

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 161
Week 42
24.10.05
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 15.10.05 until 21.10.05 (both dates inclusive) and covers the revolutions 367 & 368.

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 Bulge region (RA 17:45:36.00; DEC -28:55:60.0); IGR J17269-4737 (RA 17:26:49.80; DEC -47:38:23.3); SS433 (RA 19:11:49.56; DEC +04:58:57.6); GRS 1915+105 (RA 19:15:11.50; DEC +10:56:44.0) and GX 17+2 (RA 18:16:1.40; DEC -14:02:11.0). The activities consisted of hexagonal 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.

No slews were lost from the Timeline during this period.

The fuel consumption over the period between 01/09/2005 and 21/10/2005 was 0.1408 kg. The remaining propellant is in the order of 158.7752 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

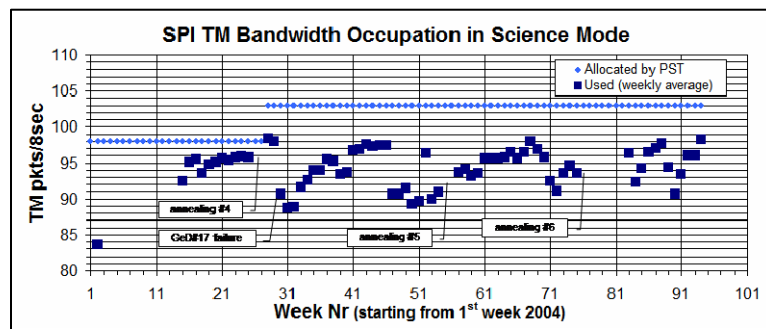
3.2.1 SPI

The overall status of the instrument is nominal.

During science operations, 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 average occupation of 98.2 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.



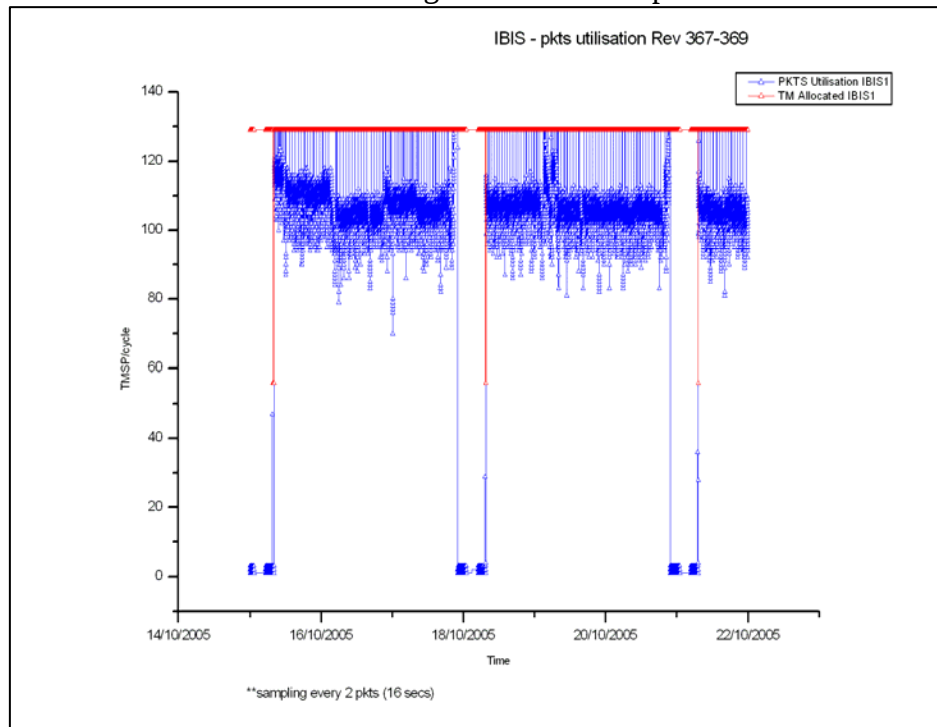
Note: Some more information concerning the SPI operations is provided in the Appendix.

3.2.2 IBIS

The Overall status of the unit is Nominal.

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 107.43 TMPS/cycle, up 0.78 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 combined with some manual commanding.

JEM-X1 was operated in Data Taking mode during science observations with a TM allocation of 8 packets/cycle and JEM-X2 was dormant with a TM allocation of 1 packet/cycle. The JEM-X2 DFEE was off until 2005-10-21 at 07:19:01Z, when the DFEE was switched on in preparation for the use of JEM-X2 during the upcoming engineering observation (revolution 370) and JEM-X2 then continued in Safe mode.

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.

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 solar activity.

The sun was very quiet this week.

During the observing period, tiny sunspot 815 appeared but posed no threat of solar flare.

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 was very good this week. No science pointing was lost. Several drops in TM were reported in REDU. The overall performance was well above the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was very good this week. No pointing was lost due to problems at the MOC. The overall performance was well above the 95% requirement.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. 4 gaps in TM were reported in REDU. But none of these had any impact on science operations. The overall performance was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSF's have been received up to revolution 375. The corresponding mission planning has been performed and the planning information sent to MOC. No new ToO requests were received however in revolution 371 is included extra observation time to the ToO HETE J1900.1-2455. This ToO was performed a couple of weeks ago but a substantial part could not be performed due to bad weather causing the instruments to be switched off.

The TSF for revolution 368 to 371 were received.

2. Observation status

No ECS's received this week.

3. ISOC science data archive

The new disk array mentioned last week has been successfully configured. Monitoring of the ISDA computer is now performed every working day. Further improvements to include also weekends in the monitoring are in progress.

4. ISOC system

The long awaited system version 11.2 was finally introduced this week. It has been successfully used for most of the mission planning this week.

5. Problems

No new problems, however the previously reported problem related to the difference in ISOC and MOC/FD constraint checks is still not resolved.

4.3.2 ISDC

Status of ISDC observation processing on 24/10/2005:

- Latest Standard Analysis completed: observation 03201090028 (Galactic Bulge, Revolution 355) on 10/10/2005
- Latest products archived: observation 03201090028 (Galactic Bulge, Revolution 355) on 11/10/2005
- Latest observation products sent to the observer: observation 02297000020 (galactic disk $l < 0$, Revolution 347) on 03/10/2005.

5 Special Events

None.

6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 289 at 23:28Z drops in TM VC0 and VC7 were reported from REDU due to a hit on the line.
- On DoY 290 at 06:15Z, data gaps on TM VC0 were reported from REDU, and bad frames were received.
- On DoY 291 at 05:09Z, the MCS- Bad frames link is down. GFCC reapplied the link. This fixed the problem.
- On DoY 292 at 05:27Z TM bad frames were received from VILSPA.
- On DoY 293 at 14:41Z, message "PDS ser TM, imca, CPD on host imca is not receiving packet" was received in the event logger. At the same time, TC D4005 "REPORT BCPKT G2" was unverified in CEV and "TCO server, imca, Time correlator inaccurate" was as well received in the event logger. Consequently, at 14:43Z, TC A2549 "AUTHORISE STR TC" failed release. At 14:48Z the CPD-TM task and the TCO server task were restarted on imca. This fixed the accuracy problem of the time correlator. Then a manual mapping was performed and the next slew (03680062) was manually updated.
- On DoY 294 at 11:24Z, imca command verifier lost connection for some seconds and reconnected to the TM cash automatically.
- On DoY 294 at 19:36Z, data gaps on VC0 online timely were reported by REDU and bad frames were received from REDU. This happened again at 22:48Z.

There were no new anomaly reports entered into the ARTS system this week.

7 Future Milestones

A patch of the IMCS is planned for November, which should fix a couple of problems.

DSS-16 is to be decommissioned, and replaced by DSS-27, the testing of which was performed this week.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 367

The observations in revolution 367 began with a hexagonal dithering observation of the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0) lasting ~3.5 hours, followed by a Target of Opportunity hexagonal dithering observation of IGR J17269-4737 (RA 17:26:49.80; DEC -47:38:23.3) lasting ~15.5 hours. A raster dithering observation of SS433 (RA 19:11:49.56; DEC +04:58:57.6) was then performed for ~17 hours, followed by a ~10 hour hexagonal dithering observation of GRS 1915+105 (RA 19:15:11.50; DEC +10:56:44.0). The raster dithering observation of SS433 (RA 19:11:49.56; DEC +04:58:57.6) was then resumed and performed for the remaining ~13 hours of observation time.

Throughout these observations all instruments were in their nominal science modes, except for JEM-X2 for which the DFEE was off, and the TM allocation was IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

Revolution 368

The observations in revolution 368 began with a hexagonal dithering observation of GRS 1915+105 (RA 19:15:11.50; DEC +10:56:44.0) lasting ~19 hours, followed by a hexagonal dithering observation of the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0) lasting ~4 hours. A raster dithering observation of SS433 (RA 19:11:49.56; DEC +04:58:57.6) was then performed for the remaining ~37 hours of observation time.

