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

INTEGRAL
Mission Report

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

No. 051
Week 37

15.09.03

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.

It addresses the activities from 06.09.03 until 12.09.03 (both dates inclusive) and covers the revolutions 110 & 111.

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 Center and SgrA* (RA 17:45:40.00; DEC -29:00:28.0), as well as SGR1806-20 (RA 18:08:40.20; DEC -20:24:47.4). The activities performed consisted of 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 unexpected behaviour / malfunction was identified.

3.1.1 AOCS

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

The week was relatively smooth. There were guide star losses after the two perigee passages included in this period. The AOCS timeline operations were interrupted twice, once due to an unclear communications problem between JPL and ESOC, and once due to a known IMCS problem.
The fuel consumption over the period between 04/09/2003 and 11/09/2003 was 0.102Kg. The remaining propellant is in the order of 174.99 Kg on the 11th of September.

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 **2250W**. This means that there is no noticeable degradation of the solar arrays since launch.

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 identified.

3.1.5 RF

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 cryo-cooler is working well: after the small stroke adjustment commanded two weeks ago, the temperature is maintained 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 is 134 pkts/8sec.

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

3.2.3 JEM-X

During the reporting period, JEM-X2 operations were executed from the Automatic Timeline and JEM-X1 was dormant. During one of the perigee passes, the JEMX-2 autonomously triggered a SAFE mode due to a high radiation environment.

Note: Some more information concerning the JEM-X operations is provided in the Appendix

3.2.4 OMC

During this period 142 OMC images were acquired with 2 missed, one due to a ground station problem, and one due the MOC.

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

3.2.5 IREM

The status of the unit is Nominal.

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

4 Ground Facilities

The performance of the ground segment was in general within the specification. The Timelines were executed in general smoothly. The main problems this week described below, concerned the consolidator, and the link to the ISDC. In order to avoid impacts on the science return some special measures have been taken, e.g. to include the Villafranca ground station in the INTEGRAL operations. Ths it was possible to retrieve all data and to consolidate the archive.

4.1 Mission Operations Centre

There were a couple of events spotted on the MCS this week that affected operations. Regarding the Consolidator, after an intense week, all the data was successfully played back from the ground stations, but the problems remain. Further details are provided in section 6.

4.2 Ground Stations & Network

The performance of the Operational Network, incl. the stations, was good despite of several problems that occurred, see section 6.

4.3 Science Ground Segment

4.3.1 ISOC

Nothing to report from MOC

4.3.2 ISDC

There were repeated problems concerning the link to the ISDC reported during this week. It should be emphasised that 'lost' data is recovered when the CD's produced by the MOC are delivered to ISDC.

- On DoY 249 at 17:34 to 17:38, and from 18:40 to 18:55, and again at 21:00, there were errors reported sending data to the ISDS. At 21:50 OSC were requested to stop & start IFRD on ISDS-A, after some difficulties, the system was up again at 22:18.
- On DoY 250 at 00:05 the status of the MADDS/ISDS connection was toggling between 'Connected' and 'TM flow'. OSC were requested to stop and start IFRD and ISDS, and at 00:18, the system was again nominal. Later that day at 12:56 there were further errors, a restart of the IFRD and ISDS did not immediately cure the problem, and a second restart was necessary. The system was not recovered until 13:31. Later on at 20:18, there were further errors, a stop and start of IFRD and ISDS server cured the problem.
- On DoY 251, at 06:15, the IFRD task on TMSpacon showed it was disconnected, the task was restarted by the OSC. Later at 11:25, the link was again disconnected, computer restarted the IFRD, and then both the IFRD and ISDS tasks, at 11:31, ISDC confirmed they were receiving TLM. Again, at 13:27 until 13:31, the ISDS-ISDC link was disconnected.
- On DoY 252 at 02:50, there were again errors sending data to ISDS., the IFRD task was stopped and started, and at 03:00, the errors ceased. At 03:57, the errors started again, the IFRD task was stopped and started, but it was not until 04:20, after both the IFRD and ISDS tasks were stopped and started that the link returned. At 05:10, the errors returned, IFDRD and ISDS were restarted by OSC, and at 05:25, the link was back. At 06:23, the errors returned, at 06:59, VC7 was swapped to NCTRS-B, and at 07:01, ISDC confirmed they were receiving data on the B-chain. At 10:31, the link was swapped back to the A-chain, without incident. At 14:00 erratic TLM was reported at ISDC, the IFRD and ISDS were restarted, at 15:30, TLM was back. At 16:25, it was again erratic, again the tasks were restarted, and at 16:41, the TLM returned. Between 17:28 and 17:44 there were again problems.
- On DoY 253, at 07:49, ISDC reported they had not received any auxiliary files since 10:30 on DoY 252. OSC was asked to restart IFTS SDS service on isdsa, at 08:16, ISDC confirmed reception of the files.
- On DoY 254 from 11:30 to 14:45 there were repeated errors sending data to ISDC, despite OSC restarting the ISDS and IFRD tasks.

