

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-TOS-OF
No. 064
Week 50
15.12.03
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 06.12.03 until 12.12.03 (both dates inclusive) and covers the revolutions 140, 141 & 142.

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 the Vela region (RA 08:27:54.70; DEC -46:18:18.4), the galactic plane and Cassiopeia A (RA 23:51:43.00; DEC +62:03:55.0). The activities consisted of raster dithering and GPS observations.

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.

There were several Star Tracker 1750 Processor Faults, all happening after close loop slews to an attitude close to RA: 08:15:17.37, DEC: -48:11:12.9 when TYCHO# 8140-06536-1 was selected as the Guide Star for the slew. This star, which was always selected for Close loop Slew to this attitude, was close to a bright object in the STR FoV (see INTEGRAL Mission Report No. 063, Sect. 8.3.1). This combination resulted in the fault during mappings that were commanded after the slew. The fault occurred in PIDs 01390067, 01390104, 01400012, 01400060 and 01400108. The OTF remained Low during these Pointings. It was requested that the Flight Dynamics exclude 8140-06536-1 in their system so that it would not be selected for slews. After this was done, the fault did not occur during the future pointings to this attitude.

Several Slews/Pointings were lost during this time because of different problems: rejection of the commanded Guide Star, RFI at Goldstone, Reed Solomon Errors, Late AD verification and loss of link to Redu.

The results from the RCS-A Thruster Calibration and the IMU1/IMU2 Health Check that had been performed before were uplinked.

The first eclipse of the season occurred on 12/12/2003 during the perigee of revolutions 141-142. AOCS operations and functioning were completely nominal during the eclipse passage.

The fuel consumption over the period between 05/12/2003 and 12/12/2003 was 0.115 kg. The remaining propellant is in the order of 173.588 Kg on the 12th of December.

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**.

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, except the isolated incident reported below:

On DOY 343.at 07.05.50Z, the CDMU generated the following OEM:

ID=91, EXCE_OBIH_TC_ST9_WRONG_RBI_STATUS_2
D0086 TC RECEIPT = NOT READY
D0089 PT APID = SPI
D0096 TCP SSC OEM = 5939

After some investigation it was found that the OEM was generated in response to TC E0257, contained in ED EEORTM01. The OEM indicated that there was a failure to transfer the command on the OBDH bus to SPI DPE as the receiving RBI (Remote Bus Interface) was not ready to receive.

Subsequent commands were accepted by SPI DPE, hence no further actions were taken.

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 ongoing 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 except an anomaly of the GE detector #2 that is described in following.

The 3rd annealing cycle of the SPI Germanium detectors was completed at the end of November. Reported during revolution 140 an anomaly on the GeD#2 . The origin of the anomaly is still under investigation by SPI Team and few attempts to recover the detector # 2 were performed during the observation period. The SDPE is running with the new IASW S/W release 4.3.0 since the annealing. The TM bandwidth assigned to SPI was 98 pkts/cycle.

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

3.2.2 IBIS

The overall status of the unit is Nominal except the temporary breakdown of the HV of one VETO module.

The TM bandwidth assigned to IBIS was 134 pkts/8sec. No occurrence of anomalous OEM generation (ID 183-184-179-180, Class 2) was reported after the VETO S/W patch. Reported during the Rev 141 a break down of the high voltage for the VETO VDM 15: the unit was recovered few hours later to the nominal value and currently the performances of the PMTs are good. Reported during revolution 141an automatic transition to Stand-By and HVs switch OFF due to the high radiation background few minutes prior the Radiation Belts entry.

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 8 packets/cycle during science observations.

Due to high radiation levels as reported by IREM, JEM-X2 made an autonomous transition to Safe mode at 2003-12-12T17:16Z and was recovered back to Data Taking by 2003-12-12T19:03Z.

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 the reporting period OMC operations were performed by the automatic timeline, with the TM allocation to OMC of 5 packets/cycle during normal science operations.

There were 246 OMC pointings executed, with 8 missed. Of the executed pointings, 1 was late, and 1 terminated early.

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

3.2.5 IREM

The unit's status is Nominal.

The observation period was characterized by low solar activity during revolution 141-142 (see details). Reported some spikes during revolution 141 and 142. The modification of the Radiation Belts Entry altitude determined in some occasion the anticipated switch OFF , due to the on-board automatism, of JEM-X and IBIS units.

4 Ground Facilities

The performance of the Operational ground facilities was in general good in the reporting period. It was well within the system requirements.

4.1 Mission Operations Centre

The performance of the MOC was generally good in the reporting period. However, there were a number of problems with disc and swap space this week, see section 6 for details.

4.2 Ground Stations & Network

As in the past weeks there were several problems related to the ground stations. A number of incidences of RFI/ TM drops / bad frames / Reed-Solomon errors occurred. Apart from this 3 problems had an impact on the executing timeline, these are detailed in section 6.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

Short term PSF: Received up to rev. 153

Long term PSF: up to rev. 164 (no change)

POS and POD generated: up to rev 150

TSF: Up to rev 144.

Rev 149 was replanned due to ISOC software problem. Rev 144 contains for the first time scheduling of full OMC calibration observations. No manual intervention is required any more. This revolution has successfully passed MOC timeline generation process.

Mid term and long term plan published on ISOC web page.

2. Observation status

ECS's for rev's 81 and 127 to 131 received. Corresponding OCS's generated and sent to ISDC. Some extra time, 87 Ksec, credited due to instruments being switched off during solar flare.

3. ISOC science archive

No archive data received from ISDC. Since processing of rev 81 is now done ISOC expects shortly a new partition of science archive data.

4. ISOC system

ISOC system version 10 was enhanced to include generation and processing of the first cycle of GCDE observations for AO 2.

5. Problems

none

6. AO 2 preparation

Amalgamation has been completed and implemented in the ISOC data base. Changing of data base to phase out AO 1 observations not to be considered for AO 2 started. TOO trigger criteria sent to ISDC. List of AO 2 targets sent to OMC PI for implementation in the star catalogue used by ISDC and ISOC.

4.3.2 ISDC

On 17/12/2003, the status of ISDC observation processing is:

- Latest Standard Analysis completed: observation 01202480001 (4U 0614+09, Revolution 129) on 10/12/2003
- Latest products archived: observation 01297000015 (SgrA*, Revolution 113-115) on 08/12/2003
- Latest observation products sent to the observer: observation 01297000015 (SgrA*, Revolution 113-115) on 10/12/2003

5 Special Events

OBDH

On DOY 345, starting at 10.47Z a new On-board monitoring table was loaded and activated on-board in preparation for Eclipse Season #3. FCP_DHS_1232.

EPS

On DOY 343 starting at 10.25Z, the configuration of the EPS for Eclipse Season #3 was started, the following operations were carried out:

FCP_EPS_1271 Select BCR1 full Charge Rate C/13
FCP_EPS_1272 Select BCR2 full Charge Rate C/13
FCP_EPS_1260 Set MRU EOC timer Threshold (a time of 4275 seconds was loaded)

12/12/2003 (DOY 346)

Eclipse passage:

Eclipse #1 of eclipse season #3.

Total Eclipse Duration: 26m 14s

Umbra Duration: 24m 13s

ECD measured DOD Battery 1 9.3% (2.24Ah)

ECD measured DOD Battery 2 9.3% (2.22Ah)

(Note DOD calculation assumes nominal battery capacity rating of 24Ah)

Recharge time battery 1 1h 19m

Recharge time battery 2 1h 18m

Both the eclipse passage and recharge executed nominally, a small increase in the battery internal temperatures towards the end of the recharge period indicates that both batteries were fully recharged.

