

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 088
Week 22
31.05.04
Routine Phase

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1 General

The Flight Control Team at MOC has compiled this report with some input provided by the Flight Dynamics Team, ISOC and ISDC.

It addresses the activities from 22.05.04 until 28.05.04 (both dates inclusive) and covers the revolutions 196 & 197.

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 Carina (RA 10:36:31.39; DEC -58:21:54.7). 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.

Three slews were missed in revolution 196 due to a problem at the station. Four more slews were missed at the beginning of revolution 197, caused by the crash of the Autostack task.

The fuel consumption over the period between 21/05/2004 and 28/05/2004 was 0.148 kg. The remaining propellant is in the order of 170.420 Kg on the 28th of May.

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

3.1.2 Power

The power subsystem is working as specified. The available power from the arrays is in the order of **2200W**.

3.1.3 Thermal

The thermal control of the satellite is working well. The temperatures are currently all within the specified operational limits.

3.1.4 OBDH

The OBDH subsystem is working flawlessly. No on-board communications problem 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 instrument was in photon-by-photon mode with spectra TM enabled, an assigned TM bandwidth in the science windows of 98 pkts/cycle and an actual average occupation of 95.3 pkts/cycle (-0.3 pkts w.r.t. previous week).

The 4th annealing of the Germanium detectors has been decided to start on 17th June at rev. 204 critical altitude descending crossing. A summary timeline is published in this report, under the future activities section.

The cryo-cooler 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 TM bandwidth assigned to IBIS during the observation period was 134 pkts/cycle. The mean IBIS bandwidth usage was 105.96 pkts/cycle (last week 106.3 pkts/cycle).

The Hard low limit of the Calibration Counter is updated in order to cope with the natural decay of the on-board radioactive (0.4 mCi of Na²², half time=2.58 years) calibration source.

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.

On 2004-05-24, at the start of revolution 197, the start of JEM-X1 science activities were delayed by about 1hour 45minutes due a crash of the Autostack, which necessitated manual activation of the unit.

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 141 OMC pointings executed nominally, 5 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.

The observation period was characterised 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 in general good this week, well above the system performance requirements.

4.1 Mission Operations Centre

The performance of the MOC was in general good in the reporting period, there was however one major problem: the autostack crashed causing the loss of 4 pointings and a number of minor problems: high cpu usage or low swap space effects that were easily overcome.

4.2 Ground Stations & Network

The performance of the ground stations and Network was in general good this week. A failure within the SUC1 (S-band Uplink Converter) at Redu caused the loss of three pointings, and there was a minor communication blip, but apart from that nothing. 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. 206

POS and POD generated: up to rev 206

TSF's: Received up to rev 198

No ToO request received. Re-planned 198 to 203 inclusive with changed JEM-X high voltage settings

2. Observation status

ECS for revolution up to 185 received except 168 which is still pending. This is no change from last week.

3. ISOC science archive

Nothing to report this week

4. ISOC system

The ISOC system version 10.4 has been patched to solve a couple of minor problems recently detected.

5. Problems

ISOC is now beginning to see the consequences of the ISOC plan to move to VILSPA. Staff not willing to move are leaving but the replacement Vacancy Notices

have not yet been published by the ESA Administration. This may have consequences on ISOC operations later this year.

4.3.2 ISDC

On 31/05/2004, the status of ISDC observation processing is:

- Latest Standard Analysis completed: observation 02201120001 (IC443, Revolution 182) on 29/05/2004
- Latest products archived: observation 02200490062 (S5 0716+71, Revolution 179-180) on 26/05/2004
- Latest observation products sent to the observer: observation 02201140002 (Sgr A*, Revolution 178-179) on 29/05/2004

5 Special Events

None.

