

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 115
Week 49
06.12.04
Routine Phase

Prepared by: M. Walker (OPS-OFO)

LIST OF CONTENTS

1	General.....	3
2	Summary of Activities.....	3
3	Satellite Status.....	3
3.1	Platform	3
3.1.1	AOCS	3
3.1.2	Power	3
3.1.3	Thermal.....	4
3.1.4	OBDH.....	4
3.1.5	RFS	4
3.2	Payload	4
3.2.1	SPI	4
3.2.2	IBIS	5
3.2.3	JEM-X	6
3.2.4	OMC.....	6
3.2.5	IREM	6
4	Ground Facilities.....	7
4.1	Mission Operations Centre.....	7
4.2	Ground Stations & Network.....	7
4.3	Science Ground Segment.....	7
4.3.1	ISOC	7
4.3.2	ISDC.....	8
5	Special Events.....	8
6	Anomalies.....	8
7	Future Milestones	8
8	Appendix.....	10
8.1	Overview of Revolutions	10
8.2	Consumables	10
8.2.1	Detailed Fuel Book-keeping.....	10
8.3	Detailed Satellite Information	11
8.3.1	AOCS Summary Operations Report 27/11/2004-03/12/2004	11
8.3.2	SPI Operations.....	13
8.3.3	IBIS Operations.....	16
8.3.4	JEM-X Operations.....	21
8.3.5	OMC Operations	25
8.3.6	IREM Operations	25

DISTRIBUTION LIST

Addressees	Copy	Addressees	Copy
D/OPS		ESA HQ	
G. Winters D/OPS	1	D. Southwood D/SCI	1
W. Frank OPS-O	1		
A. Smith OPS-OF	1	ESTEC	
J. F. Kaufeler OPS-G	1	J. Louet SCI-P	1
N. Bobrinsky OPS-ON	1	A. Gimenez-Canete SCI-S	1
R. Münch OPS-GF	1		
		ESTEC / PG	
M. Schmidt	1	G. Sarri	1
R. Southworth	1		
F. Di Marco	1		
F. Cordero	1		
M. Walker	1		
M. Rezazad	1		
P. Lippi	1	ESTEC/RSSD	
R. Lemme	1	M. Kessler SCI-SD	1
S. Fahmy	1	C. Winkler	1
SPACONs	1	A. Parmar	1
O. Bergogne	1	L. Hansson	1
I. Bayliss	1	E. Kuulkers	1
G. Di Girolamo	1		
F. Dreger	1		
G. Gienger	1	ESTEC/SCI-A	
S. Pallaschke	1	Nicola Rando	1
W. Hell	1		
K. Capelle	1	ISDC	
M. Butkovic	1	T. Courvoisier	1
D. Heinzer	1	R. Walter	1
G. Servoz	1	N. Mowlavi	1
Shift - Coord	1	ISDC Shift Team	1
Scheduling Office	1	D. Texier	1
T. Beck	1		
B. Smeds		ALENIA	
S. Scaglioni	1	M. Montagna	1
J. Wardill	1	F. Ravera	1
M. Unal	1		
		PI / Instrument Teams	
Redu		J. P. Roques – SPI	1
B. Demellenne	1	G. La Rosa – IBIS	1
		S. Brandt – JEM X	1
		E. De Miguel - OMC	1
		W. Hajdas – IREM	1
		JPL / Goldstone	
		D. Holmes	1
		J. Valencia	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 27.11.04 until 03.12.04 (both dates inclusive) and covers the revolutions 259, 260 & 261.

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 Galactic Plane; Cygnus X-1 (RA 19:58:21.68; DEC +35:12:05.7); NGC 7172 (RA 22:02:1.70; DEC -31:52:18.0); MCG-2-58-22 (RA 23:04:43.48; DEC -08:41:08.6) and Cassiopeia A (RA 23:51:39.6; DEC +61:41:40.5). The activities consisted of GPS observations as well as hexagonal and raster dithering 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.

The Eclipse season continued with the 2nd, 3rd and 4th eclipse passages. The eclipses were nominal from an AOCS point of view.

Two slews (CSL) were missed from the Timeline during this period when the STR failed to track the commanded guide star.

The LOBT clock wraparound occurred at on DoY 336 at 19:01:07z.

The fuel consumption over the period between 26/11/2004 and 02/12/2004 was 0.3661 kg. The remaining propellant is in the order of 166.1063 Kg.

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

3.1.2 Power

The EPS is working nominally, available power from the arrays is of the order of 2100W.

In line with the increasing eclipse duration the MRU Timer threshold was adjusted twice. On 30/11/2004 it was changed to a value of 31 counts, (2 hours 27 minutes) and on 2/11/2004 it was increased again to 35 counts (3 hours 46 minutes).

To date all eclipse passages have been nominal from an EPS point of view, the batteries Depth of discharge and recharge duration have been in line with predictions in all cases.

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 was identified.

3.1.5 RFS

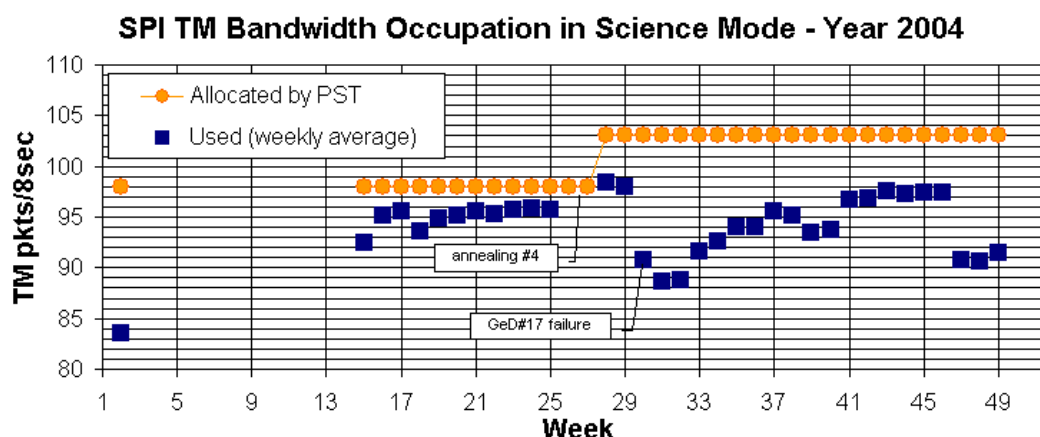
The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

3.2.1 SPI

The overall status of the instrument in this week is nominal, though the PSD (Pulse Shape Discriminator) still continues to randomly reproduce the malfunction of channels blocking.

The instrument was however kept in photon-by-photon mode for the whole period, with spectra TM enabled, an assigned TM bandwidth in the science observation windows of 103 pkts/cycle and an actual occupation of 91.5 pkts/cycle average. The following plot shows the evolution of the occupied bandwidth, since beginning of 2004.



The cryocooler is working well, maintaining the temperature within 85+/-1K.

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.

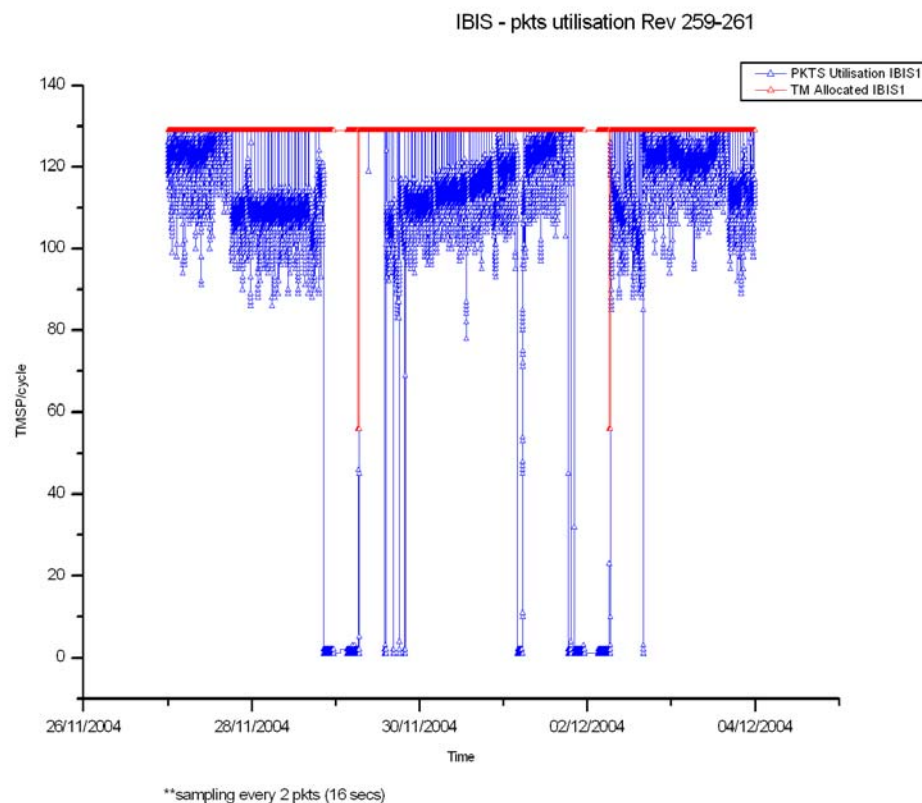
The week was characterised by low to moderate solar activity.

On DoY 336 an automatic reset of the IREM S/W (SEU #17) forced the transition of the unit to Stand-by with the VETO High Voltages and the ISGRI Biases OFF.

Reported twice during the execution of the VETO patch a rejection of a dump tele-command followed by an autonomous restore of the Context table contained in the VETO PROM, referring to the launch setting. The recovery of the unit was performed re-uplinking the patch and restoring the Context table saved in the DPE. An anomaly report has been generated (AR INT_SC-102) accordingly. Investigations are on-going at MOC and PIs side.

During the reporting period the PST allocation to IBIS was 129 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 116.8 TMPS/cycle, up 7.4 on last week. The increase of the unit pkts utilisation was likely due to the specific observations performed (e.g. Cygnus X-1) and to the moderate background during the observation period.

A plot of the IBIS TM utilisation during the observation period is shown below:



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.

JEM-X operations were performed by the automatic Timeline.

JEM-X1 was operated in Data Taking mode during science observations, with a TM allocation of 8 packets/cycle. JEM-X2 remained dormant (DFEE OFF) with a TM allocation of 1 packet/cycle.