6 Anomalies

The two main anomalies related to the Payload, i.e. the loss of the GE detector #2 and the breakdown of the HV of one VETO module are described in detail in the relevant section in the Appendix.

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

- On DoY 340, at 03:28, IDDB was showing yellow, with 3.5 GB free disc space.
- Later, at 05:19, sun128 had the same problem due to limited swap space (43MB). FD were called, and it was decided to restart the machine later in the morning. At 11:52, this was done, but the mission planning server task did not come up correctly, probably due to the tasks being started before logging into the client, this was deemed not urgent, and was left to Monday morning.
- On DoY 342 at 00:54, sun129 was indicating 'yellow' (short of disc space), at 01:38, it miraculously went back to green.
- At 05:34 there was a drop in the TM bad frame link due to Reed-Solomon alarms in Redu., no impact.
- At 16:22, there were errors sending data to ISDS.
- At 17:51, double TLM was seen coming from DSS-24, this caused errors to be generated sending data to ISDS, and to the consolidator, at 17:56, the VC7 link dropped. At 18:06, the VC7 link was 'disconnecting' from NCTRS-A, which was restarted by network at 18:09, but when it returned, there was still double TLM. At 18:38, there was a one-minute drop in VC0 TLM, at 18:45, the TLM rate returned to normal.
- At 20:20, the idda was again 'yellow', with 5.9 GB free disk space remaining.
- On DoY 343 from 00:20 until EOT at 00:24, the links to DSS-24 dropped, no impact.
- At 03:55 the IMCA indicated 'yellow' on the MMI, with the warning that the CMDreleaser was using 48% of the CPU.
- At 09:34, the links to Redu were lost, the TM returned at 09:36, and the TC at 09:38, no impact.
- On DoY 344 at 08:35, the TPF transfer from FD to the IMCA failed for slew 01410049, the impact was this manoeuvre had to be performed using default parameters.
- At 12:54, the IMCA was 'yellow', with only 42MB free swap space left. The OBS was restarted, then the IFTS-MCS, and finally the application launcher was restarted on sun127, the IMCA then returned to 'green'.
- At 20:08, there were some bad frames received from DSS-16, this was confirmed to be RFI. The RFI continued to cause correlator errors and packets to be out-of-sequence. At 20:38, all TM links were out, and TC D4004 failed release. The TLM was switched to Redu until LOS at 20:42. The TLM was restored at 21:37, the timeline was recovered at 22:00, to the attitude after slew 01410073. The impact was slews 01410070 to 01410073 were either lost, or no TLM was received during that pointing.
- On DoY 345, at 02:33, there were Reed-Solomon alarms at Redu, this caused a correlator error at 02:36, which in turn caused TC A3087 to fail release. This stopped the Timeline at 02:39, after further Reed-Solomon alarms at 02:43, the Timeline was eventually restarted at 03:04. The impact was pointing 01410081 was missed.
- On DoY 345 at 23:18, there were some bad frames and packets out-of-sequence from DSS-16.
- On DoY 346 from 09:15, to 11:57, the line to ISDC was down owing to a power cut.
- At 13:26, there was a single alarm sending data to ISDC, no impact.
- From 15:26 to 15:36, the TC link to Redu was down, the impact was pointings 01420015 to 01420017 were lost.

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

AR id	Date Occurrence	Subject	Segment	Status
INT_SC - 72	10/12/2003	SPI: GeD #2, anomaly on the offset of the pre-amplifier	Space	SPI
INT_SC - 73	10/12/2003	IBIS: VETO VDM 15 High Voltage break down	Space	IBIS
INT - 002530	05/12/2003	manual update with TPF not working	Ground	IMCS
INT - 002531	05/12/2003	No bit lock from DSS-16 DR: G-103793	Ground	NASA Sta.

INT - 002532	05/12/2003	Telemetry drops from DSS-16 due to RFI DR-Nr: G-103795	Ground	NASA Sta.
INT - 002533	05/12/2003	Error sending data to ISDS	Ground	IMCS
INT - 002534	09/12/2003	Command failure due to static PTV	Ground	IMCS
INT - 002535	09/12/2003	Double telemetry rate from DSS-24 DR -Nr. G-103812	Ground	NASA Sta.
INT - 002536	11/12/2003	RFI at DSS16 - DR # G103821	Ground	NASA Sta.
INT - 002537	11/12/2003	Reed Solomon Alarms at REDU	Ground	ESA Sta.
INT - 002538	11/12/2003	Lost TC from REDU	Ground	ESA Sta.

7 Future Milestones

- Eclipse season starts on 12/12/2003, there will be 9 eclipses, with a maximum duration of 55 min. on 27/12/2003.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 140

In revolution 140 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).

Revolution 141

In revolution 141 a raster dithering observation of the Vela region (RA 08:27:54.70; DEC -46:18:18.4) was performed for ~60 hours. This was followed by 3 pointings of a GPS lasting ~2 hours.

Revolution 142

The observations in revolution 142 consisted of 11 pointings of a GPS, lasting ~7.5 hours, followed by an amalgamated raster dithering observation of Cassiopeia A (RA 23:51:43.00; DEC +62:03:55.0) performed for the remaining ~53 hours of observation time.

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

2003-11-27T09:18:39.000Z	173.8460	F	Manual Processing of 0137_0505_M.RWB
2003-11-28T16:00:02.000Z	173.8290	F	Automatic TM processing.
2003-11-30T05:38:46.000Z	173.8250	F	Automatic TM processing.
2003-12-01T16:14:17.000Z	173.8064	F	Automatic TM processing.
2003-12-02T18:02:12.000Z	173.7915	F	Automatic TM processing.
2003-12-03T05:32:21.000Z	173.7807	F	Automatic TM processing.
2003-12-03T08:53:42.000Z	173.7635	F	Automatic TM processing.
2003-12-03T12:45:00.000Z	173.7430	F	After thruster torque calibration
2003-12-03T14:11:42.000Z	173.7221	F	Automatic TM processing.
2003-12-04T15:43:21.000Z	173.7029	F	Automatic TM processing.
2003-12-06T05:26:29.000Z	173.6830	F	Automatic TM processing.
2003-12-07T15:55:28.000Z	173.6596	F	Automatic TM processing.
2003-12-09T05:33:40.000Z	173.6341	F	Automatic TM processing.
2003-12-10T15:44:24.000Z	173.6084	F	Automatic TM processing.
2003-12-12T05:44:04.000Z	173.5878	F	Automatic TM processing.

This report was generated Fri Dec 12 08:00:09 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, 53 Open Loop Slews, 201 Closed Loop Slews and 6 Momentum Bias were executed. 8 slews were missed or executed manually. This is equivalent to a 3.1%.

06/12/03 (Day of Year 340, Revolution 139-140)

Star Tracker 1750 Processor fault: At 00:10:24.046, a STR 1750 Processor Fault terminated the mapping that was commanded after Close Loop Slew 01390104. The situation was the same as the one of Pointing 01390067 (refer to INTEGRAL Mission Report No. 063, Sect. 8.3.1):

- RA: 08:15:17.37, DEC: -48:11:12.9, POS: 132:20:25.4
- Guide Star was TYCHO# 8140-06536-1, CCD (12303, -6636) located in ESW 8 and 5.7 Mi, which was commanded for the Close Loop Slew
- After the fault, the ACC commanded a new mapping. During this mapping the Guide Star TYCHO# 8140-04503-1 with magnitude 8.3 and located at CCD (9874, -4301) was picked. This is in ESW 1 and very close to the border between ESW 1 and ESW 8. The mapping failed again while processing ESW 8.

