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

INTEGRAL
Mission Report

INT-MOC-SYS-RP-1001-TOS-OF

No. 074
Week 08

23.02.04

Routine Phase

Prepared by: M. Walker (TOS-OFI)

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1 General

The Flight Control Team at MOC has compiled this report with some input provided by the Flight Dynamics Team, ISOC and ISDC.

It addresses the activities from 14.02.04 until 20.02.04 (both dates inclusive) and covers the revolutions 164 & 165.

2 Summary of Activities

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

The targets of these revolutions were the Galactic Centre; IGR J16318-4848 (RA 16:31:48.60; DEC -48:49:00.1) and the Galactic Plane. The activities consisted of GCDE, raster dithering and GPS observations.

Note: Some further information concerning the activities is provided in the Appendix.

3 Satellite Status

3.1 Platform

The performance of the platform was good. No malfunction was identified that has a permanent effect on the mission.

3.1.1 AOCS

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

There were two cases of "Roll Error" at the end of corrective Open Loop slews. There are two factors to these kinds of errors, which are propagated from a large Open Loop Slew to the next corrective slew. One is the original error in the slew itself, the magnitude of which depends on the slew amplitude. A contribution to this error could come from the fact that the motion of the apparent solar motion is not taken into account for the duration of the slew. The discrepancy in roll thus introduced can be in the order of 1 arc-minute for a slew of 30 minutes duration. The other factor is the propagation of this error into the next slew by an attitude determination that is based on a mapping during which the SSL is enabled (the first mapping after the slew). The enabling of the SSL after a slew with roll error causes a jitter in the attitude when the ACC is trying to take the error out. Because the attitude determination is based on the position of the Guide Star at the start of the mapping, if the SSL is enabled in the

middle of a mapping that is used to update the next slew, then the error will propagate to that slew. To eliminate the propagation of the roll error, the Flight Dynamics is working on a modification in their software to always use the second mapping after an Open Loop Slew for attitude determination.

There was another roll error at the end of an Open Loop Slew. This time, the error was introduced by a mapping after a Close Loop Slew. The mapping could only use 3 close by stars for attitude determination, resulting in a poor roll estimation.

Four pointings were missed during a Goldstone (DSS-16) pass due to telemetry drops which, according to the station, were caused by RFI.

The fuel consumption over the period between 13/02/2004 and 20/02/2004 was 0.166 kg. The remaining propellant is in the order of 172.287 Kg on the 20th of February.

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

3.1.2 Power

The power subsystem is working as specified. The available power from the arrays is in the order of **2200W**.

3.1.3 Thermal

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

3.1.4 OBDH

The OBDH subsystem is working flawlessly. No on-board communications problem was identified.

3.1.5 RFS

The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

3.2.1 SPI

The overall status of the instrument is nominal.

During the reporting period the instrument was in photon-by-photon mode with spectra TM enabled and an assigned TM bandwidth in the science windows of 98 pkts/cycle.

The cryocooler is working well, keeping the Ge detector cold plate temperature within 85+/-1K.

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

3.2.2 IBIS

The status of the unit is Nominal.

The TM bandwidth assigned to IBIS was 134 pkts/cycle.

No occurrence of anomalous OEM generation (ID 183-184-179-180, Class 2) was reported after the VETO S/W patch.

There were two reports of autonomous switch-off triggered by the IREM electron counter and due to the internal radiation automatism.

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

3.2.3 JEM-X

The status of both JEM-X units is nominal.

During this period JEM-X1 was dormant with a TM allocation of 1 packet/cycle. JEM-X2 operations were performed by the automatic Timeline, with a TM allocation of 8 packets/cycle during science observations.

Due to high background radiation levels, JEM-X2 spent the following periods of time in Safe mode:

- Revolution 163: 2004-02-15T07:19Z to 2004-02-15T09:08Z (triggered by SW Ratemeter)
- Revolution 163: 2004-02-15T11:17Z to end of revolution (triggered by IREM)
- Revolution 164: 2004-02-18T01:59Z to 2004-02-18T03:26Z (triggered by IREM)
- Revolution 164: 2004-02-18T16:13Z to end of revolution (triggered by SW Ratemeter)

On 2004-02-15 there were also several occurrences of out of limits on the parameter L5136 Buffer Loss.

Further information on the JEM-X operations can be found in the Appendix Section 8.3.4.

3.2.4 OMC

The status of OMC is nominal.

During the reporting period OMC operations were performed by the automatic timeline, with the TM allocation to OMC of 5 packets/cycle during normal science operations.

There were 241 OMC pointings executed nominally, 4 were lost.

Note: Some more information concerning the OMC operations is provided in the Appendix Section 8.3.5.

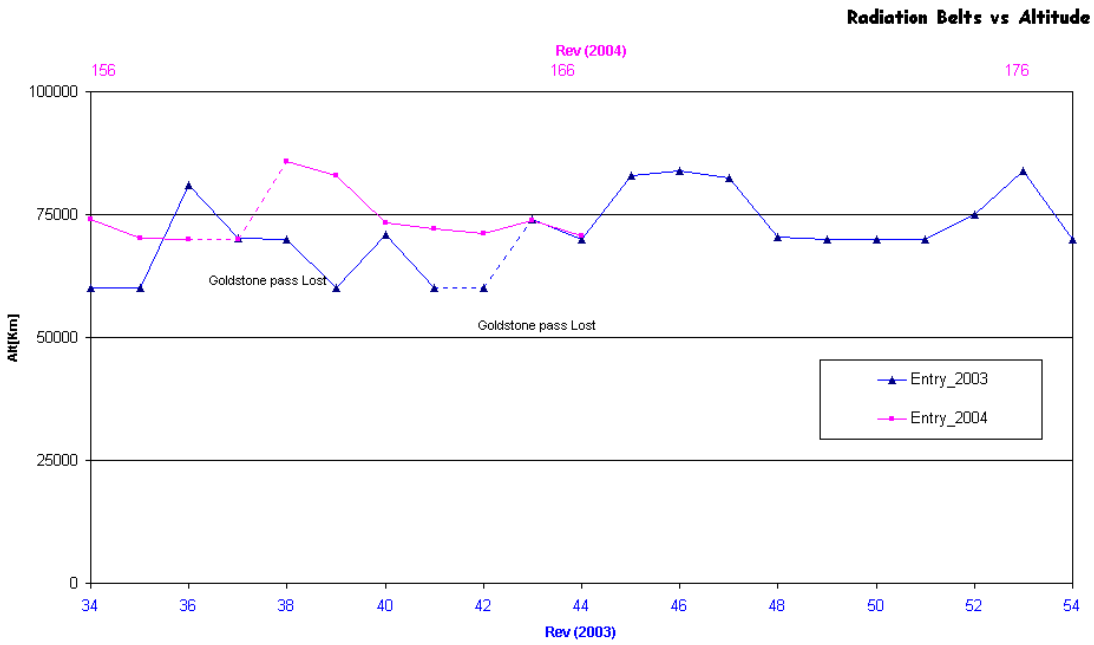
3.2.5 IREM

The overall status of the unit is Nominal.

The observation period was characterized by low solar activity but with the presence of several high radiation spikes along the orbit, that in three cases

- 2004.046.07:14Z
- 2004.046.11.16Z
- 2004.049.01.58Z

caused the transition of JEM-X2 to Safe Mode. A comparison between the Radiation Belt Entries in 2003 and 2004, for the same observation period winter->spring, shows evidence of an increase in the entry altitudes, over that observed in 2003. The Radiation Belt Entry is determined by the electron cut-off threshold (see definition below) based on JEM-X2 on-board radiation automatism.



The reported Electron Belts Entry/Exit for revs 158-->159, as defined by a cut-off flux of 3.76E+02 e/cm2/sec (E>0.5 MeV) and the predicted Proton Belts Entry/Exit, as defined by a cut-off flux of 1.25E+03 p/cm2/sec (E>8 MeV) are shown below:

Electron Belts

REV	S/C BCPKT (electron)	Electron CUT-OFF Observed Entry/Exit	Electron CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
163	RAD_ENTR R 2004-02-15T17:57:25Z	Sun 15 Feb 04, 07:1 Sun 15 Feb 04, 11:1 Sun 15 Feb 04, 16:2	15-Feb-2004 18:33:18	54703
164	RAD_EXIT R 2004-02-16T02:59:21Z	Mon 16 Feb 04, (	16-Feb-2004 01:33:18	26348
164	RAD_ENTR R 2004-02-18T17:46:24Z	Wed 18 Feb 04, (Wed 18 Feb 04,	18-Feb-2004 18:23:36	54787
165	RAD_EXIT R 2004-02-19T02:47:33Z	Thu 19 Feb 04, 0	19-Feb-2004 01:23:36	26381

Reference
Small error vs reference
Large error vs reference
Radiation Spike

Proton Belts

REV	S/C BCPKT (proton)	Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
164	PROTON_RAD_ENTR	15-Feb-2004 23:53:18	11532
164	PROTON_RAD_EXIT	16-Feb-2004 00:23:18	14802
165	PROTON_RAD_ENTR	18-Feb-2004 23:43:36	11394
165	PROTON_RAD_EXIT	19-Feb-2004 00:13:36	14726

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

4 Ground Facilities

The performance of the Operational ground facilities was in general good in the reporting period. The main problems this week, are briefly described in section 6.

