

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 293
Week 18
05.05.08
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 26.04.08 until 02.05.08 (both dates inclusive) and covers the revolutions 676, 677 and 678.

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 consisted of three raster dithers of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), a hexagonal dither (ToO), of 4U0115+63 (RA 01:18:31.90, DEC +65:44:24.0), an abbreviated OMC Flat Field calibration at attitude (RA 09:52:00.00, DEC +17:06:00.0) and a hexagonal dither of Mrk 421 (ToO) (RA 11:03:47.79, DEC +37:48:25.8)

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.

The Eclipse season was completed on 26/04/2008. All the eclipse passages were nominal from an AOCS point of view.

As part of the AOCS preparation for the summer eclipse season were verified for revolutions 675 the load of the TT sequence to re-enable the IMU Auto Switch-Off function in the ACC and the Eclipse ACC\FDE\FCE timers.

As part of the AOCS reconfiguration after the summer eclipse season, the ACC\FDE\FCE eclipse timers were stopped and the AMD thresholds were set to their non-eclipse season values at the end of rev 676

No slews were missed from TL, during the observation period. One pointing execution was not completely executed due to the problem on FDS.

The fuel consumption over the period between 03/05/2008 and 09/05/2008 was 0.1496 Kg. The remaining propellant is in the order of 140.5187 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.

The last eclipse of the 12th eclipse season took place on 26th April, the relevant details are given below

Date	Penumbra Entry	Umbra Entry	Umbra Exit	Penumbra Exit	Total Eclipse Duration	Umbra duration Only	Observed DOD 1	Observed DOD 2	Recharge Duration Battery 1	Recharge Duration Battery 2
26/04/2008	02:20:48	02:24:34	02:35:12	02:38:39	13.3396	0:17:51	1.24	1.22	0:42:16	0:41:44

From the EPS point of view all eclipse passages throughout eclipse season #12 were entirely nominal. Following the last eclipse the battery full charge rate was restored to C/26 (0.9A) and the MRU timer left with end of charge enabled.

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 has been identified.

The PST Allocation was over-subscribed by 3 packets to SPI for during the Instrument window for the entire reporting period.

Following the last eclipse of the 12th eclipse season on 26th April the on-board monitoring list for use outside of the eclipse season was loaded.

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

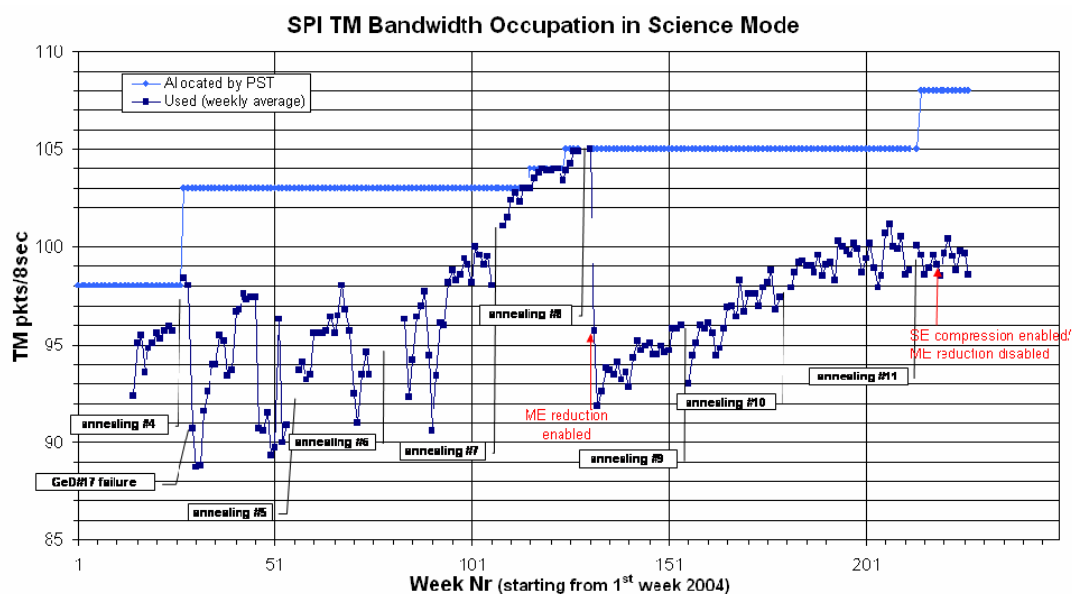
Following the 11th annealing, which ended on 30th January, the overall status of the gamma-ray spectrometer is nominal, except for the Ge detector #12 which, although its energy resolution improved since the previous annealing, is still showing a slightly degraded energy resolution compared to the other detectors and is therefore operating at a lower HV setting of 3.5kV (instead of 4kV). Detector #2 is failed since 06/12/2003 and detector #17 since 17/07/2004.

The Stirling compressors are working nominally, maintaining the Germanium detectors at 80 +/-1K.

The first eclipse in the 12th eclipse season occurred on 30/03/2008. Eclipse operations for SPI have been progressing nominally. The last eclipse of this season occurred on 26/04/2008.

During science operations, the instrument was kept in photon-by-photon mode with spectra TM enabled. The assigned TM bandwidth in the science observation windows was 108 packets/cycle. The over-allocated PST with an additional 3 packets/cycle for SPI was used however the Broadcast Packet TM allocation was not updated. The average telemetry occupation in the science window was 98.6 packets/cycle.

The following plot shows the assigned and the average occupation of the SPI TM bandwidth.



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

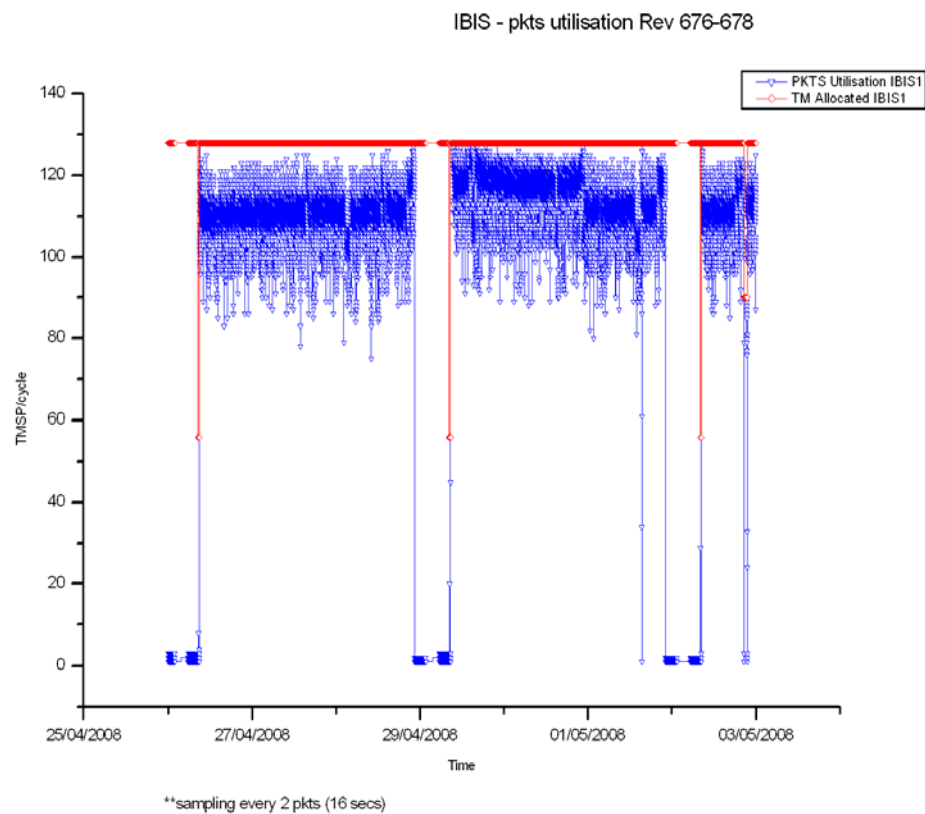
3.2.2 IBIS

The overall status of the unit is nominal.

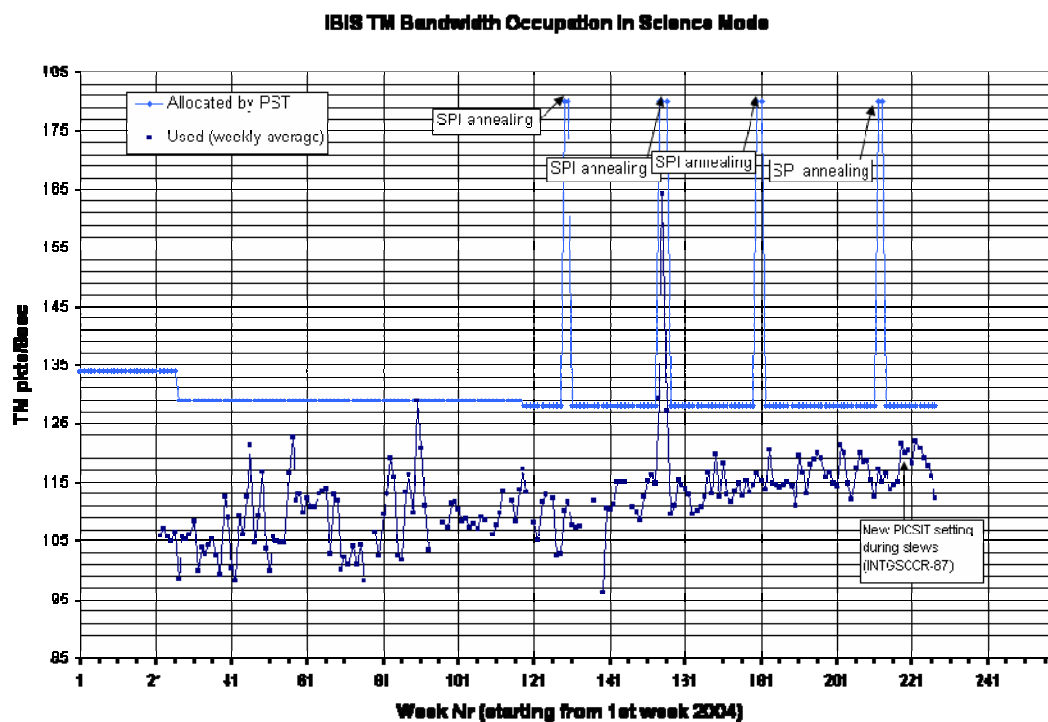
The first eclipse in the 12th eclipse season occurred on 30/03/2008. Eclipse operations for IBIS have been progressing nominally. The last eclipse of this season occurred on 26/04/2008.

During the reporting period, the PST allocation to IBIS above the radiation belts was 128 packets/cycle. During the observation period, when IBIS was in science mode, the IBIS mean bandwidth utilisation was 112.37 packets/cycle (down 3.55 on last week) and the percentage of TM cycles in which the full bandwidth of 128 packets was used was 1.26%.

A plot of the IBIS TM utilisation during the observation period is shown below:



A plot of the IBIS weekly bandwidth utilisation since 2004 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 with a TM allocation of 8 packets/cycle. JEM-X2 was dormant (DPE OFF) with no TM slots allocated.

Note: Some more information concerning the JEM-X operations is provided in the Appendix.

3.2.4 OMC

The status of OMC is nominal.

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

During this reporting period, 129 of the 130 planned science pointings were executed nominally, 1 was shortened.

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

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 blank all week. There was a very low risk of solar flares.



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 Operational ground facilities performance was good this week. One pointing was lost due to ground problems. The overall performance was well over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was very good this week. The slew TPF update failed once, leading to the loss of a pointing.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week. There were however 2 occasions where the TM dropped from DSS-27, without impact, 1 occasion when the voice loop was not working, and the links to ISDC dropped once.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 683 and 684.

Observations have been planned for revolutions 679 to 683.

Revolutions 678 and 679 were re-planned on short notice

- the former while the revolution was ongoing - due to an urgent TOO on the flaring BL Lac object Mrk 421, which reached flux levels of several Crab at ultra-high energies.

New TSFs have been received for revolutions 678 and 679.

2. Observation status

New ECS files have been received for revolutions 659 and 667 to 670.

3. ISOC Science Data Archive

No news.

4. ISOC system

V19.1 is still in preparation. A major effort went into the investigation of file transfer problems, see below.

5. Problems

File transfer to MOC and ISDC is not working correctly at the time of writing. The exact reason is being traced currently but is apparently not in IFTS, instead it seems to be a problem in FTP setup (under control of OPS-E).