Throughout these observations all instruments were in their nominal science modes, except for JEM-X2 for which the DFEE was off, and the TM allocation was IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

Revolution 369

The observations in revolution 369 began with a raster dithering observation of SS433 (RA 19:11:49.56; DEC +04:58:57.6) lasting ~18 hours, followed by a raster dithering observation of GX 17+2 (RA 18:16:1.40; DEC -14:02:11.0) lasting ~38 hours. A hexagonal dithering observation of the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0) was then performed for the remaining ~4 hours of observation time.

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 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2005-10-03T06:45:57.000Z	159.1593	F	Automatic TM processing.
2005-10-06T01:37:15.000Z	159.1429	F	Automatic TM processing.
2005-10-06T06:31:40.000Z	159.1287	F	Automatic TM processing.
2005-10-08T06:32:50.000Z	159.0960	F	Automatic TM processing.
2005-10-08T15:33:23.000Z	159.0645	F	Automatic TM processing.
2005-10-09T01:22:44.000Z	159.0533	F	Automatic TM processing.
2005-10-09T06:21:08.000Z	158.9711	F	Automatic TM processing.
2005-10-11T23:17:55.000Z	158.9196	F	Automatic TM processing.
2005-10-12T06:04:36.000Z	158.9160	F	Automatic TM processing.
2005-10-15T00:45:23.000Z	158.9081	F	Automatic TM processing.
2005-10-15T05:58:44.000Z	158.8679	F	Automatic TM processing.
2005-10-18T00:32:50.000Z	158.8544	F	Automatic TM processing.
2005-10-18T05:39:55.000Z	158.8311	F	Automatic TM processing.
2005-10-21T00:32:50.000Z	158.8189	F	Automatic TM processing.
2005-10-21T05:28:10.000Z	158.7752	F	Automatic TM processing.

This report was generated Fri Oct 21 08:00:26 GMT 2005

8.3 Detailed Satellite Information

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

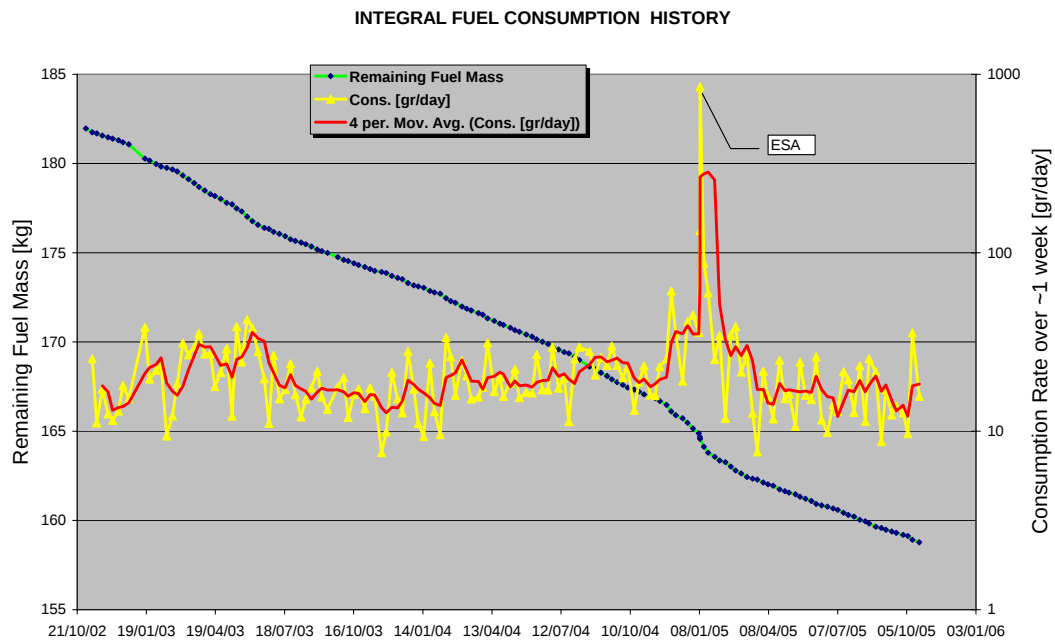
8.3.1 AOCS SUMMARY OPERATIONS REPORT, 15/10/2005 – 21/10/2005

AOCS operations were executed from the Automatic Timeline.

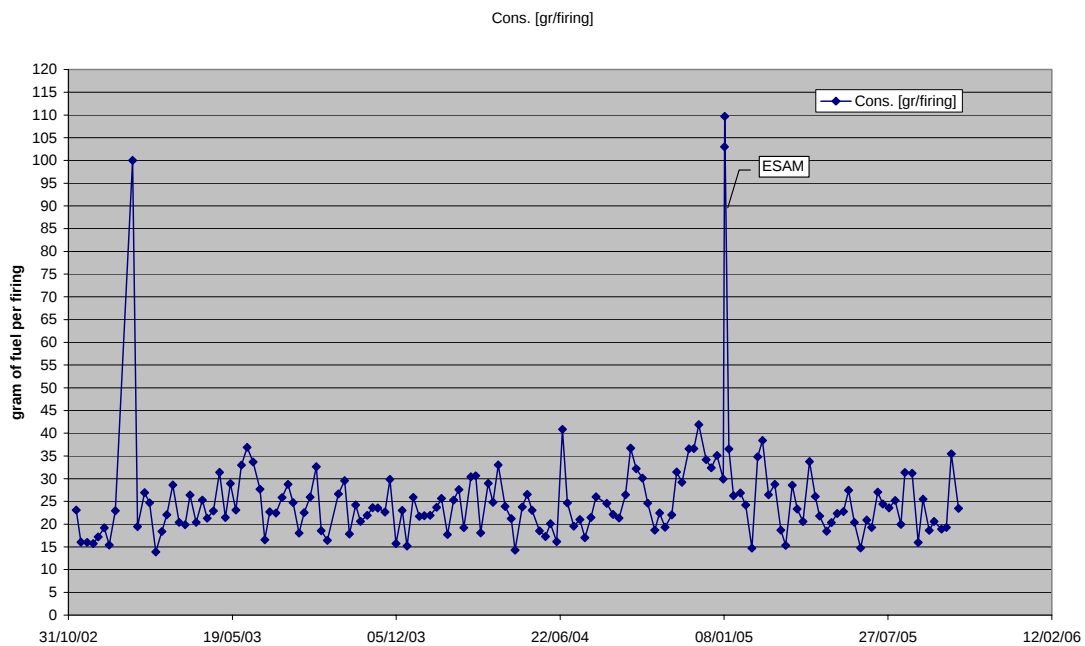
During this period, 50 Open Loop Slews, 105 Closed Loop Slews and 6 Momentum Bias were executed (TL + manual recovery). No slews were lost from the Timeline during this period.

This is equivalent to a 100 % of the total number of slews planned (155).

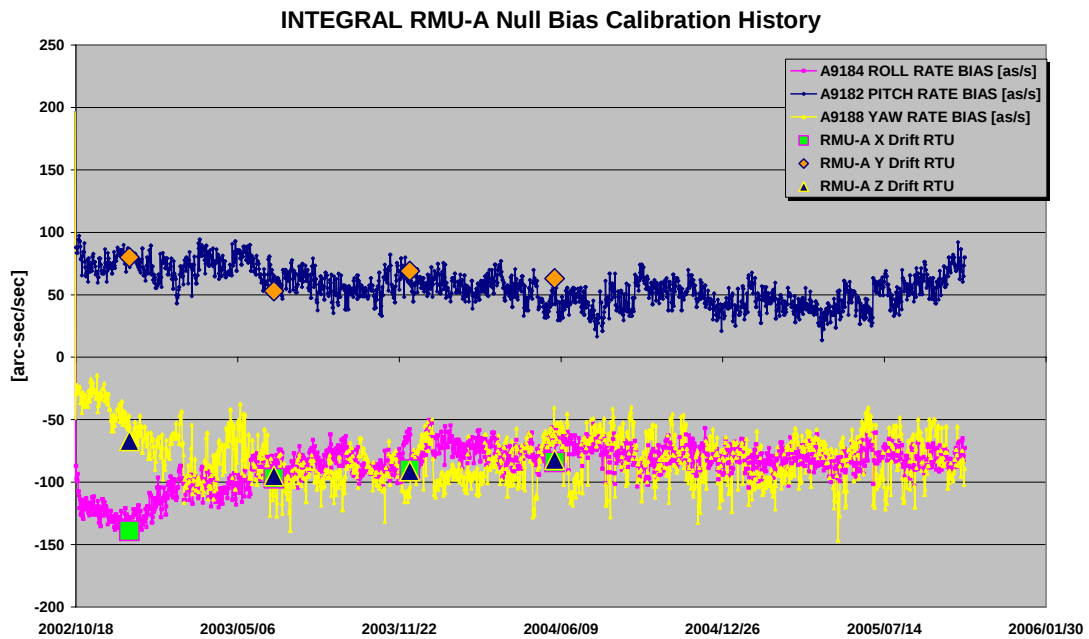
The fuel consumption (total, grams/day) over the period between 01/11/2002 and 21/10/2005 is reported in the plot below.