4.1 Mission Operations Centre

The performance of the MOC was in general good in the reporting period, with only minor problems reported, see section 6 for details.

4.2 Ground Stations & Network

There were several instances this week of RFI, and Reed-Solomon errors. On one occasion, this led to the loss of four pointings.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning
PSF's: Received up to rev. 175
POS and POD generated: up to rev 170
TSF's: Received up to rev 166

A last minute TOO request was granted and caused a re-planning of revolution 166. Due to switch of JEM-X instrument from rev 171 the subsequent revolutions will be planned later than normal to minimize. In order for Flight Dynamics to be able to optimise wheel profiles rev 171 an 172 has been sent to MOC. But they will only be scheduled during rev 169. (1 and 2 March). (See last week's report).

2. Observation status
No change this week.

3. ISOC science archive
Nothing to report

4. ISOC system
The ISOC system version 10.2 has been used without any problems.

5. Problems
None

4.3.2 ISDC

On 23/02/2004, the status of ISDC observation processing is:

- Latest Standard Analysis completed: amalgamated observation 01202140004 (MR 2251-178, Revolution 134-135) on 14/02/2004

- Latest products archived: observation 01100090008 (Vela region, Revolution 138) on 27/01/2004

- Latest observation products sent to the observer: 01202070003 (X1916-053, Revolution 131-134) on 09/01/2004

5 Special Events

Nothing to report

6 Anomalies

There were a number of problems related to the ground segment that impacted the operations:

- On DoY 045, shortly after midnight, the idda went yellow for 10 – 20 seconds, then returned to green. This happened 3 or 4 times.
- On DoY 046, shortly after midnight, sun128 showed low swap space of 49MB. By 21:20 the swap space had reduced to 23 MB.
- On DoY 047 at 13:09, 2 bad frames were received from Redu..
- At 15:55 there was an error sending data to the ISDS, at 16:01, data flow was again indicated.
- At 16:55 there were 4 bad TM frames from Redu, and at 17:00 2 more bad frames, all coupled with Reed-Solomon alarms.
- On DoY 048, at 11:00, 16 bad frames were received from Redu, caused by Reed-Solomon errors.
- At 17:01, there was an eight second drop in TM from DSS-16, due to RFI, at 17:11 there were 14 bad frames received. The impact of this drop was an AOCS command subsequently failed its PTV check, and did not uplink, a manual slew was then performed to the attitude of pointing 01640072. At 17:48, pointing 01640073 also failed due to failed PTV checks caused by the RFI. Eventually the timeline was rejoined at the end of pointing 01640075, but the RFI continued to the end of the pass at 20:03, nearly 2000 bad frames received. The impact was pointings 01640072 to 01640075 were lost. The DR# is G104051.
- At 22:27, there was a drop in the TM bad frame link with Redu, no impact.
- On DoY 049 at 19:26, there was a drop in TM from Redu, no impact.
- On DoY 050, shortly after midnight, there were continuous warning messages on idda from the HFARetri application: Cannot get data request from the cache.
- On DoY 051, at 10:01 & 10:14, there were bad frames following Reed-Solomon errors at Redu. At 11:29, there were 14 more bad frames.
- At 16:44, 16:52, 16:54, 16:56, 16:57, 18:41, 18:42 & 18:44, there were drops on the bad frame link with DSS-16, no impact.
- At 22:45 there were four bad frames from Redu, at 23:00 three more, and at 23:05 six bad frames, all following Reed-Solomon alarms. There was no impact.

The following new anomaly reports have been entered into the Anomaly Reporting and Tracking System. Repeats of existing anomalies are not shown in this table.

AR id	Date Occurrence	Subject	Segment	Status
INT-2555	19/02/2004	Major problems restarting INTEGRAL's servers from CCC		Pending

7 Future Milestones

Planned for the end of February and beginning of March are JEMX 1 & 2 patches to update the on-board background rejection criteria and the HV safety limits.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 164
The observations in revolution 164 consisted of a GCDE lasting ~48 hours, followed by a raster dithering observation of IGR J16318-4848 (RA 16:31:48.60; DEC -48:49:00.1) which was performed for the remaining ~14 hours of observation time.

Revolution 165
The observations in revolution 165 consisted of 12 pointings of a GPS lasting ~8 hours, followed by a GCDE which was performed for the remaining ~53 hours of observation time.

During these revolutions all instruments were in their nominal science modes, except for JEM-X1, which remained in Safe mode, and the TM allocation was 134 IBIS, 98 SPI, 1 JEM-X1, 8 JEM-X2, 5 OMC.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

```
2004-02-07T01:59:24.000Z     172.6214    F   Automatic TM processing.
2004-02-07T11:03:49.000Z     172.5672    F   Automatic TM processing.
2004-02-08T12:12:47.000Z     172.5561    F   Automatic TM processing.
2004-02-09T19:02:19.000Z     172.5385    F   Automatic TM processing.
2004-02-10T01:49:55.000Z     172.5167    F   Automatic TM processing.
2004-02-10T10:47:24.000Z     172.5000    F   Automatic TM processing.
2004-02-11T11:42:47.000Z     172.4853    F   Automatic TM processing.
2004-02-12T19:02:26.000Z     172.4617    F   Automatic TM processing.
2004-02-13T01:36:19.000Z     172.4529    F   Automatic TM processing.
2004-02-14T11:31:42.000Z     172.4362    F   Automatic TM processing.
2004-02-15T17:56:41.000Z     172.3993    F   Automatic TM processing.
2004-02-16T01:28:34.000Z     172.3637    F   Automatic TM processing.
2004-02-18T19:08:18.000Z     172.3517    F   Automatic TM processing.
2004-02-19T01:17:23.000Z     172.3153    F   Automatic TM processing.
2004-02-19T09:49:39.000Z     172.2873    F   Automatic TM processing.

This report was generated  Fri Feb 20 08:00:11 GMT 2004
```

8.3 Detailed Satellite Information

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

8.3.1 AOCS Operations

AOCS operations were executed from the Automatic Timeline.

During this period, 148 Open Loop Slews, 105 Closed Loop Slews and 6 Momentum Bias were executed. 4 slews were missed or executed manually. This is equivalent to 1.6%.

14/02/04 (Day of Year 045, Revolution 163)

Nothing to report.

15/02/04 (Day of Year 046, Revolution 163-164)

Roll error at the end of corrective Open Loop Slew: At the end of corrective Open Loop Slew 01630086, the error in roll with respect to the SSL assumed roll angle was –137 arc-seconds. This error, which was larger than the OTF threshold for Roll (120 arc-sec), caused flickering of the OTF. However, this was not during the science observation window:

- At the end of Open Loop Slew 01630085, the error in roll with respect to the SSL assumed roll angle was +175 arc-seconds. This error did not cause the jittering of the OTF because after large slews the SSL is enabled via a ground command.
- The SSL was enabled during the mapping that was used by the FDS to determine the attitude after slew 01630085 and to update the parameters of slew 01630086. The jitters caused by the enabling of the SSL resulted in an erroneous assumption of the roll angle at the slew end. A roll error of +379.7 arc-seconds is reported in the attitude reconstruction log file 0163_0088.attd_log.
- This error was in turn introduced into corrective Open Loop Slew 01630086 and resulted in a roll error of -137 arc-seconds at the end of the slew.

16/02/04 (Day of Year 047, Revolution 164)

Nothing to report.

17/02/04 (Day of Year 048, Revolution 164)

OTF flicker due to Roll Error at the end of Open Loop Slew: At the end of Open Loop slew 01640045 the difference between the SSL assumed roll angle and the FSS reading was –175 arc-seconds. This is more than the OTF threshold for roll and caused the jittering of the OTF. This error was introduced by the mapping after Close Loop Slew 01640044. The attitude determination that was based on this mapping estimated an error of +180 arc-seconds in roll. The reason for this error was that the FDS could only match three close by stars in the STR FoV, thus resulting in a poor estimation of the roll angle. This error was then propagated to the next Open Loop Slew. The flickering of the OTF was not seen at BCP level.

