



ESTEC, 26+27 November 2013

Minutes from 24 Jan 2014

## Attendants

Antony J. Bird	Univ. Southampton	AJB
Søren Brandt	DTU Space	SB
Roland Diehl	MPE Garching	RD
Carlo Ferrigno	ISDC	CF
Sergei Grebenev	IKI Moscow	SG
Lorraine Hanlon	UCD	LH
Dieter Hartmann	Clemson	DH
Jutta Hübner	ESA, ESOC	JH
Wim Hermsen	SRON	WH
Peter Kretschmar	ESA, ESAC	PK
François Lebrun	APC/CEA, Paris	FL
Miguel Mas Hesse	INTA Madrid	MM
Mikhail Revnivtsev	IKI Moscow	MR
Jean-Pierre Roques	CESR Toulouse	JPR
Norbert Schartel	ESA, ESAC	NS
Richard Southworth	ESA, ESOC	RS
Marc Türler	ISDC	MT
Ed van den Heuvel	Univ. Amsterdam	EvdH
Jacco Vink	Univ. Amsterdam	JV
Christoph Winkler	ESA, ESTEC	CW

## 1 Welcome, Agenda, Actions

Since Angela Bazzano could not be present, Wim Hermsen chaired the meeting on request of EK.

The agenda was approved without changes.

Action 14-1 on CF closed

Action 14-2 on FL,EJ (INVESTIGATE) Action 14-3 on ISOC/GB closed

Action 14-4 on ISOC/GB closed

Action 14-5 on MT closed by presentation later

Action 14-6 on MOC/ISDC closed, implementation ongoing

## 2 Mission Status

PK gave a brief overview of the INTEGRAL mission status (see [viewgraphs](#)).

## 3 Status report by Project Scientist

EK presented the Project Scientist report (see [viewgraphs](#)).

A discussion ensued about the impact of data right proposals on oversubscriptions. Regarding the publication rates, some members remarked that a comparison with other long-duration missions should be done.

The IUG as a whole thanked CW for his many years of work as INTEGRAL Project Scientist and the smooth handover to EK.

## 4 Instrument & Calibration status, Science Ground Segment

### 4.1 OMC

MM briefly presented the OMC status (see [viewgraphs](#)). The instrument is working fine and the visible degradation very slow with margin for many years. Some trends are possibly seen in the last months and are being followed.

Earth/CXB observations are used by OMC to further refine the flatfield calibration.

### 4.2 JEM-X

SB (see [viewgraphs](#)) explained that JEM-X operations are stable and anode loss is <1%/year.

The dependency of the gain on temperature has increased to almost 5% per degree. There is an open issue with automatic gain calibration in OSA. CF circulated results of a study to the IUG.

The particle rate has gone down by 40% compared to solar minimum. This does not directly affect the background, due to efficient on-board filtering, but the average deadtime has gone down from 18% to 12%.

Occasionally protons from a solar event entering the FOV leave a large charge deposition in the detector, effectively suppressing the gain during some hours.

### 4.3 SPI

JPR summarised the SPI status (see [viewgraphs](#)). The instrument is stable and the last two annealings went well. Annealing #21 was done with reduced telemetry coverage, which was fine but led to some worries during activation. JH commented that the next annealing will be done with full telemetry support during critical observations.

EK remarked that one should discuss the required observations to optimise SPI spectral calibration up to around 1 MeV. There is an action on E. Jourdain from the IOCG Meeting the day before to provide a report by end March.

RD briefly reported that MPE Garching is working on a precision response database. By modelling detectors individually one hopes to achieve more sensitivity for line studies.

### 4.4 IBIS

IBIS news were presented by FL (see [viewgraphs](#)).

There have been large changes in the team composition in Saclay in the last two years, but this should be more stable in the coming years. Calibration issues raised by CF are due to late delivery of updated ARFs, caused by the upheaval in the team and need for new staff to come up to speed. Two new ARFs have now been produced and work is finalised together with INAF Rome.

The extended times without telemetry contact during the last SPI annealing have not had any effects on the handling of bad pixels in ISGRI, which had been one worry.

In some revolutions with Crab observations, but not all, a strange drift of the overall Crab flux is visible. V. Savchenko at APC, Paris is investigating this behaviour, which may be partially explained by an energy drift in the detectors.

Significant work has been done by A. Goldwurm and A. Gros on improving the point-source location accuracy. It is not clear yet how this could be applied to OSA as the processing is very demanding. MR noted that this seemed a lot of work for an improvement not necessarily requested by a majority of users. FL replied that it might reduce ghosts and thus generally improve results.

To optimise the imaging it is also necessary to correct for spatial structures in the background. K. Kretschmer has been working on background maps. CF noted that parallel work on background maps is being done at ISDC using a different approach. FL proposed that K. Kretschmer could visit ISDC to compare approaches and results.

