

ESTEC, 1+2 March 2017

Minutes from 29 March 2017

Attendants

Søren Brandt	DTU Space	SB	
Volker Beckmann	CNRS / IN2P3	VB	
Roland Diehl	MPE Garching	RD	(only 1 March)
Carlo Ferrigno	ISDC	CF	
Diego Götz	CEA Saclay	DG	
Sergei Grebenev	IKI Moscow	SG	
Wim Hermsen	SRON	WH	
Peter Kretschmar	ESA, ESAC	PK	
Lucien Kuiper	SRON	LK	(only 1 March, invited)
Erik Kuulkers	ESA, ESTEC	EK	
Philippe Laurent	CEA	PL	
Alexander Lutovinov	IKI Moscow	AL	
Lorenzo Natalucci	INAF Roma	LN	(only 1 March, invited)
Jean-Pierre Roques	IRAP Toulouse	JPR	
Volodymyr Savchenko	ISDC	VS	(only 1 March, invited)
Richard Southworth	ESA, ESOC	RS	(only 1 March, invited)
Pietro Ubertini	INAF Roma	PU	
Peter von Ballmoos	IRAP Toulouse	PvB	

1 Welcome, Agenda, Actions

PvB opened the meeting, there were no changes to the agenda.

EK recalled the contributions of Mike Revnivtsev and Neil Gehrels for INTEGRAL. A minute of silence was observed. PvB called for ideas of how to honour Neil's memory from the INTEGRAL community. Neil has been involved in INTEGRAL and predecessor missions since to 1990s. PU proposed plans for a Mikhail G. Revnivtsev Prize for young scientists within the INTEGRAL mission with a first occasion at the planned workshop in Venice 2017. The Russian community has also considered similar plans within Russia. This will be discussed further. PU mentioned the COSPAR newsletter, EK the ESA Bulletin.

The actions from the last meeting have been closed.

2 Project Scientist Report

EK presented information about community interfaces, the status of the observatory, science highlights and outreach (see [viewgraphs](#) for details).

Since July 2016 Diego Götz, Angela Malizia and Diego Torres have joined the IUG, while Tony Bird, Lorraine Hanlon and Dieter Hartmann have left.

The extension for 2019 & 2020 will probably be decided at SPC meeting in June. A workshop by ESA with SPC and advisory structure on how to get along with the science budget will be held in April. An extended discussion ensued on the extension case and the most suitable next steps for IUG.

MoUs have been signed with LIGO/Virgo and IceCube. IBIS teams in both Italy and France have made contact with Fast Radio Burst community (more later). Some discussion took place about the most recent GW event and ways of follow-up with INTEGRAL.

Crab calibration observations have been coordinated with NuSTAR and AstroSat. CF asked if data from these other observatories were publicly available, as they were from INTEGRAL, but this depends on each observatories' policy.

INTEGRAL has now more than 1000 publications! The number is also rising as EK is still discovering older publications which did not mention INTEGRAL in their title or abstract via full-text searches in ADS. For the 15th anniversary of INTEGRAL a special brochure will be produced by ESA. EK asked for ideas for an accompanying infographic (deadline 31 March).

3 Instrument & Calibration status, Science Ground Segment

3.1 OMC

PK presented for MM the OMC status which is generally very stable (see [viewgraphs](#)). A new calibration strategy has been implemented together with ISOC. The Dark Current evolution shows a drop around revolution 1650, it seems that in recent months the temperature of the S/C has on average been lower than before.

3.2 JEM-X

SB summarised the JEM-X evolution since his last attendance (see [viewgraphs](#)). The detector evolution seems mostly to stabilise, with no anode losses in the last four years. The on-board particle rejection criteria have been updated, leading to a slightly increased background, but achieving a better and more even spectral response. The strong temperature dependence of the gain means that offline gain calibration is required for each orbit. This is more difficult in revolutions with grey filtering. High count rates lead to a lower gain, due to the lower conductivity of the glass plate.

The instrument team is still intact, but busy with other projects. Also several key players now have emeritus status.

3.3 SPI

JPR presented the status of SPI status (see [viewgraphs](#)). The background is increasing again, caused by the evolution of the solar cycle. JPR would be interested to see the evolution of the telemetry rate¹. The degradation before the last (28th) annealing was relatively high and the evolution of the measured energy resolution unusual with first a steeper rise and then normalising. It is unclear if this might be an artefact of the measurement procedure. For the moment, the energy resolution is still under control. The gain has decreased by 1% over the course of the mission; the reasons for this are unclear. Charge collection in Ge detectors would be a certain concern.

