
EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
Mission report

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

No. 387

01.08.2010

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 performed according to the planning inputs from ISOC combined with some manual commanding by MOC.

This report addresses the activities from July and covers the revolutions 942 until 951 (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-INTTEGRAL 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.

9 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.490 Kg. The remaining propellant is in the order of 127.225 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 $\pm$ 1K.

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 2010-07-03T15:52:59Z to the end of revolution 942 (OMC Flat Field Calibration), when it was 88 packets/cycle. The average telemetry occupation when the allocation was 105 packets/cycle was 81.01 packets/cycle.

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

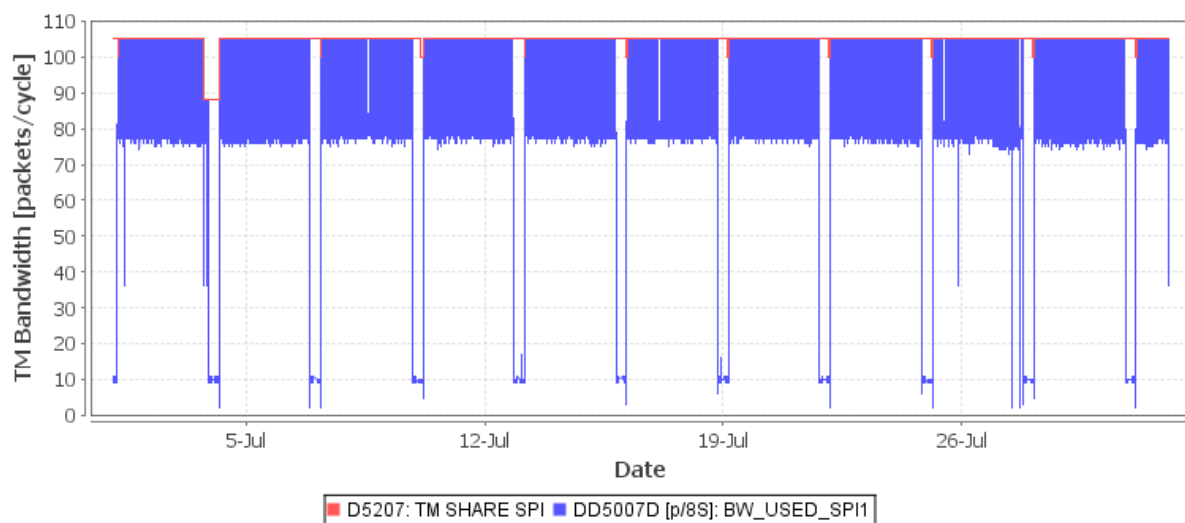


Figure 1: SPI TM bandwidth utilisation

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

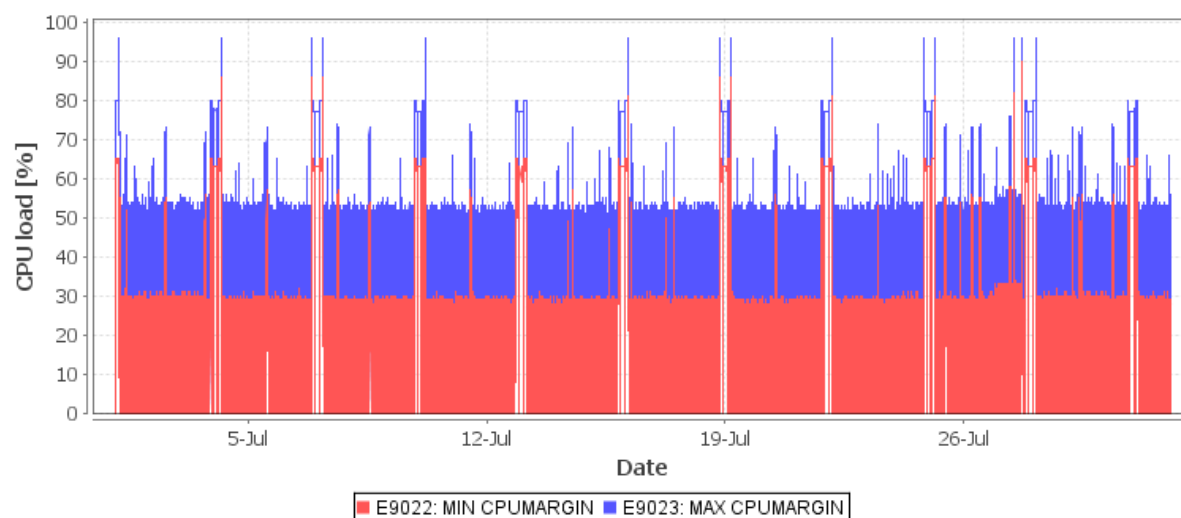


Figure 2: SPI IASW Performance

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

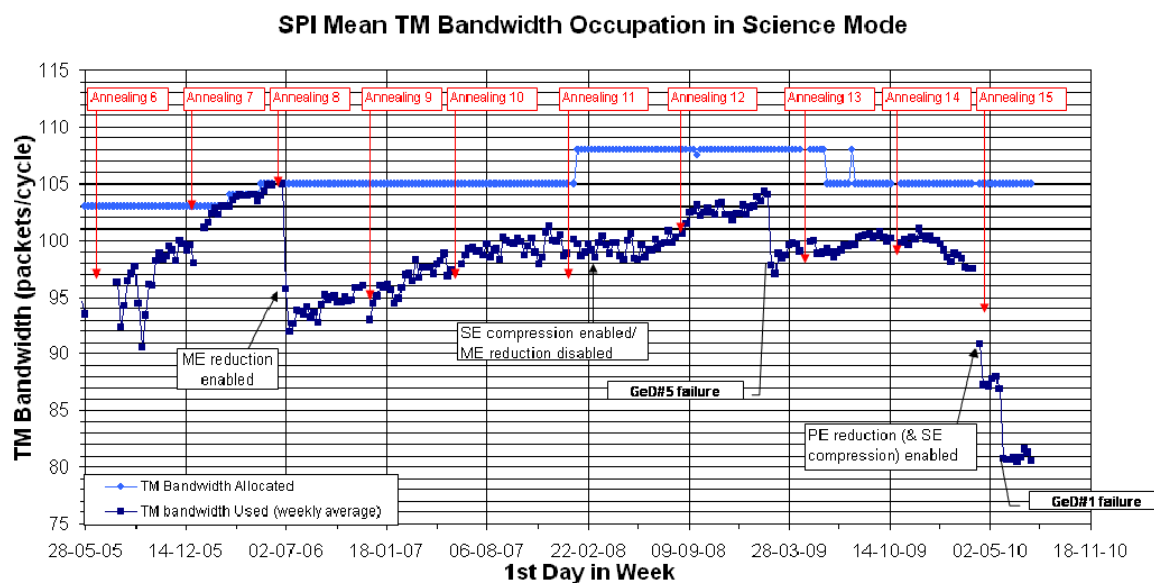


Figure 3: SPI TM bandwidth usage evolution since May 2005

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.

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 2010-07-03T15:52:59Z to the end of revolution 942 (OMC Flat Field Calibration), when it was 90 packets/cycle
- IBIS mean bandwidth utilisation in science mode: 111.67 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:

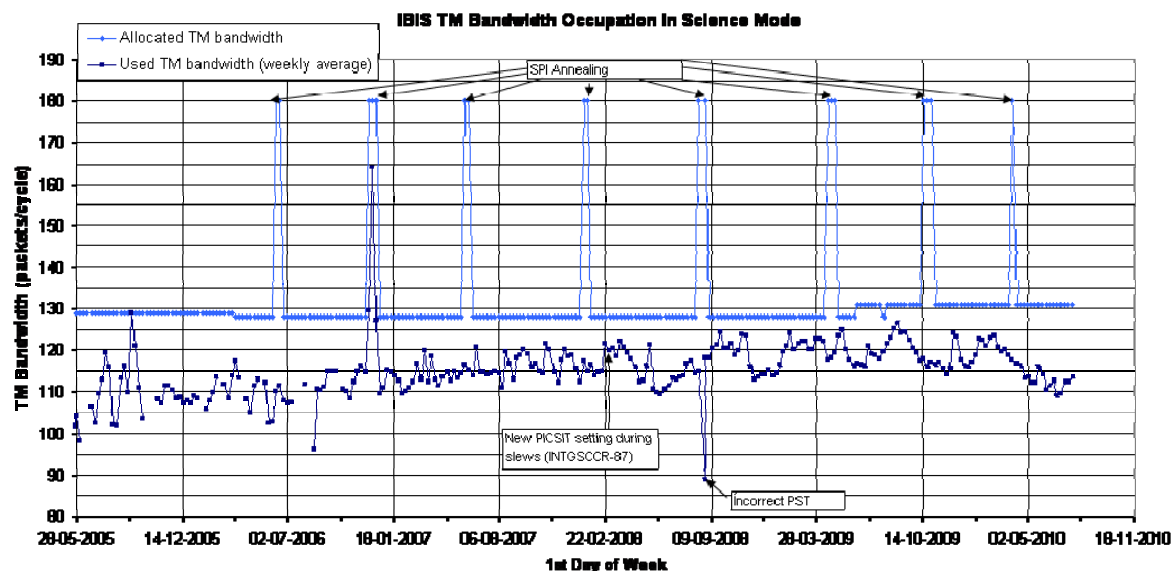


Figure 5: IBIS TM bandwidth usage evolution since May 2005

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.

