INTEGRAL User Group Meeting 23

ESTEC, 26-27 November 2019 **Minutes last updated on December 19, 2019**

Attendants

Sören Brandt	DTU Space	SB
Roland Diehl	MPE Garching	RD
Matthias Ehle	*ESA, ESAC*	*ME (Mission Manager)*
Carlo Ferrigno	ISDC	CF
Diego Götz	CEA	DG
Sergei Grebenev	IKI Moscow	SG
Jochen Greiner	*MPE Garching*	*JG (invited)*
Lorraine Hanlon	UCD	**LH *(chair)***
Wim Hermsen	SRON	WH
Erik Kuulkers	*ESA, ESTEC*	*EK (Project Scientist)*
Philippe Laurent	CEA/APC	PL
Julie McEnery	NASA	JM
Sandro Mereghetti	INAF Milano	SM
Lorenzo Natalucci	*INAF Roma*	*LN (invited)*
Jean-Pierre Roques	IRAP Toulouse	JPR
Sergey Sazonov	IKI Moscow	SS
Timothy Finn	*ESA, ESOC*	*TF (invited)*
Pietro Ubertini	INAF Roma	PU
Ed van den Heuvel	Univ. Amsterdam	EvdH

1 Welcome, Agenda, Actions, Recommendations

EK welcomed the IUG members. Apologies of absence from Angela Malizia, Diego Torres, Miguel Mas Hesse, Rashid Sunyaev.

1.1 Agenda

Agenda was accepted with no additional items.

1.2 Actions

Action 20–1 on CF: Coordinate the activity to produce a report on cross-calibration

> On-going—Infrastructure for cross-calibration product generation is in place and several example sources will be processed, e.g. allowing to compare NuSTAR and INTEGRAL-SPI results (with R. Staubert, JPR is also involved). A report has not yet been generated. Currently no due date can be given.

Action 20–8 on EK: Contact to gather results of the multiple cross-calibration efforts from teams involved (due June 2019).

> Closed—See presentation by LN, and resulting new Action Items.

Action 21–2 on EK/LH: Maintain a set of publicly available slides on mission status to be used for presentations (due Feb 2020).

> On-going—Due date changed in view of extension case preparation.

Action 21–4 on LH/EK: Make list of priorities for most essential INTEGRAL-related activities and discuss at IUG (due Nov 2019).

Closed – this meeting to focus on science case for Mission Extension, next meeting on cross-calibration activities.

Action 21–7 on EK/LH: Review the status of the documentation available to the public (due at IUG 24)

On-going—no progress to date. New due date. Actionee changed from PIs to LH/EK

Action 21–10 on PL: Deliver Compton mode analysis software to ISDC. Some difficulties encountered with integration using OSA 11 libraries (due at IUG 24).

On-going—See discussion below.

Action 21–12 on LH/EK: To draft a request to Lorenzo Natalucci to finish the cross-calibration paper on the Crab (due July 2019).

On-going—Has not been done. Actionee changed from IUG to LH/EK

Action 21–14 on PL: To begin writing ISGRI calibration report and report at next IUG.

On-going—Work has started at Saclay in a small dedicated team. New Action Items and due date. Also to be worked on during planned calibration meeting.

Action 21–15 on EK: To discuss with CF how to present the cross-calibration results and OSA11 results on the web

Pending work by LN related to Action 21–12.

Action 22–1 on LH/EK: To contact the CHIME collaboration to make links with INTEGRAL (due IUG 23).

Closed.

Action 22–2 on EK: Consider reducing the proprietary period for data from 1 year to 6 months (due IUG 23).

Closed—see Recommendation 37.

Action 22–3 on PU/LH: Make a list of things to do to get the conference preparation moving (due Sep 2019).

Closed—see presentation by PU.

Action 22–4 on RD: Find out if Andreas Von Kienlin can work on retuning the ACS parameters to improve response as was done during commissioning (due IUG 23).

Closed—Andreas von Kienlin is not available.

Action 22–5 on PL: To work with Rome team to provide updated PICsIT response matrices (due IUG 23).

Closed—work is complex and to be discussed at dedicated calibration meeting, see new Action 23–4.

