

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 107
Week 41
11.10.04
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 02.10.04 until 08.10.04 (both dates inclusive) and covers the revolutions 241 & 242.

2 Summary of Activities

The operations were performed according to the planning inputs from ISOC combined with some manual commanding by MOC.

The activities consisted of GPS and GCDE 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.

Several slews were missed from the Timeline due to problems with the links to the ground station as well as problems with the selection of guide stars for close loop slews.

The fuel consumption over the period between 01/10/2004 and 08/10/2004 was 0.148 kg. The remaining propellant is in the order of 167.443 Kg on the 8th of October.

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

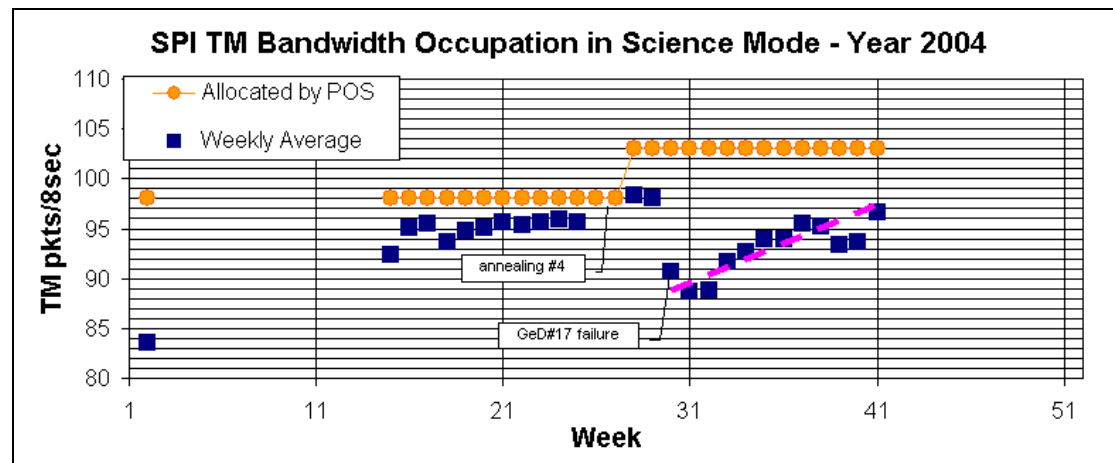
The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

3.2.1 SPI

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

The instrument was 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 actual average occupation of 96.7 pkts/cycle. The following plot shows the occupied bandwidth, since beginning of 2004.



The cryocooler is working well, maintaining the temperature within 85 $\pm$ 1K.

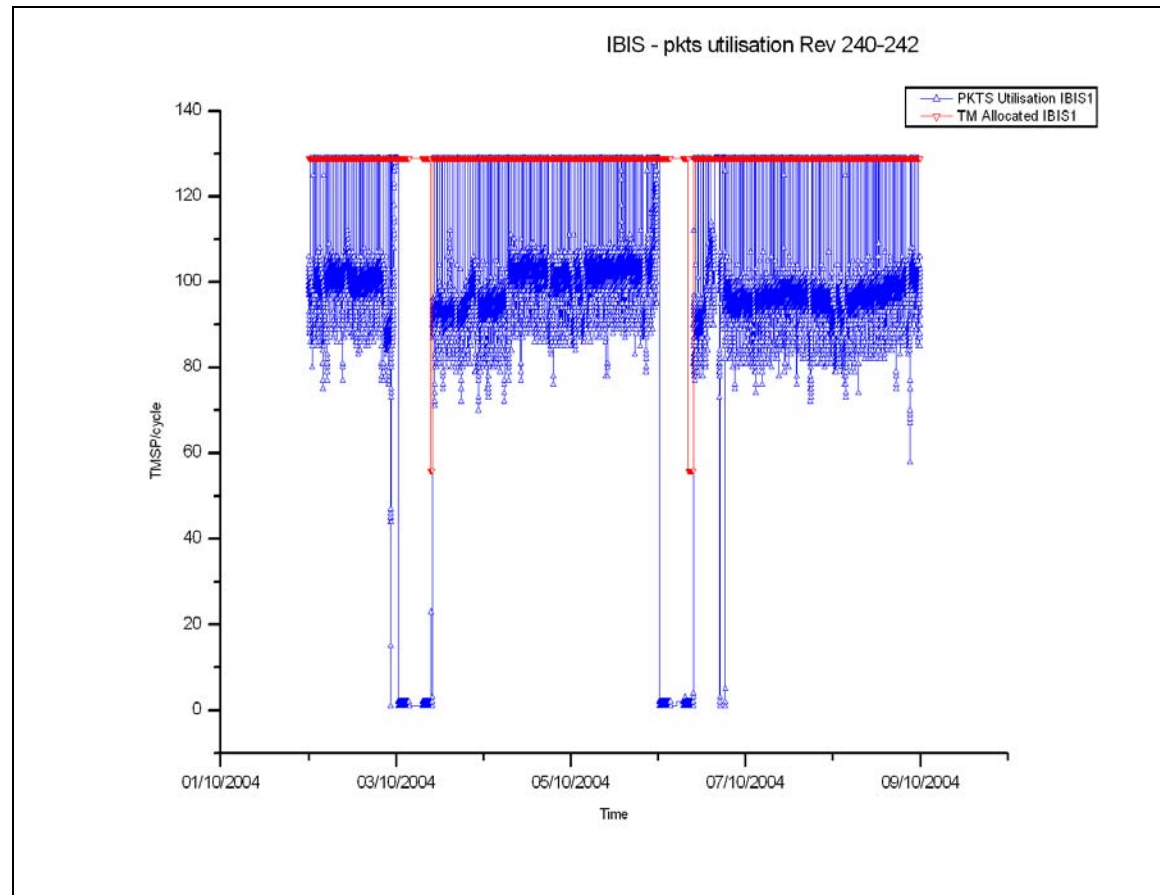
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

The overall status of the unit is Nominal.

During the reporting period the PST Allocation to IBIS was 129 TMSP / Cycle. The mean IBIS Bandwidth usage was 100.2 TMSP / Cycle.

Hereafter is reported the plot of the IBIS TM utilisation during the observation period.



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 during science observations. 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.

During the reporting period OMC operations were performed by the automatic Timeline, with the TM allocation to OMC of 5 packets/cycle.

There were 251 OMC pointings executed nominally, 1 was delayed by about 9 minutes and 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.

Solar Activity

The observation period was characterized by low solar activity. The Earth-facing side of the sun was almost blank during the week (just some small sunspots) and none of these small sunspots posed a threat for strong solar flares.

No major events were reported.

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, however a total of 5 slews from the automatic timeline were missed due to two communications interruptions between MOC and the supporting ground station. There were also a few instances of bad TM frames being received from REDU.

4.1 Mission Operations Centre

The performance of the MOC was in general good in the reporting period, there was a problem with the firewall which caused some errors in sending data to ISDC, but apart from that, a quiet week.

4.2 Ground Stations & Network

The performance of the ground stations and Network was in general good this week, apart from some interruptions on the links to the stations. The overall performance though was still above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. AO-3

Still no proposals have been received yet.

2. Mission planning

PSF complete up to revolution 250.

POS/POD for revolution 245 re-generated to implement change of JEM X-1 high voltage setting. New setting has been made the default for the future. Further POS/PODs have been generated up to and including revolution 248, but anything beyond that must await a decision by ISOC on how to handle certain observations which need to be "split" because of an instrument status change part-way through. TSF complete up to revolution 244.

3. Observation status

No ECS/OCS activity since last week.

4. ISOC science data archive

Science window data received from ISDC up to revolution 215, but not possible to ingest it at ISOC yet, owing to unplanned delay in purchase of new disc hardware.

5. ISOC system

Version 10.6.0 is still operational.

6. Problems

Nothing new to report.

4.3.2 ISDC

No inputs available.

5 Special Events

None.

6 Anomalies

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

- On DoY 277, at 01.00, the TC link to DSS16 was lost. 3 timeline slews were affected.
- On DOY 277 at 20.59 bad TM Frames were received from REDU.
- On DOY 278 at 07.31 a short drop in VC-0 TM occurred.
- On DOY 278 at 12.25 bad TM Frames were received from REDU.
- On DOY 279 at 20.15 The TC link to REDU was lost. 2 timeline slews were affected.
- On DOY 280 at 11.15 and again at 16.54 there were errors sending data to ISDC
- On DOY 281 at 10.27 the TM links to REDU were lost briefly.
- On DOY 282 at 04.22 the TM and TC links to REDU were lost for about 1 minute.

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

AR id	Date Noted	Subject	Segment	Status
INT-2652	04/10/2004	JEM-X2 Erroneously Planned to be Activated in POS for Revolution 242	ISOC	Closed
INT-2653	04/10/2004	Error sending data to ISDC - DOY 273, 274, 275	IMCS	Pending
INT-2654	04/10/2004	Lost TC, no RF lock at DSS-16	NASA Station	Pending
INT-2655	06/10/2004	OLF files without time correlation data delivered	IMCS	Closed
INT-2656	08/10/2004	Idle Gap on VC-0 TM Streams	Comms	Pending

7 Future Milestones

None

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 241

The observations in revolution 241 consisted of a GPS lasting ~12 hours followed by a GCDE observation, performed for the remaining ~49 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 242

The observations in revolution 242 consisted of a GPS lasting ~5 hours, followed by a GCDE observation, which was performed for the remaining ~53 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

2004-09-19T19:08:30.000Z	167.8696	F	Automatic TM processing.
2004-09-20T19:32:24.000Z	167.8305	F	Automatic TM processing.
2004-09-21T08:41:46.000Z	167.7697	F	Automatic TM processing.
2004-09-22T19:08:05.000Z	167.7416	F	Automatic TM processing.
2004-09-24T08:27:13.000Z	167.7095	F	Automatic TM processing.
2004-09-25T19:30:53.000Z	167.6784	F	Automatic TM processing.
2004-09-27T08:13:54.000Z	167.6629	F	Automatic TM processing.
2004-09-28T18:34:21.000Z	167.6535	F	Automatic TM processing.
2004-09-30T08:07:45.000Z	167.5911	F	Automatic TM processing.
2004-10-03T00:42:40.000Z	167.5495	F	Automatic TM processing.
2004-10-03T07:51:21.000Z	167.5376	F	Automatic TM processing.
2004-10-03T16:49:38.000Z	167.4956	F	Automatic TM processing.
2004-10-06T07:41:28.000Z	167.4932	F	Automatic TM processing.
2004-10-06T15:39:13.000Z	167.4682	F	Automatic TM processing.
2004-10-06T17:51:53.000Z	167.4434	F	Automatic TM processing.

This report was generated Fri Oct 8 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 02/10/2004-08/10/2004

AOCs operations were executed from the Automatic Timeline.

During this period, 142 Open Loop Slews, 127 Closed Loop Slews and 6 Momentum Bias were executed. 7 slews were missed or executed manually. This is equivalent to 2.6%.

02/10/04 (Day of Year 276, Revolution 240)

Nothing to report.

03/10/04 (Day of Year 277, Revolution 240-241)

Slews missed from the Timeline due to loss of TC link to the ground station: At 01:00, a drop in the TC link to Goldstone DSS-16 station interrupted the sequence for slew 02400117 (DR# G104853). This was the first part of a dogleg slew to the perigee passage attitude. A manual open loop slew was then performed to the attitude of PID 0240117 followed by another manual open loop slew to the attitude of PID 2400119. No science pointings were affected.

04/10/04 (Day of Year 278, Revolution 241)

Nothing to report.

05/10/04 (Day of Year 279, Revolution 241)

Slews missed from the Timeline: At 07:59 the sequence for close loop slew 02410082 was interrupted because the STR failed to track the commanded guide star in the search and track process. The commanded star was 6846-00066 with instrumental magnitude 7.3. The Timeline recovery tool was then used to perform a manual open loop slew to the attitude of PID 02410083. Slew 02410084 was executed from the Timeline.

Star 6846-00066 has a dim neighbour at 1.8 arc-minutes: 6846-00213 with magnitude 9.8, which has caused the failure of two other close loop slews in revolution 240. FD has excluded this star in their system to prevent it from being selected for slews in the future.

Slews missed from the Timeline: At 20:15, a problem in the TC link to the Redu ground station interrupted the sequence for slew 02410105 and resulted in the missing of the slew from the Timeline. A manual slew was then performed to the attitude of PID 02410106. The next slew was executed from the Timeline.

06/10/04 (Day of Year 280, Revolution 241-242)

Nothing to report.

07/10/04 (Day of Year 281, Revolution 242)

Nothing to report.

08/10/04 (Day of Year 282, Revolution 242)

Slews missed from the Timeline: The Flight Dynamics System failed to generate the update for close loop slew 02420092. For some reason the system could not identify a suitable star for the slew. FD is investigating this incidence. To rejoin the Timeline, an open loop slew was performed to the attitude of PID 02420092. The next slew executed from the Timeline.

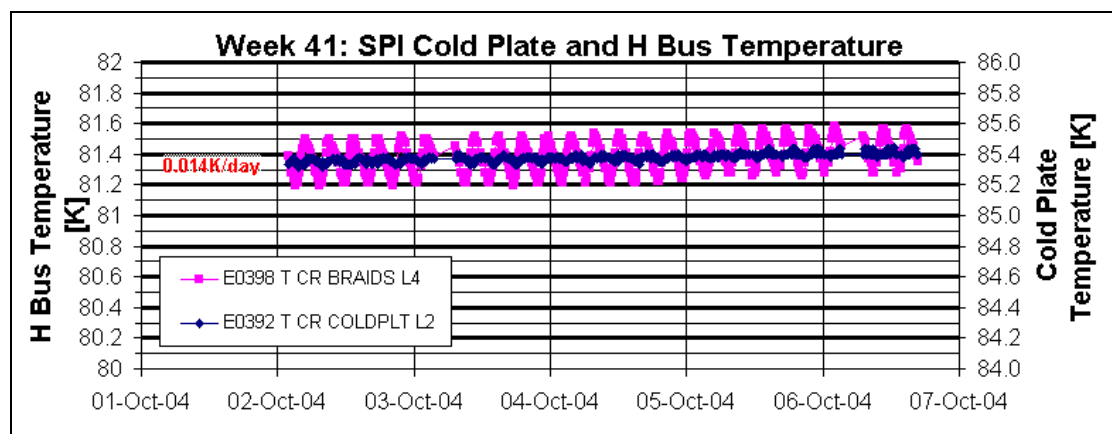
8.3.2 SPI Operations

Cryocooler / Detector Cold-Plate:

The performance of the cryocooler is nominal.

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

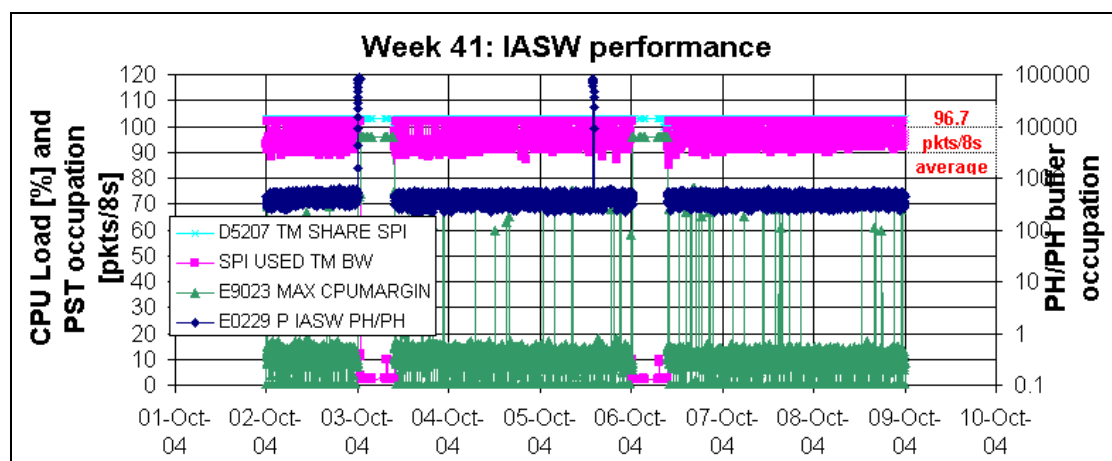
The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.



IASW/DPE:

The performance of the IASW/DPE is nominal.

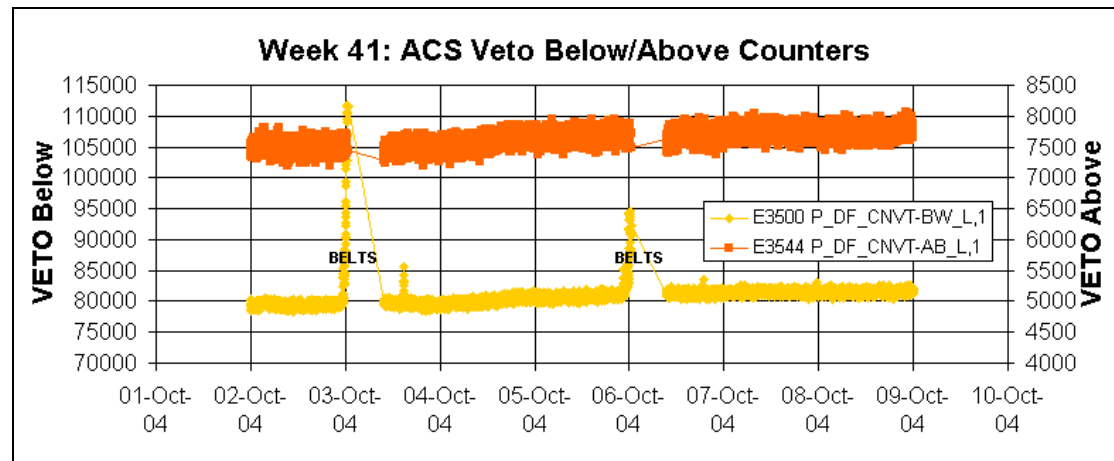
The following diagram shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

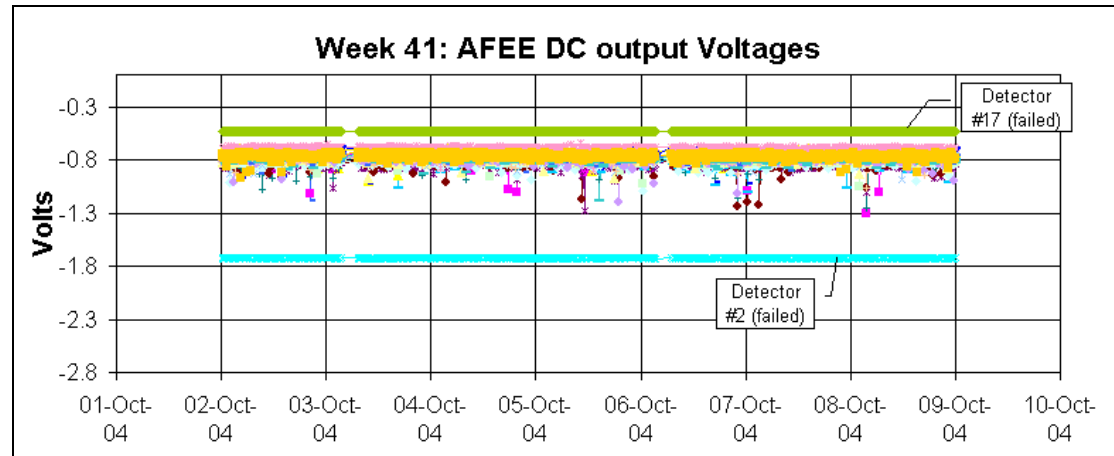
The following plot shows the ACS overall count rate evolution during the reporting period.



AFEE:

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

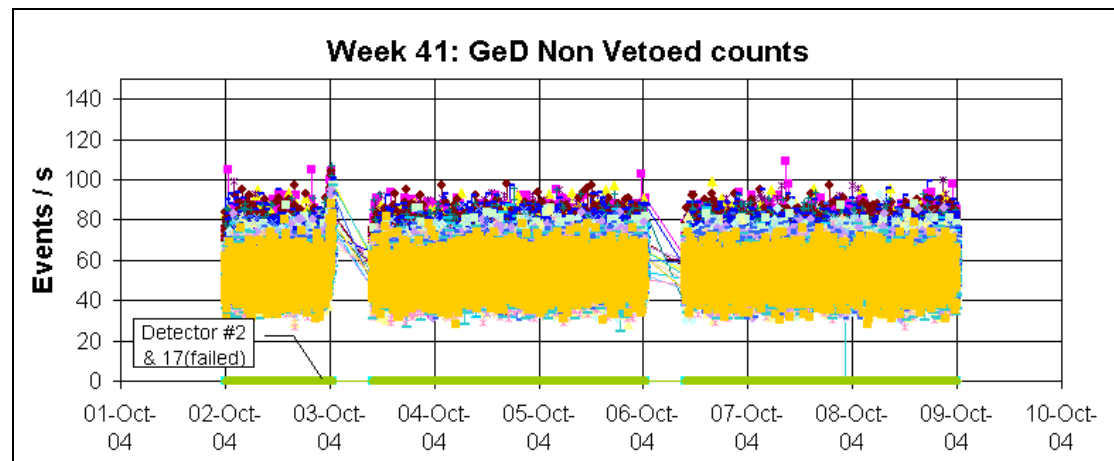
The following plot shows the AFEE dc output signals during the reporting period.



DFEE:

The performance of the unit is nominal.

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

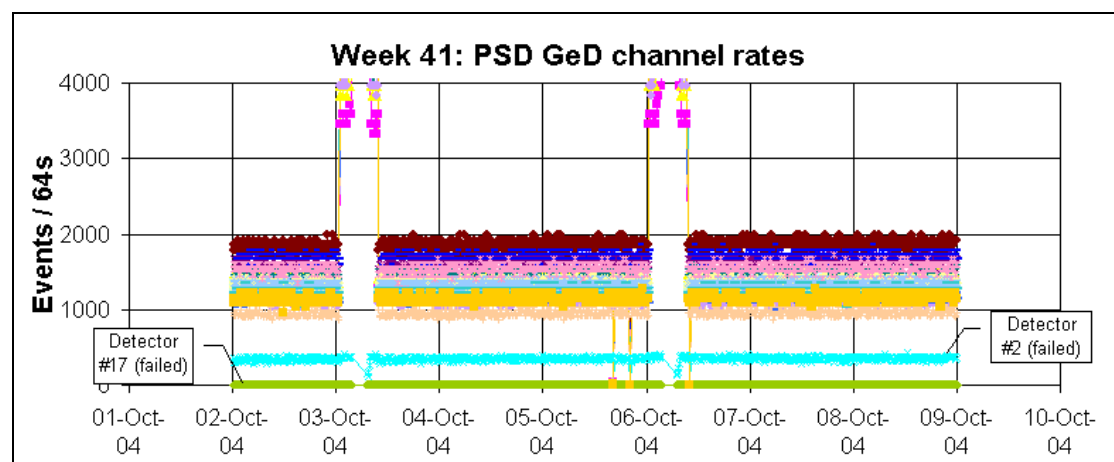


PSD:

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

A IASW patch is under development at Cessr to allow the Sci HK TM downlink inside the radiation belts. This would allow the deletion of the Out-Of-Limit currently defined on the PSD channel rates, thus removing the false alarms associated to the malfunction.

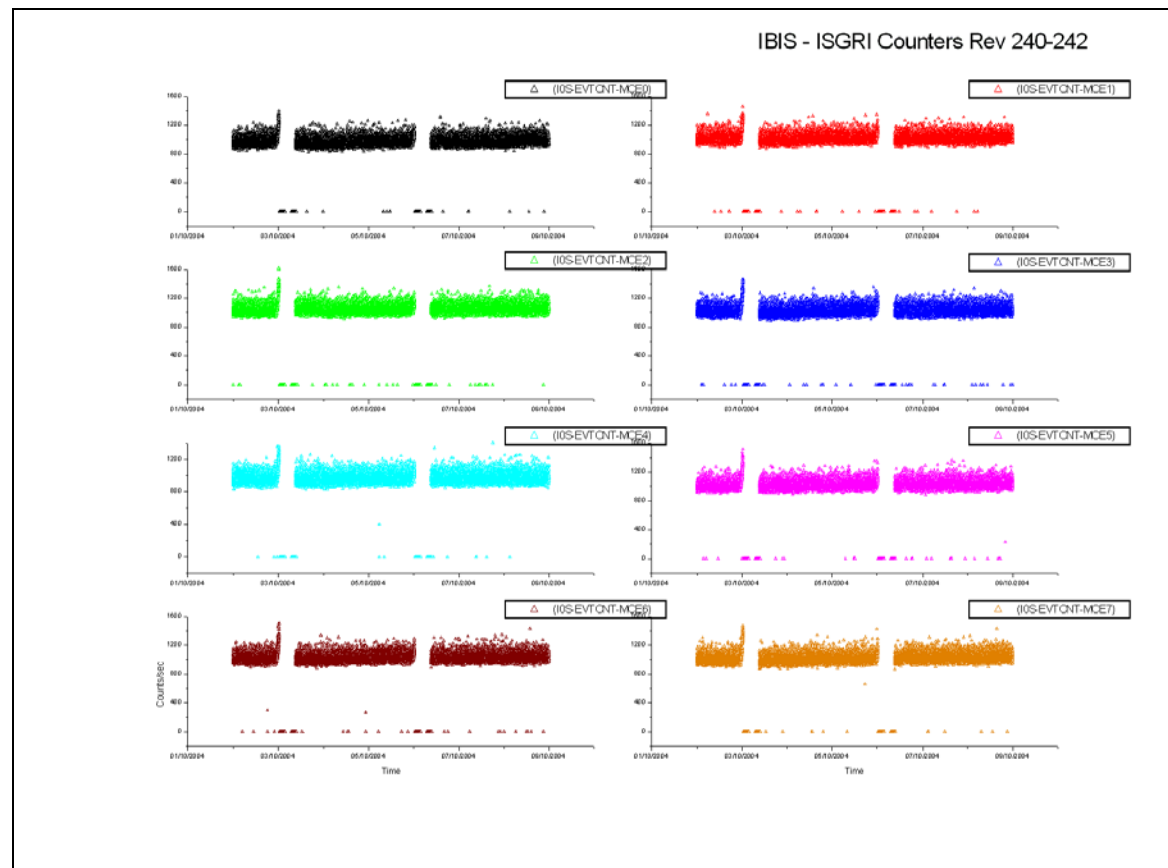
The following plot shows the PSD channel rates during the reporting period.



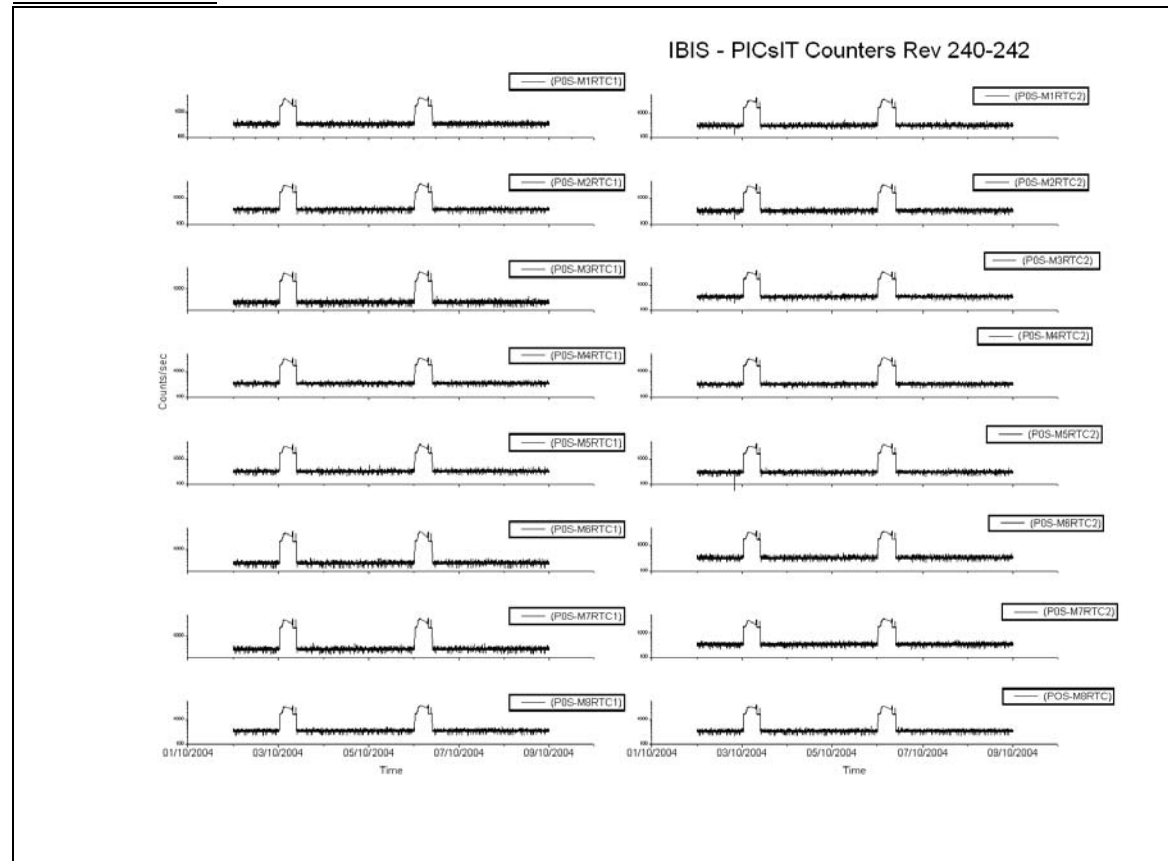
8.3.3 IBIS Operations

IBIS Event Counters Plots.

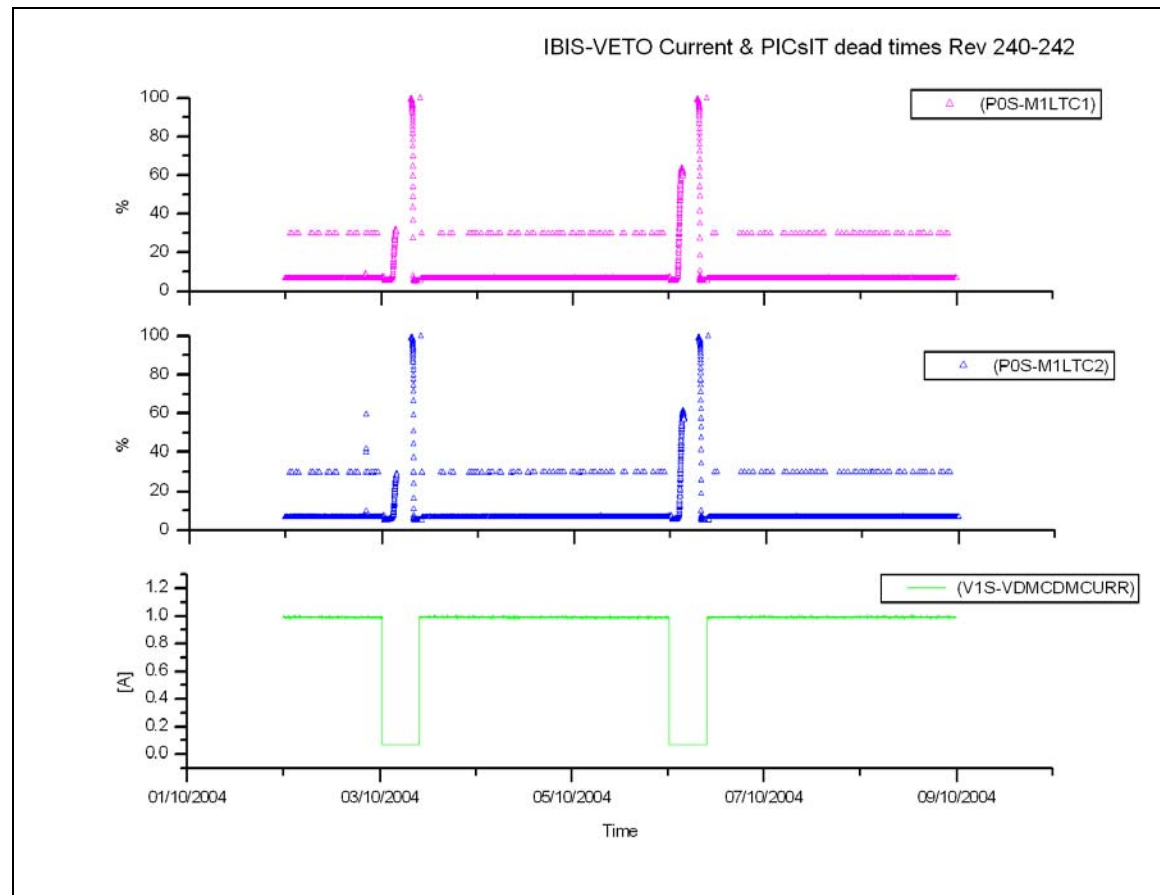
ISGRI Counters:



Picsit Counters:

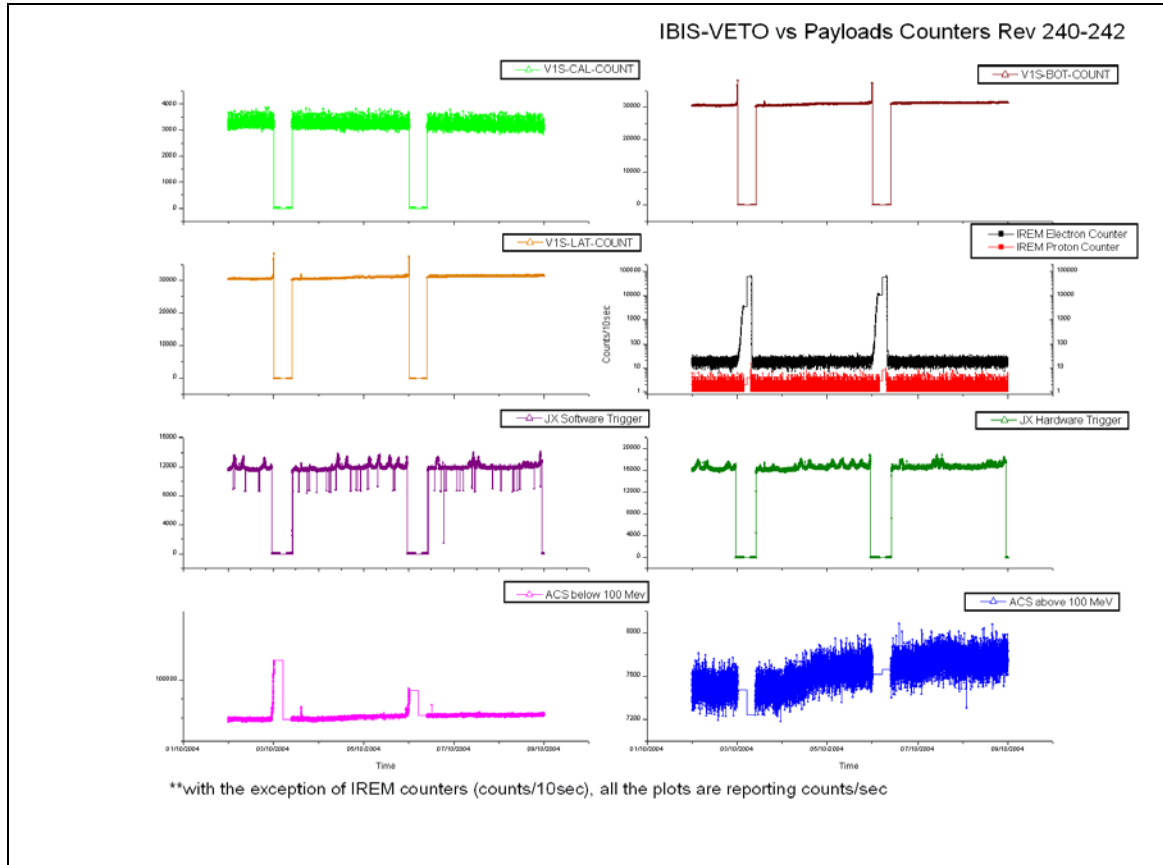


Veto Current:

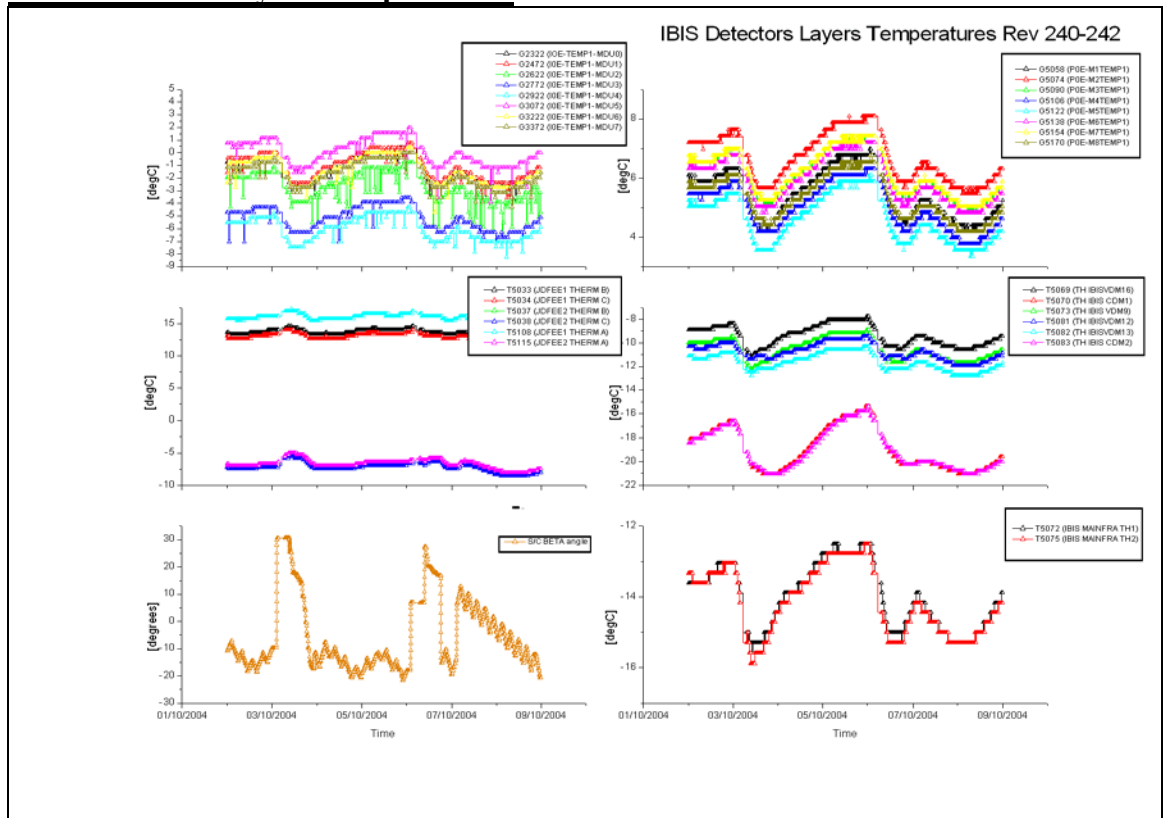


VETO vs Payloads Counters

The week was characterized by very low solar activity, but the comparison between the count-rates reported by VETO, the SPI-ACS, the IREM counters and JEM-X hardware/software triggers, gives a small tendency of increasing of radiation background. Some irregularities observed again in the JEM-X count-rates, due to the specific observation plan at that moment.



IBIS Detectors Layers Temperatures



IBIS daily report

Reported during the week many occurrences of the Veto calibration Counter (parameter G6061) in low limit (warning) for few TM cycles. The fluctuation of this parameter due to the natural decay of the Na22 radioactive source is ruled by the Poisson statistic. An update of the low limit, accordingly to the decay law, is planned in the next days.

DOY 2004.276 (02/10/04)

At 20:04Z reported the parameter family G5068 and G5072 (PICsIT Semimod XX FIFO Error Flag) in OOL (SCC Fail) for few TM cycles. Accordingly to the Payloads FDIR document no action was taken.

At 22:30Z the IBIS/PICsIT Histograms (S7,S5 pkts) generation process stopped: the anomaly is due, as in the past (see INT_SC-52-66), to the coincidence of GSHF (Ground Station Handover Flag) setting with the starting of the S5 (PICsIT Calibration Histogram) process, happened during the Station Handover from REDU to DSS16 at 21:08Z. Accordingly to the OR-109 the operator applied FCP_IBIS1_312 forcing the downloading of the PICsIT Histograms. At 22:42Z the unit went back in Scientific Standard Mode. No new AR are generated because the problem is known and the specific procedure is available (resolution of GS Coord. Meeting 13-9-03).

DOY 2004.277 (03/10/04)

Reported at 03:49Z, during the Belt passage, many occurrences of the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the fact that the PICsIT detectors are ON without the VETO anticoincidence system, as required by PIs.

DOY 2004.278 (04/10/04)

Nothing to report.

DOY 2004.279 (05/10/04)

Nothing to report.

DOY 2004.280 (06/10/04)

Reported at 03:49Z, during the Belt passage, many occurrences of the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the fact that the PICsIT detectors are ON without the VETO anticoincidence system, as required by PIs.

DOY 2004.281 (07/10/04)

Nothing to report.

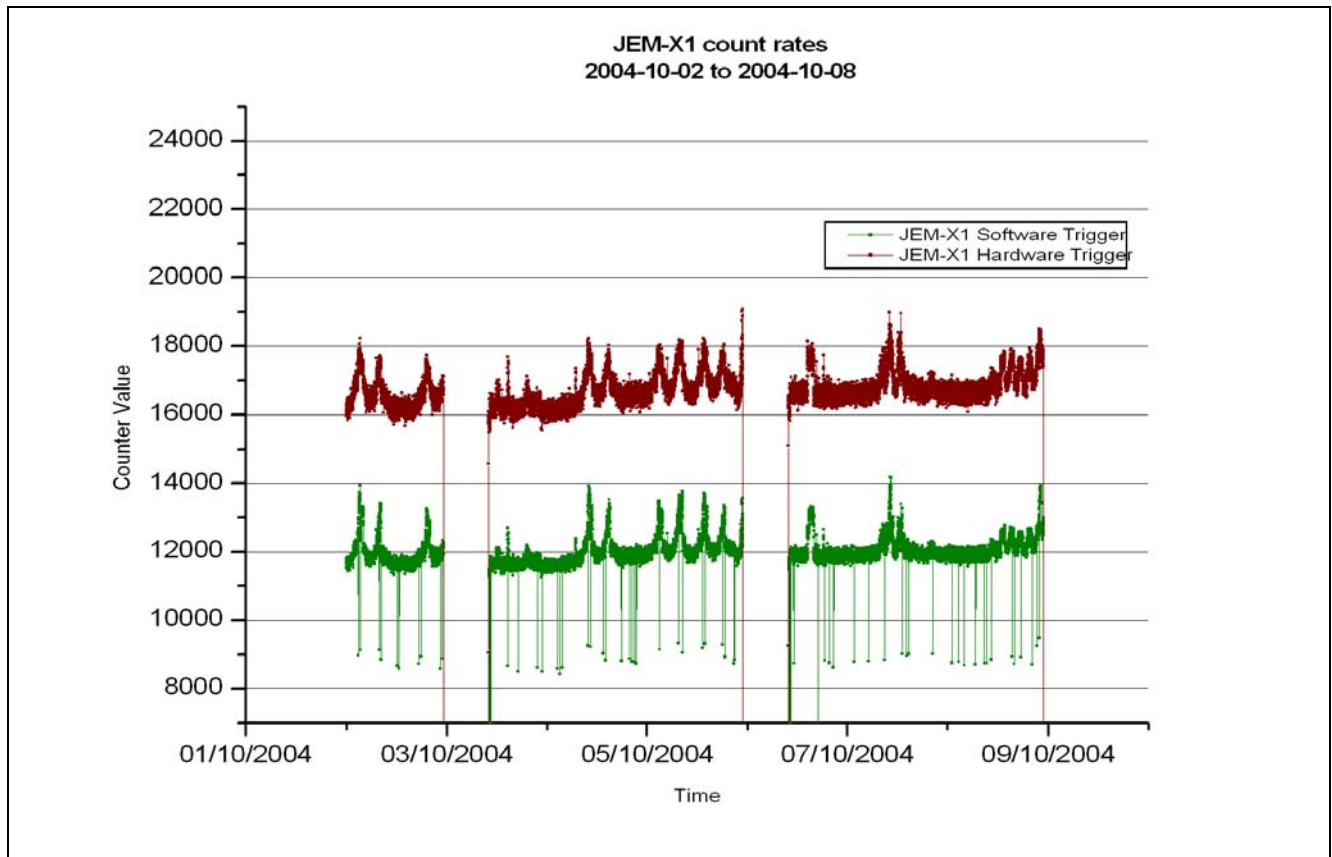
DOY 2004.282 (08/10/04)

Nothing to report.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

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

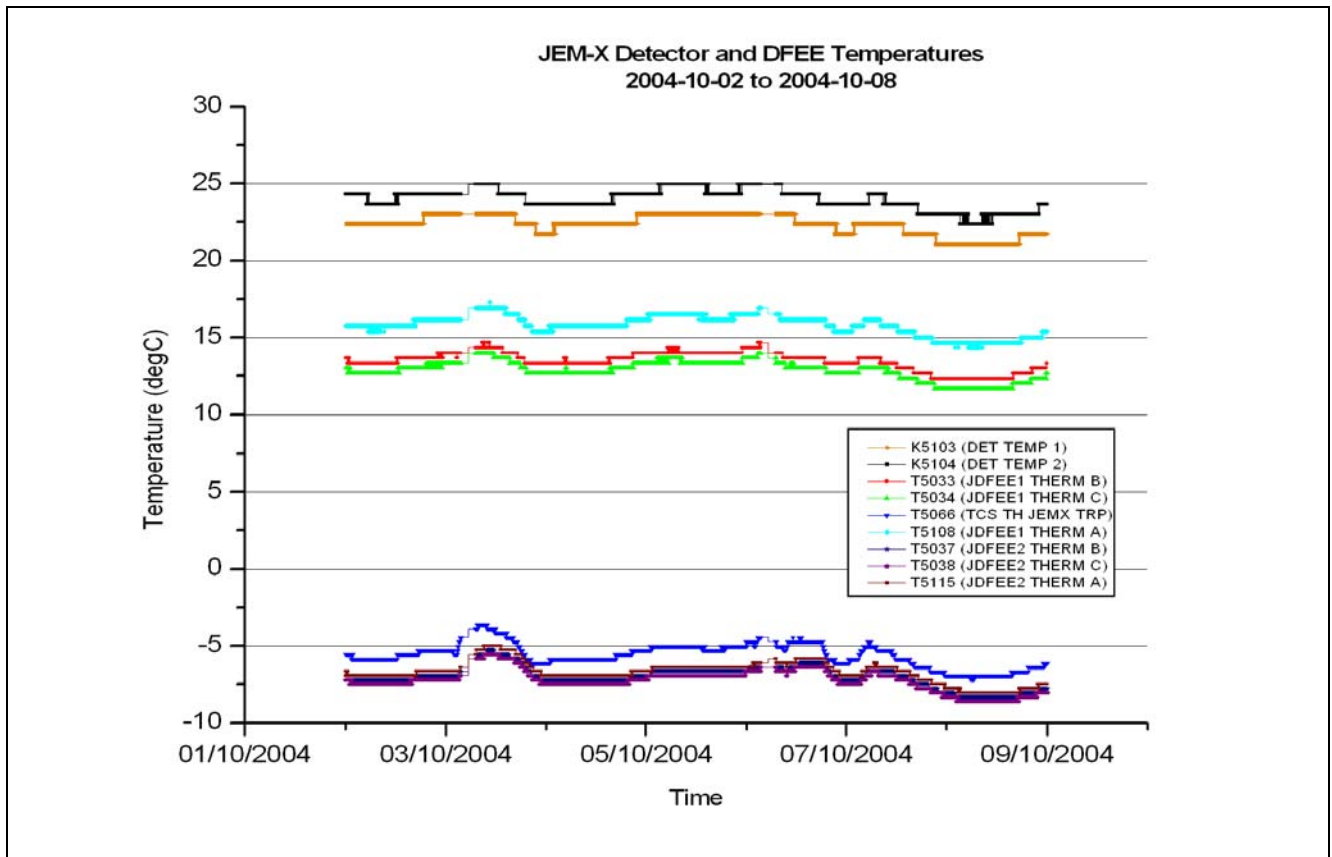


8.3.4.2 JEM-X Temperatures

JEM-X Detector and DFEE temperatures over the reporting period are displayed in the following graph, along with the temperature on the detector bench between the two units².

¹ Data sampled (1 frame in 4)

² Data sampled (1 frame in 8)



8.3.4.3 JEM-X Daily Report

Nothing to report

8.3.5 OMC Operations

02/10/04 (Day of Year 276, Revolution 240)

Nothing to report.

03/10/04 (Day of Year 277, Revolution 240-241)

Nothing to report.

04/10/04 (Day of Year 278, Revolution 241)

Nothing to report.

05/10/04 (Day of Year 279, Revolution 241)

At 07:59 the sequence for close loop slew 02410082 was interrupted because the STR failed to track the commanded guide star. OMC pointings 02400082 and 02400083 were lost.

At 20:15, a problem in the TC link to the Redu ground station interrupted the sequence for slew 02410105. OMC pointings 02410105 and 02410106 were lost.

06/10/04 (Day of Year 280, Revolution 241-242)

Nothing to report.

07/10/04 (Day of Year 281, Revolution 242)

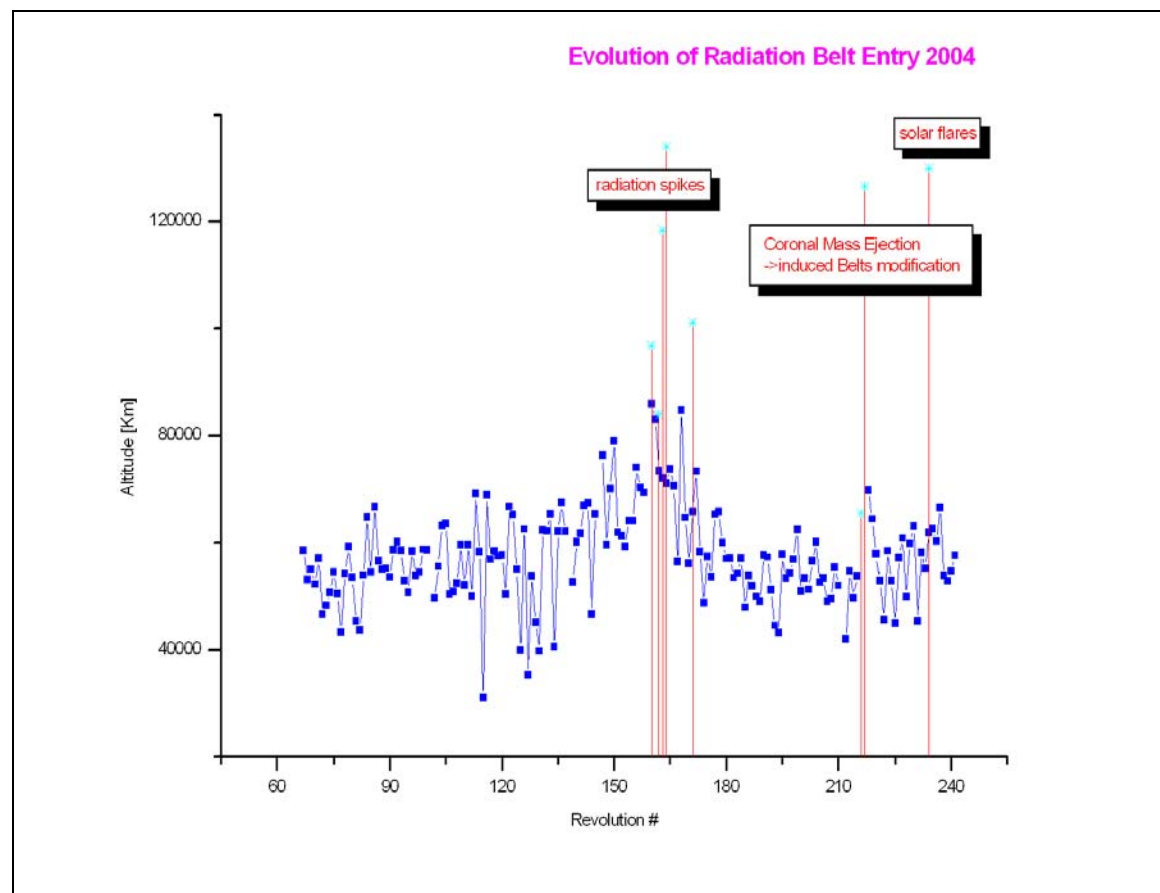
At 10:27:38, the command to start the loaded BCP parameters failed uplink due to a short drop in the links to the Redu ground station. Therefore, the OMC mode did not change to Standby before the slew start and uplink of the imaging commands. The command to rest the imaging parameters and the Imaging A1 command were rejected onboard and the rest of the imaging commands failed uplink due to PTV no-go. The BCP commands along with the OMC imaging commands were re-uplinked manually and at 10:39:25 OMC went to Science mode. In effect, there was a delay of about 9 minutes in the start of pointing 02420045, with respect to the planned start time.

08/10/04 (Day of Year 282, Revolution 242)

The Flight Dynamics System failed to generate the update for close loop slew 02420092 and the slew needed to be executed manually as an open loop slew. OMC pointing 02420092 was therefore lost.

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]
240	RAD_ENTR R 2004-10-03T00:38:47Z	2004-10-03 01:19:57	54645.4	2004-10-03 01:27:32	53399.67
241	RAD_EXIT R 2004-10-03T09:44:55Z	2004-10-03 08:04:45	23158.1	2004-10-03 08:27:32	27500.72
241	RAD_ENTR R 2004-10-06T00:25:06Z	2004-10-06 00:45:33	57634.8	2004-10-06 01:18:17	53019.7
242	RAD_EXIT R 2004-10-06T09:31:42Z	2004-10-06 07:54:37	>23165.2	2004-10-06 08:18:17	27921.63

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

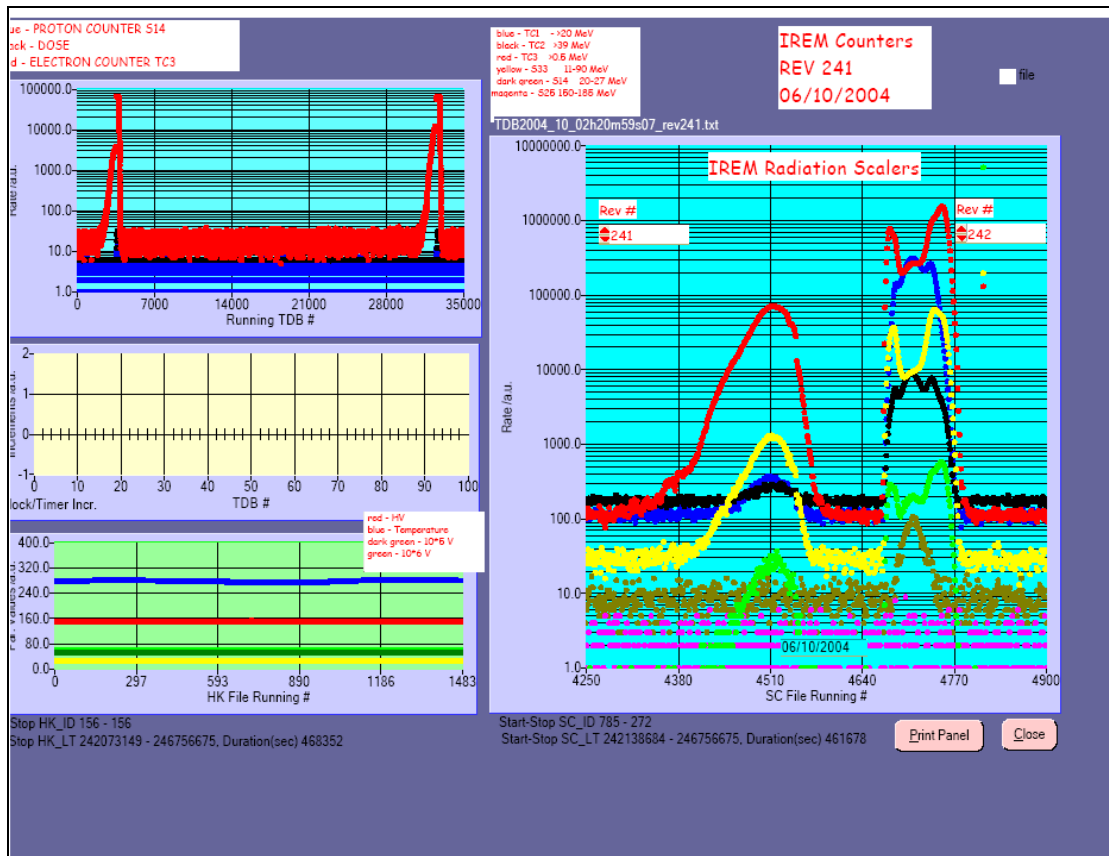
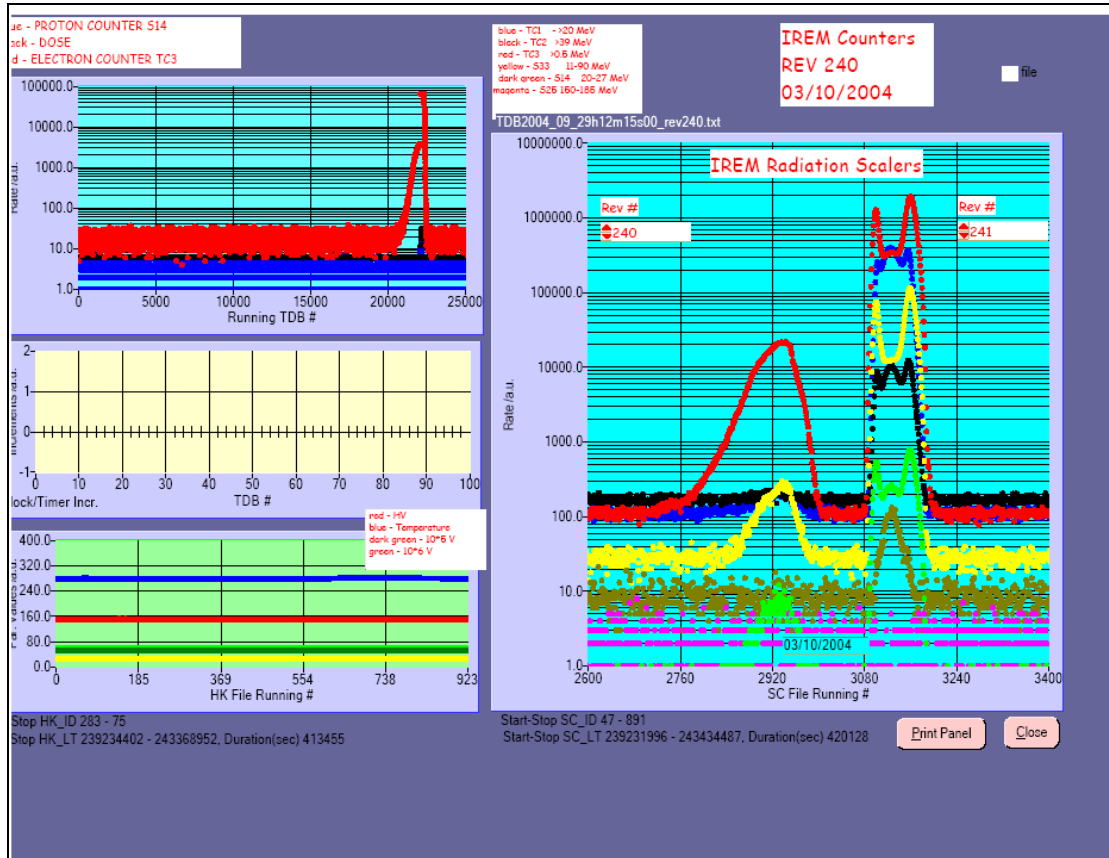
Proton Belts

REV		Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
240	PROTON_RAD_ENTR	2004-10-03 06:57:32	13552.1
241	PROTON_RAD_EXT	2004-10-03 07:07:32	14746.88
241	PROTON_RAD_ENTR	2004-10-06 06:38:17	12858.17
242	PROTON_RAD_EXT	2004-10-06 06:58:17	15120.03

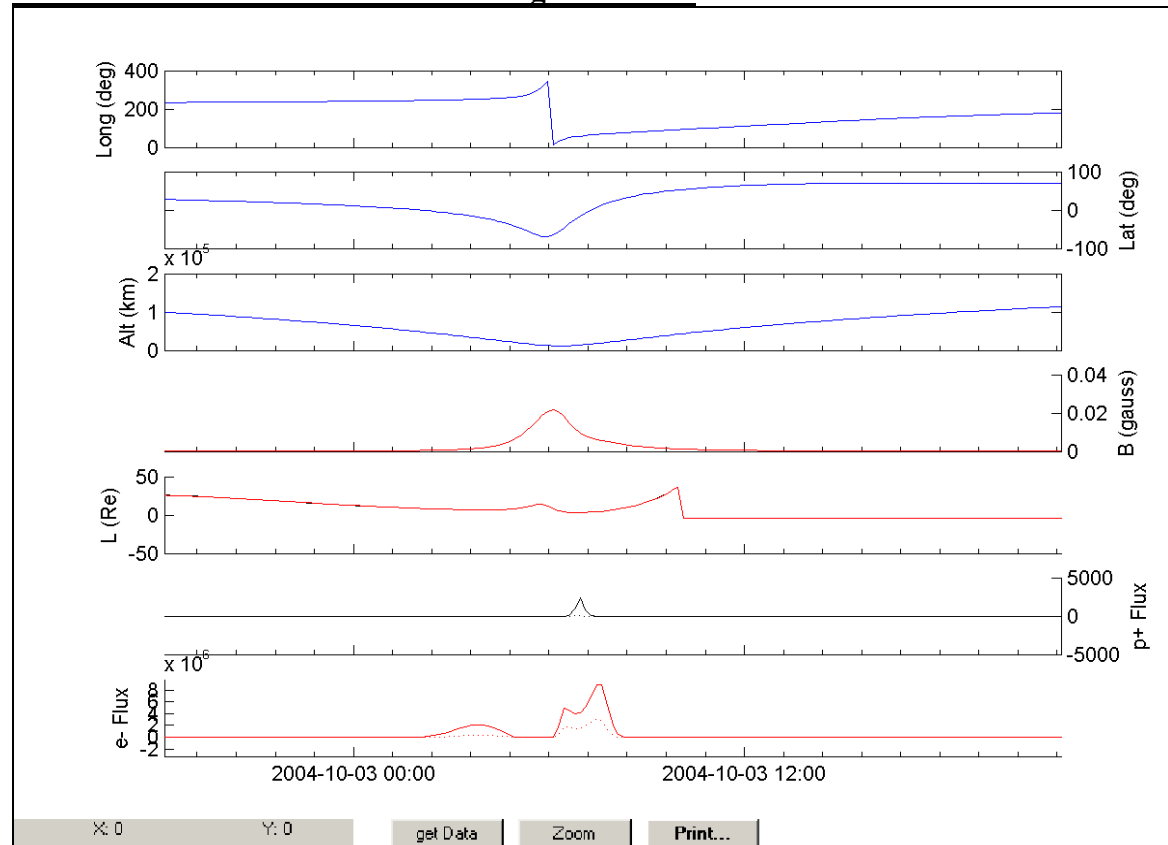
IREM daily report

Nothing to report.

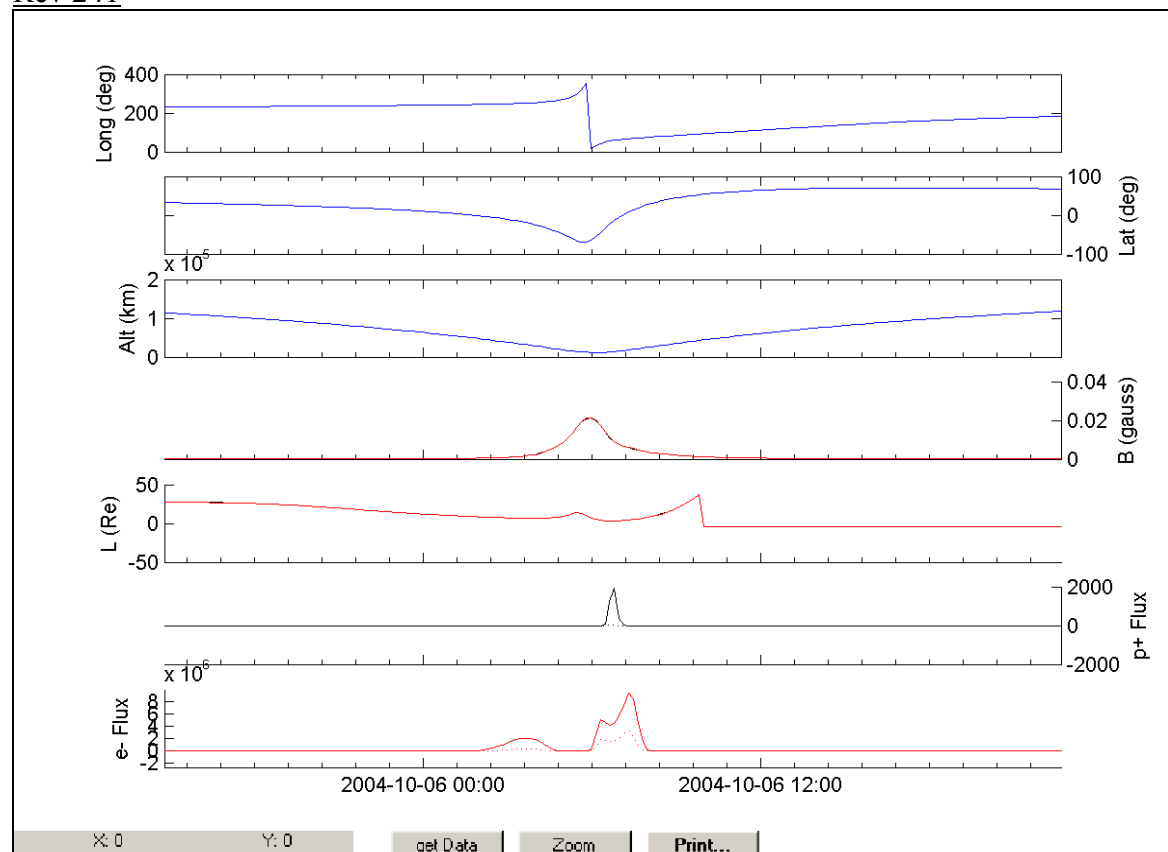
IREM radiation counters



IREM Predicted Radiation Belt Passages. Rev 240



Rev 241



SEC-GOES Observed Particles Fluxes.