JH noted that G. La Rosa was frequently not responding to operational questions for IBIS which were not urgent anomalies, due to other work. FL proposed to be put in cc for mails to G. La Rosa, but emphasised that he could only answer for ISGRI. PK will contact the PI team in Rome

#### 4.5 ISDC

CF presented news from the ISDC (see [viewgraphs](#)). Before presenting the ISDC status he raised points he felt important for INTEGRAL legacy. One example: 1A 0535+262, a very bright transient where IBIS and SPI data differ strongly (60%) for a 100 ks observation. Similarly for RX J0440.9+4431 or Swift J174510.8–262411.

JPR commented that it was too soon to focus on INTEGRAL's "legacy", one should rather concentrate on attracting users now. WH commented that the critical decision point for this was the next extension.

JV inquired if HEAVENS efforts would possibly draw resources from the INTEGRAL core tasks of the ISDC, but was assured that only the adaption of INTEGRAL Data interfaces to HEAVENS were done by INTEGRAL personnel.

Upon EK's reminder that INTEGRAL's "Legacy Data Archive" quality depends on instrumental calibration quality, it was agreed that ISDC and Instrument Teams, should jointly ensure to dedicate adequate resources and attention on tackling calibration issues, in particular actions on IBIS and JEM-X appeared necessary.

It was agreed that ISDC, assisted by Instrument Teams, must ensure this receives adequate resources and attention; in particular, IBIS and JEM-X data actions are necessary. JPR reminded that while the mission is ongoing and evolving it is too early to try and finalise a legacy archive, and rather the science exploitation of INTEGRAL data at its best should be the goal. WH added that wide and effective usage of INTEGRAL data will be a key when arguing for the next extension. CF reminded that unless an effort is started timely, the construction of an appropriate legacy archive will be very difficult, as resources will be quickly diverted from INTEGRAL at ESA and ISDC, when the mission has terminated operations. He added that exploiting INTEGRAL data at its best will naturally lead to build a good legacy archive, provided that improvements on S/W are made available to the community.

An extensive discussion of the usefulness and adequate precision of the data as provided by INTEGRAL for the broader community ensued. Using SPI as an example, it is evident that

there are various approaches to data, with different functionality and precision requirements in most cases, and few users for most of these: Different software solutions available for science analysis are from OSA tools for generic source search and broadband spectroscopy, the SPIDAI interface in Toulouse, and the specialised software used at IRAP and MPE Garching for model fitting, imaging, and high-resolution spectroscopy. RD reminded that the general agreement had always been that ISDC provides first-order analysis tools of a more robust kind, with limited service for its more ambitious usage, while users who aim to challenge instrumental resolution and sensitivity should be encouraged to work directly with the respective instrument team experts. This requires some IUG attention to monitor adequate community service and clarity in the communication of this approach to support the science community, on websites and its community documents.

After some more discussion the view was expressed that users should be clearly informed about the different options and how they might apply to their research.

**Action 15–1 on CF****Due: end January**

*Propose way how to inform users about best choice of SPI analysis between ISDC/spiros; Garching or Toulouse (SPIDAI)*

#### 4.6 ISOC

PK gave a brief overview of the ISOC status (see [viewgraphs](#)). Manpower reductions, due to saving measures, lead to less flexibility and less ability to react to changes and TOOs, but for the moment the TOO response has been maintained.

#### 4.7 MOC + Ground Segment status

RS gave some news for the MOC & Ground Segment status (see [viewgraphs](#)). From December on INTEGRAL will have Kiruna as main station instead of Redu, which has been taken over by Galileo. Kiruna has a perfect location, but there will be a strong dependence on this one station, as all other available stations will have longer visibility gaps, due to the orbit evolution. He went on to present the Flight Control Team and the plans for upgrading the Mission Control System.

## 5 Preparation mission extension

### 5.1 Technical information

RS presented the status of technical properties which could affect the mission's lifetime (see [viewgraphs](#)). The number of anomalies remains low and no effects of proton belts passage observed except on solar arrays, star tracker (mildly) and SAS (solar cell). The batteries all appear in good condition. The degradation of solar arrays increased significantly in the last few years, while the perigee height was below 6000 km. Now it appears to flatten again and no problems are expected for the next few years. Beyond 2018, perigee height will almost always remain in the proton belt region, which would probably lead to power problems. Plans for mitigation measures exist, but were not discussed at the meeting. About 104 kg of fuel remained at the time of the meeting and the average usage per month has been reduced from 0.57 kg to 0.46 kg, although the latter number is still based on relatively few data points.

