



## MEETING

|                      |                                  |                     |  |
|----------------------|----------------------------------|---------------------|--|
| <b>Meeting Date</b>  | 10+11/5/2023                     | <b>Ref</b>          | ESA-SCI-S-MIN-005  |
| <b>Meeting Place</b> | ESTEC (Room AF205)               | <b>Chairperson</b>  | Erik Kuulkers ( <b>EK</b> ), Miguel Mas Hesse ( <b>MMH</b> )   |
| <b>Minute's Date</b> | 18/07/2023                       | <b>Participants</b> | <p><u>Søren Brandt</u> (<b>SB</b>): DTU Space, Lyngby (PI JEM-X); <u>Brad Cenko</u> (<b>BC</b>): GSFC (Mission Scientist); <u>Jérôme Chenevez</u> (<b>JC</b>): DTU Space, Lyngby (future PI JEM-X); <u>Matthias Ehle</u> (<b>ME</b>): ESA ESAC, Madrid (Mission Manager); <u>Carlo Ferrigno</u> (<b>CF</b>): ISDC, Versoix (PI ISDC); <u>Sergei Grebenev</u> (<b>SG</b>): IKI, Moscow (Mission Scientist); <u>Jochen Greiner</u> (<b>JG</b>): MPE, Garching (Co-PI SPI); <u>Peter Kretschmar</u> (<b>PK</b>): ESA ESAC; <u>Erik Kuulkers</u> (<b>EK</b>): ESA ESTEC, Noordwijk (Project Scientist); <u>Philippe Laurent</u> (<b>PL</b>): APC/Université de Paris (Co-PI IBIS); <u>Julien Malzac</u> (<b>JM</b>): IRAP/CNRS, Université de Toulouse; <u>Jim Martin</u> (<b>JMa</b>): ESA/ESOC (Spacecraft Operations Engineer); <u>Miguel Mas Hesse</u> (<b>MMH</b>): Centro de Astrobiología - CSIC-INTA (IUG Chair &amp; PI OMC); <u>Sandro Mereghetti</u> (<b>SM</b>): IASF-INAF, Milano; <u>Jan-Uwe Ness</u> (<b>JUN</b>): ESA ESAC, Madrid (ISOC Coordinator &amp; IUG secretary); <u>Jean-Pierre Roques</u> (<b>JPR</b>): IRAP, Toulouse (Co-PI SPI); <u>Sergey Sazonov</u> (<b>SS</b>): IKI, Moscow; <u>Lara Sidoli</u> (<b>LS</b>): IASF-INAF, Milano; <u>Richard Southworth</u> (<b>RIS</b>): ESA EOSC (Spacecraft Operations Manager); <u>Pietro Ubertini</u> (<b>PU</b>): INAF-IAPS, Roma (Co-PI IBIS)</p> |
| <b>Subject</b>       | INTEGRAL Users Group Meeting #27 | <b>Copy</b>         | <p><u>Wim Hermsen</u> (<b>WH</b>): SRON, Utrecht (Mission Scientist); <u>Margarita Hernanz</u> (<b>MH</b>): CSIC Institut de Ciències de l'Espai, Barcelona; <u>Julie McEney</u> (<b>JME</b>): GSFC (Mission Scientist); <u>Norbert Schartel</u> (<b>NS</b>): ESA-ESAC; <u>Rashid Sunyaev</u> (<b>RaS</b>): IKI Moscow, MPA Garching (Repr. PROTON Launcher); <u>Ed van den Heuvel</u> (<b>EvdH</b>): University of Amsterdam (TAC chair)</p>  |



