

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-OPS-OF
No. 097
Week 31
02.08.04
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.

It addresses the activities from 24.07.04 until 30.07.04 (both dates inclusive) and covers the revolutions 218 & 219.

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 plane; Cygnus X (RA 20:33:10.00; DEC +41:12:00.0) and PSR B1509-58 (RA 15:13:55.62; DEC -59:08:09.0). The activities consisted of GPS and raster dithering 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 new unexpected behaviour / malfunction was identified.

3.1.1 AOCS

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

The ping-pong filter hard-limit was exceeded during the perigee passage on 29/07/2004 at 12:03:53z. The event was caused by a high radiation background and probably also by the fact that the only "trackable" star in the first elementary search window was a dim star of magnitude 8.4.

The fuel consumption over the period between 23/07/2004 and 30/07/2004 was 0.193 kg. The remaining propellant is in the order of 169.169 Kg on the 30th of July.

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

3.1.2 Power

The EPS is working nominally, available power from the arrays is of the order of 2100W.

On DoY 2004.211 at 12:47:52Z the following events were observed:

P3001 "BDR2 ON/OFF STAT" went to "OFF" from a nominal status "ON"
P3004 "BCR1 ON/OFF STAT" went to "OFF" from a nominal status "ON"
P3016 "BAT1 RECO K09" went to "ON" from a nominal status "OFF"
P3040 "BCE2 PROT ENA M" went to "Disabled" from a nominal status "Enabled"

None of the reported events, being outside the Eclipse Season, were jeopardizing the performance and functionality of the EPS.

The only effect was a slight Battery 1 voltage decrease from an average value of 46.29 V to 45.47 V. This is explained by the Trickle Charge having stopped.

The EPS was reconfigured in its nominal status by running the dedicated procedures (FCP_EPS_1245-1280-1290-1231). No problems were encountered commanding the MRU. The S/S nominal configuration was reached at 13.55Z.

The S/S was monitored to confirm its stability and after about 2 h the Battery 1 reached a voltage of 46.09 V confirming its healthy status.

The cause is probably a SEU affecting the EPS MRU Memory Load Command Decoder Circuitry during the radiation belt passage.

A preliminary analysis of the MRU circuitry shows that the ML command interface has a very basic design. The Serial 16 bit commands are re-constructed as a parallel command by a shift register. A decoder, composed simply of a gate array, then interprets this parallel command. Finally a signal is sent to the commanded device that latches it with a flip/flop. The same decoder with an interposition of a driver unit commands the Battery Reconditioning Relays. This explains why a device like a relay, which needs some current to change status, was involved. Thus, a single SEU in the decoder can cause more than one bit to change status, therefore affecting several parts of the unit.

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

After the last week's failure of Germanium Detector#17, the overall status of the instrument in this week is nominal, except for the PSD (Pulse Shape Discriminator), which malfunctioned for a few minutes on 30th July: all the PSD channel rates suddenly and unexpectedly showed zero counts for a few minutes, reproducing the anomaly already observed on 18th July (see GeD#17 Failure Report by F.Cordero).

The science observation windows were characterized by periods of strong to moderate solar activity, which influenced the background and therefore the behaviour of the instrument (see plots of the ACS and GeD counters).

The instrument was however maintained in photon-by-photon mode with spectra TM enabled, an assigned TM bandwidth in the science windows of 103 pkts/cycle and an actual average occupation of 88.7 pkts/cycle.

The cryo-cooler is working well, maintaining the temperature within 85+/-1K, though a notable temperature drift is still present, since the end of the last annealing cycle.

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

3.2.2 IBIS

The overall status of the unit is Nominal.

During the reporting period the PST Allocation to IBIS was 129 TMSP / Cycle. The mean IBIS Bandwidth usage was 108.3 TMSP / Cycle, up 2.25 TMSP on last week.

The observation period was characterized by the influence of the past solar activity and by a new radiation event (see IREM part for more detail) on the structure of the Radiation Belts, that determined in two occasions (26 and 29th July) the autonomous transition to Stand-By with the deactivation of high voltages and biases.

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

3.2.3 JEM-X

The status of both JEM-X units is nominal.

JEM-X science operations were performed by the automatic Timeline.

JEM-X1 was operated in Data Taking mode during science observations; with a TM allocation of 8 packets/cycle. JEM-X2 was dormant with a TM allocation of 1 packet/cycle.

Due to high background radiation conditions, JEM-X1 made an autonomous transition to Safe mode at 2004-07-25T16:22Z (revolution 217). It was recovered back to Data Taking mode in revolution 218 at 2004-07-27T07:39Z however it went back to Safe mode ~6 minutes later due to a further spike in the radiation monitor count rates. JEM-X1 was recovered back to Data Taking at 2004-07-27T15:33Z, once the background radiation levels were stably below the JEM-X safe thresholds.

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.

On two occasions, OMC autonomously switch to SAFE mode due to high radiation counts that were detected by IREM.

There were 114 OMC pointings executed nominally, 4 were either delayed, cut short, or interrupted, and 35 were lost due to radiation.

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.

Solar Activity

The observation period was characterized by the influence of the past solar activity on the structure of the Radiation Belts. The CME on 22/07/2004 (due to sunspot#652) determined strong modification of the Belts characteristic during revolution 217 and 218.

A spike in the electron counter was detected on the 26th of July at 22h56.

High radiation background characterized the radiation belt passage from revolution 218 to revolution 219. The proton counter presented 2 strong peaks around 11:27Z and 11:57Z, almost 3 orders of magnitude over the typical values. All the other scalars reported exceptional high values.

The anomalies (PP filter threshold exceeded and SEU on EPS) observed on the S/C on DoY 2004.211 (rev 219) could be in relation with the high count-rates observed during the Belts passage.

Retrieved data from SEC-GOES presented high proton level on the 25th, 26th and 27th of July.

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 very good this week, well above the system performance requirements, 1 pointing was interrupted.

4.1 Mission Operations Centre

The performance of the MOC was in general good in the reporting period, there was a minor problems with the FDS, and a disk space problem with sun125, but apart from that, a quiet week.

4.2 Ground Stations & Network

The performance of the ground stations and Network was in general good this week. There were some problems with DSS-16 and the links to the station. The overall performance though was well above the 95% requirement.

4.3 Science Ground Segment

4.3.1 ISOC

1. Mission planning

PSFs: new files received for revolutions 226, 227. POS and POD: no new revolutions planned this week. Revolution 220 was replanned, to correct for a procedural error, which had led to the previous version being rejected by MOC. Its POS and POD are now version 7. TSFs: received up to revolution 220.

No Targets of Opportunity requests received.

2. Observation status

ECSs received for revolutions 201, 203 and 207...210. Still not received 205. Generation of corresponding OCSs has been held up - see below under "problems". Will be performed as soon as possible next week.

3. ISOC science data archive

The two new tapes referred to in last week's report (both containing scw data) have now been ingested into ISOC Science Data Archive. The scw data are now complete up to revolution 195.

4. ISOC system

The ISOC system version 10.4 patch 5 is still in use.

5. Problems

Some internal activities at ISOC have been affected by power cuts within ESTEC, that were either unannounced or took place at different times than had been announced. The disc of the ISOC ECM (file transfer) machine was thus destroyed; meanwhile that system is available again. Although there was no significant operational impact, some routine activities are slightly late.

4.3.2 ISDC

Status of ISDC observation processing on 02/08/2004:

- Latest Standard Analysis completed: amalgamated observations 02200210001, 02201030001, 02297000004 (Carina, Revolution 197-200) on 29/07/2004

- Latest products archived: amalgamated observations 02200210001, 02201030001, 02297000004 (Carina, Revolution 197-200) on 30/07/2004

- Latest observation products sent to the observer: observation 02201040001 (Sgr arm tangent, Revolution 176-187) on 20/07/2004

5 Special Events

6 Anomalies

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

- On DoY 207, at 20:56, the FDS did not update slew 02170063, the result was the slew was executed using default parameters.
- On DoY 208, at 04:53, the TM & TC links from DSS-16 dropped, the links returned at 04:56 only to drop again at 04:57, they returned finally at 05:27, the cause seems to have been an ISO router problem, the corresponding DR# is N102252.
- On DoY 209 at 11:12, there was a disk space alarm on sun125, this was resolved at 11:23 when a temporary file was removed, there was no impact.
- On DoY 210 at 05:18, there were antenna problems, which caused a slight delay to the handover to DSS-16. There was no impact, the corresponding DR# is G104663.
- On DoY 211 at 01:33, difficulties were experienced during the handover from Redu to DSS-16 with the binding to DSS-16 using either pass-specific or default SI's on nctrs-b, at 01:44, bind with nctrs-b was successful after the nctrs-b was rebooted. At 01:56, the link with Redu was dropped in preparation for the handover, which occurred at 01:57. The impact was a small interruption in pointing 02180067. The corresponding DR# is N102264.
- Later at 12:22, after the perigee passage, the AOCS was in an anomalous state, using the IMUs rather than the STR, see section 8.3.1 for details, also the battery discharge regulators were also in an anomalous state see section 3.1.2 for details.

The following new anomaly reports were entered into the ARTS system.

AR id	Date Occurrence	Subject	Segment	Status
INT_SC-88	29/07/2004	Ping-Pong Filter of the ACC triggered due to high radiation background,...	Spacecraft	Pending
INT_SC-89	30/07/2004	DoY 211_04 EPS Autonomously Changing Items ON/OFF Status	Spacecraft	Pending
INT-2622	27/07/2004	DoY 198_04 Lost TC Link from Goldstone	NASA Station	Pending
INT-2623	27/07/2004	DoY 201_04 No TC Bitlock at H/O to Goldstone	NASA Station	Pending
INT-2624	27/07/2004	DoY 205_04 Lost TM Links from Goldstone	I/F to JPL	Pending
INT-2625	27/07/2004	DoY 208_04 Lost TM & TC Links from Goldstone	I/F to JPL	Pending
INT-2626	30/07/2004	DoY 211_04 VC0 TM Link Drop from Redu	ESA Stations	Pending

7 Future Milestones

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 218

The observations in revolution 218 consisted of 16 pointings of a GPS lasting ~11 hours followed by an amalgamated raster dithering observation Cygnus X (RA 20:33:10.00; DEC +41:12:00.0), performed for the remaining ~50 hours of observation time.

