

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 154
Week 35
05.09.05
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 27.08.05 until 02.09.05 (both dates inclusive) and covers the revolutions 351 and 352

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 XTE J1818-245 (RA 18:18:25.20; DEC -24:32:31.2); the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0); the Norma Arm; A0535+26 (RA 05:38:54.57; DEC +26:18:56.8) and Cassiopeia A (RA 23:51:39.60; DEC +61:41:40.5). The activities consisted of raster and hexagonal dithering and grid 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.

2 slews (CSL) were not executed from the Timeline during this period, due to problem on IMCS (CMDVerifier task).

The fuel consumption over the period between 25/08/2005 and 01/09/2005 was 0.0639 kg. The remaining propellant is in the order of 159.5775 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.

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.

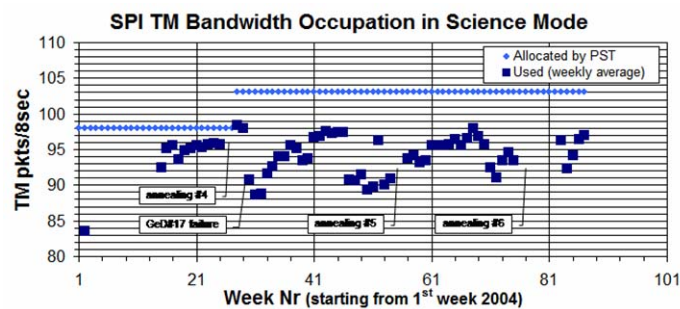
3.2 Payload

3.2.1 SPI

The overall status of the instrument is nominal.

During the reporting period, the instrument has been kept in photon-by-photon mode, with spectra TM enabled, an assigned TM bandwidth in the science observation windows of 103 pkts/cycle and an average occupation of 97 pkts/cycle. The Stirling compressors are working well, maintaining the detector cold-plate temperature within 85+/-1K.

The following plot shows the TM bandwidth occupation information.



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

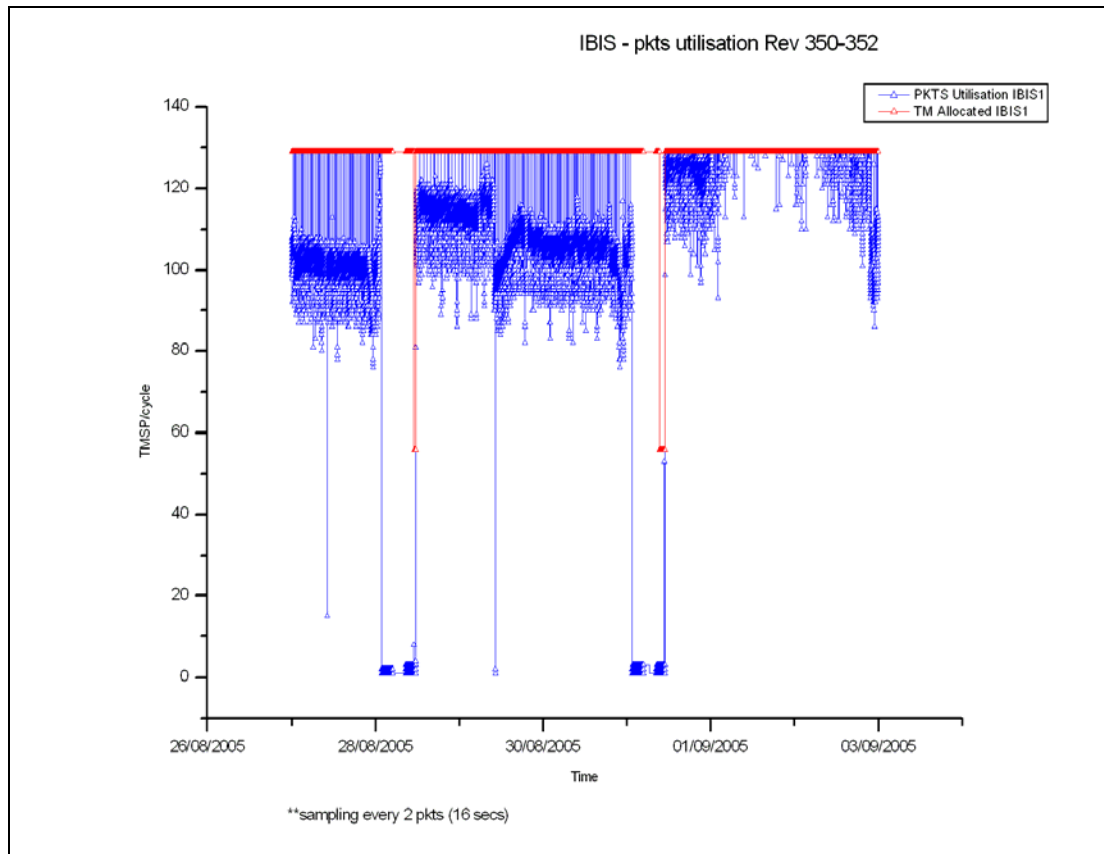
3.2.2 IBIS

The Overall status of the unit is Nominal.

The week was characterised by low to moderate solar activity.

During the reporting period, the PST allocation to IBIS was most of the time 129 TMPS/cycle. The IBIS mean bandwidth utilisation during the observation period was 116.12 TMPS/cycle, up 2.87 on last week.

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 and JEM-X2 was dormant (DFEE OFF) with a TM allocation of 1 packet/cycle.

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.

OMC operations were performed by the automatic Timeline. OMC was operated in Science Normal mode during science observations, with a TM allocation of 5 packets/cycle.

During this reporting period, 202 of the 204 planned science pointings for OMC were executed nominally, another was executed normally, but the OEM indicating pointing start was missed, and 1 pointing was lost to dynamic PTV problems.

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

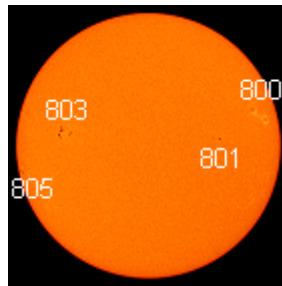
3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

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

At the beginning of the observation period, sunspot 803 (cf. picture) posed threat of M-class solar flares. It unleashed a M1-class flare on 28/08 morning. The remaining of the week was very quiet.



Reference: www.spaceweather.com

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 very good this week, 183 slews were executed correctly, 1 slew was missed due to problems at the MOC. There were also problems with bad TM packets and communications difficulties with ISDC. The overall performance was well above the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was very good this week, 1 pointing was lost due to problems with the IMCS, and there were several occurrences of icons turning red on the global MMI. The overall performance was well above the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week although there was an instance of bad packets arriving from Redu. The overall performance though was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSF's up to revolution 359 have been received. Planning has been done for all these revolutions. All planning files have been sent to MOC and ISDC. One ToO request for the target A0535+26 was received and approved for execution. This resulted in replanning of revolutions 252 and 253.

The ToO on the pulsar HETE J1900.1-2455 from last week is still pending, awaiting additional information from the PI. The problem mentioned last week causing ISOC to introduce a dummy observation in the beginning of a revolution has not been necessary since revolution 354 due to selection of targets further away from the constrained area. The TSF's up to revolution 354 have now been received.

2. Observation status

ECS's for revolutions 341 and 342 have been received. The corresponding OCS's have been sent. No extra time has been credited.

3. ISOC science data archive

The old procedure with delivery on tape of archive data has now been abandoned. Updates are now performed using electronic transfer only. The bandwidth for this is now sufficient.

4. ISOC system

A version 11.1 of the ISOC system has been used. One patch was introduced fixing some SPR's. No problems encountered.

5. Next Announcement of Opportunity (AO 4)

An ISOC internal kick-off was held this week with the entire team. Initial distribution of the tasks during the preparation phase and review of tasks and schedule was done. Also the system enhancements based on the past experiences have been scooped. Since the ISOC team is now smaller than in the past the focus of the enhancements have been to provide better support to the time consuming tasks during the AO preparation period.