Due to an IREM S/W reset (see AR INT_SC-103), JEM-X1 science operations were interrupted between 2004-12-01T04:10Z (JEM-X1 to transition to Safe mode) and 2004-12-01T05:47Z, when JEM-X1 was recovered to Data Taking mode (without IREM protection). The activation of JEM-X1 was initially performed with the IODB default value for the high voltage, which is currently 80 RAW. Once this was noticed, the high voltage was adjusted to the current nominal value of 79 RAW. These operations were performed between 2004-12-01T08:49Z and 2004-12-01T08:54Z, when JEM-X1 was returned to Data Taking mode with the nominal microstrip gas gain voltage of 79 RAW. JEM-X1 then continued to operate in Data Taking mode without IREM protection from this time until 2004-12-01T11:42Z, when IREM was recovered and all the IREM RMC protections for JEM-X1 were re-enabled.

At 2004-12-01T18:25Z JEM-X1 performed an autonomous transition to Safe mode, triggered by the unit's SW ratemeter. This was ~35 minutes before it was due to be commanded to Safe mode by the ED KESAFE01 in the Timeline, before radiation belt entry of revolution 260.

The wraparound of the DPEs' LOBT occurred on 2004-12-01 at 19:01:44Z. As JEM-X1 was already in Safe mode at this time, no special operations were required.

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.

There were 165 OMC pointings executed nominally, 2 were lost.

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

3.2.5 IREM

The overall status of the unit is nominal.

On DoY 336.04.09.44Z an automatic reset of IREM S/W (SEU#17), that had an impact on the instruments forcing them to Safe Configuration, occurred. After the Payload reconfiguration, the unit was successfully recovered and currently no degradation of the performance is reported.

Solar Activity

The observation period was characterised by low to moderate solar activity.

Note: Some more information concerning the IREM operations is provided in the Appendix Section 8.3.6.

4 Ground Facilities

The performance of the Operational ground facilities was very good this week, well above the system performance requirements, 1 pointing was lost due guide star problems, and another due to an IREM SEU.

4.1 Mission Operations Centre

The performance of the MOC was in general good in the reporting period, although there was one problem with disc space on sun128.

4.2 Ground Stations & Network

The performance of the ground stations and Network was in general good this week. There was a TM gap from Redu, and another instance when 48 bad frames arrived after some Reed Solomon alarms, but there was no impact on either occasion. The overall performance though was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSF complete up to revolution 270.

All revolutions up to 267 have been planned; 262 was also re-planned.

TSF complete up to revolution 263.

2. Observation status

ECS for revolutions 249, 250 and 251 have been received, ingested, and used to create corresponding OCS files for ISDC. An ISOC/ISDC tele-conference was held on December 3rd to review the OCS situation; as a result, 4 newly completed observations were made available for standard analysis and distribution by ISDC.

3. ISOC science data archive

Nothing special to report.

4. ISOC system

Version 10.6.2 is still operational.

5. Problems

Nothing new to report.

4.3.2 ISDC

Status of ISDC observation processing on 06/12/2004:

- Latest Standard Analysis completed: observation 02200940001 (X0115+63, Revolution 238) on 29/11/2004
- Latest products archived: observation 02200940001 (X0115+63, Revolution 238) on 01/12/2004
- Latest observation products sent to the observer: observation 02200100003 (SGR1806-20, Revolutions 225) on 09/11/2004

5 Special Events

6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 335, at 09:05, there was a bad TM frame from Redu. There was no impact.
- On DoY 335, at 21:18, sun128 was in a yellow status, with disk /dev/dsk/c0t1d0s7 99% full.
- On DoY 336, at 04:09, there was an IREM Single Event Upset, see the individual subsystems for details on the recovery.
- On DoY 337, at 07:00, there were some Reed Solomon alarms, followed by 48 bad frames from Redu, there was no impact.
- At 21:45, an AOCS command A3189 failed causing the closed loop slew 02610051 to be missed.

The following new anomaly report was entered into the ARTS system.

AR id	Date Created	Subject	Segment	Status
INT_SC-103	01/12/2004	IREM Anomaly: Reset of IREM_CSCI S/W #17, 01/12/2004	Spacecraft	Open
INT-2678	30/11/2004	Short break power glitch at REDU stopped Timeline	ESA Stations	Pending
INT-2679	01/12/2004	MCCM log files filling up disk	IMCS	Pending

7 Future Milestones

Doc. Title : INTEGRAL Mission Report #115
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 06/12/04

Issue : 1
Rev. : 0
Page : 9

The Current eclipse season started on the 23rd November 2004, and continues until the 17th December 2004. There will be a total of 9 eclipses, with a maximum duration of 57 minutes 41 seconds on 8th December 2004.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 259

The observations in revolution 259 began with 15 pointings of a GPS lasting ~10 hours, followed by a hexagonal dithering observation of Cygnus X-1 (RA 19:58:21.68; DEC +35:12:05.7) lasting ~23.5 hours. An amalgamated raster dithering observation of NGC 7172 (RA 22:02:1.70; DEC -31:52:18.0) was then performed for the remaining ~25.5 hours of observation time.

Revolution 260

The observations in revolution 260 began with 15 pointings of a GPS lasting ~10 hours, followed by a raster dithering observation of NGC 7172 (RA 22:02:1.70; DEC -31:52:18.0), amalgamated with an observation of PKS 2155-304, lasting ~9.5 hours. A raster dithering observation of MCG-2-58-22 (RA 23:04:43.48; DEC -08:41:08.6) was then performed for the remaining ~39 hours of observation time.

Revolution 261

The observations in revolution 261 began with 13 pointings of a GPS lasting ~9 hours, followed by a hexagonal dithering observation of Cygnus X-1 (RA 19:58:21.68; DEC +35:12:05.7) lasting ~23.5 hours. A raster dithering observation of MCG-2-58-22 (RA 23:04:43.48; DEC -08:41:08.6) lasting ~22 hours was then performed, followed by an amalgamated raster dithering observation of Cassiopeia A (RA 23:51:39.6; DEC +61:41:40.5), performed for the remaining ~3.5 hours of observation time.

Throughout these observations all instruments were in their nominal science modes, except JEM-X2 for which the DFEE remained off, and the TM allocation was IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2004-11-21T14:49:33.000Z	166.6089	F	Automatic TM processing.
2004-11-23T05:16:09.000Z	166.5339	F	Automatic TM processing.
2004-11-24T14:51:41.000Z	166.5045	F	Automatic TM processing.
2004-11-25T23:14:00.000Z	166.4824	F	Automatic TM processing.
2004-11-26T05:15:05.000Z	166.4724	F	Automatic TM processing.
2004-11-26T13:50:58.000Z	166.4546	F	Automatic TM processing.
2004-11-27T14:41:08.000Z	166.4214	F	Automatic TM processing.
2004-11-27T17:37:08.000Z	166.3828	F	Automatic TM processing.
2004-11-28T21:26:40.000Z	166.3329	F	Automatic TM processing.
2004-11-28T23:01:37.000Z	166.2726	F	Automatic TM processing.
2004-11-29T05:12:09.000Z	166.2568	F	Automatic TM processing.
2004-11-29T13:37:06.000Z	166.2018	F	Automatic TM processing.
2004-11-30T14:19:09.000Z	166.1798	F	Automatic TM processing.
2004-12-01T20:46:00.000Z	166.1414	F	Automatic TM processing.

Doc. Title : INTEGRAL Mission Report #115
 Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
 Date : 06/12/04

Issue : 1
 Rev. : 0
 Page : 11

2004-12-02T05:07:53.000Z 166.1063 F Automatic TM processing.

This report was generated Fri Dec 3 08:00:22 GMT 2004

8.3 Detailed Satellite Information

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

8.3.1 AOCS Summary Operations Report 27/11/2004-03/12/2004

AOCS operations were executed from the Automatic Timeline.

During this period, 58 Open Loop Slews, 94 Closed Loop Slews and 9 Momentum Bias were scheduled. 2 slews were missed. This is equivalent to a ~1.3 %.

The AOCS eclipse operations were completely nominal. For each revolution, the Eclipse Timers and the Time-Tagged sequence to re-enable the IMU Auto Switch-Off function of the ACC were loaded from the Timeline and the pre-eclipse IMU health checks were performed at the planned times. Some information regarding the eclipse times and IMU usage up to this stage of the eclipse season are provided below:

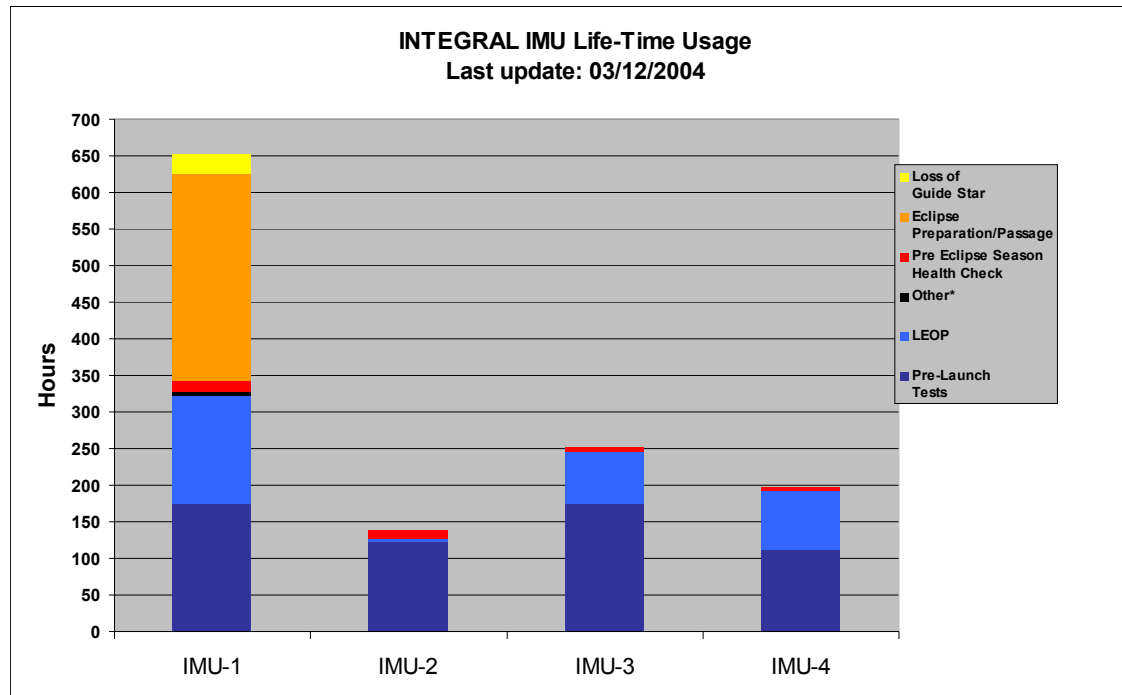
AOCS Eclipse Times															Summer 2004
Date	LOS	AOS	ACC Eclipse Imminent	ACC	FDE	FCE	Penumbra	FSS Sun Out	Umbra	Umbra	FSS Sun In	Penumbra	FDE/FCE	ACC	Eclipse Duration
2004-11-23	23:46:27	03:45:40	03:06:49	03:48:50	03:58:42	03:59:26	04:06:29	04:09:59	04:12:20	04:14:57	04:17:09	04:21:06	04:26:02	04:30:49	0:14:37
2004-11-26	23:44:00	03:34:05	02:50:42	03:32:42	03:42:24	03:43:08	03:50:22	03:51:55	03:51:57	04:22:01	04:22:35	04:23:56	04:28:48	04:33:38	0:33:34
2004-11-29	23:30:12	03:21:00	02:37:29	03:19:29	03:28:56	03:29:40	03:37:09	03:38:31	03:38:23	04:19:38	04:20:11	04:21:13	04:25:36	04:30:55	0:44:04
2004-12-02	23:18:00	03:09:00	02:24:38	03:06:33	03:15:54	03:16:38	03:24:18	03:25:38	03:25:24	04:14:07	04:14:46	04:15:32	04:19:54	04:25:08	0:51:14

