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

INTEGRAL
Mission Report

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

No. 080
Week 14

05.04.04

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 27.03.04 until 02.04.04 (both dates inclusive) and covers the revolutions 178 & 179.

2 Summary of Activities

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

The target of these revolutions was the Galactic Centre. The activities consisted of GCDE 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.

A Star Tracker 1750 Processor Fault occurred during the mapping after Close loop Slew 01790039. The reason was the presence of a bright star with an instrumental magnitude of 2.12 in the same Elementary Search Window, in which the Guide Star was also located. The 3.15 Mi Guide Star was picked by the FDS to perform the slew.

There was a case of flickering of the Pointing-Bit at the end of an Open Loop Slew, caused by a roll error. The error was introduced because of a wrong assumption of the roll angle during the attitude determination process. The mapping that was used for this attitude determination was the first mapping after an Open Loop Slew, during which the SSL was engaged.

During the reporting period one slew was missed because of a late station handover. Another two slews were missed from the Timeline (one executed manually) because the STR Search-and-Track failed to pick the FDS commanded Guide Star. This incident is being investigated.

The fuel consumption over the period between 26/03/2004 and 02/04/2004 was 0.099 kg. The remaining propellant is in the order of 171.521 Kg on the 2nd of April.

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, except during the OMC Flat Field calibration, where it was 77 pkts/cycle.

Below critical altitude of rev.178, the in-flight test for the SPI science housekeeping TM packets re-routing from VC7 to VC0 was successfully executed.

The cryo-cooler is working well maintaining the 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 during the observation period was 134 pkts/cycle. Except between DoY 093 at 13:30:00 until 20:47:44, when the OMC was performing a Flat Field Calibration.

No occurrence of anomalous OEM generation (ID 183-184-179-180, Class 2) reported.

Since DoY 064 the unit is working with the updated PICsIT binning table (HEPI table).

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 operations were performed from 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, except for the period 2004-04-02T14:33:46Z to 2004-04-02T19:08:24Z (revolution 179), during which it was operated in Data Taking mode with nominal HV and a TM allocation of 8 packets/cycle (this TM allocation was in effect from 2004-04-02T13:30:00Z to 2004-04-02T20:48:27Z).

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 143 OMC pointings executed nominally, 2 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 characterised by low solar activity and no isolated radiation spikes were reported.

A detailed analysis regarding the evolution of the Radiation Belt entry is provided in the Appendix.

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 this week, well above the system performance requirements. However there were again problems related to the ground stations but their impacts were limited.

4.1 Mission Operations Centre

The performance of the MOC was good in the reporting period.

4.2 Ground Stations & Network

The performance of the ground stations and Network was in general good this week. There were a few problems with links to the ground stations and station handovers, for details see chapter 6.

The situation regarding the Reed Solomon errors during Redu passes has improved. It is not yet clear whether this is a permanent improvement as a result of the modifications implemented at the station (power level reduction) or whether this is just a temporary effect.

4.3 Science Ground Segment

There were a couple of problems with the planning inputs from ISOC. Several planning iterations were required to correct the inputs.

4.3.1 ISOC

1. Mission planning
PSF's: Received up to rev. 188
POS and POD generated: up to rev 188
TSF's: Received up to rev 183

This week has seen a lot of replanning and interactions between MOC and ISOC. Revolutions 179 and 180 had to be replanned to accommodate an accepted ToO request. Rev 179 had to be manually edited again to accommodate JEM X 2 switch on an test. Rev 181 and 184 had to be manually edited by ISOC and resent after detection by MOC of the problem below. Sometimes this iteration had to be done more than once.

2. Observation status
ECS up to revolution 167 and 170 received. OCS sent up to revolution 166 plus 170. This last exchange has allowed ISOC to close 6 observations thus allowing ISDC to start the Standard Analysis and subsequent data distribution to the PI's.

3. ISOC science archive
No new data tape received. The data transfer from ISDC to ISOC using Internet is now set up and is running. No systematic transfer yet performed but transfer of selected information required by the ISOC scientists has been transferred successfully and is used within ISOC.

4. ISOC system
The ISOC system version 10.3 has been in use this week. The system has been patched first to detect the problem below and then to remove it completely.

5. Problems
When processing revolution 180 MOC could not complete the processing. An investigation showed that the problem was caused by missing information from the PSF that should have been copied into the POS. This problem was introduced by mistake in ISOC version 10.3. Unfortunately it is almost impossible to detect this type of errors at ISOC. However the POS checker could be quickly updated to detect this specific situation thus allowing ISOC to manually perform the necessary editing of the POS prior to transmission to MOC. Late in the week the software has also been corrected.

4.3.2 ISDC

On 05/04/2004, the status of ISDC observation processing is:

- Latest Standard Analysis completed: observation 01100090006 (Vela region, Revolution 137-141) on 03/04/2004

- Latest products archived: observation 01200470001 (NGC 4945, Revolution 149-150) on 12/03/2004

- Latest observation products sent to the observer: observation 01201250002 (Cassiopeia A, Revolution 144-148) on 19/03/2004

5 Special Events

A new S/W version had been loaded in the Goldstone antenna that is primarily been used by INTEGRAL. This S/W version seems to have a bug that can load to the crash of the processor at the station. In order to analyse the situation a special configuration had been implemented by JPL on 02 April. The uplink and downlink were routed over different antennas. JPL went back to the previous S/W version after the test.

The new distribution of the SPI TM packets over the Virtual Channels has been tested with the space segment. This will provide better monitoring capabilities to the MOC. The results are satisfying so that the new set-up will be used operationally from 15 April.

The OBIS calibration source has shown some signs of degradation. A special algorithm has been developed at MOC to predict the behaviour, for details see section 8.3.3 IBIS Operations.

6 Anomalies

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

- On DoY 087, at 12:51, there was a late handover to DSS-16 from Redu, possible due to Router problems, the DR# is N102036. The pass was eventually recovered at 14:05, after the Redu pass was extended to 13:24, which was as far as possible, pointing 01770048 was lost.
- On DoY 088, at 19:25, imca went yellow, with CPU usage at 48% due to the Releaser task. All manual and auto stacks were stopped, and the releaser task then stopped and re-started, the imca then returned to green status, no impact.
- Later, at 22:52, command U4920 initially failed the CEV check, but executed successfully.
- At 23:30, Sun124, went yellow, the TM monitor was stopped and restarted curing the problem, no impact.
- On DoY 089, from 16:11, to 16:22, the TM & TC links were taken down by sustaining engineering and software support, data was recorded at the ground station, and there was no impact.
- On DoY 090, from 15:27 to 15:31, the TM & TC links from DSS-16 dropped for reasons unknown. The DR# is G104240, there was no apparent impact.
- On DoY 091 at 13:01 there was a drop in TM, and at 13:06 TC from DSS-16, at 13:07 the links were back. DSS-16 had reloaded the desktop of the TCP, the corresponding DR# is G104244.
- On DoY 091 at 22:39, command U4920 failed completion, no apparent impact.
- On DoY 093, at 05:09, command A3189 failed release, causing pointing 01790033 to be lost.

- Later, at 06:08, the NCTRS was re-configured to allow uplink on DSS-16, and downlink on DSS-15. After the station handover at 12:44, it was established that double TM was being received, at 12:51, this was stopped by removing the DSS-16 downlink.
- Later, at 15:37, the TC link from DSS-16 dropped, the TCP was restarted, and the link was restored at 15:46. The impact was a number of OMC commands were lost, which impacted the on-going Flat Field Calibration.

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

AR id	Date Occurrence	Subject	Segment	Status
INT-2570	02/04/2004	Late TFP from FDS to IMCS	FDS	Pending
INT-2569	01/04/2004	NCTRS-B buffers Telecommands	NCTRS	Open
INT-2568	01/04/2004	NCTRS-A buffers Telecommands	NCTRS	Open
INT-2567	30/03/2004	Missing input lines in the POS supplied	ISOC	Pending
INT-2566	30/03/2004	Blank spaces after RWB parameters	ISOC	Pending
INT-2565	30/03/2004	RWB parameters in POS incorrect	ISOC	Pending
INT-2564	24/03/2004	TM drop from Goldstone DoY 072 from 15:26 to 16:40	NASA station	Pending

7 Future Milestones

The new SPI configuration related to the packet distribution over the Virtual Channels will be used operationally from 15 April.

The battery reconditioning will start mid April.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 178
The observations in revolution 178 consisted by an Hexagon dithering observation of the region Sagittarius A* (RA 17:45:40; DEC -29:00:28) for all the foreseen observation time (~58 hours).

Survey of Sgr A simultaneously with the approved XMM-Newton large project exposure monitoring program of the galactic nucleus and the associated multi-wavelength campaign planned for 2004. The primary aim is a detailed study of the X-ray/gamma-ray activity of Sgr A, the radiative manifestation of the massive black hole at the galactic center.

Revolution 179
The observations in revolution 179 consisted by:

- Hexagon dithering observation of the region Sagittarius A* (RA 17:45:40; DEC -29:00:28) for ~25 hours
- GCDE (grid 2) ** for a total of 10hours
- OMC Flat Field Calibration in the region (RA 17:12:48, DEC -06:24:00), for 5 hours
- Raster dithering observation of the source S5 0716+71*** (RA 07:21:53; DEC 71:20:36)

Survey of Sgr A simultaneously with the approved XMM-Newton large project exposure monitoring program of the galactic nucleus and the associated multiwavelength campaign planned for 2004. The primary aim is a detailed study of the X-ray/gamma-ray activity of Sgr A, the radiative manifestation of a massive black hole at the galactic center.

