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

# INTEGRAL
# Mission Report

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

**No. 052**
**Week 38**

**22.09.03**

**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.

It addresses the activities from 13.09.03 until 19.09.03 (both dates inclusive) and covers the revolutions 112, 113 & 114.

# 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). 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 smooth, with only one interruption of the AOCS timeline operations, due to a TC link problem at station handover.

The fuel consumption over the period between 11/09/2003 and 18/09/2003 was 0.088Kg. The remaining propellant is in the order of 174.90 Kg on the 19$^{th}$ 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, with the temperature 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.

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

### *3.2.4 OMC*

During this period 132 OMC images were acquired with 1 missed, due to a network problem, at 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 well within the specification. The operations were executed smoothly. The main problems this week, as with last week, concern the archive consolidator and the link to the ISDC.

## 4.1 Mission Operations Centre

The performance of the MCS was good except the problem with the data consolidation and distribution of the data to ISDC, see also section 6. Appropriate operational procedures are in place to limit the impacts of these problems.

## 4.2 Ground Stations & Network

The performance of the ground stations, Redu and Goldstone, was good in the reporting period. There were only minor problems, see section 6.

### 4.3 Science Ground Segment

#### *4.3.1 ISOC*

No ISOC Input has been provided

#### *4.3.2 ISDC*

There were repeated problems concerning the link to the ISDC reported most days 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 258 from 20:36 to 22:48, ISDC were not receiving TLM due to the activity on the IDDA triggered by the consolidator errors, the errors briefly returned between 23:38 and 23:48 when TCON-RT and TMDS-RT were stopped and started to clear consolidator errors.
- On DoY 259, at 12:42 there were several errors sending data to the ISDS.
- On DoY 260, at 00:14, when the IDDA was rebooted to clear consolidator errors, the errors started with sending data to the ISDS. When the IFRD on ISDS-A was restarted, it was unable to connect to the prime archive on IDDA. After a further reboot of ISDS, the errors stopped at 00:48. Later at 01:58, the link between ISDS and ISDC showed disconnect, it was reconnected a minute later. Later still between 06:35 and 06:39 and again between 21:16 and 21:22 there were more errors sending data to the ISDS.
- On DoY 261 at 22:24, there were two errors sending data to ISDS.
- On DoY 262 from 12:52 to 12:58, there were errors sending data to ISDS, then again from 17:43 to 17:44.

## 5 Special Events

Nothing to report

## 6 Anomalies

The space segment did not have any new anomaly. The main problems concerned the ground segment, in particular the data consolidation and the data distribution. The relevant procedures are in place to avoid the loss of scientific data.

The MOC anomalies were as follows:

- On DoY 257, between 19:37 and 1944, there were errors sending data to the consolidator...
- On DoY 258, between 02:36 and 02:57, there were more errors sending data to the consolidator, later between 20:11 and until 23:11 consolidator errors were being received, this despite several reboots of the IDDA machine. At 23:36, the errors returned, TCON-RT and TMDS-RT on MADDS IDDA were both stopped and started clearing the problem.
- On DoY 259, from 12:27 to 12:29 there were errors sending data to the consolidator. There was another at 12:41, and later from 21:13 through to 00:14 when the IDDA was successfully rebooted, there were more errors.
- On DoY 260, between 22:38 and 23:20, there were further consolidator errors, the TCON-RT task was stopped and started, but it was a reboot of IDDA that cured the problem.

- On DoY 261, from 06:12 till 06:37, when the TCON_RT task was restarted there were errors sending data to the consolidator. Later, there were more errors sending data to the consolidator, namely at 12:15, then between 15:39 and 15:51, when the IDDA was rebooted. There were more errors from 23:57 to 23:59.
- On DoY 262 at 15:13, there was an isolated error sending data to the consolidator. At 16:46, an error that MADDS-B/AUX was not extracting THF files, appeared. The IADDS-B arc task on idda was restarted.

During this week, there were only two minor events relating to the ground stations:

- On DoY 260 at 01:14, there was a 7 second drop in VC0 TLM, network reported a "hit on the line".
- On DOY 261, at 07:01, Network were late connecting the TC link, which caused slew 01130045 to be missed, and 01130046 to be performed manually.