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 6.4.

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 2010-07-03T15:52:59Z to 2010-07-03T19:17:50Z (Rev 942) during the Flat-Field calibration, when it was 63 packets/cycle.

During this reporting period, 727 of the 732 planned science pointings were executed nominally, 2 pointings were lost to an AOCS problem, 1 pointing was lost to an imcs problem, 1 pointing was lost and another interrupted to 2 independent problems at the ground station. In addition 1 Flat-field calibrations was performed this month.

Note: Some more information concerning the OMC operations is provided in Appendix 6.5.

2.2.5 IREM

The status of IREM is nominal.

On DOY211 (30/07/2010), the 94th IREM SEU occurred.

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**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).

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

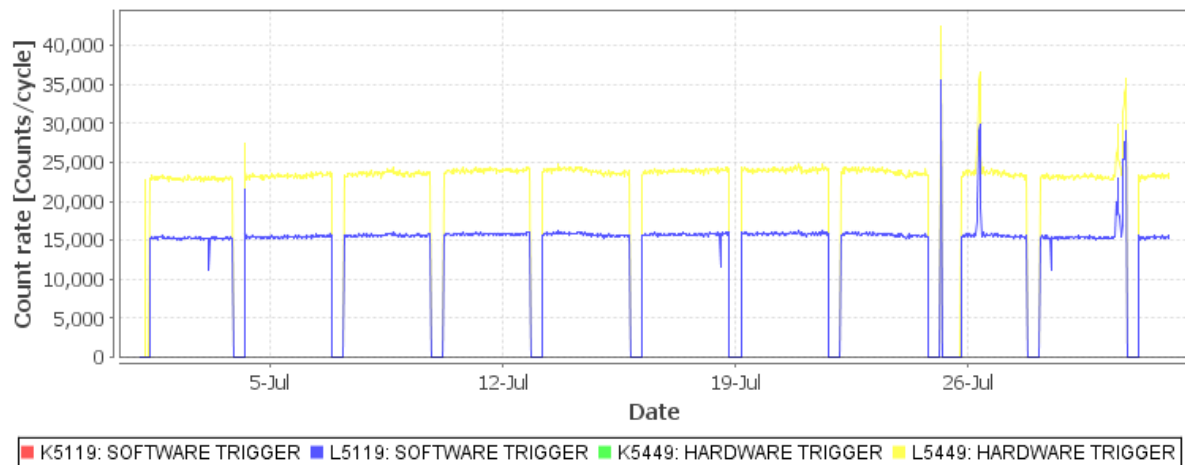


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

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.

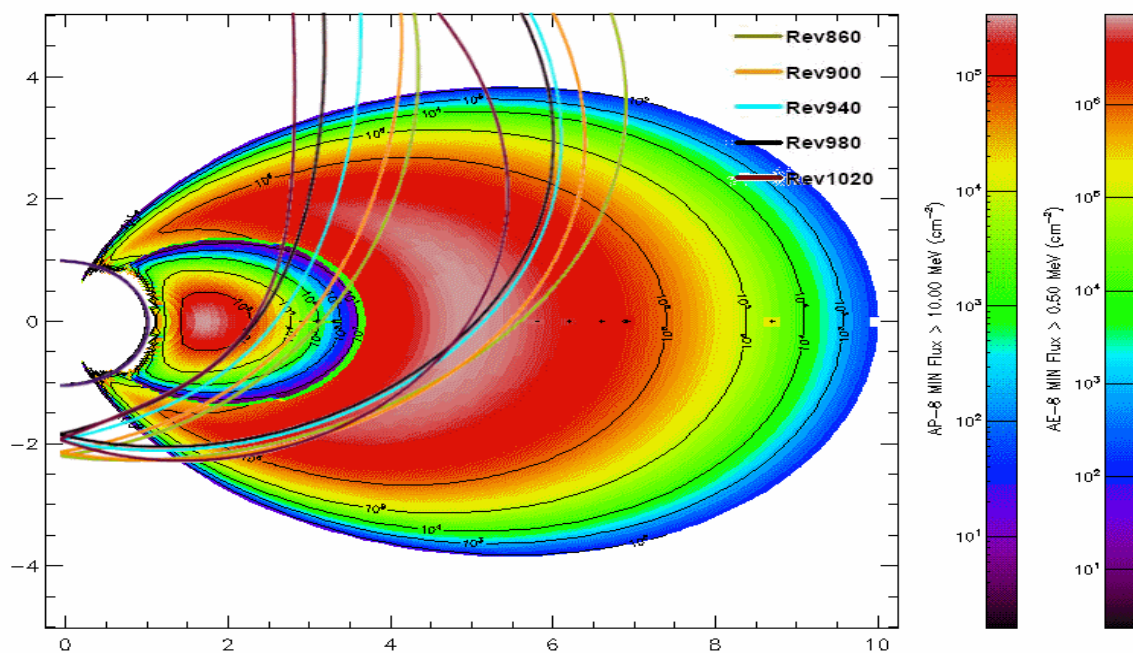


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

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.

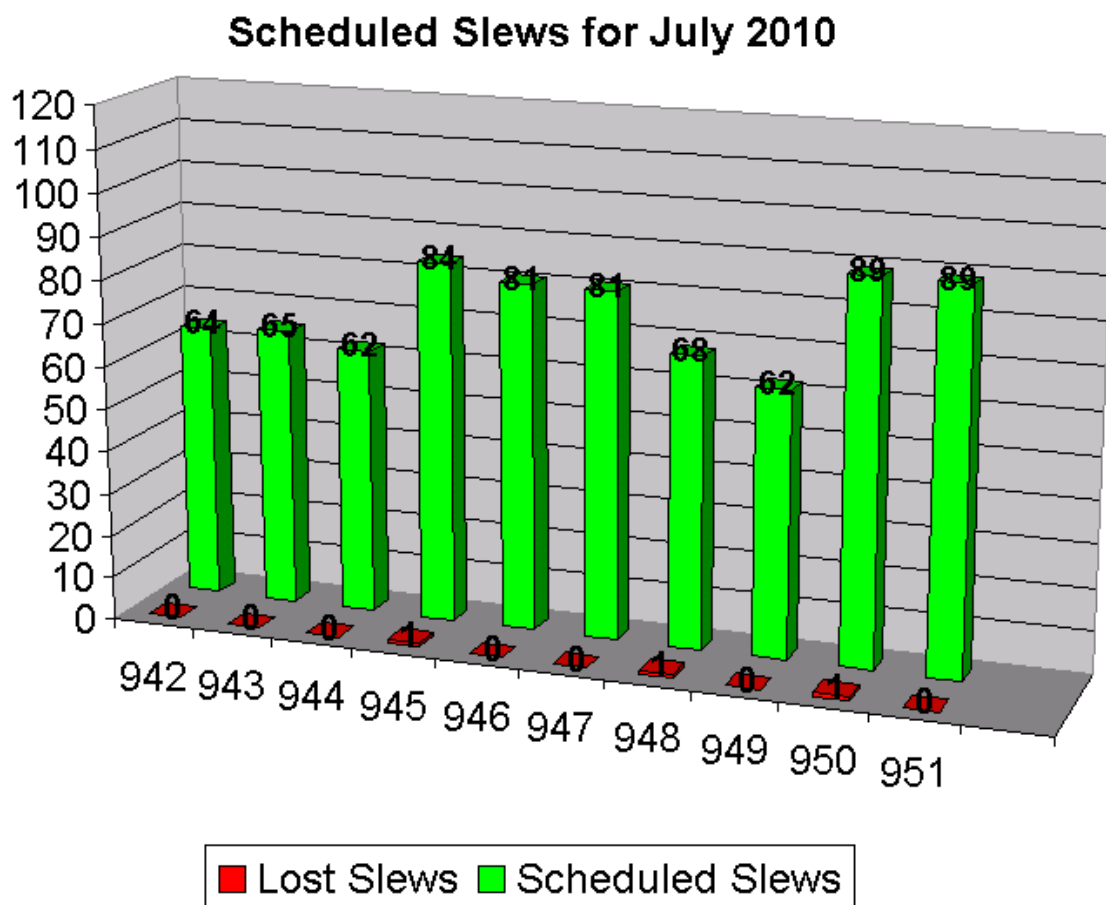


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

This month the HFA_TM task was restarted eight times on iddb (due to MUST retrievals) and twice on idda. There were nine occasions where the ISDS and IFRD tasks on isdsa had to be restarted and five occasions for a restart on isdsb. The AUX and ARCH tasks had to be restarted three times this month. On DOY208 no OLF files were received.

On DOY187 the MCCM showed that SUN123, SUN127, SUN128 and SUN129 were disconnected, though SUN 129 was able to receive telemetry from a-chain. The analyst was informed and the problem was solved by logging in to each computer from SUN121. On DOY 189 the spacon was

informed Network that there were data gaps in the TM. No alarms were sounded on the MCS and the Bad Frames link was in Drop as expected. On DOY197 the event message "Verifier Terminated" was received, while the IMCA MMI showed the verifier as 'green'. The Verifier was restarted to resume operations.

On DOY208 the MISC connection died. To fix the related problems a swap to the backup chain was performed and the primary server was restarted.

The PI workstations on the PISA LAN were move behind the firewall this month. Next to that a lot of maintenance was performed on the RELAY LAN and PISA LAN, which caused several interruptions to data to the PI workstations.

A new database was installed on DOY209.

3.2 Ground Stations and Network

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

REDU

Investigation of possible RFI at Redu is ongoing.

On DOY185, DOY186, DOY188, DOY 189, DOY202 and DOY205 bad frames were received, on DOY 205 this was accompanied by data gaps on VC-0 & VC-7. On DOY185 and DOY188 there were data gaps on VC-0 and VC-7. On DOY190 there were data gaps in VC7 every minute. After the VC7 link was swapped to chain 2 no data gaps were present any more. On DOY 193 the TMTCS1 disk space was low, therefore a swap to TMTCS2 was done. On DOY194 this was solved.

Due to LAN problems on DOY 196 REDU was not available for upcoming handover at 11:00Z, Vilspa was used instead. At 11:20z REDU was back operational and a ground station handover from Vilspa to REDU was done.

On DOY203 there was a drop in VC-0 & VC-7 for a few seconds. Network reported something briefly caused the station to go out of lock, while the drop in VC-0 & VC-7 on DOY204 was probably due to RFI as the Ranging was lost at the same time.

DSS27

On DOY188 TC was lost for two minutes due to no bit lock. On DOY190 there was a drop in VC-7, this was resolved six minutes later by recycling the VC-7 link. On DOY192, due to database problems at Goldstone the ground station handover from REDU was cancelled. A later handover the same day was delayed. Due to RFI on DOY195 there was a drop in VC-0 and VC-7, an early ground station handover to REDU was done.

Due to transmitter problems on DOY200 there were drops in VC-0 and VC-7, therefore the handover to REDU was done an hour earlier than planned. On DOY203 the handover to DSS-27 was delayed, because of connection problems. On DOY206 there was a drop in VC-0, VC-7 and telecommanding, due to a power glitch. This caused an interruption in operations.

On DOY206 a power failure at DSS27 caused the station to be unavailable for 17 minutes.

On DOY197 NCTRS-B was connected to DSS-27, in order to help with TM flow tests. Operations were not affected. After end of the test the back-up links on NCTRS-B were re-connected to REDU again.

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.

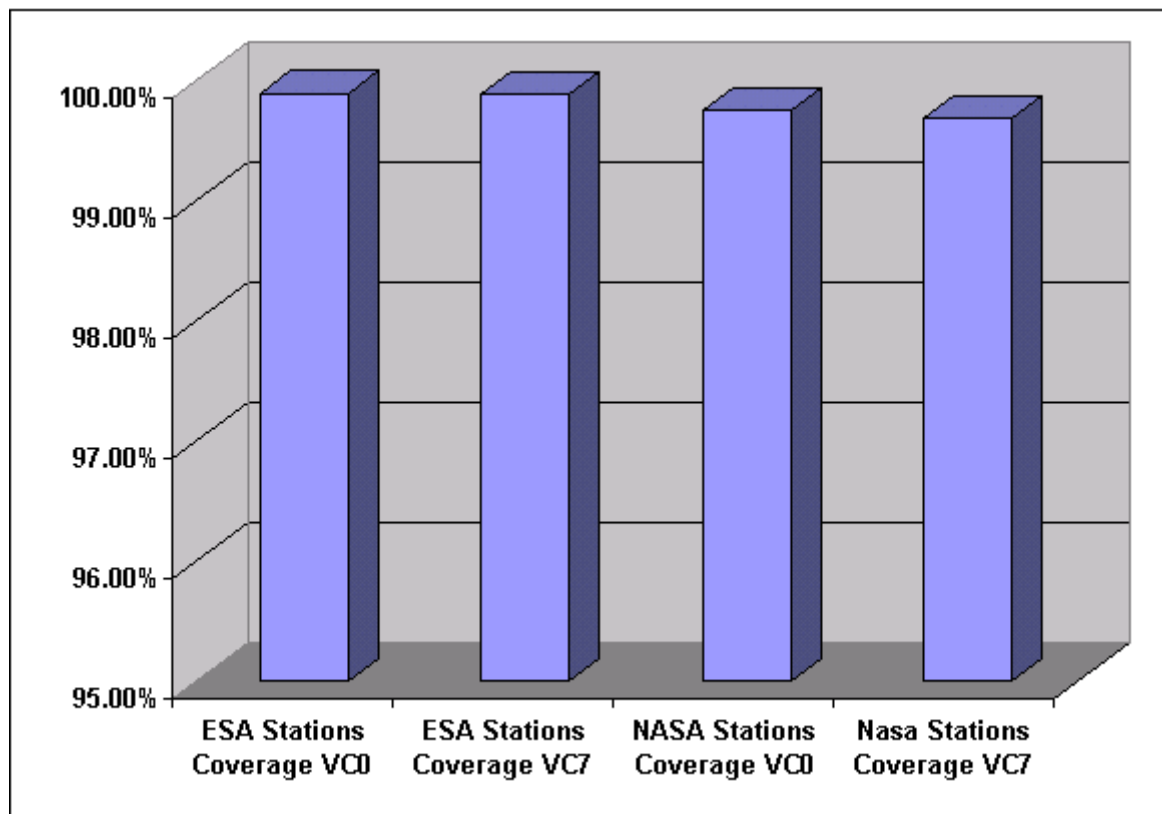


Figure 10: The usage of ESA ground stations compared to the usage of DSN ground stations

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 955 to 959, corresponding to the time range 9-23 August. Revolution 955 had four instances of the PSF delivered.

New observations have been planned for revolutions 955 (9-11 August) to 957 (15-17 August). Several revolutions were replanned more than once, due to PSF updates and a change to the JEM-X 2 S/W limit, coping with Sco X-1.

Three TOO requests were received in July, two on the AGN NGC 1275 and one on PSR J1622-4950. One TOO observation of NGC 1275 was approved and implemented, leading to replanning of revolutions 948 and 949.

TSFs have been received for revolutions 948, 949 and 951 to 953.

3.3.2 Observation Status

New ECS files have been received for revolutions 924-937 (up to 18 June).

3.3.3 ISOC Science Data Archive

Work is still ongoing on the ingestion of OSA7 data products, currently waiting for an update of the SAT software. The raw TM copied from MOC is complete until 16 July. The ISOC-MOC Archive ICD has been updated and is in review.

