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

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 092
Week 27
28.06.04
Routine Phase

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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	5
3.2.4	OMC.....	5
3.2.5	IREM	6
4	Ground Facilities.....	6
4.1	Mission Operations Centre.....	6
4.2	Ground Stations & Network.....	6
4.3	Science Ground Segment.....	6
4.3.1	ISOC	6
4.3.2	ISDC.....	7
5	Special Events.....	7
6	Anomalies.....	7
7	Future Milestones	8
8	Appendix.....	9
8.1	Overview of Revolutions	9
8.2	Consumables	9
8.2.1	Detailed Fuel Book-keeping.....	9
8.3	Detailed Satellite Information	10
8.3.1	AOCS Summary Operations Report 12/06/2004-18/06/2004	10
8.3.2	SPI Operations.....	11
8.3.3	IBIS Operations.....	13
8.3.4	JEM-X Operations.....	17
8.3.5	OMC Operations	21
8.3.6	IREM Operations	21

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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 19.06.04 until 25.06.04 (both dates inclusive) and covers the revolutions 206 & 207.

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 Abell 2256 (RA 17:03:58.30; DEC +78:38:30.9), 3C 273 (RA 12:29:6.70; DEC +02:03:09.0) and Mkn 590 (RA 02:14:33.60; DEC -00:46:00.0). The activities consisted of raster dithering observations. In addition, SPI annealing operations were completed and passive cooling was started.

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.

The fuel consumption over the period between 18/06/2004 and 25/06/2004 was 0.123 kg. The remaining propellant is in the order of 169.887 Kg on the 25th of June.

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 6 and 7 of the summer eclipse season:

A summary of the eclipses is provided in the following table:

Eclipse	Date	Penumbra Entry	Umbra Entry	Umbra Exit	Penumbra Exit	Total Duration	Umbra duration
6	20/06/04	11:36:36	11:38:39	12:35:38	12:37:11	1:00:35	0:56:59
7	23/06/04	11:32:41	11:35:01	12:20:19	12:22:09	0:49:28	0:45:18

A summary of the batteries discharge and recharge capacities is provided in the following table:

Eclipse	DOD1 (Ah)	DOD2 (Ah)	EOC Time		Recharge Duration		Recharged Capacity	
			Batt 1	Batt 2	Batt 1	Batt 2	Batt 1 (Ah)	Batt 2 (Ah)
6	5.19	5.14	15:42:15	15:40:39	3:05:04	3:03:28	5.62	5.56
7	3.88	3.84	14:39:51	14:38:39	2:17:42	2:16:30	4.20	4.16

As these eclipses all took place entirely outside ground station coverage, no direct monitoring of batteries behaviour during eclipse was possible. However all indications from on-board stored data (ECD and OBM) are that the behaviour was nominal.

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 is nominal.

During the reporting period the 4th annealing of the Germanium detectors timeline progressed nominally up to the switch off of the annealing heaters and subsequent passive cooling and cryo-cooler start-up. The annealing temperature (104degC) was maintained for 121hrs, as planned. The cryo-cooler start-up was nominal, showing the exact same characteristic signatures of the previous start-ups.

The special configuration, keeping the instrument in photon-by-photon mode, loaded at annealing start-up, was also maintained in order to monitor the faulty detector GeD#2 during the period. No signal triggered by thermal noise was however detected during the whole period from the GeD#2, thus confirming the permanent failure. The dc output voltage of the detector #2, failed since 06.12.2003, showed an unexpected, peculiar correlation with the detector temperature.

The allocated telemetry bandwidth during the period was of 98 pkts/cycle; the used bandwidth was however only 10 pkts/cycle in average, due to the on-going annealing operations.

An annealing summary timeline is published in this report, under the future activities section.

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 TM bandwidth assigned to IBIS during the observation period was 134 pkts/cycle. The mean IBIS bandwidth usage was 106.45 pkts/cycle (previous week was 104.93).

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 was dormant with a TM allocation of 1 packet/cycle.

An anomaly occurred during the post-eclipse reactivation of JEM-X1 in revolutions 206 and 207, at the stage of switching on the JEM-X1 DFEE and reloading the context from the DPE to the DFEE (see Anomaly Report INT_SC-84). Consequently, JEM-X1 operated with a CPU state of 8MHz, 1 WS (instead of 16MHz, 0WS) throughout revolution 206 and the part of revolution 207. The anomaly was detected and recovered on 2004-06-24, and JEM-X1 operations continued nominally from 2004-06-24T16:30Z onwards.

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 166 OMC pointings executed nominally, none 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.

Solar Activity

The observation period was characterized by low 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, with no pointing lost.

4.1 Mission Operations Centre

The performance of the MOC was in general good in the reporting period, there were a few minor problems that were easily resolved, one interesting problem, was the non-verification of an AOCS command, that was eventually resolved by restarting the TC chain.

4.2 Ground Stations & Network

The performance of the ground stations and Network was in general good this week. Poor communications with DSS-16 caused a couple of minor problems. The performance was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSF's: Received up to rev. 213

POS and POD generated: up to rev 209 (no change)

TSF's: Received up to rev 208

No ToO request received. No re-planning was performed this week. The proposal data base is being updated to use the modified telemetry allocation with the associated IBIS configuration change. This work needs to be completed before rev 210 can be planned.

2. Observation status

ECS's up to rev 199 have now been received. Rev 168,189 and 197 are missing. Corresponding OCS sent. No extra time credited.

3. ISOC science archive

No new data received this week. The web browser version 1.1 has now finished the beta testing and is being installed in ISOC.

4. ISOC system

The ISOC system version 10.4.4 is still in use.

5. Problems

No new problem.

4.3.2 ISDC

Status of ISDC observation processing on 28/06/2004:

- Latest Standard Analysis completed: observation 01201570003 (Cygnus X, Revolution 190-191) on 12/06/2004
- Latest products archived: 01201570003 (Cygnus X, Revolution 190-191) on 14/06/2004
- Latest observation products sent to the observer: observation 01201570003 (Cygnus X, Revolution 190-191) on 17/06/2004

5 Special Events

SPI Annealing – see 8.3.2

Some tests regarding the replacement of the X25 interface to Redu by IP are currently been performed. On 13 July a test with the Redu station regarding the upgrade to IP will be performed.

6 Anomalies

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

- On DoY 171 at 13:02 ISDC informed MOC that they are currently unable to generate context tables due to excessive noisy pixels.
- On DoY 172 between 04:19 and 04:28, double TM was received from DSS-16.
- Later, at 08:14, there was a drop in the VC7 link from DSS-16, at 08:21, the TC link dropped as well. A test command was successfully sent at 08:22, but the links dropped briefly again at 08:24, there was no impact.
- At 16:12, the TCE1 at Redu went down with the message: Operation state unknown. The impact was that EDs TEECL100, TEECL200 and AE10F_00 were only partially uplinked. The Eds are Time-Tagged commands concerning the eclipse on DoY 175, and are later uplinked without impact.

- On DoY 173 at 07:00, there was a VC0 data gap on the TM link from Redu, there was no impact, the reason given was: 'idle gap size 2'.
- Later at 11:05, the state of sun121 was yellow, some displays were closed, and the status returned to green.
- At 12:00, an AOCS command to start the slew showed status 'X', (unknown), however the slew performed ok, later in the week, this effect was repeatedly seen. At 09:37 on DoY 074, after a restarted for the TC chain tasks on IMCA, the CEV worked ok. See anomaly report INT-2609.
- At 12:35, IDDA showed a status of yellow, due to the on-going CD production, there was no impact.
- On DoY 174, from 09:42 to 09:50, several bad frames were received from DSS-16, the reason was unclear, but no RFI was seen by JPL.
- On DoY 175, at 05:09, an AOCS command failed release due to PTV failure, the AOCS interlock was re-enabled, and the command sent without impact.
- At 07:56, the TM link from DSS16 dropped due to an antenna problem, at 08:00, the TC links also dropped. At 08:02, both links returned without impact. The corresponding DR# is G104535.
- At 08:25, it was observed that the CMD releaser was consuming 43% of the CPU.
- On DoY 175, at 15:53, after the perigee pass, it was observed that JEMX-1 was in memory mode, see JEMX section for details.
- At 16:10, sun123 was red, with various problems. The machine was logged out and logged back in again, clearing the situation.
- On DoY 176, at 11:45 TM parameter RD0001D went Out-of-Limits for a few seconds.
- On DoY 177, from 05:46 to 05:51, the TM dropped, idda disconnected and madds-a & madds-b MMI stopped. The cause wasn't established, but the madds MMIs were restarted.