6 Anomalies

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

- On DoY 145 at 03:08, a failure of the power switch of SUC1 (S-band Up Converter) at Redu caused the TM & TC links to drop out. The commanding capability was restored by switching to the B-chain at the ground station. (AR INT-2603)
- Almost simultaneously, sun128 went red, necessitating a restart of the Mission Planning System. This did not impact the on-going station problem, however Flight Dynamics on-call support was necessary to restart the Flight Dynamics system.
The combined impact of these 2 problems was that the slews to pointings 01960054, 01960055 and 01960056 were lost.
- Later, at 19:37, the spacon reported a lost connection with src ID 203, followed by the Autostack crashing. At that time, the message 'Exception raised during request for "release next request" for src ID 203'. The impact was the loss of pointings 01970002, 01970003, 01970004 and 01970005 were lost (AR INT-2604).
- On DoY 146, at 18:10 the link MADDS-ISDC was reported as disconnected, it was reconnected 3 minutes later.
- At 20:05, sun121 reported a cpu usage of 42%, the workstation was logged out, and logged back into, clearing the problem.
- On DoY 147 from 13:41 to 13:44, the data flow to ISDC was interrupted due to an on-going Router re-boot.
- On DoY 148 from 07:19 to 07:39, the auxiliary task on the IDDA was stopped for CD productions. There was no impact.
- On DoY 149 at 04:45, incetra was yellow on the global MMI due to insufficient swap space. A swap was performed to incetr, and the incetra restarted clearing the problem. At 06:20, a swap back to incetra was performed. The corresponding AR# is 149_05_0445.
- Later at 12:29, 9 packets from Redu were dropped, no problem was identified on the TMP or CDS, possibly a hit on the line.

The following new anomaly reports relevant to some of the above problems were entered into the ART system.

AR id	Date Occurrence	Subject	Segment	Status
INT-2604	24/05/2004	Autostack Crash	IMCS	Open
INT-2603	24/05/2004	Failure of S-band Uplink Converter at REDU	ESA Station	Open

7 Future Milestones

The 4th SPI annealing will start on 17th June 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 to catch any signal from GeD#2 channel - faulty since 06.12.2003 - triggered by thermal noise.

A summary of the updated timeline is shown below:

3rd SPI Annealing - revs 132-136												
ID	Task Name	Duration	Start	Resource Names	Jun '04	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]								
53	Start Active Cooling	118.26 hrs	26 Jun 22:00	PST[20 pkts]								
68	Active Cooling Fine Tuning	72.2 hrs	01 Jul 20:16	PST[20 pkts]								
75	ACS Switch-on and Calibration	7.8 hrs	29 Jun 17:02	PST[98 pkts]								
80	Camera Switch on & Performance Tests	18.4 hrs	30 Jun 11:36	PST[98 pkts]								
90	Saturating Events Background Test	7 hrs	01 Jul 06:00	PST[98 pkts]								
94	Time Tag Alignment Test	2.01 hrs	01 Jul 13:00	PST[98 pkts]								
102	SPI POS Observations	62.6 hrs	02 Jul 16:46	PST[98 pkts]								

The next eclipse season will start on 5th June, the dates and times of eclipses are as follows:

Date	Penumbra Entry	Umbra Entry	Umbra Exit	Penumbra Exit
2004/06/05	12:38:59	12:43:24	13:13:44	13:17:31
2004/06/08	12:17:46	12:20:23	13:15:23	13:17:24
2004/06/11	12:03:58	12:06:09	13:10:29	13:12:08
2004/06/14	11:52:50	11:54:52	13:01:25	13:02:54
2004/06/17	11:43:28	11:45:28	12:49:17	12:50:44
2004/06/20	11:36:14	11:38:19	12:35:16	12:36:49
2004/06/23	11:32:15	11:34:34	12:19:52	12:21:41
2004/06/26	11:32:46	11:36:24	11:59:55	12:03:04

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 197

The observations in revolution 197 consisted of a GPS lasting ~5 hours, followed by an amalgamated raster dithering observation of Carina (RA 10:36:31.39; DEC -58:21:54.7), which was performed for the remaining ~54.5 hours of observation time.

Revolution 198

In revolution 198 an amalgamated raster dithering observation of Carina (RA 10:36:31.39; DEC -58:21:54.7) was performed throughout the available observation time (~62 hours).