3.3.4 ISOC System

ISOC software release V26 to support the data right proposal submission is expected for testing in early August.

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_SC-296	09.07.2010	TM parameter P2127 changed status to OPEN due to SEU	Spacecraft	Pending
INT_SC-297	16.07.2010	Anomalous wheelspeed peak on DOY 188	Spacecraft	Pending
INT_SC-298	16.07.2010	IREM Anomaly: Reset of IREM_CSCI S/W #94	Payload	Testing
INT_SC-299	16.07.2010	Anomalous value of GeD#8 DC output voltage	Payload	Pending
INT-3107	27.07.2010	IMCA - Store of packet (65535:80:.....) messages & AS/MS show no TM/TC	IMCS	Closed

5 Special Events & Future Milestones

The INTEGRAL eclipse Season starts on 02.08.2010

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, 379 Open Loop Slews, 399 Closed Loop Slews and 23 Momentum Biases were executed (as reported by ACC OEM).

9 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 01/08/2010 is reported in the following plot:

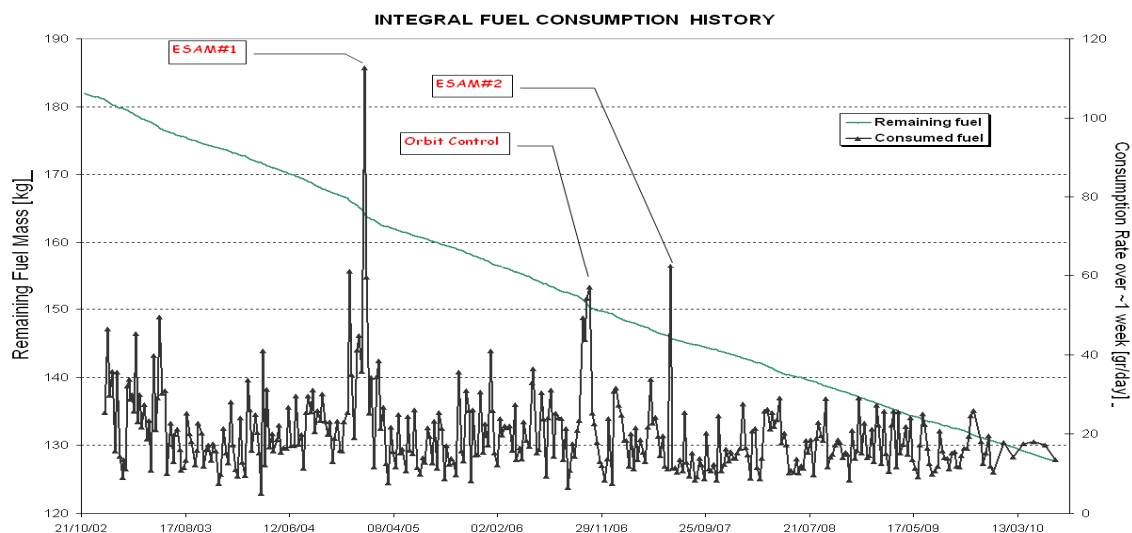


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

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.

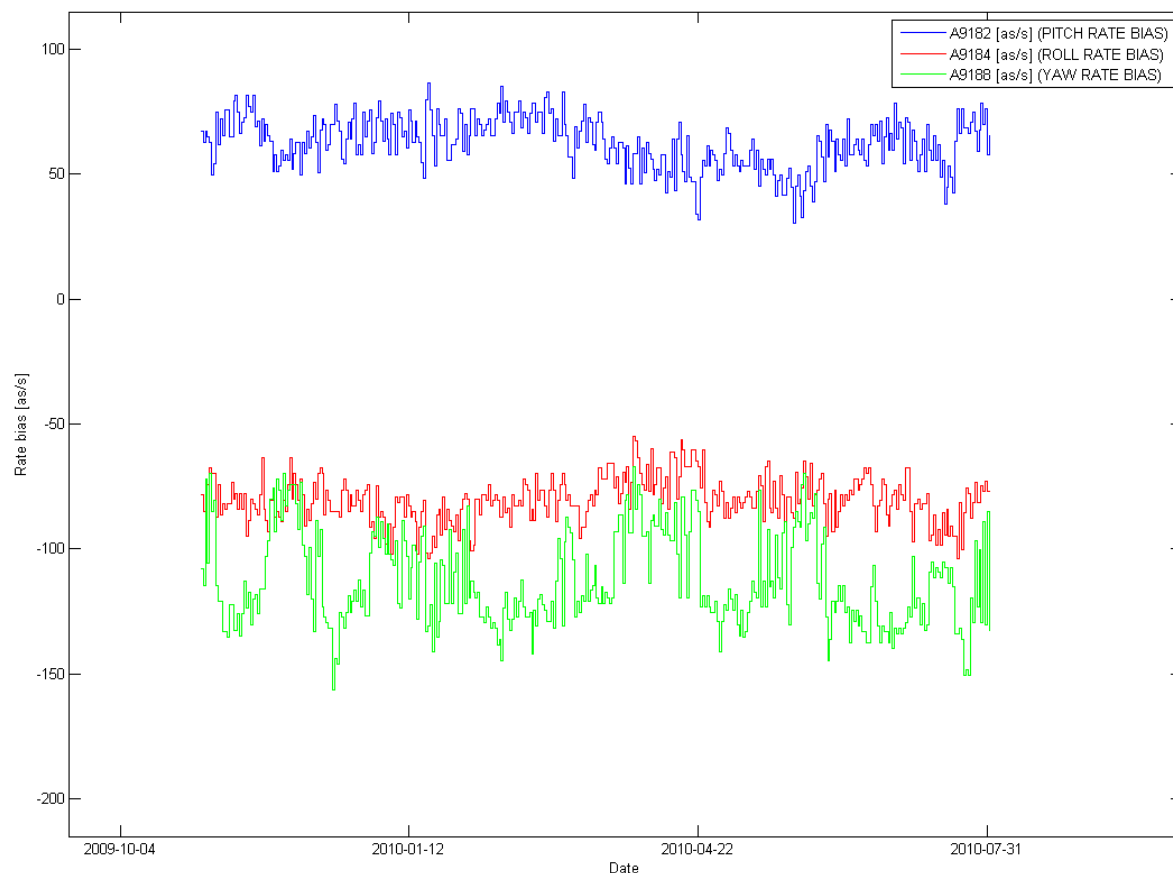


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

07/07/2010 (Day of Year 188, Revolution 943 to 944)

IMU1 switched ON during the stable pointing of PID 09440008 (11:34:18Z). At this time an anomalous peak was observed in the reaction wheelspeeds. FD and SOE were called to troubleshoot. Then it was decided to resume operations.

A manual slew was performed to go from attitude 09440008 to attitude 09440010.

Then a mapping was commanded and the parameters for slew 09440011 were manually updated (spacontool).

OTF was not reached for PIDs 09440008, 09440009 and 09440010.

Slews 09440009 and 09440010 were missed from the Timeline.

10/07/2010 (Day of Year 191, Revolution 944 to 945)

CSL 09450020 in the timeline had to be performed real time as a manual OSL (from attitude 09450019 to attitude 09450020).

After this, a mapping was commanded and the parameters for slew 09450021 were manually updated (spacontool).

OTF was not reached for PIDs 09450020.

Slew 09450020 was missed from the Timeline.

14/07/2010 (Day of Year 195, Revolution 946)

IMU1 switched ON during the stable pointing of PID 09460030 (00:16:30Z). After the IMU switched back OFF, a manual mapping was commanded and the parameters for slew 09460031 were manually updated (spacontool).

OTF was not reached for PID 09460030.

No impact on the Timeline.

16/07/2010 (Day of Year 197, Revolution 946 to 947)

IMU1 switched ON during the stable pointing of PID 09470003(03:27:00Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 09470004.

Then a mapping was commanded and the parameters for slew 09470005 were manually updated (spacontool).

OTF was not reached for PIDs 09470003 and 09470004.

Slew 09470004 was missed from the Timeline.

18/07/2010 (Day of Year 199, Revolution 947)

IMU1 switched ON during the stable pointing of PID 09470064 (04:41:00Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 09470065.

Then a mapping was commanded and the parameters for slew 09470066 were manually updated (spacontool).

OTF was not reached for PIDs 09470064 and 09470065.