- 8 more mappings failed in exactly the same way.
- Finally the 10th mapping was completed normally with Guide Star TYCHO# 8140-04503-1.

The OTF remained low during Pointing 01390104. This was not however a science observation (below the critical altitude).

Star Tracker 1750 Processor fault, OTF Low during PID 01400012: The STR 1750 processor Fault happened at 13:54:44.009 during the mapping after Close Loop Slew 01400012. This was the same attitude and exactly the same conditions as the previous pointings with this fault. Two mappings failed and the third mapping was completed normally. The OTF remained Low during PID 01400012.

07/12/03 (Day of Year 341, Revolution 140)

Star Tracker 1750 Processor fault, OTF Low during PID 01400060: The STR 1750 processor Fault happened at 15:21:12 during the mapping after Close Loop Slew 01400060. This was the same attitude and exactly the same conditions as the previous pointings with this fault. Two mappings failed and the third mapping was completed normally. The OTF remained Low during PID 01400060.

08/12/03 (Day of Year 342, Revolution 140)

Star rejected in the Search-and-Track of Close Loop Slew 01400082: The STR Search/Track that was commanded before Close Loop Slew 01400082, to pick the star for slew, failed in the first cycle (Search) because the star was rejected. Bit 5 of the STR Health Check Status 2 was set to 1: STARS REJECTED. The commanded star was TYCHO# 7684-01734-1 with instrumental magnitude 7.76. This star was detected in the previous mapping at CCD coordinates (-28542, 16323) with magnitude 8.0. During the Search/Track process, the Star(s) Rejected is reported in STR HC2 when the Large Object or Minimum Distance criteria are not satisfied in the Search cycle. However, there is nothing peculiar about the commanded star. There is only a very dim star (7684-01645-1) of magnitude 10.54 at a distance of 2.3 arc-minutes. This magnitude is below the lower limit of the STR Dynamic Range for this class of stars (K0).

After the slew failed, a manual mapping was commanded during which 7684-01734-1 was detected again with magnitude 8.00. This star was selected once more for the manual Close Loop Slew to the attitude of Pointing 01400083 by the FDS. This time the Search/Track was performed, the star was picked and it was used for the slew. Only Pointing 01400082 was lost.

Uplink of the updates from RCS-A Thruster Calibration: With the results of the RCS-A Thruster Calibration that was performed on 03/12/2003 and from the estimations of the thrust level and remaining fuel mass the following updates were made:

- | | |
|---|------------------|
| • Update of the RCS-A Thruster Torque Reciprocals | 08/12/2003 15:20 |
| • Update of the Spacecraft Inertias | 08/12/2003 15:40 |
| • Update of AMD On times for RCS-A | 08/12/2003 16:10 |

- Update of TIM thresholds (only YTIM and TTIM) 08/12/2003 17:27
- In addition to the above, the results were used to update the FDS data for RCS-B

Star Tracker 1750 Processor fault, OTF Low during PID 01400108: The STR 1750 processor Fault happened again at 18:03:24 during the mapping after Close Loop Slew 01400108. This was the same attitude and exactly the same conditions as the previous pointings with this fault. ACC commanded a new mapping and Guide Star 8140-04503-1 was picked. The OTF remained Low during PID 01400108.

It was requested from the Flight Dynamics to exclude TYCHO# 8140-06536-1 in their system. This was the Guide Star that was always selected by the FDS for Close Loop Slew to RA: 08:15:17.37 and DEC: -48:11:12.9. Because of its proximity to a bright object in the STR FoV (see INTEGRAL Mission Report No. 063, Sect. 8.3.1) 1750 Faults were occurring whenever a mapping was done while this star was selected as the Guide. After the star was excluded, no more problems were encountered at this attitude, which was visited a few more times.

09/12/03 (Day of Year 343, Revolution 140-141)

Update of ACC IMU Drift Corrections: Starting at around 11:10:00, the ACC IMU Drift Corrections were updated with the results of the IMU1/IMU2 calibration that had been performed on 05/12/2003.

10/12/03 (Day of Year 344, Revolution 141)

Slews/Pointings lost due to Ground Station problem (Goldstone Dss-16): At 20:38 after station handover from Redu To Goldstone, RFI caused loss of all links from the station. Slew 01410070 was performed but the update of Broadcast Packet at the start of PID 01410070 failed uplink. At 21:03 the Timeline was stopped and Slews/Pointings 01410071 to and including 01410073 were missed. After TM/TC was restored a manual slew was performed to the attitude of PID 01410073. The next slew was performed from the Timeline.

11/12/03 (Day of Year 345, Revolution 141)

Slew missed due to loss of packets: At 02:39 the command to start the Sun-Steering Law failed uplink due to Dynamic PTV No-Go. This was caused by loss of a packet that contained the TM for the confirmation of the previous TC, report of pending SSL parameters. Reed Solomon Error warnings were being received during this time and the altitude was about 142000 km. The Reed Solomon errors are attributed to a low link margin near the apogee. Slew/Pointing 01410081 was missed. A manual slew was performed to the attitude of PID 01410081 and the next slew was performed from the Timeline.

Command in slew sequence failed uplink due to late AD verification of previous TC: At 17:44 the TC to report the pending Search/Track parameters failed uplink due to Dynamic PTV in Wait. As previously reported, this problem is seen during Goldstone passes in which the CLCW is extracted from VC0 packets at the station. An unfavourable distribution of VC0 packets can then cause late AD verification of

the TC and result in the uplink failure of the next Interlocked command. Recently, this problem has been happening quiet often. It is planned to adjust the onboard CLCW ratio in favour of VC0 CLCWs to avoid this problem. The failed TC was part of a Close Loop Slew sequence. After verification of the first command came, the Interlock on the AOCS subsystem was cleared by a bug in the IMCS software and the remaining TCs of the sequence were uplinked. Since the failed TC was a report command, nothing went wrong and the slew was performed nominally.

12/12/03 (Day of Year 346, Revolution 141-142)

AOCS During Eclipse: The first eclipse of the season occurred during the perigee of revolutions 141-142. The eclipse timers and the Time-Tagged TCs to enable IMU autonomous switch off after the eclipse were loaded at the beginning of revolution 141 from the Timeline. The IMU health check was performed at the planned time and the eclipse was completely nominal from and AOCS point of view. Some details regarding the AOCS eclipse operations/monitoring are given in the table below.

