
EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-TOS-OF
No. 062
Week 48
01.12.03
Routine Phase

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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 22.11.03 until 28.11.03 (both dates inclusive) and covers the revolutions 135, 136 & 137.

2 Summary of Activities

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

The targets of these revolutions were MR 2251-178 (RA 22:54:5.91; DEC - 17:34:54.3), the galactic plane and the Vela region (RA 08:27:54.70; DEC - 46:18:18.4). The activities consisted of staring, raster dithering and GPS observations. In addition, SPI underwent ACS and Camera switch on and performance tests following the annealing operations.

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.

A considerable number of slews were missed due to different problems, either at the station or here at MOC. 14 slews were missed or were performed manually, which affected 7 science Pointings.

Everything was nominal from an AOCS point of view during the lunar eclipse of 24/11/2003. The AOCS was completely configured and prepared, as it would have been for a complete eclipse season. The ACC FDE and FCE eclipse timers were loaded and running, so the AOCS went to eclipse during the eclipse proper. However, the Fine Sun Sensor did not lose the Sun signal during this time. After the eclipse, the sunlight season AMD thresholds were loaded and the ACC, FDE and FCE eclipse timers were stopped.

An IMCS software bug caused two times the uplink of telecommands, which should not have been uplinked. The no-go dynamic PTV on these commands was erroneously cleared. An investigation on the source of this problem is underway.

The fuel consumption over the period between 21/11/2003 and 28/11/2003 was 0.06Kg. The remaining propellant is in the order of 173.86 Kg on the 28th of November.

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 **2200W**.

On 24th November, Integral experiences a lunar eclipse; at the deepest point of the eclipse the visible fraction of the solar disk was 0.47. The available power from the arrays was enough to power the Satellite and so no battery discharge occurred. However, the reduction in Arrays current was sufficient to trigger the PDUs Sun / Eclipse transition.

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 RFS

The RF subsystem is working properly. There are some Reed Solomon errors for a couple of weeks. A preliminary investigation shows that these problems occur around Apogee when in a certain Azimuth range. This seems to indicate that the link margin is limited. It is currently not clear whether this is a temporary or a permanent problem. If the problem remains further investigations will be performed including a switch-over to the redundant transmitter to check that there is no degradation of the prime transmitter. Shadow tracking from VILSPA is also planned to provide an independent assessment of the link budget and to exclude any possible Ground segment mis-configuration in REDU.

3.2 Payload

3.2.1 SPI

The overall status of the instrument is nominal.

During the reporting period, the 3rd annealing cycle of the SPI Germanium detectors was completed, the camera switched on at 117K and the normal science operations resumed after leveling off at the temperature of 85K. The new software version of the DPE was successfully tested and additional tests to investigate the ACS FEE57 anomaly were also performed.

Preliminary results of the 3rd annealing cycle – communicated by the SPI PI – shows that the mean energy resolution of the camera has been recovered to the same level, if not better, as one year ago, immediately after launch.

SPI is now working in photon mode with a telemetry allocation of 98 pkts/cycle in the science observation windows

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 VETO S/W update was performed successfully on 21/11/03 and 24/11/04 , during the Lunar Eclipse (see detailed part). The TM bandwidth assigned to IBIS was 134 pkts/8sec. The detectors are progressively recovering the nominal count-rates after the high radiation event of last month.

No occurrence of anomalous OEM generation (ID 183-184-179-180, Class 2) was reported after the VETO S/W patch.

Reported (few) during Belt passages the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the fact that the PICsIT detectors are ON without the VETO anticoincidence system, as it required by PIs.

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-X1 was dormant with a TM allocation of 1 packet/cycle. JEM-X2 operations were performed by the automatic Timeline, with a TM allocation of 16 packets/cycle during science observations in revolution 135 and 8 packets/cycle in revolutions 136 and 137.

JEM-X2 began the reporting period in Safe mode, due to high radiation levels as reported by IREM, but was recovered to Data Taking mode by 2003-11-22T03:11Z.

Further information on the JEM-X operations can be found in the Appendix Section 8.3.4.

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.

During this period, 5 of the 108 planned science pointings for OMC were missed. In addition, OMC Imaging TCs had to be uplinked manually on 10 occasions (8 were related to a forced flickering of the OTF for tests with SPI and 2 were in the frame of Timeline recovery operations).

Note: Some more information concerning the OMC operations is provided in the Appendix Section 8.3.5.

3.2.5 IREM

The status of the unit is Nominal.

The observation period was still characterized by the tail of the exceptional solar activity that interested the Earth in the period end of October-beginning of November.

4 Ground Facilities

The performance of the Operational ground facilities was in general good in the reporting period. The main problems were caused by anomalies related to the ground stations and Mission Control System.

4.1 Mission Operations Centre

The performance of the MOC was generally good in the reporting period. However a number of incidents occurred which impacted the execution of the timeline, these are detailed in section 6:

4.2 Ground Stations & Network

As mentioned above there were several problems related to the ground stations. A number of minor TM drops / bad frames / Reed-Solomon errors occurred. Apart from this 2 problems had a n impact on the executing timeline, these are detailed in section 6:

4.3 Science Ground Segment

4.3.1 ISOC

No inputs provided.