IMU Usage during Eclipse Season					Summer 2004	
IMU On	IMU Off	From Health Check		From Auto Calibration	On Time	Accumulated On Time
		Noise Roll [as/s]	Drift Roll [as/s]	Drift Roll [as/s]		
2004-11-22 20:56:00	2004-11-23 04:33:06	0.2117	0.1986	0.2548	7:37:06	7:37:06
2004-11-25 21:08:31	2004-11-26 04:42:27	0.2808	0.1480	0.1334	7:33:56	15:11:02
2004-11-28 20:21:18	2004-11-29 04:33:34	0.1839	0.2401	aborted (lost of guide star	8:12:16	23:23:18
2004-12-01 20:14:00	2004-12-02 04:27:32	0.3523	0.2516	aborted (lost of guide star	8:13:32	31:36:50

An update of the IMU usage up to 03/12/2004 is provided in the following table and plot:

INTEGRAL IMU Life-Time Usage									
Unit	Total [hours]	% Usage WRT 1800 hr Reserved Flight Time	Pre-Launch Tests	LEOP	Loss of Guide Star	Eclipse Preparation/Passage	Pre Eclipse Season Health Check	Other*	Last Switch-Off
IMU-1	651.048780	36.17	175.045556	147.371944	25.726003	283.236111	13.871944	5.797222	02/12/2004
IMU-2	138.462500	7.69	123.023889	3.871111	0.000000	0.000000	11.567500	0.000000	16/11/2004
IMU-3	251.777778	13.99	175.449167	70.057500	0.000000	0.000000	6.271111	0.000000	01/06/2004
IMU-4	197.518611	10.97	111.528889	80.834167	0.000000	0.000000	5.155556	0.000000	01/06/2004

* Other consists of operations like STR bright object test, STR window dump, etc.



* **Other** consists of operations like the STR Bright Object Test, STR Window Dump, etc.

27/11/04 (Day of Year 332, Revolution 29)

Nothing to report.

28/11/04 (Day of Year 333, Revolution 259)

Nothing to report.

29/11/04 (Day of Year 334, Revolution 259-260)

Flickering of the Pointing-Bit at the end of open loop slew due to Roll Error: At the end of open loop slew 02600018 the error in roll with respect to the Sun-Steering-Law assumed roll angle was ~ -142 arcsec, more than the OTF threshold for roll and resulted in the flickering of the Pointing-Bit, which was not seen at BCP level. This error already existed at the start of the slew and was introduced by the attitude reconstruction after open loop slew 02600017. The attitude determination was based on the first mapping after this slew, during which the SSL was enabled. The jitter caused by enabling of the SSL after the slew introduced the error in roll, which was propagated to the next slew by the slew update.

30/11/04 (Day of Year 335, Revolution 260)

Nothing to report.

01/12/04 (Day of Year 336, Revolution 260)

The LOBT clock wraparound occurred at 19:01:07z.

A SATENG window was included in the Timeline to cover the period of the OBT wraparound with some margin and allow time for required operations before and after the wraparound:

```
2004-12-01T18:40:00Z SATENG_OPEN  
2004-12-01T19:20:00Z SATENG_CLOSE
```

In order to prevent any possible problems, was performed a report and reset the AOCS OEM buffer starting at 18:30z.

02/12/04 (Day of Year 337, Revolution 260-261)

Nothing to report.

03/12/04 (Day of Year 338, Revolution 261)

Slews missed from the Timeline: At 21:45Z the sequence for the closed loop slew 02610051 was interrupted when the STR failed to track the commanded guide star in the search and track process. The commanded star was 5823-802 with instrumental magnitude 7.6. The Timeline recovery tool was used to perform a manual close loop slew to the attitude of PID 02610051 but failed to track the commanded guide star because the selected star was again 5823-802. The Timeline recovery tool was then used to perform a manual open loop slew to the attitude of PID 02610052. The next slew (02610053) was manually updated and executed from the Timeline.

Star 5823-802 has a dim neighbour at ~3.5 arc-minutes: 5823-437 with magnitude 9.5, which has likely caused the release of the selected guide star for slew 02610051.

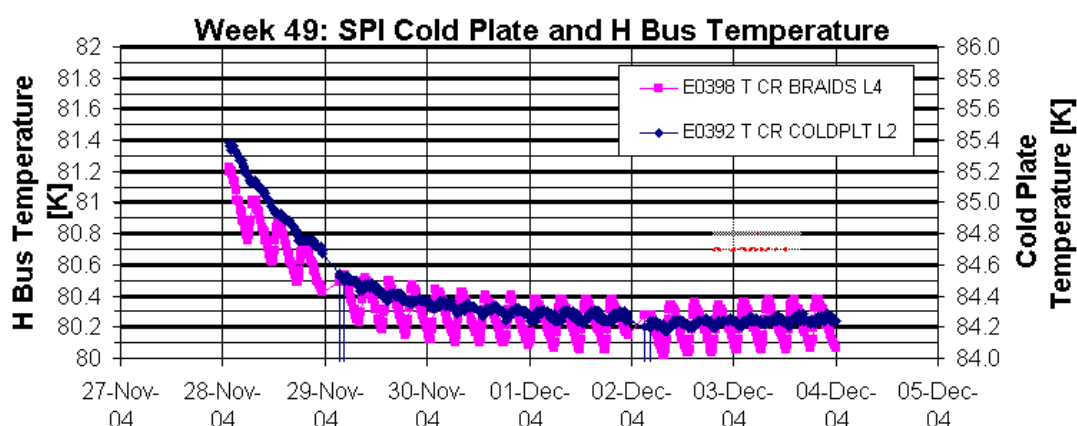
8.3.2 SPI Operations

Cryo-cooler / Detector Cold-Plate:

The performance of the cryo-cooler is nominal.

The cold plate temperature was maintained at 85K $\pm$ 1K. The compressor stroke was adjusted from 4x38 to 4x39dec(raw) amplitude, on DOY 332 (Saturday 27th Nov) at 16:48z, to compensate for the slow temperature drift over the last months, which led to the upper limit of 85.9K being exceeded.

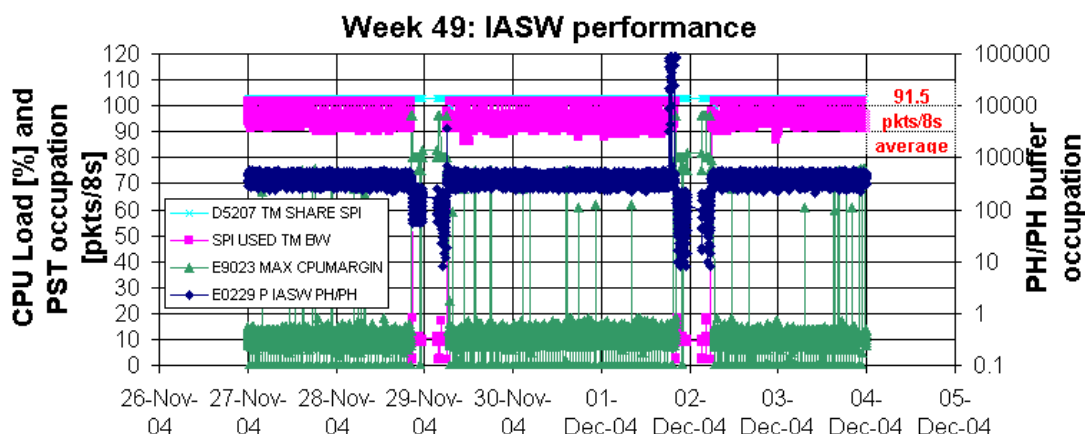
The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.



IASW/DPE:

The performance of the IASW/DPE is nominal.