Throughout these observations all instruments were in their nominal science modes, except for JEM-X2, which was in Safe mode, and the TM allocation was IBIS 134; SPI 98; JEM-X1 8; JEM-X2 1; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2004-05-09T19:31:57.000Z	170.6958	F	Automatic TM processing.
2004-05-12T13:16:37.000Z	170.6806	F	Automatic TM processing.
2004-05-12T19:13:50.000Z	170.6604	F	Automatic TM processing.
2004-05-15T13:07:01.000Z	170.6516	F	Automatic TM processing.
2004-05-15T19:03:17.000Z	170.6123	F	Automatic TM processing.
2004-05-16T04:03:42.000Z	170.5920	F	Automatic TM processing.
2004-05-18T18:51:33.000Z	170.5682	F	Automatic TM processing.
2004-05-21T18:38:04.000Z	170.5566	F	Automatic TM processing.
2004-05-23T04:29:52.000Z	170.5357	F	Automatic TM processing.
2004-05-24T12:28:27.000Z	170.4700	F	Automatic TM processing.
2004-05-24T18:23:00.000Z	170.4637	F	Automatic TM processing.
2004-05-25T01:51:25.000Z	170.4514	F	Automatic TM processing.
2004-05-26T04:49:04.000Z	170.4431	F	Automatic TM processing.
2004-05-27T12:11:31.000Z	170.4313	F	Automatic TM processing.
2004-05-27T18:07:56.000Z	170.4201	F	Automatic TM processing.

This report was generated Fri May 28 08:00:19 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 Operations

AOCS operations were executed from the Automatic Timeline.

During this period, 21 Open Loop Slews, 130 Closed Loop Slews and 7 Momentum Bias were executed. 7 slews were missed or executed manually. This is equivalent to a 4.6%.

22/05/04 (Day of Year 143, Revolution 196)

Nothing to report.

23/05/04 (Day of Year 144, Revolution 196)

Nothing to report.

24/05/04 (Day of Year 145, Revolution 196-197)

Slews missed due to a ground station problem (Redu): Because of a failure at the Redu ground station, the TM/TC lines dropped out at 03:08. The Timeline was stopped and slews 01960054 and 01960055 were missed. After re-establishment of the links, the Timeline was rejoined by performing a manual Open Loop Slew to the attitude of PID 01960056 followed by a corrective manual Close Loop Slew to the same attitude. Slew 01960057 was executed from the Timeline.

Slews missed at the beginning of revolution 197 due to the crash of the Autostack task: The execution of the Timeline was interrupted at the beginning of revolution 197 when the Autostack task crashed at 19:37. This was before the execution of slew 01970002 from the Timeline. The situation could not be recovered before 20:20, after which the Autostack was restarted and the Timeline was loaded. The Timeline was rejoined (as long as AOCS operations are concerned) by performing the following:

- Open Loop Slew to the attitude of PID 01970003
- Close loop Slew (corrective) to the attitude of PID 01970004
- Open Loop Slew to the attitude of PID 01970005
- Manual update of the parameters of slew 01970006

Slews 10970002 to 01970005 were missed and slew 01970006 was executed from the Timeline.

25/05/04 (Day of Year 146, Revolution 197)

Nothing to report.

26/05/04 (Day of Year 147, Revolution 197)

Nothing to report.

27/05/04 (Day of Year 148, Revolution 197-198)

Nothing to report.

28/05/04 (Day of Year 149, Revolution 198)

Nothing to report.

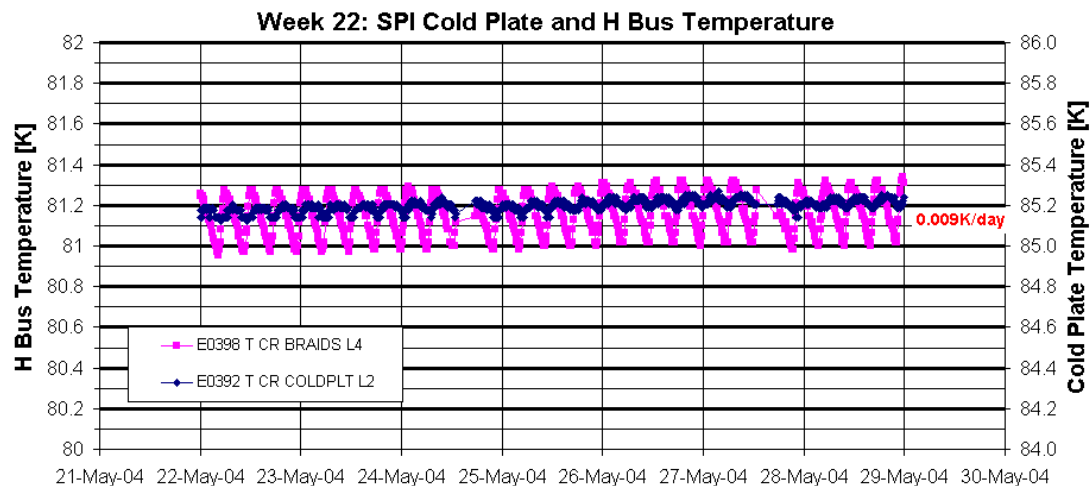
8.3.2 SPI Operations

Cryo-cooler / Detector Cold-Plate:

The performance of the cryo-cooler is nominal.

The cold plate temperature is leveled off at around 85.15K with a drift over the whole week of +0.009K/day, which is well within the expected range.

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 average TM bandwidth occupation was 95.3 pkts/cycle in the science windows (-0.3 pkts w.r.t. previous week).

As the occupation is approaching the maximum allocated bandwidth (98 pkts/cycle), the disabling of the PSD pulse shape sample downlink is being considered as a recovery step to gain (reduce) about one pkt/cycle.

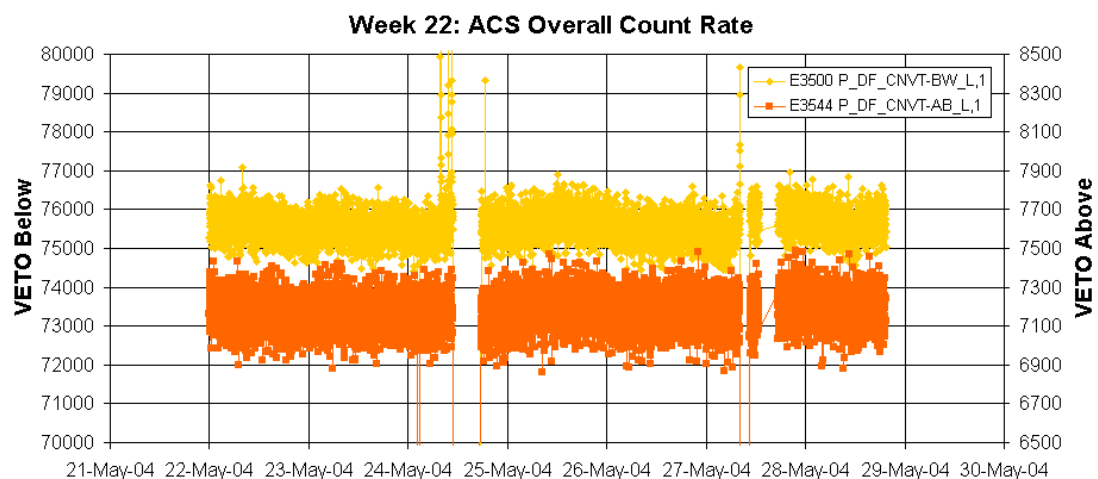
The following diagram shows the IASW performance in terms of TM bandwidth and event buffer occupation during the reporting period.



ACS:

The performance of the ACS is nominal.

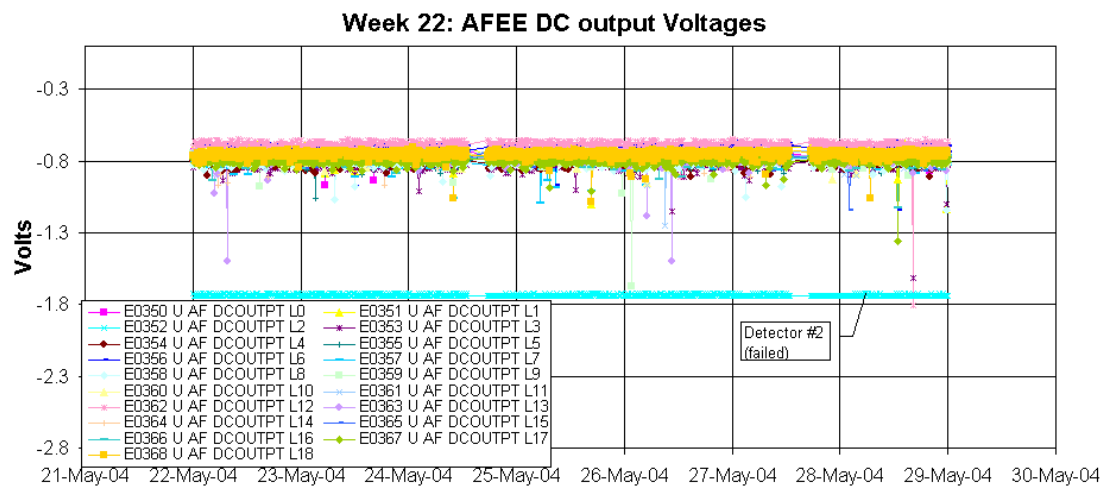
The following plot shows the ACS overall counts and IREM counters evolution during the reporting period.