New anomalies raised during the past week are listed below:

| ARid | Date Occurrence | Subject | Segment | Element | Status |
|---|---|---|---|---|---|
| INT - 002449 | 15/09/2003 | Early carrier from DSS-16 DR:G10338 | Ground | NASA Sta. | Pending |
| INT - 002450 | 17/09/2003 | Timeline generation does not fail if Raw parameter value in APF is out of range | Ground | IMCS | Pending |

The list of pending anomalies is currently been revised.

# 7 Future Milestones

The SPI annealing qualification is ongoing. The next annealing procedure is planned for early November.

The SPI team has raised a new Change Request to update the SPI DPE IASW. This is currently been analysed at MOC. The relevant change will be implemented when approved at Ground Segment level.

# 8 Appendix

The appendix includes various detailed information.

## 8.1 Overview of Revolutions

**Revolution 112**
In revolution 112 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).

**Revolution 113**
The observations in revolution 113 consisted of a raster dithering observation of the Galactic Center (RA 17:45:40.00; DEC -29:00:28.0) lasting ~31.5 hours, followed by an amalgamated raster dithering observation of SgrA* and the Galactic Center, performed at the same attitude, for the remaining ~28.5 hours of observation time.

**Revolution 114**
In revolution 114 an amalgamated raster dithering observation of SgrA* and the Galactic Center (RA 17:45:40.00; DEC -29:00:28.0) was performed throughout the available observation time (~61 hours).