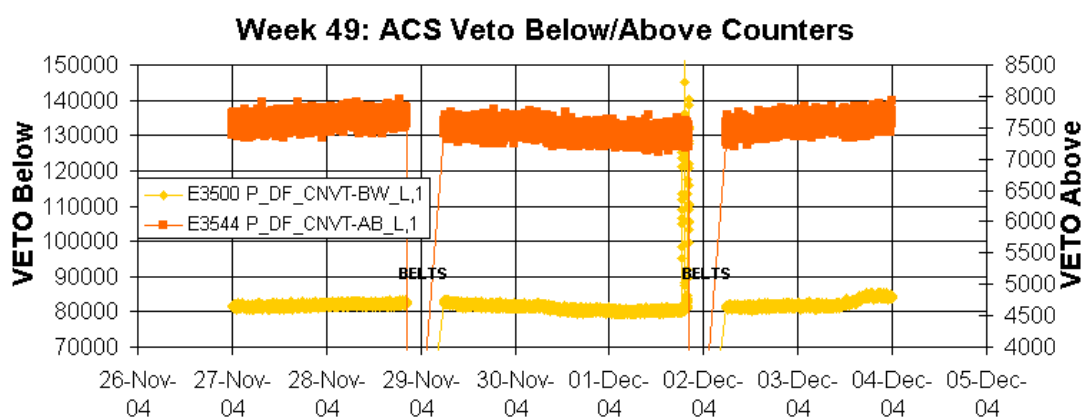
The following diagram shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

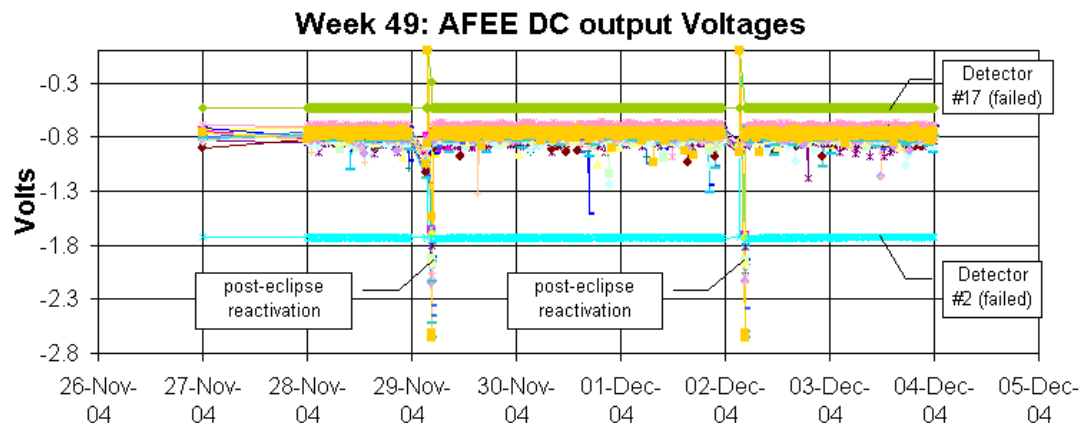
The following plot shows the ACS overall count rate evolution during the reporting period.



AFEE:

The performance of the detectors is nominal except for the detector #2, failed since 06.12.2003, and detector #17, failed since 17.07.2004.

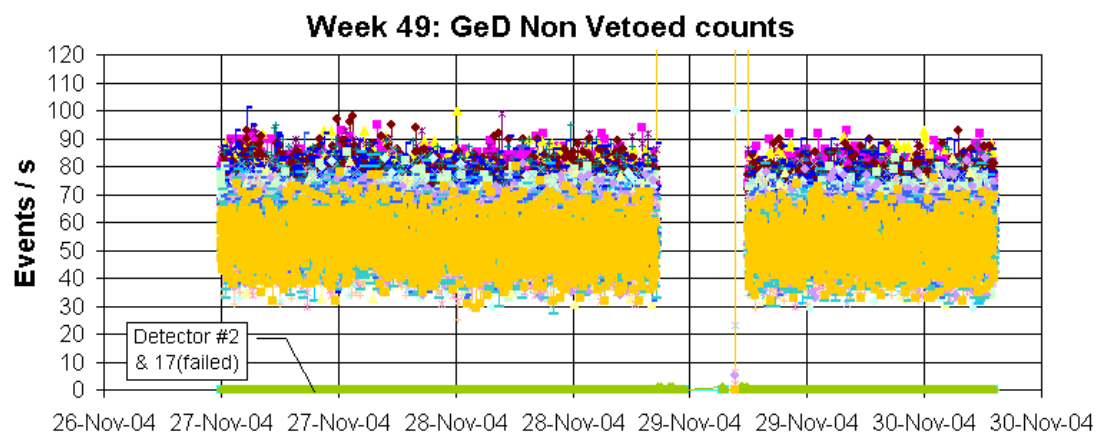
The following plot shows the AFEE dc output signals during the reporting period.



DFEE:

The performance of the unit is nominal.

The following plot shows the Non Vetoed event rates, processed by the DFEE during the reporting period. The count rate of each detector is within the expected range, except for the failed detector #2 and #17.

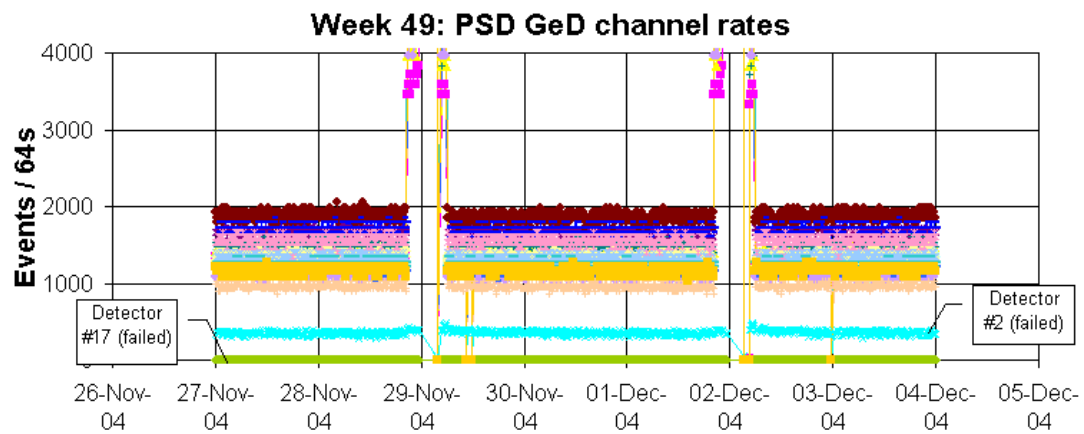


PSD:

The performance of the unit is nominal, though the malfunction of the channel rates blanking reproduced itself also this week (see AR INT_SC-90 for a detailed description of the anomaly).

An IASW patch is under delivery from Cesr to enable the Sci HK TM downlink inside the radiation belts. This would allow the deletion of the Out-Of-Limit currently defined for the PSD channel rates, thus removing the false alarms associated to the malfunction.

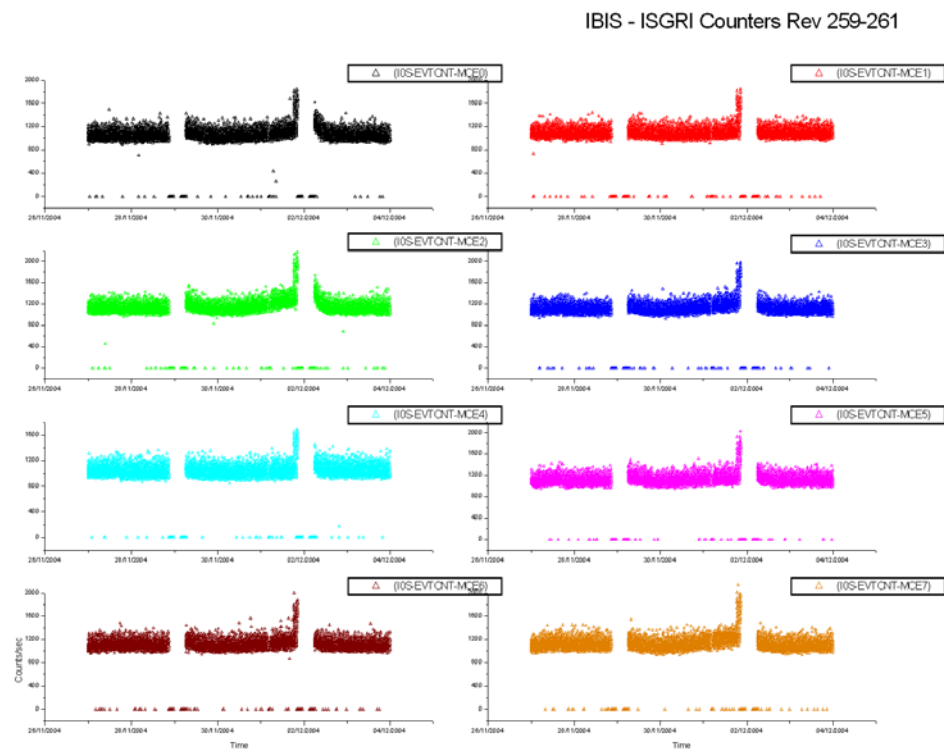
The following plot shows the PSD channel rates during the reporting period.



8.3.3 IBIS Operations

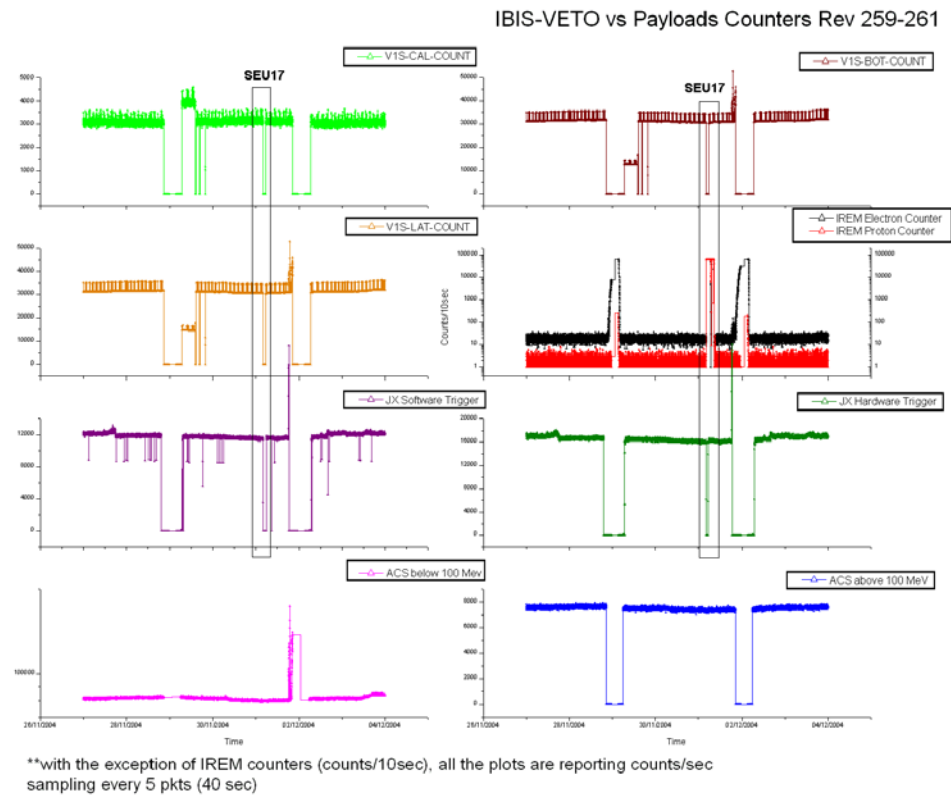
IBIS Event Counters Plots.

