EUROPEAN SPACE AGENCY

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MISSION OPERATIONS DEPARTMENT

INTEGRAL

Mission report

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

No. 382

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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 February and covers the revolutions 892 untill 900. 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.

Two slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.4046 Kg. The remaining propellant is in the order of 129.7206 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 14th SPI annealing, which ended on 06/11/2009, 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 eclipse season started on 16-02-2010. Eclipse operations for SPI are progressing nominally.

The Germanium detectors' temperature was kept in the range 80K+/-1K. However, following the CDE2 LCL trip-off which occurred on 04/11/2009 (AR INT_SC-273), the drift of the Cold Plate temperature has been higher than nominal and the compressor stroke settings are therefore higher than usual for the same time after annealing. This behaviour is thought to be due to a degraded efficiency of the cryocooler as a result of contaminant evaporation and re-condensation during the period in which compressors C and D were off due to this anomaly.

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, except from 2010-02-08T15:55:27Z to 2010-02-08T19:41:27Z (OMC Flat Field Calibration), when it was 88 packets/cycle. The average telemetry occupation when the allocation was 105 packets/cycle was 98.6 packets/cycle.

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

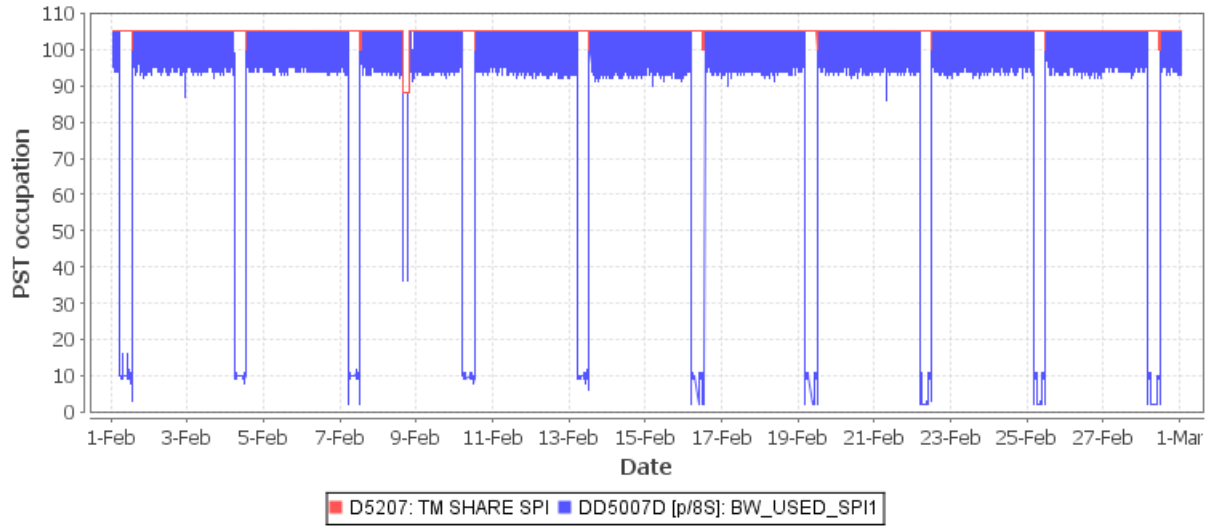


Figure 1: SPI TM bandwidth utilisation

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

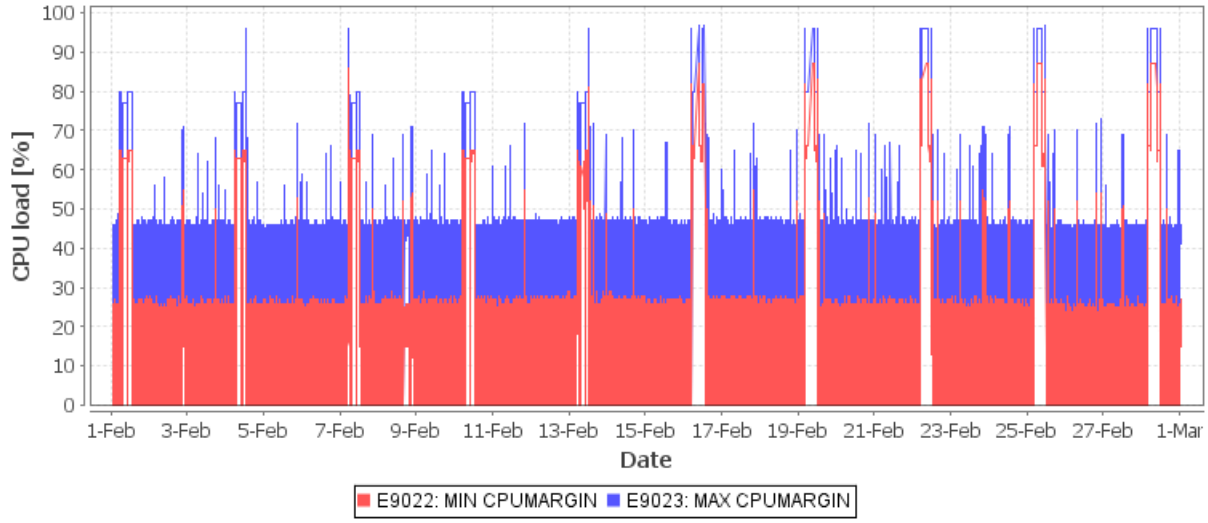


Figure 2: SPI IASW Performance

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

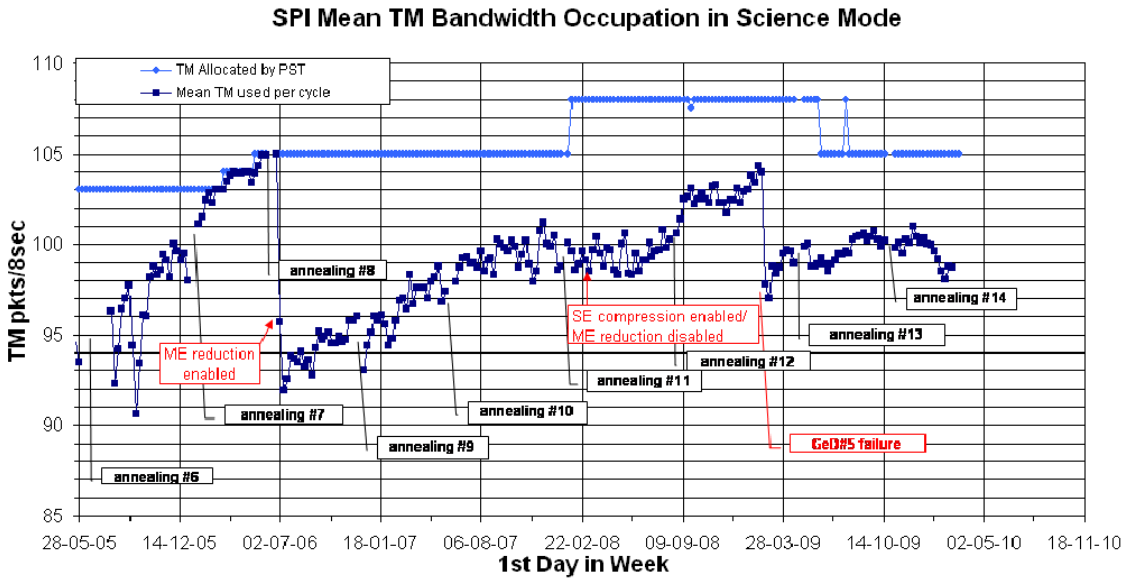


Figure 3: SPI TM bandwidth usage evolution since May 2005

Note: Some more information concerning the SPI operations is provided in Appendix 6.2.

2.2.2 IBIS

The overall status of IBIS is nominal. The eclipse season started on 16-02-2010. 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, except from 2010-02-08T15:55:27Z to 2010-02-08T19:41:27Z (OMC Flat Field Calibration), when it was 90 packets/cycle.