| Action   | Actionee   | Status   |
|--|------------|--|
| Action 20-1: Coordinate the activity to produce a report on cross-calibration  | CF         | Closed (see Action 27-1)   |
| Action 21-2: Maintain a set of publicly available slides on mission status to be used for presentations (due Feb 2020).  | EK/LH      | Closed (dropped)   |
| Action 21-10: Deliver Compton mode analysis software to ISDC.<br>Some difficulties encountered with integration using OSA 11 libraries (originally due at IUG #24).  | PL         | PL has worked on it and found a lot of bugs, now has a new PhD student. An update was sent to CF but it was found later that the solution sent doesn't work. |
| Action 21-14: To begin writing ISGRI calibration report and report at IUG #24.   | PL         | Combining Actions 21-14, 21-15 in Action 27-1  |
| Action 21-15: To discuss with CF how to present the cross-calibration results and OSA11 results on the web   | EK         | Combining Actions 21-14, 21-15 in Action 27-1  |
| Action 23-4: Write a brief explanation of new calibration approach for IBIS to go on the OSA web-page (due December 2021)  | PL         | PL reported this is done and informed GB and EK on 17-Feb-2022 via email => Closed. Inclusion in OSA web-page as Action 27-2                                 |
| Action 24-1: Call for calibration meeting in October 2020  | PU         | Closed (dropped)   |
| New Actions  | Actionee   | Due by   |
| Action 27-1: Coordinate calibration activities to start on time to be completed until end of Post-Operations phase   | EK         | Next IUG meeting   |
| Action 27-2: Include explanation of new calibration approach delivered under Action 23-4 in the OSA web-page   | CF         | As soon as possible  |
| Action 27-3: Circulate ideas about Fast-TOO Earth observations to the IUG for them to feedback whether there is any interest.  | EK         | As soon as possible (already done before end of meeting)   |
| Action 27-4: Collect IUG input for suggestions of new enthusiastic TAC members   | EK         | Summer 2023  |
| Action 27-5: Report to EK new PhD theses using INTEGRAL data   | IUG        | Standing action  |
| Action 27-6: Kick off plans to represent INTEGRAL at COSPAR Meeting in Busan.  | IUG        | Next IUG Meeting (PU already circulated some information by email on May 10 2023, 10:05)   |
| Action 27-7: To increase time resolution of PiCSIT: PL to provide details of the needs for the Compton mode data. Then the IBIS team to issue an OCR for approval by Project Scientist (EK) and Spacecraft Operations Manager (RS) for fast implementation by ISOC | PL, EK, RS | As soon as possible  |
| Action 27-8: Include in the IUG#27 minutes the number of subscribers to the INTEGRAL Newsletter before and after the change of subscription method   | JUN        | Done (see minutes below)   |
| Action 27-9: Invite other communities to subscribe to the INTEGRAL Newsletter (e.g. Athena, Swarm, see Action 27-2)  | EK         | End June 2023  |



|   |                        |  |
|---|------------------------|--|
| Action 27-10: Organise a dedicated meeting to coordinate the needs of the legacy archive  | EK, MMH, PK            | Before summer break 2023               |
| Action 27-11: Inform EK, MMH, PH who should be involved in the meeting and ideas important to be discussed (Action 27-9)  | IUG coordinated by MMH | End of May 2023                        |
| Action 27-12: Prepare a document summarizing all the ideas from IUG what is needed for the legacy archive   | MMH                    | Mid June 2023                          |
| Action 27-13: CF to reach out to MPE for access to their triangulation information.   | CF                     | Next IUG                               |
| Action 27-14: For AO21 call, write special invitation letter (on behalf of D/SCI) with emphasis on this being last opportunity to use INTEGRAL but care to be taken to keep the door marginally open in case we get an AO22 after all | EK                     | Early June                             |
| Action 27-15: ACTION 27-15: MMH suggested the ESA team that the IUG would be pleased to write a support letter to the ESA management in case it is considered at any time that the ISOC would benefit to increase its manpower.       | MMH, IUG, EK, ME       | To be triggered by ME and EK if needed |

### **Welcome, Approval of Agenda (MMH/EK)**

### **Review of past Actions (JUN)**

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

Status as of IUG#26: *On Hold—Infrastructure for cross-calibration product generation is in place and several example sources will be processed e.g., allowing comparison of NuSTAR and INTEGRAL-SPI results (with R. Staubert, JPR is also involved). A report has not yet been generated. Waiting for finalisation of calibration files and OSA release.*