During these observations all instruments were planned to be in their nominal science modes, except for JEM-X2, which was to remain in Safe mode. However, due to high levels of background radiation IBIS, JEM-X1 and OMC were in Safe mode during parts of these observations. The TM allocation throughout these observations was IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

Revolution 219

In revolution 219 an amalgamated raster dithering observation of PSR B1509-58 (RA 15:13:55.62; DEC -59:08:09.0) was performed throughout the available observation time (~61.5 hours).

During this observation all instruments were in their nominal science modes, except for JEM-X2, which was in Safe mode, and the TM allocation was IBIS 129; SPI 103; JEM-X1 8; JEM-X2 1; OMC 5.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2004-07-14T14:53:56.000Z	169.4535	F	Automatic TM processing.
2004-07-16T00:05:27.000Z	169.4302	F	Automatic TM processing.
2004-07-17T13:48:03.000Z	169.4113	F	Automatic TM processing.
2004-07-19T00:46:39.000Z	169.3948	F	Automatic TM processing.
2004-07-20T13:30:19.000Z	169.3825	F	Automatic TM processing.
2004-07-22T00:32:31.000Z	169.3621	F	Automatic TM processing.
2004-07-23T13:17:55.000Z	169.3384	F	Automatic TM processing.
2004-07-23T22:20:59.000Z	169.3178	F	Automatic TM processing.
2004-07-25T00:00:38.000Z	169.3016	F	Automatic TM processing.
2004-07-26T07:57:38.000Z	169.2291	F	Automatic TM processing.
2004-07-26T13:02:18.000Z	169.2216	F	Automatic TM processing.
2004-07-26T22:02:27.000Z	169.2060	F	Automatic TM processing.
2004-07-27T23:41:26.000Z	169.2020	F	Automatic TM processing.
2004-07-29T14:12:27.000Z	169.1809	F	Automatic TM processing.
2004-07-29T14:58:27.000Z	169.1691	F	Automatic TM processing.

This report was generated Fri Jul 30 08:00:16 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 Summary Operations Report 24/07/2004-30/07/2004

AOCS operations were executed from the Automatic Timeline.

During this period, 58 Open Loop Slews, 100 Closed Loop Slews and 8 Momentum Bias were executed. No slews were missed or executed manually.

24/07/04 (Day of Year 206, Revolution 217)

Nothing to report.

25/07/04 (Day of Year 207, Revolution 217)

Nothing to report.

26/07/04 (Day of Year 208, Revolution 217-218)

Flickering of the OTF due to yaw errors: After open loop slew 02180005, The ACC selected the guide star 3723-00483. The 8.3 Mi star was located on CCD position [-15213, -13509]. Due to a neighbouring 8.04 magnitude star (3723-00034), located at a distance of about 1.7 arc-minutes, the CCD position of the guide-star image was rather unstable and the OTF flickered several times during this pointing.

27/07/04 (Day of Year 209, Revolution 218)

Loss of guide star: At 16:24:11 the guide star was lost. The 8.4 Mi star was picked by the ACC after open loop slew 02180034 and was located on CCD location [-481, 21898]. The OTF dropped as a result.

28/07/04 (Day of Year 210, Revolution 218)

Nothing to report.

29/07/04 (Day of Year 211, Revolution 218-219)

The Ping-Pong Filter of the ACC triggered (hard limit) due to high radiation background at 12:03:53 during the perigee passage: At LOS the STR was tracking the 6.10 Mi Guide star on CCD location [4757, -15943] (Star Cat. #3159 1886). At 11:22:12, the number of detected False Events on the STR exceeded the STR SEU Filter of the ACC. The Guide star was released and the IMU was switched on by the ACC for control on Yaw. From this time on, the situation of the STR was very unstable because of high radiation and it could not hold onto the Guide Star. Each time the control of pitch and yaw was reverted to the STR but again the Guide Star was lost/released and the IMU was put back on control. Finally at 12:03:53, the hard-limit threshold (50) of the ping-pong filter was exceeded, the STR use was invalidated by the ACC and control on yaw was set permanently on the IMU. After AOS, all the

OEMs and the TM indicated the invocation of the ping-pong filter, hard-limit (not the rate). The recovery action started after performing the first investigations. With the first successful mapping after the anomaly, the STR found a guide star of magnitude 8.4 at CCD location [2914, -5427]. This was the only star brighter than magnitude 8.5 (the STR mapping threshold) in the first Elementary Search Window. Probably each time after the loss of the guide star, this same dim star was being picked by the ACC, which was then easily lost/released due to SEUs.

At 13:47:00, the STR was put back into the control loop by ground command and the recovery to rejoin the Timeline started. Slews 02190001 to 02190003 inclusive were missed from the Timeline.

The event was followed by another anomaly on the power subsystem, caused also by SEUs. IREM and SPI were also indicating a high radiation background

30/07/04 (Day of Year 212, Revolution 219)

Nothing to report.

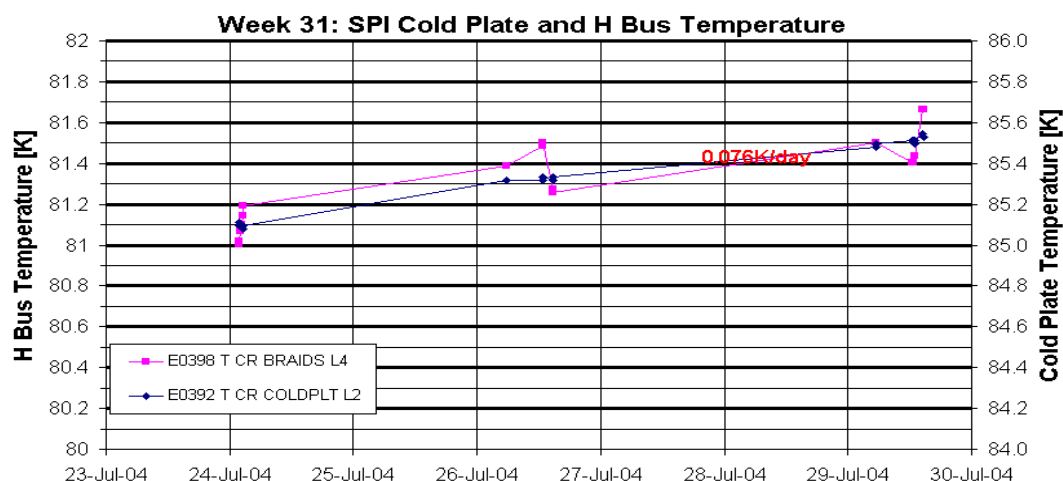
8.3.2 SPI Operations

Cryo-cooler / Detector Cold-Plate:

The performance of the cryo-cooler is nominal.

The cold plate temperature was maintained at 85K $\pm$ 1K though still showed a notable positive drift (+0.076K/day), present since the last annealing cycle, completed on 30th June. The SPI PI has been contacted to provide an assessment of this drift.

Due to data retrieval problems the plot showing the evolution of the cold-plate and H bus temperatures during the reporting period is affected by large data gaps.

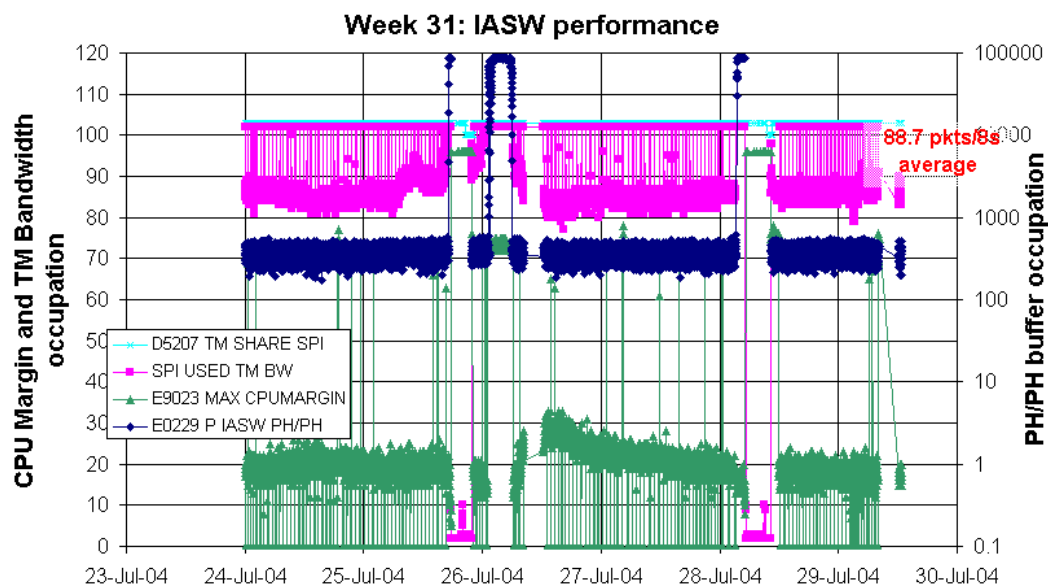


IASW/DPE:

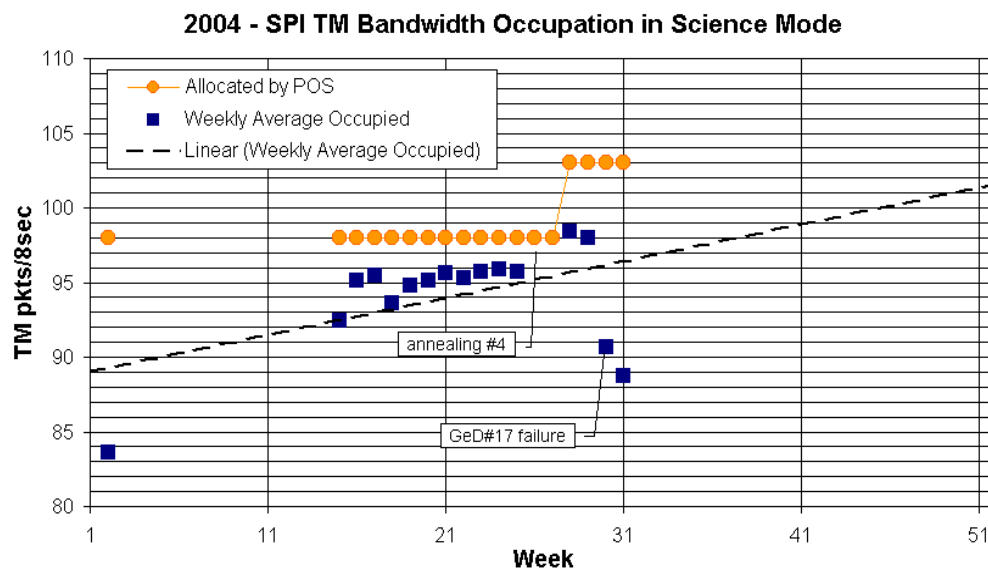
The performance of the IASW/DPE is nominal.