Slew 09470065 was missed from the Timeline.

19/07/2010 (Day of Year 200, Revolution 947 to 948)

As a consequence of DSS27 GS drop, the commanding release for slew 09480014 failed.

Once GS TC link was recovered, a manual slew was performed from attitude 09480013 to attitude 09480014.

After the manual slew was completed, the parameters for slew 09480015 were manually updated (spacontool).

Slew 09480014 was missed from the Timeline.

OTF was not reached for PID 09480014.

25/07/2010 (Day of Year 206, Revolution 949 to 950)

As a consequence of DSS27 GS drop, the commanding release for slew 09500011 failed.

Once GS TC link was recovered, a manual slew was performed from attitude 09500010 to attitude 09500012.

After the manual slew was completed, the parameters for slew 09500013 were manually updated (spacontool).

Slews 09500011 and 09500012 were missed from the Timeline.

OTF was not reached for PIDs 09500011 and 09500012.

29/07/2010 (Day of Year 210, Revolution 951)

IMU1 switched ON during the stable pointing of PID 09510045 (06:23:00Z). After the IMU switched back OFF, a manual slew was performed to go to attitude 09510046.

Then a mapping was commanded and the parameters for slew 09510047 were manually updated (spacontool).

OTF was not reached for PIDs 09510045 and 09510046.

Slew 09510046 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 40 throughout the month and the average CDE LCL currents were as follows:

- CDE1 LCL1 Current = 4.77A
- CDE2 LCL1 Current = 2.21A
- CDE2 LCL2 Current = 2.29A

The following plot shows the evolution of the cold plate and H bus temperature during the reporting period:

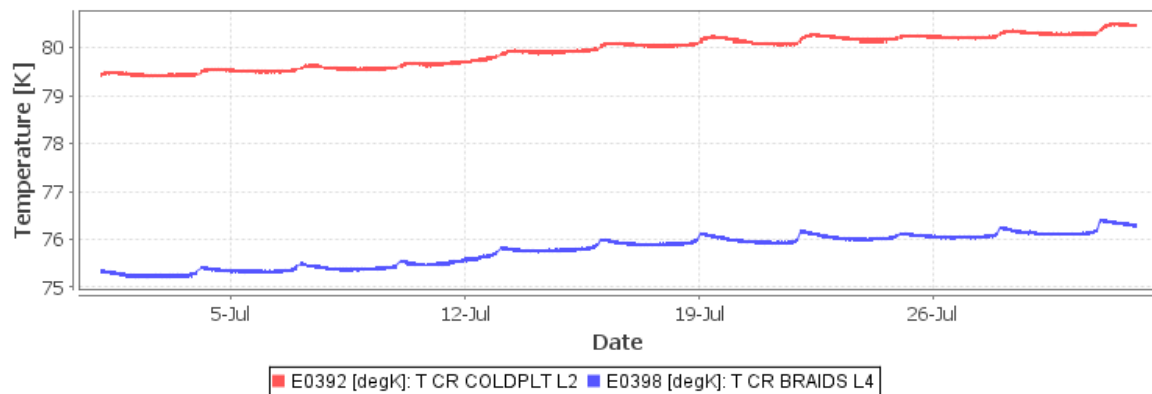


Figure 13: SPI Cold Plate and H-bus temperatures

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

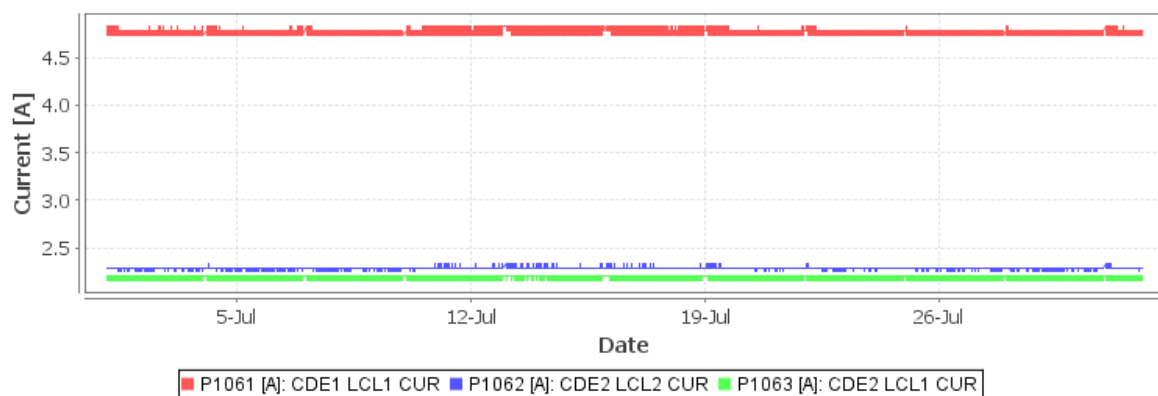


Figure 14: SPI CDE LCL current

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 and the spectra scaling factor set to 7/19 SE. 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.

The following plot shows the AFEE DC output voltages over the reporting period. The DC output voltage of GeD#8 can be seen to have been at a slightly higher value than normal since 10-07-2010

at 13:28Z. At the same time, the count rates from GeD#8 went to zero however they recovered after a few TM cycles and this was not detected in real-time. The count rates from GeD#8 have since been nominal but the DC output voltage seems not to have recovered fully. However the PI has confirmed that the energy resolution of GeD#8 is nominal. The performance of this detector is being monitored pending any further action requested by the PI. This is recorded as Anomaly Report INT_SC-299.

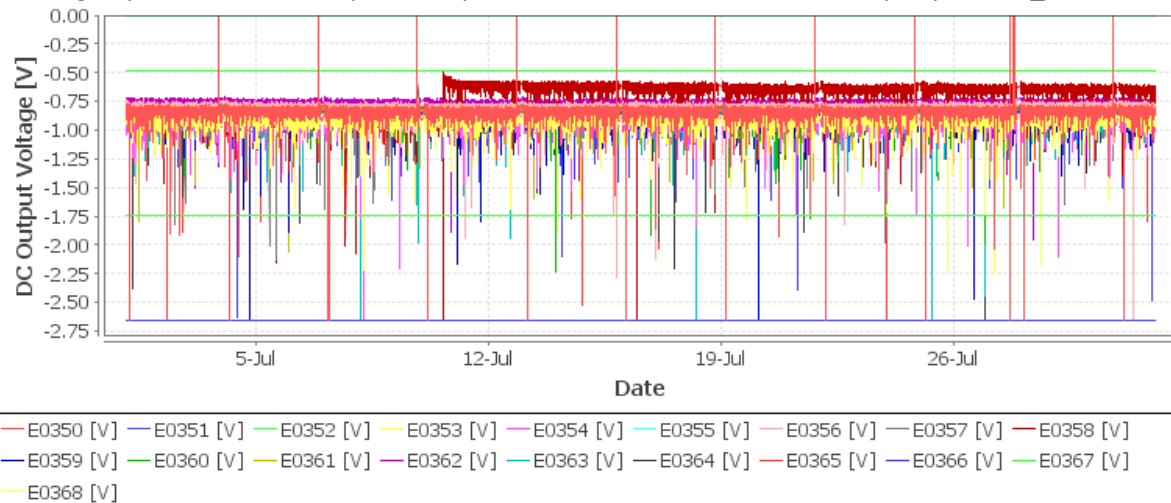


Figure 15: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

DFEE

The health of the unit is nominal. The following plots show the Non Vetoed, Time 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 Tag saturated count rates

PSD

The health of the PSD is nominal. However, a PSD channel rates malfunction occurred on 26-07-2010, requiring a PSD reset in order to recover. The following plot shows the PSD channel rates over the reporting period:

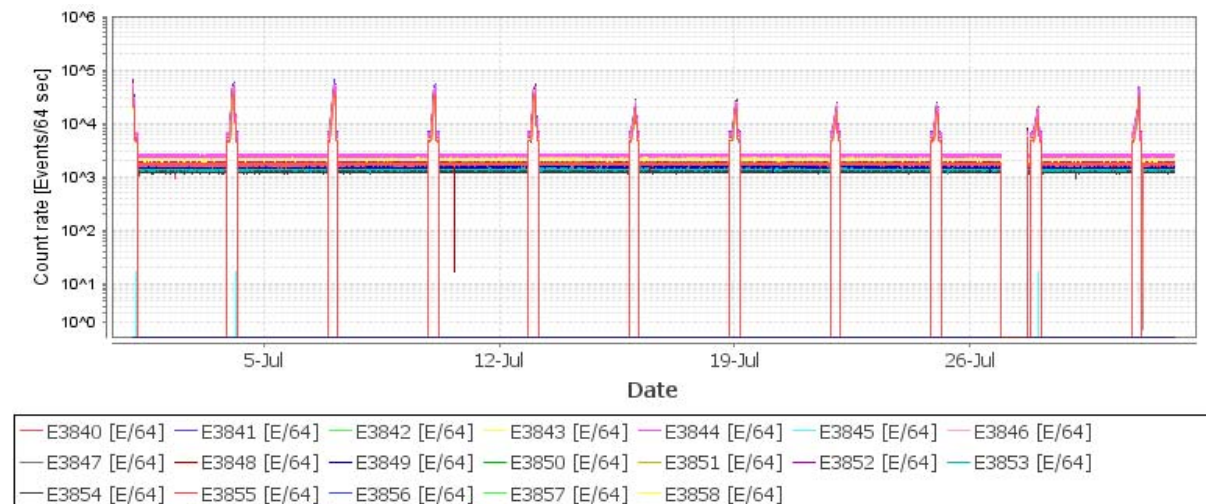


Figure 19: SPI PSD GeD Channel Rates

6.2.2 Event Log

01-07-2010 (Day of Year 182, Revolution 942)

Due to continuing high radiation after the expected radiation belt exit of revolution 942, the TM parameter E3500 (ACS Counter Below 100MeV) toggled OOL from 03.56.30Z to 04.08.30Z. As it returned within limits of its own accord, no action was taken.

09-07-2010 (Day of Year 190, Revolution 944-945)

At 17.53.28Z TM parameter E2262 (ACS FEE analogue status 5 V #12) went OOL with value = NO EXIST VAL. TCs E0282 and E0287 to report the ACS HK TM were sent at 17.57Z and the parameter returned within limits.

10-07-2010 (Day of Year 191, Revolution 945)

At 11.40.08Z TM parameter E3122 (ACS FEE analogue status -5 V #51) went OOL with value = "PARAM > SPEC". TCs E0282 and E0287 to report the ACS HK TM were sent at 11.48Z and the parameter returned within limits.

At 13.26.54Z TM parameter E3328 went OOL (value = 0). This is the AFEE Time-Tagged count rate for GeD #8. It returned within limits of its own accord at 13.27.18Z and no action was taken. However this seems to be correlated with an apparently anomalous value of the GeD#8 DC output voltage which has been observed since this time (see AR INT_SC-299).

16-07-2010 (Day of Year 197, Revolution 947)

At 03.01.38Z 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 03.01.46Z, no action was taken.

18-07-2010 (Day of Year 199, Revolution 947-948)

At 07.34.48Z TM parameter E2018 went OOL (value = PARAM > SPEC). This is the ACS FEE HV status #16. As it returned within limits of its own accord at 07.56.08Z, no action was taken.

23-07-2010 (Day of Year 204, Revolution 949)

One occurrence of OEM APID 1024 ID 243 EXCEPTION SPI1 SPECTRA BUILDING NOT COMPLETED was received at 15.56.05Z. As it was a single occurrence, no action was taken.

25-07-2010 (Day of Year 206, Revolution 950)

At 17.00.09Z TM parameter E2093 went OOL (value = PARAM > SPEC). This is the ACS FEE HV status #52. As it returned within limits of its own accord at 17.10.49Z, no action was taken.

26-07-2010 to 27-07-2010 (Day of Year 207-208, Revolution 950-951)

On 26-07-2010 at 20.32.20Z a PSD channel rates malfunction occurred, with all PSD Channel Rates (TM parameters E3840- E3858) going to zero. As the PSD configuration had already been set in line with the GeD#1 failure, it was decided to wait and observe if the PSD channel rates recovered of their own accord. However they remained at zero until the next day when the following was then performed in order to attempt to recover:

- On 27-07-2010 at 09.33.55Z SPI was commanded to CONF mode (FCP_SPI1_0160) and then returned to Photon mode (FCP_SPI1_0130) at 09.36.20Z. However this did not fix the problem.
- Following consultation with the PI, a PSD reset was performed using CRP_SPI1_3030 starting on 27-07-2010 at 14.34.07Z. Operations were completed at 14.55.03Z, after which the PSD Channel Rates returned to nominal.

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:

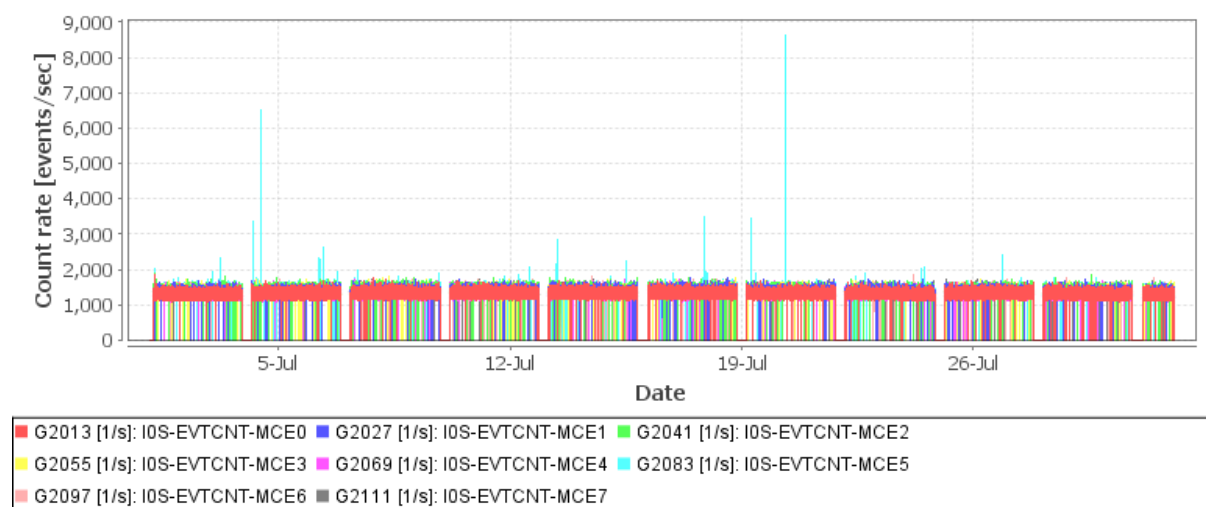


Figure 20: ISGRI MCE Counters

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

07-07-2010 (Day of Year 188, Revolution 944)

Following a ground station handover at 05:25Z, 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:

- 2010.188.06.29.00Z FCP_IBIS1_0312
- 2010.188.06.30.26Z TC G0129 uplinked to return IBIS to Science Standard mode

IBIS operations continued nominally.

08-07-2010 (Day of Year 189, Revolution 944)

At 2010.189.02.05.51Z the TM parameters families G5068 and G5072 failed status consistency check (value = TRUE). These are the PDM semi-module FIFO error flags. At 2010.189.02.08.26Z the TM parameter families G5002 and G5003 for the PDM semi-module counters started going OOL Low. As these were followed at 2010.189.02.12.06Z 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.

16-07-2010 (Day of Year 197, Revolution 947)

At 05.27.46Z TM parameter G2055 went OOL (value = 0). This is the number of events triggering the MCE3 per second. As it returned within limits of its own accord at 05.29.46Z, no action was taken.

20-07-2010 (Day of Year 201, Revolution 948)

At 05.08.26Z TM parameter G2083 went OOL (value = 7503). This is the number of events triggering the MCE5 per second. As it returned within limits of its own accord at 05.09.06Z, no action was taken.

22-07-2010 (Day of Year 203, Revolution 949)

Following a ground station handover at 18:19Z, 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:

- 2010.203.18.27.10 Z FCP_IBIS1_0312
- 2010.203.18.33.17Z TC G0129 uplinked to return IBIS to Science Standard mode

IBIS operations continued nominally.

23-07-2010 (Day of Year 204, Revolution 949)

Following a ground station handover at 00:54Z, 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:

- 2010.204.01.09.26Z FCP_IBIS1_0312;
- 2010.204.01.11.04Z 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 JEMX DFEE and detector temperatures over the reporting period.