6. Problems

The problem reported last week concerning discrepancy between the constraint checking in ISOC and MOC is still under investigation. As mentioned above it is less critical at the moment since we are performing observations in other area of the sky.

The network router problem could not be solved. Therefore the old router was reinstalled. The ISOC connections are since then working without problems.

4.3.2 ISDC

Status of ISDC observation processing on 05/09/2005:

- Latest Standard Analysis completed: observation 03201020002 (Crux Arm, Revolution 327-329) on 05/09/2005

- Latest products archived: observation 03201020001 (Crux Arm, Revolution 322-325) on 18/08/2005

- Latest observation products sent to the observer: observation 02201540001 (Coma Cluster, Revolution 315-319) on 28/07/2005

5 Special Events

None

6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 239, at 07:53, the IMCS lost connection to the CPD TM. The recovery was delayed when problems were encountered with CPU usage by the behaviour limit checker. All the commands from the Autostack continued as normal, the impact appears to be that some TM is missing from the caches, eg, the OMC OEM for the start of pointing 03500061.
- At 13:06, ISDC informed MOC that they had not received any Aux files since DoY 238 at 14:30. At 13:13, CCC restarted the ifts tasks on idda to the MOC, IMC and MAB. At 13:25, ISDC informed the MOC that there were still no files being received, at 13:26, the ifts instance to the SDS on isds-a was restarted, at 13:31, ISDC reported, the files were being received. At 14:35, ISDC informed the MOC that no further files had been received since the reboot. At 15:25, the links were restored after a reboot of the isds-a, there was no impact.
- On DoY 240, at 04:59, the TM desktop on sun121 was using 45.6% of the available cpu, it was stopped and restarted, there was no impact.
- At 05:24, after the inctr-a was rebooted, its MMI in the global overview disappeared, the global MMI was restarted, there was no impact.
- At 22:03, the idda briefly went red on the global MMI for about 10 seconds, the cause was too high a cpu load for the MCCMcentralMonitor, there was no impact.
- On DoY 241, at 11:05, the sun129 icon on the Global MMI turned briefly red, showing high cpu usage for the MCCM monitor, there was no impact.
- On DoY 242, at 01:12:58, an AOCS command failed release due to the dynamic PTV. After the recovery the timeline was resumed at 09:55. The impact was the loss of pointing 03510056.
- At 06:22, there was a drop in the TM link from Redu, followed by Reed-Solomon alarms and 39 bad frames, there was no impact.
- At 22:45, shortly after the handover from Redu to DSS-16, there was no bit-lock, this was, however recovered in time, there was no impact.
- On DoY 243, at 12:10, there was an error sending data to the ISDC, at 12:11, the link madds-isds was again connected. No action was taken, and there was no impact.
- On DoY 245, at 01:35, the idda icon on the global MMI briefly turned red with the MCCM using 48% of the available cpu. No action was taken and there was no impact.

- At 05:49, 53 bad frames were received from Redu, at the same time there was a data gap in the on-line timely VC0 TM from Redu, there was no impact.

The following anomaly reports were entered into the ARTS system this week:

AR id	Date Created	Subject	Segment	Status
INT-2786	30/08/2005	IMCA cache connectivity problems	IMCS	Pending
INT-2787	31/08/2005	IBIS2: Telecommand P4415 operates the wrong thermostat.	Simulator	Open
INT-2788	02/09/2005	Dyn. PTV failure due to double CEV of TC A7192 from Timeline	IMCS	Pending

7 Future Milestones

Change of communication protocol to ESA Station from X25 to TCP IP: The testing has been performed. The release is not yet operational because an upgrade of the communications set-up is required.

Another patch of the IMCS is planned for September/October, which should fix a couple of problems.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 351

The observations in revolution 351 began with a raster dithering observation of XTE J1818-245 (RA 18:18:25.20; DEC -24:32:31.2) lasting ~18 hours, followed by a hexagonal dithering observation of the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0) lasting ~3.5 hours. A grid observation of the Norma Arm was then performed for the remaining ~39 hours of observation time.

Revolution 352

The observations in revolution 352 consisted of a hexagonal dithering observation of the Target of Opportunity A0535+26 (RA 05:38:54.57; DEC +26:18:56.8) lasting ~58 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 ~3.5 hours of observation time.

Throughout these observations all instruments were in their nominal science modes, except for 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

2005-08-11T20:35:11.000Z	159.9539	F	Automatic TM processing.
2005-08-13T10:13:23.000Z	159.9361	F	Automatic TM processing.
2005-08-14T20:18:14.000Z	159.9032	F	Automatic TM processing.
2005-08-16T10:01:14.000Z	159.8886	F	Automatic TM processing.
2005-08-16T18:54:11.000Z	159.8285	F	Automatic TM processing.
2005-08-19T09:52:34.000Z	159.8062	F	Automatic TM processing.
2005-08-20T09:09:40.000Z	159.7680	F	Automatic TM processing.
2005-08-22T09:44:25.000Z	159.7524	F	Automatic TM processing.
2005-08-23T22:19:49.000Z	159.7280	F	Automatic TM processing.
2005-08-25T09:32:57.000Z	159.7155	F	Automatic TM processing.
2005-08-25T12:11:29.000Z	159.6414	F	Automatic TM processing.
2005-08-28T09:17:52.000Z	159.6253	F	Automatic TM processing.
2005-08-29T19:34:05.000Z	159.6084	F	Automatic TM processing.
2005-08-31T09:06:33.000Z	159.5876	F	Automatic TM processing.
2005-09-01T19:58:04.000Z	159.5775	F	Automatic TM processing.

This report was generated Fri Sep 2 08:00:25 GMT 2005

8.3 Detailed Satellite Information

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

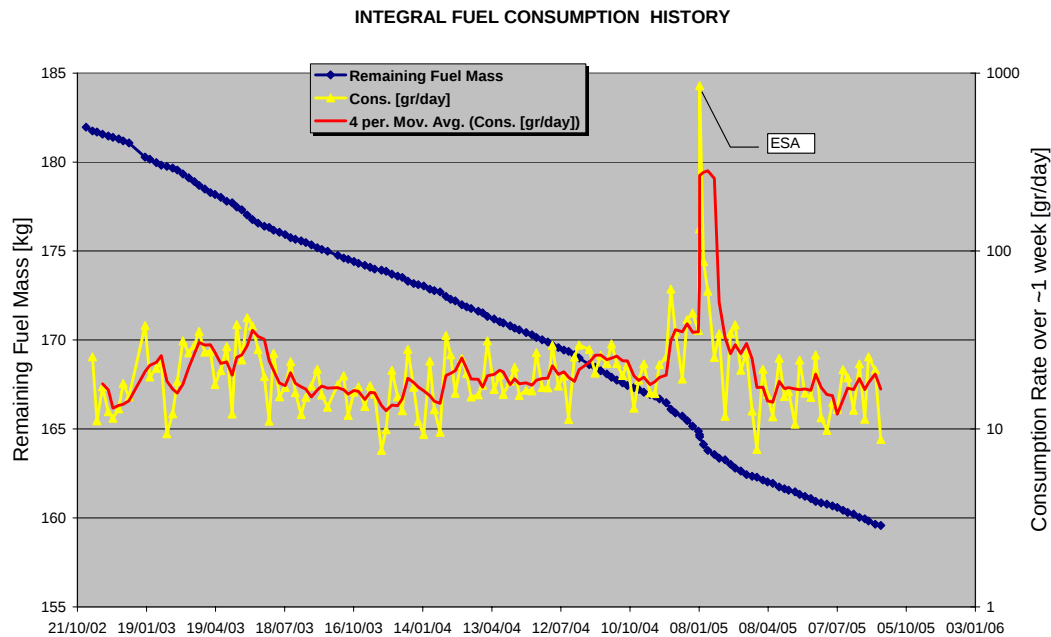
8.3.1 AOCS SUMMARY OPERATIONS REPORT, 27/08/2005 – 02/09/2005

AOCS operations were executed from the Automatic Timeline.

During this period, 75 Open Loop Slews, 139 Closed Loop Slews and 4 Momentum Bias were executed (TL + manual recovery). 2 slews (CSL) were not executed from the Timeline during this period, due to problem on IMCS (CMDVerifier task).