The average TM bandwidth occupation was 88.7 pkts/cycle in the science windows.

The following diagram shows the IASW performance in terms of TM bandwidth, event buffer occupation and DPE CPU load during the reporting period.



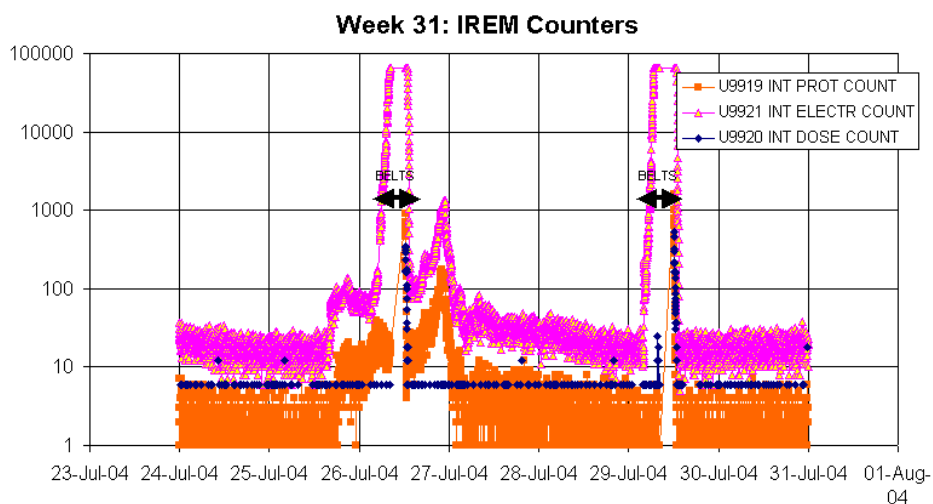
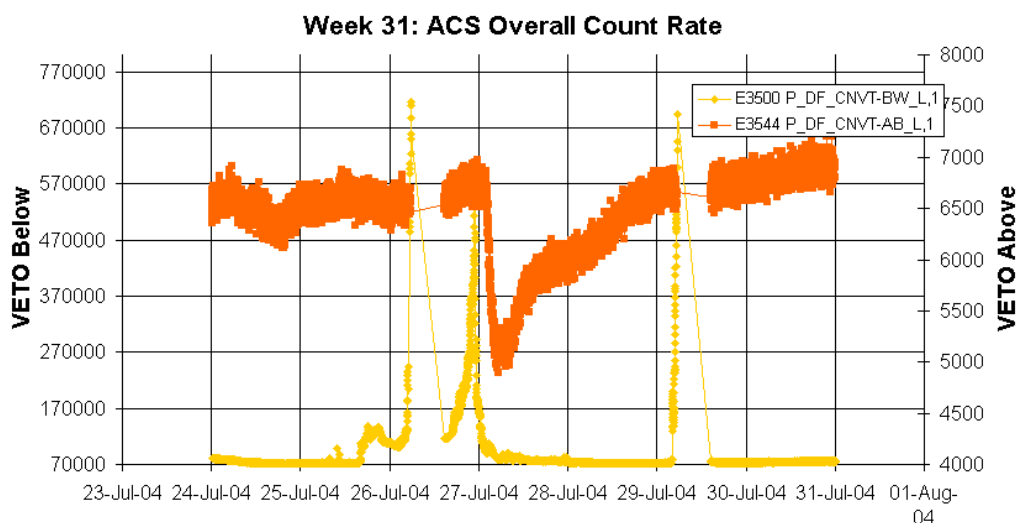
The following plot shows the trend of the occupied bandwidth, since beginning of 2004.



ACS:

The performance of the ACS is nominal. The increased background was clearly detected by the ACS veto below ($<100\text{MeV}$) counts, which showed peaks of an order of magnitude higher than normal (from $70\text{E}4$ to $70\text{E}5$), while the veto above ($>100\text{MeV}$) counts were not affected. The peaks correlate very well with the IREM proton counts, here attached for completeness.

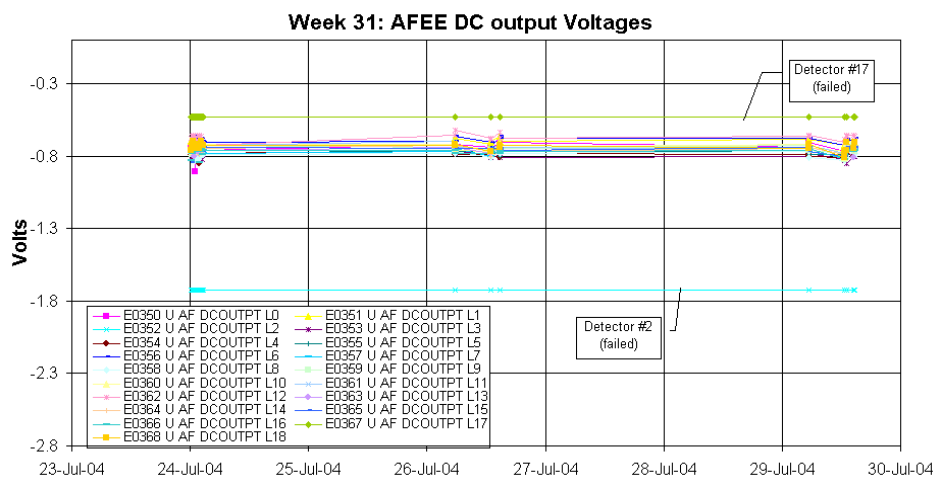
The plot showing the ACS overall count rate evolution during the reporting could not be produced.



AFEE:

The performance of the detectors is nominal except for the detector #2, failed since 06.12.2003, and detector #17, failed since 17.07.2004.

The following plot shows the AFEE dc output signals during the reporting period (Due to data retrieval problems the plot is affected by large data gaps).

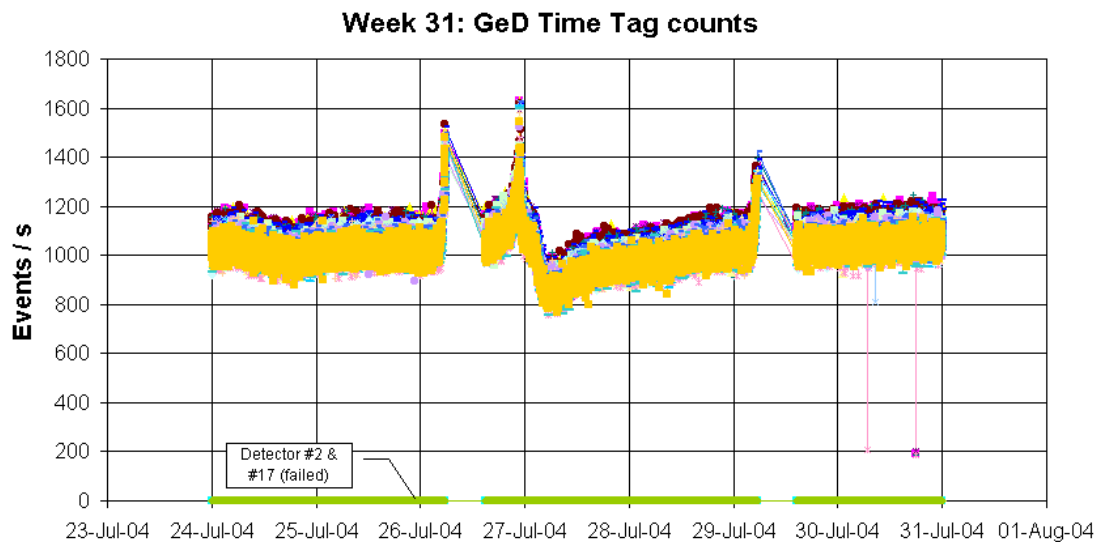
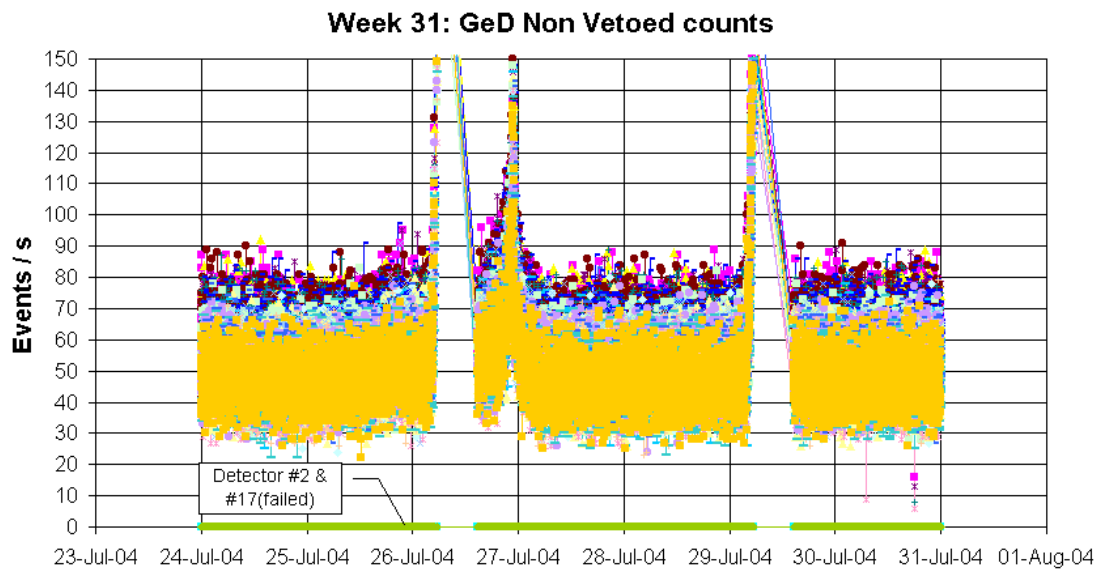