## 5.2 Disposal options

RS explained results from a study of disposal options for INTEGRAL (see [viewgraphs](#)). Further studies, especially a break-up analysis still need to be completed (results awaited early 2014), but some scenarios appear possible. The natural orbital evolution, which can not be affected significantly, leads to strong variations of the perigee attitude, but no natural re-entry. If no special measures are taken, the spacecraft will intermittently enter the Low-Earth Orbit (LEO) zone below 2000 km and roughly once per decade, the orbit will cross the Geostationary Orbit (GEO) ring.

A perigee raise manoeuvre would not be sufficient to keep INTEGRAL outside of the LEO zone. Re-entry at the next natural perigee minimum, around 2020, is no longer possible, even for an uncontrolled reentry. Two options are being studied that might lead to an uncontrolled, but geographically constrained reentry in 2029:

1. Apogee Lowering Manoeuvre, amplifying natural orbital perturbations. This might be possible up to mid 2017 with a later trim manoeuvre.
2. Lunar Resonance Delta-V (a special case of apogee adjustment), which would amplify lunar perturbations and remove randomness. This would need to be done by mid 2014!

Both variants and similar options would affect ground station coverage. The latter would lead to a shorter orbital duration (2.8 d instead of 3 d) and thus slight loss in available science time. All ideas need further studying in detail, the studies are ongoing.

CW inquired about a timeline and/or process for these activities. PK and RS commented that these studies form part of the preparation for the upcoming MEOR.

## 5.3 Impact of saving measures on science operations and science community

PK summarised the implementation of saving options, as already published on the Web (see [viewgraphs](#)).

This triggered a first discussion about how to handle data rights in the future with some members in favour of making more or all data public, except for the scientific objective of the proposers. AJB cautioned that “public” could also be associated with “free & worthless” for an observatory which had explicit data rights before. The idea of two classes of proposals was raised with a simplified structure for “opportunistic” proposals wishing data rights in generally observed fields. EK proposed to identify amalgamation candidates before the TAC meeting, and revisit the amalgamation rules to allow more merging of proposals, which would then be discussed at the TAC meeting.

## 5.4 Mission extension – Long term planning

EK discussed the probable timeline for the mission extension effort (see [viewgraphs](#)).

The format of the extension is expected to be similar to 2012 with five pages of summarised science case and two pages for technical and financial matters. NS commented that the structure is defined by ESA management and that for the last extension exercise D/SRE has emphasised the need for *new* science to be put into the extension request. JV underlined the importance of having a strong executive summary for the committees and recommended to write this first and then expand on this.

Various ideas for the contents of the science case were raised by different IUG members, including, e.g., high-energy spectroscopy at several 100 keV, gamma-ray polarisation, dark matter tests, a timeline of INTEGRAL discoveries, ... The ideas sent in by L. Sidoli (Galactic transients) and V. Beckmann (Extragalactic Ultra-Deep Field) were also discussed. A breakdown by physical themes instead of Galactic/Extragalactic/... was proposed.

After some more discussion, four teams were identified with IUG members taking a lead:

**Gamma-ray lines:** JV, DH, RD

**High-energy from 'compact' objects/Polarization:** MR, JPR, WH

**Extragalactic sky:** MR to connect to V. Beckmann

**Transients/Variable HE sky:** CF, PK, EvDH

First drafts should be circulated in March. In May/June a special IUG meeting shall be arranged to finish the science case. DH asked CW to contribute also from retirement.

## 5.5 Increase awareness of INTEGRAL in the community

The question of general awareness was raised by EK (see [viewgraphs](#)).

Some discussion took place about further synergies with other observatories. There will be coordinated observations with Swift as a new option in AO-12.

NS recommended to include scientists from high-energy gamma-ray (GeV/TeV) observatories in the TAC.

Using Twitter to announce TOO's and setting up an INTEGRAL page on Facebook were raised as ideas.

Regarding the impact of press releases, NS remarked that the ESA press releases per se were often not well picked up, but releases coordinated with national institutions like CNES or the Max Planck Society had more success in the popular press.

## 6 Data Rights in AO12

EK picked up the discussion on how to handle data rights in the future, when no second round of proposals is available to request specific data rights (see [viewgraphs](#)).

Options that were raised included:

1. All data (except possibly that with Russian PIs) is stored in the public archive at ISDC, with science data rights advertised.
2. Data is kept in the private archive, but access to it is facilitated for selected users.
3. For transient sources with a need for fast reaction, the Project Scientist could decide on specific access for users requesting this.
4. The TAC could discuss proposal amalgamation already based on science and position, to some extent combining the two proposal phases into one.

CW noted that any change in data access would mean changing the Science Management Plan, requiring AWG approval.

An extended discussion ensued where some members emphasised the positive signal given by opening up access to data, while others were worried that a too easy access to data might rather suppress the incentive to write proposals. Involving the Project Scientist in permitting data access would alleviate some worries, but with the reduced manpower in the SOC and a 50% Project Scientist a simple mechanism is required.

