EUROPEAN SPACE AGENCY

DIRECTORATE OF HUMAN SPACEFLIGHT AND OPERATIONS

MISSION OPERATIONS DEPARTMENT

INTEGRAL

Mission report

INT-MOC-SYS-RP-1001-OPS-OAI

No. 417

01.02.2013

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. Nominal science operations were perfomed according to the planning inputs from ISOC combined with some manual commanding by MOC.

This report addresses the activities from January and covers the revolutions 1248 untill 1258 (included). The targets of these revolutions can be found on the ISOC web: http://integral.esac.esa.int/isocweb/schedule.html?action=intro .

Summary of the main activities during the reporting period

- Nominal science operations. During this reporting period, 756 of the 760 planned science pointings were executed nominally. 3 pointings were lost due to TM drops from Weilheim, one was cut short due to a lost guide star.
- Eclipse season #22 until 01.01.2013
- Reconfiguration of AOCS, EPS and OBDH after end of eclipse season
- IMCS E3.6.0 for testing installed on C-chain
- Start of SPI annealing #20 on 04.01.2013
- Rev 1250: all slews as Open Loop Slews test was performed.
- Validation of Kiruna Cortex equipment for Integral has started
- LCTF test at REDU on 23./24.01.2013
- Development and testing of an upgraded MCS based on a virtualised Solaris 10 environment has started, in collaboration with 4 other missions in extended operations phase.
- Due to the unavailability of REDU to Integral, frequent ground station conflicts with other missions have to be resolved, at significant extra effort. Additionally the scheduled ground station time has increased due to the high number of Ground Station handovers.

Summary of the overall status and performance of S/C

- Nominal for platform and payload
- Fuel consumption was 0.43kg which is in line with the long term average (~108kg remaining).
- Spectrometer annealing # 20 took place from 4th to 21st January, all indications are that the annealing was successful and the expected energy resolution was recovered.
- The Perigee altitude has started to rise and is now at a height of about 4400km. This very low perigee has led to increased exposure to proton radiation with the consequences of:
    - An increased rate of solar array degradation.
    - Indications of an increased number of Star Tracker blemish pixels.
- This condition will probably persist until late 2013. As the power margin is currently still very good it is expected that it will not be necessary to constrain the solar aspect angle.

Summary of the overall status and performance of the ground segment

- Problems with REDU:
    - Ongoing occasional RFI at Redu, some sources identified, filter installed for testing

  - REDU G/S: track ended by STC schedule even though support should continue
- Problems with WHM:
  - Ongoing problems with WHM: low signal
  - TM Problems from Weilheim
  - Low signal downlink and uplink to WHM
- Problems with Kiruna:
  - Kiruna G/S: IFMSs not configured properly
  - Kiruna G/S: not possible to connect to either TMTCS on DOY005
  - Kiruna G/S: Prime IFMS did not lock on the ranging tone
  - KIRUNA NCTRS & TMTCS Configuration
  - Unexpected Loss of TM TC Connectivity to Kiruna 1
- Ongoing occasional interruptions to ISDS-ISDC link
- Disable SSC Checking for individual SPIDs doesn't work
- ARCH/MAN task cannot handle leap years (DOY 366)
- JEMX-1 & JEMX-2 HV activation failure due to High Radiation
- FDS reported problem when generating RMU drift update

Note:

- **EO 2.6 was cancelled due to the unavailability of REDU to Integral.**
- **In the IUG meeting on Jan 22nd 2013 it was agreed to cancel all post perigee EOs and perform pre-perigee EOs instead for getting better science data.**

The previous weekly and monthly reports are available at the XMM-INTEGRAL website: http://xmm.esoc.esa.int/documentation/wops.php .

2 Satellite status

2.1 Platform

2.1.1 AOCS

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

4 slews were missed from the Timeline.

The fuel consumption over the reporting period was 0.4058 Kg. The remaining propellant is in the order of 107.9962 Kg.

Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix 6.1.

2.1.2 Power

All units of the EPS are working nominally. From the EPS point of view eclipse season #22 was nominal. Despite the increased rate of degradation the solar array output is still sufficient to comfortable operate nominal mission operations.

2.1.3 Thermal

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

2.1.4 OBDH

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

The PST was over-subscribed by 3 packets, which were allocated to SPI during the Instrument window for the entire reporting period.

2.1.5 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. The transmitter is still switched off every perigee below 4500km to comply with ITU regulations.

2.2 Payload

2.2.1 SPI

Following the 20th SPI annealing, which ended on 21/01/2013, the overall status of the gamma-ray spectrometer is nominal, except for detector #2 (failed since 06/12/2003), detector #17 (failed since 17/07/2004), detector #5 (failed since 19/02/2009) and detector #1 (failed since 27/05/2010).

The Germanium detectors' temperature was kept in the range 80K+/-1K until the start of the 20th SPI annealing on 04/01/2013 at 00:43Z. Operations for the SPI annealing #20 were performed according to OCR 329. SPI annealing #20 was performed with the outgassing of the cold box, i.e., the cold box temperature was increased to +30°C during the annealing cycle. The 20th SPI ended on 21/01/2013.

The times for the main activities for SPI annealing #20 were as follows:

Date/Time	**Activity**
2013-01-04 00:43:00Z	Configure SPI for start of Annealing and stop SPI active cooling
2013-01-04 02:00:00Z	Annealing Heater Main ON
2013-01-04 04:00:00Z	Annealing Heater Redundant ON
2013-01-04 16:55:00Z	Heat Pipe Heater Main ON, All Antifreeze Heaters (1A; 2A; 1B; 2B) OFF
2013-01-05 04:55:00Z	Heat Pipe Heater Redundant ON
2013-01-05 13:07:00Z	Cold plate temperature reached 373K (100degC)
2013-01-13 22:48:00Z	Stop SPI Annealing: Annealing Heater Main and Redundant OFF
2013-01-13 23:43:37Z	ACS switch-on and start of ACS calibration (also FEE#57 and FEE#81 ON)
2013-01-17 02:12:00Z	End of ACS Calibration
2013-01-17 02:37:00Z	Thermal braids temperature TM EU0398A reached 308K
2013-01-17 04:18:06Z	Start of Cryocooler switch-on
2013-01-17 05:17:43Z	Cyrocooler switch-on complete and stroke set to 4x45
2013-01-20 13:30:00Z	Cold plate temperature TM EU0392A reached 127K
2013-01-21 09:42:00Z	Cold plate temperature TM E0392 reached 100K
2013-01-21 13:50:17Z	Selected narrow range cold plate temperature acquisition and restored PSD nominal threshold

2013-01-21 10:26:41Z	Camera switch-on start; HV of all GeD increased in 500V steps to 0.5kV; 1kV; 1.5kV; 2kV; 2.5kV with acquisitions in PHOTON mode from 2kV onwards
2013-01-21 13:02:00Z	Thermal braid temperature TM E0398 reached 86K
2013-01-21 13:16:00Z	Start of reduction of Cryocooler stroke for 80K target (FCP_SPI1_0072)
2013-01-21 13:57:17Z	Camera switch-on end: SPI in PHOTON mode with all GeD HV at 2.5kV
2013-01-21 15:07:14Z	Set nominal GeD HV back to 2.5kV and restore nominal ACS configuration (FEE#57 and FEE#81 OFF).
2013-01-22 09:04:30Z	End of reduction of Cryocooler stroke for 80K target: Stroke set to 4x37
2013-01-23 11:04:00Z	Set nominal IASW parameters (Cold Plate Monitoring temperature)
2013-01-23 12:32:00Z	Cold plate temperature TM E0392 reached 80.9K

Results of the SPI annealing: The camera degradation has been entirely recovered. The behaviour of detectors #4 and #12 at “high” temperature is now nominal: the cold box outgassing has been successful.

SPI was operated in photon-by-photon mode with spectra TM enabled during science observations. The assigned TM bandwidth in the science observation windows was 89 packets/cycle. The average telemetry occupation was 73.1 packets/cycle, except from rev. 1249 to 1253 (SPI annealing #20), when it was 30 packets/cycle.

The following plot shows the TM bandwidth allocation and occupation during the reporting period. The period of the SPI annealing #20 can clearly be seen from the change in TM allocation and usage.

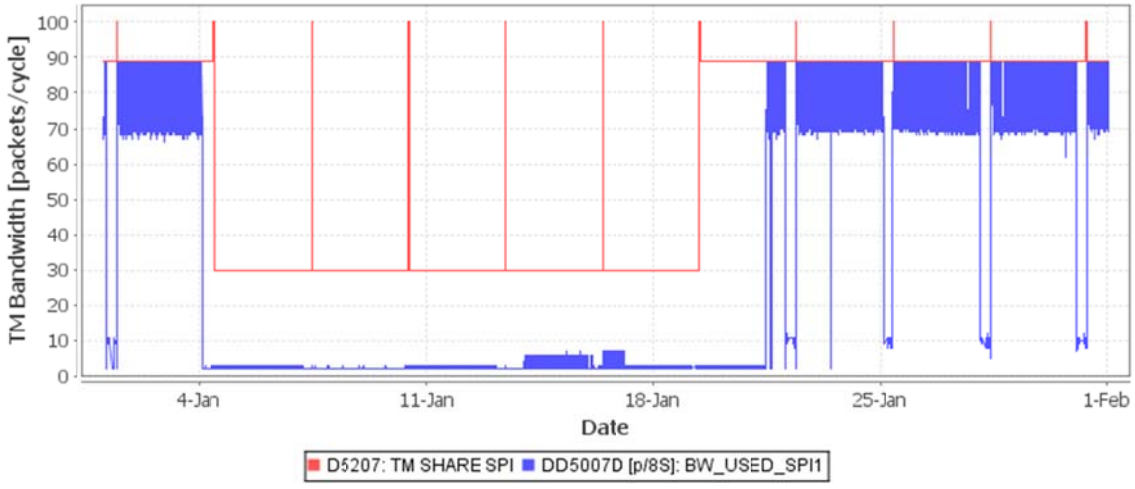


Figure 1: SPI TM bandwidth utilisation

The following plot illustrates the DPE CPU load during the reporting period.