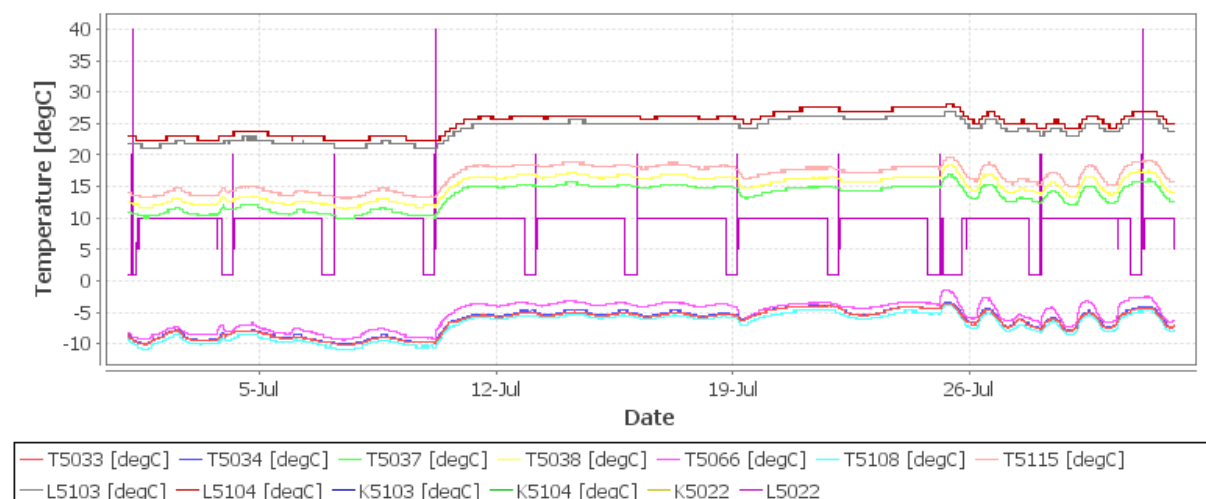


Figure 22: JEMX Detector and DFEE Temperatures

During the month, the following Out-of-limits were observed:

From DoY 182 at 00:12:20 to DoY 191 at 07:28:14, parameter L5102 (detector pressure 2) was continuously toggling in and out of soft limit. This was due to the relatively low unit temperatures around this time. The limit has since been reduced to prevent further occurrences.

Other Out of limits observed were L5136, L5449, L5119 & L9104, but these were sporadic, and had no impact.

6.4.2 Event Log

01-07-2010 (Day of Year 182, Revolution 942)

At 03:57, after AOS, it was observed that JEMX-2 was in SAFE mode due to the on-going high radiation. The unit was manually recovered, and placed back in data-taking at 06:30, after the radiation had dropped.

25-07-2010 (Day of Year 206, Revolution 950)

At 01:48, after High Voltage activation the Out-Of-Limit: LD5020D EQ DFEE State, 3min, according to the Cross ref - no was action was taken.

At 02:30, the OEM: JEMX2 Prob Dfee 9 was received. At this point, JEMX-2 was manually put to SAFE, and then reactivated.

At 03:15, the same problem was encountered, and again the unit was manually put to SAFE.

At 17:22, after a consultation with the SOE, the unit was successfully reactivated. The cause was a bright source being observed at the time.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log

07-07-2010 (Day of Year 188, Revolution 944)

At 11:34, a loss of guide star forced an interruption to operations. A recovery was performed, and the timeline rejoined at 13:11. The impact was the loss of pointings 09440009 & 09440010. It was at this time that the following pair of commands were rejected:

2010.188.13.03.24.850 TC1	2010.188.13.03.37.870	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E
2010.188.13.03.31.412 TC1	2010.188.13.03.45.716	1792 0	RealTime 0	131 65535	PR	TC REJECT N E	REJECTED E

These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands for pointing 09440010.

19-07-2010 (Day of Year 200, Revolution 948)

At 12:32, a problem at DSS-27 forced an interruption to operations. Operations continued at 12:59 after a handover, and a recovery performed. The timeline was recovered at 13:15. The impact was that pointing 09480014 was cut short from a planned 3334 to 1184 seconds. It was around this time the following command was rejected:

2010.200.13.14.21.448	2010.200.13.14.32.482	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

This corresponds to the M1130 (RESET IM) command for pointing 09440014.

25-07-2010 (Day of Year 206, Revolution 950)

At 07:54, a power glitch at DSS27 forced an interruption to operations. At 08:11, the ground station was available again. A spacecraft recovery was performed, and the timeline rejoined at 08:44. The impact was the loss of pointing 09500011. It was at this time that the following pair of commands were rejected:

2010.206.08.11.49.988	2010.206.08.11.59.927	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

2010.206.08.11.56.426	2010.206.08.12.06.995	1792	RealTime	131	TC	REJECT	REJECTED
TC1		0	0	65535	PR	N	E

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

31-07-2010 (Day of Year 212, Revolution 952)

At 17:21, an imcs problem forced an interruption to operations. A recovery was performed, and the timeline rejoined at 18:30. The impact was the loss of pointing 09520025.

6.6 IREM

6.6.1 Operations

Radiation belts entry and exit

The following plots show the Radiation Belt Entry (Figure 23, red line) and Exit times (Figure 24, blue line) obtained from the ISDC website, defined where the IREM TC3 (soft electrons) rate reads 600 counts. The blue line in Figure 23 and the magenta line in Figure 24 are the altitudes used by the MOC for planning purposes.

