

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OAI
No. 363
Week 36
07.09.09
Routine Phase

Prepared by: F. Schmidt (OPS-OAI) and INTEGRAL FCT

LIST OF CONTENTS

1	General.....	3
2	Summary of Activities.....	3
3	Satellite Status.....	3
3.1	Platform.....	3
3.1.1	AOCS.....	3
3.1.2	Power.....	3
3.1.3	Thermal.....	3
3.1.4	OBDH.....	3
3.1.5	RFS.....	4
3.2	Payload.....	4
3.2.1	SPI.....	4
3.2.2	IBIS.....	5
3.2.3	JEM-X.....	7
3.2.4	OMC.....	7
3.2.5	IREM.....	7
3.2.6	Radiation Background.....	8
4	Ground Facilities.....	10
4.1	Mission Operations Centre.....	10
4.2	Ground Stations & Network.....	10
4.3	Science Ground Segment.....	11
4.3.1	ISOC.....	11
5	Special Events.....	11
6	Anomalies.....	11
7	Future Milestones.....	11
8	Appendix.....	12
8.1	Consumables.....	12
8.2	Detailed Satellite Information.....	12
8.2.1	AOCS SUMMARY OPERATIONS REPORT, 29/08/2009 – 04/09/2009.....	12
8.2.2	SPI Operations.....	14
8.2.3	IBIS Operations.....	18
8.2.4	JEM-X Operations.....	21
8.2.5	OMC Operations.....	22
8.2.6	IREM Operations.....	22

DISTRIBUTION LIST

Addressees	Copy	Addressees	Copy
D/OPS		ESAC	
G. Winters D/OPS	1	P. Kretschmar	1
J. F. Kaufeler OPS-G	1	M. Kessler SCI-O	1
N. Bobrinsky OPS-ON	1	E. Kuulkers	1
A. Rudolf OPS-OA	1	K. Engan	1
		A. Parmar SRE-OA	1
M. Kirsch	1	ESTEC/SCI-A	
R. Southworth	1	Nicola Rando	1
F. Di Marco	1		
F. Cordero	1	ESA HQ	
M. Walker	1	D. Southwood D/SRE	1
S. DePadova	1		
S. Fahmy	1	ESTEC	
F. Schmidt	1	J. Ellwood SRE-P	1
C. Lozano	1		
D. Webert	1	ESTEC / PG	
M. Pantaleoni	1	G. Sarri	1
J. Martin	1		
U. Weissmann	1	ESTEC/RSSD	
N. von Krusenstiern	1	C. Winkler	1
L. Spiteri	1		
A. Mantineo	1	ISDC	
K. Scott	1	R. Walter	1
		ISDC Shift Team	1
SPACONs	1	ALENIA	
I. Bayliss	1	M. Montagna	1
G. Di Girolamo	1	F. Ravera	1
F. Dreger	1		
G. Gienger	1	PI / Instrument Teams	
S. Pallaschke	1	J. P. Roques – SPI	1
W. Hell	1	G. La Rosa – IBIS	1
K.J. Schulz	1	P. Ubertini – IBIS	1
M.A. Larsen	1	A. Bazzano - IBIS	1
		F. Lebrun - IBIS	1
M. Butkovic	1	S. Brandt – JEM X	1
D. Heinzer	1	E. De Miguel - OMC	1
U. Feucht	1	W. Hajdas – IREM	1
Shift – Coord	1		
Scheduling Office	1	JPL / Goldstone	
T. Beck	1	D. Holmes	1
M. Rossmann	1	J. Valencia	1
M. Unal	1	Jesse Velasco	1
P. Maldari	1	Julia Bell	1
		DSN - MPSETD	1
Redu			
B. Demellenne	1		

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 29.08.09 until 04.09.09 (both dates inclusive) and covers the revolutions 839, 840 and 841.

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 raster dither of Crab cal 5x5w r839 and Crab cal JEM-X r839 for JEM-X (RA 05:34:31.90, +22:00:52.0), a hexagonal dither of Galactic Bulge region (RA 17:45:36.00, -28:56:00.0), a raster dither of the Galactic disk, l=+25 (RA 18:36:53.70, -07:03:19.4) and a raster dither of the Galactic disk, l=-25 (RA 16:27:14.74, -48:57:19.9).

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.

The fuel consumption over the period between 29/08/2009 and 04/09/2009 was 0.1154 Kg. The remaining propellant is in the order of 132.6240 Kg.

Note: Some more information concerning the AOCS operations 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

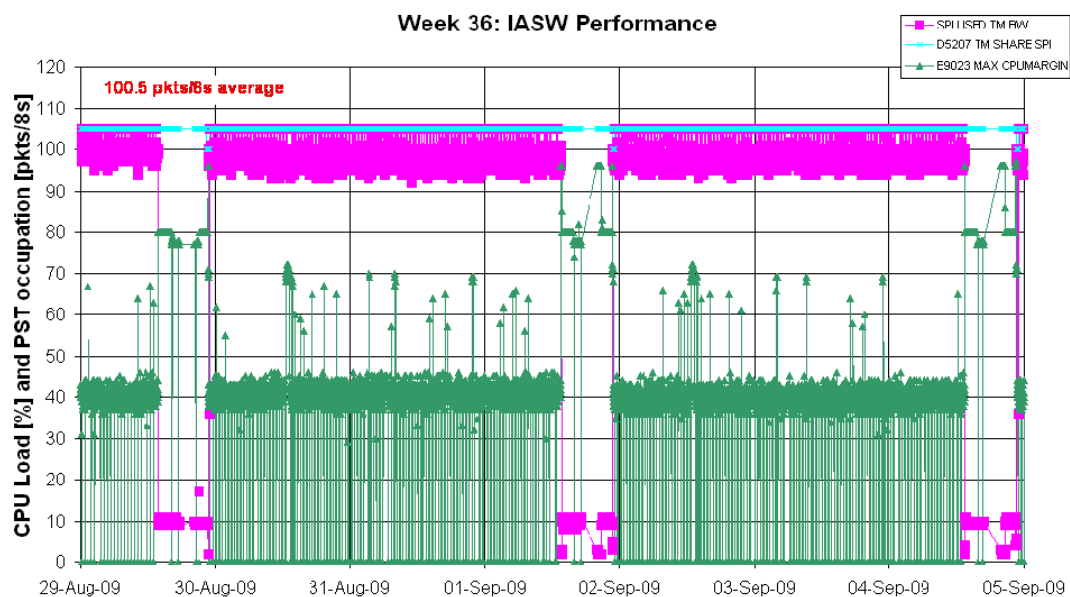
Following the 13th SPI annealing, which ended on 11/05/2009, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003); detector #17 (failed since 17/07/2004) and detector #5 (failed since 19/02/2009).

The Stirling compressors are working nominally. The Germanium detectors' temperature was kept in the range 80K+/-1K.

The first eclipse of the eclipse season occurred on 01/09/2009, at the start of revolution 841. Eclipse operations for SPI are progressing nominally.

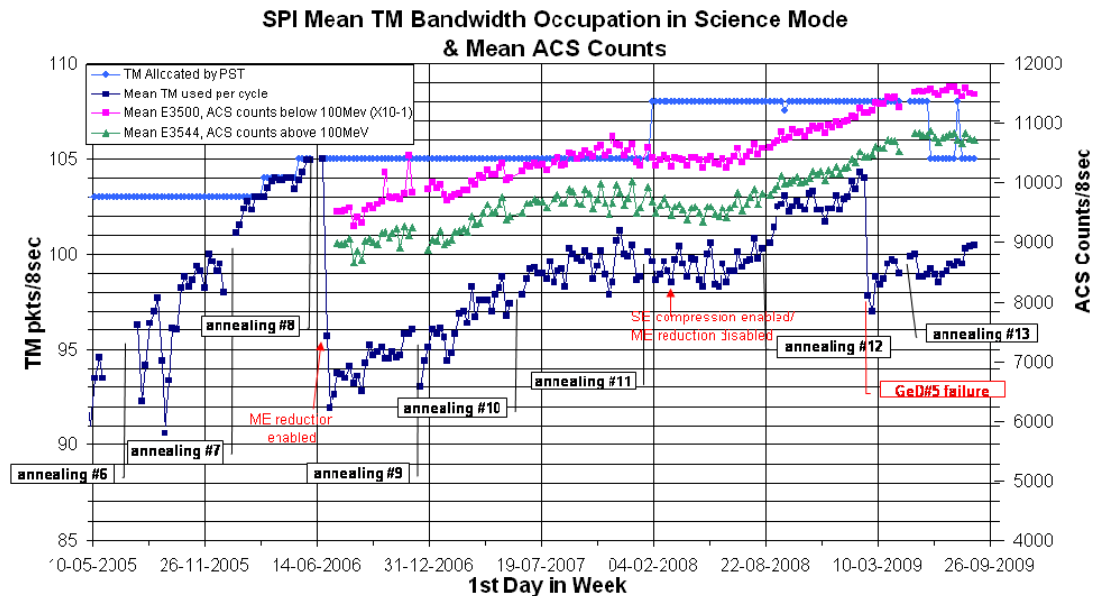
SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 105 packets/cycle the average telemetry occupation was 100.5 packets/cycle.

The following plot shows the TM bandwidth allocation, occupation and DPE CPU load during the reporting period¹:



¹ Data sampled every 8th packet (64sec)

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth since May 2005 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 IBIS is nominal.