Throughout these observations 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*

```
2003-08-30T22:03:53.000Z     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.
2003-09-13T10:05:22.000Z     174.9826    F   Automatic TM processing.
2003-09-14T21:14:46.000Z     174.9562    F   Automatic TM processing.
2003-09-16T09:54:10.000Z     174.9324    F   Automatic TM processing.
2003-09-17T21:04:37.000Z     174.9049    F   Automatic TM processing.

This report was generated  Fri Sep 19 08:00:16 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, 62 Open Loop Slews, 86 Closed Loop Slews and 5 Momentum Bias were executed. 2 slews were missed or executed manually. This is equivalent to a 1.4%.

**13/09/03 (Day of Year 256, Revolution 111-112)**

Nothing to report.

**14/09/03 (Day of Year 257, Revolution 112)**

**Pitch and Yaw Errors due to undetected SEUs:** For the pointing 01120018, the ACC selected a very dim guide star. The start (Tycho#7379-0015501) has a catalogue expected instrumental magnitude of 8.7, but was detected by the STR with 8.4. This marginal star was affected twice by undetected false events causing a pointing error above the OTF threshold (one cycle each time, at 04:40:05 and 04:59:06). This was not seen at Broadcast Packet level, and the problem had no impact.

**15/09/03 (Day of Year 258, Revolution 112)**

Nothing to report.

**16/09/03 (Day of Year 259, Revolution 112-113)**

Nothing to report.