**The Galactic Centre Deep Exposure consists of deep exposures of the central Galactic radian (+/ 30 deg in longitude, +/- 20 deg in latitude, centred on (l, b) = (0, 0). Individual pointings (30 min exposure each) on a regular pointing grid with 2.4 and 1.2 deg spacing, respectively.

***Target-of-opportunity (TOO): INTEGRAL and XMM-Newton concurrent observations of blazars in outburst.

Instruments Modes and Telemetry allocation
Throughout these revolutions all instruments were in their nominal science modes, except for JEM-X2, which was in Safe mode for a large part of the week, and data-taking during the OMC Flat Field calibration during revolution 179. The TM allocation was IBIS 134; SPI 98; JEM-X1 8; JEM-X2 1; OMC 5, except from 2004-

04-02T13:30:00 to 2004-04-02T20:48:27 (the FF Calibration) when the allocation was IBIS 90; SPI 77; JEM-X1 8; JEM-X2 8; OMC 63.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

```
2004-03-11T00:13:11.000Z     171.8557    F   Automatic TM processing.
2004-03-13T17:26:54.000Z     171.8492    F   Automatic TM processing.
2004-03-13T23:48:23.000Z     171.8481    F   Automatic TM processing.
2004-03-15T09:38:34.000Z     171.8288    F   Automatic TM processing.
2004-03-16T16:00:37.000Z     171.8088    F   Automatic TM processing.
2004-03-16T23:38:46.000Z     171.7653    F   Automatic TM processing.
2004-03-19T23:27:25.000Z     171.7437    F   Automatic TM processing.
2004-03-22T23:17:17.000Z     171.7353    F   Automatic TM processing.
2004-03-25T15:12:52.000Z     171.6783    F   Automatic TM processing.
2004-03-25T23:12:13.000Z     171.6485    F   Automatic TM processing.
2004-03-26T07:37:33.000Z     171.6204    F   Automatic TM processing.
2004-03-26T14:43:42.000Z     171.5861    F   Automatic TM processing.
2004-03-28T16:29:15.000Z     171.5737    F   Automatic TM processing.
2004-03-28T22:58:36.000Z     171.5479    F   Automatic TM processing.
2004-03-31T22:46:52.000Z     171.5211    F   Automatic TM processing.

This report was generated  Fri Apr 2 08:00:20 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, 62 Open Loop Slews, 94 Closed Loop Slews and 3 Momentum Bias were executed. 3 slews were missed or executed manually. This is equivalent to a 1.9%.

27/03/04 (Day of Year 087, Revolution 177)

Slew/Pointing lost due to late station handover: The station handover from Redu to Goldstone DSS-16, which was planned for 12:51, could not be performed because no contact to the station was possible (DR#: N102036). At 13:25 the Timeline was stopped and slew 01770048 was missed. At 14:05 the contact to JPL was established and the TM/TC links were connected. To rejoin the Timeline, a manual Open loop Slew was performed to the attitude of PID 01770048. The next slew was executed from the Timeline.

28/03/04 (Day of Year 088, Revolution 177-178)

Nothing to report.

29/03/04 (Day of Year 089, Revolution 178)

Nothing to report.

30/03/04 (Day of Year 090, Revolution 178)

Nothing to report.

31/03/04 (Day of Year 091, Revolution 178-179)

Nothing to report.

01/04/04 (Day of Year 092, Revolution 179)

Nothing to report.

02/04/04 (Day of Year 093, Revolution 179)

Execution of Close loop Slew failed because the Search-and-Track could not find the commanded star: Close Loop Slew 01790033 failed execution because the commanded star for the slew could not be picked during the STR Search-and-Track sequence. The Guide-Star catalogue number of the 7.3 Mi star is 6846-0066 and was expected to be at CCD location [18242, -11194]. The STR could not see this star, neither in Full Accuracy nor in Reduced Accuracy, during the previous mapping based on which the parameters of the Close Loop Slew were updated. This incident is being investigated. To rejoin the Timeline, a manual Open Loop Slew was performed to the attitude of PID 01790034. The next slew was executed from the Timeline.