ISGRI Counters:



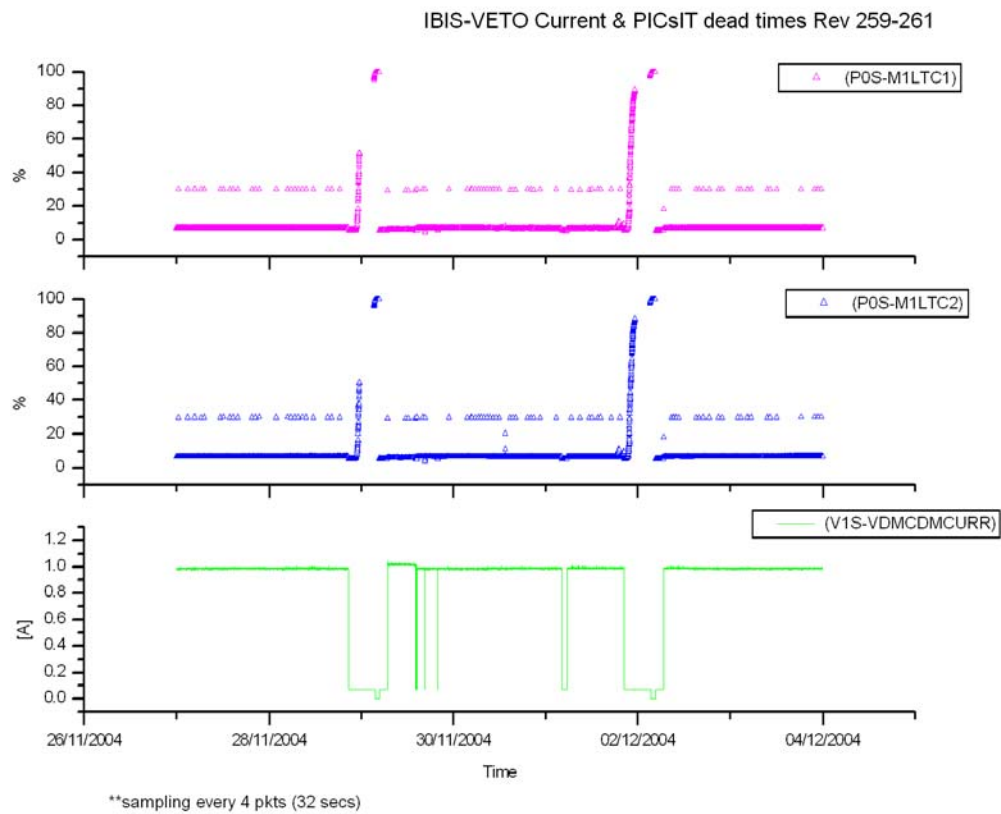
**sampling every 4 pkts (32 secs)

VETO vs Payloads Counters

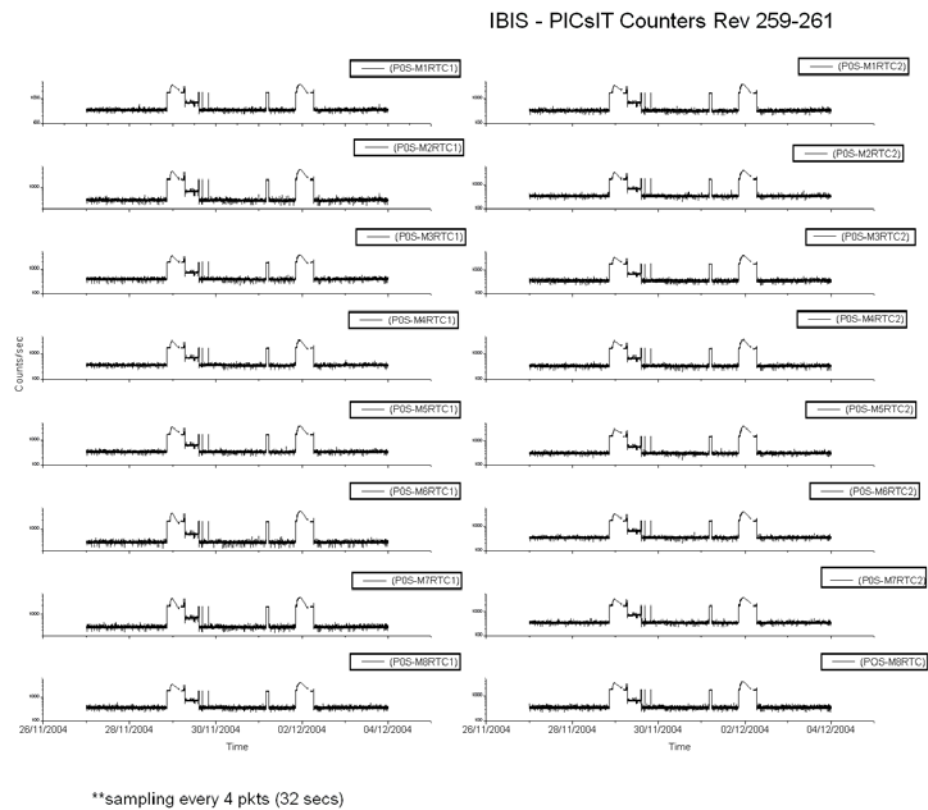


The week was characterized by low to moderate solar activity.
 An automatic reset of the IREM SW (SEU #17) occurred on DoY 336.04.09.44z, which had an impact on the instruments, also forcing them to Safe Configuration.

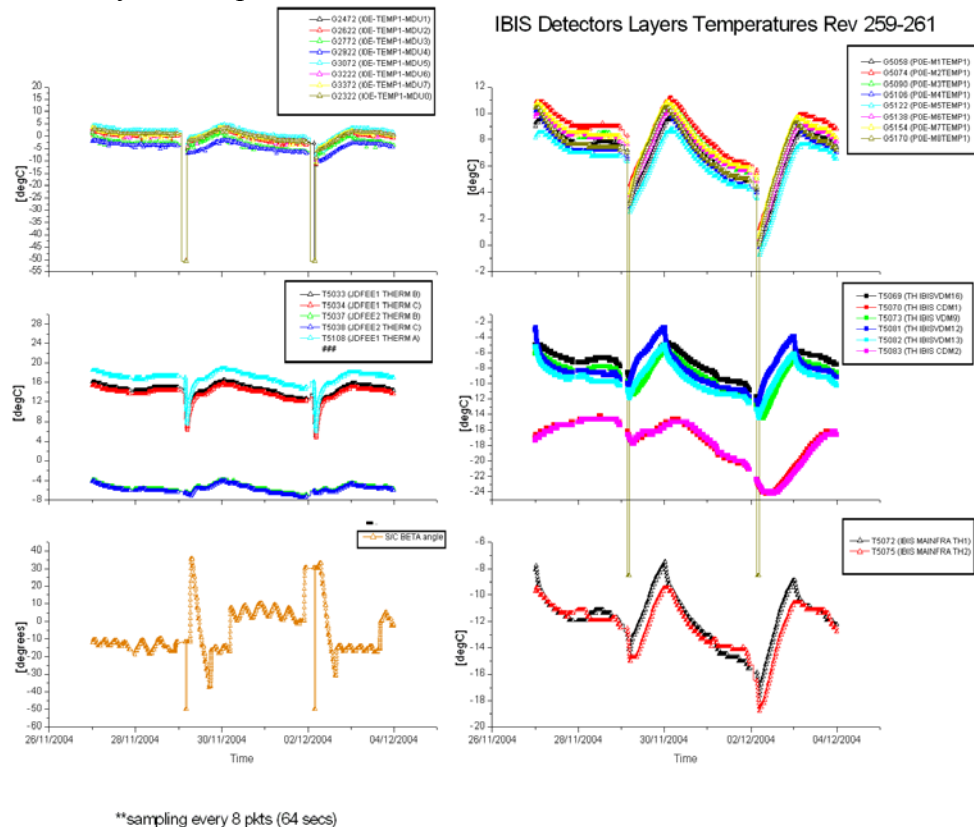
Veto Current:



Picsit Counters:



IBIS Detectors Layers Temperatures



IBIS daily report DoY 2004.332 (27/11/2004)

Nothing to report.

DoY 2004.333 (28/11/2004)

At 20:40Z, the VETO 28V PMT set by IASW (G8015) toggled in and out of limit (high).

DoY 2004.334 (29/11/2004)

After the 3rd eclipse of the winter season, at 04:45.04z, during the uplink of the VETO patch 3.2, the following OEMs were reported simultaneously with the rejection of the dump tele-command GU613TC:

04:45:04z:

OEM APID 1280 ID 129 CLASS 2 <<IASW TIME-OUT LSL DATA>>

04:45:04z:

OEM APID 1280 ID 134 CLASS 3 <<IASW EXTERNAL TC REJECTED COULD NOT BE EXECUTED>>

04:45:07z:

OEM APID 1280 ID 129 CLASS 2 <<IASW TIME-OUT LSL DATA>>

This happened during the execution of the ED GEVESP01, used during the Eclipse season to uplink the patches (anomalous OEM generation and counters rescaling

factor). The OEM flagged an on-board problem during the execution of the patch TC just before the mentioned dump, with a temporary interruption of the LSL (low speed line, TC/HK) communication between the DPE and the peripheral (VETO).

After consultation with the s/s SOE (FDM) and considering the recovery applied for a similar problem (AR INT_SC-86) which happened during the last summer eclipse it was decided to re-uplink the sequence for the VETO patch . This time the TCs were all executed and no problems were observed. The unit therefore continued its nominal reconfiguration before exit from the Radiation Belts.

At 14:06z the VETO HVs were reported out of the nominal observation values, while resulted that the applied values, were those loaded in the VETO PROM at launch (launch configuration), to be considered safe values but not nominal. The calibration unit #2 was ON, confirming the application of the launch Context Table.

Under the guidance of the s/s SOE the following recovery was performed:

- 1) Transition IASW to STD-BY;
- 2) Transition VETO to STD-BY;
- 3) Re-verification of the VETO status performing a transition to Nominal; the verification confirmed the wrong configuration;
- 4) Transition to STD-BY and re-uplink of the VETO patch(ED GEVESP01);
- 5) Transition to Nominal; the wrong configuration was still present;
- 6) Transition to STD-BY and restore VETO CTX from DPE, plus re-set of the PlcSIT and ISGRI zoning to the nominal values;
- 7) Transition to Nominal and verification of the correct configuration. All the HVs reported correct values and the CDM02 was set OFF;
- 8) IASW transition to Standard.

The last activity (set of the zoning) was completed around 16:38z.