The fuel consumption (grams/firing) over the period between 01/11/2002 and 21/10/2005 is reported in the plot below.



The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 21/10/2005 is reported in the plot below.



15/10/05 (Day of Year 288, Revolution 366-367)

Nothing to report.

16/10/05 (Day of Year 289, Revolution 367)

Nothing to report.

17/10/05 (Day of Year 290, Revolution 367)

Nothing to report.

18/10/05 (Day of Year 291, Revolution 367-368)

Nothing to report.

19/10/05 (Day of Year 292, Revolution 368)

Nothing to report.

20/10/05 (Day of Year 293, Revolution 368)

Nothing to report.

21/10/05 (Day of Year 294 Revolution 368-369)

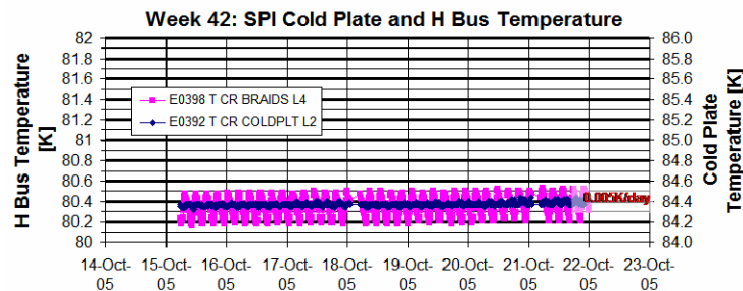
Nothing to report.

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 (+0.005K/day).

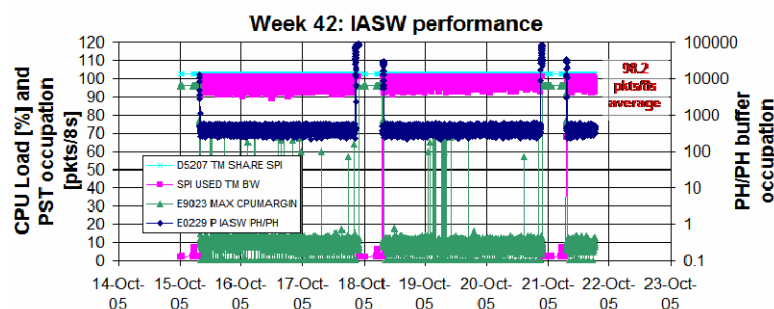
The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.



DPE & IASW:

The IASW performance is nominal.

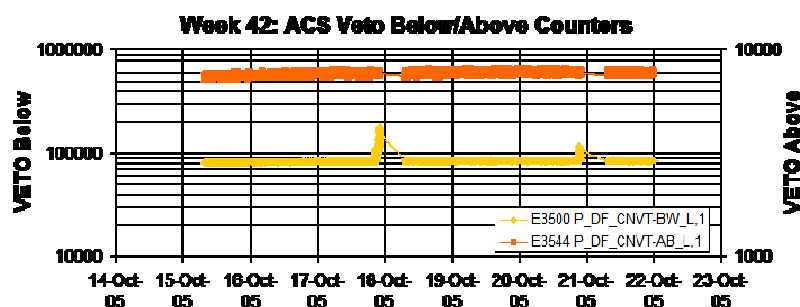
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

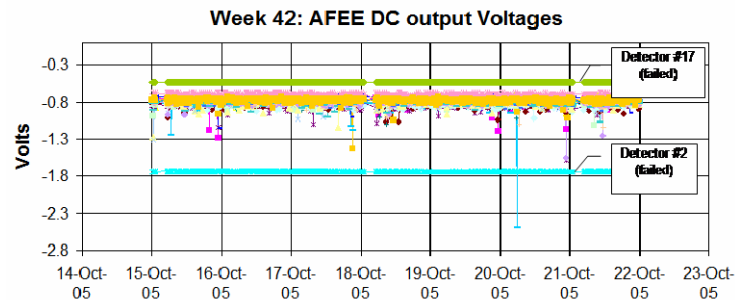
The following plot shows the ACS overall count rate evolution during the reporting period.



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.

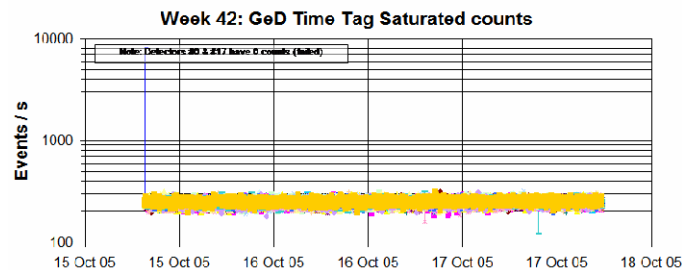
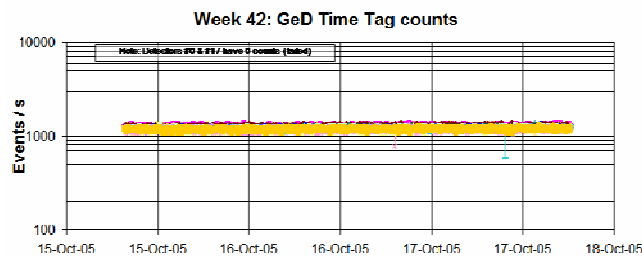
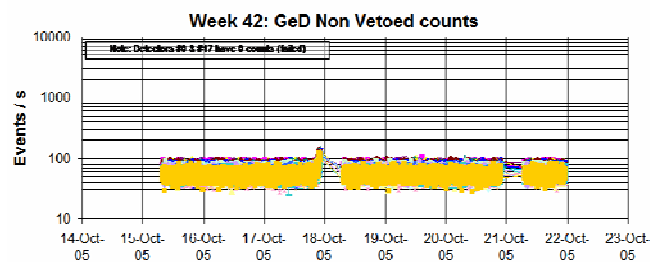
The following plot shows the dc voltage offset of the detector channels during the reporting period.



DFEE:

The performance of the unit is nominal

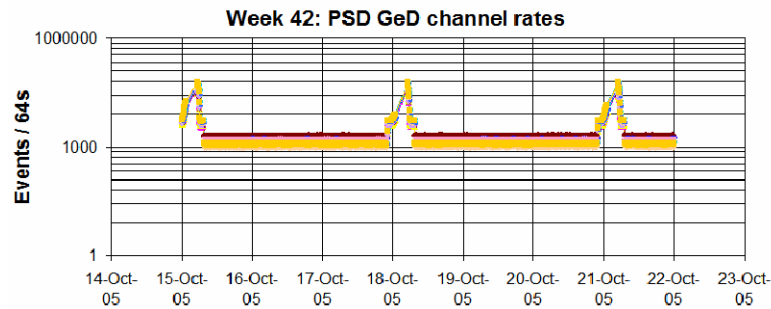
The following plots show the count rates of the detectors during the reporting period (due to problems in the data retrieval tool, some gaps could be present).



PSD:

The performance of the unit is nominal

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



SPI EVENTS LOG

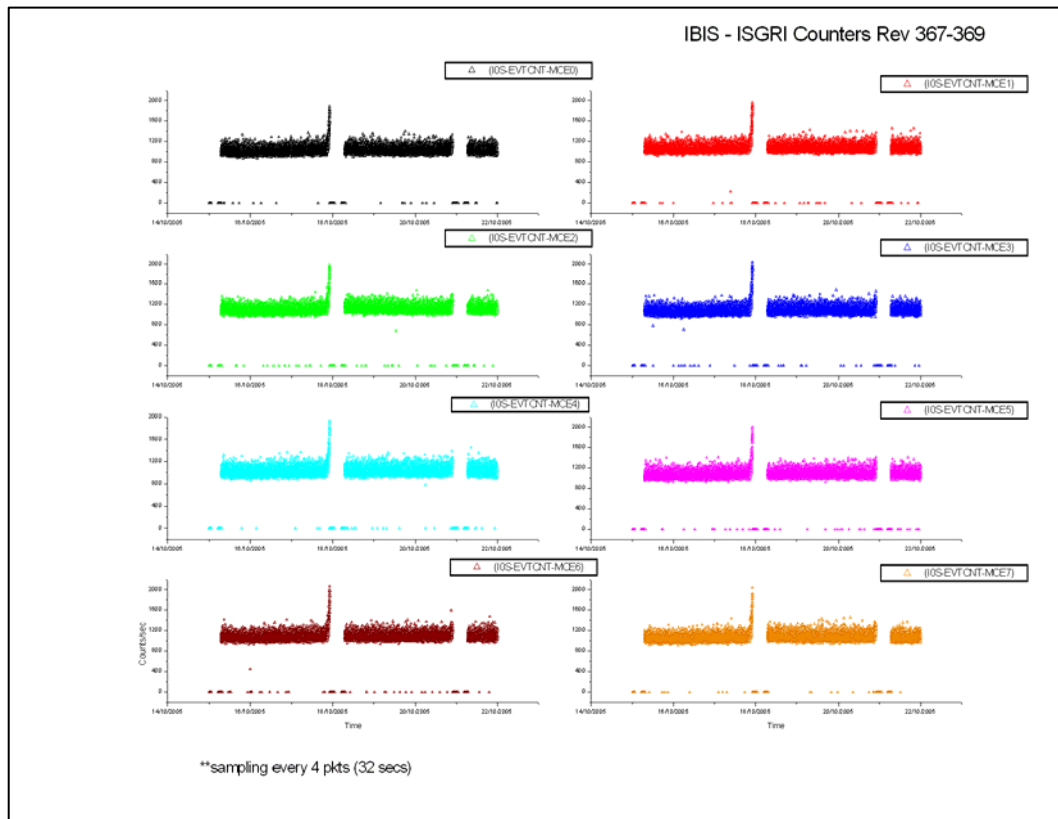
NOTE: The events log is extracted from the revolution pass summaries (courtesy of the Integral Analysts).