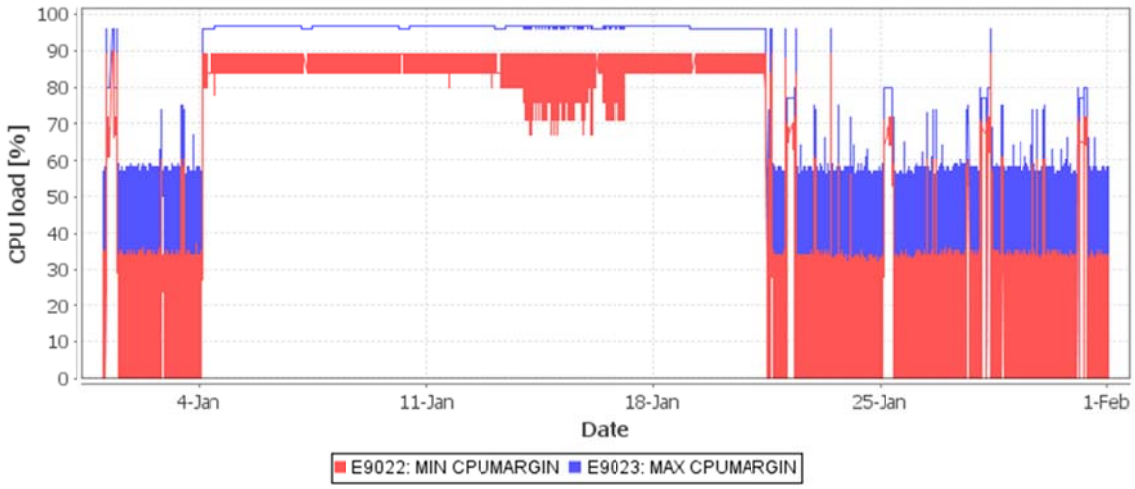


Figure 2: SPI IASW Performance

The following plot shows the evolution of the assigned and the average occupation of the SPI TM bandwidth since May 2010.

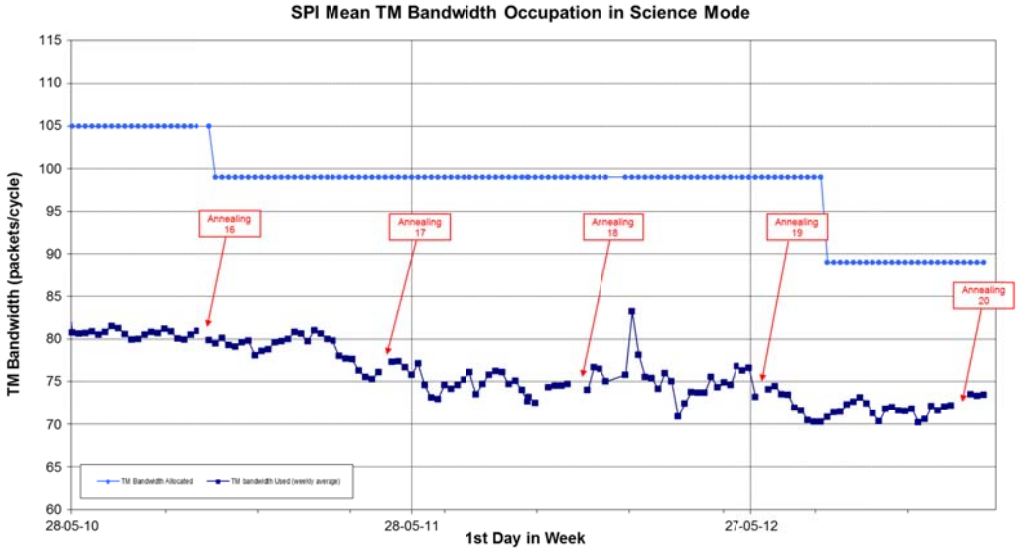


Figure 3: SPI TM bandwidth usage evolution since May 2010

Note: More information concerning the SPI operations is provided in Appendix 6.2.

2.2.2 IBIS

The overall status of IBIS is nominal.

During the reporting period, IBIS was operated in Science Standard mode during science observations. The TM bandwidth statistics were as follows:

- PST allocation to IBIS above radiation belts: 129 packets/cycle , except from rev. 1249 to 1253 (SPI annealing #20), when it was 180 packets/cycle.
- IBIS mean bandwidth utilisation in science mode: 98.47 packets/cycle

The plot below shows the IBIS TM utilisation during the reporting period.

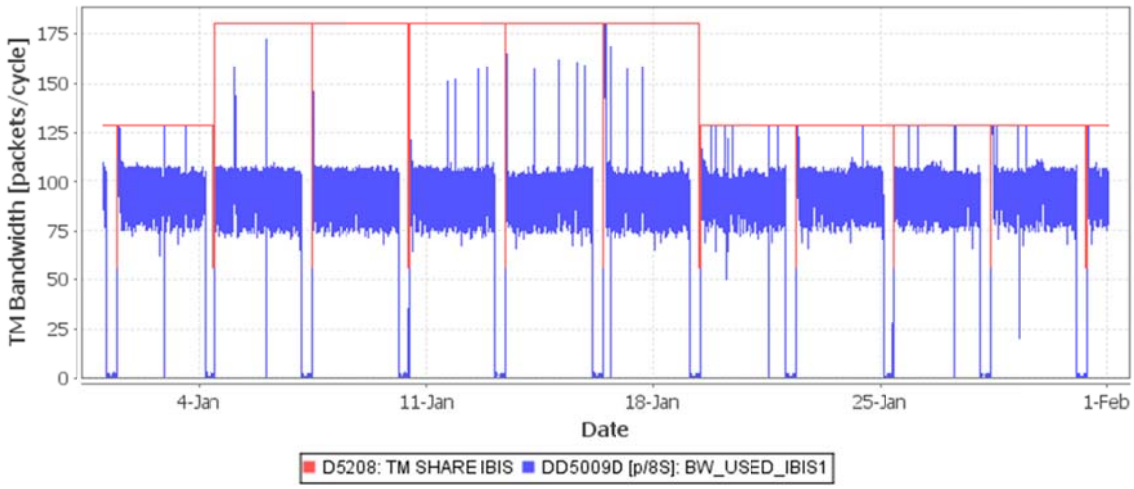


Figure 4: IBIS TM bandwidth utilisation

A plot of the IBIS weekly bandwidth utilisation since May 2005 is shown below.

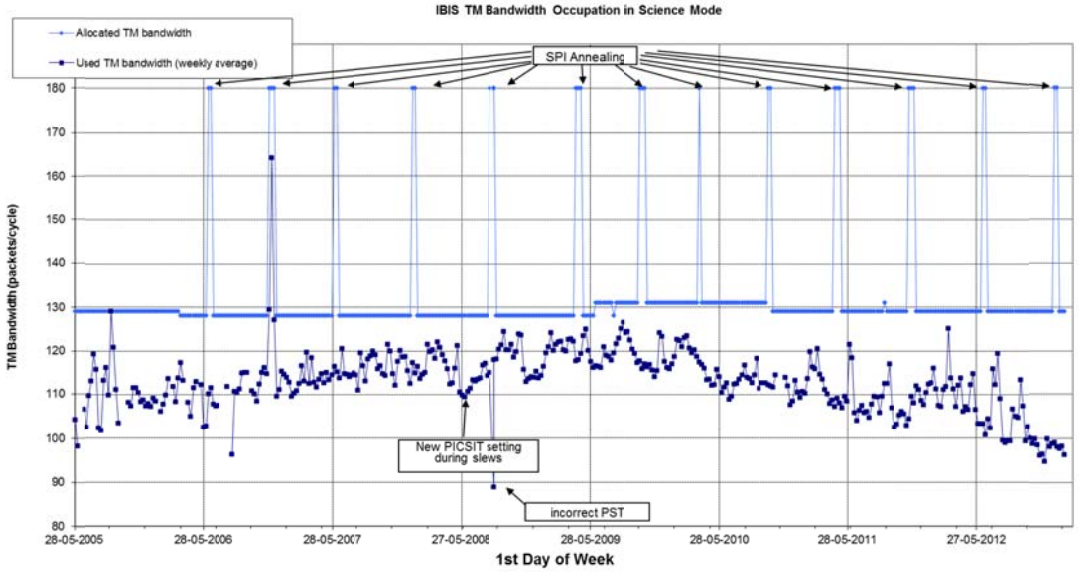


Figure 5: IBIS TM bandwidth usage evolution since May 2005

Note: More information concerning the IBIS operations is provided in Appendix 6.3.

2.2.3 JEM-X

The status of both JEM-X units is nominal:

- JEM-X1 & 2 were operated in Data Taking mode with a TM allocation of 13 packets/cycle except from 2013-01-04T10:29:52Zto 2013-01-19T01:05:37Z during the SPI annealing, when it was 15 packets/cycle each.

Note: Some more information concerning the JEM-X operations is provided in Appendix 6.4*.*

2.2.4 OMC

The status of OMC is nominal.

OMC was operated in Science Normal mode during science observations, with a TM allocation of 5 packets/cycle.

During this reporting period, 3 pointings were lost due to TM drops from Weilheim, one was cut short due to a lost guide star, another was cut short when the CCCFs were activated.

Note: Some more information concerning the OMC operations is provided in Appendix 6.5.

2.2.5 IREM

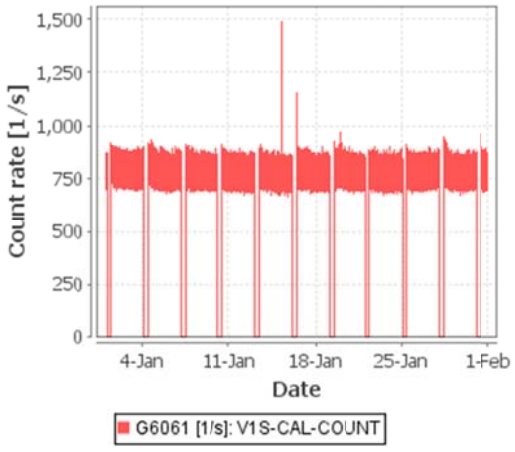
The status of IREM is nominal.

Note: Some more information concerning the IREM operations is provided in Appendix 6.6.