- IBIS mean bandwidth utilisation in science mode: 122.5 packets/cycle

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

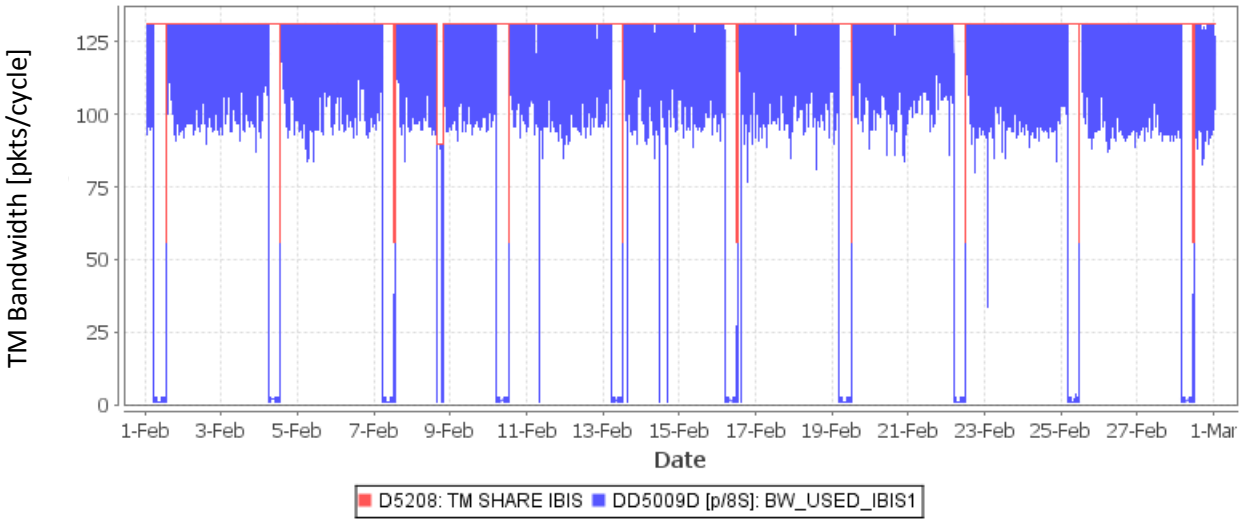


Figure 4: IBIS TM bandwidth utilisation

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

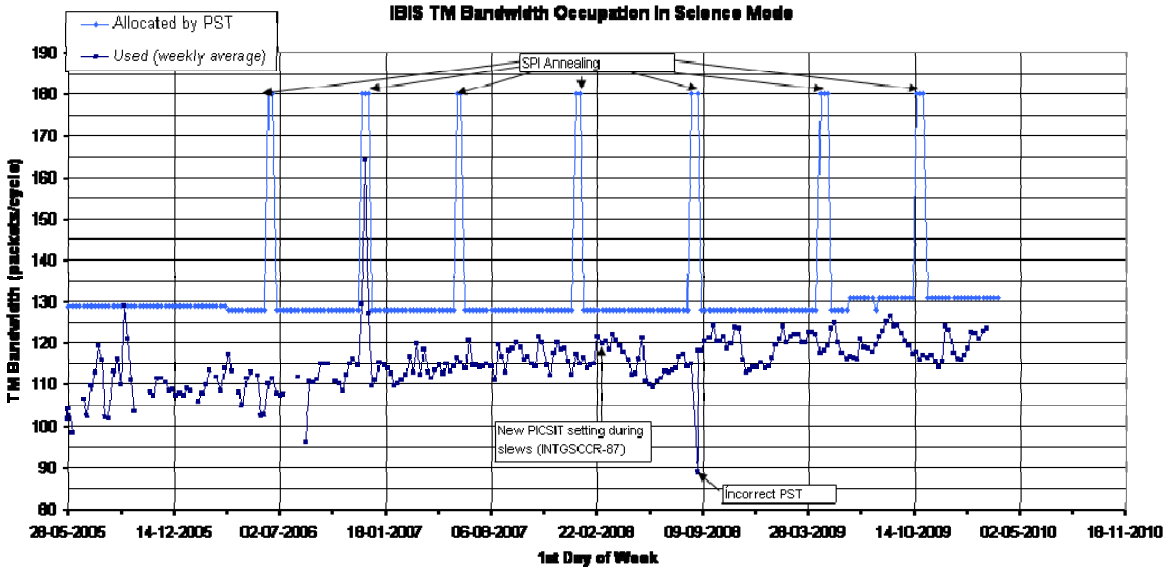


Figure 5: IBIS TM bandwidth usage evolution since May 2005

Note: Some more information concerning the IBIS operations is provided in Appendix 6.3.

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.

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, except from 2010-02-08T15:55:27Z to 2010-02-08T19:41:27Z during the Flat-Field calibration, when it was 63 packets/cycle.

During this reporting period, 673 of the 674 planned science pointings were executed nominally, 1 pointing was lost to an AOCS problem. There was also a Flat-field calibration, which was performed nominally.

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

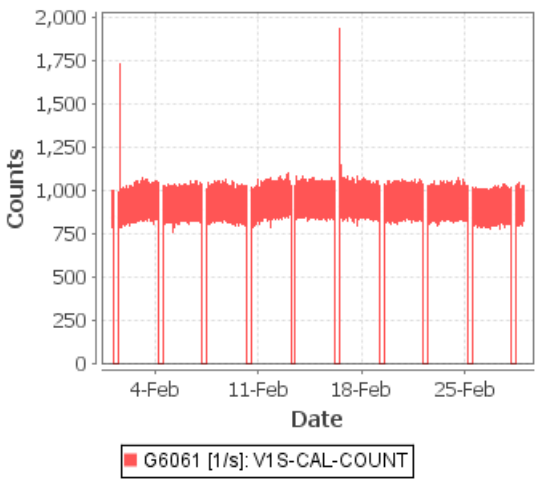
2.2.5 IREM

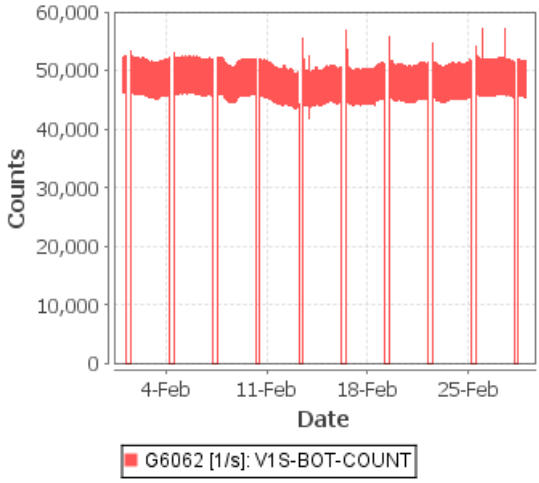
The status of IREM is nominal.

Note: Some more information concerning the IREM operations is provided in Appendix 6.6.

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 reporting period:





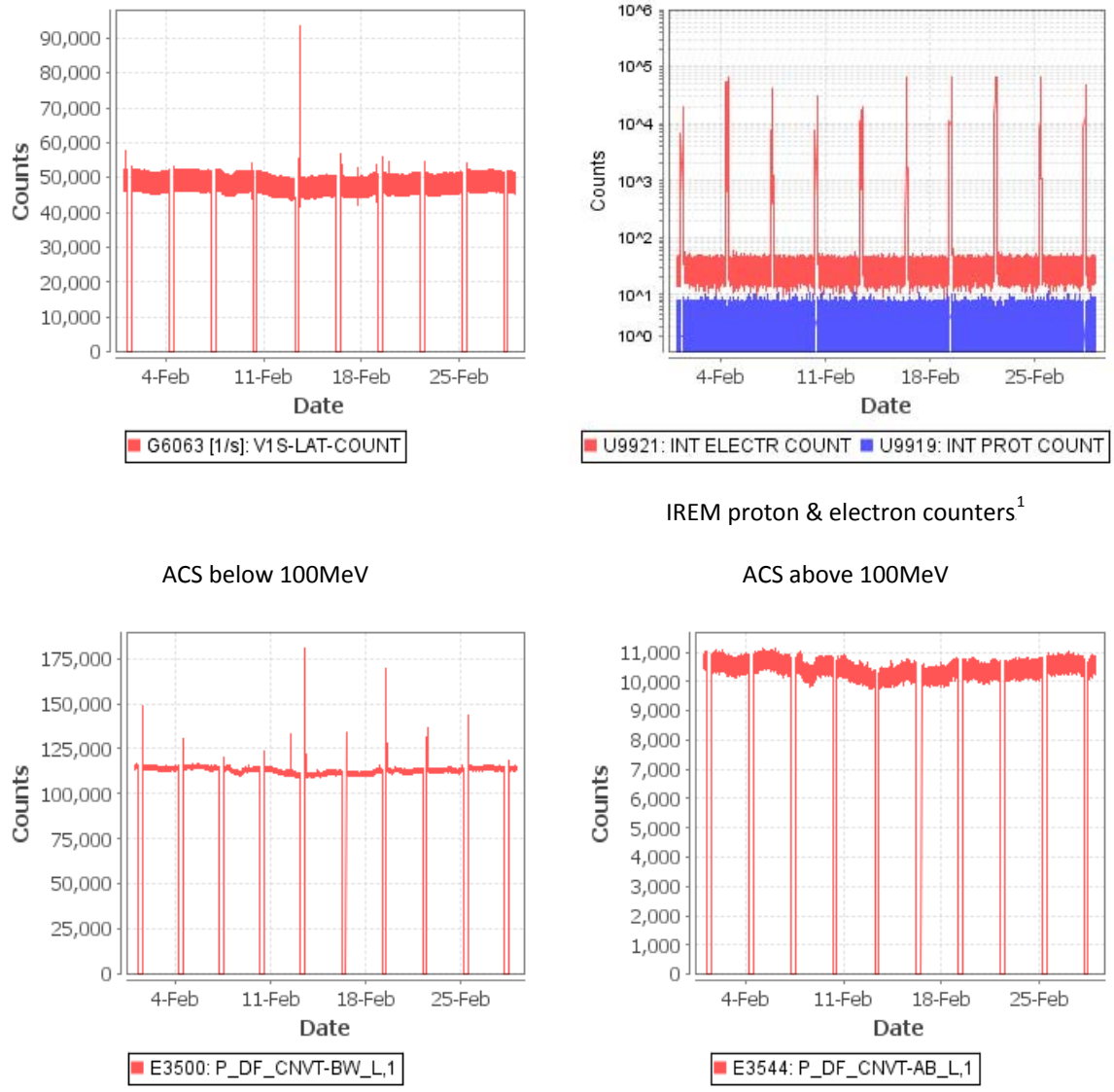


Figure 6: Instrument Count Rates

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

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

K5119/L5119 - JEM-X1/2 Software trigger, K5449/L5449 - JEM-X1/2 Hardware trigger

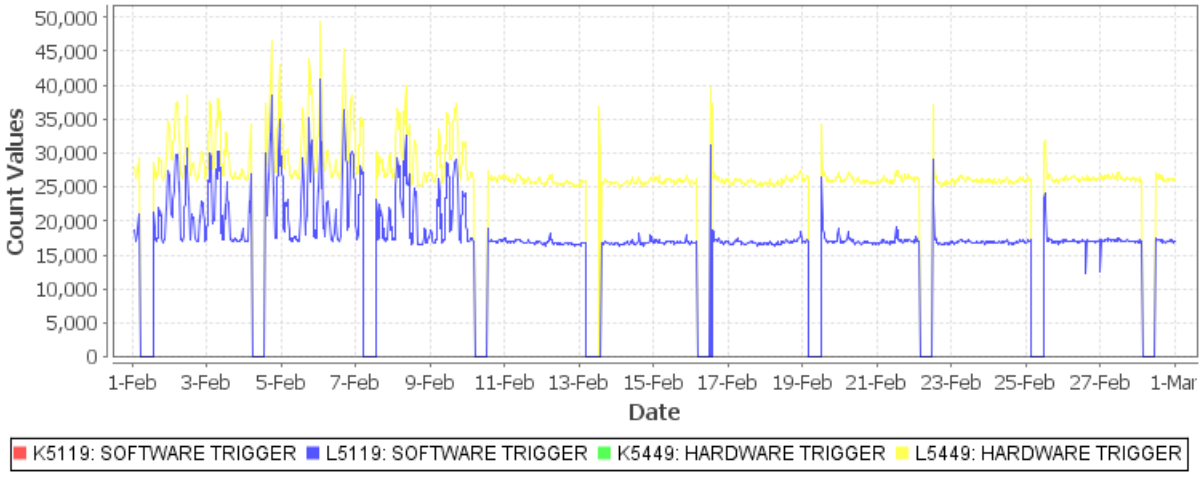


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

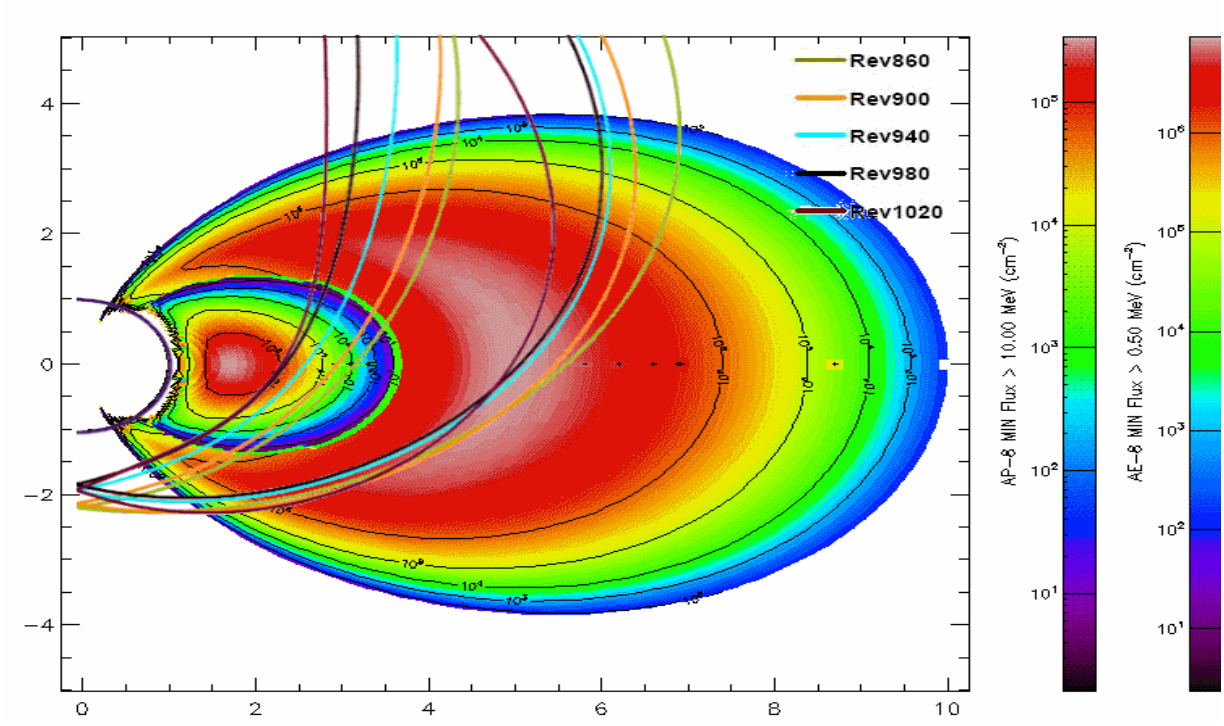


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

Not available this month

Figure 9: Predicted radiation belt passages

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.

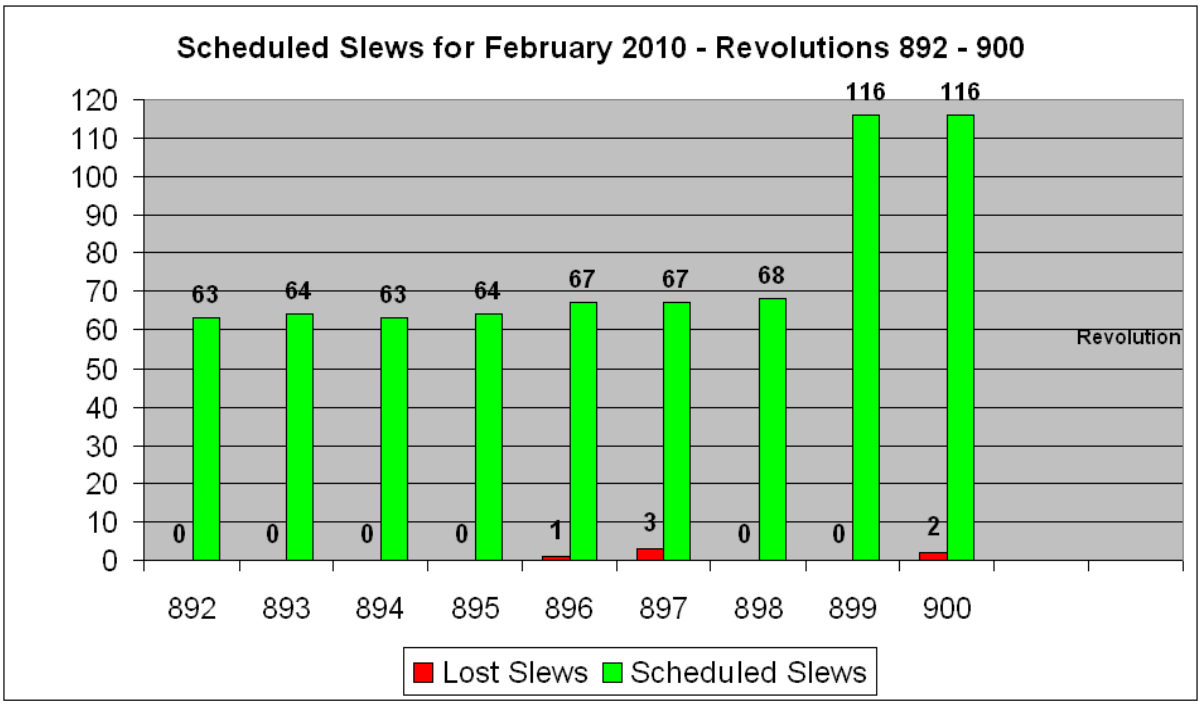


Figure 10: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

On DOY041 a new database was released.

The following restarts were necessary this month:
The IFRD and ISDS tasks on isdsa: none
The IFRD and ISDS tasks on isdsb: one
The HFA_TM task on idda: four times
The HFA_TM task on iddb: eight times
The PSRV task on idda: one time
The DDS (on isdsc and iddb) and the IFTS were both restarted one time.

There were several occasions where the HFA_TM task on idda and iddb was using a high CPU (>40%). On DOY032 iddb was shut down to investigate the corrupt segment catalogue on /lts13 and /lts14 (closed segments). On DOY34 idda was stopped, later that day idda showed red again. Eventually the OLF and TCOC task were restarted. There were two occasions (DOY042 and DOY047) where there were no ASF files received for some hours. On DOY047 a hard disk was exchanged on idda.

On DOY035 a test of file transfer with ISDC was performed following change of password for isds machines. On DOY041 tests were done to send the OMC GRB command from ISDC to MOC. For these tests two times TC was removed for 6 minutes, and OMC was disabled Auto and Manual stacks one time. The command failed to arrive on MCS. Next to that the voiceloop and FTP to ISDC was not working for about 30 minutes, due to maintenance on the firewall. On DOY041 there was an error sending a TPF update for an Open Loop Slew. Flight Dynamics was notified and solved the problem.