DOY Time	Event
290 20:29-22:10	TM E3500 "P_DF_CNVT-BW_L,1" Out Alarm High and back in limits. / Several times.
293 05:44-05:56	TM E0357 "U AF DCOUTPT L7" OOL Alarm Low @ -2,49 V. and back into limits. This voltage is proportional to the SPI detectors bias current. The OOL is caused by high energy particles, clashing on the detectors and affecting its bias current. The parameter stayed OOL for ~ 12 minutes because this TM is down-linked every 10'. Very probably the event lasted for a much shorter time.
293 19:48-21:35	TM E2115 "T AS PSAC L1" OOL Warning Low at - 10,69° C and back into limits.
293 / 21:06	TM E3500 "P_DF_CNVT-BW_L,1" OOL Alarm High.

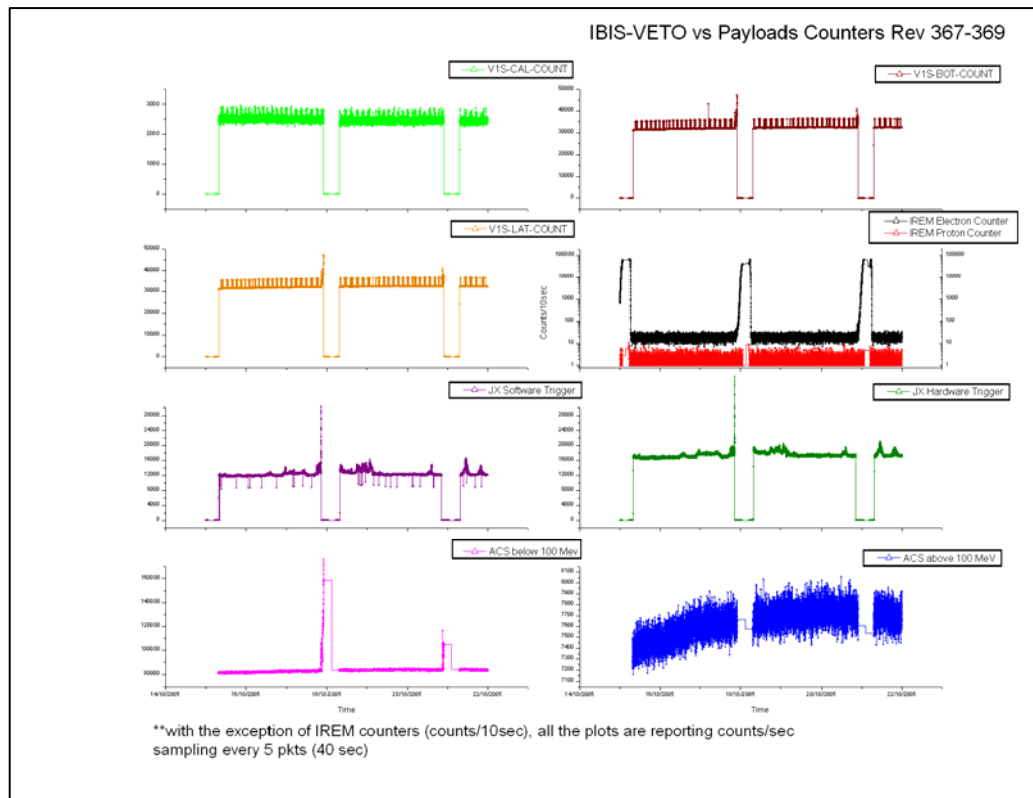
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

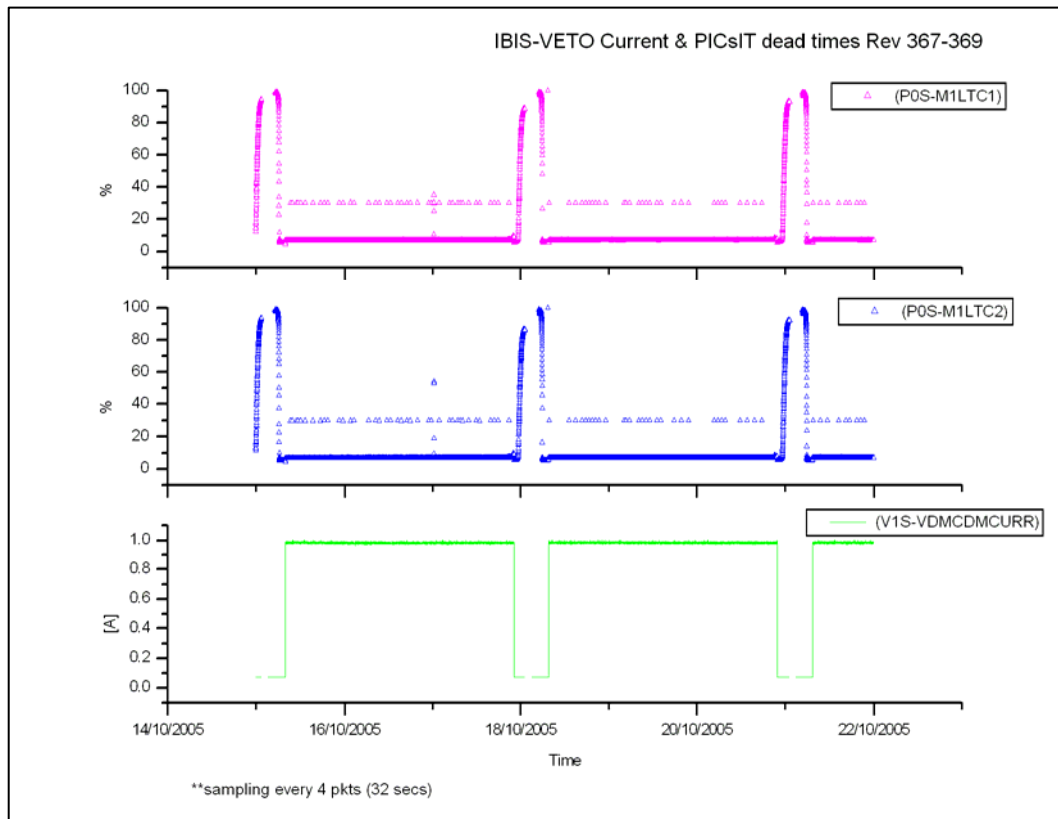


VETO vs Payloads Counters:

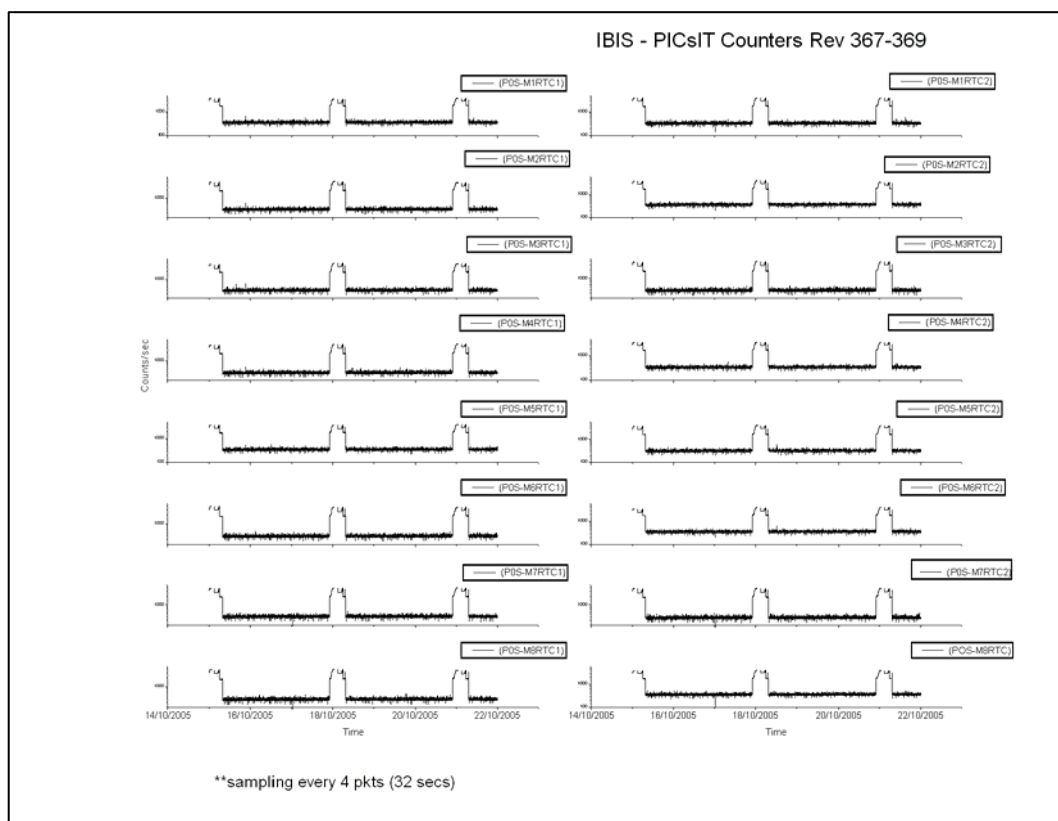


The week was characterised by low radiation.

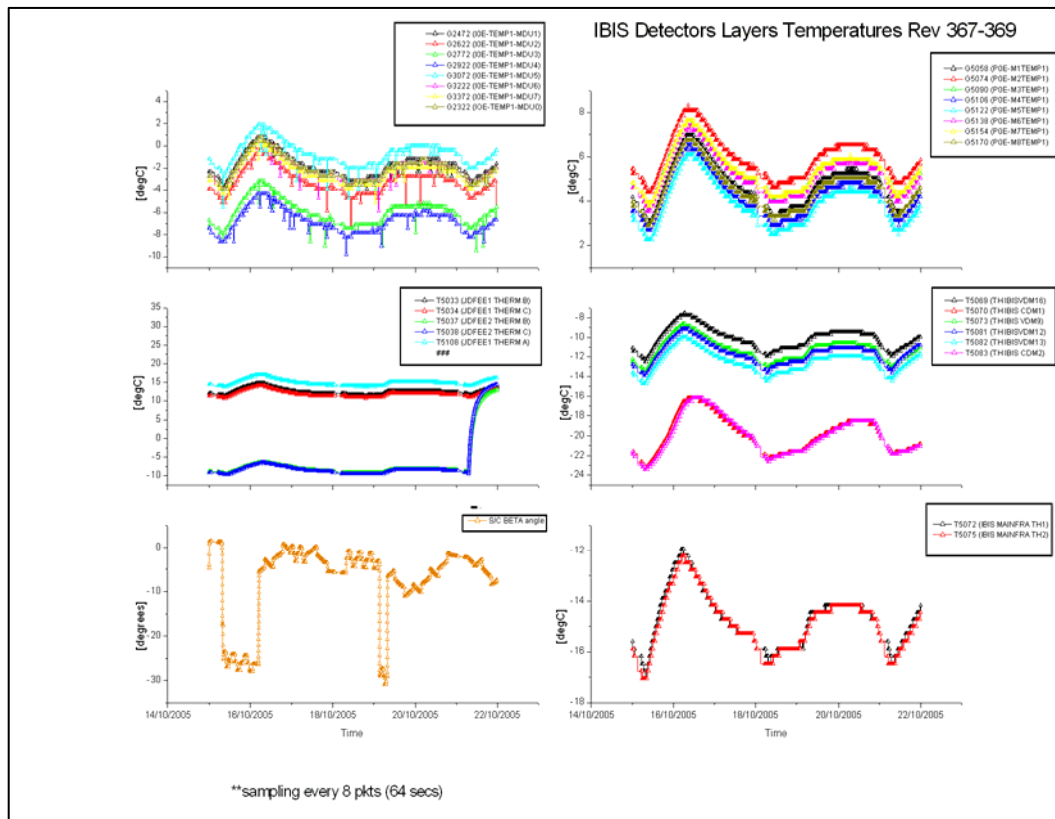
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



It can be noted on the temperature plot that T5038 (JDFEE 2 thermistor C) features a step up on the 21st. Actually this is because JEM-X2 DFEE was switched ON for engineering reason.

IBIS daily report:

DoY 2005.288 (15/10/2005):

On DoY 287 at 22:22Z TM parameter G8015 (28V PMT set by IASW) went OOL High with the value 29.4V. It went back inside limits on DoY 288 at 7:51Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

At 00:52Z, TM parameter G5027 (P0S-M6 RTC1) was toggling OOL high for about 5 minutes. It happened again at 06:03Z. According to P-CNT-1, as this happened in radiation belts, no action was taken.

At 07:21Z, TM parameter G2070 I0E-OVDWPXADD-M5) failed SCC and back. According to I-OVF-1 no action was taken.

DoY 290 (17/10/2005):

At 00:19Z TM parameters G5084 (P0S M2 F1ERRF), G5100 (P0S M3 F1ERRF), G5104 (P0S M3 F2ERRF), G5116 (P0S M4 F1ERRF), G5120 (P0S M4 F2ERRF), G5132 (P0S M5 F1ERRF), G5136 (P0S M5 F2ERRF), G5180 (P0S M8 F1ERRF) failed SCC and back. According to P-FIF-1, no action was taken.

At 22:09Z TM parameter G8015 (28V PMT set by IASW) went OOL High with the value 29.4V. It went back inside limits on DoY 291 at 7:37Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

DoY 291 (18/10/2005):

At 00:12Z, TM parameters G5037 (P0S-M8 RTC1), G5038 (P0S-M8 RTC2), G5023 (P0S-M5 RTC2), G5012 (P0S-M3 RTC1), G5007 (P0S-M2 RTC1), and G5008 (P0S-M2 RTC2) were toggling OOL high until LOS (01:08Z). It happened again for 10 minutes at 05:39Z. According to P-CNT-1, as this happened in radiation belts, no action was taken.

At 07:17Z TM parameter G2014 (I0E-OVDWPXADD-M1) failed SCC and back. According to I-OVF-1 no action was taken.

DoY 293 (20/10/2005):

At 21:53Z TM parameter G8015 (28V PMT set by IASW) went OOL High with the value 29.4V. It went back inside limits on DoY 294 at 07:23Z. As this happened inside the radiation belts, according to V-VLT-1 no action was taken.

DoY 294 (21/10/2005):

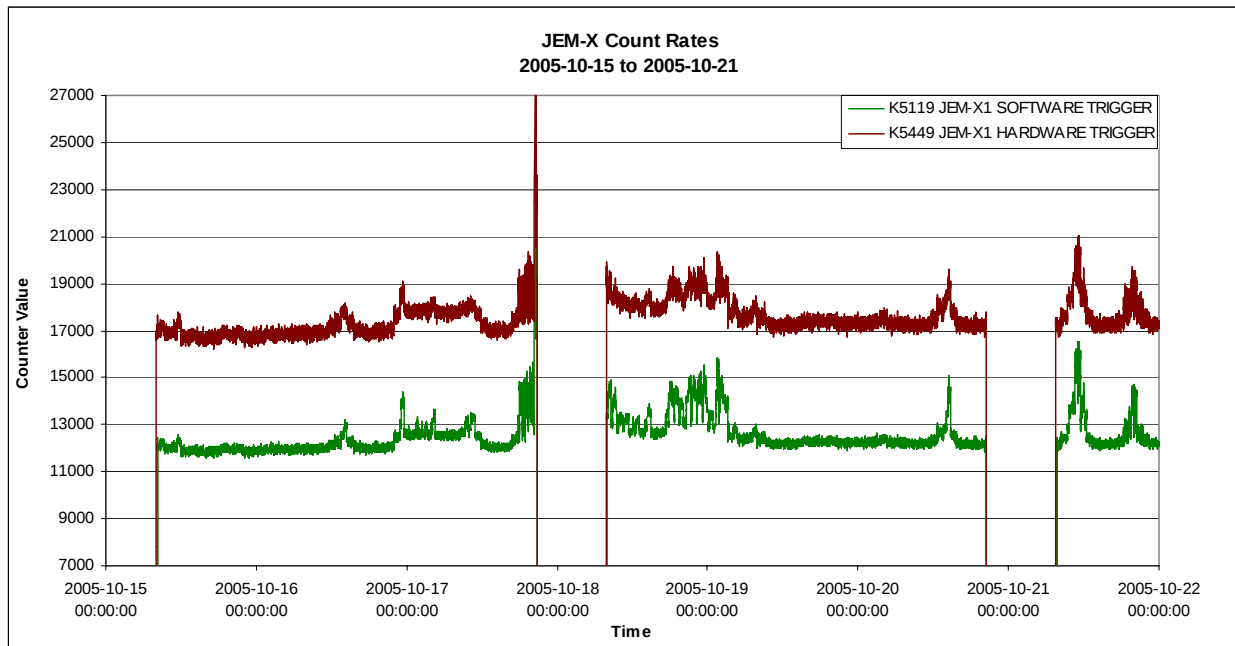
At 00:07Z, TM parameters G5032 (P0S-M7 RTC1), G5017 (P0S-M4 RTC1), G5028 (P0S-M6 RTC2) and G5023 (P0S-M5 RTC2) were toggling OOL high until LOS (01:17Z). It happened again for 10 minutes at 05:32Z. According to P-CNT-1, as this happened in radiation belts, no action was taken.

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.

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

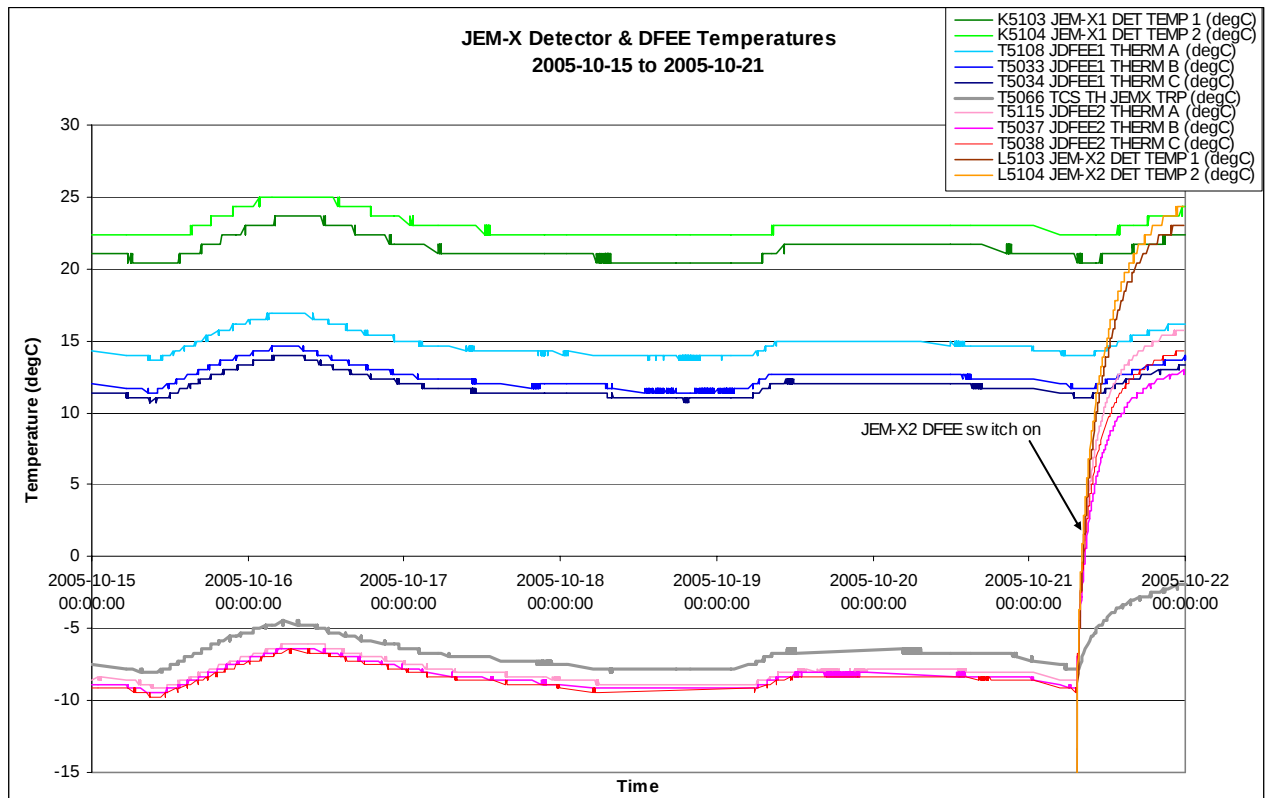


8.3.4.2 JEM-X Temperatures

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.

The effect of the switch-on of the JEM-X2 DFEE on 2005-10-21 is evident. The JEM-X1 temperatures increased by ~3 degC and those of JEM-X2 by ~25 degC.

² Data sampled (1 frame in 8)



8.3.4.3 JEM-X Daily Report

2005-10-15 (DOY 288, Rev 366-367) to 2005-10-16 (DOY 289, Rev 367)

Nothing to report

2005-10-17 (DOY 290, Rev 367)

At 20:27:03Z the TM parameter K5119 SOFTWARE TRIGGER went Out of Limits Warning High (value = 20188) and at 20:27:27Z it went Out of Limits Alarm High (value = 26096). At this time K5449 HARDWARE TRIGGER also went OOL High (value = 34264). However, JEM-X1 continued in Data Taking mode as the SW Trigger Limit is currently set to 40000. K5449 returned within limits at 20:37:35Z and K5119 at 20:39:43Z. At 20:45:01Z the ED KESAFE01 was uplinked as planned from the Timeline to put JEM-X1 in Safe mode before radiation belt entry.

2005-10-18 (DOY 291, Rev 367-368) to 2005-10-20 (DOY 293, Rev 368)

Nothing to report

2005-10-21 (DOY 294, Rev 368-369)

In line with OCR 201 (Special JEM-X1 and 2 reduced HV engineering session during October 2005 OMC Flat Field), the JEM-X2 DFEE was switched on at the start of revolution 369, after radiation belt exit. The activities were performed according to INT_OR_0223, as follows:

- 07:19:01Z FCP_JEM2_0021 JEMX2 DFEE ACTIVATION

- 07:32:48Z FCP_JEM2_0040 JEMX2 TRANSITION TO SAFE

As is usually the case when the DFEE is switched on after having been off for a considerable period of time, the JEM-X2 Detector Pressures went Out of Limits Low when the DFEE was switched on (TM parameter L5101 DET PRESSURE 1 = 132650Pa and L5102 DET PRESSURE 2 = 135200Pa). L5101 returned stably within limits (137000Pa) at 15:23:28Z and L5102 at 17:02:23Z.

8.3.5 OMC Operations

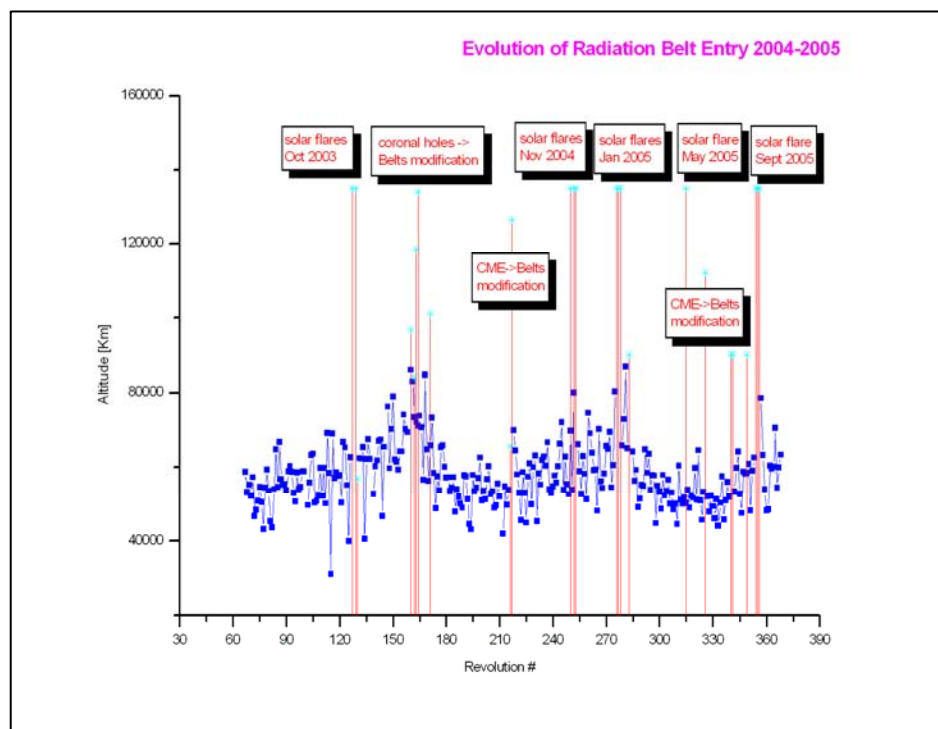
2005-10-15 (DOY 288, Rev 366-367) to 2005-10-21 (DOY 294, Rev 368-369)

Nothing to report

On DoY 290 at 22:09:11Z and DoY 293 at 21:54:07Z OMC was switched by the Timeline to SAFE mode, at the nominal time.

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]
367	RAD_EXIT R 2005-10-15T07:37:16Z	2005-10-15 06:36:32	>>26535.3	2005-10-15 06:37:57	31014
367	RAD_ENTR R 2005-10-17T22:08:52Z	2005-10-17 22:14:41	<59819.6	2005-10-17 23:12:56	51619
368	RAD_EXIT R 2005-10-18T07:24:52Z	2005-10-18 06:19:29	>>24938.2	2005-10-18 06:22:56	30274
368	RAD_ENTR R 2005-10-20T21:53:47Z	2005-10-20 21:24:33	>63302.4	2005-10-20 22:52:56	52720
369	RAD_EXIT R 2005-10-21T07:10:30Z	2005-10-21 06:09:05	>>24947.8	2005-10-21 06:12:56	30503

Reference

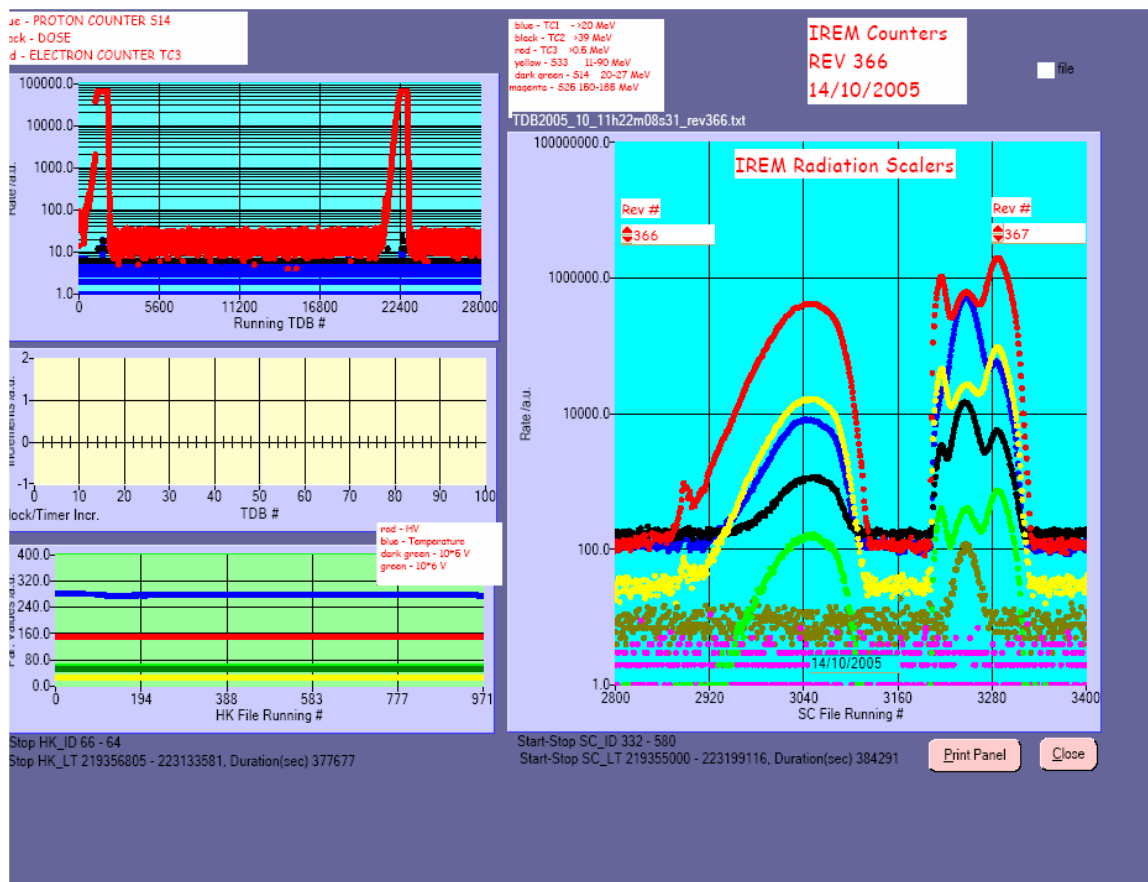
Very small error vs reference (less than 10 minutes)

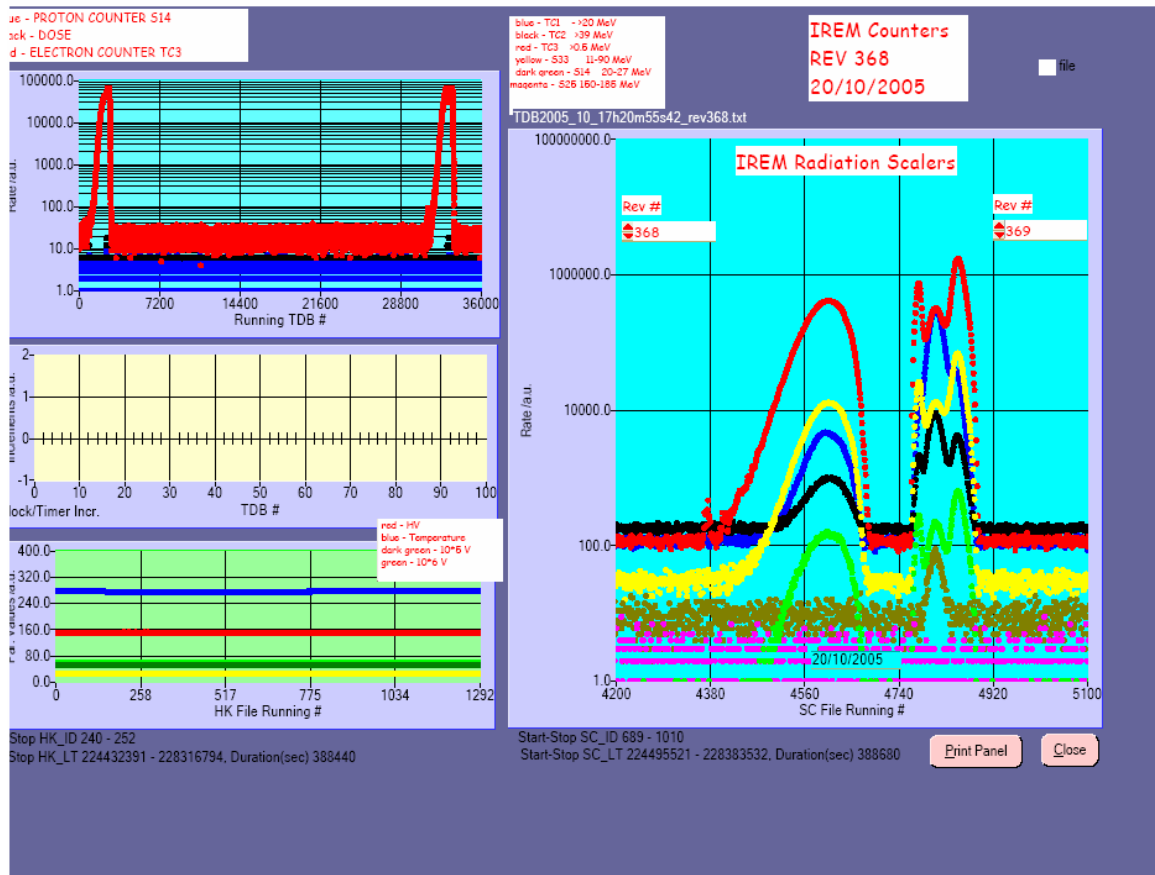
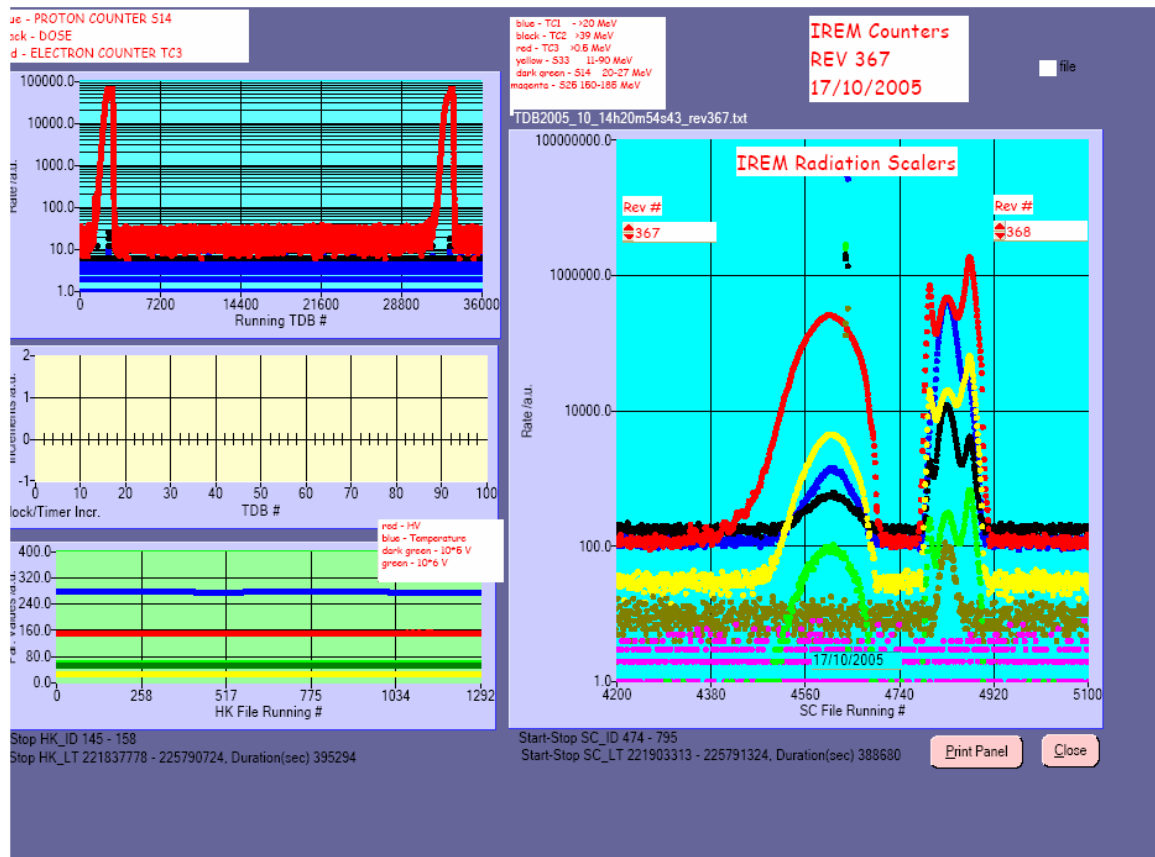
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