4.3.2 ISDC

On 02/12/2003, the status of ISDC observation processing is :

- Latest Standard Analysis completed: observation 01202130004 (Galactic Center, Revolution 111-113) on 22/11/2003
- Latest products archived: observation 01202130004 (Galactic Center, Revolution 111-113) on 26/11/2003
- - Latest observation products sent to the observer : observation 01202130001 (Galactic Center, Revolution 104-107) on 19/11/2003

5 Special Events

A penumbra only lunar eclipse occurred on DOY 328, between 02.58z and 03.29z.

On DOY 331 the 3rd SPI annealing was completed.

6 Anomalies

There were a number of problems related to the ground segment that impacted the operations:

- On DOY 327 slew 01350029 and some OMC TCs was lost due to problems starting uplink at DSS16 following Handover.
- DOY 328, slew 01360001 was not updated on the ASTACK and hence not uplinked.
- DOY 330, the dynamic PTV of TC A2554 was wrongly cleared on the ASTACK and the TC was released when in fact it should not have been.
- On DOY 330 a TM loss caused an update of the Sun Steering law to fail its dynamic PTV condition.
- DOY 330, slew 01360006 failed due to a delay in CLCW reception from DSS16 causing a dynamic PTV failure. During the recovery (AOCS Timeline commanding disabled) slews 01360007, 01360008, 01360009 were subsequently missed.
- On DOY 331 misunderstanding of the reason for a TC failing its static PTV condition caused the AOCS timeline commanding to be disabled. The impact of this was that the first RWB of revolution 137 was missed, along with slews 01370001 to 01370007.
- On DOY 332, slew 01370073 failed due to a delay in CLCW reception from DSS16 causing a dynamic PTV failure.

The following new anomaly reports have been entered into the Anomaly Reporting and Tracking System:

AR id	Date Occurrence	Subject	Segment	Status
INT-2527	2003-12-02	Command Failure die to Static PTV	IMCS	Open
INT-2526	2003-11-30	TM + TC Lost	ESA Station	Open
INT-2525	2003-11-30	No Bitlock Alarms from REDU	ESA Station	Open
INT-2524	2003-11-30	No TPF update generated	FDS	Open
INT-2523	2003-11-27	AUTOSTACK: The Dyn PTV of a TC that should fail uplink is wrongly cleared	IMCS	Pending
INT-2522	2003-11-23	Late carrier from DSS16 – DR # g103742	NASA Station	Pending
Int-2521	2003-11-23	JEMX2 to safe due to radiation	Payload	Pending

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 136

The observations in revolution 136 consisted of a staring observation of MR 2251-178 (RA 22:54:5.91; DEC -17:34:54.3) lasting 57 hours, followed by 4 pointings of a GPS lasting ~2.5 hours.

Throughout these observations, SPI was undergoing ACS and Camera switch on and performance tests. JEM-X1 remained in Safe mode and IBIS, JEM-X2 and OMC were in their nominal science modes. The TM allocation was 134 IBIS, 98 SPI, 1 JEM-X1, 8 JEM-X2, 5 OMC.

Revolution 137

In revolution 137 a raster dithering observation of the Vela region (RA 08:27:54.70; DEC -46:18:18.4) was performed throughout the available observation time (~62 hours).

Throughout this observation, 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

2003-11-01T09:50:52.000Z	174.1850	F	Automatic TM processing.
2003-11-01T12:04:12.000Z	174.1420	F	Automatic TM processing.
2003-11-03T06:55:38.000Z	174.1230	F	Automatic TM processing.
2003-11-05T22:11:12.000Z	174.1048	F	Automatic TM processing.
2003-11-06T06:48:01.000Z	174.0819	F	Automatic TM processing.
2003-11-07T17:22:21.000Z	174.0727	F	Automatic TM processing.
2003-11-09T06:46:41.000Z	174.0543	F	Automatic TM processing.
2003-11-10T08:38:27.000Z	174.0111	F	Automatic TM processing.
2003-11-12T06:40:00.000Z	173.9877	F	Automatic TM processing.
2003-11-15T06:31:20.000Z	173.9656	F	Automatic TM processing.
2003-11-17T10:51:25.000Z	173.9430	F	Manual Processing of
0133_0513_M.RWB			
2003-11-18T06:20:23.000Z	173.9170	F	Automatic TM processing.
2003-11-21T06:23:51.000Z	173.8970	F	Automatic TM processing.
2003-11-23T23:30:30.000Z	173.8735	F	Automatic TM processing.
2003-11-27T06:57:10.000Z	173.8600	F	Automatic TM processing.

This report was generated Fri Nov 28 08:00:06 GMT 2003

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, 13 Open Loop Slews, 101 Closed Loop Slews and 5 Momentum Bias were executed. 14 slews were missed or executed manually. This is equivalent to a 12.2%. 7 science pointings were affected

22/11/03 (Day of Year 326, Revolution 135)

Nothing to report.

23/11/03 (Day of Year 327, Revolution 135)

Slew missed due to late TC link establishment (Goldstone DSS-16): After station handover from Redu to Goldstone at 18:45, the TC link could not be established due to a problem at the station. The Timeline was stopped and slew/pointing 01350029 was missed. After the reboot of the TCP at the station and establishment of the link, a manual slew was performed to the attitude of pointing 01350029. The next slew was performed from the Timeline after being manually updated.