Slews missed due to RFI at ground station (Goldstone, DSS-16): at 17:15, an AOCS command failed the execution verification stage due to drops in the telemetry. This caused the release failure of the next command and stopping of the AOCS commanding. Slew 01640072 was missed. The Timeline recovery tool was then used and a manual Close Loop Slew was performed to the attitude of PID 01640072. The drops in TM continued and during the uplink of commands for slew 01640073 again interrupted the AOCS commanding. The SPACON waited until the TM link stabilized and then recovered the Timeline by performing a manual Open Loop Slew to the attitude of PID 01640075. Pointings 01640072 to and including 01640075 were affected.

18/02/04 (Day of Year 049, Revolution 164-165)

Nothing to report.

19/02/04 (Day of Year 050, Revolution 165)

Roll error at the end of corrective Open Loop Slew: At the end of corrective Open Loop Slew 01650002, the error in roll with respect to the SSL assumed roll angle was –168 arc-seconds. This error, which was larger than the OTF threshold for Roll (120 arc-sec), caused flickering of the OTF. However, this was not during the science observation window:

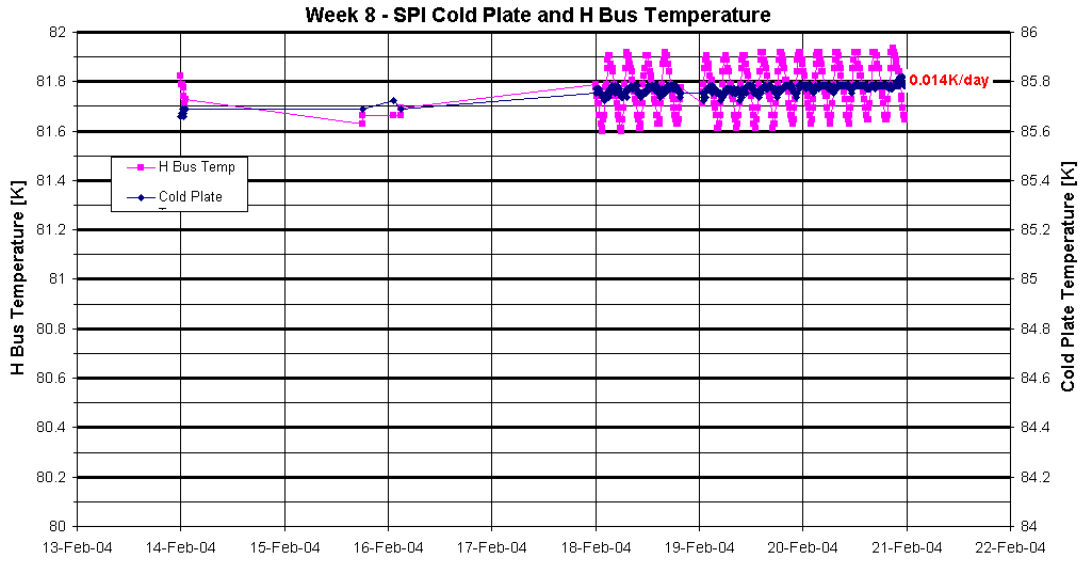
- At the end of Open Loop Slew 01630001, the error in roll with respect to the SSL assumed roll angle was +137 arc-seconds. This error did not cause the jittering of the OTF because after large slews the SSL is enabled via a ground command.
- The SSL was enabled during the mapping that was used by the FDS to determine the attitude after slew 01630001 and to update the parameters of slew 01630002. The jitters caused by the enabling of the SSL resulted in an erroneous assumption of the roll angle at the slew end. A roll error of –742.3 arc-seconds is reported in the attitude reconstruction log file 0165_0002.attd_log.
- This error was in turn introduced into corrective Open Loop Slew 01630002 and resulted in a roll error of –168 arc-seconds at the end of the slew.

20/02/04 (Day of Year 051, Revolution 165)

Nothing to report.

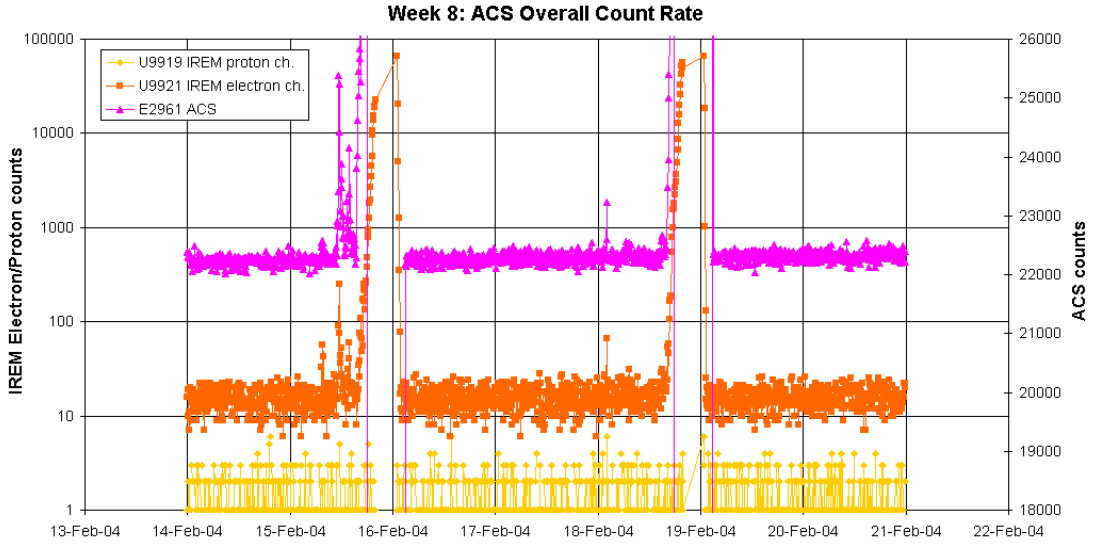
8.3.2 SPI Operations

Cryo-cooler / Detector Cold-Plate:
The cold-plate temperature is leveled at around 85.75K with a small positive drift of 0.014K/day, which is within the expected range. The performance of the cryo-cooler is nominal.
The following plot shows the evolution of the cold-plate and H bus temperatures during the reporting period.

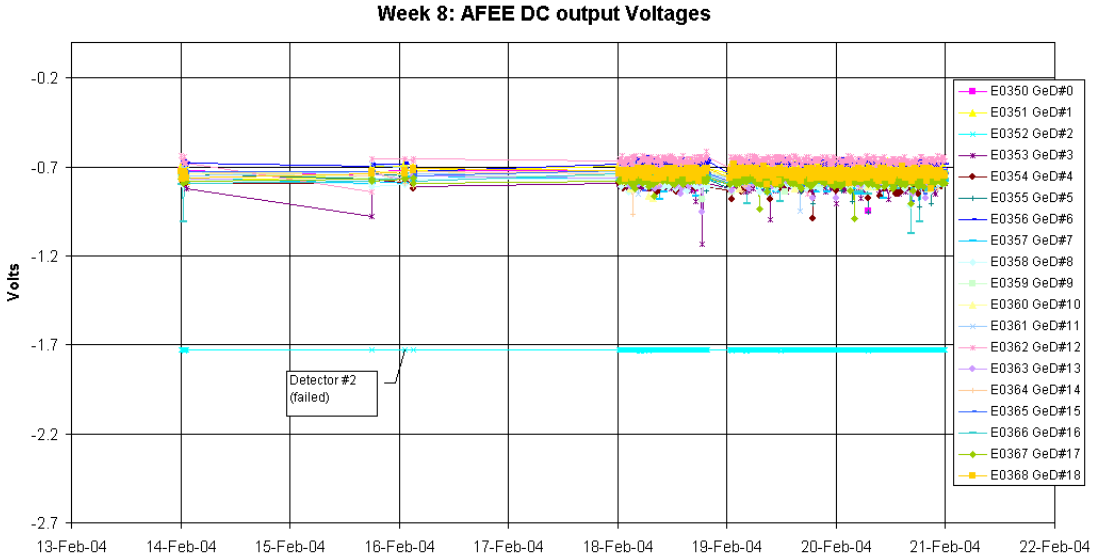


IASW/DPE:
Nothing to report.

ACS:
The following plot shows the ACS overall count rate evolution during the reporting period.
The performance of the ACS is nominal.

