

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 335
Week 08
23.02.09
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 14.02.09 until 20.02.09 (both dates inclusive) and covers the revolutions 774, 775 and 776.

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 a Crab calibration (RA 05:34:31.90, DEC +22:00:52.0), an OMC Flat-Field calibration (RA 02:28:24.00, DEC +15:30:00.0), a raster dither of the Perseus OB2 Cloud (RA 03:32:48.00, DEC +31:26:00.0), a raster dither of “Loop I-Loop IV Super circles” (RA 13:57:10.00, DEC +07:34:37.0), a raster dither of Centaurus A (RA 13:25:27.6, DEC -43:01:08.9), a hexagonal dither of the Galactic bulge region (RA 17:45:36.00, DEC -28:56:00.0) and a raster dither of the Galactic Centre (RA 17:45:40.03, DEC -29:00:28.1).

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.

In preparation for the lunar eclipse on 25/02/2009 and for the summer eclipse season (starting on 12/03/2009), the IMUs 1-2-3-4 were health checked, the ACC IMUs drifts evaluated and the RMU-B health checked during rev 776.

One slew was missed from TL, during the observation period, due to loss of guide star.

The fuel consumption over the period between 14/02/2009 and 20/02/2009 was 0.1681 Kg. The remaining propellant is in the order of 135.7881 Kg.

Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix.

3.1.2 Power

All the other units of EPS are 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 has been identified.

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

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 12th annealing, ended on 04/09/2008 at 23:50Z, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003); detector #17 (failed since 17/07/2004) and detector #5 which experienced an anomaly on 19/02/2009 and has so far not been recoverable (see detailed report in Section 8.3.2).

The energy resolution of the previously degraded GeD#12 has improved following the last annealing and the bias of this detector is now set to 4kV as for the other detectors.

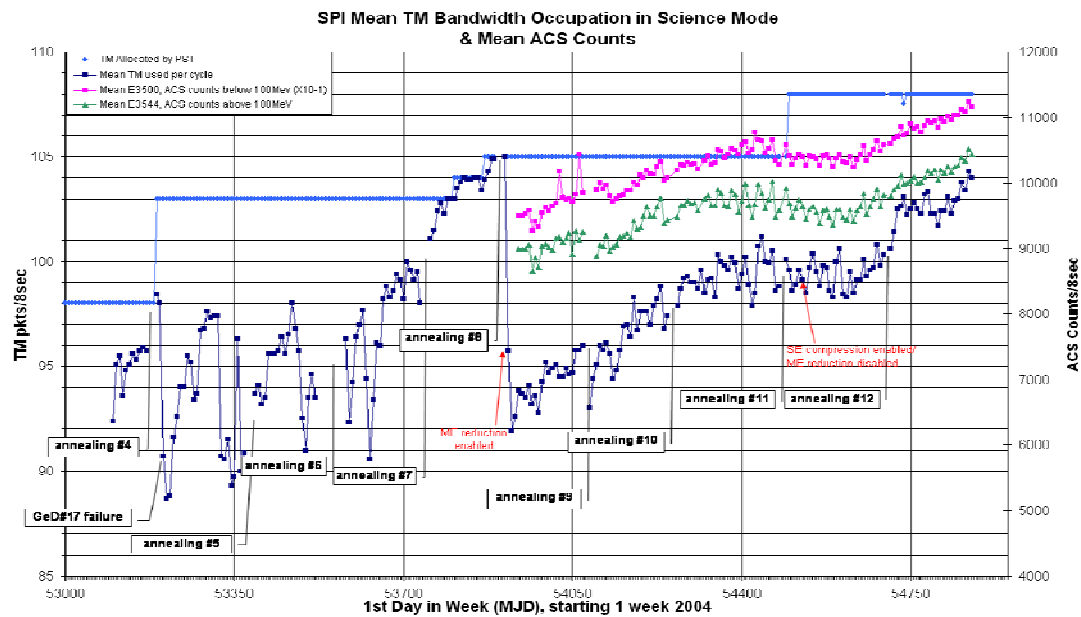
The Stirling compressors are working nominally. The Germanium detectors temperature was kept in the range 80K $\pm$ 1K throughout the week.

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 except for the following periods during the Crab calibration observations in revolution 774:

- 2009-02-14T03:20:42Z - 2009-02-14T10:36:33Z: 106 packets/cycle (for JEM-X specific Crab observation)
- 2009-02-16T00:02:00Z – end of revolution 774: 88 packets/cycle (for OMC FFC).

The average telemetry occupation when the allocation was above 100 packets/cycle was 104 packets/cycle.

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth along with the mean ACS count rate evolution (since July 2006). As can be seen, there is a strong correlation between the evolution of the background as measured by the ACS and the overall TM bandwidth usage.



Note: Some more information concerning the SPI operations is provided in the Appendix 8.3.2.

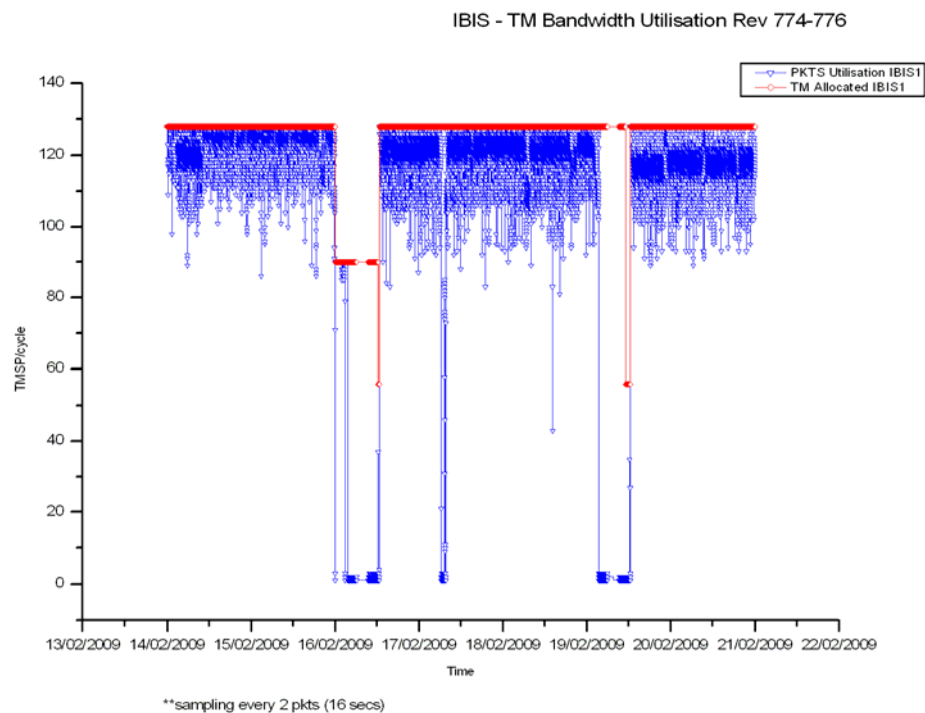
3.2.2 IBIS

The overall status of the unit is nominal.

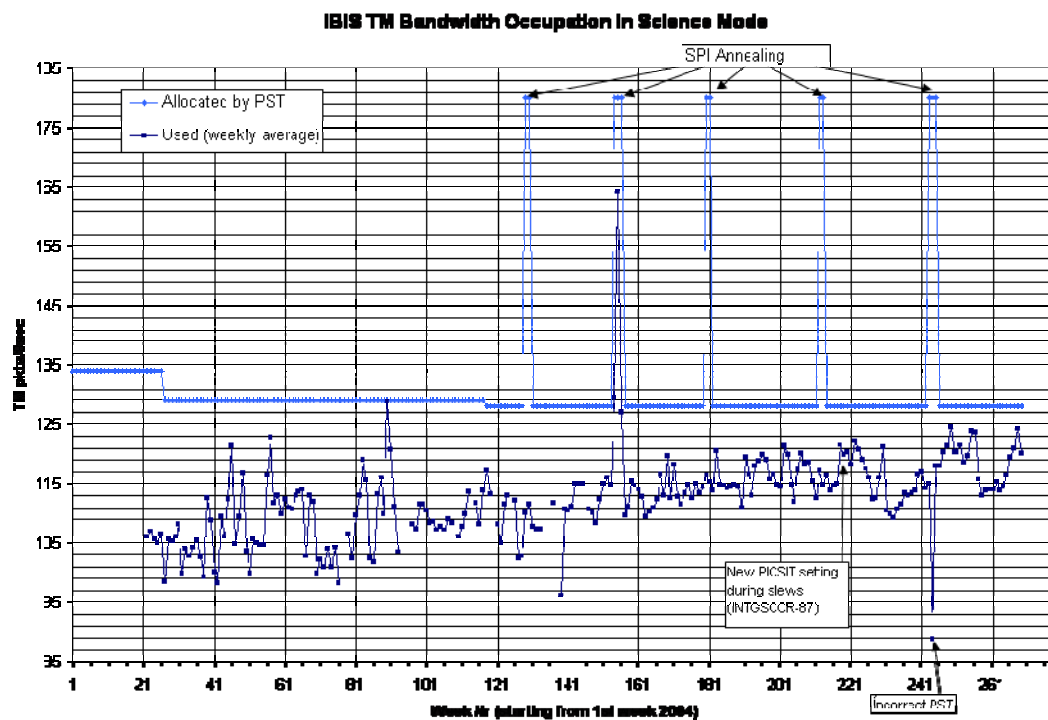
During the reporting period, the TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 128 packets/cycle except from 2009-02-16T00:02:00Z until the end of revolution 774, when it was 90 packets/cycle due to an OMC Flat Field Calibration.
- IBIS mean bandwidth utilisation in science mode: 120.02 packets/cycle (down 4.16 on previous week)
- Percentage of TM cycles in which full bandwidth (128 packets/cycle) was used: 17.56%

The plot below shows the IBIS TM utilisation during the reporting period.



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.

During revolution 774, JEM-X1 & JEMX2 were operated in parallel with a TM allocation of 4 or 5 packets each per cycle (depending on the observation). During revolutions 775 & 776, JEMX-1 was operated in Data Taking mode with a TM allocation of 8 packets/cycle, with JEM-X2 dormant (DPE OFF) and no TM slots allocated.

Note: Some more information concerning the JEM-X operations is provided 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 per cycle, except during the Flat-Field and Dark Current calibrations from 2009-02-16T00:02:43Z to the end of revolution 774 when it was 63 packets per cycle.

During this reporting period, 175 of the 177 planned science pointings were executed nominally, 1 was interrupted, and 1 lost.

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. The risk of solar flares was very low.



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. No pointing was lost due to ground problems. The overall performance was over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was good this week. No restarts of ifrd or isds were necessary this week, it appears that the firewall stability is much improved.

4.2 Ground Stations & Network

The performance of the ground stations and Network was good this week. On DoY 046 at 06:32:00Z, DoY 047 at 18:56:00Z and DoY 048 at 20:20:00Z bad frames were received from Redu for a few seconds.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

A new PSF has been received for revolution 786. The PSF for revolution 780 was changed to include an additional SATENG window, forcing a replanning of revolutions 780 and 781.

New observations were planned for revolutions 782-784.

New TSFs have been received for revolutions 779 and 780.

2. Observation status

A new ECS files has been received for revolution 768.

3. ISOC Science Data Archive

Installation of the new INGEST software is on-going. The documentation has been updated. The 3rd ISGRI catalogue data is ready for inclusion, but for a few sources the data products provided by Southampton are incomplete.

4. ISOC system

Work is continuing on V22 (post TAC s/w).

5. Problems

No new problems.

4.3.2 ISDC

Status of ISDC observation processing on 20/02/2009:

- Latest Standard Analysis completed: observation 06200280123 (PKS 1510-089, Revolution 766) on 19/02/2009.
- Latest products archived: observation 06200280123 (PKS 1510-089, Revolution 766) on 20/02/2009.
- Latest observation products sent to the observer: observation 06200280123 (PKS 1510-089, Revolution 763) on 20/02/2009.

5 Special Events

6 Anomalies

The following anomaly reports were entered into the ARTS system this week.

AR id	Date Created	Subject	Segment	Status
INT_SC-246	2009-02-20	SPI GeD #5 Anomaly	Payload	Pending

7 Future Milestones

- Lunar eclipse 25/2/2009
- Reconfiguration of Ita disks on idda

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 774

The observations in revolution 774 were dedicated to the Crab calibration with an attitude of (RA 05:34:31.90, DEC +22:00:52.0). They began with a 5x5 raster dither , lasting ~13.3 hours. This was followed by an arc around the Crab dedicated to JEM-X, lasting ~6.4 hours. Subsequently, a 3x3 raster was performed, lasting ~33.8 hours. Finally, an OMC Flat-Field calibration was performed at attitude (RA 02:28:24.00, DEC +15:30:00.0), lasting ~3.4 hours, until the end of the revolution.

Revolution 775

The observation in revolution 775 was a raster dither of the Perseus OB2 Cloud (RA 03:32:48.00, DEC +31:26:00.0), lasting ~58.8 hours.

Revolution 776

The observations in revolution 776 began with a raster dither of “Loop I-Loop IV Super circles” (RA 13:57:10.00, DEC +07:34:37.0), lasting ~9.6 hours. They continued with a raster dither of Centaurus A (RA 13:25:27.6, DEC -43:01:08.9), lasting ~30.6 hours. This was followed by a hexagonal dither of the Galactic bulge region (RA 17:45:36.00, DEC -28:56:00.0), lasting ~3.5 hours. This was followed by a raster dither of the Galactic Centre (RA 17:45:40.03, DEC -29:00:28.1), lasting ~12.5 hours, until the end of the revolution.

Throughout the observation 774, all instruments were in their nominal science modes. The TM allocation began with IBIS 128; SPI 108; JEM-X1 4; JEM-X2 4; OMC 5. At 2009-02-14T03:21:25Z this was changed to IBIS 128; SPI 106; JEM-X1 5; JEM-X2 5; OMC 5 for the JEM-X part of the calibration. At 2009-02-14T10:37:16Z, the allocation was returned to IBIS 128; SPI 108; JEM-X1 4; JEM-X2 4; OMC 5 until 2009-02-16T00:02:43Z, when it was set to IBIS 90; SPI 88; JEM-X1 4; JEM-X2 4; OMC 63 for the Flat-Field calibration, until the end of the revolution. During the observations 775 and 776, 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.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2009-02-01T11:18:49.000Z	136.1510	F	Automatic TM processing.
2009-02-02T21:25:08.000Z	136.0877	F	Automatic TM processing.
2009-02-04T11:04:25.000Z	136.0671	F	Automatic TM processing.
2009-02-05T21:24:36.000Z	136.0506	F	Automatic TM processing.
2009-02-07T10:51:04.000Z	136.0430	F	Automatic TM processing.
2009-02-08T16:02:35.000Z	136.0016	F	Automatic TM processing.
2009-02-10T10:36:24.000Z	135.9839	F	Automatic TM processing.

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2009-02-11T20:38:44.000Z	135.9616	F	Automatic TM processing.
2009-02-13T10:24:41.000Z	135.9562	F	Automatic TM processing.
2009-02-14T19:50:45.000Z	135.9170	F	Automatic TM processing.
2009-02-16T10:10:33.000Z	135.9051	F	Automatic TM processing.
2009-02-17T20:13:33.000Z	135.8569	F	Automatic TM processing.
2009-02-19T05:28:09.000Z	135.8338	F	Automatic TM processing.
2009-02-19T10:00:09.000Z	135.8280	F	Automatic TM processing.
2009-02-19T22:39:22.000Z	135.7881	F	Automatic TM processing.

This report was generated Fri Feb 20 08:00:31 GMT 2009

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, 14/02/2009 – 20/02/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 81 Open Loop Slews, 114 Closed Loop Slews and 6 Momentum Biases were executed (as reported by ACC OEM).

1 slew (CSL) was missed from TL, during the observation period, due to loss of guide star.

This is equivalent to ~ 0.5 % of the total number of slews planned (195).

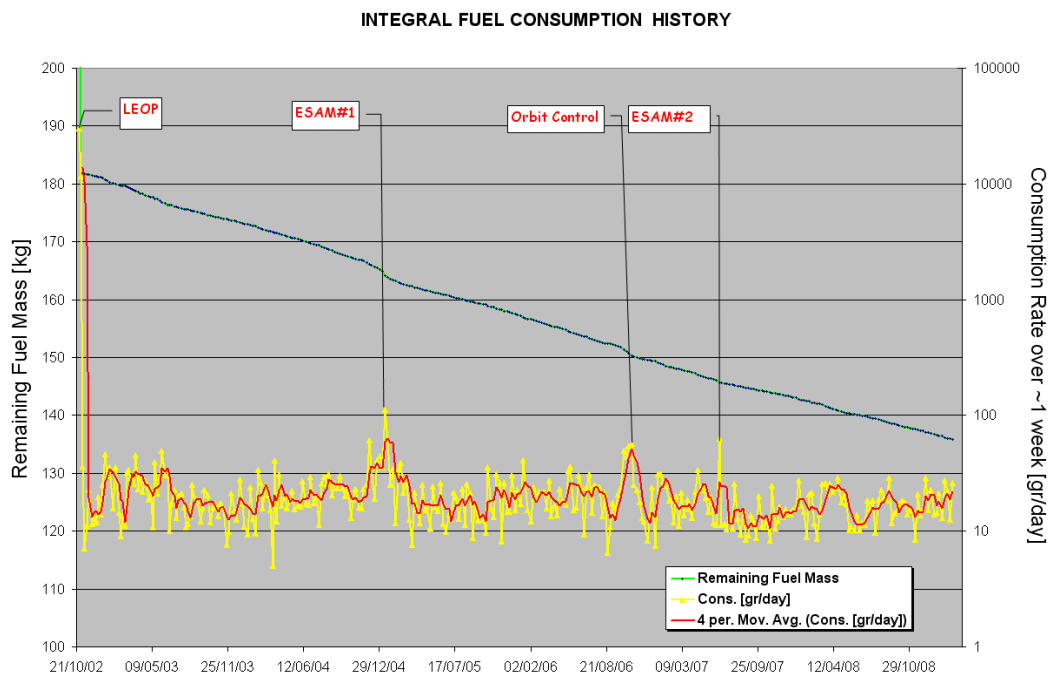
The OTF was not reached during part of PID 07760025 and PID 07750027, due to loss of guide star.

Orbit Control

No update.

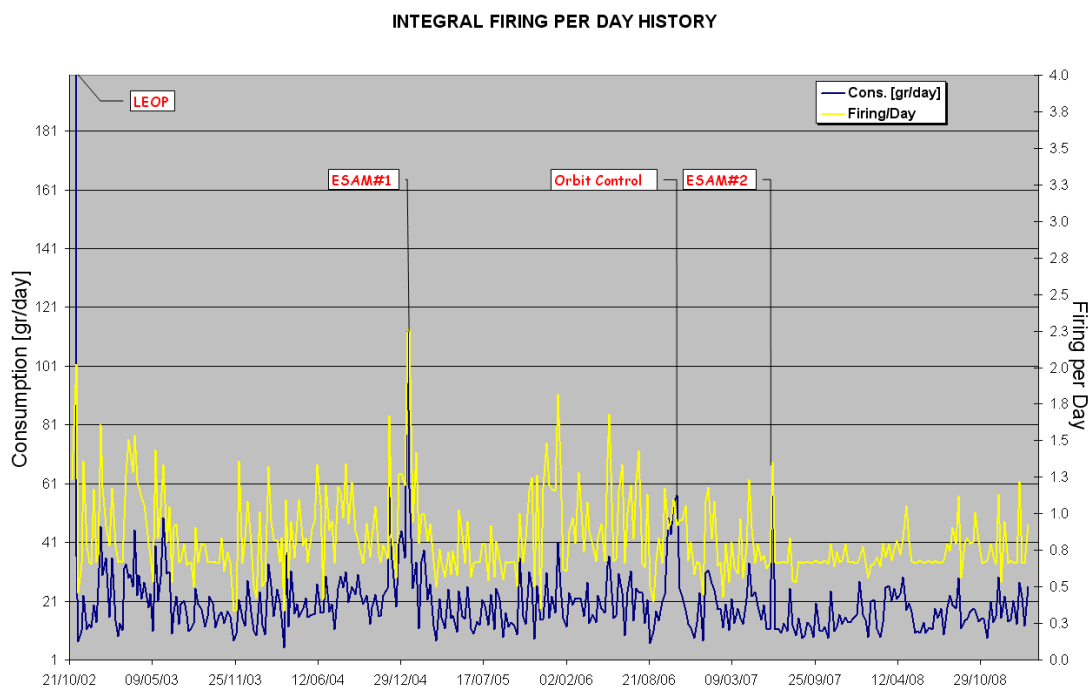
Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 20/02/2009 is reported in the plot below.



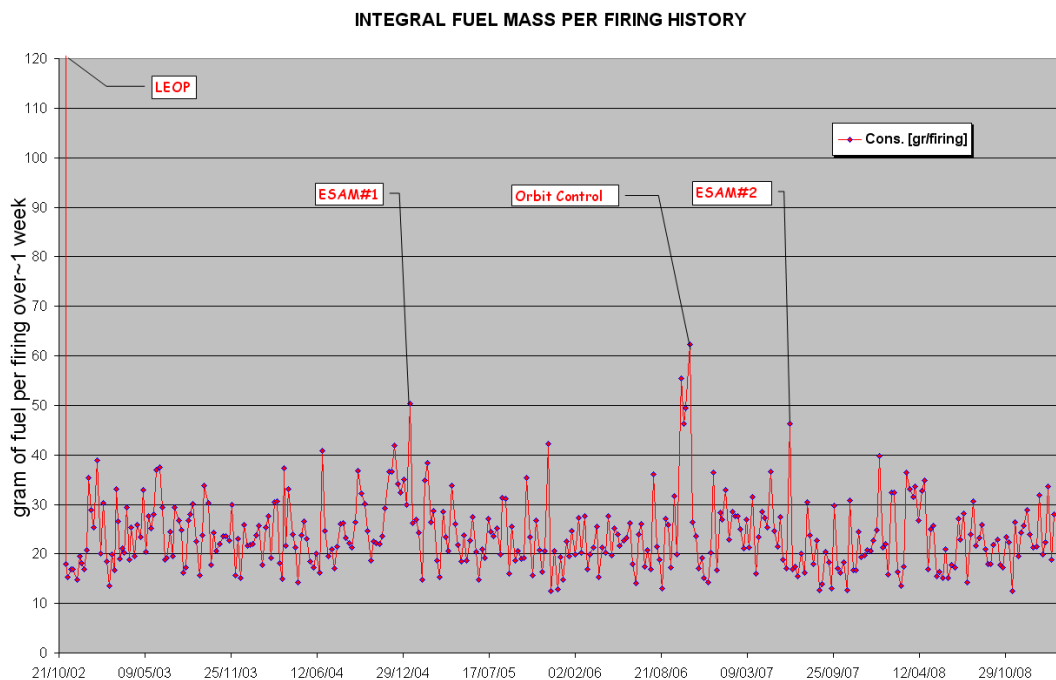
The above plot considers the ESAM fuel consumption spread over period of ~1 week.

The firing per day over the period between 01/11/2002 and 20/02/2009 is reported in the plot below.



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

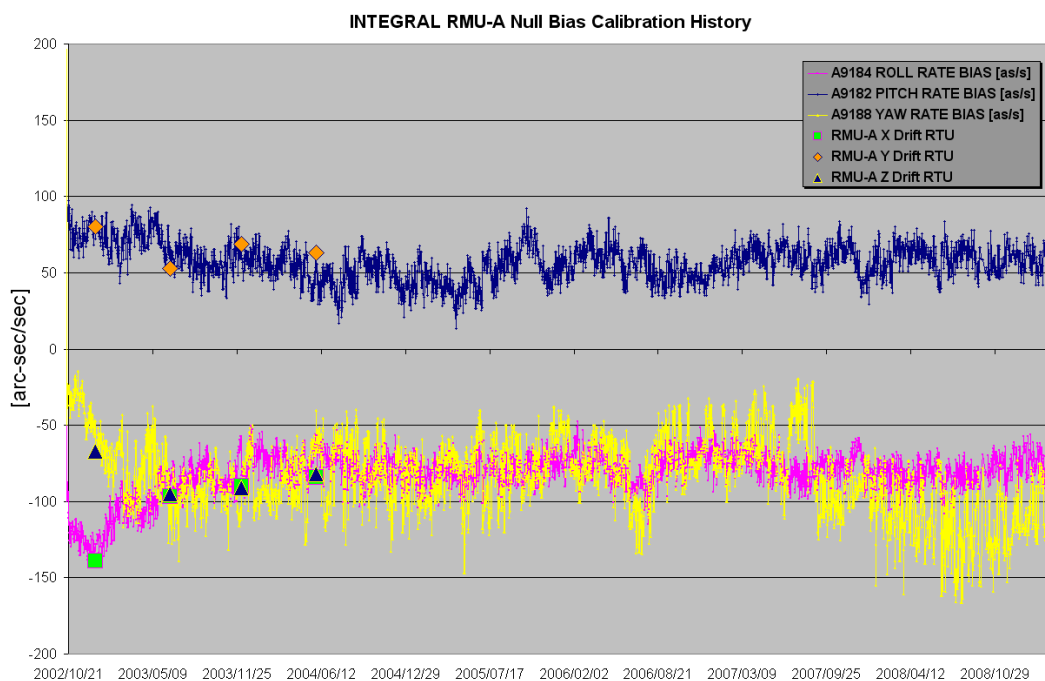
The fuel per firing over the period between 01/11/2002 and 20/02/2009 is shown in the plot below.



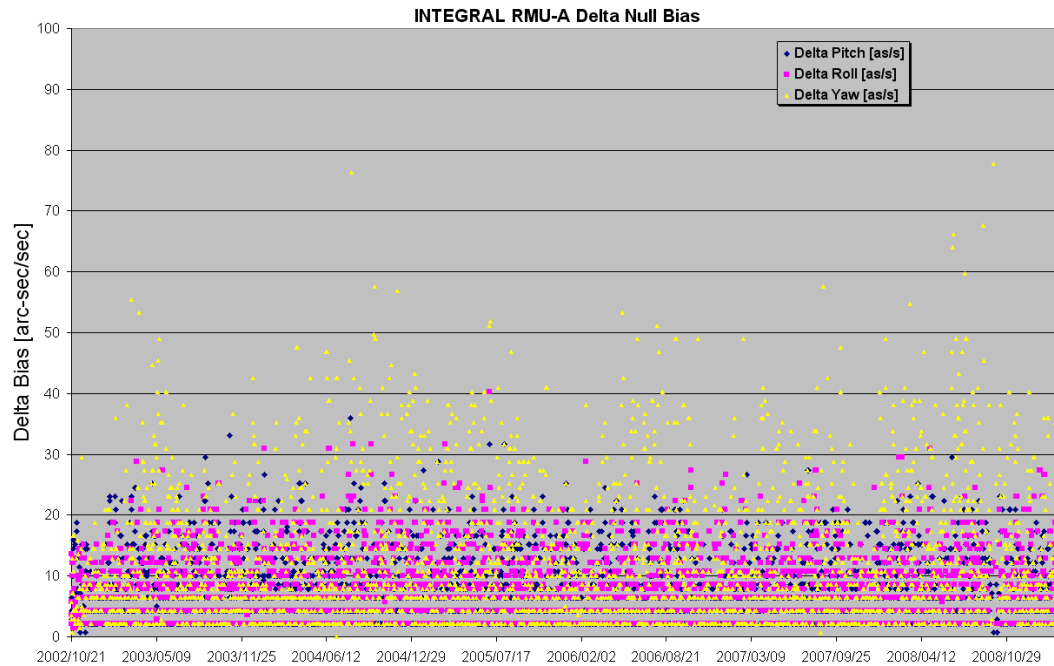
The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the period between 01/11/2002 and 20/02/2009 is reported in the plot below.

The evolution of the drift on yaw channel is under constant monitoring but the values are still well within the specs. At the moment the current constraints (for drift update generation) on the FDS have been relaxed to cope with the current situation.



The RMU-A delta null bias calibration history, on pitch, roll and yaw channel over period between 01/11/2002 and 20/02/2009 is reported in the plot below.



14/02/2009 (Day of Year 045, Revolution 774)

Nothing to report.

15/02/2009 (Day of Year 046, Revolution 774)

Nothing to report.

16/02/2009 (Day of Year 047, Revolution 774-775)

Nothing to report.

17/02/2009 (Day of Year 048, Revolution 775)

FDS failed slew update: at 04:59z the FDS failed the update of slew ID 07750019. FDS reported an error during the update process.

A manual recovery was performed and the slew ID 07750019 was manually updated in TL.

No impact on TL.

Loss of guide star: at 14:29:32z a loss of the selected guide star occurred during PID 07750027. The origin of the event is not clear, likely due to a false event affecting the STR.

As foreseen by the IPS logic, the ACC switched ON the IMU 1, a new automatic mapping was commanded and a new guide star picked. During the following recovery process, the FDS reported an error: The slew needed to be recovered as an OSL instead of the planned CSL.

A manual recovery (OSL) was then performed from attitude PID 07750027 to the attitude of PID 07750028. The next slew ID 07750029 was manually updated in TL at 15:11z.

The OTF was not reached during the part of PID 07750027.

The following slews were not executed in TL: 07750028(CSL).

18/02/2009 (Day of Year 049, Revolution 775)

Nothing to report.

19/02/2009 (Day of Year 050, Revolution 775-776)

Nothing to report.

20/02/2009 (Day of Year 051, Revolution 776)

Loss of guide star: at 09:45:20z a loss of the selected guide star occurred during PID 07760025. The origin of the event is likely due to a false event affecting the STR.

As foreseen by the IPS logic, the ACC switched ON the IMU 1, a new automatic mapping was commanded and a new guide star was picked. The next slew 07760026 was manually updated in TL.

No impact on TL.

The OTF was not reached during the part of PID 07760025.

Lunar + Summer 2009 Eclipse Season preparation: in preparation for the lunar + summer 2009 eclipse season the ACC IMU 1-2-3-4 drifts were evaluated and the RMU-B health was checked during rev 776.

The calculated FD drifts (**below in red**) resulted consistent with the evaluation performed in parallel by FCT and with the drifts history.

Time z	Complete IMU Health-Check / Calibration and RMU-B Health Check 20/02/2009 (DoY 051)	
13:26:00	Verify the end of AOCS TL commanding Disable ACC Autonomous IMU Switch Off, FCP-AOC-1051 Remark for procedure AOC_1051: Step 2.2 the correct TC-parameters setting is A1379=INHIBIT, A1380=ENABLE, A1381=ENABLE Load GRD to visualize the IMUs temperatures	Step 1, IMU1 and IMU3 PID 07760029 Start at 13:26:00Z End at 14:14:53Z
13:38:30	IMU1 Switch On, FCP-AOC-1600 Remark for procedure AOC_1600: Step 4.2 for the SOE: remember to log the IMU time of activation in the IMU lifetime log T6009= 17.31 degC T6010= 13.67 degC T6011= 27.5 degC	(AOCS TL commanding start) Altitude > 150925.5 Km
13:44:04	IMU3 Switch On, FCP-AOC-1604 Remark for procedure AOC_1604: Step 4.2 for the SOE: remember to log the IMU time of activation in the IMU lifetime log	
13:47:21	RMU-B switch On, FCP-AOC-1902 T0052= 28.5 degC T0028= 22.5 degC	
	IMUs warm-up time (>30 minutes)	
14:03:00	Set IMU Selection	PID 07760030 Start at 14:26:00Z End at 15:17:20Z (AOCS slew start) Altitude > 151831.7 Km
14:09:00	ACC: Set IMU1 on Roll, IMU1 on Yaw, FCP-AOC-1050 FDE: Set IMU1-X on Roll(X), IMU3-Y on Pitch(Y), IMU3-Z on Yaw(Z), FCP-AOC-1218	
14:26:30	Verify the end of AOCS TL commanding Reset IAAD Accumulators, FCP-AOC-1210 Reset FCE RMU Integrators, FCP-AOC-1254 Perform IMU-1 Drift and Noise evaluation, FCP-AOC-1623	
14:27:00 to 15:15:00	~48 minutes of data collection Calculated by FCT: IMU1 Noise Roll = 0.2076 as/s IMU1 Drift Roll = 0.3295 as/s IMU1 Noise Yaw = 0.0779 as/s IMU1 Drift Yaw = 0.3264 as/s T6009= 23.33 degC T6010= 19.62 degC T6011= 27.5 degC	
	Calculated by FD: => 0.3178 as/s => 0.3275 as/s	
		PID 07760031

15:24:00 15:27:00	Verify the end of AOCS TL commanding Set IMU Selection ACC: Set IMU1 on Roll, IMU3 on Yaw, FCP-AOC-1050 FDE: Set IMU1-X on Roll(X), IMU3-Y on Pitch(Y), IMU1-Z on Yaw(Z), FCPAOC-1218	Start at 15:24:00Z End at 16:14:00Z (AOCS slew start)
15:28:52 15:32:00	Reset IAAD Accumulators, FCP-AOC-1210 Reset FCE RMU Integrators, FCP-AOC-1254 Perform IMU-3 Drift and Noise evaluation, FCP-AOC-1623 <i>Remark for the SOE: compare with values of the previous IMU drift reported in the specific IMU drift file</i>	
15:29:00 to 16:12:00	~ 43 minutes of data collection Calculated by FCT: IMU1 Noise Roll = 0.2166 as/s IMU1 Drift Roll = 0.3297 as/s IMU3 Noise Yaw = 0.1082 as/s IMU3 Drift Yaw = 0.0425 as/s T6009= 25.5 degC T6010= 21.67 degC T6011= 28.5 degC Calculated by FD: => 0.3323 as/s => 0.0448 as/s	
16:24:00	Verify the end of AOCS TL commanding Deselect IMU1 and IMU3 from ACC Word B, FCP-AOC-1050	PID 07760032 Start at 16:24:00Z End at 17:11:41Z (AOCS TL commanding start)
16:28:02	Deselect IMU1 and IMU3 from FDE, FCP-AOC-1218	
16:28:27	Switch Off IMU1, FCP-AOC-1601 <i>Remark: report the IMU1 on-time in the log</i> T6009=26.5 degC T6010= 22.5 degC T6011= 29.0 degC	
16:30:04	Switch Off IMU3, FCP-AOC-1605 <i>Remark: report the IMU3 on-time in the log</i>	
16:37:00	Re-enable ACC Autonomous IMU Switch Off, FCP-AOC-1051 <i>Remark for procedure AOC_1051: Step 2.2 the correct TC-parameters setting is A1379=ENABLE, A1380=ENABLE, A1381=ENABLE</i>	
16:40:00	RMU-B switch Off, FCP-AOC-1903 T0052= 31.67 degC T0028= 25.0 degC	
Thermal stabilisation after IMU1 and IMU3 Switch Off PID 07760032-PID 07760033 16:34:00 – 17:45:00		
17:42:00	Verify the end of AOCS TL commanding Disable ACC Autonomous IMU Switch Off, FCP-AOC-1051 <i>Remark for procedure AOC_1051: Step 2.2 the correct TC-parameters setting is A1379=INHIBIT, A1380=ENABLE, A1381=ENABLE</i>	Step 2, IMU2 and IMU4
17:45:12	IMU2 Switch On, FCP-AOC-1602 <i>Remark for procedure AOC-1602: Step 2.2.1 do not requested to check if IMU1 is selected for YAW. If for any reason</i>	PID 07760033 End at 18:13:00Z (AOCS slew start)

	during the calibration, the guide star is lost the controller will switch ON the IMU1: the contingency reaction foresees to switch OFF the IMU2 to avoid thermal problem Step 4.2 remember to log the IMU time of activation in the IMU lifetime log T6009= 22.92 degC T6010= 18.85 degC T6011= 27.0 degC	
17:50:06	IMU4 Switch On, FCP-AOC-1606 Remark for procedure AOC-1606: Step 4.2 remember to log the IMU time of activation in the IMU lifetime log	
18:00:00	Set IMU Selection ACC: Set IMU2 on Roll, IMU2 on Yaw, FCP-AOC-1050	
18:04:00	FDE: Set IMU2-X on Roll(X), IMU4-Y on Pitch(Y), IMU2-Z on Yaw(Z), FCP-AOC-1218	
	IMUs warm-up time (>30 minutes)	
18:23:40	Reset IAAD Accumulators, FCP-AOC-1210 Perform IMU-2 Drift and Noise evaluation, FCP-AOC-1623 Remark: compare with values of the previous IMU drift reported in the specific IMU drift file	
18:24:00 to 18:54:00	~30 minutes of data collection Calculated by FCT: IMU2 Noise Roll = 0.1929 as/s IMU2 Drift Roll =0.2259 as/s IMU2 Noise Yaw =0.030 as/s IMU2 Drift Yaw = -0.010 as/s T6009= 26.0 degC T6010=22.5 degC T6011=27.5 degC	Calculated by FD: => 0.2249 as/s => -0.0103 as/s
18:54:40	Verify the end of AOCS TL commanding Set IMU Selection ACC: Set IMU4 on Roll, IMU2 on Yaw, FCP-AOC-1050	
18:57:03	FDE: Set IMU4-X on Roll(X), IMU4-Y on Pitch(Y), IMU2-Z on Yaw(Z), FCP-AOC-1218	
18:57:59	Reset IAAD Accumulators, FCP-AOC-1210 Perform IMU-4 Drift and Noise evaluation, FCP-AOC-1623 Remark: compare with values of the previous IMU drift reported in the specific IMU drift file	
18:58:00 to 19:33:00	~35 minutes of data collection Calculated by FCT: IMU4 Noise Roll = 0.2076 as/s IMU4 Drift Roll = -0.0057 as/s IMU2 Noise Yaw = 0.031 as/s	Calculated by FD: => -0.0060 as/s

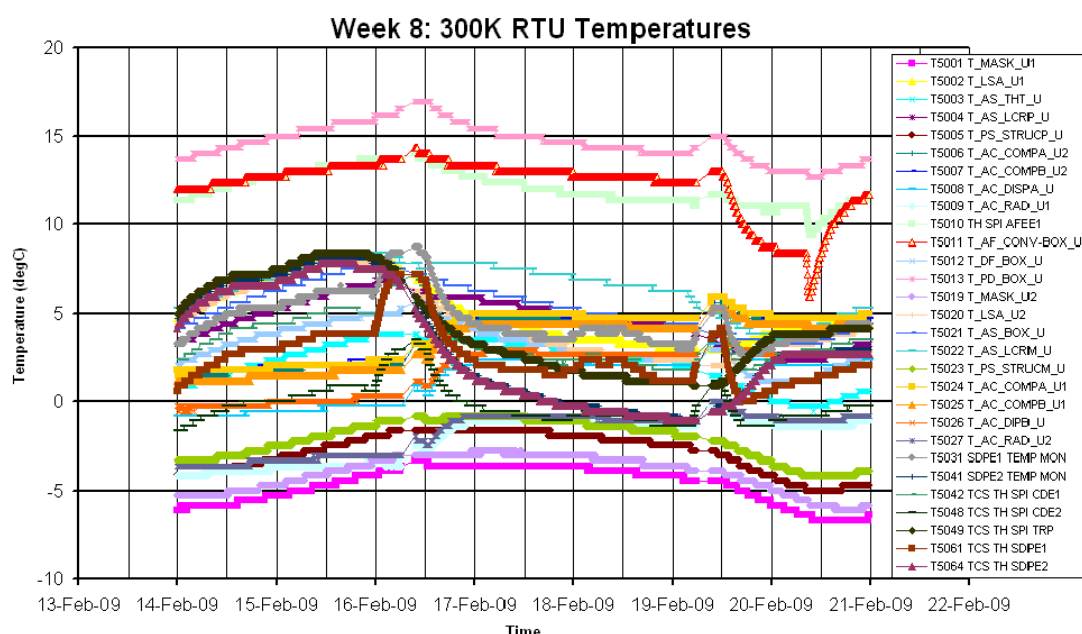
PID 07760034
 Start at 18:21:00Z
 End at 19:40:04Z
 (AOCS slew start)

Altitude > 153907.8 Km

	IMU2 Drift Yaw = 0.006 as/s T6009= 28.0 degC T6010=23.75 degC T6011=28.0 degC	=> 0.0033 as/s	
19:47:00	Deselect IMU2 and IMU4 from ACC Word B, FCP-AOC-1050		PID 07760035 Start at 19:47:00Z End at 20:37:00Z (AOCS TL slew start) Altitude >153908.4
19:49:11	Deselect IMU2 and IMU4 from FDE, FCP-AOC-1218		
19:50:22	Switch Off IMU2, FCP-AOC-1603 <i>Remark for the SOE: report the IMU2 on-time in the log</i> T6009= 28.5 degC T6010= 24.17 degC T6011= 28.0 degC		
19:52:04	Switch Off IMU4, FCP-AOC-1607 <i>Remark for the SOE: report the IMU4 on-time in the log</i>		
19:52:37	Re-enable ACC Autonomous IMU Switch Off, FCP-AOC-1051 <i>Remark for procedure AOC_1051: Step 2.2 the correct TC-parameters setting is A1379=ENABLE, A1380=ENABLE, A1381=ENABLE</i>		

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.

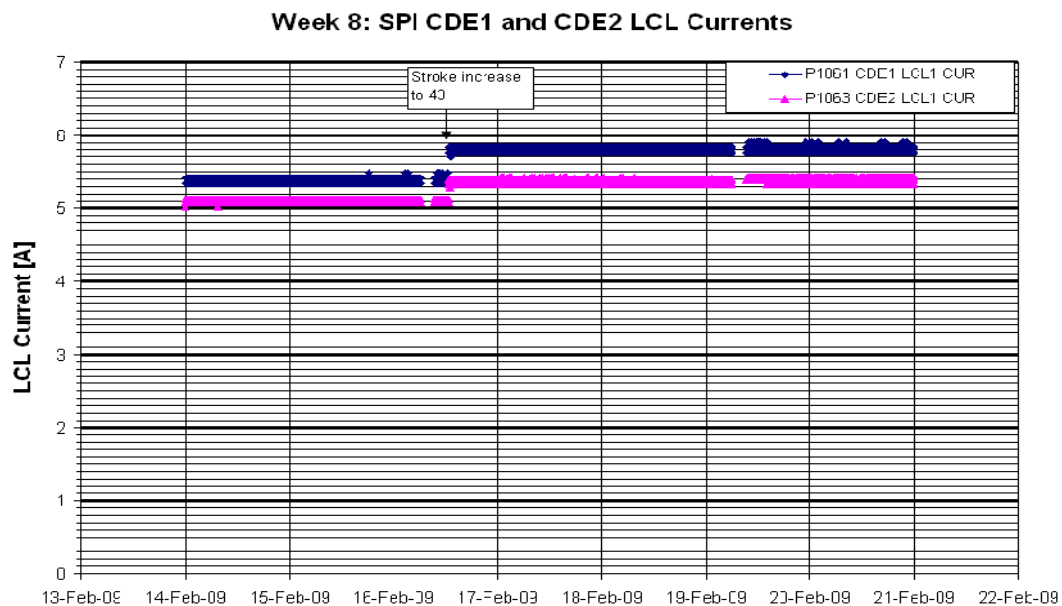


Stirling Compressors and Cryostat: The performance of the compressors is nominal.

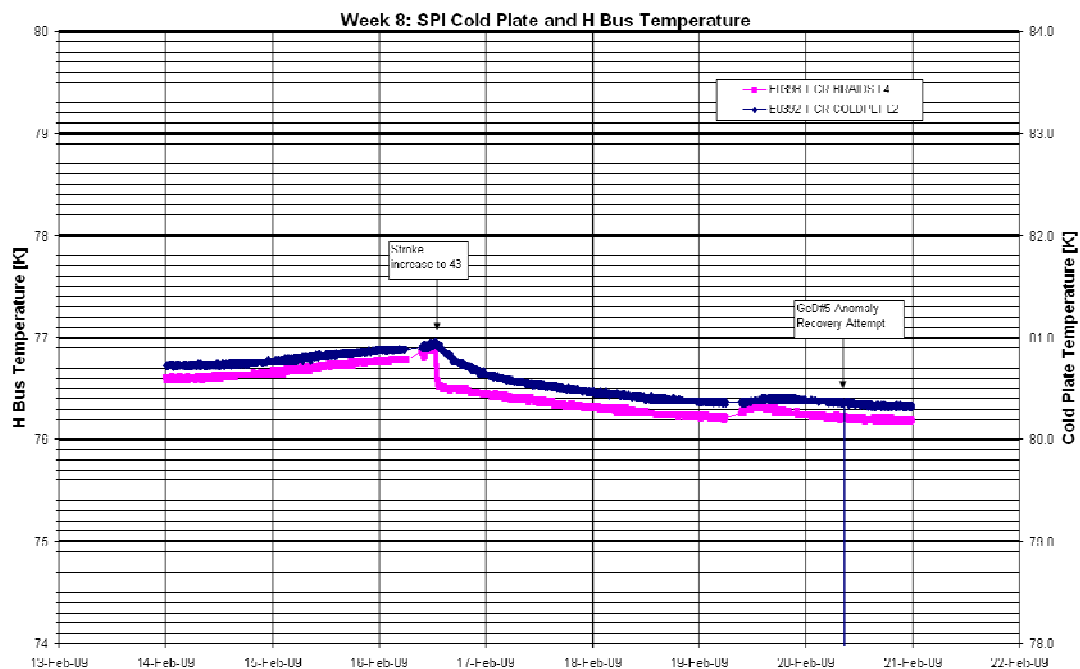
The cold plate temperature was maintained in the range 80K +/-1K.

The stroke of all four compressors was set to 42 until 2009-02-16 at 12:50Z, when it was increased to 43 on all four compressors as the Cold Plate temperature had reached 80.9K.

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



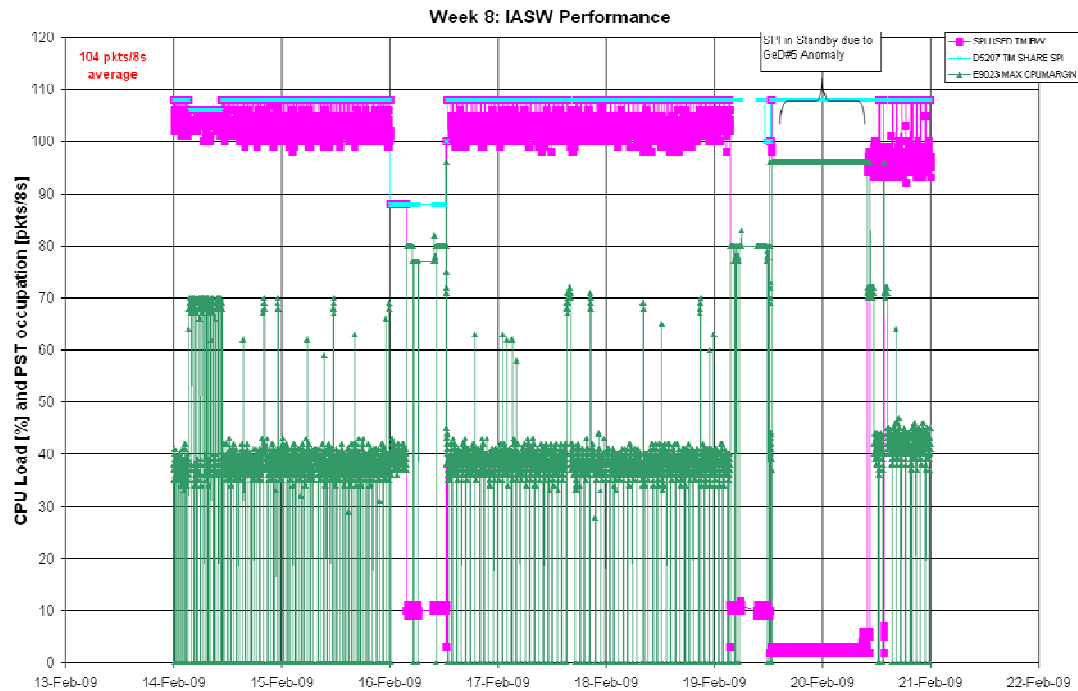
The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period.



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

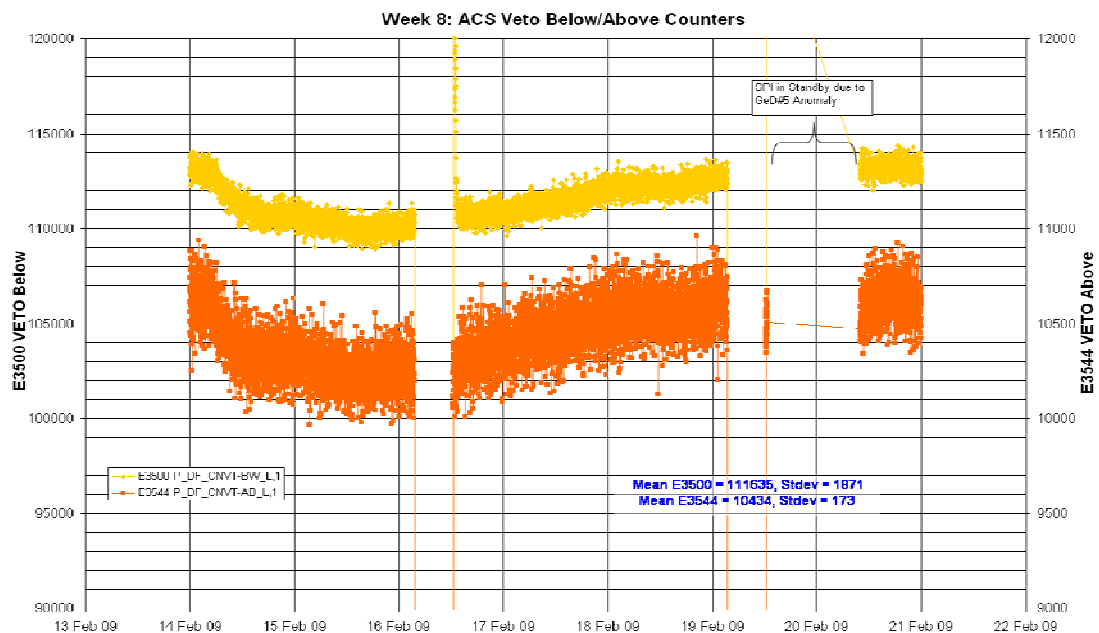
The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The average TM bandwidth occupation of SPI was 104 packets/cycle over the science window when the TM allocation was over 100 packets/cycle.

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



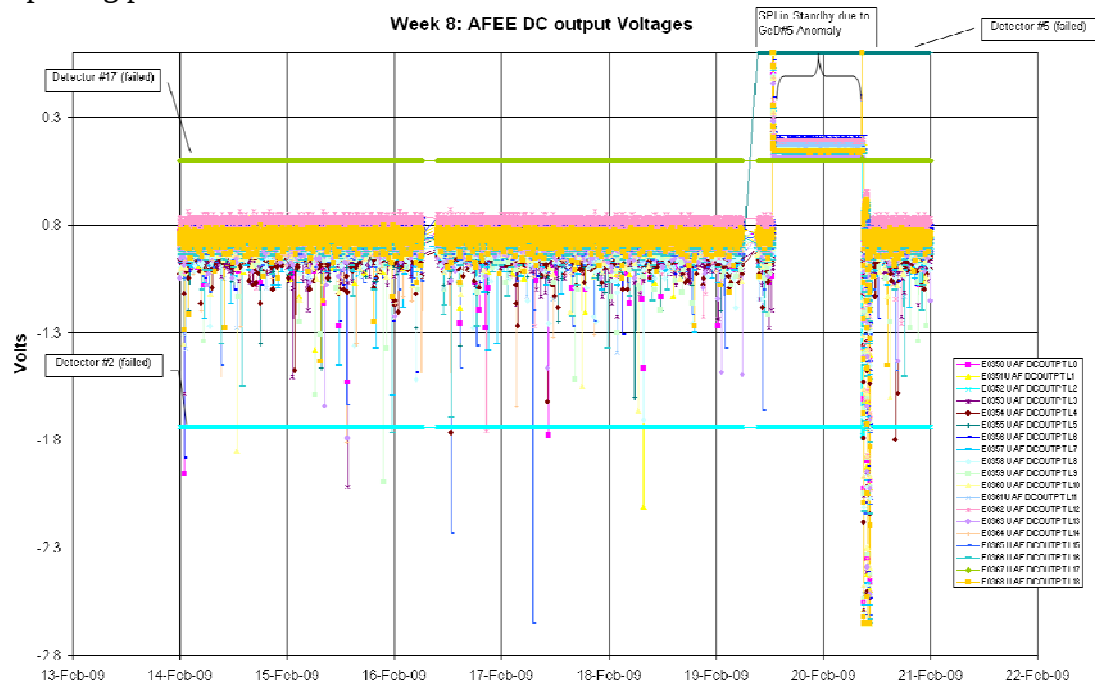
ACS: The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61).

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

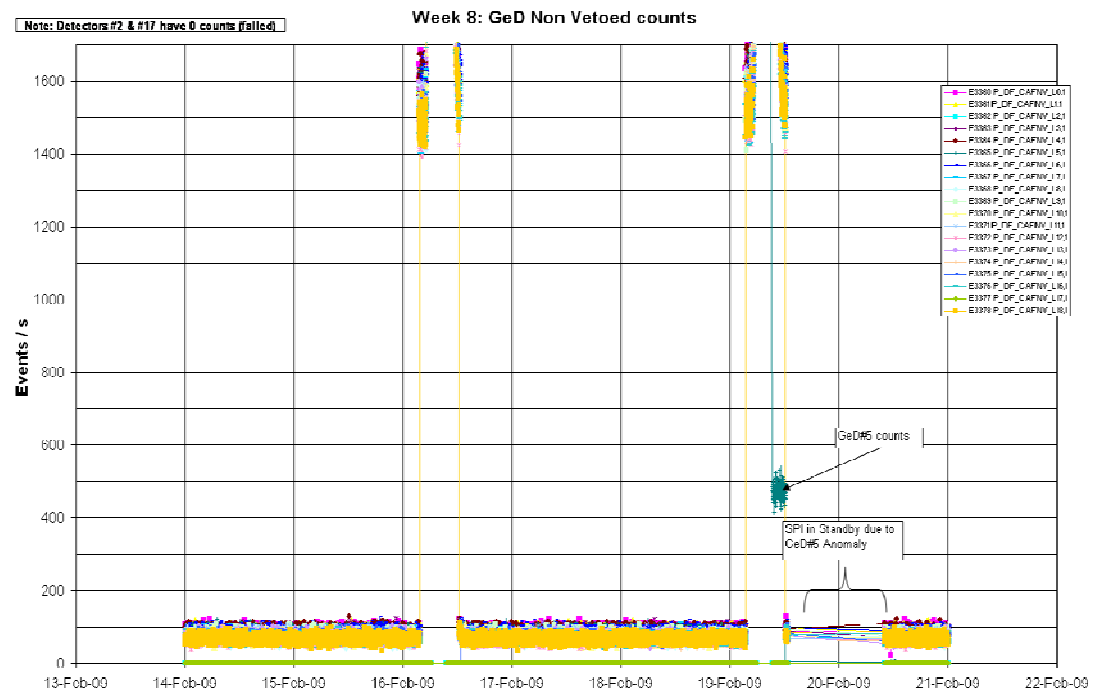


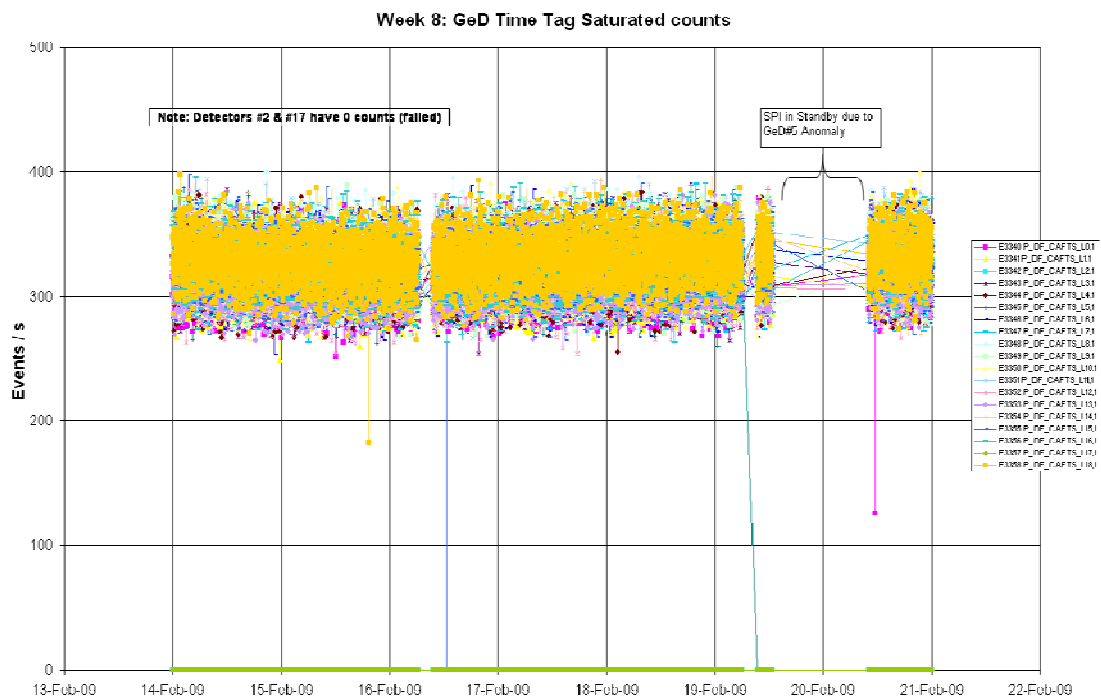
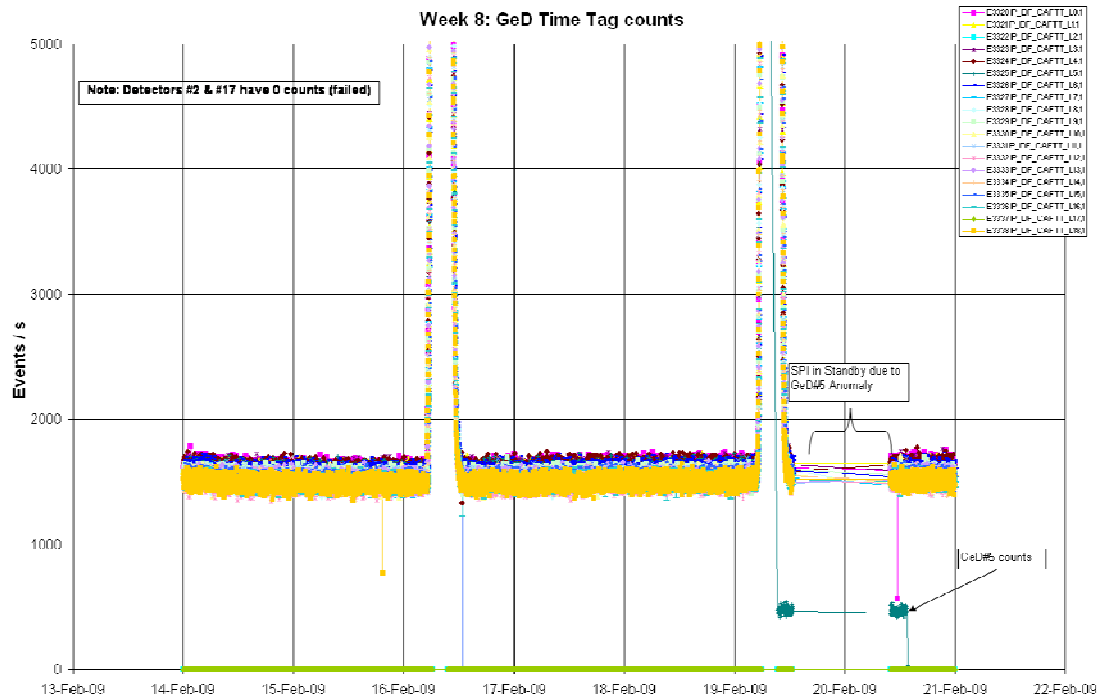
AFEE: The overall health of the AFEE is nominal, although an anomaly occurred on GeD#5 on 19/02/2009, which failed with a DC output voltage fixed at 0V (see details below). Detector #2 is failed since 06/12/2003 and detector #17 is failed since 17/07/2004.

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

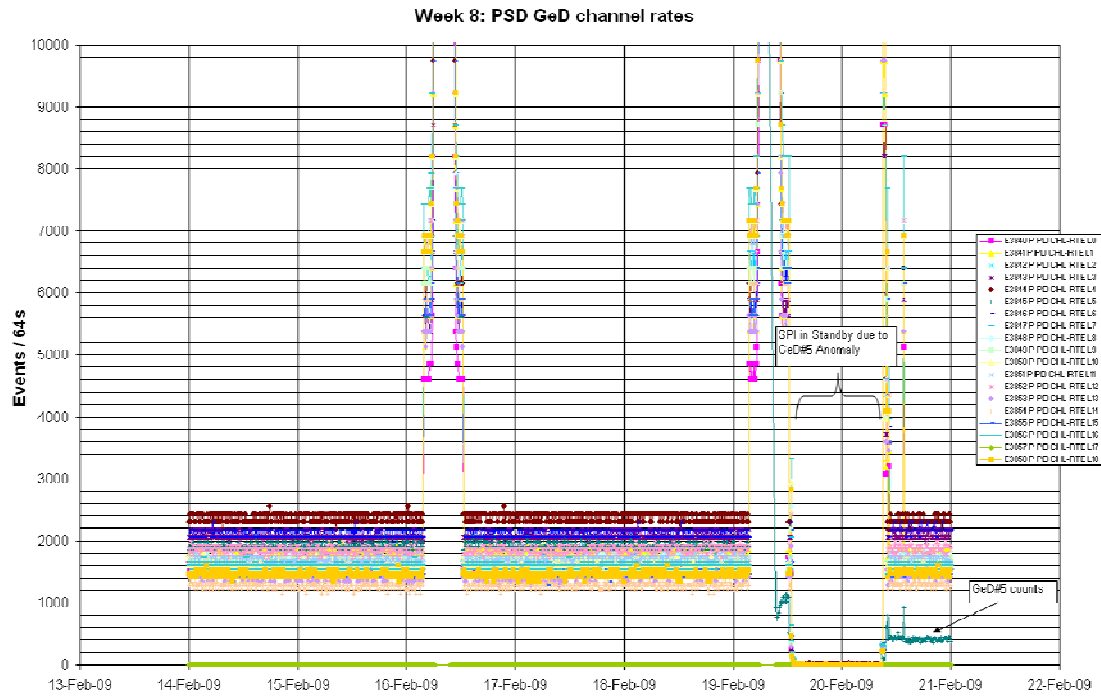


DFEE: The performance of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period.





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 with SPI during the reporting period:

1. GeD#5 Anomaly (Anomaly Report INT_SC-246)

Symptoms

On 19-02-2009, during the perigee passage ground station outage between revolutions 775 and 776, an anomaly occurred on GeD#5. As the anomaly occurred during the outage, the exact time is not known and neither is the behaviour of SPI immediately prior to the anomaly. However, the all SPI parameters were nominal prior to LOS at the end of revolution 775 and there had been no indication of problems.

The symptoms of the anomaly, observable at AOS at 09:21Z were as follows:

- OOL on DC output voltage of GeD#5 (TM parameter E0355). The value was fixed at 0V instead of nominal $\sim -0.9V$.
- All count rates from the GeD#5 were reporting much lower values than nominal, resulting in occasional OOLs on E3325 GeD#5 Time-tagged counts:
 - GeD#5 Time Tagged counts (TM E3325) and GeD#5 Non-Vetoed counts (TM E3365) = ~ 500 instead of ~ 10000 .
 - GeD#5 Time Tagged Saturated counts (TM E3345) = 0 instead of ~ 300 .
 - GeD#5 PSD channel rates (TM E3845) = ~ 1000 instead of ~ 20000 .

Following radiation belt exit and the switch-on of the ACS at 12:16:33Z, the only changes observed were:

- GeD#5 Non-Vetoed counts (TM E3365) reduced to a few counts/cycle instead of ~ 100 counts/cycle as for the other detectors.
- GeD#5 PSD channel rates (TM E3845) reduced to ~ 500 instead of ~ 2000 .

The DC output voltage of GeD#5 remained at 0V.

No other parameters (e.g. GeD HV setting; AFEE LVPS or AFEE LCL currents) showed any anomalous values.

This anomaly is similar to that on the other failed GeDs (#2 and #17), however the symptoms are not identical:

- In all cases, the DC output voltage is frozen at a certain value, however this value is different in all three cases ($-1.7V$ for GeD#2; $-0.4V$ for GeD#17 and 0V for GeD#5), see Figure 1 above
- In all cases the AFEE count rates are reduced, however all AFEE count rates for GeDs #2 are zero and for GeD#17 they were a few counts/minute while the TT counts for GeD#5 are $\sim 500/\text{cycle}$.
- In all cases the PSD channel rates are reduced, however not by the same amount. GeD#5 displays a similar behaviour to GeD#2 in this regard:
 - GeD#2 had ~ 400 counts/64sec
 - GeD#17 had a few counts/64sec
 - GeD#5 has ~ 500 counts/64sec

Recovery

As first reaction, SPI was commanded to a safe configuration, Standby Mode (in which GeD HV and ACS are OFF) via FCP_SPI1_0120 at 12:41:21Z. SPI was left in Standby pending further analysis by the PI and FCT and determination of recovery actions to be performed the following day.

On 20-02-2009 the following recovery actions were performed following analysis of the anomaly and discussion with the SPI PI:

- 08:25:19Z Power cycle of AFEE by executing steps 5.1 to 15 of CRP_SPI1_3010. Step 16 (reload of nominal configuration) was not performed as it was desired to switch on the GeD HVs in steps.
 - 08:43:06Z FCP_SPI_0179 to load the AFEE HV ON configuration in 500 volt steps, going only to 500V on all GeD (at 09:02:31Z). During the HV switch-on, no change was observed on the DC output voltage of GeD#5. Following the switch-on, some counts were seen on PSD channel rates for GeD #5.
 - 09:10:51Z FCP_SPI_0177 to load the ACS flight configuration
 - 09:34:52Z FCP_SPI_0171 to load the PSD flight configuration
 - 09:47:25Z FCP_SPI_0174 to load the DFEE flight configuration
 - 09:54:25Z FCP_SPI1_1713 to set HV to 2kV on all GeD. Again, no change was seen in the DC output voltage of GeD#5.
 - 10:00:46Z FCP_SPI1_0130 SPI to PHOTON mode. At this point GeD#5 was still observed to have the anomalously low Time-tag; Non-Vetoed counts and PSD channel rates and no Time-tag saturated counts. The counts from the other GeDs were nominal.
 - 10:20:35Z SPI commanded to CONF mode (FCP_SPI1_0160), nominal HV restored on all GeD except GeD#5 via FCP_SPI1_1713 and returned to PHOTON mode (FCP_SPI1_0130).
- It was decided to stay at this HV setting for a few hours in order to gather spectra from GeD#5. Later analysis of this data revealed only few counts at high energy from GeD#5.
- 13:32:35Z SPI commanded to CONF mode (FCP_SPI1_0160), GeD#5 HV set to zero via FCP_SPI1_1713 and returned to PHOTON mode (FCP_SPI1_0130).

SPI was left in this safe configuration with GeD#5 isolated pending further analysis and elaboration of a plan for further investigations of the anomaly.

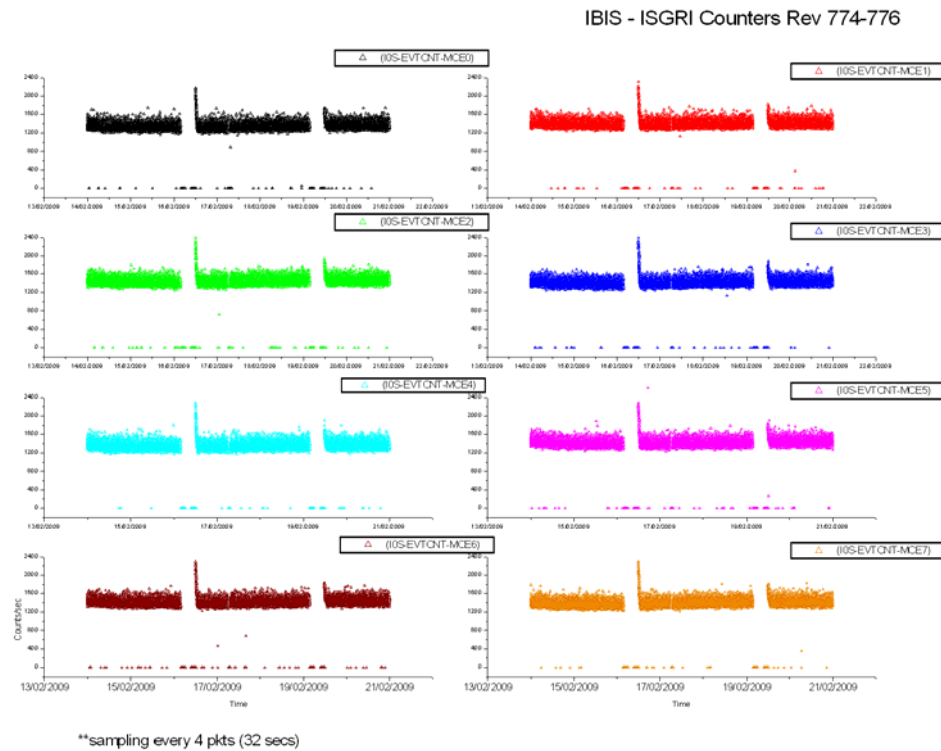
2. High radiation at radiation belt exit

- Due to continuing high radiation after the expected radiation belt exit of revolution 775, TM parameter E3500 (ACS CntVetoBelow) went OOL High on 2009-02-16 at 12:34:34Z. As it returned within limits of its own accord at 13:02:02Z, no action was taken.
- Also due to continuing high radiation after the expected radiation belt exit of revolution 776, TM parameter E3500 (ACS CntVetoBelow) went OOL High on 2009-02-19 at 12:24:10Z, remaining OOL until SPI was commanded to CONF mode at 12:41:21Z as part of the GeD#5 anomaly recovery.

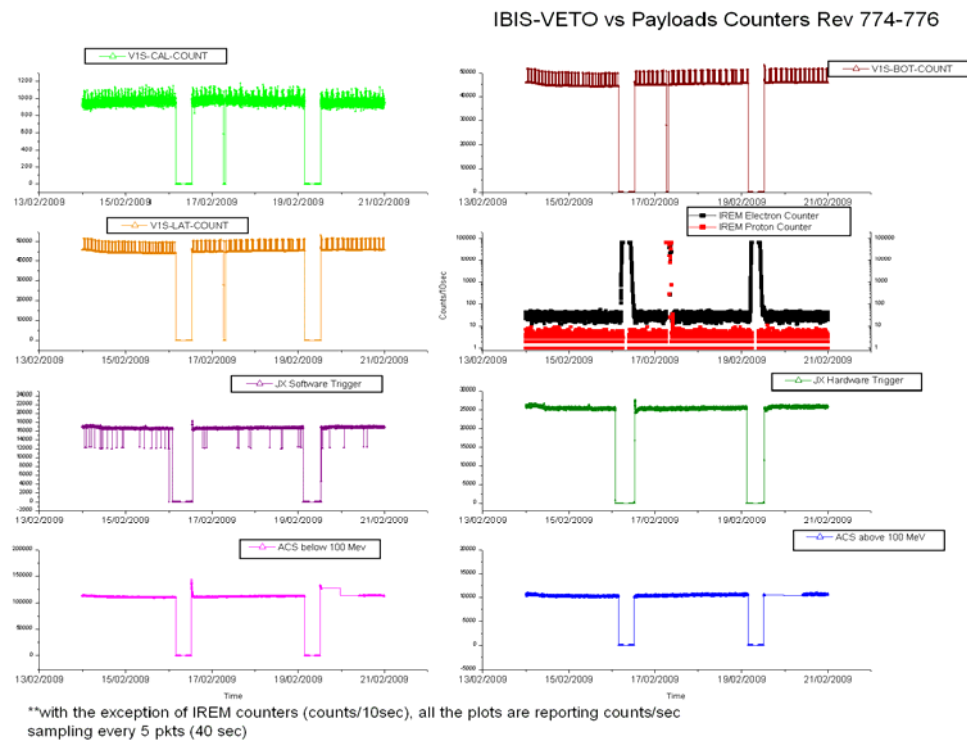
8.3.3 IBIS Operations

IBIS Event Counters Plots

ISGRI Counters:

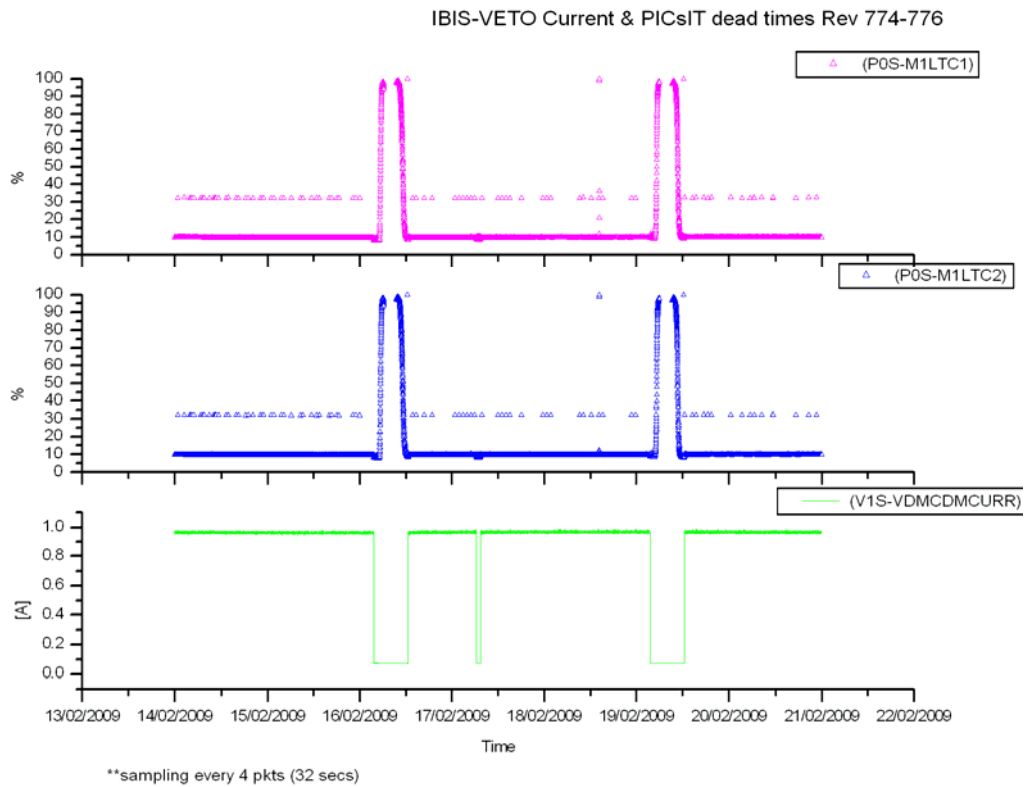


VETO vs Payload Counters:

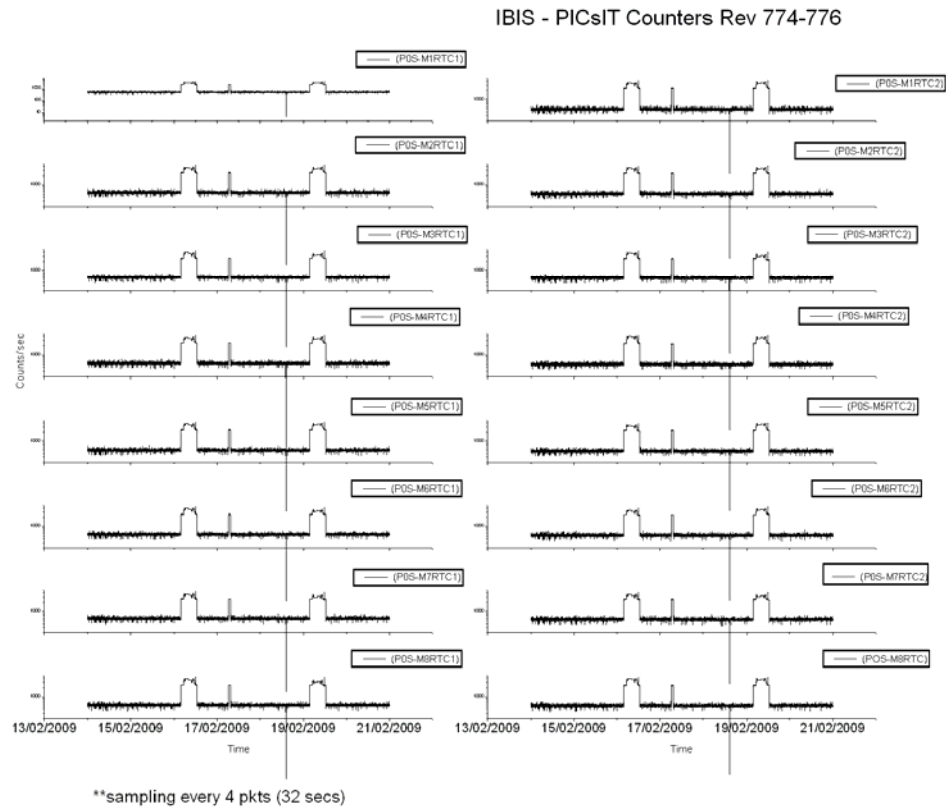


The week was characterised by slightly high radiation after the expected radiation belt exit of revolutions 775 and 776 as reported by the payload.

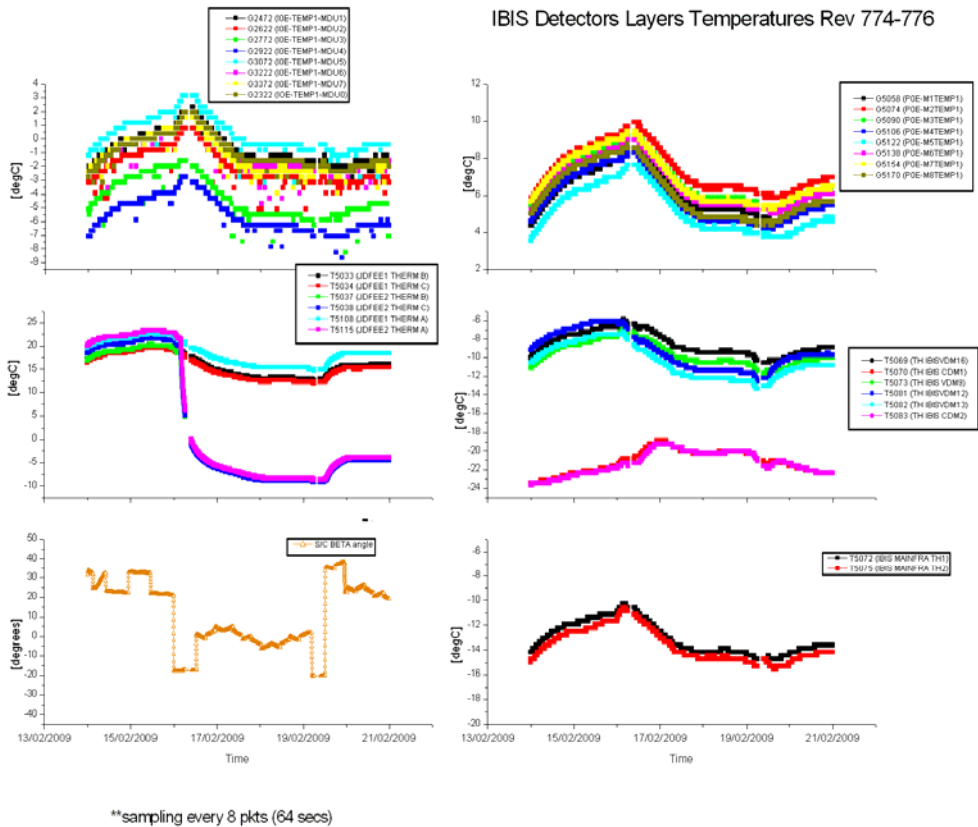
VETO Current:



PICsIT Counters:



IBIS Detectors Layers Temperatures:



IBIS daily report:

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

2009-02-14 (DOY 045, Rev 774)

IBIS operations executed nominally.

2009-02-15 (DOY 046, Rev 774)

At 12:21:49Z TM parameter G2070 went OOL, indicating an overflow of the noisy pixel address buffer in MCE5. As it returned within limits of its own accord at 12:22:05Z, no action was taken. G2070 went OOL again at 23:55:33Z, returning within limits at 23:55:41Z.

2009-02-16 (DOY 047, Rev 774-775)

IBIS operations executed nominally.

2009-02-17 (DOY 048, Rev 775)

Due to an IREM SEU, IBIS transitioned autonomously to Safe configuration at 06:24:08Z. It was recovered as follows:

- At 07:16:47Z FCP_IBIS1_0803 IBIS EXIT FROM SAFE MODE
- At 07:41:35Z ED GESTAN02 uplinked with the planned observation parameters and commanding to IBIS from the Timeline re-enabled.

IBIS operations continued nominally.

2009-02-18 (DOY 049, Rev 775)

At 14:17:38Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 14:18:45Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 14:22:02Z by OEM APID 1280 ID 132 EVENT IBIS1 IASW HEPI RESYNCHRONIZED, indicating that HEPI resynchronised autonomously, by which time all the above parameters had returned within limits, no action was taken.

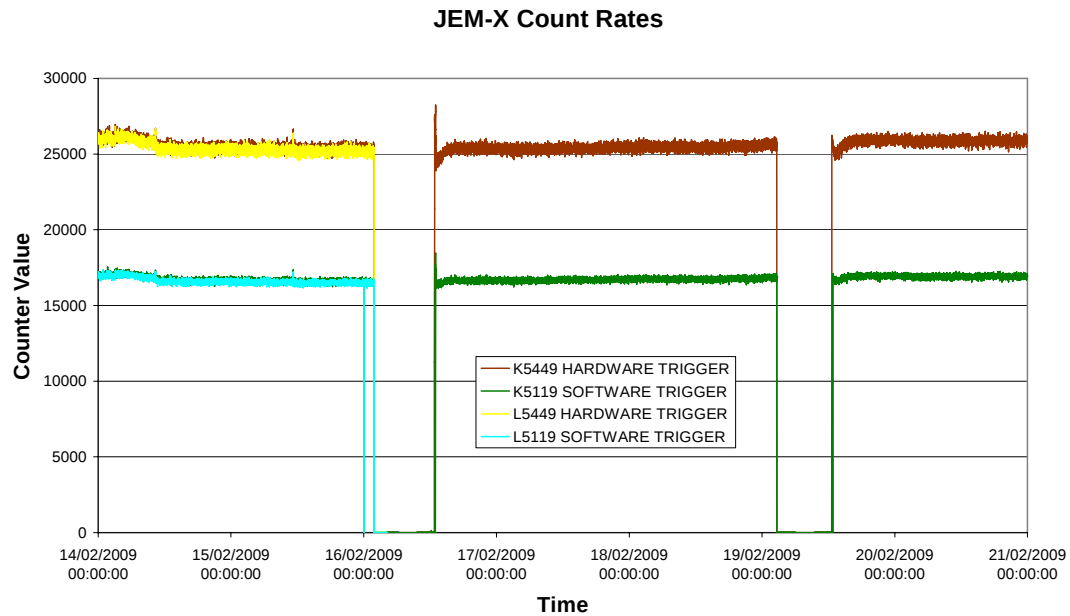
2009-02-19 (DOY 050, Rev 775-776) to 2009-02-20 (DOY 051, Rev 776)

IBIS operations executed nominally.

8.3.4 JEM-X Operations

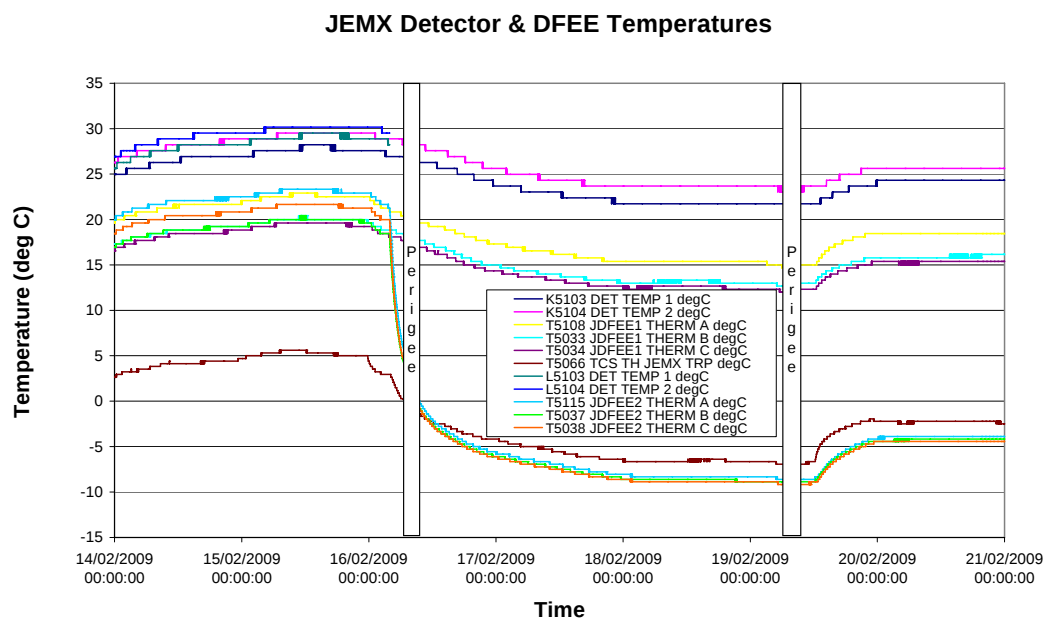
JEM-X Count Rates

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)

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Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OAI
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JEM-X Daily Report

2009-02-14 (DoY 045, Rev 774) to 2009-02-15 (DoY 046, Rev 774)

JEM-X 1 and 2 operations executed nominally.

2009-02-16 (DoY 047, Rev 774-775)

At 03:50, JEMX-2 was manually switched off as scheduled.

At 12:11:44, parameter K5317 exceeded hard limits for 5 minutes, 15 seconds.

At 12:18:00, the same parameter again exceeded hard limits for 11 seconds.

No action was taken and there was no impact.

The following OEMs were received at the indicated times:

2009.047.12.56.04.732	2009.047.12.56.09.791	1536	RealTime	5		EXCEPTION
JEM-X1 EXC IACS INTERF EXID			0	0	65535	PR N
E E						
FIX6		0				
K9079	MESS CLASS	1				
K9080	MESS ID	5				
K9065	CSSW OPERAT ID	START				
K9066	TASK ID 8	IASW				
K9067	LOGICAL ADDRESS	4989				
2009.047.12.56.04.732	2009.047.12.56.09.827	1536	RealTime	6		EXCEPTION
JEM-X1 EXC IACS INTERF CULP			0	0	65535	PR N
E E						
FIX6		0				
K9079	MESS CLASS	1				
K9080	MESS ID	6				
K9065	CSSW OPERAT ID	START				
K9066	TASK ID 8	IASW				
K9067	LOGICAL ADDRESS	19726				

No action was taken and there was no impact.

2009-02-17 (DoY 048, Rev 775)

At 06:24:30 JEMX parameters K5315, K5316 & K5317 went Out-of-Limits due to an IREM SEU (#71). There was no impact as the reaction has been disabled.

2009-02-18 (DoY 049, Rev 775) to 2009-02-20 (DoY 051, Rev 776)

JEM-X 1 operations executed nominally.

8.3.5 OMC Operations

2009-02-14 (DoY 045, Rev 774) to 2009-02-15 (DoY 046, Rev 775)

Nothing to report.

2009-02-16 (DoY 047, Rev 775)

From 00:02:43 to 02:54:11, a Flat-Field calibration was performed. This was followed from 02:54:41 to 03:26:22 by a Dark-Current calibration. Both were performed nominally.

2009-02-17 (DoY 048, Rev 775)

At 06.23.60, an IREM SEU, (#71) forced the OMC to SAFE mode. A recovery was performed, and the unit returned to STAND-BY at 07:05:19. The impact was pointing 07750019 was cut short from a planned 3530 to 1625 seconds, and pointing 07750020 was lost.

2009-02-18 (DoY 049, Rev 775) to 2009-02-20 (DoY 051, Rev 776)

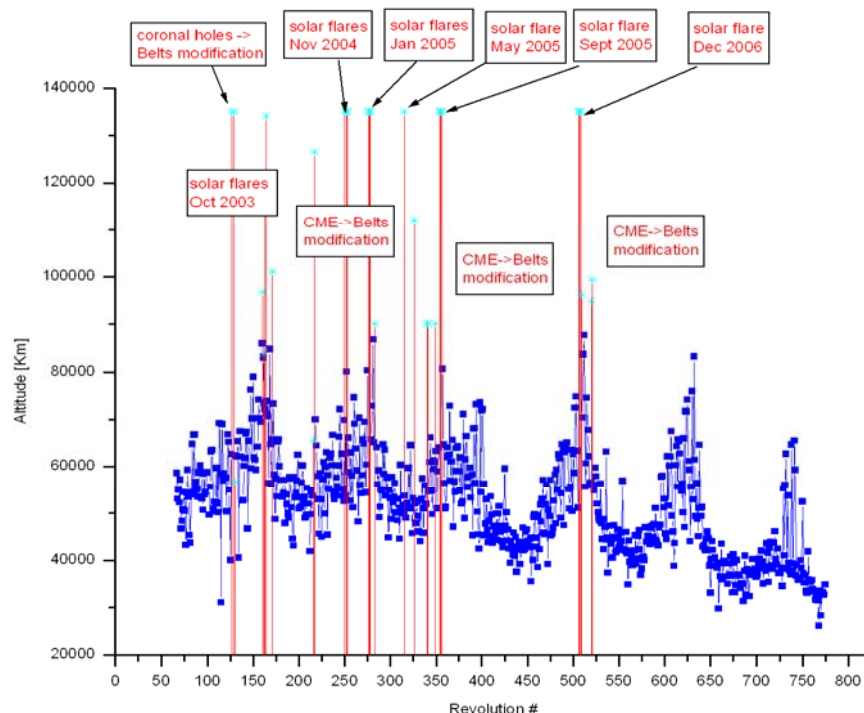
Nothing to report.

On DoY 047 at 03:40:00 and DoY 050 at 03:29:52 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

DoY 2009.048 (17/02/2009):

At 06:23:59Z, a local reset of the IREM CSCI S/W (SEU #71) occurred. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;
- 4) The anomaly occurred at 2009.048.06.23:59Z (138932.2 km). The unit had performed an automatic transition to Standard Mode (ie. no block counter increasing, all the TM words= FFFF hex); just before the anomaly, radiation counters reported nominal values considering the position of the S/C along the orbit;
- 5) The recovery of the unit started immediately using procedure CRP_SYS_2570. The first dump of the status word after the anomaly reported a value of BCC0 HEX = 48320 DEC = 1011110011000000, i.e. the Checksum Failure Flag ON. The unit was still reporting the status as if it was in Integral mode with counting ON and accumulation ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.
- 6) The patch was performed successfully with the correct re-starting of the S/W following procedure FCP_RM_0081. The operation was completed at 10:25:00Z.

The IREM automatic transition to Standard Mode affected the instruments by forcing them to automatically enter Safe configuration, except for SPI and JEM-X whose automatisms are disabled according to the PIs request. OMC was recovered at 07:05:19Z and IBIS at 07:49:00Z.

The cause of these S/W resets is apparently due to the unit's memory device that is sensitive to high energy radiation, as proved during test campaign on-ground.

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]
774	RAD_ENTR R 2009-02- 16T03:39:59Z	16/02/2009 05:13:35	32785.3	16-Feb-2009 05:08:45	33913.47
775	RAD_EXIT R 2009-02- 16T12:25:58Z	16/02/2009 12:22:39	52497.1	16-Feb-2009 11:48:45	47217.8
775	RAD_ENTR R 2009-02- 19T03:29:46Z	19/02/2009 04:55:11	34825.3	19-Feb-2009 05:01:34	33467.78
776	RAD_EXIT R 2009-02- 19T12:15:33Z	19/02/2009 12:40:55	56841.7	19-Feb-2009 11:31:34	46048.85

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)

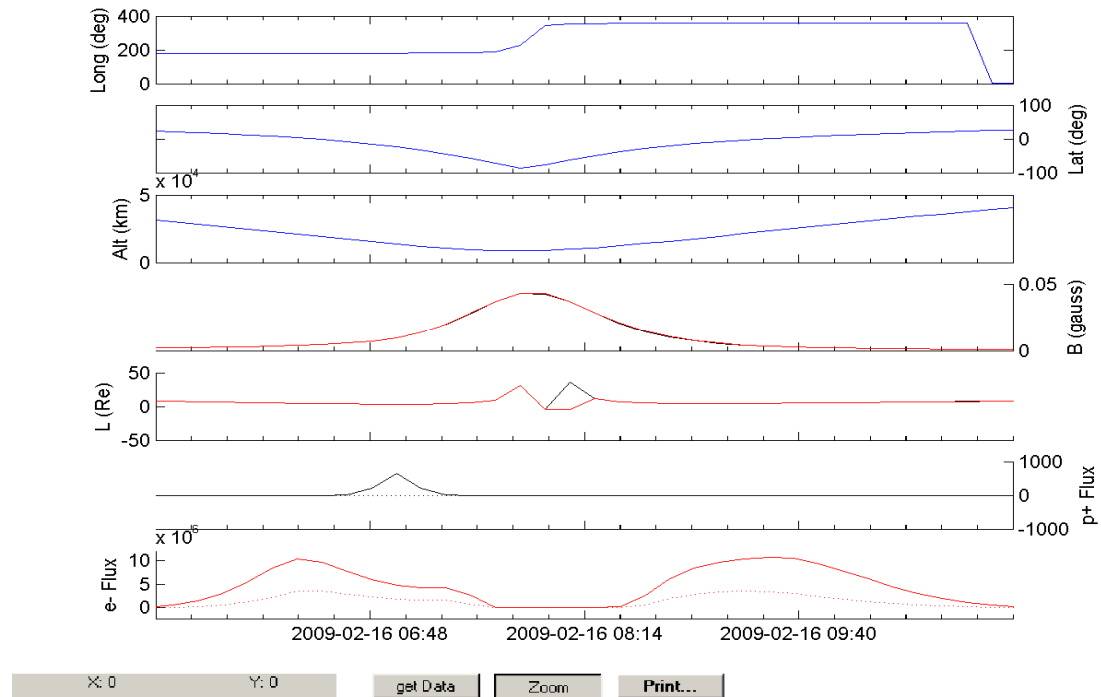
* Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM radiation counters:

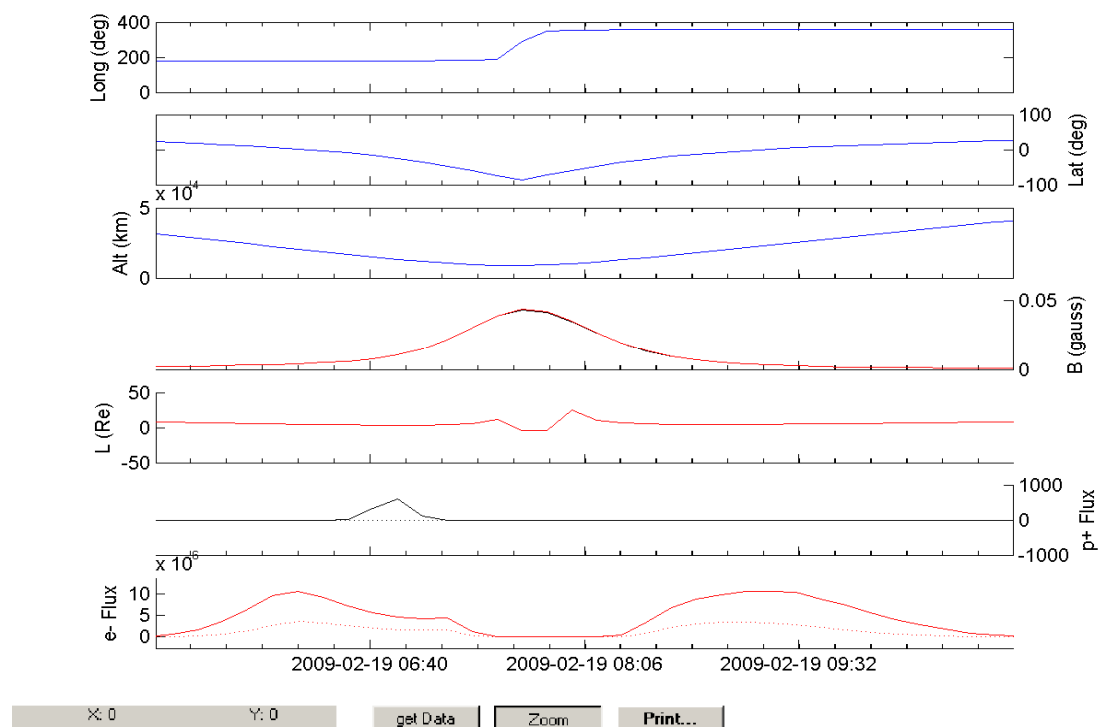
The IREM radiation counter plots are not available this week.

IREM Predicted Radiation Belt Passages

Rev 774



Rev 775



Radiation Assessment

Generated with SEIS Report and Analysis tool.

INTRODUCTION

This note summarises the space weather status over the observation period

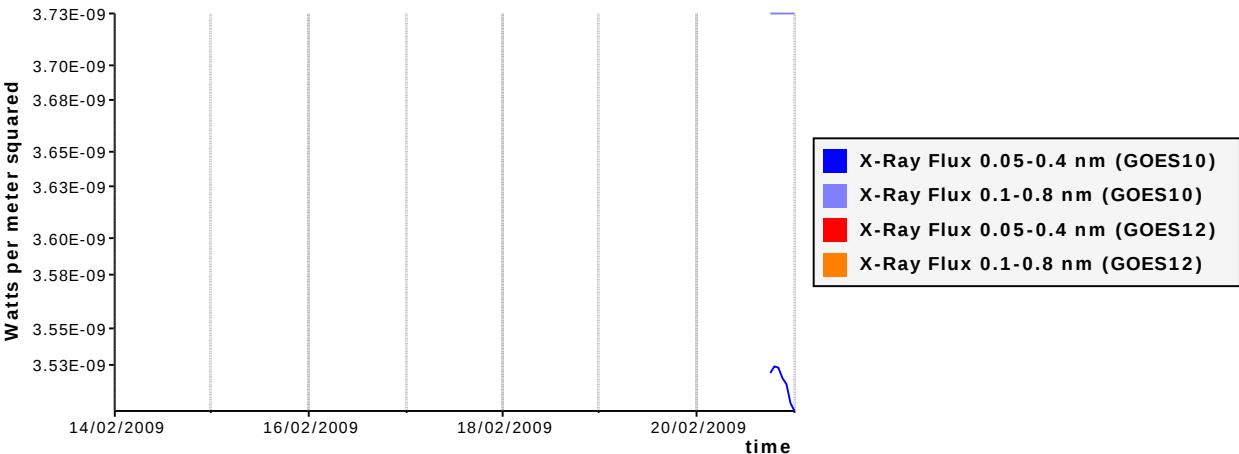
DAILY SUN

see in WR section 3.2.5

RADIATION FLUXES

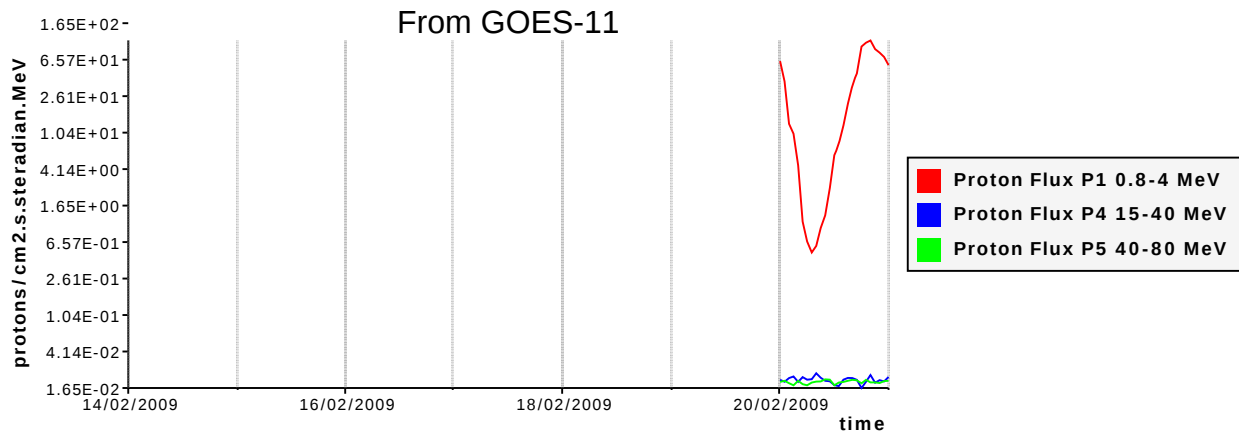
X-ray fluxes

X-ray fluxes for different energies are presented below as reported by GOES satellites. From $1\text{E-}5$ W/m^2 , they start featuring significant radiation activity corresponding to M-class solar flares from $1\text{E-}5$ to $1\text{E-}4$ W/m^2 , and to X-class solar flares from $1\text{E-}4$ and onwards.



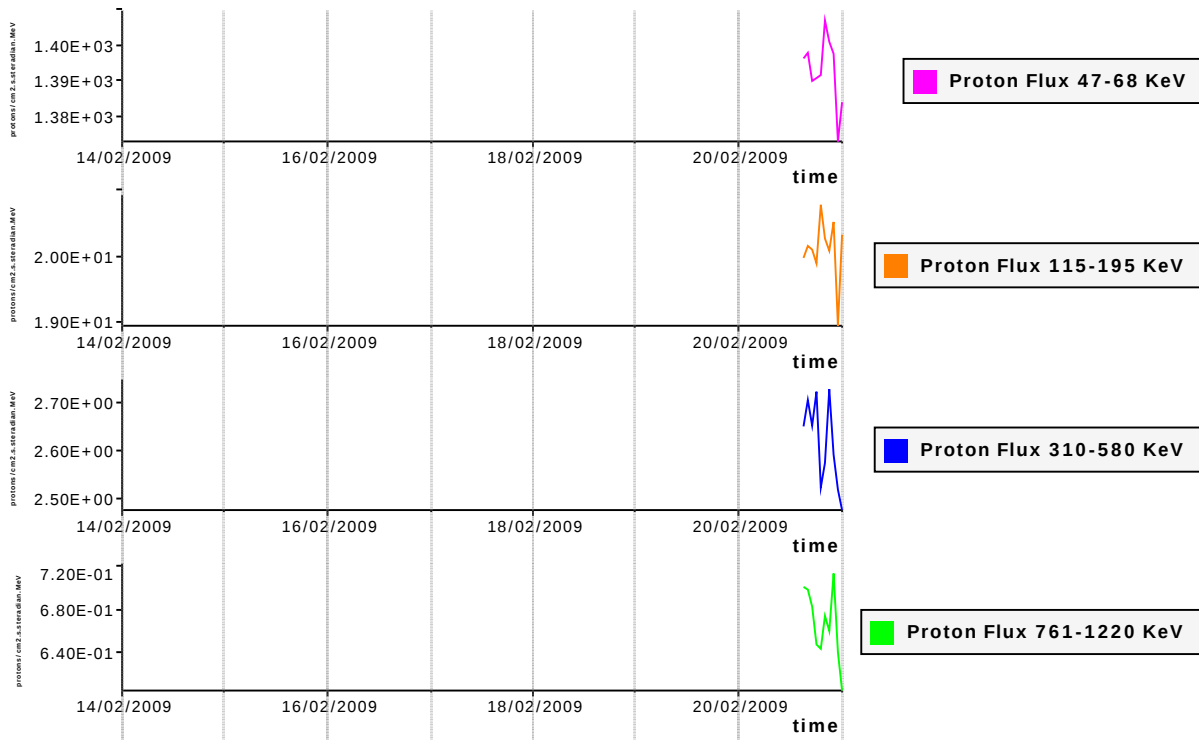
Proton fluxes (GOES-11)

Proton fluxes as measured by GOES satellites are presented in the following plot. Usually P1 oscillates between $1\text{E}+1$ and $1\text{E}+2$, while P2 and P3 evolve around $1\text{E-}2$.



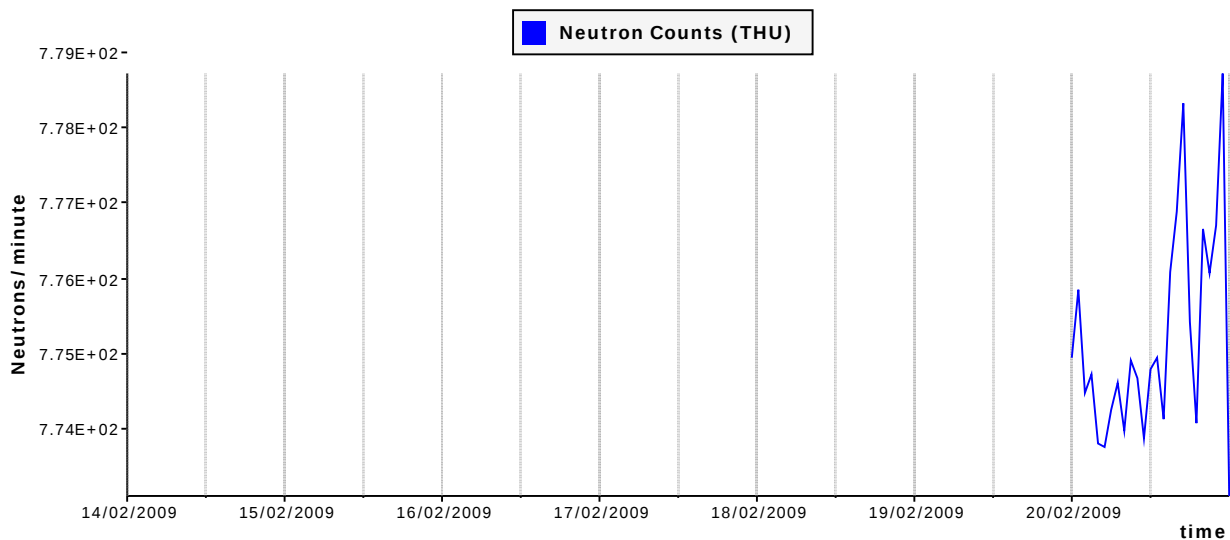
Proton fluxes (ACE)

Proton fluxes as measured by ACE satellite are presented in the following plot.



Neutron counts

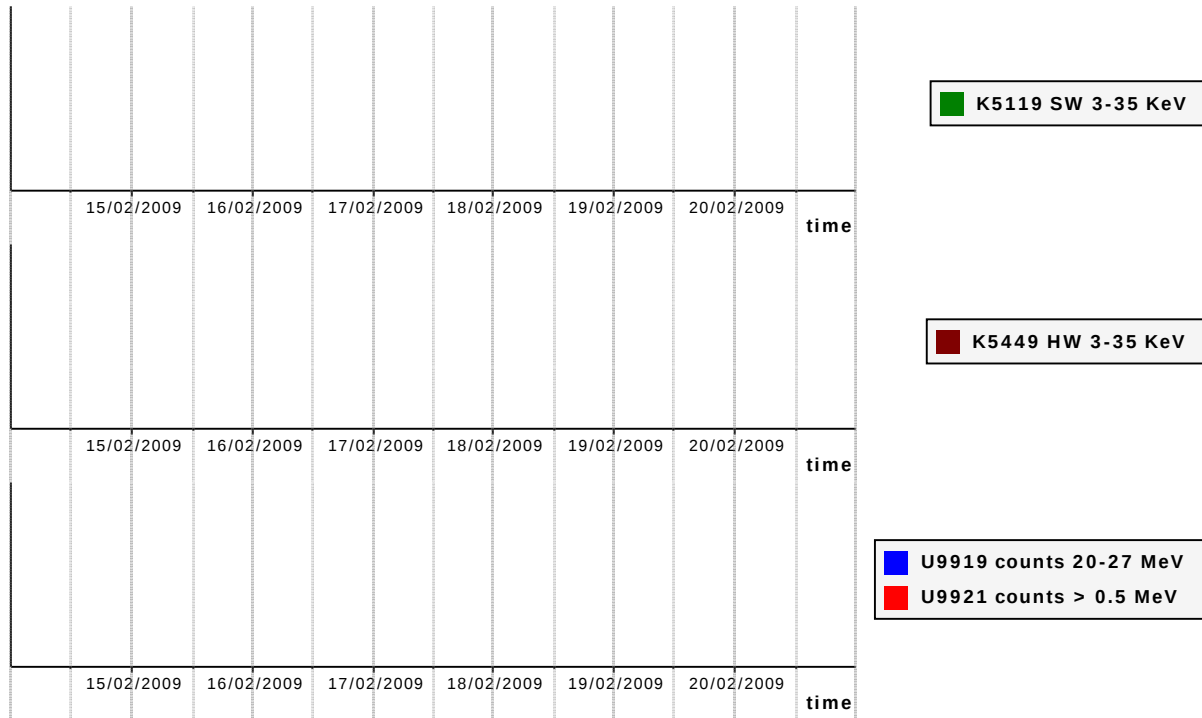
The neutron counts for the last 3 days are presented in the following plot. Nominally they remain stable around 7.2E+2.



IREM and JEM-X (INTEGRAL)

IREM proton and electron fluxes as well as JEM-X1 software and hardware triggers are presented in the following plots.

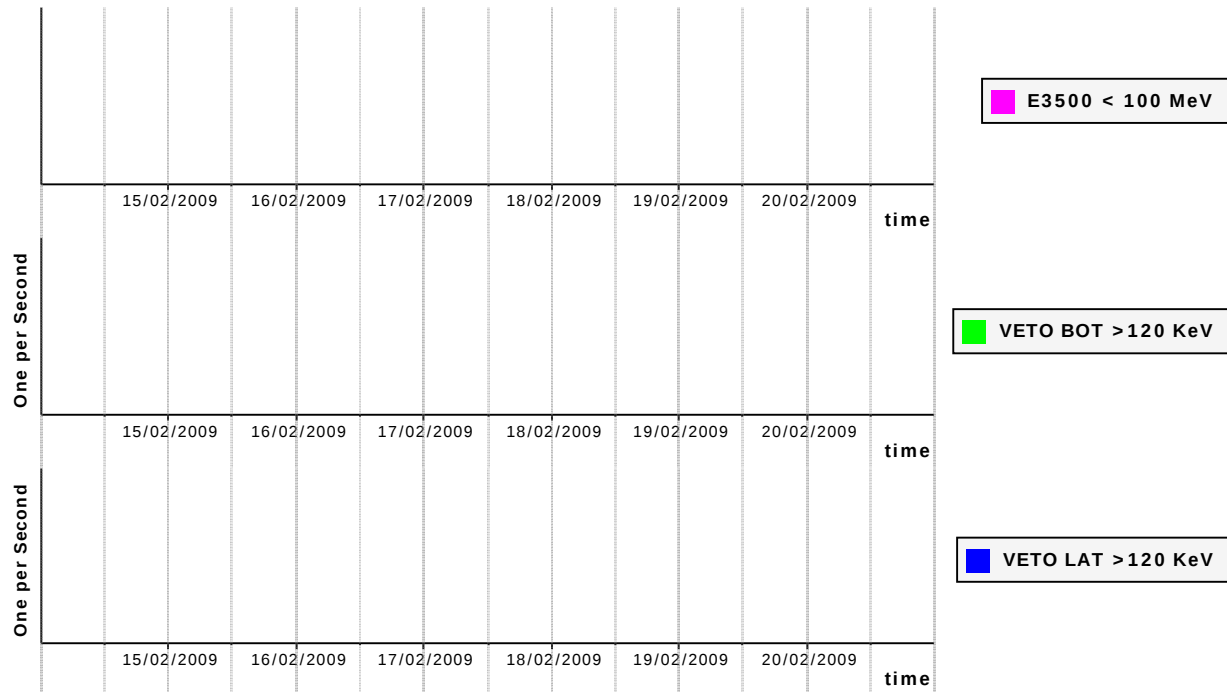
Nominal values are respectively about 1 and 18 for IREM counts, and, 13000 and 19000 for JEM-X ones.



SPI and IBIS (INTEGRAL)

SPI-ACS counters below 100MeV as well as IBIS-VETO bottom and lateral counters are presented in the following plots.

Nominal values are respectively about 90000 for SPI counts, and 36000 for IBIS ones.



SOLAR FLARES FORECAST

The probabilities of M and X-class solar flares during the last month are presented below. Chances of solar flare start to be meaningful from 15%.