**17/09/03 (Day of Year 260, Revolution 113)**

**18/09/03 (Day of Year 261, Revolution 113)**

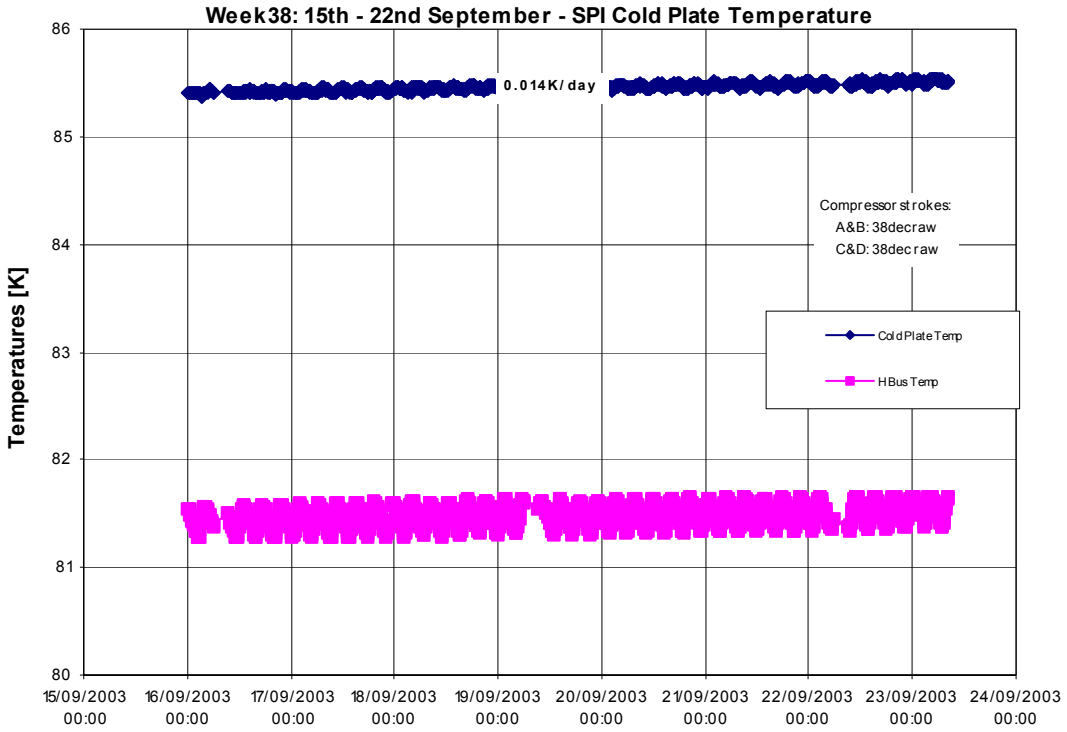
**Slew lost due to TC link problem at station handover:** During the station H/O from Goldstone to Redu, there was a problem establishing the TC link, with the result that the connection was delayed. Due to this, the slew 01130045 was missed and 01130046 was performed manually. In addition there was a problem to update manually the timeline parameters for slew 01130047, but this had no impact since the initial attitude for this slew was nominal (acquired with a closed loop slew).

**19/09/03 (Day of Year 262, Revolution 113-114)**

Nothing to report.

### *8.3.2 SPI Operations*

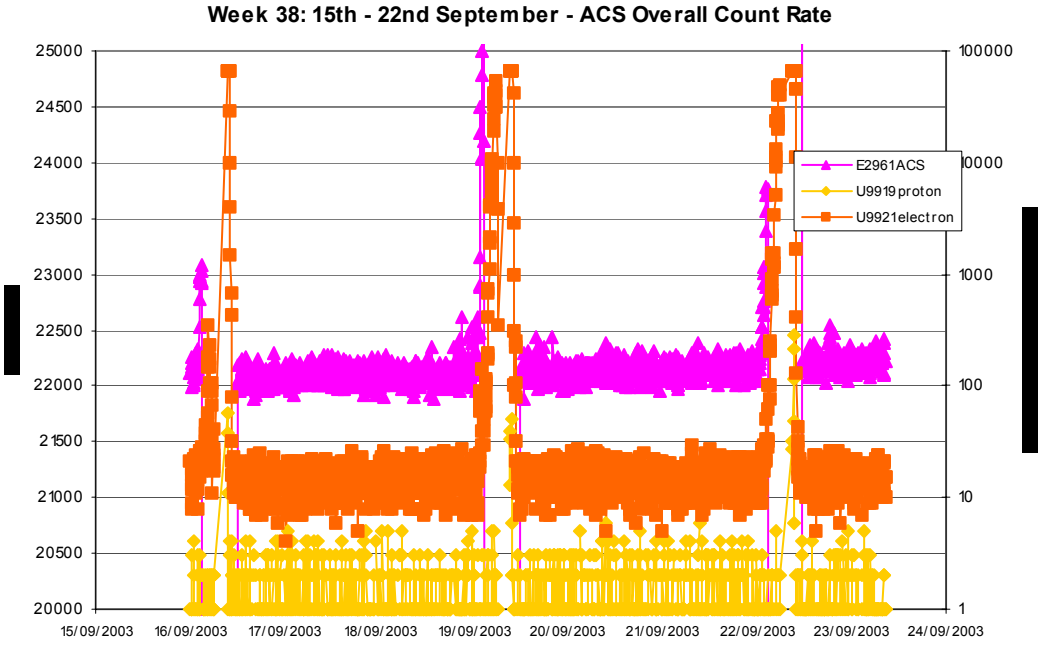
Cryo-cooler:
The long stabilization process, started after the annealing in July, is definitively over: the temperature is now leveled at around 85.5K with a very small positive drift of 0.014K/day, well within the expected value.




IASW/DPE:
The exception OEM 242 "Failure in analyzing the HSL data" with parameters E9786=PSD, E9788=EOT, E9789=INVALID were down-linked each time the instrument was approaching the belt entry at 2003.265.02.37, 2003.262.02.51, 2003.259.03.02.
No action was taken as the messages appeared only once and in coincidence with the belt entries, where an increase of the PSD false events rate might cause this HSL data transmission exception.