Flickering of the Pointing-Bit due to Roll Error at the end of Open Loop Slew 01790035: After manual slew to the attitude of PID 01790034, the Timeline Recovery Tool was used to update the parameters of Open Loop slew 01790035. This was done by using the first automatic mapping after the manual slew, during which the SSL was enabled. The wrong assumption in the Roll angle thus introduced resulted in a roll error of –162 arc-seconds at the end of Open Loop Slew 01790035. The OTF flickering was not seen at BCP level.

Star Tracker 1750 Processor Fault, caused by bright object in the FoV: The mapping that was commanded after Close loop Slew 01790039 was interrupted prematurely at 08:55:05 due to a STR 1750 Processor Fault. The G/S Catalogue number of the Guide Star, which was used for the slew, is 7387-01249. It was located at CCD location [-100, 15388] with a magnitude of 3.15. Another bright star with instrumental magnitude 2.12 was also in the FoV in the same Elementary Search Window as the Guide star (ESW 29), located at [-7933, 19332]. The G/S Catalogue

Number of this star is 7388-01093. The mapping started at 08:54:21 and when the cycle reached ESW 29, in which the Guide Star and the bright object were located, the 1750 Fault occurred. A new mapping was then commanded by the ACC and a new Guide Star was found near the centre of the FoV: [1133, -2868], 6.75 Mi. The OTF remained LOW during PID 01790039.

8.3.2 SPI Operations

Cryo-cooler / Detector Cold-Plate:
The performance of the cryo-cooler is nominal.
The cold plate temperature is leveled off at around 80.5K with a small positive drift of 0.014K/day, which is within the expected range.

IASW/DPE:
The performance of the IASW/DPE is nominal.

Change Request for packets re-routing
The Change Request to re-route the 5 science housekeeping packets from VC7 to VC0 was tested on the satellite on 31st March at 15:03z, at critical altitude entry (<60000km), in revolution #178.
The following test procedure was executed:

1. 2004-03-31T15:03:55z: Critical altitude entry, automatic transition to conf/protégé mode and switch off of ACS hv power supplies (AND E0435, E0436 should contain all off).
2. 2004-03-31T15:10:00z: Uplink ES1700_IASW-PAR_fmconfig.vvvv.TPF with parameters E8944=0, E8946=0 (see procedure FCP_SPI1_1700). The instrument mode will change from conf/protégé to conf/commanded.
3. Uplink sequence ES0332v0 (see procedure FCP_SPI1_0332) to load the new APID table for sci hk packets.
4. Uplink sequence ES0130 (see procedure FCP_SPI1_0130) to enter photon mode and check that the sci hk packets are now routed through VC0 and that the IMCS is correctly processing them.
5. Stay in this configuration for 10min.
6. Uplink sequence ES0160 (see procedure FCP_SPI1_0160) to go back to conf mode.
7. Uplink ES1721_DF-CLPAR_fmconfig_vvvv.TPF (in dir ~/CMD/TPF/PI/SPI1/fmconfig; procedure FCP_SPI1_1721) with TC para E7777, E7778, E7779 = NO: To disable the generation of the anomaly OEM 229 SPI Partial Flag Overflow, due to the high number of spurious events collected by the DFEE when the ACS is off.
8. Uplink sequence ES0130 (see procedure FCP_SPI1_0130).
9. Stay in this configuration for ~40min. During this time check with ISDC, on the voice loop, if they receive the packets through VC0 correctly.
10. Uplink sequence ES0160 (see procedure FCP_SPI1_0160) to go back to conf mode.
11. Uplink sequence ES0332v7 (see procedure FCP_SPI1_0332) to re-load the old APID table for sci hk packets.

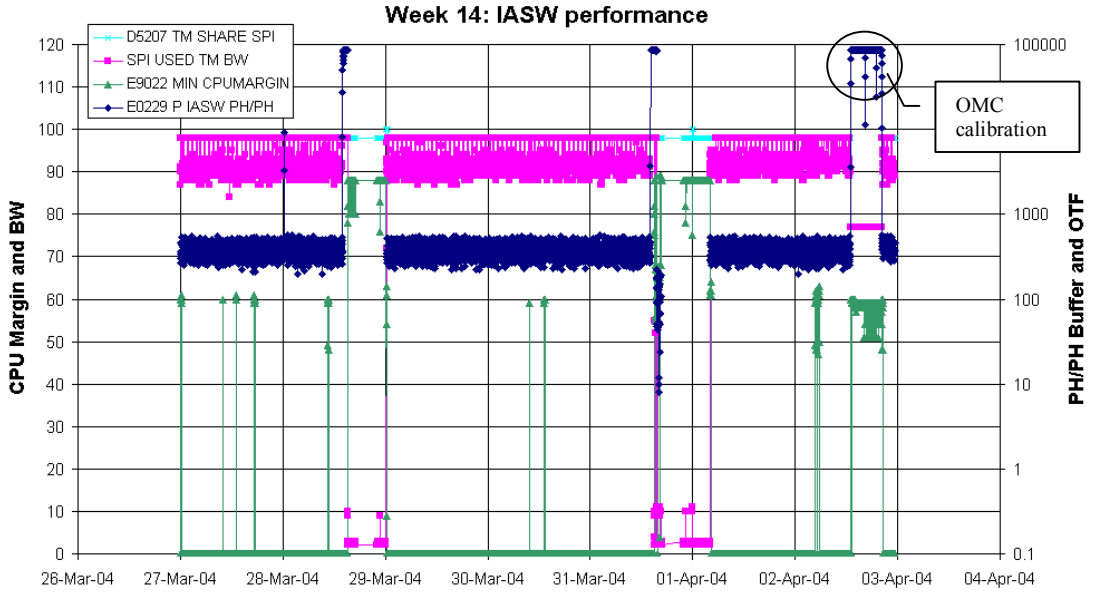
12. Uplink sequence ES0130 (see procedure FCP_SPI1_0130) to enter photon mode and check that the sci hk packets are routed again through VC7.
13. Stay in this configuration for ~10min. During this time check with ISDC, on the voice loop, if they receive the packets through VC7 correctly.
14. Uplink sequence ES0160 (see procedure FCP_SPI1_0160) to go back to conf mode.
15. Uplink ES1721_DF-CLPAR_fmconfig_vvvv.TPF (in dir ~/CMD/TPF/PI/SPI1/fmconfig; procedure FCP_SPI1_1721) to re-establish the correct DFEE configuration.
16. Uplink ES1700_IASW-PAR_fmconfig.vvvv.TPF (in dir ~/CMD/TPF/PI/SPI1/fmconfig; procedure FCP_SPI1_1700): The instrument mode will change from conf/commanded to conf/protégé.
17. 2004-03-31T16:59:00z: LOS.
18. 2004-03-31T22:15:00z: AOS.
19. 2004-04-01T00:04:43z: Critical altitude exit, monitor the correct automatic reconfiguration (AND E0435, E0436 should contain all on, except FEE#57).
20. Uplink sequence ES0130 (see procedure FCP_SPI1_0130) to enter photon mode.

The in-flight test was successful, the packets were correctly received by IMCS, which correctly extracted, processed and displayed all the new packets and parameters defined in the TM/TC database.
The packets were also received at ISDC, in Genever, and, via IFRD, at CSER, in Toulouse, without any problem. No ground station or communication line problem was detected. The test was executed with TM/TC link via Goldstone ground station.
The test with the pkts in VC0 lasted about 1 hr and IMCS did not show any performance problem during this time.

As the Spacon was busy at critical altitude exit, he could not check the status of SPI and photon mode was commanded about 4 hrs later than due.

Impacts of OMC calibration activities
Between 2004-04-02T13:30:00Z and 2004-04-02T20:47:44Z (OMC Flat Field Calibration), the PST was re-programmed to reflect the following TM bandwidth distribution: IBIS 90; SPI 77; JEM-X1 8; JEM-X2 8; OMC 6.
This caused the IASW to immediately saturate the allocated TM bandwidth, followed by the saturation of the photon event buffer within a few minutes. Operations returned nominal when the bandwidth was re-assigned to 98 pkts/cycle.

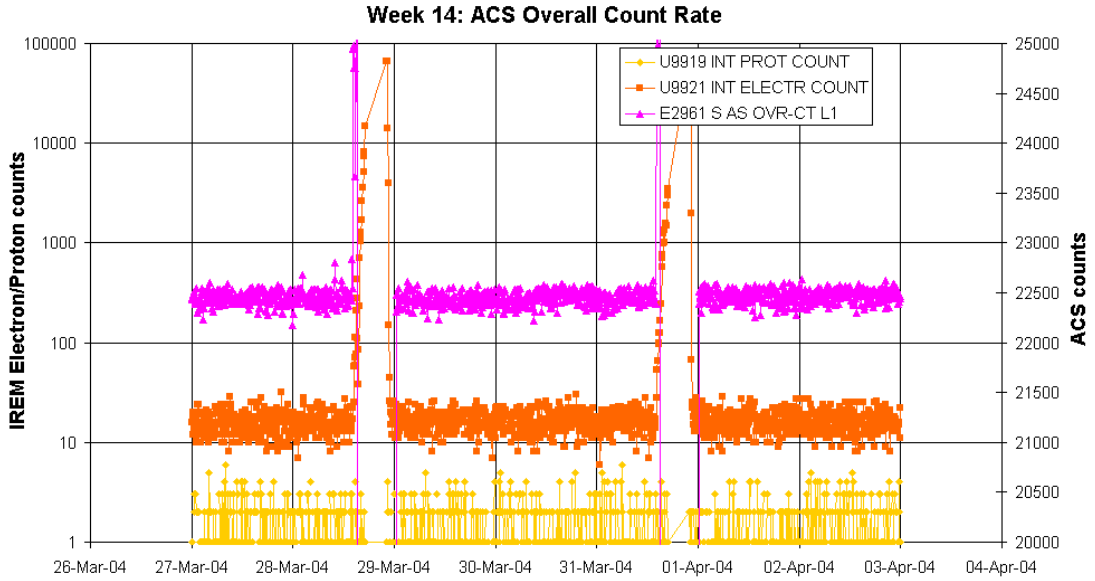
The following diagram shows the IASW performance in terms of TM bandwidth and event buffer occupation during the reporting period:



ACS:

The performance of the ACS is nominal.

The following plot shows the ACS overall count rate evolution during the reporting period.



AFEE:

The performance of the detectors is nominal except for the detector #2 failed since 06.12.2003 (see anomaly report INT_SC-72).

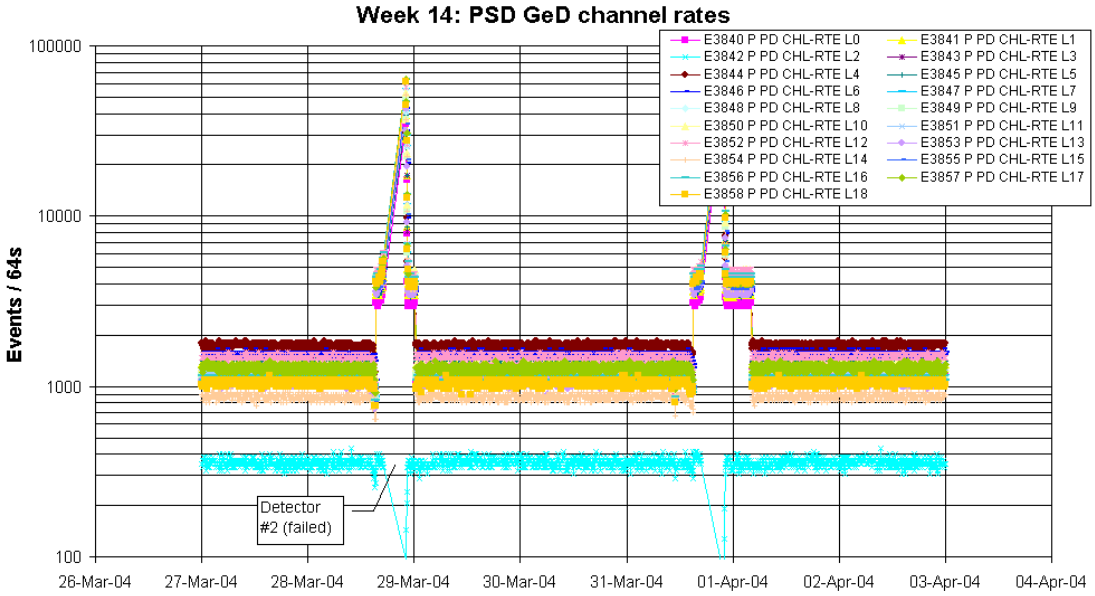
DFEE:

The performance of the unit is nominal.

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

Calibration Unit#1

The IBIS on-board unit, designed to provide flux of tagged events (photons @511 KeV and 1275KeV) to the IBIS detector planes and provide in flight monitoring of the detectors performances, reported in the last weeks an anomalous low count-rate, exceeding the limit fixed during the Commissioning phase. The problem on the reduced count-rate has been probably identified as natural decay of the installed source (0.4 μCi of Na^{22}, half life=2.58 years).
In order to assess the status of the source, have been considered data from the unit first switch ON (November 2002) until end of March 2004.
This data set has been filtered (green data in the plot below) by using the VETO and IREM count-rates, to reduce the internal (VETO data accumulation mechanism) and external influences (solar flares, high radiation) on the measurement, and fitted using the exponential decay law as shown below:

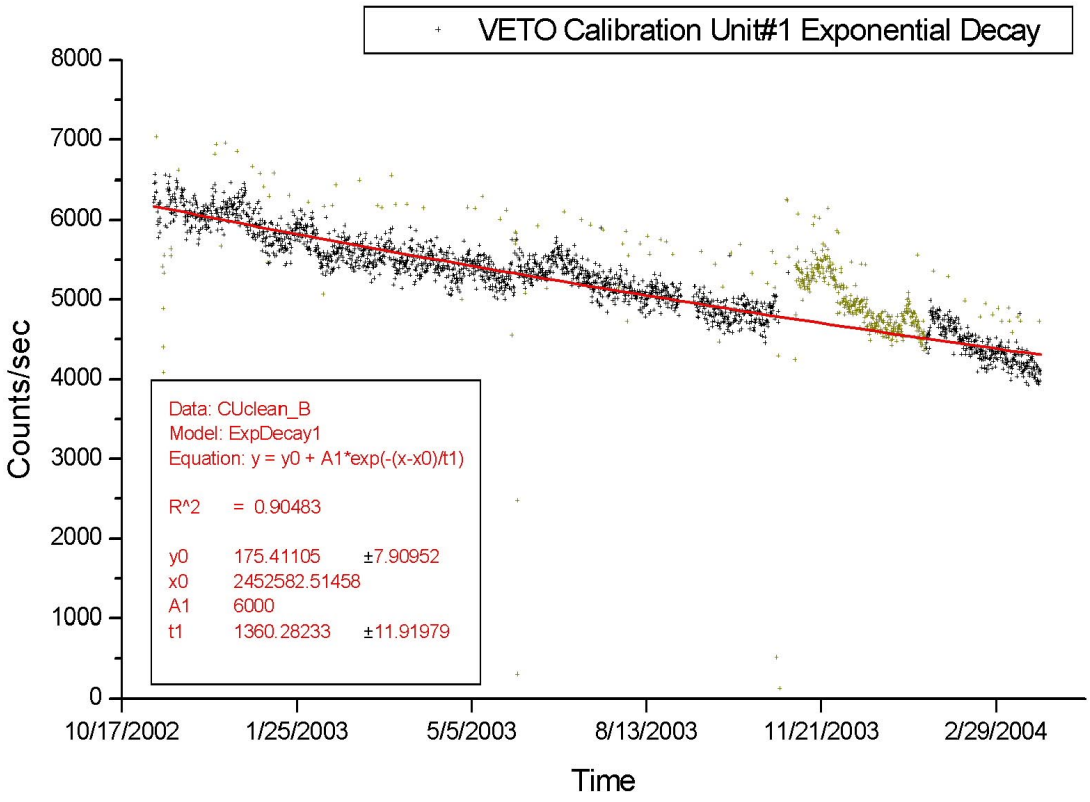
$$y = y_0 + A_1.e^{(-(x-x0)/t_1)}$$

where:

A_1 = count-rate at switch ON in flight, assumed ~6000 cts/sec (see Performance of Calibration Unit during PV Phase)
y_0 = estimated background, when the source is @EOL;
x_0 = time of the switch ON (11/2002);
t_1 = mean lifetime, i.e. time required to decay e^{-1} of the initial activity (t_1=half life/ln2)

For an Na^{22} source the mean lifetime reported in the IBIS EID-B is t_1 =3.72 years=1358 days

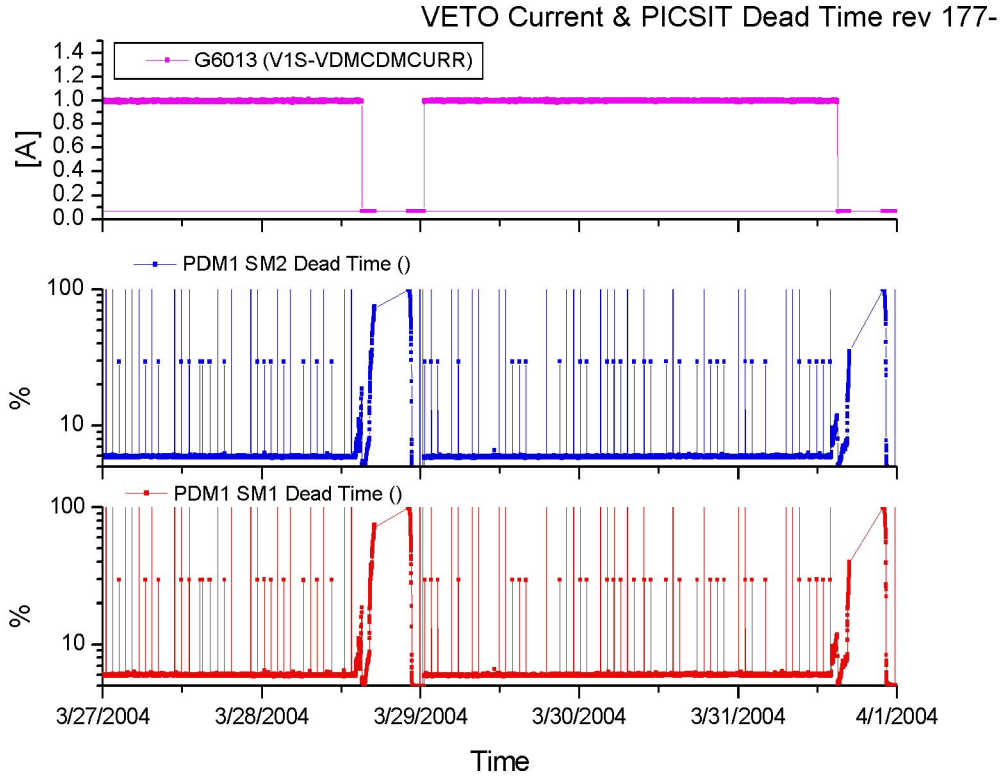
The results of this analysis are presented in the plot below

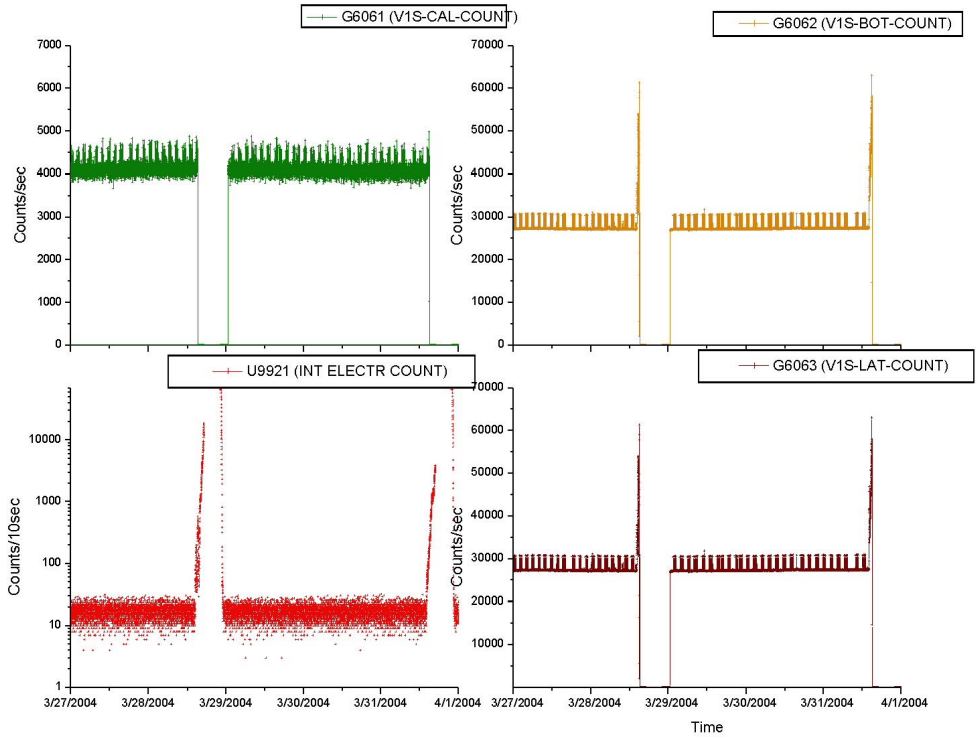


For t_1 the fit gives a value of ~ 1360 counts/sec which agrees within the tolerance, with the EID-B value , while for the background @EOL ~ 175 counts/sec.
To cope with the natural decay, the lower limit for the count-rate of the calibration Unit #1 will be from now on be adjusted by using either the analytical expression given above or using operational experience.

IBIS event counters plot

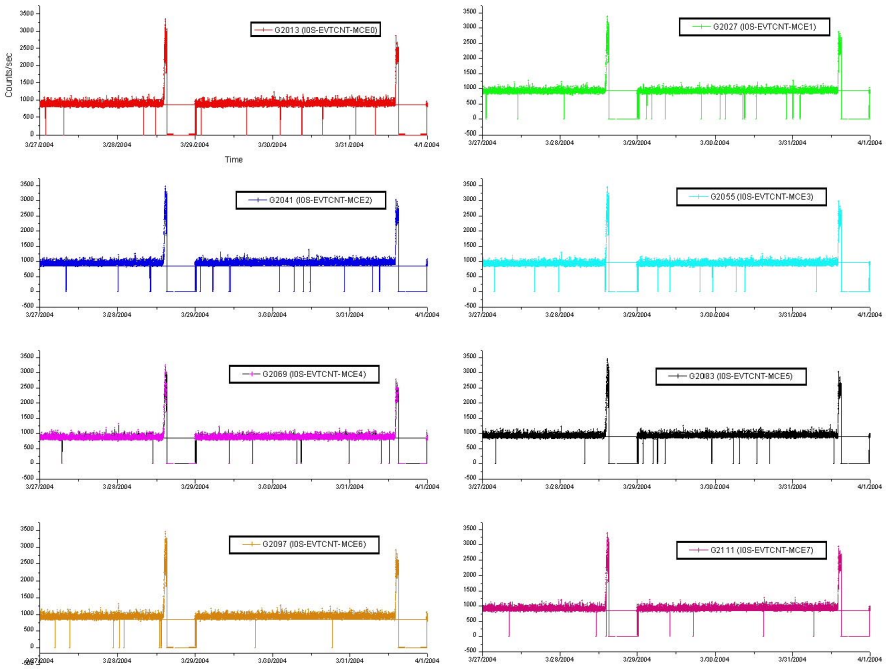
Plots of the reported VETO VDM/CDM current, the VETO bottom-lateral-calibration counters, the PICsIT PDM#1 SM1-2 dead times are shown below:



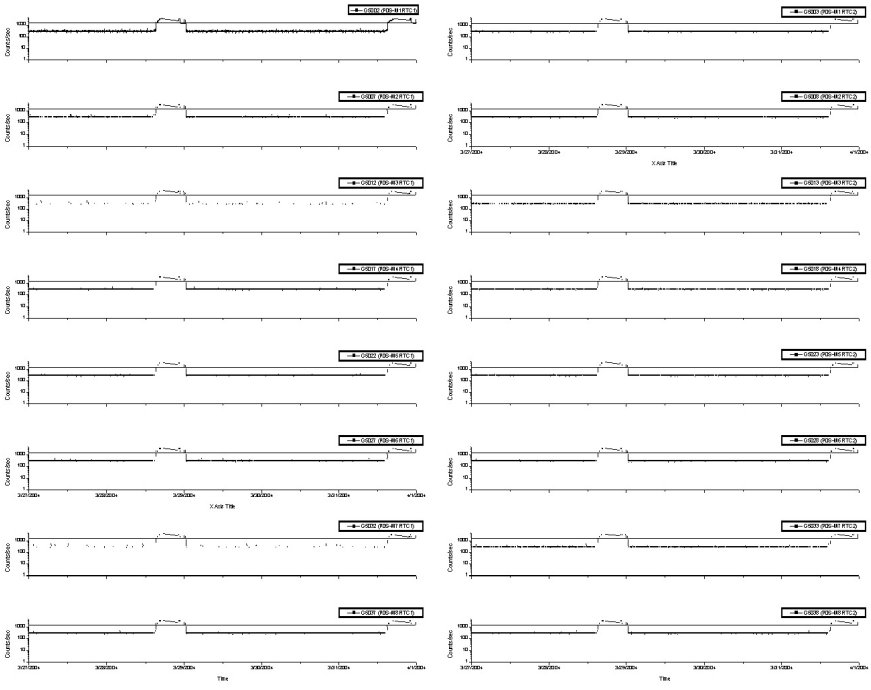


Plots of the ISGRI and PICsIT counters, during the observation period, are shown below:

IBIS/ISGRI Counters rev177-178



IBIS\PICsIT Counters rev 177-178



IBIS daily report

DOY 2004.087 (27/03/04)

Nothing to report.

DOY 2004.088 (28/03/04)

At 15:06Z, the automatic transition to Safe configuration (IASW In Stand-By + HVs OFF) due to the high radiation background (electron counter > 384 cts/10 sec), ~10 minutes prior the S/C broadcasted Radiation Belts entry time (see below), corresponding to an altitude of ~61000 Km was reported.

RAD_ENTR R 2004-03-28T15:16Z D Radiation belt entry time

DOY 2004.089 (29/03/04)

Nothing to report.

DOY 2004.090 (30/03/04)

Nothing to report.

DOY 2004.091 (31/03/04)

At 14:29Z, the TM parameter family G2013 reported OOL, for few TM cycles, due to the high radiation background, ~33 minutes prior the S/C broadcasted Radiation Belts entry time (corresponding to an altitude of ~64594 Km)

RAD_ENTR R 2004-03-31T15:02Z D Radiation belt entry time

DOY 2004.092 (01/04/04)

Nothing to report.

DOY 2004.093 (02/04/04)

Nothing to report.

8.3.4 JEM-X Operations

2004-03-27 (DOY 087, Rev 177)

Nothing to report

2004-03-28 (DOY 088, Rev 177-178)

At 00:22:26Z the TM parameter K5136 BUFFER LOSS went out of limits (value = 118) and remained out of limits for 5 TM cycles, reaching a maximum value of 698 at 00:22:50Z. In addition, at 00:22:34Z, the parameter K5119 SOFTWARE TRIGGER

went soft out of limits (value = 16245) and remained soft out of limits for 4 TM cycles reaching a maximum value of 18158 at 00:22:58Z.

There were also the following occurrences of soft out of limits on the parameter K5119 SOFTWARE TRIGGER:

Time	Value
09:54:58Z	15021
09:55:14Z	15601
09:56:10Z	15039
09:56:18Z	15160

2004-03-29 (DOY 089, Rev 178)

Nothing to report

2004-03-30 (DOY 090, Rev 178)

Nothing to report

2004-03-31 (DOY 091, Rev 178-179)

Nothing to report

2004-04-01 (DOY 092, Rev 179)

Nothing to report

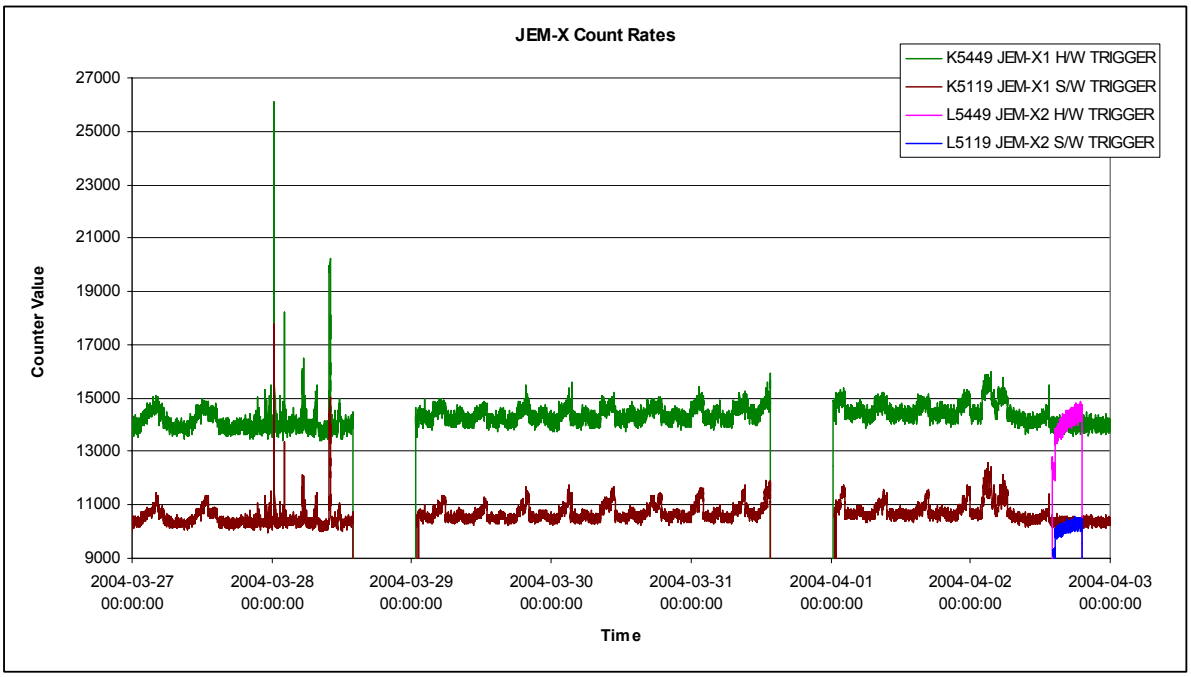
2004-04-02 (DOY 093, Rev 179)

Nothing to report

8.3.4.1 JEM-X Count Rates

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

[1] Data smoothed to remove spikes in S/W Trigger due to flushing of buffer during slews. JEM-X1 data sampled (1 frame in 4).



8.3.5 OMC Operations

On DoY 087, at 12:51, due to handover problems at DSS-16, pointing 01770048 was lost.

On DoY 093 at 05:09, an AOCS problem caused the loss of pointing 01790033. It was at this time that 2 commands were rejected:

```
2004.093.05.13.04.750 2004.093.05.12.57.868   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=718
2004.093.05.13.04.697 2004.093.05.12.52.118   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=717
```

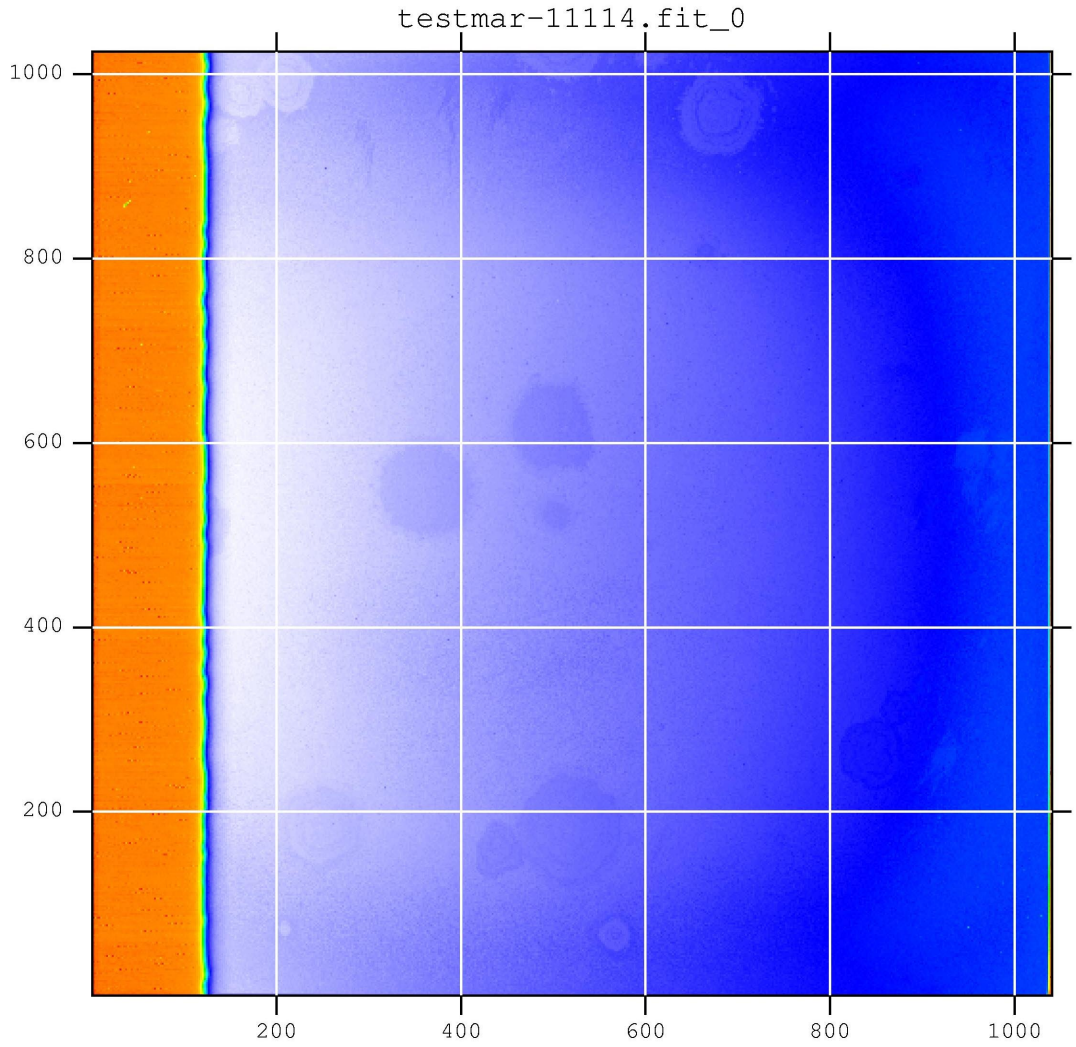
These correspond to the M1130 (RESET IM) and MU1310 (IMAGING-A) commands.
Later on the same day at 15:46, due to ground station problems, the following commands were missed during the Flat Field Calibration:

M1500	STDBY
M1540	FFCALIBRATE
M1340	FFCALIBRATE PAR
M1142	FFCALIBRATE ON

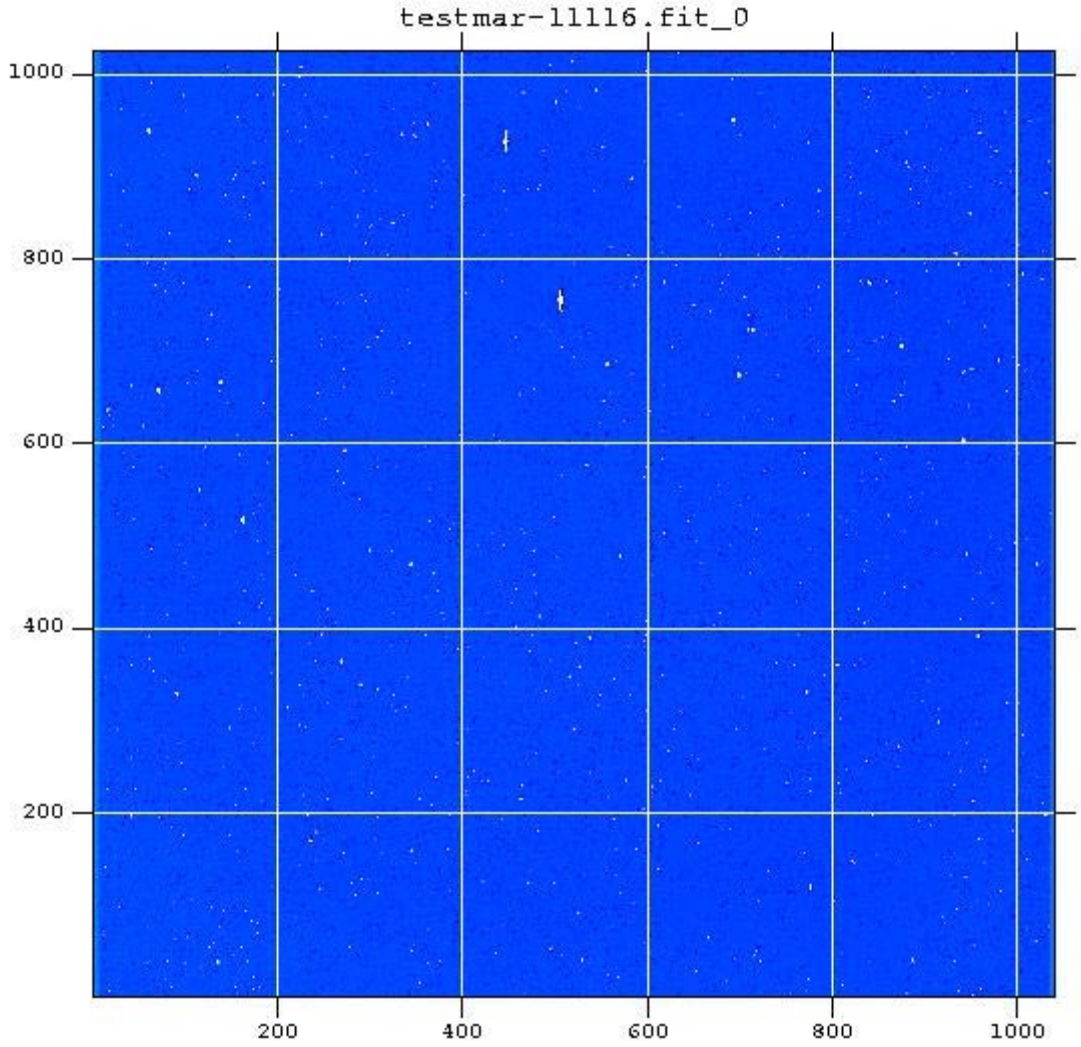
The commanding sequence was resumed at 16:02.

On DoY 088 at 15:16:39 and DoY 091 at 15:02:32, OMC was switched by the Timeline to SAFE mode, at the nominal times.

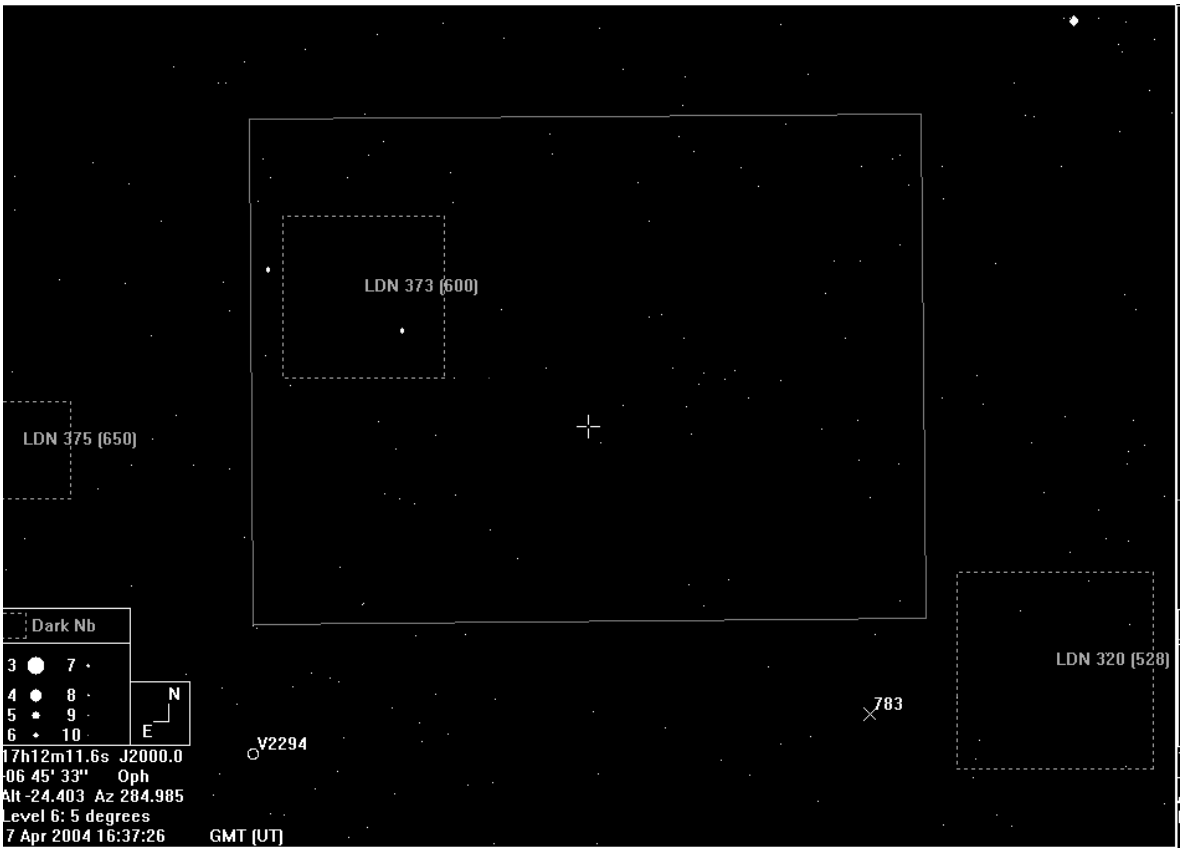
The following two plots were recorded with OMC ECOE (courtesy of the OMC team). The first shows the flat field calibration with the CCD illuminated by the LED.



An image of the integrated star field after the calibration is shown below:



A star map of the corresponding area is shown below:



8.3.6 IREM Operations

IREM daily report

DOY 2004.088 (28/03/04)

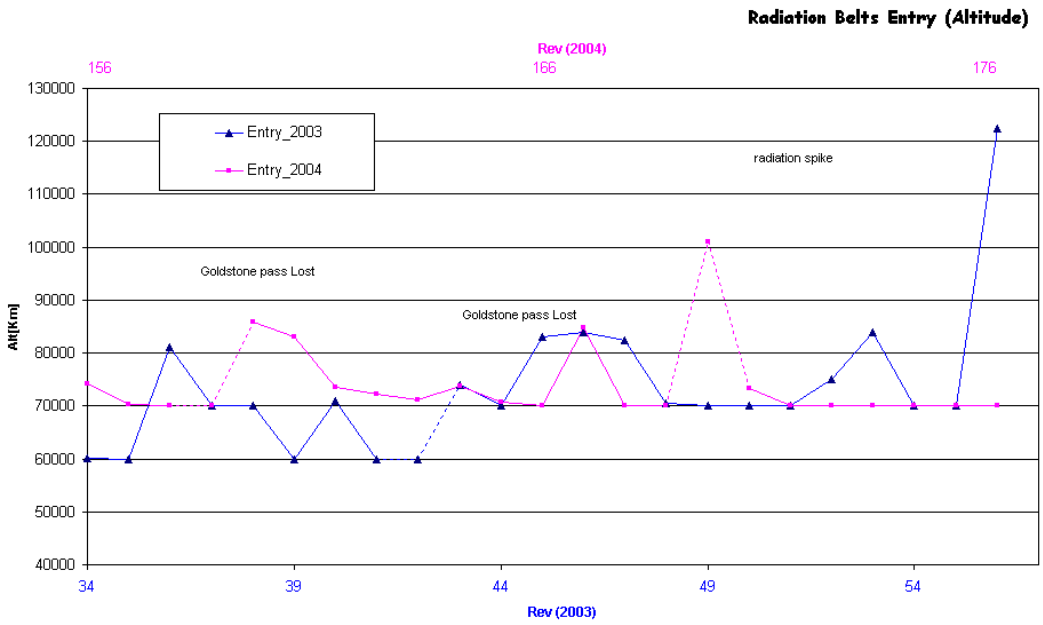
At 22:52Z the failure of the Command Execution Verification for the TC U4920 (INT GND LINK ON) due to late TM verification was reported. The correct TM status was verified, no further action was taken.

DOY 2004.091 (31/03/04)

At 22:39Z the failure of the Command Execution Verification for the TC U4920 (INT GND LINK ON) due to late TM verification was reported. The correct TM status was verified, no further action was taken.

Radiation Belt Entry Analysis

A comparison between the Radiation Belt Entries in 2003 and 2004, along the same observation period winter->spring is shown below:



The Radiation Belts Entry is determined by the electron cut-off threshold (see definition below) based on JEM-X on-board radiation automatism.

The reported Electron Belts Entry/Exit for revs 175-->176, 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
177	RAD_ENTR R 2004-03-28T15:16	28/03/2004	28-Mar-2004 15:56	54709
178	RAD_EXIT R 2004-03-29T00:17	28/03/2004	28-Mar-2004 22:56	26433
178	RAD_ENTR R 2004-03-31T15:02	31/03/2004	31-Mar-2004 15:43	54721
179	RAD_EXIT R 2004-04-01T00:03	31/03/2004	31-Mar-2004 22:43	26453

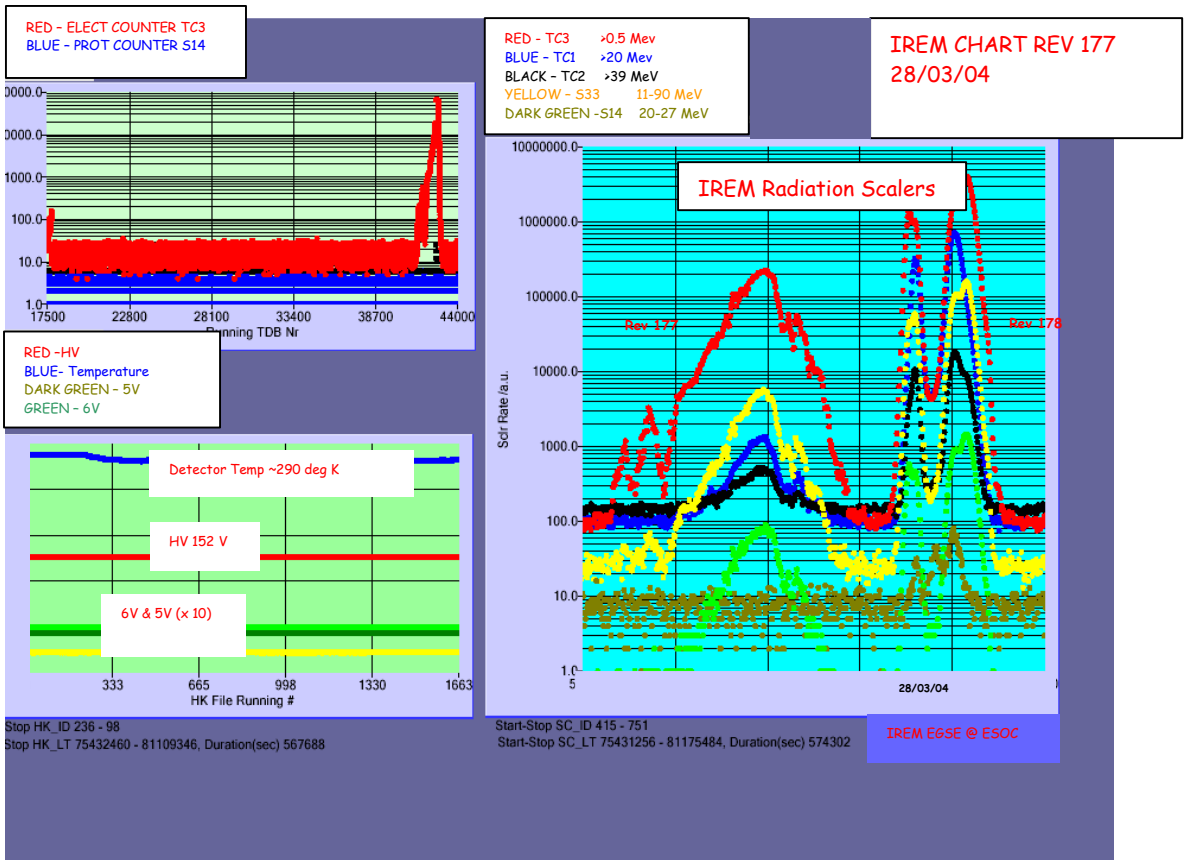
Reference
Small error vs reference
Large error vs reference
Radiation Spike

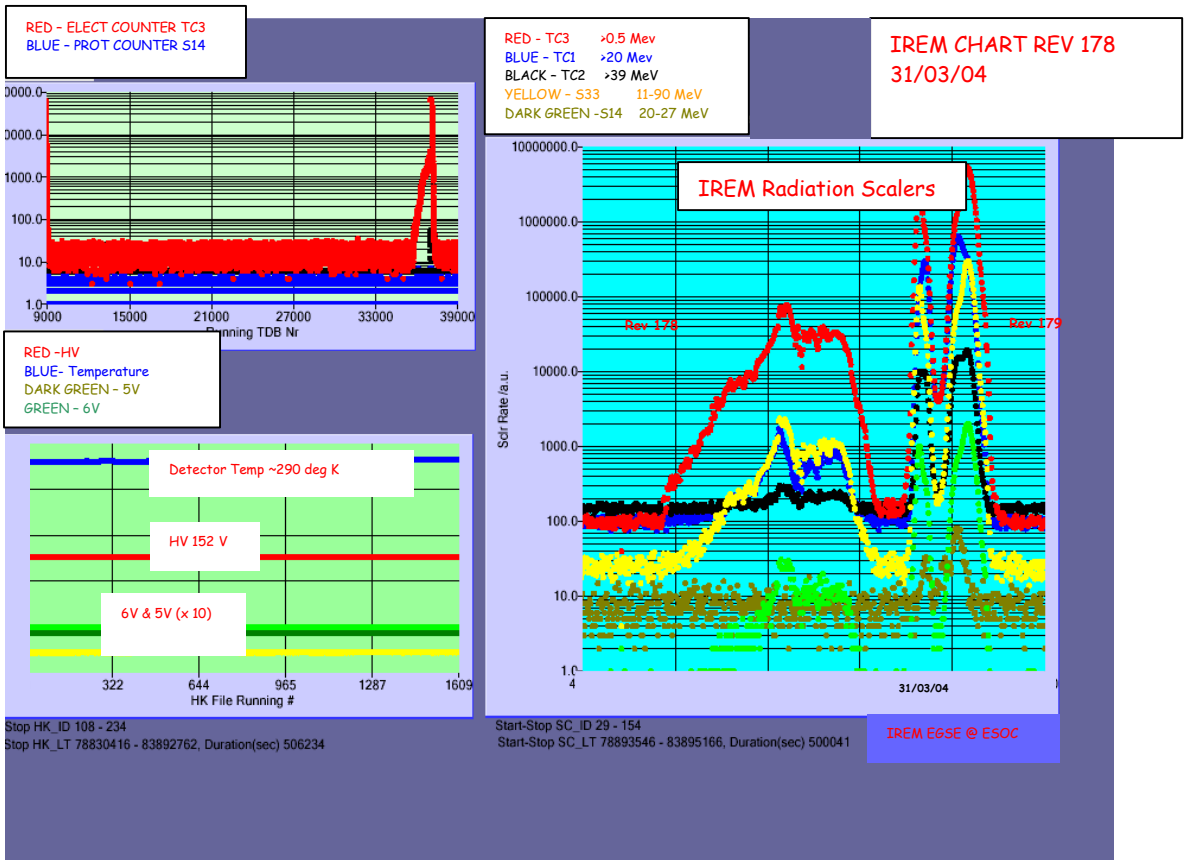
Proton Belts

REV	S/C BCPKT (proton)	Proton CUT-OFF Predicted Entry/Exit	ALT[Km] predicted
177	PROTON_RAD_ENTR	28-Mar-2004 21:16	11463
177	PROTON_RAD_EXIT	28-Mar-2004 21:46	14801
178	PROTON_RAD_ENTR	31-Mar-2004 21:03	11428
178	PROTON_RAD_EXIT	31-Mar-2004 21:33	14789

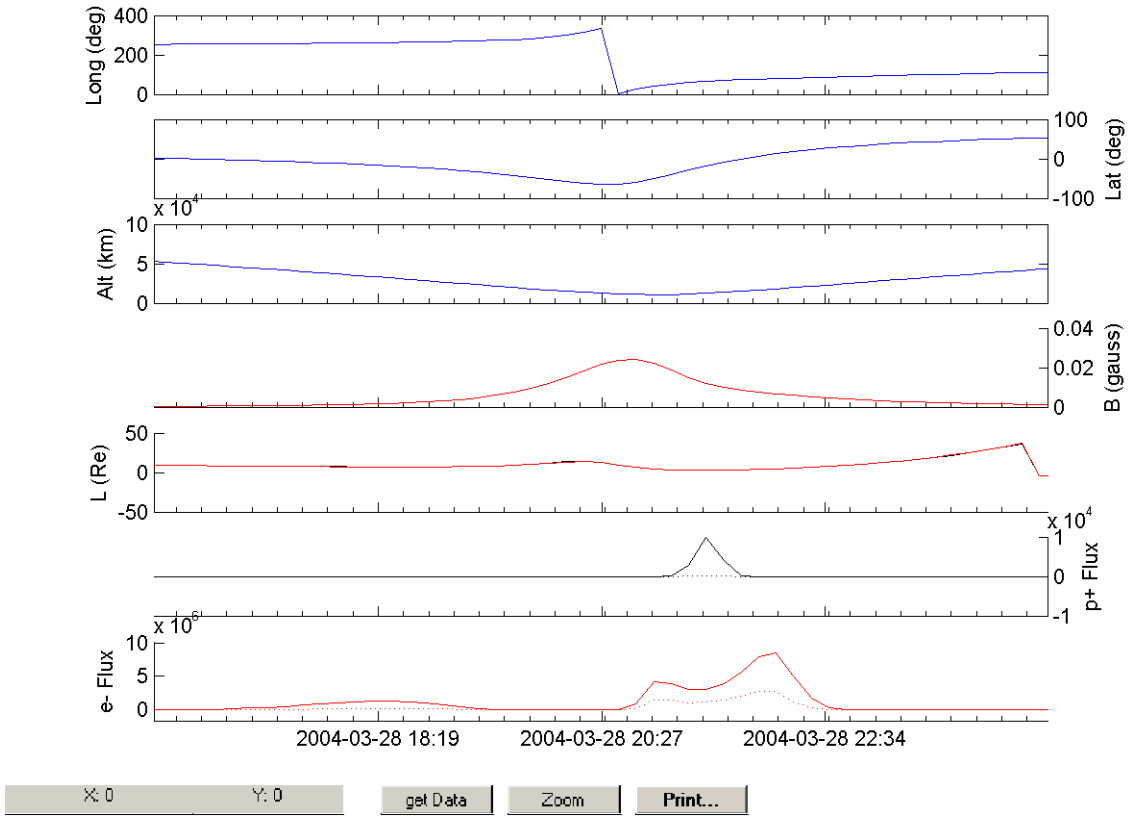
IREM radiation counters plot

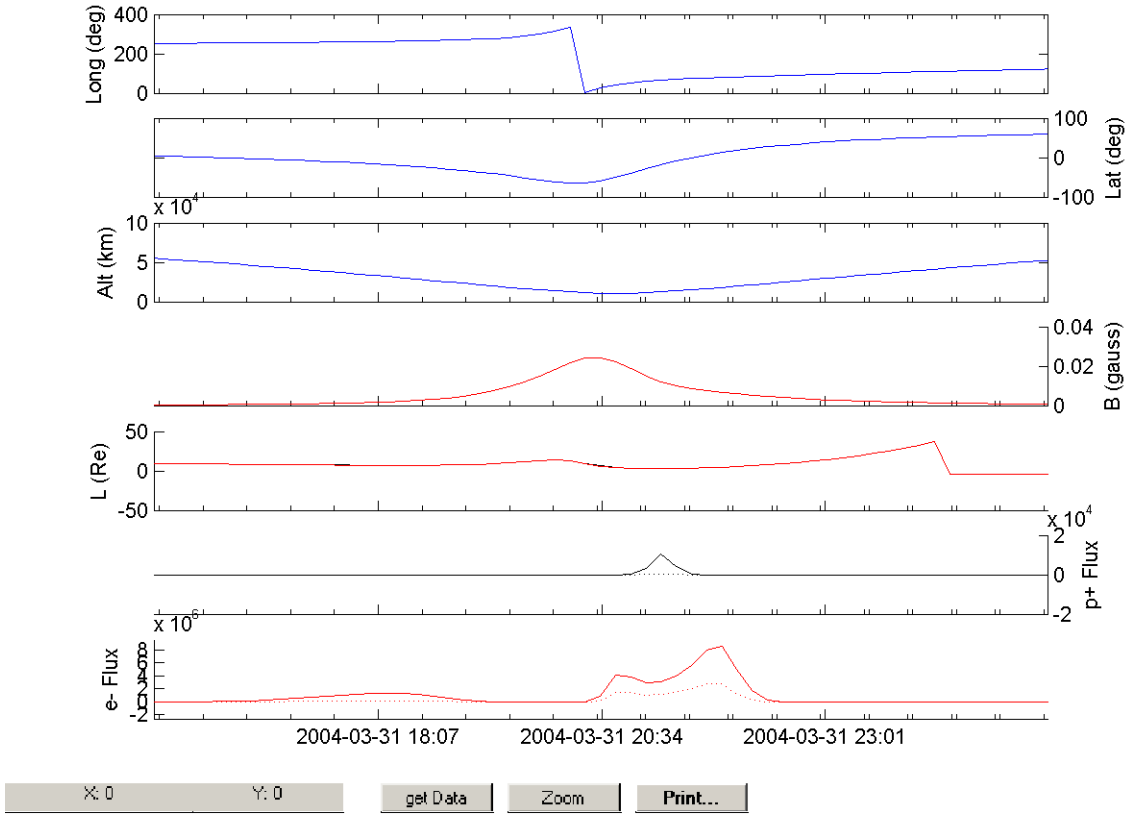
Plots of the evolution of the IREM counters from rev 177-178 are shown below:





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


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
10
5
0
2004-03-28 18:19
2004-03-28 20:27
2004-03-28 22:34
X: 0
Y: 0
get Data
Zoom
Print...


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
8
6
4
2
0
-2
2004-03-31 18:07
2004-03-31 20:34
2004-03-31 23:01
X: 0
Y: 0
get Data
Zoom
Print...