action was performed, by forcing the last Hist accumulated on board by using FCP_IBIS1_0312. Investigations are on-going, but the anomaly is likely related to the coincidence of the two processes: the generation of the Calibration Histograms and the set of Ground Station Handover Flag. The recovery started at 11:52Z and was completed at 11:55Z. ISDC confirmed the receiving of the Histograms at 12:06Z.

At 21:04Z the problem with the Histogram downloading was again reported after the Station Handover REDU->DSS16 (at 20:33Z). The same recovery procedure was applied and completed at 21:08Z.

On DOY 2003.295 (22/10) during Belt passages there were a few reports of the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the PICsIT detectors being ON without the VETO anticoincidence system, as it required by PIs.

At 23:19 the OEM ID 179 Class 2 <<IBIS1 VETO COUNTER BOTTOM EXCEEDS ALERT VALUE>> was reported. The relevant TM_para G6062 reported values inside limits therefore the problem has been disregarded, as suggested by the nominal reaction to this OEM.

A second and a third high radiation counting occurred in the evening around the time indicated by the two OEM above. The VETO-PICsIT-ISGRI count-rates are shown below.



8.3.4 JEM-X Operations

2003-10-18, DOY 291, Rev 123

Nothing to report

2003-10-19, DOY 292, Rev 123 - 124

At 17:41Z the following radiation monitoring parameters from IREM went Out of Limits:

K5317 RAD MONITOR 3 (Electron Counter), value = 78

L5317 RAD MONITOR 3 (Electron Counter), value = 78,

and JEM-X2 went to Safe mode autonomously (issuing OEM 231 JEM-X2 AUTO EVENT 1). Commanding to JEM-X2 was then disabled from the Autostack at 17:43Z.

At 17.53Z JEM-X2 performed an autonomous recovery to Set-up mode (issuing OEM 233 JEM-X2 AUTO EVENT 3) and at 18:04Z the procedure FCP_JEM2_1010 (JEM-X2 Configuration Setting for Science Ops) was started.

However, at 18:07Z the IREM Electron Counter parameters K5317 and L5317 went out of limits again with a value of 67, causing JEM-X2 to autonomously transition to Safe mode (issuing OEM 231).

Therefore the TC LU0004 SET Vc NOMINAL, uplinked at 18.07.48Z, from the sequence LS1010 was rejected on board, with the issuing of OEM 135 JEM-X2 TC REJECTED 8 (HW Command illegal because of shutdown in progress) and the manual recovery was stopped.

At 18.18Z JEM-X2 performed an autonomous recovery to Set-up mode (issuing OEM 233), however the full recovery of JEM-X2 was delayed until the IREM radiation counters had remained below the JEM-X2 threshold for ~1 hour.

At 19.18Z JEM-X2 was put in Safe mode via the TC L0008 STATE SAFE and was then put back in Set-up mode at 19.21Z via the TC L0009 STATE SETUP. At 19:27Z the recovery of JEM-X2 was recommenced by the execution of procedure FCP_JEM2_1010, followed by the procedure FCP_JEM2_0044 to put JEM-X2 back into Data Taking mode (TC L0011 STATE DATA TAKE uplinked at 19.57.50Z).

At 20:14Z JEM-X2 commanding from the Autostack was re-enabled and JEM-X2 operations continued nominally.

Enhanced background radiation during this period was reported in an alert issued on 2003-10-19 of a class X1 Solar Flare. Further information can be found in the IREM section of this report.

2003-10-20, DOY 293, Rev 124

Nothing to report

2003-10-21, DOY 294, Rev 124

Nothing to report

2003-10-22, DOY 295, Rev 124-125

Nothing to report

2003-10-23, DOY 296, Rev 125

Nothing to report

2003-10-24, DOY 297, Rev 125

Nothing to report

8.3.5 OMC Operations

On DoY 291 at 01:52, a command was rejected, this was due to the missed pointing of 01230076, probably caused by RFI at the ground station. The next pointing was performed normally.

On DoY 292 at 13:14, two commands were rejected, two more were rejected at 14:15, these were due to the missed pointings of 01240005 and 01240006, caused by guide star failing. Pointing 01240006 was completed manually at 14:48.

On DoY 296 at 23:40 and on 297 at 02:46 pointing 01250038 and 01250041 were missed due to a command failure, and ground station link problems, when the Timeline had to be stopped.