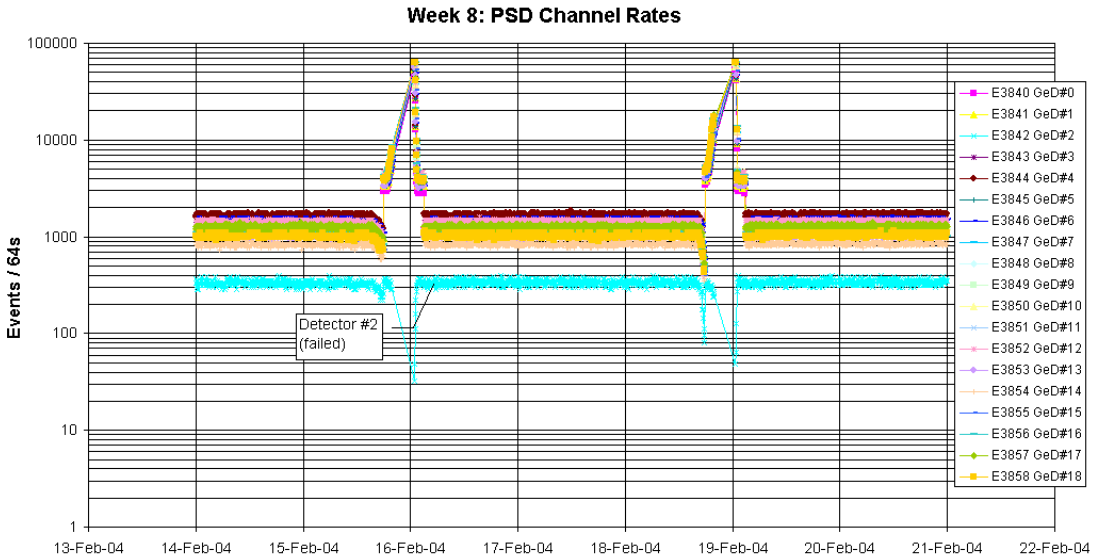


AFEE:
The AFEE dc output signals are here after plotted during the reporting period.
These signals represent the DC component of the current flowing through the Ge crystals polarised at 4kV; they provide a measure of the health status of both the detectors and the HV section.
The performance of the detectors is nominal except for the detector #2 failed since 06.12.2003 (see anomaly report INT_SC-72).



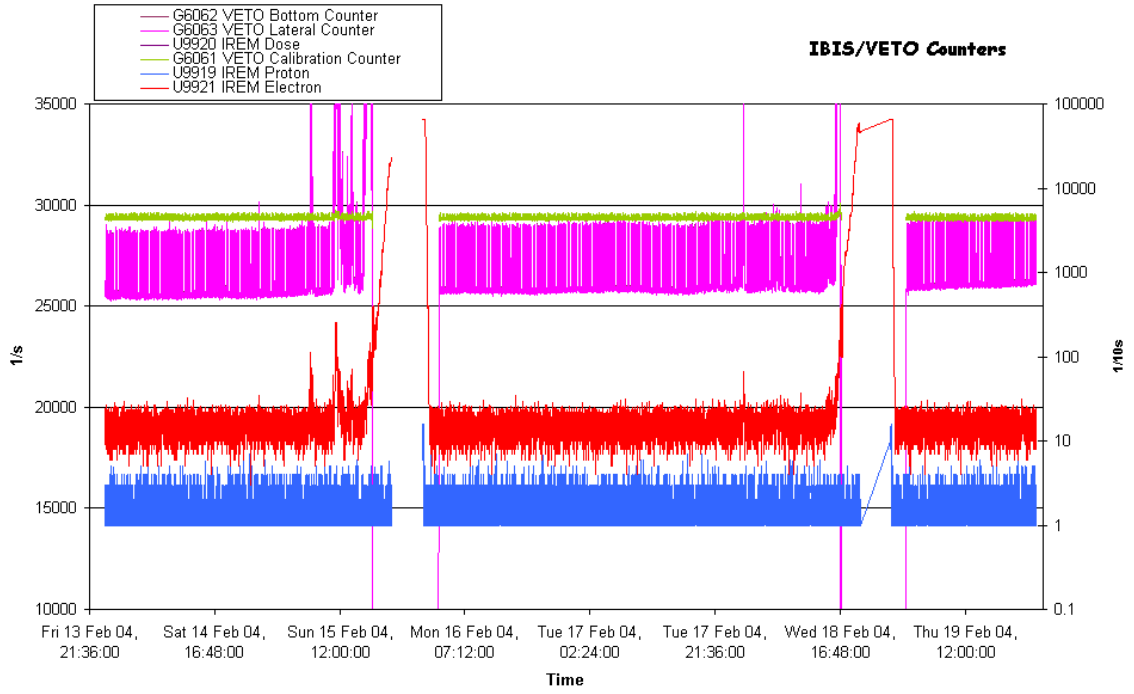
DFEE:
Nothing to report.

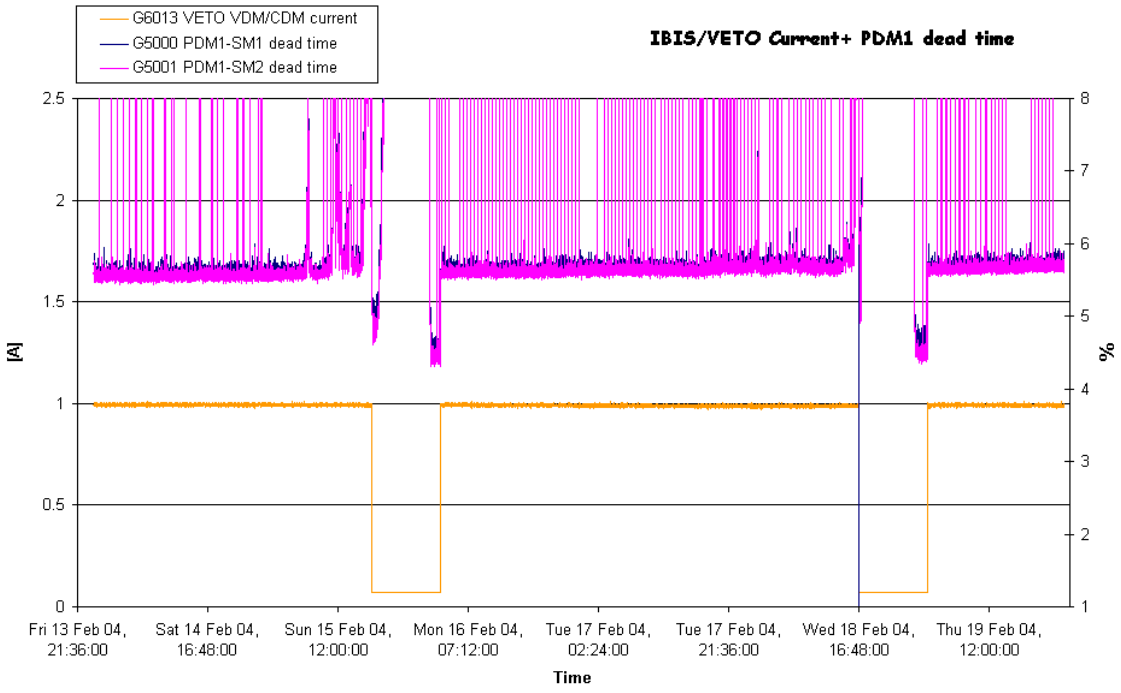
PSD:
The following plot shows the GeD channel rates detected by the PSD during the reporting period. The count rate of each detector is within the expected range, except for the failed detector #2, whose residual counts are triggered by noise.



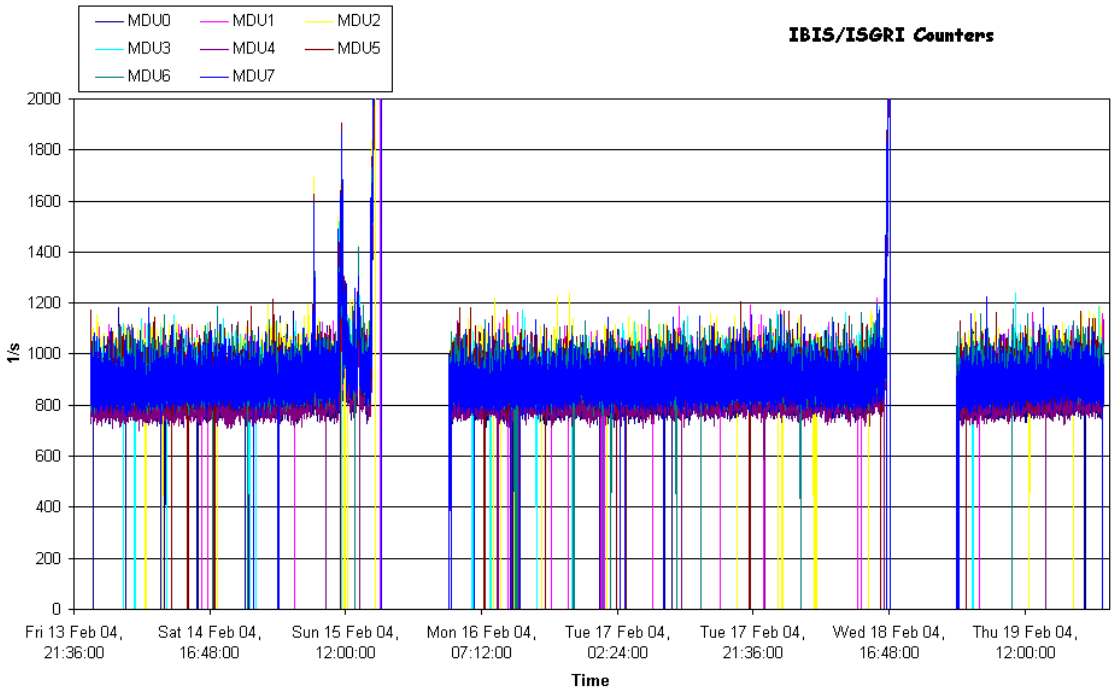
8.3.3 IBIS Operations

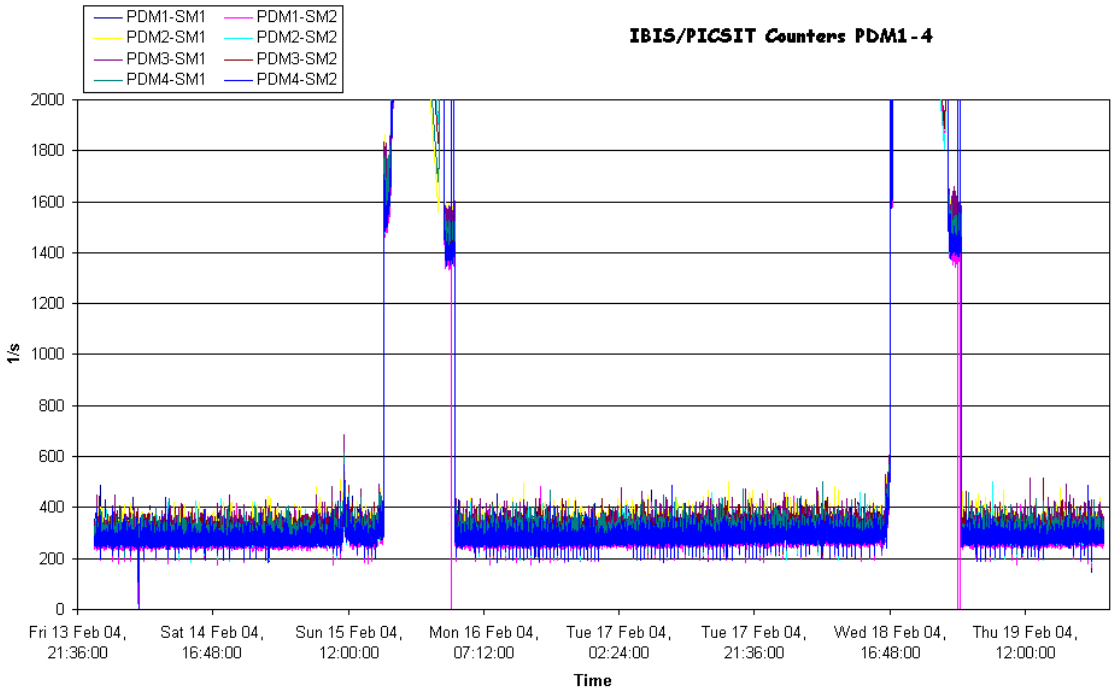
Plots of the VETO VDM/CDM current, the VETO bottom and lateral counter and the PICsIT PDM#1 SM1-2 dead times are shown below:

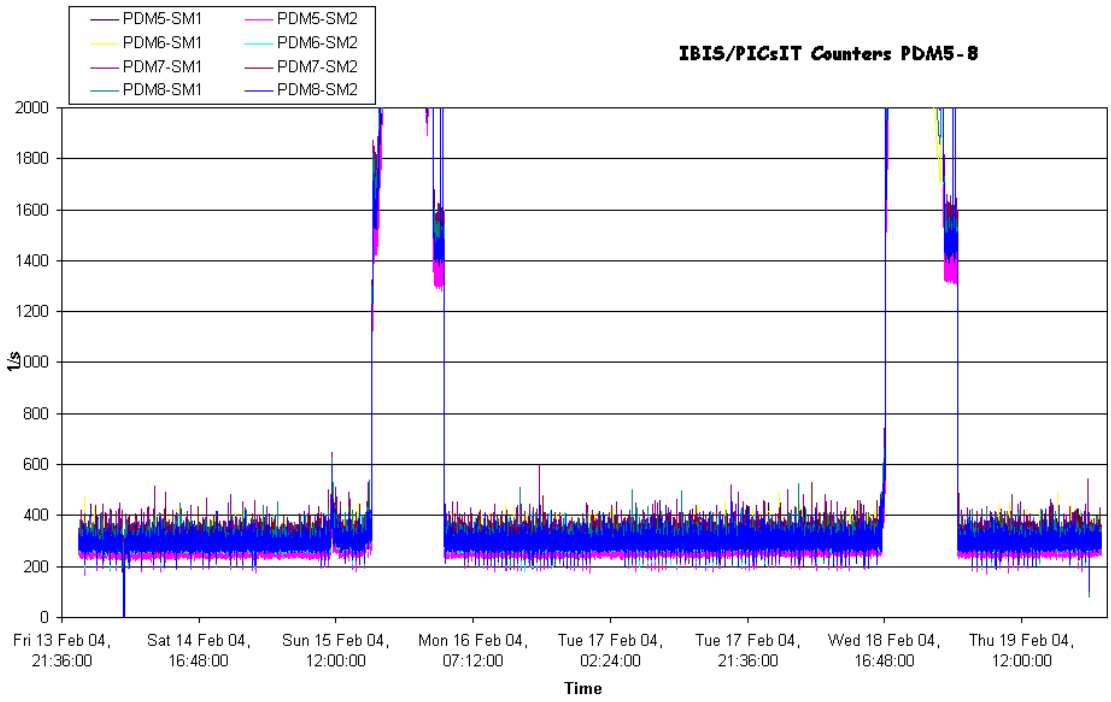




Plots of ISGRI and PICsIT counters, during the observation period are shown below.


IBIS/ISGRI Counters
MDU0
MDU1
MDU2
MDU3
MDU4
MDU5
MDU6
MDU7
1/s
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Fri 13 Feb 04, 21:36:00
Sat 14 Feb 04, 16:48:00
Sun 15 Feb 04, 12:00:00
Mon 16 Feb 04, 07:12:00
Tue 17 Feb 04, 02:24:00
Tue 17 Feb 04, 21:36:00
Wed 18 Feb 04, 16:48:00
Thu 19 Feb 04, 12:00:00
Time


IBIS/PICSIT Counters PDM1-4
PDM1-SM1
PDM1-SM2
PDM2-SM1
PDM2-SM2
PDM3-SM1
PDM3-SM2
PDM4-SM1
PDM4-SM2
1/s
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Fri 13 Feb 04, 21:36:00
Sat 14 Feb 04, 16:48:00
Sun 15 Feb 04, 12:00:00
Mon 16 Feb 04, 07:12:00
Tue 17 Feb 04, 02:24:00
Tue 17 Feb 04, 21:36:00
Wed 18 Feb 04, 16:48:00
Thu 19 Feb 04, 12:00:00
Time



DOY 2004.045 (14/02/04)

At 06:07Z the parameter families G5068 and G5072 (PDM semimodules FIFO error flag) reported out of limits SCC (status consistency check fail) followed few minutes later by the PICSIT counters decreasing and the resynchronization of the HEPI HBR interface (OEM APID 1280 ID 132 Clas 0). The operator applied the recovery action P-FIF1 & 2 reported in the Payloads FDIR document clearing the problem.