This is equivalent to a $\sim 0.9\%$ of the total number of slews planned (215).

The fuel consumption over the period between 01/11/2002 and 01/09/2005 is reported in the plot below.



27/08/05 (Day of Year 239, Revolution 350)

Nothing to report.

28/08/05 (Day of Year 240, Revolution 350-351)

Guide star released by the STR SEU Filter: at 08.08.24z (not yet in coverage) the SEU Filter threshold of the ACC was exceeded, the current guide star released and the IMU1 switched ON. A new guide star was picked in the first automatic mapping, which was kept afterwards.

No impact on TL.

Guide star released by the STR SEU Filter: at 08.38.22z (not yet in coverage) the SEU Filter threshold of the ACC was exceeded, the current guide star released and the IMU1 switched ON. A new guide star was picked in the first automatic mapping, which was kept afterwards.

No impact on TL.

29/08/05 (Day of Year 241, Revolution 351)

Nothing to report.

30/08/05 (Day of Year 242, Revolution 351)

Slews missed from the Timeline: Due to a problem on IMCS (CMDVerifier task reported problem, TC A7192 passed completion of execution stage twice preventing the starting of the slew by Dyn PTV failure, see AR INT-2788), the slew ID 03510056(CSL) failed release and the AOCS s/s disabled in TL at 01:12:58z. A manual recovery was then performed from attitude of PID 03510055 to the attitude of PID 03510057. The next slew (CSL) for PID 03510058 was manually updated and executed from the Timeline. The AOCS s/s was re-enabled in TL at 01:55z.

The following slews were not executed from TL while recovering the AOCS s/s: 03510056(CSL)-57(CSL).

31/08/05 (Day of Year 243, Revolution 351-352)

Nothing to report.

01/09/05 (Day of Year 244, Revolution 352)

Nothing to report.

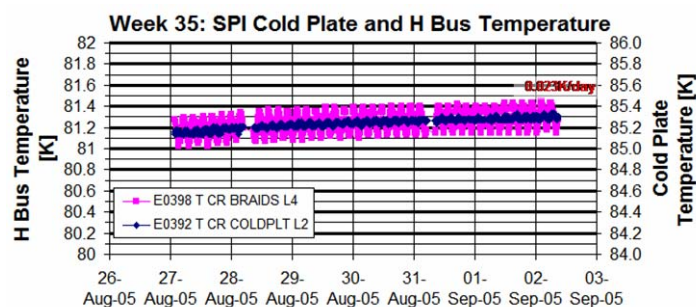
02/09/05 (Day of Year 245, Revolution 352)

Nothing to report.

8.3.2 SPI Operations

Stirling compressors and Cryostat

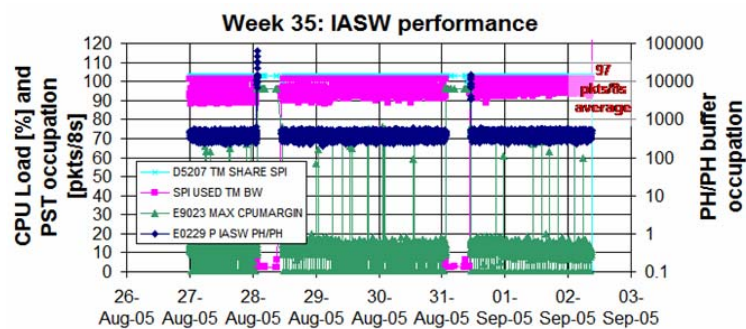
The performance of the compressors is nominal. The cold plate temperature was maintained at 85K $\pm$ 1K showing the usual positive drift with the expected slope. The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.



DPE & IASW

The IASW performance is nominal.

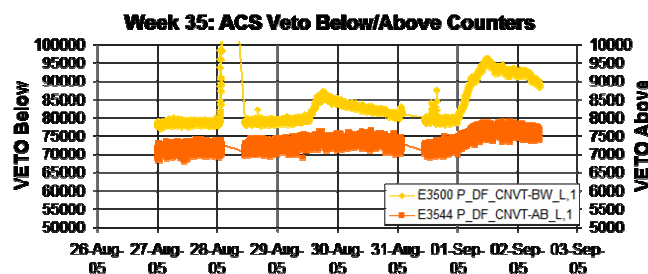
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS

The performance of the ACS is nominal. High solar radiation is evident between 23rd and 25th August.

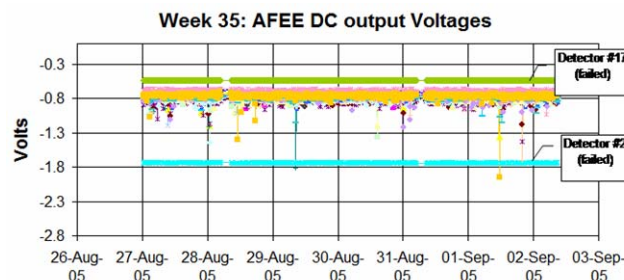
The following plot shows the ACS overall count rate evolution during the reporting period.



AFEE and Germanium Detectors

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

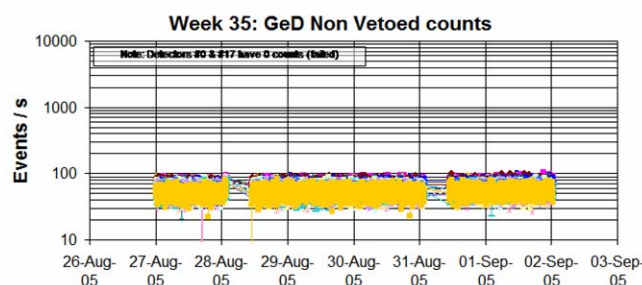
The following plot shows the dc voltage offset of the detector channels during the reporting period.

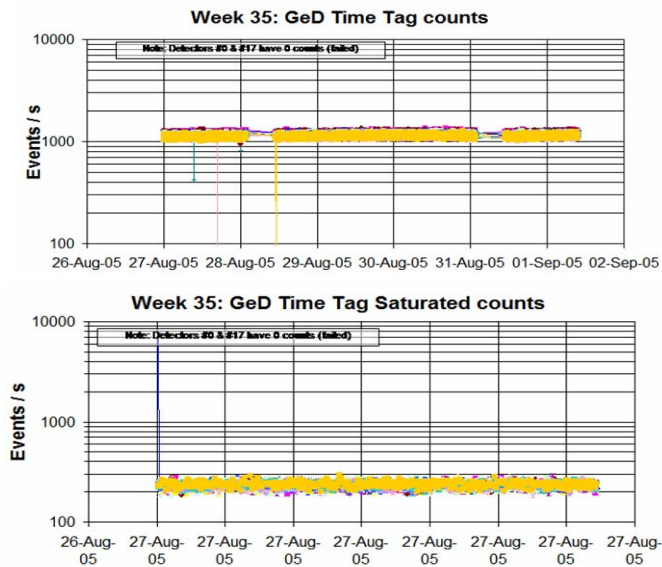


DFEE

The performance of the unit is nominal.

The following plots show the count rates of the detectors during the reporting period (due to problems in the data retrieval tool, some gaps could be present).

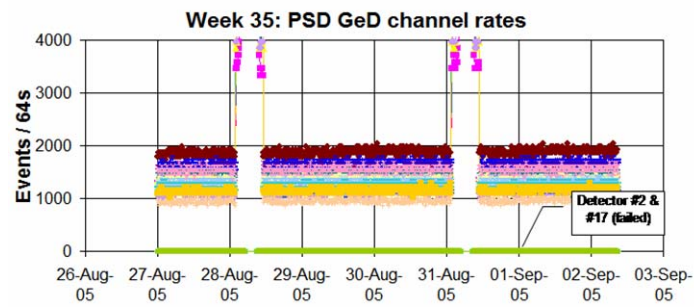




PSD

The performance of the unit is nominal.

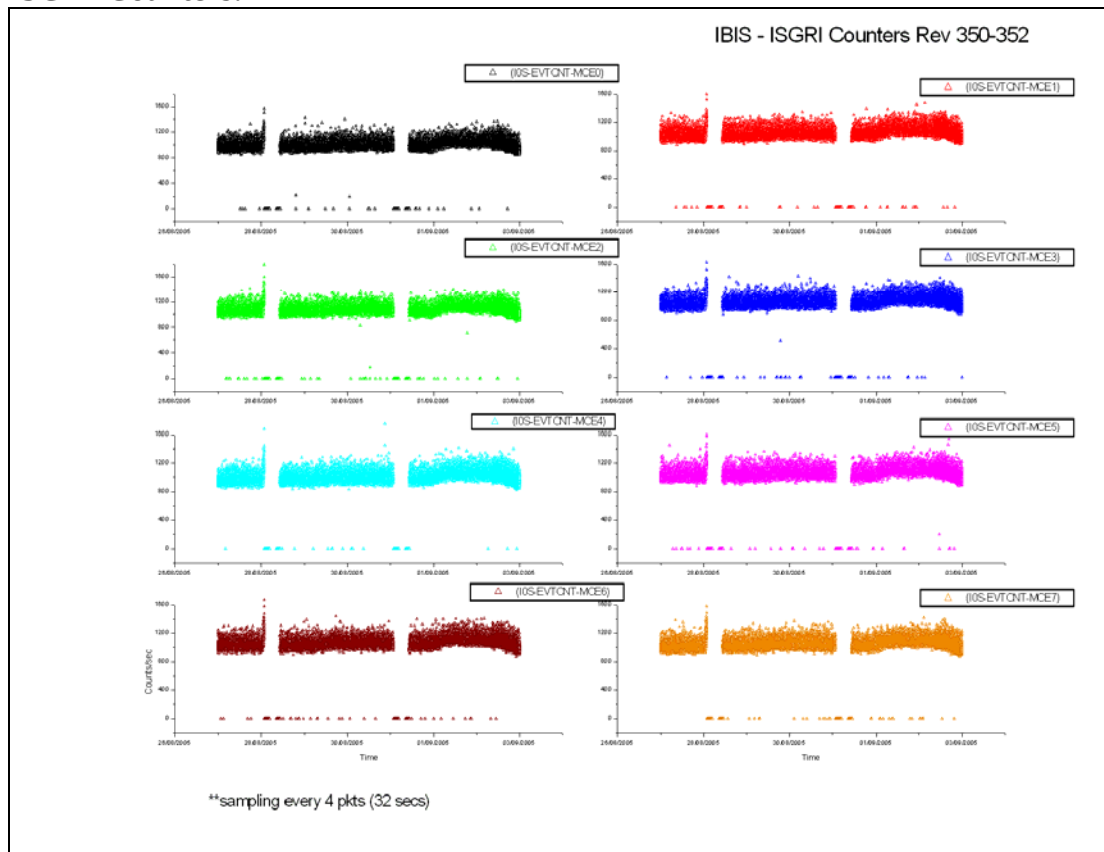
The following plots show the PSD channel rates during the reporting period.



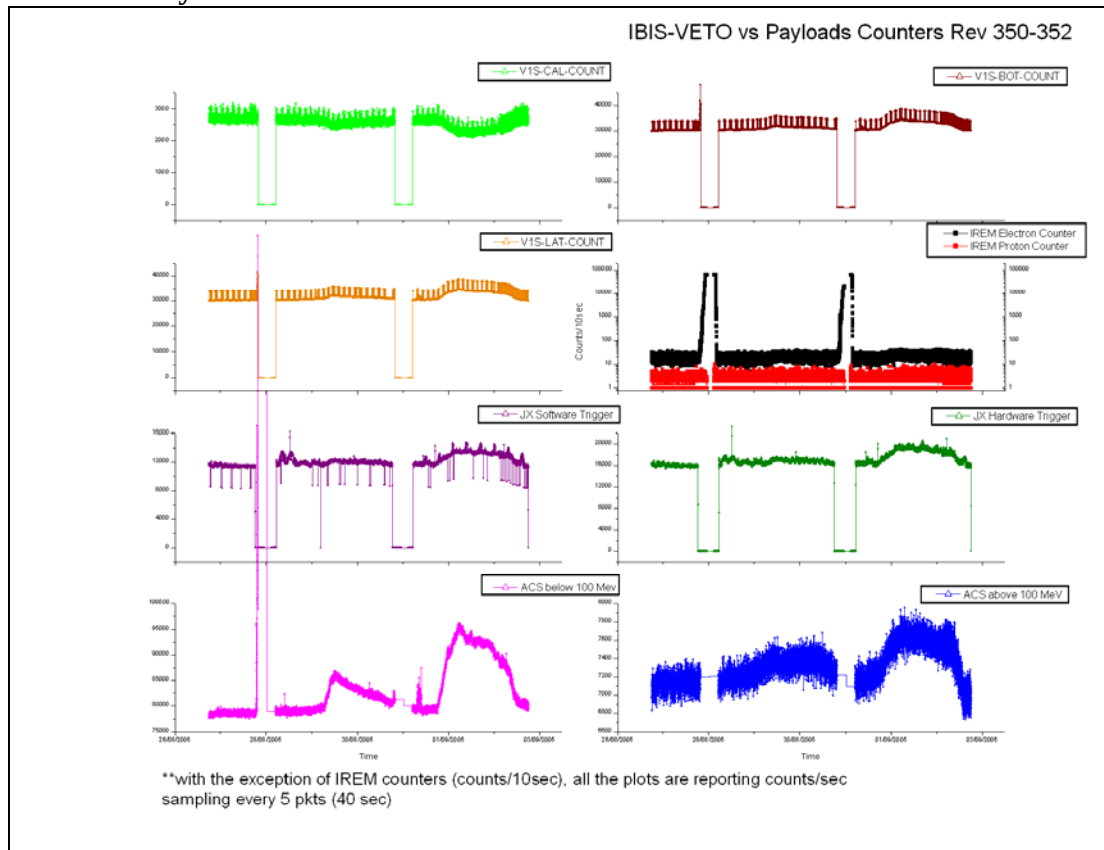
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

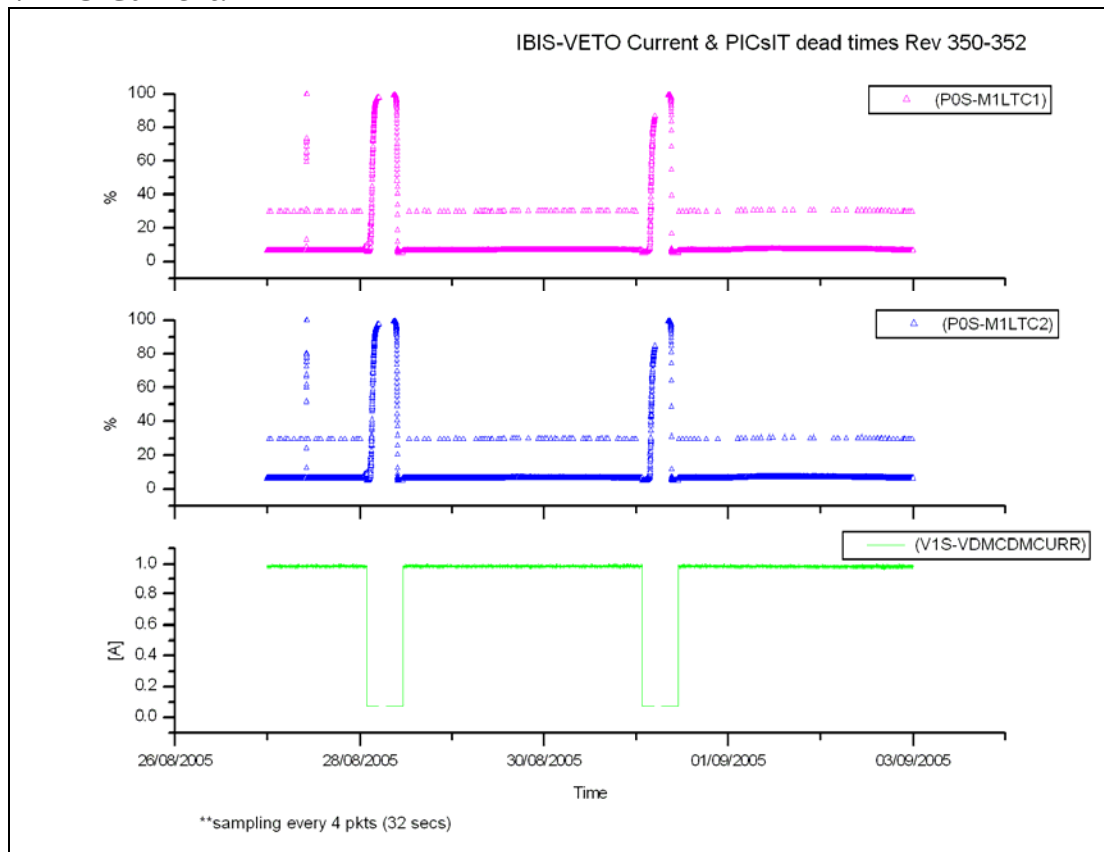


VETO vs Payloads Counters:

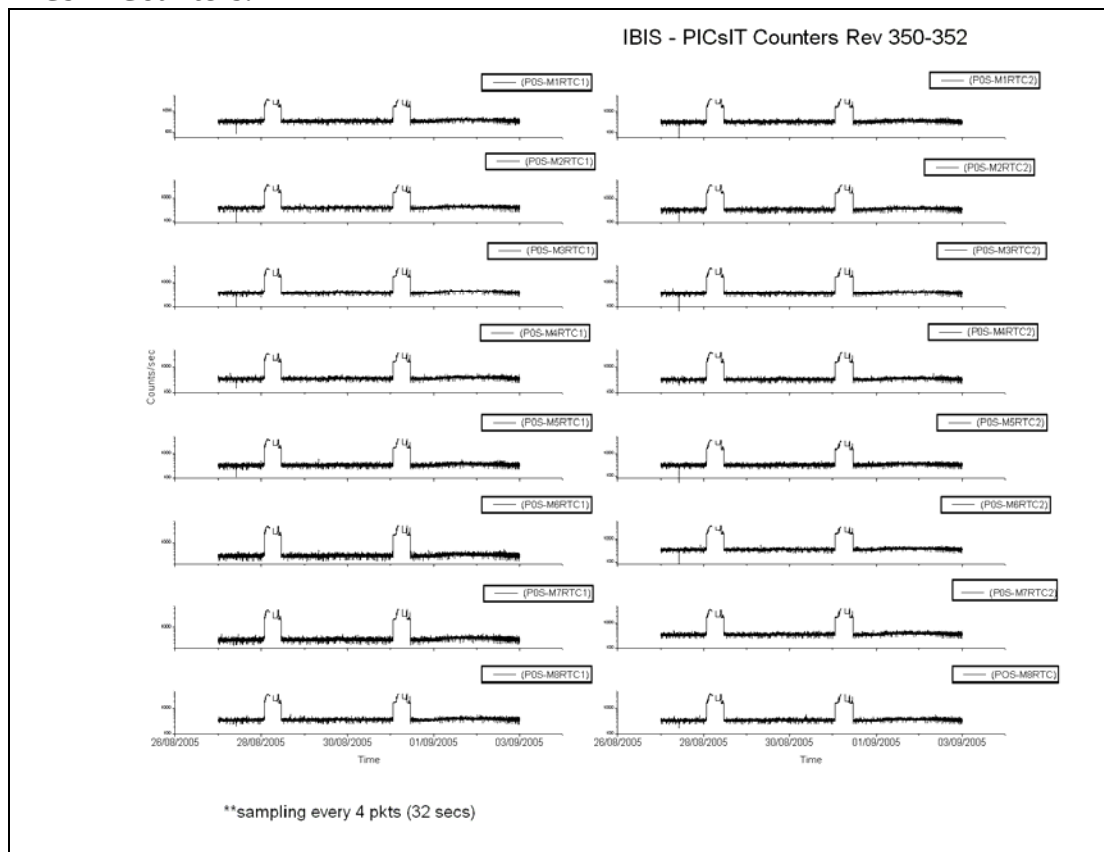


The week was characterised by low to moderate radiation.

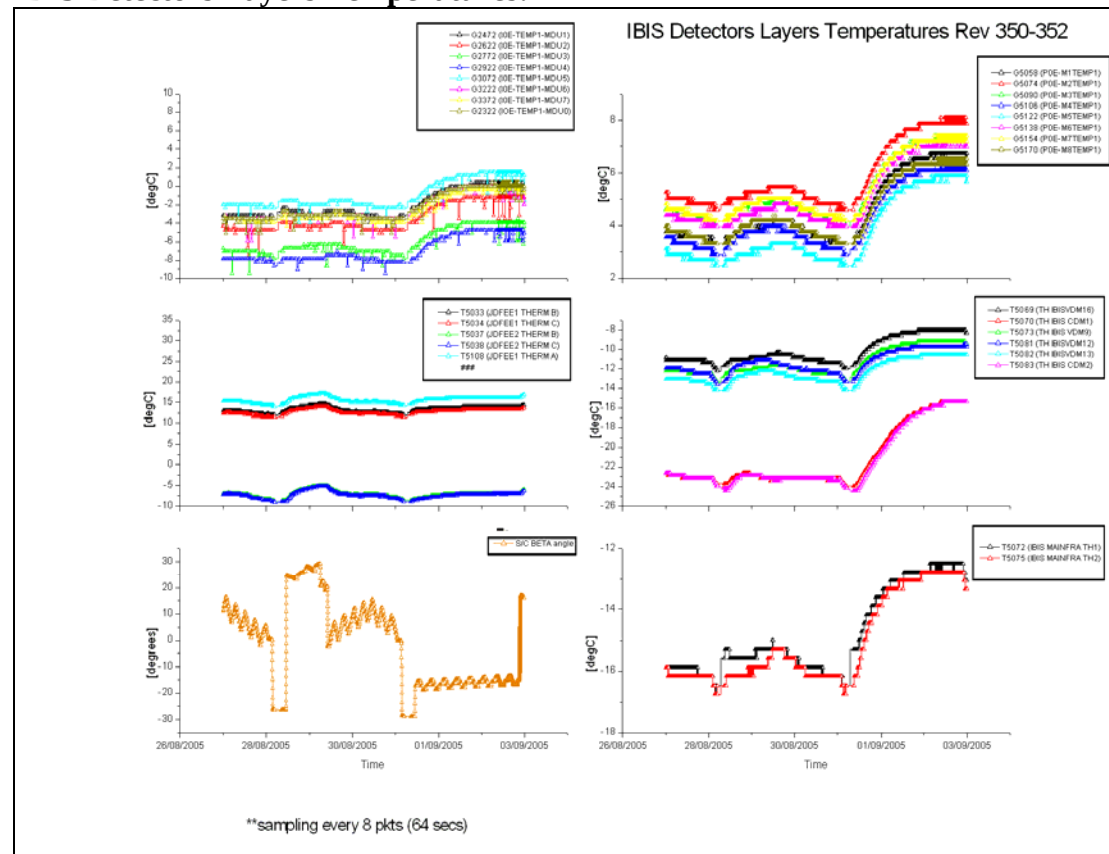
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report

DoY 2005.239 (27/08/2005)

At 10:03Z, TM families G5068 and G5072 (POS-MiF #1 and #2 ERRF) failed SCC.
 At 10:11Z, TM families G5002 and G5003 (POS-MiRTC #1 and #2) went OOL 'low-low'.
 At 10:14Z, the OEM id 132 class 0 "IBIS1 IASW HEPI RESYNCHRONISED" was reported.
 According to reaction P-CNT-1 that describes the coincidence of these 3 events outside Radiation Belts, no action was taken. IBIS was monitored for 15 minutes during which all the parameters returned within their limits.

DoY 2005.240 (28/08/2005)

At 01:48Z, TM parameter G8015 (28V PMT set by IASW) went OOL High with the value 29.4V. It went back inside limit at 11:14Z. As this happened inside the Radiation Belts, according to V-VLT-1, no action was taken.