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

AR id	Date Occurrence	Subject	Segment	Status
INT-SC-84	24/06/2004	JEM-X1 DFEE anomaly during post-eclipse reactivation	Payload	Open
INT-2609	23/06/2004	IMCS: TC A3129 would not pass CEV although the TM parameter on which the...	IMCS	Pending
INT-2610	25/06/2004	The TCO_SC_DELAY parameter is commented out in the MISCONFIG file.	IMCS	Open

7 Future Milestones

The Summer Eclipse season is on-going, eclipses are scheduled for:

Date	Penumbra Entry	Umbra Entry	Umbra Exit	Penumbra Exit
2004/06/26	11:32:46	11:36:24	11:59:55	12:03:04

The 4th SPI annealing has started on 17th June as planned and will last until 2nd July (revs 204 to 209). The annealing timeline includes 121hours annealing time at 104degC, a few additional tests to calibrate the ACS, investigate the background of the camera saturating events, align the ACS veto pulse with the camera time tag events. During the warm phase, the instrument will also be maintained in photon-by-photon mode to catch any signal from GeD#2 channel - faulty since 06.12.2003 - triggered by thermal noise.

Here follows the summary view of the updated timeline:

3rd SPI Annealing - revs 132-136																										
ID	Task Name	Duration	Start	Resource Names	Jun '04							21 Jun '04							28 Jun '04							05
					Jun '04	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo
4	Start SPI Annealing	2.58 hrs	17 Jun 08:53	PST[20 pkts]	n 08:53																					
21	Warm up to Annealing Temperature	37.55 hrs	17 Jun 10:56	PST[20 pkts]	n 10:56																					
28	Annealing at 104degC	121 hrs	19 Jun 00:29	PST[20 pkts]				19 Jun 00:29																		
43	Stop SPI Annealing - Passive Cooling	68.52 hrs	24 Jun 01:29	PST[20 pkts]									24 Jun 01:29													
53	Start Active Cooling	118.26 hrs	26 Jun 22:00	PST[20 pkts]										26 Jun 22:00												
68	Active Cooling Fine Tuning	72.2 hrs	01 Jul 20:16	PST[20 pkts]																01 Jul 20:16						
75	ACS Switch-on and Calibration	7.8 hrs	29 Jun 17:02	PST[98 pkts]																29 Jun 17:02						
80	Camera Switch on & Performance Tests	18.4 hrs	30 Jun 11:36	PST[98 pkts]																30 Jun 11:36						
90	Saturating Events Background Test	7 hrs	01 Jul 06:00	PST[98 pkts]																01 Jul 06:00						
94	Time Tag Alignment Test	2.01 hrs	01 Jul 13:00	PST[98 pkts]																01 Jul 13:00						
102	SPI POS Observations	62.6 hrs	02 Jul 16:46	PST[98 pkts]																	02 Jul 16:46					

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 206

In revolution 206 an amalgamated raster dithering observation of the galaxy cluster Abell 2256 (RA 17:03:58.30; DEC +78:38:30.9) was performed throughout the available observation time (~62 hours).

Throughout this observation IBIS, JEM-X1 and OMC were in their nominal science modes, JEM-X2 was in Safe mode and SPI was undergoing annealing. The TM allocation during this observation was IBIS 134; SPI 98; JEM-X1 8; JEM-X2 1; OMC 5.

Revolution 207

The observations in revolution 207 consisted of a raster dithering observation of 3C 273 (RA 12:29:6.70; DEC +02:03:09.0) lasting ~27 hours, followed by a raster dithering observation of Mkn 590 (RA 02:14:33.60; DEC -00:46:00.0), performed for the remaining ~32 hours of observation time.

The TM allocation throughout these observations was IBIS 134; SPI 98; JEM-X1 8; JEM-X2 1; OMC 5. During these observations IBIS, JEM-X1 and OMC were in their nominal science modes and JEM-X2 was in Safe mode. SPI operations in this revolution consisted of the end of annealing and the start of passive cooling.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2004-06-08T17:37:54.000Z	170.1974	F	Automatic TM processing.
2004-06-09T01:59:23.000Z	170.1846	F	Automatic TM processing.

2004-06-09T05:45:48.000Z	170.1498	F	Automatic TM processing.
2004-06-10T03:24:22.000Z	170.1384	F	Automatic TM processing.
2004-06-11T10:34:41.000Z	170.1182	F	Automatic TM processing.
2004-06-11T17:17:46.000Z	170.1102	F	Automatic TM processing.
2004-06-12T01:40:11.000Z	170.0993	F	Automatic TM processing.
2004-06-13T02:44:21.000Z	170.0911	F	Automatic TM processing.
2004-06-14T10:24:24.000Z	170.0471	F	Automatic TM processing.
2004-06-14T17:06:01.000Z	170.0434	F	Automatic TM processing.
2004-06-16T02:42:05.000Z	170.0215	F	Automatic TM processing.
2004-06-17T16:49:29.000Z	170.0093	F	Automatic TM processing.
2004-06-20T16:33:53.000Z	169.9927	F	Automatic TM processing.
2004-06-23T16:18:32.000Z	169.9595	F	Automatic TM processing.
2004-06-24T21:32:59.000Z	169.8868	F	Automatic TM processing.

This report was generated Fri Jun 25 08:00:16 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 12/06/2004-18/06/2004

AOCS operations were executed from the Automatic Timeline.

During this period, 60 Open Loop Slews, 117 Closed Loop Slews and 3 Momentum Bias were executed. No slews were missed from the Timeline.

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	Eclipse Start					Eclipse End					ACC	Eclipse Duration	
				ACC	FDE	FCE	Penumbra	FSS Sun Out	Umbra	Umbra	FSS Sun In	Penumbra	FDE/FCE			
2004-06-05	12:18:43	16:31:03	11:39:19	12:21:18	12:32:08	12:32:52	12:38:59	12:42:36	12:43:26	13:13:44	13:14:33	13:17:34	13:23:40	13:27:13	0:38:35	
2004-06-08	12:06:19	16:21:15	11:18:06	12:00:14	12:10:32	12:11:16	12:17:46	12:20:01	12:20:23	13:15:23	13:15:47	13:17:24	13:22:36	13:27:14	0:59:38	
2004-06-11	11:53:50	16:03:15	11:04:18	11:46:18	11:56:00	11:56:44	12:03:58	12:05:53	12:06:09	13:10:29	13:10:50	13:12:08	13:16:52	13:21:50	1:08:10	
2004-06-14	11:39:27	15:51:03	10:53:03	11:35:14	11:44:49	11:45:33	11:52:43	11:54:40	11:54:44	13:01:16	13:01:46	13:02:45	13:07:53	13:12:40	1:10:02	
2004-06-17	11:26:28	15:35:29	10:43:31	11:25:36	11:35:00	11:35:44	11:43:11	11:45:19	11:45:12	12:49:00	12:49:47	12:50:29	12:55:08	13:00:16	1:07:18	
2004-06-20	11:13:02	15:20:06	10:36:11	11:18:09	11:29:40	11:30:24	11:35:51	11:38:14	11:37:54	12:34:53	12:35:51	12:36:26	12:43:12	12:46:05	1:00:35	
2004-06-23	10:59:55	15:03:44	10:31:45	11:13:49	11:23:30	11:24:14	11:31:25	11:34:31	11:33:45	12:19:03	12:20:39	12:20:53	12:26:02	12:30:39	0:49:28	