3.2 Ground Stations and Network

The performance of the ground stations and Network was very good this month. There were two occasions of Bad frames and two occasions of data gaps on VC-0 & VC-7 from REDU. On DOY053 TMTCS at REDU was not working properly, therefore there was no TM on the B-chain the complete day.

On DOY034 TM was removed on NCTRS-B because software support was working on the machine. On the same day a scheduled station handover was missed because the spacon was busy with an instrument safety on XMM-Newton at the same time. Network notified the spacon when DSS27 was close to end of track and the delayed station handover was done. On DOY042 the B-chain was removed in order to test the links to Goldstone.

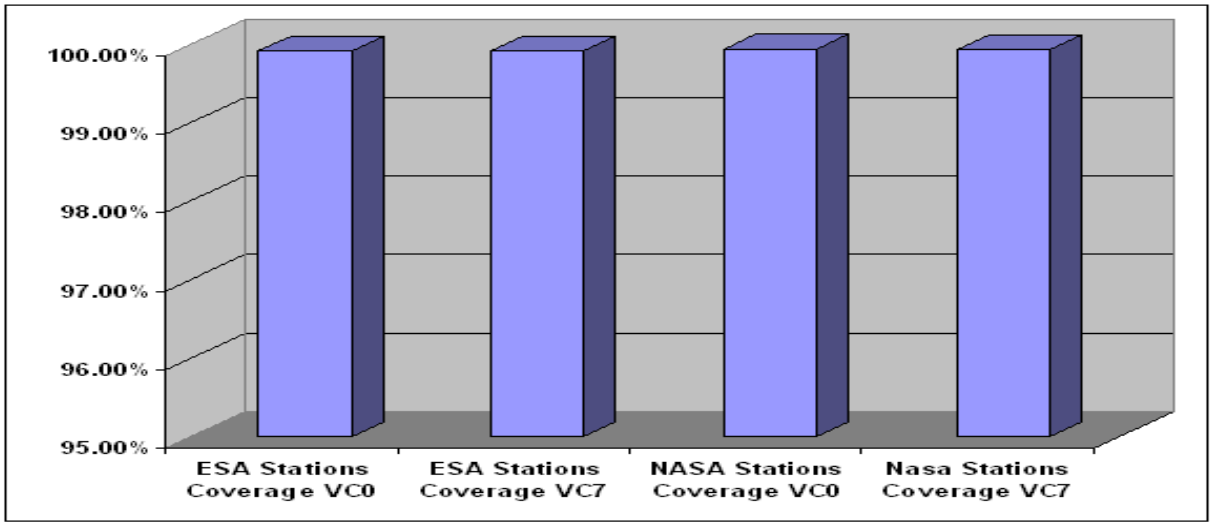


Figure 11: The usage of ESA ground stations compared to the usage of DSN ground stations

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 896 to 907, corresponding to the time range 13 February to 20 March.

For revolution 896 a FIRST_SLEW_START came in the file position before a NEXT_ECLIPSE window, although with an identical time tag. Thus led to an error when importing this PSF, fixed at MOC by changing the PSF. Work is ongoing to investigate a solution, which probably means a significant change for one side at least.

The PSFs for revolutions 897-900 had to be manually edited at ISOC to change a DUMMY window parameter not accepted by the ISOC software and not present in this way in the past. The ISOC software will be updated for this case.

Observations have been planned up to revolution 903 (6-9 March), including the Crab calibration observations in revolutions 902 and 903 and a short TOO on GX 339-4 in revolution 902.

TSFs have been received for revolutions 893 to 901.

3.3.2 Observation Status

New ECS files have been received for revolutions 879 to 888, i.e. up to 22 January 2010.

3.3.3 ISOC Science Data Archive

Intense work is ongoing on the next ISDA release.

Raw TM data are routinely transferred from MOC. Several gaps have been filled, but a few still remain. Transfer of the historical data from Toulouse is foreseen for June.

3.3.4 ISOC System

The proposal handling system for AO-8 has been released for testing and tested intensively by the scientists. Updates are ongoing.

3.3.5 Problems

The problems with PSF contents are recurring and will require an update of the ISOC software soon.

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-3095	16/02/2010	AUX and ARCH tasks crash when producing CDs	IMCS	Pending

5 Special Events & Future Milestones

Eclipse season: 14.02.2010 - 31.03.2010
SPI Annealing is planned to start after the end of the eclipse season, date TBD.

6 Appendix

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

6.1 AOCS operations

During this period, 463 Open Loop Slews, 256 Closed Loop Slews and 19 Momentum Biases were executed (as reported by ACC OEM).

Slews 08970062 and 09000087 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 01/03/2010 is reported in the following plot:

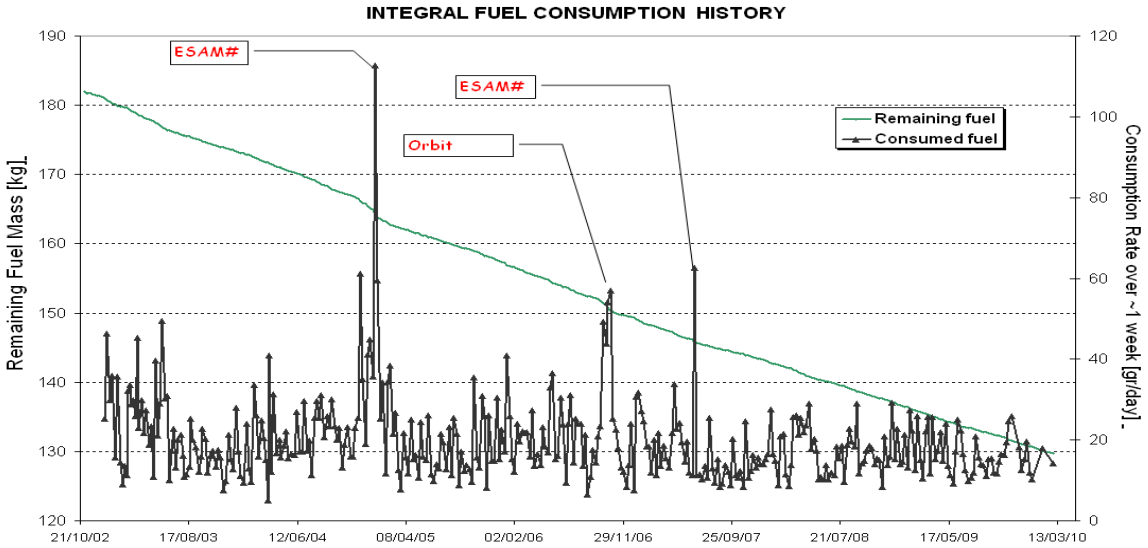


Figure 12: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

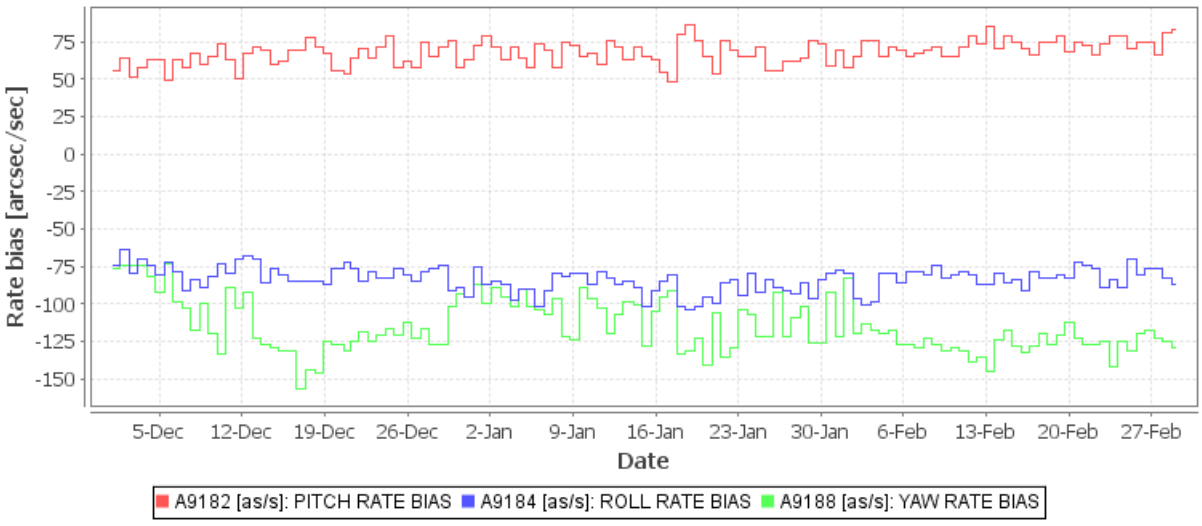


Figure 13: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

- **03-02-2010 (Day of Year 34, Revolution 892)**

FDS TPF update failed for slew 08920052 (17:48:00Z), the reason being a missed GS handover from DSS27 to Redu. A manual update, 0892_0500_A.CSL TPF was generated with Spacontool after the GS handover to Redu was completed.

No impact on the Timeline.

- **04-02-2010 (Day of Year 35, Revolution 892 to 893)**

IMU calibration and RMU B health check performed, as preparation for the eclipse season.