AFEE:

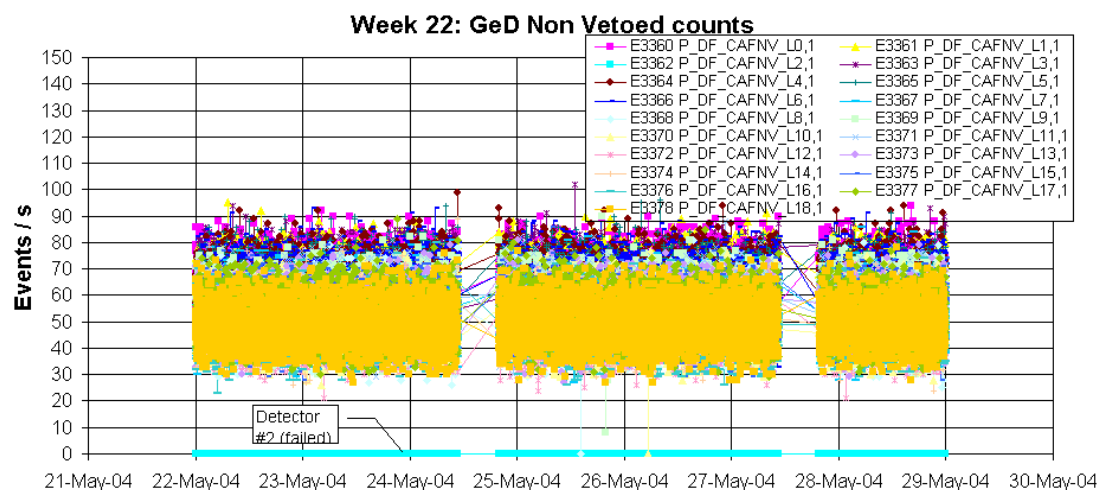
The performance of the detectors is nominal except for the detector #2 failed since 06.12.2003 (see anomaly report INT_SC-72).

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



DFEE:

The following plot shows the GeD 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.



PSD:

The performance of the unit is nominal.
 Nothing to report.

8.3.3 IBIS Operations

IBIS event counters plot

The plots will be provided in next week's report.

IBIS daily report

DOY 2004.143 (22/05/04)

A problem in the LSL interface between the PICsIT detector modules and the HEPI was reported.

The sequence of the events was:

1. At 23:25Z the parameters G5088-G5116-G5148-G5168-G5180 (PDMi: semimodule #1 and 2 FIFO error) failed SCC.
2. At 23:32 the parameters families G5002 and G5003 went in out of limit HARD LOW (values =0 cts/s).
3. At 23:35 received the OEM APID 1280 ID 132 CLASS 0 <<IBIS IASW HEPI RESYNCH>> flagging an HEPI resynchronization.
4. After the generation of the OEM above the PICsIT Real Time Counters (G5002 and G5003) returned within limits.

This behaviour, as observed previously, is likely to be due to a loss of synchronization between the HEPI and the PICsIT modules and cleared autonomously by the unit. No action was taken as suggested by the recovery action P-FIF-1 reported in the Payloads Contingency Recovery Document

DOY 2004.144 (23/05/04)

Nothing to report.

DOY 2004.145 (24/05/04)

There were a few reports during the Belt passage of the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the PICsIT detectors being ON without the VETO anticoincidence system, as required by the PIs.