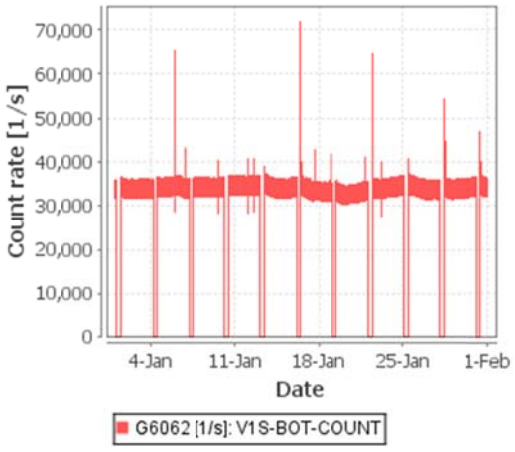
Radiation background

The background radiation level as measured by the instrument counters was low during the reporting period. The following plots show the SPI ACS, IBIS VETO, JEM-X Triggers and IREM count rates over the reporting period:

VETO Calibration Source Count Rate



VETO Bottom Count Rate



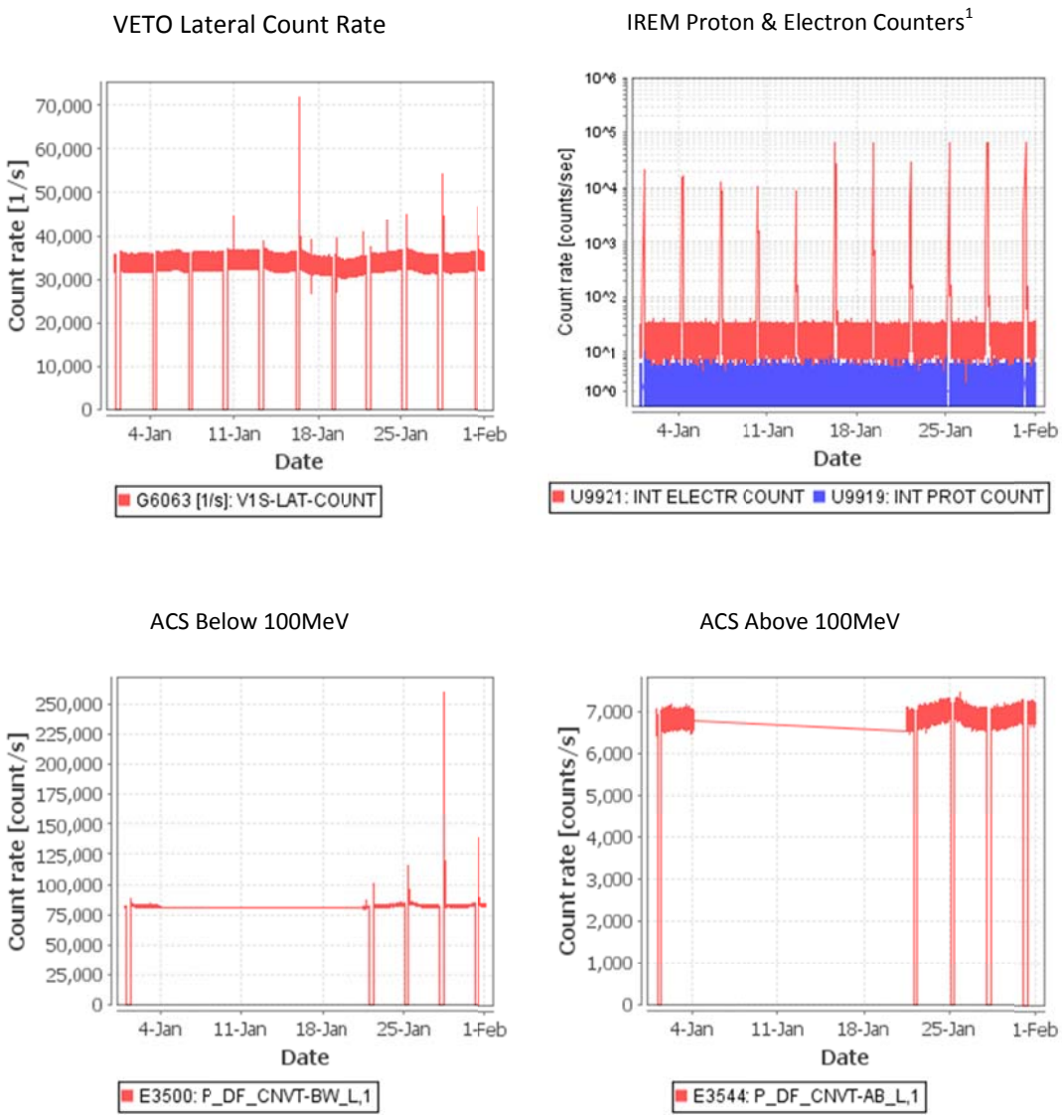


Figure 6: Instrument Count Rates

The JEM-X count rates are plotted for both JEM-X units, the data is sampled every 8th packet (64sec).

[1] Note that the scale used in this plot is logarithmic.

K5119/L5119 - JEM-X1/2 Software trigger, K5449/L5449 - JEM-X1/2 Hardware trigger

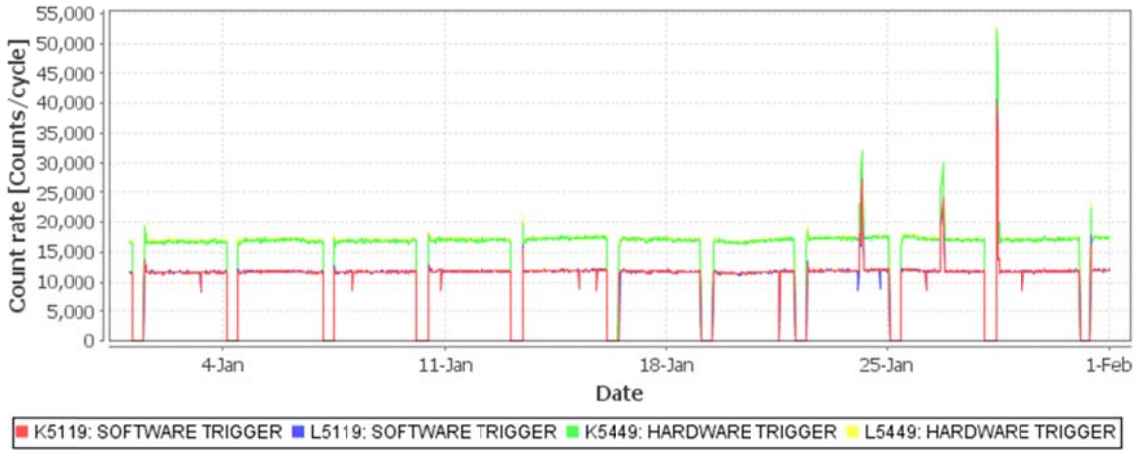


Figure 7: JEM-X Count rates. The smaller downward spikes in the figure are due to the slews of the spacecraft

Radiation Belts

Figure 8 gives a prediction of the trapped radiation environment sensed by the S/C when descending into perigee; the different areas crossed, the Radiation Belt entry/exit points, the shape of the Radiation Belt passage and a rough estimation of the trapped proton and electron fluxes.

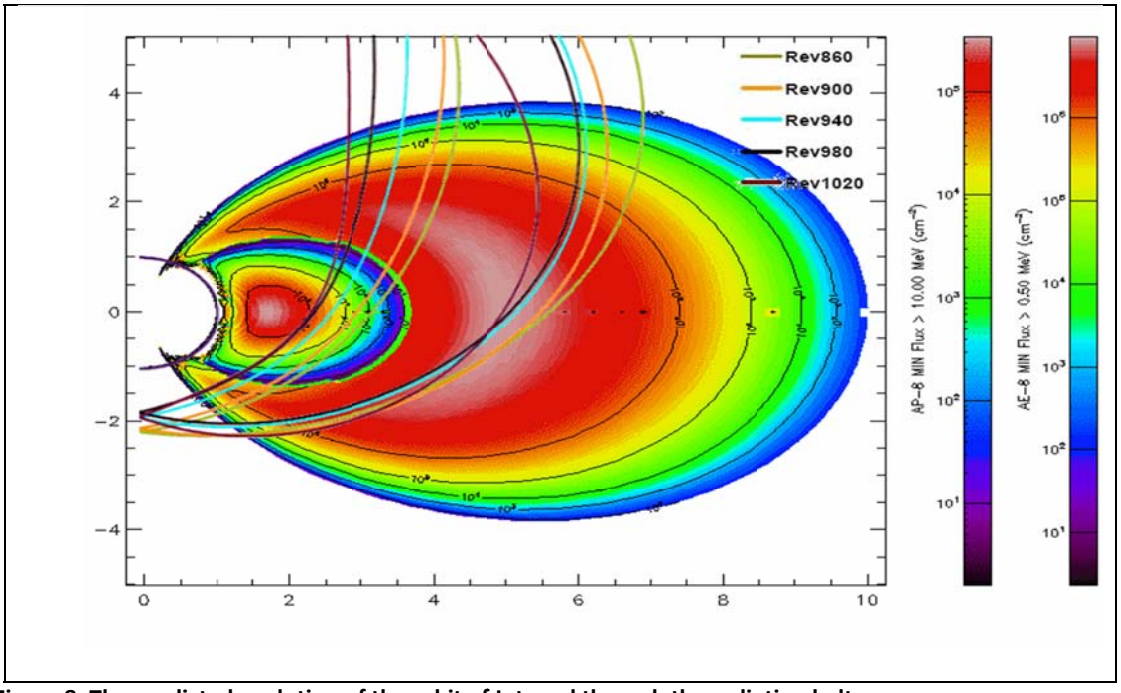


Figure 8: The predicted evolution of the orbit of Integral through the radiation belts

3 Ground Facilities

The Operational ground facilities performance was good this month. The overall performance was over the 95% requirement.

The following figure shows the number of slews executed by the ground segment and the number of slews missed per revolution. These numbers give a very good indication of the performance of the operational ground facilities, because it involves all the different elements of the ground facilities to complete all slews scheduled. Slews lost due to problems outside the control of the ground segment are not taken into account in the plot below.

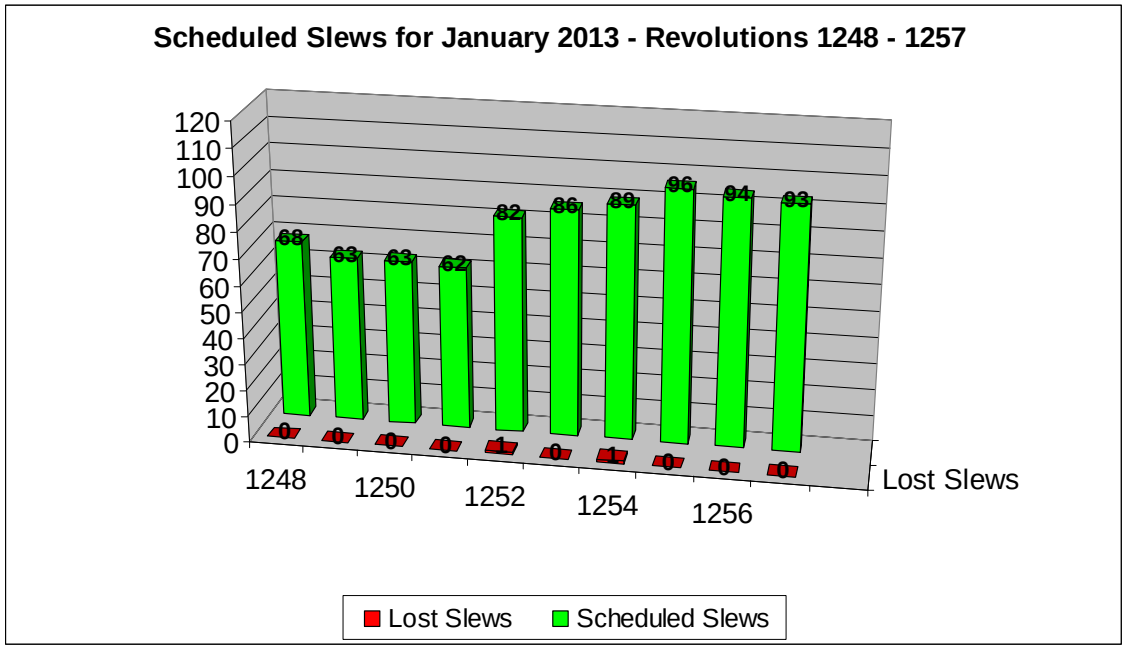


Figure 9: The number of slews scheduled compared to the number of slews lost

3.1 Mission Control System

To increase the security of the network, the PISA LAN was moved behind a new set of firewalls. All IFRD connections were tested successfully and the PIs were requested to test their external connections.

The following MCS events were logged:

DOY 009	18:17	SYS: Error sending data to isds(a)
	18:33	SYS: Performed restart of ISDS + IFRD (isdsa)
DOY 010	06:35	SYS: Manual Stack crashed on SUN121/122 & 129. All Restated
	18:00	SYS: Performed restart of ISDS + IFRD (isdsb)
DOY 016	06:10	SYS: task OMCH crashed on imca. Re-started task.

DOY 021	12:36	SYS: CMD Verifier crashed
DOY 022	17:58	SYS: Error sending data to isds(a)
DOY 028	22:22	Lost connection to TM CPD, was automatically re-established
DOY 031	10:17	SYS: Performed restart of ISDS + IFRD (isdsa)
	14:00	SYS: Error sending data to isds(a)
	14:15	SYS: Performed restart of ISDS + IFRD (isdsa)
	15:22	SYS: Error sending data to isds(a)
	15:25	SYS: Performed restart of ISDS + IFRD (isdsa) - down for 5 min.
	15:37	SYS: Error sending data to isds(a) - every 30 minutes

3.2 Ground Stations and Network

The performance of the ground stations and Network was good this month.

DOY 002	02:33	data gaps from REDU → RFI Both chains
	05:15	data gaps from REDU → RFI Both chains
	05:44	data gaps from REDU → No problem was seen on STC log or STC charts. Probably a comms hit between Redu and ESOC.
	12:34	data gaps from REDU --> RFI chain 1 only
	19:18	during Kiruna-1 support, the IFMSs were not configured properly for Integral support, due to the SCD acquisition tasks still being active. ECC informed the Spacon that support would remain on Redu-1until the problem at Kiruna was solved. ECC had to manually stop the SCD acquisition tasks then rerun the station configuration to recover Kiruna. TM was available from Kiruna at ca. 20:05.
	19:46	TM and TC was lost after the track had been ended at 19:45 by the STC schedule, which had not been stopped by the ECC operator when informing the Spacon that support would continue on Redu-1. ECC reconfigured Redu-1 and restarted the track, so that TM and TC were available again at ca. 19:54.
DOY 005 and	19:08	during Kiruna-1 support, the Spacon reported that it was not possible to connect to either TMTCS from INCTRA. ECC restarted the TMTCSs, restarted the Return sessions, but the Spacon reported that still no connection to the TMTCSs possible. Support remained on Redu-1. This incident is still under investigation.
DOY 006	11:06	data gaps from REDU --> RFI Both chains
DOY 008 on this	08:35	at the start of the Weilheim support, GSOC informed ECC that the support would start about twenty minutes later than scheduled, due to a problem swapping Cortexes. No further information available yet from DLR incident.
DOY 009	05:58	data gaps from REDU --> RFI chain 1 only

	17:03	data gaps from VIL2 --> RFI
DOY 011	15:01	during Weilheim support, data gaps were seen, also at 15:02, 15:10 and 15:21. GSOC informed ECC that the downlink signal level was low, causing the downlink chain to unlock intermittently. ECC configured VIL-2 for support. VIL-2 Es/No value was ca. 5.7 dB at this time. At ca. 19:00 support was swapped to RED-1, which ECC had configured early. No further information available yet from DLR on this incident.
	19:16	TM and TC were interrupted by the STC schedule, which had not been stopped by the ECC operator when configuring Redu-1 early. ECC waited until the STC schedule's configuration job had completed, then restarted the uplink. TM and TC were available again at ca. 19:20.
DOY 013	01:35	during Kiruna-1 support, after starting ranging, the prime IFMS did not lock on the ranging tone. This incident is under investigation.
DOY 021	10:09	data gaps from REDU --> RFI Both chains
DOY 021	16:43	data gaps from REDU --> RFI chain 1 only
DOY 022	08:11	during Kiruna-1 support, the configuration job for GOCE support at KIR-2 configured both TMTCSs rather than only TMTCS-1, so that the Integral TM and TC binds were disconnected from TMTCS-2. ECC restarted the Integral Return and Forward Sessions on TMTCS-2, so that TM and TC were recovered after about one minute. Integral support was later moved to Redu-1 to allow the Kiruna station engineer time to correct the CSMC jobs, in order to prevent a recurrence.
DOY 031	16:54	during KIR-1 support, data gaps --> RFI RFI predictions for Kiruna are not yet delivered by Flight Dynamics.

Figure 10 shows the quality of the ground station performance. The data received from the ground stations is compared to the data that is expected to be received.

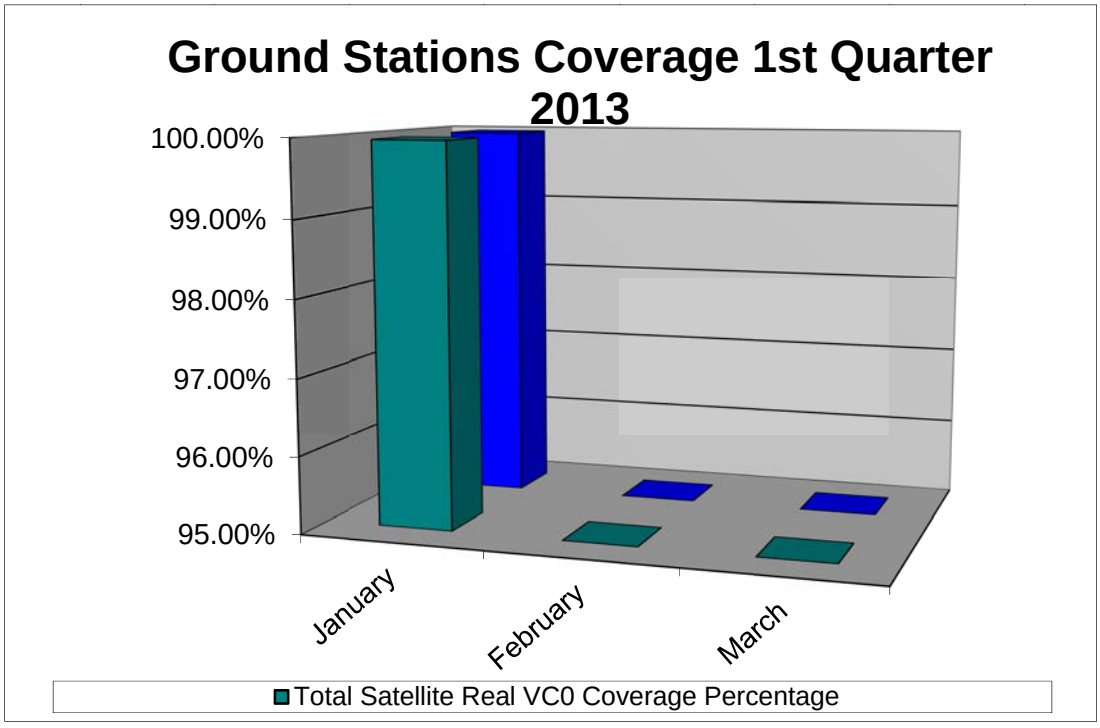


Figure 10: Comparison of VC0 to VC7 coverage

3.3 ISOC

3.3.1 Mission Planning

New or updated PSFs have been received for revolutions 1253 to 1265, corresponding to the time range 16 January to 23 February. The PSFs for revolutions 1255 to 1262 had to be updated due to a change in ground-station scheduling, leading to corresponding re-planning at ISOC. The Earth Observation 2.6, planned for revolutions 1259/1260 was dropped in consultation between MOC and ISOC.

New observations have been planned for revolutions 1253 (16-19 January) to 1265 (20-23 January).

TSFs have been received for revolutions 1252 to 1260.

3.3.2 Observation Status

New ECS files have been for revolutions 1236 to 1241, covering observations up to 14 December.

3.3.3 ISOC Science Data Archive

Work is ongoing on the testing of basic functionality in the new Archive.

About 8 TB of disk space on ISOC disks were recovered as the move of the data to disks maintained by the SAT was completed.

Raw telemetry is available up to 11 January 2013 with minor gaps.

3.3.4 ISOC System

ISOC system V34.0 was released on 15 January.

3.3.5 Problems

No new problems, except the trouble caused by the sudden change in available ground stations.

4 Anomalies

Table 1 contains the anomalies that occurred in the reporting period:

Table 1: Anomalies reported

AR id	Date of occurrence	Subject	Segment	Status
INT-3321	2013-01-02	Kiruna G/S: IFMSs not configured properly	ESA Stations	Closed
INT-3322	2013-01-02	REDU G/S: track ended by STC schedule even though support should continue	ESA Stations	Pending
INT-3323	2013-01-05	Kiruna G/S: not possible to connect to either TMTCS on DOY005	ESA Stations	Closed
INT-3324	2012-12-31	TCONmainRT task died due to the configuration not supporting DOY366 (leap year)	IMCS	Pending
INT-3325	2013-01-11	TM Problems from Weilheim	ESA Stations	Pending
INT-3326	2013-01-14	Disable SSC Checking for individual SPIDs doesn't work	IMCS	Pending
INT-3327	2013-01-13	Kiruna G/S: Prime IFMS did not lock on the ranging tone	ESA Stations	Testing
INT-3328	2013-01-17	ARCH/MAN task cannot handle leap years (DOY 366)	IMCS	Pending
INT-3329	2013-01-19	KIRUNA NCTRS & TMTCS Configuration	NCTRS	Testing
INT-3330	2013-01-20	Low signal downlink to WHM	ESA Stations	Closed
INT-3331	2013-01-15	Low signal downlink and uplink to WHM	ESA Stations	Closed
INT-3332	2013-01-16	JEMX-1 & JEMX-2 HV activation failure due to High Radiation.	Payload	Closed
INT-3333	2013-01-21	FDS: reported problem when generating RMU drift	FDS	Pending

AR id	Date of occurrence	Subject	Segment	Status
		update		
INT-3334	2013-01-22	Unexpected Loss of TM TC Connectivity to Kiruna 1	ESA Stations	Closed

5 Special Events & Future Milestones

- Following the unexpected results of the first series of 5 earth observations which took place in 2012, all planned earth observations in 2013 have been cancelled. Instead a pre perigee test earth observations will be scheduled in an attempt to produce better quality data.
- Kiruna G/S: Set up and validation of Kiruna; Cortex validation for Integral should be completed early February
- Lowering of AMD thresholds beginning of February
- All earth observations in 2013 abandoned, will be replaced with 2 pre perigee EOs
- Implementation of all slews as OSLs

6 Appendix

The appendix contains some detailed information concerning the AOCS subsystem and the instruments.

6.1 AOCS operations

During this period, 358 Open Loop Slews, 459 Closed Loop Slews and 23 Momentum Biases were executed (as reported by ACC OEM).

2 slews were missed and one delayed from the Timeline due to ground segment issues. A further slew was lost when the guide star was lost by the Star Tracker. For slews interrupted due to other issues (guide star problems, etc) please see the INTEGRAL weekly reports: http://xmm.esoc.esa.int/documentation/wops.php

6.1.1 Fuel consumption

The fuel consumption (total, grams per day) over the period between 01/11/2002 and 01/02/2013 is reported in the following plot:

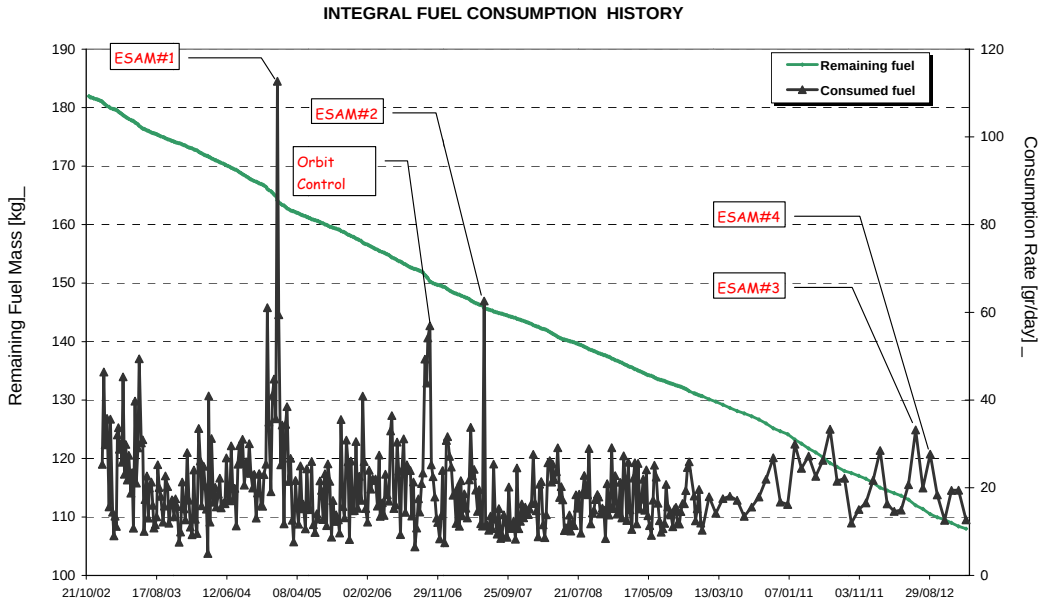


Figure 11: Fuel consumption. Note: ESAM fuel consumption is spread over period of ~1 week.

6.1.2 The RMU-A null bias calibration

The RMU-A null bias calibration history, on pitch, roll and yaw channel over the last month are reported in the plot below. The evolution of the drift on yaw channel is under constant monitoring but the values are still well within the specs.

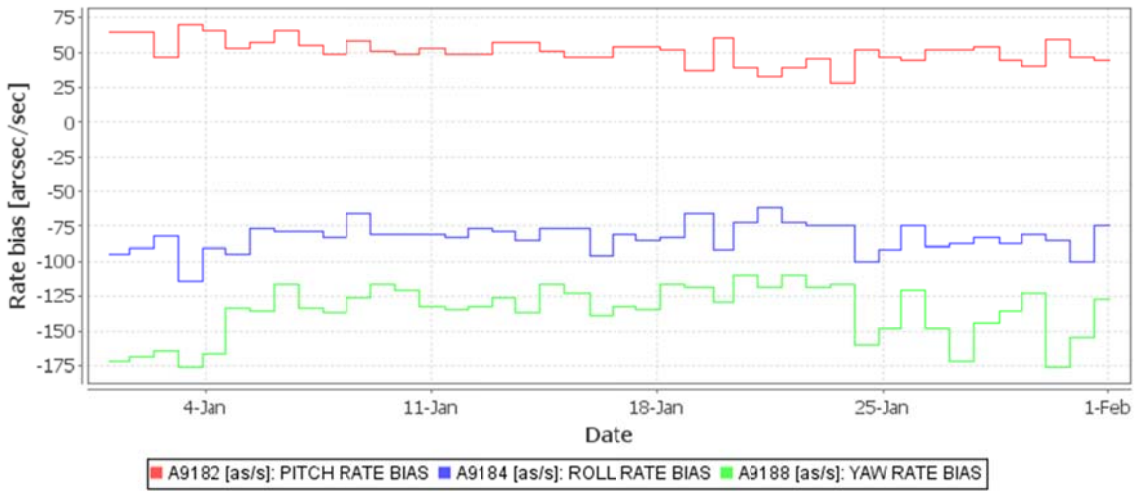


Figure 12: RMU pitch, roll and yaw. Historic data is available on request

6.1.3 Event log

Please refer to the INTEGRAL weekly reports for all AOCS issues not considered as anomaly (e.g., TPF update failures that forced an interruption to the timeline and have led to a loss of a slew, TC Start Sun Steer Law failed at CEV level completion, events where the IMU came on due to the loss of a

guide star,..). In the following, only the AOCS anomalies are listed which occurred during the reporting period.

05-01-2013 (Day of Year 005, Revolution 1249)

Slew 12490016 was delayed due to a lost guide star.

15-01-2013 (Day of Year 015, Revolution –1252)

Slew lost (12520061) due to G/S drop at Weilheim: see ARTS INT-3331

20-01-2013 (Day of Year 020, Revolution –1254)

Slew lost (12540027) and another delayed (12540028) due to G/S drop at Weilheim: see ARTS INT-3330

6.2 SPI

6.2.1 Operations

Stirling Compressors and Cryostat

The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K but for the SPI annealing #20.

The cryocooler had been put in standby at the start of annealing on 04/01/2013 and remained in Standby until the start of active cooling on 17/01/2013 04:18Z. The cryocooler switch-on was completed and the stroke set to 4x45 at 05:17Z. After the cryocooler switch-on, all four compressors were operated at full stroke (45) until 21/01/2013 13:16:00Z, when the stroke reduction to achieve 80K on the cold pate was started. The final stroke of 37 was reached at 22/01/2013 09:04:28Z and the 80K range on the cold plate was reached at 23/01/2013 12:32:09Z. Since then the cold plate temperature was maintained in the range 80K +/- 1K. Outgassing of the cold box was performed at a temperature of +30°C.

The following plot shows the evolution of Cold Plate, thermal braids and Cold Box temperatures during the annealing cycle.

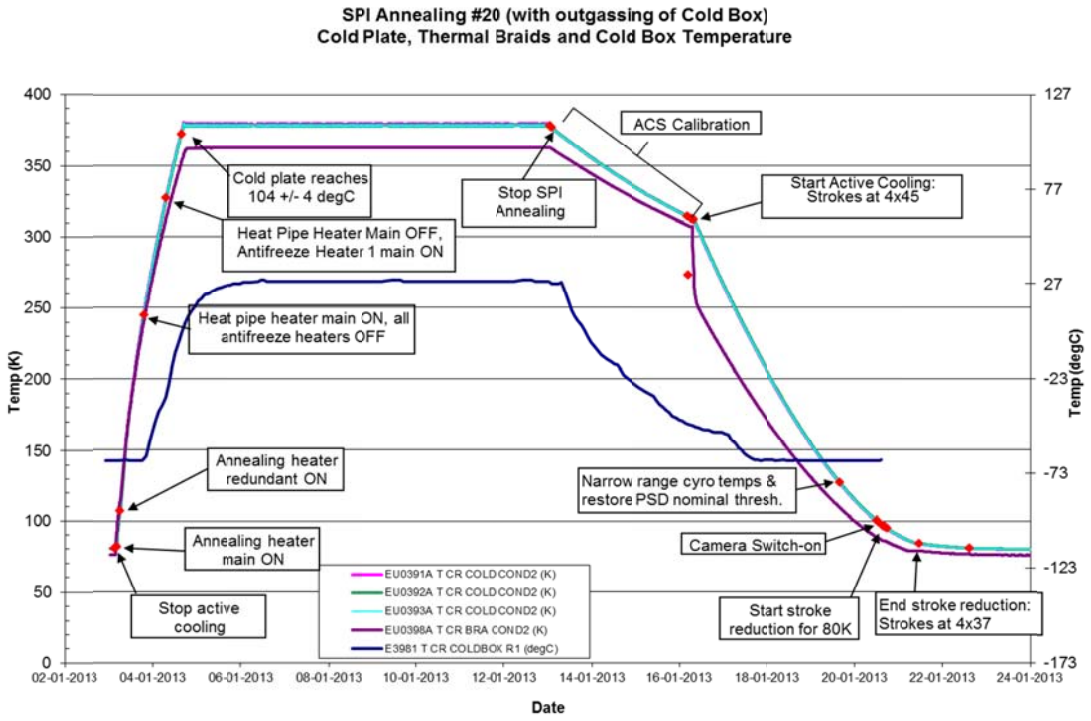


Figure 13: SPI Cold plate and H-bus temperature

The performance of the compressors is nominal. The cold plate temperature was maintained in the range 80K +/-1K after annealing #20.

The evolution of the cold plate and H bus temperature since the end of annealing is illustrated in the following plot.

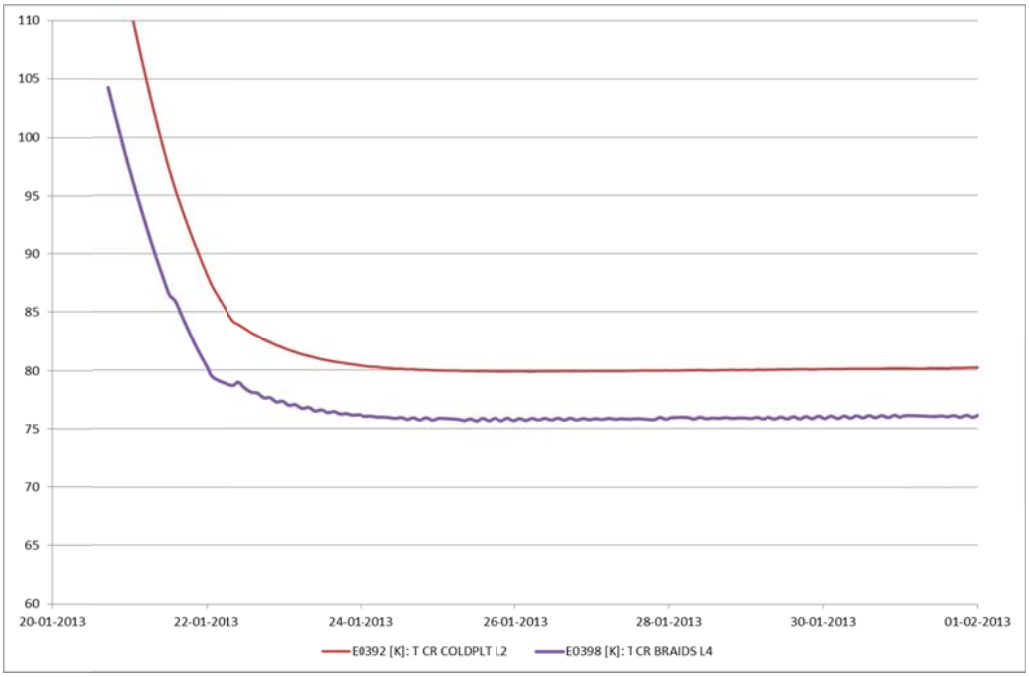


Figure 14: SPI Cold plate and H-bus temperature since the end of annealing #20.

The following plot shows the evolution of the CDE LCL currents during the reporting period.

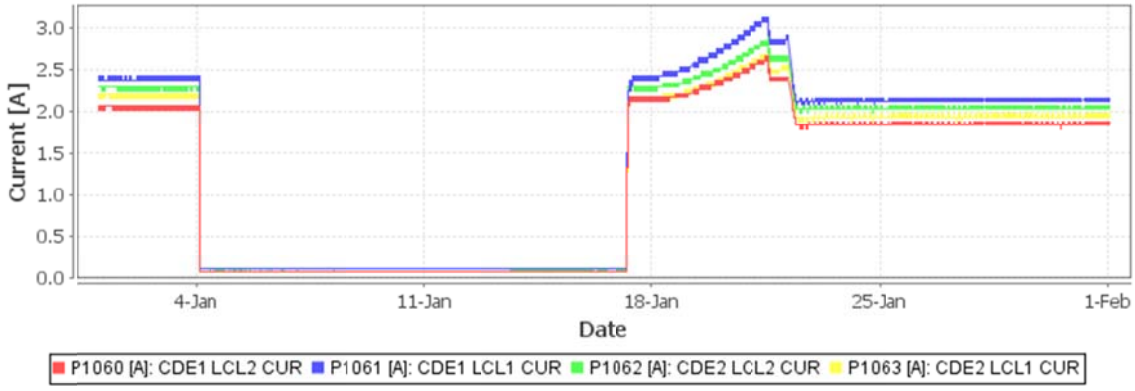


Figure 15: SPI CDE LCL current

DPE & IASW

The DPE health and IASW performance are nominal. The IASW version installed is v4.3.5 with both SE compression and PE reduction enabled and the spectra scaling factor set to 7/19 SE. Due to the annealing operations, the IASW was in CONF mode from the start of annealing until the camera switch-on performed on 21/01/2013. The DPE CPU usage was nominal during the reporting period (see Figure 2).

ACS

The performance of the ACS is nominal, except for FEE #81 which remains nominally switched off since the anomaly on 29/10/2006 (INT_SC-162) and FEE #57 which is nominally OFF due to the anomaly on 5/8/2003 (INT_SC-61). Due to the annealing operations, the ACS High Voltages were set to the minimum voltage (~980V) and the ACS was in CONF mode until the start of passive cooling on 13/01/2012, when the ACS Calibration was performed. A plot of the ACS counts is given in Figure 6: Instrument Count Rates.

AFEE

The health of the AFEE is nominal. Detector #2 is failed since 06/12/2003, detector #17 is failed since 17/07/2004, detector #5 is failed since 19/02/2009 and detector #1 is failed since 27/05/2010. The HV of the failed detectors are nominally set to 0.5kV and events from these GeDs are disabled in the DFEE and PSD.

Due to the annealing operations, all detector HVPSs were switched off including the switch off of the LVPS of Det #2, 8 and 11 (due to anomaly during outgassing of the cold box during SPI annealing #18). The rest of the LVPSs were left on with the AFEE in CONF mode from the start of annealing until the SPI camera switch-on, which started on 21/01/2013 at 10:27:41Z. Following the end of the camera switch-on, the nominal GeD High Voltages have been set to 2.5kV.

Note: For this SPI annealing, there was a significant time delay for the switch on of the SPI camera after annealing due to problems with the connectivity to the SPI PI machines due to firewall change at ESOC. Furthermore, since no stable connection was possible, the increase of the high voltage was only performed until the operational voltage of 2.5kV. Normally, the first switch on includes tests up to at least 3 kV.

The following plot shows the AFEE DC output voltages over the reporting period.

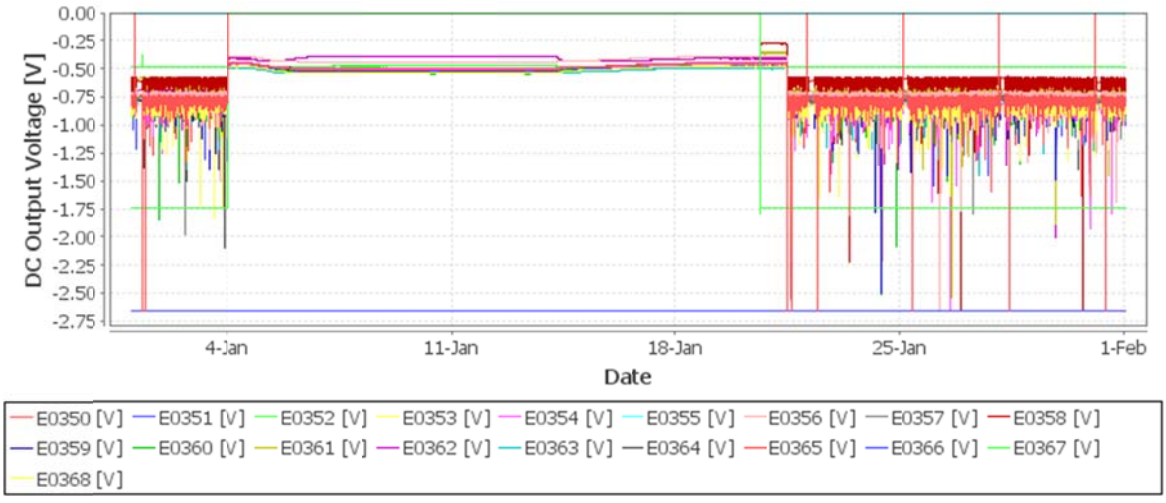


Figure 16: AFEE DC Output Voltages. Note that the data is sampled every 8th packet (64sec)

DFEE

The health of the unit is nominal. The following plots show the Non Vetoed, Time Tagged and Time Tagged Saturated Event count rates during the reporting period.

Due to the annealing operations, the DFEE was in CONF mode from the start of annealing until the SPI camera switch-on.

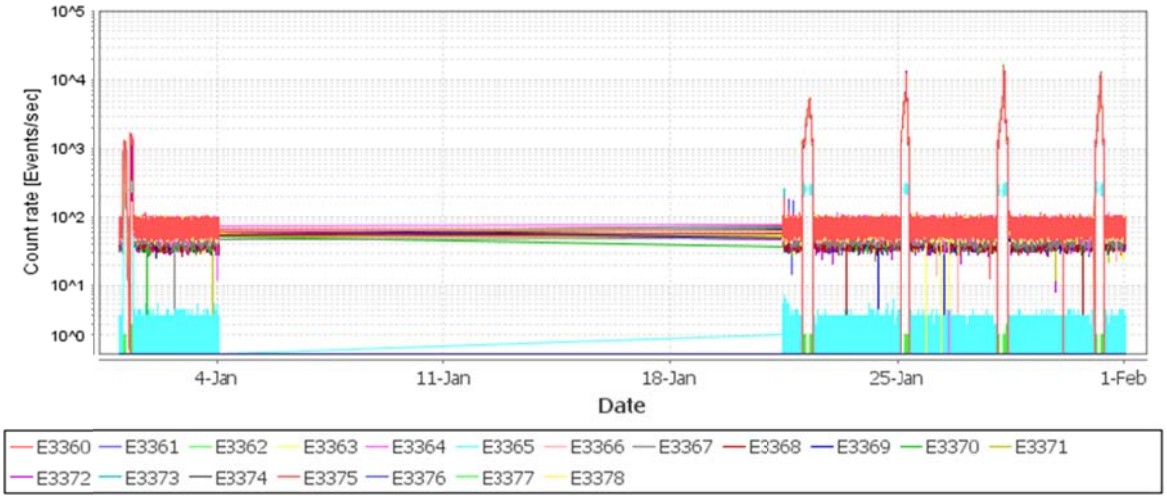


Figure 17: SPI GeD Non-Vetoed count rates. Note that the scale used for plotting is logarithmic.

Figure 18: SPI GeD Time Tagged count rates. Note that the scale used for plotting is logarithmic.

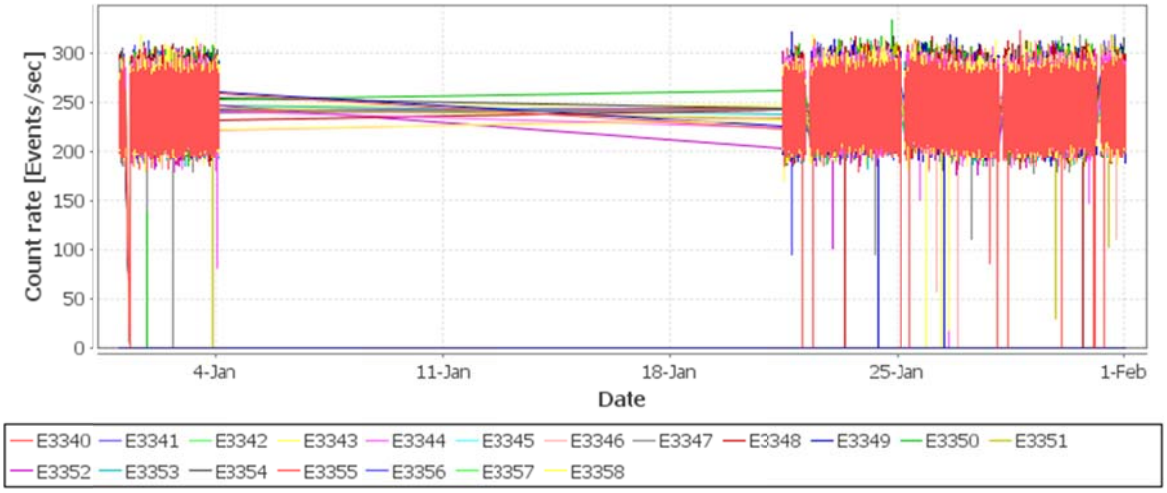


Figure 19: SPI GeD Time Tagged Saturated count rates

PSD

The health of the PSD is nominal. Due to the annealing operations, the PSD was in CONF mode from the start of annealing until the SPI camera switch-on. The following plot shows the PSD channel rates over the reporting period.

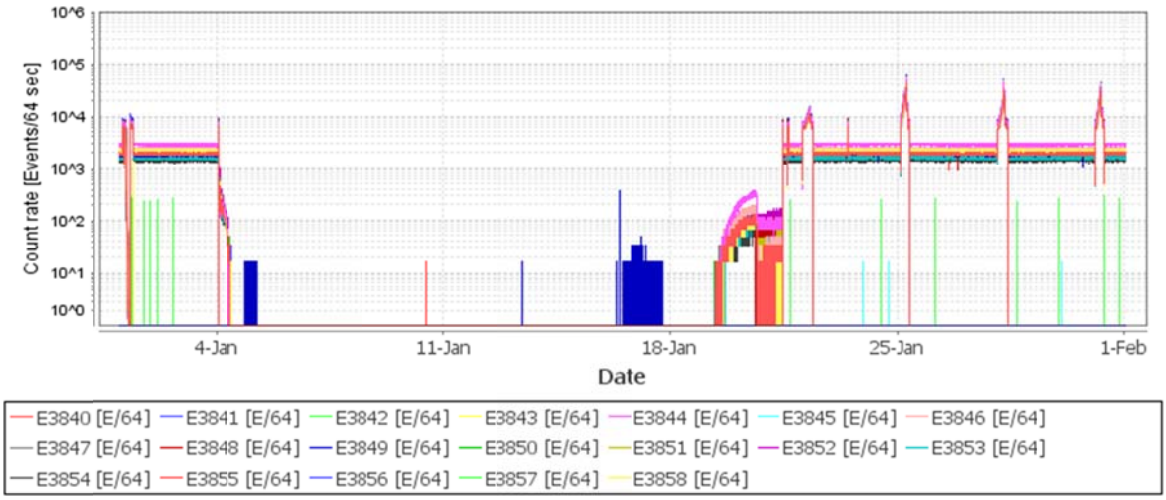


Figure 20: SPI PSD GeD Channel rates

6.2.2 Event Log

No SPI anomalies occurred in the reporting period.

04.-21.01.2013 (Day of Year 004-021, Revolution 1249-1254)

SPI annealing #20 was performed in this period with outgassing of the cold box as per OCR#329. The times for the main activities for SPI annealing #20 are summarized in the section 2.2.

6.3 IBIS

6.3.1 Operations

ISGRI

The health and performance of ISGRI was nominal during the reporting period. The following plot shows the ISGRI MCE counters during the reporting period:

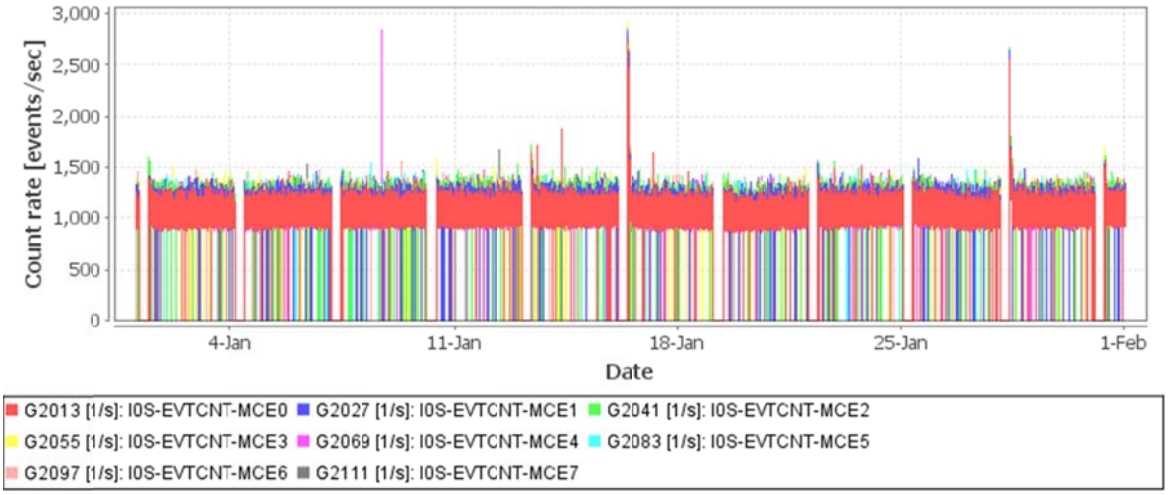


Figure 21: ISGRI MCE Counters

PICsIT

The health and performance of PICsIT was nominal during the reporting period. The following plot shows the PICsIT semi-module counters during the reporting period.

Figure 22: PICsIT semi-module counters. Note that the scale used for plotting is logarithmic.

VETO

The health and performance of VETO was nominal during the reporting period. Plots of the VETO counters are given in Figure 6: Instrument Count Rates.

6.3.2 Event Log

No IBIS anomalies occurred in the reporting period.

31-01-2013 (Day of Year 031, Revolution 1258)

OEM: "IBIS1 IASW HEPI DATA INCLUDES TIME OVERRUN" occurred several times at 08:42:45.848Z followed by OEM: "IBIS1 HEPI RESYNCHRONIZED" at 08:43:01.497Z

6.4 JEM-X

6.4.1 Operations

The Status of JEMX-1 & 2 is nominal. The following plot shows the JEMX DFEE and detector temperatures over the reporting period.

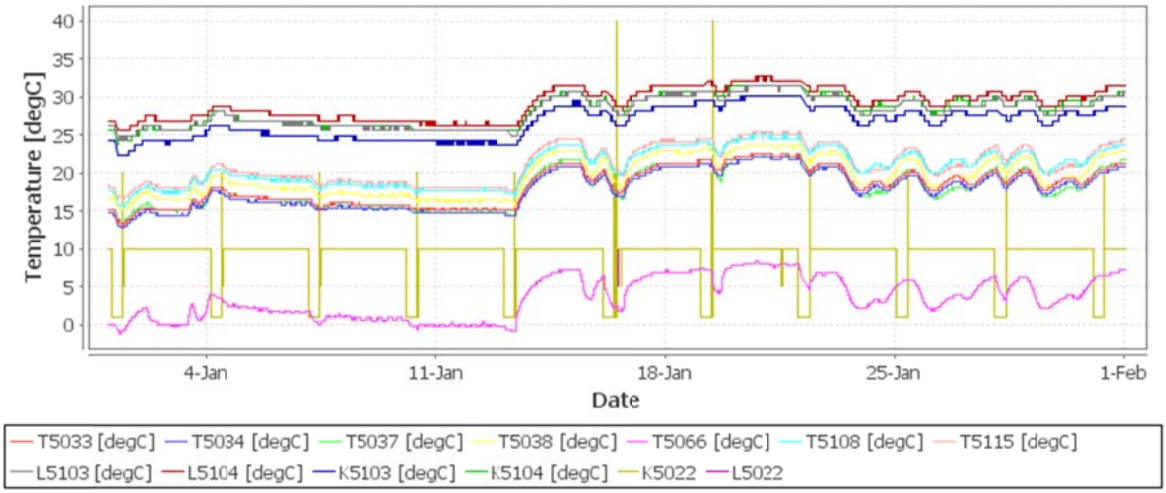


Figure 23: JEMX Detector and DFEE Temperatures

6.4.2 Event Log

16-01-2013 (Day of Year 016, Revolution 1253)

At 09:48, high radiation caused the High Voltage activation for both JEMX-1 and JEMX-2 to abort. At 10:54, after radiation levels had fallen, the activation was re-started for JEMX-1, which completed successfully at 11:17. At 11:19, the same was performed for JEMX-2, which was then completed at 11:42. The impact was the loss of 1 hour science for JEMX-1 and 2 hours for JEMX-2.

21-01-2013 (Day of Year 021, Revolution 1254)

At 12:36:05, the EDs KEDATA02 & LEDATA02 failed release owing to a Command Verifier crash. These 2 EDs were manually re-sent at 12:59:04 & 13:00:39 respectively. The impact was the loss of 23 and 24½ minutes science time for JEMX-1 & JEMX-2 respectively.

28-01-2013 (Day of Year 028, Revolution 1257)

At 09:01:00, the OEM 154 JEM-X1 HSL PROB 11 Synchronization loss on High Speed Line was received. This was followed by the out-of-limits: K5136 'BUFFER LOSS' (value= 6242) and L5136 'BUFFER LOSS' (value= 6961) According to the cross reference, no action was taken. There was no impact.

6.5 OMC

6.5.1 Operations

The status and performance of OMC is nominal.

6.5.2 Event Log

05-01-2013 (Day of Year 005, Revolution 1249)

At 00:39, a lost guide star forced a timeline interruption. A recovery was performed and the timeline re-joined at 01:25. The impact was pointing 12490016 was cut short from a planned 3572 to 2584 seconds.

15-01-2013 (Day of Year 015, Revolution 1252)

At 13:58, a drop in TM from Weilheim forced an interruption to the timeline. At 13:06, the signal was restored, and a recovery performed. The timeline was re-joined at 13:37. The impact was the loss of pointing 12520061.

20-01-2013 (Day of Year 020, Revolution 1254)

At 07:43, a loss of TM from Weilheim forced an interruption in the timeline. The signal was recovered at 08:36, and by 09:11, the timeline was recovered. The impact was the loss of pointings 12540027 & 12540028. It was at this time the following OEMs were received:

```
2013.020.08.43.05.035   2013.020.08.43.17.271   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E

2013.020.08.43.11.160   2013.020.08.43.25.289   1792   RealTime   131     TC REJECT   REJECTED
TC1                                             0       0    65535   PR    N     E   E
```

These correspond to the rejected M1130 (RESET IM) and MU1310 (IMAGING-A) commands sent from the auto-stack for pointing 12540028.

21-01-2013 (Day of Year 021, Revolution 1254)

At 12:35, due to the CCCFs (Conditional Control Command Flag), being enabled, as part of the recovery from an IBIS histogram download problem, OMC switched prematurely back to STAND-BY, the impact was pointing 12540067 was cut short from a planned 3102 to 304 seconds.

6.6 IREM

6.6.1 Operations

Radiation belts entry and exit

The following plots show the Radiation Belt Entry (Figure 24, red line) and Exit times (Figure 25, blue line) obtained from the ISDC website, defined where the IREM TC3 (soft electrons) rate reads 600 counts. The blue line in Figure 24 and the magenta line in Figure 25 are the altitudes used by the MOC for planning purposes.

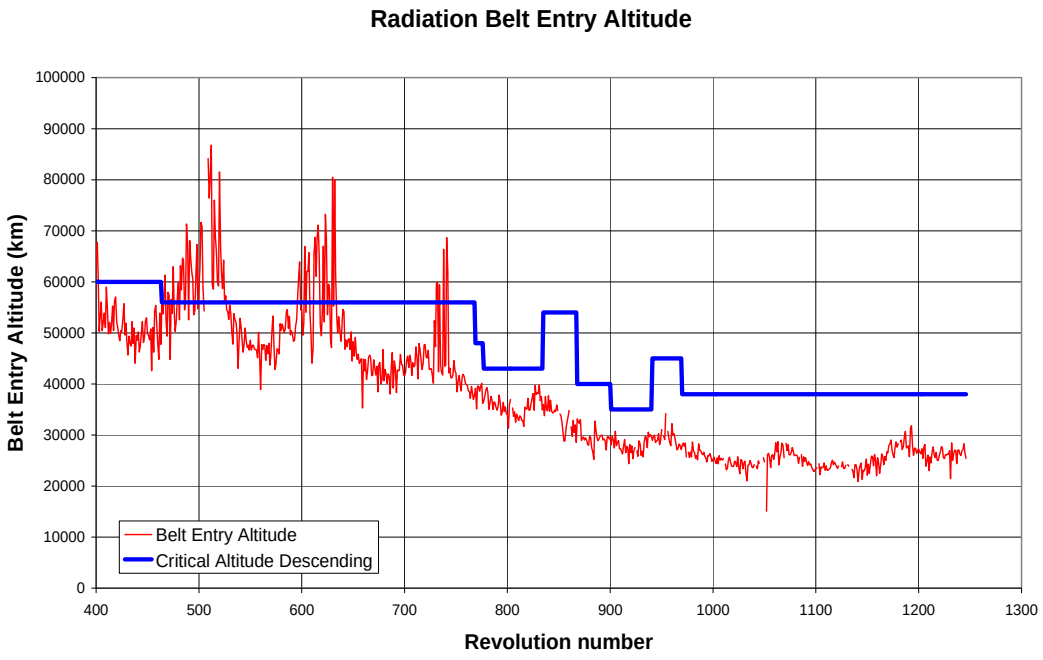


Figure 24: Radiation belt entry

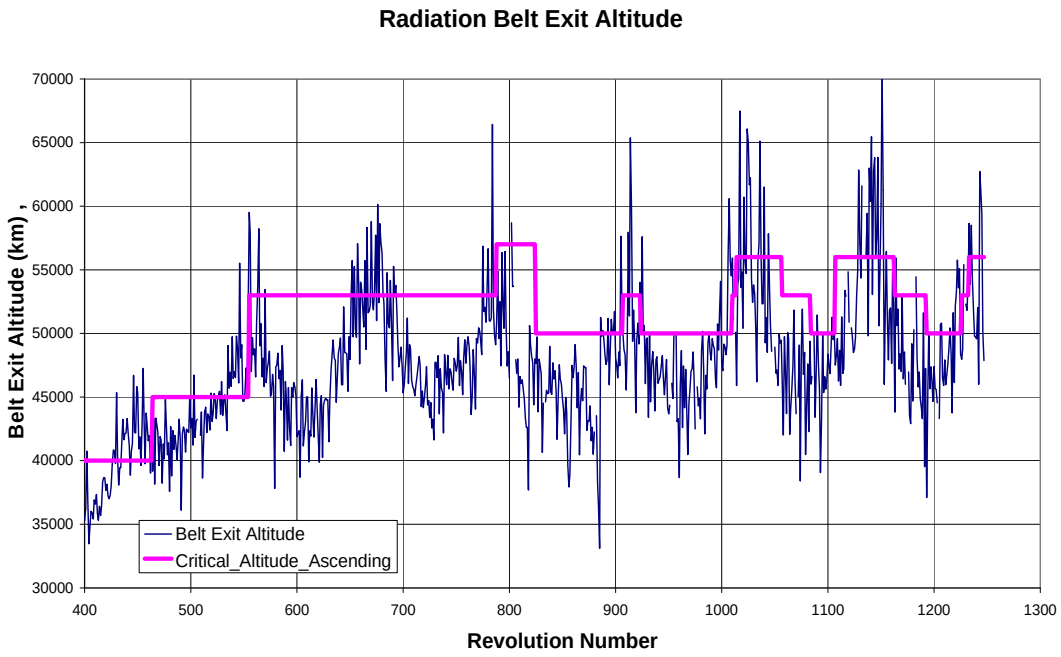


Figure 25: Radiation belt exit

Table 2: Radiation belts. Radiation belt entry crossings are ignored if there is a subsequent gap of at least 30 minutes of low radiation.

Revo number	Spacecraft BCPKT (electron)	Observed entry/exit time by Electron CUT-OFF	Observed entry/exit altitude [km] by Electron CUT-OFF	Predicted entry/exit time by Electron CUT-OFF	Predicted entry/exit altitude [km] by Electron CUT-OFF	Predicted entry/exit time by Proton CUT-OFF	Predicted entry/exit altitude [km] by Proton CUT-OFF
1247	RAD_ENTR R 2013-01-01T02:57:06Z	N/A	N/A	01-Jan-2013 04:04:14	23058.01	01-Jan-2013 05:04:14	9368.348
1248	RAD_EXIT R 2013-01-01T10:26:07Z	01/01/2013 09:13:57	50747	01-Jan-2013 09:44:14	50738.94	01-Jan-2013 05:34:14	4569.664
1248	RAD_ENTR R 2013-01-04T02:46:36Z	N/A	N/A	04-Jan-2013 04:01:33	21224.87	04-Jan-2013 04:51:33	9724.645
1249	RAD_EXIT R 2013-01-04T10:15:24Z	04/01/2013 08:45:50	47672	04-Jan-2013 09:31:33	50500.37	04-Jan-2013 05:31:33	4461.971
1249	RAD_ENTR R	N/A	N/A	07-Jan-2013	22492.38	07-Jan-2013	11074.49

Revo number	Spacecraft BCPKT (electron)	Observed entry/exit time by Electron CUT-OFF	Observed entry/exit altitude [km] by Electron CUT-OFF	Predicted entry/exit time by Electron CUT-OFF	Predicted entry/exit altitude [km] by Electron CUT-OFF	Predicted entry/exit time by Proton CUT-OFF	Predicted entry/exit altitude [km] by Proton CUT-OFF
	2013-01-07T02:35:55Z			03:43:48		04:33:48	
1250	RAD_EXIT R 2013-01-07T10:05:09Z	07/01/2013 08:27:50	46241	07-Jan-2013 09:13:48	49497.84	07-Jan-2013 05:13:48	4530.054
1250	RAD_ENTR R 2013-01-10T02:23:06Z	N/A	N/A	10-Jan-2013 03:28:01	23223.23	10-Jan-2013 04:28:01	9642.6
1251	RAD_EXIT R 2013-01-10T09:53:02Z	10/01/2013 08:09:18	45024	10-Jan-2013 09:08:01	50465.33	10-Jan-2013 05:08:01	4669.495
1251	RAD_ENTR R 2013-01-13T02:09:26Z	N/A	N/A	13-Jan-2013 03:22:11	21416.3	13-Jan-2013 04:12:11	10004.28
1252	RAD_EXIT R 2013-01-13T09:39:20Z	13/01/2013 07:59:42	45848	13-Jan-2013 08:52:11	50226.38	13-Jan-2013 04:52:11	4577.996
1252	RAD_ENTR R 2013-01-16T01:58:03Z	N/A	N/A	16-Jan-2013 03:07:30	21481.35	16-Jan-2013 03:57:30	10025.18
1253	RAD_EXIT R 2013-01-16T09:27:33Z	16/01/2013 10:26:30	70737	16-Jan-2013 08:37:30	50250.15	16-Jan-2013 04:37:30	4497.465
1253	RAD_ENTR R 2013-01-19T01:45:29Z	19/01/2013 03:01:18	29223	19-Jan-2013 02:52:00	22094.05	19-Jan-2013 03:42:00	10684.04
1254	RAD_EXIT R 2013-01-19T09:15:11Z	19/01/2013 08:38:54	56807	19-Jan-2013 08:22:00	49752.8	19-Jan-2013 04:22:00	4539.441
1254	RAD_ENTR R 2013-01-22T01:32:16Z	22/01/2013 02:54:39	27794	22-Jan-2013 02:37:02	22411.23	22-Jan-2013 03:27:02	11032.49
1255	RAD_EXIT R 2013-01-22T09:02:11Z	22/01/2013 08:12:31	54662	22-Jan-2013 08:17:02	51072.04	22-Jan-2013 04:07:02	4602.746

Revo number	Spacecraft BCPKT (electron)	Observed entry/exit time by Electron CUT-OFF	Observed entry/exit altitude [km] by Electron CUT-OFF	Predicted entry/exit time by Electron CUT-OFF	Predicted entry/exit altitude [km] by Electron CUT-OFF	Predicted entry/exit time by Proton CUT-OFF	Predicted entry/exit altitude [km] by Proton CUT-OFF
1255	RAD_ENTR R 2013-01-25T01:19:26Z	N/A	N/A	25-Jan-2013 02:20:34	22965.03	25-Jan-2013 03:20:34	9316.842
1256	RAD_EXIT R 2013-01-25T08:49:00Z	25/01/2013 08:59:27	63918	25-Jan-2013 08:00:34	50748.93	25-Jan-2013 03:50:34	4613.133
1256	RAD_ENTR R 2013-01-28T01:08:01Z	28/01/2013 02:28:07	28233	28-Jan-2013 02:08:58	23098.87	28-Jan-2013 03:08:58	9378.389
1257	RAD_EXIT R 2013-01-28T08:36:55Z	28/01/2013 09:44:07	71872	28-Jan-2013 07:48:58	50758.63	28-Jan-2013 03:48:58	4512.096
1257	RAD_ENTR R 2013-01-31T00:57:55Z	31/01/2013 02:13:59	29091	31-Jan-2013 02:04:11	21569.57	31-Jan-2013 02:54:11	10044.71
1258	RAD_EXIT R 2013-01-31T08:26:26Z	31/01/2013 09:12:23	68990	31-Jan-2013 07:34:11	50300.93	31-Jan-2013 03:34:11	4372.846

Reference:

- High radiation
- Very small error vs reference (less than 10 minutes)
- Small error vs reference (between 10 and 30 minutes)
- Large error vs reference (more than 30 minutes)

6.6.2 Event Log

Nothing to report.