EUROPEAN SPACE AGENCY

DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT

MISSION OPERATIONS DEPARTMENT

# INTEGRAL

## Mission report

INT-MOC-SYS-RP-1001-OPS-OAI

No. 386

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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. Nominal science operations were perfomed according to the planning inputs from ISOC combined with some manual commanding by MOC.

This report addresses the activities from June and covers the revolutions 932 untill 941 (included). The targets of these revolutions can be found on the ISOC web: http://integral.esac.esa.int/isocweb/schedule.html?action=intro .

The previous weekly and monthly reports are available at the XMM-INTEGRAL website: http://xmm.esoc.esa.int/documentation/documentation.php3 .

# 2 Satellite status

## 2.1 Platform

### *2.1.1 AOCS*

The AOCS operations were performed from the timeline during this period.

8 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.404 Kg. The remaining propellant is in the order of 127.715 Kg.

*Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix 6.1.*

### *2.1.2 Power*

All units of the EPS are working nominally; available power from the arrays is of the order of 2100W.

### *2.1.3 Thermal*

The thermal control of the satellite is working well. The temperatures are currently all within the specified operational limits.

### *2.1.4 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.

### *2.1.5 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.

## 2.2 Payload

### *2.2.1 SPI*

Following the 15th SPI annealing, which ended on 16/04/2010, 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); detector #5 (failed since 19/02/2009) and detector #1 (failed since 27/05/2010).

The Germanium detectors' temperature was kept in the range 80K+/-1K.

OCR-280 (Re-determination of GeD characteristics to reduce HV) was implemented in revolution 937. Details are given in the Event Log section below.

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 and the average telemetry occupation was 80.69 packets/cycle.

The following plot shows the TM bandwidth allocation and occupation during the reporting period:

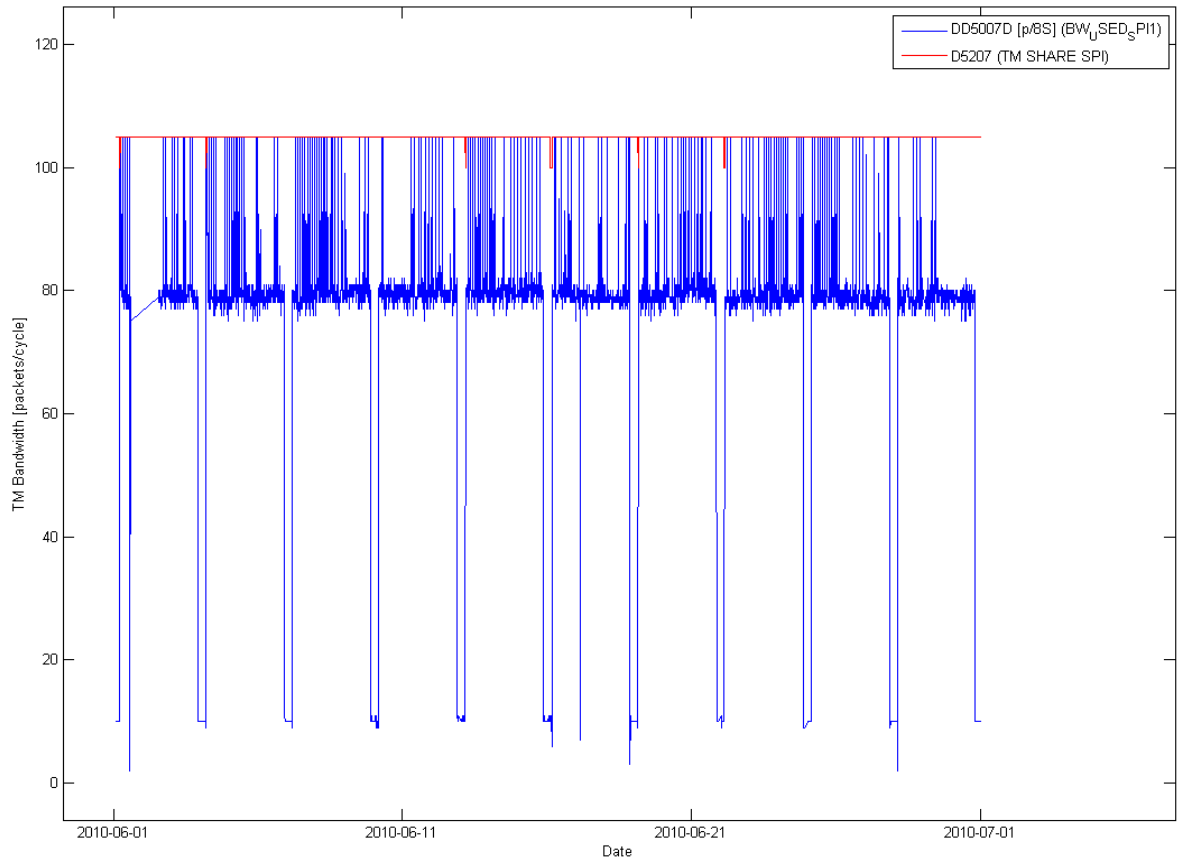



**Figure 1: SPI TM bandwidth utilisation**

The following plot shows the DPE CPU load during the reporting period:

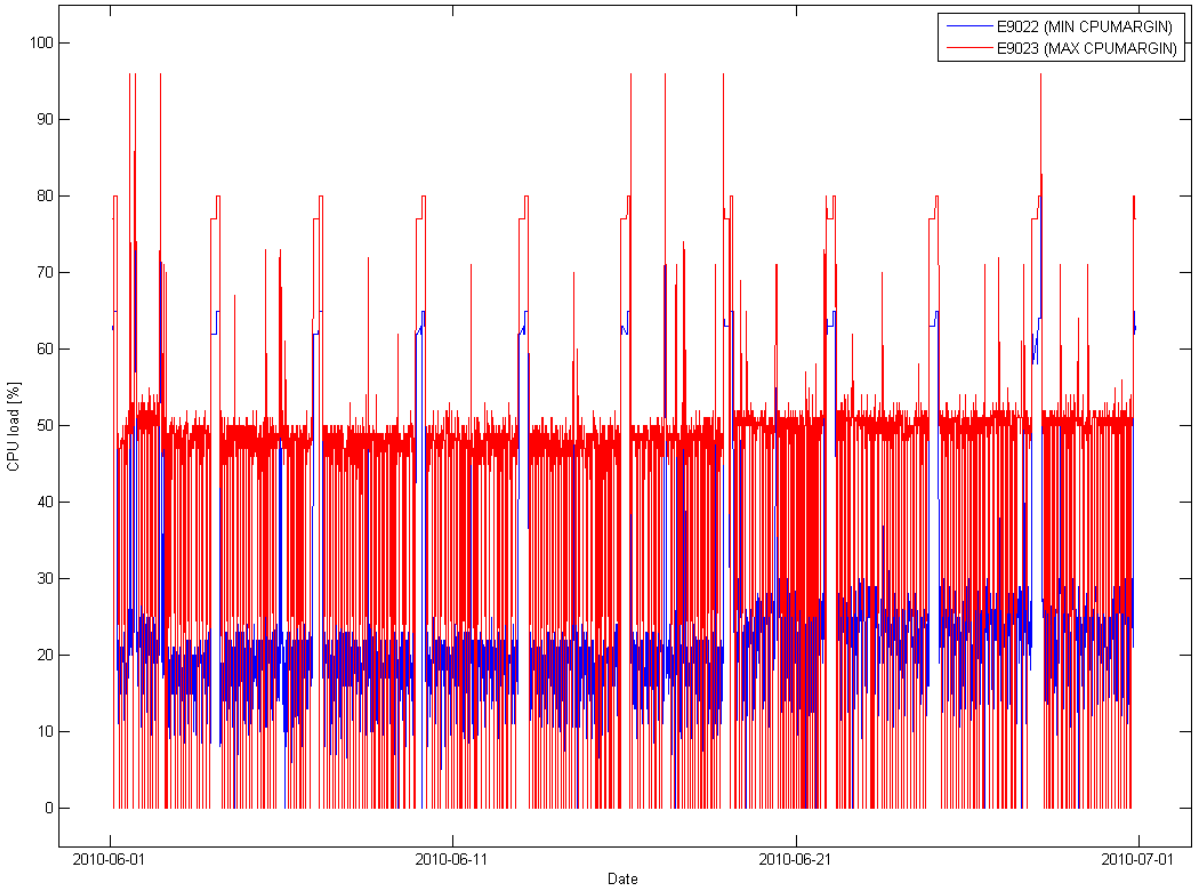



**Figure 2: SPI IASW Performance**

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth since May 2005:

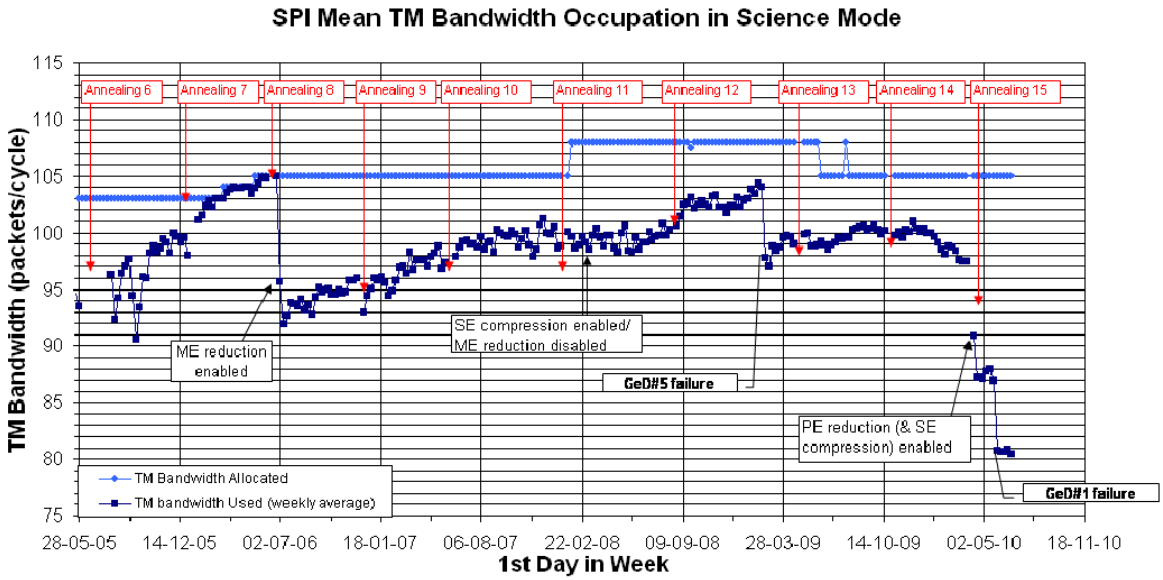


**Figure 3: SPI TM bandwidth usage evolution since May 2005**

*Note: Some more information concerning the SPI operations is provided in Appendix 0.*

### *2.2.2 IBIS*

The overall status of IBIS is nominal.

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: 111.29 packets/cycle

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

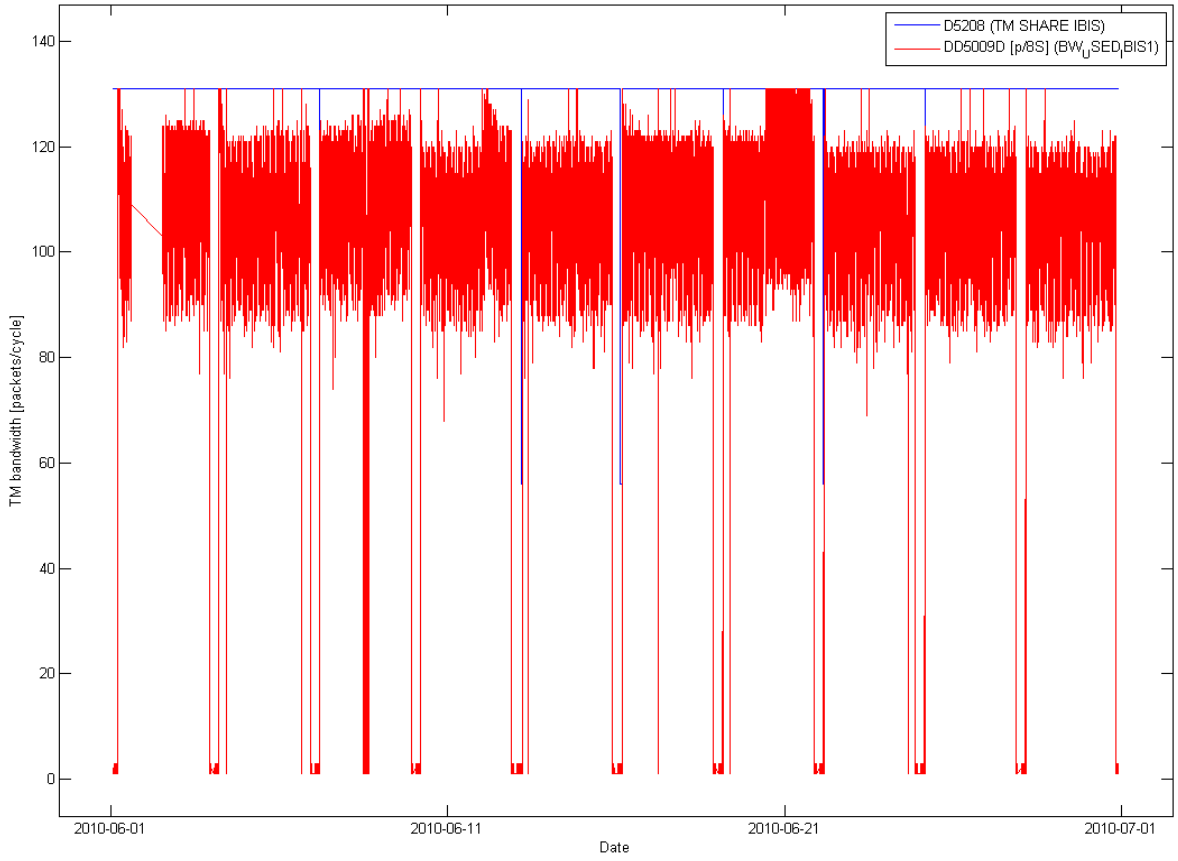



**Figure 4: IBIS TM bandwidth utilisation**

A plot of the IBIS weekly bandwidth utilisation since May 2005 is shown below:

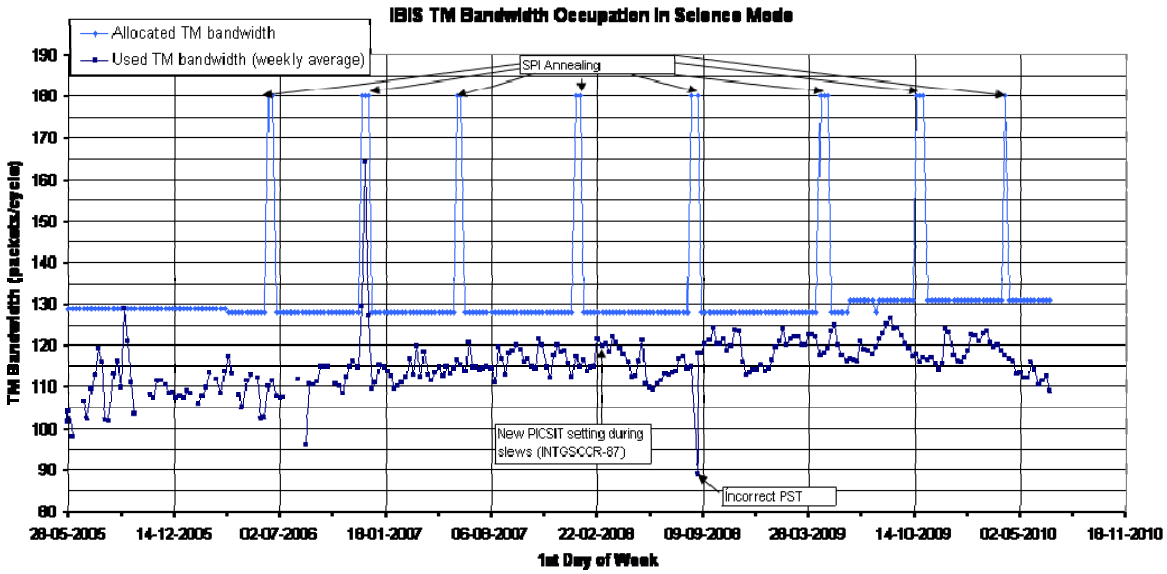



**Figure 5: IBIS TM bandwidth usage evolution since May 2005**

*Note: Some more information concerning the IBIS operations is provided in Appendix 6.2.2.*

### *2.2.3 JEM-X*

The status of both JEM-X units is nominal.

JEM-X2 was operated in Data Taking mode with a TM allocation of 8 packets/cycle. JEM-X1 was dormant (DPE OFF) with no TM slots allocated. A small drop in the detector temperatures during the month caused the detector pressure to repeatedly dip under the lower soft limit.

*Note: Some more information concerning the JEM-X operations is provided in Appendix 0.*

### *2.2.4 OMC*

The status of OMC is nominal.

OMC was operated in Science Normal mode during science observations, with a TM allocation of 5 packets/cycle.

During this reporting period, 631 of the 641 planned science pointings were executed nominally. 1 pointing was lost to a ground station drop, 2 pointings were lost and 3 interrupted to guide star loss problems, an Attitude determination error caused a pointing to be interrupted, an AOCS command failure caused a pointing to be interrupted, and finally 2 pointings were interrupted as part of a other recoveries. No Flat-field calibrations were performed this month.

*Note: Some more information concerning the OMC operations is provided in Appendix 0.*

### *2.2.5 IREM*

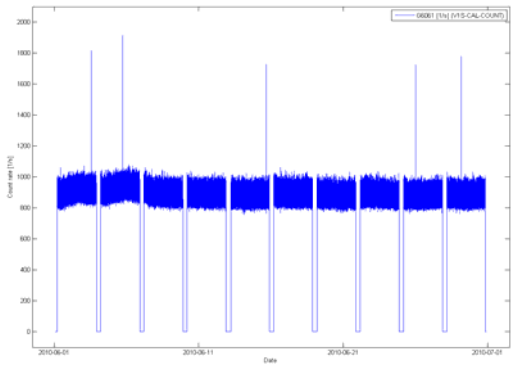
The status of IREM is nominal.

*Note: Some more information concerning the IREM operations is provided in Appendix 0.*

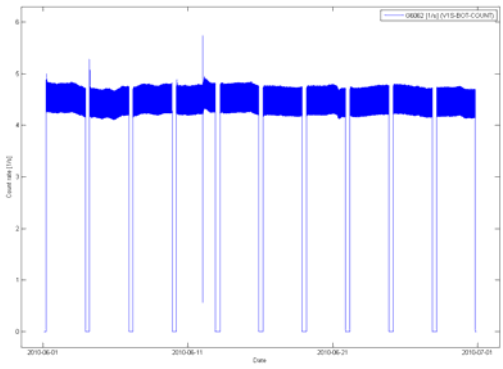
## Radiation background

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 reporting period:

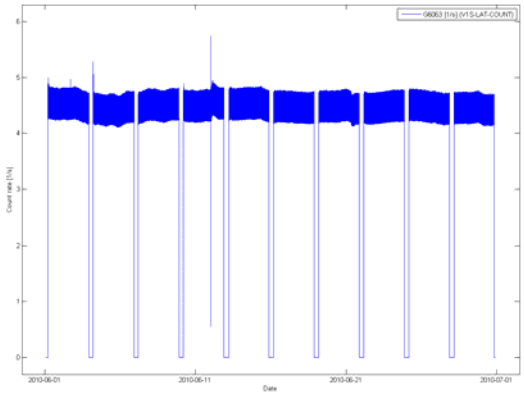
G6061 VETO CAL Counter



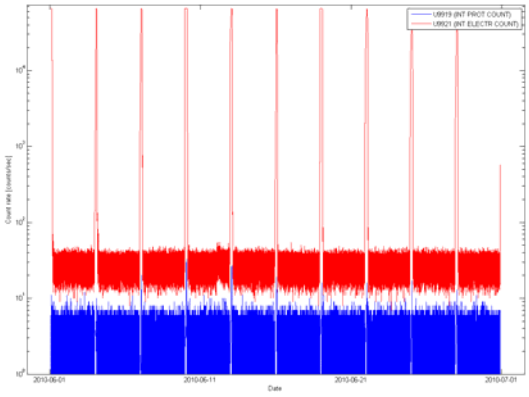
G6062 VETO BOT Counter



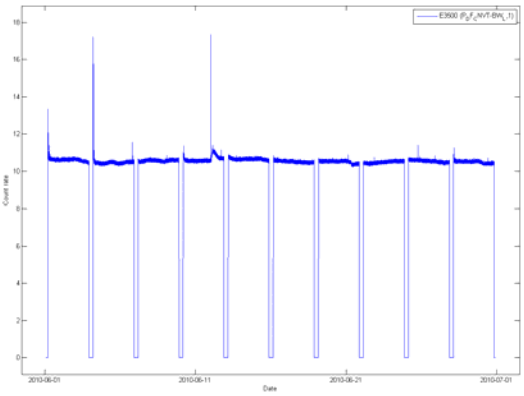
G6063 VETO LAT Counter



U9919 IREM proton & U9921 electron counters[1]



E3500 ACS Counter Below 100MeV



E3544 ACS Counter Above 100MeV

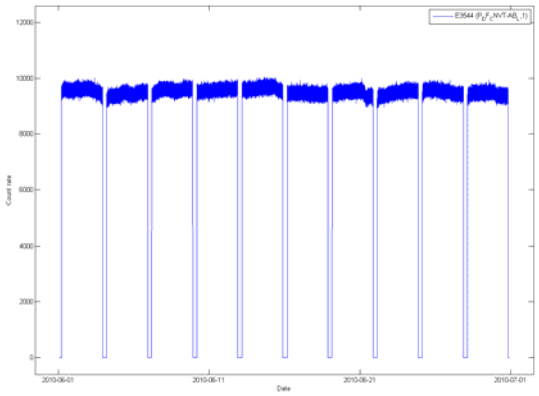


**Figure 6: Instrument Count Rates**

[1] Note that the scale used in this plot is logarithmic.

The JEM-X count rates are only plotted for the active JEM-X unit, the data is sampled every 8th packet (64sec).


**Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft.**

## Radiation Belts

Figure 8 gives a prediction of the trapped radiation environment sensed by the S/C when descending into perigee; the different areas crossed, the Radiation Belt entry/exit points, the shape of the Radiation Belt passage and a rough estimation of the trapped proton and electron fluxes.

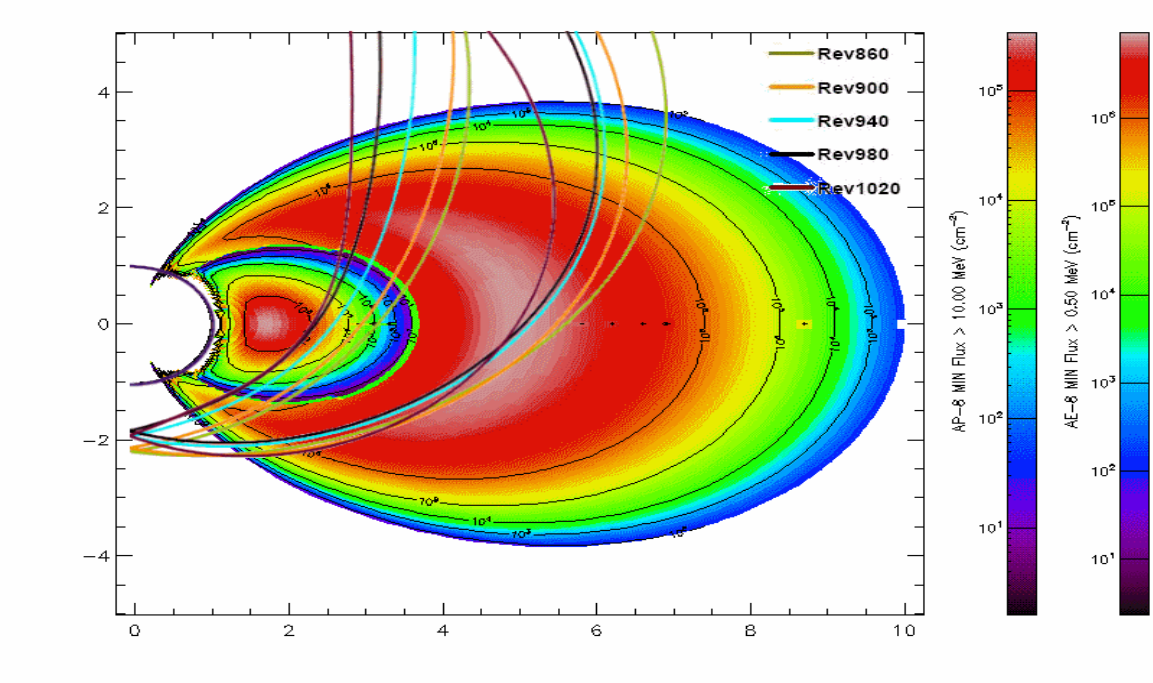



**Figure 8: The predicted evolution of the orbit of Integral through the radiation belts**

# 3 Ground Facilities

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

The following figure shows the number of slews executed and the number of slews missed per revolution. These numbers give a very good indication of the performance of the operational ground facilities, because it involves all the different elements of the ground facilities to complete all slews scheduled.