At 19:37Z a problem with the automatic scheduling system affecting the instrument reconfiguration after perigee passage was reported. The sequence of calibration and HVs switch ON was not executed at the time fixed in the timeline. The recovery of the unit started at 21:26 Z with the transition of IBIS to Safe Mode to start the configuration of the payload from a known and safe status. The following procedures were executed in order:

- ISGRI CTX table uplink FCP_IBIS1_0401
- GEISCL03 ISGRI calibration
- GEBEXT01 VETO HV ON

The recovery of the unit was completed at 23:54Z when the CCCF set the instrument to the expected configuration.

DOY 2004.146 (25/05/04)

Executed at 07:58Z the sequence GEBENT02 (time tagged) setting the configuration for the unit for the next Belts Entry.

DOY 2004.147 (26/05/04)

Nothing to report.

DOY 2004.148 (27/05/04)

There were a few reports during the Belt passage of the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the PICsIT detectors being ON without the VETO anticoincidence system, as required by the PIs.

DOY 2004.149 (28/05/04)

Nothing to report.

8.3.4 JEM-X Operations

2004-05-22 (DOY 143, Rev 196) to 2004-05-23 (DOY 144, Rev 196)

Nothing to report

2004-05-24 (DOY 145, Rev 196-197)

At 19:37Z, about 15 minutes before radiation belt exit of revolution 197, the Autostack crashed and therefore the JEM-X1 anode calibration ED KEACAL01, scheduled in the Timeline at 2004-05-24T19:39:00Z, and the activation ED KEACT_03, scheduled at 2004-05-24T20:10:00Z, were missed.

At 21:14Z, once commanding capability was regained from the Autostack, the Timeline was restarted, with commanding to both JEM-X units disabled from the Autostack. The activation of JEM-X1 was then performed manually, by first executing FCP_JEM1_0040 to command JEM-X1 to Safe mode at 21:38Z. The ED KEACAL01 was then uplinked at 21:44Z followed by the ED KEACT_03 at 21:57Z. JEM-X1 began operating in Data Taking mode at 22:31Z and commanding to both JEM-X units from the Autostack was then re-enabled.

In addition, the next CCCF was enabled and therefore the CCCF block starting at 23:53:02Z, containing the ED KEDATA01 at 23:54:02Z, was executed.

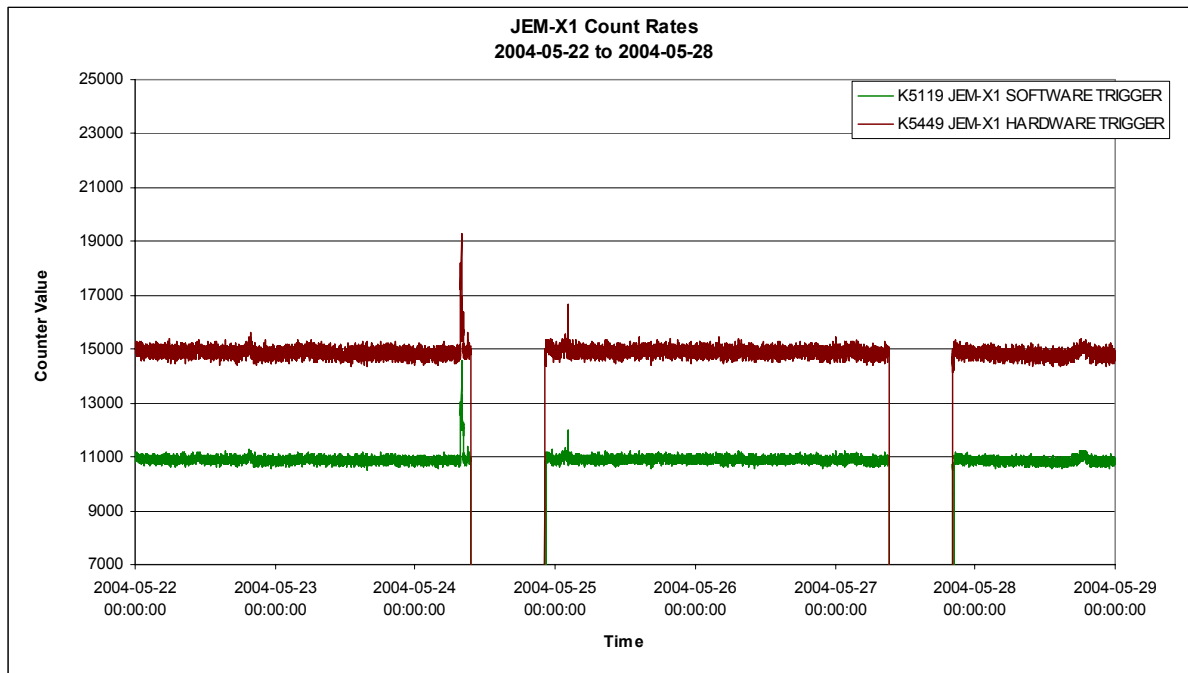
JEM-X operations continued nominally for the remainder of the revolution.

2004-05-25 (DOY 146, Rev 197) to 2004-05-28 (DOY 149, Rev 198)

Nothing to report

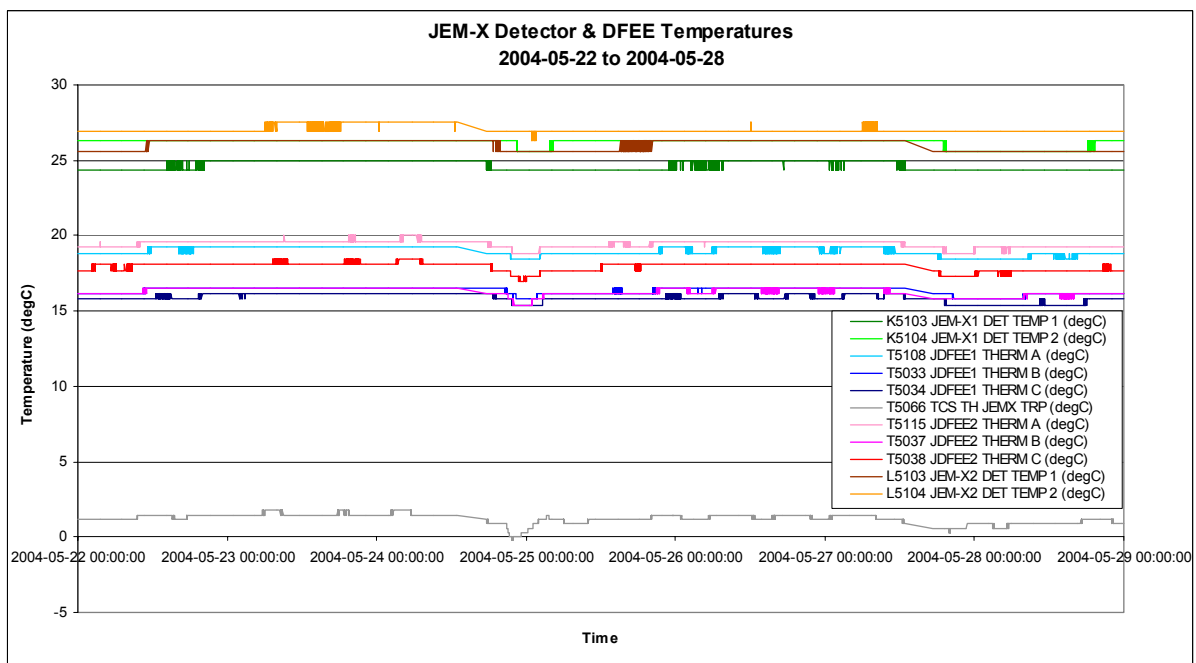
8.3.4.1 JEM-X Count Rates

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



8.3.4.2 JEM-X Temperatures

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)

8.3.5 OMC Operations

On DoY 145 at 03:08, ground station problems caused the loss of pointings 01960054, 01960055 and 01960056.

Later, at 19:37, the autostack crashed causing the loss of OMC pointings 01970004 and 01970005 were lost.

No Commands were rejected this week.

On DoY 145 at 10:47:37 and DoY 148 at 10:32:06, OMC was switched by the Timeline to SAFE mode, at the nominal times.

8.3.6 IREM Operations

IREM daily report

Nothing to report.

Radiation Belt Entry Analysis

The plots will be provided in next week's report.

IREM radiation counters plot

The plots will be provided in next week's report.

IREM predicted radiation counters

The plots will be provided in next week's report.

SEC-GOES observed particles fluxes

The plots will be provided in next week's report.