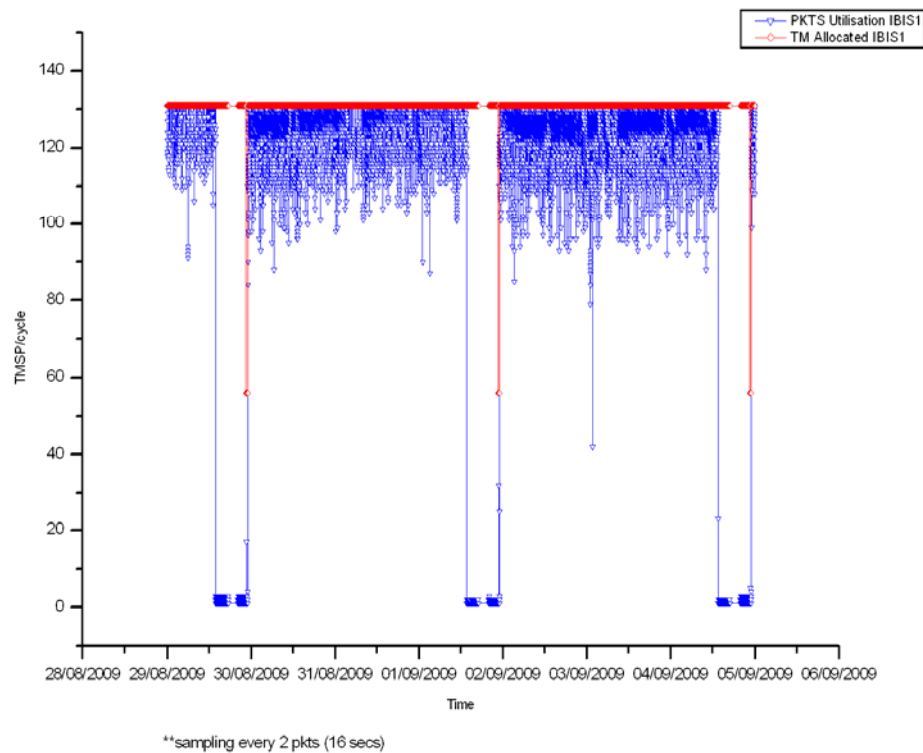
The first eclipse of the eclipse season occurred on 01/09/2209, at the start of revolution 841. Eclipse operations for IBIS are progressing nominally.

During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

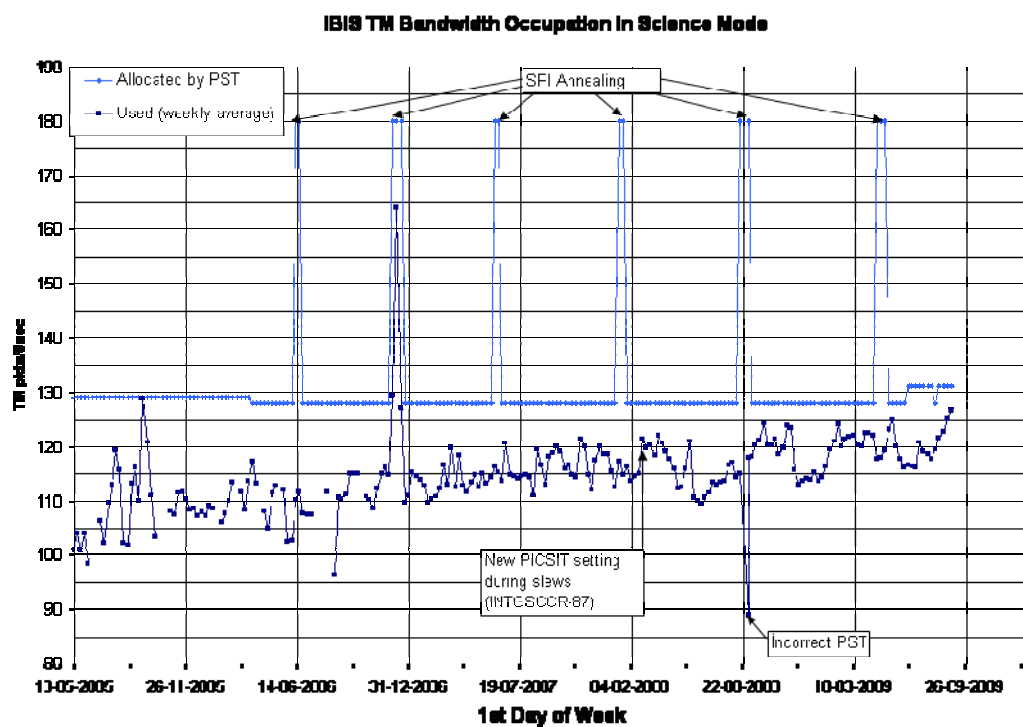
- PST allocation to IBIS above radiation belts: 131 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 126.53 packets/cycle (up 1.35 on previous week)
- Percentage of TM cycles for which full bandwidth was used: 39.6%

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

IBIS - TM Bandwidth Utilisation Rev 839-842



A plot of the IBIS weekly bandwidth utilisation since May 2005 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 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 reporting period, all of the 238 planned science pointings were executed nominally.

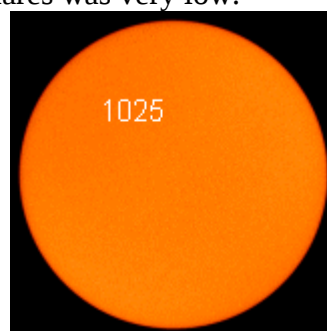
Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The overall status of the unit is nominal.

Solar Activity

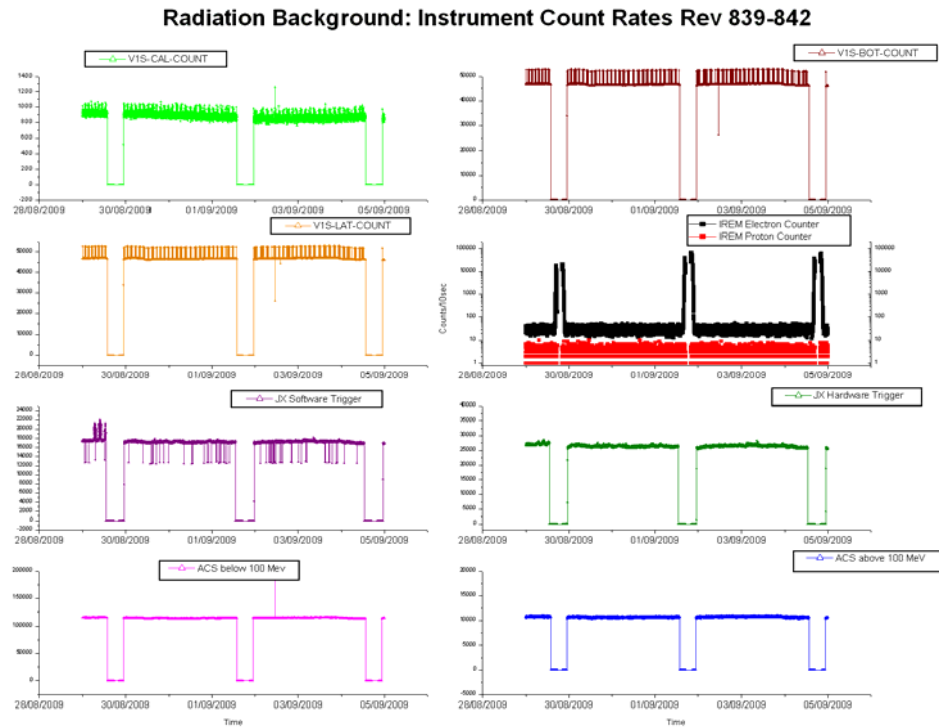
The observation period was characterised by low solar activity. The sun began the week blank. A new spot appeared on the 31st August, and had disappeared by the 3rd September. The risk of solar flares was very low.



Note: Some more information concerning the IREM operations is provided in the Appendix Section 8.3.6.

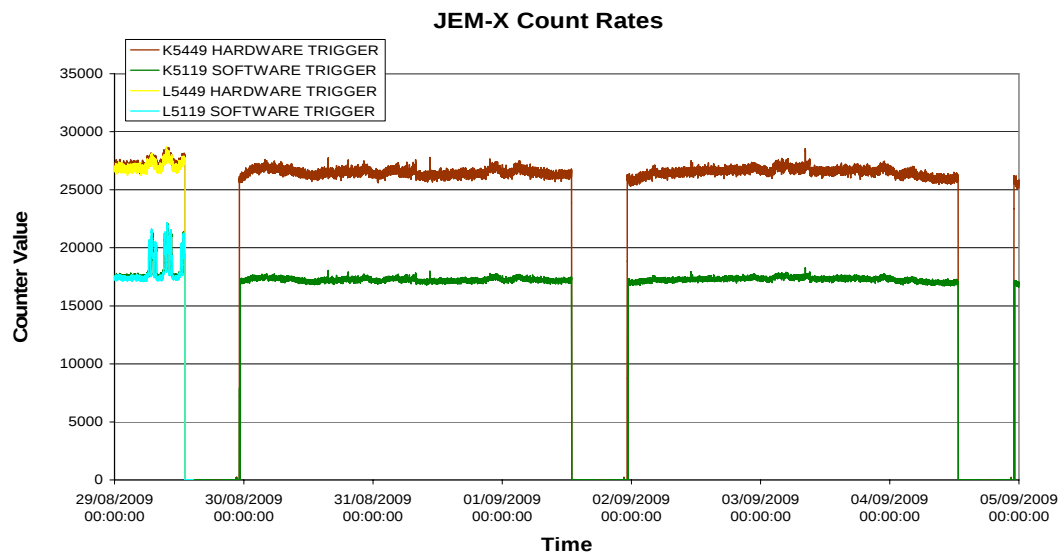
3.2.6 Radiation Background

The background radiation level as measured by the instrument counters was low during the reporting period. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the week²:



JEM-X Count Rates

JEM-X count rates over the reporting period are displayed in the following graph³.