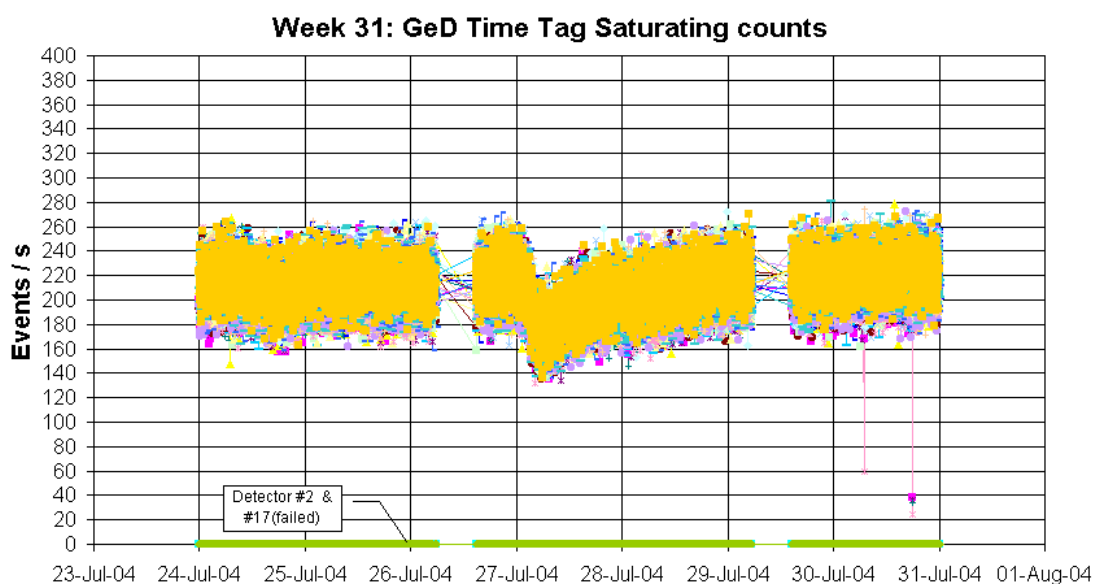
DFEE:

The performance of the unit is nominal.

The following plot shows the GeD Time Tagged, Time Tagged Saturating and Non Vetoed event rates processed by the DFEE during the reporting period.

The count rate of each detector is within the expected range, except for the failed detector #2 and #17. Peaks are due to the approaching belts passages or to increased background following solar activity.





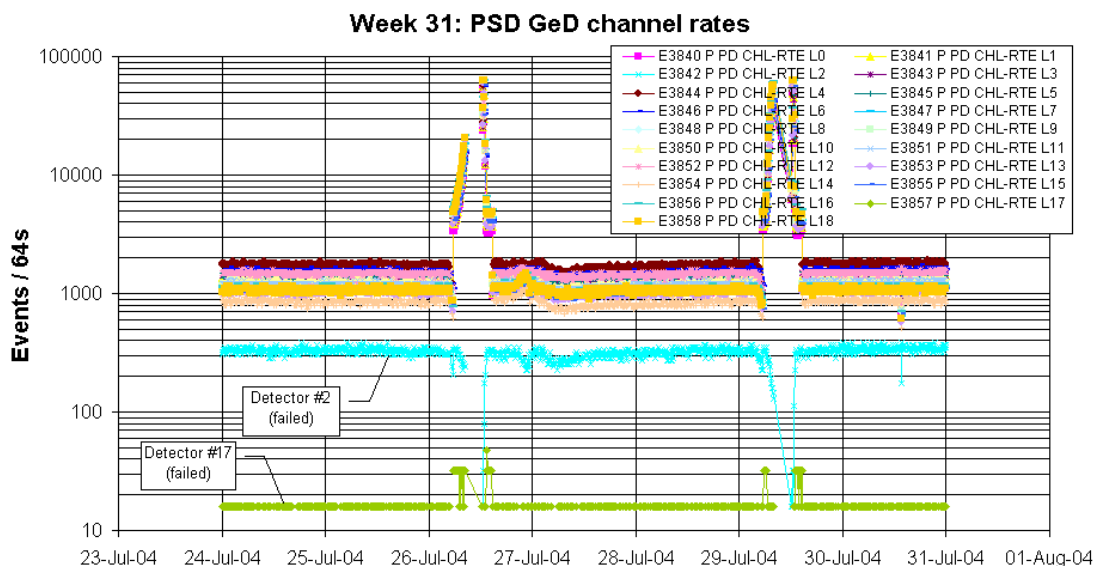
PSD:

The performance of the unit is nominal, though the malfunction for a few minutes on 30th July, where all the PSD channel rates suddenly and unexpectedly showed zero counts.

The anomaly affected only the PSD locally as the GeD count rates measured by the DFEE (see above) were still nominal; also the dc output voltage showed a nominal pattern during the malfunction.

This anomalous “hang-up” was already observed once, the day after the GeD#17 failure and current explanations correlate it to this failure.

The following plot shows the PSD channel rates during the reporting period.

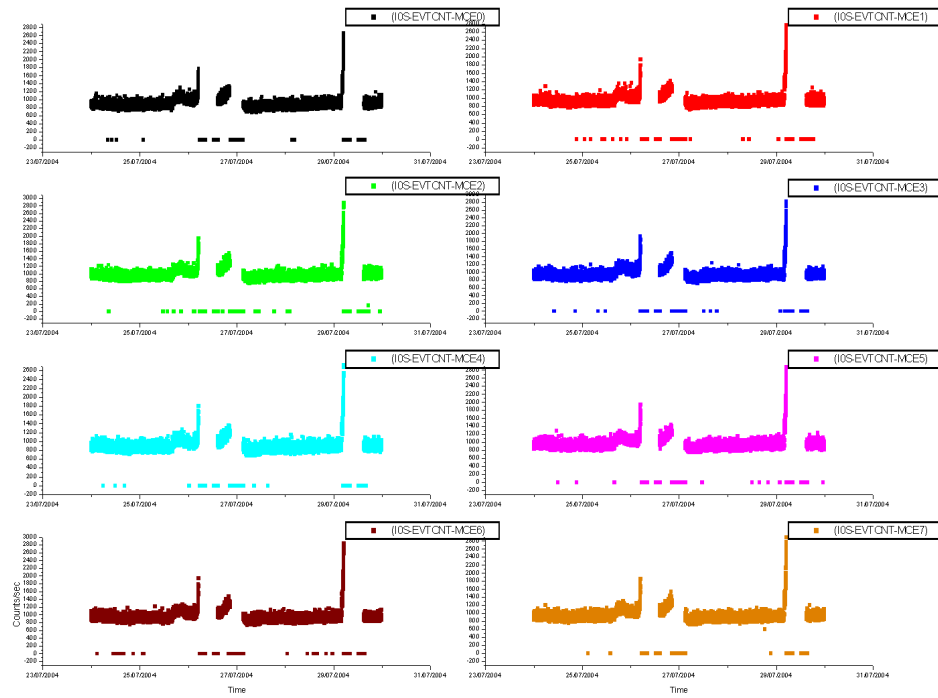


8.3.3 IBIS Operations

IBIS Event Counters Plots.

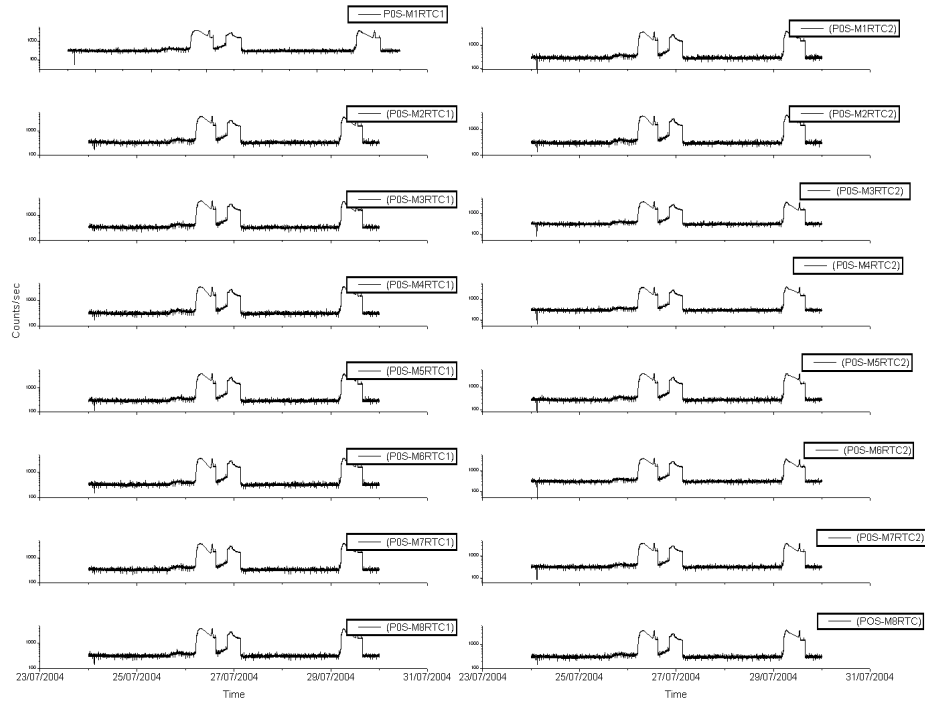
ISGRI Counters:

IBIS - ISGRI Counters Rev 217-218

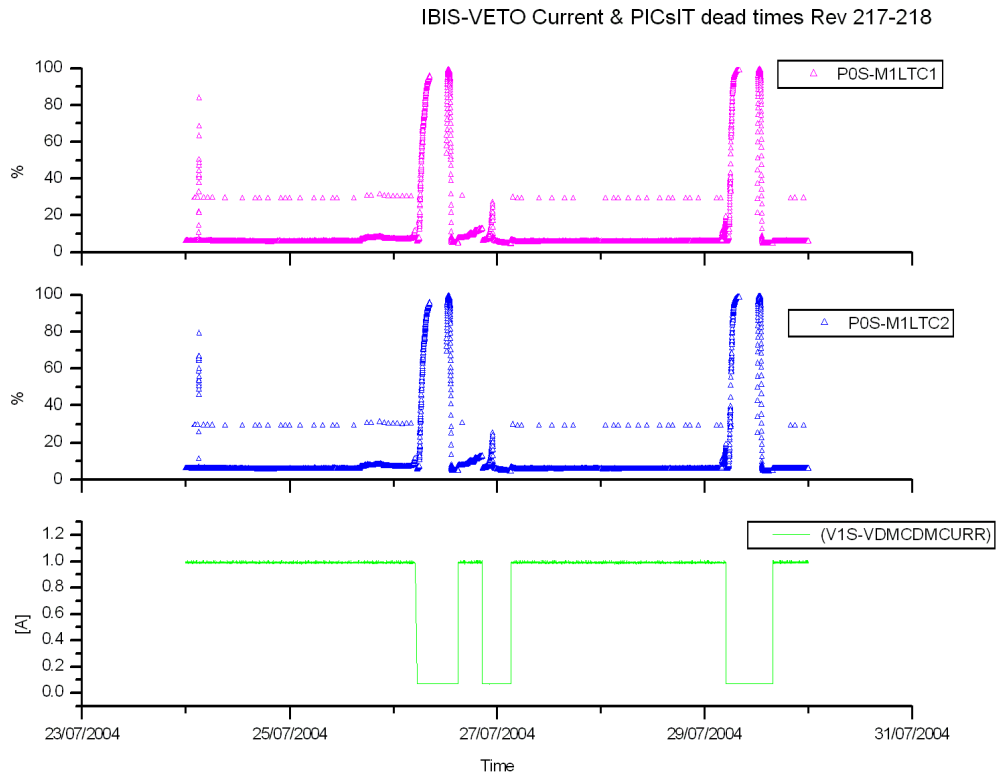


Picsit Counters:

IBIS - PICsIT Counters Rev 217-218



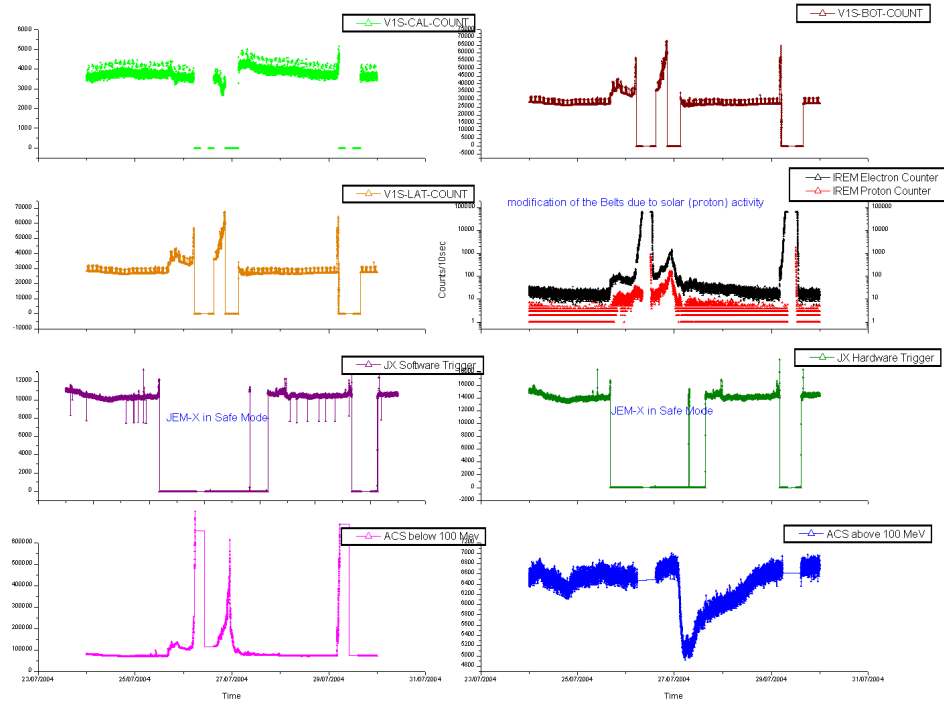
Veto Current:



VETO vs Payloads Counters

The comparison between the count-rates reported by VETO, the SPI-ACS, the IREM counters and JEM-X hardware/software triggers, gives in general an indication of stabilization of the background (protons and heavy ions) across the rev 217-218 (apart the temporary effect of the solar activity): this is shown by the following plot, in which all the on-board sources mentioned are considered.

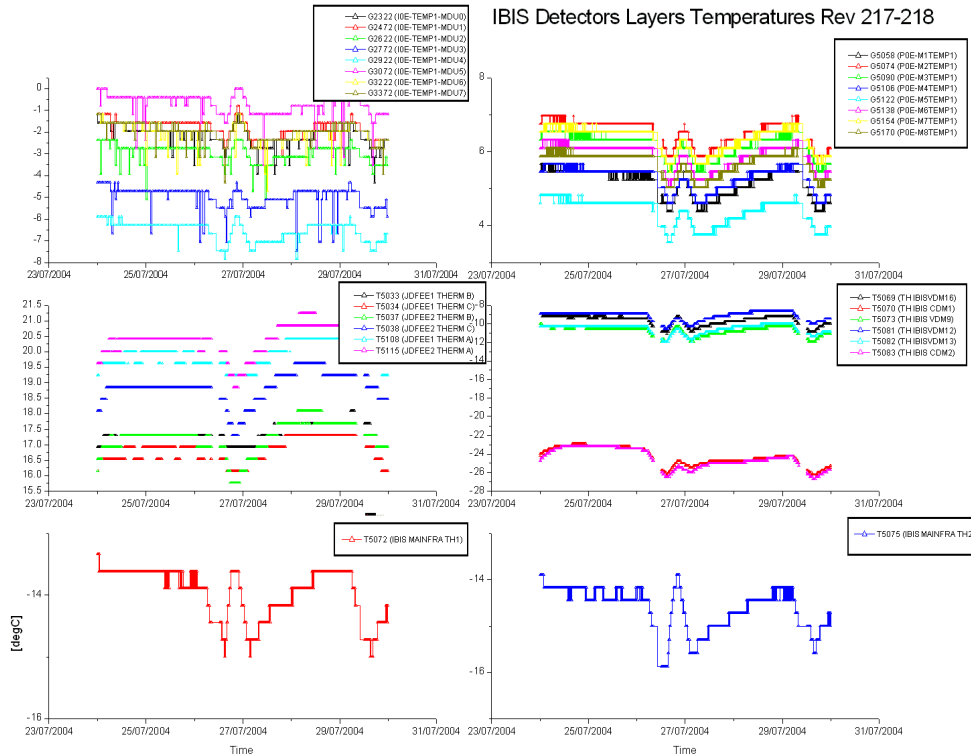
IBIS-VETO vs Payloads Counters Rev 217-218



*with the exception of IREM counters (counts/10sec), all the plots are reporting counts/sec

IBIS Detectors Layers Temperatures

IBIS Detectors Layers Temperatures Rev 217-218



IBIS daily report

DoY 2004.206 (24/07/04)

At 02:51 the TM parameter family G5068 (POS- M FIERRF) failed the SCC. After a few minutes the SCC was cleared and no further action was taken.

DoY 2004.207 (25/07/04)

At 17:33Z the TM parameter family G5004 (PDMs VETO strobe raw counters) reported alarm low several times for 1 or max 2 TM Cycles. This is an effect of the internal division factor (=16) applied and of the algorithm used for the calculation of count-rates, when in presence of high radiation environment. Was decided in agreement with the IBIS SOE to monitor the evolution of the VETO Lateral and Bottom counter and no further action was considered. The JEM-X1 and OMC units went in Safe Mode almost in the same period (at16:22Z and 19:43Z respectively)

DoY 2004.208 (26/07/04)

Due to high radiation condition, during the day, the TM parameter family G5004 (PDMs VETO strobe raw counters) reported alarm low several times for 1 or max 2 TM Cycles. This is an effect of the internal division factor (=16) applied and of the algorithm used for the calculation of count-rates, when in presence of high radiation environment. In agreement with the IBIS PIs was decided to modify the low limit to 1, to generate an alarm on-board only if the electrical link is affected.

There were a few reports 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.

Due to the high radiation condition that characterized the day, the following parameters

G8080 Valid event rate on HBRA
G6062 counter for VETO bottom
G6063 counter for VETO lateral

several times were observed to enter/exit the alarm high condition for few minutes. No further action was taken.

At 20:36Z due to the increasing of the radiation (electron) count-rate the unit performed an autonomous transition to Stand-By with all the high voltages and biases deactivated.

DoY 2004.209 (27/07/04)

At 03:07Z after the radiation count-rates dropped down well below the IBIS radiation thresholds the unit was recovered and reconfigured to Standard Mode (03:18Z)

At 7:28Z the sequence GESTAN02, which was not uplinked at 02:40Z as the unit was disabled from the timeline, was re-uplinked to correct the configuration for the running observation.