At 10:47Z, TM G2014 (I0E-OVFWPXADD-M1) failed SCC. According to I-OVF-1, as this happened inside the radiation belt, no action was taken.

DoY 2005.243 (31/08/2005)

At 01:35Z, TM parameter G8015 (28V PMT set by IASW) went OOL High with the value 29.4V. It went back inside limit at 11:02Z. As this happened inside the Radiation Belts, according to V-VLT-1, no action was taken.

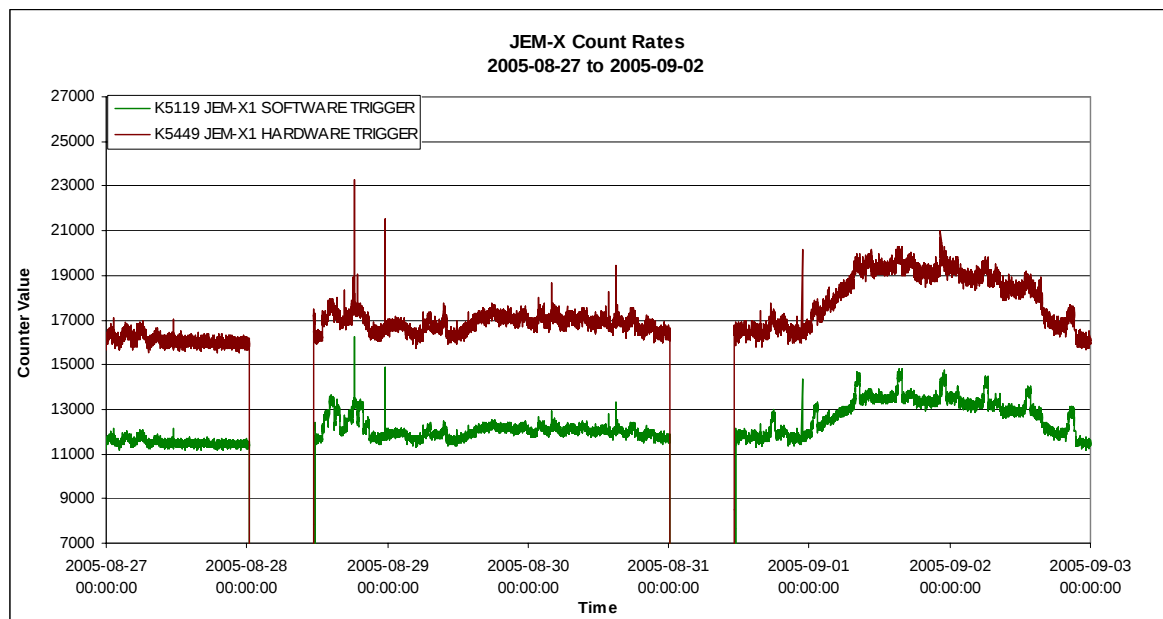
DoY 2005.244 (01/09/2005)

From 11:10Z until 20:36Z, while the radiation background was higher than usually, TM parameter G6061 was toggling OOL low-low close to its limit (2200). This seemed to be due to a known problem of the VETO CDM01 FEE not able to follow higher count-rates. Therefore no action was taken.

8.3.4 JEM-X Operations

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

As is evident from this plot, several spikes were observed on the count rates throughout the week. These were associated with high values of the buffer loss TM parameter K5136, although this parameter did not always go out of limits as two consecutive instances of OOL values are required for an OOL to be issued.

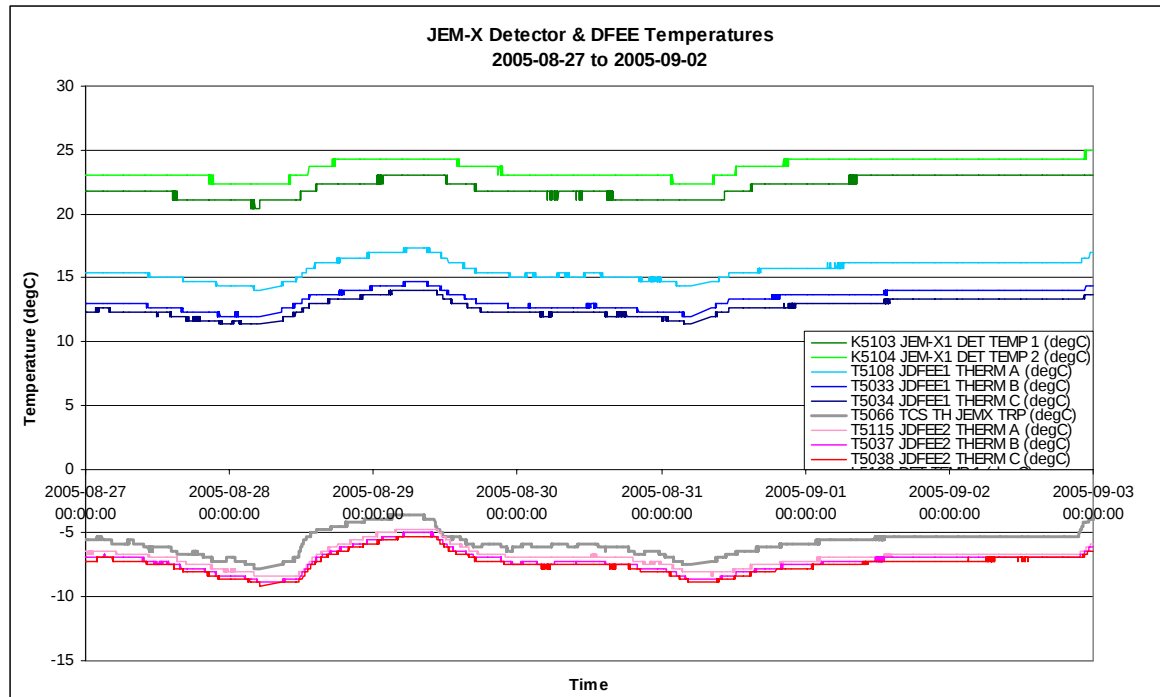


8.3.4.2 JEM-X Temperatures

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

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)



8.3.4.3 JEM-X Daily Report

2005-08-27 (DOY 239, Rev 350) to 2005-08-30 (DOY 242, Rev 351)

Nothing to report

2005-08-31 (DOY 243, Rev 351-352)

At 22:45:40Z the TM parameter K5136 BUFFER LOSS went Out of Limits High (value = 471), returning within limits at the next TM cycle.

At 22:47:40Z the TM parameter K5136 BUFFER LOSS went Out of Limits High again (value = 245), returning within limits at the next TM cycle.

2005-09-01 (DOY 244, Rev 352) to 2005-09-02 (DOY 245, Rev 352)

Nothing to report

8.3.5 OMC Operations

2005-08-27 (DOY 239, Rev 350)

From 07:53, to 08:39, problems with the IMCS at the MOC caused the loss of the OEM indicating the start of pointing 03500061, however the observation itself appears to have been performed nominally.

2005-08-30 (DOY 242, Rev 351)

At 01:12:58, an AOCS command failed release due to the dynamic PTV. The timeline was resumed at 01:55. The impact was the loss of pointing 03510056. It was at this time the following commands were rejected:

Doc. Title : INTEGRAL Mission Report #154
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OF
Date : 05/09/05

Issue : 1
Rev. : 0
Page : 20

2005.242.01.13.29.040	2005.242.01.13.37.397	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					
2005.242.01.13.35.290	2005.242.01.13.44.600	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					

Which correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) for pointing 03510056.