AOCS ECLIPSE MONITORING

Revolution: 141-142

Date: 12/12/2003

DoY: 346

Penumbra Start: 12/12/2003 04:35:47

Umbra Start: 12/12/2003 04:37:29

Umbra End: 12/12/2003 04:59:59

Penumbra End: 12/12/2003 05:02:01

LOS: 12/12/2003 00:28:59

AOS: 12/12/2003 04:32:34

Eclipse Duration: 0:26:14

Eclipse Duration [sec]: 1574

IMU Health Check Start 11/12/2003 21:03:59

Eclipse Imminent Flag 12/12/2003 03:36:07

ACC IMU AutoCal Start 12/12/2003 03:50:33

ACC IMU AutoCal End 12/12/2003 04:10:33

Sun out of FSS FoV 12/12/2003 04:37:05

Sun back in FSS FoV 12/12/2003 05:00:15

Eclipse Timers	From Loaded Timers		Actual From Telemetry		UM [sec]	LSB [sec]
	Absolute	WRT Pen. Start [sec]	Absolute	WRT Pen. Start [sec]		
ACC Eclipse Start	12/12/2003 04:18:10	-1057.00	12/12/2003 04:18:11	-1056.00	-1064	
FDE Eclipse Start	12/12/2003 04:29:09	-398.00			-404	176
FCE Eclipse Start	12/12/2003 04:29:53	-354.00			-360	176

	From Loaded Timers		Actual From Telemetry		UM [sec]	LSB [sec]
	Absolute	WRT Pen. End [sec]	Absolute	WRT Pen. End [sec]		
FCE Eclipse End	12/12/2003 05:08:13	372			360	176
FDE Eclipse End	12/12/2003 05:08:13	372			360	176
ACC Eclipse End	12/12/2003 05:11:46	585	12/12/2003 05:11:47	586.00	578	

IMU	Uplink	Execution	WRT Penumbra End [sec]
IMU Auto Off Enable	09/12/2003 05:15:19	12/12/2003 05:13:41	700
IMU On	11/12/2003 21:23:04	IMU H/C Noise Roll [as/s]	0.1884
IMU Off	12/12/2003 05:14:00	IMU H/C Drift Roll [as/s]	0.2421
IMU On Time	7:50:56	IMU Auto Cal Result [as/s]	0.2052

Slows/Pointings lost due to loss of TC link form Redu: At 15:26 the TC link from Redu Ground Station was lost (no clear reason given). The AOCS commanding from the Timeline was disabled and slew 01420015 was missed. The TC link was re-established at 15:36 and then a manual Open Loop Slew was performed to the attitude of Pointing 01420017. Pointings 01420015 to and including 01420017 were affected. The next slew was performed from the Timeline.

Loss of Guide Star due to False Event: At 16:44:57 an undetected False Event caused a jump of -130 arc-sec in Pitch and +104 arc-sec in Yaw in the position of the Guide Star, as seen by the STR. The Guide was at CCD (6812, -1879) and had a magnitude of 8.35. This caused generation of Pitch and Yaw Error OOL by the ACC. In the next cycle, the real Guide Star was detected as False Event and its status was latched as false event until the STR SEU Filter Threshold was exceeded and the star

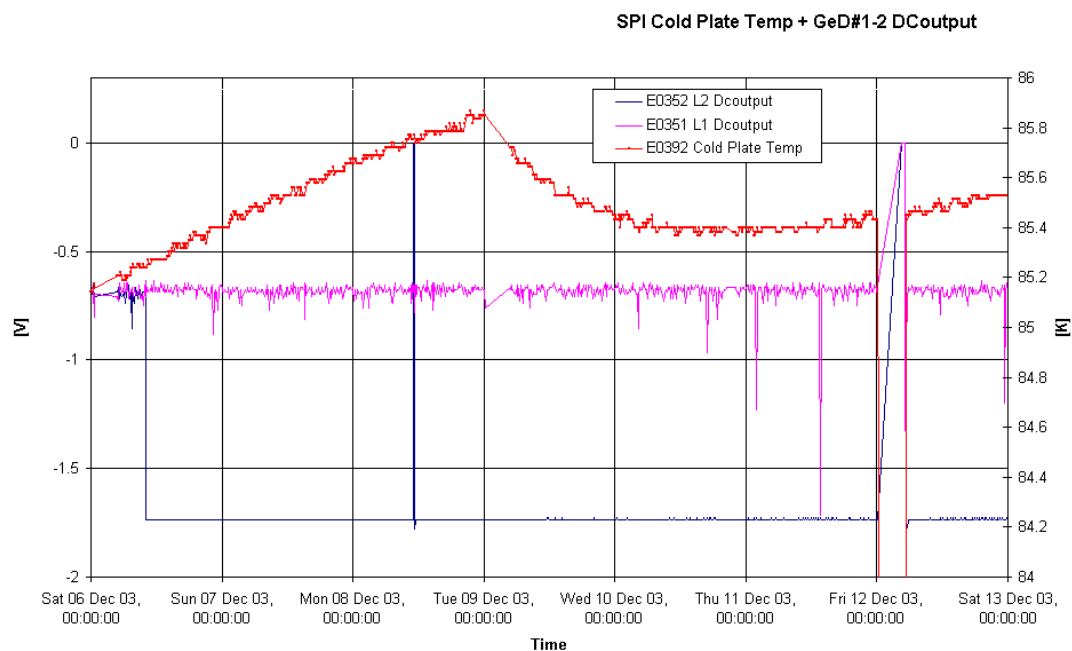
was released. New mapping was commanded and another guide star was selected: (-5349, 2517), 8.3 Mi. The OTF remained Low for the rest of PID 01420017. The altitude was about 104000 km. IREM was also showing some spikes in the radiation levels during this time.

8.3.2 SPI Operations

Cryocooler:

After the completion of the planned annealing cycle and the subsequent cryo-cooler start-up in the previous weeks, the observation period was characterized by the fine-tuning of the detector camera temperatures.

In this phase the cryo-cooler was commanded to maintain 85 K within a band of ± 0.9 K. The plot below summarizes the information on the Cold Plate Temperatures and on the DC output voltages for GeD # 1 and #2. The estimated Cold Plate temperature drift was ~ 0.1 K/day at the end of the observation period.



On DOY 2003.342 (08/12/03) at 23:47Z the SPI compressor strokes for the CDE1(sections A+B) were set to the value 37.

IASW/DPE:

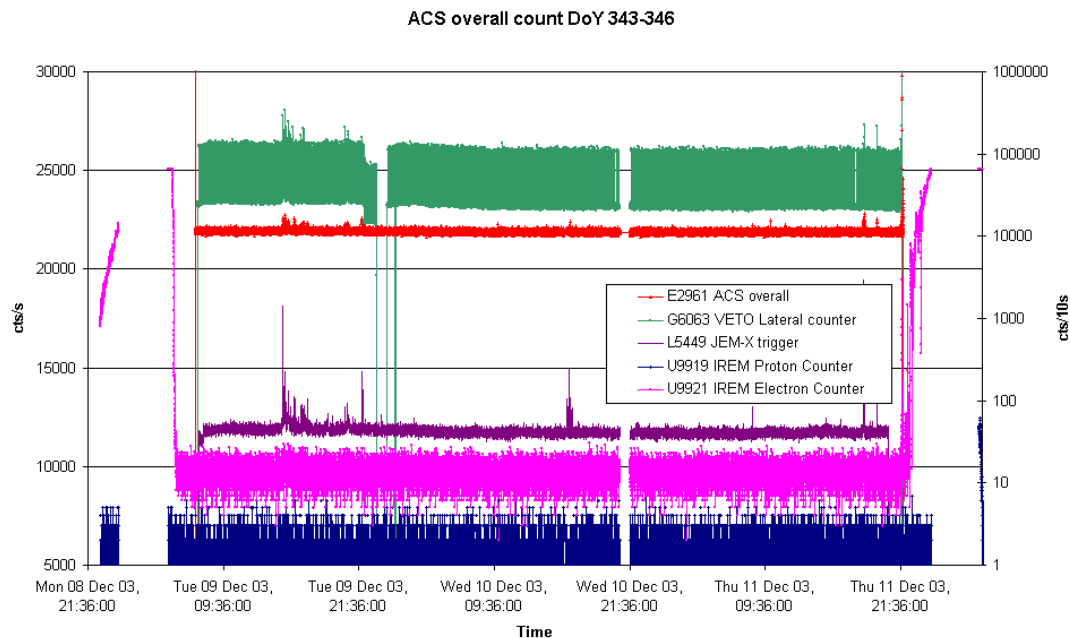
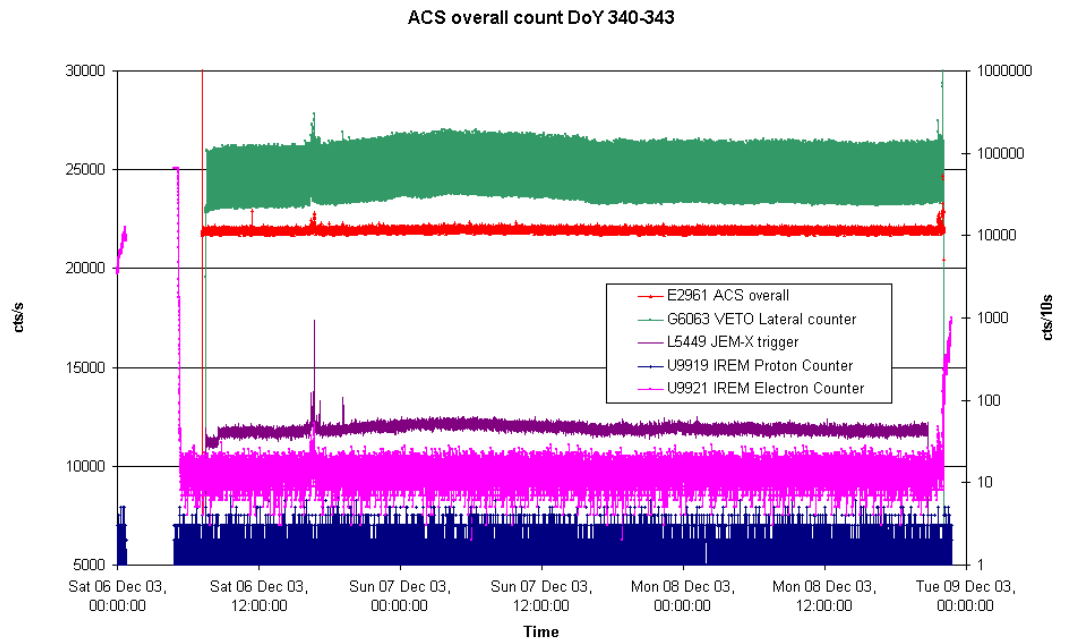
Nothing to report.

