

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 117
Week 51
20.12.04
Routine Phase

Prepared by: M. Walker (OPS-OFO)

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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 11.12.04 until 17.12.04 (both dates inclusive) and covers the revolutions 264 & 265.

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 and Cassiopeia A (RA 23:51:39.60; DEC +61:41:40.5). The activities consisted of GPS 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 passages were completely nominal from an AOCS point of view, with the last eclipse of this season occurring on 17/12/2004. After the end of the season, the AMD thresholds were set to their non-eclipse season values and the ACC/FDE/FCE Eclipse Timers were stopped.

8 slews were missed from the Timeline during this period:

- 2 slews (CSL) were missed in revolution 264 due to problem on TM/TC link with DSS16 station and NCTRS-A machine;
- 2 slews (1 OSL and 1 CSL) were missed in revolution 264 due to problem on TM/TC link with REDU station;
- 2 slews (CSL) was missed in revolution 266 due to problem on the NCTRS.
- 2 slews (CSL) were missed in revolution 266 due to problem on NCTRS-A during DSS16 pass.

An update of the complete IMU usage up to 17/12/2004 is provided in the Appendix.

The fuel consumption over the period between 08/12/2004 and 17/12/2004 was 0.171 kg. The remaining propellant is in the order of 165.7258 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.

During the reporting period Integral passed through eclipses 7, 8 and 9 of the current eclipse season. All 3 eclipse passages were nominal from an EPS point of view, the batteries Depth of discharge and recharge duration were in line with predictions in both cases. The MRU EOC Timer was adjusted according to the duration of each eclipse. Eclipse 9 was the last eclipse of the current eclipse season.

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.

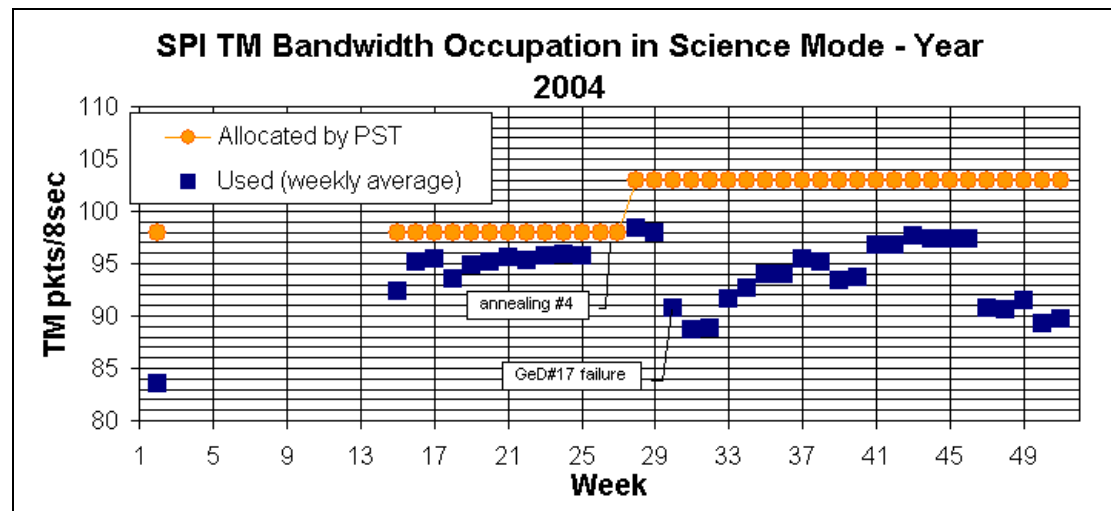
3.2 Payload

3.2.1 SPI

The overall status of the instrument in this week is nominal; the DPE SPIASW 431 installation was carried out without problems between 10th and 11th December, while passing through the belts. After the patch, the new IODB was installed, removing the Out-Of-Limits, defined for the PSD (Pulse Shape Discriminator) channel rates. In this way the PSD channels blocking malfunction, though still continues to randomly reproduce itself, will not affect the operations.

Following the patch of SPIASW431, the effects of the known TM leakage anomaly became slightly worse than expected. Such effects were only partially mitigated on 16th December, following some recovery attempts (see detailed discussion later in the report).

The instrument was 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 89.7 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 $\pm$ 1K.

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

3.2.2 IBIS

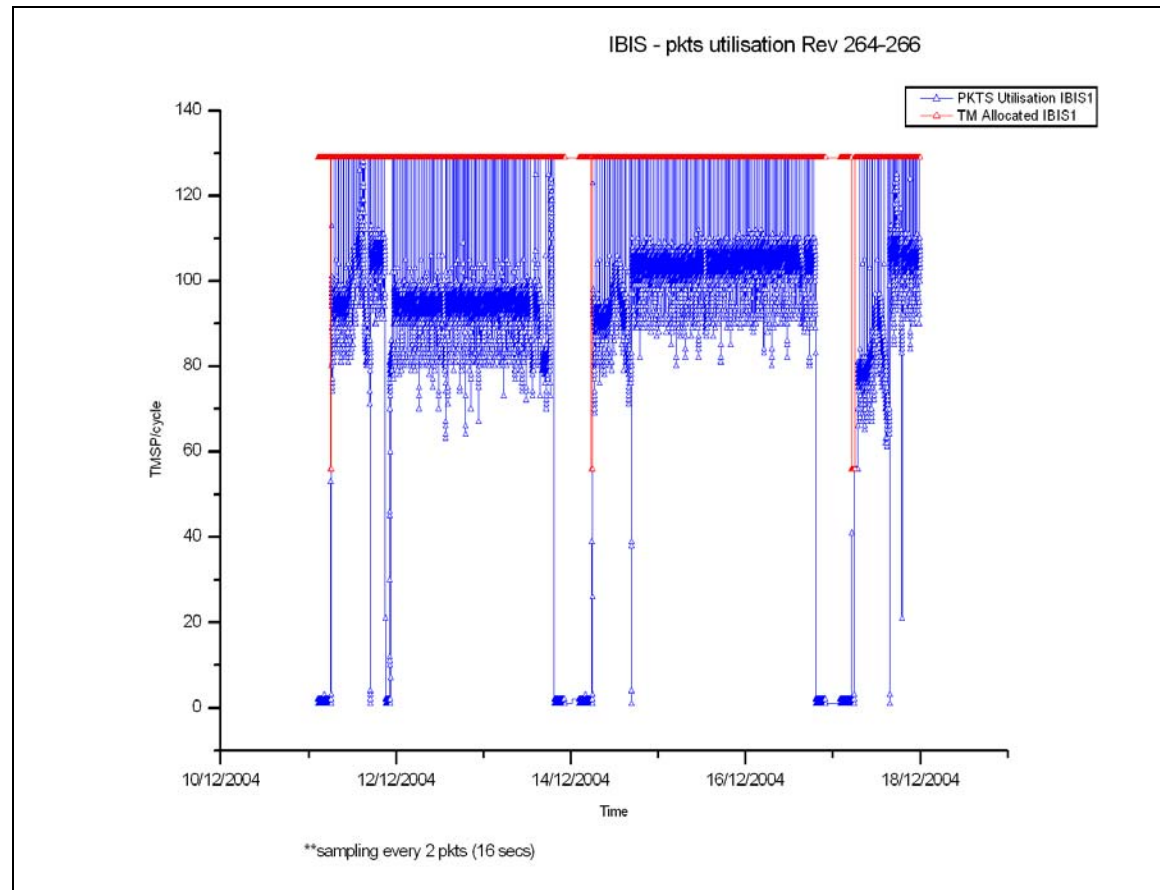
The Overall status of the unit is Nominal.

The week was characterised by low to moderate solar activity.

On DoY 346 an automatic reset of the IREM S/W (SEU #18) forced the transition of the unit to Stand-by with the VETO High Voltages and the ISGRI Biases OFF.

During the reporting period the PST allocation to IBIS was 129 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 99.9 TMPS/cycle.

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-105), JEM-X1 science operations were interrupted between 2004-12-11T21:06Z (JEM-X1 to transition to Safe mode) and 2004-12-11T23:32Z, when JEM-X1 was recovered to Data Taking mode (without IREM protection). JEM-X1 operated in Data Taking mode without IREM protection from this time until 2004-12-12T05:35Z, when IREM was recovered and all the IREM RMC protections for JEM-X1 were re-enabled.

At 2004-12-15T15:26Z OCR-187 was implemented to disable JEM-X1 and JEM-X2 reactions to the IREM count rates in the broadcast packet. This is in order to avoid interruptions to JEM-X operations caused by IREM S/W resets. Pending the next IODB release, INT_OR_0189 has been applied to set the JEM-X1 RMC flags back to DISABLED following execution of the JEM-X1 anode calibration ED KEACAL01 in the Timeline at the start of each revolution.

On 2004-12-17, due to a temporary loss of commanding capability, the activation of JEM-X1 by the automatic Timeline at the start of revolution 266 was interrupted. JEM-X1 was then activated manually, being put in Data Taking mode at 06:31Z, which was about 20 minutes later than planned in the Timeline.

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 231 OMC pointings executed nominally, 1 was interrupted, and 9 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 346 at 21:06:16Z an automatic reset of IREM S/W (SEU#18), that impacted the instruments, forcing them to Safe Configuration, occurred. After the Payload reconfiguration, the unit was successfully recovered and currently no degradation of the performances is observed.

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 poor this week, although still above the system performance requirements, a total of 8 pointings were lost due to ground problems.

4.1 Mission Operations Centre

The performance of the MOC was fair this week, 6 pointings were lost due to NCTRS problems.

4.2 Ground Stations & Network

The performance of the ground stations and Network was in general good this week. There were some problems with the links with Redu, which caused the loss of 2 pointings. The overall performance was above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. General

The TAC process is now finished and a recommendation for the AO 3 program is being sent to D/SCI for approval

1. Mission planning

PSF's up to revolution 274.

All these revolutions have been planned. Revolutions 268 to 270 were replanned to accommodate changed JEM X High Voltage settings. Revolution 267 has a window for AOCS calibrations.

TSF complete up to revolution 269.

2. Observation status

ECS for revolutions up to 255 has been received, ingested, and used to create corresponding OCS files for ISDC.

3. ISOC science data archive

The archive hardware rack was exposed to a too high temperature due to a malfunctioning air-conditioning unit. This caused a disk and tape unit to stop working. Urgent repair has been requested from SUN. This will cause a couple of days delay in the shipment to Spain planned for this week. This rack will now leave during next week. No data ingestion has taken place.

4. ISOC system

Version 10.6.3 has been updated with two patches. Hence current version is 10.6.5. The reason for the changes were a change of limits to allow for support to special observations for the AOCS calibrations and the second one was to resolve an urgent SPR.