4.3.2 ISDC

Status of ISDC observation processing on 05/05/2008:

- Latest Standard Analysis completed: observation 05200260005 (mid-latitude 1, Revolutions 664) on 23/04/2008.

- Latest products archived: observation 05200680001 (4U0115+63, Revolutions 664) on 24/04/2008.

- Latest observation products sent to the observer: observation 05200320002 (X Per, Revolutions 662) on 25/04/2008.

5 Special Events

6 Anomalies

The following problems were reported this week that impacted operations.

- On DoY 121, at 20:57, the automatic TPF generation failed for slew 06770040. Subsequently, the recover schedule failed, as the wheel speeds were not suitable. FD were called in to perform a manual Reaction Wheel Bias, after which a recovery was performed. The Timeline was rejoined at 22:11:00. The impact was the loss of pointing 06770040.

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

7 Future Milestones

The following activity is foreseen in the next few weeks.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 676

The observations in revolution 676 consisted entirely of a raster dither of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), lasting ~56.8 hours.

Revolution 677

The observations in revolution 677 began with a hexagonal dither of the Gamma Ray Source 1915+105 (RA 19:15:11.50, DEC +10:56:44.0), lasting ~5.6 hours. They continued with a hexagonal dither (ToO), of 4U0115+63 (RA 01:18:31.90, DEC +65:44:24.0), lasting ~27.8 hours. Finally, a raster dither of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), lasting ~20.2 hours was performed until the end of the revolution.

Revolution 678

The observations in revolution 678 began with a raster dither of the Galactic Plane Region 2 (RA 07:13:42.62, DEC -10:43:25.4), lasting ~10.6 hours. They continued with an abbreviated OMC Flat Field calibration at attitude (RA 09:52:00.00, DEC +17:06:00.0), for ~0.5 hours. Finally, a hexagonal dither of Mrk 421 (ToO) (RA 11:03:47.79, DEC +37:48:25.8), lasting ~44.5 hours was performed, until the end of the revolution.

Throughout these observations, all instruments were in their nominal science modes, except JEM-X2, which is switched off. The TM allocation was IBIS 128; SPI 108; JEM-X1 8; JEM-X2 0; OMC 5, except during the Flat Field calibration from 2008-05-02T20:32:59Z to 2008-05-02T21:28:39Z when it was IBIS 90; SPI 88; JEM-X1 8; JEM-X2 0; OMC 63.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2008-04-17T07:49:23.000Z	141.0347	F	Automatic TM processing.
2008-04-18T16:12:22.000Z	140.9775	F	Automatic TM processing.
2008-04-20T07:35:22.000Z	140.9390	F	Automatic TM processing.
2008-04-21T15:58:55.000Z	140.9168	F	Automatic TM processing.
2008-04-23T07:21:47.000Z	140.9010	F	Automatic TM processing.
2008-04-24T04:12:13.000Z	140.8562	F	Automatic TM processing.
2008-04-24T16:10:06.000Z	140.8029	F	Automatic TM processing.
2008-04-26T00:49:38.000Z	140.7817	F	Automatic TM processing.
2008-04-26T06:54:58.000Z	140.7694	F	Automatic TM processing.
2008-04-27T15:58:46.000Z	140.7444	F	Automatic TM processing.
2008-04-29T06:14:50.000Z	140.7361	F	Automatic TM processing.
2008-04-29T14:42:27.000Z	140.6962	F	Automatic TM processing.
2008-04-30T21:58:22.000Z	140.6940	F	Automatic TM processing.
2008-05-02T01:02:24.000Z	140.6719	F	Automatic TM processing.
2008-05-02T06:02:57.000Z	140.6683	F	Automatic TM processing.

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, 26/04/2008 – 02/05/2008

The AOCS operations were executed from the Automatic Timeline.

During this period, 92 Open Loop Slews, 54 Closed Loop Slews and 9 Momentum Biases were executed (as reported by ACC).

No slews were missed from TL, during the observation period. One pointing was not completely executed due to a problem on TPF update on FDS and the consequent recovery for next slew update.

Summer Eclipse Season 2008 Summary

The AOCS eclipse operations were nominal. After the end of the season the ACC/FDE/FCE Eclipse Timers were stopped and the AMD thresholds were set to their non-eclipse season values. The complete eclipse times and IMUs usages are provided below:

Complete Eclipse Times

AOCS Eclipse Times														Summer 2008	
Date	LOS	AOS	ACC Eclipse Imminent	Eclipse Start					Eclipse End					Eclipse Duration	
				ACC	FDE	FCE	Penumbra	FSS Sun Out	Umbra	Umbra	FSS Sun In	Penumbra	FDE/FCE	ACC	
2008-03-30	03:48:00	07:37:00	02:49:20	03:31:38	03:42:39	03:43:23	03:49:00	ns	03:49:00	04:04:40	ns	04:04:40	04:10:43	04:14:40	0:15:40
2008-04-02	03:36:00	07:29:00	02:25:30	03:07:35	03:17:27	03:18:11	03:25:10	03:26:55	03:27:24	04:06:07	04:06:31	04:07:55	04:12:39	04:17:45	0:42:45
2008-04-05	03:25:00	07:16:00	02:08:47	02:51:01	03:00:18	03:01:02	03:08:27	03:09:55	03:10:14	04:00:16	04:00:30	04:01:36	04:06:30	04:11:31	0:53:09
2008-04-08	03:08:00	07:01:14	01:54:21	02:36:23	02:47:17	02:48:01	02:54:01	02:55:16	02:55:34	03:50:28	03:50:40	03:51:36	03:57:53	04:01:19	0:57:34
2008-04-11	02:57:00	06:50:00	01:43:54	02:25:30	02:37:21	02:36:30	02:43:34	02:44:45	02:45:01	03:40:56	03:41:06	03:41:59	03:47:58	03:51:25	0:58:25
2008-04-14	02:44:58	14:06:38	01:34:52	02:16:22	02:28:05	02:27:22	02:34:32	02:35:43	02:35:58	03:29:53	03:30:02	03:30:54	03:36:30	03:40:05	0:56:22
2008-04-17	02:32:00	06:23:00	01:26:42	02:08:48	02:19:16	02:20:00	02:26:22	02:26:43	02:27:49	03:17:10	03:18:14	03:18:14	03:24:00	03:28:00	0:51:52
2008-04-20	02:19:00	06:10:00	01:20:59	02:03:13	02:14:21	02:15:05	02:20:39	02:21:50	02:22:12	03:04:28	03:04:37	03:05:38	03:11:45	03:15:34	0:44:59
2008-04-23	02:06:00	05:58:00	01:18:24	02:00:37	02:12:20	02:11:37	02:18:04	02:19:27	02:18:04	02:51:35	02:51:52	02:53:04	02:59:29	03:02:58	0:35:00
2008-04-26	01:56:00	05:44:00	01:20:19	02:02:23	02:13:12	02:13:56	02:19:59	02:22:27	02:23:46	02:54:29	02:55:33	02:57:55	02:44:12	02:47:42	0:17:56

IMU1 Usage during Eclipse

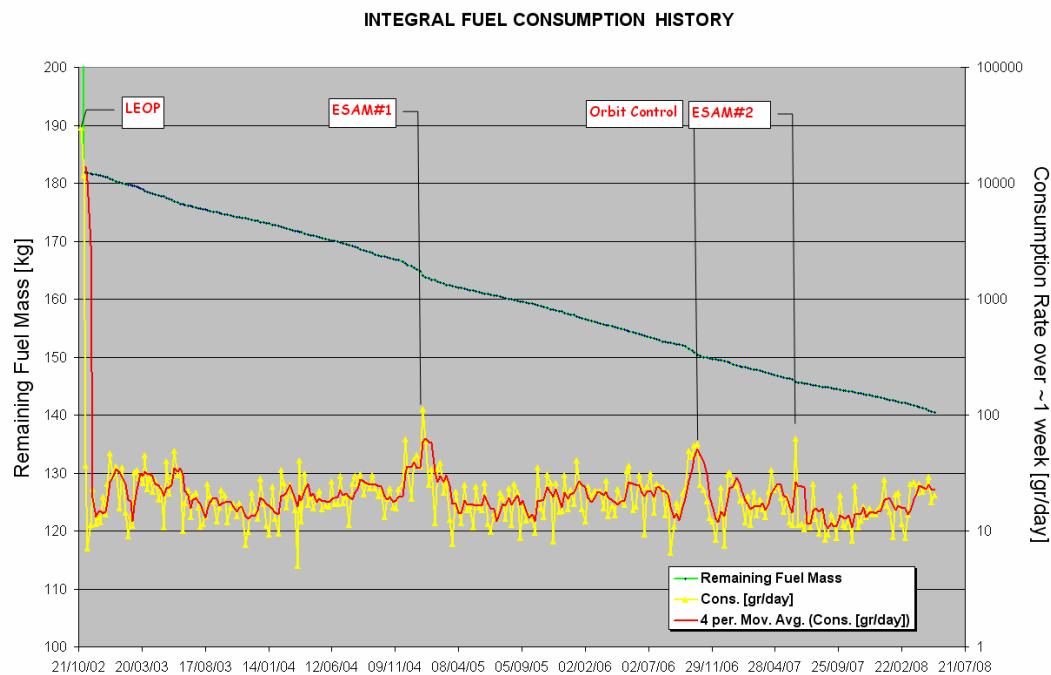
IMU Usage during Eclipse Season				Summer 2008		
IMU On	IMU Off	From Health Check		From Auto Calibration	On Time	Accumulated On Time
		Noise Roll [as/s]	Drift Roll [as/s]	Drift Roll [as/s]		
2008-03-30 00:04:03	2008-03-30 04:16:52	0.2257	0.2217		0.2477	4:12:49
2008-04-02 00:11:36	2008-04-02 04:19:49	0.3040	0.1621		0.2133	4:08:13
2008-04-04 23:56:51	2008-04-05 04:13:42	0.3568	0.2644		0.2992	4:16:51
2008-04-07 23:54:46	2008-04-08 04:03:33	0.1975	0.2583		0.2992	4:08:47
2008-04-10 23:30:54	2008-04-11 03:53:46	0.2001	0.2133			4:22:52
2008-04-13 23:17:05	2008-04-14 03:42:26	0.3097	0.2105		0.2456	4:25:21
2008-04-16 23:18:56	2008-04-17 03:42:26	0.2439	0.2400		0.3930	4:23:30
2008-04-19 23:08:00	2008-04-20 03:17:54	0.2348	0.1567			4:09:54
2008-04-22 23:02:29	2008-04-23 03:05:20	0.2573	0.3071		0.3474	4:02:51
2008-04-25 22:35:34	2008-04-26 02:50:00	0.2268	0.2783			4:14:26

Orbit Control

No update

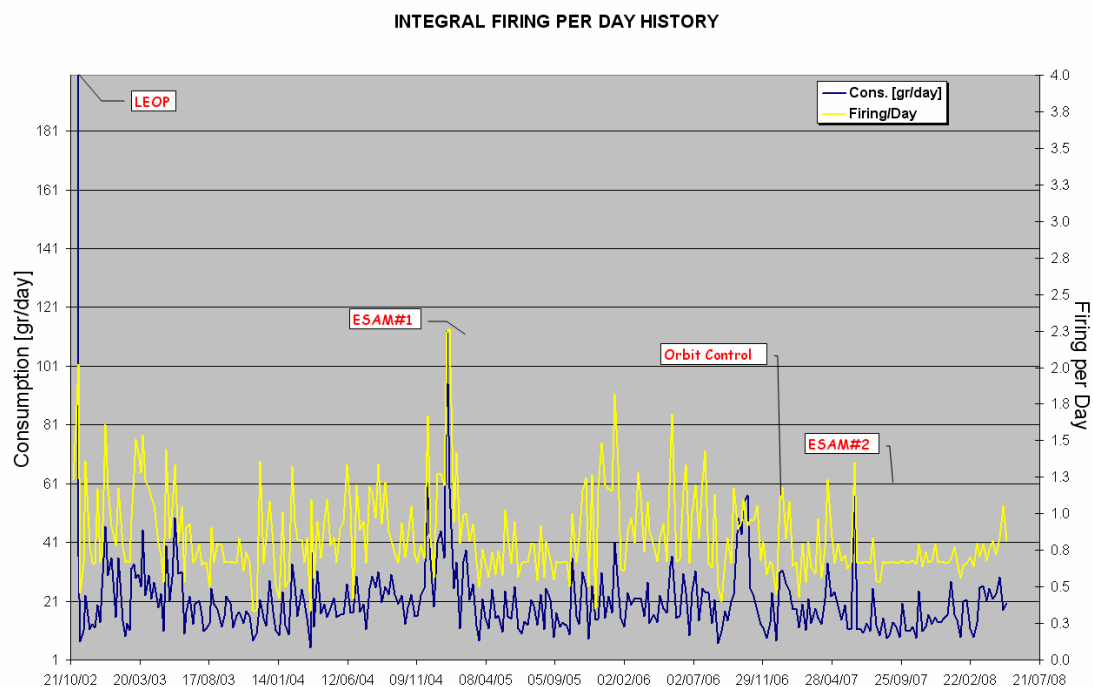
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 02/05/2008 is reported in the plot below.