Action 22–6 on EK: Formulate a reply to TAC about the question of the polarisation software, and a statement to be posted on the INTEGRAL AO documentation and News (due Feb 2020).

On-going—to be addressed in AO-18 documentation.

Action 22–7 on PL: Check mission documentation for agreement on software deliverables from instrument PI in regards to polarisation-specific software (due IUG 23).

On-going—new due date **TBC.**

Action 22–8 on RS: Explore and present an update on the long-term degradation of solar arrays (due IUG 23).

Closed—cf. presentation on MOC status.

Action 22–9 on CF: Request update about IBAS software validation from Sandro Mereghetti (due Sep 2019).

Closed.

Action 22–10 on CF: Investigate how to isolate the HEAVENS from main ISDC services (due Sep 2019).

Closed—HEAVENS is decoupled. A disclaimer has been put at the HEAVENS web page `https://www.isdc.unige.ch/heavens/` clarifying that INTEGRAL products have been derived with OSA version 9.

Action 22–11 on JM/PU: Explore and propose ways to promote INTEGRAL at Fermi, and equivalently, to promote Fermi at INTEGRAL conferences (due IUG 23).

Closed—plan is to include invited talks from the missions cross-wise, and to inform and explicitly invite both user communities for future conferences (the next Fermi Symposium takes place 29.03 - 03.04.2020 to be followed by one $\sim$ 18 months later in autumn 2021; the next INTEGRAL Conference is planned for the 1st week of Oct 2020).

Action 22–12 on GB: Explore possibility of institutional support from ESA for calibration activities (due IUG 23).

Closed—a request for support has been sent to higher management in the ESA directorate of science.

Action 22–13 on PU: Coordinate and ensure the delivery of PICsIT spectral analysis matrices (due IUG 23).

Dropped—this is included in Action 22–5

Action 22–14 on EvdH: Find out what is the production deadline in order to have the special issue published before Sep 2020 in order to have it ready for the next INTEGRAL conference (due Dec 2019).

Closed—in order to reach the planned milestones, papers have to be submitted to the editors by end of 2019.

Action 22–15 on PU: Gather inputs from stakeholders for a further discussion on the topic of working towards a final INTEGRAL catalogue at the next IUG.

Closed—cf. presentation on INTEGRAL Catalogue.

1.3 Recommendations from previous Meeting

Recommendation 36: Make production of ISGRI calibration files a top priority
The IUG recommends making the production of ISGRI calibration files to allow the analysis of all data back to the start of the mission with OSA 11 a top priority.

A new ESA contract with ISDC, including a work package on ISGRI calibration, has been kicked-off in Sep 2019.

2 Mission Status Report — ME (viewgraphs)

- ME presented the Mission Manager report. New colleague in operations group to be appointed to compensate for core staff being involved in other activities. Satellite health remains very good with low fuel consumption. Permanent loss of bearing assembly heater on reaction wheel #4, should have no impact on operations.
- INTEGRAL SOC report by ME on behalf of GB: More distributed and agile approach to operations being implemented. Literature study linking papers to data requests. New ISDC contract for IBAS, Jupyter notebooks for OSA, legacy archive support, ISGRI cal files and OSA documentation. VS working with GB as Technical Officer. DTU contract for post-doc in preparation for JEM-X calibration, all-sky mosaics, restricted imaging mode data.
  Request for statistics on downlaods of OSA. Leaflets for conferences, or tutorials for new users.
  LIGO/Virgo O4 will start in mid 2021 to end 2023. INTEGRAL needs to stay alive for that.

3 Project Scientist Status Report — EK (viewgraphs)

- EK presented the Project Scientist report.
- Three new IUG members need to be appointed by mid 2020. Suggestions welcome.
- INTEGRAL achieved 17 years of operations in October 2019.
- MEOR needed by February 2020. Extension case ready by March 2020, for AWG in middle of May.
- Release of AO March 2nd 2020. BMcB will take over as TAC Chair from EdvH for AO18. Request for new TAC members also solicited.
- Four coordinated/cross-calibration observations e.g. ToO on IceCube 190730A, ToO on FRB121102, ToO on Cen X-3, coordinated with Spectr-RG/ART-XC, ToO on GRS1915 coordinated with XMM-Newton and Crab calibration with NICER, NuSTAR etc., 4 GRBs in FOV. Fastest ToO response was 3.7 hours in test mode.
- Over-subscription $\times$ 3 in AO17, from $\times$5 in previous few cycles.
- 20 GW events since last meeting. No EM counterparts found. 9 high energy neutrino events, no hard x-ray/gamma-ray counterparts seen.
- PU - big change in how we do science with more open distribution of results via GCNs/ATels. Concern about reduction in numbers of refereed papers in the last year.