DOY 2004.046 (15/02/04)

At 11:26Z the parameters G6062(VETO Bottom Counter) - G6063 (VETO Lateral Counter) - G8080 (HBR-A valid event rate meter) reported Soft High limits (went in/out limit for fewTM cycles). No action was taken, as suggested by FDIR doc.

At 16:04Z the parameter families G2013 (ISGRI Event Counter) reported Soft High limits (went in/out limit for fewTM cycles). The operator applied the recovery action I-CNT-1 reported in the FDIR document, clearing the problem.

At 17:04Z, the automatic transition to Safe configuration (IASW In Stand-By + HVs OFF) due to the high radiation background (electron counter > 384 cts/10 sec), was reported, about 53 minutes prior the S/C broadcasted Radiation Belts entry time (see below).

RAD_ENTR R 2004-02-15T17:57Z D Radiation belt entry time

There were a few reported during the Belt passage the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the PICsIT detectors being ON without the VETO anticoincidence system, as required by the PIs.

DOY 2004.047 (16/02/04)

There were a few reported during the Belt passage the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the PICsIT detectors being ON without the VETO anticoincidence system, as required by the PIs.

DOY 2004.048 (17/02/04)

Nothing to report

DOY 2004.049 (18/02/04)

At 16:56Z, the automatic transition to Safe configuration (IASW In Stand-By + HVs OFF) due to the high radiation background (electron counter > 384 cts/10 sec), was reported, about 50 minutes prior the S/C broadcasted Radiation Belts entry time (see below).

RAD_ENTR R 2004-02-18T17:46Z D Radiation belt entry time

There were a few reported during the Belt passage the OEM APID 1280 ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the PICsIT detectors being ON without the VETO anticoincidence system, as required by the PIs.

DOY 2004.050 (19/02/04)

Reported at 21:28Z the parameters family G5072 (PDM semimodules FIFO error flag) in out of limits SCC (status consistency check fail). At 21:29Z the problem was cleared autonomously and no further action was taken, according to the recovery action P-FIF2, given in the FDIR document.

DOY 2004.051 (20/02/04)

Nothing to report.

8.3.4 JEM-X Operations

2004-02-14 (DOY 045, Rev 163)

Nothing to report

2004-02-15 (DOY 046, Rev 163)

Starting at 00:28:40Z, there were several occurrences of the TM parameter L5136 BUFFER LOSS going out of limits as follows:

- 00:28:40Z (value = 138), remained out of limits for 6 TM cycles, reaching a maximum value of 709 at 00:29:04Z;
- 02:55:28Z (value = 126);
- 02:56:16Z (value = 109);

- 03:28:16Z (value = 106);
- 07:11:36Z (value = 401), remained out of limits for 8 TM cycles, reaching a maximum value of 1094 at 07:12:00Z.

At 07:13Z, about 9 hours before it was planned to put JEM-X2 into Safe mode before radiation belt entry, the parameter L5119 SOFTWARE TRIGGER went soft out of limits (value = 20211). At 07:18Z this parameter went hard out of limits (value = 24034) and at 07:19Z JEM-X2 made an autonomous transition to Safe mode. At this time, OEM189 JEM-X2 PROB DFEE 9 followed by OEM 254 ERROR OFF were received. Timeline commanding to JEM-X2 was disabled at 07:25Z.

At 07:30Z the IREM electron counter parameters K5317 and L5317 RAD MONITOR 3 also went out of limits (value = 69) and the OEM 231 JEM-X2 AUTO EVENT 1 was received. At 07:57Z OEM 233 JEM-X2 AUTO EVENT 3 was received after the IREM RMCR values had remained below the JEM-X2 thresholds for exiting from Safe mode for more than 10 minutes.

At 08:35Z, once the radiation counters had remained below the JEM-X2 threshold for exiting from Safe mode for more than 30 minutes, the recovery of JEM-X2 was started by executing procedure FCP_JEM2_0041 to bring JEM-X2 up to Setup mode. Procedure FCP_JEM2_1010 (JEM-X2 Configuration Setting for Science Ops) was then executed and at 09:08Z JEM-X2 was commanded back to Data Taking mode by the procedure FCP_JEM2_0044. At 09:09Z commanding to JEM-X2 by the automatic Timeline was re-enabled and JEM-X2 operations continued nominally.

At 10:56:32Z the TM parameter L5136 BUFFER LOSS went out of limits (value = 227) and remained out of limits for 6 TM cycles, reaching a maximum value of 708 at 10:57:04Z.

At 10:57:20Z the parameter L5119 SOFTWARE TRIGGER went soft out of limits (value = 20244) and remained out of limits for 3 TM cycles.

At 11:13:12Z the parameter L5119 went soft out of limits again (value = 20282) and at 11:17Z the IREM electron counter parameters K5317 and L5317 RAD MONITOR 3 also went out of limits (value = 90), causing the autonomous transition of JEM-X2 to Safe mode (issuing OEM 231 JEM-X2 AUTO EVENT 1). Timeline commanding to JEM-X2 was disabled at 11:35Z.

At 12:20Z JEM-X2 performed an autonomous recovery to Setup mode (issuing OEM 233 JEM-X2 AUTO EVENT 3) after the IREM RMCR values had remained below the JEM-X2 thresholds for exiting from Safe mode for more than 10 minutes.

Around 13:50Z there were a few more occurrences of out of limits on the IREM electron counter parameters K5317 and L5317 but, as they did not occur in 2 consecutive TM frames, JEM-X2 did not transition back to Safe mode. However, as the radiation levels were not stably within the JEM-X2 safe thresholds, no recovery to Data Taking mode was attempted.

At 16:21Z JEM-X2 made another transition back to Safe mode (issuing OEM 231 JEM-X2 AUTO EVENT 1) after the parameters K5317 and L5317 RAD MONITOR 3 went out of limits again (value = 70).

At 16:31Z commanding to JEM-X2 from the autostack was enabled to allow the ED LESAFE01 to be executed from the Timeline at 16:36:02Z, such that JEM-X2 would remain in Safe mode as planned for the remainder of the revolution. At this time another OEM 231 JEM-X2 AUTO EVENT 1 was received.

2004-02-16 (DOY 047, Rev 163-164)

Nothing to report

2004-02-17 (DOY 048, Rev 164)

Nothing to report

2004-02-18 (DOY 049, Rev 164)

At 01:59Z the following radiation monitoring parameters from IREM went Out of Limits:

K5317 RAD MONITOR 3 (Electron Counter), value = 66
L5317 RAD MONITOR 3 (Electron Counter), value = 66,

causing JEM-X2 to transition to Safe mode autonomously (issuing OEM 231 JEM-X2 AUTO EVENT 1). Timeline commanding to JEM-X2 was disabled at 02:01Z.

At 02:13Z JEM-X2 performed an autonomous recovery to Setup mode (issuing OEM 233 JEM-X2 AUTO EVENT 3) after the IREM RMCR values had remained below the JEM-X2 thresholds for exiting from Safe mode for more than 10 minutes.

At 02:54Z the recovery of JEM-X2 was started by executing procedure FCP_JEM2_1010 (JEM-X2 Configuration Setting for Science Ops) and at 03:26Z JEM-X2 was returned to Data Taking mode by procedure FCP_JEM2_0044. Timeline commanding to JEM-X2 was then re-enabled.

At 16:12Z the parameter L5119 SOFTWARE TRIGGER began to be out of limits (value = 20158) and at 16:13Z JEM-X2 transitioned back to Safe mode. The parameter L5462 DFEE STATE IASW reported state Safe (value = 1) on one occurrence but then started to report state Setup (value = 5), and there were two occurrences of the OEM189 JEM-X2 PROB DFEE 9 at this time.