2005-08-31 (DOY 243, Rev 352)

At 11:22:19, an external command M1329 (IMAGING BX) was received to put the instrument into Trigger Mode. At 11:26:45, the same command was received again, and rejected, as the instrument was already in Trigger Mode:

2005.243.11.26.44.984	2005.243.11.26.48.696	1792	RealTime	131	TC REJECT
REJECTED TC1			0	0	65535 PR N
E E					

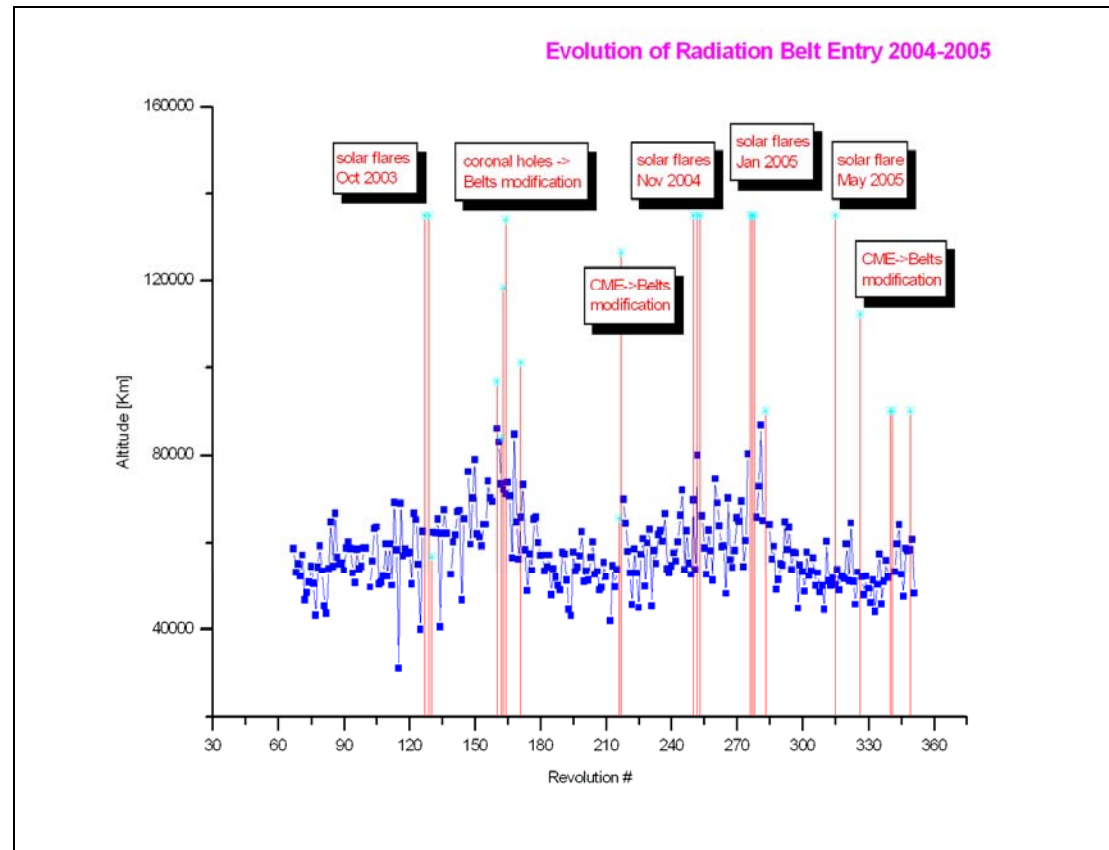
There was no impact.

On DoY 240 at 01:48:39 and DoY 243 at 01:35:43 OMC was switched by the Timeline to SAFE mode, at the nominal time.

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8.3.6 IREM Operations

Radiation Belts Entry



IREM daily report

Nothing to report.

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]
350	RAD_ENTR R 2005-08-28T01:48:34Z	2005-08-28 01:38:38	>60808.6	2005-08-28 02:47:55	52039
351	RAD_EXIT R 2005-08-28T11:02:07Z	2005-08-28 10:10:30	>>24905.6	2005-08-28 09:57:55	30043
351	RAD_ENTR R 2005-08-31T01:35:38Z	2005-08-31 03:02:22	48269.7	2005-08-31 02:30:09	52679
352	RAD_EXIT R 2005-08-31T10:48:56Z	2005-08-31 09:36:46	28662.3	2005-08-31 09:40:09	29334

Reference

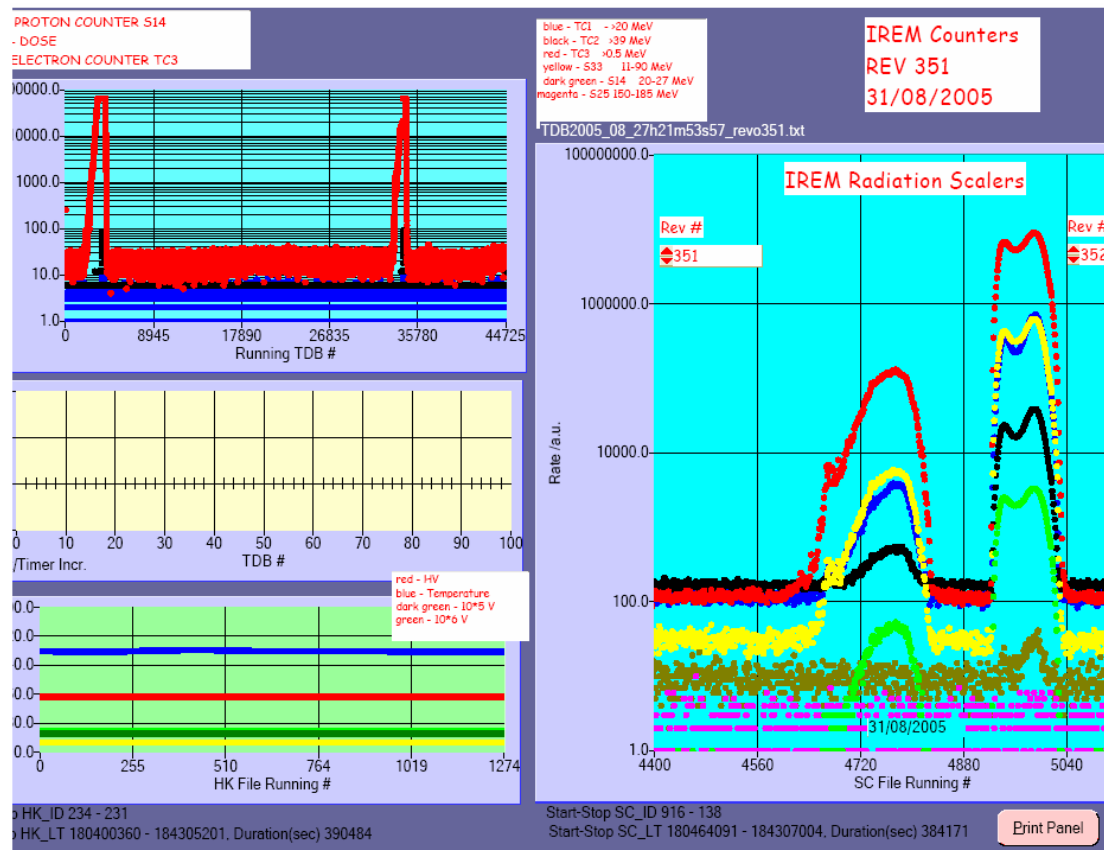
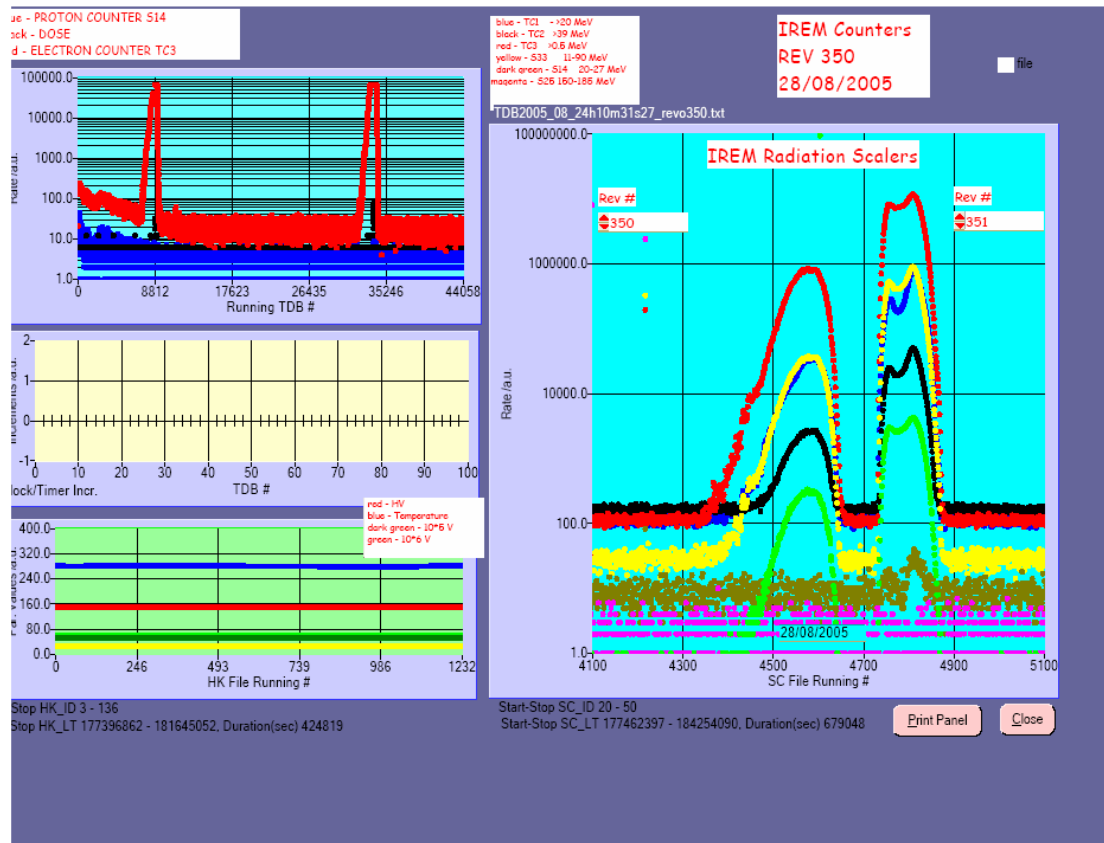
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