For all the duration of the day was reported moderate/high radiation condition that triggered the autonomous reaction of the OMC and JEM-X1 unit. IBIS continued the observation in Scientific Mode because none of the radiation thresholds was exceeded or ~ reached.

DoY 2004.210 (28/07/04)

Nothing to report.

DoY 2004.211 (29/07/04)

Due to moderate radiation conditions during the early morning, the parameter family

G2013	number of events triggering the MCEs per second
G8080	Valid event rate on HBRA
G6062	counter for VETO bottom
G6063	counter for VETO lateral

reported OOL several times for few TM Cycles.

At 05:05Z almost 20 minutes before the radiation Belts Entry, triggered by the radiation count-rates the unit performed an autonomous transition to Stand-By with all the high voltages and biases deactivated.

During the two anomalies reported by the S/C (Star tracker and Battery 1) at 12:22Z the status of the unit was nominal. The reconfiguration of the unit inside the Belts was anyway delayed after the recovery of the AOCS and EPS s/s. IBIS went in Scientific Standard Mode at 15:50Z

DoY 2004.212 (30/07/04)

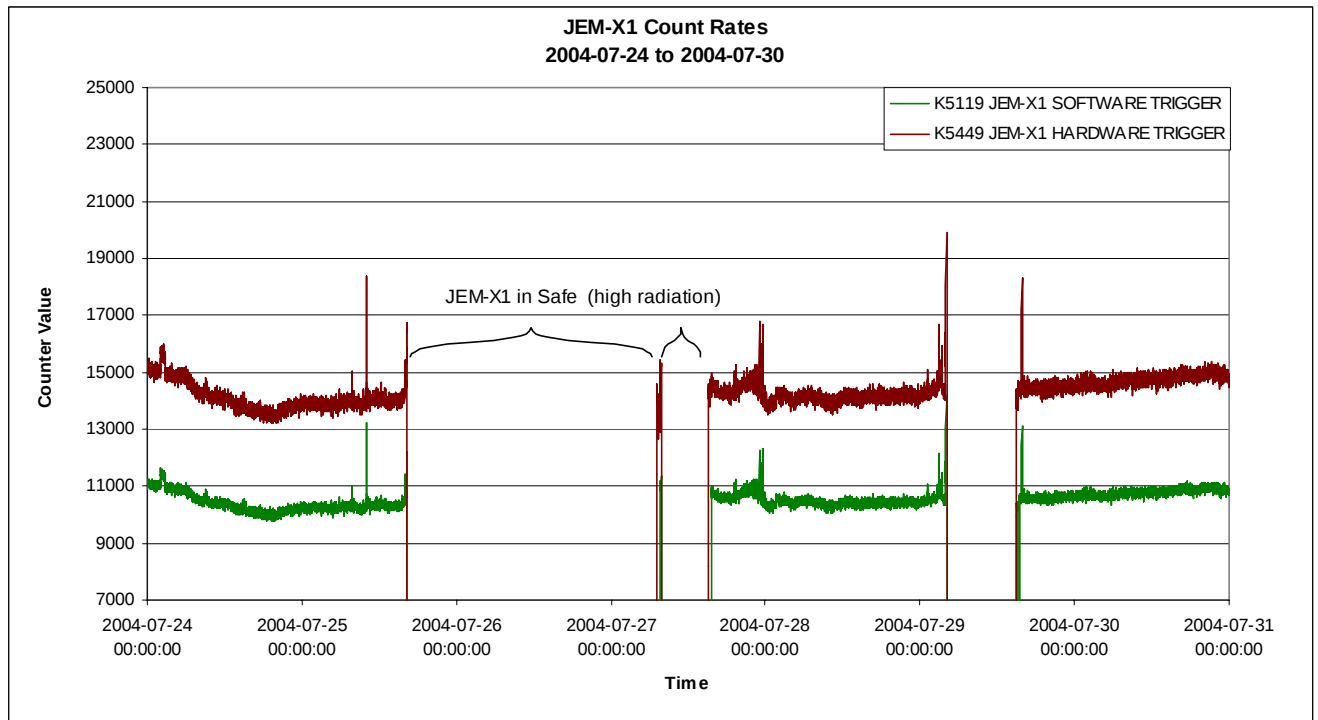
At 2:50Z the parameter G6061 (counter for VETO calibration unit) reported alarm low. After consultation with the IBIS SOE it was decided to switch OFF the VETO high voltages (by cycling the VETO mode Nominal/Stand-By) for 5 minutes. After the transition back to Standard Mode the parameter G6061 reported within limits. No further action was taken.

8.3.4 JEM-X Operations

8.3.4.1 JEM-X Count Rates

JEM-X count rates over the reporting period are displayed in the following graph¹.

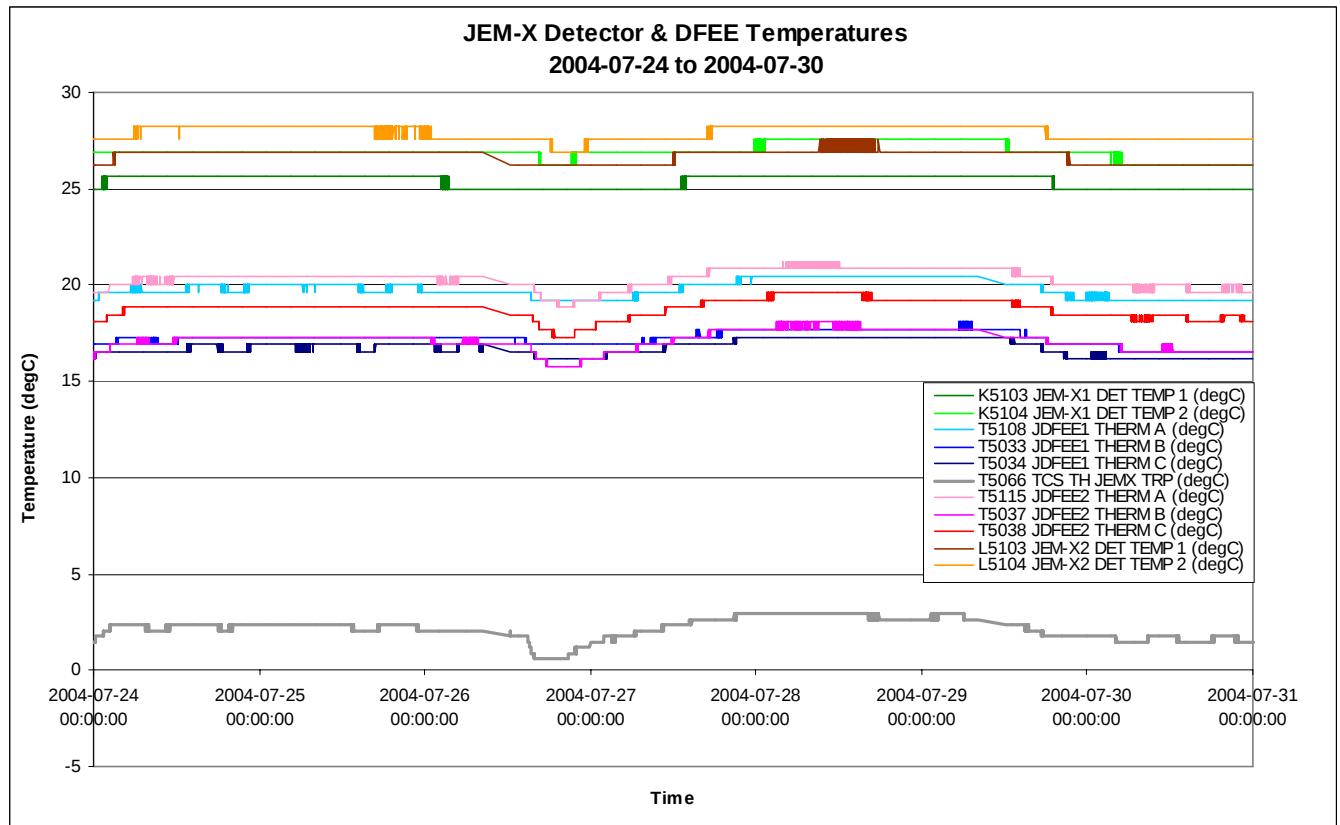
¹ Data sampled (1 frame in 4) and smoothed to remove spikes in S/W Trigger due to flushing of buffer after slews.



8.3.4.2 JEM-X Temperatures

The JEM-X1 and JEM-X2 detector temperatures over the reporting period are displayed in the following graph, along with the temperatures at a selection of DFEE locations and on the detector bench between the two units².

² Data sampled (1 frame in 8)



8.3.4.3 JEM-X Daily Report

2004-07-24 (DOY 206, Rev 217)

Nothing to report.

2004-07-25 (DOY 207, Rev 217)

At 16:22Z the following radiation monitoring parameters from IREM went Out of Limits:

K5317 RAD MONITOR 3 (Dose Counter), value = 71,
 causing JEM-X1 to transition to Safe mode autonomously (issuing OEM 231 JEM-X1 AUTO EVENT 1). At 16:26Z commanding to both JEM-X units was disabled from the automatic Timeline.

JEM-X1 remained in Safe mode for the rest of this day.

2004-07-26 (DOY 208, Rev 217-218)

JEM-X1 began the day in Safe mode due to high background radiation levels.

Although JEM-X1 was already in Safe mode, commanding to JEM-X1 from the automatic Timeline was temporarily re-enabled between 04:16Z and 04:20Z in order to allow the ED KESAFE01 (JEM-X1 to Safe mode) scheduled in the Timeline at 04:19Z, before radiation belt entry of revolution 217, to be executed. (The resulting

transition of the Active Shutdown Level through NORMAL and back to RAD BELTS generated the OEM 231 JEM-X1 AUTO EVENT 1.)