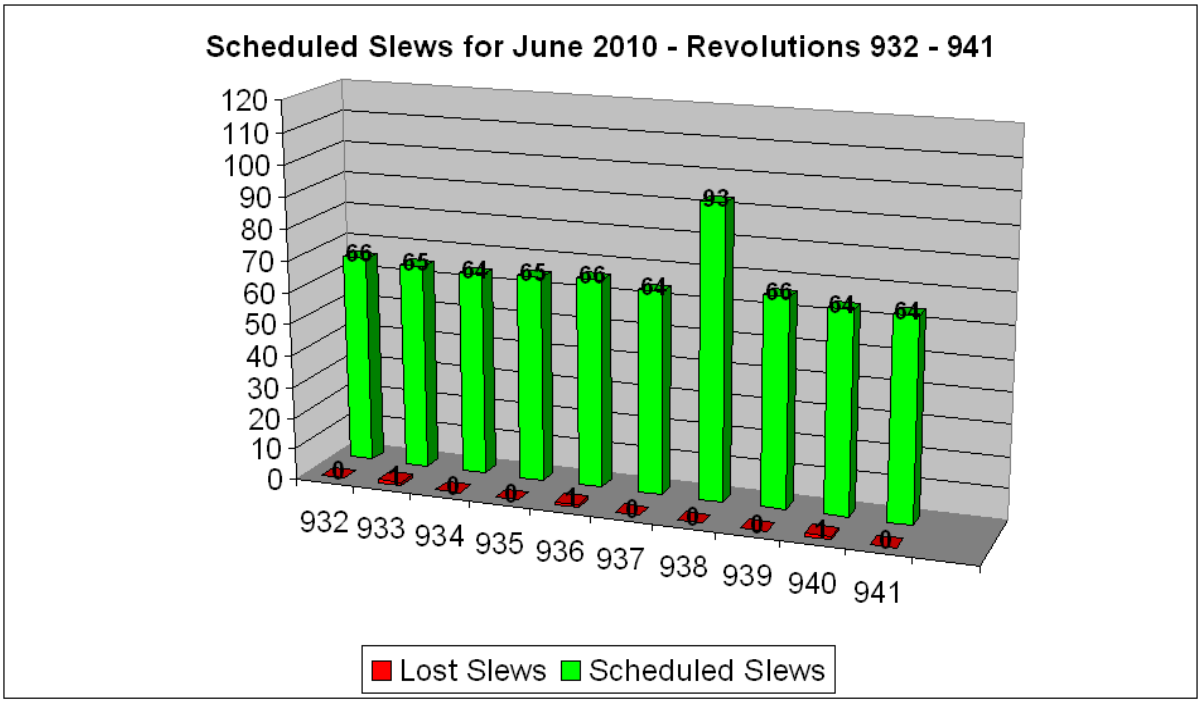



**Figure 9: The number of slews scheduled compared to the number of slews lost**

## 3.1 Mission Control System

This month the HFA_TM task was restarted one time on iddb (due to MUST retrievals) and one time on idda. The PSRV task had to be restarted on idda once too, due to high CPU usage. There were three occasions where the ISDS and IFRD tasks on isdsa had to be restarted and there was one occasion where the AUX and ARCH tasks had to be restarted.

A restart of the OLF task on idda was required once, after which the OLF files from DOY 160.12.00.00 were manually regenerated by the Analyst. On DOY 160 the autostack and manual stack had to be restarted. On DOY 180 the OMCH task crashed on imca and imcb. Both tasks were restarted, but crashed again. A restart of first imcb (08:15:00) and later imca (10:10:00) was performed to solve this problem.

The FDS system showed an error "0k free disk space" on the MCCM on DOY163, DOY164 and DOY165; this was checked by Flight Dynamics and proved no effect on operations. Investigations have started on the check of FDS system by the MCCM and the alarms it should raise.

On DOY172 the IBIS PI workstation was not updating for a period of time.

The line to ISDC was upgraded on DOY173.

## 3.2 Ground Stations and Network

The performance of the ground stations and Network was good this month.

On DOY168 the LNA1 at Vilspa failed and was replaced. Due to an ECC operator error, Redu-1 station

was misconfigured, leading to a late uplink handover from DSS-27.

REDU

Investigation of possible RFI continues at Redu and Vilspa. Shadow tracking has been carried out several times the past month.

Currently LNA2 in use at Redu (LNA1 switched off).

Due to a hit on the line there was loss of tm links for 20 seconds on DOY155. On DOY159, DOY161, 163 and DOY 170 bad frames were received. On DOY163 this was combined with data gaps on VC-0 and VC-7 and on DOY164 there was a drop in VC-0 and VC-7. On DOY 170 there were missing source packets. On DOY 174 there was a drop in VC-0 and VC-7 due to RFI. The RFI was not seen at VIL2, which was shadow tracking at that time. On DOY176 there were to occasions of a drop in VC-0 and VC-7, the first due to problems with the line, the second due to RFI. Bad frames were received for unknown reason on DOY177 and DOY180. On DOY181 Bad frames were received again, network reported that the signal was distorted, though they did not have an explanation. Commanding was not affected.

DSS27

Due to RFI on DOY154 there were data gaps on VC-0 and VC-7. On DOY159 there were missing source packets and data gaps for a couple of minutes and later a drop VC-0 and VC-7 for 9 seconds. Bad frames were received on DOY160.

Figure 10 shows the quality of the ground station performance. The data received from the ground stations is compared to the data that is expected to be received.

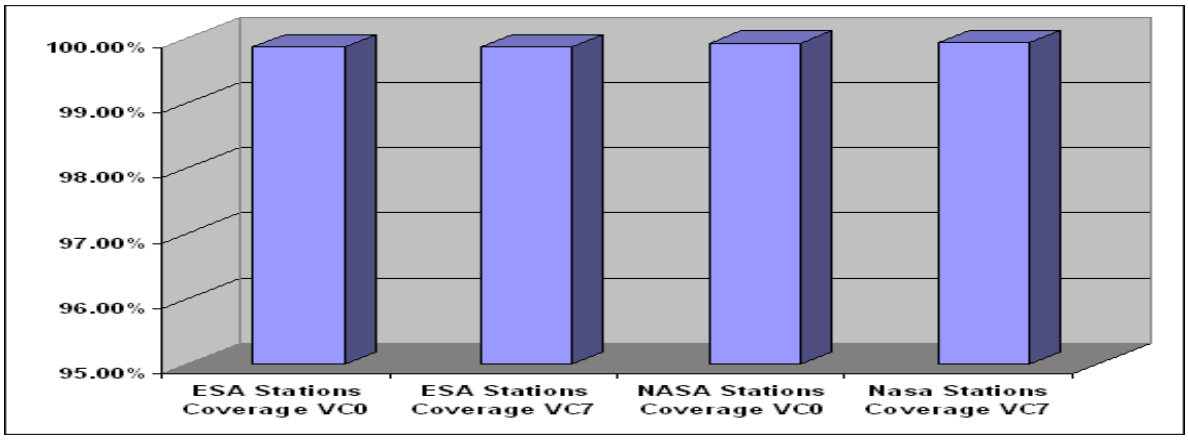



**Figure 10: The usage of ESA ground stations compared to the usage of DSN ground stations**

## 3.3 ISOC

### *3.3.1 Mission Planning*

New or updated PSFs have been received for revolutions 938 to 954, corresponding to the time range 19 June to 8 August. This is further ahead than usual, preparing for the holiday season.

Observations have been planned for revolutions 937 (16-18 June) to 953 (3-5 August). For revolution 953 the PSF had to be regenerated with a larger RMU window to permit planning.

No TOO request was received in June.

TSFs have been received for revolutions 934 to 951.

### *3.3.2 Observation Status*

New ECS files have been received for revolutions 916-923 (up to 7 May).

### *3.3.3 ISOC Science Data Archive*

Work is ongoing on the ingestion of OSA7 data products. The raw TM copied from MOC is complete until 8 May; copying of the historical data at Toulouse has begun. A new ISDA server has been delivered and is being configured. The future disk space requirements have been assessed and a further disk array is being ordered to cope with the expected added load.

### *3.3.4 ISOC System*

ISOC software releases V25.1 to 25.3 have been released in June mainly to cope with AO-8 post-TAC work and to fix a numerical bug in misalignment correction.

### *3.3.5 Problems*

No new problems.

# 4 Anomalies

Table 1 contains the anomalies that occurred in the reporting period:

**Table 1: Anomalies reported**

| AR id | Date of occurrence | Subject | Segment | Status |
|---|---|---|---|---|
| INT-3106 | 22.06.2010 | TC: U4920 INT GND LINK ON failed CEV. | IMCS | OPEN |

# 5 Special Events & Future Milestones

- The INTEGRAL eclipse Season starts on 02.08.2010
- An IODB update is planned before next eclipse season (rev 952).
- Start of transmitter switch-off at perigee in mid-August.
- Move back to renovated DCA is planned for September 2010.

# 6 Appendix

The appendix contains some detailed information concerning the AOCS subsystem and the instruments.

## 6.1 AOCS operations

During this period, 385 Open Loop Slews, 293 Closed Loop Slews and 20 Momentum Biases were executed (as reported by ACC OEM).

8 slews were missed from the Timeline.

### *6.1.1 Fuel consumption*

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 30/06/2010 is reported in the following plot:

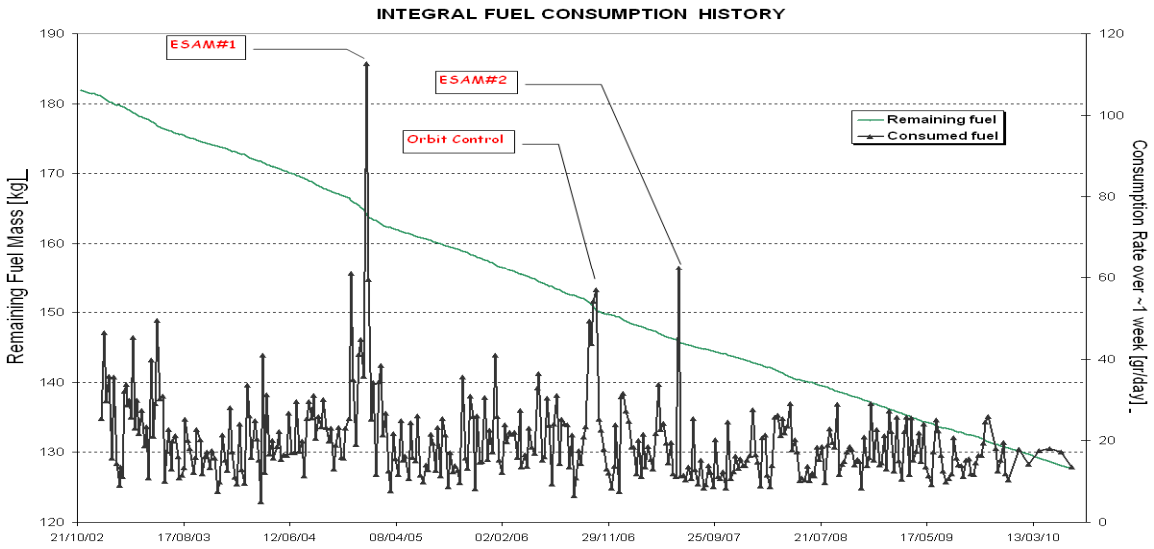



**Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.**

### *6.1.2 The RMU-A null bias calibration*

The RMU-A null bias calibration history, on pitch, roll and yaw channel as from December 2009 up to date are reported in the plot below. Historic data is not available at the moment, but present in the archives. The evolution of the drift on yaw channel is under constant monitoring but the values are still well within the specs.

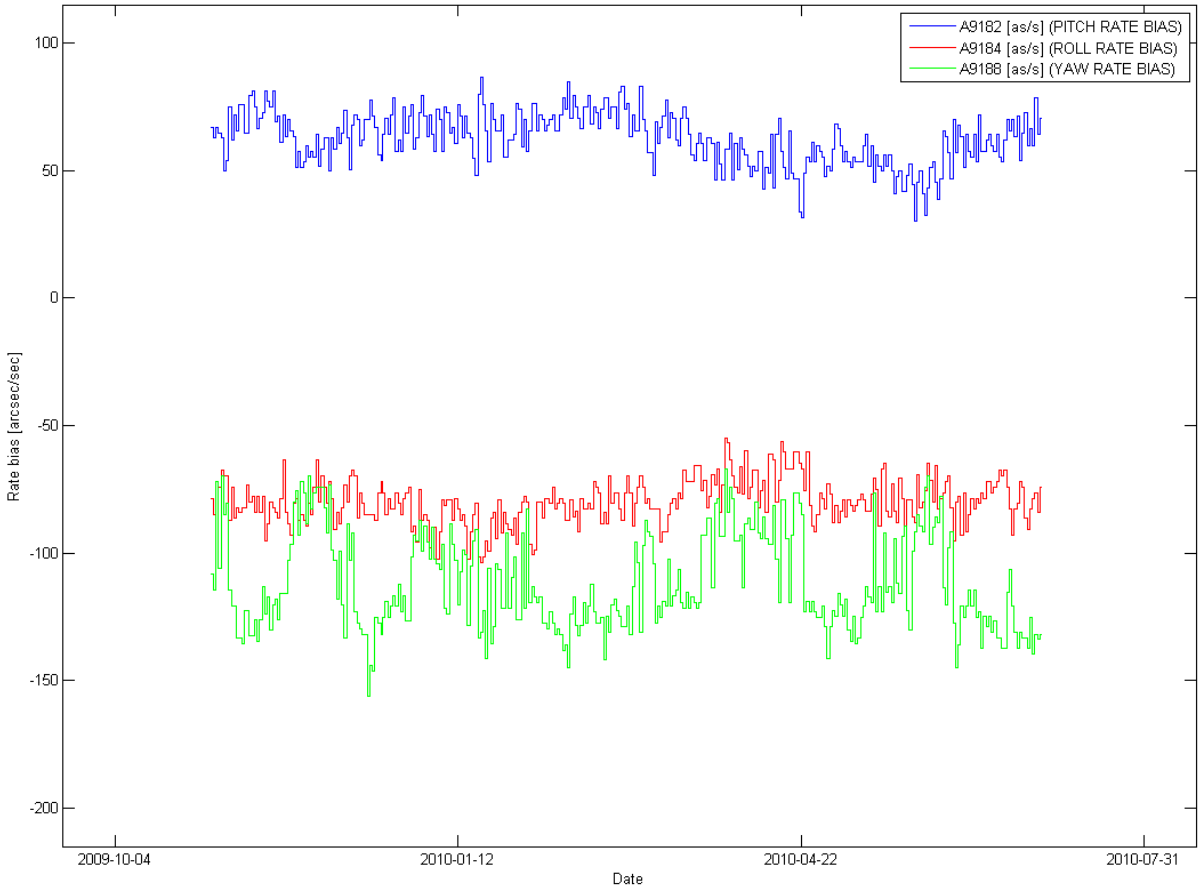



**Figure 12: RMU pitch, roll and yaw. Historic data is available on request**

### *6.1.3 Event log*

**05/06/2010 (Day of Year 156, Revolution 933)**

FDS TPF update failed (attitude determination) for slew 09330039 (19:12:00Z). FD was called in and generated a manual slew from attitude 09330038 to attitude 09330039.