⇒ Closed (obsolete by now)

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

Status as of IUG#26: *On-going - EK to upload and circulate link with IUG. New due date: Dec 2021.*

⇒ Closed (obsolete by now)

**Action 21-10 (PL):** Deliver Compton mode analysis software to ISDC.

Status as of IUG#26: *On-going - Software has been completed and tested with Cyg X-1 and Crab. Further test with a bright Compton source MAXI J1820+070 to be done. This is the brightest source of all sources observed since launch. Code will be shared with ISDC.*

⇒ PL has worked on it and found a lot of bugs, now has a new PhD student. An update was sent to CF but it was found later that the solution sent doesn't work.

**Action 21-14 (PL):** To begin writing ISGRI calibration report and report at IUG #24.



Status as of IUG#26: *Needed for archive phase and will be picked up by archive scientist. PU cautions that all this works take a long time. EK, ME, MMH reminded that post-operations phase is limited to two years without any perspective extension, and we should stick to the current timeline*

- ⇒ PL: Not started
- ⇒ **ACTION 27-1:** Coordinate calibration activities to start on time to be completed until end of Post-Operations phase. With this new action, close Action 21-14.

#### Action 21-15 (EK):

Status as of IUG#26: *To discuss with CF how to present the cross-calibration results and OSA11 results on the web (Pending work related to Action 21–12)*

For reference: Action 21–12: To draft a request to Lorenzo Natalucci (LN) to finish the cross-calibration paper on the Crab.

Closed in IUG#26: PU updated IUG that LN has been working on the paper which is being finalised. CF concerned that if we are about to release a new version of OSA, makes little sense to publish a paper that will be outdated as soon as it is published.

- **ACTION 27-1:** Coordinate calibration activities to start on time to be completed until end of Post-Operations phase. With this new action, close Action 21-15.

Action 23-4 (PL): Status as of IUG#26: *Write a brief explanation of new calibration approach for IBIS to go on the OSA web-page (due December 2021)*

- ⇒ PL reported this is done and he informed GB and EK on 17-Feb-2022 by email. EK forwarded this email to the IUG on May 10 2023 at 16:55
- ⇒ **ACTION 27-2:** Include these explanations in the OSA webpages (CF)

Action 24-1 (PU): Status as of IUG#26: *Call for calibration meeting in October 2020*

*Meeting was put on hold due to limited reply after 1st invitation and later due to unknown extension status. Meeting planned for Summer 2021. This is linked to Action 20-1.*

- ⇒ Closed (obsolete by now)

## Mission Status Report (ME)

Since last meeting, in Dec 2021, there was a lot of uncertainty about INTEGRAL mission extension, and ME presented the status of the mission.

During the presentation, PU asked how much the operations of the spacecraft will cost with or without science data taken. He advocated keeping the instruments enabled and sending down the data even if there are no targeted observations performed. ME clarified that various proposals in such a direction have been made but the one described in the slides (Science Operations until end of 2024 and Post-Operations 2025 and 2026) was selected by the SPC.

EK clarified about the original motivation for an Ultra-Fast Too process that there was an idea to follow up “Swarm” mission alerts for Earth observations (Aurorae) but didn’t see much response from the INTEGRAL community and has thus not followed this up further. The Ultra-Fast TOO process might still be useful for Gravitational Wave (GW) follow ups. Perhaps this idea should be made more visible, e.g., in the AO21 call (JG).

**ACTION 27-3:** EK to circulate the ideas about fast-TOO Earth observations to the IUG for them to feedback whether there is any interest.



Regarding optimizing angular momentum control, RS clarified that this is to make the scientific scheduling processes more efficient, but further improvements for the science will not be possible.