Recommendation 37: Shorter proprietary period
IUG recommends a proprietary period of 6 months for proposals allocated time through the TAC process.

4 Instruments and Ground Segment

4.1 SPI — JPR (viewgraphs) and RD (viewgraphs)

- JPR presented his summary of the SPI status. 33rd annealing took place between September 22nd and October 9th (200 hours). Behaviour of GeD 8 and GeD 14 during switch-on requires attention. Not new behaviour. Energy resolution history shows slow drift with time (of order 10%) and don't recover previous performance any more, since about the 16th annealing. Should not be impacting on scientific performance.
- High voltage test to check for increase in noise as a function of HV - no clear need for HV reduction from that point of view.
- SPI telemetry seems to be saturating occasionally, 3-5 pkts going missing per 8 second cycle.

Action 23–1 on TF	**Due: IUG 24**
MOC to confirm the reason for the occasionally missing SPI telemetry packets and possible workaround.	

- RD presented his summary of the SPI status. Recovery after annealing okay. No need for change in HV. Suggests next annealing around revolution 2220 (March 2020).
- JPR noted that previously could operate at 118K, but now operating temperature required to be close to 80K for good performance.
- If annealing conducted for 300 hours, is this too big a risk for little gain? Reduction below 200 hours was tried in previous annealings, but the drift required increase to 200 hours.
- PU suggests adopting a conservative approach to ensure instruments' continued safe operation. Now working at way beyond qualification levels.
- RD presented previous ACS calibration activity, no progress since June 2019.

4.2 JEM-X — SB

- SB presented an oral summary of the status of JEM-X. In the process of hiring a post-doc. Still dependent on 3 Emeritus staff for effort.

4.3 IBIS — PU (viewgraphs) and PL (viewgraphs)

- PU and PL presented the IBIS status.
- PU reported that funds for ongoing operations and PI duties guaranteed.
- Continuing the technical work to generate off-axis IBIS response for real-time deconvolution of GRBs connected to GW events. Two different test cases - GRBs from 10-15 degrees to 90 degrees and GRBs from beneath (through 2cm of BGO) +/-70-80 degrees. 8 energy channels, better than 8 msec time resolution. Off-axis get bigger effective area by almost a factor of two because the mask is out of the way. Almost at the stage to present a full analysis of off-axis GRBs. Would like to have a matrix built on the angles of the GRBs and have as outputs the RMF. A fully general version is too complex to implement.
- SM suggested also including long GRBs since there are more photons and it is a bigger sample to work from.

- PL reported on status of Compton mode software to ISDC with a first delivery of Dal3ibis-calib and ic_MosaIma. Papers planned on the Compton mode software development. A 'true' Compton imaging software is under development at Saclay (G. Daniel).
- GRandMa network Antier et al., MNRAS 2019. 23 telescopes, 11 countries, 70 scientists.
- Polarisation in V404 Cygni, looking at PA and PF during Rev. 1555 on ScW timescale. Clear variations seen.
- FRB ToO programme underway. INTEGRAL contribution noted by FAST/CAS.

4.4 OMC

- No report.

4.5 MOC — TF (viewgraphs)

- TF reported on MOC status. 6.5 FTEs on the flight control team, quite stable.
- In addition to the INTEGRAL dedicated Kiruna groundstation, a default backup antenna provided by INTA, VIL2, currently under revalidation by INTA and the INTEGRAL Flight-Control Team will become operational in 2020. There will be no clashes with the other mission supported by INTA.
- Expected re-entry early 2029. Effects of disposal manoeuvre have been fully compensated, propellant will probably not be exhausted before re-entry. Might allow longitude control for re-entry.
- Radiation environment - ESAC 5DRBM-e model predicts long term smoothed trend that will extend science window using IREM data. Plan to increase science window with possible reduction in accumulated dose.
- Solar Array Degradation - Technical Note has now been prepared by RS. Lower perigee altitude caused increase in rate of degradation of solar panels in 2009-2012. A similar change in rate was not observed from late 2017. This may mean there is no power constraint until possibly late 2023. Spurious eclipse ECL issue causes PLM to power off unexpectedly and takes a long time to recover. Given slower rate of degradation may not be an issue before 2021. A proposed solution is to limit pitch angle in eclipse season only and disable ECL outside eclipse season. Temporary loss of part of the celestial sphere for 90 days per year.

4.6 ISDC — CF (viewgraphs)

- CF presented an update of activities and manpower at ISDC.

4.7 NASA GSFC — JM (viewgraphs)

- JM reported about the INTEGRAL status at GSFC, and provided updates on the Neil Gehrels Swift and the Fermi observatories:
- INTEGRAL archive at HEASARC is 3rd largest after Swift and Fermi. Significant fraction of INTEGRAL papers have US co-authors.
- Senior review of Swift and Fermi complete and continue until 2022. Typically renew contracts for 6 years. Invited to resubmit to senior review in 2022, indicating intent to continue operations.
- One of Fermi solar panels is slightly stuck, constraining sun angle to be within a certain range. Change from seeing full-sky every 3 hours to seeing 85% of the sky every 1.5 hours when this constraint is active.

- Decadal survey underway to be released in 2020. Likely that multi-messenger astrophysics will have a prominent role. Positive for high energy missions. Prioritises science questions and goals, relevant to existing missions as well as future ones.
- GBM has occasional thermal issues and sometimes detectors need to be switched off.
- Fermi symposium is in Johannesburg, March 29-April 3, 2020.

4.8 ISOC — ME (viewgraphs)

- ME presented a status update on ISOC activities since the last IUG meeting.

4.9 RSDC — SG (viewgraphs)

- SG presented a summary of activities at RSDC.
- Seven GRBs identified that were not seen by IBAS. Plus 4 previously detected GRBs by Konus-Wind were localised. 1010 GRBs in total, 121 in FOV, 889 outside FOV. 90 of these not seen by SPI-ACS. SM - we need to understand why IBAS did not detect these GRBs. Sometimes one module gets switched off if noise increases. PU - difficult to disentangle short GRBs from charged particle events. EK - For S190425z event is there a discrepancy between 2 INTEGRAL teams' findings?

Action 23–2 on SG/SM	**Due: IUG 24**
Share data on GRBs found by RSDC analysis with SM to understand why they were not triggered by IBAS	

4.10 Mission Extension

- ME - New approach from 4 years now to 5 years in 2020 to 6 years as of 2022.In 2020 need to ask for confirmation for 2021-22 and indicative extension for 2023-24-25.
- Science extension case required by end of March.
- EK - Deliverable is the Science Case. How should it be tackled this time?
- Multi-messenger astronomy case to be updated. Reasonable to have not seen anything - state this in a positive way. Prospects for future O4 with improved LIGO/VIRGO sensitivity very good.
- INTEGRAL has very good characteristics e.g. all-sky sensitivity, solid angle, on-time, and is therefore unique. Emphasise now how the changing landscape makes INTEGRAL contribution of growing significance. Super-Kamiokande neutrino observatory is coming on-line. Every MM observation has included gamma-rays, including nearby supernovae (detected lines). Emphasise TOOs. Most of this already in previous case. Probably an update now is sufficient.
- INTEGRAL is improving capabilities, using instruments in a different way. All-sky observatory not foreseen 5 or 10 years ago. Revolution with eROSITA - make a science case with them. CF has an input catalogue that will be revolutionised with low energy survey of eROSITA. Synergy with new high energy missions. Also SVOM and Einstein Probe (2022).
- XMM-Newton host community workshops to solicit ideas for future science topics, observing modes etc., that go into the extension case.