JPR continued with an update of the – stable – SPI calibration. A cross-calibration with NuSTAR, based on 2014 observations, finds a similar spectral shape but normalisation differences of 12–16%, depending on the exact model used. The last formal cross-calibration between the INTEGRAL instruments took place in 2007 after the release of OSA7 and JPR recommended

¹Link from ESOC provided after meeting

a new effort, using OSA 11. CF commented that ISDC has been doing comparisons in recent years and reported issues and discrepancies to the teams. RD mentioned that he has been in contact with CF to monitor the SPI gain evolution. He also has students working on high-resolution spectroscopy evaluation. LN will present INTEGRAL results at IACHEC meeting in March.

Recommendation 36: Cross-calibration report with OSA 11

IUG recommends to generate a report on the cross-calibration of the INTEGRAL instruments after the official release of OSA 11.

The SPI budget in France has strongly decreased in 2017. Operations-performance monitoring is no more supported by CNES, an industrial contract and a temporary position have ended. Operation support and performance monitoring will continue on best effort basis; on-board software maintenance is no longer possible in Toulouse. JPR and E. Joudain will maintain calibration activities.

3.4 IBIS

PU presented the status in Italy in some detail (see [viewgraphs](#)). The team in Rome has slightly increased, F. Panessa is now staff. A. Bazzano has taken over management of the contract from PU, who is by now formally retired (but remaining active). One person is starting to work on PICsIT calibration and data exploitation together with ISDC and P. Lubinski, results are expected within 2017.

The INTEGRAL Crab spectrum is relevant especially for multi-wavelength models of the Crab Nebula and an update with OSA 11 is required.

PU finished with the proposition of a Mikhail G. Revnivtsev memorial award for a young scientist with significant contributions within the framework of the INTEGRAL mission. SG remarked that there were also ideas within Russia, PU proposed to discuss this further offline.

PL continued with an overview of the ISGRI status (see [viewgraphs](#)). The percentage of dead pixels is now very stable. The background and thus total countrate is increasing with solar cycle, as expected. PL went on to detail the updates for OSA 11, which will presumably be the last major update for ISGRI calibration. The delivery of OSA 11 was delayed due to a hard disk problem. AL asked about the timeframe for final availability, leading to some discussion, which then was deferred to after CF's presentation on ISDC status.

Some work is continuing to improve the imaging calibration, including an optimised cleaning of ghosts from brighter sources. A. Gros has found a systematic shift of the determined Crab position related to position angle, which is not yet fully understood.

A cross-calibration effort with ASTROSAT on Crab timing and polarimetry, based on data from November 2015, found reasonably consistent results.

Another area of work is to deliver to ISDC software to generate images and spectra from Compton data. Most of the software is similar to the existing analysis tools, only the software to remove spurious events is specific and needs to be rewritten for inclusion in OSA.

Finally, PL gave a quick overview of recent scientific activities, including Gravitational Wave and Fast Radio Burst follow-up as well as joint γ -ray/NIR polarimetric observations.

3.5 MOC

RS reported on the evolution of the MOC in recent years and on the spacecraft status (see [viewgraphs](#)). A relatively large, experienced team is available, despite limited resources, by sharing with XMM-Newton. The operational system has been renewed; the simulator is being ported to a modern Linux-based environment. Further savings are foreseen by sharing SPACONS with Gaia as well, but this may lead to delayed recovery from non-critical anomalies. Automation of routine tasks and standard anomalies is ongoing.

IREM crashes are the main recurring anomaly, affecting IBIS and OMC (the reaction of SPI and JEM-X has been disabled). Some discussion ensued if also IBIS and OMC could disable their reaction to IREM without undue risk.

Action 19–1 on PU <i>Verify if IBIS reaction to IREM can be disabled.</i>	Due: 1 April 2017
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Action 19–2 on MM <i>Verify if OMC reaction to IREM can be disabled.</i>	Due: 1 April 2017
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RS continued with the evolution of remaining propellant since 2014, showing the large loss through the disposal manoeuvres in early 2015 as well as the strongly reduced consumption (~50%!) by suppressing thruster tranquilisation in early 2016 after careful evaluation. At the current rate, propellant should be sufficient until ~2027. A proposal is ongoing to reduce propellant usage further by use of the – currently forbidden – low speed region of the reaction wheels. A proposal for this will be discussed soon.

From 2018 onward and up to the end of the mission, the perigee height will be again below 6000 km which based on previous experience means a stronger degradation of the solar arrays. According to the predictions there will be no limitation of operations until well after 2020, then initially only during eclipse seasons. The batteries are essentially unchanged and can buffer for short peaks of power demand. A newly identified potential risk is that in the worst case at some point (well after 2020) the eclipse detection threshold is passed and the instruments are switched off. This threshold is hardwired; the algorithm can be disabled, but this risks loss of mission if a real eclipse is not detected in time. Safe solutions are being investigated.

Action 19–3 on RS <i>Prepare Technical Note on options for Eclipse Entry handling when array currents approach critical threshold.</i>	Due: end 2017
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3.6 ISDC

CF reported on the situation at ISDC ([viewgraphs](#)). The funding situation is satisfactory and near real time operations are maintained. Quick look analysis is proceeding routinely leading to information for the PIs and on occasion ATels being published.

NRT data are available within 3 hours, processing is usually smooth. The delay for consolidated data varies due to issues and holiday seasons with the fastest turnaround times ~20 days. ISDC usually processes in <10 days, further delays are from delivery to ISDC. Early access to private data is currently used by only a few users per year. The total size of the Archive is currently ~14 TB compressed. SPI ACS public data services are regularly used by IPN and Konus Wind.

There have been very few downloads of OSA 10.2 in 2016, the community is waiting for OSA 11. OSA is supporting recent Mac OS/X platforms plus three flavours of Linux. OSA 11 is mainly an update of the ISGRI energy calibration. The plan is to provide one RMF per revolution. Also improvements to SPI and JEM-X. The beta release is foreseen for March, after first testing by instrument teams and partners. Future OSA versions may include Compton Imaging (see PL's presentation) and possibly PiCSIT analysis (see PU's presentation).

Further development of the High-Level data archive HEAVENS is currently on hold for lack of funding. The inclusion of high-level products in ESASky or other platforms will be discussed in the future. PK commented that an activity in this direction was being started between ESAC and ISDC.

3.7 ISOC

PK very briefly presented ISOC news (see [viewgraphs](#)). Due to the loss of the Hitomi mission, synergies with the Hitomi SOC have been lost. ISOC is now down to 0.5 FTE on software support, achieved by mostly freezing work on improvements and moving some technical tasks to C. Sanchez. TOO implementation has not suffered yet, also due to luck in arrival times of requests and a good team spirit.

The presentation of INTEGRAL data in ESASky has been improved.

3.8 RSDC

SG reported on the status of the RSDC (see [viewgraphs](#)). The total archive now holds more than 35 TB of data. For the moment resources of the SpectrumRoentgenGamma (SRG) Data Centre can be used. Some scientists involved in INTEGRAL also work on software for the SRG mission, which is scheduled for launch in March 2018.

SG continued with scientific results from within the Russian community in recent years. He noted as a general problem that the status of INTEGRAL related software does not allow non-specialists to correctly analyse the data, leading to restricted interest from the community. Some discussion ensued, it was generally expected that the release of OSA 11 would resolve this problem. Some IUG members commented that the analysis of Swift/BAT data (a similar instrument to ISGRI) was also currently not working well.

In continuation, AL discussed ideas for targets covering the current gap in AO-14 LTP and reducing the Russian under-return, which are also relevant for the INTEGRAL legacy (see [viewgraphs](#)). They propose a survey covering all point sources in the Galaxy down to 2 (possibly 1) $\times 10^{35}$ erg/s. In the sky region between Cyg X-1 and GRS 1915+105 the effective sensitivity is lower not only because of lacking exposure, but also because of systematic effects from these bright and variable sources. Thus the Russian team proposes a specific target region and observing strategy around galactic coordinates (50, -3) excluding Cyg X-1. The proposal found general approval within IUG, details will be settled with ISOC.

The spectral calibration with OSA 10.2 did not allow inclusion of ISGRI data in an important paper on V 0332+53 (Doroshenko et al. 2017, MNRAS 466, 2143). This led to an extended discussion about spectral calibration. PU stated that the IBIS team in Rome could have helped to obtain a specific calibration for that period. CF commented that corrections by adjusting the ARF at this stage were no longer sufficient and the new energy correction of OSA 11 was the only working solution.