- **13-02-2010 (Day of Year 44, Revolution 895 to 896)**

Start of the eclipse season. Update of WSMAX (1,x) and WSMIN(1,x) AMD thresholds.

- **15-02-2010 (Day of Year 46, Revolution 896)**

IMU1 switched ON during the stable pointing of PID 08960057 (18:37:00Z). A manual mapping was commanded and the parameters for slew 08960058 were afterwards manually updated (spacontool).

OTF was not reached for PID 08960057.

- **16-02-2010 (Day of Year 47, Revolution 896 to 897)**

First eclipse of the eclipse season.

- **18-02-2010 (Day of Year 49, Revolution 897)**

STR A5091 1750 fault (06:47:00Z). A manual mapping was commanded and the parameters for slew 08970047 were afterwards manually updated (spacontool).

OTF was not reached for PID 08970047.

IMU1 switched ON during the stable pointing of PID 08970061 (23:04:00Z). A manual mapping was commanded after the IMU switched OFF.

A manual slew was performed from attitude 08970061 to attitude 08970062 and the parameters for slew 08970063 were afterwards manually updated (spacontool).

Slew 08970062 was missed from the Timeline.

OTF was not reached for PID 08970061 and 08970062.

- **26-02-2010 (Day of Year 57, Revolution 900)**

FDS TPF update failed for slew 09000041 (09:02:00Z). A manual mapping was commanded and the parameters for slew 09000041 were afterwards manually updated (spacontool).

- **27-02-2010 (Day of Year 58, Revolution 900)**

IMU1 switched ON during the stable pointing of PID 09000086 (10:49:00Z). A manual mapping was commanded after the IMU switched OFF.

A manual slew was performed from attitude 09000086 to attitude 09000087 and the parameters for slew 09000088 were afterwards manually updated (spacontool).

Slew 09000087 was missed from the Timeline.

OTF was not reached for PID 09000086 and 09000087.

6.2 SPI

6.2.1 Operations

Stirling Compressors and Cryostat

The performance of the compressors is nominal however their efficiency appears to be degraded following the CDE2 LCL trip-off which occurred on 04/11/2009 (AR INT_SC-273). This degraded efficiency is thought to be due to contaminant evaporation and re-condensation during the period of the anomaly.

The Cold Plate temperature evolution is being carefully monitored and was maintained in the range 80K +/-1K throughout the reporting period. As the temperature drift has decreased, it seems that the next annealing can be performed after the end of eclipse season, which is close to what would be the nominal time (as determined by the GeD energy resolution evolution). However, as the stroke settings are now at the maximum considered safe for operations, the Cold Plate temperature will probably have drifted out of the 80K range prior to the next annealing.

The stroke of CDE1 (compressors A and B) was set to 43 throughout the reporting period. The stroke of CDE2 (compressors C and D) was set to 44 until 9-2-2010 at 09:22:39Z when it was increased to 45 as the Cold Plate temperature had reached 80.9K. At these stroke settings, the LCL currents of CDE1 and CDE2 are almost equal and have been stable:

- CDE1 LCL Current = 5.8A
- CDE2 LCL Current = 5.9A

The following plots show the evolution of the cold plate and H bus temperature as well as the CDE LCL currents during the reporting period. The downward spikes in the cold plate temperature should be disregarded as these are zero values acquired when the AFEE is OFF during eclipse.

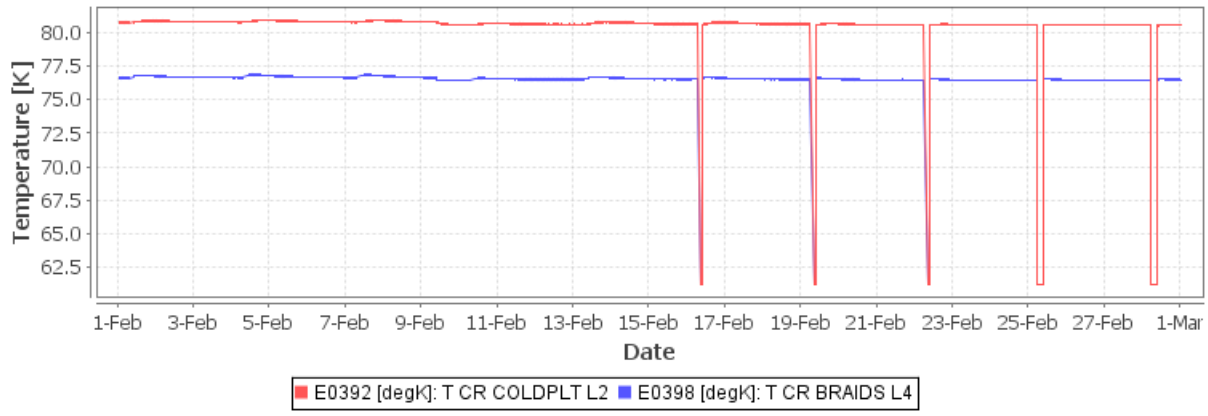


Figure 14: SPI Cold plate and H-bus temperature

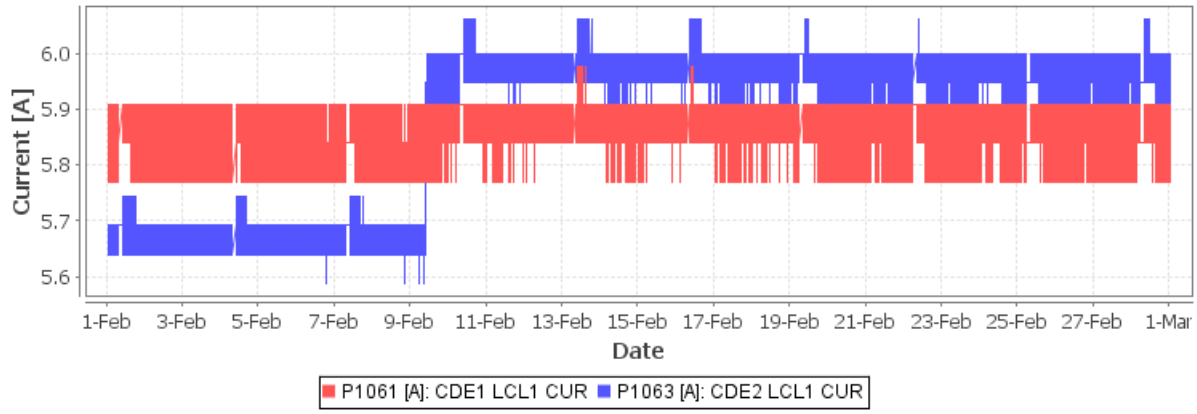


Figure 15: SPI CDE LCL curent

DPE & IASW

The DPE health and IASW performance are nominal. The IASW version installed is v4.3.5 with SE compression only enabled and the spectra scaling factor set to 7/19 SE. The DPE CPU usage was nominal during the reporting period (see Figure 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 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 and detector #5 is failed since 19/02/2009. The HV of the failed detectors are nominally set to 0.5kV. The following plot shows the DC output voltages of the detector channels over the reporting period.

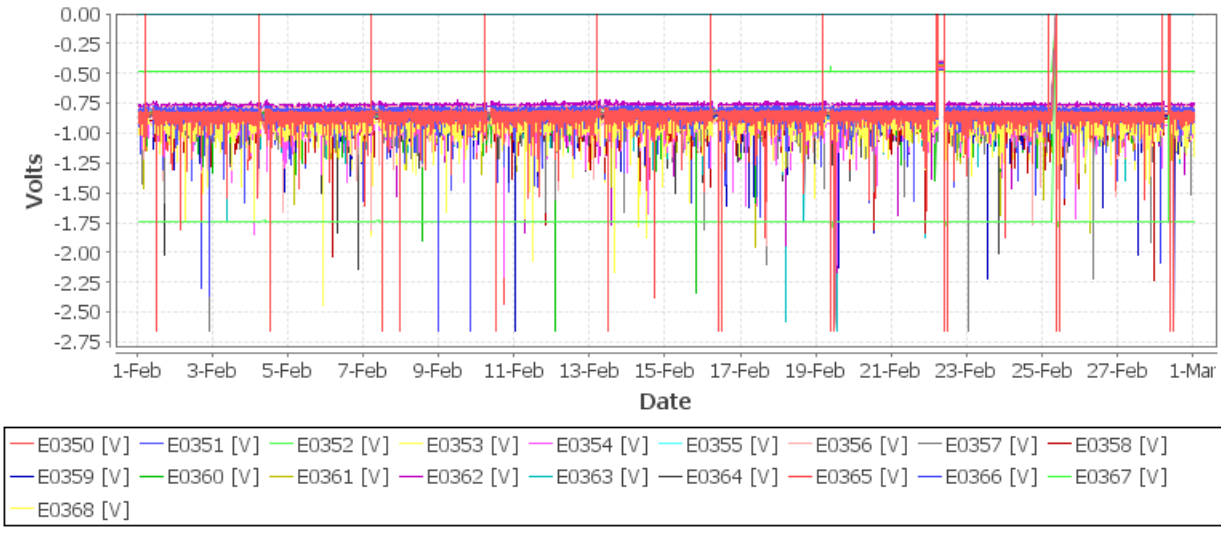


Figure 16: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

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 period.