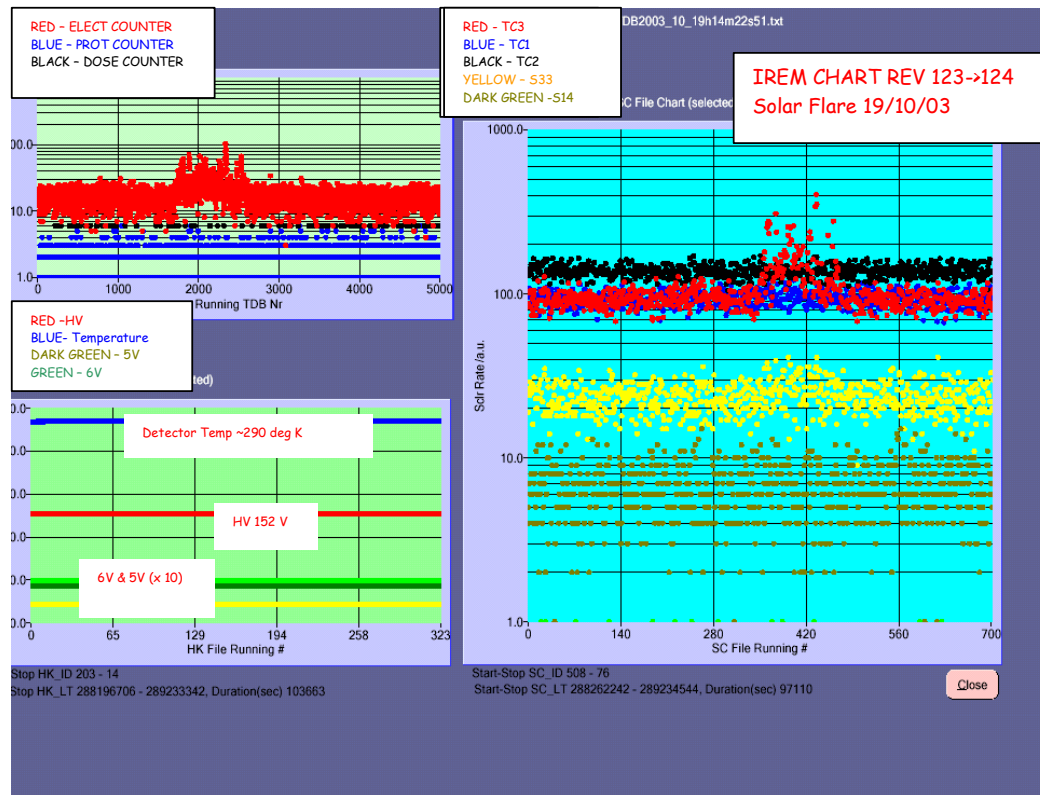
On DoY 292 at 00:55 and DoY 295 at 00:43, the instrument went to SAFE mode, as expected, both times commanded from the Timeline. The Solar flares this week appear not to have affected OMC.