ISDC was informed of problem and recovery. Investigations are on-going at MOC and PIs side. An anomaly report has been generated (AR INT_SC-102) accordingly.

DoY 2004.335 (30/11/2004)

At 13:27Z the TM parameters G5068-5084-5100-5116-5120-5168-5180 (PDM X: Semi-mod Y FIFO Error Flag) went OOL (SCC fail) for about 2min. Following the reaction P_FIF_1 reported in the Payload Recovery doc, no action was taken.

DoY 2004.336 (01/12/2004)

At 04:09Z an IREM SW failure (SEU #17) forced IBIS to Stand-by mode. The recovery was completed at 05:25Z when IBIS exit from Safe Mode. At 05.42, IBIS was back to Scientific Standard mode

At 19:01:07z, the LOBT (on-board time) wraparound occurred. A SATENG window was included in the Timeline to cover the period of the OBT wraparound with some margin:

2004-12-01T18:40:00Z SATENG_OPEN
2004-12-01T19:20:00Z SATENG_CLOSE

According to the SUM (payload constraints section), IBIS was set In Stand-By during the OBT wraparound, by executing OR 184.

DoY 2004.337 (02/12/2004)

After Eclipse passage (4th), at 04:38Z, the unit reported the same problem observed on DoY 334: during the uplink of the VETO patch 3.2, the following OEMs were reported in coincidence of the rejection of a dump tele-command GU613TC:

```
OEM APID 1280 ID 129 CLASS 2 <<IASW TIME-OUT LSL DATA>>  
OEM APID 1280 ID 134 CLASS 3 <<IASW EXTERNAL TC REJECTED COULD NOT  
BE EXECUTED>>  
OEM APID 1280 ID 129 CLASS 2 <<IASW TIME-OUT LSL DATA>>
```

After consultation with the s/s SOE and based on the previous experience, it was decided to re-uplink the patch and perform a restore of the VETO Context Table from DPE to the peripherals. The Patch (ED GEVESP01) was re-uplinked at 04:43Z. After the recovery the VETO statuses and HVs resulted nominal. Investigations are on-going at MOC and PIs side.

DoY 2004.338 (03/12/2004)

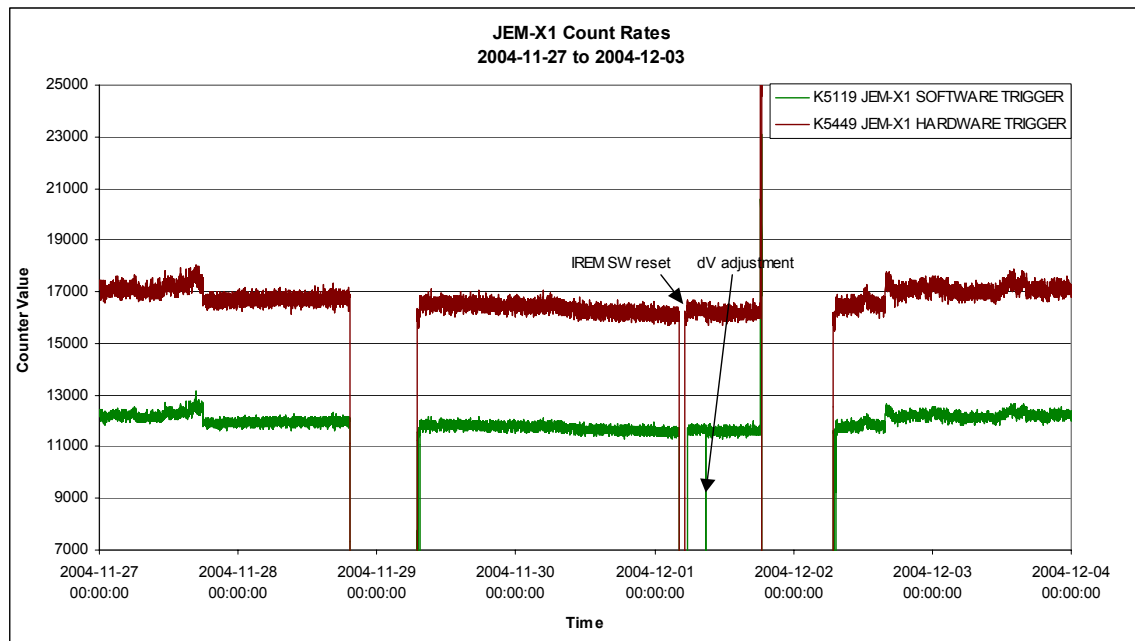
Nothing to report.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

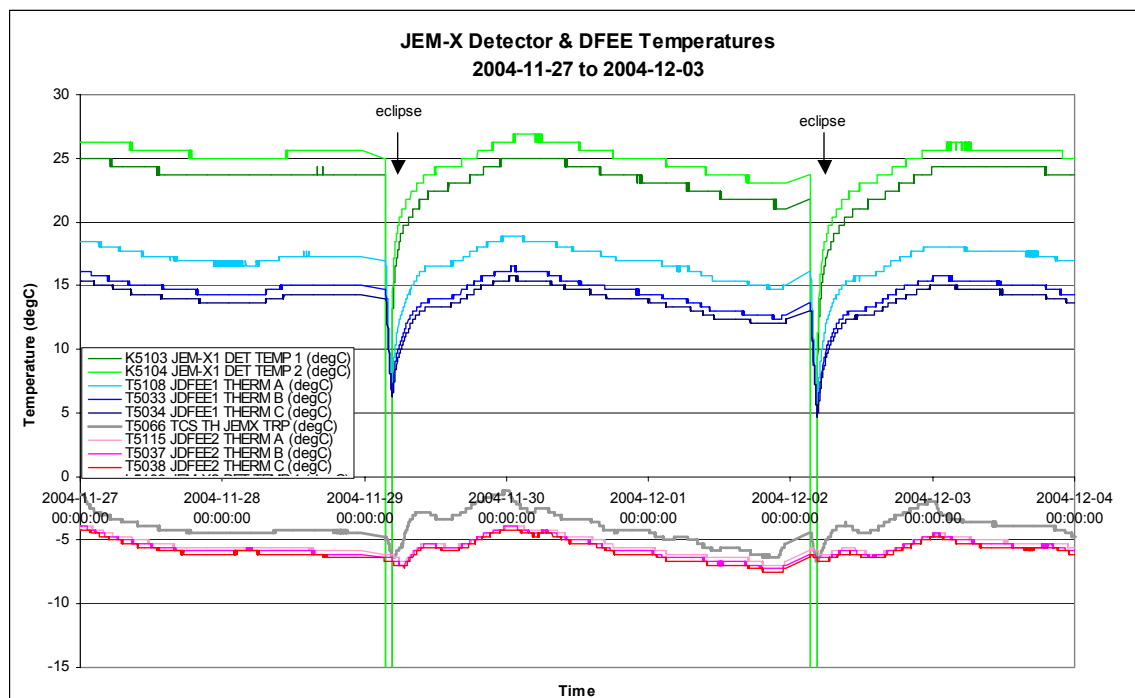
JEM-X count rates over the reporting period are displayed in the following graph¹.

¹ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.



8.3.4.2 JEM-X Temperatures

JEM-X Detector and DFEE temperatures, along with the temperature on the detector bench between the two units, over the reporting period are displayed in the following graph².



² Data sampled (1 frame in 8)

8.3.4.3 JEM-X Daily Report

2004-11-27 (DOY 332, Rev 259) to 2004-11-28 (DOY 333, Rev 259)

Nothing to report

2004-11-29 (DOY 334, Rev 259-260)

The following non-nominal On Event Messages were received at the time of the start of eclipse on 2004-11-29:

```
2004.334.03.37.57.913 1536 Real Time Event 163 JEM-
X1 LSL PROBLEM 3 FIX6=3 K9079=0 K9080=163 K5412=18193 K5413=30583
>> Indicating a parity error on the Low Speed Line for command 18193
```

```
2004.334.03.38.12.755 2004.334.03.37.59.663 1536 Real Time
Event 169 JEM-X1 LSL PROBLEM 9
FIX6=9 K9079=0 K9080=169 K5412=18193 K5413=0
>> Indicating a Timeout on the command 18193
```

Following this the DFEE was switched off by the PPDU (S/E) sequence and the following OEM was generated as normal:

```
2004.334.03.38.05.538 1536 Real Time Event 231 JEM-
X1 AUTO EVENT 1 FIX6=1 K9079=0 K9080=231 K5419=64,ECLIPSE K5420=80,LV
OFF
```

When the DFEE was switched back on after eclipse by the ED KECLEX01 (uplinked at 2004-11-29T04:38:46Z), in addition to the normal OEMs received at this time:

```
2004.334.04.38.53.575 1536 Real Time Event 233 JEM-
X1 AUTO EVENT 3 FIX6=3 K9079=0 K9080=233 K5419=80,LV OFF
K5420=48,RAD. BELTS
```

```
2004.334.04.38.54.540 1536 Real Time Event 233 JEM-
X1 AUTO EVENT 3 FIX6=3 K9079=0 K9080=233 K5419=64,ECLIPSE
K5420=48,RAD. BELTS,
```

the following OEM was received:

```
2004.334.04.39.09.915 1536 Real Time Event 254
ERROR OFF FIX6=0 K9079=0 K9080=254 K5408=160,LSL FIX16=0
>> Indicating that the LSL problem had been rectified.
```

2004-11-30 (DOY 335, Rev 260)

Nothing to report

2004-12-01 (DOY 336, Rev 260)

At 04:10Z an IREM S/W reset (# 17, ref: AR INT_SC-103) occurred, with all radiation monitor counters from IREM (TM parameters K5315-K5317) giving a value of 65535, causing JEM-X1 to transition to Safe mode, issuing OEM 231 JEM-X1 AUTO EVENT 1. Commanding to JEM-X1 was then disabled from the automatic Timeline at 04:37Z.