Figure 17: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic

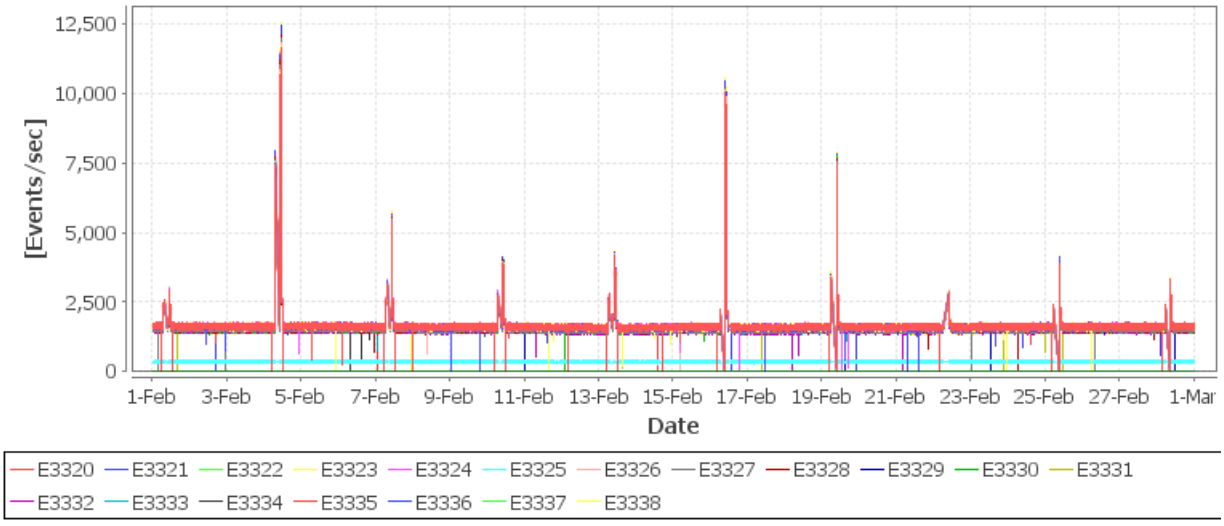


Figure 18: SPI GeD Time Tag count rates

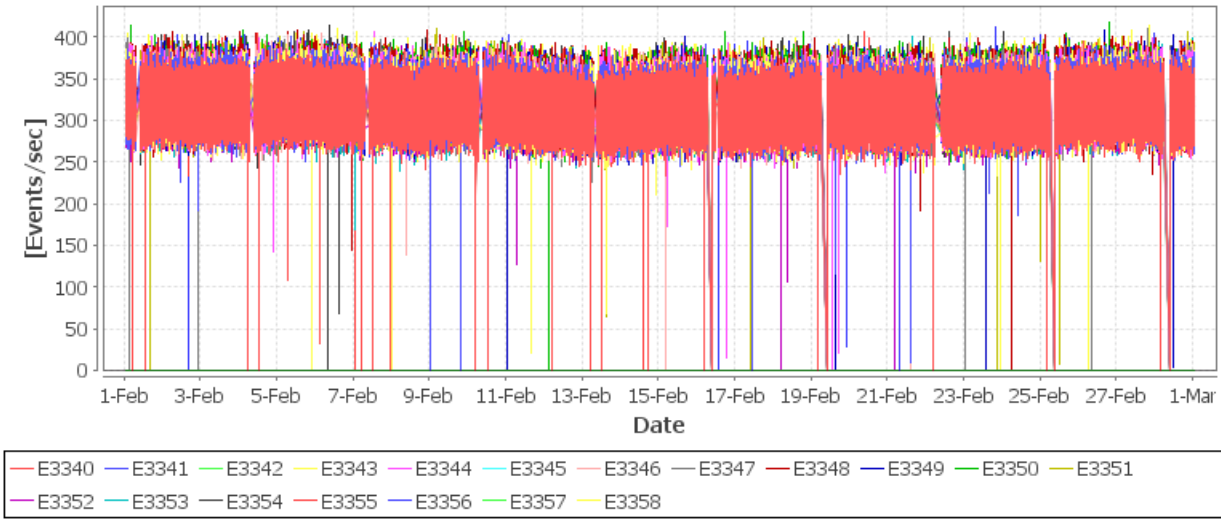


Figure 19: SPI GeD Time Tag Saturated count rates

PSD

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

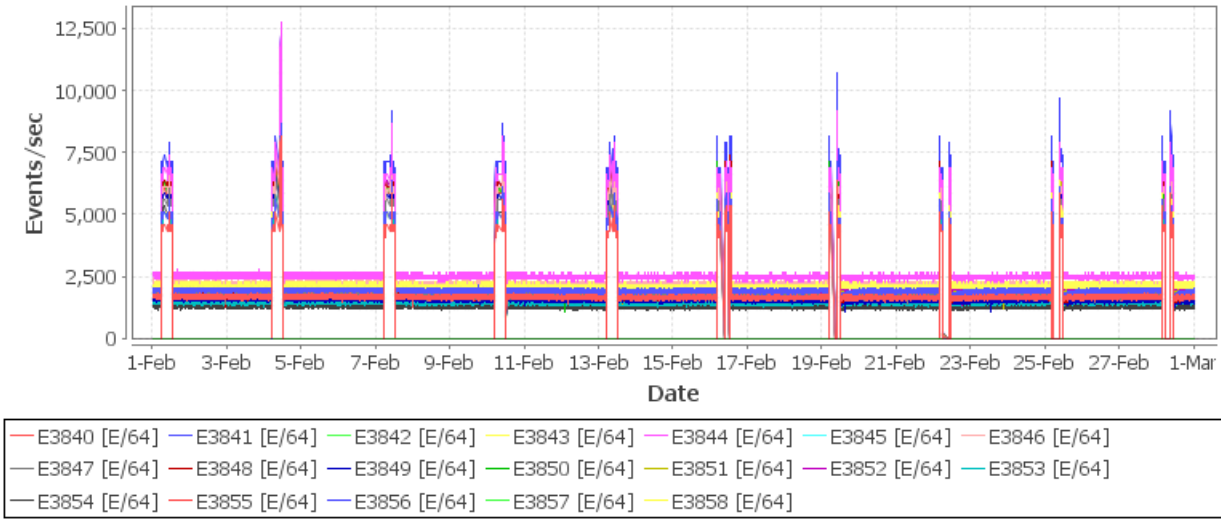


Figure 20: SPI PSD GeD Channel Rates

6.2.2 Event Log

- **22-02-2010 (Day of Year 053, Revolution 898-899)**

Due to a failure of TC E0021 during sequence EENTRY03 before radiation belt entry of revolution 898, the following recovery was implemented:

- 2010.053.04.29.18Z TPF ES1700_IASW-PAR_disbelts_0012.TPF was uplinked to disable radiation belt reactions
- 2010.053.04.31.12Z ED EENTRY03 was re-uplinked successfully. However as the TM parameter E3944 (Automatic reconfiguration capability) was OOL with value DISABLE due

to the uplink of the above TPF, following the recovery procedure the following was performed:

- 2010.053.05.43.13Z FCP_SPI1_0120 to put SPI to Standby
- 2010.053.09.05.13Z, after eclipse, at the start of revolution 899, FCP_SPI1_1700 executed to restore the nominal IASW parameters, but with the reaction to radiation belts only disabled (automatic reconfiguration enabled). After EECLEX02 was executed from the Timeline, SPI remained in Standby2 mode as expected as this had been the last commanded mode.
- 2010.053.10.05.05Z FCP_SPI1_0080 SPI Transition from Standby2 to Conf
- 2010.053.10.06.11Z FCP_SPI1_0176 SPI Restore all Subassembly SW Patches
- 2010.053.10.07.48Z FCP_SPI1_0175 SPI Restore all Configuration settings
- 2010.053.10.08.34Z FCP_SPI1_0045 SPI Subassemblies extended TM check
- 2010.053.10.10.57Z FCP_SPI1_0130 SPI Transition to Photon Mode. SPI operations continued nominally.

- 4 occurrences of OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED were received during the reporting period (at 2010.032.19.29.19Z, 2010.044.16.38.35Z, 2010.048.21.37.18Z and 2010.049.21.26.36Z). As these were single occurrences and not frequent, no action was required.

- Due to continuing high background radiation after the expected radiation belt exit of revolutions 892, 896, 897 and 898, TM parameter E3500 (ACS Counts Below 100MeV) was OOL from 2010.032.13.05.18Z - 2010.032.13.08.38Z, 2010.044.12.25.26Z - 2010.044.12.45.50Z, 2010.047.13.22.19Z - 2010.047.13.45.39Z and 2010.050.12.04.22Z - 2010.050.12.29.10Z. As in each case it returned within limits of its own accord as the background radiation level decreased, no action was taken. However, the radiation belt exit altitude may need to be increased in the near future.

- TM parameter E3216 (ACS FEE temperature status #52) went OOL on two occasions during the reporting period (at 2010.042.20.01.19Z with value NO EXIST VAL and at 2010.048.05.48.00Z with value PARAM > SPEC). As in each case it returned within limits when the next packet was received, no action was taken.