5. ISOC move to Spain

Some office computers and other office articles to ESAC together with part of the archive system is on their way to Spain. This will allow the ISOC staff arriving in Spain to have access to the standard office facilities from the start. The remaining archive equipment will be shipped with a few days delay. See above. Temporary procedures for parallel mission planning activities in ISOC during January are established.

6. Problems

The problem reported last week could not be reproduced. Therefore a temporary procedure to check and compare a POS and a RPOS has been introduced. The likelihood of having to use this procedure is very low. Investigation is still ongoing. No new problems to report.

4.3.2 ISDC

Status of ISDC observation processing on 20/12/2004:

- Latest Standard Analysis completed: observation 02201120003 (IC443, Revolution 247-248) on 12/12/2004

- Latest products archived: observation 02200940001 (X0115+63, Revolution 238) on 01/12/2004

- Latest observation products sent to the observer: observation 02297000016 (IGR J16320-4751, Revolutions 226) on 08/12/2004

5 Special Events

None.

6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 346, at 21:06, an IREM SEU forced the instruments to SAFE mode. See the relevant section in the Appendix for the effect on each instrument.
- On DoY 348, at 13:19, both TC & TM links to Redu failed. At 13:26, the links returned, the impact was pointings 02640099 & 02640100 were lost.
- From 15:40 to 15:41, there was a drop in TM flow from Redu, and from 15:58 to 16:01, the TM & TC from Redu dropped. On each occasion there was no impact, the cause was put down to ongoing testing with VILSPA.
- At 16:14, after a handover from Redu to DSS-16, problems were experienced with the links. The NCTRS was rebooted, and the timeline restarted at 17:22. Initially double TM was received, but at 17:55 after recycling the VC-7 link, the TM was nominal. The impact was the loss of pointings 02640104, 02640105 & 02640106.
- On DoY 350, at 05:11, a hit on the line caused the links with Redu to drop, the TM returned at 05:12, and the TC at 05:17, there was no impact.
- At 10:12, 10 bad frames were received from Redu.
- On DoY 351 at 16:18, there was a late station handover from Redu to DSS-16, there was no impact.
- At 19:03, there was an error receiving updates from the pif server.
- On DoY 352, at 05:32, all the commands sent were timed out with the condition G,T,O, the TCE was switched from 1 to 2, and the timeline continued, the impact was pointing 02660002 was lost, eventually this was traced to a problem with the NCTRS.
- At 20:20, an AOCS command failed uplink due to a problem with the nctrs-a, which was subsequently rebooted. The timeline was eventually recovered at 21:14. The impact was the loss of pointings 02660025 and 02660026.

The following new anomaly reports were entered into the ARTS system.

AR id	Date Created	Subject	Segment	Status
INT_SC-105	14/12/2004	IREM Anomaly: Reset of IREM_CSCI S/W #18, 11/12/2004	Payload	Open
INT-SC-107	11/12/2004	SPI TM packet leakage anomaly	Payload	Pending
INT-2685	15/12/2004	DoY 344 14:07 Redu TCE1 is not receiving commands	ESA Stations	Pending
INT-2686	17/12/2004	DoY 352 05:32 Redu TCE1 is not receiving commands	ESA Stations	Pending
INT-2686	21/12/2004	DOY 352 20:20: TCs received on-board with large delays.	NCTRS	Pending

7 Future Milestones

The Current eclipse season started on the 23rd November 2004, and continued until the 17th December 2004. The eclipse season is now over, the next eclipse season will start in summer 2005.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 264

The observations in revolution 264 consisted of 14 pointings of a GPS lasting ~9.5 hours, followed by an amalgamated raster dithering observation of Cassiopeia A (RA 23:51:39.60; DEC +61:41:40.5), performed for the remaining ~50 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.

Revolution 265

The observations in revolution 265 consisted of 14 pointings of a GPS lasting ~9.5 hours, followed by an amalgamated raster dithering observation of Cassiopeia A (RA 23:51:39.60; DEC +61:41:40.5), performed for the remaining ~50.5 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.

Revolution 266

The observations in revolution 266 consisted of 13 pointings of a GPS lasting ~9 hours, followed by an amalgamated raster dithering observation of Cassiopeia A (RA 23:51:39.60; DEC +61:41:40.5), performed for the remaining ~51 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

2004-11-29T05:12:09.000Z	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.
2004-12-02T05:07:53.000Z	166.1063	F	Automatic TM processing.
2004-12-04T15:10:15.000Z	166.0740	F	Automatic TM processing.
2004-12-05T05:02:40.000Z	166.0124	F	Automatic TM processing.
2004-12-05T15:49:21.000Z	165.9742	F	Automatic TM processing.
2004-12-06T14:30:20.000Z	165.9618	F	Automatic TM processing.
2004-12-08T04:52:32.000Z	165.8968	F	Automatic TM processing.
2004-12-11T04:40:16.000Z	165.8869	F	Automatic TM processing.
2004-12-11T13:05:53.000Z	165.8150	F	Automatic TM processing.
2004-12-14T04:28:32.000Z	165.7845	F	Automatic TM processing.
2004-12-14T12:51:52.000Z	165.7379	F	Automatic TM processing.
2004-12-17T03:58:08.000Z	165.7258	F	Automatic TM processing.

This report was generated Fri Dec 17 08:00:21 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 11/12/2004-17/12/2004

AOCS operations were executed from the Automatic Timeline.

During this period, 68 Open Loop Slews, 177 Closed Loop Slews and 6 Momentum Bias were scheduled. 8 slews were missed or executed manually. This is equivalent to a ~ 3.2 %.

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 the end of the eclipse season are provided below:

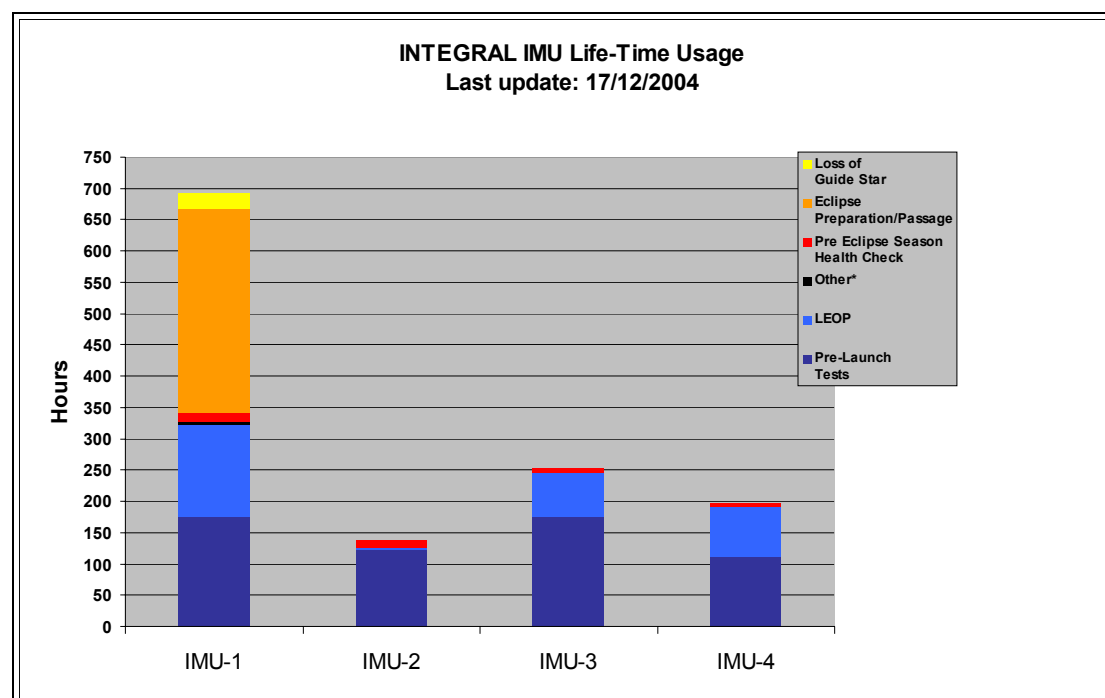
AOCS Eclipse Times														Winter 2004	
Date	LOS	AOS	ACC Eclipse Imminent	Eclipse Start					Eclipse End					ACC	Eclipse Duration
				ACC	FDE	FCE	Penumbra	FSS Sun Out	Umbra	Umbra	FSS Sun In	Penumbra	FDE/FCE		
2004-11-23	23:46:27	03:45:40	03:06:49	03:48:50	03:58:42	03:59:26	04:06:29	04:09:59	04:12:20	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
2004-12-05	23:18:00	02:56:00	02:13:52	02:55:54	03:05:20	03:06:04	03:13:32	03:14:22	03:14:37	04:07:58	04:08:02	04:09:21	04:13:44	04:19:05	0:55:49
2004-12-08	22:54:00	02:45:00	02:04:35	02:46:31	02:57:05	02:57:49	03:04:15	03:04:58	03:05:19	04:00:31	04:00:34	04:01:56	04:07:41	04:11:33	0:57:41
2004-12-11	22:54:00	02:31:00	01:55:38	02:37:20	02:48:41	02:49:25	02:55:18	02:56:06	02:56:28	03:50:15	03:50:18	03:51:49	03:57:49	04:01:14	0:56:31
2004-12-14	22:29:00	02:18:00	01:47:04	02:29:13	02:39:50	02:40:34	02:46:44	02:48:14	02:48:07	03:36:14	03:36:50	03:38:02	03:43:50	03:47:53	0:51:18
2004-12-17	22:08:00	02:08:00	01:44:46	02:26:13	02:35:25	02:36:09	02:44:26	02:46:06	02:46:28	03:21:08	03:21:42	03:23:34	03:28:57	03:32:44	0:39:08

IMU Usage during Eclipse Season						Winter 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	
2004-12-04 19:47:45	2004-12-05 04:21:36	0.1867	0.1332	aborted (lost of guide star)	8:33:51	40:10:41	
2004-12-07 20:01:43	2004-12-08 04:13:55	0.1830	0.2500	0.2949	8:12:12	48:22:53	
2004-12-10 19:36:59	2004-12-11 04:03:00	0.2211	0.2078	aborted(lost of guide star)	8:26:01	56:48:54	
2004-12-13 19:29:00	2004-12-14 03:50:02	0.2147	0.2648	aborted(lost of guide star)	8:21:02	65:09:56	
2004-12-16 19:03:00	2004-12-17 03:35:03	0.1936	0.1458	0.1715	8:32:03	73:41:59	

An update of the IMU usage up to 17/12/2004 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	693.301280	38.52	175.045556	147.371944	25.892669	325.321944	13.871944	5.797222	17/12/2004
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.