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]		
2004-06-05 07:54:32	2004-06-05 13:29:34	0.1920	0.2305	0.2725	5:35:02	5:35:02
2004-06-08 08:16:42	2004-06-08 13:29:24	0.1928	0.0839	0.1378	5:12:42	10:47:44
2004-06-11 08:28:19	2004-06-11 13:24:08	0.1989	0.2500	0.2155	4:55:49	15:43:33
2004-06-14 08:40:08	2004-06-14 13:14:45	0.2243	0.2163	0.1670	4:34:37	20:18:10
2004-06-17 08:13:32	2004-06-17 13:02:29	0.2391	0.2825	0.2420	4:48:57	25:07:07
2004-06-20 07:59:30	2004-06-20 12:48:26	0.1993	0.1010	0.1053	4:48:56	29:56:03
2004-06-23 07:43:01	2004-06-23 12:32:52	0.1837	0.1234	0.1765	4:49:51	34:45:54

19/06/04 (Day of Year 171, Revolution 205)

Nothing to report.

20/06/04 (Day of Year 172, Revolution 205-206)

Nothing to report.

21/06/04 (Day of Year 173, Revolution 206)

Nothing to report.

22/06/04 (Day of Year 174, Revolution 206)

Nothing to report.

23/06/04 (Day of Year 175, Revolution 206-207)

Nothing to report.

24/06/04 (Day of Year 176, Revolution 207)

Nothing to report.

25/06/04 (Day of Year 177, Revolution 207)

Slew 02070073 executed with the Timeline default values, without being updated:

After slewing to the attitude of PID 02070072 with RA: 01:58:05.64, DEC: -00:50:15.8 and POS: 064:19:35.1, the Flight Dynamics System failed to reconstruct the reached attitude, because from the STR mapping data only two stars could be matched with the star-catalogue extract. Another mapping was commanded and a second attempt was made to manually update the slew parameters using the Timeline Recovery Tool. This time as well the FDS could not determine the attitude because only two stars could be matched. The FDS needs to match at least four stars for a valid attitude determination. The end effect was that the parameters of Open Loop Slew 02070073 could not be updated in the Timeline. Since the previous slew was a Close Loop Slew, which had been correctly executed, it was decided to let slew 02070073 execute with the Timeline-default values. This had no impact on the observations.

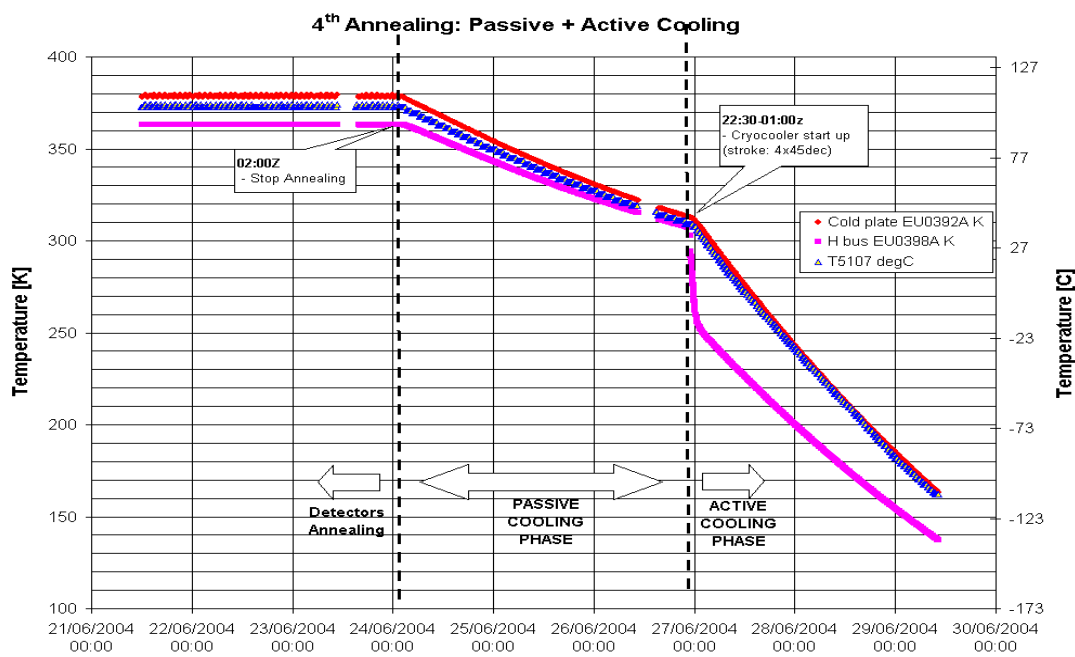
8.3.2 SPI Operations

Cryo-cooler / Detector Cold-Plate:

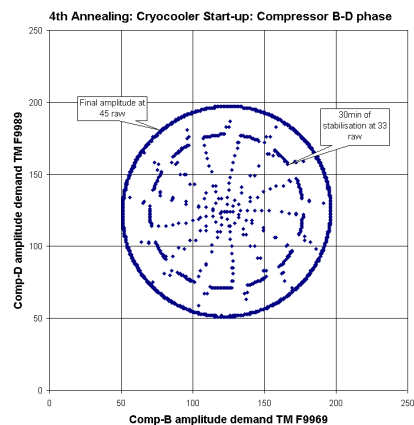
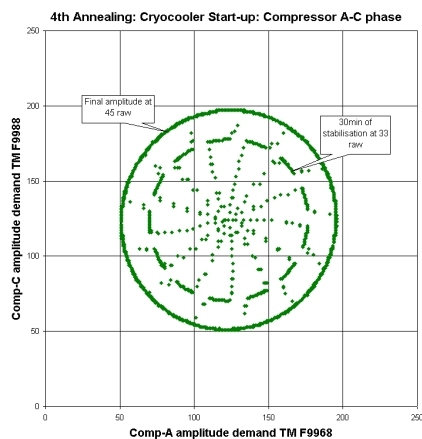
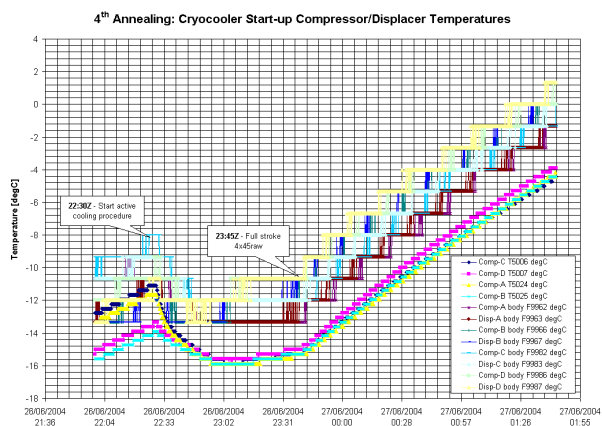
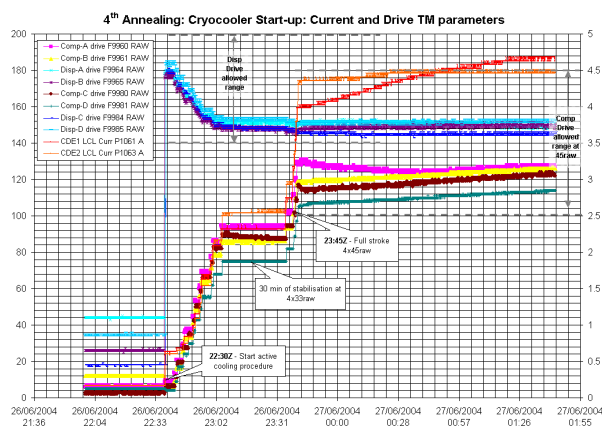
The performance of the cryo-cooler is nominal.