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:

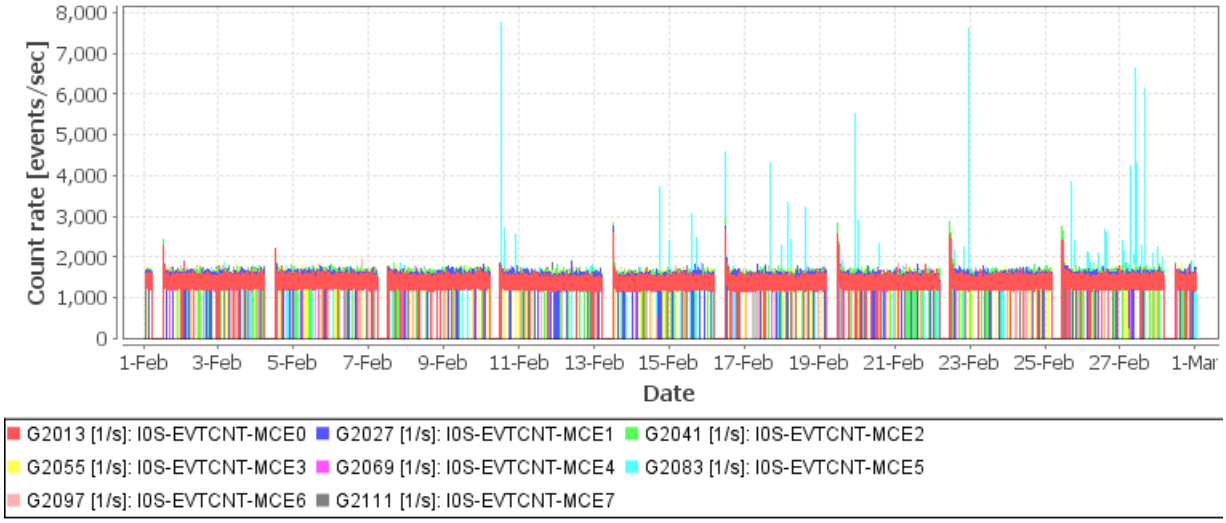


Figure 21: ISGRI MCE Counters

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 22: 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.

6.3.2 Event Log

- 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 soon returned within limits of its own accord, no action was taken.

- Due to continuing high radiation at radiation belt exit of revolutions 896-900, the ISGRI MCE counters (TM parameter family G2013) toggled OOL Soft High during and after the execution

of the ED GEISCL03 in these revolutions (from 2010.044.11.57.21Z - 2010.044.12.31.05Z; 2010.047.11.45.14Z - 2010.047.12.11.06Z; 2010.050.11.32.26Z - 2010.050.12.02.58Z; 2010.053.11.20.58Z - 2010.053.11.48.02Z and 2010.056.11.08.50Z - 2010.056.11.25.30Z). In addition, the VETO count rate TM parameters G6062 and G6063 were OOL from 2010.044.12.29.45Z - 2010.044.12.30.41Z and 2010.047.12.17.38Z - 2010.047.12.22.10Z. As in each case they returned within limits of their own accord as the background radiation level decreased, no action was taken. However, the radiation belt exit altitude may need to be increased in the near future.

- **11-02-2010 (Day of Year 042, Revolution 895)**

At 06:37Z, following a ground station handover, TM parameter X7500 went OOL, indicating a problem with the histogram process. The following recovery procedure was then executed to force the histogram accumulation and download process to resume:

- 2010.042.08.13.50Z FCP_IBIS1_0312
- 2010.042.08.20.12Z TC G0129 uplinked to return IBIS to Science Standard mode.

IBIS operations continued nominally.

- **12-02-2010 (Day of Year 043, Revolution 895)**

At 2010.043.13.55.53Z TM parameter G2000 went OOL, indicating an overflow of the noisy pixel address buffer in MCE0. As it returned within limits of its own accord at 2010.043.13.56.01Z, no action was taken.

- **14-02-2010 (Day of Year 045, Revolution 896)**

At 11:42Z, following a ground station handover, TM parameter X7500 went OOL, indicating a problem with the histogram process. The following recovery procedure was then executed to force the histogram accumulation and download process to resume:

- 2010.045.11.51.27Z FCP_IBIS1_0312
- 2010.045.11.52.40Z TC G0129 uplinked to return IBIS to Science Standard mode.

IBIS operations continued nominally.

- **16-02-2010 (Day of Year 047, Revolution 896-897)**

Due to the fact that the first eclipse of the season was a penumbra-only eclipse and the PPDU (SUN-ECL) signal did not trigger, the following activities were required at the start of revolution 897:

- Commanding to IBIS from the Timeline was disabled such that EDs GECLEX02 and GEVESP01 were not uplinked.
- 2010.047.09.31.22Z TC P4204 (TSW IBISDET A OFF) sent to switch IBIS Detector Additional Heater Line A off (had been switched on by time-tagged ED GEDHON01).
- 2010.047.09.50.02Z FCP_IBIS1_0084 IBIS ECR(s) setting to set all ECRs to ON
- 2010.047.09.51.33Z steps 3.2 to 3.4 of FCP_IBIS1_0228 PICsIT CTX Restore to return PICSIT to nominal mode.
- 2010.047.09.56.06Z step 3.1 of FCP_IBIS1_0199 IBIS: VETO Restore CTX.

IBIS operations continued nominally.

- **23-02-2010 (Day of Year 054, Revolution 899)**

At 2010.054.02.17.27Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 2010.054.02.17.22Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 2010.054.02.20.04Z 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.

At 2010.054.11.07.03Z the TM parameters families G5068 and G5072 failed status consistency check again (value = TRUE) and at 2010.054.11.07.22Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As all the above parameters were back in limits by 2010.054.11.08.42Z, no action was taken.

- **28-02-2010 (Day of Year 059, Revolution 900-901)**

At 2010.059.16.38.15Z the TM parameters families G5068 and G5072 (PDM semi-module FIFO error flags) failed status consistency check (value = TRUE) and at 2010.059.16.39.06Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As all the above parameters were back in limits by 2010.059.16.39.30Z, no action was taken.

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 JEMX and DFEE detector temperatures over the reporting period.

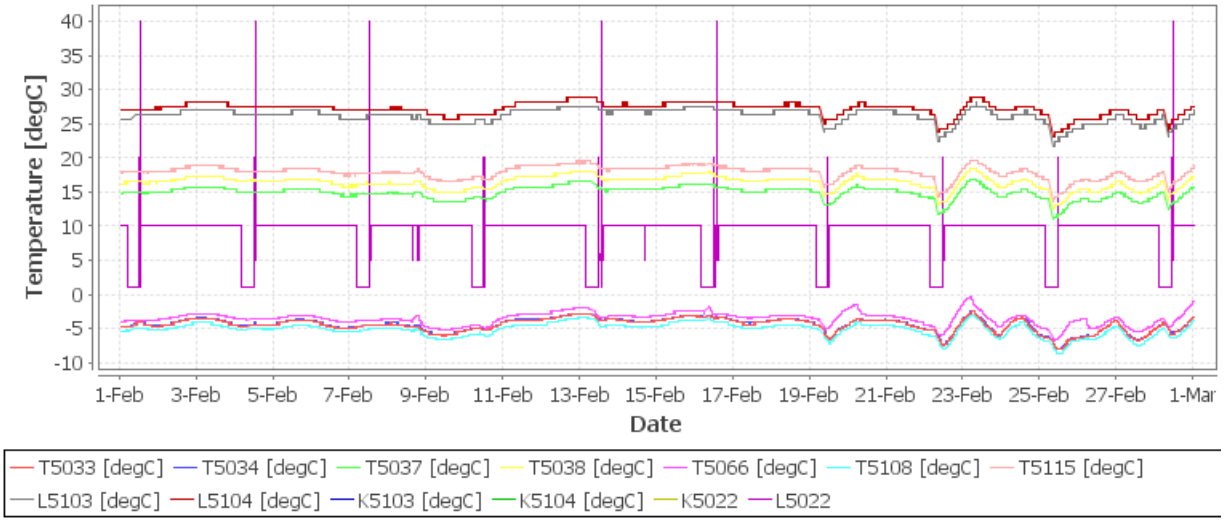


Figure 23: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

- **01-02-2010 (Day of Year 032, Revolution 891-892) to 10-02-2010 (Day of Year 041, Revolution 894-895)**

Starting at the end of revolution 891 and continuing for the entire revolutions 892, 893, 894 and into 895 TM parameters L5449 & L5136, L5119 were intermittently outside soft upper limit, there was also one occurrence when L9104 exceeded soft limit. No action was taken, and there was no impact.

- **13-02-2010 (Day of Year 044, Revolution 896)**

At 12:39, during the High-Voltage switch-on, high radiation caused the L5449 Hardware trigger exceeded hard limits forcing JEMX-2 back to SAFE mode. The recovery was delayed due to on-going XMM activities, and did not commence until 13:14. At this point, the EDs LEHVAC01 and LEDATA02 were manually re-uplinked. The Timeline was rejoined at 14:27. The impact was the loss of 1 hour 40 minutes science time.

- **16-02-2010 (Day of Year 047, Revolution 896-897)**

Between 12:34:36 and 13:05:28, there were a few occurrences of parameters L5136, L5449, L9134 & L5119 exceeding soft limits. At 13:12, it was observed that TM parameter LD5020D was in an incorrect (false) state. This occurs when the mode of the DFEE is different from that expected by the DPE, in this case caused when high radiation at the start of the orbit caused a switch to SAFE mode. A recovery was performed, and the timeline rejoined at 14:01. The impact was the loss of 50 minutes science time.

- **19-02-2010 (Day of Year 050, Revolution 897-898)**

At 12:14:12 parameter L5449 exceeded hard limits, then between 12:16:28 and 13:11:32 parameters L9110, L5449 & L5136 each occasionally exceeded soft limits. There was no impact.

- **22-02-2010 (Day of Year 053, Revolution 898-899)**

Between 12:02:44 and 12:53:58 parameters L5449, L9134, L5136 & L5119 each exceeded soft limits. There was no impact.

- **23-02-2010 (Day of Year 054, Revolution 899)**

At 21:01:49 parameters L5449 & l5136 exceeded soft limits. There was no impact.

- **25-02-2010 (Day of Year 056, Revolution 899-900)**

Between 11:50:28 and 13:12:45 parameters L5449, L9140 & l5136 each exceeded soft limits. There was no impact.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log

- **27-02-2010 (Day of Year 058, Revolution 900)**

At 10:49, an AOCS problem forced an interruption of operations. A recovery was performed, and the timeline rejoined at 11:26. The impact was the loss of pointing 09000087.

6.6 IREM

6.6.1 Operations

Radiation belts entry and exit

The following plots show the Radiation Belt Entry (Figure 24, red line) and Exit times (Figure 25, blue line) obtained from the ISDC website, defined where the IREM TC3 (soft electrons) rate reads 600 counts. The blue line in Figure 24 and the magenta line in Figure 25 are the altitudes used by the MOC for planning purposes.

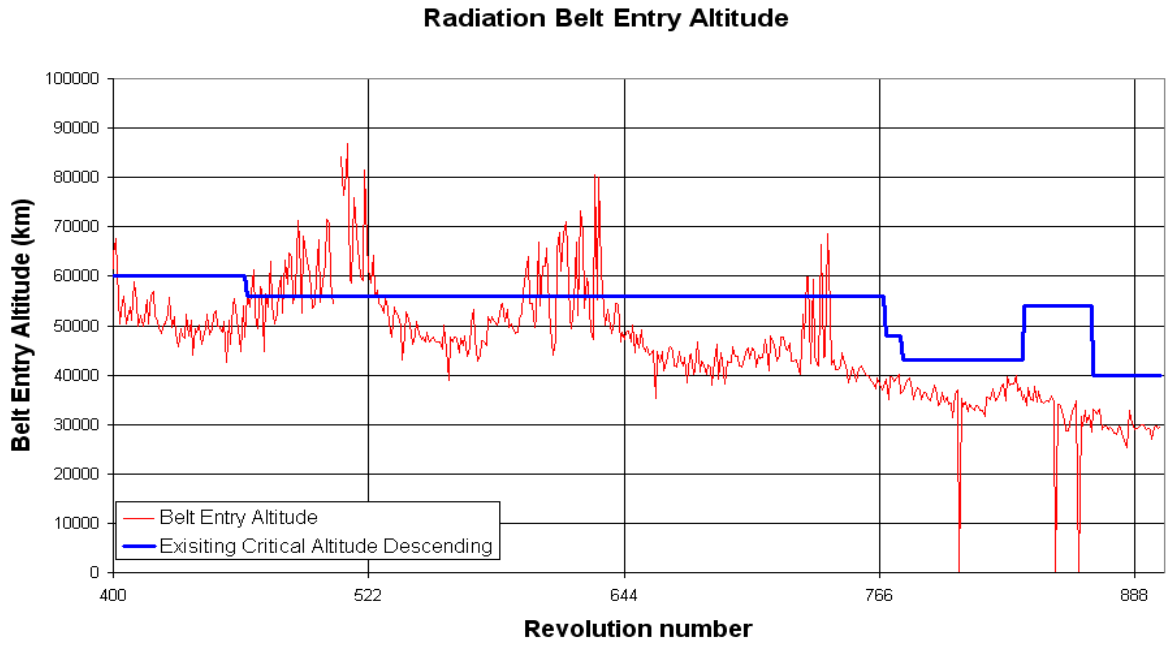


Figure 24: Radiation belt entry

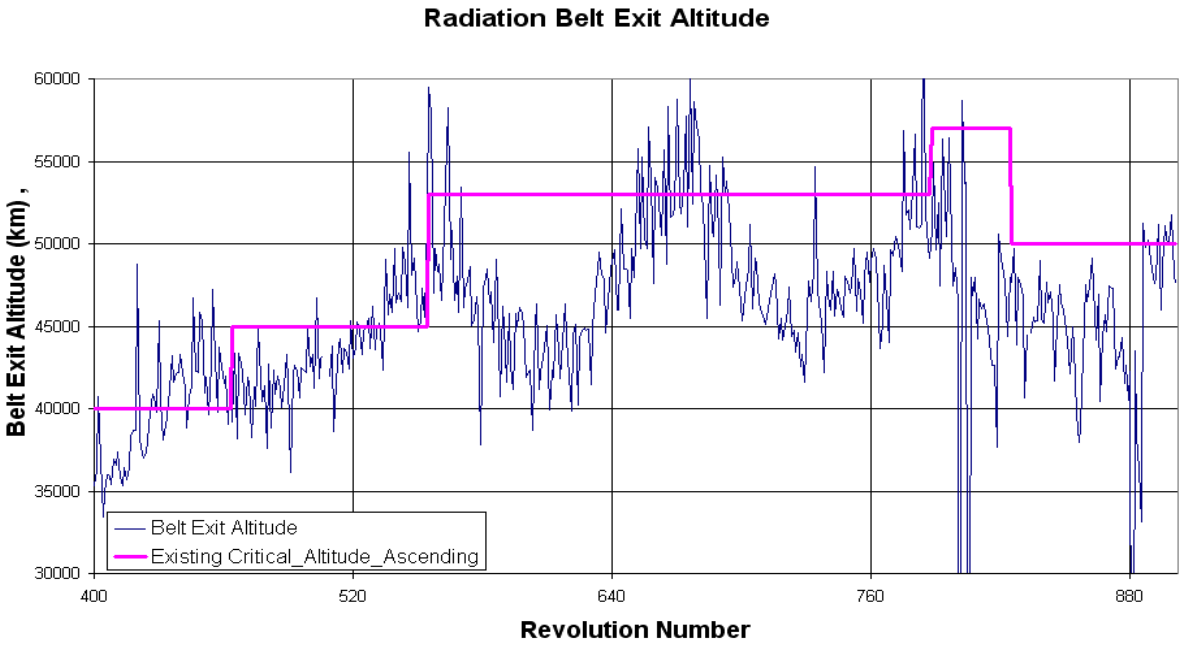


Figure 25: Radiation belt exit

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

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]	Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
891	RAD_ENTR R 2010-02-01T05:41:43Z	01/02/2010 07:05:22	23987.0				
892	RAD_EXIT R 2010-02-01T12:56:38Z	01/02/2010 12:18:42	>>29550.6				
892	RAD_ENTR R 2010-02-04T05:31:19Z	04/02/2010 06:55:46	23574.7				
893	RAD_EXIT R 2010-02-04T12:45:37Z	04/02/2010 12:20:10	>>29584.8				
893	RAD_ENTR R 2010-02-07T05:22:33Z	07/02/2010 06:49:47	23999.1				
894	RAD_EXIT R 2010-02-07T12:36:33Z	07/02/2010	>>29600.8				

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]	Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
		11:40:51					
894	RAD_ENTR R 2010-02-10T05:13:00Z	10/02/2010 06:39:31	24097.0				
895	RAD_EXIT R 2010-02-10T12:27:16Z	10/02/2010 11:48:35	>>29587.9				
895	RAD_ENTR R 2010-02-13T05:02:04Z	13/02/2010 06:30:19	23273.9				
896	RAD_EXIT R 2010-02-13T12:16:50Z	13/02/2010 11:57:23	>>31483.2				
896	RAD_ENTR R 2010-02-16T04:49:37Z	16/02/2010 06:28:59	22166.6				
897	RAD_EXIT R 2010-02-16T12:04:38Z	16/02/2010 12:07:23	50380.5				
897	RAD_ENTR R 2010-02-19T04:37:15Z	19/02/2010 06:02:03	24731.5				
898	RAD_EXIT R 2010-02-19T11:51:54Z	19/02/2010 11:23:23	>>38805.4				
898	RAD_ENTR R 2010-02-22T04:25:35Z	22/02/2010 05:51:15	23417.4				
899	RAD_EXIT R 2010-02-22T11:39:46Z	22/02/2010 11:25:39	>>38839.5				
899	RAD_ENTR R 2010-02-25T04:12:51Z	25/02/2010 05:39:56	23617.1				
900	RAD_EXIT R 2010-02-25T11:27:16Z	25/02/2010 10:48:04	>>38819.9				
900	RAD_ENTR R 2010-02-28T03:59:04Z	28/02/2010 05:23:48	23449.6				

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]	Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
901	RAD_EXIT R 2010-02-28T11:13:24Z	28/02/2010 10:29:08	>>38828.5				

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

No events occurred this month.