For the start of revolution 218, commanding to both JEM-X units from the Autostack was re-enabled at 11:06Z. The ED KEACAL01 (JEM-X1 anode calibration) was thus executed nominally before radiation belt exit. However, as the background radiation level was still above the safe threshold for JEM-X at radiation belt exit, commanding to both JEM-X units was disabled from the Timeline at 14:49Z. Thus JEM-X1 was not activated at radiation belt exit but instead remained in Safe mode for the remainder of the day.

2004-07-27 (DOY 209, Rev 218)

JEM-X1 began the day in Safe mode due to high background radiation levels.

At 04:06Z JEM-X1 performed an autonomous recovery to Setup mode (issuing OEM 233 JEM-X1 AUTO EVENT 3) after the IREM RMCR values had remained below the JEM-X1 thresholds for exiting from Safe mode for more than 10 minutes.

At 06:34Z the TM parameter K5317 RAD MONITOR 3 went out of limits (value=66) but then returned within limits in the next TM cycle and thus JEM-X1 remained in Setup mode.

At 07:01Z the procedure FCP_JEM1_1010 (JEM-X1 Configuration Setting for Science Ops) was executed and at 07:39Z JEM-X1 was then commanded back to Data Taking mode by the procedure FCP_JEM1_0044. However, at 07:45Z the parameter K5317 RAD MONITOR 3 went out of limits again (value = 68), causing JEM-X1 to go back to Safe mode autonomously (issuing OEM 231 JEM-X1 AUTO EVENT 1).

At 11:27Z JEM-X1 performed an autonomous recovery to Setup mode (issuing OEM 233 JEM-X1 AUTO EVENT 3) after the IREM RMCR values had remained below the JEM-X1 thresholds for exiting from Safe mode for more than 10 minutes. The recovery was postponed until it was observed that the background radiation levels had remained stably below the JEM-X safe thresholds for a considerable period of time (~3 hours). Considering the length of time for which JEM-X1 had been in Safe mode (~2 days), an anode calibration was performed at 14:52Z by procedure FCP_JEM1_0042, prior to the activation of the unit. At 15:02Z the procedure FCP_JEM1_1010 (JEM-X1 Configuration Setting for Science Ops) was executed and at 15:33Z JEM-X1 was then commanded back to Data Taking mode by the procedure FCP_JEM1_0044. At 15:35Z commanding to both JEM-X units from the automatic Timeline was re-enabled and JEM-X1 operations continued nominally.

2004-07-28 (DOY 210, Rev 218) to 2004-07-30 (DOY 212, Rev 219)

Nothing to report.

8.3.5 OMC Operations

On DoY 207, at 19:43:50, OMC went to SAFE mode due to the high levels of radiation being experienced. It was not put back into SCIENCE mode until DoY 209 at 04:17:26, the impact was pointing 02170060 was cut slightly short, with pointings 02170061 through to 02170069 at the end of the revolution lost. In the following revolution, the radiation was still too high resulting in OMC staying in SAFE mode, during the early part of revolution 218, the impact was pointings 02180004 through to 02180021 completely lost, pointing 02180022, was started late, with the following pointing continuing as per the timeline.

On DoY 208, at 12:42, during the perigee passage from Rev 217 to 218, there was a non-critical SECL OEM, when temperature detected in the middle of the lens barrel (parameter T5016, OMC LENS TEMP1) went below the limit of -10°C. The autonomous on-board monitoring routine SECL turned on heater 39 (ref: OMC LNSA ON in SECL nominal heater table) to control the situation.

On DoY 209, at 07:50:22, OMC autonomously switched to SAFE mode due to the high levels of radiation being experienced. It remained in SAFE mode until later in the day at 14:40:13, the impact was pointing 02180026 was interrupted, and pointings 02180027 through to 02180032 inclusive were lost

On DoY 211, at around 02:00, there was a small interruption in pointing 02180067 due to antenna problems.

Later, at 12:22, after the perigee passage, due to high radiation, the spacecraft emerged with the IMU's on and no star being tracked. The problem was eventually resolved at 16:32, the impact being pointings 02190002 and 02190003 were lost.

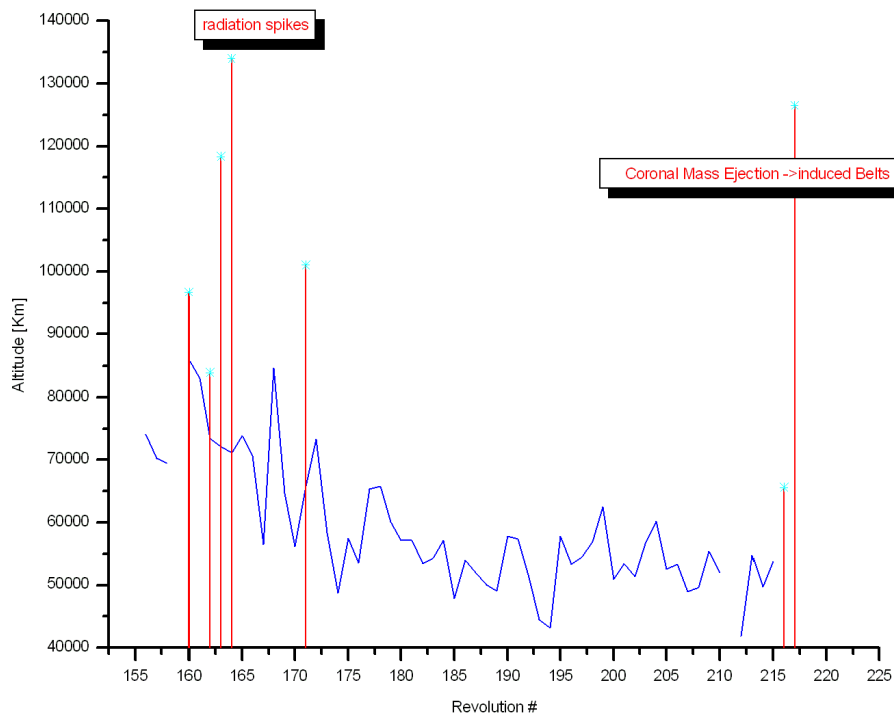
No commands were rejected this week.

On DoY 211 at 05:26:36, OMC was switched by the Timeline to SAFE mode, at the nominal time.

8.3.6 IREM Operations

Radiation Belts Entry

Evolution of Radiation Belt Entry 2004



Electron Belts

REV	S/C BCPKT (electron)	Electron CUT - OFF Observed Entry/Exit	Observed Entry/Exit Altitude [Km]	Electron CUT - OFF Predicted Entry/Exit	Predicted Entry/Exit Altitude [Km]
210	RAD_ENTR R 2004-07-05T07:17Z	05/07/2004 08:16Z	52025	Not available	Not available
211	RAD_EXIT R 2004-07-05T16:24Z	05/07/2004 14:57Z	24849	Not available	Not available
211	RAD_ENTR R 2004-07-08T07:05Z	08/07/2004 08:20Z	49280	Not available	Not available
212	RAD_EXIT R 2004-07-08T16:12Z	08/07/2004 14:54Z	>24848	Not available	Not available
217	RAD_ENTR R 2004-07-26T05:41:46Z	2004-07-25 16:22:09	126506.6	26-Jul-2004 06:26	53684
218	RAD_EXIT R 2004-07-26T14:49:18Z	2004-07-27 10:44:49	137490.8	26-Jul-2004 13:26	27011
218	RAD_ENTR R 2004-07-29T05:26:22Z	2004-07-29 04:05:30	69961.3	29-Jul-2004 06:09	54331
219	RAD_EXIT R 2004-07-29T14:33:44Z	2004-07-29 13:24:58	>24852.9	29-Jul-2004 13:19	27932

Reference

Small error vs reference

Large error vs reference

Radiation Spike

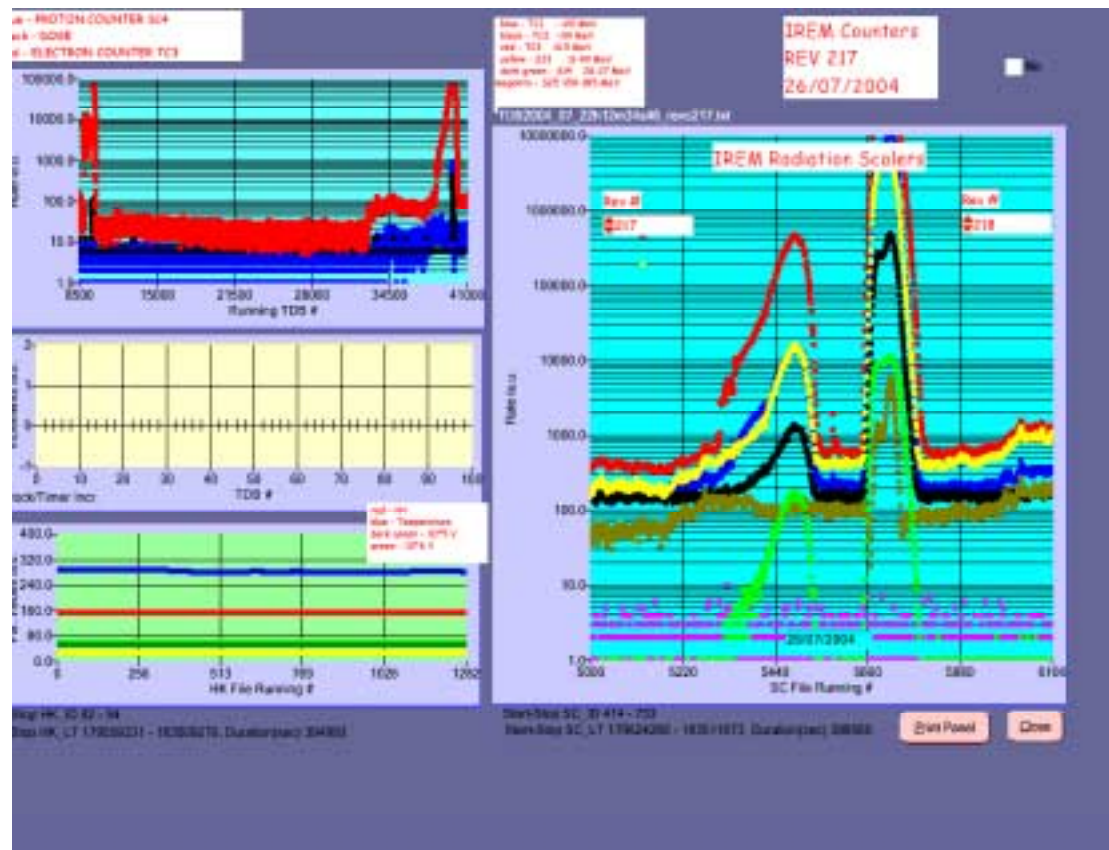
Proton Belts

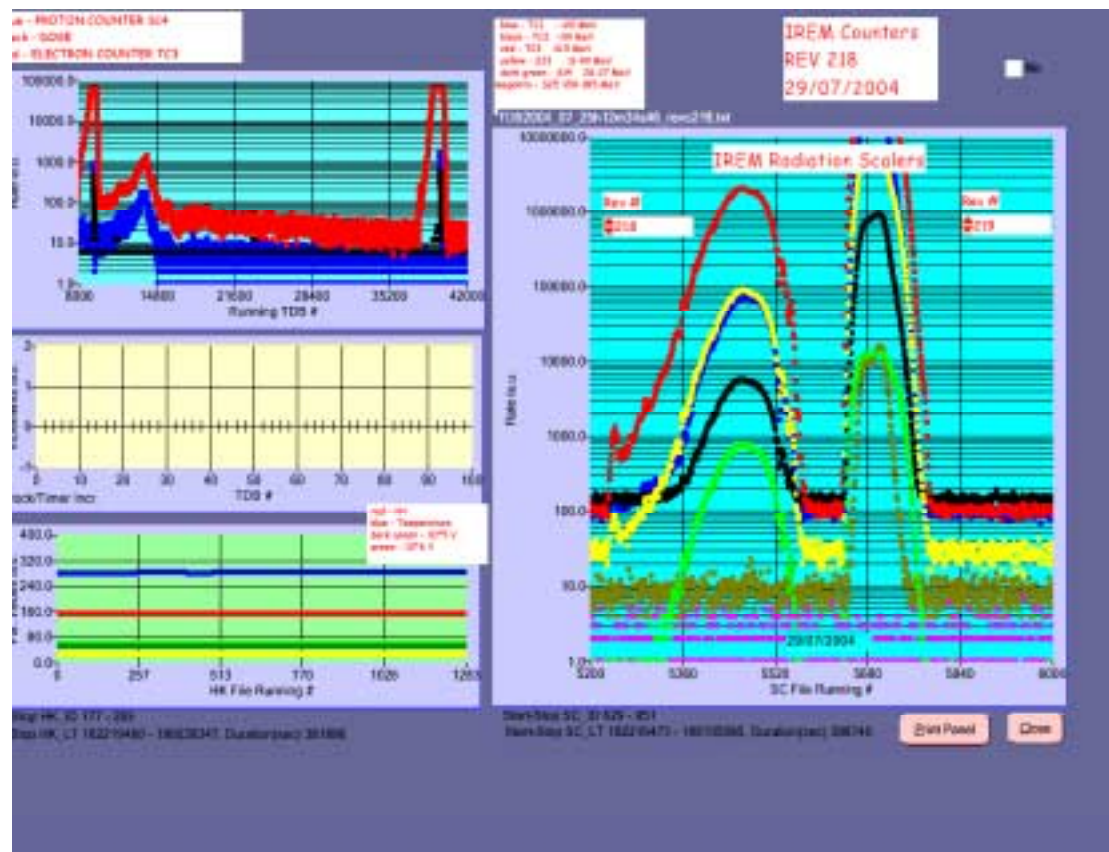
REV		Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
217	PROTON_RAD_ENTR	26-Jul-2004 11:56	13397
218	PROTON_RAD_EXIT	26-Jul-2004 12:06	14514
218	PROTON_RAD_ENTR	29-Jul-2004 11:39	12921
219	PROTON_RAD_EXIT	29-Jul-2004 11:59	15173

IREM daily report

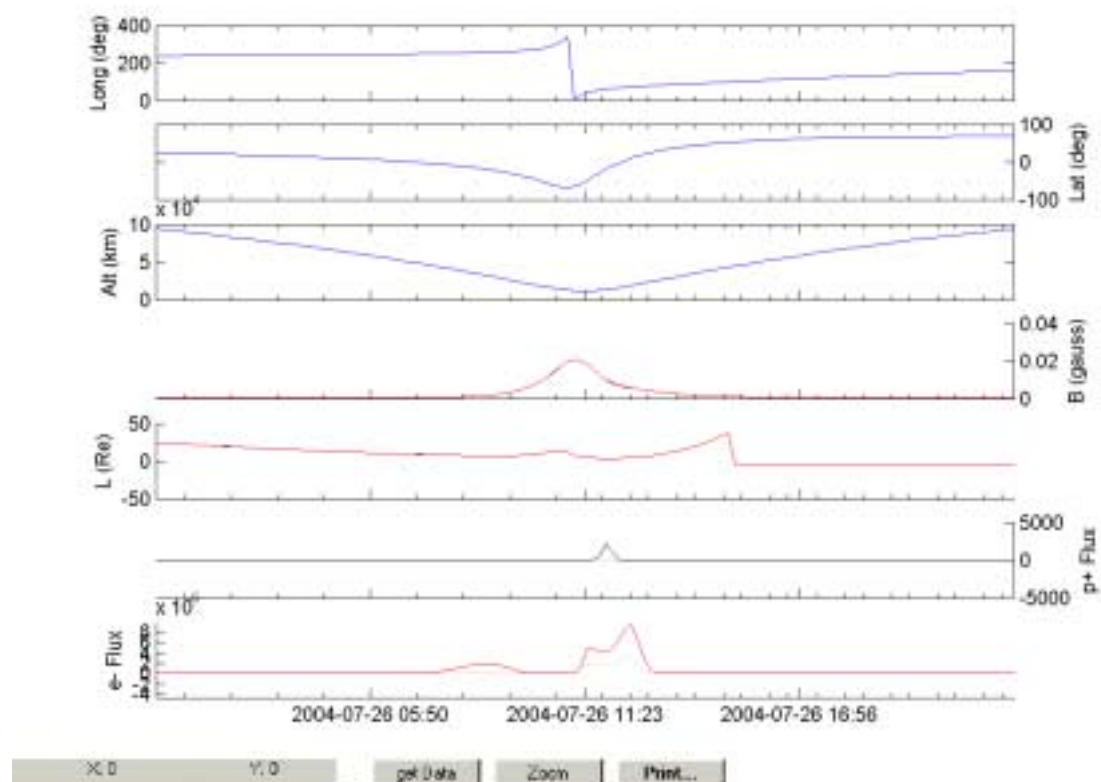
Nothing to report.

IREM radiation counters

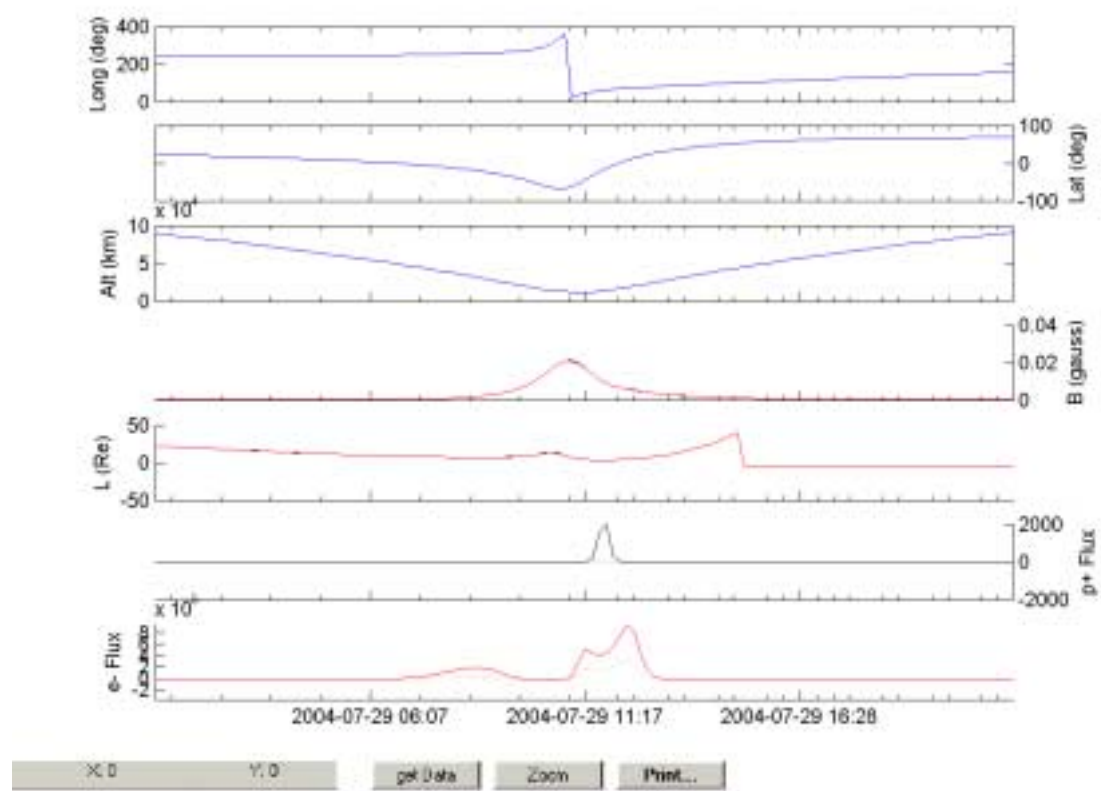




IREM Predicted Radiation Belt Passages. Rev 217



Rev 218



SEC-GOES Observed Particles Fluxes.