IMU-1 switch-on and health check before the lunar eclipse: About 3 hours before Loss of Signal prior to the lunar eclipse, IMU-1 was switched on and a health check was performed on it. The operation was done according to the nominal IMU health check procedure before any eclipse:

IMU-1 Noise Roll = 0.2092 arc-sec/sec, IMU-1 Drift Roll = 0.1389 arc-sec/sec

OOL warnings on the speed of Reaction Wheel 2: Starting around 22:30, Out-of-Limit warnings were generated (Soft Low) on the speed of RW#2. The speed of the wheel reached values of 628 rpm (absolute), which is below the 630 rpm Soft Low Limit of the eclipse season. RW#2 speed was off by about 70 rpm with respect to the predicted profile for this time. The AMD threshold for the sunlit part of the eclipse season is 477 rpm and the Flight Dynamics system respects a margin of 200 rpm, i.e. in the FD system the predicted wheel speed cannot go below 677 rpm. The RW#2 speed kept traversing the OOL limit until around 23:24, when a Reaction Wheel Bias was executed from the Timeline.

24/11/03 (Day of Year 328, Revolution 135-136)

Lunar eclipse: The lunar eclipse occurred with the penumbra starting at 02:57:52 and ending at 03:28:57, according to the predictions. The ACC, FDE and FCE eclipse timers were loaded at the beginning of the previous revolution along with the time-tag commands to enable the automatic switch off of the IMU by the ACC. The ACC eclipse started at 02:40:15 and ended at 03:38:42. The Fine Sun Sensor however did not lose the sun signal; the OEMs, which indicate that the sun has left the FSS field-of-view were not issued. The minimum visible fraction of the solar disk was about 0.47 during this eclipse. IMU-1 was switched off by the ACC at 03:40:57.

Slew lost due to late TC verification: at 07:51, late “on-board reception” verification of the command to report the SSL parameters caused the uplink failure of

the next TC, which should have started the SSL. This was during a Redu pass and the problem was probably caused by a delay in the line (to be investigated). Commanding the AOCS subsystem was disabled on the Autostack and slew 01360002 was missed. A manual slew was then commanded to the attitude of pointing 01360003. This attitude was reached at 08:22:48, ~7 minutes later than the originally planned time.

Reconfiguration after Eclipse: The post-eclipse reconfiguration consists of change of the AMD thresholds back to their sunlight season values and disabling the eclipse timers.

Change of AMD thresholds back to the sunlight season levels:

Thresholds from INT-MA-AI-0001, 5.3.2.4.2.2, and INT-PR-MMB-0005 page 5-9, modified as per new AMD Threshold agreement for the eclipse season.						
Wheel Inertia:						
RW#1:	0.096		Kgm**2			
RW#2:	0.09768		Kgm**2			
RW#3:	0.09729		Kgm**2			
RW#4:	0.09763		Kgm**2			
Sunlight Season:						
	Subset 1		Subset 2			
WSMAX	39		35.9			
WSMIN	2.2		4.8			
WSMAX	To Uplink:				In rpm:	
	X1		X2		X1	X2
RW#1:	406.25	rd/s	373.9583	rd/s	3879	3571
RW#2:	399.2629	rd/s	367.5266	rd/s	3813	3510
RW#3:	400.8634	rd/s	368.9999	rd/s	3828	3524
RW#4:	399.4674	rd/s	367.7148	rd/s	3815	3511
WSMIN	To Uplink:				In rpm:	
	X1		X2		X1	X2
RW#1:	22.91667	rd/s	50	rd/s	219	477
RW#2:	22.52252	rd/s	49.14005	rd/s	215	469
RW#3:	22.61281	rd/s	49.33703	rd/s	216	471
RW#4:	22.53406	rd/s	49.16522	rd/s	215	469

Disabling the eclipse timers.

- Freezing the FDE Eclipse Timer in the sunlight state.
- Freezing the FCE Eclipse Timer in the sunlight state.
- Stopping the ACC Eclipse Timer task.

25/11/03 (Day of Year 329, Revolution 136)

Nothing to report.

26/11/03 (Day of Year 330, Revolution 136)

Manual update of the Sun Steering Law: At 01:24, Loss of telemetry from Goldstone (DSS-16) caused the uplink failure of the sequence to update the SSL parameters during staring observation of pointing 01360005. The sequence was then copied to the Manual Stack and was uplinked manually starting at 01:26. Although the delay in uplink was very short, this in principle should not be done. The SSL parameters are calculated for the exact time at which the SSL is to be activated. Relevant instructions were given on this matter.

Slews/pointings missed due to late TC verification: At 19:06:12, the AOCS command to report the currently loaded SSL parameters failed uplink, because the on-board reception verification of the previously interlocked command was still pending. The reason for this late verification is that during Goldstone coverage, the CLCW is extracted from the VC0 packets at MOC, by the IMCS. Depending on the distribution of the VC0 packets it can happen that the onboard reception verification of a command is done later than expected. During Redu passes the CLCW is extracted at the station and from all packets. This problem is being investigated now and the solution might be a change in the VC0 distribution (TBC by the experts). The effect of this failure was that slews 01360006 to and including 01360008 were lost. The first two science observations of Exposure 01360004 were missed. Manual recovery was then done to the attitude of pointing 01360009. The attitude was reached at 20:57:34, before the planned time in the Timeline. The observation of this pointing was therefore not affected.