The SPI team has been contacted to help in further investigations.

ACS:
Nothing to report.

The following plot shows the ACS overall count rate during week38.




AFEE:
Nothing to report.

DFEE:

PSD:
See IASW/DPE.

### *8.3.3 IBIS Operations*

On DoY 256 at 11.52Z, the parameter G2014 was reported as failing the SCC (the detection of the Noisy Pixels >1) in MDU0. After a few TM cycles the parameter was set back in limit. No further action was taken.

On DoY 262 at 11.44Z the parameter G2098 was reported as failing the SCC (detection of the Noisy Pixels) in MDU0. Again, after a few TM cycles the parameter was set back in limit. No further action was taken.

On DoY 261 at 23:12Z the OEM ID 133 Class 2 <<IASW LSL TRANSFER FAILED (LOW LEVEL)>> flagging a problem on the low speed line for the peripherals, together with the OEM ID 131 Class 2 <<IASW LSL TRANSFER FAIL REPORT FOR HIGH-LEVEL MODULE RESET>>. The generation of both the OEMs is expected when a problem occurs on the LSL (FDIR doc). Immediately afterwards, the MCE 5 generated the following OEM ID 238 Class 3 << IBIS MCE5 TIME OUT>> flagging an on-board rejection due to a time-out. The problem in the LSL (TC/HK line) appeared to determine the rejection (time out) in the MCE #5 of an internal TC (CID 254 and APID 1). Investigations are on-going.

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 on DoY 256 were: PDM6 SM-2 and PDM4 SM-2, and on DoY 262 they were: PDM7 SM-2 and PDM8 SM-2.

The following OEM ID 179 Class 2 <<IBIS1 VETO COUNTER BOTTOM EXCEEDS ALERT VALUE>> was reported on sixteen 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 258 at 00.21, 02.16, 15:40, 20:22, 21:36 and 22:11, DoY 259 at 13:41, 20:45, 22:07 and 23:24, DoY 261 at 00:43, 01:27, 03:25, 03:40, 08:16, 19:36

The following OEM ID 180 Class 2 <<IBIS1 VETO COUNTER LATERAL EXCEEDS ALERT VALUE>> was reported on ten 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 257 at 22:35, DoY 258 at 15:11, 18:23 and 20:32, DoY 259 at 21:52, DoY 260 at 00:51, DoY 261 at 09:22, 10:56 and 22:19, and DoY 262 at 01:07.

On DOY 258 at 03:20, the OEM ID 183 Class 2 <<IBIS1 VETO +5V 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 256 at 15.31, 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.

### *8.3.4 JEM-X Operations*

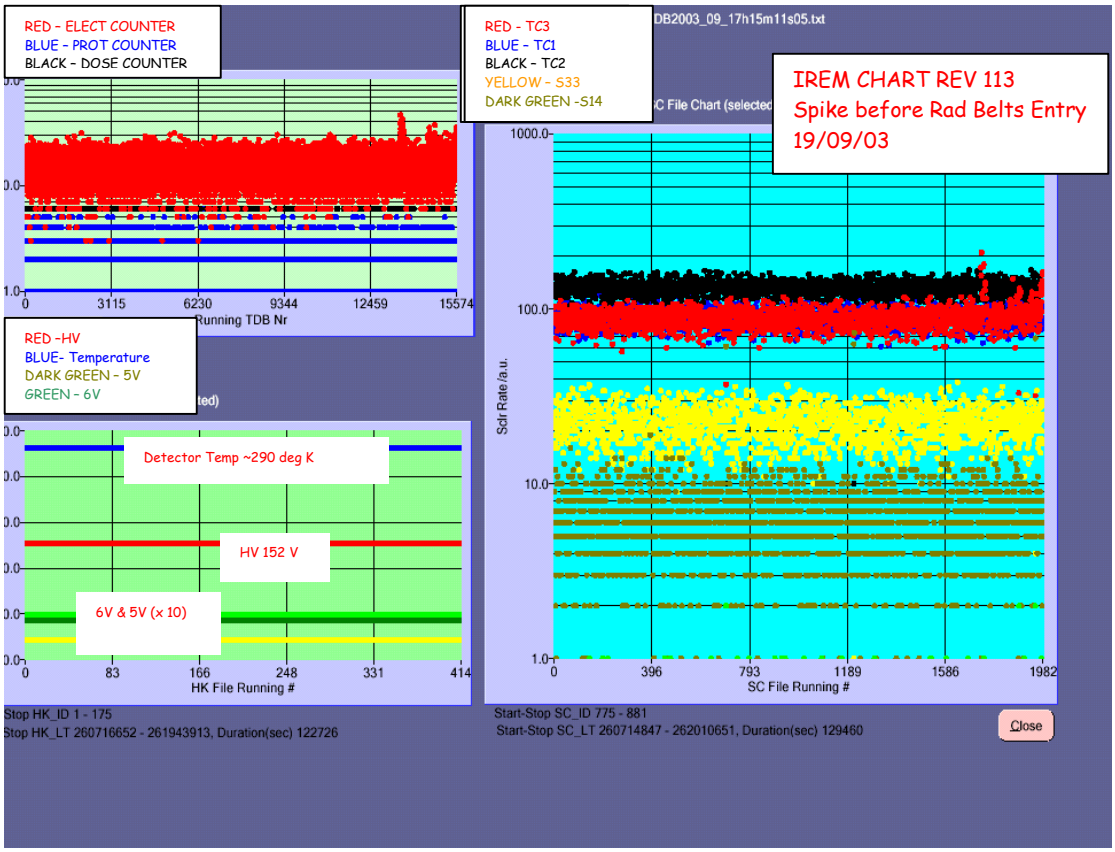
During the perigee passage for revolution 112, on DoY 259 at 01:42, JEM-X went to SAFE mode commanded by the Autostack, however, on the following perigee on DoY 262, at 01:25, the on-board automatism triggered a SAFE mode when high radiation count rates were sensed, (L5119 > 25000 cts/8sec), the scheduled transition time in the Autostack was 01:30.

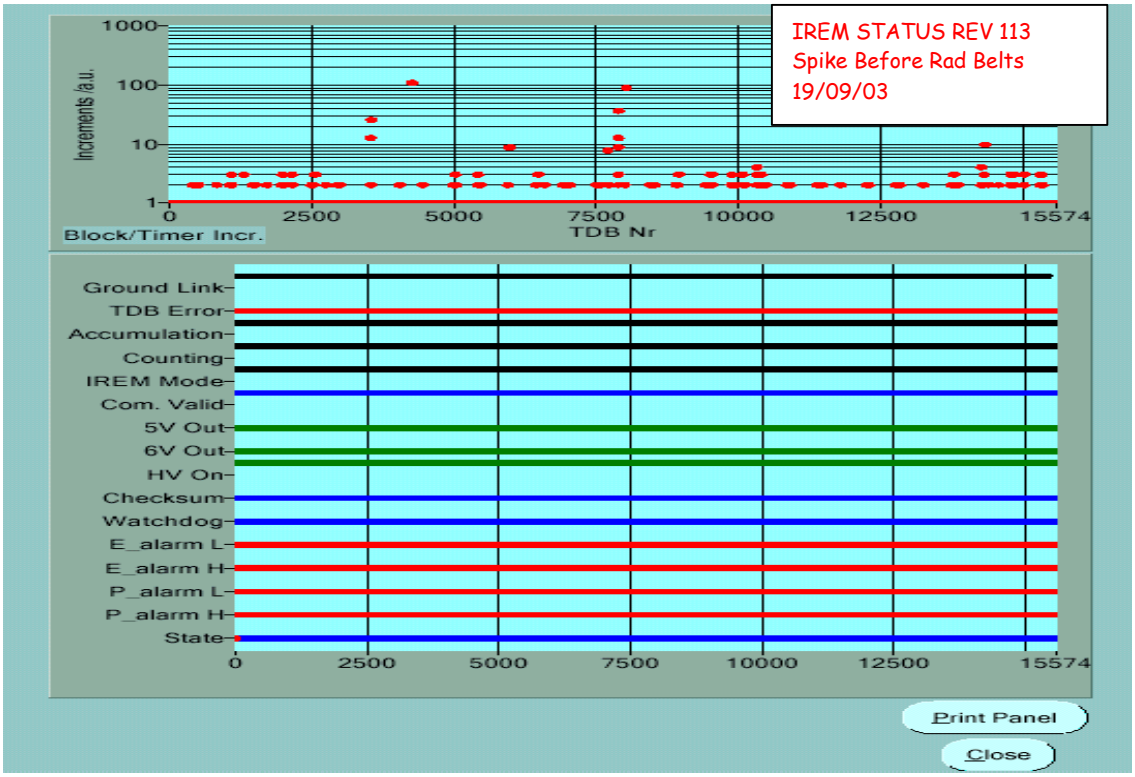
### *8.3.5 OMC Operations*

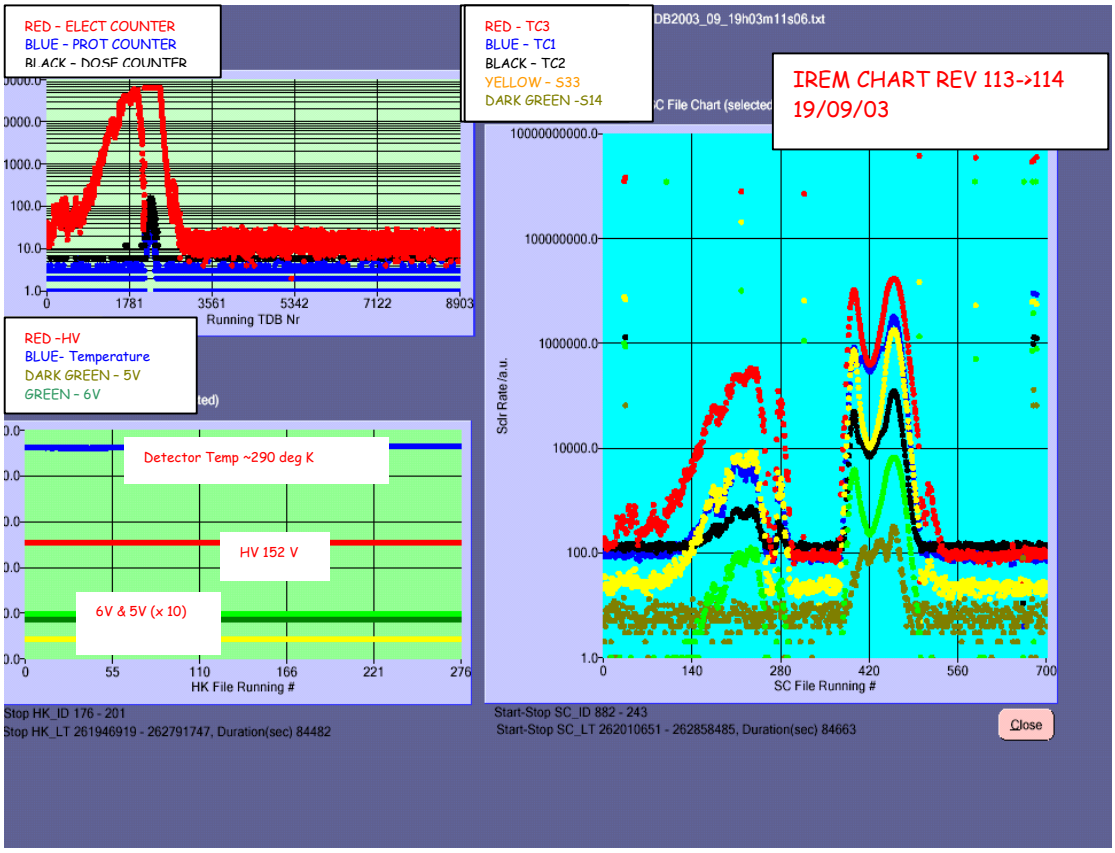