### ***Mission operations/ESOC status report (RS)***

RS reported positive news about operating the satellite. Especially the New Safe Mode (NSM) impressed the IUG as only two years ago this was unthinkable to be possible. The satellite can be considered re-conditioned, e.g., the original 36-hour autonomy requirement has been restored.

- ⇒ **The IUG congratulated and thanked Jim Martin and Richard Southworth with his team for all the wonderful work done for INTEGRAL.**
- ⇒ **RS noted that Jim Martin is proposed for a DG (=ESA Director General) award, and the IUG had endorsed this request with a support letter.**

RS commented that this was “innovation by desperation”. The gyros are more reliable than expected, they had only been used for recovering from ESAM but turn out to be usable for more permanent operations. In addition, RS emphasised the high quality of people who made the NSM possible.

JG asked about the Earth albedo that in the past had produced an effect on the SPI temperature. This effect has not been seen again. RS could provide further details on the albedo on request.

RS also elaborated on the operations setup after science operations which still incurs substantial cost but still less than with science operations. He recommends keeping the instrument functionality and so INTEGRAL could be activated if needed while still in orbit. Maintenance activities (annealing) should perhaps be continued every 6 months, at least in the short term (1-2 years), but keeping the expertise for longer would be difficult. However, ME noted that this is not in the current baseline of the ESA science directorate. He reported that ESA management is monitoring INTEGRAL science return and the science budget evolution, but we should stick to the current baseline.

PU appealed to ESA to recognise the unique capabilities of INTEGRAL, while stopping as a consequence of technical failure is of course ok, but he objected to “suiciding” the mission to save marginal amounts of money. MMH described his perception that the door to beyond 2024 wasn’t completely closed, at least compared to the initial plans to put a hard stop at end of 2024.

### ***Project Scientist Status Report (EK)***

EK appealed to the IUG that the new AO21 should receive strong response as demonstration of the importance of INTEGRAL for the science community. ESA considers the oversubscription as an important key indicator.

**ACTION 27-4:** The IUG is asked to make proposals for new, enthusiastic TAC members.

The extension to end 2024 was driven by the GW observatories, but the 5th observing round will be too late, and for extension beyond 2024, something else would be needed.

EK asked whether everybody has received a hard copy of the New Astronomy Review book about INTEGRAL which he described as being high quality and well suited to promote INTEGRAL.

**ACTION 27-5:** All IUG members to report to EK new PhD theses using INTEGRAL data.

PU proposes to run a booth on INTEGRAL or perhaps a public speech at the COSPAR 2024, 45th Scientific Assembly - July 13-21, 2024, in Busan, Korea. Tomaso Belloni might propose that.



**ACTION 27-6:** Kick off plans to represent INTEGRAL at COSPAR Meeting in Busan (due by next IUG in 6 months)

### ***Instruments: Status update reports & Calibration***

#### **SPI**

\* **IRAP (JPR)** Good news from SPI Annealing with increasing energy resolution. MMH asked why the energy resolution has become better in the last annealings, and JPR clarified that the energy resolution relates to the count rate which was lower. Also, there was less cosmic rays penetrating the solar cavity.

\* **MPE (JG)** For the post-operations phase MPE already has the funding from DLR. JG presented the MPE tool PySPI for GRB analysis, and CF asked about sky and background modelling, whether science windows with poor fits would be removed. JG answered that there is no longer a modelling of the background but an analysis slide through pairs of two science windows assuming the background not to change within hour time scales. They also tried with three science window which, however, is computationally expensive. The PySPI tool is an MPE tool that works independently of OSA, and ME commented that this software should be shared in the legacy archive. JG confirmed that the tool is already publicly available.

#### **IBIS**

##### **\* INAF (PU)**

Performance of instrument in good shape given the age. Everything is ready for the GW triggers. CF commented that the burst advocate is no longer needed.

##### **\* CEA (PL)**

PL has worked on the actions (see above).