ACS:

DOY 2003.345 (11/12/03)

At 2:49 the parameter E2121 (VCU AC current) was reported OOL ($=1.39$ A). No action was taken and the out of limit was clarified when the first report commanded by the automatic timeline was received.

The following plots show the ACS overall count rate evolution during the observation period.



AFEE:

DOY 2003.340 (06/12/03)

At 10.07 an anomaly in the pre-amplifier PA2 of the SPI Germanium Detector #2 was observed. No count-rate was reported by ISDC almost in the same period. The problem was identified later in the DC output voltage of the pre-amplifier that changed from an average value of -0.6 V to -1.7 V. Since Saturday 06/12/03, no further count rates were produced by the GeD #2;

DOY 2003.341 (07/12/03)

First recovery of the GeD#2 detector attempted by executing OCR 160:

- 1) at 14:46 the SPI was set to CONF mode ;
- 2) at 15:08 the HV of GeD2 set to 1 kV, with all the other detectors remaining at 4 kV;
- 3) at 15:25 the SPI was set to PHOTON Mode.

No count-rate was reported by the unit.

DOY 2003.342 (08/12/03)

A second attempt to recover the detector #2 was performed at 10:33:

- 1) Power cycle of the high and low voltages power supplies for GeD #2 and set of the HV to 0.5 KV (i.e. a reduced value respect the nominal 4 KV) only for GeD #2
- 2) During the recovery the problem, affecting the pre-amplifier of the GeD#2, was still present and was reported only a slight increasing over the 1 lsb variation of the # 2 DC-output voltage; the value was -1.737 V against a nominal value of - 0.6 V;
- 3) at 11:37Z the unit was set back in PHOTON Mode.

A third attempt to recover the detector was executed at 14:28:

- 1) The recovery consisted in enabling/disabling the high energy clamping for the pre-amplifier of GeD #2;
- 2) During the recovery at 14:43 the unit was set in PPM for few minutes with the clamping enable, to perform a short acquisition; no count-rate coming from GeD#2 was reported by SPI Team connected to the ECOE at ESOC;
- 5) After the recovery the problem was still present and at 14:52 the unit was set back to the PHOTON Mode.

The SPI team reported as additional information:

- Observed anomalous drift of the SPI compressor temperature >0.2 deg K/day against a nominal value of 0.01 deg K/day, after the 3rd annealing;

A SPI MRB was held on DoY 2003.343 (09/12/03). The following actions were assigned to clarify the anomaly:

on SPI Team:

- To investigate whether the thermal behaviour after the recent annealing was nominal
- To distribute the detailed drawing of the electrical circuits as drawing AN3-4 of the EID-B provides a functional overview only.
- Provide with the drawing a list of used types of components (JFET, diodes) and their characteristics
- Try to reproduce the -1.7 V output on the preamplifier on the FS

on Project:

- To collect the reports on the FEE #57 failure study
- To clarify whether the amplifier type A250 was also used in the ACS FEE

The Main conclusions of the MRB were:

- Setting the HV of GeD#2 to 0 V.
- No need to change the SPI operation strategy for the incoming Eclipse season.

DOY 2003.343 (09/12/03)

At 06:11 the parameter E3825 (U PD 5V+ANL L) was reported OOL LOW for few TM cycles. No further action was taken.

At 17:24 following the conclusion of the SPI MRB held on DoY 342, the HV of GeD#2 was set to 0.0 V.

DFEE:

Nothing to report

PSD:

DOY 2003.340 (06/12/03)

At 16:26 the parameter P2016 was reported OOL for few TM cycles. No further action was taken.

8.3.3 IBIS Operations

There were a few reportes during the Belt passages 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.

DOY 2003.340 (06/12/03)

Nothing to report.

DOY 2003.341 (07/12/03)

At 21:30 the stop of the IBIS/PICsIT Histogram downloading due to a previous Station Handover Redu->Goldstone occurred. At 21:35Z the OR 109 to recover the anomalous condition was performed.

DOY 2003.342 (08/12/03)

At 18:49 the parameter G2056 (IOE-OVFWPXADD-M4) was reported OOL for few TM cycles. No further action was taken

DOY 2003.343 (09/12/03)

At 05.05 the parameter family G5008 was reported OOLs due to the high radiation background inside the Radiation Belts.

Reported an anomaly on the VETO VDM # 15:

1) at 22:06 the parameter G6049 (VDM 15 HV) was reported out of limits ALARM LOW, the value was -55.80 V; the VDM 15 temperatures were in limits and consistent with the others VDMs. The VETO lateral and bottom count rate dropped down from ~23000 cts/s to 22000 cts/s. The VETO current was 1.55 A against a nominal value of 1.6 A and the VDM/CDM current dropped to 0.95 A against a nominal value of 1.00 A;

2) at the same time the IASW was generating the OEM ID 186 Class 2 << IBIS1 VETO PMTXX IS ON AND CORRESPONDING HV MONIT IS ABOUT ZERO>>

3) at 23:10, following the OOL reaction reported in the payloads FDIR doc, the VETO was set in Stand-By Mode switching off all the HVs ;

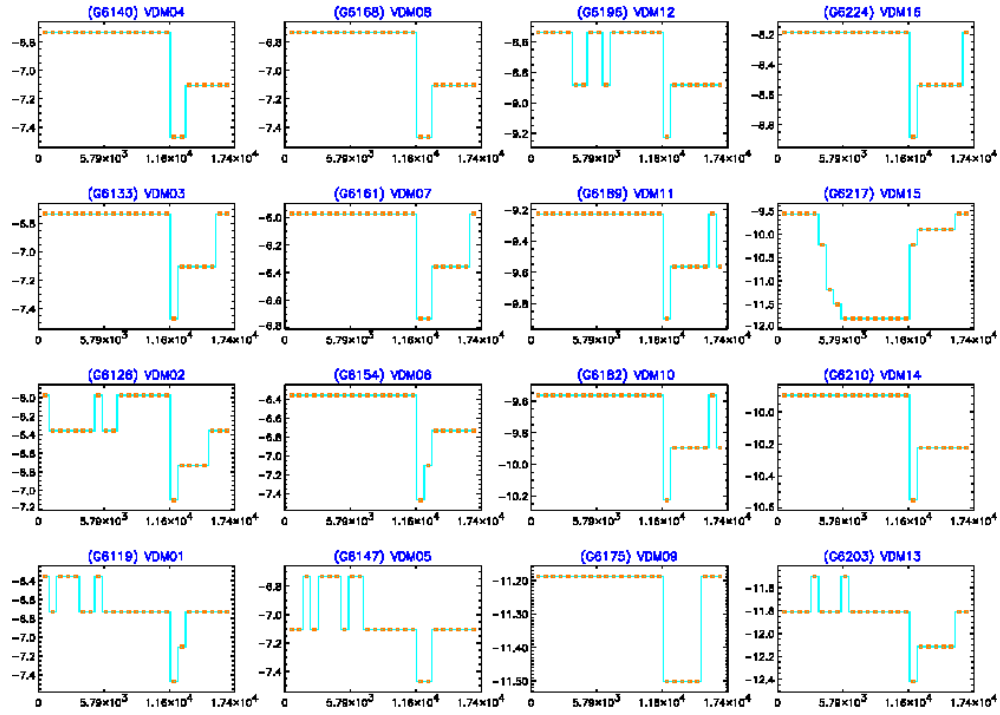
4) at 00:06 was started the recovery of the VDM 15 by using the OR 0018 (VETO HVs break down). The VETO was set back in Maintenance Mode and left in monitoring for ~45 minutes. The value of the HV was Nominal for all the period and no anomaly occurred again;

5) at 00:51 VETO was set back in Nominal and IBIS in SCI Standard Mode. For all the observation period the VDM 15 HV was = 990.72 (nominal) and the VETO counters were both ~23400 cts/sec.

The reason of is under investigation but should be remarked that this problem had not occurred since December 2002. In the past resulted that all the VDMs (11-12- 4) affected by the break down were those positioned on the -Z side of the unit (i.e. not directly illuminated by the sun): possible reason temperature effect (colder part) together with a not complete out-gassing of the unit. This time the anomaly happened in the VDM 15 that is positioned on the +Z axis i.e. in direction of the Sun a year after launch, few days after an anomaly on the SPI GeD #2 (see AR 72). It should be considered a possible effect of S/C surface charging with consequent static discharge following the exceptional solar event at the end of October. The anomaly is recorded in **AR 73**.

Hereafter follow the plots of the VDMs HVs and temperatures during the anomaly:

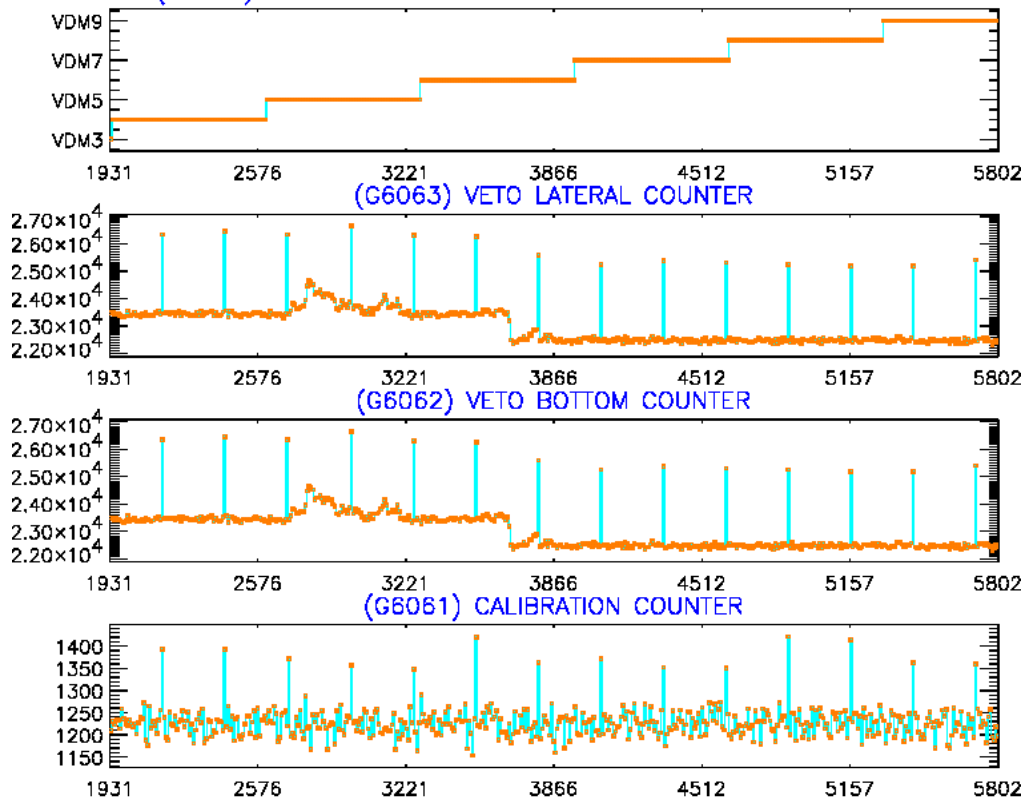
VDM HPVS Temperatures



RUN ID: 28172;
 Start Time (OBT): 9214 s
 Time Unit = sec

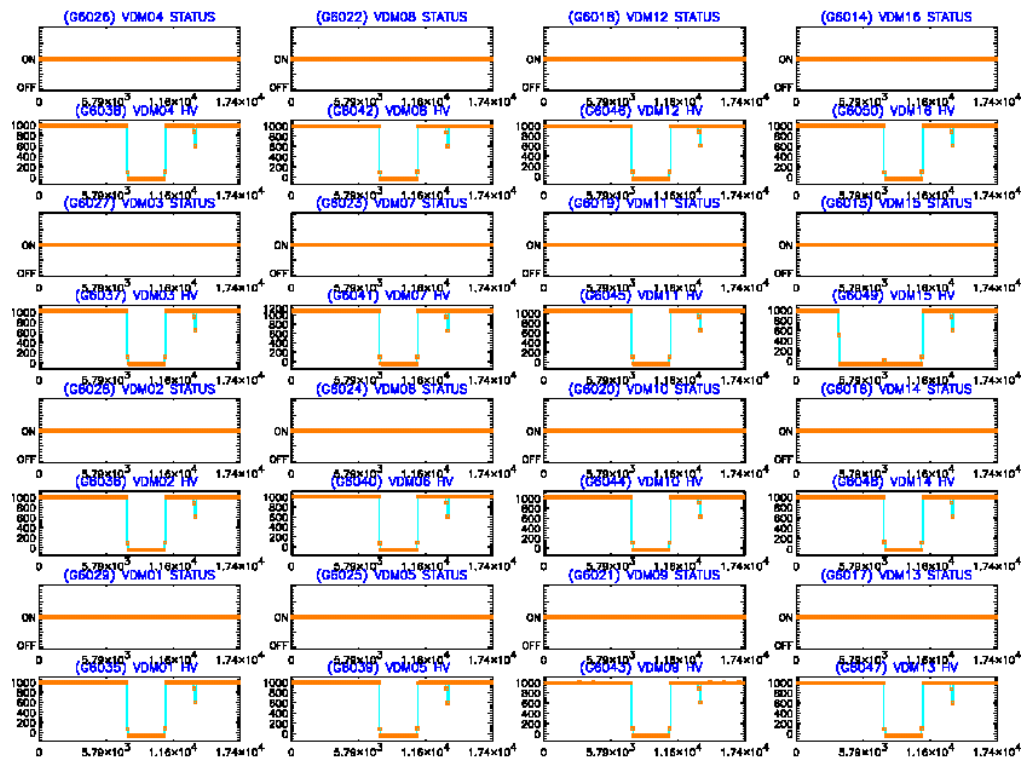
VETO Counters

(G6230) MODULE CURRENTLY UNDER SAMPLING FOR H4 SPECTRA

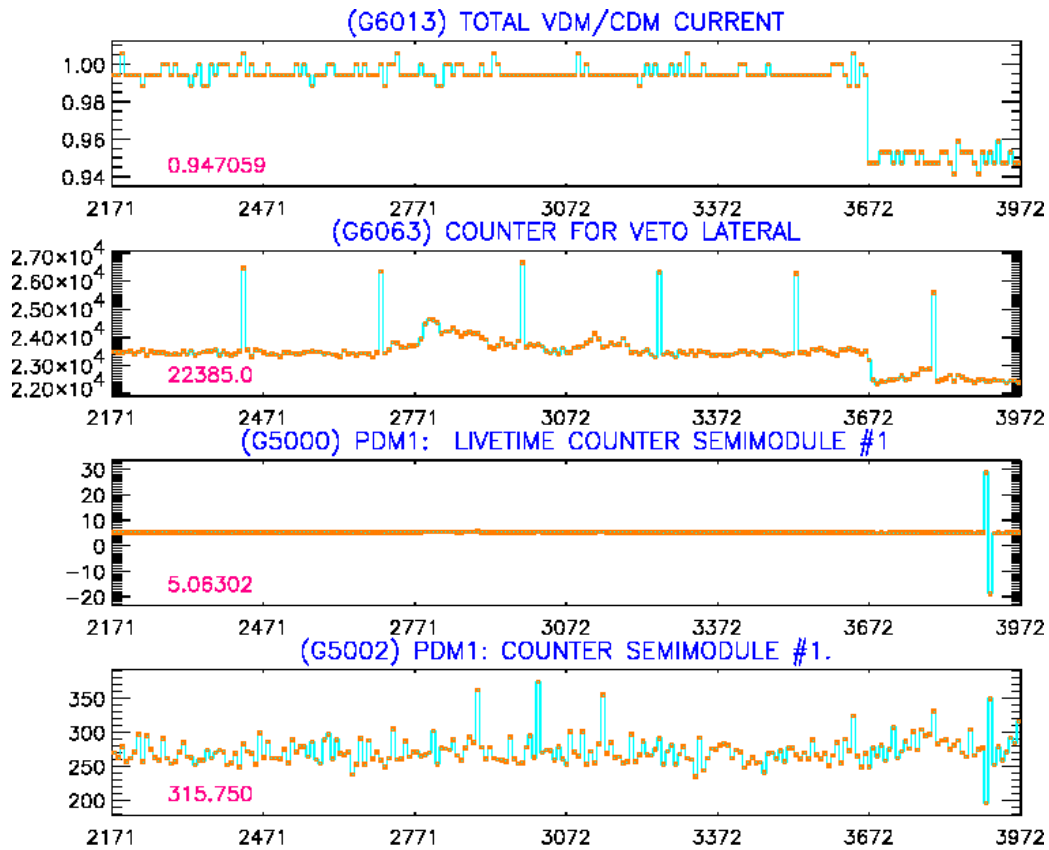


RUN ID: 28172;
 Start Time (OBT): 9214 s
 Time Unit = sec

VDM HV and Status

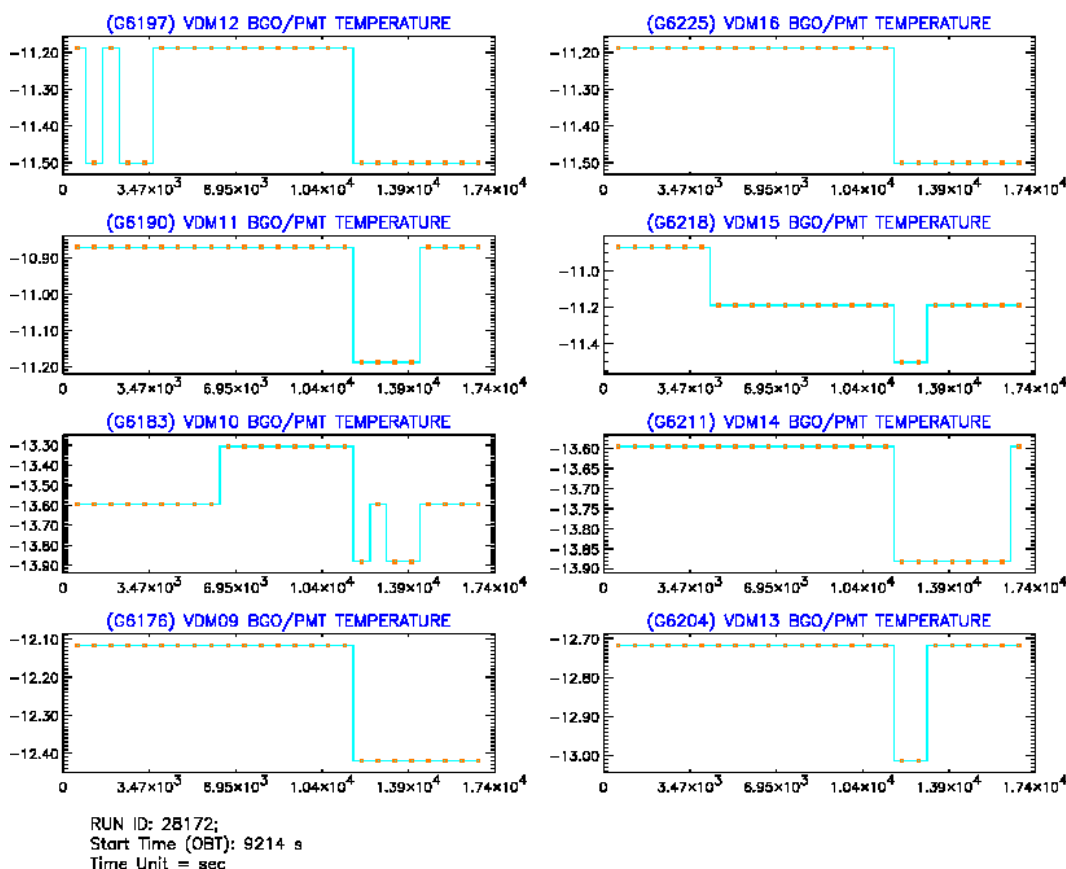


RUN ID: 28172;
 Start Time (OBT): 9214 s
 Time Unit = sec



RUN ID: 28172;
 Start Time (OBT): 9214 s
 Time Unit = sec

/users/ecoe/IPAMON/Veto_Jat_temp.set



DOY 2003.344 (10/12/03)

At 22:04 the OEM ID 131 Class 2 <<IBIS1 IASW LSL TRANSFER FAIL REPORT FOR HIGH-LEVEL>> together with OEM ID 133 Class 2 <<IBIS1 IASW LSL TRANSFER FAIL REPORT FOR LOW-LEVEL>> was reported. Monitoring the repetition of the OEMs, as suggested in the FDIR doc, no further occurrences of the OEMs above were found.