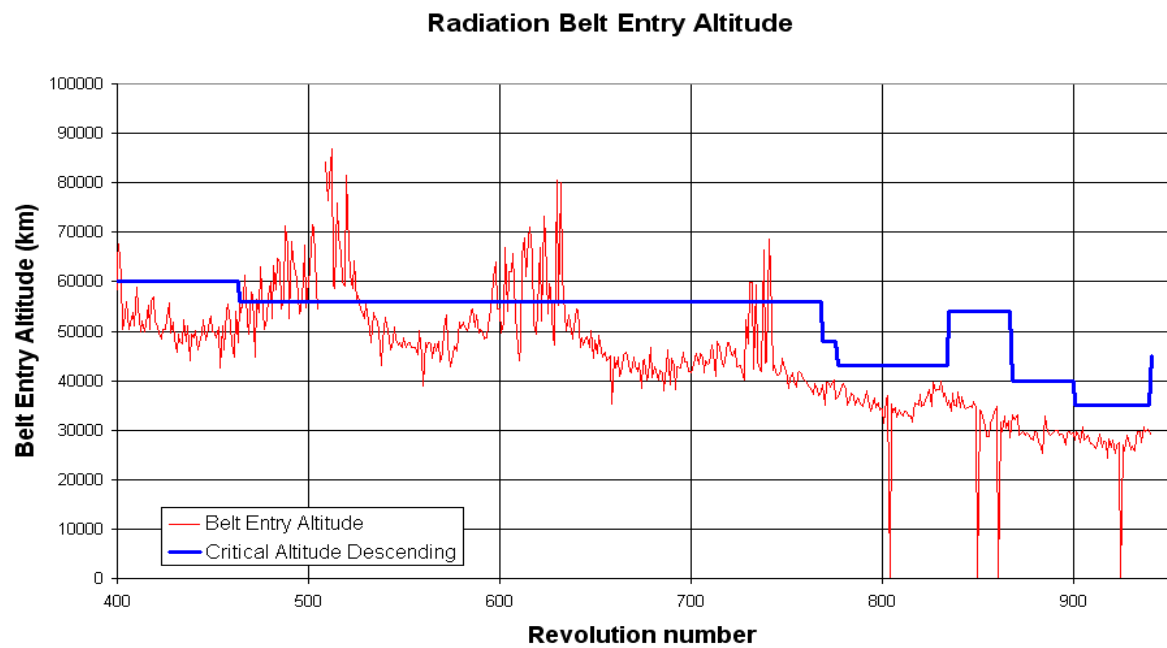


Figure 23: Radiation belt entry

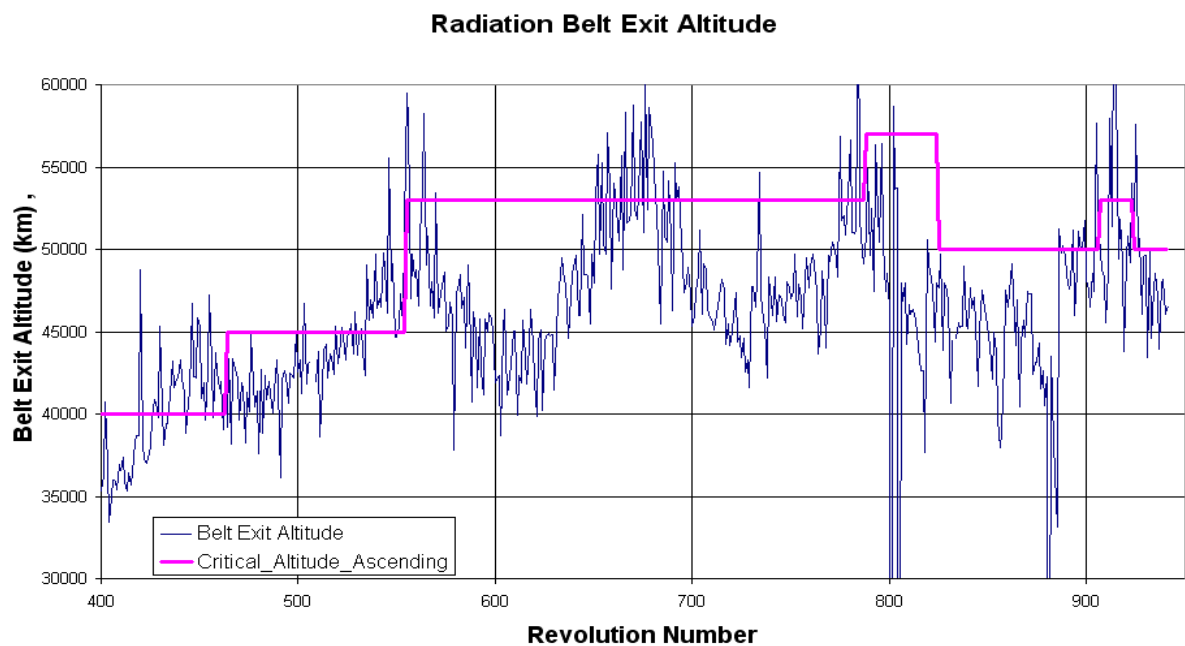


Figure 24: Radiation belt exit

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
942	RAD_EXIT R 2010-07-01T03:06:08Z	01/07/2010 02:14:11	>>28102.5	01-Jul-2010 02:36:45	45894.2	30-Jun-2010 22:56:45	5007.429
942	RAD_ENTR R 2010-07-03T19:18:12Z	03/07/2010 21:02:19	24612.1	03-Jul-2010 21:08:17	22654.06	03-Jul-2010 21:58:17	11471.83
943	RAD_EXIT R 2010-07-04T02:52:15Z	04/07/2010 02:08:42	>>28097.9	04-Jul-2010 02:28:17	47352.68	03-Jul-2010 22:38:17	5003.086
943	RAD_ENTR R 2010-07-06T19:05:00Z	06/07/2010 20:55:15	24712.6	06-Jul-2010 20:58:20	23265.26	06-Jul-2010 21:58:20	9867.69
944	RAD_EXIT R 2010-07-07T02:38:39Z	07/07/2010 01:52:19	>>28119.1	07-Jul-2010 02:18:20	46951.32	06-Jul-2010 22:28:20	5085.782
944	RAD_ENTR R 2010-07-09T18:51:45Z	09/07/2010 20:48:03	23962.1	09-Jul-2010 20:49:27	22162.22	09-Jul-2010 21:39:27	10962.7
945	RAD_EXIT R 2010-07-10T02:25:35Z	10/07/2010 01:31:23	40961.7	10-Jul-2010 01:59:27	46097.92	09-Jul-2010 22:19:27	4929.444
945	RAD_ENTR R 2010-07-12T18:36:23Z	12/07/2010 20:31:31	23931.7	12-Jul-2010 20:36:09	22159.17	12-Jul-2010 21:26:09	11006.95
946	RAD_EXIT R 2010-07-13T02:10:45Z	13/07/2010 01:05:07	>>28082.1	13-Jul-2010 01:46:09	46025.79	12-Jul-2010 22:06:09	5018.007
946	RAD_ENTR R 2010-07-15T18:22:18Z	15/07/2010 20:12:51	23912.8	15-Jul-2010 20:18:53	22642.86	15-Jul-2010 21:08:53	11453.92
947	RAD_EXIT R 2010-07-16T01:56:18Z	16/07/2010 01:01:31	>>28102.8	16-Jul-2010 01:38:53	47376.45	15-Jul-2010 21:48:53	4990.448
947	RAD_ENTR R 2010-07-18T18:10:56Z	18/07/2010 19:56:36	26221.8	18-Jul-2010 20:12:12	21685.49	18-Jul-2010 21:02:12	10432.01

948	RAD_EXIT R 2010-07- 19T01:44:21Z	19/07/2010 00:57:32	40821.1	19-Jul-2010 01:22:12	46541.59	18-Jul-2010 21:32:12	5253.215
948	RAD_ENTR R 2010-07- 21T18:00:07Z	21/07/2010 19:59:56	22343.8	21-Jul-2010 19:57:22	22344.92	21-Jul-2010 20:47:22	11116.03
949	RAD_EXIT R 2010-07- 22T01:33:32Z	22/07/2010 00:22:28	>>28132.1	22-Jul-2010 01:07:22	46012.61	21-Jul-2010 21:27:22	4885.195
949	RAD_ENTR R 2010-07- 24T17:48:23Z	24/07/2010 19:41:32	22837.2	24-Jul-2010 19:48:52	21603.81	24-Jul-2010 20:38:52	10427.12
950	RAD_EXIT R 2010-07- 25T01:22:22Z	25/07/2010 00:10:28	>>30115.8	25-Jul-2010 00:58:52	46481.4	24-Jul-2010 21:08:52	5358.461
950	RAD_ENTR R 2010-07- 27T17:34:27Z	27/07/2010 19:18:28	25313.0	27-Jul-2010 19:30:55	22789.12	27-Jul-2010 20:20:55	11668.27
951	RAD_EXIT R 2010-07- 28T01:09:01Z	28/07/2010 00:01:24	38674.6	28-Jul-2010 00:50:55	47154.96	27-Jul-2010 21:00:55	5144.923
951	RAD_ENTR R 2010-07- 30T17:20:00Z	30/07/2010 18:36:12	31467.2	30-Jul-2010 19:24:50	21188.99	30-Jul-2010 20:14:50	10049.78
952	RAD_EXIT R 2010-07- 31T00:54:36Z	N/A	-	31-Jul-2010 00:34:50	46750	30-Jul-2010 20:44:50	5267.826

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

12-07-2010 (Day of Year 193, Revolution 945)

At 01:19:00 the TC: U4921 INT GND LINK OFF (part of the sequence UEGROF01) failed its CEV. The TM parameters U9903 SR INT GND LINK = OFF. No action was taken, and there was no impact.

30-07-2010 (Day of Year 211, Revolution 952)

At 22:03:16Z, a local reset of the IREM CSCI S/W (SEU #94) was observed. The status of the unit, before the local reset of the IREM CSCI S/W, was nominal, here is a summary:

- 1) The temperatures were nominal;
- 2) The LCL current was nominal;
- 3) The last HK before the anomaly showed HV, 5V and 6V voltages inside limits;
- 4) The anomaly was observed at AOS for revolution 952: 2010-07-30T22:03:16Z (30080.6 km). The unit had performed an automatic transition to Standard Mode (i.e. no block counter increasing, all the TM words= FFFF hex); just before the anomaly, radiation counters reported nominal values considering the position of the S/C along the orbit;
- 5) The recovery of the unit started immediately using procedure CRP_SYS_2570. The recovery of the unit started immediately using procedure CRP_SYS_2570. The first dump of the status word after the anomaly reported a value of 3CC0 HEX = 15552 DEC = 0011110011000000, i.e. the Checksum Failure Flag ON & Ground Link Off. The unit was still reporting the status as if it was in Integral mode with counting ON and accumulation ON. This value of the status word is assumed to be an old one written by the S/W at the moment of the anomaly.
- 6) The patch was performed again, this time successfully with the correct re-starting of the S/W following procedure FCP_RM_0081. The operation was completed at 03:04:00Z the following day.