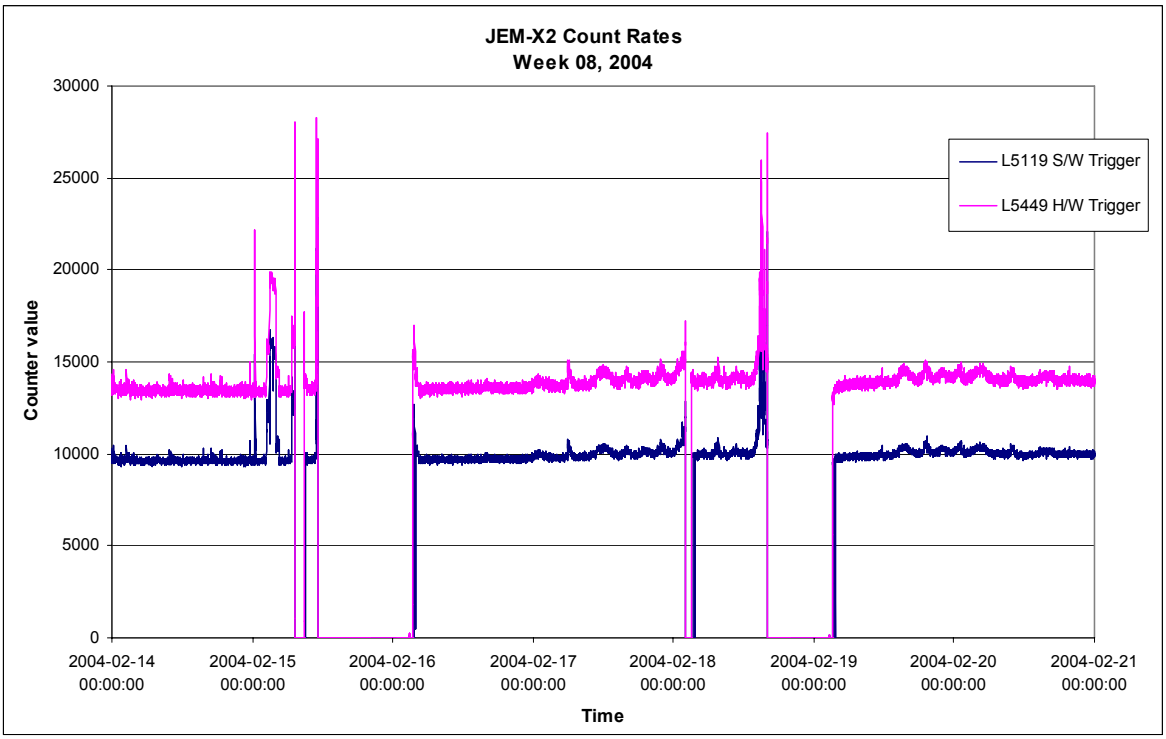
The status remained as such until 16:25Z, when the ED LESAFE01 was executed from the Timeline. At this time the parameter L5462 DFEE STATE IASW began to report state Safe (value = 1) and OEM 254 ERROR OFF was issued.

2004-02-19 (DOY 050, Rev 164-165)

Nothing to report

2004-02-20 (DOY 051, Rev 165)

Nothing to report



8.3.4.1 JEM-X2 Count Rates

JEM-X2 count rates over the reporting period are displayed in the following graph[1].

8.3.5 OMC Operations

On DoY 048 at 17:15, due to problems at the ground station from RFI, a command failed release, which caused the Timeline to be stopped. Subsequently more RFI hampered the recovery, and although OMC was put into SCIENCE mode, the attitude was not correct, the Timeline was eventually rejoined at the end of pointing 01640075, but the RFI continued until the end of the pass, the impact was pointings 01640072 to 01640075 were lost.

On DoY 046, at 17:57:41, and again on DoY 049, at 17:46:37, OMC was switched by the Timeline to SAFE mode, at the nominal time.

Rejected Commands:

On DoY 048 at 17:19:25, 2 commands were rejected.

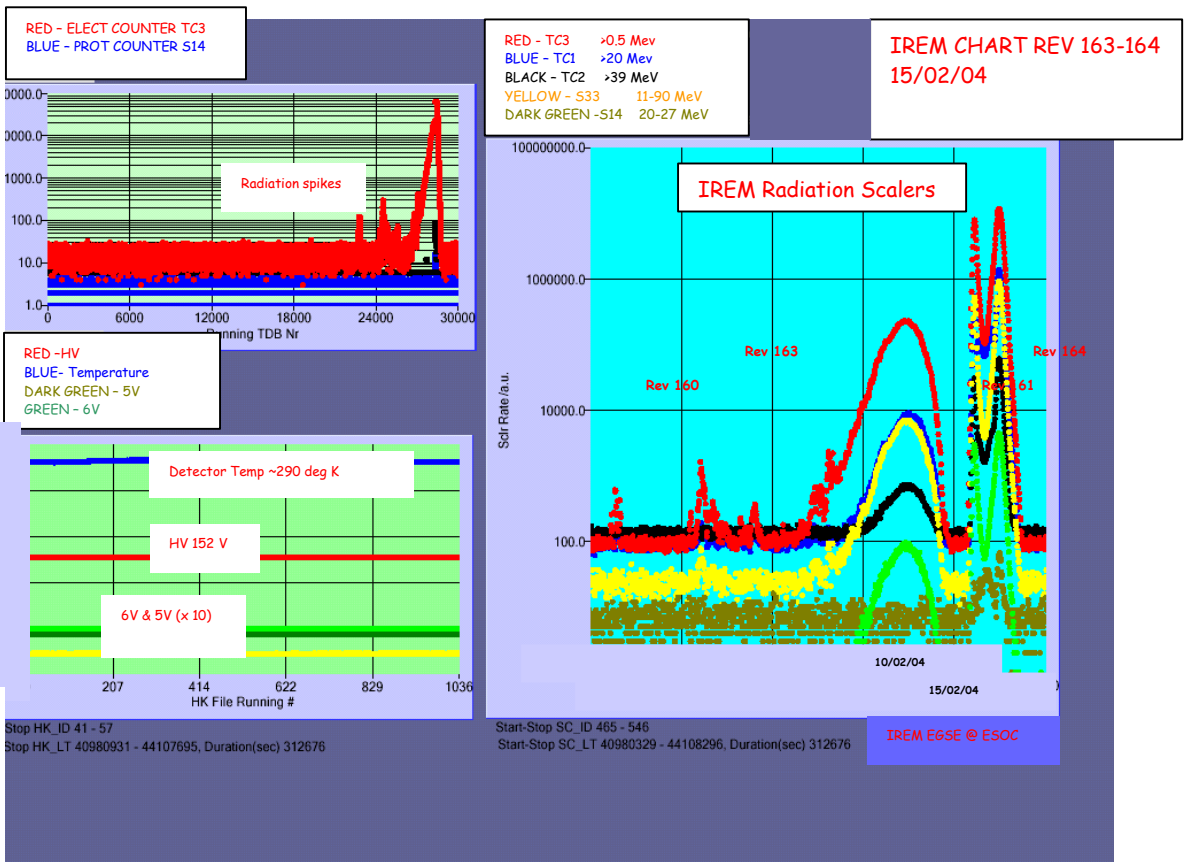
[1] Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer during slews.

```
2004.048.17.19.25.320 2004.048.17.19.15.000   1792  Real Time
Rejection 131       REJECTED TC1
        FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=60,IM A M9068=1
FIX2=0 M9069=611
2004.048.17.19.17.137 2004.048.17.19.08.750   1792  Real Time
Rejection 131       REJECTED TC1
        FIX2=0 M5010=6,NORMAL M9079=3 M9080=131 M5001=130,RESET IM
M9068=1 FIX2=0 M9069=610
```

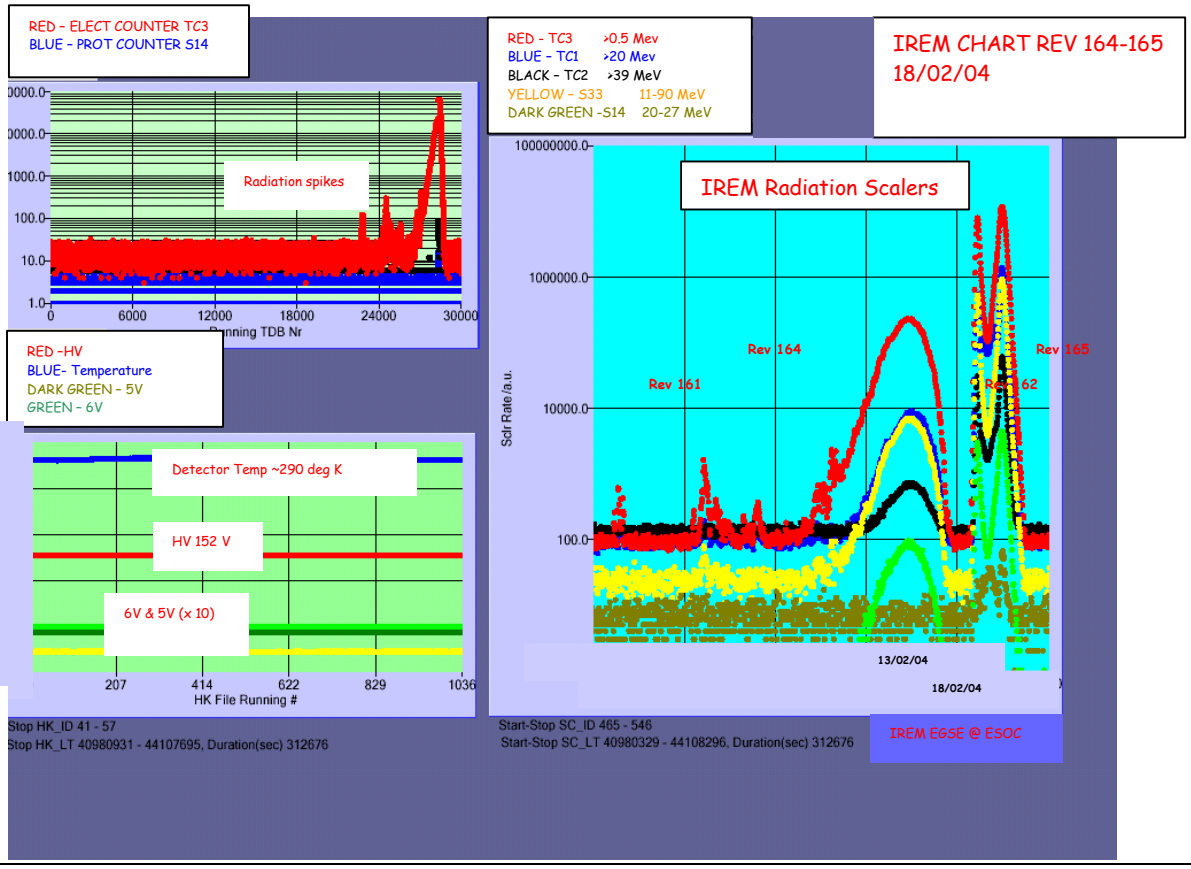
These correspond to the M1130 (Reset IM), and MU1310 (Imaging A) commands from the lost pointing: 01640072.