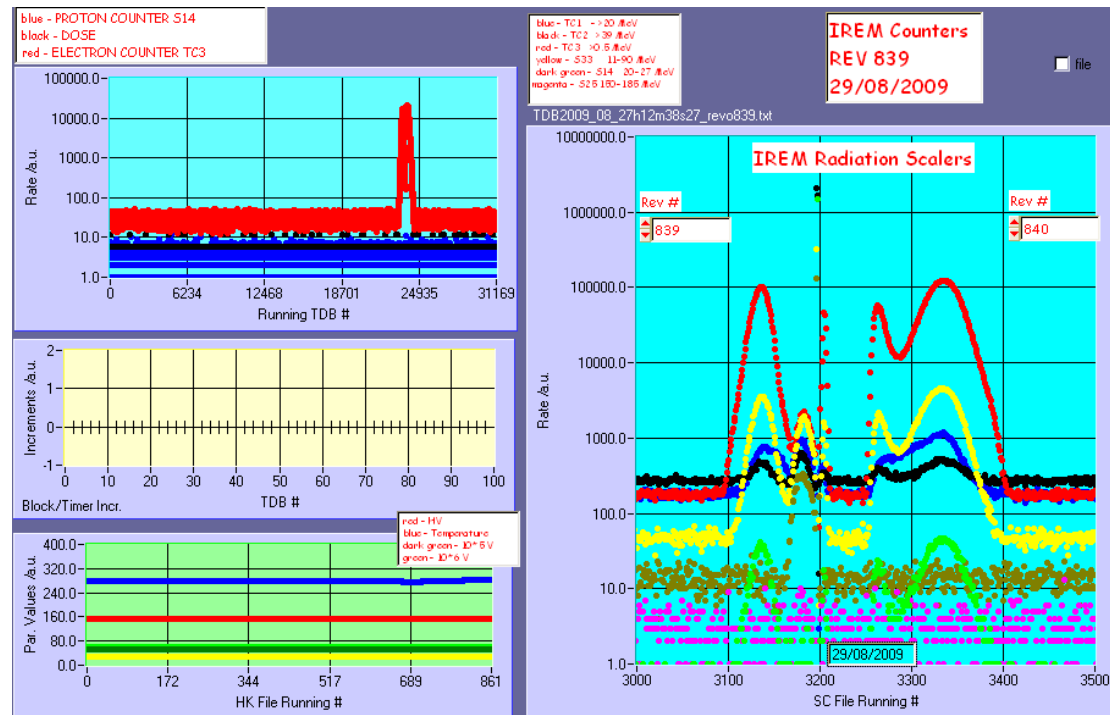


² Data sampled every 6th packet (48sec)

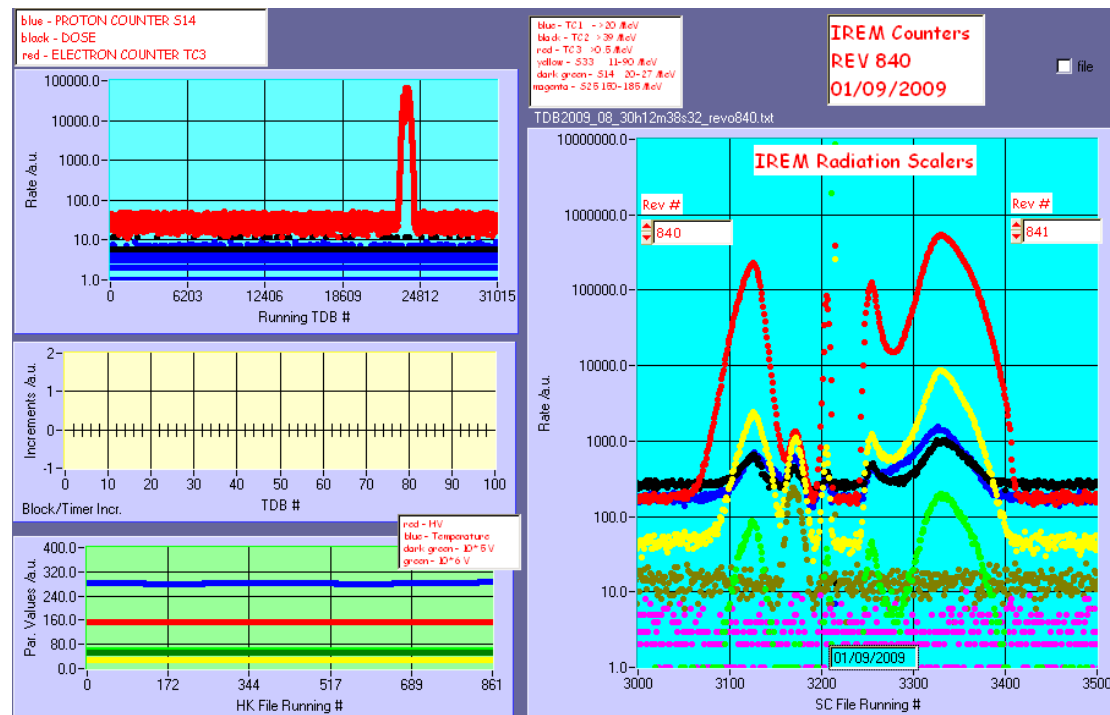
³ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.

IREM radiation counters:

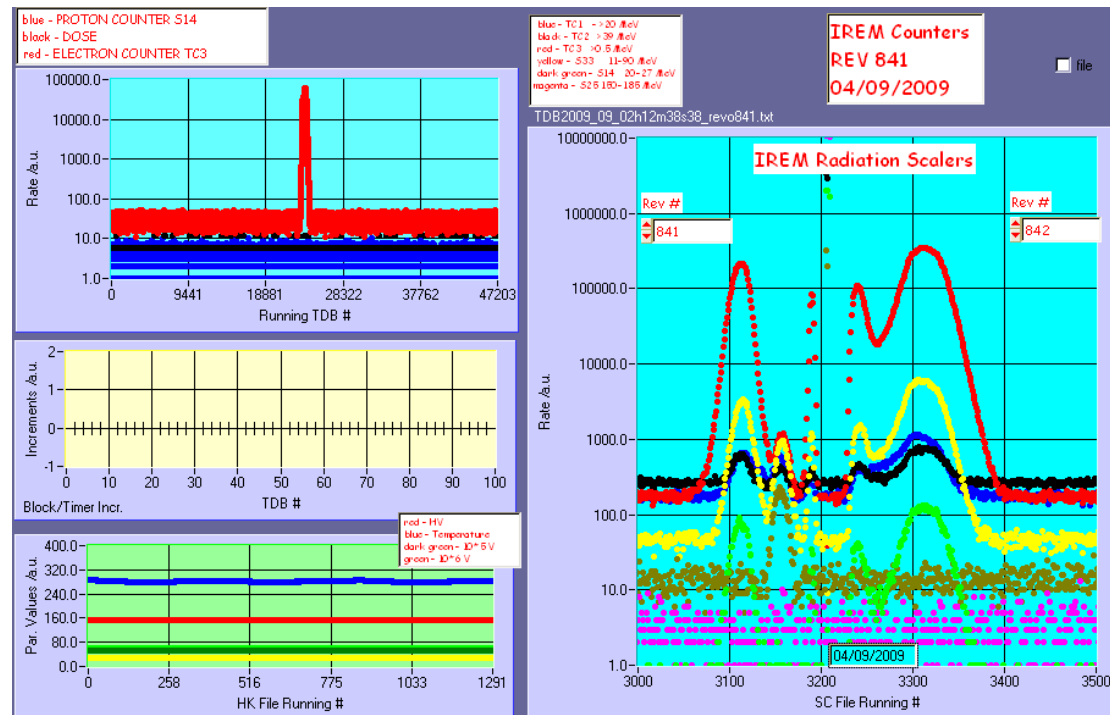
Revolution 839



Revolution 840



Revolution 841



4 Ground Facilities

The Operational ground facilities performance was good this week. The overall performance was over the 95% requirement.

4.1 Mission Operations Centre

The performance of the MOC was very good this week. There were two occasions when the links with ISDC dropped, necessitating a restart of the isds & ifrd, there was no impact.

4.2 Ground Stations & Network

The performance of the ground stations and Network was very good this week. Nothing to report

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

New PSFs have been received for revolutions 849 and 850.

New TSFs have been received for revolutions 842-844.

2. Observation status

New ECS files have been received and processed for revolutions 827-829.

3. ISOC Science Data Archive

A test system to verify migration of ISDA to Linux is being set up.

4. ISOC system

ISOC software V23 has been installed on the operational system.

5. Problems

No new problems.

5 Special Events

6 Anomalies

The following anomalies occurred this week:

AR id	Date Created	Subject	Segment	Status
INT-3072	2009-08-29	Wheel 4 OOL after activation of eclipse timers (AEAES_00)	FDS	Pending
INT-3073	2009-09-01	Suspected problem in the FDCE eclipse timer counters MCS calibration	IMCS	Pending

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Consumables

8.2 Detailed Satellite Information

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

8.2.1 AOCS SUMMARY OPERATIONS REPORT, 29/08/2009 – 04/09/2009

The AOCS operations were executed from the Automatic Timeline.

During this period, 172 Open Loop Slews, 88 Closed Loop Slews and 5 Momentum Biases were executed (as reported by ACC OEM).

No slews were missed from the timeline.

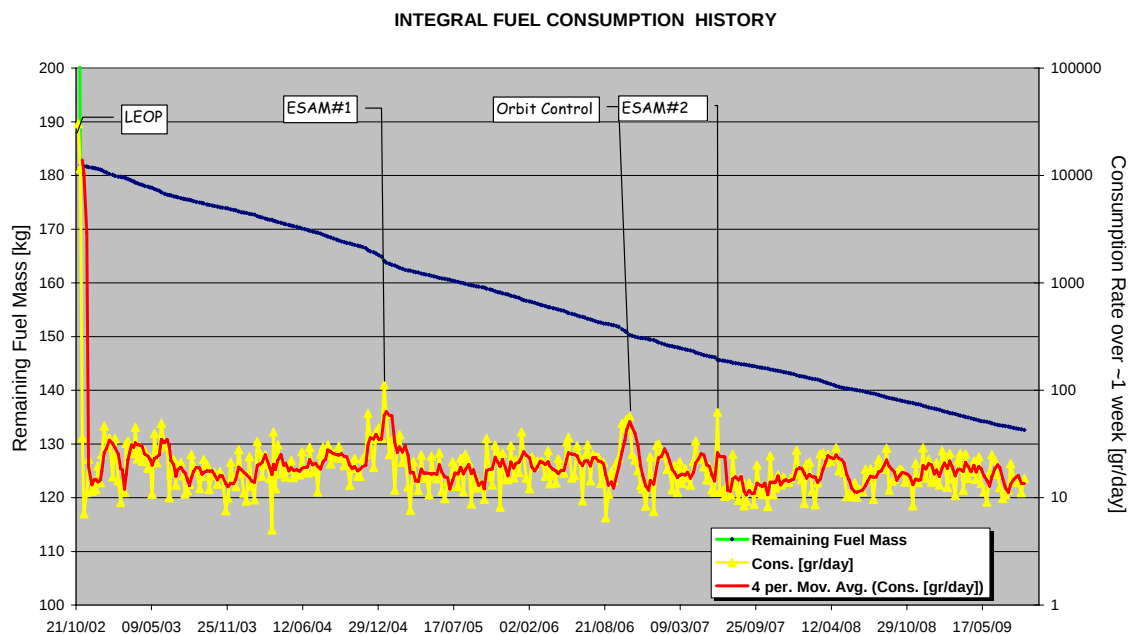
The OTF was not reached for PID 08400024.

Orbit Control

No update.

Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 04/09/2009 is reported in the plot below.

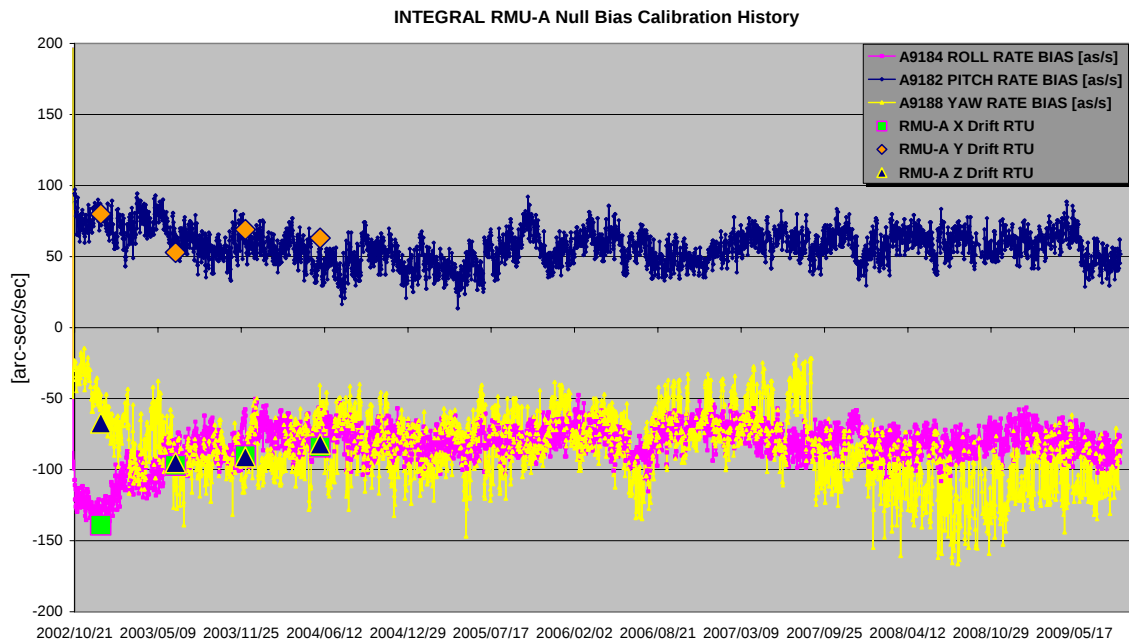


The above plot considers the ESAM fuel consumption spread over period of ~1 week.

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 04/09/2009 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 moment the current constraints (for drift update generation) on the FDS have been relaxed to cope with the current situation.



Daily events Log:

Week 362

29/08/2009 (Day of Year 241, Revolution 839 to 840)

- Update on-board subset 1 AMD thresholds at perigee, prior to the start of the eclipse season (20:31:00Z)

30/08/2009 (Day of Year 242, Revolution 840)

- IMU1 switched ON during the stable pointing of PID 08400024 (10:54:00Z). A manual mapping was commanded and the parameters for slew 08400025 manually updated (spacontool).

No impact on the Timeline.

OTF was not reached for PID 08400024.

31/08/2009 (Day of Year 243, Revolution 840)

Nothing to report

01/09/2009 (Day of Year 244, Revolution 840 to 841)

Nothing to report

02/09/2009 (Day of Year 245, Revolution 841)

Nothing to report

03/09/2009 (Day of Year 246, Revolution 841)

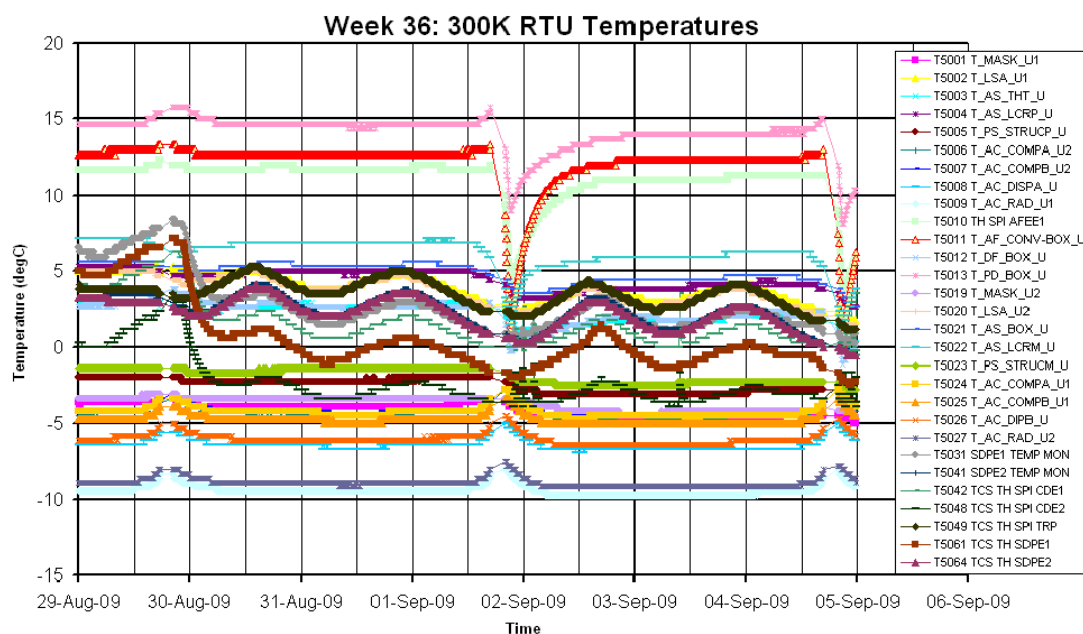
Nothing to report

04/09/2009 (Day of Year 247, Revolution 841 to 842)

Nothing to report

8.2.2 SPI Operations

Unit Temperatures: All the equipment temperatures are inside the operational limits. The following plot shows their evolution during the reporting period. The temperature recovery after eclipse was nominal:

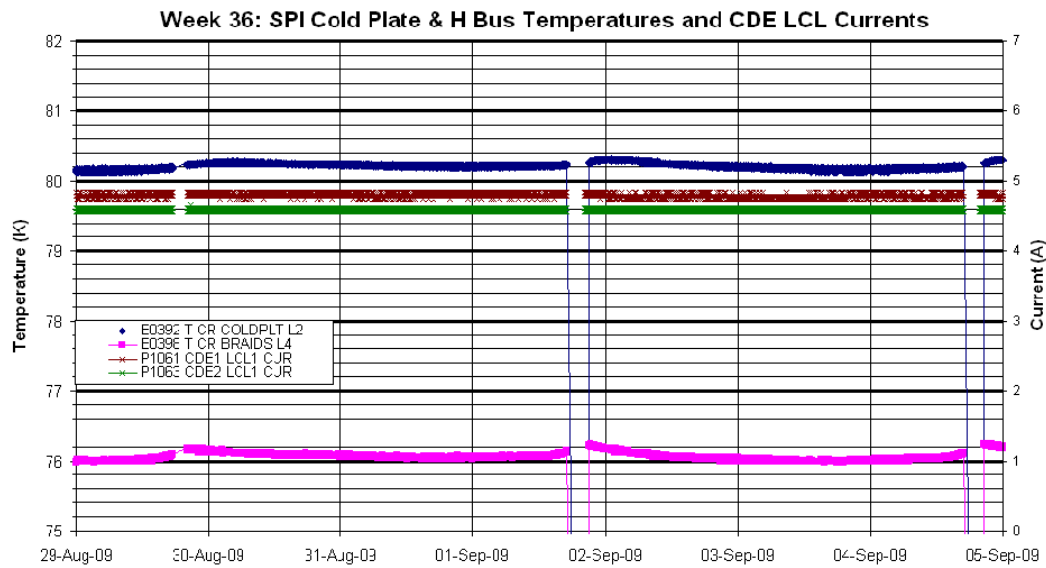


Stirling Compressors and Cryostat: The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K.

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

- CDE1 LCL Current = 4.79A
- CDE2 LCL Current = 4.59A

The following plot shows the evolution of the cold plate and H bus temperature as well as the CDE LCL currents during the reporting period⁴:



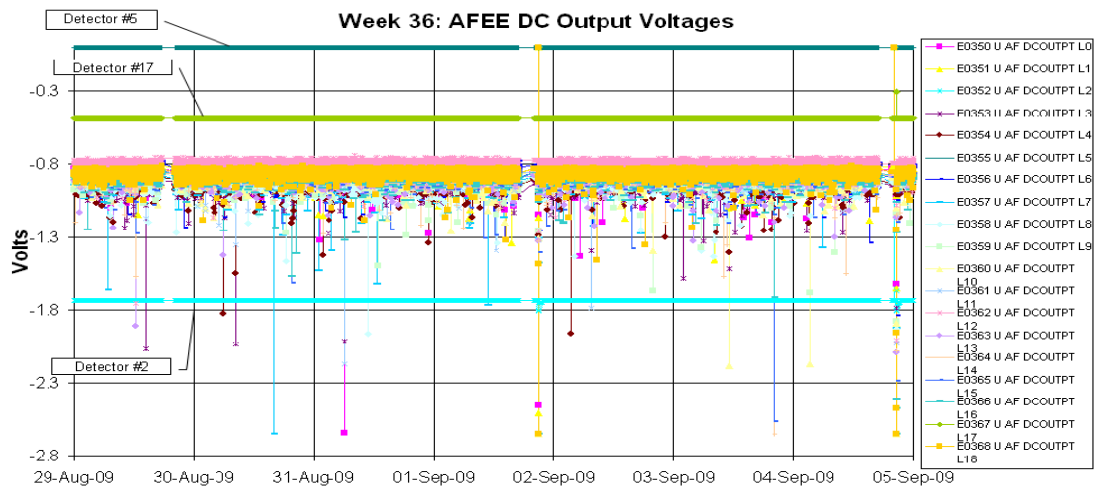
DPE & IASW: The DPE health and IASW performance are nominal. The IASW version installed is v4.3.4 with SE compression only enabled and the spectra scaling factor set to 8/19 SE. The DPE CPU usage was nominal during the reporting period (see plot in Section 3.2.1).

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). A plot of the ACS counts is given in Section 3.2.6.

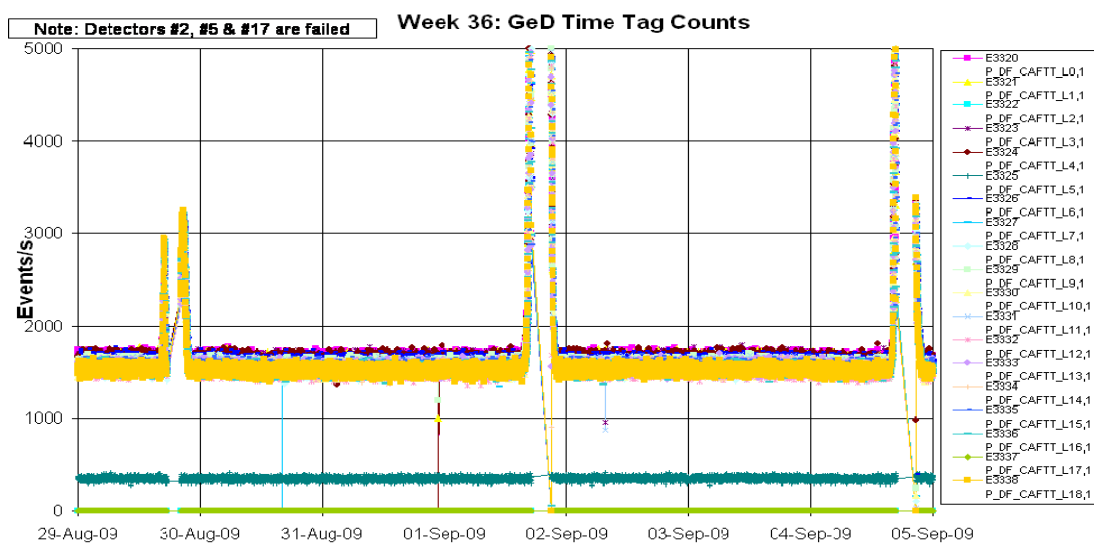
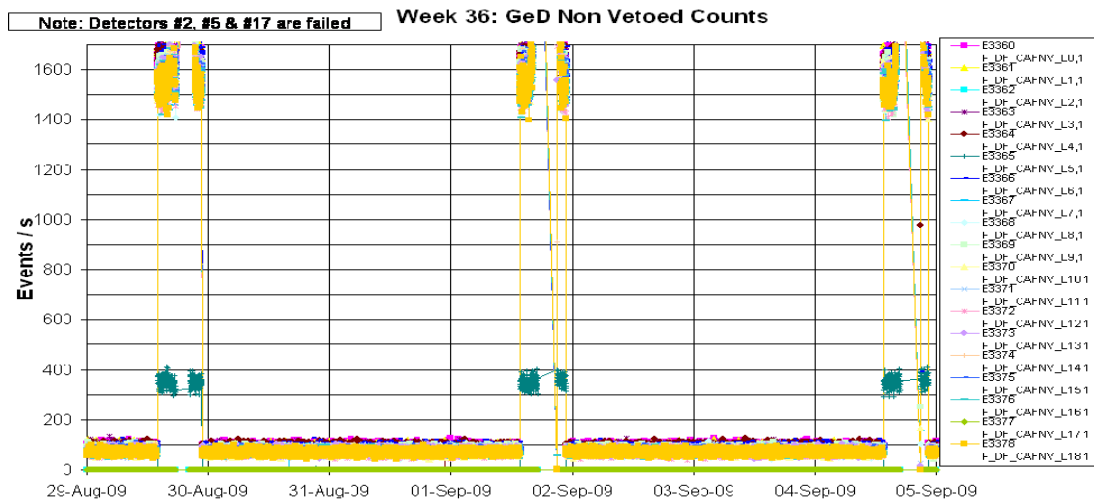
AFEE: The health of the AFEE is nominal. The following plot shows the dc output voltage of the detector channels during the reporting period⁵. The values are nominal. Detector #2 is failed since 06/12/2003; detector #17 is failed since 17/07/2004 and detector #5 is failed since 19/02/2009. The HV of the failed detectors are nominally set to 0.5kV.

⁴ Data sampled every 8th packet (64sec)

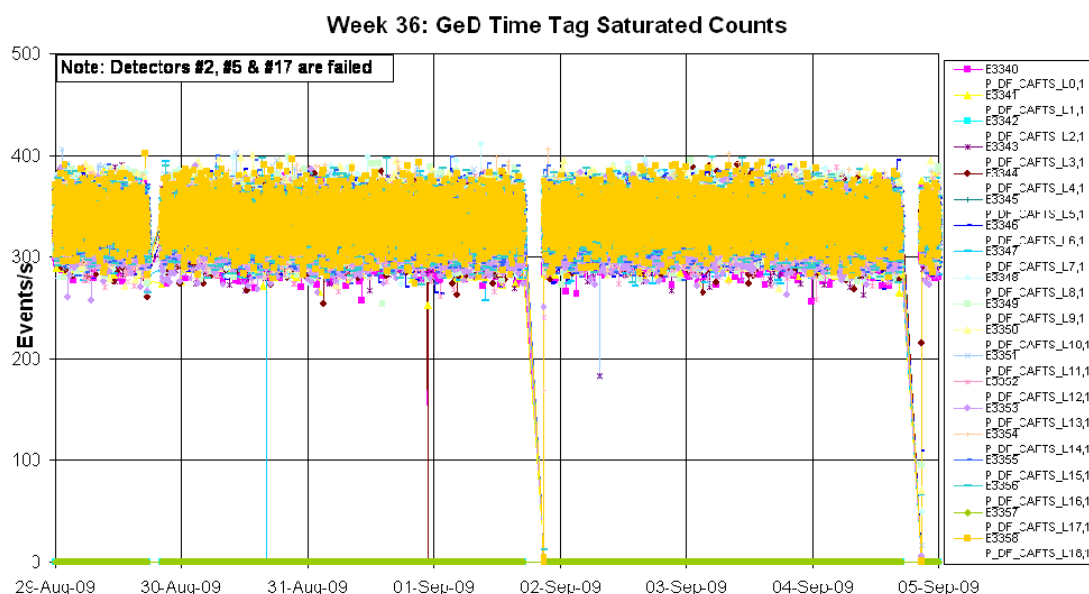
⁵ Data sampled every 8th packet (64sec)



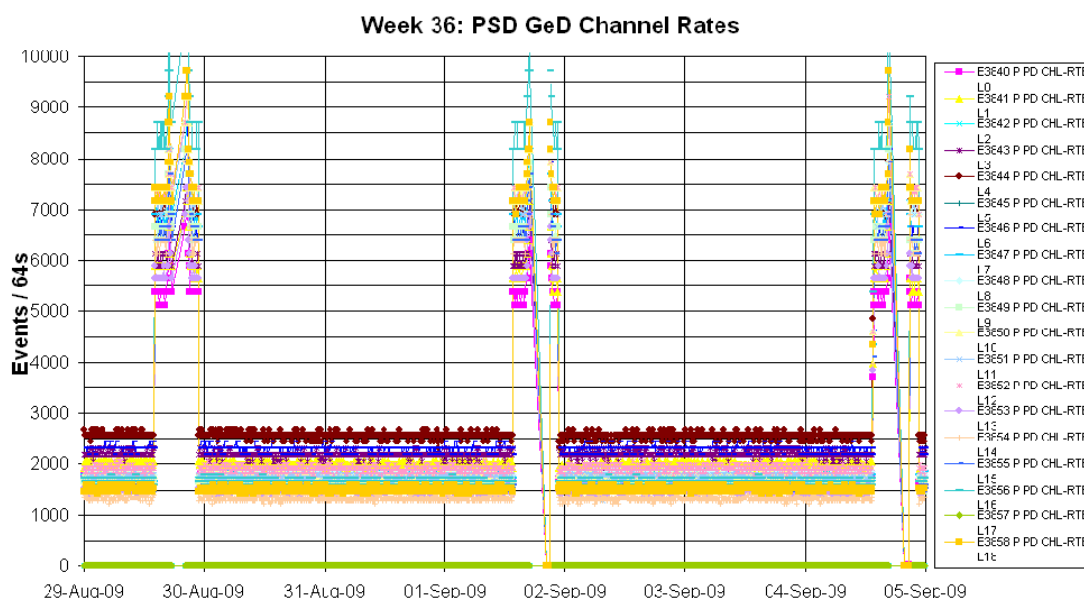
DFEE: The health of the unit is nominal. The following plots show the Non Vetoed, Time Tag and Time Tag Saturated Event count rates during the reporting period⁶.



⁶ Data sampled every 8th packet (64sec)



PSD: The overall health of the unit is nominal. The following plot shows the PSD channel rates over the reporting period⁷:



Event Log:

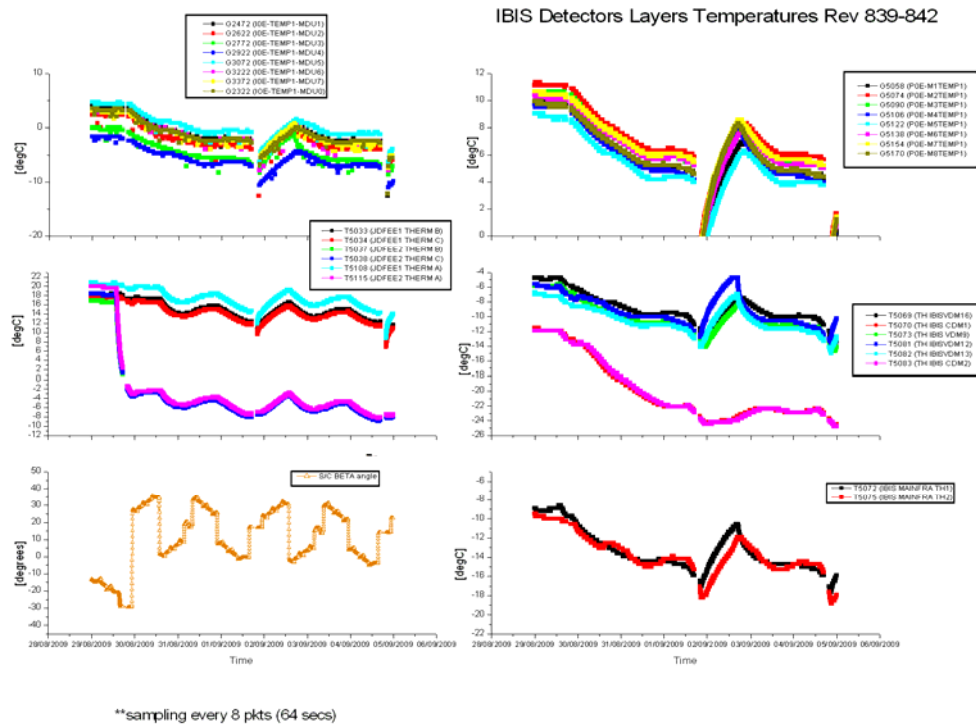
The following non-nominal events occurred with SPI over the reporting period:

- On 2009-09-01 at 01:49:36Z TM parameter E1296 went OOL (value = ERROR STATE). This is the ACS ISB response parity error. As it returned within limits of its own accord at 01:49:44Z, no action was taken.
- On 2009-09-03 at 04:16:36Z OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED was received with parameter E9780 (DETECTOR ID) = 17. As it was a single occurrence, no action was taken.

⁷ Data sampled every 8th packet (64sec)

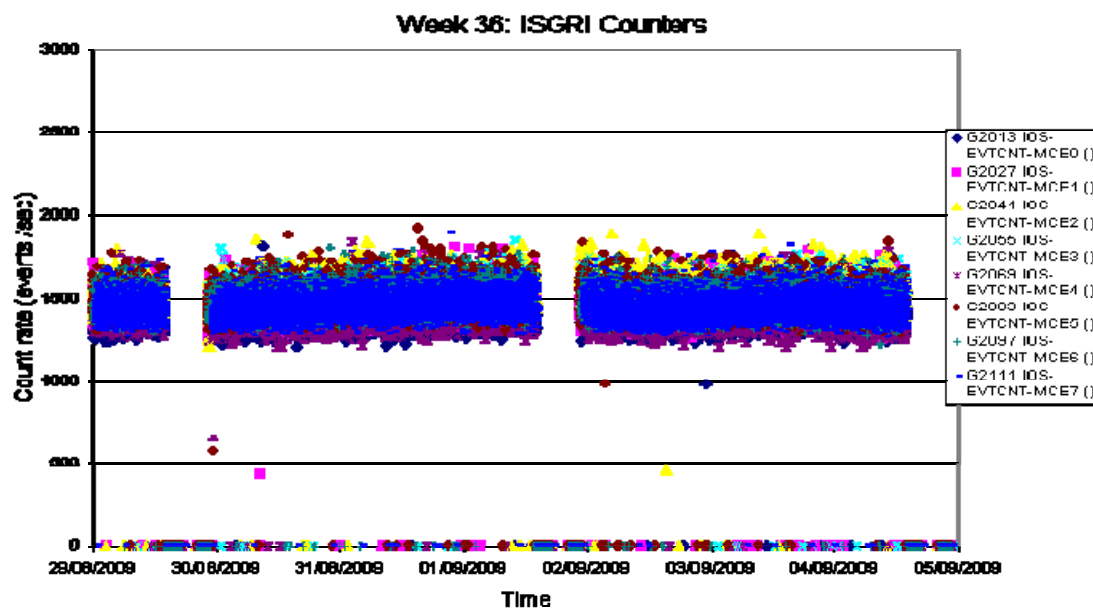
8.2.3 IBIS Operations

Unit Temperatures: All the equipment temperatures were inside the operational limits throughout the week. The following plot shows selected IBIS temperatures, along with those of the JEM-X DFEF and the S/C beta angle for comparison. The temperature recovery of the units after eclipse was nominal.



ISGRI

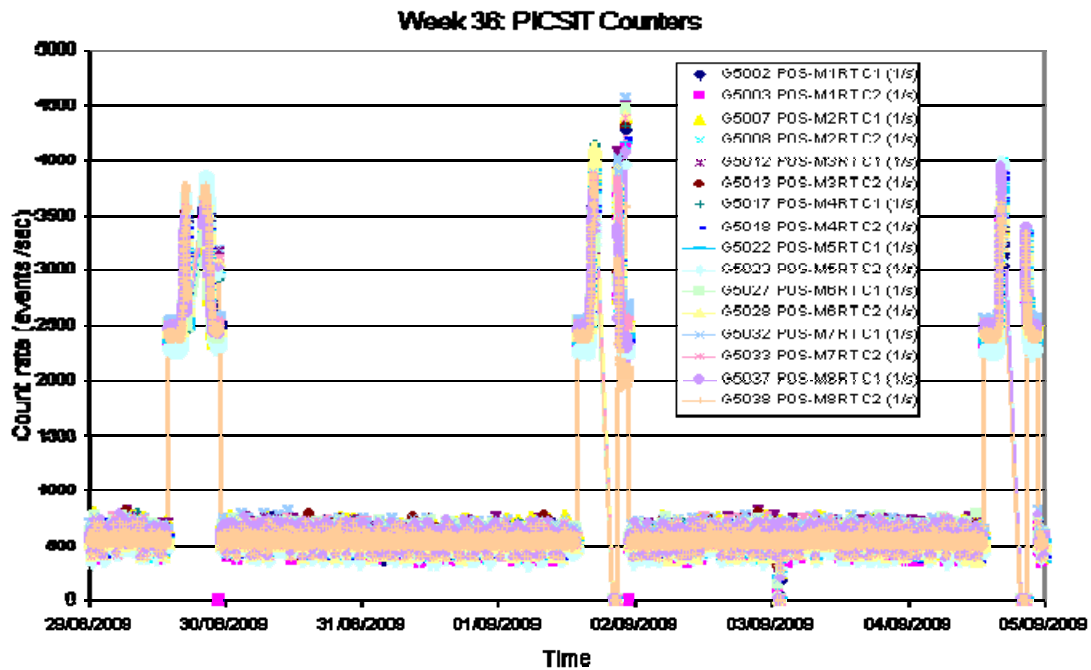
The health and performance of ISGRI was nominal during the reporting period. The following plot shows the ISGRI MCE counters during the week⁸:



⁸ Data sampled every 4th packet (32sec)

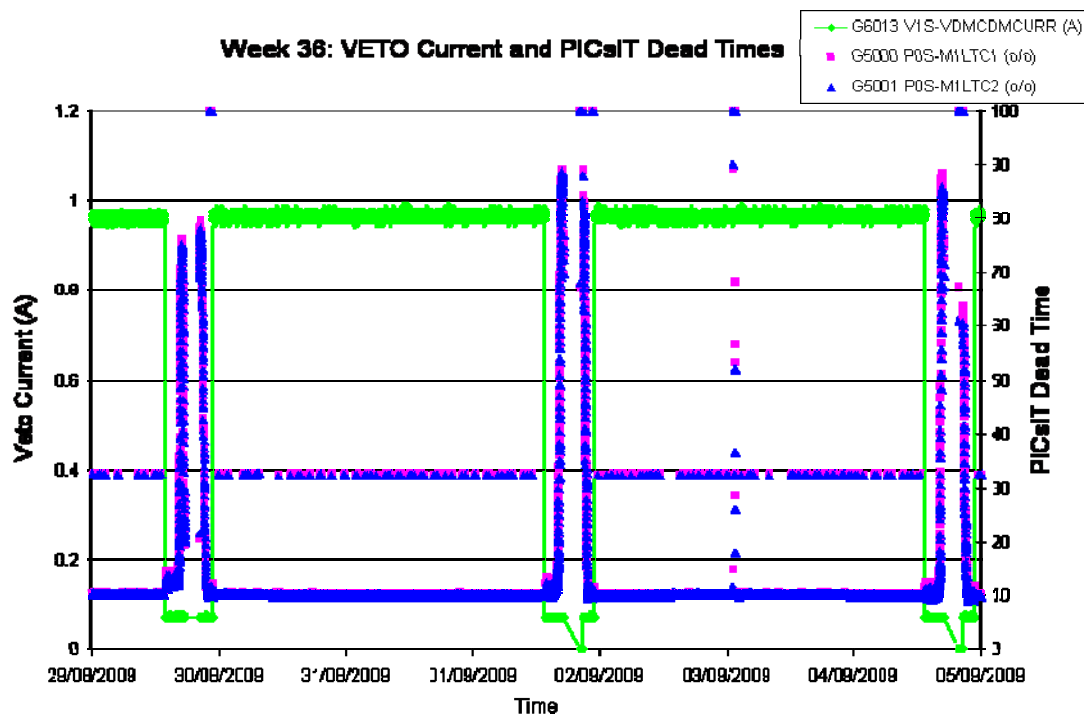
PICsIT

The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the week⁹:



VETO

The health and performance of VETO was nominal during the reporting period. The following plot shows the VETO current and PICsIT dead-times during the week¹⁰:



⁹ Data sampled every 4th packet (32sec)

¹⁰ Data sampled every 4th packet (32sec)

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.

TM parameter G2070 went OOL several times during the week, indicating an overflow of the noisy pixel address buffer in MCE5. As in each case it returned within limits of its own accord at the next TM cycle, no action was taken.

TM parameter G6061 (VETO calibration source counter) went OOL briefly on a couple of occasions. As in each case it returned within limits of its own accord, no action was taken. However the value of this parameter is decreasing due to the radioactive decay of the source and the lower limit for this parameter will be reduced to 700counts/s in the next IODB release.

2009-08-29 (DOY 241, Rev. 839-840) to 2009-09-02 (DOY 245, Rev. 841)

IBIS operations executed nominally.

2009-09-03 (DOY 246, Rev. 841)

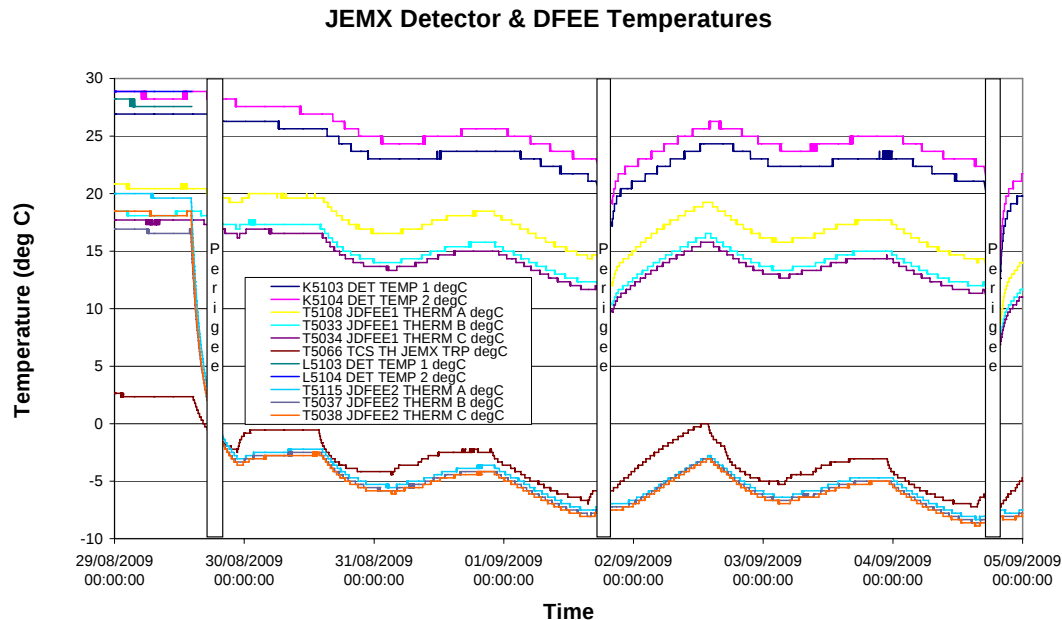
At 01:07:57Z the TM parameter families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 01:07:52Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As all parameters had returned within limits by 01:09:44Z no action was taken. Again at 01:42:37Z TM parameter families G5068 and G5072 failed status consistency check and at 01:44:00Z TM parameter families G5002 and G5003 went OOL Low. As these were followed at 01:46:44Z 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.

2009-09-04 (DOY 247, Rev. 841-842)

IBIS operations executed nominally.

8.2.4 JEM-X Operations

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 graph¹¹.



JEM-X Daily Report

2009-08-29 (DoY 241 Rev 839)

At 14:00, operations to switch off JEMX-2 after the Crab-calibration were commenced. At the indicated times, the following procedures were completed:

```
14:00:00 FCP_JEM2_9010 JEMX2 DFEE SWITCH OFF (commenced)
14:00:00 FCP_JEM2_0120 JEMX2 SET BCP OVERRIDES
14:08:00 OEM, jemx2 auto event 1, as per step 5 of fcp_jem2_9010
14:10:00 FCP_JEM2_0120 JEMX2 SET BCP OVERRIDES
14:13:00 FCP_JEM2_9001 JEMX2 JEMX2 DISABLE BCP DISTRIBUTION
14:18:00 FCP_JEM2_9000 JEMX2 DPE SWITCH OFF
```

2009-08-30 (DoY 242 Rev 840)

At the indicated times, the following OEMs were received:

2009.242.19.26.47.503		2009.242.19.26.50.747		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			

¹¹ Data sampled (1 frame in 8)

Doc. Title : INTEGRAL Mission Report #363
 Doc. Ref. : INT-MOC-SYS-RP-1001-OPS-OAI
 Date : 07/09/09

Issue : 1
 Rev. : 0
 Page : 22

```

2009.242.19.26.47.503  2009.242.19.26.50.771  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.

2009-08-31 (DoY 243 Rev 840) to 2009-09-04 (DoY 247 Rev 842)

JEM-X 1 operations executed nominally.

8.2.5 OMC Operations

2009-08-29 (DoY 241, Rev 839) to 2009-09-04 (DoY 247, Rev 842)

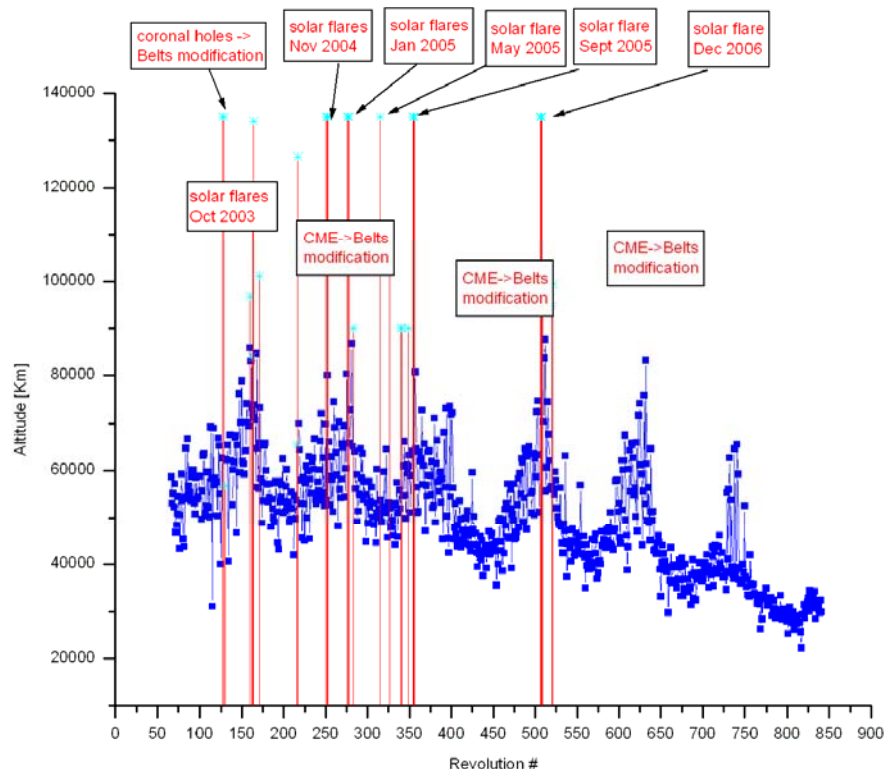
Nothing to report.

On DoY 241 at 13:55:07, DoY 244 at 13:44:27 and DoY 247 at 13:32:19 OMC went to SAFE mode nominally, at the radiation belt entry time as set in the Broadcast Packet.

8.2.6 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]
839	RAD_ENTR R 2009-08-29T13:55:02Z	29/08/2009 16:26:57	29643.8	29-Aug-2009 16:18:45	30091.61
840	RAD_EXIT R 2009-08-29T22:48:26Z	29/08/2009 21:39:21	36389.1	29-Aug-2009 22:28:45	47128
840	RAD_ENTR R 2009-09-01T13:44:24Z	01/09/2009 15:56:18	32395.3	01-Sep-2009 16:09:25	29770.4
841	RAD_EXIT R 2009-09-01T22:38:13Z	01/09/2009 21:46:02	41495.6	01-Sep-2009 22:19:25	47320.13
841	RAD_ENTR R 2009-09-04T13:32:15Z	04/09/2009 16:01:38	29850.0	04-Sep-2009 15:59:25	29097.74
842	RAD_EXIT R 2009-09-04T22:26:32Z	04/09/2009 21:30:18	41465.7	04-Sep-2009 22:09:25	47824.56

Reference

High radiation

Very small error vs reference (less than 10 minutes)

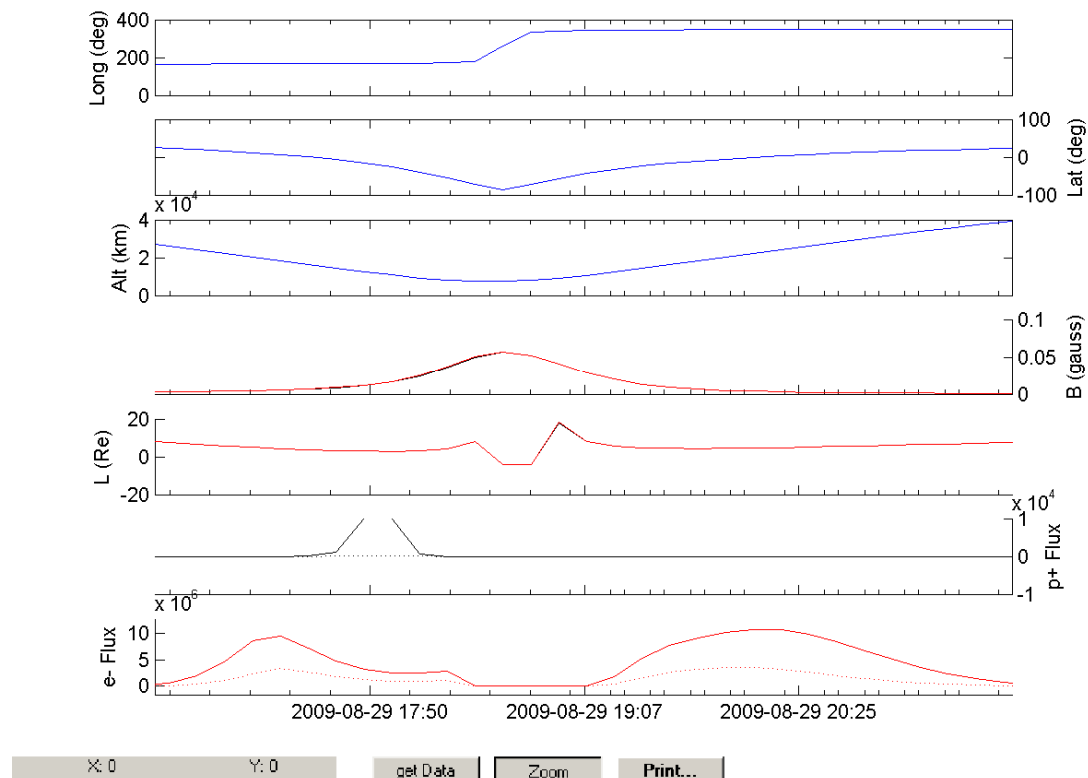
Small error vs reference (between 10 and 30 minutes)

Large error vs reference (more than 30 minutes)

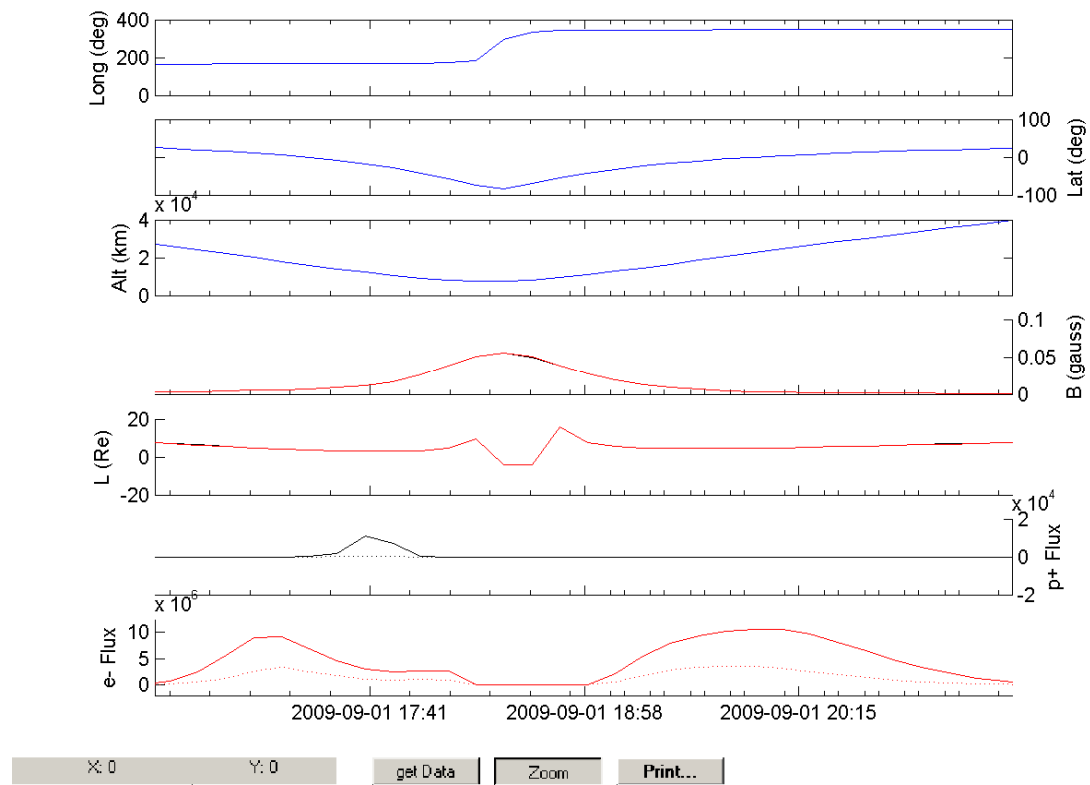
Rad belt entry time ignoring previous threshold crossings where a gap of more than 30 minutes is present.

IREM Predicted Radiation Belt Passages

Rev 839



Rev 840



Rev 841