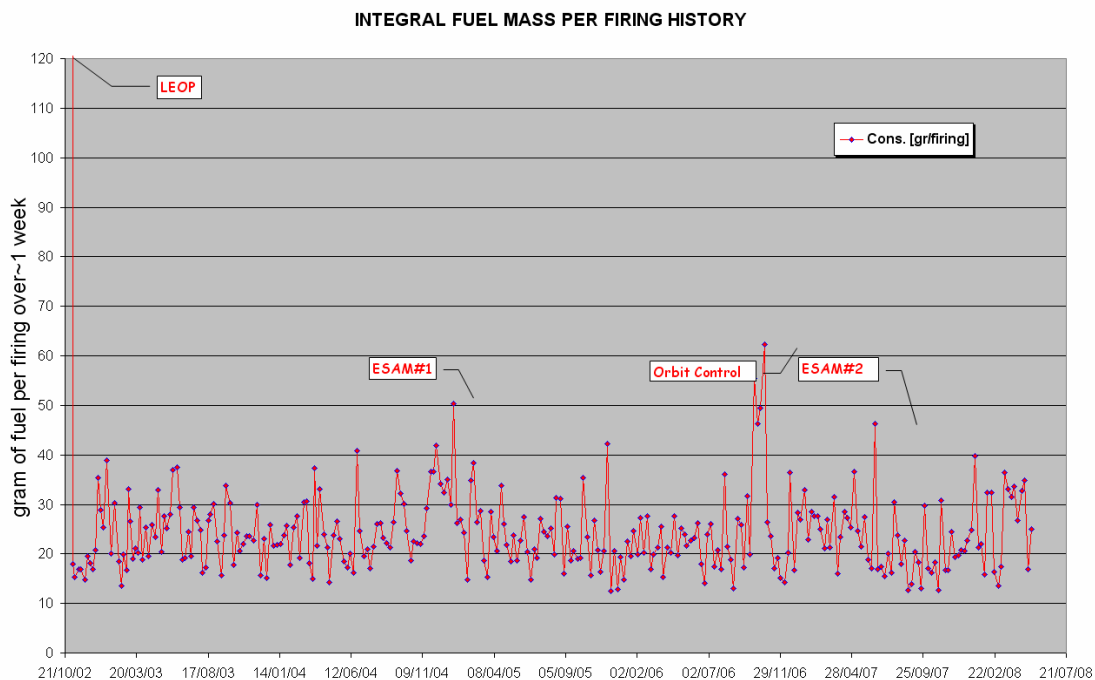
The above plot considers the ESAM fuel consumption spread over period of ~1 week.

The firing per day over the period between 01/11/2002 and 02/05/2008 is reported in the plot below.



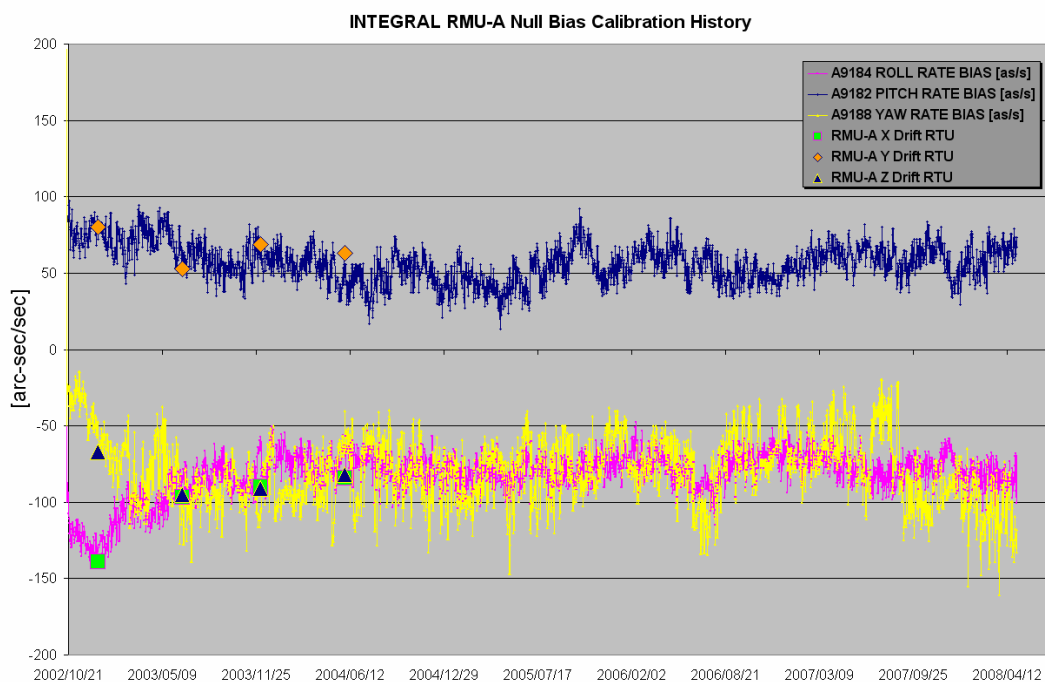
The above plot considers the ESAM fuel consumption spread over period of ~1 week.

The fuel per firing over the period between 01/11/2002 and 02/05/2008 is shown in the plot below.



The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 02/05/2008 is reported in the plot below.



Problems have been reported during the last period on FDS when generating the drift update for the RMU-A Yaw channel: the limits set on FDS have been violated few times. The evolution of the drift on yaw channel is under constant monitoring but the values are still well within the specs. At moment the current constraints (for drift update generation) on the FDS have been relaxed to cope with the current situation.

Thresholds from INT-MA-AI-0001, 5.3.2.4.2.2, and INT-PR-MMB-0005 page 5-9, modified as per new AMD Threshold agreement for the eclipse season.									
01- Update of thresholds after uplink of new RW Inertias on 22/01/2004. 0155_0001_M.RWI									
Wheel Inertia:									
RW#1:	0.096000	Kgm**2							
RW#2:	0.097650	Kgm**2							
RW#3:	0.097272	Kgm**2							
RW#4:	0.097649	Kgm**2							
Sunlight Season:									
	Subset 1		Subset 2						
WSMAX	39		35.9						
WSMIN	2.2		4.8						
WSMAX	To Uplink:					In rpm:			
	X1		X2			X1	X2		
RW#1:	406.250000	rd/s	373.958333	rd/s		3879	3571		
RW#2:	399.387606	rd/s	367.641411	rd/s		3814	3511		
RW#3:	400.938401	rd/s	369.068939	rd/s		3829	3524		
RW#4:	399.388015	rd/s	367.641788	rd/s		3814	3511		
WSMIN	To Uplink:					In rpm:			
	X1		X2			X1	X2		
RW#1:	22.916667	rd/s	50.000000	rd/s		219	477		
RW#2:	22.529557	rd/s	49.155398	rd/s		215	469		
RW#3:	22.617038	rd/s	49.346265	rd/s		216	471		
RW#4:	22.529580	rd/s	49.155448	rd/s		215	469		

In the same time frame the ACC/FDE/FCE Eclipse Timers were stopped to reconfigure permanently the S/C in sunlight.

29/04/2008 (Day of Year 120, Revolution 676-677)

Nothing to report.

30/04/2008 (Day of Year 121, Revolution 677)

FDS failed slew update: at 20:57z the FDS failed the update of slew ID 06770040. FDS reported an error during the update process: the TPF update software spotted a constraint violation on current wheels speeds. The TPF generation was aborted.

A manual recovery was performed at 21:48z by generating a change of guide star followed by a Reaction Wheel Bias. At 22:10z the slew ID 06770040 was manually updated in TL.

The following pointing ID 06770039 was not correctly executed due to the on-going recovery of slew ID 06770040.

01/05/2008 (Day of Year 122, Revolution 677)

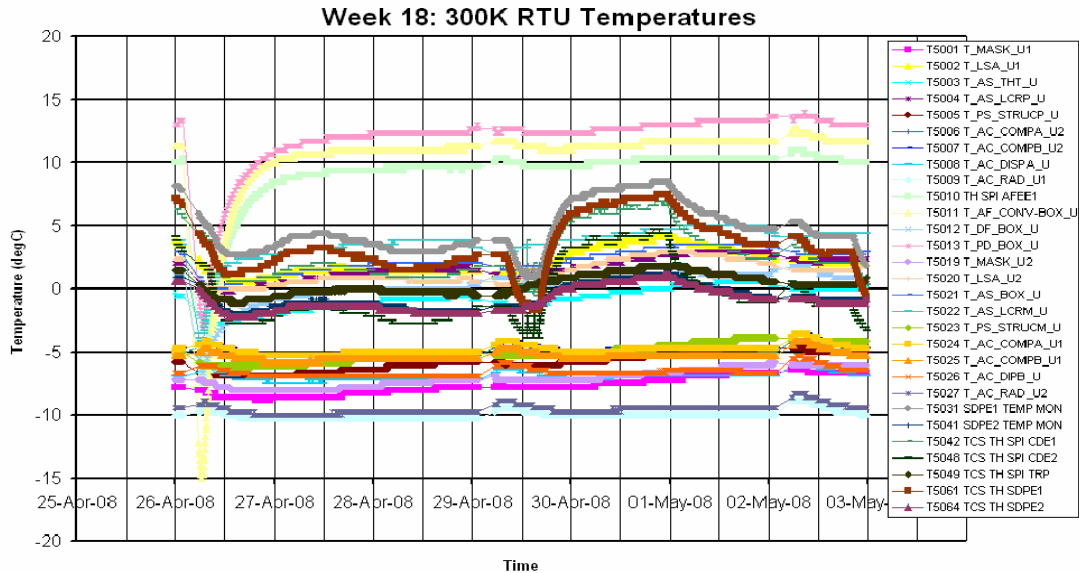
Nothing to report.

02/05/2008 (Day of Year 123, Revolution 677-678)

Nothing to report.

8.3.2 SPI Operations

Unit Temperatures: All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period.

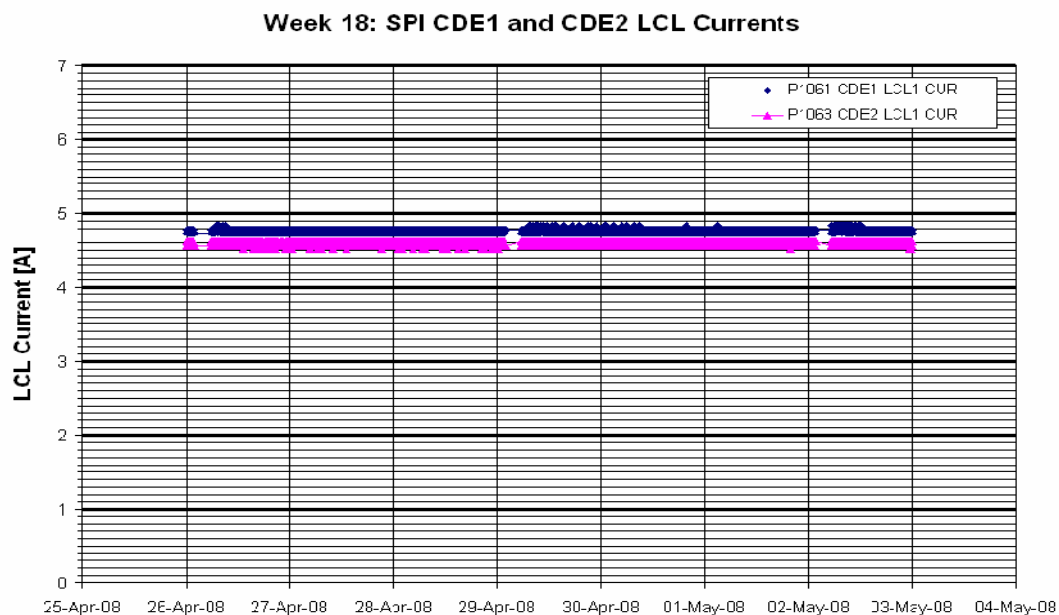


Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

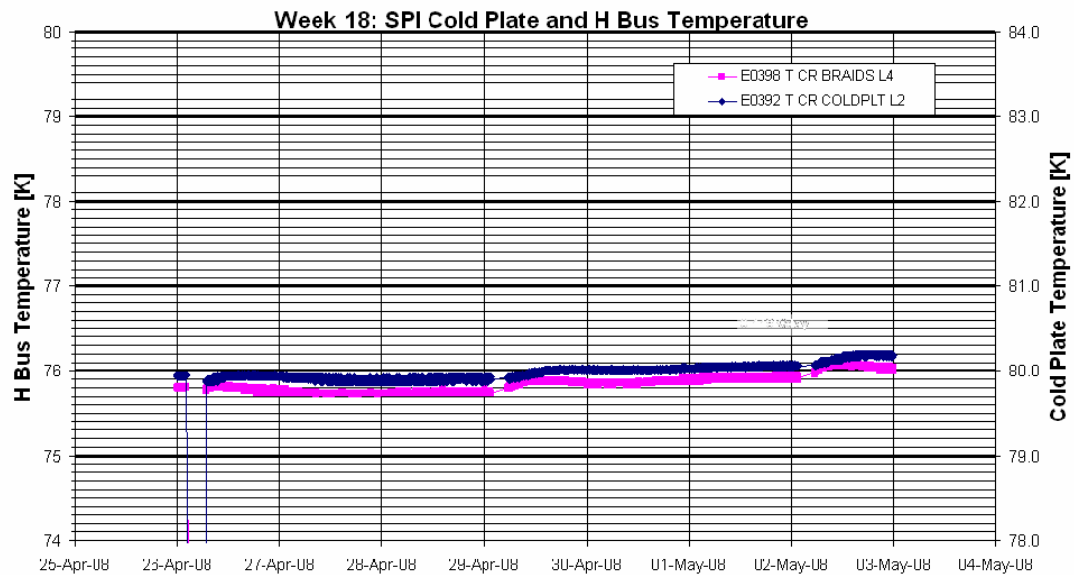
The stroke of all four compressors was set to 40 throughout the week. The average CDE LCL currents were as follows:

- CDE1 LCL Current = 4.77A
- CDE2 LCL Current = 4.57A

The following plot shows the evolution of the CDE LCL currents during the reporting period.



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



DPE & IASW: The DPE health and IASW performance is nominal.

The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE.

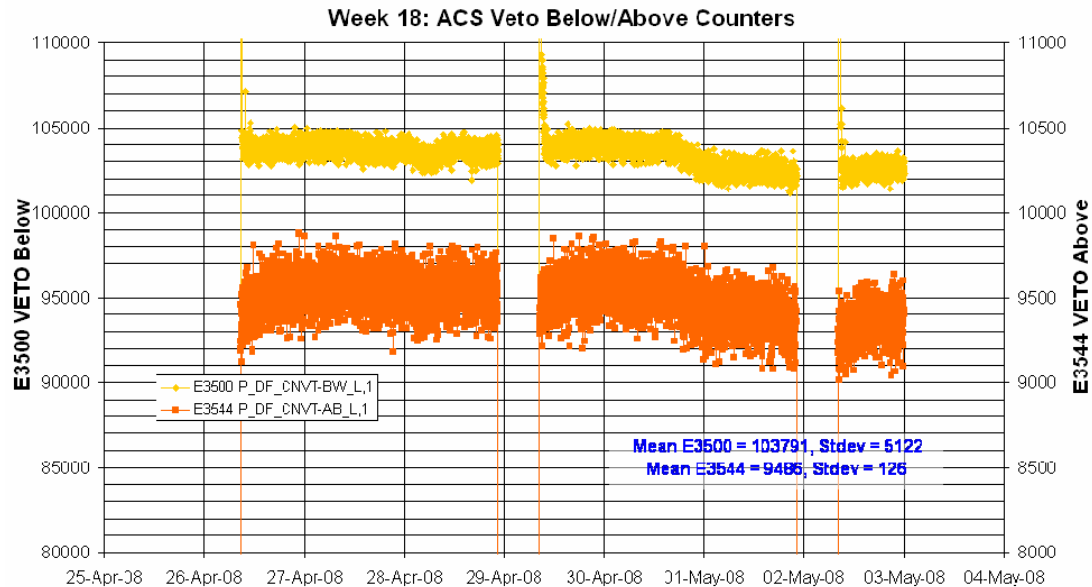
The average TM bandwidth occupation of SPI was 98.6 packets/cycle over the science window. The TM allocation in the science window was 108 packets/cycle. This allocation is considering that the over-allocated PST with the additional 3 packets/cycle for SPI was being used, however the Broadcast Packet TM allocation was not updated (see plot below).

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

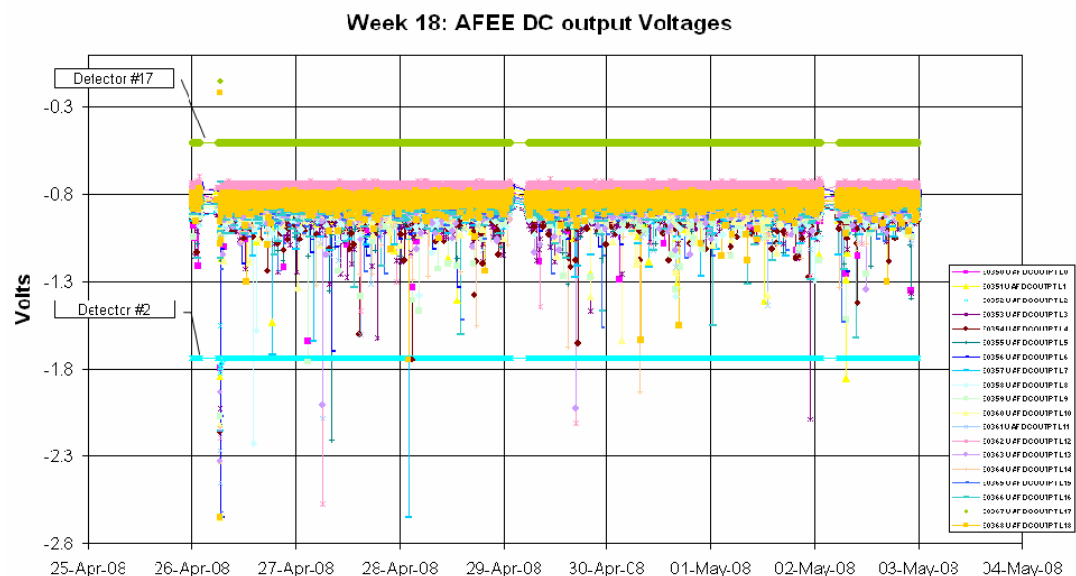


ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

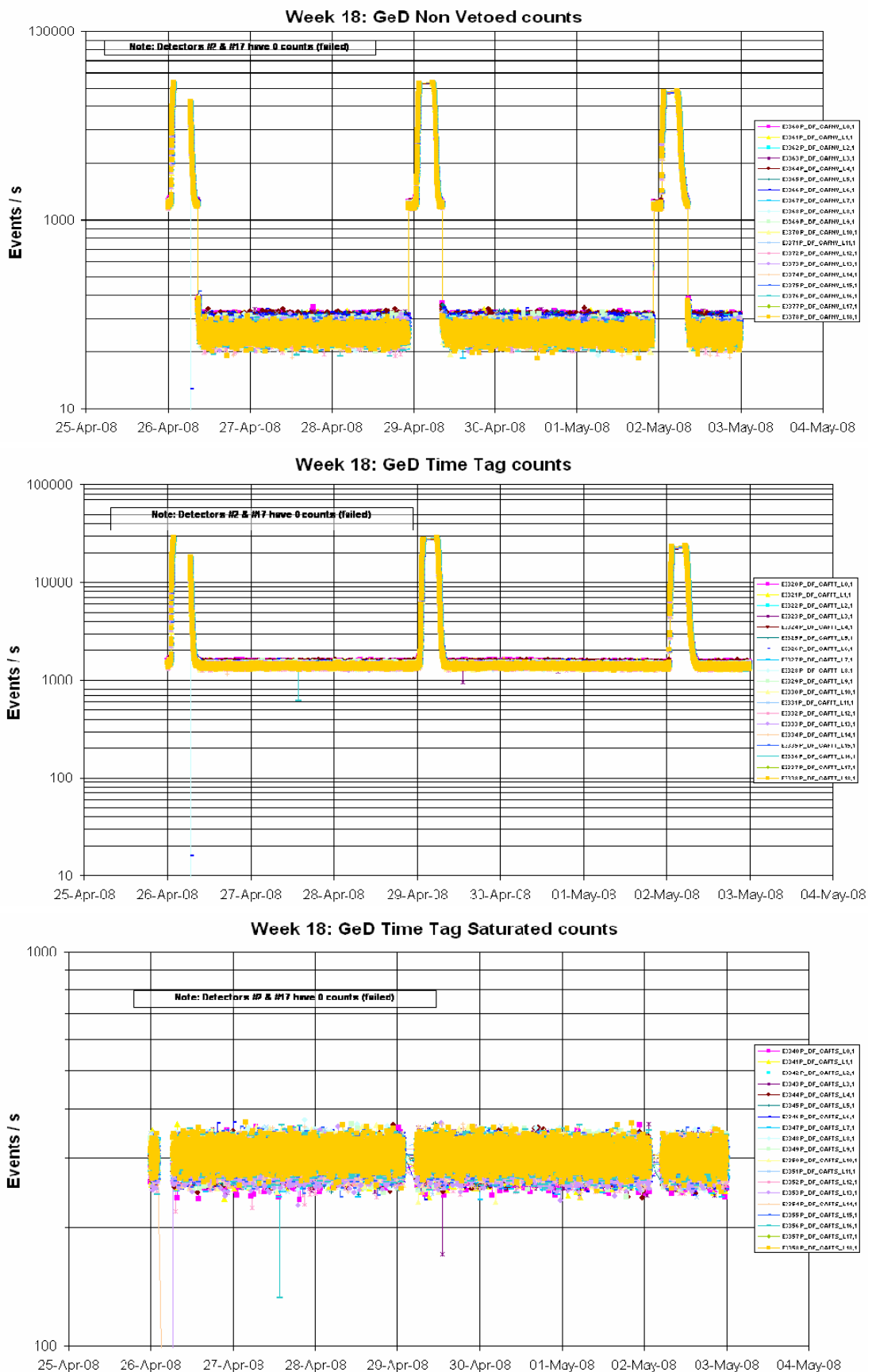
The following plot shows the ACS overall count rate evolution during the reporting period:



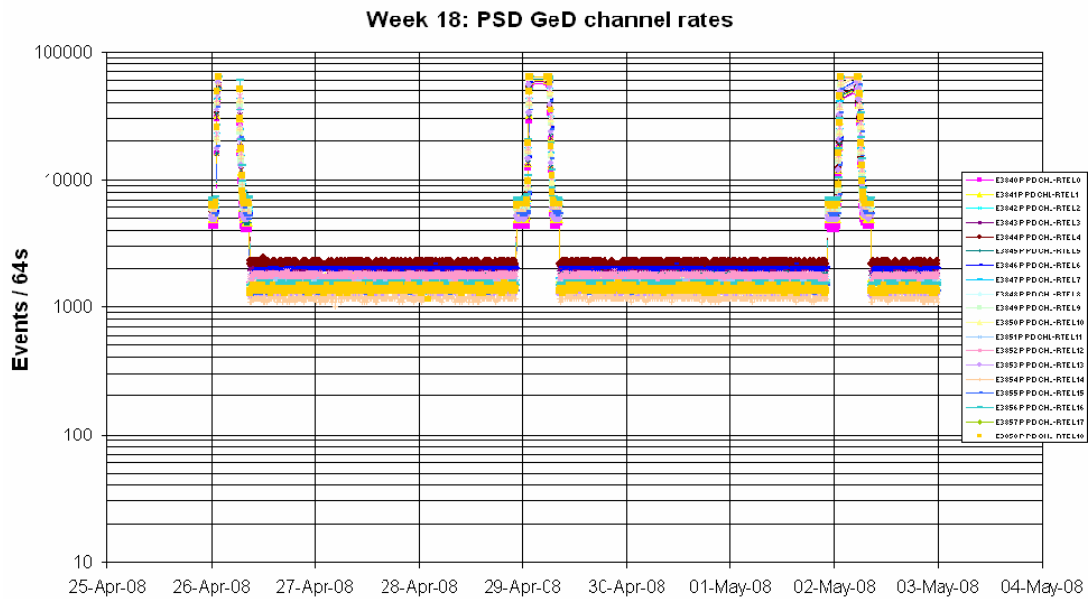
AFEE: The health of the AFEE is nominal. The following plot shows the dc voltage offset of the detector channels during the reporting period. The values are nominal. Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.



DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.



PSD: The health of the unit is nominal. The following plot shows the PSD channel rates during the reporting period.



Event Log:

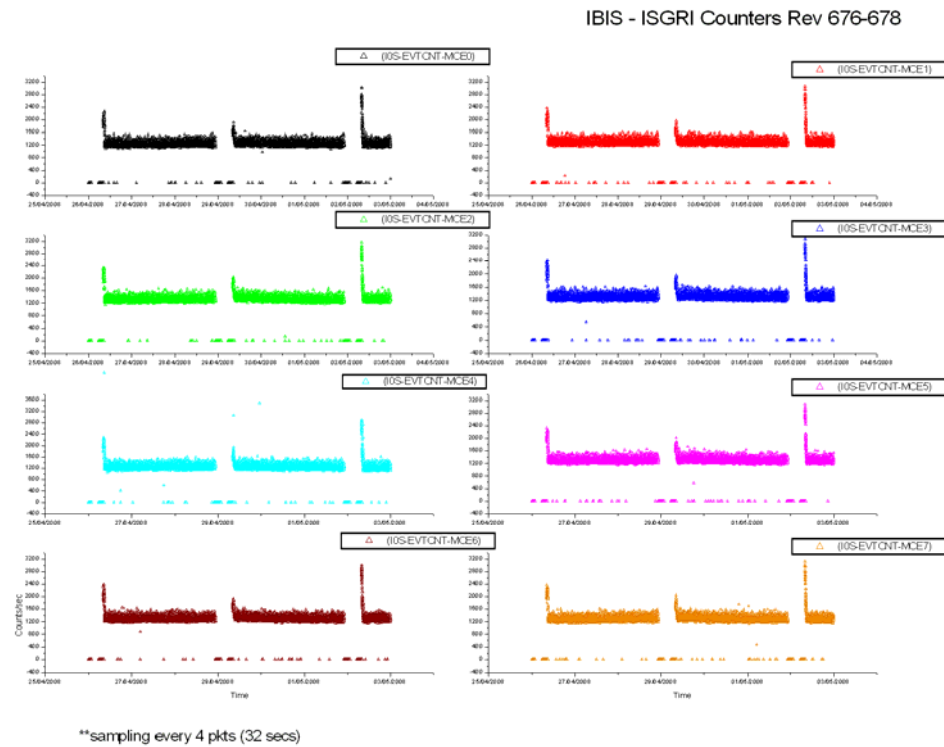
The following non-nominal events occurred on SPI over the reporting period:

- On 2008-04-26 at 06:57:45Z (about 30 minutes after the subassemblies' switch-on after eclipse) OEM APID 1024 ID 145 EXCEPTION SPI1 LSL ERROR was received, with parameters indicating a NACK from the PSD. As it was a single occurrence, no action was taken.
- Due to high background radiation after the expected radiation belt exit of revolution 676, TM parameter E3500 was OOL High on 2008-04-26 from 08:53:07Z to 09:04:27Z, returning within limits of its own accord.
- On 2008-04-27 at 21:05:08Z TM parameter E2338 went OOL (value = PARAM > SPEC). This is the ACS FEE analogue status 5 V #88. As it returned within limits of its own accord at 21:15:48Z, no action was taken.
- On 2008-04-29 from 05:35:26Z to 06:13:58Z TM parameter E4009 toggled OOL and back, indicating errors on the HSL. It returned stably within limits of its own accord.
- Due to high background radiation after the expected radiation belt exit of revolution 677, TM parameter E3500 was OOL High on 2008-04-29 from 08:38:43Z to 08:50:51Z, returning within limits of its own accord.
- On 2008-05-02 at 08:17:09Z, during the reconfiguration of SPI at radiation belt exit of revolution 678, TM parameters E2366; E3180; E2122 and E2123 went OOL (value = 0). These are ACS parameters in SPID 60601. They returned within limits at 08:19:37Z. This is a re-occurrence of the known anomaly recorded in AR INT_SC-211.
- Due to high background radiation after the expected radiation belt exit of revolution 678, TM parameter E3500 was OOL High on 2008-05-02 from 08:26:12Z to 08:49:24Z, returning within limits of its own accord.
- TM parameter E2115 went OOL Warning Low on several occasions during the week. In each case it returned within limits of its own accord and no action was taken. However, this parameter is displaying a trend indicating degradation of the thermistor, as occurred for the TM parameter E2116. The lower limit for E2115 will be updated in the next IODB release.

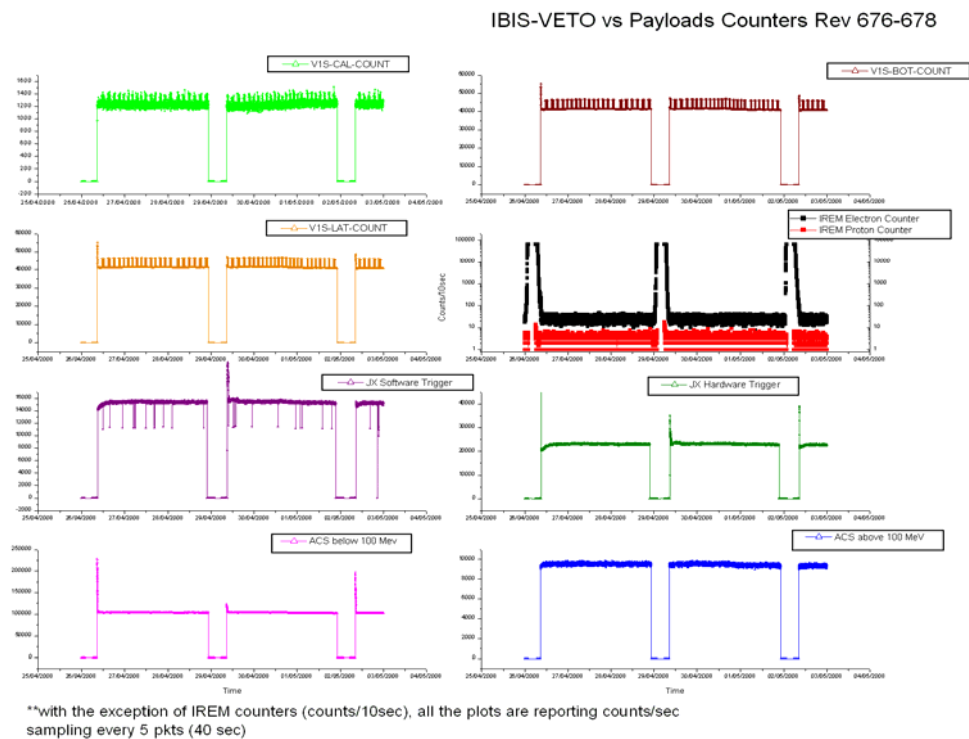
8.3.3 IBIS Operations

IBIS Event Counters Plots

ISGRI Counters:



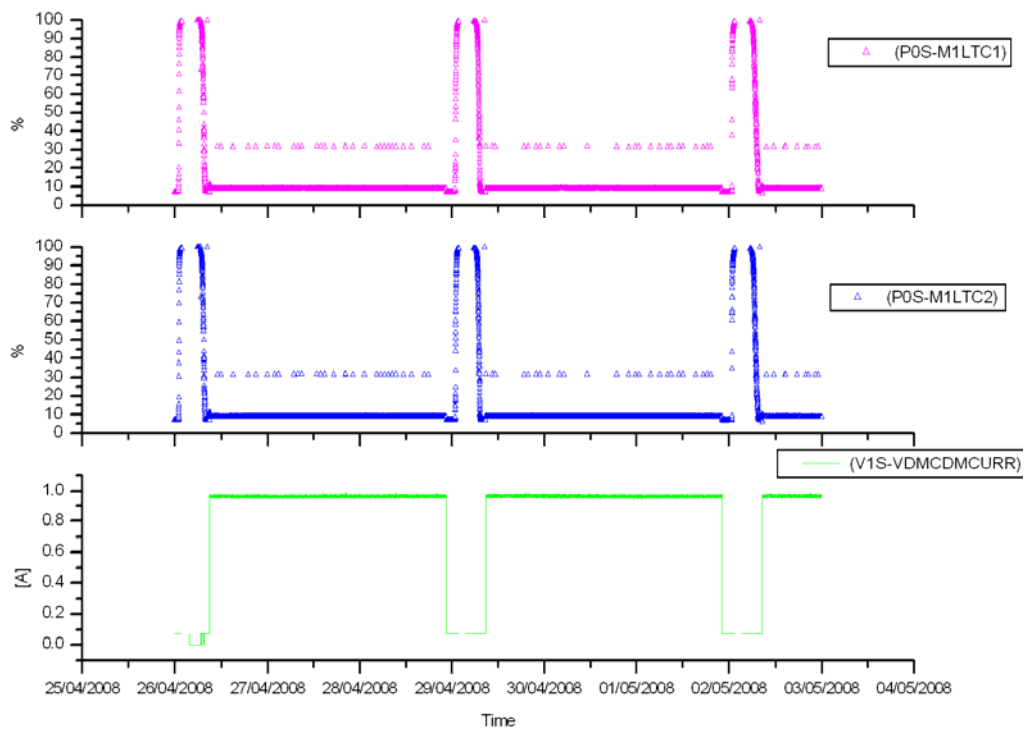
VETO vs Payload Counters:



The week was characterised by slightly high radiation after the expected radiation belt exit of these revolutions as reported by the payload.

VETO Current:

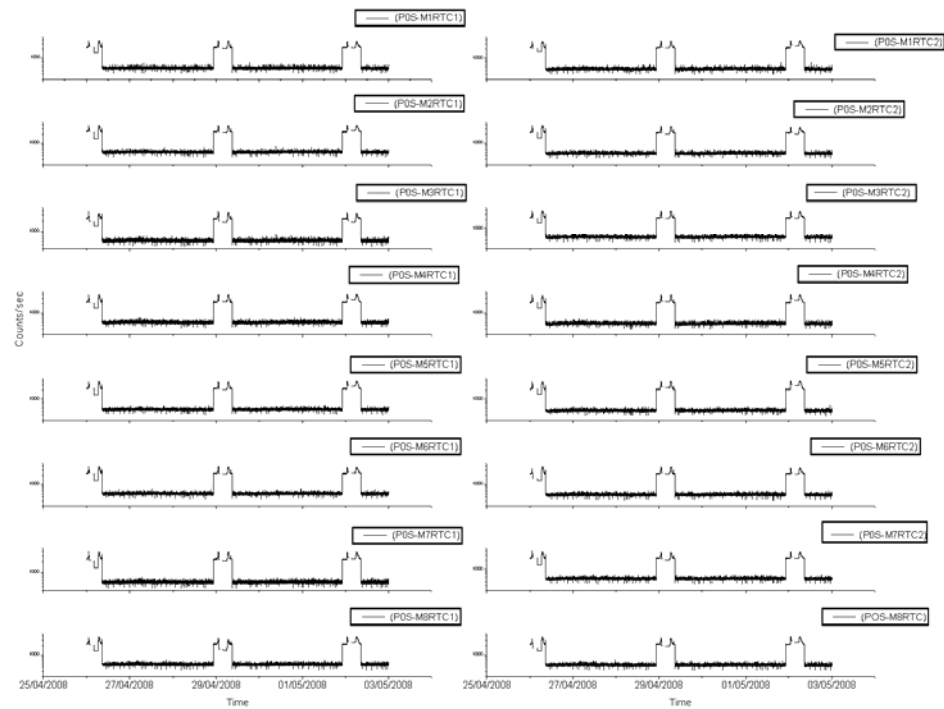
IBIS-VETO Current & PICsIT dead times Rev 676-678



**sampling every 4 pkts (32 secs)

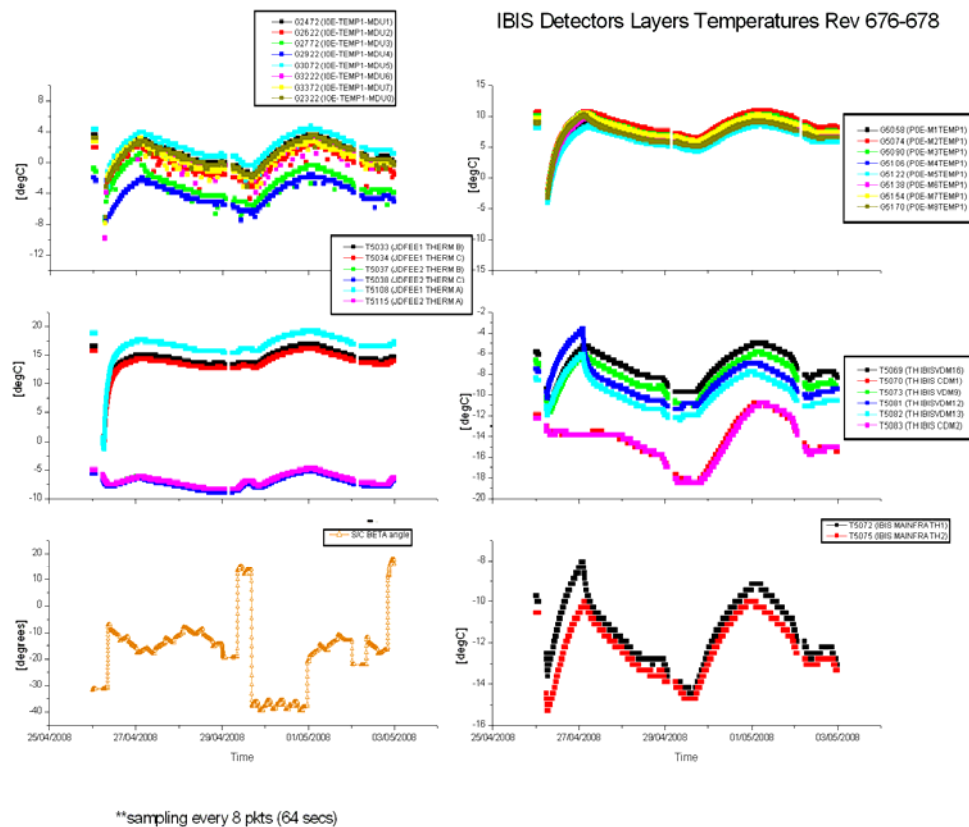
PICsIT Counters:

IBIS - PICsIT Counters Rev 676-678



**sampling every 4 pkts (32 secs)

IBIS Detectors Layers Temperatures:



IBIS daily report:

The usual Out Of Limits on TM parameter G8015 (S1E-A2_PMT_V), G5002 (P0S-Mi_RTC1) and G5003 (P0S-Mi_RTC2) families and G2000 family (I0E-OVFWPXADD-Mi) were received during the radiation belt passages.

In addition:

- At the start of revolutions 676 and 678, during the execution of the ED GEISCL03, the TM parameter family G2013 started toggled OOL Warning High. These are the number of events triggering the MCEi per second. They all returned within limits of their own accord shortly after radiation belt exit and no action was taken.
- Following a request from the IBIS PI, the Module Counter Maximum of the Noisy Pixel Handling System was changed from 10000 to 20000 at the start of each revolution. This was done by disabling the Timeline such that the ED GEISCL03 for the ISGRI calibration was not released and a manually edited GEISCL03 sequence with the new parameter value was uplinked instead.

2008-04-26 (DOY 117, Rev 675-676)

At 06:48:54Z, during the execution of the VETO patch ED GEVESP01, TM parameter G8012 failed SCC with value = ON (indicating a VEB reset generated by Watchdog) and G6030 failed SCC with value = ON, indicating the CDM02 was ON, which is the default configuration of VETO after a reset. The following OEMs were also received, indicating errors on the LSL at this time:

Doc. Title : INTEGRAL Mission Report #293
Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OAI
Date : 05/05/08

Issue : 1
Rev. : 0
Page : 24

```
2008.117.06.48.48.474 1280 ID 129 ANOMALY IBIS1
IASW TIME-OUT TRANSMITTING LSL DATA (NO ANSWER FR
2008.117.06.49.20.595 1280 ID 129 ANOMALY IBIS1
IASW TIME-OUT TRANSMITTING LSL DATA (NO ANSWER FR
2008.117.06.49.20.610 1280 ID 129 ANOMALY IBIS1
IASW TIME-OUT TRANSMITTING LSL DATA (NO ANSWER FR
```

and at 06:49:16Z, TC GU0613TC failed on-board acceptance with the following OEM:

```
2008.117.06.49.20.611 1280 ID 134 TC REJECT IBIS1
IASW EXTERNAL TC REJECTED COULD NOT BE EXECUTED
```

This is a known problem (see AR INT_SC-130), that occasionally VETO resets during the execution of the VETO patch (ED GEVESP01) after eclipse.

Therefore the following recovery procedure was executed:

- 07:18:43Z FCP_IBIS1_0332 IBIS VEB-A Deactivation
- 07:24:19Z FCP_IBIS1_0111 VETO VEB Activation. In executing this procedure, the commands to switch the VEB heater A OFF during the procedure were omitted as the VEB Heater A was already disabled following post-eclipse reconfiguration and was due to be enabled by the Timeline at later stage.
- 07:33:27Z FCP_IBIS1_0199 IBIS: VETO Restore CTX
- 07:35:48Z ED GEVESP01 re-uplinked.

IBIS operations continued nominally.

Due to slightly high radiation after the expected radiation belt exit of revolution 676, from 08:55:50Z to 09:00:38Z the VETO counters, TM parameters G6062 and G6063, toggled OOL High. As they returned within limits of their own accord, no action was taken.

2008-04-27 (DOY 118, Rev 676) to 2008-04-30 (DOY 121, Rev 677)

IBIS operations executed nominally.

2008-05-01 (DOY 122, Rev 677)

At 14:26Z, following a ground station handover, TM parameter X7500 went OOL, indicating a problem with the histogram process. The following recovery procedure was then executed to force the histogram accumulation and download process to resume:

- 15:34:19Z FCP_IBIS1_0312
- 15:35:34Z TC G0129 uplinked to return IBIS to Science Standard mode.

IBIS operations continued nominally.

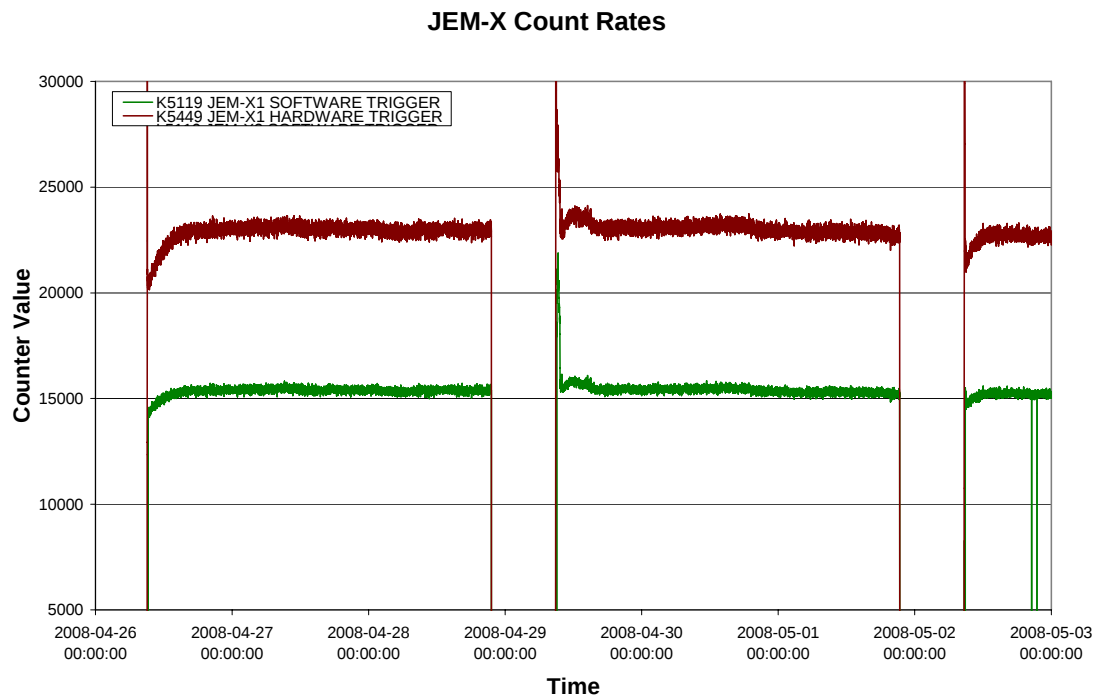
2008-05-02 (DOY 123, Rev 677-678)

IBIS operations executed nominally.

8.3.4 JEM-X Operations

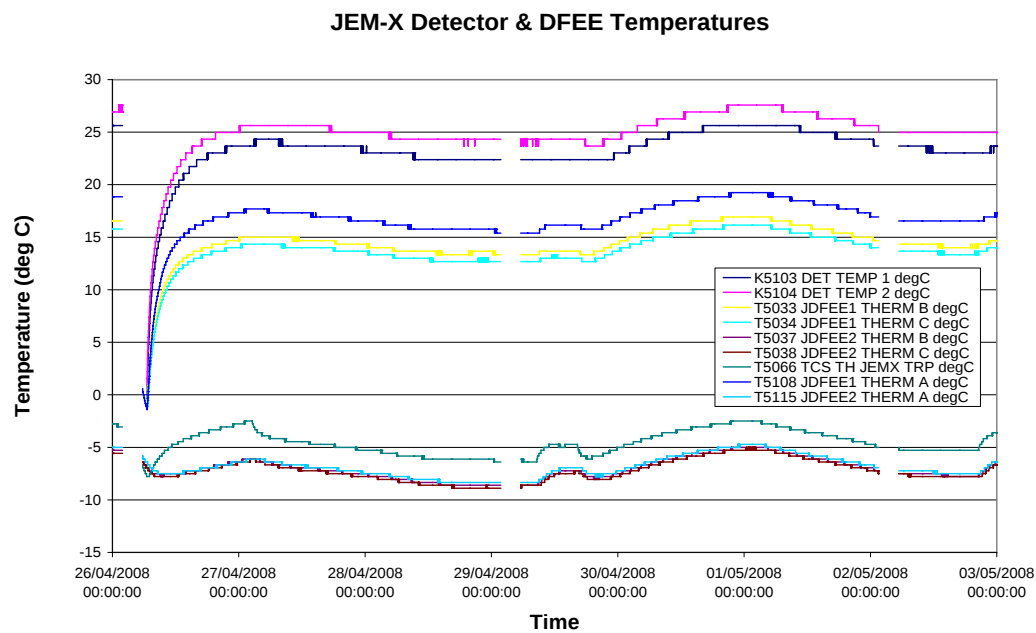
JEM-X Count Rates

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



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)

JEM-X Daily Report

2008-04-26 (DoY 117, Rev 676)

From 06:37:00 to 06:37:21, parameter KD5380D was briefly out of hard limits. At 08:28:14 and 08:41:53, parameter K5317 exceeded hard limits. From 09:05:29 to 09:06:20, parameter K5449 was briefly outside soft limits. No action was taken on any of the above events, and there was no impact.

2008-04-27 (DoY 118, Rev 676) to 2008-04-28 (DoY 119, Rev 676)

JEM-X1 operations executed nominally.

2008-04-29 (DoY 120, Rev 677)

From 08:53:43 to 08:59:53, parameter K5449 was briefly outside soft limits. At 08:56:49, parameter K9134 exceeded soft limits. From 08:58:37 to 09:01:37, parameter KD5380D was briefly out of hard limits. No action was taken on any of the above events, and there was no impact.

2008-04-30 (DoY 121, Rev 677) to 2008-05-01 (DoY 122, Rev 677)

JEM-X1 operations executed nominally.

2008-05-02 (DoY 123, Rev 678)

At 08:05:37, 08:18:58, 08:25:31 and 08:26:33, parameter K5317 briefly exceeded hard limits. From 08:42:42 to 08:49:21, parameter K5449 exceeded soft limits. At 08:44:52, parameter K9104 exceeded soft limits. From 08:46:33 to 08:49:39, parameter KD5380D was briefly out of hard limits. At 08:52:08, 20:32:56, and 20:33:03, the TC KU0014 had terminations of unknown, affected and unverified respectively. No action was taken on any of the above events, and there was no impact.

8.3.5 OMC Operations

2008-04-26 (DoY 117, Rev 676) to 2008-05-01 (DoY 122, Rev 677)

Nothing to Report.

2008-05-02 (DoY 123, Rev 677)

At 21:28, the OMC commands for pointing 06780016 failed. This was due to the unit still being in Flat-Field calibration mode. This revolution had been replanned at short notice, with the calibration being interrupted and the unit left in the wrong mode. OMC was manually returned to stand-by, and the pointing commands re-uplinked. The impact was a shortening of the pointing from a planned 2858 to 1872 seconds. It was at this time the following OEMs were received:

```

2008.123.21.28.12.333    2008.123.21.28.18.784    1792    RealTime    131    TC REJECT
REJECTED TC1            0            0    65535    PR    N
E    E
2008.123.21.28.18.083    2008.123.21.28.28.849    1792    RealTime    131    TC REJECT
REJECTED TC1            0            0    65535    PR    N
E    E

```

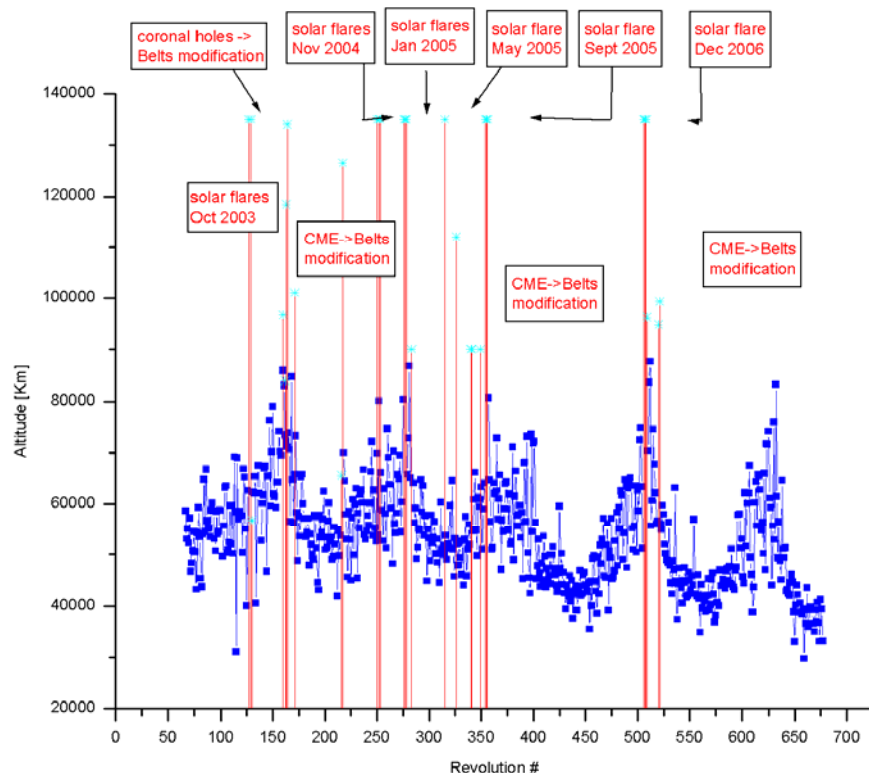
These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for that pointing.

On DoY 119 at 22:29:13 and DoY 122 at 22:16:17 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

8.3.6 IREM Operations

Radiation Belts Entry

Evolution of Radiation Belt Entry 2003-2008



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]
675	RAD_ENTR R 2008-04-25T22:40:10Z	26/04/2008 00:27:04	41232.2	26-Apr-2008 00:17:11	41807.4
676	RAD_EXIT R 2008-04-26T08:41:11Z	26/04/2008 09:16:41	58204.0	26-Apr-2008 07:47:11	45425.45
676	RAD_ENTR R 2008-04-28T22:29:06Z	29/04/2008 00:22:52	39444.7	29-Apr-2008 00:07:16	41615.92
677	RAD_EXIT R 2008-04-29T08:30:02Z	29/04/2008 07:53:52	>>34956.6	29-Apr-2008 07:37:16	45604.67

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]
677	RAD_ENTR R 2008-05-01T22:16:15Z	02/05/2008 00:46:56	33242.8	01-May-2008 23:57:16	41113.12
678	RAD_EXIT R 2008-05-02T08:17:35Z	02/05/2008 08:32:40	55225.6	02-May-2008 07:27:16	46047.71

Reference

High radiation

Very small error vs reference (less than 10 minutes)

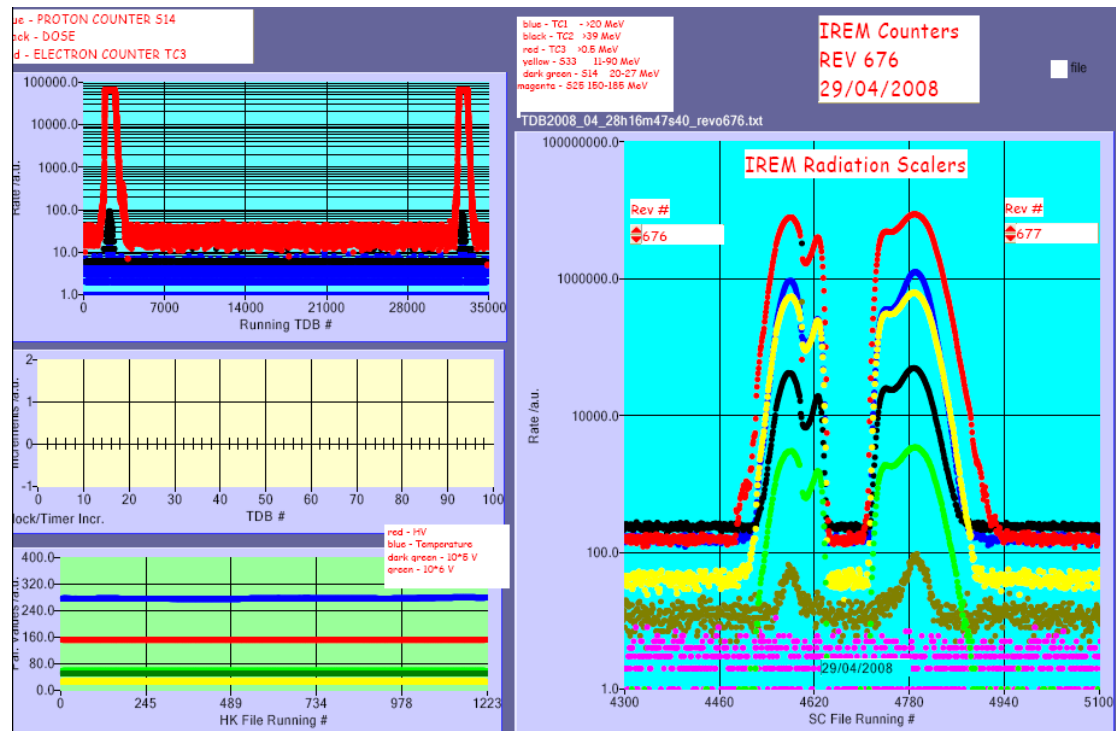
Small error vs reference (between 10 and 30 minutes)

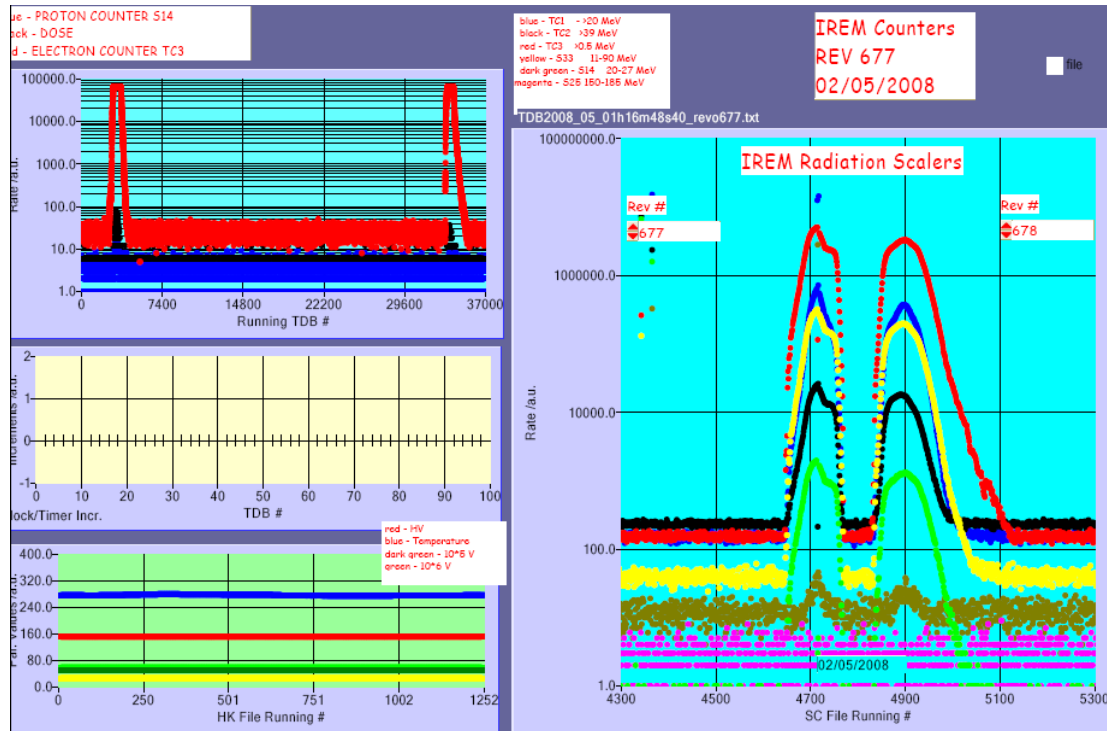
Large error vs reference (more than 30 minutes)

* Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM radiation counters:

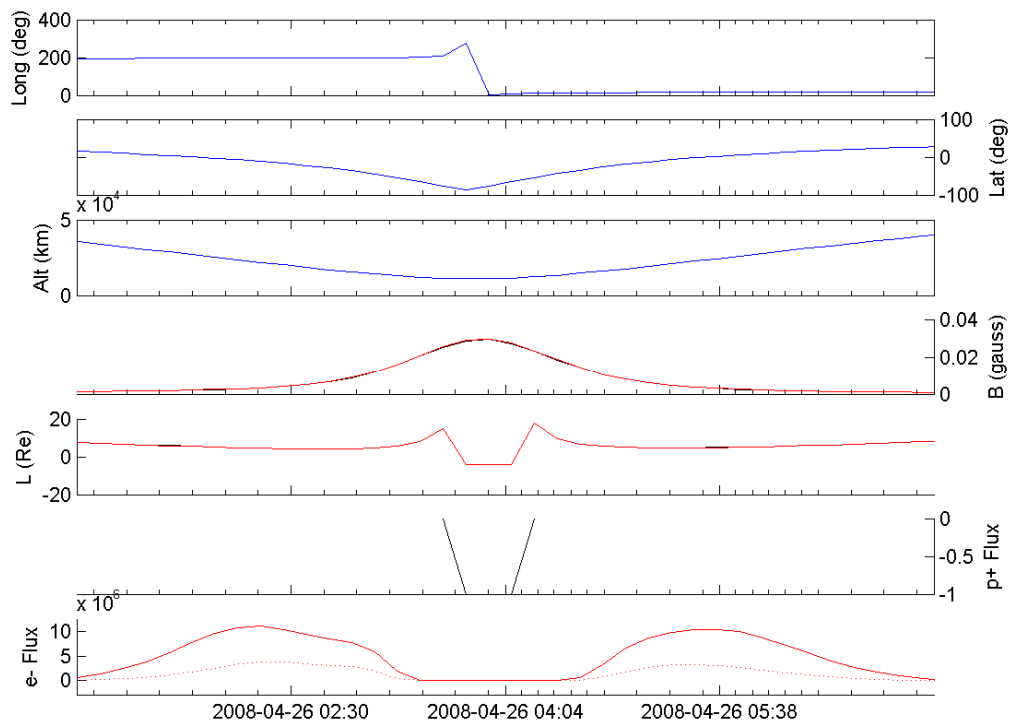
There is no plot for revolution 675 as the data was corrupted



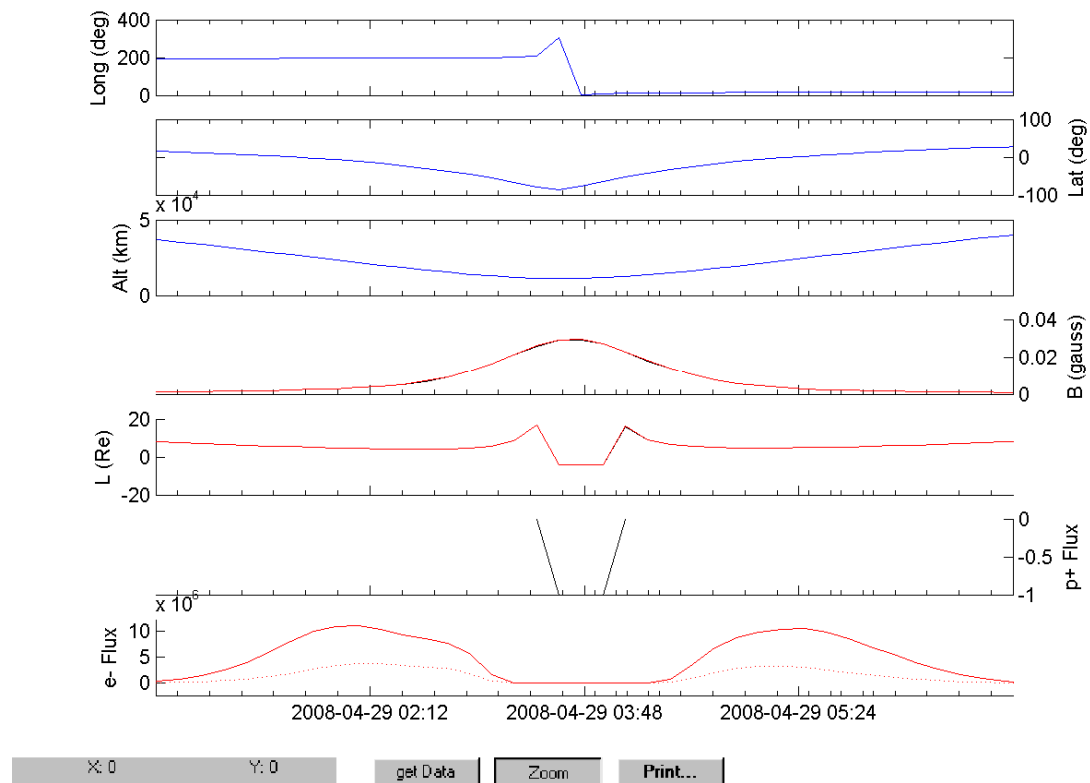


IREM Predicted Radiation Belt Passages

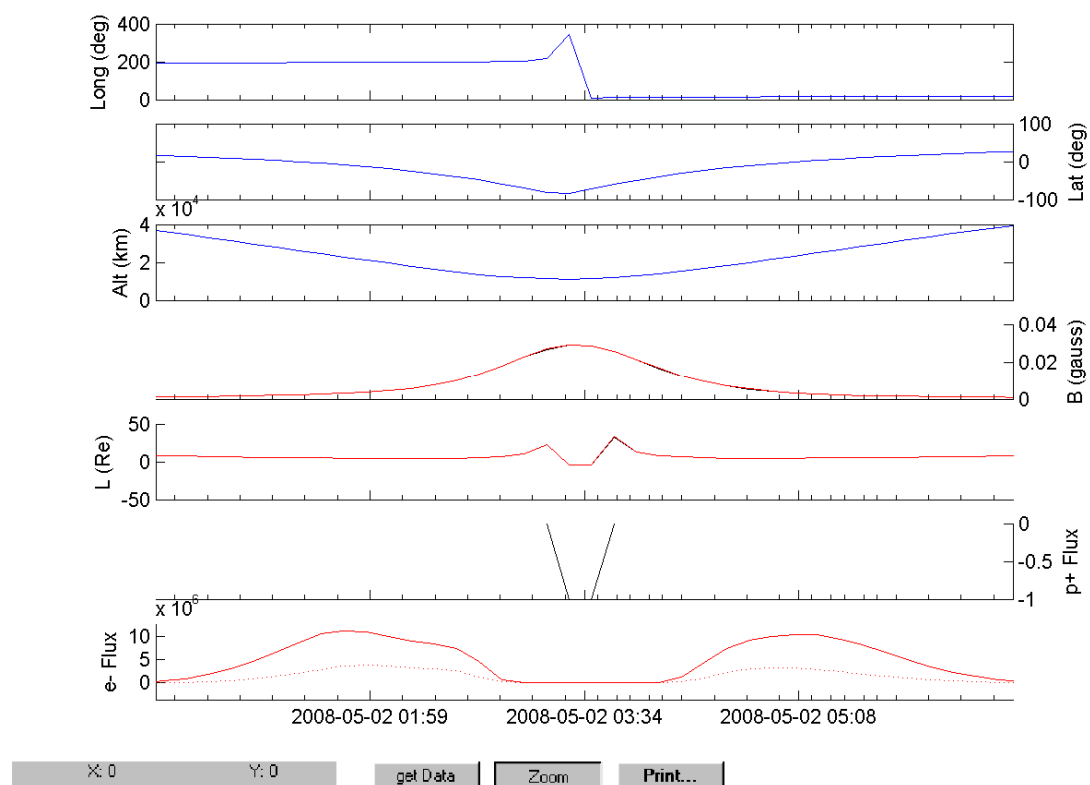
Rev 675



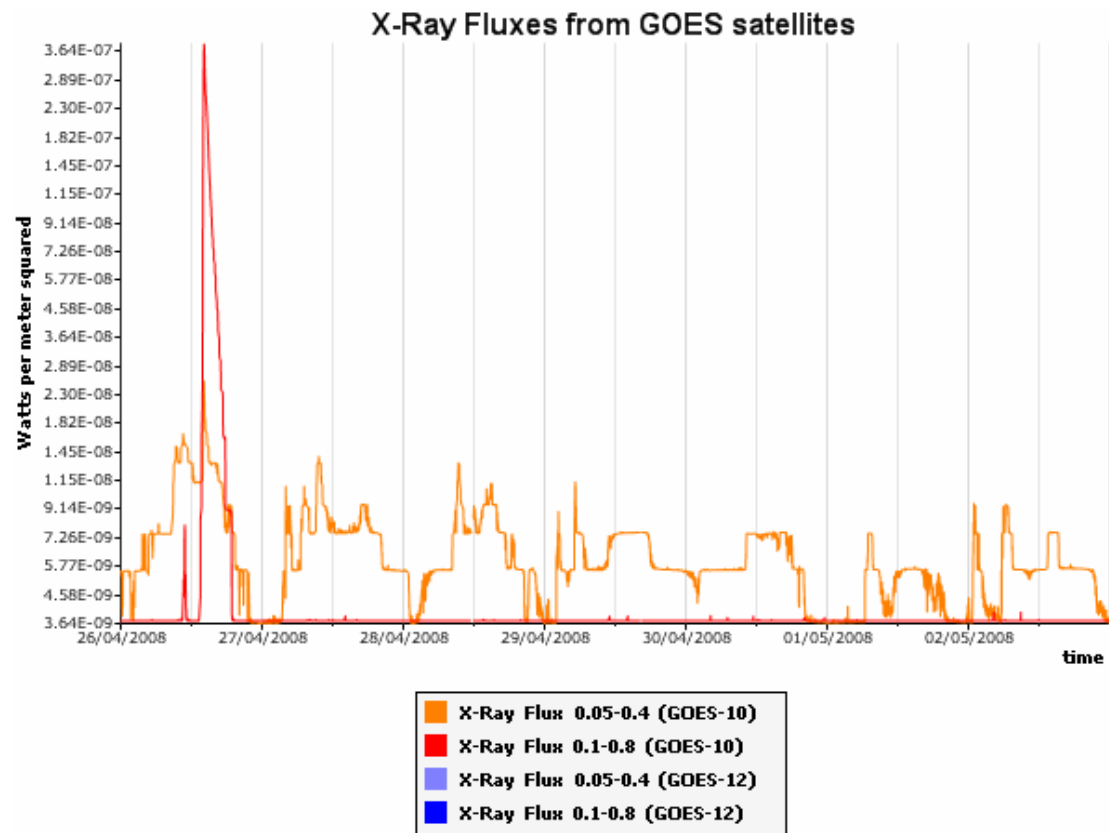
Rev 676



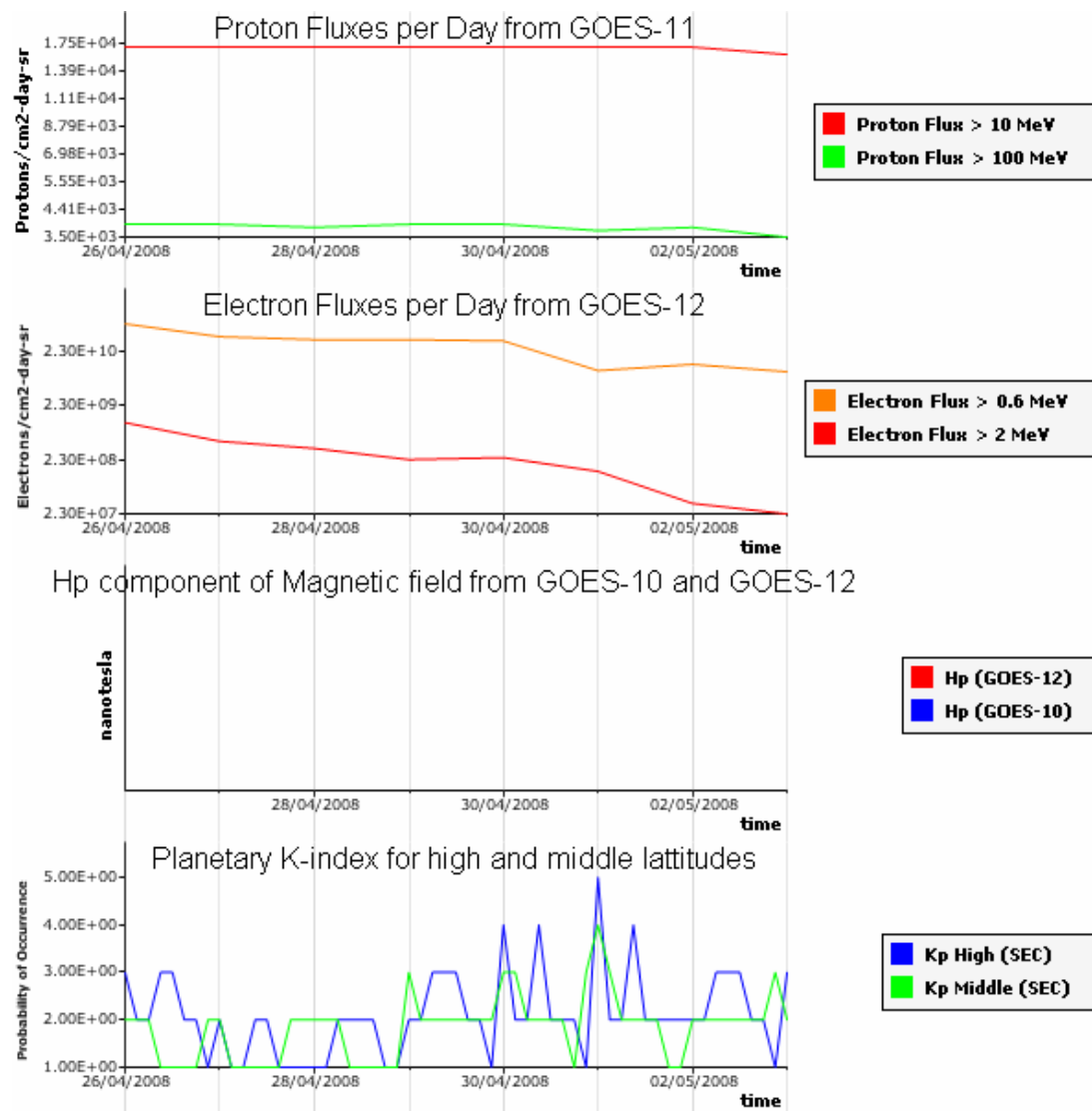
Rev 677



SEC-GOES Observed Particles Fluxes (using SEIS/RAT tool):



X-Ray fluxes start to be significant over 10^{-5} W/m^2 (corresponding to M-class flares). Above 10^{-4} W/m^2 , they correspond to strong X-class flares.



Proton and electron flux report low radiation background.

Hp component of the Geomagnetic Field is essentially parallel to the Earth's rotation axis. A drop near 0 nT is associated with a significant variation in the magnetic field. Kp index is based on ground magnetometers. Kp ≥ 5 features storm-level geomagnetic activity.