8.3.6 IREM Operations

Plots of the evolution of the IREM counters from rev 163-164 are shown below:

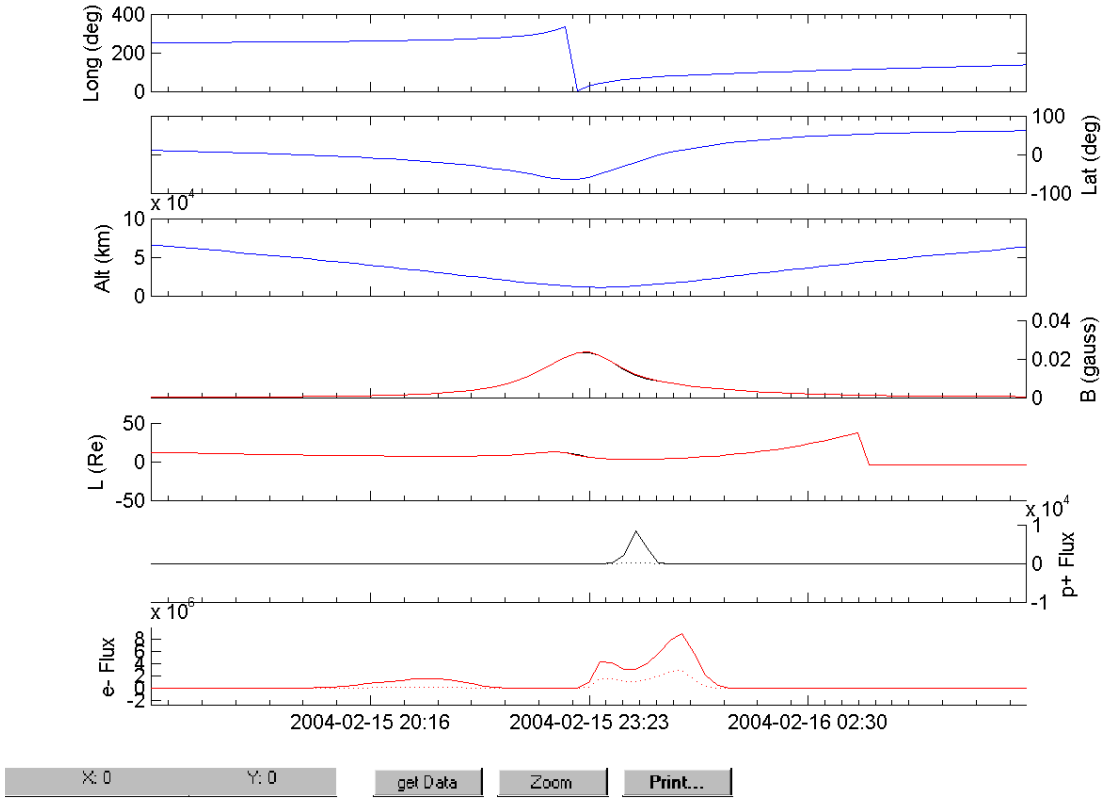


and rev 164-165

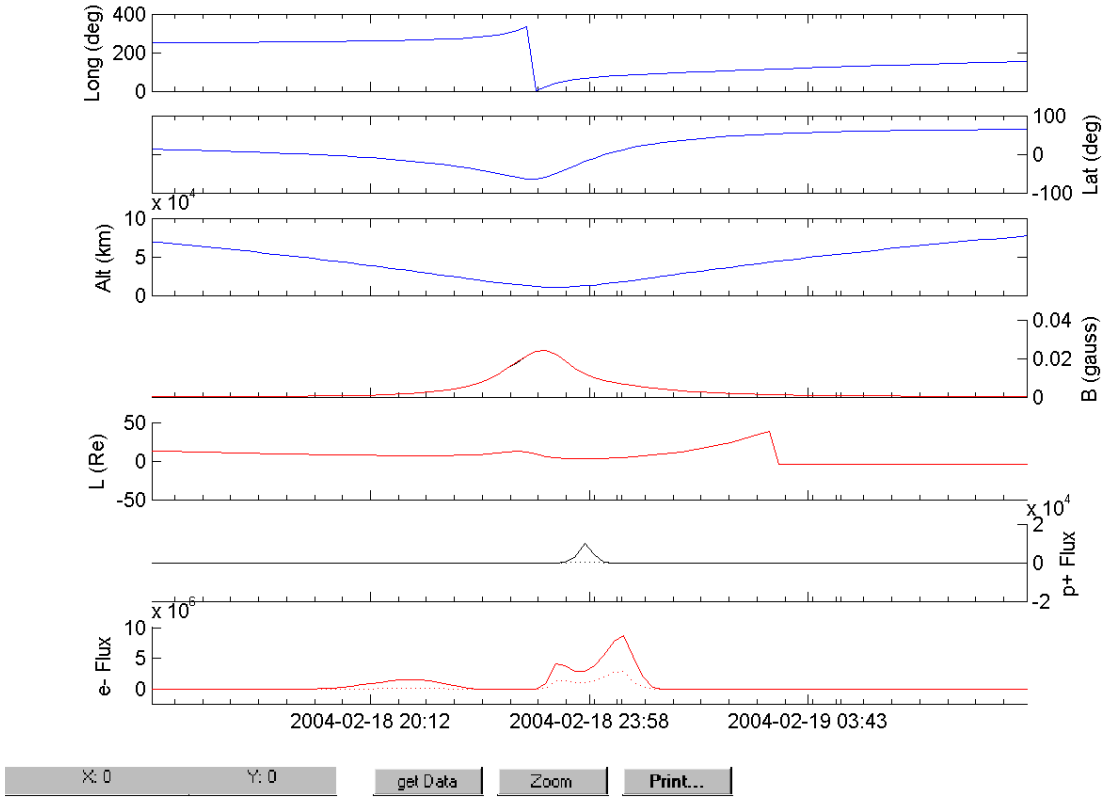


and the corresponding predictions for the Belts passages (as calculated with AP8Max and AE8Max models by using the RADMON tool).

Rev 163-164


Long (deg)
400
200
0
100
0
-100
Lat (deg)
x 10^4
Alt (km)
10
5
0
0.04
0.02
0
B (gauss)
L (Re)
50
0
-50
x 10^4
1
0
-1
p+ Flux
x 10^6
e- Flux
2004-02-15 20:16
2004-02-15 23:23
2004-02-16 02:30
X: 0
Y: 0
get Data
Zoom
Print...

rev 164-165


Long (deg)
400
200
0
100
0
-100
Lat (deg)
x 10^4
Alt (km)
10
5
0
0.04
0.02
0
B (gauss)
L (Re)
50
0
-50
x 10^4
2
0
-2
p+ Flux
x 10^6
e- Flux
2004-02-18 20:12
2004-02-18 23:58
2004-02-19 03:43
X: 0
Y: 0
get Data
Zoom
Print...