High

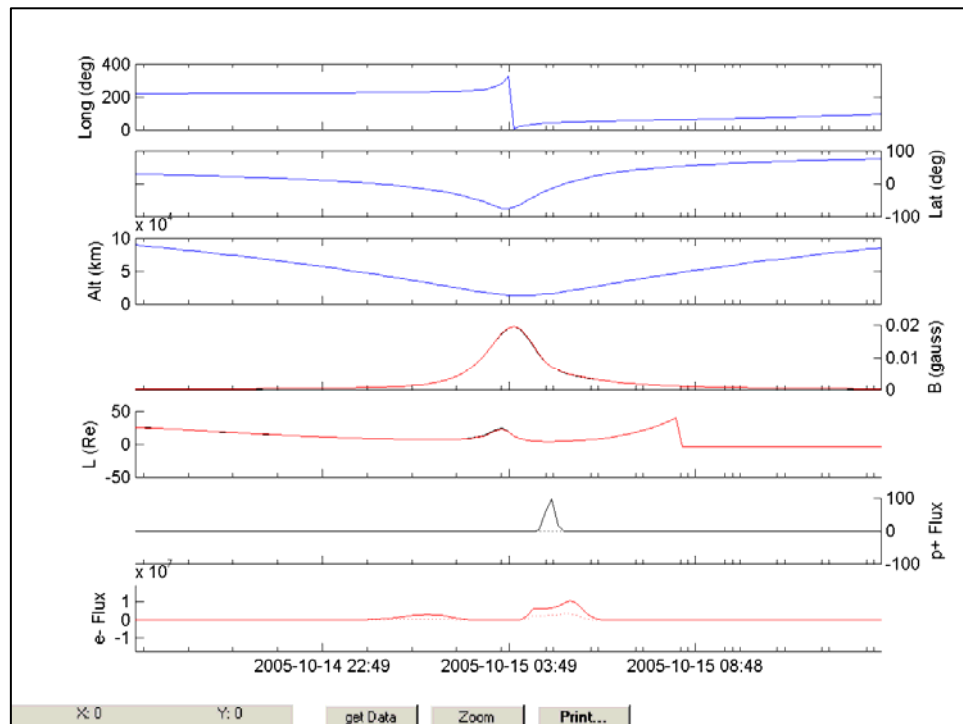
IREM radiation counters:



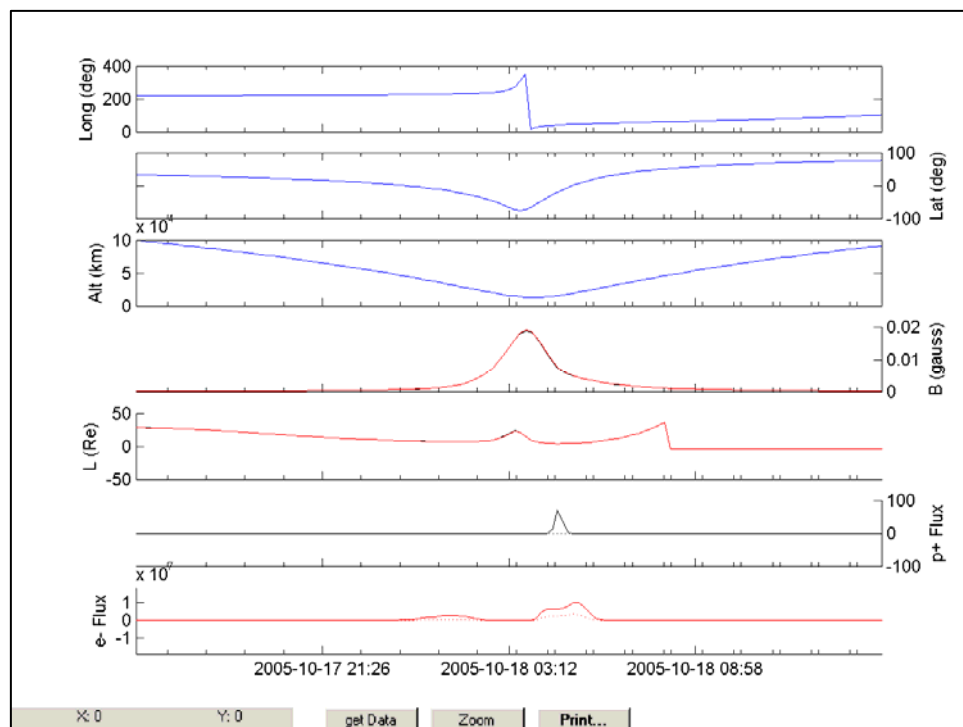


IREM Predicted Radiation Belt Passages:

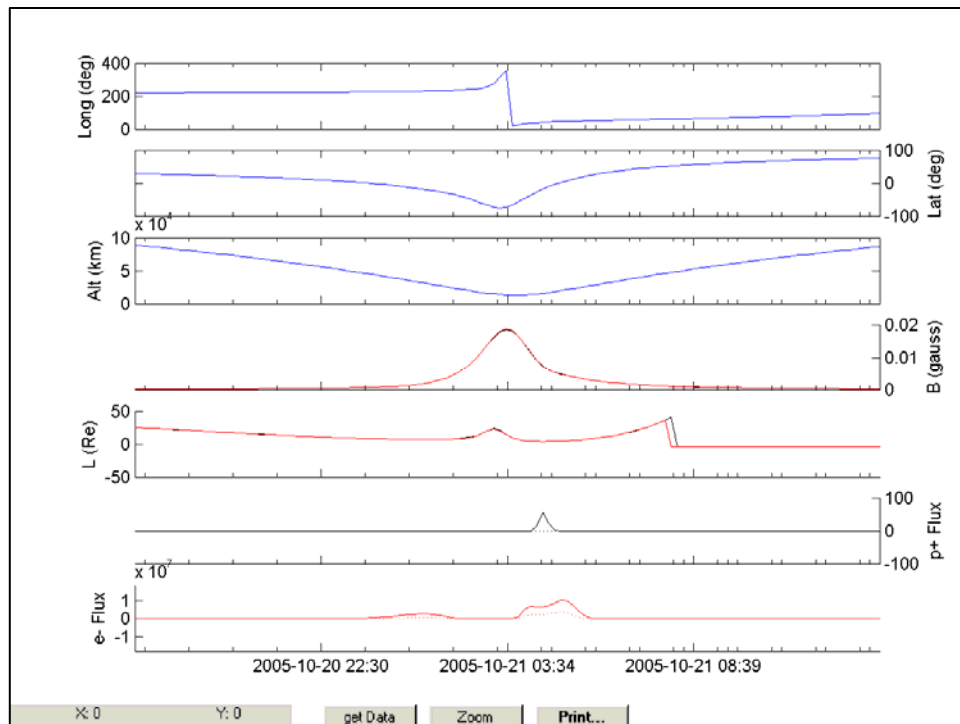
Rev 366:



Rev 367



Rev 368:



SEC-GOES Observed Particles Fluxes:

