

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 129
Week 10
14.03.05
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 05.03.05 until 11.03.05 (both dates inclusive) and covers the revolutions 293 & 294.

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); the galactic disk $l < 0$ (RA 16:18:32.00; DEC -50:22:26.0) and the Galactic Centre. The activities consisted of raster and hexagonal dithering as well as 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.

1 slew (1 OSL) was missed from the Timeline during this period due a problem on FD system, concerning the TPF generation for the slew update.

The fuel consumption over the period between 04/03/2005 and 10/03/2005 was 0.2013 kg. The remaining propellant is in the order of 162.4308 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.

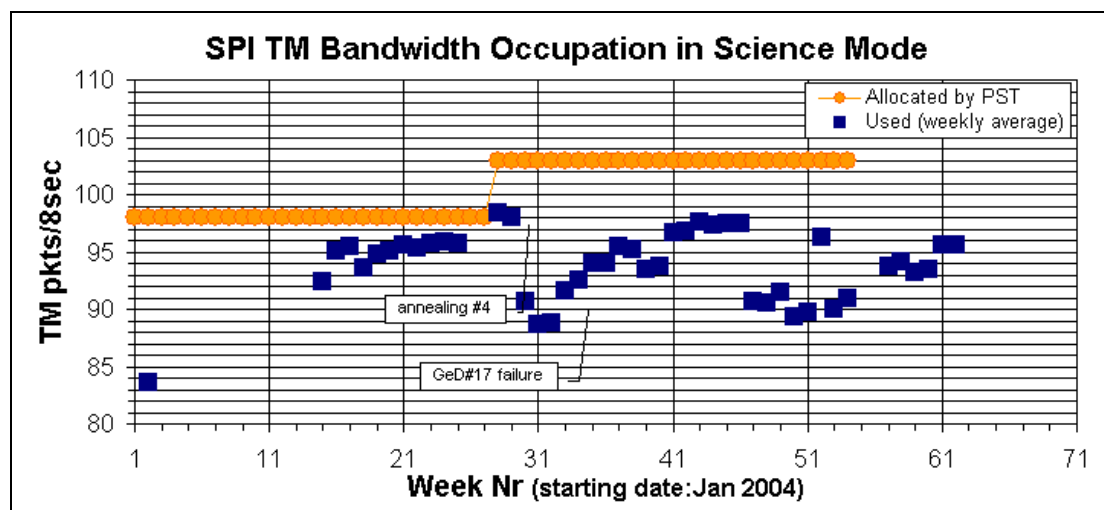
3.2 Payload

3.2.1 SPI

The overall status of the instrument in this week is nominal.

Following the execution of OCR#191 (PSD input channels #2 and #17 disable), executed at belts entry of rev.290), the channel rates blocking malfunction did not appear again. It was therefore decided to keep this setting. On 10/3/2005 a new Database was imported onto the Control system, implementing 92 new Limit Checks, to verify the ACS High Voltage switch-off at belts entry.

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 actual occupation of 95.6 pkts/cycle average. The Stirling compressors are working well, maintaining the detector cold-plate temperature within 85+/-1K.



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

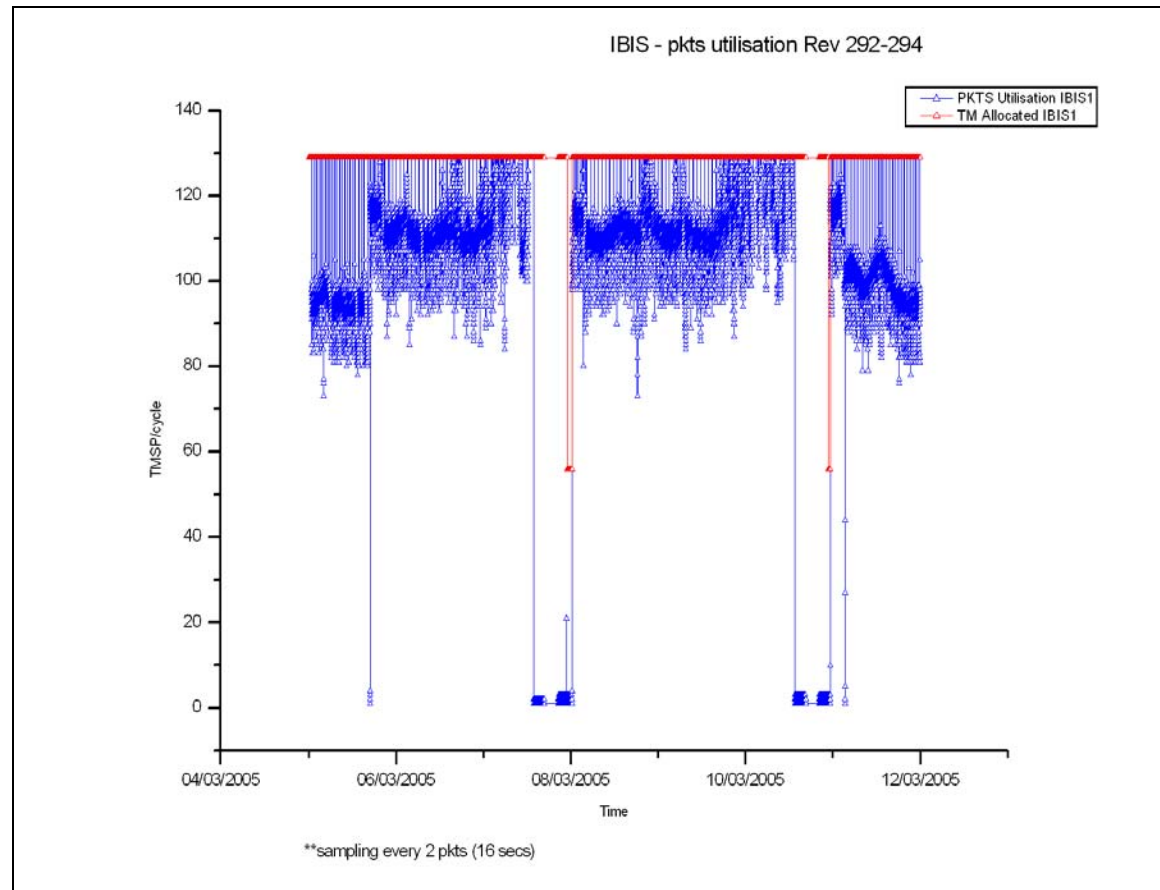
3.2.2 IBIS

The Overall status of the unit is Nominal.

The week was characterised by low 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 110.8 TMPS/cycle, down 0.9 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. JEM-X2 remained dormant (DFEE OFF) with a TM allocation of 1 packet/cycle.

INT_OR_0189 was executed at the start of revolution 293 to reset the JEM-X1 Broadcast Packet override flags for the IREM RMC parameters to DISABLED following the anode calibration ED KEACAL01 in the Timeline.

A new release of the IODB was propagated to the control system during the perigee pass of revolution 293-294, containing updated anode electronic calibration sequences KEACAL01 and LEACAL01. In these updated sequences, the JEM-X reactions to the IREM RMC parameters are left DISABLED, and therefore INT_OR_0189 was no longer required as of revolution 294 and has been closed.

Due to high background radiation conditions, JEM-X1 made an autonomous transition to Safe mode, triggered by the unit's Software Trigger, on 2005-03-07 at 08:49Z. This

was ~3.5 hours before it was due to be commanded to Safe mode before radiation belt entry of revolution 292.

In addition, there were a few instances of the TM parameters K5119 SOFTWARE TRIGGER and K5136 BUFFER LOSS going out of limits.

Further information on 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 period, 1 out of the 169 planned science pointings for OMC was missed, due to a problem with the Flight Dynamics System.

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.

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 good this week, only one slew was missed.

4.1 Mission Operations Centre

The performance of the MOC was good this week, the only problem which impacted operations was a FD problem which caused the loss of 1 slew.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. No significant problem were noted.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

This week planning up to revolution 298 has been performed and sent to MOC.

Replanning of rev's 295 and 296 was performed to accommodate a ToO. Rev 296 was

replanned once more to get a better overlap of the ToO observation with XMM-Newton. PSF's up to rev 300 have been received. TSF for rev 294 was received.

2. Observation status

ECS's up to rev 279 have been received, except rev's 273 and 277. Corresponding OCS files have been sent to ISDC. 170 Kseconds have been credited to an observation due to high solar activities during the observation.

3. ISOC science data archive

The ISDA installation progresses well. A major milestone was the successful installation of Oracle SUN Solaris client installation on Net-1 in ESAC. Eight data tapes received containing science window data up to rev 269 as well as reprocessed science window data (so called revision 2 data) up to rev 115.

4. ISOC system

Version 10.7.3 is still in use. No major problems reported.

5. ISOC move

A second batch of computers and office equipment was received in ESAC. Installation is in progress.

6. Problems

The problem reported last weeks with unavailable science staff in ISOC is still not yet formally resolved Very little progress achieved to resolve the problem.

4.3.2 ISDC

Status of ISDC observation processing on 14/03/2005:

- Latest Standard Analysis completed: observation 02201460002 (3C273, Revolution 268) on 04/03/2005

- Latest products archived: observation 02201460002 (3C273, Revolution 268) on 11/03/2005

- Latest observation products sent to the observer: observation 02297000015 (Abell 2256, Revolution 257) on 20/02/2005

5 Special Events

None.

6 Anomalies

There were a few problems that impacted the operations:

- On DoY 066 (7/3/2005), at 15:08, the TPF update for an Open loop slew was transferred with delay from the FDS. The result was that the slew was executed with the default parameters.
- On DoY 067 (8/3/2005), at 11:35, a reboot of the firewall in ESOC caused a 9 minute interruption in data flow to ISDC.

- On DoY 068 (9/3/2005), at 07:59, a number of errors were noted sending data to ISDC, the reason is unknown and the problem cleared itself.
- On DoY 069 (10/3/2005), at 14:34, a number of errors were noted sending data to ISDC, the reason is unknown and the problem cleared itself.
- On DoY 069 (10/3/2005), at 22:54, 2 commands failed release from the Autostack, due to release window failure (ie release from MCS delayed by more than allowed threshold). This occurred during a period of intense commanding, however the uplink bandwidth was not saturated, hence the reason for the delay is unclear. The missed commands were re-uplinked, there was no impact to science.
- On DoY 070 (11/3/2005), at 15:22, , a number of errors were noted sending data to ISDC, these continued to occur occasionally until 16:49, the reason is unknown and the problem cleared itself.

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

AR id	Date Created	Subject	Segment	Status
INT-2711	10/03/2005	TCs Fail Release from IMCS	IMCS	Pending

7 Future Milestones

Upgrade of the NCTRS (Network Controller and Telemetry Router System) for Integral to release 9.1.4. This will cure some known problems with the current release and is also compatible with TCP IP communications to ESA Stations as well as X25. The upgrade is currently planned to take place in April.

Upgrade of the IMCS, to use S2K release 3.1, a major update of the MCS is currently undergoing acceptance testing. A date for installation on the operational machines has not yet been decided.

Change of communication protocol to ESA Station from X25 to TCP IP, testing of this change will start in April. It will be used operationally only once testing is complete and the operational machines have been upgraded with the latest versions of the NCTRS and MCS.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 293

The activities in revolution 293 consisted of 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 an amalgamated raster dithering observation of the galactic disk $l < 0$ (RA 16:18:32.00; DEC -50:22:26.0), performed for the remaining ~56 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.

Revolution 294

The activities in revolution 294 consisted of 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 GCDE observation, performed for the remaining ~57.5 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

2005-02-23T17:27:49.000Z	162.8084	F	Automatic TM processing.
2005-02-23T22:14:54.000Z	162.7909	F	Automatic TM processing.
2005-02-25T08:19:53.000Z	162.7694	F	Automatic TM processing.
2005-02-27T02:21:58.000Z	162.7460	F	Automatic TM processing.
2005-02-28T08:01:05.000Z	162.7320	F	Automatic TM processing.
2005-03-01T16:38:04.000Z	162.6647	F	Automatic TM processing.
2005-03-01T21:48:45.000Z	162.6546	F	Automatic TM processing.
2005-03-03T08:12:40.000Z	162.6321	F	Automatic TM processing.
2005-03-04T21:21:48.000Z	162.6225	F	Automatic TM processing.
2005-03-04T22:50:37.000Z	162.5894	F	Automatic TM processing.
2005-03-04T23:52:13.000Z	162.5603	F	Automatic TM processing.
2005-03-05T06:17:25.000Z	162.5362	F	Automatic TM processing.
2005-03-06T07:28:00.000Z	162.5002	F	Automatic TM processing.
2005-03-07T21:12:36.000Z	162.4472	F	Automatic TM processing.
2005-03-10T21:01:24.000Z	162.4308	F	Automatic TM processing.

This report was generated Fri Mar 11 08:00:23 GMT 2005

8.3 Detailed Satellite Information

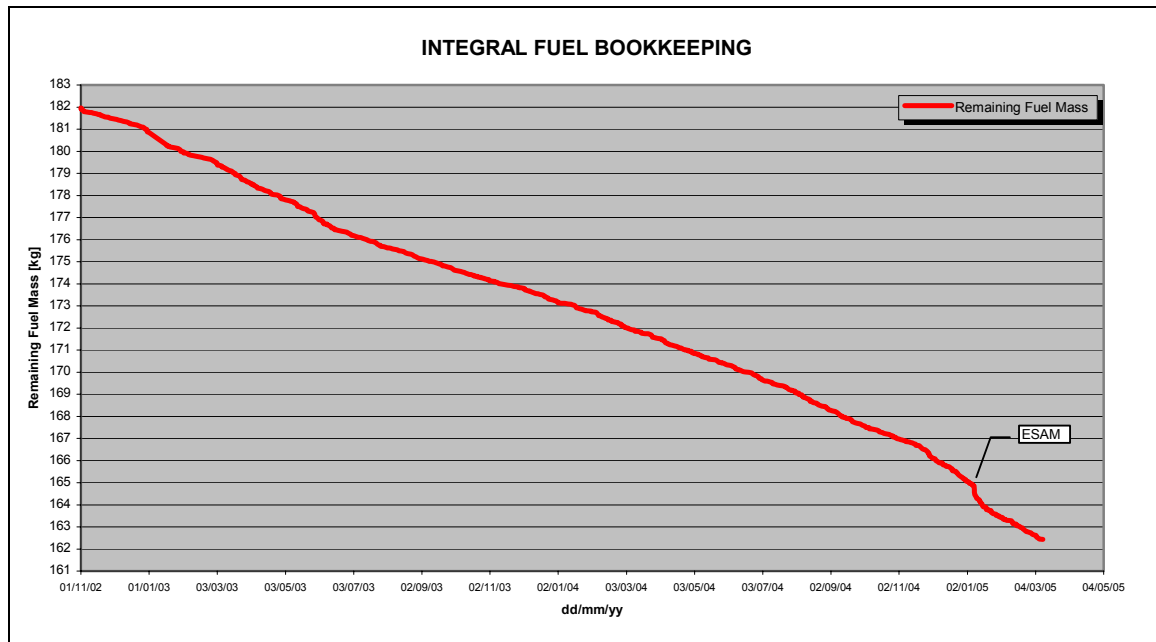
This section contains some detailed information concerning the various subsystems of the satellite and instruments.

8.3.1 AOCS Summary Operations Report 05/03/2005-11/03/2005

AOCS operations were executed from the Automatic Timeline.

During this period, 75 Open Loop Slews, 108 Closed Loop Slews and 4 Momentum Bias were executed. 1 slew was not executed due a problem to update the slews (TPF generation) on FD system. This is equivalent to a ~ 0.5 %.

The fuel consumption over the period between 01/11/2002 and 11/03/2005 is reported in the plot below.



05/03/05 (Day of Year 064, Revolution 292)

Slews missed from the Timeline: Due to a problem on FD system (failed TPF generation), the slews ID 02920001(OSL)-02(OSL)-03(OSL) were not executed and the AOCS s/s disabled in TL on DoY 2005.063 at 22:39z. A manual recovery was then performed to the attitude of PID 02920003. The next slew (OSL) for PID 02920004 was manually updated and executed from the Timeline. The AOCS s/s was re-enabled in TL on DoY 64 at 00:22z.

06/03/05 (Day of Year 065, Revolution 292)

Nothing to report

07/03/05 (Day of Year 066, Revolution 292-293)

Nothing to report

08/03/05 (Day of Year 067, Revolution 293)

Nothing to report.

09/03/05 (Day of Year 068, Revolution 293.

Nothing to report.

10/03/05 (Day of Year 069, Revolution 293-294)

Nothing to report

11/03/05 (Day of Year 070, Revolution 294)

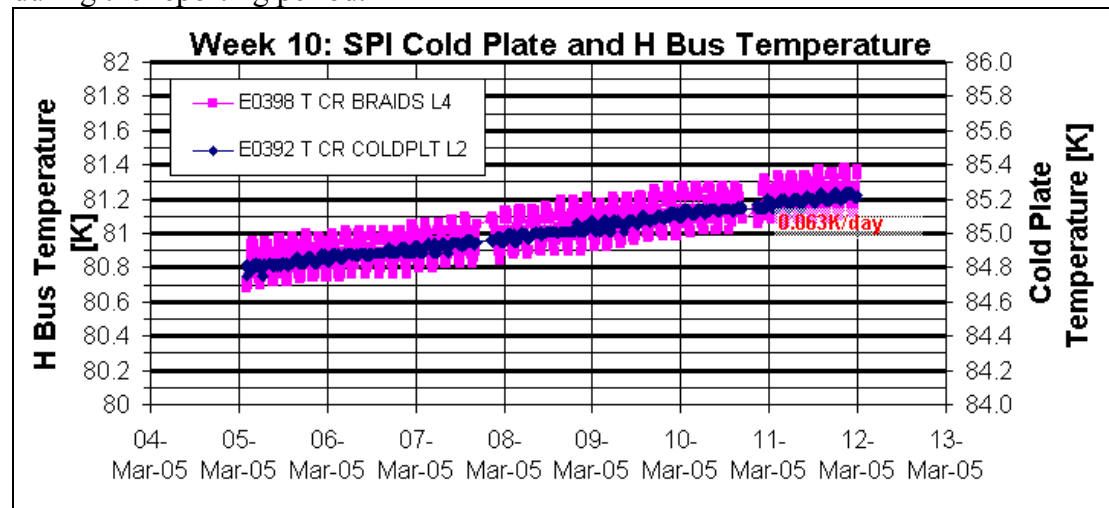
Nothing to report.

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 over the reporting period, showing a remarkable positive drift, expected after the annealing ended at the beginning of February.

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



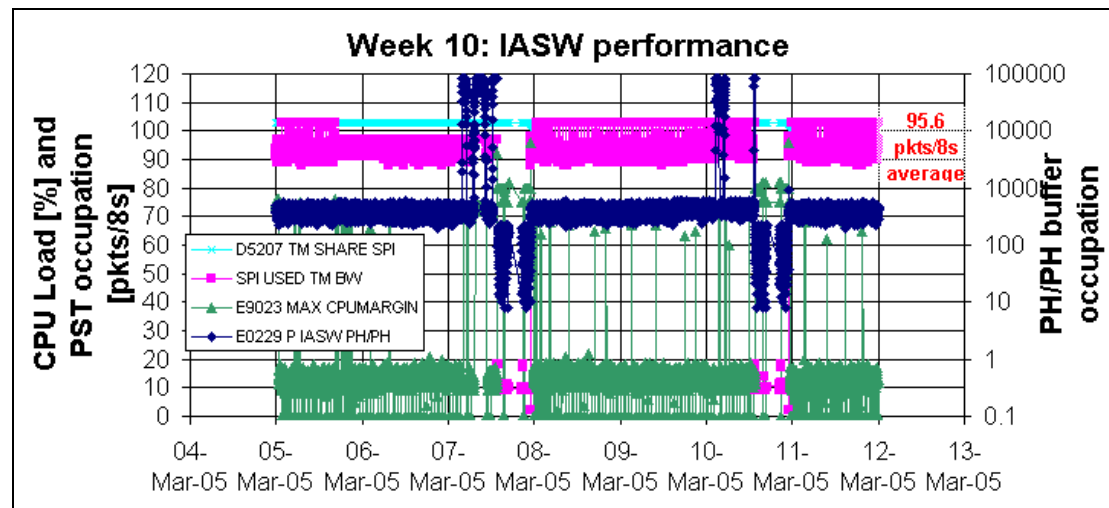
DPE & IASW:

The IASW performance is nominal. The PST TM bandwidth allocation was 103 pkts/cycle in the science windows; the actual TM bandwidth usage is :

- 103 pkts/cycle peak;
- 95.6 pkts/cycle average in science mode.

The SPI team is currently analysing the IASW code, investigating on the TM leakage anomaly INT_SC-107. As a temporary workaround to the malfunction, the SPACON uplink at every beginning of rev. a new PST rearranged such to avoid the problem. The malfunction of the missed ACS HV switch off at belts entry of rev.290 is being discussed with the PI to first identify if it is actually a IASW problem.

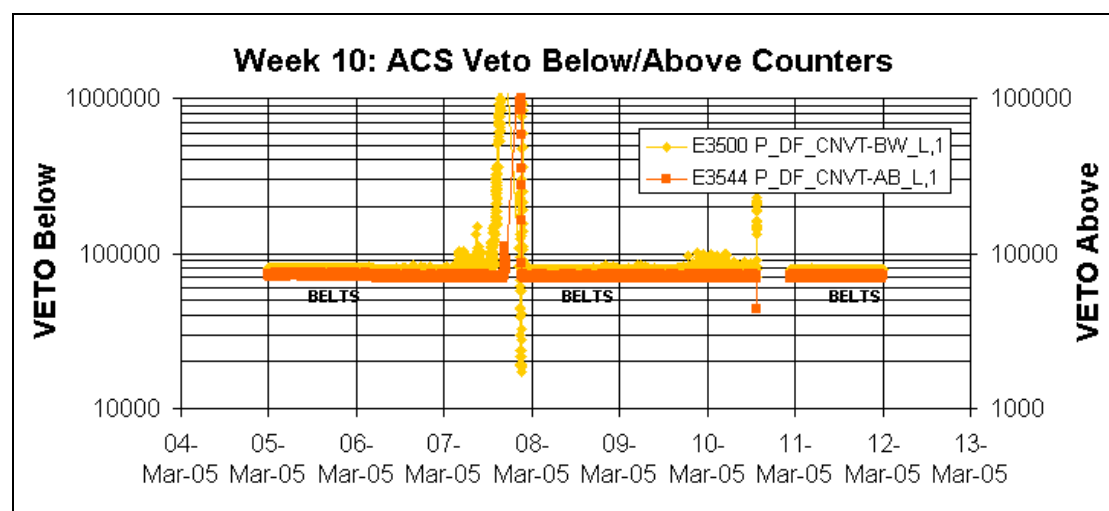
The following diagram shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

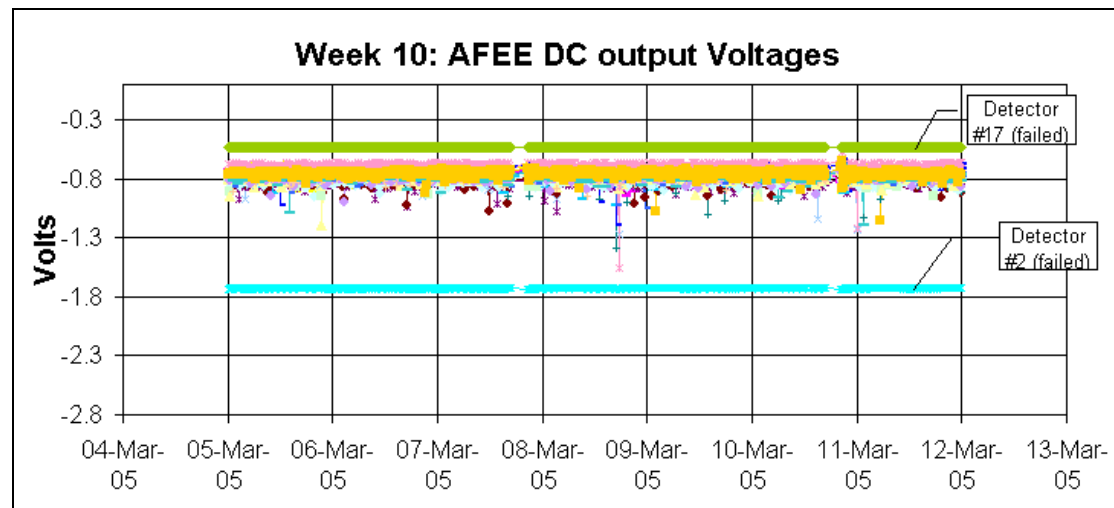
The following plot shows the ACS overall count rate evolution during the reporting period.



AFEE and Germanium Detectors:

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.

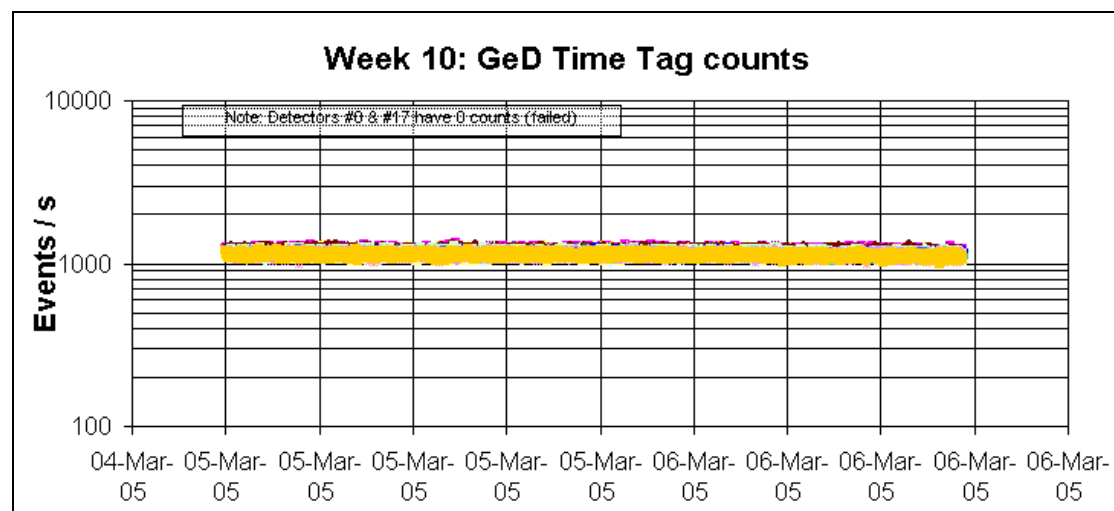
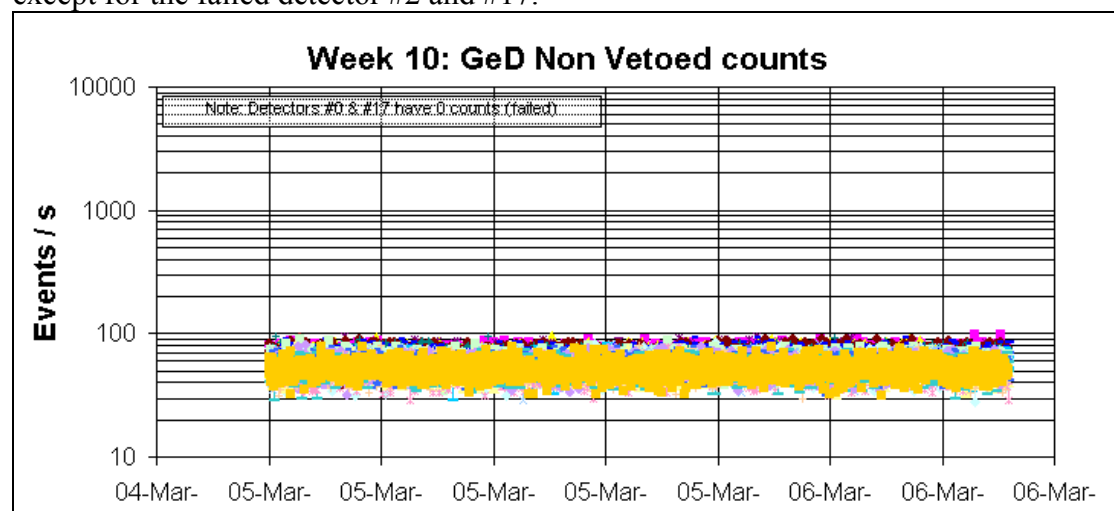
The following plot shows the AFEE dc output signals during the reporting period.



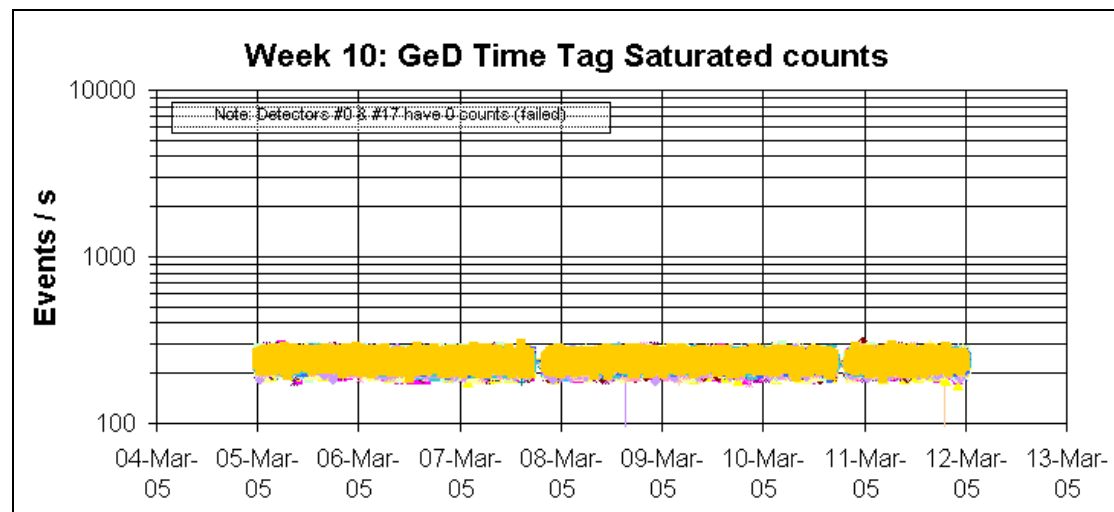
DFEE:

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.



Note that due to an offline retrieval problem, the above 2 plots span only 2 days.

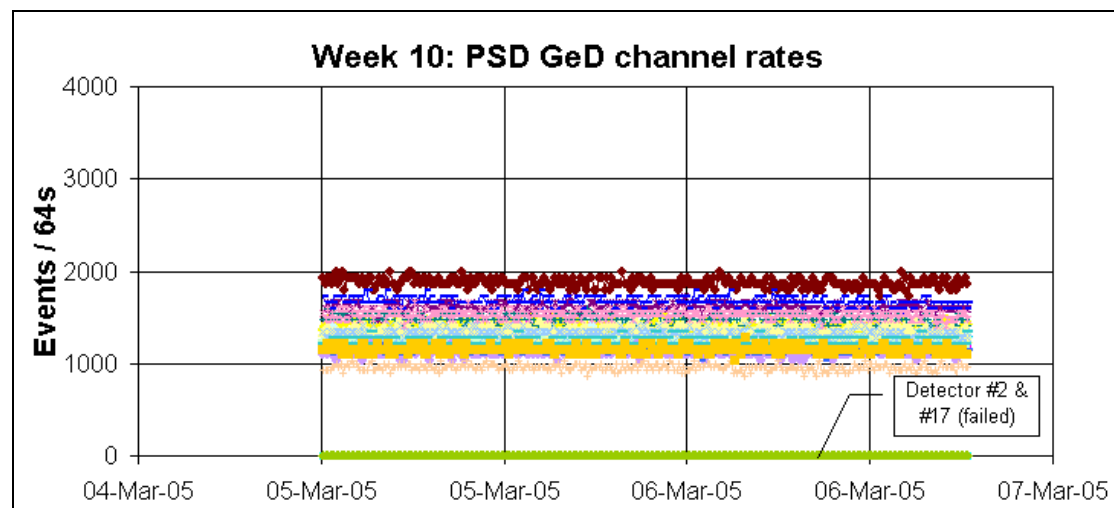


PSD:

The performance of the unit is nominal.

Following the execution of OCR#191 (PSD input channels #2 and #17 disable), executed at belts entry of rev.290), the channel rates blocking malfunction did not appear again. It was therefore decided to keep this setting.

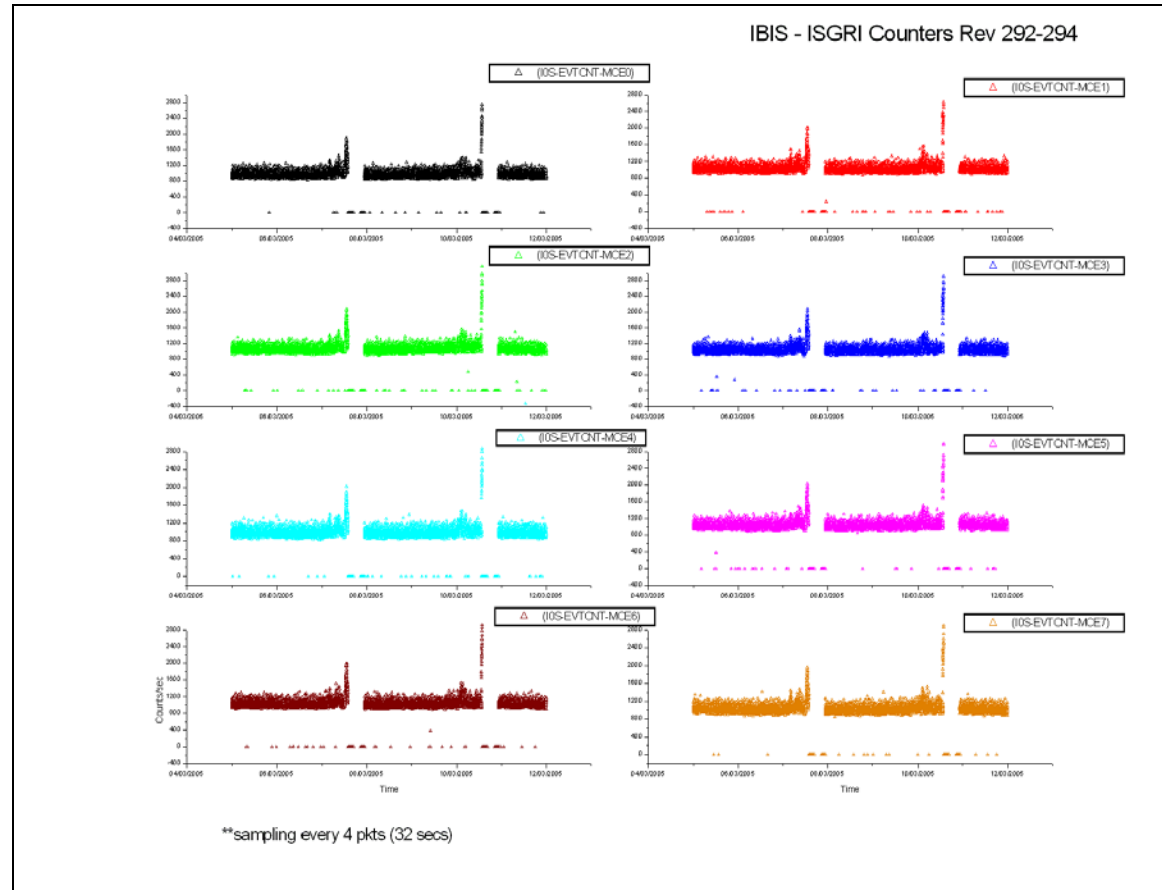
The following plot shows the PSD channel rates during the reporting period.



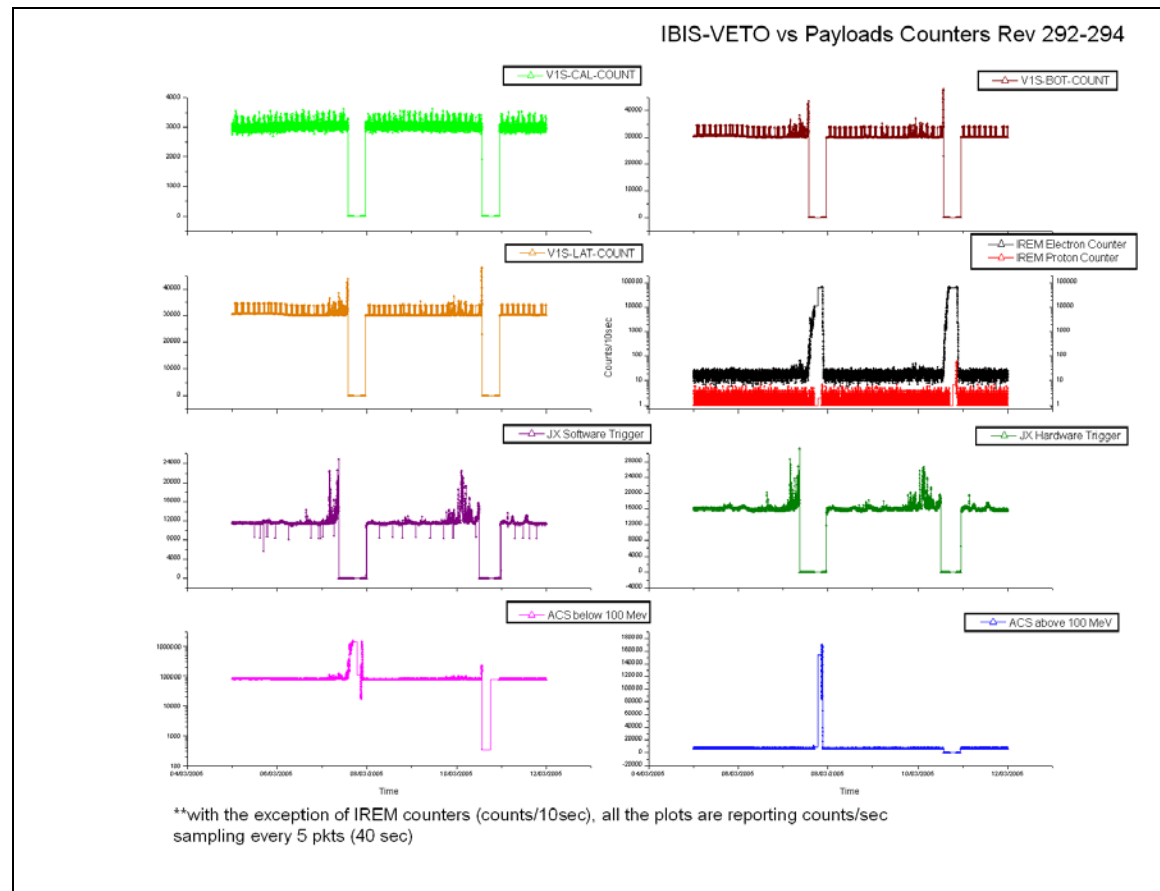
8.3.3 IBIS Operations

IBIS Event Counters Plots.

ISGRI Counters:

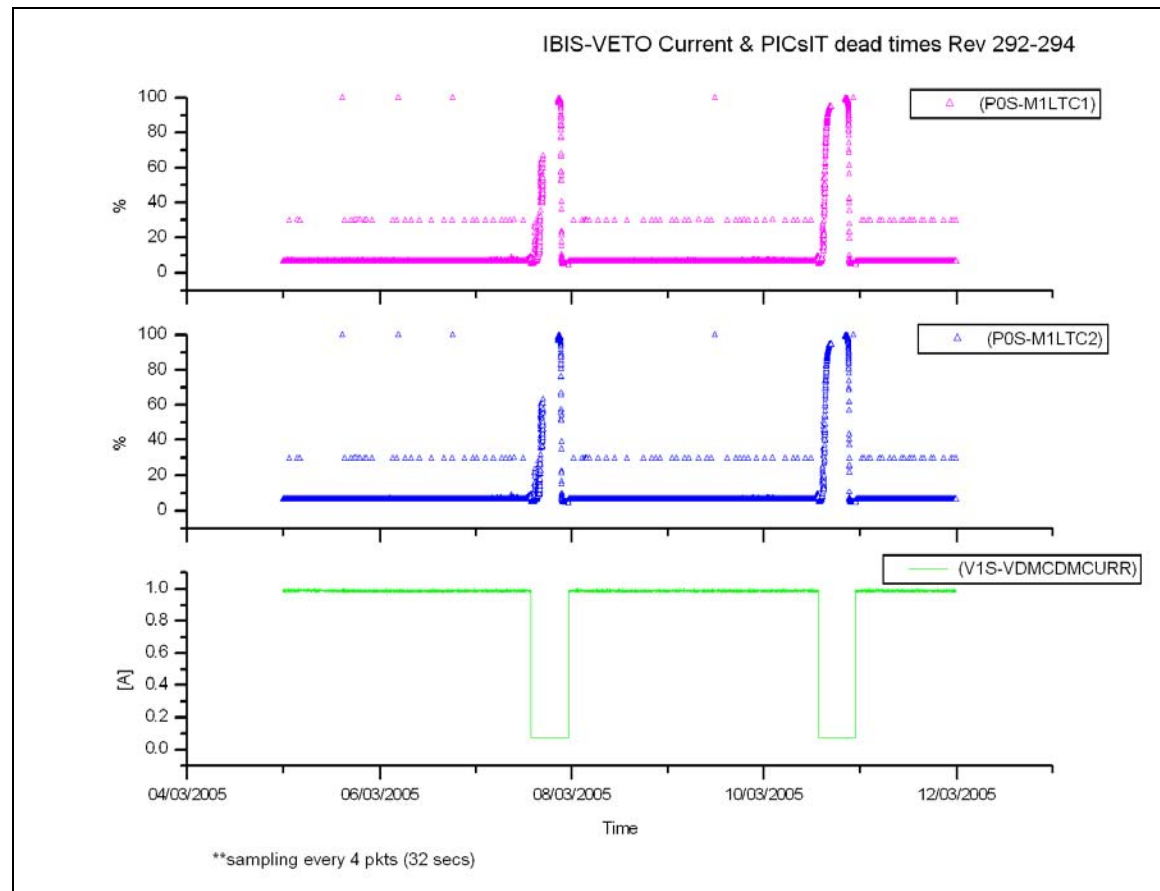


VETO vs Payloads Counters

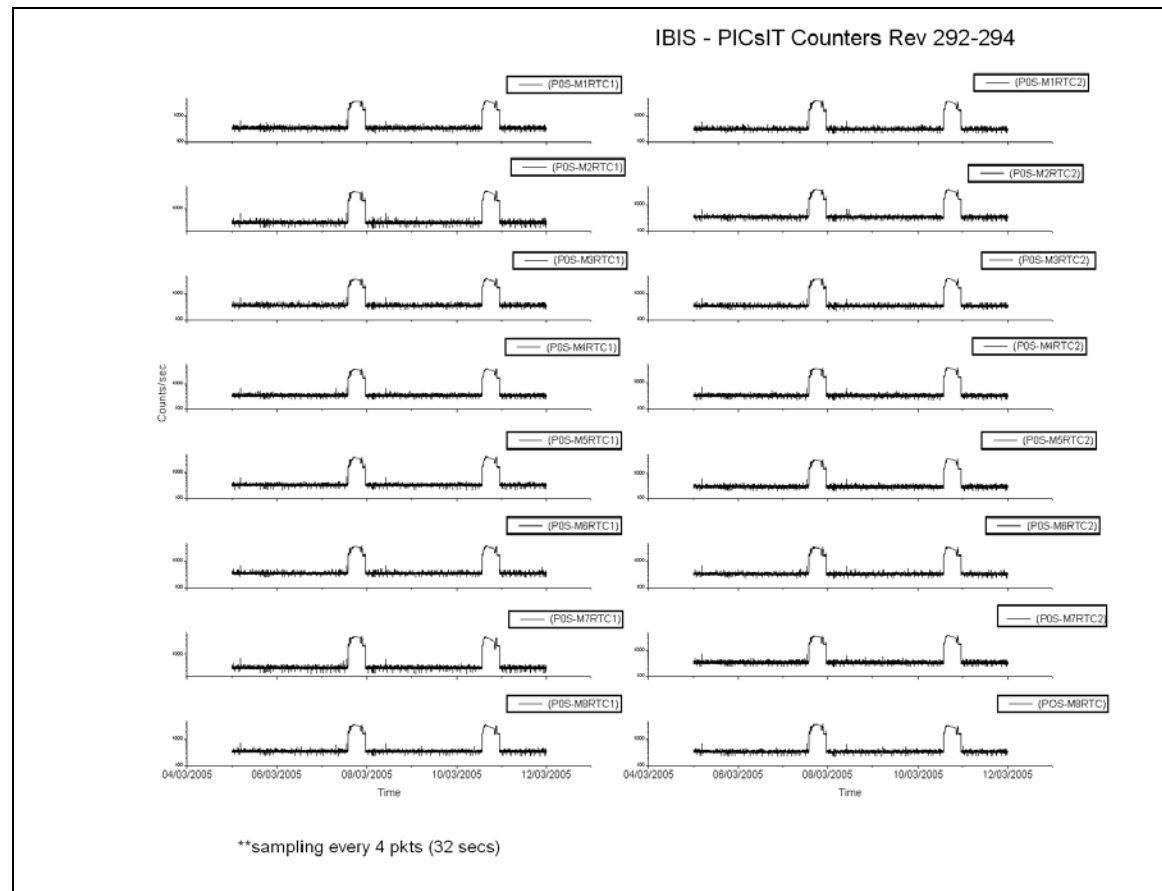


The week was characterised by low solar activity.

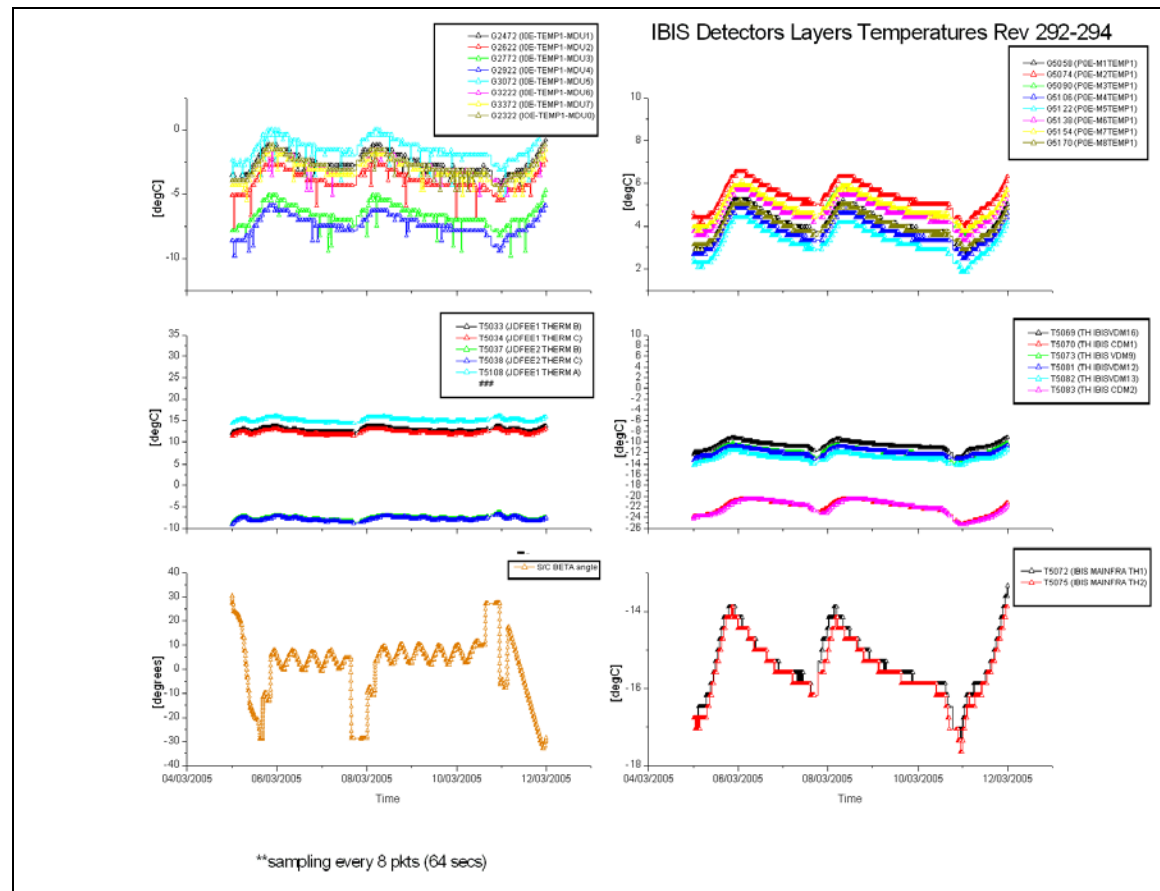
Veto Current:



Picsit Counters



IBIS Detectors Layers Temperatures



IBIS daily report

DoY 2005.069 (10/03/2005):

At 13:28Z, TM parameter G8080 (S1E-VS HBRA-RT) and TM family G2013 (IOS-EVTCNT-MCEi) went Out Of Limit 'High' due to high radiations detected by ISGRI when approaching Radiation Belts. At the BCPKT time of Belts Entry (13:39Z) all parameters went back within limits.

At 13:39Z, TM parameter G8015 (S1E-A2_PMT_V) went Out Of Limit 'high' with the value 29.4 V that is indeed the limit. As this happened inside the Radiation Belts and as the parameter was still close to its defined range, no action was taken.

At 20:21Z TM parameter G8015 went OOL 'high' one more time. For the same reason no action was taken.

At 22:36Z TM parameter G2014 (IOE_OVF_MPX_ADD_M1) failed SCC, and then went back within limit. As indicated in reaction I-OVF-1, no action was taken.

At 22:54Z TC G0479 of the Event Designator GEBENT02 failed release window check. This command was uplinked again in the next free window that was on DoY 070 at 00.03Z.

The execution of INTGSCCR-76 was performed for Revolution 294 via a database modification. The changes were the following:

TC para G8824 (TC G0836) Spectral Timing Histograms threshold #5, from 676 KeV to 2600 KeV

TC para G8825 (TC G0836) Spectral Timing Histograms threshold #4, from 364 KeV to 1196 KeV

TC para G8826 (TC G0836) Spectral Timing Histograms threshold #3, from 260 KeV to 676 KeV

TC para G8827 (TC G0836) Spectral Timing Histograms threshold #2, from 208 KeV to 364 KeV

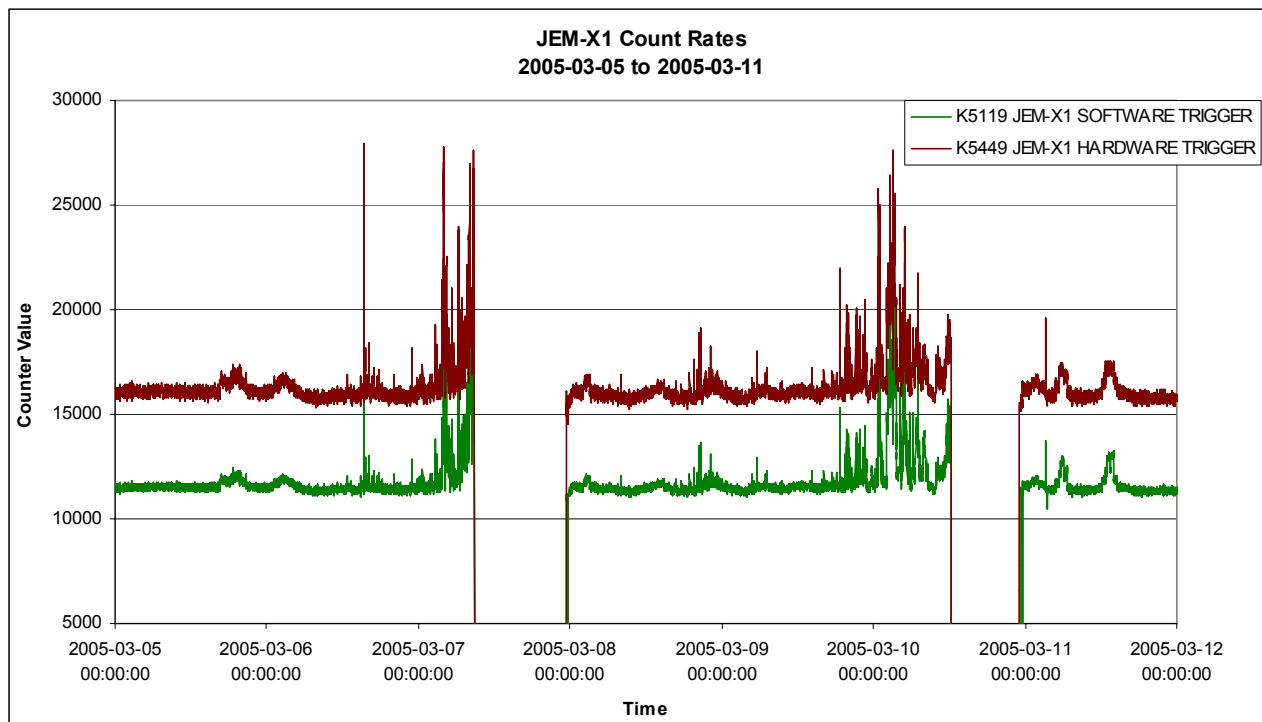
TC para G8828 (TC G0836) Spectral Timing Histograms threshold #1, from 156 KeV to 260 KeV.

The execution of INTGSCCR-77 was performed for Revolution 294. It resulted in the change of the energy threshold for Compton selection (ISOC formal parameter G8602) from 5000keV to 1500 keV for GPS and GCDE-like observations.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

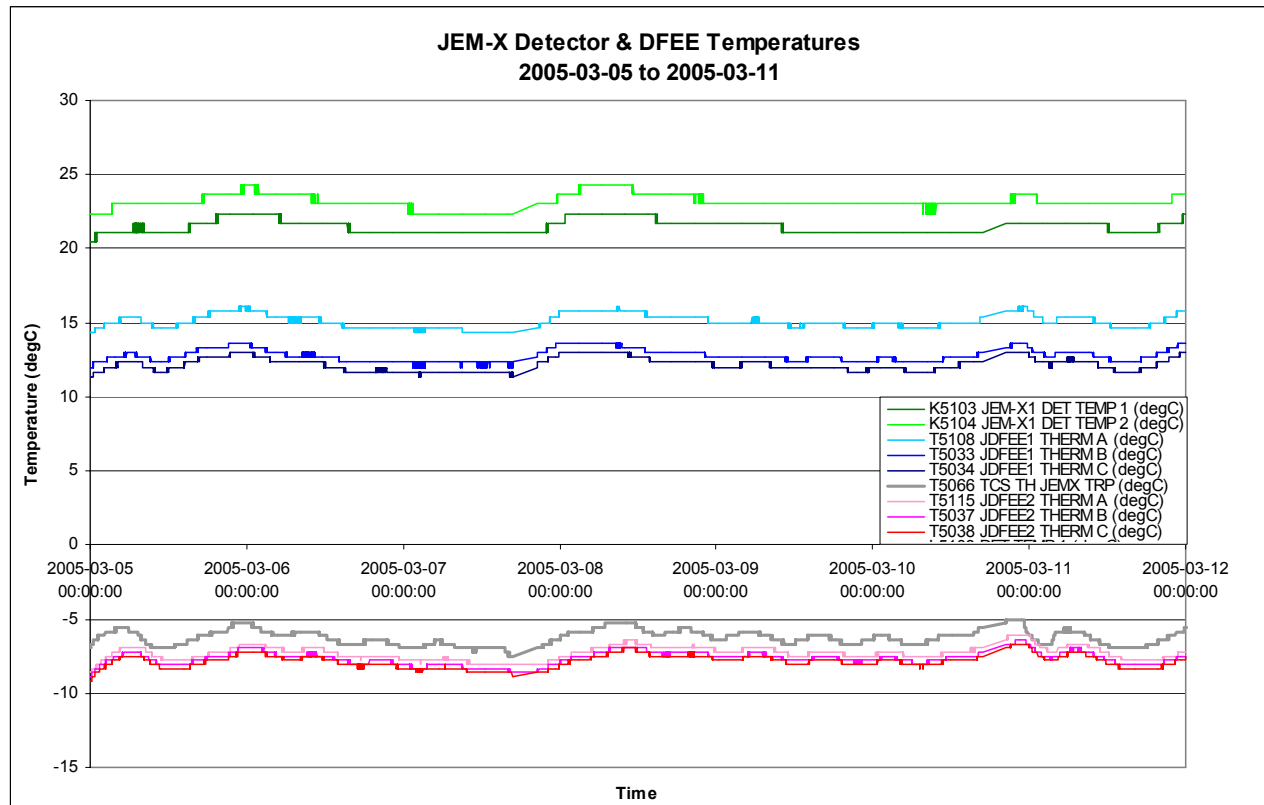
JEM-X1 count rates over the reporting period are displayed in the following graph¹.



8.3.4.2 JEM-X Temperatures

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

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.



8.3.4.3 JEM-X Daily Report

2005-03-05 (DOY 064, Rev 292)

Nothing to report

2005-03-06 (DOY 065, Rev 292)

At 15:29:31Z the parameter K5119 SOFTWARE TRIGGER went out of limits Warning High (value = 21863) for 1 TM cycle.

2005-03-07 (DOY 066, Rev 292-293)

At 03:55:15Z K5119 SOFTWARE TRIGGER went out of limits Warning High (value = 22338) and then fluctuated in and out of its soft limit until 04:00:51Z.

At 07:34:35Z the parameter K5136 BUFFER LOSS went out of limits High (value= 143), but then returned within limits at the next TM cycle.

² Data sampled (1 frame in 8)

At 08:03:23Z K5119 SOFTWARE TRIGGER went out of limits Warning High (value = 20035) and then fluctuated in and out of its soft limit until 08:06:51Z. At 08:39:39Z it went out of limits Warning High again (value = 20103) and then fluctuated in and out of its soft limit until 08:49:39Z, when it exceeded the Safe threshold for JEM-X1, causing JEM-X1 to make an autonomous transition to Safe mode. The TM parameter K5462 DFEE STATE IASW transitioned to state Setup and thus OEM 189 JEM-X1 PROB DFEE 9 was received. This was ~3.5 hours before JEM-X1 was planned to be commanded to Safe mode before radiation belt entry of revolution 292.

At 09:00:05Z FCP_JEM1_0040 was executed to command JEM-X1 to Safe mode, thereby setting K5462 DFEE STATE IASW to Safe as well and thus OEM 254 ERROR OFF was received. Commanding to JEM-X1 from the Timeline was then disabled at 09:05:54Z.

At the start of revolution 293, at 22:53:03Z, FCP_JEM1_0120 was executed to disable the JEM-X1 reactions to the IREM count rates in the Broadcast Packet as per INT_OR_0189.

2005-03-08 (DOY 067, Rev 293) to 2005-03-09 (DOY 068, Rev 293)

Nothing to report

2005-03-10 (DOY 069, Rev 293-294)

At 02:31:08Z the TM parameter K5119 SOFTWARE TRIGGER went out of limits Warning High (value = 20318) and then fluctuated in and out of its soft limit until 03:25:56Z. At 03:17:48Z the TM parameter K5136 BUFFER LOSS also went out of limits High (value= 186), reaching a maximum of 206 at 03:18:20Z, and returning within limits at 03:18:52Z.

2005-03-11 (DOY 070, Rev 294)

Nothing to report

8.3.5 OMC Operations

2005-03-05 (DOY 064, Rev 292)

Due to the fact that the Flight Dynamics System failed to provide an update after the first slew in revolution 292 (on 2005-03-04), see Anomaly Report INT-2713, commanding to the AOCS was disabled from the Timeline and the first few AOCS manoeuvres at the start of this revolution were performed manually. Therefore, slew ID 02920003 was missed and OMC lost the associated science pointing (the OMC Imaging EDs were uplinked but OMC did not transition to Science Mode as the OTF remained low after the manual slew due to the Sun Steering Law remaining disabled).

2005-03-06 (DOY 065, Rev 292) to 2005-03-09 (DOY 068, Rev 293)

Nothing to report

2005-03-10 (DOY 069, Rev 293-294)

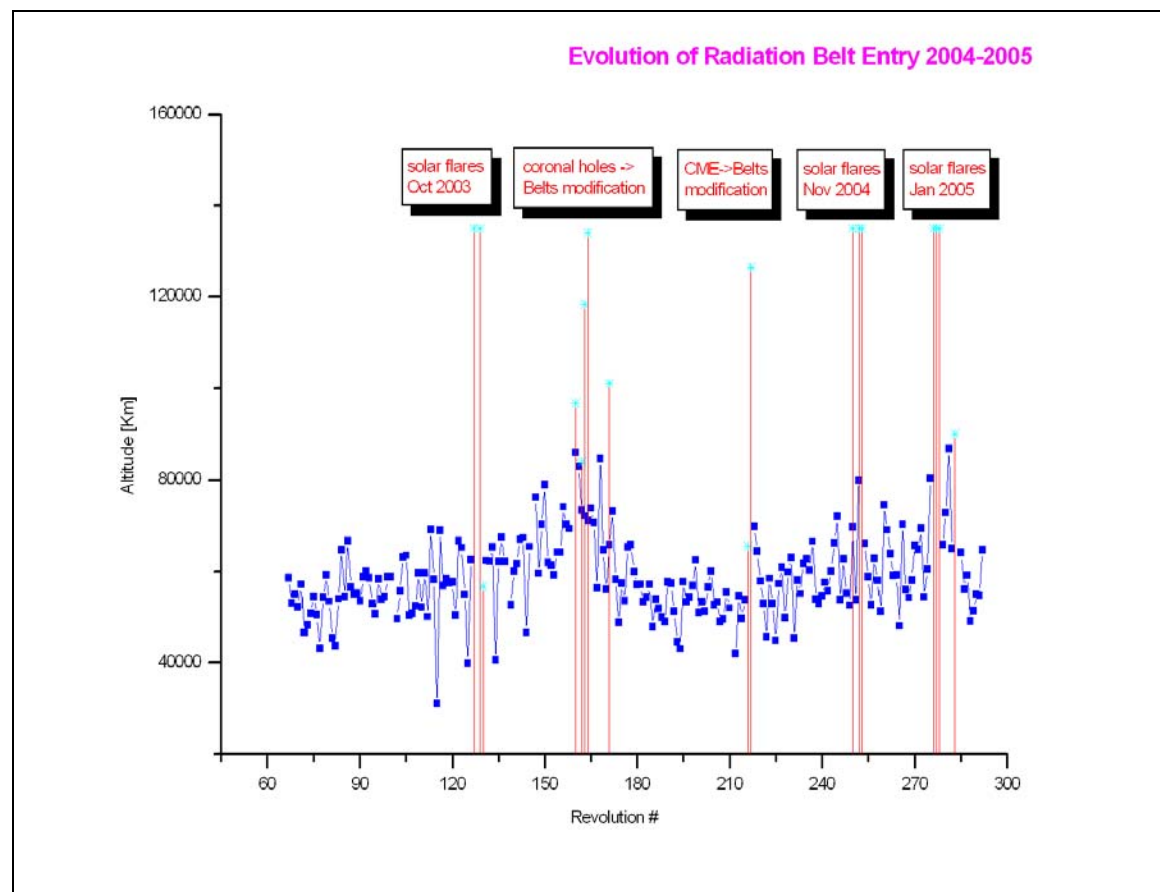
At 21:11:55Z the TM parameter T5016 OMC LENS TEMP1 went out of limits
Warning Low (value = -10.28degC), returning within limits at 21:15:56Z.

2005-03-11 (DOY 070, Rev 294)

Nothing to report

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]
292	RAD_ENTR R 2005-03-07T13:49:15Z	2005-03-07 13:15:32	<64754.4	2005-03-07 14:38:08	53158
293	RAD_EXIT R 2005-03-07T22:58:21Z	2005-03-07 21:40:37	>24860.5	2005-03-07 21:48:08	29254
293	RAD_ENTR R 2005-03-10T13:38:58Z	2005-03-10 13:46:21	>58424.4	2005-03-10 13:05:39	51190
294	RAD_EXIT R 2005-03-10T22:47:53Z	2005-03-10 21:33:49	>>24860.0	2005-03-10 20:05:39	29461

Reference

Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

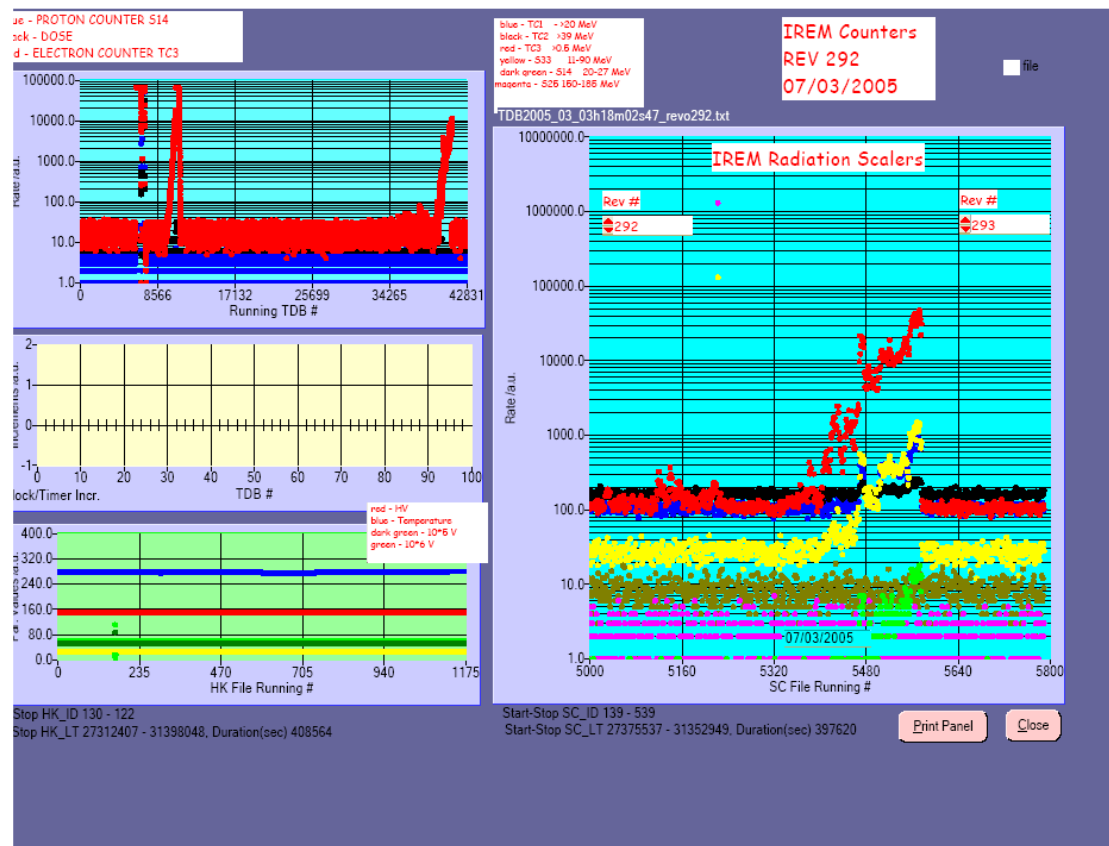
Large error vs reference (more than 30 minutes)

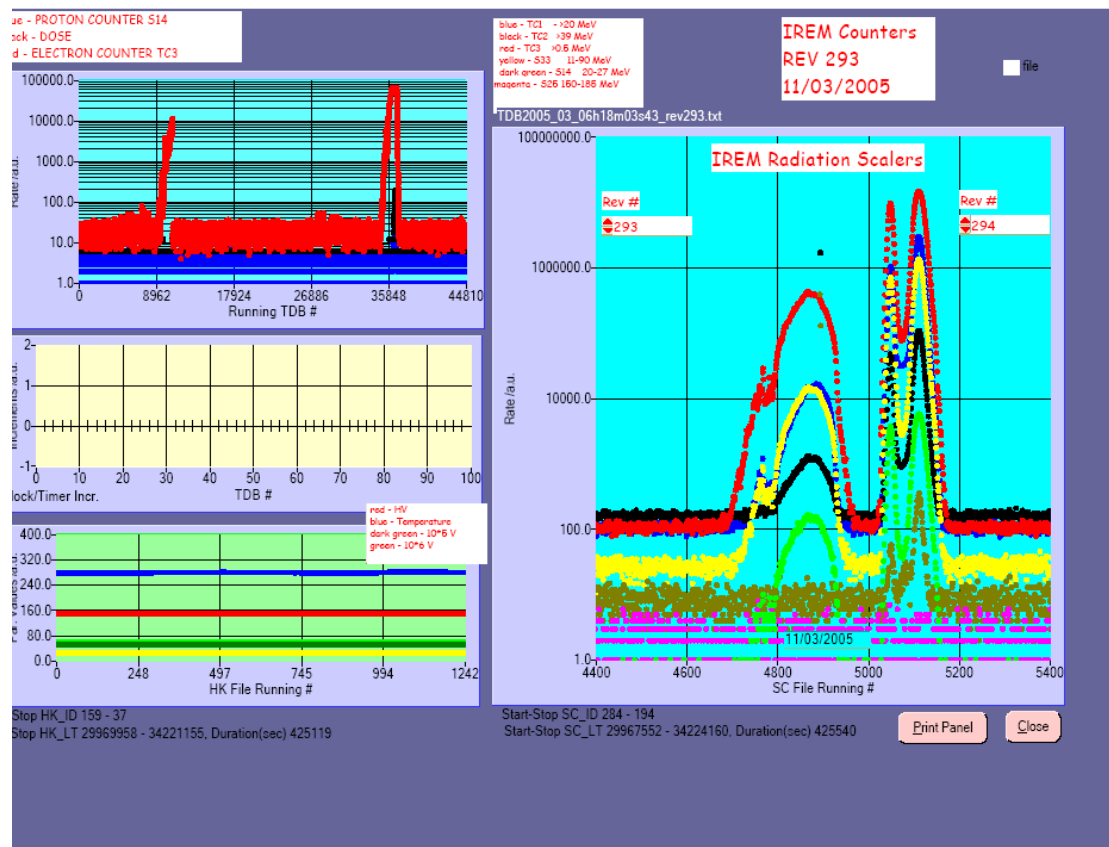
Radiation Spike

Proton Belts

The flux of protons >8MEV computed by RadMon, did not exceed the threshold. Therefore, no predicted proton cut-off is provided for this week.

IREM radiation counters

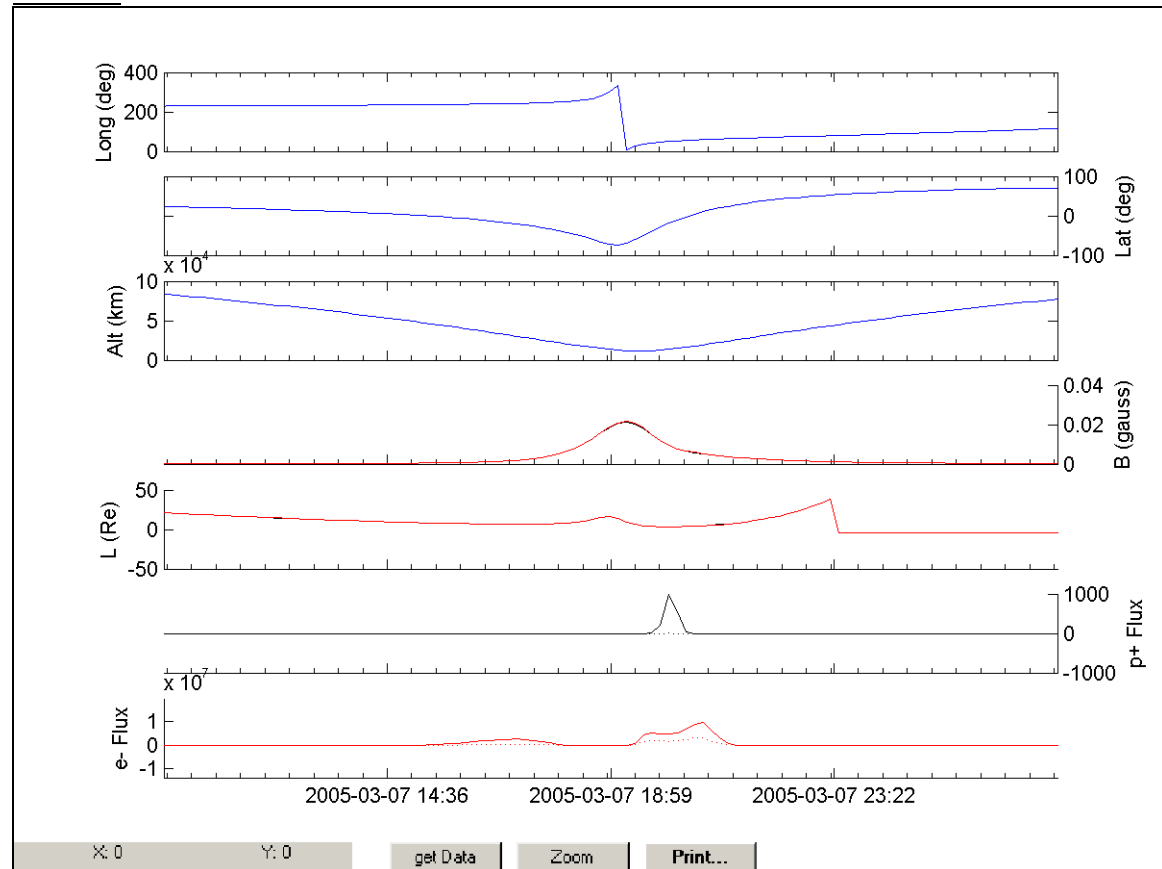




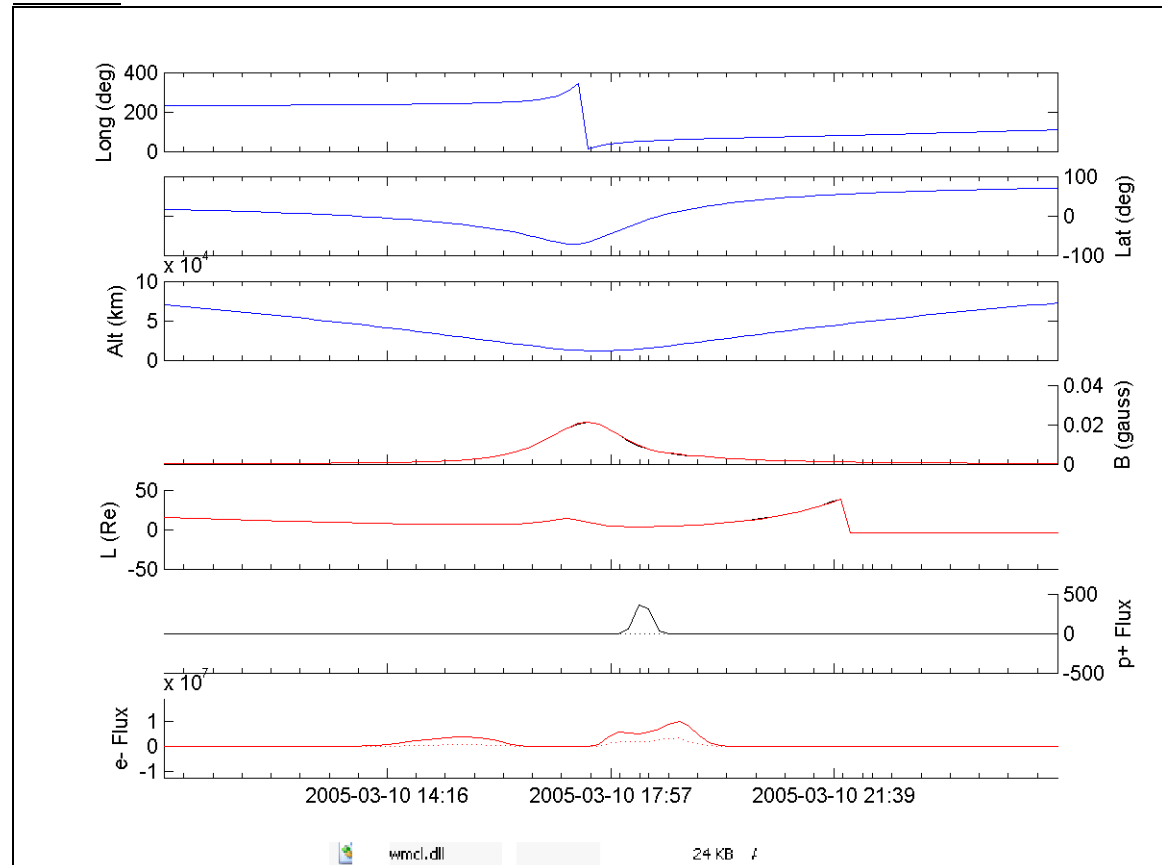
Due to problems on the TM distributor machine, IREM radiation counters data, acquired by IREM ECOE, are not fully available for the perigee passage of revolution 292.

IREM Predicted Radiation Belt Passages.

Rev 292



Rev 293



SEC-GOES Observed Particles Fluxes.