After the manual slew was completed, the parameters for slew 09330040 were manually updated (spacontool).

Slew 09330039 was missed from the Timeline.

OTF was not reached for PID 09330039.

**13/06/2010 (Day of Year 164, Revolution 935 to 936)**

As a consequence of Redu GS drop, the commanding release for slew 09360002 failed. Once GS TC link was recovered, a manual slew was performed from attitude 09360001 to attitude 09360002.

After the manual slew was completed, the parameters for slew 09360003 were manually updated (spacontool).

Slew 09360002 was missed from the Timeline.

OTF was not reached for PID 09360002.

**14/06/2010 (Day of Year 165, Revolution 936)**

IMU1 switched ON during the stable pointing of PID 09360040 (19:30:18Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 09360041.

Then a mapping was commanded and the parameters for slew 09360042 were manually updated (spacontool).

OTF was not reached for PIDs 09360040 and 09360041.

Slew 09360041 was missed from the Timeline.

**17/06/2010 (Day of Year 168, Revolution 937)**

IMU1 switched ON during the commanding of slew 09370037 (16:54:00Z). After the IMU switched back OFF, a manual slew was performed to go from attitude 09370036 to attitude 09370037.

Then a mapping was commanded and the parameters for slew 09370038 were manually updated (spacontool).

OTF was not reached for PID 09370037.

Slew 09370037 was missed from the Timeline.

**22/06/2010 (Day of Year 173, Revolution 938 to 939)**

IMU1 switched ON during the stable pointing of PID 09390001 (03:52:00Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 09390002.

Then a mapping was commanded and the parameters for slew 09360042 were manually updated (spacontool).

OTF was not reached for PIDs 09390001 and 09390002.

Slew 09390002 was missed from the Timeline.

**26/06/2010 (Day of Year 177, Revolution 940)**

Execution of slew 09400042 failed since the star for the slew couldn't be tracked (21:29:00Z). AOCS subsystem was disabled and a manual mapping was commanded, based on which a manual slew from attitude 09400041 to attitude 094000042 was generated and performed.

Then a mapping was commanded and the parameters for slew 09400043 were manually updated (spacontool).

OTF was not reached for PIDs 09400042.

Slew 09400042 was missed from the Timeline.

**27/06/2010 (Day of Year 178, Revolution 940)**

IMU1 switched ON during the stable pointing of PID 09400058 (14:45:18Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 09400059.

Then a mapping was commanded and the parameters for slew 09400060 were manually updated (spacontool).

OTF was not reached for PIDs 09400058 and 09400059.

Slew 09400059 was missed from the Timeline.

**28/06/2010 (Day of Year 179, Revolution 940 to 941)**

IMU1 switched ON during the stable pointing of PID 09410012 (16:28:00Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 09410013.

Then a mapping was commanded and the parameters for slew 09410014 were manually updated (spacontool).

OTF was not reached for PIDs 09410012 and 09410013.

Slew 09410013 was missed from the Timeline.

## 6.2 SPI

### *6.2.1 Operations*

**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 39 until 2010.174.08.34Z when it was increased to 40 on all four compressors. The following plot shows the evolution of the cold plate and H bus temperatures during the reporting period:

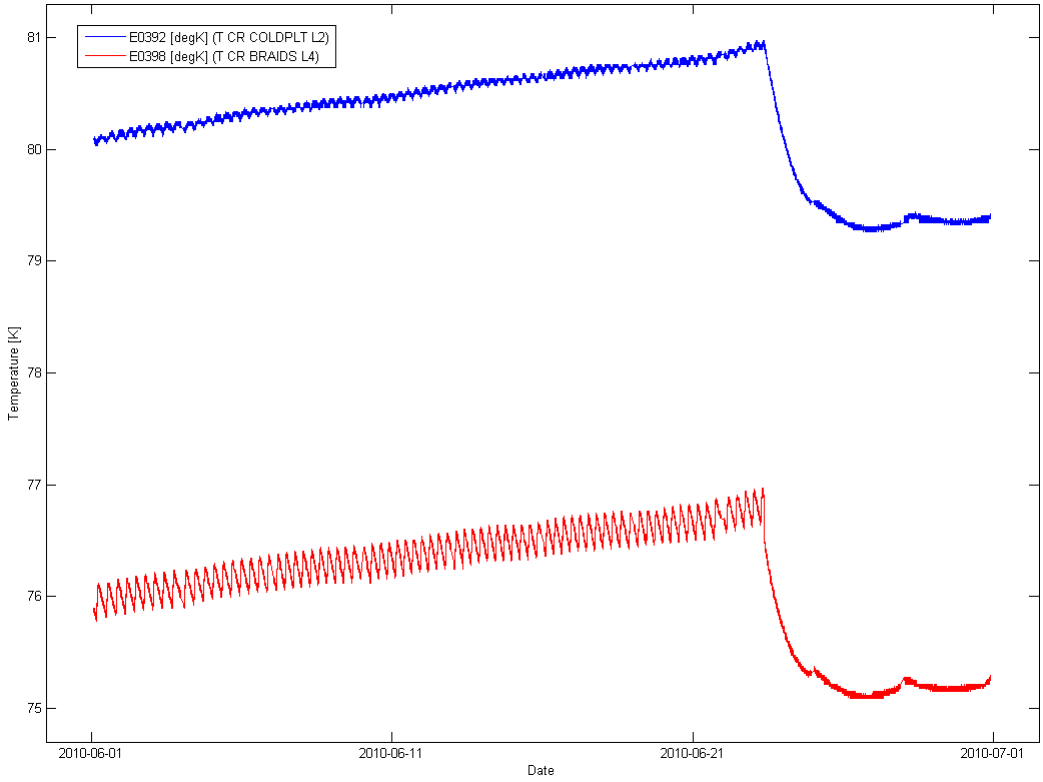



**Figure 13: SPI Cold plate and H-bus temperature**

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

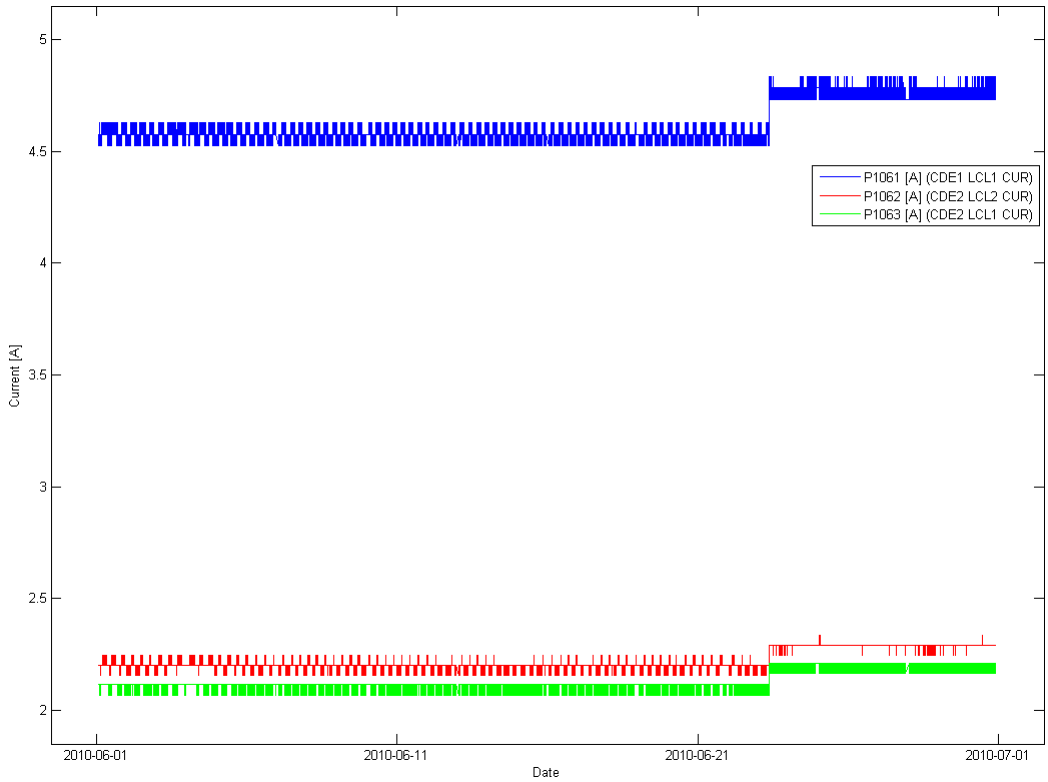



**Figure 14: SPI CDE LCL currents**

## DPE & IASW

The DPE health and IASW performance are nominal. The IASW version installed is v4.3.5 with both SE compression and PE reduction enabled. The spectra scaling factor set to 8/19 SE until 2010-06-18T21:06Z, when it was reduced to 7/19 SE due to the frequent issuing of OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED. The DPE CPU usage was nominal during the reporting period (see Figure 2).

## 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 Figure 6: Instrument Count Rates.

## AFEE

The health of the AFEE is nominal. Detector #2 is failed since 06/12/2003; detector #17 is failed since 17/07/2004; detector #5 is failed since 19/02/2009 and detector #1 is failed since 27/05/2010. The HV of the failed detectors are nominally set to 0.5kV and events from these GeDs are disabled in the DFEE and PSD. OCR-280 (Re-determination of GeD characteristics to reduce HV) was implemented in revolution 937 and involved setting the GeD HV to various different values during the revolution. The following plot shows the AFEE DC output voltages over the reporting period.

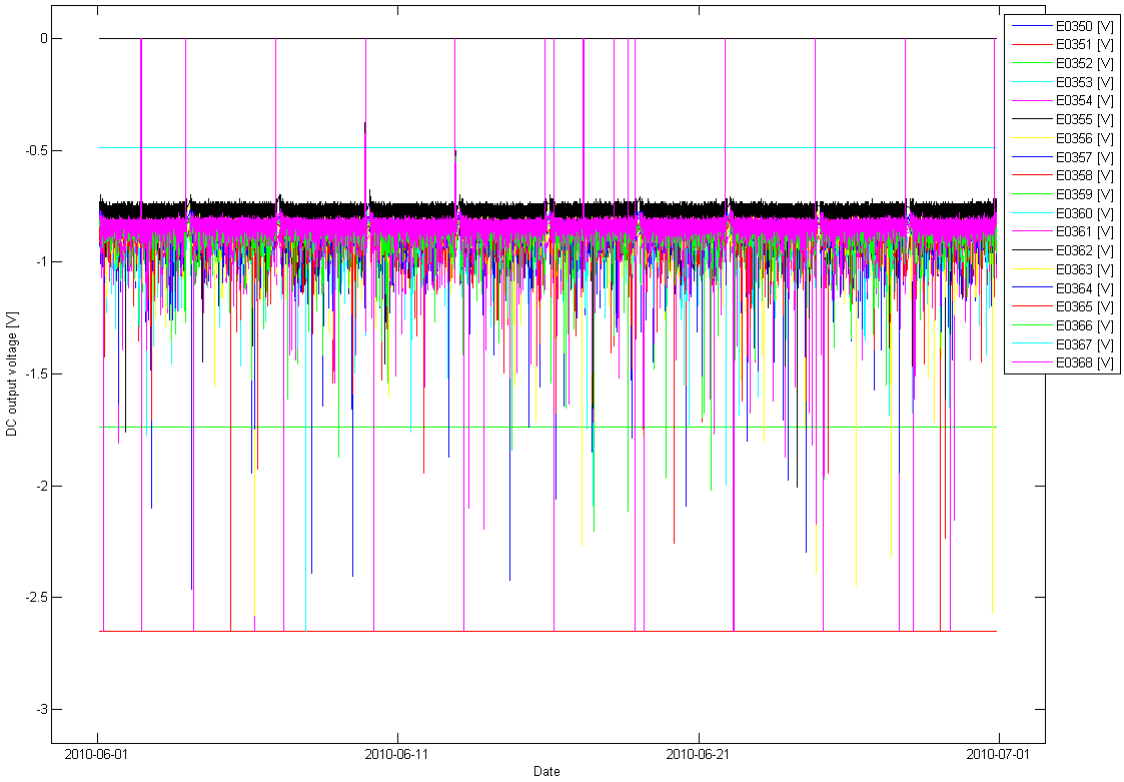



**Figure 15: AFEE DC Output Voltages.**

**DFEE**

The health of the unit is nominal. The following plots show the Non Vetoed, Time Tagged and Time Tagged Saturated Event count rates during the reporting period.