8.3.6 IREM Operations

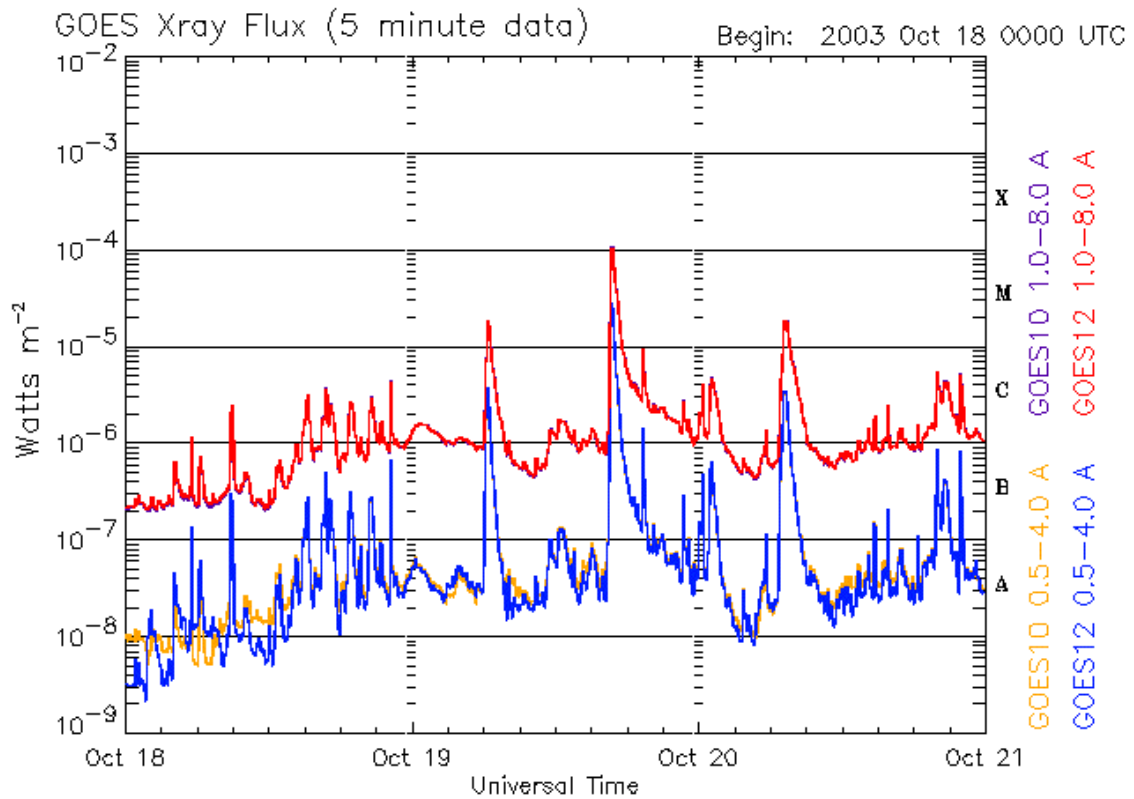
On DOY 2003.292 (19/10) at 17:41 the JEM-X2 automatic transition to SAFE Mode due to high radiation count was reported. The event was observed by IREM was probably coincidental with a solar flare X-ray class 1.1, as reported by NOAA bulletin, see below.

SUMMARY: X-ray Event exceeded X1
Begin Time: 2003 Oct 19 1629 UTC
Maximum Time: 2003 Oct 19 1650 UTC
End Time: 2003 Oct 19 1704 UTC
X-ray Class: X1.1
Location: N05E56

During the flare the IREM electron counter exceeded the JEM-X 2 threshold by reaching a max value of >10cts/sec. The evolution of the flare as recorded by the IREM EGSE at ESOC is shown below:



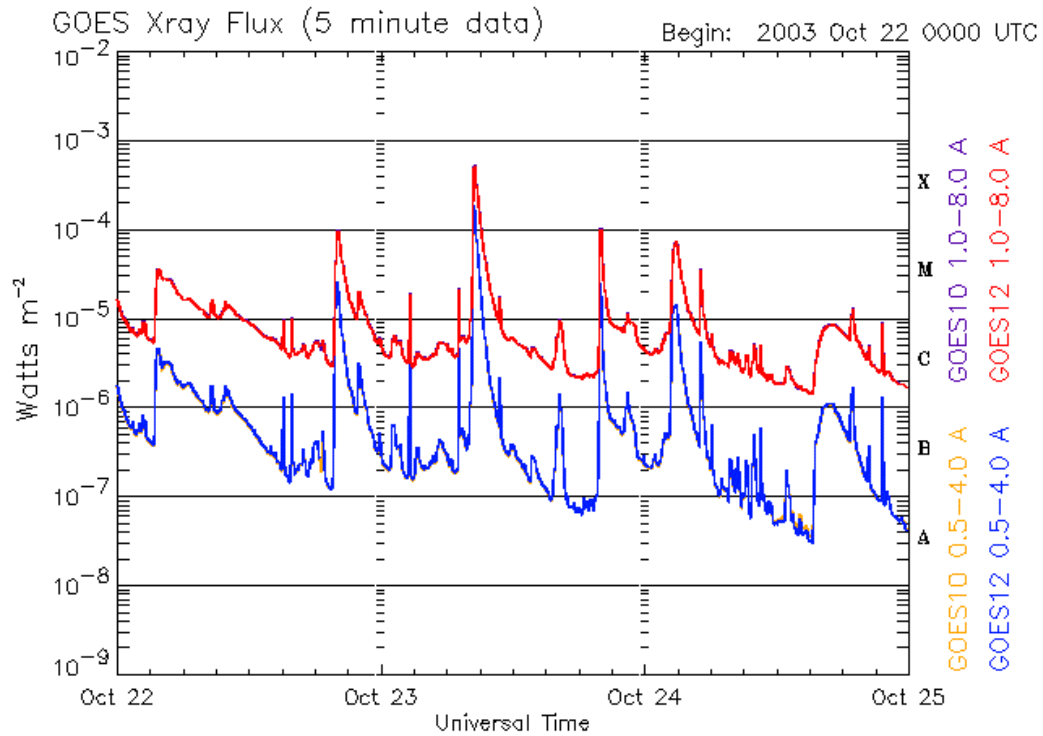
and by the SEC (Space Environment Centre) at NOAA (X-ray Flux).



Updated 2003 Oct 20 23:56:06 UTC

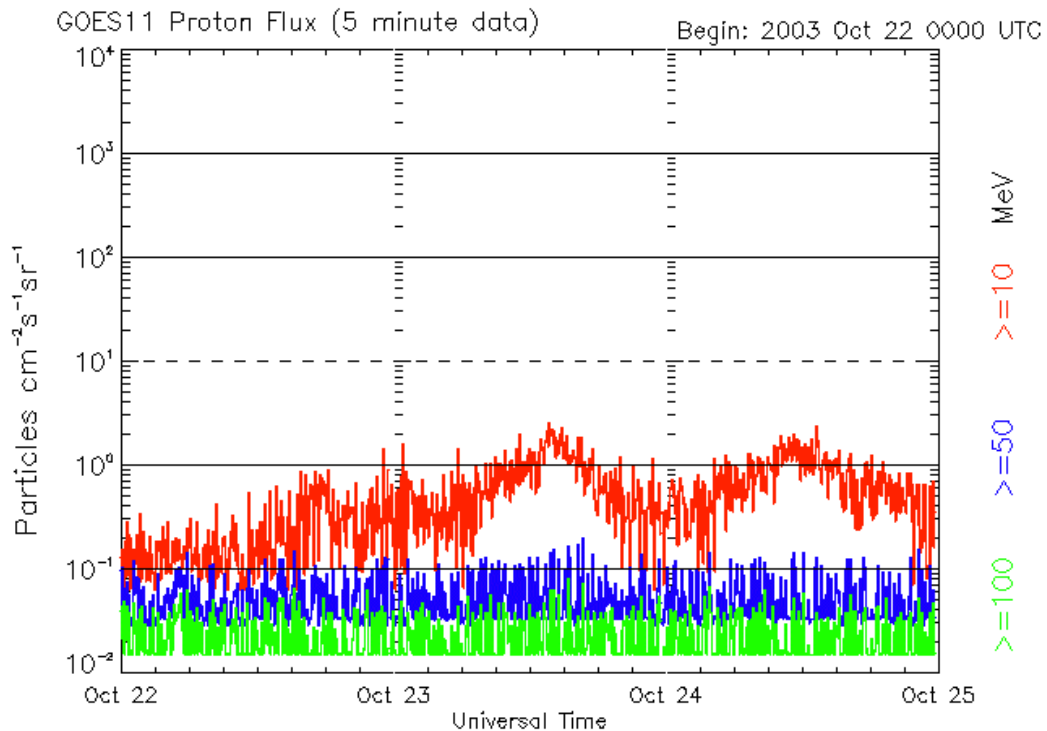
NOAA/SEC Boulder, CO USA

On DOY 2003.296 (23/10) at 08:25 the IBIS VETO counters (Lateral+Bottom) was reported OOL High. The event was probably coincidental with a solar flare with X-ray class X5, as reported by the NOAA bulletin. The assumed flare was not registered by the IREM unit and investigations are on-going. A second and third event, in the same day, were registered by the IBIS ECOE but not evidenced in the IREM data. The plots of the event from the SEC centre at NOAA (X-ray and proton Fluxes) are shown below:



Updated 2003 Oct 24 23:56:04 UTC

NOAA/SEC Boulder, CO USA



Updated 2003 Oct 24 23:56:04 UTC

NOAA/SEC Boulder, CO USA

The plots of the IREM count rates and statuses for the Belts passage in rev 123-124, and 124->125 are shown below.