Erroneous clearance of the PTV of an Interlocked command by the IMCS: During the above mentioned sequence of events, the no-go Dynamic PTV of the command to report the pending star brightness threshold, from the Open Loop Slew sequence, was erroneously cleared by a bug in the IMCS and the command was uplinked while it should not have been uplinked. See ARTS entry INT-2523 for details. The TC was rejected by the ACC and the Bad TC Sequence OEM was generated.

27/11/03 (Day of Year 331, Revolution 136-137)

Slews/pointings missed at the beginning of revolution 137: At 05:19, the ACC command to report the onboard-stored ACC OEMs failed uplink. The command has a PTV on the number of stored OEMs. If there are no OEMs in the ACC buffer, the command will fail uplink. The reason for this PTV is to prevent onboard rejection of the TC by the ACC when the buffer is empty. The situation was not clear to the SPACON and the AOCS commanding was disabled and Flight Dynamics support was called in. Since this happened at the beginning of the revolution the initial slews and RWB needed to be done manually. At the end, the timeline could not be rejoined before the start of slew 01370008. The first three science observations of Exposure 01370001 were affected.

28/11/03 (Day of Year 332, Revolution 138)

Command failed uplink due to late TC verification and the next TC was uplinked erroneously: At 21:24:14, The TC to report the pending Close Loop slew parameters failed uplink because the on-board reception of the previous interlocked command was still pending. The failed command had interlock on completion and its failure should have stopped the commanding to the AOCS subsystem. However, due to the same IMCS bug that was previously mentioned, the next AOCS TC was uplinked by the IMCS, when it should not have been. The Close Loop slew sequence therefore continued execution. Since the lost TC was a report command, the slew was not affected. See also DoY 330.

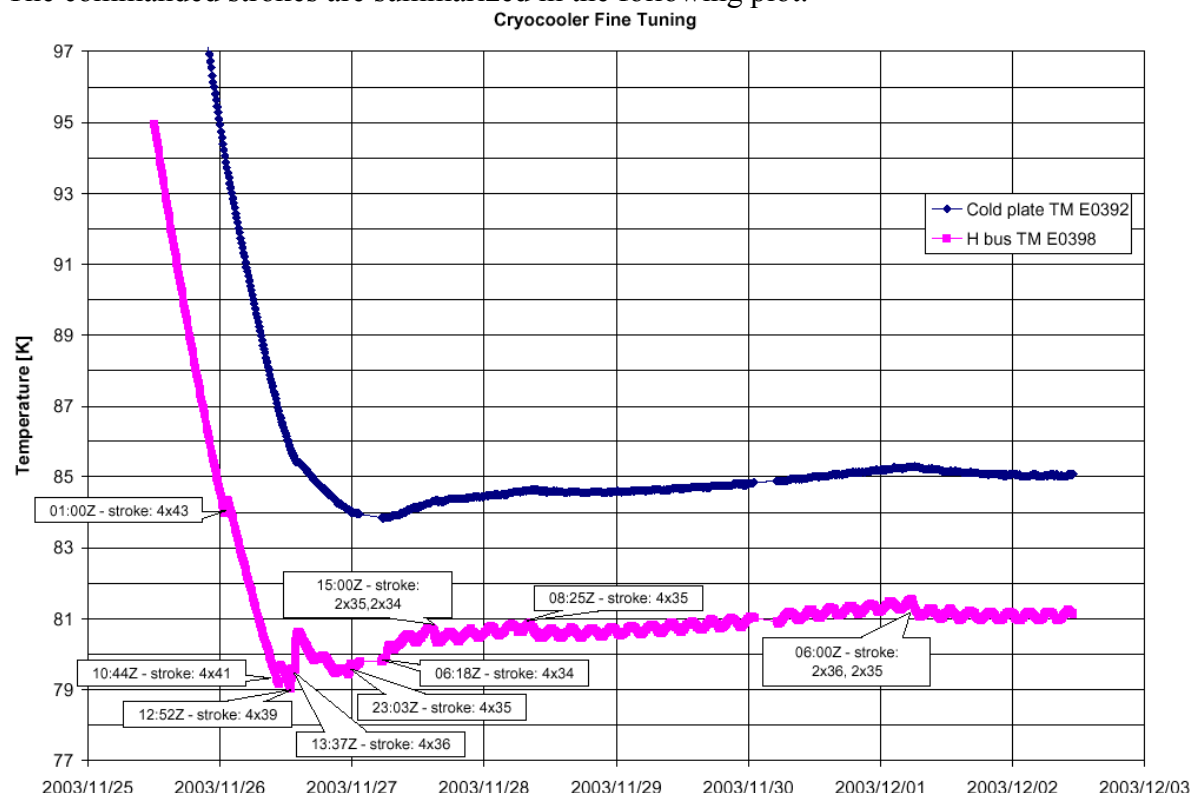
Note; an urgent Software problem Report has been generated in order to get a fix for this problem in the next IMCS S/W release, which is currently planned for January.

8.3.2 SPI Operations

Cryocooler / GeD cold-plate:

After the completion of the planned annealing cycle and the subsequent cryocooler start-up in the previous week, during the reporting period the cold plate reached 85K, thus entering the fine tuning phase. In this phase the cryocooler is commanded to level off at 85K and to maintain it within a band of $\pm 0.9K$.

The commanded strokes are summarized in the following plot.



IASW/DPE:

IASW release 4.3.0

During the passive cooling phase, on 20th November, a new release of the DPE software (IASW release nr. 4.3.0) was successfully patched on-board the DPE memory and the instrument re-started.

In this week, after the camera switch on, a series of tests were performed to validate in-flight, at nominal detector conditions, the new features introduced by this release: the single event line filtering and the multiple event reduction.

The tests showed that the new features work as expected, though the DPE was affected by the generation of a few anomaly on-event-messages (id 7, 10, 224, 242), reporting task overrun problems every two-three hours of science acquisition operations. Apparently the problem was not identified during ground tests and is probably due the increased processor load in-flight, in certain conditions. The problem was logged in the ESOC anomaly report system as INT_SC-71 and is currently under investigation by CNES/CESR, which is trying to reproduce it.

At the end of the tests, the new functions were left disabled as their use is intended to cope with possible future telemetry shortage scenarios, caused by background radiation increase.

The major test steps executed on 25th Nov are here after summarized :

- at 11:11z: science acquisition with photon events downlink over spectra
- at 11:51z: science acquisition with spectra downlink over photon events
- at 13:09z: science acquisition with single events filtering enabled but with zero lines (no change)
- at 13:26z: science acquisition with single events filtering enabled, five spectra lines selected and multiple events reduction enabled
- at 14:11z: science acquisition with multiple events reduction enabled only
- at 14:52z: science acquisition with single events filtering enabled only and five spectra lines selected
- at 15:34z: normal science acquisition (no filtering and no reduction)

Anomaly INT_SC-21

As an unexpected benefit introduced by IASW 4.3.0, it was observed that although nothing was done to fix it, all the allocated packets are now used by SPI IASW (see anomaly INT_SC-21), also in case of automatic transition from configuration to photon mode. Thanks to it, we can remove the Event Designator (ED) EEPPI-02 scheduled by the automatic timeline at each belts exit to partially work-around the problem (recovery of 2 out of 3 lost packets), thus the belts passage of SPI can be driven fully automatically again.

We will still maintain the EDs EENTRY02, EEXIT-01, EECLEX02 to manage the belts passage in case of eclipses, to allow the earliest possible switch on of the AFEE LVPSs, to reduce the temperature drop in the pre-amplifiers.

Anomaly INT_SC-70

Thanks to the help of CNES people at MOC, further investigations were performed on the anomaly INT_SC-70 "SPI Wrong On Request Report Generation by IASW 4.2.0". Apparently the problem originated during the annealing plateau at 104degC, a few days before the date logged in the anomaly report, when the telemetry allocation to SPI was reduced to 5 pkts/cycle and a series of on-request commands was automatically sent by the automatic timeline every second, to refresh the SPI telemetry parameters at the belts entry/exit.

The problem is believed to be very similar to the one observed during the SVT-F prior to the launch. In both cases, the content of the on-request telemetry packets have been observed getting frozen during the uplink of on-request commands.

This anomaly has low priority and criticality since a very easy work around solution can be adopted: the minimum SPI telemetry allocation must be increased from 5 to 20 pkts/cycle, during the annealing period and any other time that SPI science operations are not scheduled.

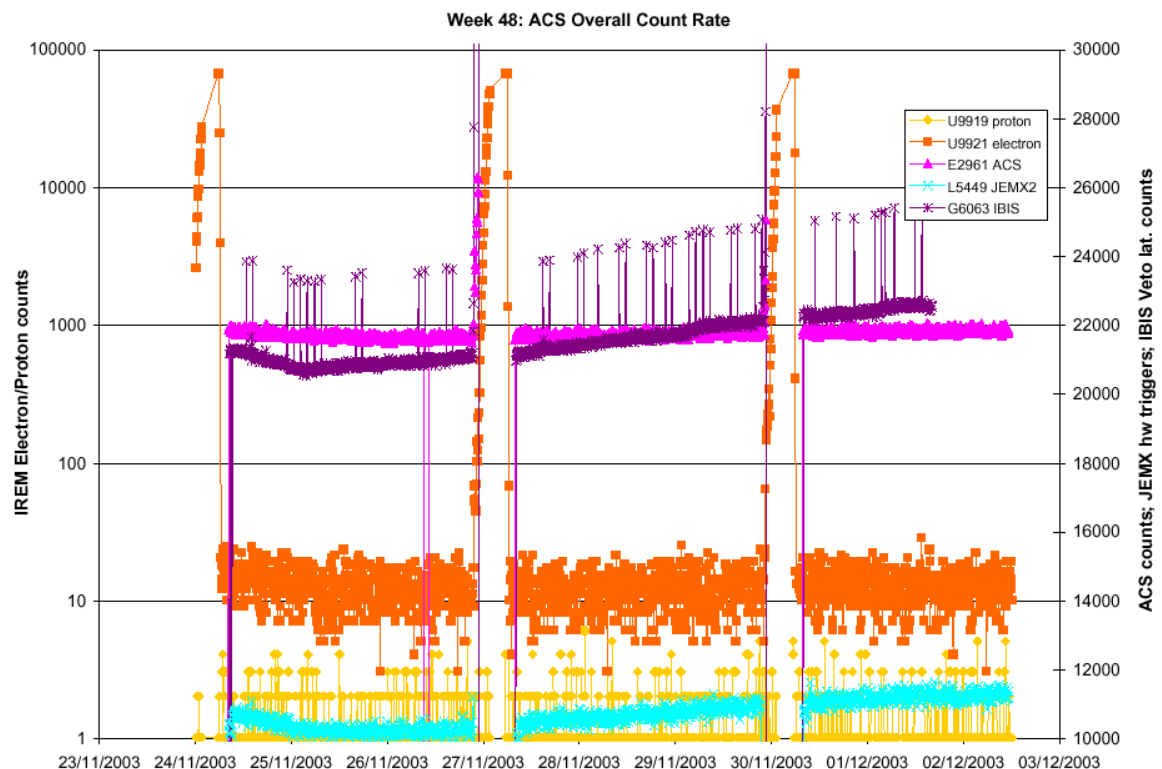
ACS:

After the SPI camera switch on, the ACS was configured to perform a series of tests with the aim to get any further evidence of FEE57 fault location. Different configurations were tested, none of them were able to produce a single veto signal/internal count in the FEE57.

The major test steps executed on 26th Nov in configuration mode are here after summarized:

1. Disable FEE57 watchdog
2. Select FEE57 rate-meter based on integration cycles instead of veto pulses
3. Select FEE57 delay line zero
4. Set FEE57 in forced veto mode (both normal and extended veto signals)
5. Reduce FEE57 event trigger threshold to 2raw
6. Mask all FEEs except FEE57 on VCU overall veto signal
7. Toggle veto signal generation en/dis every 10s on FEE57
8. Enable FEE57 test generator
9. Go to Diag mode
10. Go to Conf mode, restore ACS nominal configuration
11. Go to Photon mode

The following plot shows the ACS overall count rate evolution during the reporting period.



AFEE:

The Germanium detector High Voltage power supplies were switched off at the annealing start-up. This week they have been switched on again during the so called “camera switch on”, when the detectors temperature reached 117K, on Tuesday 25th Nov at 06:30z. The switch on was performed in steps of 500V with two intermediate reference science acquisitions at 2kV and 3kV, as requested by the PI. Preliminary results of the 3rd annealing cycle - communicated by the SPI PI - shows that the mean energy resolution of the camera has been recovered to the same level, if not better, as one year ago, immediately after launch.

DFEE:

Nothing to report.

PSD:

Nothing to report.

8.3.3 IBIS Operations

DOY 2003.328 (24/11/03)

Lunar Eclipse.

Verified the IBIS configuration after the Lunar Eclipse at the beginning of revolution 136. The configuration was set by executing the OR-112 on day 21/11/2003.

The IBIS Instrument was commanded manually into its eclipse configuration before the earliest possible time for the ECL(s/e) transition; The IBIS Eclipse configuration was reached by executing the command sequence GC0060, built of commands identical to the part of the PPDU ECL(s/e) PROM sequences applicable to the unit and relevant Heaters.

The time-tagged commands to place IBIS in its eclipse configuration were executed at 2003-11-24T03.05Z.

The IBIS Instrument was commanded manually into its sunlight configuration after the latest possible time for the ECL(e/s) transition. The IBIS Post-Eclipse configuration was reached by executing the sequence GC0062, built of commands identical to the part of the PPDU ECL(s/e)PROM sequence applicable to the relevant Heaters.

The time-tagged commands to place IBIS in its post-eclipse configuration must be executed at 2003-11-24T03:22Z.

During the Lunar Eclipse event the ECL (s/e) (e/s) thresholds were anyway exceeded and the PPDU automatic sequences executed on-board.

In detail:

- the Sun to Eclipse ECL(S/E) automatic sequence executed at 2003-11-24T03:10Z

- Eclipse to Sun PPDU ECL(E/S) sequence executed at 2003-11-24T03:19Z.

VETO Patch

Performed the VETO VECU1 S/W patch by executing OR-111 after the re-configuration from Lunar Eclipse.

The activity was performed, as planned, below radiation belts with minimum impact on the scientific observation. The selected time window for the patch uplink and comparison started at the opening of the SATENG window (just after the completion of ISGRI CTX uplink).

2003-11-24T06:33:22Z SATENG_OPEN

At 06.51 started the patch of VETO with the unit in Stand-By.

At 06.53Z during the execution of the dump sequence two OEM were generated by the IASW for each dump TC:

ID 134 Class 3 <<IBIS IASW EXTERNAL TC REJECTED, COULD NOT BE EXECUTED>>

ID 129 Class 2 <<IBIS IASW TIME-OUT TRANSMITTING LSL DATA>>

During the request of dump the IASW produced the packet 70613 (VETO dump RAM) but with the content all 0. This flagged a problem in the communication between the DPE and the peripheral, i.e. the IASW prepared the packet but no data came from VETO to fill it;

At 07.29Z ,as first attempt to recover VETO, was repeated the transition to Stand-By. The TC was apparently executed. The first dump TC , repeated again , was rejected with the generation of the two OEMs above.

The uplink of the TC for VETO CTX saving was just followed by the OEM ID 129 Class 2 flagging a problem in the communication on the low speed line (LSL).

At 07.44Z was agreed to proceed for a VEB OFF/ON and re-execution of the patch/dump activity. During the dump sequence was received the OEM ID 134 Class 3 and ID 129 Class 2, while the TC for the transition to Nominal was not executed without any rejection.

At 08.13Z was repeated a power cycle of the VEB but leaving the old S/W running. This time the unit was working properly and performed the following transition to Nominal in the correct way. After transition to Stand-By was tested the first dump TC and it worked properly filling the packet 70613 with meaningful data.

At 08.45Z the patch sequence was then re-uplinked , this time uplinking the last TC, as generated by the OBSM image, as first (with data field relevant to the 128 bytes of free memory area used for this patch) . The following TCs up to the transition to Nominal were executed nominally without problem.

Originally was assumed no influence on the system by using the patch TCs as they were produced by the OBSM tool (i.e. in logical address order) but the experience shown that even in Stand-By VETO was having access on that area where the patch was localised causing rejection of TC and problem in communication with the DPE. The same problem was not present during the first uplink of the patch on 21/11 because was used a manual TC sequence.

The reference image used for the patch was:

IIMG_B_VET_1281_49856_F_V_003_001_0.INT
as provided by IBIS PI.

The unit was under monitoring until the end of rev 136. It is expected no occurrence anymore of "anomalous" OEM generation, see details below:

OEM ID 183 Class 2 <<IBIS1 VETO +5V VOLTAGE OUT OF RANGE>>

OEM ID 184 Class 2 <<IBIS1 VETO +28V VDM/CDM VOLTAGE OUT OF RANGE>>

OEM ID 180 Class 2 <<IBIS1 VETO COUNTER LATERAL EXCEEDS ALERT VALUE>>

OEM ID 179 Class 2 <<IBIS1 VETO COUNTER BOTTOM EXCEEDS ALERT VALUE>>.

8.3.4 JEM-X Operations

2003-11-22, DOY 326, Rev 135

JEM-X2 began the reporting period in Safe mode (having entered Safe mode autonomously at 2003-11-21T22:47Z due to high radiation levels as reported by IREM).

At 02:05Z JEM-X2 performed an autonomous recovery to Setup mode (issuing OEM 233 JEM-X2 AUTO EVENT 3) after the IREM RMCR values had remained below the JEM-X2 thresholds for exiting from Safe mode for more than 10 minutes.

At 02:35Z the recovery of the unit was started by first executing procedure FCP_JEM2_0041 (JEM-X2 Transition to Setup), followed by the procedure FCP_JEM2_1010 (JEM-X2 Configuration Setting for Science Ops) at 02:40Z.

At 03:11Z JEM-X2 was commanded back to Data Taking mode by the procedure FCP_JEM2_0044 and JEM-X2 operations continued nominally.

2003-11-23, DOY 327, Rev 135

Nothing to report

2003-11-24, DOY 328, Rev 135-136

A lunar eclipse occurred from 2003-11-24T02:58:14Z to 2003-11-24T03:29:27Z. Due to the fact that this lunar eclipse was a penumbra only, the DFEE of both JEM-X units had been switched off by time tagged commands, executed before the earliest possible time of a PPDU ECL(S/E) sequence (see Integral Mission Report No. 061). The PPDU ECL(S/E) sequence executed at 2003-11-24T03:10Z and the PPDU ECL(E/S) sequence executed at 2003-11-24T03:19Z.

During the post-eclipse reconfiguration of JEM-X2 via the ED LECLEX01 in the Timeline (at 2003-11-24T06:08:32Z), an unusual sequence of state transitions of the JEM-X2 DFEE was observed. Instead of performing the expected transitions DFEE OFF > SAFE > MEMORY > SETUP > SAFE (as JEM-X1 did), JEM-X2 DFEE performed the following transitions:

2003-11-24T06:08:36.54Z: DFEE OFF
2003-11-24T06:08:44.54Z: SAFE
2003-11-24T06:08:52.54Z: MEMORY
2003-11-24T06:09:00.54Z: **DFEE OFF**
2003-11-24T06:09:08.54Z: SAFE

This is currently being investigated by the JEM-X PI.

2003-11-25, DOY 329, Rev 136

Nothing to report

2003-11-26, DOY 330, Rev 136

Nothing to report

2003-11-27, DOY 331, Rev 136-137

Nothing to report

2003-11-28, DOY 332, Rev 137

Nothing to report

8.3.5 OMC Operations

2003-11-22, DOY 326, Rev 135

Nothing to report

2003-11-23, DOY 327, Rev 135

Pointing 01350029 achieved late

Due to a late establishment of the TC uplink during the handover from Redu to Goldstone, the Timeline was stopped at 18:54Z and Slew ID 01350029, along with the OMC imaging EDs scheduled at 18:59Z for pointing 01350029 were missed from the Timeline.

Once the TC link had been established, the Timeline was restarted (19:09Z) and a manual slew to the attitude of this pointing was performed.

At 19:30Z OMC was commanded to Standby via the TC M1500 (issuing OEM 150 MODE TRANS) and then the OMC imaging commands which had been missed for this pointing were uplinked manually (OEM 174 RESET IM issued at 19:31Z).

At 19:31Z the Broadcast Packet Group 2 parameters for this pointing were set manually and OMC went back to Normal Science mode at 19:32Z, issuing OEM 233 TO SCIENCE.

2003-11-24, DOY 328, Rev 135-136

Pointing 01360003 achieved late

Due to the lack of AOCS manoeuvre parameter updates from the Flight Dynamics System, commanding of the AOCS was disabled from the Timeline at 07:51Z and the slews to the attitude of the first science pointing were performed manually. The manual slew to the attitude of pointing 01360003 was started at 08:17Z.

As only the AOCS was disabled from the Timeline, the OMC imaging EDs, scheduled at 08:14Z, for pointing 01360003 were uplinked (OEM 174 RESET IM issued at 08:14:30Z) but OMC did not enter science mode until 08:23:02Z when the OTF was reached again, issuing OEM 233 TO SCIENCE).

Commanding of the AOCS from the Timeline was re-enabled at 08:31Z and the operations continued nominally.

2003-11-25, DOY 329, Rev 136

OTF flicker due to SPI tests

For the purpose of tests being performed with SPI, an OTF transition was forced several times during the ongoing staring observation by masking and unmasking of the OTF.

At each instance, this caused a transition of OMC to Standby. The OMC imaging commands for this pointing (01360004) were then re-uplinked from a saved stack to put OMC back in Normal Science mode with the correct imaging parameters for this observation.

At each occurrence the following set of OEMs was received:

232 TO STDBY
174 RESET IM
233 TO SCIENCE
179 CENT CYCLE

This occurred at the following times:

10:42Z: OMC to Standby

10:45Z: Uplink Imaging TCs and OMC to Normal Science mode

11:14Z: OMC to Standby

11:15Z: Uplink Imaging TCs and OMC to Normal Science mode

11:53Z: OMC to Standby

11:55Z: Uplink Imaging TCs and OMC to Normal Science mode

13:29Z: OMC to Standby

13:30Z: Uplink Imaging TCs and OMC to Normal Science mode

14:12Z: OMC to Standby

14:14Z: Uplink Imaging TCs and OMC to Normal Science mode

14:53Z: OMC to Standby

14:55Z: Uplink Imaging TCs and OMC to Normal Science mode

15:35Z: OMC to Standby

15:37Z: Uplink Imaging TCs and OMC to Normal Science mode

2003-11-26, DOY 330, Rev 136

OTF flicker due to SPI tests

During pointing 01360005, forcing of an OTF transition was performed once again at 10:28Z, with the following impact on OMC:

10:29Z: OMC to Standby (OEM 232 TO STDBY)

10:32Z: Re-uplink Imaging TCs for Pointing 01360005 and OMC to Normal Science mode (OEM 174 RESET IM; OEM 233 TO SCIENCE; OEM 179 CENT CYCLE).

Pointings 01360007, 01360008 and 01360009 missed

At 19:06Z the commanding to the AOCS was disabled from the Timeline due to a PTV failure of one of the slew TCs for Slew ID 01360006. At 19:33Z OMC went to Standby mode as a result of the OTF going low at the start of the manual slew to recover the Timeline (OEM 232 TO STDBY).

The imaging EDs scheduled during the following two slews (Slew ID 01360007 and 01360008) were uplinked (OEM 174 RESET IM received at 19:39Z and 20:19Z).

At 20:22Z the Timeline was stopped, therefore the Imaging EDs scheduled in the Timeline at 20:59Z for Pointing 01360009 were not uplinked.

OMC returned to Normal Science mode at 20:58Z (OEM 233 TO SCIENCE) when the OTF was reached after completion of the manual slew to the attitude of pointing 01360009. However, as the imaging parameters were still those of pointing 01360008, a series of OEM 179 CENT CYCLE were received between 20:58Z and 21:32Z.

The Timeline was restarted at 21:18Z and normal operations resumed for OMC at 21:39Z with the execution of Slew ID 01360010, along with the OMC imaging EDs for pointing 01360010, from the Timeline.

2003-11-27, DOY 331, Rev 136-137

Pointings 01370005 and 01370006 missed

AOCS manoeuvres from the Timeline at the start of revolution 137 were not executed due to disabling of the AOCS commanding from the Autostack at 05:40Z.

Therefore, the first two science pointings for OMC were missed (Pointing 01370005 and 01370006). However, the imaging EDs for these pointings were uplinked (OEM 174 RESET IM received at 08.05Z and 08.36Z).

A manual recovery to the attitude of pointing 01370007 was performed. Imaging EDs for this pointing were uplinked from the Timeline (OEM 174 RESET IM received at 09:31Z) and OMC returned to Normal Science mode during this pointing once the OTF was reached at 09:39Z (OEM 233 TO SCIENCE).

At 09:46Z AOCS commanding from the Timeline was re-enabled and OMC operations continued nominally.

2003-11-28, DOY 332, Rev 137

Nothing to report

8.3.6 IREM Operations

No Graphic available.