DOY 2003.345 (11/12/03)

At 20:55 the parameter G2000 (IOE-OVFWPXADD-M0) in OOL for few TM cycles was reported. No further action was taken.

At 21:23 the automatic transition to Safe configuration (IASW In Stand-By + HVs OFF) due to the high radiation background few minutes prior the S/C broadcasted Radiation Belts entry time occurred.

DOY 2003.346 (12/12/03)

At 13:30 the parameter family G5072 (semi-modules FIFO error flag) went OOLs. Following these error flags, the PICsIT counters started to decrease slowly and after 16 minutes all the count-rates went in OOL (=0 cts/sec).

After ~5 minutes (13.30Z) the following OEM APID 1280 ID 132 Class 0 << IBIS HEPI IASW RESYNCH>> flagged the resynchronization of the HEPI-PICsIT HBR interface and the resolution of the problem. This behaviour is known since the beginning of the mission and happens occasionally due to a loss of synch between the PFDM (PICsIT FIFO) and the HEPI. No re-action is triggered for the operator because the unit is able to solve the conflict by performing a resynchronization.

8.3.4 JEM-X Operations

2003-12-06, DOY 340, Rev 139-140

Nothing to report

2003-12-07, DOY 341, Rev 140

Nothing to report

2003-12-08, DOY 342, Rev 140

Nothing to report

2003-12-09, DOY 343, Rev 140-141

The new configuration for JEM-X High Voltage activation was implemented at the start of revolution 141. The initial high voltage activation, followed by 15 minutes spent in Data Taking mode and then the high voltage adjustment was performed by the ED LEACT_02, executed from the automatic Timeline at 2003-12-09T07:20:24Z. This ED is scheduled in the POS by ISOC and replaces the previously scheduled sequence of EDs LEVHON01, LEDATA01 and LEHVAJ01.

2003-12-10, DOY 344, Rev 141

Nothing to report

2003-12-11, DOY 345, Rev 141

Nothing to report

2003-12-12, DOY 346, Rev 141-142

The first eclipse of the third eclipse season took place at the start of revolution 142. The reconfiguration of both JEM-X units following the eclipse was nominal. During the post-eclipse reconfiguration, the unusual sequence of reported state transitions of the JEM-X2 DFEE, observed following the lunar eclipse in revolution 135 (see Integral Mission Report # 62), was observed again. However, this has been explained by the JEM-X PI as being due to the loading of the stored patches from the DPE to the DFEE which, being a high priority task, may result in one or more packets

being received with no data from the DPE. In fact, all HK values from the DPE and DFEE for the packet in question were 0.

At 17:16Z the following radiation monitoring parameters from IREM went Out of Limits:

K5317 RAD MONITOR 3 (Electron Counter), value = 80
L5317 RAD MONITOR 3 (Electron Counter), value = 80,
causing JEM-X2 to transition to Safe mode autonomously at this time (issuing OEM 231 JEM-X2 AUTO EVENT 1).

At 17:29Z 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. Commanding to JEM-X2 from the Timeline was then disabled at 18:05Z.

At 18:31Z the procedure FCP_JEM2_1010 (JEM-X2 Configuration Setting for Science Ops) was executed and at 19:03Z JEM-X2 was then commanded back to Data Taking mode by the procedure FCP_JEM2_0044.

At 19:06Z commanding to JEM-X2 by the automatic Timeline was enabled and JEM-X2 operations continued nominally.

8.3.5 OMC Operations

On DoY 342, at 03:58, two command were rejected:

```
2003.342.03.58.50.306 2003.342.03.58.42.395 1792 Real Time
Rejection 131 REJECTED TC1
FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=130,RESET IM
M9068=1 FIX2=0 M9069=1555
2003.342.03.58.58.637 2003.342.03.58.48.395 1792 Real Time
Rejection 131 REJECTED TC1
FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=60,IM A M9068=1
FIX2=0 M9069=1556
```

This corresponds to the time when due to AOCS problems pointing 01400082 was delayed, the pointing finally started at: 04.22.10.

On DoY 344, starting at 20:08 to 22:46 RFI from the ground station caused numerous problems, the impact on OMC was that pointings 01410070 to 01410073 were lost.

On DoY 345 at 02:39, due to a failed AOCS command caused by loss of packets, pointing 01410081 was missed. The timeline was recovered and the next pointing proceeded nominally.

On DoY 345, at 09:07, the following OEMs were received:

```
2003.345.09.07.14.865 2003.345.09.07.08.669
1792 Real Time Exception 7 OMC CONSTRAINT D
M9073=4,IASW TASK 4 M9079=1 M9080=7 M9076=11 M9067=20216
```

Doc. Title : INTEGRAL Mission Report # 64
Doc. Ref. : INT-MOC-SYS-RP-1001-TOS-OF
Date : 15/12/03

Issue : 1
Rev. : 0
Page : 26

```
2003.345.09.07.14.983 2003.345.09.07.08.669
1792 Real Time Anomaly 5 OMC CSSW INT ER
FIX6=0 M9079=2 M9080=5 M9074=4 M9067=5531
```

This corresponds to about 3 minutes after the start of pointing 01410093, there appears to have been no further effect, and the pointing proceeded nominally.

On DoY 345, at 21:43 OMC autonomously switched to SAFE mode due to the high radiation level, the planned time for this switch would have been 21:51.

```
2003.345.21.43.54.399 2003.345.21.43.43.443 1792 Real Time Event 231 TO
SAFE
FIX2=0 M5010=2,SAFE M9079=0 M9080=231 M5800=823,RAD 3 M5899=2973
```

The impact was pointing 01410114 was cut short by 8 minutes.

On DoY 346 at 07:14, CMD M1131 failed release, at 07:21, OMC was disabled in the autostack, at 07:46 CMD M1151 (OMC Exit from SAFE, FCP_OMC_0041) was executed, and OMC was immediately re-enabled in the autostack, the scheduled pointing started almost immediately, and there was no loss of data.

On DoY 346, at 16:24, two more commands were rejected:

```
2003.346.16.24.10.468 2003.346.16.24.00.979 1792 Real Time
Rejection 131 REJECTED TC1
FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=130,RESET IM
M9068=1 FIX2=0 M9069=2288
2003.346.16.24.18.782 2003.346.16.24.06.604 1792 Real Time Event
172 CENT WIN OUT
FIX2=0 M5010=6,NORMAL M9079=0 M9080=172 M5916=65436 FIX10=0
M5621=8
2003.346.16.24.18.758 2003.346.16.24.06.604 1792 Real Time Event
179 CENT CYCLE
FIX2=0 M5010=6,NORMAL M9079=0 M9080=179 FIX8=0 M5917=77
M5910=0 M5911=156
2003.346.16.24.18.795 2003.346.16.24.07.604 1792 Real Time
Rejection 131 REJECTED TC1
FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=60,IM A M9068=1
FIX2=0 M9069=2289
```

This corresponds pointing 01420017 and to the time when due to AOCS problems pointings 01420015 to 01420017 were lost.

8.3.6 IREM Operations

The evolution of the IREM counters from rev 140->142 are shown below.