5 Special Events

Nothing to report

6 Anomalies

There was a new problem with SPI. The ACS FEE showed some out-of-limits regarding the secondary power supply. The SPI PI has been informed and an investigation is ongoing. In addition, the problem regarding the interruption of the production of the IBIS histogram occurred. The Flight Control Team at MOC is currently installing a mechanism that should allow a fast detection of this problem so that the impacts can be limited.

The main problem regarding the ground segment concerns the regular stop of the data consolidator. The following list summarises the main problems related to the MOC.

- On DoY 250 at 11:31, the Auto-stack crashed. It was restarted and reloaded for Revolution 110, there as no impact.
- On DoY 250, at 21:51, there was an error sending data to the consolidator, at 22:08, computer were requested to stop and start the IDDA, at 22:33, the errors stopped.
- On DoY 251, at 09:29, sun128 was logged-out and back in again, to clear a problem with low swap space, the soda server was also restarted.
- On DoY 251, at 20:58, there was another error sending data to the consolidator, computer were asked to restart the IDDA, which was completed at 21:16.
- On DoY 252, at 07:01, the IDDA was taken down to replace a disk, at 10:30 it was back up and running. Later at 17:51, errors were again seen sending data to the consolidator, at 19:00 computer was requested to reboot IDDA, at 19:17, the reboot was completed, and the alarms stopped. Later at 21:54, there were again errors from the consolidator, at 22:41, the IDDA reboot was started, but due to the IDDA machine 'Blocking', the reboot did not complete until 23:11.
- On DoY 253, at 14:33, the command A3189 erroneously failed to release. This is a known IMCS problem that occasionally occurs. The impact was that pointing 01110004 was lost and 01110005, performed manually.
- On DoY 253 at 22:31, there were errors reported on the consolidator, computer rebooted the IDDA, and at 23:05, the activity was complete.
- On DoY 254 at 06:14, the playback had to be aborted, as no TM was being received.

During this week, there were several events relating to the ground stations:

- On DoY 249 at 01:45, no TLM was received from DSS16 through the NCTRS. At 01:48, DSS16 reported a 'break' between JPL & ESA. The VC0 and VC7 TLM returned at 02:14, the impact was pointings 01090043 and 01090044 manually executed. When attempting to update the slew to attitude 01090045, the FD tool crashed, and the manoeuvre had to be executed using default parameters.
- On DOY 251, at 17:04, VC0 TLM from Redu dropped for ~1 second, and at 19:12, the TM and TC dropped, network reported a 'hit on the line', at 19:24, the links were back, no apparent impact.
- On DoY 252 at 11:07, there were short drops of TLM from Redu, probably due to the start of the recall.
- On DoY 253, at 03:48 there was a short drop in VC0 and VC7 TLM from DSS-24, the cause is unknown, the relevant DR# is G103302, there was no impact.
- On DoY 255, at 23:20 during the Ground Station handover, the TLM from Redu was lost early, this caused the updates to the Broadcast packet not be up-linked, there was no impact.

The list of the pending anomalies since Launch is currently being revised. The main pending anomalies concern the data consolidator and the interruptions of the link to

ISDC. A test bed has been set up in order to perform further investigations outside the operational environment.
New anomalies raised during the past week are listed below:

ARid	Date Occurrence	Subject	Segment	Element	Status
INT_SC - 66	09/09/2003	IBIS: Histogram production stopped.	Space	IBIS	Pending
INT_SC - 67	12/09/2003	SPA ACS FEE out-of-limits on secondary power supply	Space	SPI	Pending
INT - 002434	05/09/2003	FOPGEN database tables column width inconsistency	Ground	FOPGEN	Pending
INT - 002435	07/09/2003	Sudden disappearance of the Auto-Stack task during commanding	Ground	IMCS	Pending
INT - 002439	10/09/2003	IPKT cannot receive message from service NCTRS	Ground	IMCS	Pending

7 Future Milestones

It was agreed that the battery reconditioning is not required at this stage. Since this is a critical operation it was decided to move the first reconditioning to Spring 2004 before the Eclipse Season #4.

Since the last SPI annealing process did not have the desired effect, i.e. the recovery of the performance was less than anticipated it has been agreed to perform another annealing procedure in November this year. Since the pre-launch qualification was limited to two annealing processes another qualification campaign is being performed to verify that further annealing processes can be performed without impacting the health of the instrument.

There are a few On-board S/W patches related to the instruments (OMC, IBIS) in the pipeline that should cure a few open problems. It is currently panned to upload these patches in October.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 110
Revolution 110 began with a raster dithering observation of SGR1806-20 (RA 18:08:40.20; DEC -20:24:47.4) lasting ~5hrs30mins. This was followed by an amalgamated raster dithering observation of SgrA* and the Galactic Center (RA 17:45:40.00; DEC -29:00:28.0), performed throughout the remaining observation time (~55 hours).

Revolution 111

In revolution 111 a raster dithering observation of the Galactic Center (RA 17:45:40.00; DEC -29:00:28.0) was performed throughout the available observation time (~61 hours). The first ~7 hours of this was amalgamated with an observation of SgrA*.

Throughout both 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

```
2003-08-24T22:54:49.000Z     175.3184    F   Automatic TM processing.
2003-08-26T11:35:33.000Z     175.2518    F   Automatic TM processing.
2003-08-27T22:41:45.000Z     175.2272    F   Automatic TM processing.
2003-08-29T11:18:45.000Z     175.1844    F   Automatic TM processing.
2003-08-30T22:03:53.000Z     175.1486    F   Automatic TM processing.
2003-09-01T11:02:13.000Z     175.1321    F   Automatic TM processing.
2003-09-02T22:10:57.000Z     175.1154    F   Automatic TM processing.
2003-09-04T05:17:56.000Z     175.0947    F   Automatic TM processing.
2003-09-04T10:47:16.000Z     175.0917    F   Automatic TM processing.
2003-09-05T21:58:08.000Z     175.0710    F   Manual Processing of 0109_0501_M.RWB
2003-09-07T05:06:03.000Z     175.0524    F   Automatic TM processing.
2003-09-07T10:31:24.000Z     175.0503    F   Automatic TM processing.
2003-09-08T21:41:03.000Z     175.0165    F   Automatic TM processing.
2003-09-10T10:18:19.000Z     175.0086    F   Automatic TM processing.
2003-09-11T21:27:35.000Z     174.9931    F   Automatic TM processing.

This report was generated  Fri Sep 12 08:00:14 GMT 2003
```

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, 65 Open Loop Slews, 94 Closed Loop Slews and 5 Momentum Bias were executed. 4 slews were missed or executed manually. This is equivalent to a 2.5% loss.

06/09/03 (Day of Year 249, Revolution 109)

Slew lost due to unclear problem with JPL: Shortly after the TM H/O from Redu to DSS-16, the TM was lost. This coincided with the uplink sweep from DSS-16. DSS-16 reported that in their view the reason was a communications problem between JPL and ESOC. In any case, the TM was flowing again after a disconnection and reconnection of the links (TC and TM).
The impact of this problem was that the slew to pointing 01090043 was missed, and the slew to 01090044 was performed manually.
During the recover schedule, the FDS application crashed when trying to update the parameters for slew 01090045. The slew was performed with the default parameters, and the problem had no impact. The problem is under investigation.

07/09/03 (Day of Year 250, Revolution 109-110)

Guide Star released due to the ACC STR SEU Filter: After the open loop slew 01090070, the star that was picked up as guide by the ACC was giving very frequent False Event readings. At 04:33:32 the SEU Filter threshold was exceeded. Since this occurred inside the first minute after the end of the slew, the IMU was not powered on. The star continued giving numerous False Event readings, and at 04:34:07, when the threshold was exceeded more than one minute after the end of the slew, the IMU was powered on and put in the control loop. In the subsequent mapping, a new guide star was found by the ACC.
The lost star was Tycho#9077-02086-1, with expected magnitude and coordinates 8.11 (-10370, -17779), and reported in TM as 8.20 (-10360, -17789). It could be, that the detection of this star, was affected by a close neighbour, Tycho#9077-02103-1m, with expected magnitude and coordinates 8.4 (-9743, -17937).
The altitude at the time of the problem was 52000 Km.

The impact of the problem was that the OTF for pointing 01090070 stayed low.

Guide Star released due to the ACC STR SEU Filter: Shortly after AOS in revolution 110, at 10:00:33.788 the guide star was lost due to the SEU Filter Threshold being exceeded. The star was a magnitude 6.0 at (-20707, 13129). The altitude in the orbit was 14560 Km.
The new star found by the ACC, had a reported magnitude 8.30, and coordinates (14430, -11950). Looking into the catalogue, this seems to be the combination of two stars, Tycho#8245-01040-1 with 8.35 (14796, -10224), and Tycho#8245-01114-1 with 8.15 (13675, -10651).
This star, which was very noise all the time, was lost at 10:29:33.847, from one cycle to the next. In the subsequent mapping a stable star was picked up by the ACC.
This problem had no impact, since all occurred before the first slew of the revolution.

08/09/03 (Day of Year 251, Revolution 110)

Nothing to report.

09/09/03 (Day of Year 252, Revolution 110)

Nothing to report.

10/09/03 (Day of Year 253, Revolution 110-111)

Guide Star released due to the ACC STR SEU Filter: Shortly after AOS in revolution 111, at 09:56:53.788 the guide star was lost due to the SEU Filter Threshold being exceeded. The star was a magnitude 6.75 at (-15713, 7448). The altitude in the orbit was around 15500 Km.
The new star acquired was adequate for the RWB, so there was no impact on the timeline execution.

Slew lost due to IMCS problem: At 14:33 the command to swap the guide star prior to a Closed Loop Slew failed static PTV. All the conditions were actually OK, the command should not have failed. This is a known occasional IMCS problem.
The impact of the problem was that slew 01110004 was lost, and 01110005 performed manually.

11/09/03 (Day of Year 254, Revolution 111)

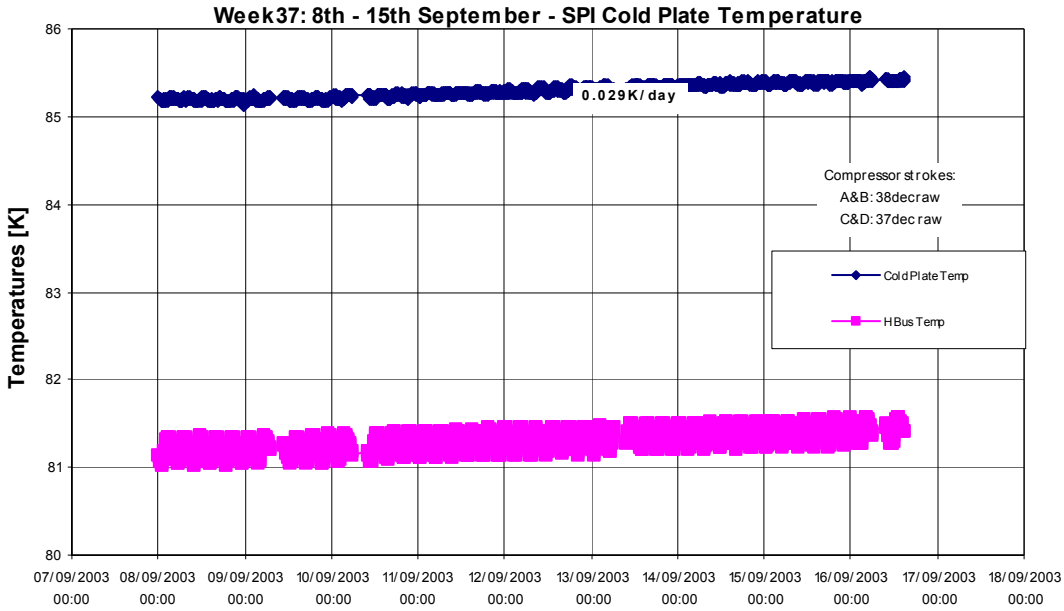
Nothing to report.

12/09/03 (Day of Year 255, Revolution 111)

Nothing to report.

8.3.2 SPI Operations

Cryocooler:
After the compressor stroke adjustment to 4x38dec raw commanded two weeks ago, the cold-plate temperature reversed its trend decreasing down to 85.2K and starting, after a few days, to drift high again at the expected rate (0.029K/day).



IASW/DPE:
Nothing to report

ACS:
Out-Of-Limits:
The following ACS FEE out of limits were detected during the reporting period:

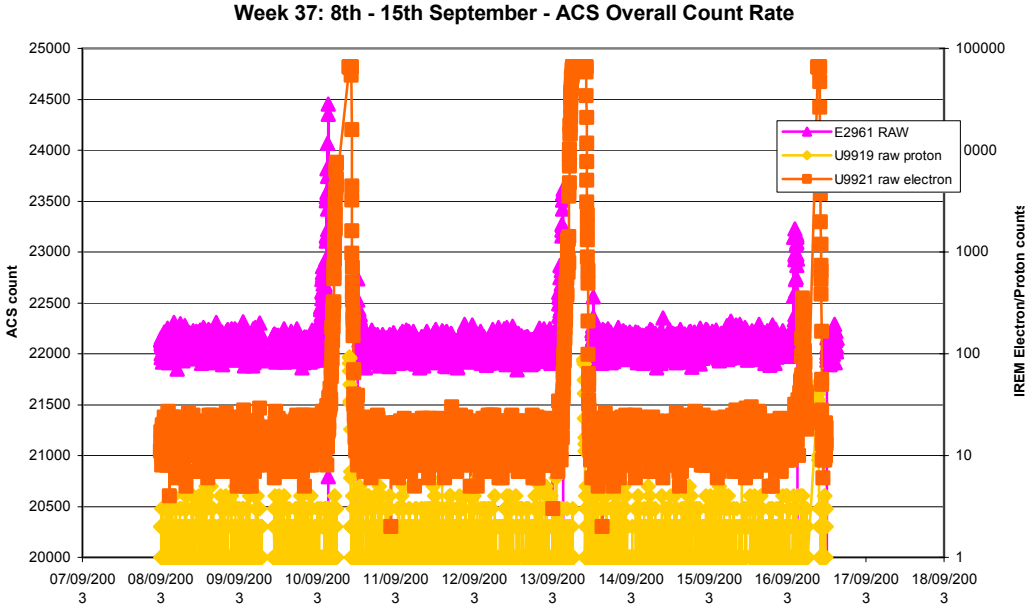
TM E3175 S AS TEMP L11 = PARAM>SPEC at 2003.257.04.50.55: this parameter is the result of the FEE#11 temperature self-check. The exception indicates that the temperature was exceeding 50degC.

TM E1296 S AS IBS ST L = ERROR at 2003.255.03.26.41: This flag is set to error by the VCU when it receives a response from the Internal Serial Bus (ISB, connecting the FEEs to the VCU for data i/o) showing Parity error or Address/Command code not ok.

They both occurred well away from the automatic switch off/on of the ACS high voltages at belts entry/exit, performed by the DPE IASW, and therefore it cannot be due to transients in the FEE status.
However, since the duration of the exceptions was very short (1 TM cycle) no contingency procedure was started.

An anomaly report (INT_SC-67) was opened last week to report the similar previous ACS exceptions. The above ones will be added to the list.

The following plot shows the ACS overall count rate during week37.



AFEE :
Nothing to report

DFEE, PSD:
Nothing to report

8.3.3 IBIS Operations

There were a few reports during Belt passage the OEM ID 167 Class 2<<IBIS1 PICsIT NOISY SEMIMODULE SIGNALLING>> due to the PICsIT detectors being ON without the VETO anticoincidence system, as required by PIs. The Noisy semimodules were SM1-PDM2, SM2-PDM4, SM2-PDM7, SM1-PDM8.

The following OEM ID 179 Class 2 <<IBIS1 VETO COUNTER BOTTOM EXCEEDS ALERT VALUE>> was reported on three occasions. The relevant TM_para G6062 showed values inside limits therefore the problem was disregarded, as suggested by the nominal reaction to this OEM. The times when the OEM was observed were: DoY 252 at 00.49, 02.59 and 07.12.

The following OEM ID 180 Class 2 <<IBIS1 VETO COUNTER LATERAL EXCEEDS ALERT VALUE>> was reported on five occasions. The relevant TM_para G6063 showed values inside limits therefore the problem was disregarded, as suggested by the nominal reaction to this OEM. The times when the OEM was observed were: DoY 251 at 03.21, 12.07, 15.46 and 19.59, DoY 252 at 05.03.

On DOY 251 at 21.26 and DoY 252 at 21.26, the OEM ID 183 Class 2 <<IBIS1 VETO +5V VECU VOLTAGE OUT OF RANGE>> was reported. The relevant TM_para G6106 showed values inside limits therefore the problem was disregarded, as suggested by the nominal reaction to this OEM.

On DOY 254 at 15.37, the OEM ID 184 Class 2 <<IBIS1 VETO +28V VDM/CDM VOLTAGE OUT OF RANGE>> was reported. The relevant TM_para G6107 showed values inside limits therefore the problem was disregarded, as suggested by the nominal reaction to this OEM.

On DoY 253 at 00:25 IBIS Histogram downloading stopped as indicated by the HK TM. The operator started the recovery action following the OR-92. At 00:28 IBIS was reset back to Scientific Standard Mode and the downloading of the PICsIT Histograms was restarted. The anomaly is due likely to the coincidence of GSHF setting with the starting of the S5 (PICsIT Calibration Histogram) process, this occurred during the Station Handover from DSS16 to REDU on DoY 2003.252.23.35, and has happened on previous occasions.

8.3.4 JEM-X Operations

During the perigee on DoY 250 at 02:13, JEM-X went to SAFE mode commanded by the Autostack, however, on the following perigee on DoY 253, at 01:33, JEM-X the on-board automatism triggered a SAFE mode when high radiation count rates were sensed, (L5119 > 25000 cts/8sec), (the scheduled transition time in the Autostack was 02:01). The JEM-X DFEE reported an unexpected DFEE state due to a loss of communication between the DPE and DFEE (OEM ID 189), but after ~30 minutes, the communication problem was solved automatically, the OEM 254 was issued indicating the units were communicating again.

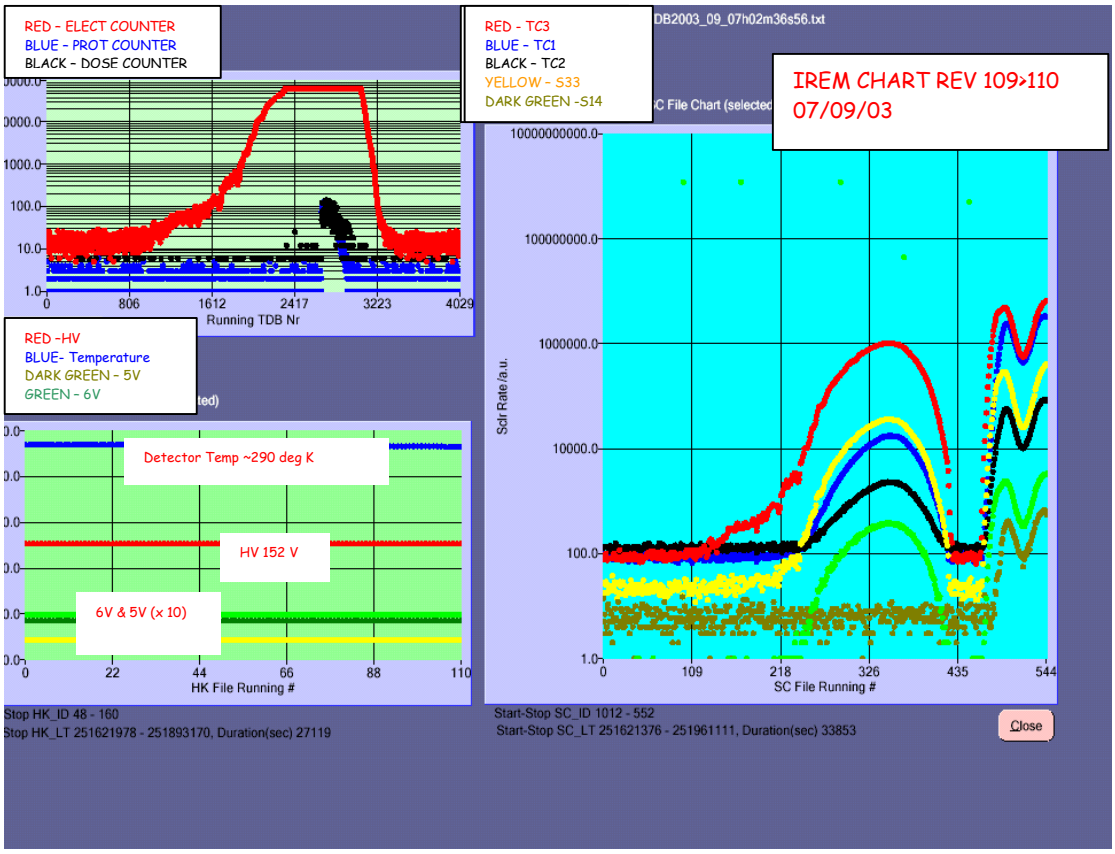
8.3.5 OMC Operations

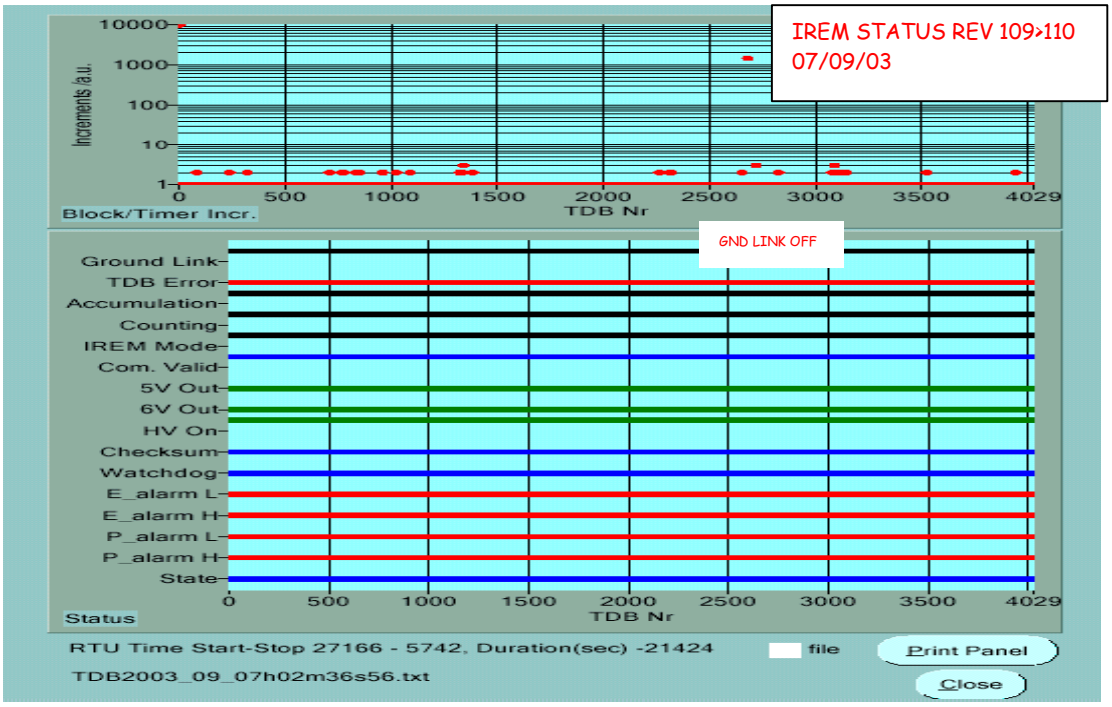
On DoY 249 at 02:48 two TCs were rejected, this was due to the lost pointing of 01090044. Later on that day between 03:25 and 03:43 there were seven On Event Messages indicating that the Science Window was being rejected, this was probably due the Flight Dynamics parameters not being updated in this period. On DoY 253 at 14:37 two more TCs were rejected, due to the lost pointing 01110004.

8.3.6 IREM Operations

On DOY 253 at 06.00Z a loss of TM from DSS-24 station was reported, the IREM Ground Link OFF ED was not up-linked and the data relevant to the perigee passage for revolution 110->111 were not down-linked on ground at following AOS

Plots of the IREM count rates and statuses for the Belts passage in rev 110 (during rev 111 the IREM ECOE was disconnected) are shown below:


RED - ELECT COUNTER
BLUE - PROT COUNTER