11/12/04 (Day of Year 346, Revolution 264)

Nothing to report.

12/12/04 (Day of Year 347, Revolution 264)

Nothing to report.

13/12/04 (Day of Year 348, Revolution 264)

Slews missed from the Timeline: Due to a problem on TM/TC links with REDU station, the slews 02640099(CSL) and 02640100(OSL) were not executed. A manual open loop slew was then performed to the attitude of PID 02640100. The next slew for PID 02640101 was manually updated and executed from the Timeline.

Slews missed from the Timeline: Due to problems with DSS16 station and on the NCTRS-A machine, the slews 02640105(CSL) and 02640106(CSL) were not executed. A manual close loop slew was then performed to the attitude of PID 02640106. The next slew for PID 02640107 was manually updated and executed from the Timeline.

14/12/04 (Day of Year 349, Revolution 264-265)

Nothing to report.

15/12/04 (Day of Year 350, Revolution 265)

Nothing to report.

16/12/04 (Day of Year 351, Revolution 265)

Flickering of the pointing-bit due to yaw error: At 07:40:13z an undetected false event on the star tracker caused a jump (~ 80 arcsec in yaw) in the position of the CCD image of the guide star. The error in yaw was more than the OTF threshold for this axis and resulted in the flickering of the pointing-bit. This was not seen at BCP level. The magnitude 8.45-guide star was picked by the ACC after an open loop slew at CCD location [-1907, -11083].

17/12/04 (Day of Year 352, Revolution 265-266)

Slews missed from the Timeline: Due to problems with NCTRS as a consequence the slews 02660002(CSL) and 02660003(CSL) were not executed. A manual open loop slew was then performed to the attitude of PID 02660003 and the pointing was completely recovered. The next slew for PID 02660004 was manually updated and executed from the Timeline.

Slews missed from the Timeline: Due to problems with NCTRS-A machine, the slews 02660025(CSL) and 02660026(CSL) were not executed. A manual open loop slew was then performed to the attitude of PID 02660027 and slew 02660027 manually updated and executed from the Timeline.

Reconfiguration of the AOCS after the eclipse season: With the ending of the eclipse season, the AMD thresholds were set back to their non-eclipse season values. The manual operation started at 11:05z and the following AMD thresholds were loaded:

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.							
01- Update of thresholds after uplink of new RW Inertias on 22/01/2004. 0155_0001_M.RWI							
Wheel Inertia:							
RW#1:	0.096000	Kgm**2					
RW#2:	0.097650	Kgm**2					
RW#3:	0.097272	Kgm**2					
RW#4:	0.097649	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:	406.250000	rd/s	373.958333	rd/s	3879	3571	
RW#2:	399.387606	rd/s	367.641411	rd/s	3814	3511	
RW#3:	400.938401	rd/s	369.068939	rd/s	3829	3524	
RW#4:	399.388015	rd/s	367.641788	rd/s	3814	3511	
WSMIN	To Uplink:				In rpm:		
	X1		X2		X1	X2	
RW#1:	22.916667	rd/s	50.000000	rd/s	219	477	
RW#2:	22.529557	rd/s	49.155398	rd/s	215	469	
RW#3:	22.617038	rd/s	49.346265	rd/s	216	471	
RW#4:	22.529580	rd/s	49.155448	rd/s	215	469	

The ACC, FDE and FCE Eclipse Timers were stopped. The following steps were performed:

- freezing the FDE Eclipse Timer in the sunlight state (by loading zero and starting the Timer);
- freezing the FCE Eclipse Timer in the sunlight state (by loading zero and starting the Timer);
- stopping the ACC Eclipse Timer task.

8.3.2 SPI Operations

Cryocooler / Detector Cold-Plate:

The performance of the cryocooler is nominal.

The cold plate temperature was maintained at 85K $\pm$ 1K over the reporting period, showing the expected small positive drift.

Due to a problem in the data retrieval system, the plot showing the evolution of the cold-plate and H bus temperatures is not available.

IASW/DPE:

On the night between 10th and 11th December, the new DPE SPIASW431 was installed on-board.

This version introduced the following functionalities:

- a) Option to stay in Photon mode in case of radiation conditions. This is performed ensuring the SPI safe configuration and disabling the acquisition of photon/spectra data. The new option can be enabled by setting the IASW parameter E8936 P SW RAD-MOD L=PHOTON.
- b) APIDs for science hk telemetry packets VC0 routing: The original APIDs in 4.30 were 1120 to 1124 (VC7 routing); new APIDs in 4.31 are 1056 to 1060 (VC0 routing), reflecting the current APIDs set on-board since March 2004.
- c) Removal of a known software bug causing the generation of spurious OEMs at radiation conditions entry (flare begin). This known software shortcoming in 4.30 and earlier versions is documented by the operations constraint nr.14 in the SPI UM.

After the patch, the instrument was re-started and the new functionalities enabled, restoring the nominal performances of the IASW/DPE.

As mentioned in the summary, an exception is the known anomaly of TM packet leakage, whose effects are no more negligible after the installation of SPIASW431 (6 pkts out of 103 allocated are lost), considering an average TM bandwidth occupation already approaching saturation due to high radiation background.

TM leakage anomaly description

The malfunction manifests itself by the under-exploitation of the TM resource assigned to SPI by the PST. In details, the CDMU PST allocates 103 fixed length TM packets to SPI every 8s TM cycle; SPI is able to produce more than this TM rate but, due to this anomaly, is not able to transmit at a rate greater than 97 packets every 8s.

The anomaly is already known since Commissioning time (November 2002) and is systematic. So far, several investigations were performed by CNES/CESR w/o finding any result and w/o being able to reproduce the anomaly on-ground, using the SPI simulation facilities at Toulouse. The anomaly never appeared during ground pre-launch tests.

In summary this is the history of the problem across the different sw version so far installed on-board:

- SPIAW 410 : 1 packet lost (allocation 90);
- SPIAW 420 : 1 packet loss with allocation 90 / 3 packets lost with allocation 98 , reduced to 1 after transition Photon/Conf/Photon regularly performed at belts exit;
- SPIAW 430 : 1 packet lost (allocation 103). In 430 version, immediately after the patch, it was observed 0 pkt loss. Later it changed to 1 pkt loss.

AR INT_SC-21, written during Commissioning, first describing the anomaly, has remained open until recent decision to close it and use the instrument as is as, with SPIASW430, the effects were negligible (just 1 pkt lost).

A new AR, INT_SC-107, was therefore written, reporting the latest developments and effects.

It must be noted that in-flight troubleshooting tests show that the anomaly is weakly coupled to the sw version being executed on-board. In fact, all the versions so far uploaded have the same code involving the TM pkt acquisition and transmission over the OBDH bus, where the bug is believed to reside. This part of the code is indeed the same as pre-launch.

In-flight tests show instead that the TM leakage rather depends on the TM slots distribution over the PST cycle as varying it, it changes the number of lost pkts, increasing or decreasing until to zero.
 At the moment there is no clear evidence why a particular slot distribution/pattern is more adverse than others.

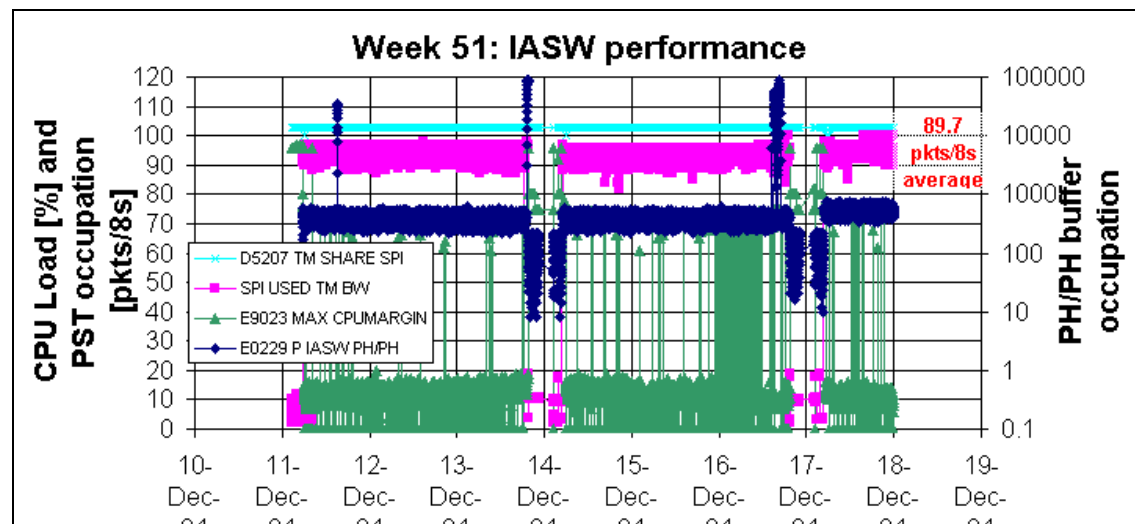
Recovery attempts:

Attempts to find a more favourable PST arrangement were carried out in order to try to recover the SPI TM bandwidth as much as possible, on 16th December, between 10:50z and ~17:00z.

The attempts were partially succesful: 100 pkts/cycle is now the maximum TM rate (only 3 pkts loss).

Further tests/recovery attempts are under development. Additional analyses on the IASW code have started at CESR (SPI PI team).

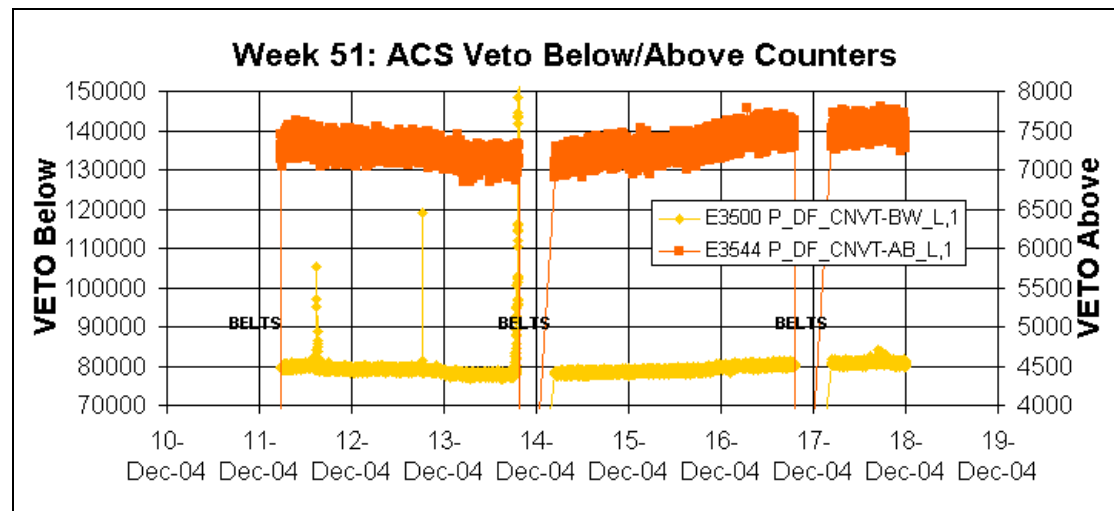
The following diagram shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

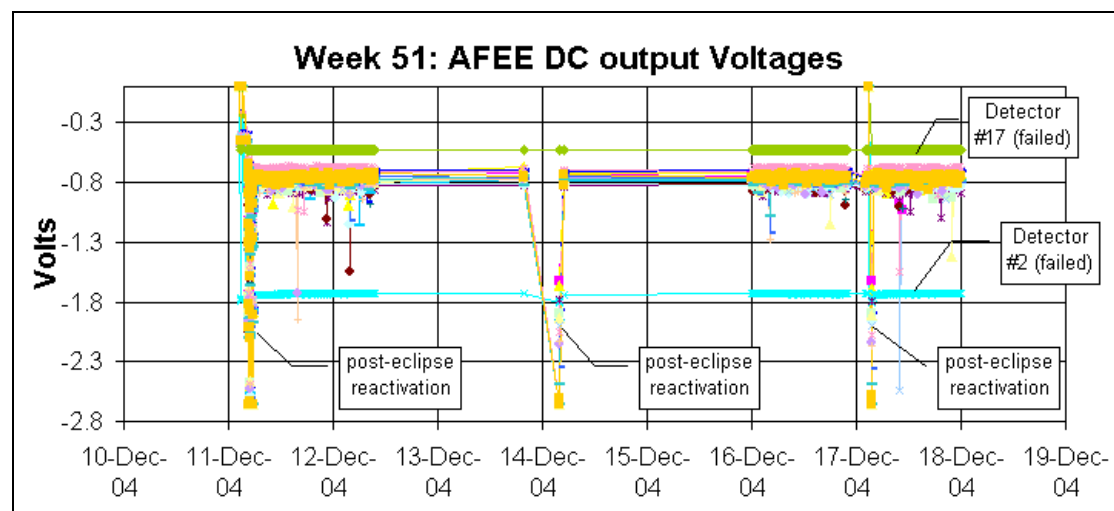
The following plot shows the ACS overall count rate evolution during the reporting period.



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.

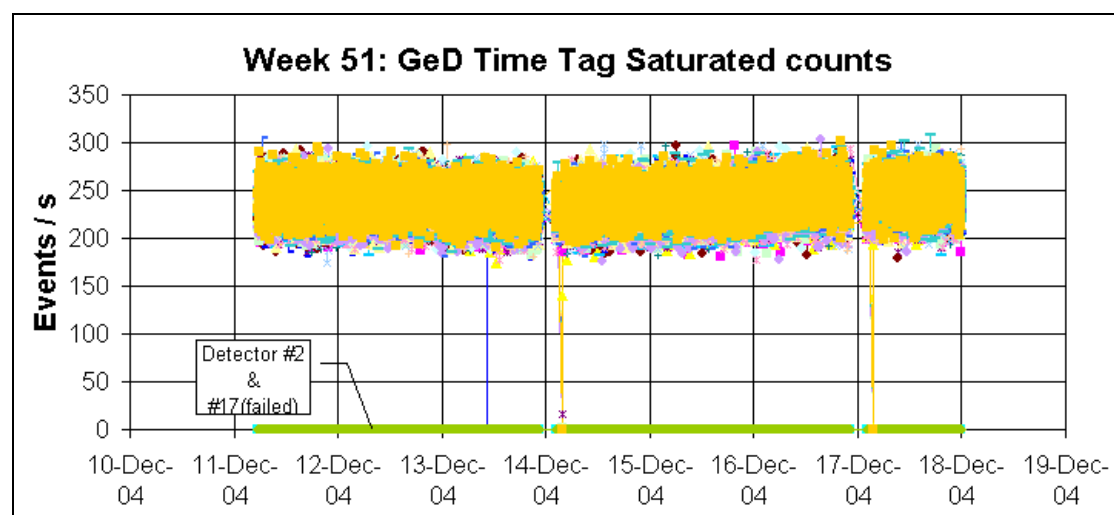
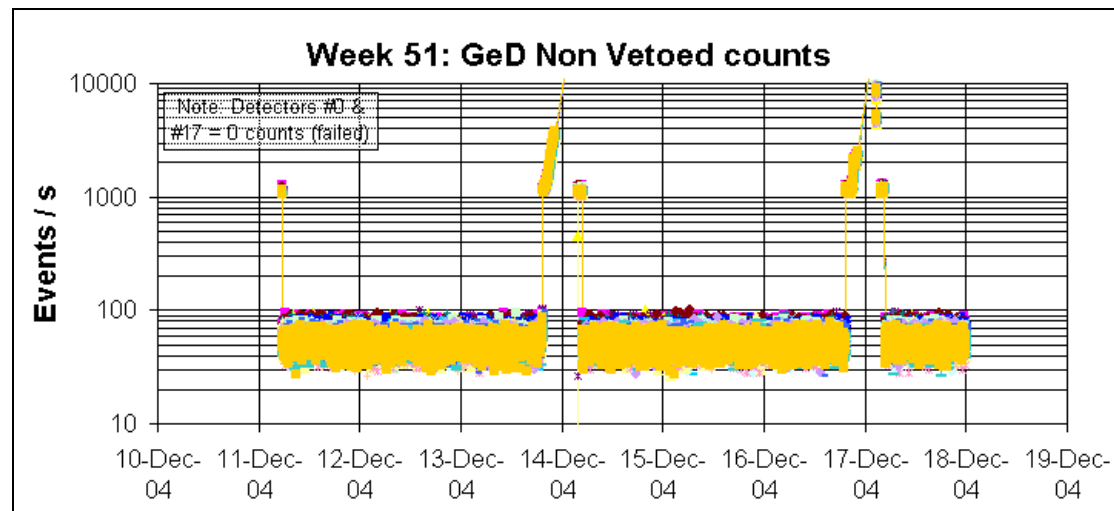
The following plot shows the AFEE dc output signals during the reporting period.



DFEE:

The performance of the unit is nominal.

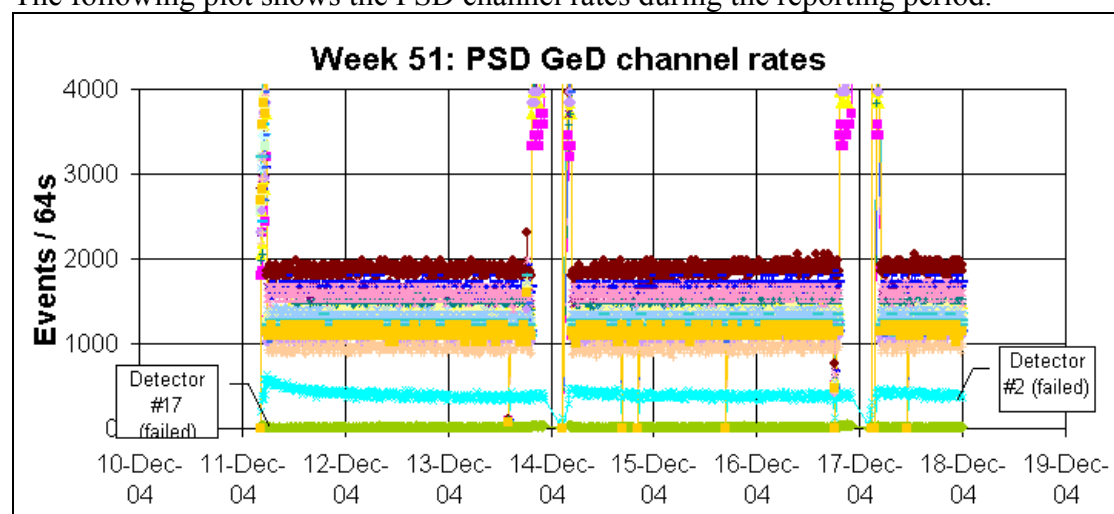
The following plot shows the Non Vetoed event rates, processed by the DFEE during the reporting period. The count rate of each detector is within the expected range, except for the failed detector #2 and #17.



PSD:

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

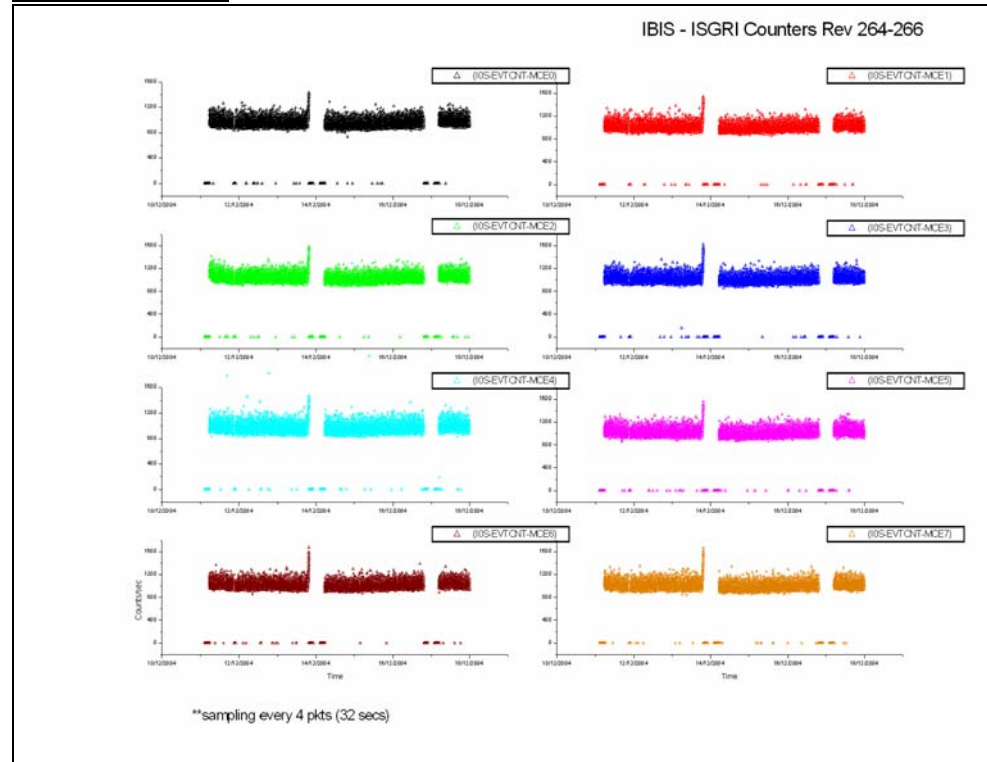
The following plot shows the PSD channel rates during the reporting period.



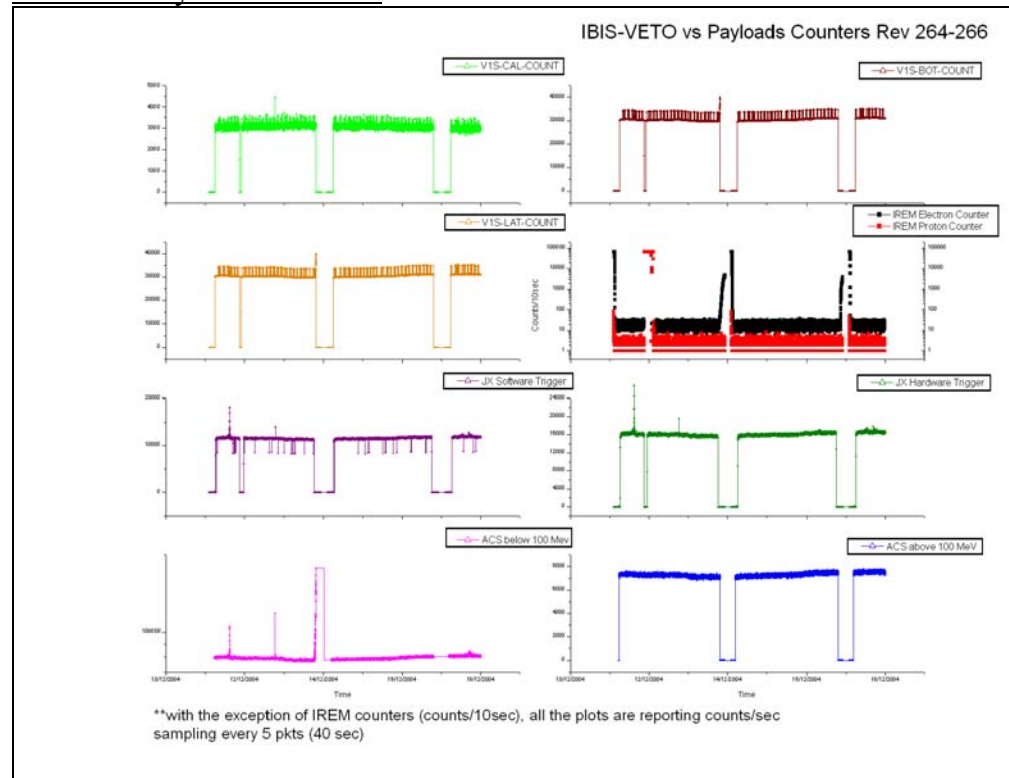
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

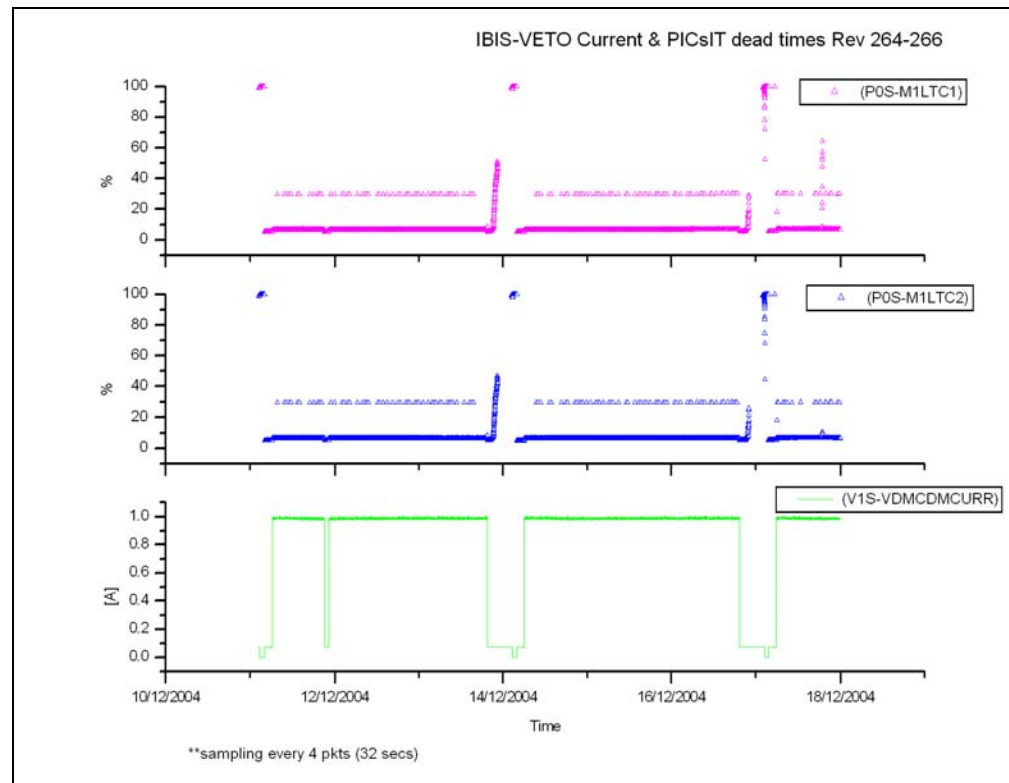


VETO vs Payloads Counters

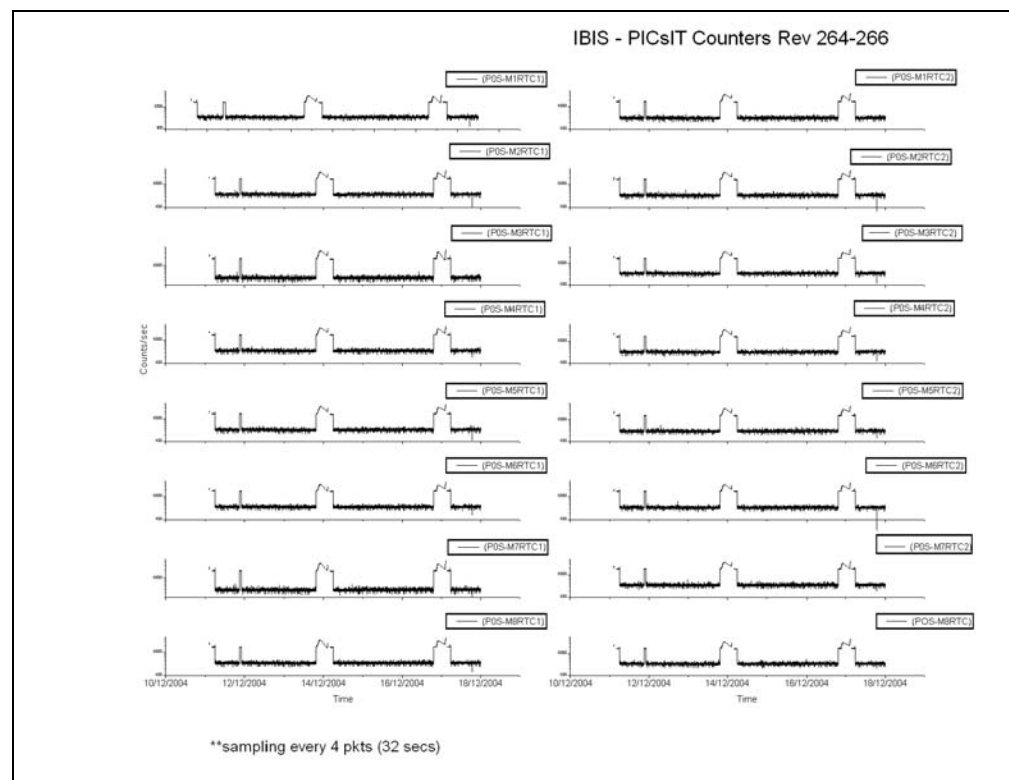


The week was characterised by low to moderate solar activity.

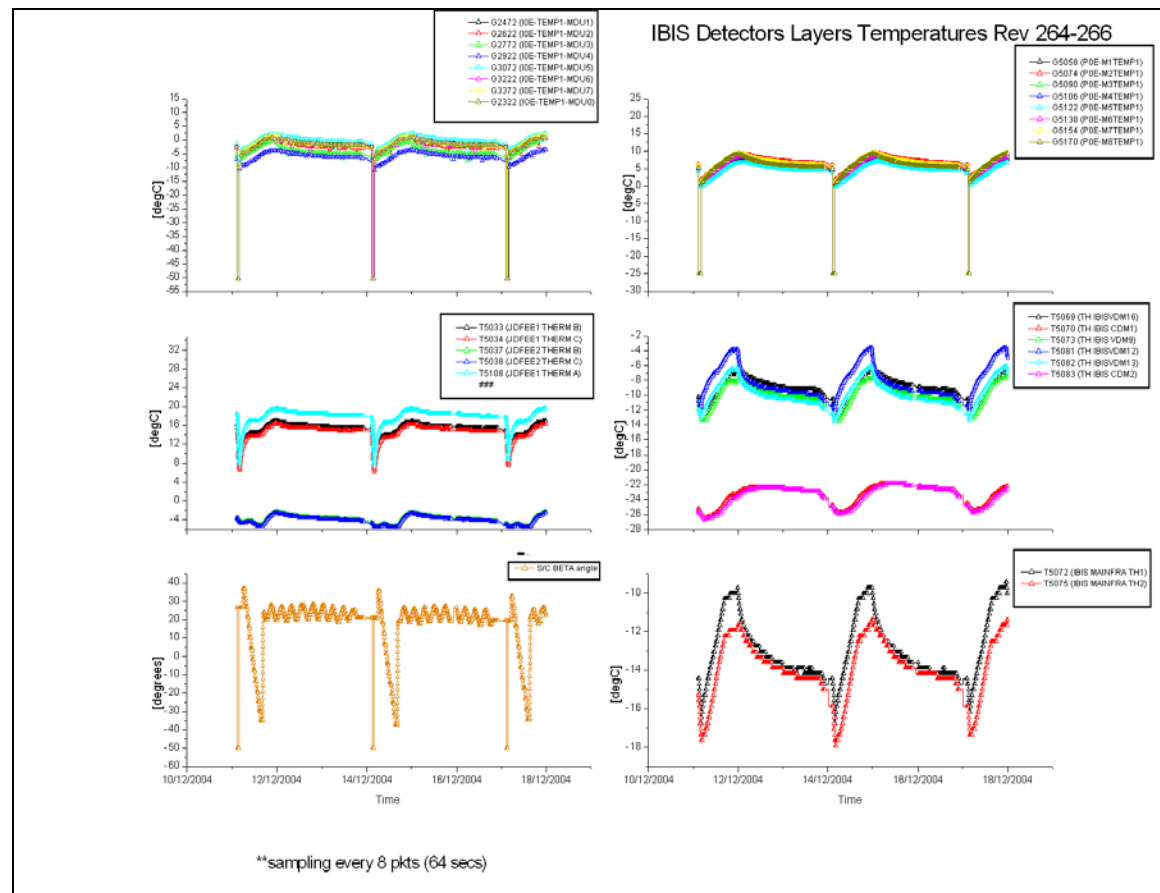
Veto Current:



Picsit Counters:



IBIS Detectors Layers Temperatures



IBIS daily report DoY 346 (11/12/2004)

At 21.06Z an IREM SW failure (SEU #18) forced IBIS to Stand-by mode. Following procedure FCP_IBIS_0803, IBIS exited this safe configuration at 22.11Z, and was back to Scientific Standard Mode at 22.32Z.

DoY 347 (12/12/2004)

Nothing to report.

DoY 348 (13/12/2004)

Nothing to report.

DoY 349 (14/12/2004)

Nothing to report.

DoY 350 (15/12/2004)

At 00.22Z, the TM parameter G2056 (ISGRI Overflow of the noisy pixel address buffer in MCE4) was reported in OOL (SCC FAIL). According to OEM reaction I-OVF-1 no action was taken.

DoY 351 (16/12/2004)

Nothing to report.

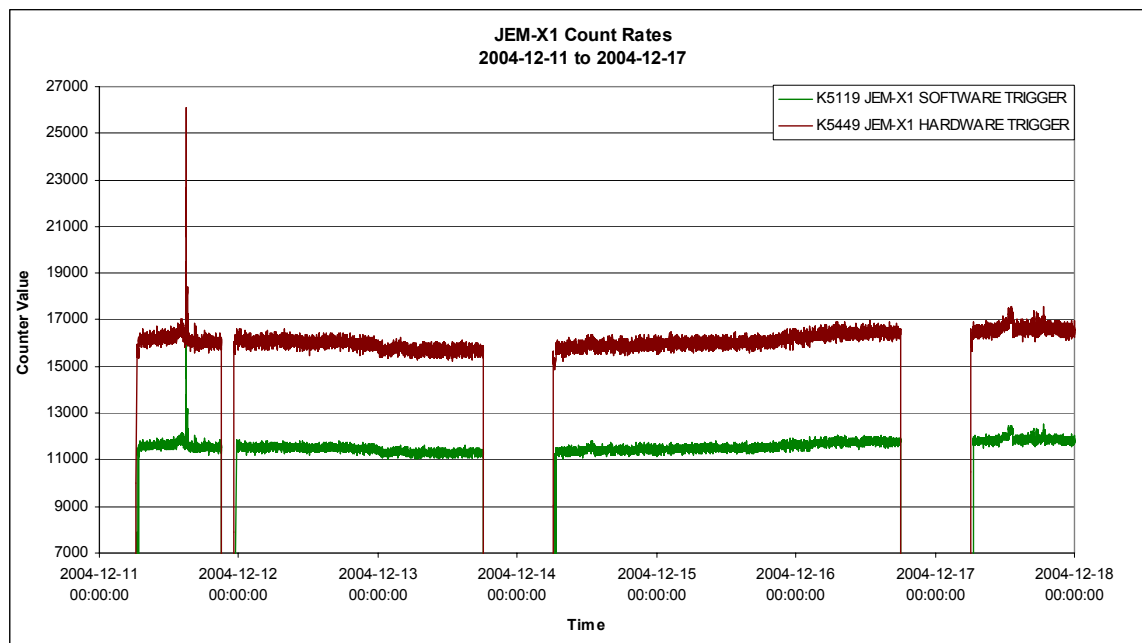
DoY 352 (17/12/2004)

At 18.51Z the TM parameter family G5068 failed status consistency check (SCC FAIL). According to reaction P-FIF-1 no action was taken.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

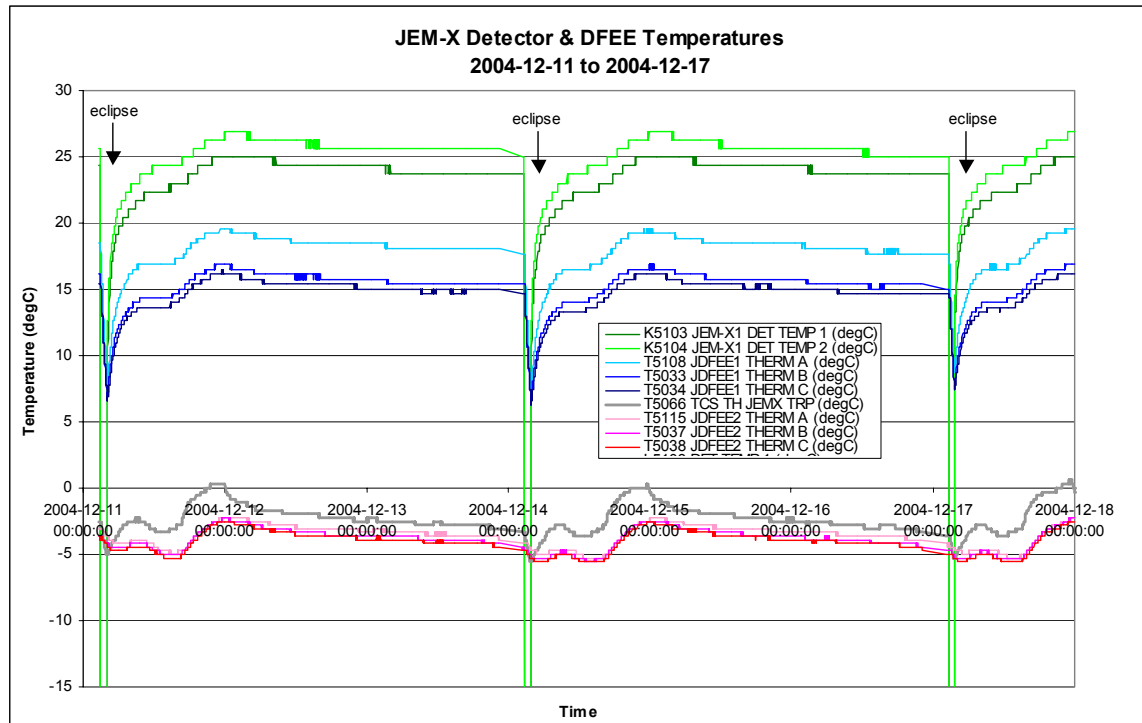
JEM-X1 count rates over the reporting period are displayed in the following graph¹.



8.3.4.2 JEM-X Temperatures

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

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.



8.3.4.2 JEM-X Daily Report

2004-12-11 (DOY 346, Rev 263-264)

At 21:06Z an IREM S/W reset (#18, ref: AR INT_SC-105) 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 21:08Z.

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 21:30Z. 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 22:58Z, with the procedure FCP_JEM1_1010. When executing this procedure, INT_OR_0176 was applied to edit the values for the microstrip gas gain voltage from the IODB defaults to the current operational settings, with the final nominal dV set to 79 RAW. Procedure FCP_JEM1_0044 was then executed to put JEM-X1 in Data Taking mode at 23:32Z. Commanding to JEM-X1 from the automatic Timeline was then re-enabled at 23:34Z.

² Data sampled (1 frame in 8)

At 23:41Z 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 for the remainder of the day.

2004-12-12 (DOY 347, Rev 264)

Once IREM had been recovered and the IREM count rates had been monitored for ~2 hours to check their stability, at 05:13Z FCP_DHS_1301 was executed to set the broadcast packet DRMC flag back to REGARD. At 05:35Z the JEM-X1 RMC flags were set back to ENABLED by procedure FCP_JEM1_0120.

JEM-X1 operations then continued nominally.

2004-12-13 (DOY 348, Rev 264) to 2004-12-14 (DOY 349, Rev 264-265)

Nothing to report

2004-12-15 (DOY 350, Rev 265)

At 15:26Z OCR-187 (Disable JEM-X1 & JEM-X2 reactions to IREM count rates in the Broadcast packet) was implemented. JEM-X1 and JEM-X2 reactions to the IREM count rates, i.e. RMC#1, RMC#2 and RMC#3 flags, were set to DISABLED via procedures FCP_JEM1_0120 and FCP_JEM2_0120.

2004-12-16 (DOY 351, Rev 265)

As Goldstone was not able to start the pass at the scheduled handover time at the end of revolution 265, and reported that probably the entire Goldstone pass would be lost, FCP_JEM1_0040 was executed at 16:01Z, with the execution time of TC K0008 set to 2004.351.18.01.18Z (the uplink time of the ED KESAFE01 in the Timeline) in order to ensure that JEM-X1 would go to Safe mode at the planned time before radiation belt entry. The Goldstone pass was later recovered and the Time-Tag TC K0008 was then deleted from the on-board Time-Tag Buffer at 16:49Z.

JEM-X1 operations then continued nominally.

2004-12-17 (DOY 352, Rev 265-266)

At 05:19Z FCP_JEM1_0120 was executed, according to INT_OR_0189, to reset the JEM-X1 RMC flags back to DISABLED following execution of the JEM-X1 anode calibration ED KEACAL01 in the Timeline. (At the end of the KEACAL01 ED, all the BCP override flags are set to ENABLED. Thus this OR is required until the next IODB release, which will include updated KEACAL01 and LEACAL01 sequences, in which the RMC flags are left DISABLED.)

Starting at 05:32Z, a problem developed with commanding (see Anomaly Report INT-2686) and, as a result, at 05:34:39Z (after the first TC of the ED KEACT_03 had been uplinked) the automatic Timeline was stopped.

Once the problem had been fixed by a swap from TCE1 to TCE2 at Redu and commanding capability was restored, the automatic Timeline was restarted at 06:00Z, with commanding to JEM-X1 disabled.

The activation of JEM-X1 was then performed manually via FCP_JEM1_1010 at 06:03Z. INT_OR_0176 was applied to this procedure to edit the values for the microstrip gas gain voltage from the IODB defaults to the current operational settings, with the final nominal dV set to 79 RAW. At 06:31Z FCP_JEM1_0044 was executed to put JEM-X1 in Data Taking mode and commanding to JEM-X1 from the Autostack was then re-enabled.

JEM-X1 operations then continued nominally.

8.3.5 OMC Operations

On DoY 346, at 21:06:29, the instrument autonomously switched to SAFE mode due to an IREM SEU. The unit was returned to Stand-by at 21.48.21, and was back in Science mode at 21.50.51. The impact was pointing 02640024 was interrupted after 1177 from a scheduled 1800 seconds, and pointing 02640025 was lost.

On DoY 348, at 13:19, due to link problems with Redu, pointings 02640099 & 02640100 were lost.

At 16:14, due to NCTRS-A problems pointings 02640104, 02640105 & 02640106 were lost.

On DoY 352, at 05:32, due to problems with NCTRS, pointing 02660002 was lost

On DoY 352, at 20:27, due to nctrs problems pointings 02660025 and 02660026 were lost, it was at this time that the following pairs of commands were rejected:

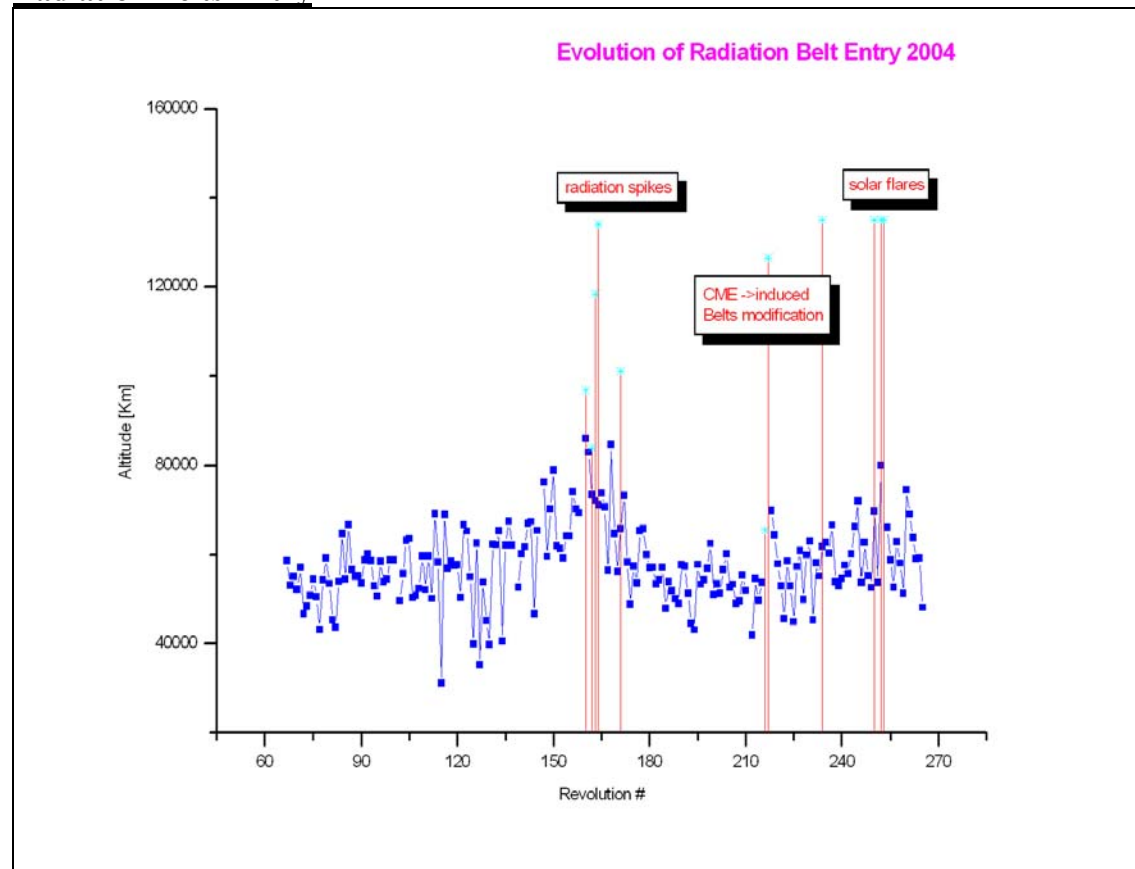
```
2004.352.20.27.49.577  2004.352.20.27.43.783      1792      Real  Time  Rejection  131
REJECTED TC1
2004.352.20.27.57.593  2004.352.20.27.50.283      1792      Real  Time  Rejection  131
REJECTED TC1
      FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=60,IM A M9068=1 FIX2=0 M9069=385
2004.352.21.00.05.390  2004.352.20.59.54.784      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=386
2004.352.21.00.05.427  2004.352.20.59.56.784      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=387
```

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

On DoY 348 at 19:34:27 and DoY 351 at 19:24:36, 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]
264	RAD EXIT R 2004-12-11T04:59:29Z	2004-12-11 03:20:24	<24893.7	2004-12-11 03:49:19	28712.1
264	RAD ENTR R 2004-12-13T19:34:15Z	2004-12-13 19:43:36	<59186.5	2004-12-13 20:20:57	54126.12
265	RAD EXIT R 2004-12-14T04:46:16Z	2004-12-14 03:17:52	<26528.3	2004-12-14 03:40:57	29353.05
265	RAD ENTR R 2004-12-16T19:24:21Z	2004-12-16 20:50:48	>48187.4	2004-12-16 20:20:57	53328.23
266	RAD EXIT R 2004-12-17T04:35:49Z	2004-12-17 02:44:33	21632.0	2004-12-17 03:30:57	28734.56

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
263	PROTON_RAD_ENT	Not available in RadMon
264	PROTON_RAD_EXT	Not available in RadMon
264	PROTON_RAD_ENT	Not available in RadMon
265	PROTON_RAD_EXT	Not available in RadMon
265	PROTON_RAD_ENT	Not available in RadMon
266	PROTON_RAD_EXT	Not available in RadMon

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

IREM daily report

DoY 2004.346 (11/12/04)

At 21:06Z a local reset of the IREM CSCI S/W (SEU #18): 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, 01/12/2004) the status of the unit, before the occurrence of the anomaly, was nominal, here is a summary:

- 1) Temperatures nominal
- 2) LCL current nominal
- 3) The last HK before the anomaly HV, 5V and 6V voltages were within limits
- 4) The anomaly occurred at 2004.346.21.06.16z at 127286.8 km. 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 commenced at about 01:00z using the 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 of the register bank give a status word BC80 HEX = 48256 DEC = 1011110010000000, ie. the unit is still 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 05:14Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing 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 22:32Z
- JEM-X1 re-enabled at 23:32Z
- OMC re-enabled at 21:36Z

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.

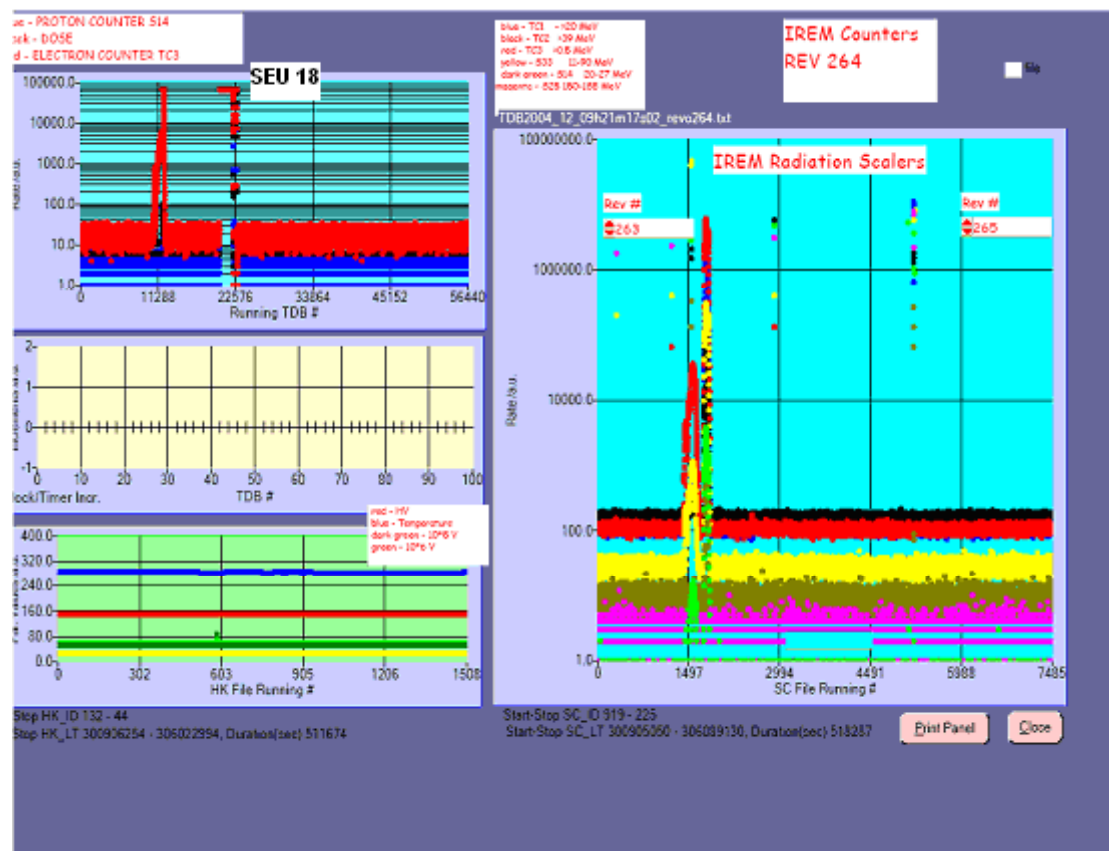
DoY 2004.349 (14/12/04)

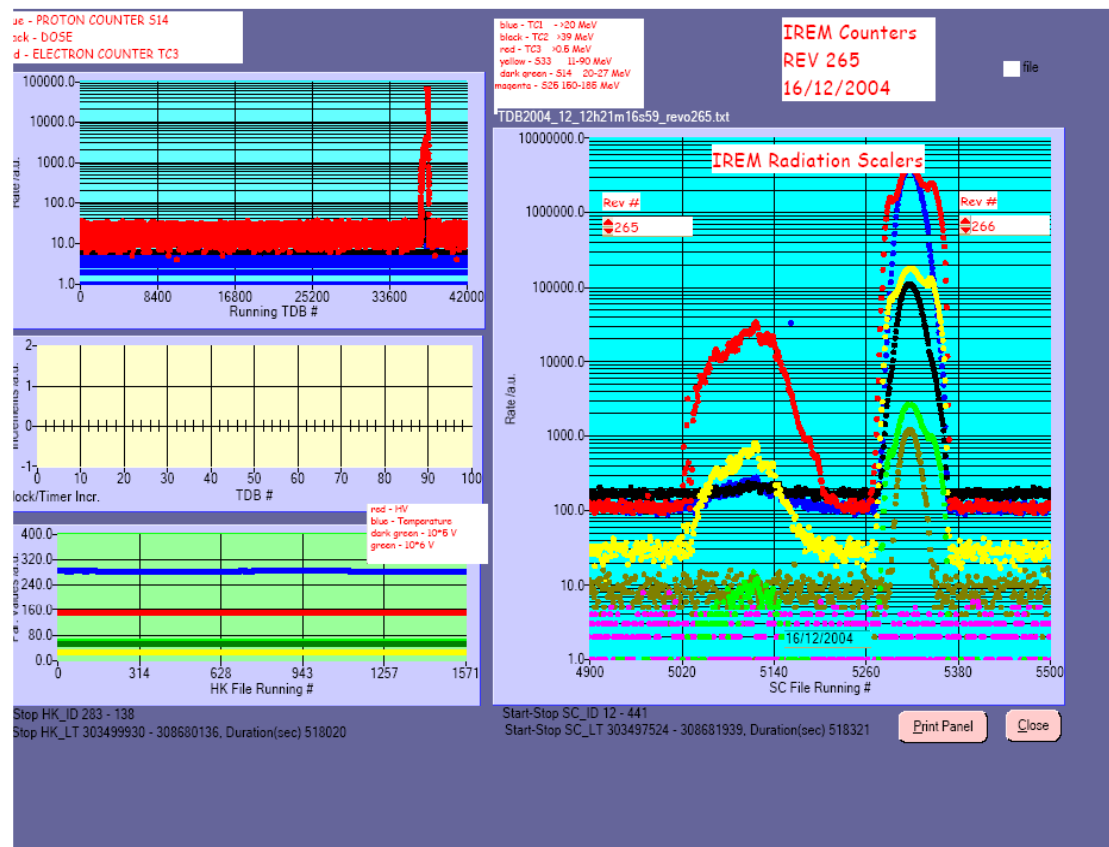
At 02:47 the IREM TC U4920 (INT GND LINK ON) failed completion. As it was resent, no impact was reported.

DoY 2004.352 (17/12/04)

At 02:37 the IREM TC U4920 (INT GND LINK ON) failed completion but was on-board OK. No action was taken.

IREM radiation counters

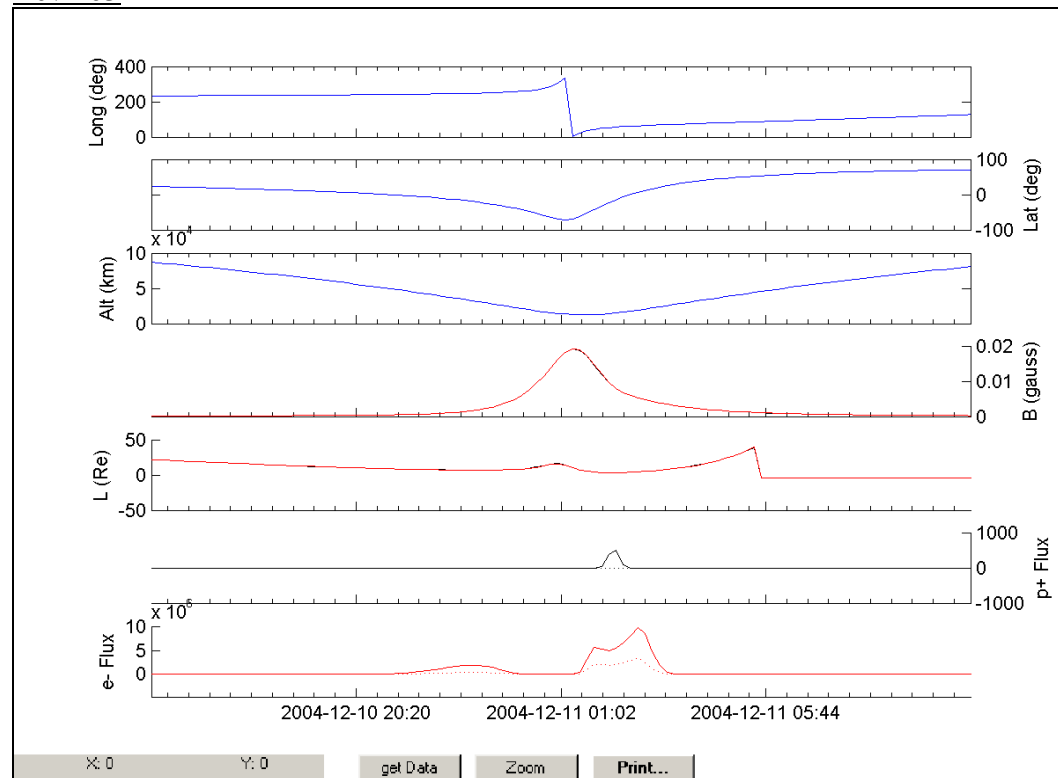




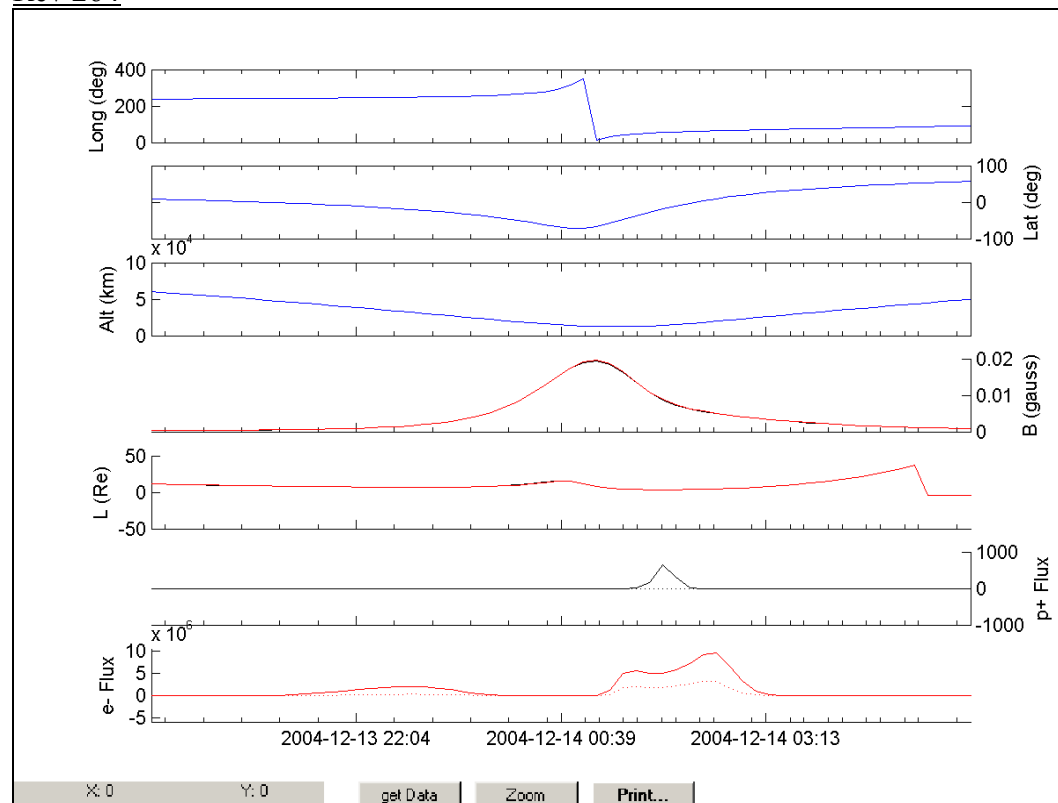
Due to connection problems with TCPIP server, IREM radiation counters data, acquired by IREM ECOE, are not completely available for the perigee passages of revolution 264.

IREM Predicted Radiation Belt Passages.

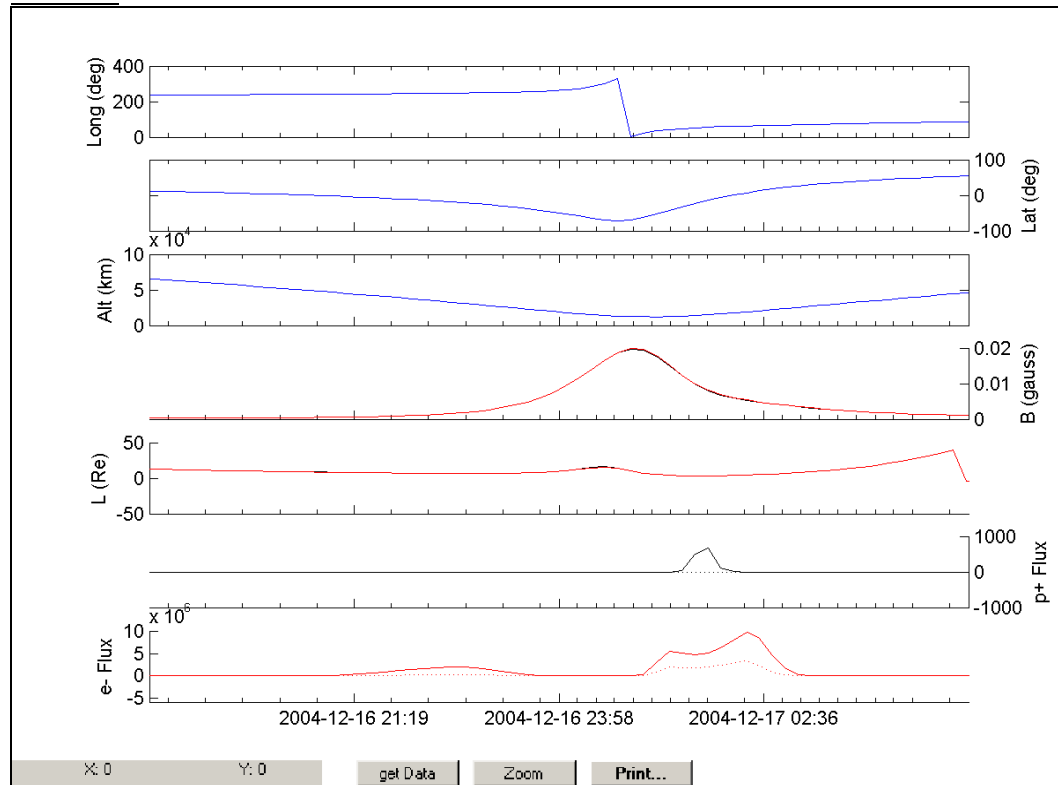
Rev 263



Rev 264



Rev 265



SEC-GOES Observed Particles Fluxes.