#### **IBIS/PiCsIT spectral timing data (PU)**

Drawing on experience from GRB221009A shows that a time resolution of 3.9ms would be desirable, not the least also to reduce losses to saturation (see POM May 2023). Testing will be needed, and to understand the effort, impact, and benefit:

**ACTION 27-7:** PL to formulate the needed changes, then on the IBIS team to issue an OCR via the ESA system. It needs to be approved by Project Scientist (EK) and Spacecraft Operations Manager (RS) for fast implementation.

ME clarified that there are no movements of TM across instruments, but just internally which PU confirmed.

#### **JEM-X (SB)**

SB is retiring soon, handing over to Jérôme Chenevez (JC). The instrument is stable with no major issues. SB reported some budget pressures at DTU, e.g., with his position disappearing, support disappears, plus external funding. Good PRODEX support also coming under pressure; on the second day, SB reported that the PRODEX funding request was approved.

There will be support from retired people, and instrument will continue. **The IUG thanked SB for his 20-year support and welcomed JC into his new role.**



## OMC (MMH)

Everything appears perfect except for the increased dark current since the 22 Sep 2021 (rev2414) anomaly. It is not clear how this is connected, but the scientific impact is low.

## Centre Status update reports

### - NASA/GSFC (BC)

Brad Cenko updated on INTEGRAL data hosted at HEASARC. They observed a peak in data downloads from Japan without really understanding what they were doing with the data. CF commented they had some questions from a Japanese PhD student, but they downloaded their data from the ISDC interface.

### - Russian Science Data Centre - RSDC (SG)

Sergei Grebenev described the objectives and work of the RSDC. CF asked about the Internet links to ISDC, and SG explained that the Russian scientists cannot access the ISDC (not even via email) and thus rely on access to INTEGRAL data via the RSDC.

### - INTEGRAL Science Operations Centre - ISOC (JUN)

JUN is temporarily filling in the role of the ISOC coordinator and reported the status of the ISOC. He praised the wonderful teamwork with the MOC for achieving the return to pre-ESAM planning overheads. Following the presentation, the following actions are agreed:

**ACTION 27-8:** Find out the number of subscribers to the Newsletter before and after the new subscription process and include in these minutes:

- ⇒ Before the change, there were 586 subscribers to the int\_all email distribution list.
- ⇒ In the new system, 146 users have registered with consent to the Privacy Notice.

**ACTION 27-9:** EK to invite other communities to subscribe (e.g., Athena and Swarm).

PL asked about the Fast TOO and JUN clarified that the mentioned few minutes to half hour is not the response time itself but only what can be *gained* with the Fast TOO procedure. The response time was mentioned by RS to be 2-3 hours under ideal circumstances. If the new target is nearby, the Fast TOO procedure may not be worth it, but it depends on the science.

During the presentation, the feedback tool

<https://www.cosmos.esa.int/web/integral/feedback>

was mentioned that can be used by all users but also by IUG members to provide feedback on INTEGRAL Science Support.

### INTEGRAL Science Legacy Archive (ISLA): status & plans (PK)

Peter Kretschmar (PK) took over the INTEGRAL Archive Scientist role temporarily from Guillaume Belanger (GB) who has set up the concepts presented here, starting 2018.

During the presentation, PU intervened about the ISLA chosen nomenclature for entry portals suggesting INTEGRAL can only observe point sources. He requested to interact with the science teams for a more appropriate nomenclature. PK emphasised that he is giving a status description. He considers it difficult to undo what has been done in the past (2018 onwards) given the time left.



MMH asked about the difference between ISLA and the final legacy archive hosted at ESAC, and PK clarified that ISLA is what is planned to lead to the final archive.

Intense discussion followed the presentation. Several IUG members expressed discontent with the involvement of the science communities in designing the ISLA, giving some concrete examples of where things can go wrong when ESA designs the legacy archive alone. The ESA representatives conceded that things could have been done better in the recent past and emphasised that the input from the science communities is instrumental for the design of the INTEGRAL legacy archive.

PK advertised true high-level products and warned of products depending on software that is not commonly available, and CF clarifies all the software they use is public.