BLACK - DOSE COUNTER
Running TDB Nr
RED - TC3
BLUE - TC1
BLACK - TC2
YELLOW - S33
DARK GREEN -S14
DB2003_09_07h02m36s56.txt
IREM CHART REV 109>110
07/09/03
Sclr Rate /a.u.
SC File Running #
RED -HV
BLUE- Temperature
DARK GREEN - 5V
GREEN - 6V
Detector Temp ~290 deg K
HV 152 V
6V & 5V (x 10)
HK File Running #
Stop HK_ID 48 - 160
Stop HK_LT 251621978 - 251893170, Duration(sec) 27119
Start-Stop SC_ID 1012 - 552
Start-Stop SC_LT 251621376 - 251961111, Duration(sec) 33853
Close


IREM STATUS REV 109>110
07/09/03
Increments /a.u.
Block/Timer Incr.
TDB Nr
GND LINK OFF
Ground Link
TDB Error
Accumulation
Counting
IREM Mode
Com. Valid
5V Out
6V Out
HV On
Checksum
Watchdog
E_alarm L
E_alarm H
P_alarm L
P_alarm H
State
Status
RTU Time Start-Stop 27166 - 5742, Duration(sec) -21424
TDB2003_09_07h02m36s56.txt
file
Print Panel
Close

8.4 List of Anomalies since Launch

A clean-up of the list of pending anomalies is in preparation.