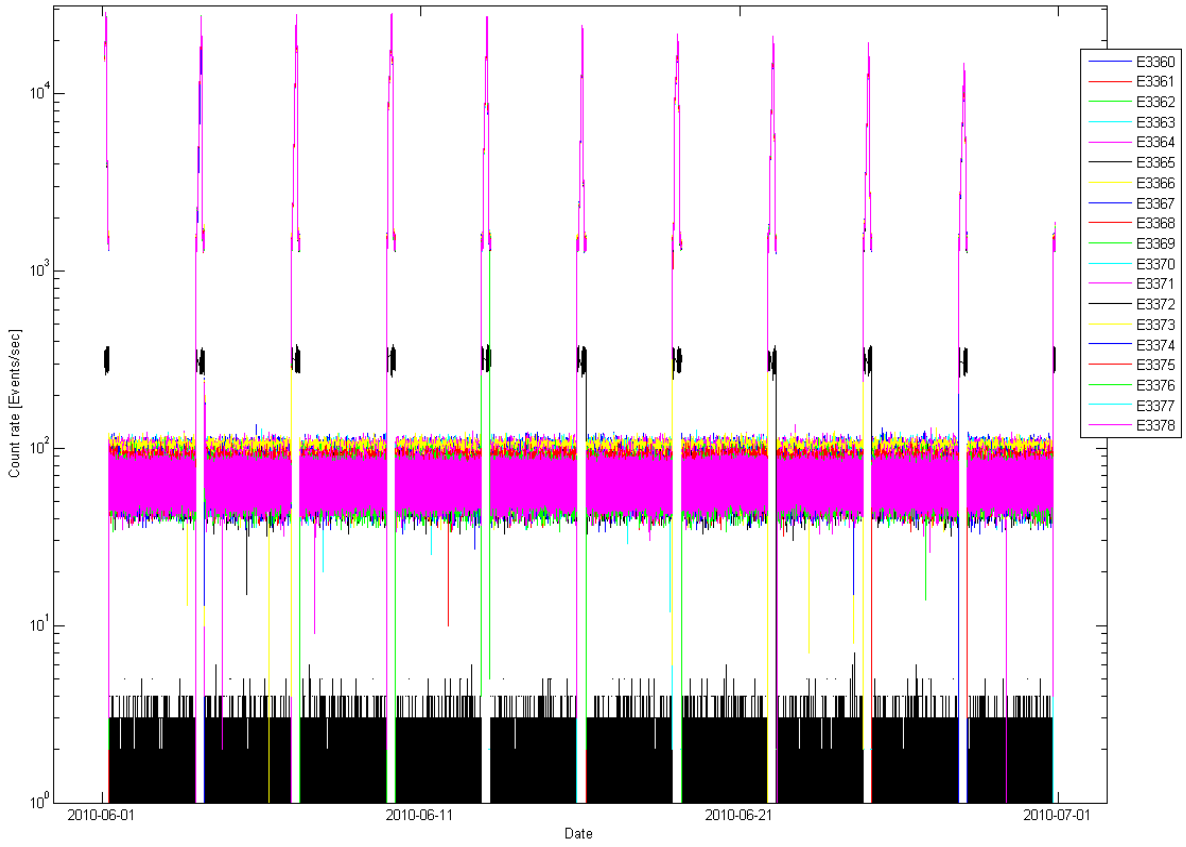



**Figure 16: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic**

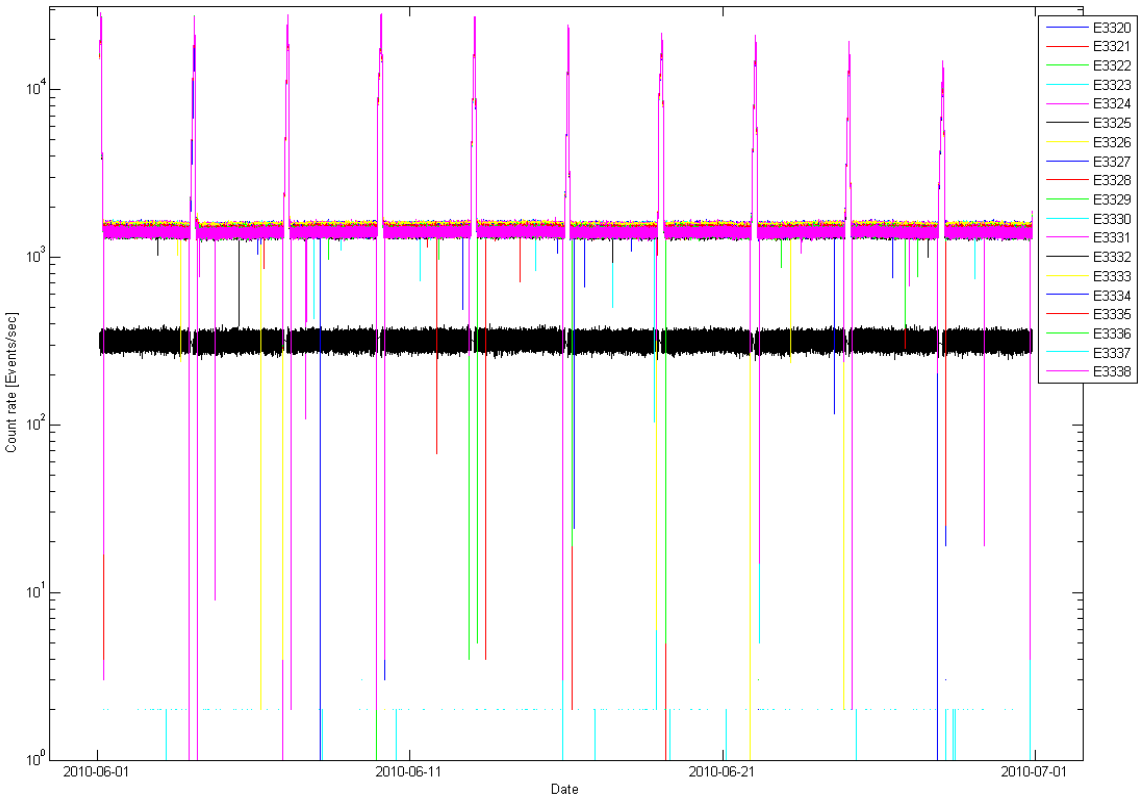



**Figure 17: SPI GeD Time Tagged count rates**

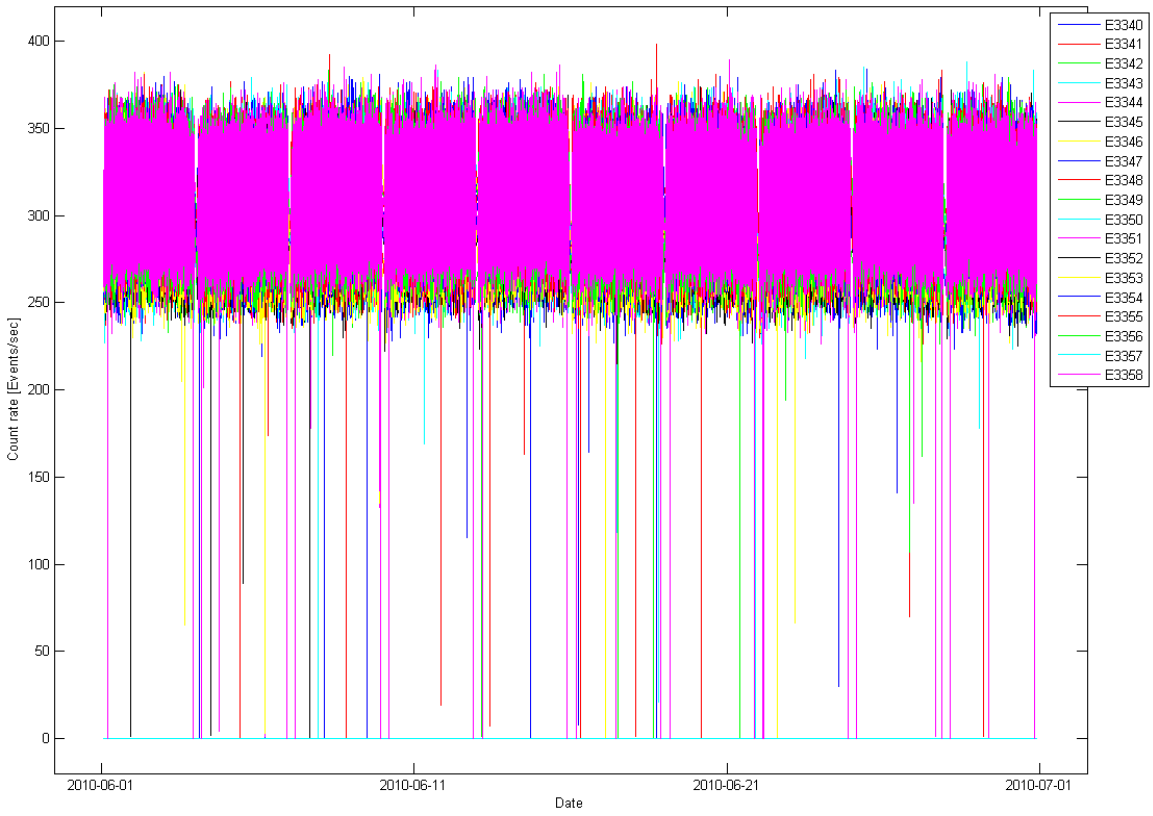



**Figure 18: SPI GeD Time Tagged Saturated count rates**

**PSD**

The health of the PSD is nominal. A PSD Channel Rates Malfunction occurred on 01/06/2010, as a consequence of the GeD#1 failure, and was recovered by a PSD reset. Details are given in the Event Log section below.

The following plot shows the PSD channel rates over the reporting period:

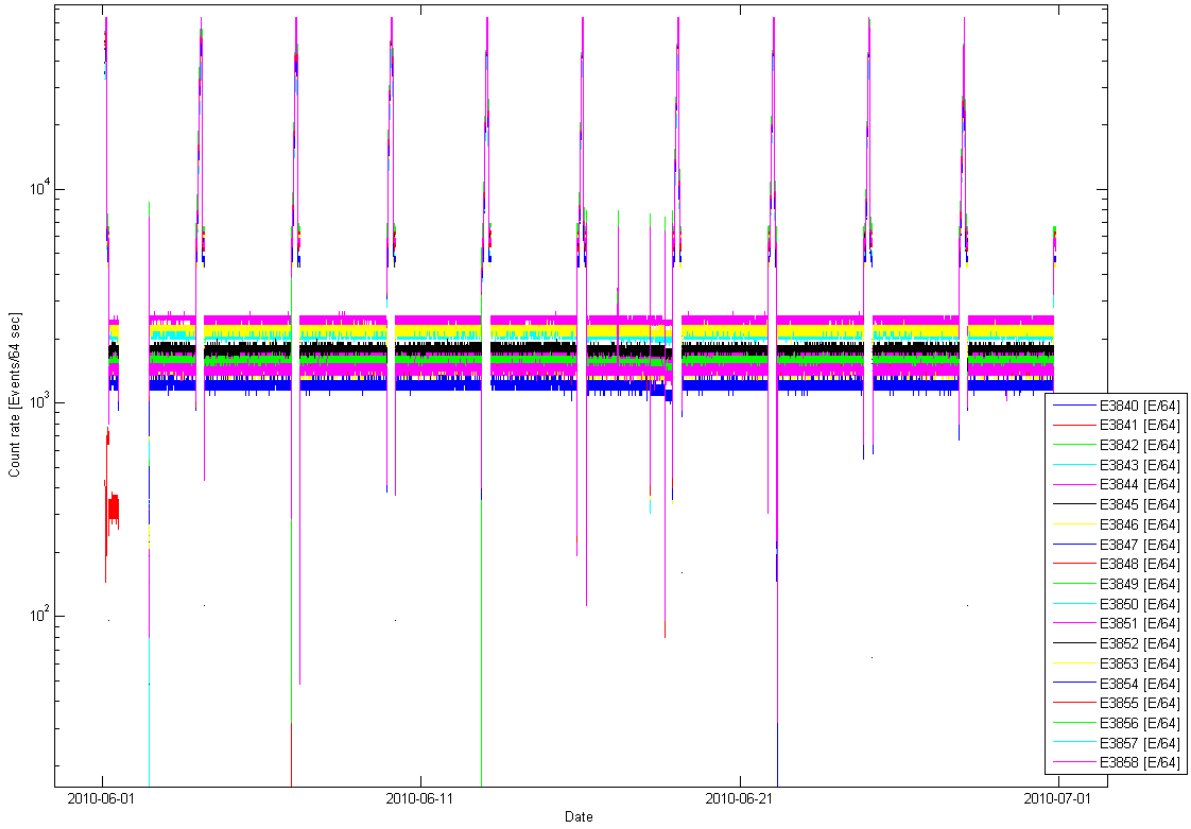



**Figure 19: SPI PSD GeD Channel rates**

## *6.2.2 Event Log*

- 15 occurrences of OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED were received during the reporting period. The spectra scaling factor was reduced from 8/19 SE to 7/19 SE on 2010-06-18T21:06Z, after which no further occurrences of this OEM were received.

**01-06-2010 (Day of Year 152, Revolution 931-932) to 02-06-2010 (Day of Year 153, Revolution 932)**

On 01-06-2010 at 12.18.25Z a PSD channel rates malfunction occurred, with all PSD Channel Rates (TM parameters E3840- E3858) going to zero. As this was as a consequence of the GeD#1 failure which had occurred on 27-05-2010 (it had also occurred following previous GeD failures), the following was performed in order to attempt to recover:

- At 2010.152.13.46.08Z SPI was commanded to CONF mode (FCP_SPI1_0160); GeD#1 was disabled in the PSD (FCP_SPI1_1740) and SPI was returned to Photon mode (FCP_SPI1_0130) at 13.50.14Z. However this did not fix the problem.

- At 17.17.21Z a mode cycle to CONF (FCP_SPI1_0160) and back to PHOTON (FCP_SPI1_0130) was performed, returning to PHOTON mode at 17.18.03Z. This also had no effect.

- At 17.26.32Z SPI was returned to CONF (FCP_SPI1_0160); GeD#1 was re-enabled in the PSD (FCP_SPI1_1740); GeD#1 HV was returned to 4kV (FCP_SPI1_1713) and SPI was returned to PHOTON mode (FCP_SPI1_0130) at 17.28.43Z. Then the sequence to disable GeD#1 in the PSD first, before reducing the GeD#1 HV, was performed by returning SPI to CONF at 17.32.11Z, disabling GeD#1 in the PSD (FCP_SPI1_1740); reducing the High Voltage of GeD#1 to 0.5kV (FCP_SPI1_1713) and returning SPI to PHOTON mode (FCP_SPI1_0130) at 17.35.00Z.

As this did not cure the problem either, no further attempt was made until after radiation belt exit of the next revolution (rev 932) when, following consultation with the SPI PI, a reset of the PSD was performed on 02-06-2010 at 11.00.09Z via CRP_SPI1_3030, which involved commanding SPI to Standby mode. This was completed at 11.18.17Z and recovered the problem with the PSD Channel Rates. Prior to returning to PHOTON mode, GeD#1 was also disabled in the DFEE as for the other failed GeDs by executing FCP_SPI1_1721 at 11.20.29Z. SPI was returned to PHOTON mode at 11.21.15Z.

**04-06-2010 (Day of Year 155, Revolution 932-933)**

Due to continuing high radiation after the expected radiation belt exit of revolution 933, the TM parameter E3500 (ACS Counter Below 100MeV) toggled OOL from 05.05.57Z to 05.33.17Z. As it returned within limits of its own accord, no action was taken.

**16-06-2010 (Day of Year 167, Revolution 937) to 18-06-2010 (Day of Year 169, Revolution 937)**

Inline with OCR-280 (Re-determination of GeD characteristics to reduce HV) the following activities were performed in revolution 937:
After radiation belt exit, at 2010-06-16T04:10Z:

- SPI to Conf (FCP_SPI1_0160);
- Set the HV of all GeDs except the failed ones to **3.5 kV** (FCP_SPI1_1713);
- SPI to Oper (FCP_SPI1_0130) at 04.17.33Z.

At 2010-06-17T03:55Z:

- SPI to Conf (FCP_SPI1_0160);
- Set the HV of all GeDs except the failed ones to **3 kV** (FCP_SPI1_1713);
- SPI to Oper (FCP_SPI1_0130) at 04.01.40Z.

At 2010-06-18T04:00Z:

- SPI to Conf (FCP_SPI1_0160);
- Set the HV of all GeDs except the failed ones to **2.5 kV** (FCP_SPI1_1713);
- SPI to Oper (FCP_SPI1_0130) at 04.06.47Z.

At 2010-06-18T15:24Z:

- SPI to Conf (FCP_SPI1_0160);

- Set the HV of all GeDs except the failed ones to **2 kV** (FCP_SPI1_1713);
- SPI to Oper (FCP_SPI1_0130) at 15.30.04Z.

At 2010-06-18T21:00Z (just before radiation belt entry):

- SPI to Conf (FCP_SPI1_0160);
- Set the HV of all GeDs back to nominal (FCP_SPI1_1713);
- SPI back to Oper (FCP_SPI1_0130) at 21.07.47Z.

## 6.3 IBIS

### *6.3.1 Operations*

**ISGRI**

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

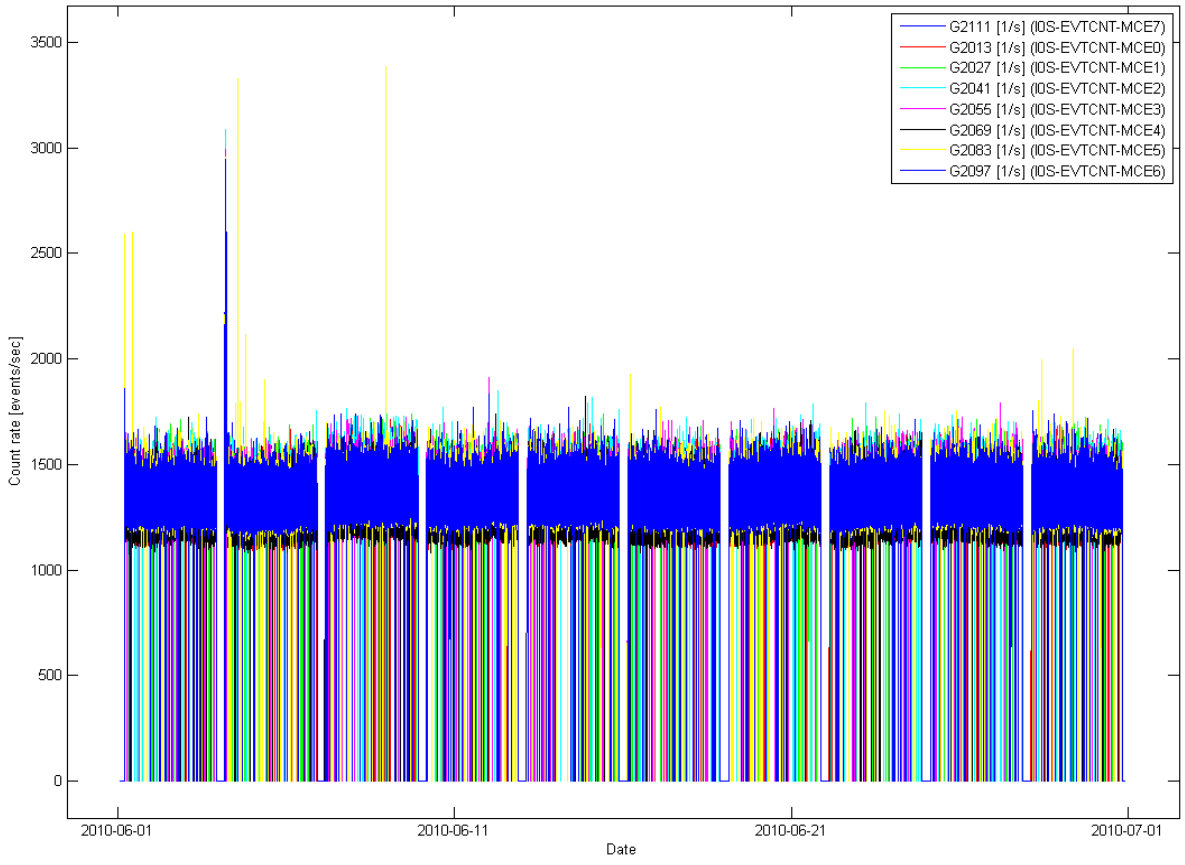



**Figure 20: ISGRI MCE Counters**

**PICsIT**

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

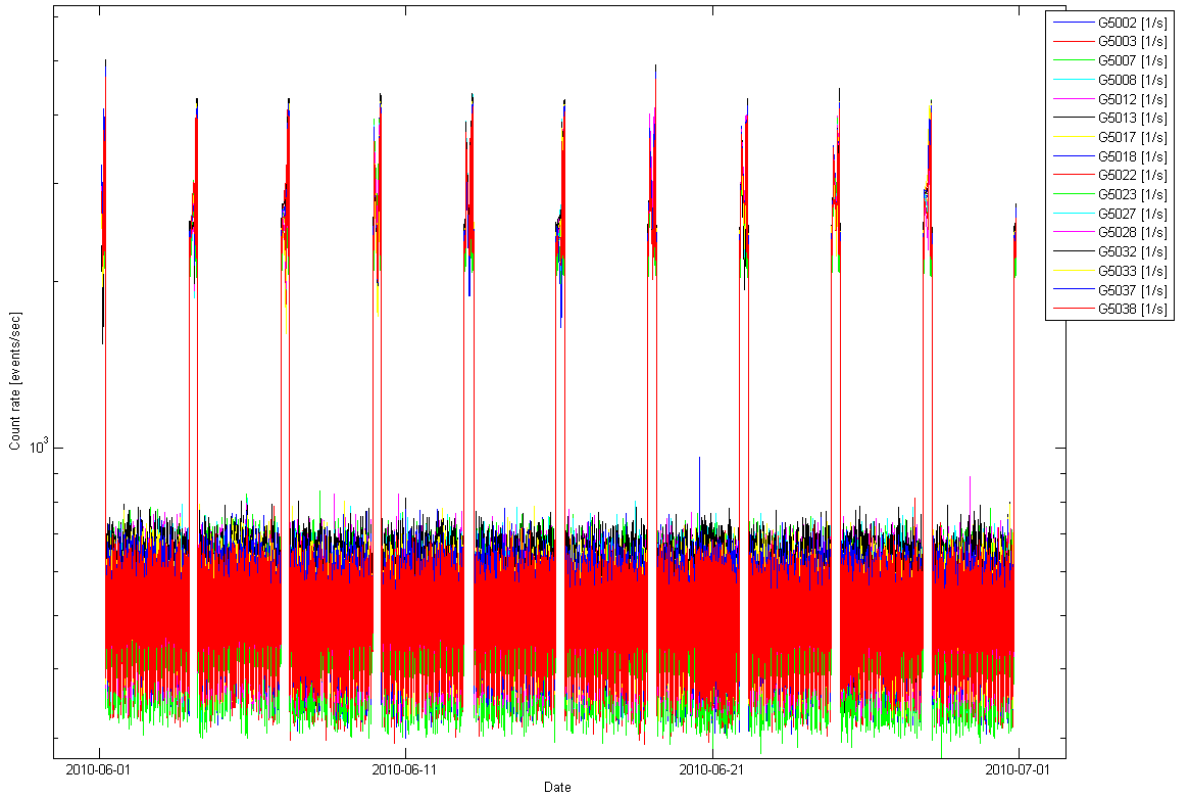



**Figure 21: PICsIT semi-module counters. Note that the scale used for plotting is logarithmic**

**VETO**

The health and performance of VETO was nominal during the reporting period. Plots of the VETO counters are given in Figure 6: Instrument Count Rates.

### *6.3.2 Event Log*

**04-06-2010 (Day of Year 155, Revolution 932 - 933)**

Due to continuing high radiation at radiation belt exit of revolution 933, the ISGRI MCE counters (TM parameter family G2013) toggled OOL from 05.01.36Z to 05.26.24Z and TM parameter G8080 toggled OOL from 05.14.08Z to 05.16.56Z. There was no impact on operations; the parameters returned within limits of their own accord as the background radiation level decreased and no action was taken.

**06-06-2010 (Day of Year 157, Revolution 933)**

Following a ground station handover at 14:58Z, 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:

- 2010.157.16.03.09Z FCP_IBIS1_0312
- 2010.157.16.04.58Z TC G0129 uplinked to return IBIS to Science Standard mode.

IBIS operations continued nominally.

**08-06-2010 (Day of Year 159, Revolution 934)**

Following a ground station handover at 11:32Z, TM parameter X7500 went OOL, indicating a problem with the histogram process. Starting at 12.05.19Z several attempts were made to restart the histogram process by executing FCP_IBIS1_0312 followed by TC G0129 to return IBIS to Science Standard mode. However the procedures were performed without waiting for the next pointing to start in order to verify that the histogram process had resumed, as should be the case. At 13.59Z FCP_IBIS1_0312 was executed again and CCCF was enabled such that IBIS was left in Standby mode until the CCCF_ED GESTAN02 was uplinked at 14.53.37Z. Following this X7500 was still OOL and further attempts of recovery via FCP_IBIS1_0312 followed by TC G0129 were performed between 14.59.27Z and 15.58.47Z, when IBIS was returned to Science Standard mode. At this time no further action was taken and at the start of the next pointing the TM parameter X7500 was observed to return within limits, indicating that the histogram process had resumed.

IBIS operations continued nominally.

**12-06-2010 (Day of Year 163, Revolution 935)**

At 00.56.00Z the VETO count rates (TM parameters G6062 and G6063) went OOL Low (value = 5600). As they returned within limits of their own accord at 00.56.16Z, no action was taken. The spike was also seen in the ACS count rates and was therefore likely due to an external source.

**13-06-2010 (Day of Year 164, Revolution 935-936)**

Due to a problem with the Redu ground station, the EDs in the Timeline to configure IBIS at radiation belt exit of revolution 936 were missed starting from GEBENT02, scheduled at 04.22.50Z. Once stable ground station coverage was regained, IBIS was configured manually as follows:

- 2010.164.05.17.44Z ED GEBENT02 re-uplinked;
- 2010.164.05.21.26Z ED GEBEXT01 re-uplinked;
- 2010.164.05.27.00Z ED GESTAN02 re-uplinked to put IBIS in Science Standard mode.

IBIS operations continued nominally.

**17-06-2010 (Day of Year 168, Revolution 937)**

Following a ground station handover at 05:36Z, 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:

- 2010.168.05.40.16Z FCP_IBIS1_0312
- 2010.168.05.41.16Z TC G0129 uplinked to return IBIS to Science Standard mode.

IBIS operations continued nominally.

**24-06-2010 (Day of Year 175, Revolution 939-940)**

At 14:42Z, 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:

- 2010.175.15.52.24Z FCP_IBIS1_0312
- 2010.175.16.06.07Z TC G0129 uplinked to return IBIS to Science Standard mode.

IBIS operations continued nominally.

## 6.4 JEM-X

### *6.4.1 Operations*

The Status of JEMX-2 is nominal. JEMX-1 is currently inactive. The following plot shows the JEM-X DFEE and detector temperatures over the reporting period.

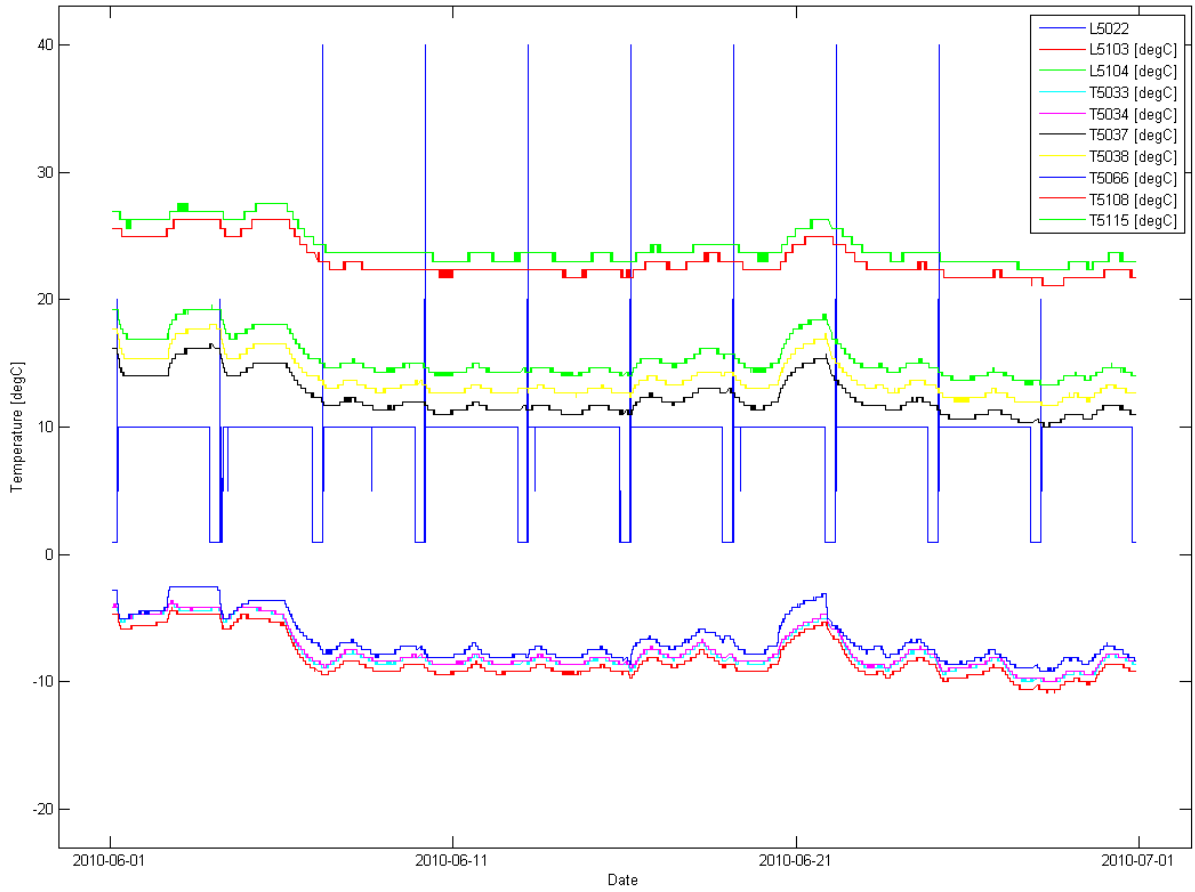



**Figure 22: JEMX Detector and DFEE Temperatures**

### *6.4.2 Event Log*

**01-06-2010 (Day of Year 152, Revolution 932)**

The following out-of-limits were noted:

- 05:44:21, 06:08:02 & 06:08:26 parameter L5136 outside soft limits.
- 05:44:21 & 05:53:38 parameter L5449 outside soft limits.

**04-06-2010 (Day of Year 155, Revolution 933)**

At 05:49, high radiation caused parameters L9104 & L5119 to simultaneously exceed limits forcing JEMX to SAFE mode. According to procedure, the recovery was started after a half hour wait to allow the radiation to decay. The recovery was completed at 07:00. The impact was a 1½ hour delay in the start of scientific observations.

The following out-of-limits were noted:

- Between 05:19:22 & 05:47:54 parameter L5449 repeatedly outside soft limits.
- 05:21:22 & 05:22:36 L5449 outside hard limits.
- 05:21:40 L9134 outside soft limits.
- 05:31:30 & 05:32:02 L5136 outside soft limits.
- 05:33:38 & 05:49:18 L5119 outside soft limits.
- 05:49:46 L5119 outside hard limits.
- 05:49:54 L9104 outside soft limits.

**14-06-2010 (Day of Year 165, Revolution 936)**

The following out-of-limits were noted:

- Between 06:30:52 and 15:40:29 parameter L5102 repeatedly outside soft limits.

**15-06-2010 (Day of Year 166, Revolution 936)**

The following out-of-limits were noted:

- Between 20:57:15 and 22:13:55 parameter L5102 repeatedly outside soft limits.

**16-06-2010 (Day of Year 167, Revolution 937)**

The following out-of-limits were noted:

- Between 01:17:15 and 04:22:39 parameter L5102 repeatedly outside soft limits.

**19-06-2010 (Day of Year 170, Revolution 938)**

At 06:09:22 the TC L0021 failed with status uncertain_failed. This command is part of the LEDATA02 sequence. As a precaution, the spacon enabled the CCCF, which executed at 09:20. There was no impact.

**25-06-2010 (Day of Year 176, Revolution 940)**

From 07:28:52 onward to the end of the reporting period, the parameter L5102 (Detector pressure) started to toggle in and out of the lower soft limit. The behaviour coincided with a slight drop in the temperature of the unit. See Figure 23 for the detector pressure and Figure 24 for the detector temperature. An adjustment of the limits will be included in the next database release to correct the problem.

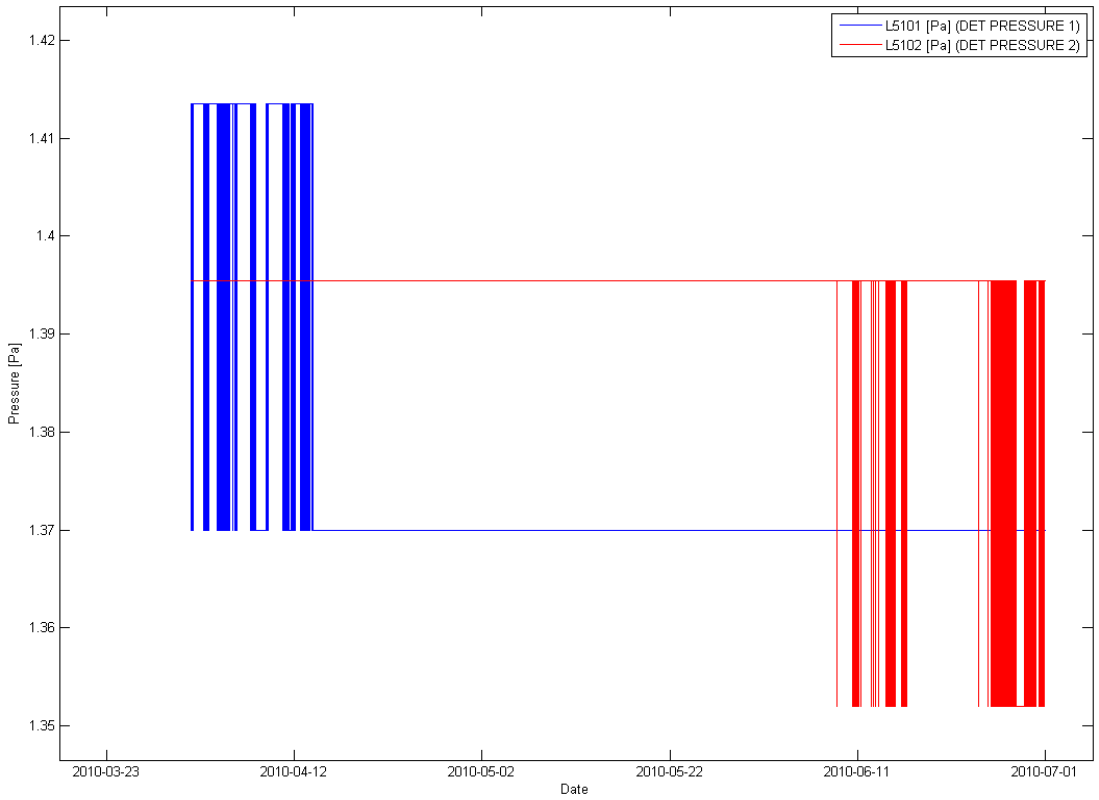



**Figure 23: JEM-X Detector pressure 1 (L5101 – blue line) and Detector pressure 2 (L5102 – red line)**

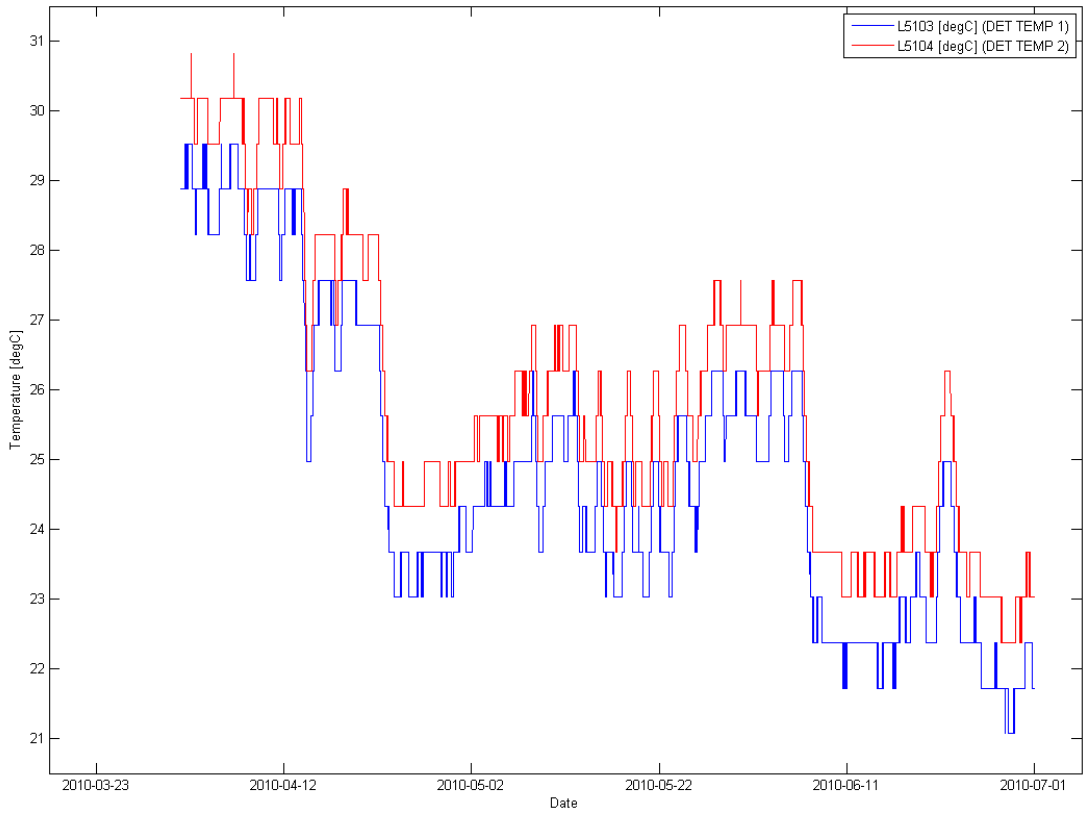



**Figure 24: JEM-X Detector temperature 1 ( L5103 - blue line) and detector temperature 2 (L5104 – red line)**

## 6.5 OMC

### *6.5.1 Operations*

The status and performance of OMC is nominal.

### *6.5.2 Event Log*

**04-06-2010 (Day of Year155, Revolution 933)**

At 07:14:00, after a recovery of a JEM-X problem, the CCCF was enabled, and as a precaution OMC was manually sent to standby, and back to normal mode. This resulted in pointing 09330007 being cut short from a planned 3479 to 1808 seconds.

**05-06-2010 (Day of Year 156, Revolution 933)**

At 19:12:00, an attitude determination error forced an interruption of operations. A recovery was performed, and the timeline rejoined at 20:24. The impact was pointing 09330039 being cut short from a planned 3479 to 3136 seconds.

**13-06-2010 (Day of Year 164, Revolution 936)**

At 04:17, a ground-station drop forced a suspension of operations. A recovery was performed, and the timeline rejoined at 05:08. The impact was the loss of pointing 09360002.

At 09:42:00, after a recovery of an IBIS problem, the CCCF was enabled, and as a precaution OMC was manually sent to standby, and back to normal mode. The impact was pointing 09360007 was cut short from a planned 3479 to 3088 seconds.

**14-06-2010 (Day of Year 165, Revolution 936)**

At 19:30:18, a loss of the guide star forced an interruption to operations. A recovery was performed, and the timeline rejoined at 20:04. The impact was pointing 09360041 was cut short from a planned 3334 to 2992 seconds.

**17-06-2010 (Day of Year 168, Revolution 937)**

At 16:54, a loss of guide star forced an interruption to operations. A recovery was performed, and the timeline rejoined at 18:28. The impact was the loss of pointings 09330037 & 09370038. It was at this time that the following pair of commands were rejected:

```
2010.168.17.56.38.803   2010.168.17.56.43.416   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E

2010.168.17.56.45.178   2010.168.17.56.57.068   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 pointing 09370038.

**26-06-2010 (Day of Year 177, Revolution 940)**

At 21:30, an AOCS command failed its PTV, which forced an interruption. A recovery was performed, and the timeline rejoined at 21:56. The OMC commands were manually sent at 22:01. The impact was pointing 09400042 was cut short from a planned 3334 to 1712 seconds.

**27-06-2010 (Day of Year 178, Revolution 940)**

At 14:45, a loss of the guide star forced an interruption. A recovery was performed, and the timeline rejoined at 15:40. The impact was pointing 09400059 was cut short from a planned 3334 to 2280 seconds.

**28-06-2010 (Day of Year 179, Revolution 941)**

At 16:28, a loss of the guide star forced another interruption. A recovery was performed, and the timeline rejoined at 17:02. The impact was pointing 09410013 was cut short from a planned 3334 to 1952 seconds.

## 6.6 IREM

### *6.6.1 Operations*

**Radiation belts entry and exit**

The following plots show the Radiation Belt Entry (Figure 25, red line) and Exit times (Figure 26, blue line) obtained from the ISDC website, defined where the IREM TC3 (soft electrons) rate reads 600 counts. The blue line in Figure 25 and the magenta line in Figure 26 are the altitudes used by the MOC for planning purposes.

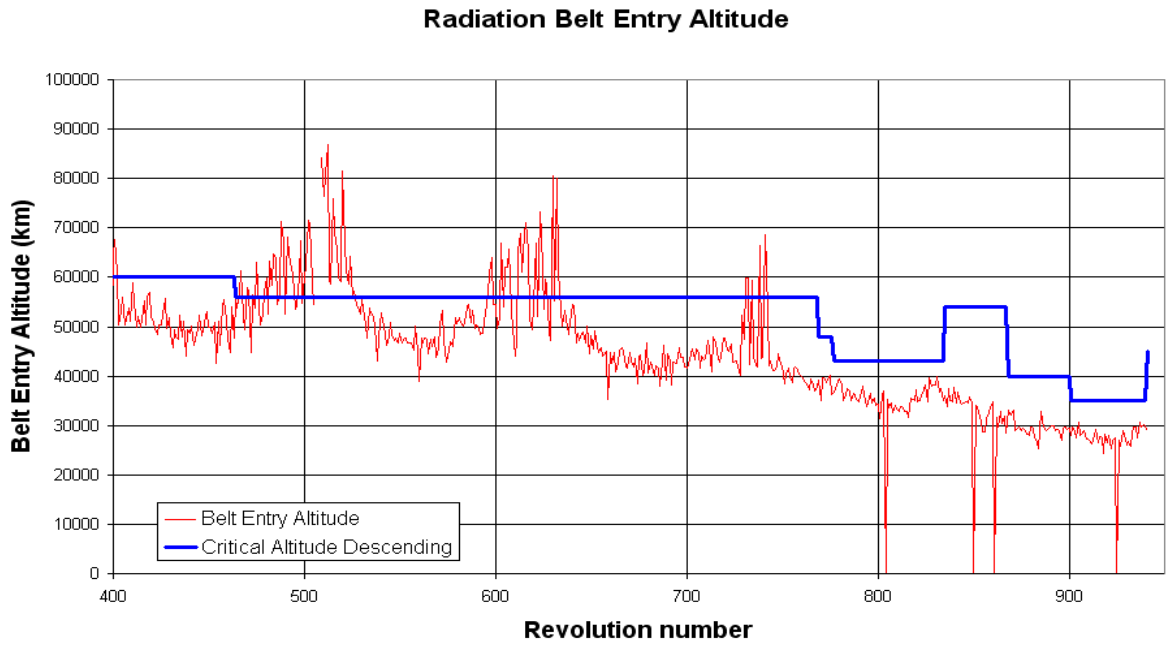



**Figure 25: Radiation belt entry**

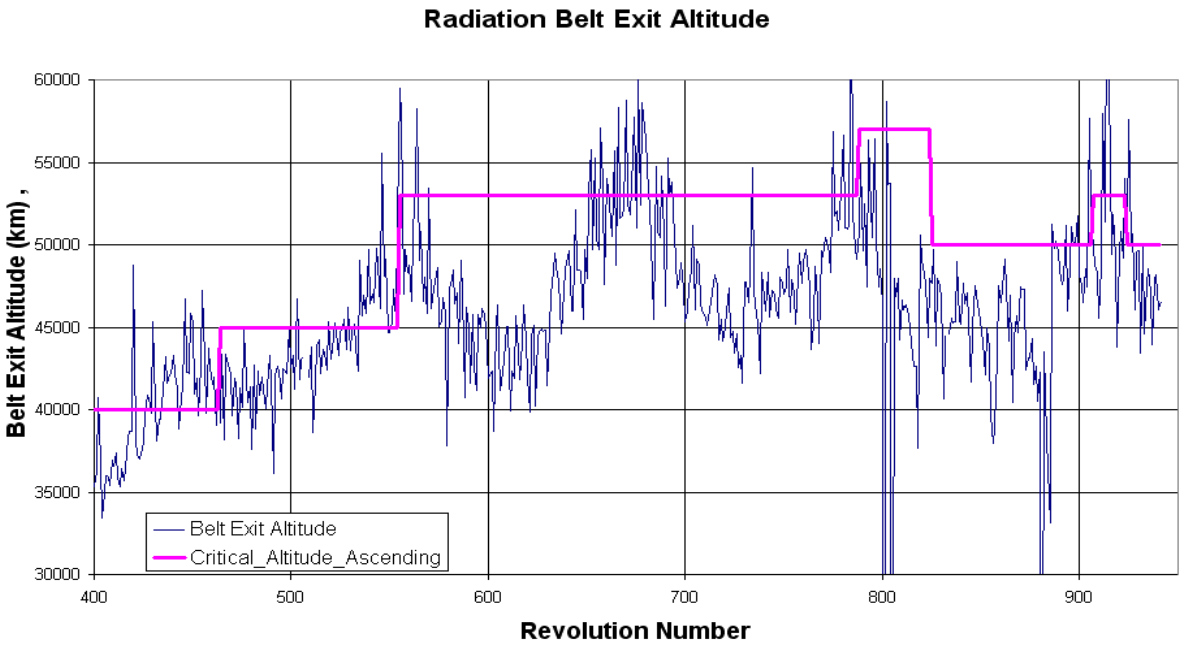



**Figure 26: Radiation belt exit**

**Table 2: Radiation belts. Radiation belt entry crossings are ignored if there is a subsequent gap of at least 30 minutes of low radiation.**

| Revo number | Spacecraft BCPKT (electron) | Observed entry/exit time by Electron CUT-OFF | Observed entry/exit altitude [km] by Electron CUT-OFF | Predicted entry/exit time by Electron CUT-OFF | Predicted entry/exit altitude [km] by Electron CUT-OFF | Predicted entry/exit time by Proton CUT-OFF | Predicted entry/exit altitude [km] by Proton CUT-OFF |
|---|---|---|---|---|---|---|---|
| 932 | RAD_EXIT R 2010-06-01T05:09:39Z | 01/06/2010 04:39:45 | >>28128.0 | 01-Jun-2010 04:47:19 | 46552.39 | 01-Jun-2010 00:57:19 | 5260.548 |
| 932 | RAD_ENTR R 2010-06-03T22:19:48Z | Not available | - | 03-Jun-2010 23:22:08 | 22226.66 | 04-Jun-2010 00:12:08 | 11042.2 |
| 933 | RAD_EXIT R 2010-06-04T04:57:19Z | 04/06/2010 05:26:25 | 54128.2 | 04-Jun-2010 04:32:08 | 46028.74 | 04-Jun-2010 00:52:08 | 4962.023 |
| 933 | RAD_ENTR R 2010-06-06T22:06:29Z | 06/06/2010 23:04:17 | 22343.0 | 06-Jun-2010 23:06:18 | 22756.89 | 06-Jun-2010 23:56:18 | 11559.39 |
| 934 | RAD_EXIT R 2010-06-07T04:43:52Z | 07/06/2010 03:57:21 | >>28114.9 | 07-Jun-2010 04:16:18 | 45665.95 | 07-Jun-2010 00:36:18 | 4988.401 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 934 | RAD_ENTR R 2010-06-09T21:53:54Z | 09/062010 22:47:22 | 23879.3 | 09-Jun-2010 22:50:52 | 23299.48 | 09-Jun-2010 23:50:52 | 9859.952 |
| 935 | RAD_EXIT R 2010-06-10T04:30:50Z | 10/06/2010 03:49:22 | >>28141.6 | 10-Jun-2010 04:10:52 | 46984.78 | 10-Jun-2010 00:20:52 | 5029.678 |
| 935 | RAD_ENTR R 2010-06-12T21:41:02Z | 12/06/2010 22:36:18 | 24134.9 | 12-Jun-2010 22:46:16 | 21681.27 | 12-Jun-2010 23:36:16 | 10446.39 |
| 936 | RAD_EXIT R 2010-06-13T04:18:07Z | 13/06/2010 03:26:58 | >>28133.7 | 13-Jun-2010 03:56:16 | 46516.48 | 13-Jun-2010 00:06:16 | 5285.408 |
| 936 | RAD_ENTR R 2010-06-15T21:26:58Z | 15/06/2010 22:32:42 | 22241.0 | 15-Jun-2010 22:31:01 | 21936.79 | 15-Jun-2010 23:21:01 | 10737.97 |
| 937 | RAD_EXIT R 2010-06-16T04:04:23Z | 16/06/2010 03:04:10 | 39917.5 | 16-Jun-2010 03:41:01 | 46267.84 | 15-Jun-2010 23:51:01 | 5458.817 |
| 937 | RAD_ENTR R 2010-06-18T21:13:53Z | 18/06/2010 22:01:14 | 25543.0 | 18-Jun-2010 22:17:13 | 21914.68 | 18-Jun-2010 23:07:13 | 10661.47 |
| 938 | RAD_EXIT R 2010-06-19T03:50:53Z | 19/06/2010 03:04:58 | >>28135.7 | 19-Jun-2010 03:27:13 | 46370.23 | 18-Jun-2010 23:37:13 | 5348.68 |
| 938 | RAD_ENTR R 2010-06-21T21:03:25Z | 21/06/2010 21:53:14 | 24074.7 | 21-Jun-2010 22:01:51 | 23026.65 | 21-Jun-2010 22:51:51 | 11762.22 |
| 939 | RAD_EXIT R 2010-06-22T03:39:56Z | 22/06/2010 02:56:34 | >>28167.6 | 22-Jun-2010 03:11:51 | 45595.04 | 21-Jun-2010 23:31:51 | 4892.471 |
| 939 | RAD_ENTR R 2010-06-24T20:53:17Z | 24/06/2010 21:45:14 | 24244.9 | 24-Jun-2010 21:59:04 | 21170.79 | 24-Jun-2010 22:49:04 | 9895.434 |
| 940 | RAD_EXIT R 2010-06-25T03:29:51Z | 25/06/2010 02:29:22 | >>28163.9 | 25-Jun-2010 03:09:04 | 46964.59 | 24-Jun-2010 23:19:04 | 5023.513 |
| 940 | RAD_ENTR R 2010-06-27T20:41:46Z | 27/06/2010 21:33:54 | 24635.5 | 27-Jun-2010 21:46:45 | 21356.2 | 27-Jun-2010 22:36:45 | 10143.07 |
| 941 | RAD_EXIT R 2010-06-28T03:18:52Z | 28/06/2010 02:27:15 | >>28132.7 | 28-Jun-2010 02:56:45 | 46728.07 | 27-Jun-2010 23:06:45 | 5198.131 |
| 941 | RAD_ENTR R 2010-06-30T19:32:07Z | 30/06/2010 21:18:51 | 24600.9 | 30-Jun-2010 21:26:45 | 22362.16 | 30-Jun-2010 22:16:45 | 11197.09 |

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)

### *6.6.2 Event Log*

**22-06-2010 (Day of Year 173, Revolution 939)**

At 01:19:00 the TC: U4920 INT GND LINK ON (part of the sequence UEGRON01) failed its CEV. The TM parameters U9903 SR INT GND LINK = ON, and U9902 BLOCK STATE were cycling. No action was taken, and there was no impact.