- Include Burst Advocate system, rapid TOO capability, all-sky capability - these are new features implemented
- WH - magnetars/AXPs, need to check what could be done with INTEGRAL from 100 keV to a few MeV, that isn't done by GBM. Need ephemeris from X-rays. Non-pulsed can only be done with INTEGRAL.
- CF - proposes to reconstitute TAC structure that is more open to longer proposals such as magnetars. Want to encourage a wider community.
- SM - what is the TOO policy? How is it regulated in AO? It can be very difficult to get TOOs for XMM.
- EK - no real limitation. Some guidelines for the TAC, but no strict limit.
- JM - Fermi doesn't pre-allocate time based on proposal pressure. Want to allocate based on scientific excellence, not on how long it will take.
- PU - need to include Spectrum X/gamma, reserve TOOs for joint programmes?
- DG doesn't see a large number of joint TOOs.
- EK - IUG can use DDT for TOOs. Advertise this possibility more widely.

Action 23–3 on PIs **Due: 1st week of February 2020**
Instrument and Centre PIs to provide info on future funding to 2025, ensuring National Funding Agencies are informed as to the assumptions being made in the submission.

4.11 Cross-mission Calibration — LN (viewgraphs)

- LN gave an overview of IACHEC activities.
- OSA 11 counts for Crab nebula 30–300 keV are about $\times$ 1.5 those from OSA 10.2.
- PU noted the new approach to IBIS calibration that has been implemented since 2017. Monte Carlo used for energies above 60 keV.
- JPR asked that the new processes for generating the response matrices and calibration, and assumptions behind them, be documented for users.
- PU emphasised all of this activity and new work by IACHEC was the motivation to re-start the calibration sub-group.
- PL - modelling of the low energy threshold has become more complex as the mission has gone on, because the calibration line at 30 keV is now at the threshold instead of above it.
- LN asked for advice on way forward regarding Crab multi-mission paper and use of OSA 10.2.
- PL would like a first paper on ISGRI Crab results, before the multi-mission paper.
- Modelling instruments' response and cross-calibration are the two priorities for calibration group meeting in May 2020
- WH - separate actions on ISGRI Crab paper and on cross-calibration IACHEC paper?
- CF - OSA 10.2 validated up to $\sim$Rev1600, so can be used in the cross-calibration paper. Suggests IACHEC puts all FITS files and calibration files in a public database.
- LN - some already is, but this is an open discussion point.

Action 23–4 on PL	**Due: December 2019**
Write a few line explanation of new calibration approach for IBIS to go on the OSA web-page	

Action 23–5 on PU	**Due: January 2019**
Organise calibration meeting to be held in/around May 2020	

4.12 15 Year Special Issue

- EvDH reported on the status of the special issue. Only two papers submitted to date. A plea was made to have papers submitted by the end of 2019.
- Several papers authored by IUG members are almost ready for submission.

4.13 INTEGRAL Catalogue — PU (viewgraphs)

- PU corrected point regarding catalogue availability to Rev. 1500. For catalogue there are 1,000 sources only (until Dec. 2010), plus spectra and lightcurves until Jan. 2015. No current plan for a final IBIS catalogue due to lack of manpower.
- ESA Fellowship or direct support to teams easiest route to address lack of manpower for catalogue effort. AHEAD may help on this.
- IBIS Survey team willing to contribute but would require 2 long-term post-doc positions.
- Should distinguish between IBIS catalogue and an INTEGRAL catalogue. For IBIS, there is no real value in a centralised catalogue.

4.14 INTEGRAL Conference 2020 — PU (viewgraphs by S. Zampieri)

- The next 'Italian-organized' workshop is planned to be held in Cagliari, Sardinia at the Flamingo Resort hotel. Dates proposed were Sep. 14-18, 2020 but this clashes with ESA-ESO Multi-messenger workshop. PU explored rescheduling the meeting and a change to Oct. 5-10 was found to be possible. The workshop will be announced in the list of International Astronomy Meetings (maintained by CADC).

5 AOB

- PL asked about the planet observations item that was not covered in the discussion due to lack of time. EK will provide documentation for discussion at next IUG meeting. MOC confirmed (after the meeting) that Jupiter observations should be feasible (details TBC) and further Earth Observations are still possible, depending on dates and amount.

6 Next Meeting

The next meeting will be in ESAC, Paris, or Toulouse (TBC) in mid-June 2020. EK to circulate a Doodle to ask for preferences for dates and location.