AL finished with news on SRG, which will now be launched with the same combination as INTEGRAL.

3.9 NASA GSFC

EK presented the news from the US, on behalf of Steve Sturmer (see [viewgraphs](#)). Downloads of INTEGRAL data have been roughly stable over the last three years at ~ 0.9 TB/yr. There is a good fraction of US first and co-authors, but very few US PIs in accepted proposals of last AO. A Fermi-INTEGRAL joint programme is continuing.

PU asked who would be the US representative after N. Gehrels passed away. EK commented that there would not be an automatic replacement at this stage of the mission. A general consensus was expressed by IUG that it would be beneficial to have one US member in IUG, due to the various productive collaborations between INTEGRAL and US missions.

4 Absolute timing efforts

LK reported on Crab timing study with INTEGRAL ISGRI, Fermi LAT, XMM-Newton EPIC PN, RXTE PCA and Fermi GBM (since Nov 2012). The baseline is always Jodrell Bank Observatory (JBO) radio data, which covers >30 years (see [viewgraphs](#)). SPI data has so far not been used in this comparison. The relative arrival times have a distribution width of $\sim 60 \mu\text{s}$ (somewhat wider for XMM-Newton), which is largely driven by the uncertainty in the JBO ephemeris ($\sim 42 \pm 16 \mu\text{s}$).

A comparison of Fermi GBM with ISGRI for both Crab and the transitional ms-pulsar IGR J18245–2452 ($P=3.9$ ms) finds a consistent small timeshift, demonstrating a great job by the ground segment on timing data quality.

5 Cross-calibration efforts

LN presented information on the results of various cross-calibration campaigns mainly within the IACHEC collaboration (see [viewgraphs](#)). The various high-energy instruments still significantly differ by sometimes $\sim 10\%$ in flux normalisation. The next IACHEC meeting will take place 27–30 March 2017 in Lake Arrowhead, California, attended by VS and LN.

A discussion about the expected differences between OSA 10 and OSA 11 results followed.

6 Transients outside the field of view

VS explained in detail how INTEGRAL and other detectors can be used to check for possible counterparts of Gravitational Wave events or similar transients (see [viewgraphs](#)). The multi-mission cross-calibration will be also useful for GRB detections with IPN. VS also explained the workflow for transient detection and communication of results in some detail. More services are expected to become public in the future.

For pointed follow-up very fast TOO observations would be very useful, also, e.g., for a hard GRB. EK and PK explained the operational constraints for a mission like INTEGRAL which has not been built for immediate response.

DG asked if 5×5 patterns were really the best follow-up option compared, e.g., to a sequence of staring pointings covering the ‘banana’ shape of location uncertainties. This was discussed at some length, but CF and others also noted that any non-standard patterns have been found to increase systematics and the risk of fake detections.

PvB encouraged to add more manpower to the efforts by VS and ISDC by including more people from other sites. He also noted that the SPI background was even smoother in comparison with other instruments than visually evident from the figure due to the axis scaling. PU noted that some support effectively exists already and proposed to plan regular meetings on this subject.

7 Legacy Archive

In the open discussion about ideas for a Legacy Archive, several ideas were raised. PL wondered if a tool for the kind of lightcurves shown by VS would be feasible. JPR proposes to have data like energy resolved total detector light curves, based on the science events instead of housekeeping data, publicly available. This raised some concerns about data rights.

The idea to make *all* data public immediately, possibly with some special provision for the share of the Russian Federation, was raised again, but was confronted with the same issue as in the past, i.e., direct links between successful proposals with specific data rights and research funding in some countries.

Changing the default time for proprietary data to 6 months instead of 12 was briefly discussed, but several IUG members questioned the usefulness as a large part of the data is effectively public.

It was pointed out that the access to proprietary data with limited data rights available at the ISDC was not trivial to find and inviting users to explore this data. Some steps to improve this were implemented before the meeting ended.

8 INTEGRAL Conference 2017

PU presented the [existing plans](#) for the upcoming Italian INTEGRAL Conference in Venice as well as an [‘advertisement’ slide show](#). The conference should, as usual, have a broad coverage of INTEGRAL-related topics. “New Astronomies” was proposed as topic for special emphasis. As another possibly higher interest topic, ULX were mentioned. Further inputs from IUG were requested soon.

9 Next Meeting

The next IUG meeting shall be held early in 2018 or late 2017, depending on the outcome of the June SPC meeting.