The cold plate temperature was kept leveled off at 104degC for about 121hrs, to ensure the planned Ge detectors annealing. The subsequent passive cooling phase and compressors start-up was nominal, showing the same characteristics noted in the previous annealing cycles.

The following plot shows the detectors cold-plate temperature covering the annealing stop, passive cooling and active cooling start-up phase.



The following plots show the typical signatures of the 4 compressors TM parameters at start-up.



IASW/DPE:

The performance of the IASW/DPE is nominal. The average TM bandwidth occupation was only 10 pkts/cycle due the on-going annealing operations.

ACS:

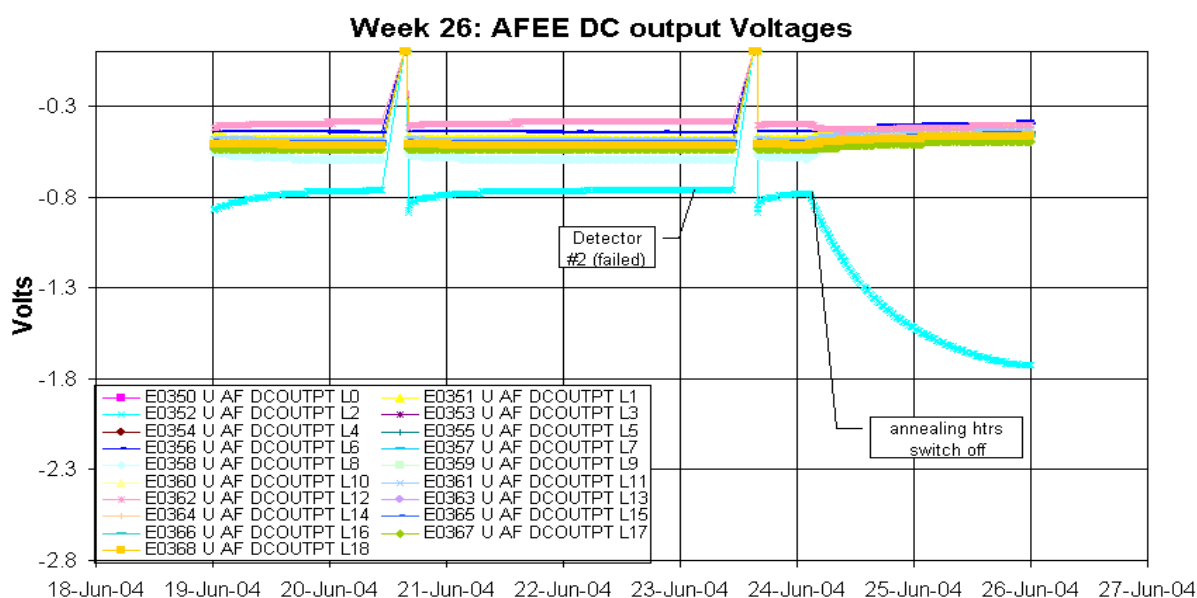
The performance of the ACS is nominal. The ACS PMT HV power supplies were kept switched off for the entire period due to the on-going annealing operations.

AFEE:

The performance of the unit is nominal.

The HV power supply of the Ge detectors was kept switched off due to the on-going annealing operations. The dc output voltage of the detector #2, failed since 06.12.2003 (see anomaly report INT_SC-72), showed an unexpected, peculiar correlation with the detector temperature. No signal triggered by thermal noise was however detected during the whole period from Ge detector #2, thus confirming the permanent failure.

The AFEE dc output signals are here after plotted during the reporting period.



AFEE:

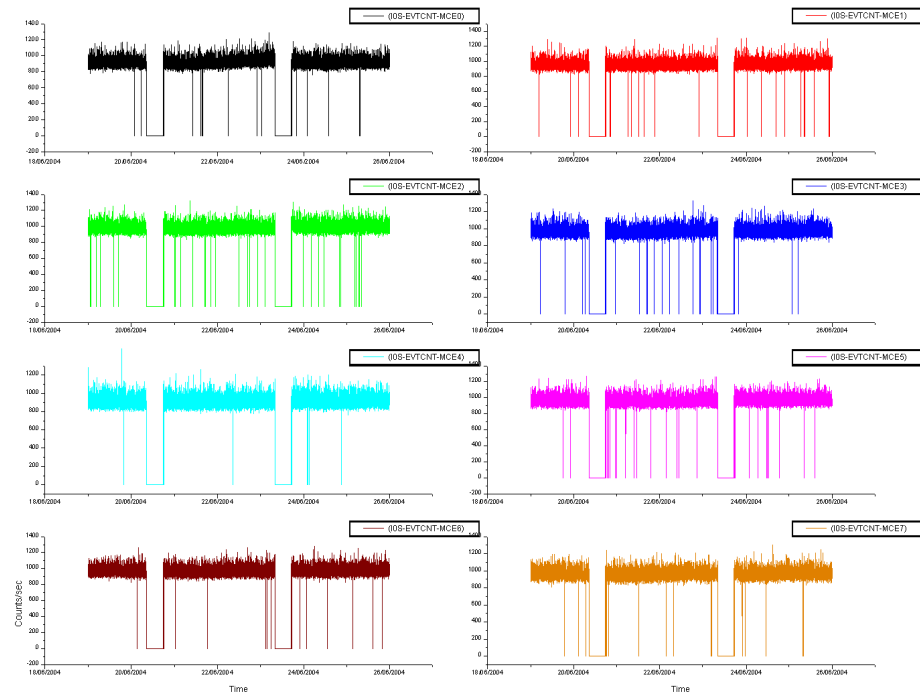
The performance of the unit is nominal.

No thermal-noise counts were detected from the faulty GeD#2 during the period, while the other detectors showed the expected noise count rates.

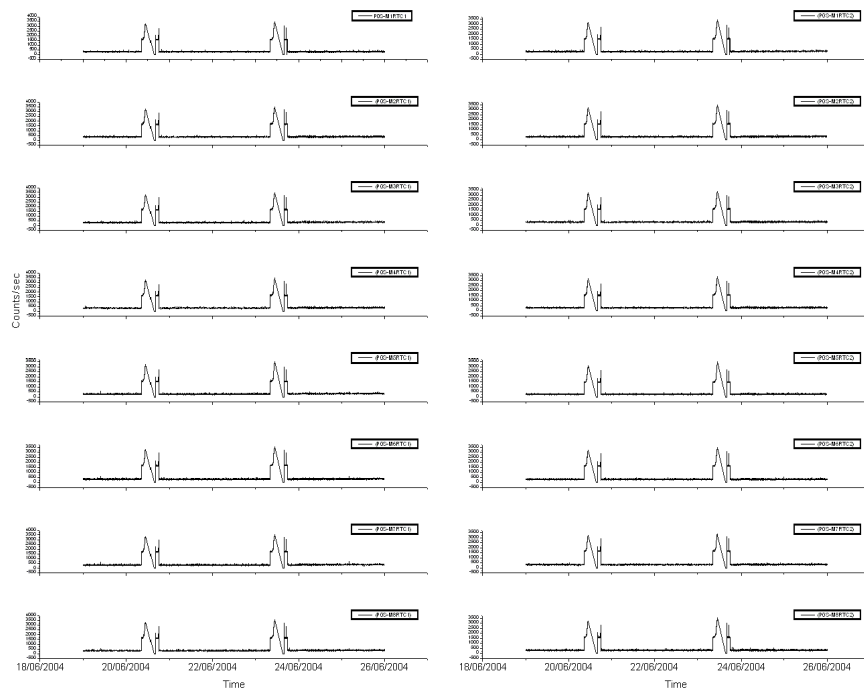
8.3.3 IBIS Operations

IBIS Event Counters Plots.