As part of the instruments' recovery procedure in case of an IREM S/W reset, procedure FCP_DHS_1301 was executed to set the broadcast packet DRMC flag to DISREGARD at 04:51Z. JEM-X1 then transitioned to Setup mode and issued OEM 233 JEM-X1 AUTO EVENT 3. The reconfiguration of JEM-X1 for the resumption of science activities was started at 05:08Z, with the procedure FCP_JEM1_1010. This was followed by procedure FCP_JEM1_0044 to command JEM-X1 back to Data Taking at 05:47Z. Commanding to JEM-X1 from the automatic Timeline was then re-enabled at 05:49Z. This activation of JEM-X1 was performed with the IODB default values for the microstrip gas gain voltage (dV) of 80 RAW (rather than the current JEM-X1 nominal HV, set by ISOC via the POS, of 79 RAW). Therefore, once this was realised, the HV was adjusted as follows:

- At 08:46Z commanding to JEM-X1 from the Auto-stack was disabled.
- At 08:49Z FCP_JEM1_0041 was performed to put JEM-X1 in Setup mode.
- At 08:50Z FCP_JEM1_0032 JEMX1 SETTING OF MICROSTRIP GAS GAIN VOLTAGE (dV) was executed, setting the value of the parameter of TC K0003 as follows:
K0001 HV DELTA = 79 RAW.
- At 08:54Z JEM-X1 was returned to Data Taking mode via FCP_JEM1_0044.
- At 08:55Z commanding to JEM-X1 from the Auto-stack was re-enabled.

At 09:01Z FCP_JEM1_0120 was executed to set the JEM-X1 broadcast packet overrides for the IREM Radiation Monitor Count flags (TM parameters K5474 to K5476) to DISABLED. JEM-X1 then continued to operate in Data Taking mode without IREM protection until IREM had been recovered and the IREM count rates had been monitored for ~2 hours to check their stability. Then, at 11:25Z FCP_DHS_1301 was executed to set the broadcast packet DRMC flag back to REGARD. At 11:42Z the JEM-X1 RMC flags were set back to ENABLED by procedure FCP_JEM1_0120.

JEM-X1 operations then continued nominally.

At 18:22:31Z the parameter K5119 SOFTWARE TRIGGER went soft out of limits (value = 20120). It then fluctuated in and out of soft limits until 18:25:27Z, when it exceeded its hard limit (value = 25000), causing JEM-X1 to transition to Safe mode autonomously. The TM parameter K5462 DFEE STATE IASW reported SAFE on one occurrence and then reverted to SETUP and two occurrences of the OEM 189 JEM-X1 PROB DFEE 9 were received, as the IASW registered the unexpected state change.

At 19:02:22Z the ED KESAFE01 was executed from the Timeline, causing the DFEE STATE IASW (TM parameter K5462) to also be set to SAFE and the OEM 254 ERROR OFF to be issued.

At 19:03:20Z OEM 231 JEM-X1 AUTO EVENT 1 was received, indicating the transition of the JEM-X1 Shutdown Level from NORMAL to RAD. BELTS, after the IREM RAD MONITOR 3 counter (TM parameter K5317) had exceeded its safe threshold for JEM-X1 for two consecutive TM cycles.

The wraparound of the DPEs' LOBT occurred at 19:01:44Z. As JEM-X1 was in Safe mode at the time of the wraparound, there were no special activities to be performed.

2004-12-02 (DOY 337, Rev 260-261) to 2004-12-03 (DOY 338, Rev 261)

Nothing to report

8.3.5 OMC Operations

On DoY 336, at 04:09:59, an IREM SEU caused the unit to switch autonomously to SAFE mode, interrupting pointing 02600056 (2226sec. into a 2667sec. observation). It was shortly after this time that the following pairs of commands were rejected:

```
2004.336.04.17.48.995 2004.336.04.17.36.125 1792 Real Time Rejection 131
REJECTED TC1
FIX2=0 M5010=2,SAFE M9079=3 M9080=131 M5001=60,IM A M9068=1 FIX2=0 M9069=504
2004.336.04.17.41.706 2004.336.04.17.29.250 1792 Real Time Rejection 131
REJECTED TC1
FIX2=0 M5010=2,SAFE M9079=3 M9080=131 M5001=130,RESET IM M9068=1 FIX2=0
M9069=503
```

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 02600057, rejected as the unit was still in SAFE mode. The following pointing was executed nominally

At 21:45, an AOCS command failed, causing pointing 02610051 to be missed, it was at this time that the following pairs of commands were rejected:

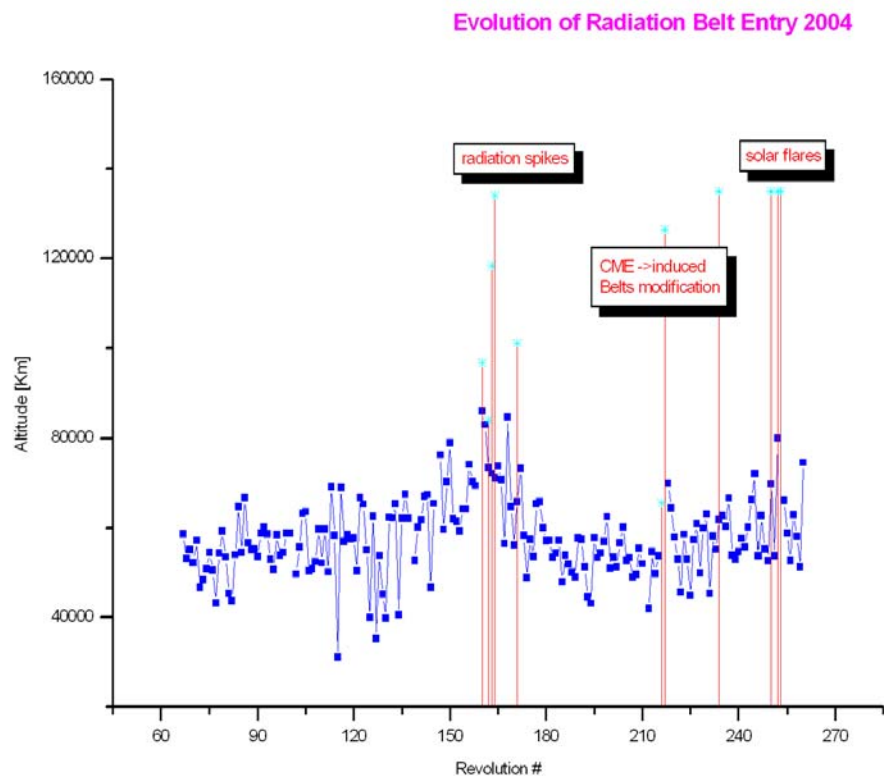
```
2004.338.21.48.37.673 2004.338.21.48.30.010 1792 Real Time Rejection 131
REJECTED TC1
FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=60,IM A M9068=1 FIX2=0 M9069=498
2004.338.21.48.37.534 2004.338.21.48.24.260 1792 Real Time Rejection 131
REJECTED TC1
FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=130,RESET IM M9068=1 FIX2=0
M9069=497
```

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for that pointing.

On DoY 333 at 20:39:02 and DoY 336 at 20:25:41, OMC was switched by the Timeline to SAFE mode, at the nominal times.

8.3.6 IREM Operations

Radiation Belts Entry



Electron Belts

REV	S/C BCPKT (electron)	Electron CUT-OFF Observed Entry/Exit	Observed Entry/Exit Altitude [Km]	Electron CUT-OFF Predicted Entry/Exit	Predicted Entry/Exit Altitude [Km]
259	RAD ENTR R 2004-11-28T20:38:43Z	2004-11-28 21:42:00	51259.1	2004-11-28 21:29:03	53329.49
260	RAD EXIT R 2004-11-29T05:50:24Z	2004-11-29 04:18:00	24884.4	2004-11-29 04:39:03	28654.15
260	RAD ENTR R 2004-12-01T20:25:27Z	2004-12-01 18:24:48	74612.7	2004-12-01 21:15:52	53562.18
261	RAD EXIT R 2004-12-02T05:37:09Z	2004-12-02 04:06:24	24884.2	2004-12-02 04:25:52	28414.7

Reference

Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

Radiation Spike

Proton Belts

REV	Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
259	PROTON_RAD_ENT	Not available in RadMon
260	PROTON_RAD_EXT	Not available in RadMon
260	PROTON_RAD_ENT	Not available in RadMon
261	PROTON_RAD_EXT	Not available in RadMon

As for the 3 previous weeks, the flux of protons >8MEV computed by RadMon, did not exceed the threshold. Therefore, no predicted proton cut-off is provided for this week either.

IREM daily report

DoY 2004.336 (01/12/04)

At 04:09Z a local reset of the IREM CSCI S/W (SEU #17) occurred: as previously (see anomalies on 16/12/02, 01/01/03, 03/06/03, 11/07/03, 19/07/03, 05/08/03, 24/08/03, 26/12/03, 13/05/04, 16/05/04, 09/06/04, 12/06/04, 10/09/04, 14/09/04, 28/10/04, 06/11/04) the status of the unit, before the anomaly, was nominal, here is a summary:

- 1) Temperatures nominal
- 2) LCL current nominal
- 3) Last HK before the anomaly HV, 5V and 6V voltages inside limits
- 4) The anomaly occurred at 2004.336.04.09.44z at 134083.5 km altitude. The unit performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex); just before the anomaly, radiation counters reported nominal values considering the position of the S/C along the orbit
- 5) The recovery of the unit started at 04:43z using procedure CRP_SYS_2570. The first dump of the status word after the anomaly showed a value of BCC0 HEX = 48320 DEC = 1011110011000000, ie. the unit was still reporting the status as if it was in Integral mode with counting ON, accumulation ON and checksum failure flag ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.
- 6) dumping all the register bank give a status word BC80 HEX = 48256 DEC = 1011110010000000, ie. the unit is reporting the status as if it was in Integral mode but the checksum failure flag is now OFF and the checksum counter in the register number 3 incremented of 1 unit.
- 7) The patch was performed successfully with the correct re-starting of the S/W. The operation was completed at 09:08Z.