On DoY 261 at 07:05 two TCs were rejected, this was due to the lost pointing of 01130046. Nothing further to report.

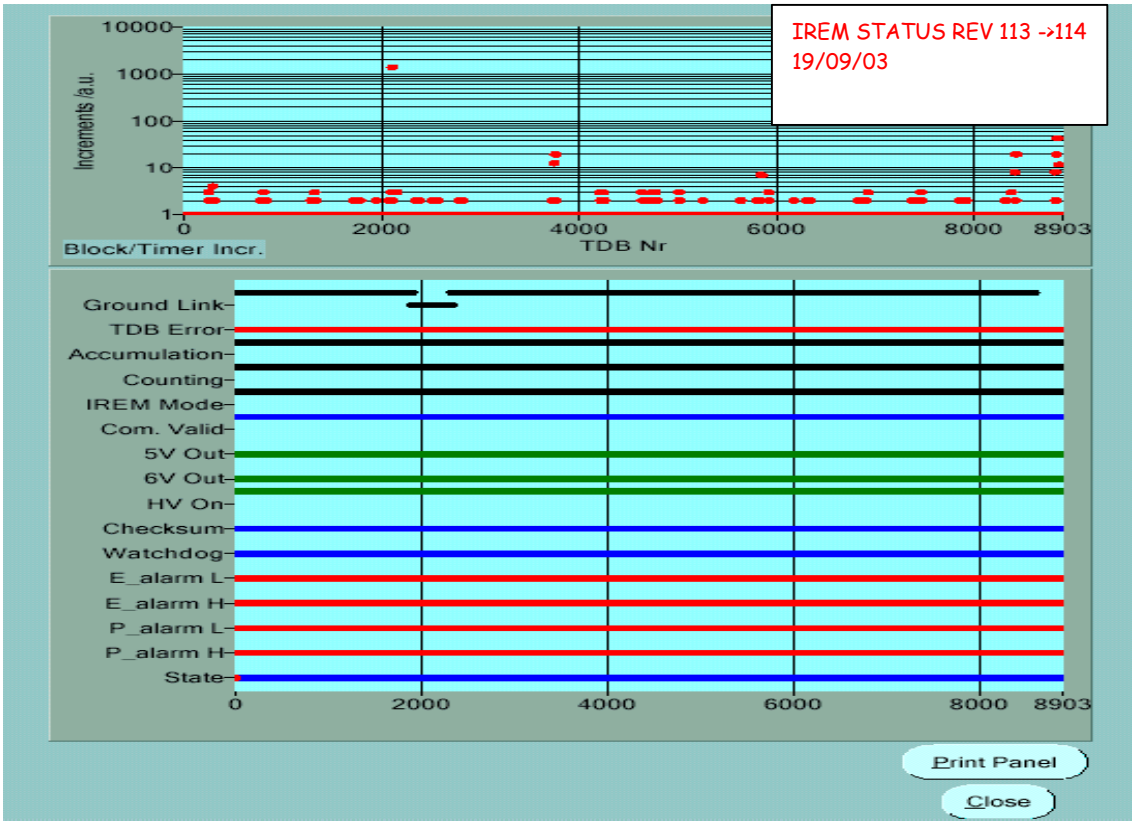
### 8.3.6 IREM Operations

Plots of an electron counter spike just before Radiation Belt entry on rev 113, together the IREM count rates and statuses for the Belts passage in revs 113 and 114 (during rev 112 the IREM ECOE was disconnected), are shown below:




IREM STATUS REV 113
Spike Before Rad Belts
19/09/03
Increments /a.u.
1000
100
10
1
0
2500
5000
7500
10000
12500
15574
TDB Nr
Block/Timer Incr.
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
Print Panel
Close


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_19h03m11s06.txt
IREM CHART REV 113->114
19/09/03
SC File Chart (selected
Scir 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 176 - 201
Stop HK_LT 261946919 - 262791747, Duration(sec) 84482
Start-Stop SC_ID 882 - 243
Start-Stop SC_LT 262010651 - 262858485, Duration(sec) 84663
Close


IREM STATUS REV 113 ->114
19/09/03
Increments /a.u.
10000
1000
100
10
1
0
2000
4000
6000
8000
8903
TDB Nr
Block/Timer Incr.
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
0
2000
4000
6000
8000
8903
Print Panel
Close

## 8.4 List of Anomalies since Launch

There are a lot of “Pending” Anomalies. However, most of these anomalies have already been solved and do not further impact the operations. A clean-up of the list of pending anomalies is in preparation.