In the end a large majority agreed (at least for the non-Russian time), that the data rights for the PIs of accepted observing proposals should be limited to their specific science and/or targets, while a mode of access for serendipitous science for the community should be found. The treatment of observations with Russian PIs is pending a response from the Russian community.

<b>Action 15–2 on CF</b> <i>Propose technical implementation for new scheme to make data available to the community.</i>	<b>Due: end Dec</b>
<b>Action 15–3 on EK</b> <i>Formulate future data right strategy.</i>	<b>Due: end Dec</b>
<b>Action 15–4 on MR/SG</b> <i>Provide response from Russian community to the possible opening of data rights.</i>	<b>Due: end Jan</b>

MR noted that to have more scientists involved in INTEGRAL it would be more important to have easy access to publication-ready quick results than to the raw data. CW noted that this is provided by HEAVENS at ISDC, but only for consolidated data. It would be hard to adapt the automatic analysis to NRT data.

## 7 Earth/CXB Observations

MT presented the results from the Earth/CXB observations in 2012 and 2013 (see [view-graphs](#)), including a summary of the history of these observations.

For the November 2012 observation E. Churazov has managed to visualise auroral activity while MT has extracted spectra on sub-storm events.

MT advocates extension of the program (see vgs) and noted that NuSTAR has found to be unlikely to improve on the ISGRI CXB measurements above 20–30 keV.

MR noted that HEAO-1 measured spectral shape up to 40 keV much better than possible by current instruments and wondered about the accuracy that can be achieved towards higher energies, e.g., at 100 keV.

NS proposed to have the TAC decide on further observations, but this could only apply from AO-12 onward, i.e., for observations in 2015 or beyond. EvdH, as TAC Chair, agreed to this proposal. For AO-11 observations in 2014 an IUG decision is still required.

<b>Action 15–5 on MT</b> <i>Report on results, including Dec 2013 observations and focussing on questions raised by MR.</i>	<b>Due: end Jan</b>
<b>Action 15–6 on EK</b> <i>Take decision on EOs in 2014, including IUG advice.</i>	<b>Due: mid Feb</b>

## 8 Future calibration and cross-calibration status

EK noted that while the end of operations is not known, there are a few more years to get the best possible calibration for INTEGRAL.

One long Crab calibration (>2 revolutions) would be appreciated by SPI (JPR will provide an estimate, discussed at IOCG). FL would like to use the “large 5×5” grid for this, which was acceptable to the SPI team.

LN discussed the cross-calibration status, starting with a description of the IACHEC (see [viewgraphs](#)). Standard candles and reference sources have been defined within IACHEC. For several sources results of comparison, e.g., with NuSTAR were demonstrated.

## 9 Shorter INTEGRAL exposures

Having pointing durations smaller than the current limit of 1800 s would allow more long-term planning of repeated scans or alternating fields (see [presentation on planning difficulties](#) at IUG Meeting 12). Technically, 900 s pointings would be possible foresaking PICsIT data. But since the time spent in slewing would not diminish this would increase the effective overhead. The IUG recommended not to implement this idea.

## 10 Planning for end of AO-10

There are not enough AO-10 targets remaining visible to completely fill the time up to the end of the year. About 600 ks of observing time need to be filled. EK proposed to either advance some AO-11 observations (which could result in a similar problem end of 2014 or to fill this time with specific calibration observations. A majority voted for advancing observations of the AO-11 programme.

## 11 INTEGRAL Workshop 2014

DH reported on the plans for the INTEGRAL Workshop 2014 in Annapolis. There are ongoing efforts to include members of other teams, e.g., NuSTAR and Fermi. Help with transfer from the nearest airports will be provided, a circular needs to go out soon.

A discussion ensued on the format for proceedings with implications for the status of the contributions as refereed or non-refereed papers. It was decided to remain with PoS for the publication of proceedings.



## 12 AOB

MM raised the idea of specific large programmes for INTEGRAL. This should be considered as part of the discussion on the science case for mission extension.

EK mentioned that due to an accepted Crab monitoring programme, there would no be need for a dedicated short ‘control’ observation of the Crab at the end of the visibility window, as in 2013. In order to reduce carry-over EK proposed to as a matter of principle not carry over monitoring programmes, as well as B and C grade proposals (see [viewgraphs](#)). No objections were raised.

Another issue affecting carry-over is that the next SPI annealings are predicted to fall into the Galactic Centre (and also Crab) visibility time interval, which always has the highest time pressure. After some discussion JPR agreed that an earlier annealing with a somewhat shorter heating period would be possible. RS warned that due to the short time to implement this in January, it might be required to have full ground station support, foregoing the accepted saving measures. PK agreed to investigate this option.

**Action 15–7 on PK+EK+JPR+JH**

**Due: end Nov**

*Decide on SPI annealing, possibly requesting funding for having exceptional GS support*