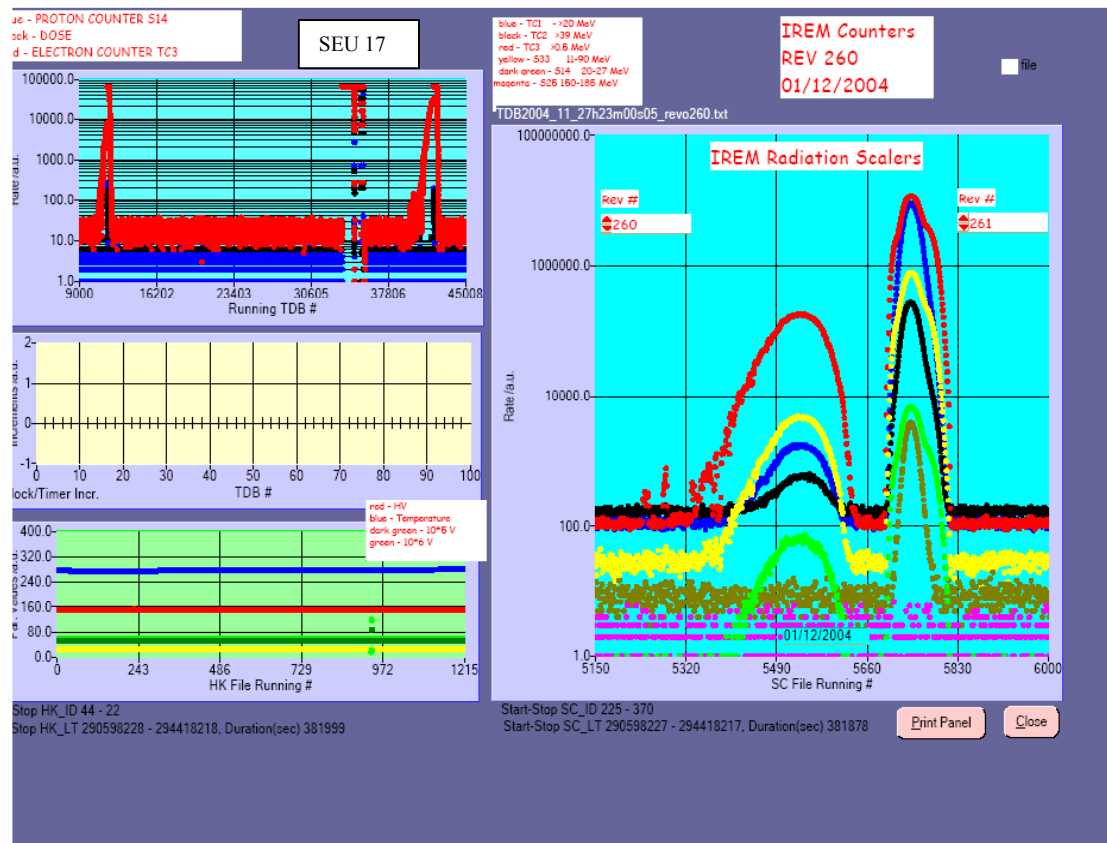
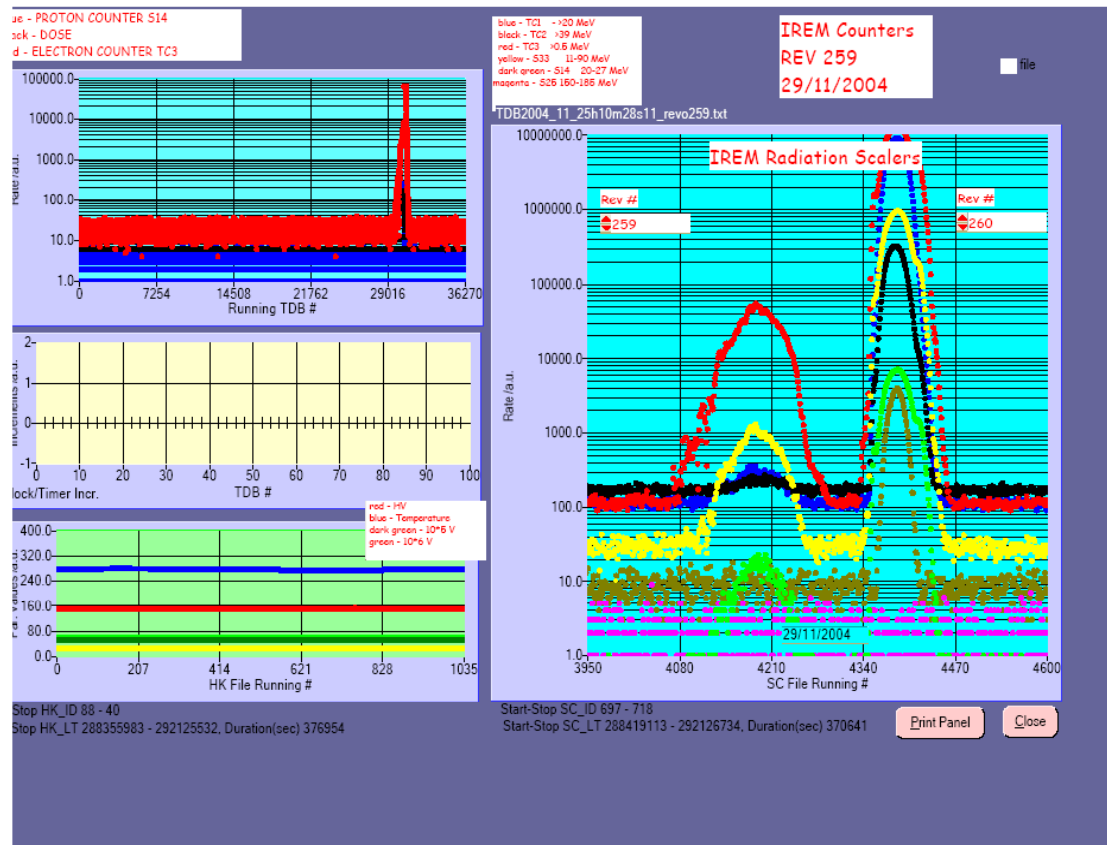
The IREM automatic transition to Standard Mode affected the instruments since it forced them to automatically enter Safe configuration, except for SPI whose automatism is disabled according to SPI PIs request.

The recovery of the payloads was performed as follows:

- IBIS re-enabled at 05:59Z
- JEM-X1 re-enabled at 05:59Z
- OMC re-enabled at 04:57Z

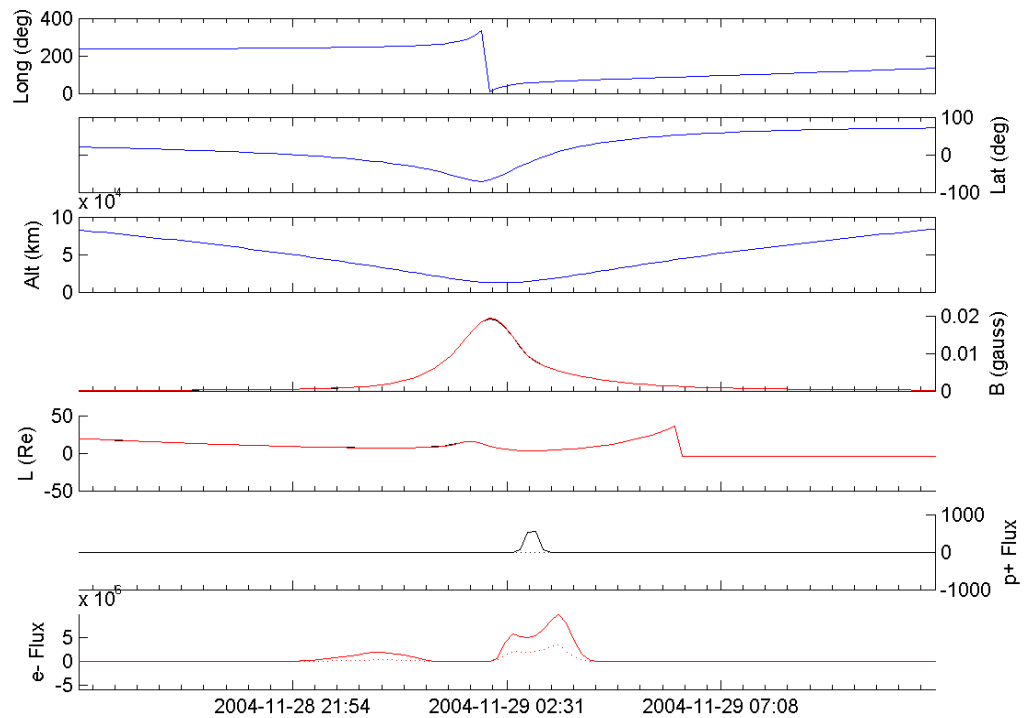
The cause of this S/W reset is still under investigation, but it is apparently due to the unit's memory device, which is sensitive to ionising radiation.

IREM radiation counters



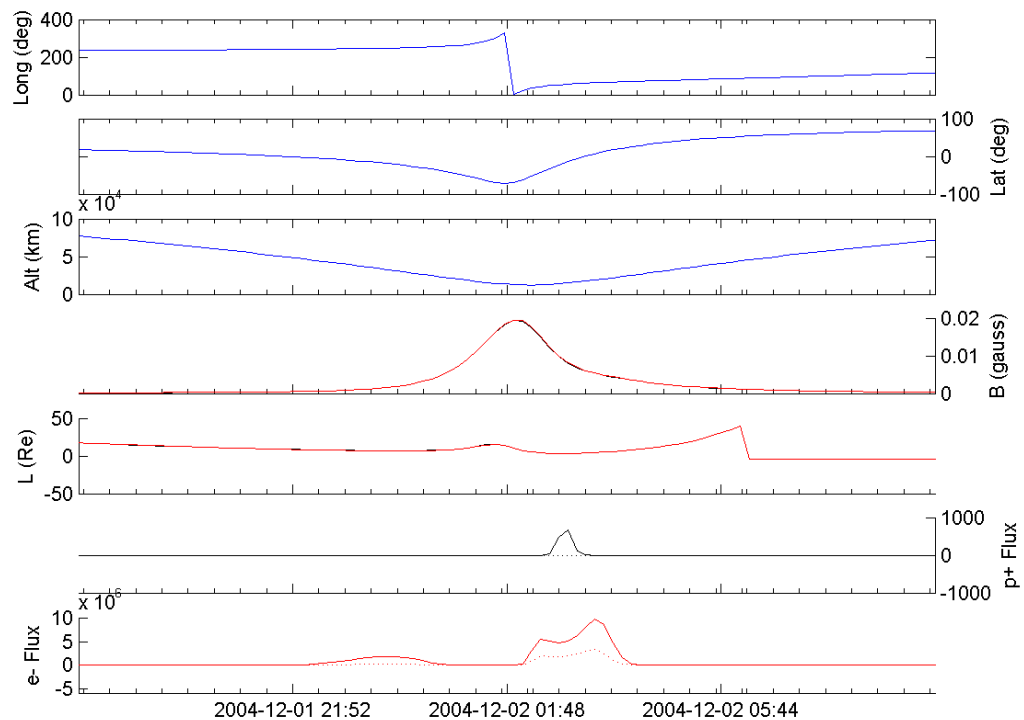
IREM Predicted Radiation Belt Passages.

Rev 259



X: 0 Y: 0 get Data Zoom Print...

Rev 260



X: 0 Y: 0 get Data Zoom Print...

SEC-GOES Observed Particles Fluxes.