Several principles and concepts for the legacy archive were exchanged, and MMH suggested to organise a dedicated meeting on how to proceed; PU asked to extend such a meeting beyond the IUG inviting further relevant people, e.g., representatives from each PI team, institutes, to reach a number of ~20 people. Given the short time remaining for INTEGRAL science operations, this should be organised as soon as possible.

Three actions were agreed:

**ACTION 27-10:** EK, MMH, PK to organise a dedicated meeting (format to be agreed) before the summer break 2023.

**ACTION 27-11:** All IUG members: Tell the meeting organisers who should be involved and topics important to discuss by the end of May 2023.

**ACTION 27-12:** MMH to prepare a document with draft requirements by mid-June 2023.

PK offered to collect all requirements from IUG and experts in a shared document and start asap to group requirements and check if and how they fit to requirements that we already have.

### ***ISDC status & OSA: status updates, documentation, results (CF)***

CF reported highlights from the ISDC archive and (cross)calibration work.

After the presentation PL asked about the mentioned jump in the ISGRI light curve of the Crab (slide 2 of the [Cross Calibration presentation](#)) which he does not see with OSA 11.1. This artifact is not due to the OSA version but the version of the calibration files. This jump is only seen in one revolution, and no real explanation was found for lack of manpower: CF asked to recommend competent people needing a short-term position to work on the investigation of this artefact.

CF asked about the priority of including (cross)calibration files in the legacy archive as there will be a lot of 'nice-to-have's. EK confirmed that calibration data should be included in the archive, and the prioritization should be detailed in the requirements to be discussed in the anticipated meeting about the archives (Action 27-10).

### ***Scientific objectives for 2023 & 2024 (All)***

CF reported about the Multi-Messenger (MM) activities lead by Volodymyr Savchenko (VS). PL asked who is invited to the mentioned Zoom meeting on May 17, and CF responded that all who are involved in the mentioned proposals. It is not completely closed, and CF is open to invite anyone else the IUG suggests participating, e.g., new students. JG asked (in the light of experience with NASA on GW170817) why CF contacted NASA for the triangulation while MPE could have given better



support. CF responded that the data are publicly available near real-time while he is not closed to work with MPE. SM asked whether the data are equally immediately open at MPE which JG confirmed. It is agreed that the triangulation should be done in Europe, thus:

**ACTION 27-13:** CF to reach out to MPE for access to their triangulation information.

MMH calls for reaching out to the communities that AO21 is the last opportunity to use INTEGRAL. PU cautioned to be careful with the phrasing.

**ACTION 27-14:** For AO21 call, write special invitation letter (on behalf of D/SCI) with emphasis on this being last opportunity to use INTEGRAL but care to be taken to keep the door marginally open in case an AO22 may be possible against all expectations.

EK has circulated the announcement of opportunity to all relevant high-energy communities and some individual people with influence. PU suggests reaching out to the GW communities who might be interested in submitting proposals. SB also reminded of an important high-energy community in China.

#### ***Date and Place of next IUG meeting (All)***

Will be decided offline. The meeting should take place after AO21 TAC results are known, thus November 2023. It is also TBC if it will be done in person or (more likely) remotely.

#### ***Users Group satisfaction survey (All)***

ME encouraged the IUG to use the general Feedback form on the ISOC web page at

<https://www.cosmos.esa.int/web/integral/feedback>

Feedback can be anonymous.

#### ***AOB Wrap Up (All)***

PU praised the great support by late Stavros Katsanevas.

EK reminded, as said earlier, that any further extension will not again be able to draw on multi-wavelength astronomy as the GW ops run 5 will not come before 2027. A Science case of waiting for the next important Supernova alone may not fly, so if an attempt for further extension of science operations is to be made, some extra effort is needed.

#### ***Post-meeting decision:***

**ACTION 27-15:** MMH suggested the ESA team that the IUG would be pleased to write a support letter to the ESA management in case it is considered at any time that the ISOC needs to increase its manpower.