

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 135
Week 16
25.04.05
Routine Phase

Prepared by: O. Bergogne (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 16.04.05 until 22.04.05 (both dates inclusive) and covers the revolutions 306, 307 & 308.

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 Center field (RA 17:45:40.00; DEC -29:00:28.0); the Galactic Bulge region (RA 17:45:36.00; DEC -28:55:60.0); the Galactic Plane and the Scutum Arm of the Galaxy. The activities consisted of raster and hexagonal dithering; GPS 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.

No slews were missed from the Timeline during this period.

The fuel consumption over the period between 14/04/2005 and 22/04/2005 was 0.2024 kg. The remaining propellant is in the order of 161.7421 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.

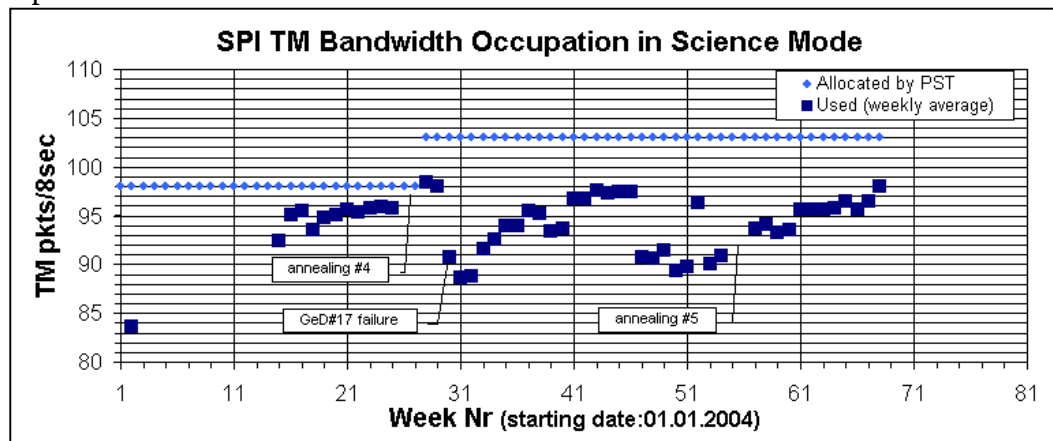
3.2 Payload

3.2.1 SPI

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

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 98 pkts/cycle average. The workaround to the TM leakage anomaly (INT_SC-107) has been resumed on revolution basis, since 11th April.

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.

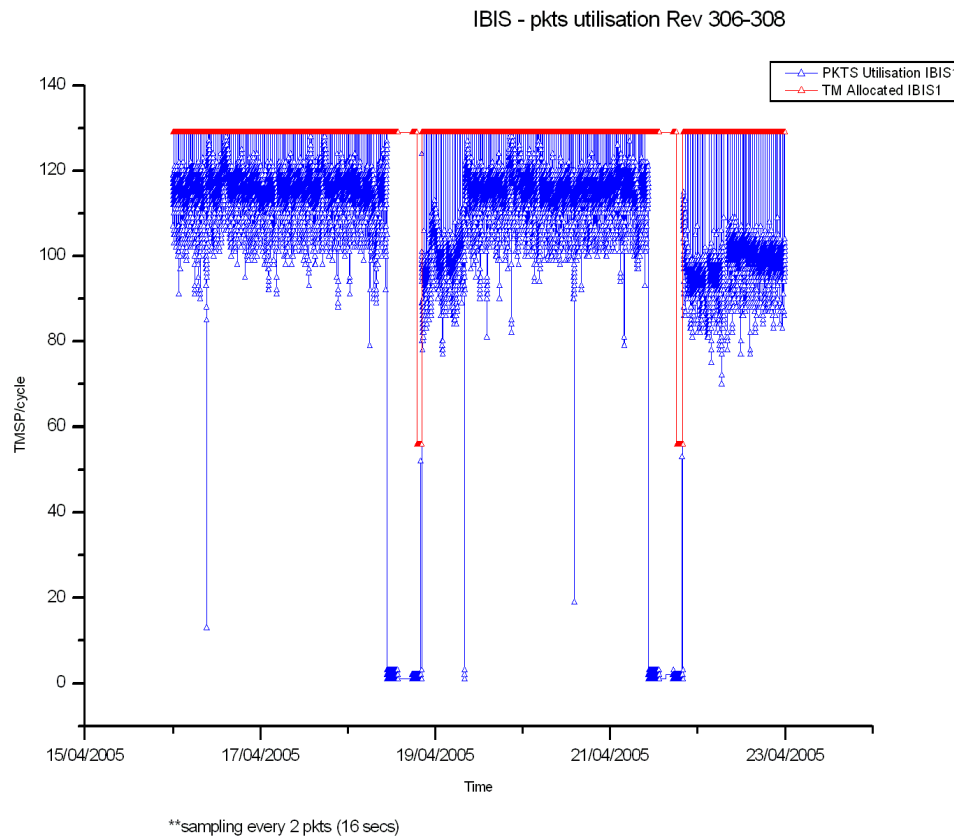
3.2.2 IBIS

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 111.95 TMPS/cycle, down 1.03 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 period, all 259 planned science pointings for OMC were executed.

The TM parameter T5016 OMC LENS TEMP1 went out of limits Warning Low several times throughout the week, but always returned within limits after a few minutes (between 3-7 minutes). In addition, on 2005-04-17 at 03:38:49Z an under-temperature was detected on this thermistor by the SECL task, resulting in an issuing of the TCs to close the TSW OMC LNSA, which was already closed.

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 excellent this week, well above the system performance requirements, 271 pointings were executed correctly, none were lost. There were only occasional packets lost due to hits on the line.

4.1 Mission Operations Centre

The performance of the MOC was excellent this week, with no pointings lost.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. There were few occasions when the line from REDU dropped, probably due to hits on the line, but apart from that nothing.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

Mission planning for revolution 315 generated and sent to MOC. POS's for revolutions 311 to 314 were regenerated to accommodate a change of the JEM-X high voltage setting. No ToO request was received. PSF's up to rev 315 have been received. TSF for rev 308 and 309 were received.

2. Observation status

ECS's up to rev 299 including the previously missing rev 277. Corresponding OCS's were sent to ISDC. Rev. 277 was basically scientifically a lost revolution since the instruments were switched off due to high background radiation. Potential extra time to be added for this revolution is still under discussion. No other extra time has been credited.

3. ISOC science data archive

The major achievement this week is the full functioning of the very large disk arrays. It consists of one volume of 4 Tbytes. The population of this volume has started.

4. ISOC system

The version 10.8.2 of the ISOC system that was installed last week has been used without problems this week. There has been major effort put into preparing to move the ISOC web pages, both external and internal ones to a new dedicated server at ESAC. Also the ISOC configuration control system will move at the same time. This work has progressed as planned. The intention is to move the web pages early next week. A notification to users of the web pages will be broadcast when the system has been checked out after the move. The INTEGRAL help desk system will also move but this will happen later.

5. Problems

The problem reported last weeks with unavailable science staff in ISOC, is still not yet fully resolved. For one company the finalisation is still pending.

4.3.2 ISDC

Status of ISDC observation processing on 25/04/2005:

- Latest Standard Analysis completed: observation 02201410002 (PSR B1509-58, Revolution 279-280) on 25/04/2005
- Latest products archived: observation 02297000013 (CAS A, Revolution 261-269) on 23/03/2005
- Latest observation products sent to the observer: observation 02297000013 (CAS A, Revolution 261-269) on 24/03/2005

5 Special Events

6 Anomalies

There were a number of problems that impacted the operations:

- On DoY 109, Network reported Integral on a split pass ending at 01:13Z and starting again at 02:16Z. This was apparently due to corrupted STDMS sent from NCTRS-A; when sent from NCTRS-B, the problem resolved.
- On DoY 109, at 20:12Z there were several TM drops, GFCC reported Reed Solomon Alarms.
- On DoY 110, at 04:41Z there were several TC & TM drops, GFCC reported hits on line. TC and TM links were back at 04:48Z
- On DoY 111, at 05:15Z "TMDS main, idda, ERROR, software, error sending data to ISDS" was reported in the Event Logger. The TM flow was back to nominal at 05:16Z.
- On DoY 111, at 13:35 a drop in TM bad frame from DSS-16 was reported.
- On DoY 111, at 22:33Z there were several drops in the TM from REDU. It was fixed by a Stop'n'Restart of links to REDU by Network.

No new anomaly report was entered into the ARTS system.

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 May.

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 306

The observations in revolution 306 began with a raster dithering observation of the Galactic Center field (RA 17:45:40.00; DEC -29:00:28.0) performed for ~1hr, 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. The raster dithering observation of the Galactic Center field was then resumed and performed for the remaining ~57 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 307

The observations in revolution 307 began with 17 pointings of a GPS performed for ~12 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 raster dithering observation of the Galactic Center field (RA 17:45:40.00; DEC -29:00:28.0) was then performed for the remaining ~46 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 308

The observations in revolution 308 consisted of 16 pointings of a GPS lasting ~11 hours, followed by a grid observation of the Scutum Arm of the Galaxy, performed for the remaining ~49 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.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2005-04-01T04:22:03.000Z	162.1202	F	Automatic TM processing.
2005-04-03T19:15:22.000Z	162.1045	F	Automatic TM processing.
2005-04-05T05:45:34.000Z	162.0605	F	Automatic TM processing.
2005-04-06T19:05:46.000Z	162.0495	F	Automatic TM processing.
2005-04-07T03:56:51.000Z	162.0269	F	Automatic TM processing.
2005-04-09T18:55:29.000Z	162.0095	F	Automatic TM processing.
2005-04-11T05:15:09.000Z	161.9784	F	Automatic TM processing.
2005-04-12T18:43:53.000Z	161.9711	F	Automatic TM processing.
2005-04-14T05:01:01.000Z	161.9445	F	Automatic TM processing.
2005-04-15T18:31:38.000Z	161.9368	F	Automatic TM processing.
2005-04-17T04:38:13.000Z	161.8691	F	Automatic TM processing.
2005-04-18T18:14:09.000Z	161.8549	F	Automatic TM processing.
2005-04-19T03:08:34.000Z	161.8321	F	Automatic TM processing.
2005-04-21T18:05:29.000Z	161.7674	F	Automatic TM processing.
2005-04-22T07:26:26.000Z	161.7421	F	Automatic TM processing.

This report was generated Fri Apr 22 08:00:21 GMT 2005

8.3 Detailed Satellite Information

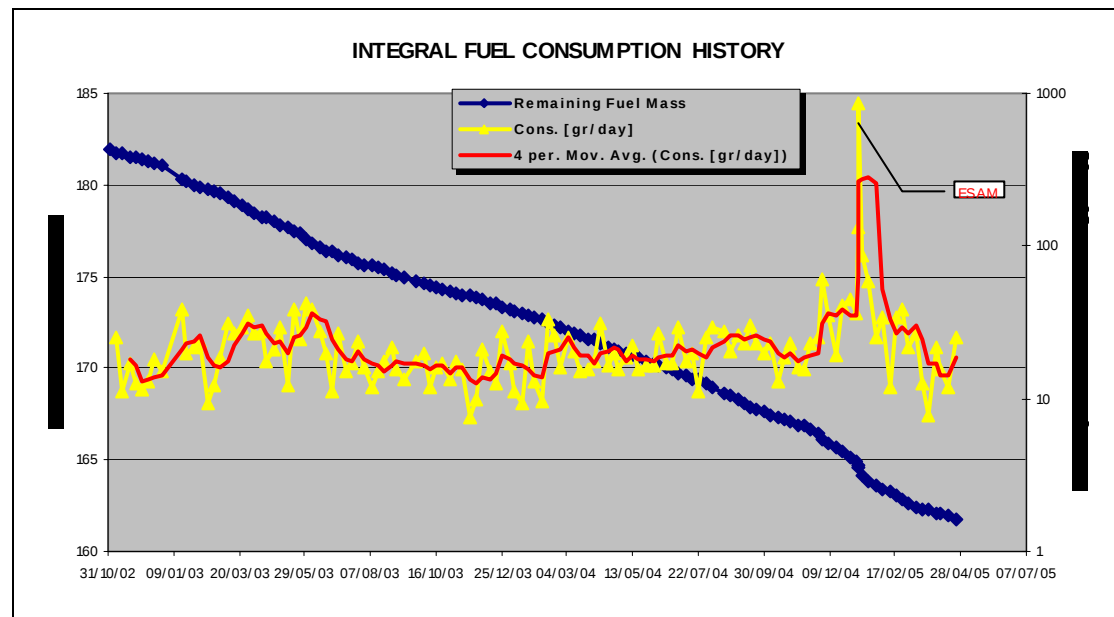
This section contains some detailed information concerning the various subsystems of the satellite and instruments.

8.3.1 AOCS SUMMARY OPERATIONS REPORT, 16/04/2005 - 22/04/2005

AOCS operations were executed from the Automatic Timeline.

During this period, 148 Open Loop Slews, 123 Closed Loop Slews and 5 Momentum Bias were executed. No slews were missed.

The fuel consumption over the period between 01/11/2002 and 22/04/2005 is reported in the plot below.



16/04/05 (Day of Year 106, Revolution 306)

Nothing to report.

17/04/05 (Day of Year 107, Revolution 306)

Nothing to report.

18/04/05 (Day of Year 108, Revolution 306-307)

Nothing to report.

19/04/05 (Day of Year 109, Revolution 307)

Nothing to report

20/04/05 (Day of Year 110, Revolution 307)

Nothing to report.

21/04/05 (Day of Year 111, Revolution 307-308)

Nothing to report.

22/04/05 (Day of Year 112, Revolution 308)

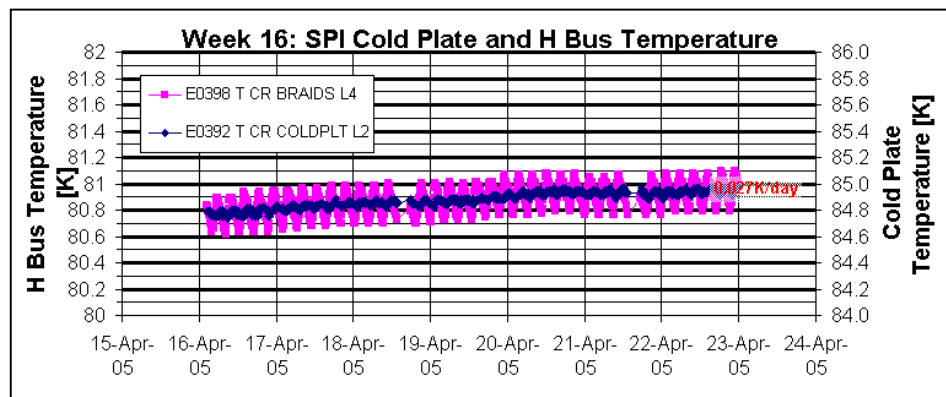
Nothing to report.

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 the expected positive drift.

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



DPE & IASW:

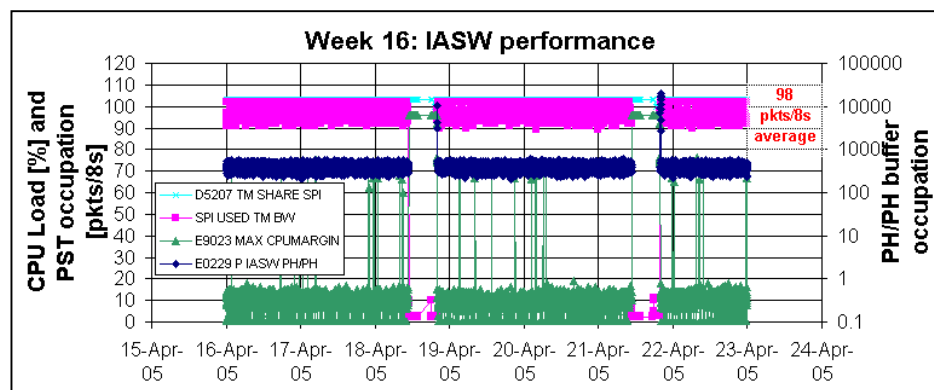
The IASW performance is nominal. The PST TM bandwidth allocation was 103 pkts/cycle in the science windows; the actual TM bandwidth usage is:

- 102 pkts/cycle peak (1 pkt/cycle is unused due to TM leakage problem, see after);
- 98 pkts/cycle average in science mode.

The temporary workaround (INT_OR_0190) to the TM leakage anomaly (AR INT_SC-107), applied at every revolution, has been resumed since 11th April.

A software patch to fix both the TM leakage malfunction and the missed belts entry ACS HV switch off malfunction (INT_SC-115) is ready; however due to an anomaly in the DPE used for ground testing, validation of the patch is not progressing.

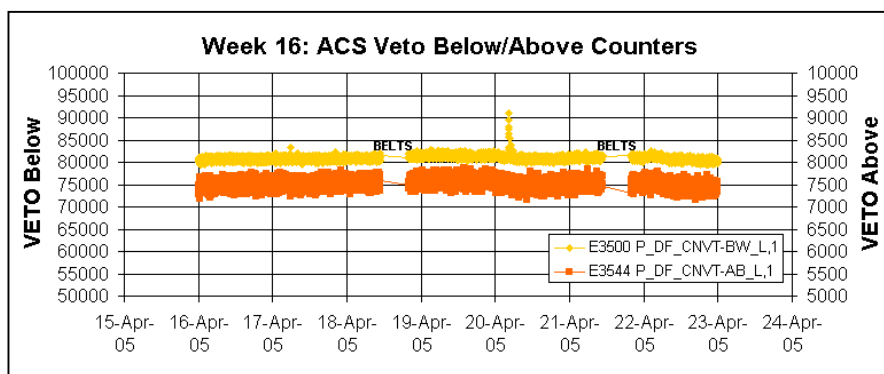
The following plot shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



ACS:

The performance of the ACS is nominal.

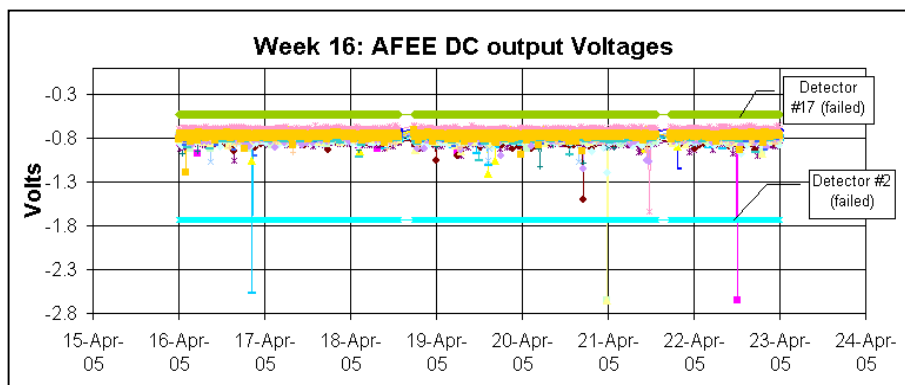
The following plot shows the ACS overall count rate evolution during the reporting period.



AFEE and Germanium Detectors:

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

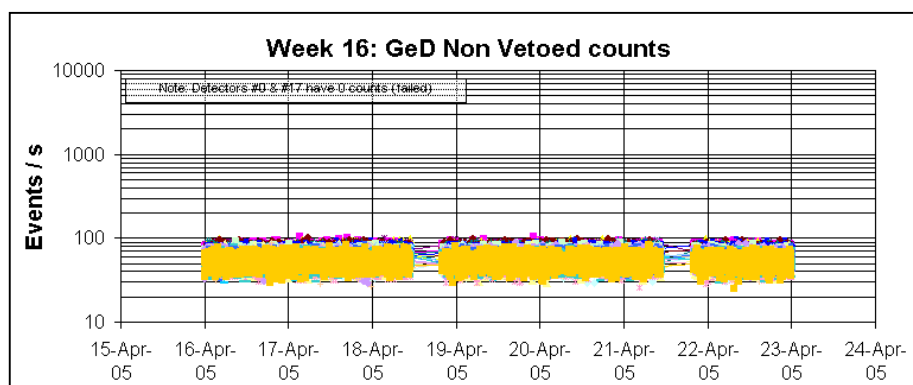
The following plot shows the AFEE dc output signals during the reporting period.

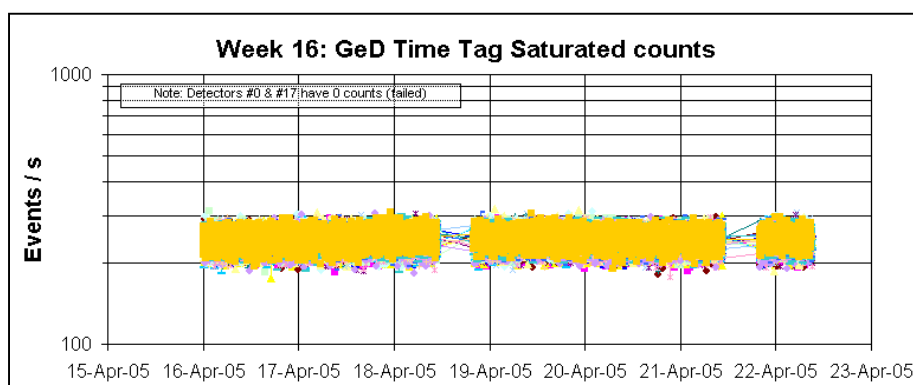
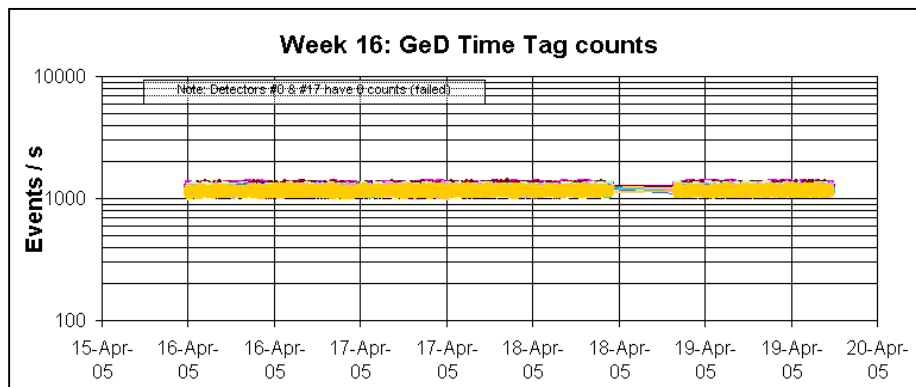


DFEE:

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: due to problems in the data retrieval system some plot may be affected by large gaps).



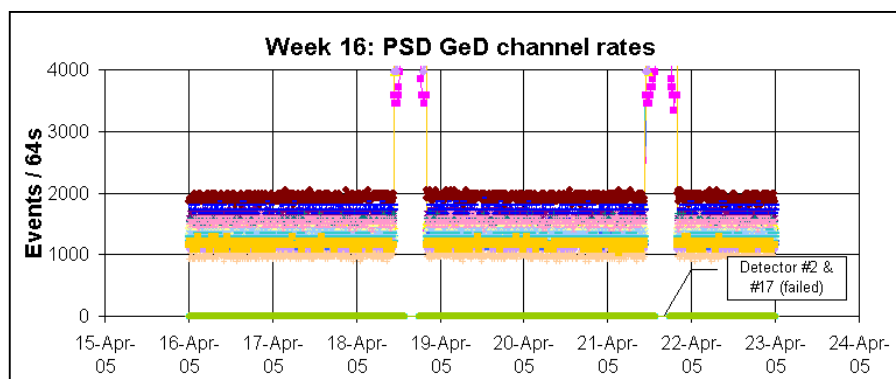


PSD:

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.



SPI DAILY EVENTS:

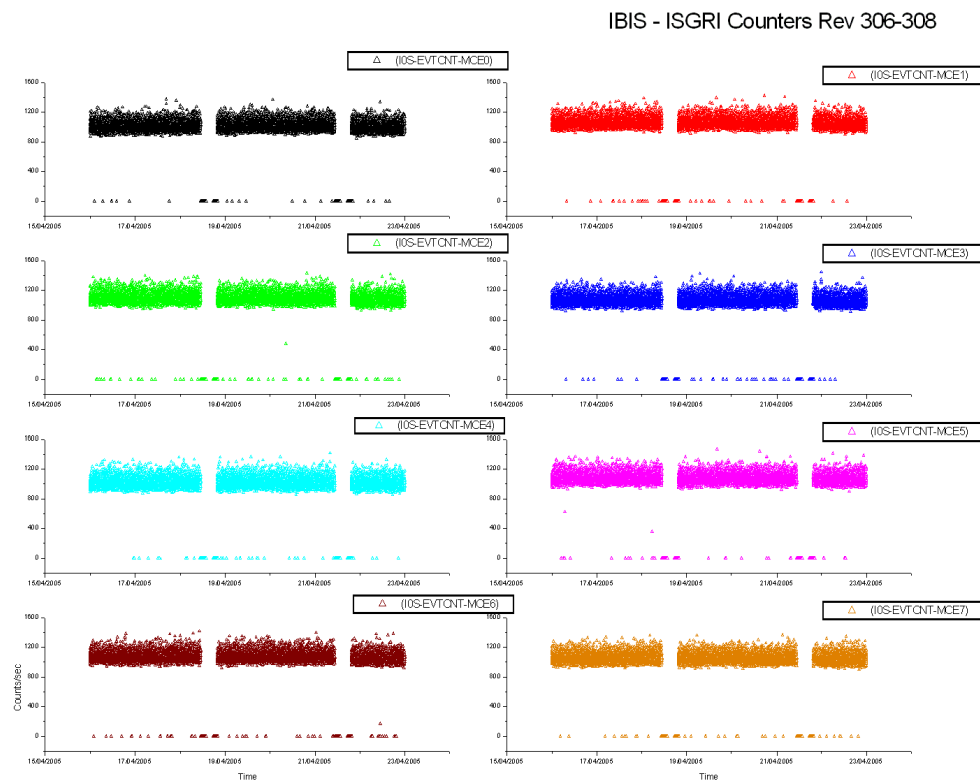
NOTE: The events log is extracted from the revolution pass summary.

DOY Time	Event
105 - 20:36	Man. PST update, INT_OR_0190
110 - 23:47	TM E0359 & E0360 00L, back in limits @ 23:58
111 - 20:13	Man. PST update, INT_OR_0190
112 - 12:02	TM E0350 00L, back in limits @ 12:09

8.3.3 IBIS Operations

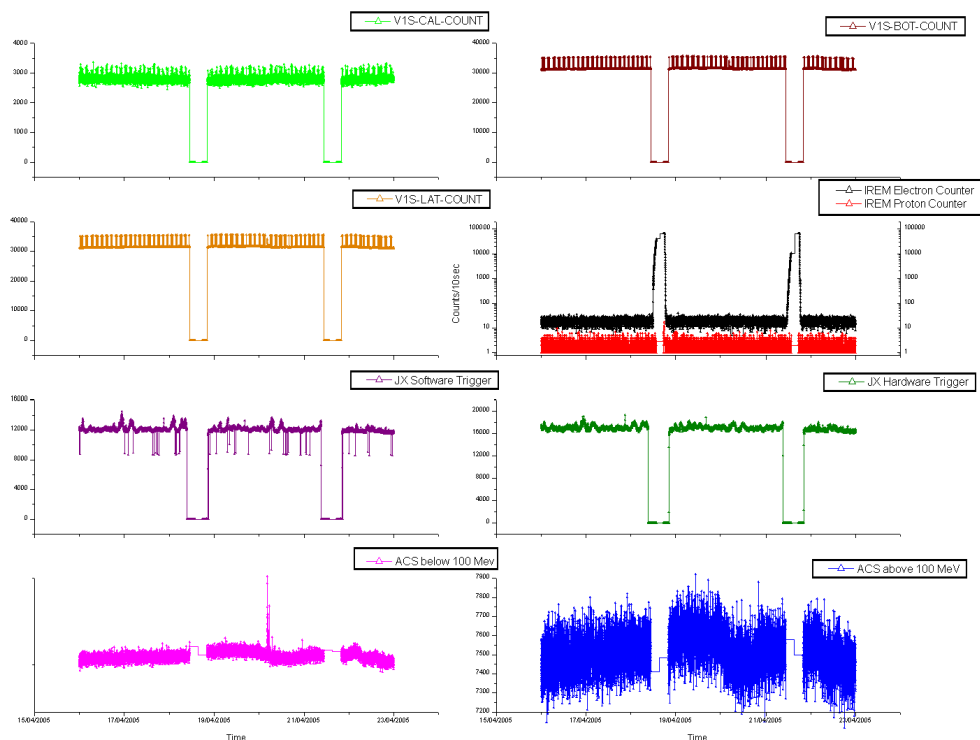
IBIS Events Counters Plots.

ISGRI Counters:



VETO vs Payloads Counters:

IBIS-VETO vs Payloads Counters Rev 306-308

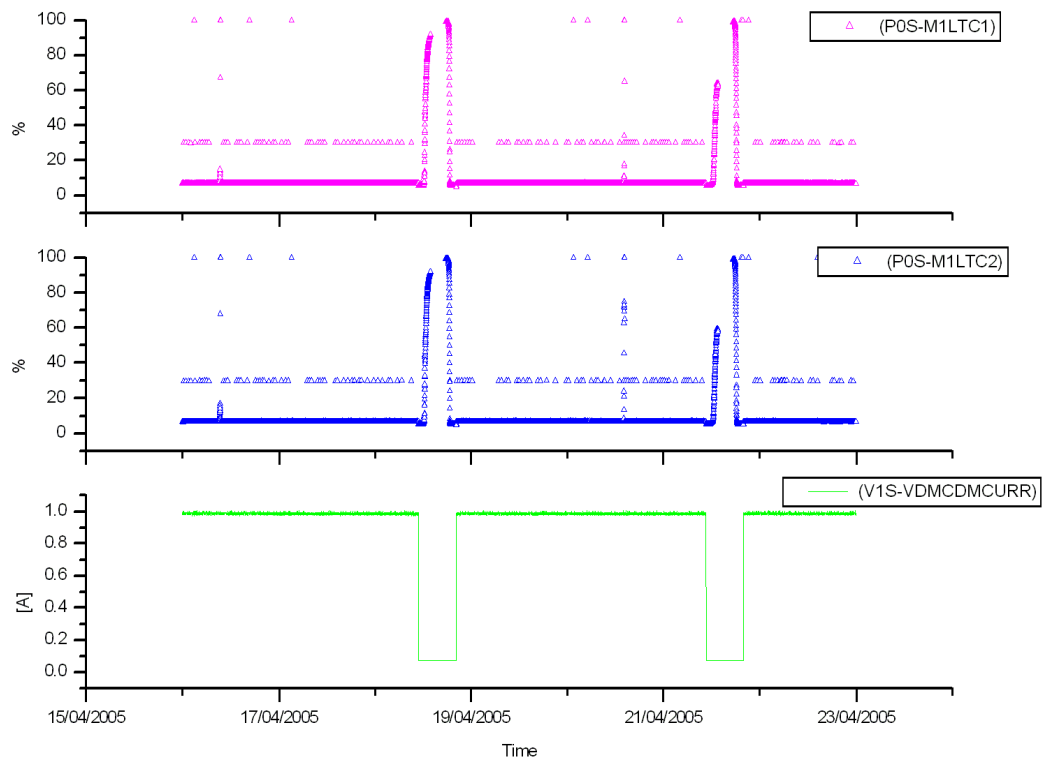


**with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec sampling every 5 pkts (40 sec)

The week was characterised by low solar activity.

Veto Current:

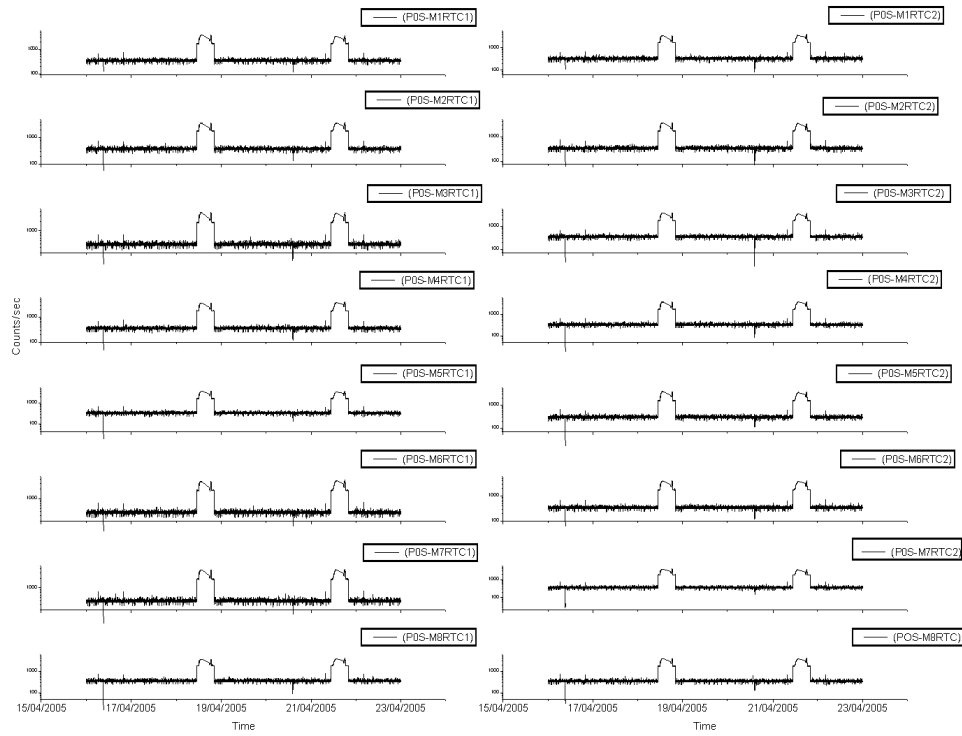
IBIS-VETO Current & PICsIT dead times Rev 306-308



**sampling every 4 pkts (32 secs)

Picsit Counters:

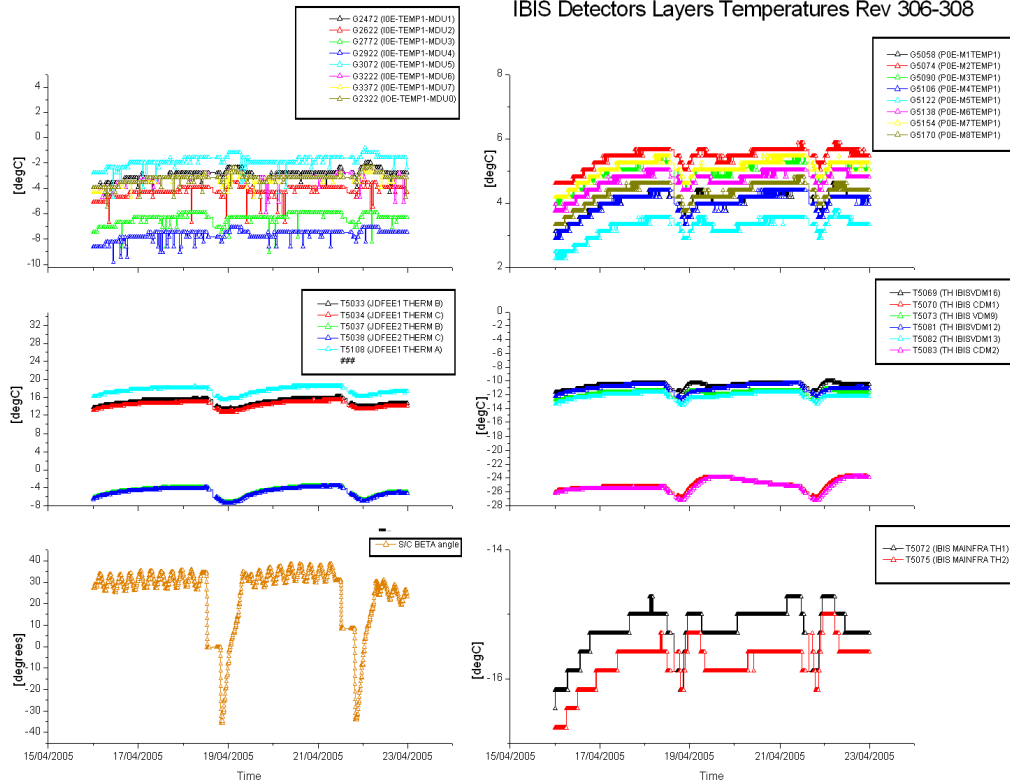
IBIS - PICsIT Counters Rev 306-308



**sampling every 4 pkts (32 secs)

IBIS Detectors Layers Temperatures:

IBIS Detectors Layers Temperatures Rev 306-308



**sampling every 8 pkts (64 secs)

IBIS daily report :

DoY 2005.106 (16/04/2005):

At 09:08Z, TM families G5072 and G5068 (POS-MiF #2 and #1 ERRF) failed SCC.
At 09:19Z, TM families G5002 and G5003 (POS-MiRTC #1 and #2) went OOL 'low-low'.
At 09:22Z 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 to within their limits.

DoY 2005.107 (17/04/2005):

Nothing to report.

DoY 2005.108 (18/04/2005):

At 10:51Z TM G8015 (28V PMT set by IASW) went out of limit 'high' with the value of 29.4V (limit value). It went back inside limit at 20:16Z. As this happened inside radiation belts, according to V-VLT-1 no action was taken.

At 13:16Z TM G5023 (PDM5 counter semimodule 2) went OOL 'high'. It toggled in and out for some minutes. According to P-CNT-1, as this happened inside radiation belts, no action was taken.

At 20:00Z G2014 (overflow of the noisy pixel address register in MCE2) failed SCC. According to I-OVF-1, no action was taken.

DoY 2005.109 (19/04/2005):

Nothing to report.

DoY 2005.110 (20/04/2005):

At 14:08Z, TM families G5068 and G5072 (PDMi semi-module #1 and #2 FIFO error flag) failed SCC.
At 14:14Z, TM families G5002 and G5003 (PDMi counter semi-module #1 and #2) went OOL 'low-low'.
At 14:17Z, 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 to within their limits.

DoY 2005.111 (21/04/2005):

Nothing to report.

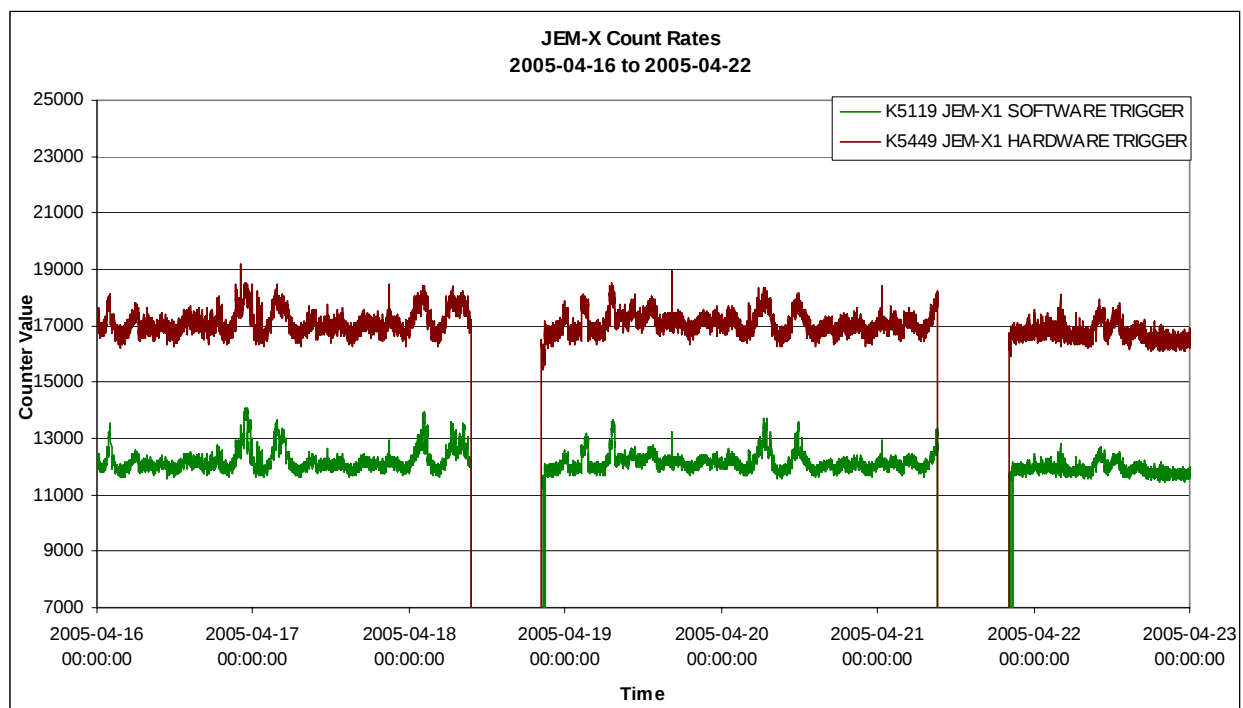
DoY 2005.112 (22/04/2005):

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.

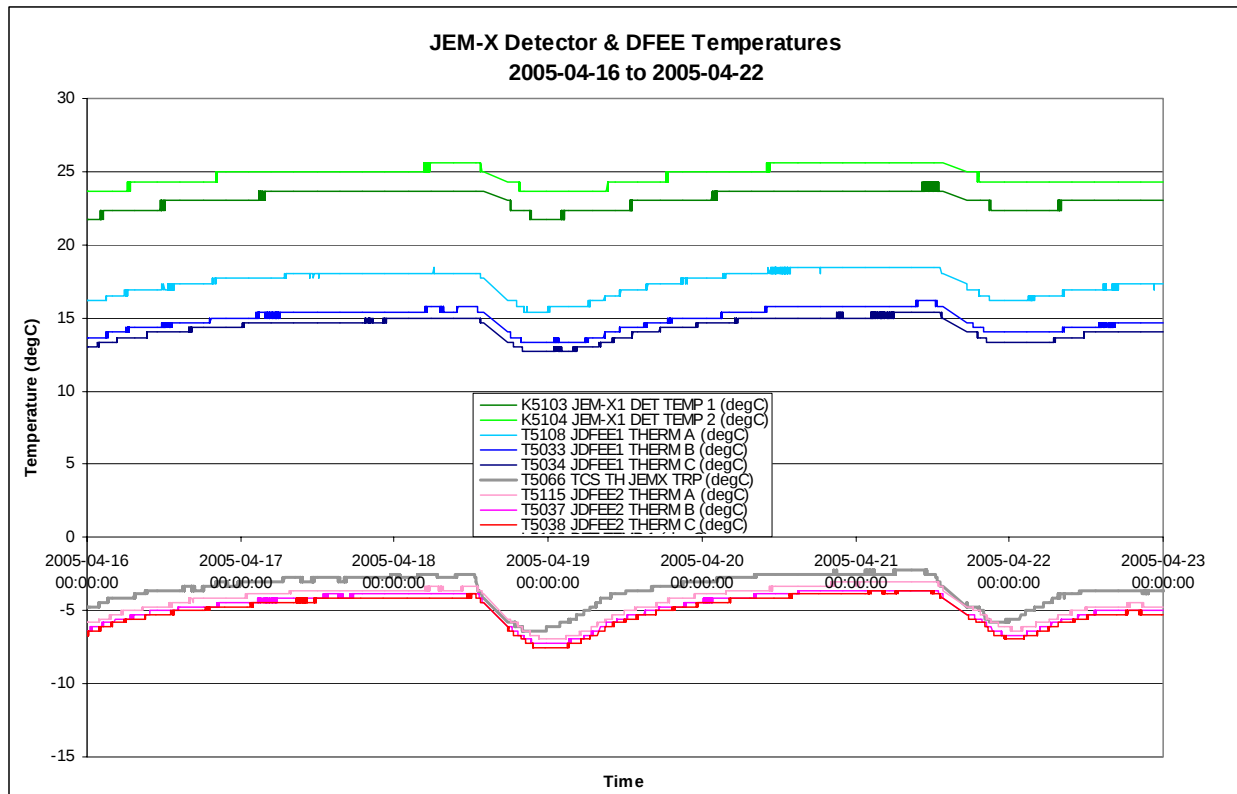


8.3.4.2 JEM-X Temperatures

JEM-X Detector and DFEE temperatures, 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

2005-04-16 (DOY 106, Rev 306)

Nothing to report.

2005-04-17 (DOY 107, Rev 306)

At 21:00:13Z the TM parameter K5136 BUFFER LOSS went out of limits High (value = 164), but then returned within limits at the next TM cycle.

2005-04-18 (DOY 108, Rev 306-307) to 2005-04-22 (DOY 112, Rev 308)

Nothing to report.

8.3.5 OMC Operations

2005-04-16 (DOY 106, Rev 306)

The TM parameter T5016 OMC LENS TEMP1 went out of limits Warning Low (value = -10.28degC) on 8 occasions (at 01:38:06Z; 03:13:18Z; 04:58:22Z; 06:47:18Z; 08:38:54Z; 10:29:26Z; 12:25:42Z and 14:44:14Z). On each occasion, it returned within limits within a few minutes.

2005-04-17 (DOY 107, Rev 306)

At 03:38:49Z OEM Apid 129 ID 241 MS EVE SECL OEM1 was issued, indicating that the SECL task had issued the TCs to close the TSW for OMC Lens Barrel Heater loop A to ensure that this heater loop was enabled. The status of TSW OMC LNSA (TM parameter T1023) was already CLOSE and therefore no change in status occurred as a result of the TCs issued by the SECL task.

The TM parameter T5016 OMC LENS TEMP1 went out of limits Warning Low (value = -10.28degC) on 7 occasions (at 03:35:34Z; 06:26:46Z; 08:46:38Z; 11:05:18Z; 13:07:58Z; 15:17:58Z and 17:54:38Z). On each occasion, it returned within limits within a few minutes.

2005-04-18 (DOY 108, Rev 306-307)

The TM parameter T5016 OMC LENS TEMP1 went out of limits Warning Low (value = -10.28degC) on 3 occasions (at 07:55:26Z; 10:31:26Z and 13:00:38 Z). On each occasion, it returned within limits within a few minutes.

2005-04-19 (DOY 109, Rev 307)

The TM parameter T5016 OMC LENS TEMP1 went out of limits Warning Low (value = -10.28degC) on 7 occasions (at 10:19:42Z; 12:02:06Z; 14:07:02Z; 16:13:10Z; 18:11:26Z; 20:20:54Z and 23:09:42Z). On each occasion, it returned within limits within a few minutes.

2005-04-20 (DOY 110, Rev 307)

The TM parameter T5016 OMC LENS TEMP1 went out of limits Warning Low (value = -10.28degC) on 5 occasions (at 13:39:42Z; 16:25:26Z; 19:02:30Z; 21:28:54Z and 23:47:58Z). On each occasion, it returned within limits within a few minutes.

2005-04-21 (DOY 111, Rev 307-308)

The TM parameter T5016 OMC LENS TEMP1 went out of limits Warning Low (value = -10.28degC) on 1 occasion (at 17:23:34Z), returning within limits after a few minutes.

2005-04-22 (DOY 112, Rev 308)

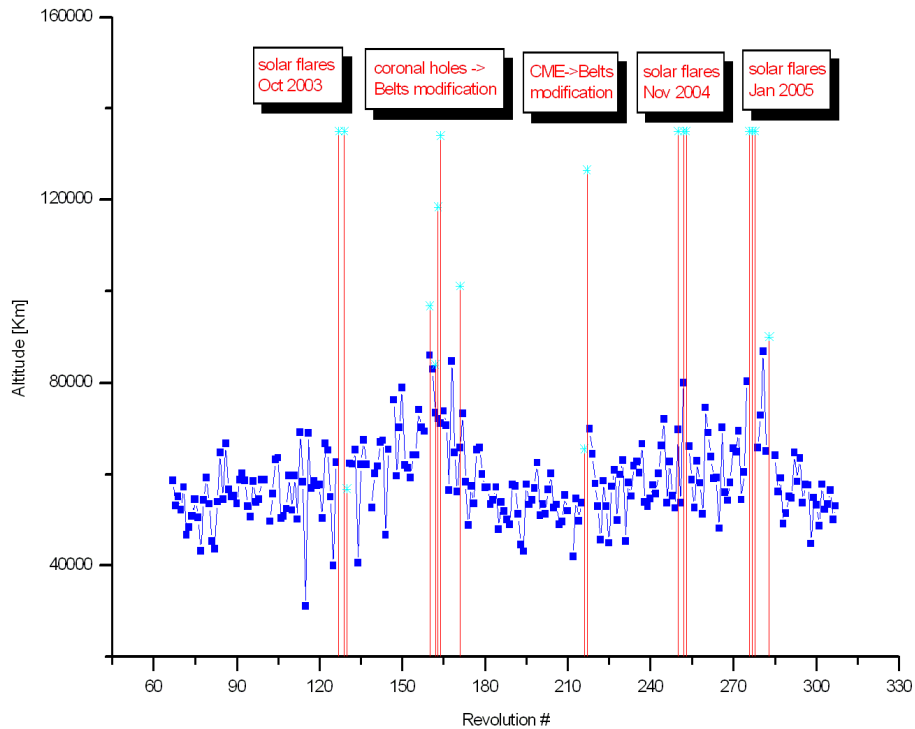
The TM parameter T5016 OMC LENS TEMP1 went out of limits Warning Low (value = -10.28degC) on 7 occasions (at 10:28:38Z; 12:08:46Z; 14:17:02Z; 16:33:10Z; 18:54:38Z; 21:24:06Z and 23:27:02Z). On each occasion, it returned within limits within a few minutes.

Note that the low OMC lens temperatures are caused by the Satellite Pitch angle (PLM cold case) selected during much of the reporting period.

8.3.6 IREM Operations

Radiation Belts Entry

Evolution of Radiation Belt Entry 2004-2005



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]
306	RAD_ENTR R 2005-04-18T10:51:30Z	2005-04-18 12:02:38	50130.7	2005-04-18 11:36:27	53573
307	RAD_EXIT R 2005-04-18T20:03:51Z	2005-04-18 18:53:26	<30427.6	2005-04-18 18:46:27	28359
307	RAD_ENTR R 2005-04-21T10:38:28Z	2005-04-21 11:33:34	53073.7	2005-04-21 11:28:06	53404
308	RAD_EXIT R 2005-04-21T19:51:02Z	2005-04-21 18:33:58	27778.5	2005-04-21 18:38:06	28523

Reference

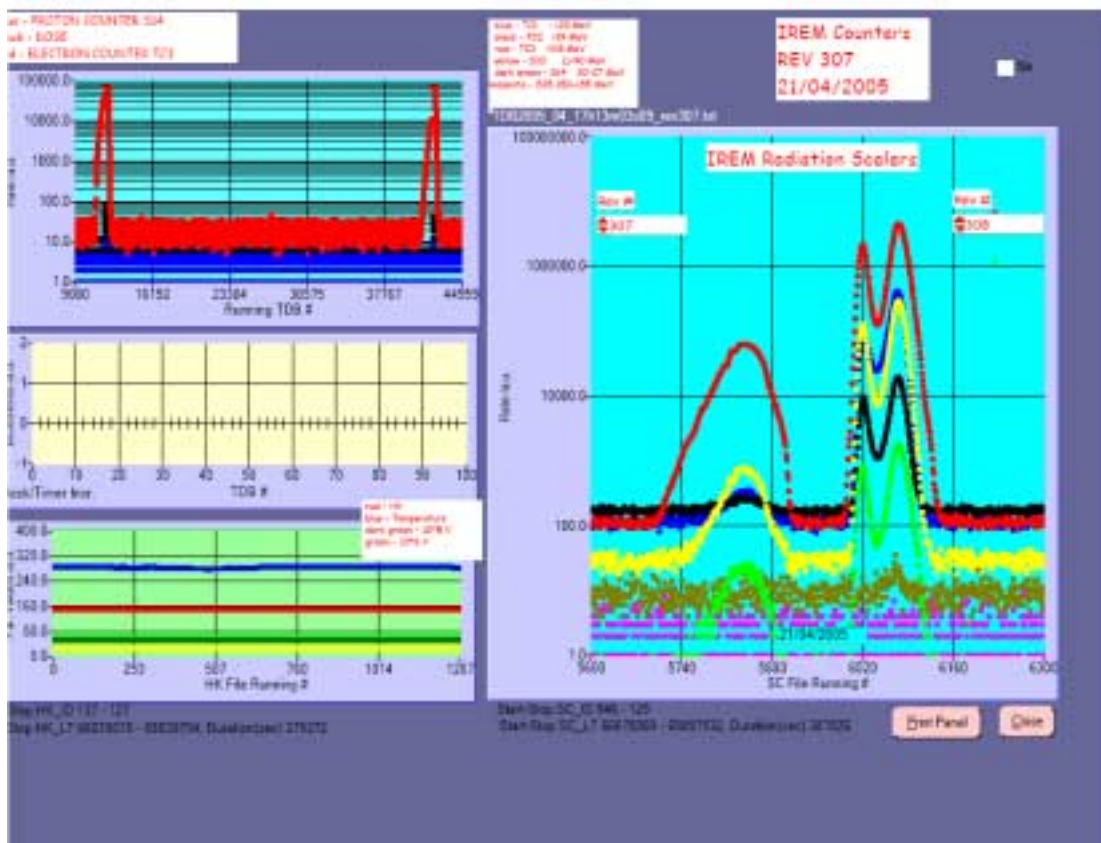
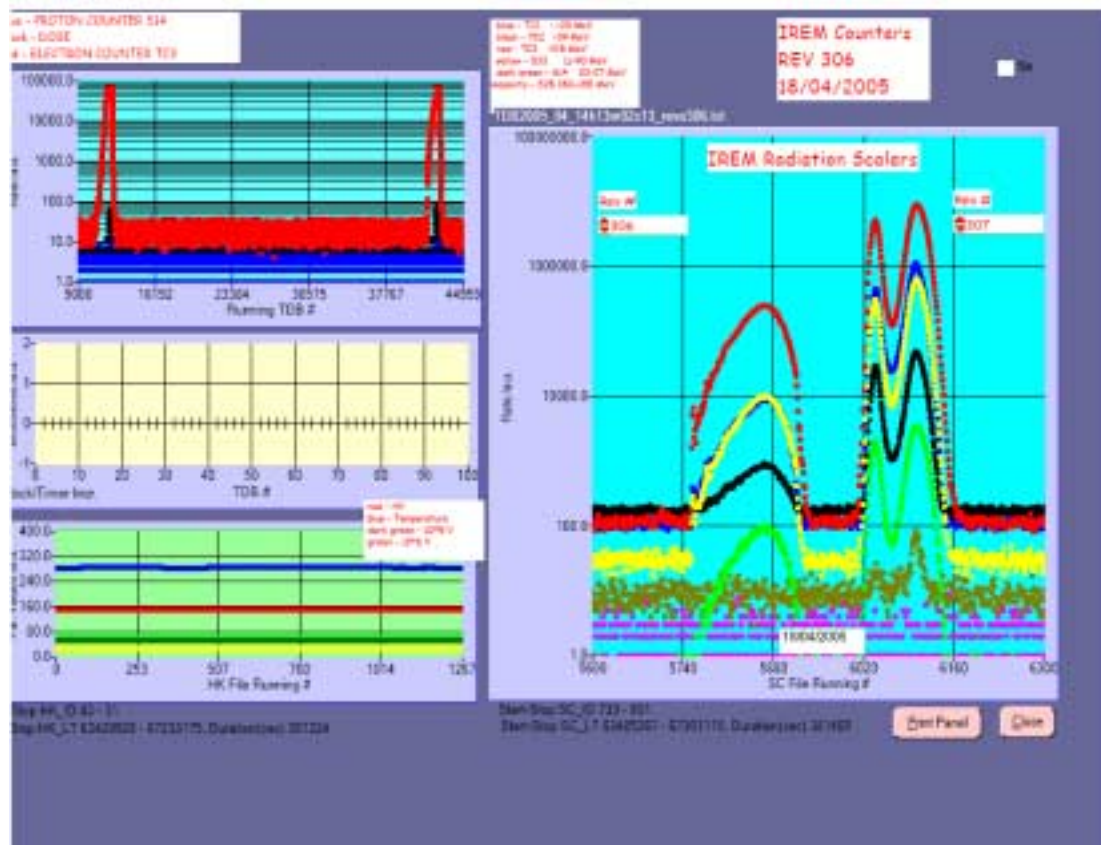
Very small error vs reference (less than 10 minutes)

Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

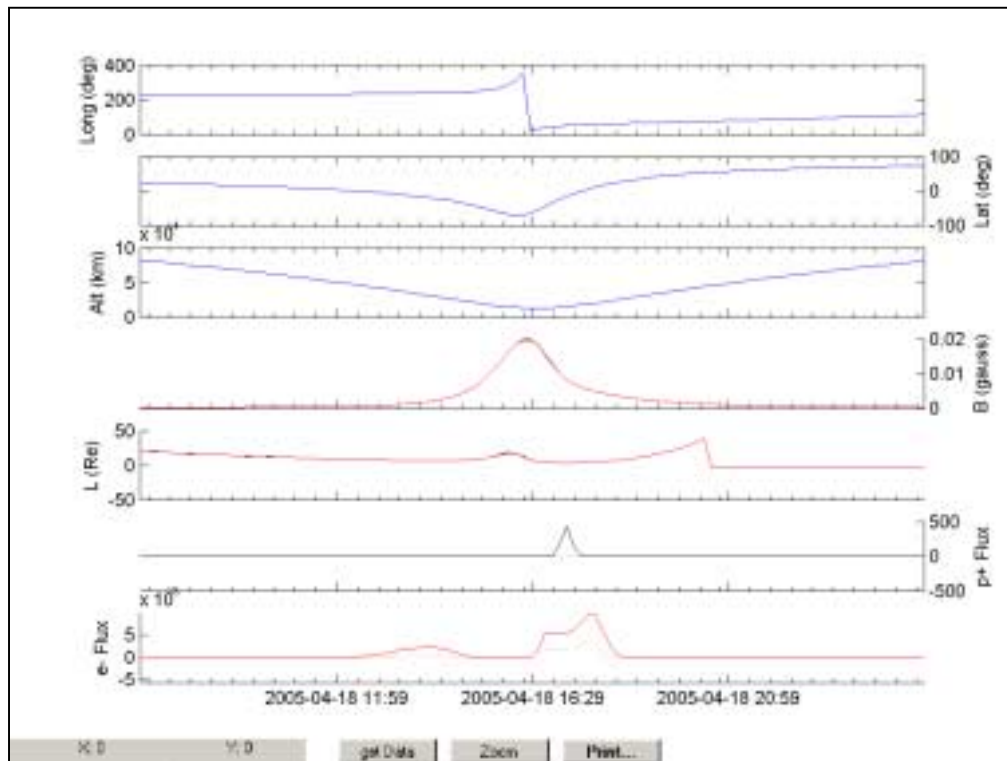
Radiation Spike

IREM radiation counters

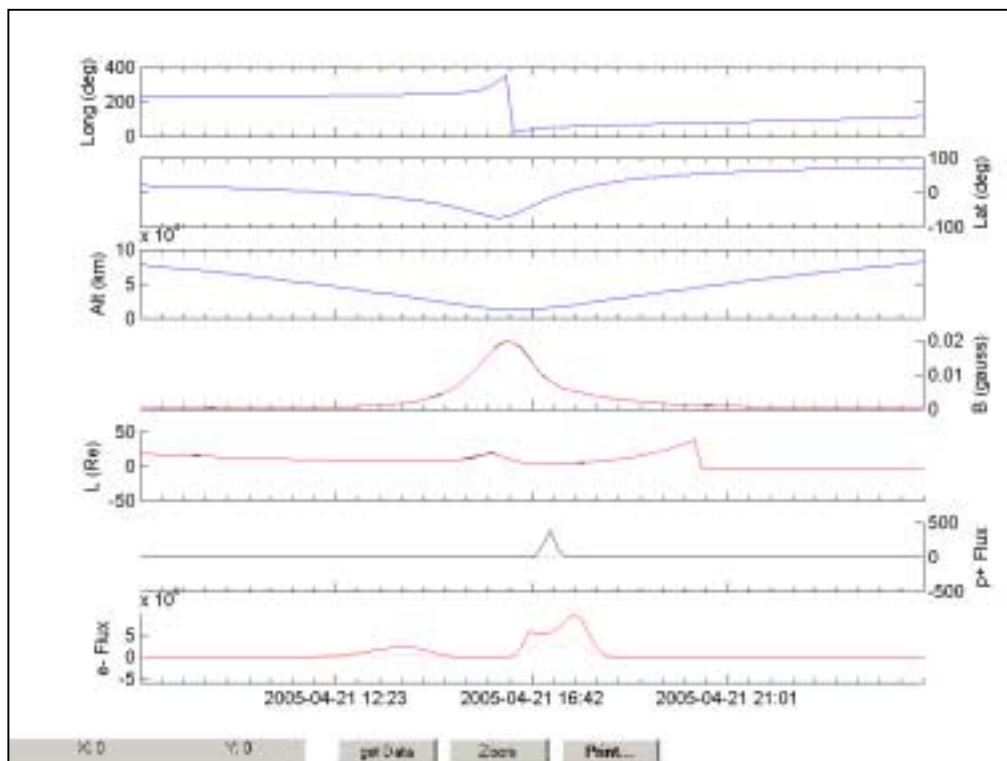


IREM Predicted Radiation Belt Passages.

Rev 306:



Rev 307:



SEC-GOES Observed Particles Fluxes.