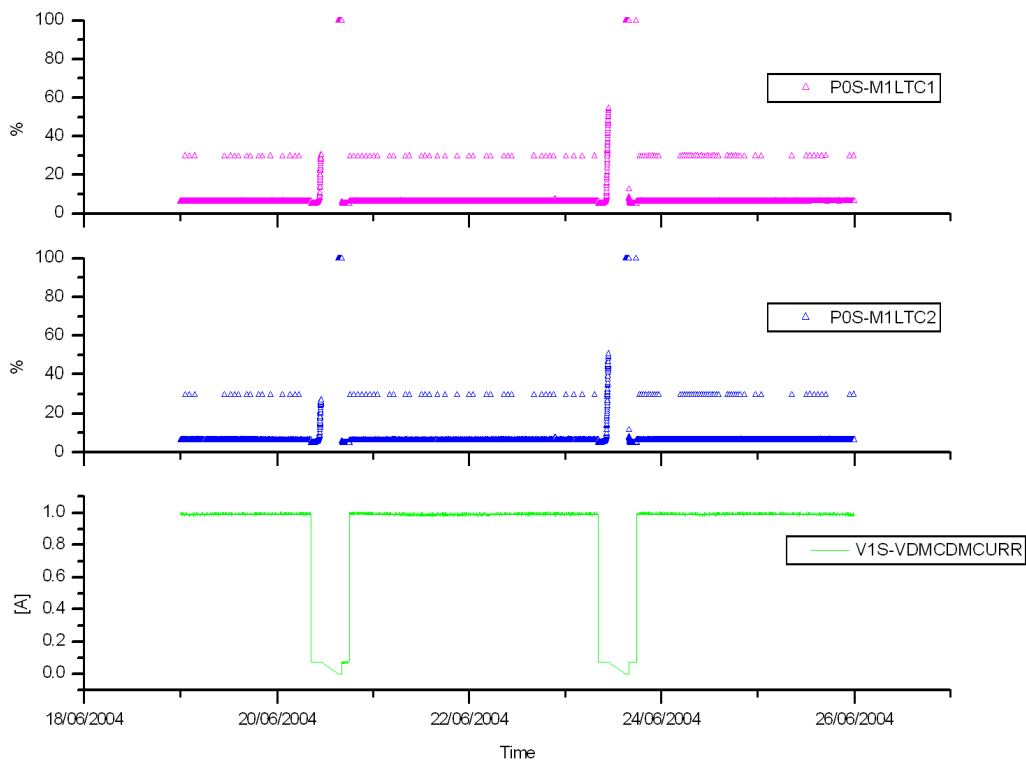
IBIS - ISGRI Counters Rev 205-207



IBIS - PICsIT Counters Rev 205-207



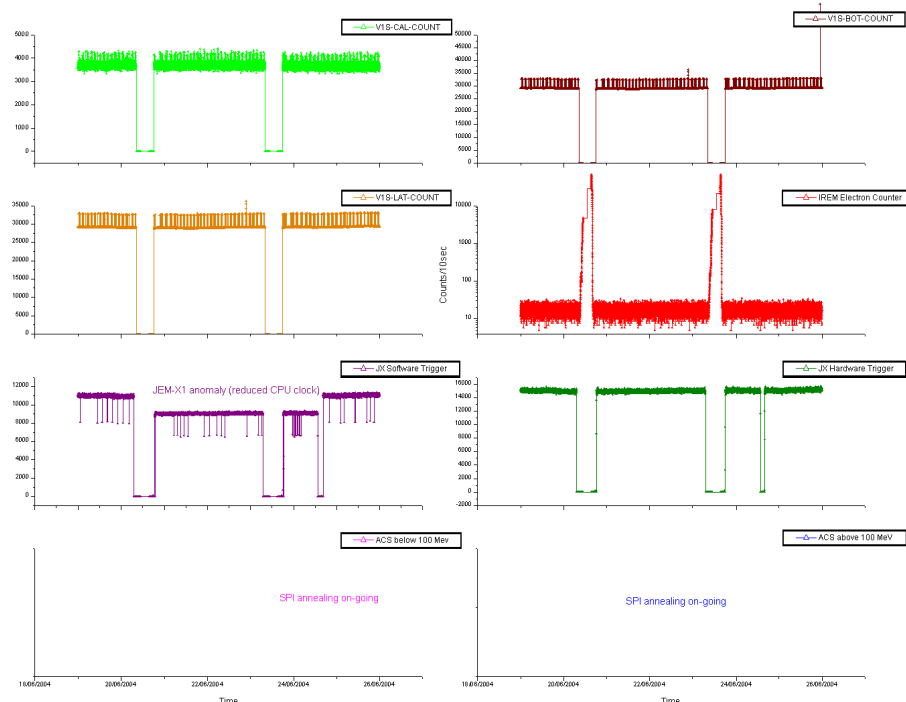
IBIS-VETO Current & PICsIT dead times Rev 205-207



VETO vs Payloads Counters

The comparison between the count-rates reported by VETO, the SPI-ACS and JEM-X hardware/software triggers, gives in general an indication of stabilization of the environmental background (protons and heavy ions): this is shown by the following plot, in which all the on-board sources mentioned are considered.

IBIS-VETO vs Payloads Counters Rev 205-207



**with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec

IBIS daily report

DOY 2004.171 (19/06/04)

Nothing to report.

DOY 2004.172 (20/06/04)

Nothing to report

DOY 2004.173 (21/06/04)

Nothing to report.

DOY 2004.174 (22/06/04)

At 17:25Z the TM parameter G2056 (IOE-OVFWPXADD-M4) failed the SCC. This parameter is reporting the dynamic status of the noisy pixels for the module 4. After few TM cycles the parameter went back in limit and no further action was taken.

DOY 2004.175 (23/06/04)

Nothing to report.

DOY 2004.176 (24/06/04)

Nothing to report.

DOY 2004.177 (25/06/04)

Nothing to report

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.



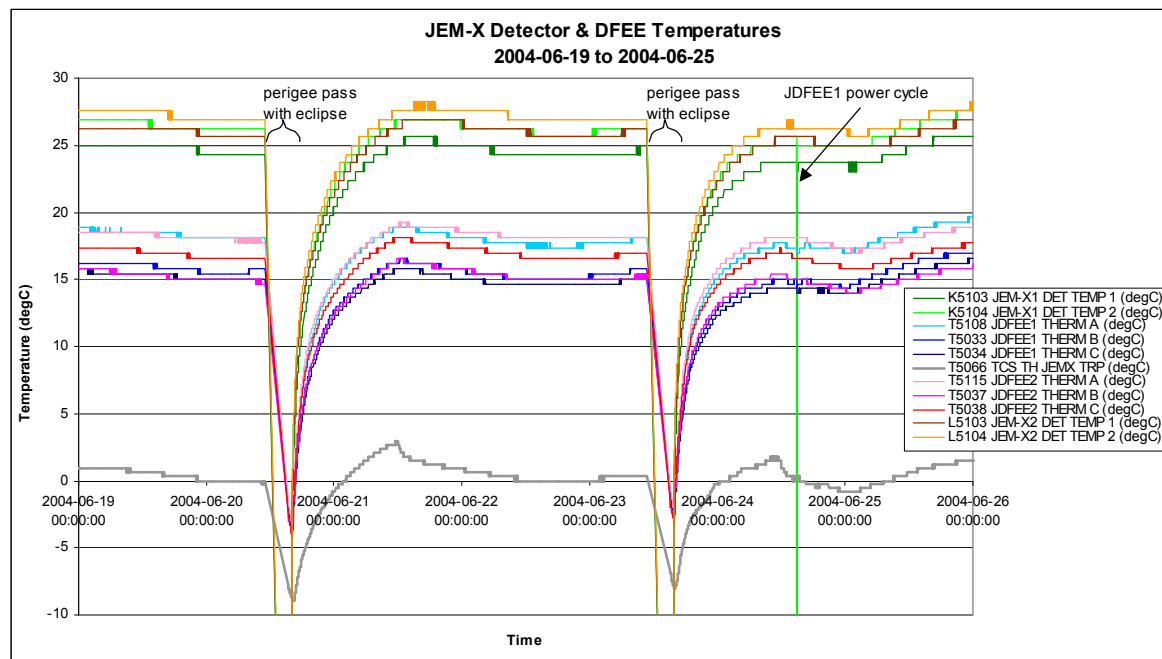
The lower than normal count rates of the JEM-X1 Software Trigger during revolution 206 and the first part of revolution 207 (from ~2004-06-20T18:30Z to ~2004-06-24T13:30Z) is due to the DFEE anomaly which occurred during post-eclipse reactivation in revolutions 206 and 207 (see Section 8.3.4.3 below).

8.3.4.2 JEM-X Temperatures

The JEM-X1 and JEM-X2 detector temperatures over the reporting period are displayed in the following graph, along with the temperatures at a selection of DFEE locations and on the detector bench between the two units².

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

² Data sampled (1 frame in 8)



The negative spike in the JEM-X1 Detector temperature parameters (K5103 and K5104) on 2004-06-24 is a manifestation of no data being received from the JEM-X1 DFEE due to a DFEE power cycle, which was performed as part of the recovery from the DFEE anomaly that occurred during post-eclipse reactivation (see Section 8.3.4.3 below).

8.3.4.3 JEM-X Daily Report

2004-06-19 (DOY 171, Rev 205)

Nothing to report

2004-06-20 (DOY 172, Rev 205-206)

An anomaly occurred during the post-eclipse reconfiguration of JEM-X1 in revolution 206. This anomaly occurred at the stage of switching on the JEM-X1 DFEE and reloading the context from the DPE to the DFEE (see Anomaly Report INT_SC-84).

No alarms were generated and thus this anomaly was not observed in real time, but was detected on 2004-06-24. The symptoms were as follows:

1) The DFEE performed the following sequence of state transitions:

TIME	K5022 DFEE STATUS
2004-06-20T15:18:38.568045	DFEE OFF
2004-06-20T16:10:38.570671	SAFE
2004-06-20T16:10:46.570677	MEMORY
2004-06-20T16:11:02.570685	SETUP
2004-06-20T16:11:10.570690	MEMORY (instead of going back to Safe)

Staying in Memory mode until anode calibration at radiation belt exit:

Doc. Title : INTEGRAL Mission Report # 92
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 28/06/04

Issue : 1
Rev. : 0
Page : 19

2004-06-20T17:39:42.573529 SAFE
2004-06-20T17:39:58.573537 SETUP

In addition, the parameter K5381 ACT SHUTDOWN LEV remained ECLIPSE from the time of DFEE activation until the anode calibration at radiation belt exit, when it transitioned to NORMAL. Thus OEM 233 JEM-X1 AUTO EVENT 3 indicating the auto-recovery from shutdown level RAD BELTS to shutdown level NORMAL, which is normally received at Broadcast Packet radiation belt exit time, was not received.

2) The following OEMs were issued during the post-eclipse reactivation (execution of the ED KECLEX01):

2004.172.16.11.14.980 Real Time Event 234 JEM-X1 AUTO EVENT 4
FIX6=4 K9079=0 K9080=234 K5419=64,ECLIPSE K5420=48,RAD. BELTS

Indicating failure of the auto-recovery from shutdown level ECLIPSE to shutdown level RAD BELTS

2004.172.16.11.14.980 Real Time Event 191 JEM-X1 PROB DFEE 11
FIX6=11 K9079=0 K9080=191 FIX16=8 FIX16=0

Indicating operation 'Load DFEE context' unsuccessful due to failed CRC.

3) The DFEE CPU speed, TM parameter K5583 CPU MODE, remained at a value of 8MHz WAIT (as at startup) rather than the nominal value of 16MHz.

4) The JEM-X1 SW Trigger count rate was lower than normal.

2004-06-21 (DOY 173, Rev 206) to 2004-06-22 (DOY 174, Rev 206)

No alarms or unusual OEMs. JEM-X1 continued science operations with DFEE CPU MODE = 8MHz WAIT and a SW Trigger count rate which was lower than normal.

2004-06-23 (DOY 175, Rev 206-207)

The same anomaly as occurred on 2004-06-20 occurred again during the post-eclipse reactivation of JEM-X1 in revolution 207. Again the symptoms were as follows:

1) The DFEE performed the following sequence of state transitions:

TIME	K5022 DFEE STATUS
2004-06-23T15:53:34.710171	DFEE OFF
2004-06-23T15:53:34.710172	SAFE
2004-06-23T15:53:42.710176	MEMORY
2004-06-23T15:53:58.710186	SETUP
2004-06-23T15:54:06.710190	MEMORY (instead of going back to Safe)
Staying in Memory mode until anode calibration at radiation belt exit:	
2004-06-23T17:22:38.713068	SAFE
2004-06-23T17:23:02.713081	SETUP

As occurred on 2004-06-20, the parameter K5381 ACT SHUTDOWN LEV remained ECLIPSE from the time of DFEE activation until the anode calibration at radiation belt exit, when it transitioned to NORMAL. Thus OEM 233 JEM-X1 AUTO EVENT 3 indicating the auto-recovery from shutdown level RAD BELTS to shutdown level

NORMAL, which is normally received at Broadcast Packet radiation belt exit time, was not received.

2) The following OEMs were issued during the post-eclipse reactivation (execution of the ED KECLEX01):

2004.175.15.54.10.995 Real Time Event 234 JEM-X1 AUTO EVENT 4
FIX6=4 K9079=0 K9080=234 K5419=64,ECLIPSE K5420=48,RAD. BELTS

Indicating failure of the auto-recovery from shutdown level ECLIPSE to shutdown level RAD BELTS

2004.175.15.54.10.995 Real Time Event 191 JEM-X1 PROB DFEE 11
FIX6=11 K9079=0 K9080=191 FIX16=8 FIX16=0

Indicating operation 'Load DFEE context' unsuccessful due to failed CRC.

3) The DFEE CPU speed, TM parameter K5583 CPU MODE, remained at a value of 8MHz WAIT (as at startup) rather than the nominal value of 16MHz.

4) The JEM-X1 SW Trigger count rate was lower than normal.

2004-06-24 (DOY 176, Rev 207)

The symptoms of the anomaly which occurred on 2004-06-20 and 2004-06-23 were detected and the following recovery actions were then performed (in consultation with the JEM-X PI):

JEM-X1 DFEE memory dump:

13:31Z FCP_JEM1_0040 JEMX1 TRANSITION TO SAFE
13:34Z FCP_JEM1_0045 JEMX1 TRANSITION TO MEMORY
MAINTENANCE
13:36Z FCP_JEM1_0051 JEMX1 DFEE MEMORY DUMP to dump the
DFEE memory area B000 (hex) to CFFF (hex).
Comparison of the dumped memory area with the on-ground image for the current
SW version (DFEE SW version 5.3) indicated no differences in the area, which was
dumped.
13:41Z FCP_JEM1_0040 JEMX1 TRANSITION TO SAFE
13:42Z FCP_JEM1_0041 JEMX1 TRANSITION TO SETUP
13:43Z FCP_JEM1_0071 JEMX1 REPORT DFEE INTEGER
PARAMETERS
13:45Z FCP_JEM1_0081 JEMX1 REPORT DFEE FLOAT PARAMETERS
13:46Z FCP_JEM1_0040 JEMX1 TRANSITION TO SAFE

Set JEM-X1 DFEE CPU speed to 16MHz:

14:23Z FCP_JEM1_0041 JEMX1 TRANSITION TO SETUP
14:25Z FCP_JEM1_0161 JEMX1 SET CPU CONFIGURATION.
Following this, the TM parameter K5583 CPU MODE was set to a value of 16MHz.
14:26Z FCP_JEM1_0040 JEMX1 TRANSITION TO SAFE

Power cycle the JEM-X1 DFEE:

14:40Z FCP_JEM1_9010 JEM-X1 DFEE SWITCH OFF
14:54Z FCP_JEM1_0021 JEMX1 DFEE ACTIVATION

The power cycle was successfully performed, with the context reloaded from the DPE to the DFEE without the occurrence of OEM 191 and with the CPU speed returning to a value of 16MHz.

Reactivation of JEM-X1 for science operations:

15:23Z FCP_JEM1_0042 JEM-X1 ELECTRONIC CALIBRATION
15:43Z FCP_JEM1_1010 JEMX1 CONFIGURATION SETTING FOR
SCIENCE OPS
16:30Z FCP_JEM1_0044 JEMX1 DATA TAKING

JEM-X1 operations then continued nominally.

2004-06-25 (DOY 177, Rev 207)

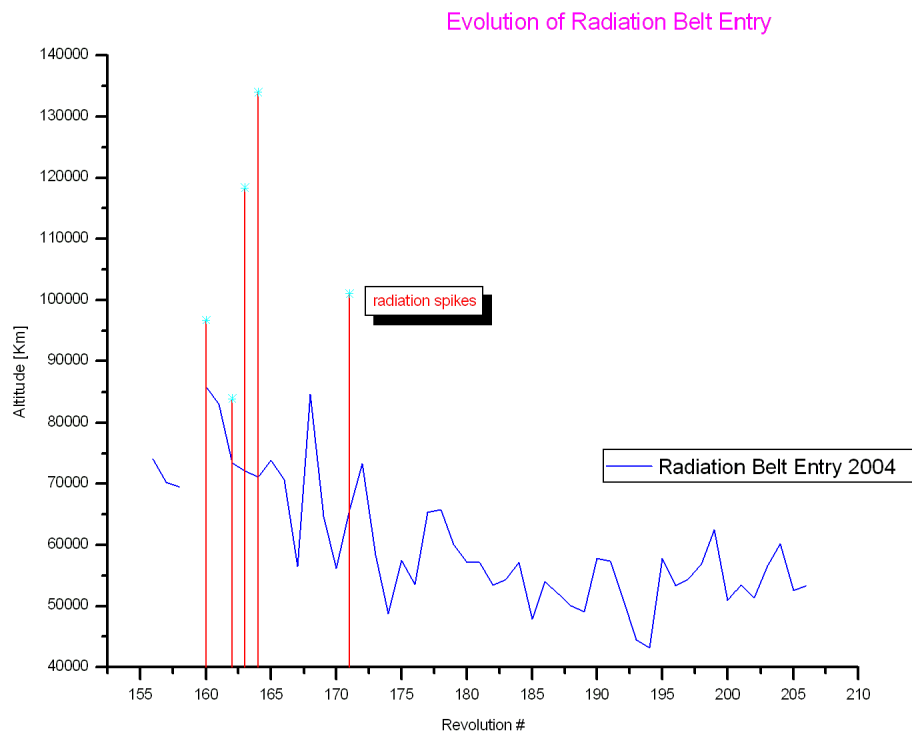
Nothing to report

8.3.5 OMC Operations

Nothing to report

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]
205	RAD_ENTR R 2004-06-20T08:31	20/06/2004 09:26	52645	20-Jun-2004 09:11	54753
206	RAD_EXIT R 2004-06-20T17:39	20/06/2004 16:16	28207	20-Jun-2004 16:21	27347
206	RAD_ENTR R 2004-06-23T08:15	23/06/2004 09:05	53379	23-Jun-2004 08:57	54565
207	RAD_EXIT R 2004-06-23T17:23	23/06/2004 16:05	>26533	23-Jun-2004 16:07	27647

Reference

Small error vs reference

Large error vs reference

Radiation Spike

Proton Belts

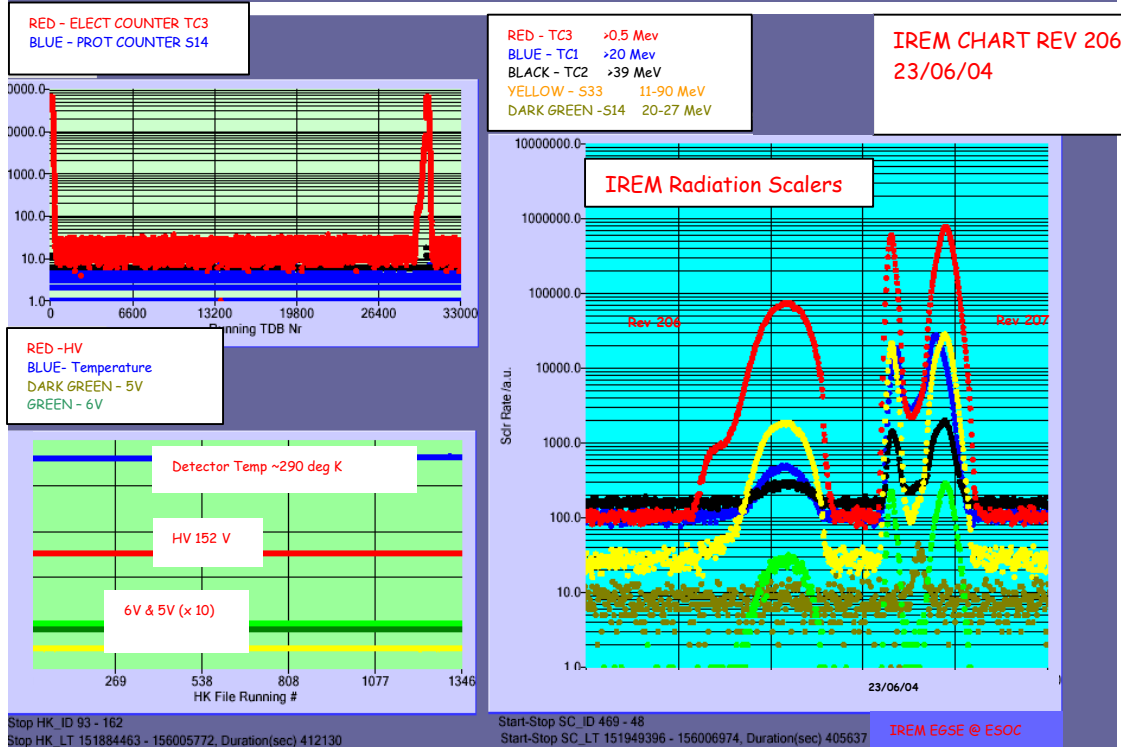
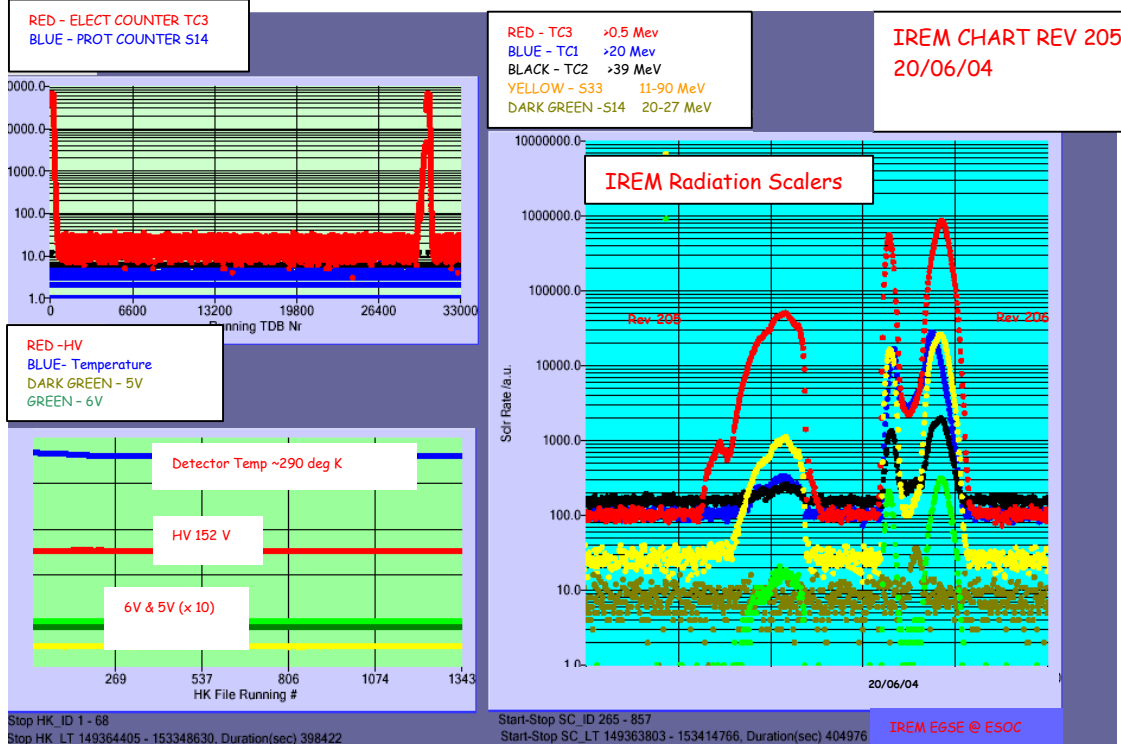
REV		Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
205	PROTON_RAD_ENTR	20-Jun-2004 14:51	13626
205	PROTON_RAD_EXIT	20-Jun-2004 15:01	14780
206	PROTON_RAD_ENTR	23-Jun-2004 14:27	12764
206	PROTON_RAD_EXIT	23-Jun-2004 14:47	14946

IREM daily report

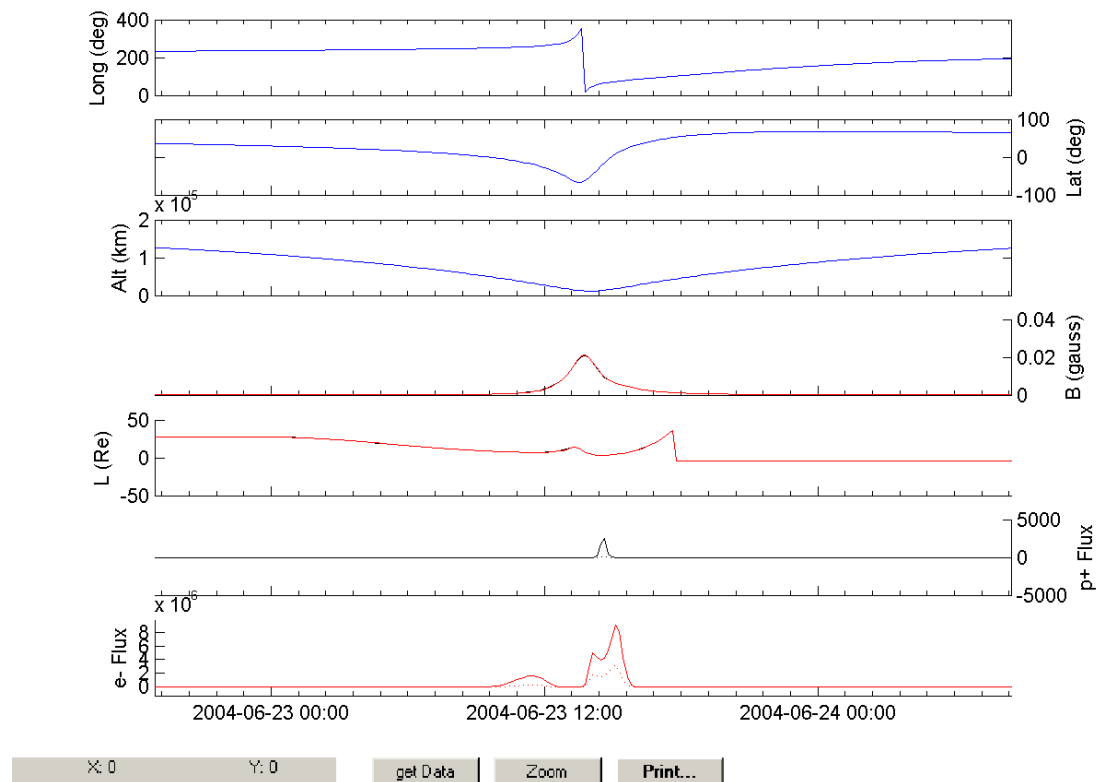
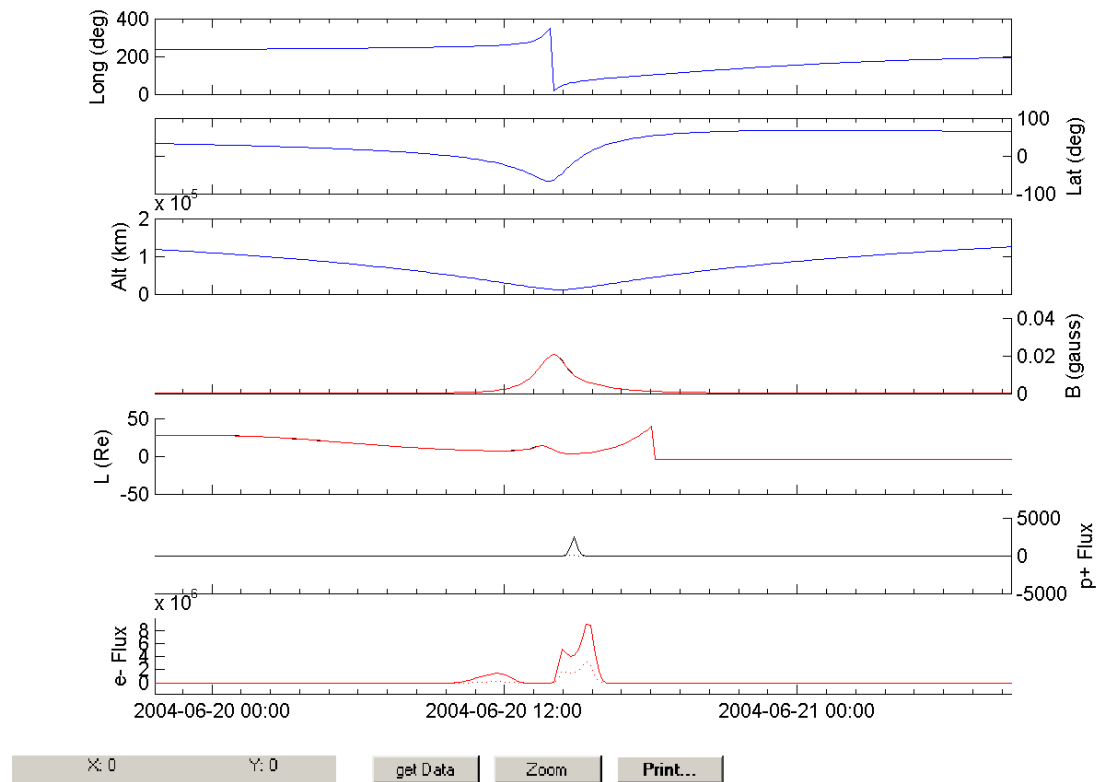
DOY 2004.172 (20/06/04)

At 15:52Z the CEV (command execution verification) for the TC U4920 (INT GND LINK ON) failed, due to late update of the Command Verifier task. The execution of the TC was verified against the relevant TM parameter using the monitoring task and no further action was taken.

IREM radiation counters



IREM Predicted Radiation Counters.



SEC-GOES Observed Particles Fluxes.