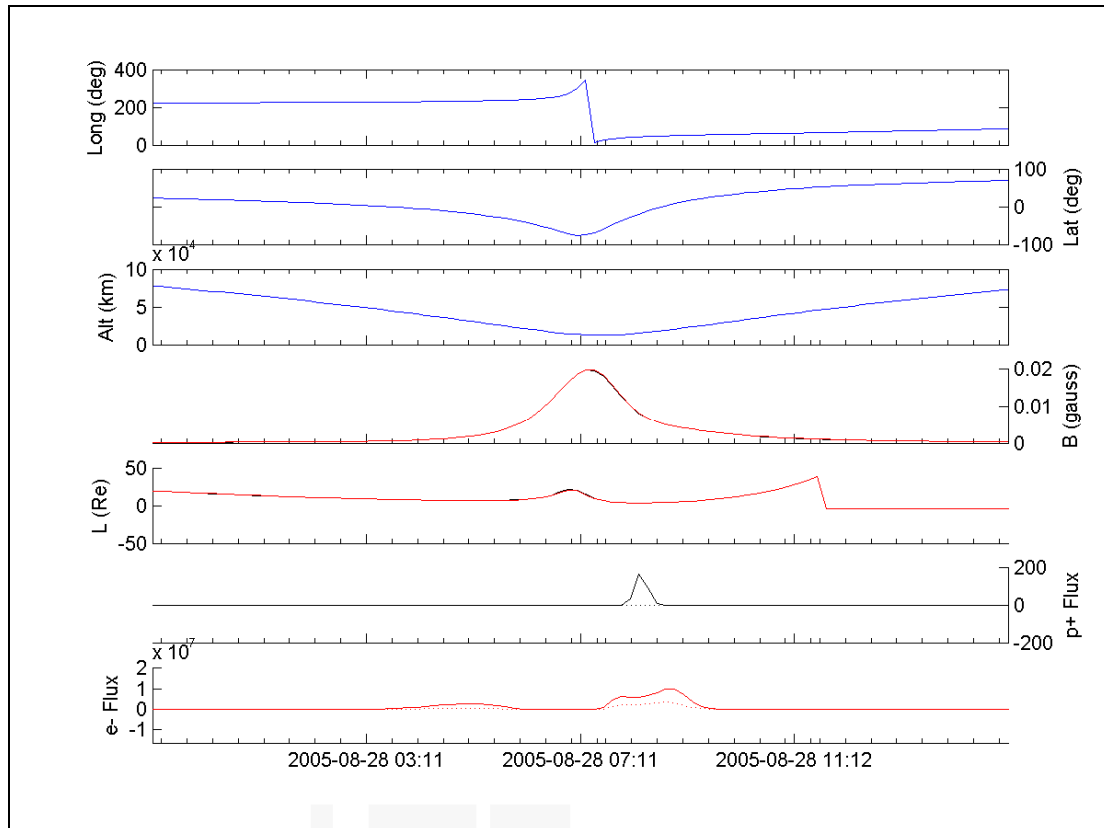
Radiation Spike

IREM radiation counters:

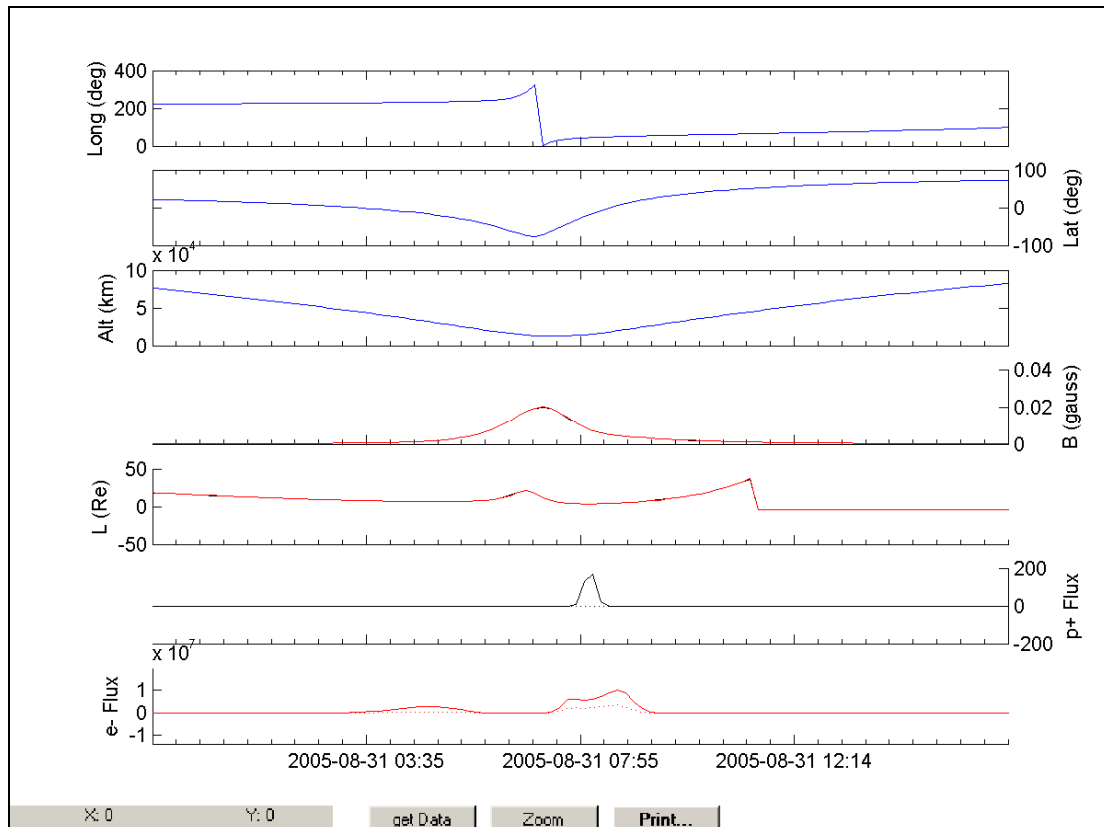


IREM Predicted Radiation Belt Passages:

Rev 350



Rev 351



SEC-GOES Observed Particles Fluxes:

