INTEGRAL User Group Meeting 21

ESTEC, 7-8 November 2018 **Minutes last updated on February 22, 2019**

Attendants

Sören Brandt	DTU Space	SB
Volker Beckmann	CNRS / IN2P3	VB
Guillaume Bélanger	*ESA, ESAC*	*GB (secretary)*
Brad Cenko (remotely)	NASA	BC *(Nov 7)*
Roland Diehl	MPE Garching	RD
Matthias Ehle	*ESA, ESAC*	*ME (Mission Manager)*
Carlo Ferrigno	ISDC	CF
Sergei Grebenev	IKI Moscow	SG
Lorraine Hanlon	UCD	**LH *(chair)***
Wim Hermsen	SRON	WH *(Nov 8)*
Miguel Mas Hesse	INTA Madrid	MM
Elisabeth Jourdain	*IRAP Toulouse*	*EJ (invited)*
Erik Kuulkers	*ESA, ESTEC*	*EK (Project Scientist)*
Philippe Laurent	CEA/APC	PL
Alexander Lutovinov	IKI Moscow	AL
Angela Malizia	INAF Bologna	AM
Jean-Pierre Roques	IRAP Toulouse	JPR
Richard Southworth	*ESA, ESOC*	*RS (invited)*
Diego Torres	ICE, CSIC	DT
Pietro Ubertini	INAF Roma	PU
Ed van den Heuvel	Univ. Amsterdam	EvdH

1 Welcome, Agenda, Actions, Recommendations

EK welcomed everyone and Lorraine Hanlon (LH) as new IUG chair. LH is chairing for the first time, taking over from PvB. The following IUG members contacted EK to mention they could not attend: Diego Götz, Norbert Schartel, Rashid Sunyaev.

1.1 Agenda

Two additional agenda item were added:

- A status update on INTEGRAL special issue by EvdH.
- A point on a comment made by the TAC and OSA support from DTU.

1.2 Actions

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

> On-going—The focus has been on releasing the new OSA, and this cross-calibration effort should really be done with the new OSA.

Action 20–2 on RS: Report about impact on ToOs of SPACON merger (due April 2017).

> Closed—Note was sent just after the merger. There is no issue; all is running smoothly.

Action 20–3 on AL: To explore and report back on the possibility of connecting INTEGRAL to Baikal Project (due April 2017).

Closed—Team is ready to work with INTEGRAL. A formal agreement is needed.

Action 21–1 on PL	**Due: Dec 2018**
Send template of LoI to AL, and explain what to do. **This action is already closed.**	

Action 20–4 on PvB/EK/VB: To propose a systematic way to keep track of meetings, and ensure official INTEGRAL mission representation (not individuals presenting their own work) (due end April).

Dropped—Consensus that this is not worth pursuing further; that natural (non-organised) scientific representation at related conferences is enough.

Action 21–2 on EK/LH	**Due: IUG 22**
Maintain a set of publicly available slides on mission status to be used for presentations.	

Action 20–5 on DG/PU: To prepare INTEGRAL representation at GEMA meeting in Italy.

Closed—Presentation was given. There will be a special book for the ten years of Agile in which the INTEGRAL mission review paper will appear. James Rodi also presented a talk on GRB with PICsIT.

Action 20–6 on CF: Update general catalog to include missing newly detected sources (due OSA11 release).

Closed—Completed in June. Next update will be around March.

Action 20–7 on ME: Send request for letters summarising funding situation from each PI/institute (due end April).

Closed—Request was sent and the responses were received. JPR mentioned that the report that was received by CNES doesn't contain any information on the French labs. ME confirmed that the intention of info about funding given in this report is to list critical support that is limited in time and for the specific mission only. Permanent position that exist independent of the mission, i.e./ that would even continue when the mission is no longer operational, are excluded. The French funding situation for INTEGRAL has not changed with respect to non-CNES funding, the listing under "Other" was empty already for the previous extension case.

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

On-going—Sent an email. Didn't receive responses. A plan of action should be elaborated. (Updated due date.)

Action 20–9 on EK: Formulate statement in announcement for increased time for TOOs (due end April 2017).

Closed—Included in the AO documentation. It was also communicated to the AWG.

Action 20–10 on EK: Incorporate comments from discussion into reworked extension case (due October 2018).

Closed—Extension case was submitted to the AWG in October 2018.

Action 20–11 on IUG: Transmit to each national delegates the conclusions from IUG discussions (due October 2018).

Closed

Action 20–12 on EK: Send link to IUG members for feedback (due end March 2018).

Closed—No feedback from IUG received.

Action 20–13 on EK: Decide on location for next conference (due end April 2018).

Closed—The conference will be held in Geneva on 11-15 Feb 2019.

Action 20–14 on EK: Decide on location and date of next IUG (due end June 2018).

Closed—Meeting is taking place at ESTEC.

1.3 Recommendations

Recommendation 36: IUG recommends to generate a report on the cross-calibration of the INTEGRAL instruments after the official release of OSA 11.

On-going—Plans for this are in the making. Manpower is an issue.

2 Mission Status Report — ME (viewgraphs)

- There will be a study by the MOC to explore the evolution of the power from the solar panels.
- Operational ground segment (ESAC and ESOC) are exploring the process of how to put in place a fast TOO reponse.
- Legacy archive activity will start in 2019. Will be led by archive scientist (GB) and project scientist (EK). Will try to minimise use of INTEGRAL specific software and dependencies. Online processing is certainly important. Catalogue is an important legacy product.
- OSA11: a big thanks to the ISDC and everyone who made this happen. How can we (ESA) help in the progress on the calibration and finalisation of the release. How can we promote the use of INTEGRAL data? Leaflet? Dedicated OSA workshop at ISOC? Please think about ways to promote INTEGRAL like the use of Jupyter notebooks, and more detailed tutorials.
- INTEGRAL funded until end of 2018; indicative until 2020. MEOR in June went very well. The AWG and SSAC have passed and very positive feedback was received. SPC in Nov to approve indicative extension until 2020, and indicative extension until 2022.
- Thanks to SPI and especially JPR for support on the instrument and particularly over the last weeks in the recovery from the DPE crashing.
- Comments:
  - PU: Most important to have an archive that is geared to non-gamma-ray astronomers with products that can be used immediately, but also to provide a mechanisms for non-experts to be able to use and analyse the data. We don't have to fight for our survival as we did a few years ago. Now, we need to promote and advertise the mission. We have to care more about the international community and maybe less about the specific issues and detailed problems.
  - CF: The main problem is manpower: there are simply not enough.
  - EK&ME: The ESAC Science Data Centre is responsible for building the legacy archive; we need a clear definition of products and processing ability.
  - JPR: We are asked to do more for GW, on calibration, on instrument maintenance, on archive. There are so many things to do, and so many things being asked, but in

the end the problem is that there are no people nor resources to do everything. We need to make a list of priorities. If there is no injection of manpower and resources nothing can happen.

Action 21–3 on GB/EK **Due: IUG 22**
Consider idea of a WG on the legacy archive.

Action 21–4 on LH/EK **Due: IUG 22**
Make list of priorities for most essential INTEGRAL-related activities and discuss at IUG.

3 Project Scientist Status Report — EK (viewgraphs)

- Results from AO-16 call for proposals: good response; improved from last year.
- Results of SPC, MEOR, AWG and SSAC: all positive feedback.
- Deadline for abstract submission for the 2019 INTEGRAL conference was extended to 2018 December 5.
- GB presented idea of having focused workshops on themes to collaborate on review papers.
- TAC meeting is fixed to 13-15 May 2019.
- Motivation for preparing report on cross-calibration efforts?
- Number of TOOs: 2018 already 15 requests.; time spent in 2018 already more than 6 Ms; and 90% has been made public immediately.
- TOO on ASASSN-18fv: after 2.8 Ms (32 days); no lines.
- TOO on IceCube-170922A/TXS 0506+056: upper limits; large MW collaboration.
- TOO on AT2018cow: new kind of transient; 900 ks; would have been missed without INTEGRAL/NuSTAR; paper submitted and PR event is in preparation.
- Number of refereed papers is now 1577.
- Comments:
  - PL was invited to India to promote INTEGRAL next week.
  - SB proposed to have longer AOs. (To be considered by PS/MM.)
  - PU: Interest in TOOs shows INTEGRAL can be competitive with NuSTAR for hard sources.
  - EvdH: In regard to the INTEGRAL special issue, I have put together a small committee of senior INTEGRAL scientists and PIs to propose lead authors from whom feedback is awaited.
  - There was a discussion of the criticisms received by expert users about the state of the OSA user manual. Maybe it's not worth it to spend the time on the manual that few people will use. But instead we can provide a reliable online analysis software. No INTEGRAL instrument team has the resources to work on the documentation.

Action 21–5 on EK/ME **Due: IUG 22**
Consider longer AO periods to reduce pressures from workload.

Action 21–6 on EK/LH **Due: Nov 2018 (Closed)**
Draft letter to reply to expert users.

Action 21–7 on PIs **Due: IUG 22**
Review the status of the documentation available to public.

4 Instruments and Ground Segment

4.1 JEM-X — SB (viewgraphs)

- Had a celebration at the institute for the celebration of orbit 2018.
- No lost anodes in more than 5 years.
- Gain calibration takes up most of the practical manpower. Calibration sources are almost gone. Every orbit must be calibrated using the fluorescence line, which is significant work. Reliable analysis depends on this calibration that is delivered to the ISDC.
- Improvements on the JEM-X software was released into OSA which includes very fine time resolution and automatic burst searching algorithm.
- Operations are smooth. External funding is tight, but internal DTU support is solid to 2022.

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

- Currently at highest of the background in the solar cycle: first reached in 2009 and now again.
- Summary of DPE crashes: memory locations were corrupted; problem has been solved by stopping to write there where were written veto events, and hence no impact on science data; DPE2 has been successfully started after 16 years of hibernation.
- ACS: each BGO block of the ACS should give more or less the same count rate. There is now a deviation between some of 10-20%. In-flight threshold of 75 keV comes from a computation based on the calibration on ground at 20C where the threshold was 100 keV estimated for the effects of keeping the BGO at 0C. (BGO stands for bismuth germanate: $Bi_4Ge_3O_{12}$.)
- Performance is very stable.
- There is a buildup of Co60 in the background emission from the conversion of Cu over time. This is the only background line that has a direct science impact.
- Have made progress on modelling in the ACS calibration.
- DLR support ended this year. New proposal is official approved.
- Group at MPE working on multi-instrument analysis software. Ongoing efforts to include SPI in that.
- RD is officially retiring in 3 months.

4.3 OMC — MMH (viewgraphs)

- No anomalies; seeing ageing effects; system in good health; now doing a new and improved flat field calibration.
- Procedure already in place to correct for temperature dependence.
- Lenses are darkening, but effect is negligible.
- Photometric calibration is stable.
- New strategies for identifying hot pixels; count up to about 4000, but that's 0.4% of total so small.
- Optics, CCD, and thermal control hardware performing excellently after 16 years of operation. No CCD columns lost, CCD temperature range within prediction.
- Plan to write a technical paper on CCD performance in space.
- Showed recently published, very detailed paper on V404 Cyg with OMC combined with JEM-X and ISGRI (available here).

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

- PU showed results from the work on the analysis of PICsIT. Of the 100 bursts detected by GBM, about 70% are seen by ACS and about 50% are seen by ACS and PICsIT.
- Request: change to 8 ms resolution for PICsIT. Could be accompanied with need for additional packets.
- Request: allocate 8 TM packets for PICsITduring slews.
- Showed several INTEGRAL related points from last IACHEC meeting. Important: analysis should be updated to OSA 11.
- Recommendation: Release PICsITtiming and IBIS Compton mode software into OSA. (Giovanni Larosa will submit the OCR.)
- PL gave the status report on IBIS/ISGRI
- Dead pixels are stable at 5%
- Anomaly with ISGRI a few weeks ago (scw 201500260010) related to very long waiting times between events (probably an SEU).
- OSA 11 with new energy reconstruction for ISGRI and new background maps. Tested and validated.
- Showed results of OSA 11 on Sco X-1.
- Multi-messenger team at CEA/APC has a couple of new members; team comprises PL, DG, Christian Gouiffes, and now Alexis Coleiro and Sarah Antier.
- Compton mode software for spectral-imaging analysis is ready to be released; polarization software will not be released for now.
- One PhD student (F. Cangemi) is working on Cyg X-1 polarization.
- New PhD student (G. Daniel) working on nuclear reactor safety, but will collaborate on INTEGRAL. Because he works on coded mask imaging and spectral analysis, it could be useful as alternative validation software.

Action 21–8 on GL **Due: Nov 2018 (Closed)**
Submit OCR to perform test on TM packets at 8 ms time resolution

Action 21–9 on RS **Due: Dec 2018 (Closed)**
Investigate what caused the anomaly at the start of scw 201500260010

Action 21–10 on PL **Due: Mar 2019**
Deliver Compton mode analysis software to ISDC. Some difficulties encountered with integration using OSA 11 libraries. (Extended from Jan to Mar.)

4.5 MOC — RS (viewgraphs)

- Most flight control team members are 50% INTEGRAL and 50% XMM-Newton.
- Simulator ported to linux.
- Kiruna availability, reliability and coverage are very good.
- Merger with Gaia was very smooth. Operator time spent is about 70% on XMM-Newton and 30% on INTEGRAL. Operations on INTEGRAL are highly automated, robust, well planned due to smooth and well coordinated activities between MOC and SOC.
- Minor anomalies are not reacted to during Gaia operations; they are turned off.
- Six months into merger; no significant problems noted.
- More serious degradation of the solar arrays is expected from now on (until 2028) because perigee is below 6000 km.

- Major efforts towards fuel saving measures now ensure fuel for operations until 2029; currently using 6g/d compared to 20 g/d initially.
- Could even have enough fuel to have a controlled re-entry.
- The TN about solar array degradation will be updated.
- Batteries are healthy. Can be recharged at half the current rate, to help accommodate peak power demands. No power constraints until end 2022, 2024 before strong constraints. Study with solar array experts was kicked off to investigate details.
- Slide 11: note that this is not a power budget issue, but rather power management.
- In case this signal is disabled an On board monitoring entry will be loaded to monitor panels 2 and 4 output currents and rep-enable the ECL(s/e) in case they ae critically low, this will ensure satellite safety. As the power budget degrades it will be come necessary to limit the pitch angle progressively, first to 35, then to 30 deg, etc.
- Reported on SPI DPE crash. Conclusion is disabling the veto spectra acquisition solved the problem, and things can just run as they are now. However. some investigation with DPE2 could be carried out if need be.
- PU thanked RS for the MOC's great work with the SPI recovery and continued smooth operations.

Action 21–11 on RS	**Due: IUG 23**
Report on result of study by solar array expert team.	

4.6 NASA GSFC — BC (viewgraphs)

- INTEGRAL is the third largest mission that HEASARC manages.
- Downloads are mostly from US scientists.
- Preparation for 2019 NASA Senior Review: all high energy missions are going to be reviewed. The metric is science output per dollar.
- Will focus on multi-messenger, time-domain, TOO automation, nearby galaxy survey, fast blue optical transients, X-ray binaries.
- PU commented that they could mention during the review about the fact that PICsIT-time analysis software will be released very soon.
- PL asked if they have a programme to observe FRBs with other observatories: Will be done with Swift; nothing seen so far. Deep limits from Chandra from repeating FRB but only upper limits. As a consequence, it's not going to be high priority science for US high energy missions.

4.7 IACHEC — EJ (viewgraphs)

- Summary of INTEGRAL related results from the last IACHEC meeting.
- Of note: discrepancy of 12% in flux between the two configurations of NuSTAR.
- WG on Heritage (M. Guainazzi) and concordance project (H. Marshall) to combine several instruments with various weighting factors in order to derive combined result and help define correction factors for each instrument.
- IACHEC DB (J. Rodi) to gather all published spectra of cross-calibration analysis to be available to all.
- Cross-calibration (J. Nevalainen) progress is ongoing.
- AM: What reference can be used to cite when stating a cross-calibration factor between instruments?
- EJ: There isn't one yet. In the last meeting, there were no presentation of INTEGRAL with another instrument.

- PU: Maybe the IACHEC could have a section on the website where results of cross-calibration are given.
- JPR: There is a fundamental problem in having free exchange of data.
- EJ: A major difficulty is that the cross-calibration constants between instruments varies in time.

Action 21–12 on IUG	**Due: Dec 2018**
To draft a request to Lorenzo Natalucci to finish the cross-calibration paper on the Crab.	

4.8 ISOC — GB (viewgraphs)

- GB is now 20% Science Operations Study Lead for the M5 candidate Theseus. Hence, 80% as INTEGRAL Science Operations Center Coordinator.
- Jan-Uwe Ness (JUN) is now 50% INTEGRAL Operation Scientist, remaining 50% on XMM-Newton.
- Celia Sanchez is now the lead ISOC mission planner: she coordinates and shares the scheduling with JUN.
- Monica Fernandez will join the team as the person who will provide 0.5 FTE from the archives team at ESAC at the start of 2019.
- The Target Visibility Predictor has been upgraded to provide full sky visibility per revolution or group of revolutions in order to simplify the ability to evaluate follow-up opportunities for high energy transients.
- Have started work on setting up an automatic processing of transient alerts of relevance to INTEGRAL.
- Currently migrating ISOC procedures documentation, software change request (SCR), and operational change request (OCR) systems into the integrated platform SOCCI with Jira for SCRs and OCRs, and Confluence for documentation.
- Gearing up for the AO-17 call for proposals and subsequent TAC meeting with plans for plans for extended integration between the TAC web-based software and database with the operational proposals database.

4.9 ISDC — CF (viewgraphs)

- Ran demonstration of online CDCI analysis of INTEGRAL data on 4U1700: analysis failed with connection to data server error message.
- Funding for 2018 was 1 FTE shared between 2 people; Funding for 2019 requested; hope to get 1 FTE. The FTE is shared as 50% to operator and 50% for Volodymyr Savchenko. Operator is retiring in May. ESA contributes 3 half FTEs.
- 4 GRBs in IBIS FOV in 2018; 200 GRBs in SPI-ACS; IBAS energy calibration not yet updated (ongoing).
- NRT is available usually within 3 hours.
- SPI gain coefficients monitored by Lorenzo Ducci; some automatic checks implemented.
- CONS data is currently delivered with old calibration; there is no manpower to do a revision 4 (reprocessing of level 1 data), but if analysis is started at COR level (as users usually do), the correct calibration calculation is applied.
- Online SPI-ACS public web data access is maintained.
- MoU with Antares; MoU with IceCube for non-public alerts; LIGO-VIRGO will issue public notices; ISDC is developing an API to offer real-time services via notebooks.
- PL: expressed dissatisfaction about the lack of clear communications between ISDC and Saclay about collaborating on activities.

- Discussion about activities surrounding MoUs.

Action 21–13 on LH	**Due: IUG 22**
To clarify issues with MoUs/LoI, and consider inclusion of wider INTEGRAL community.	

4.10 RSDC — SG (viewgraphs)

- RSCD supports archive of all public and Russian data; OSA11 installed; used by scientists from several institutes. Now using the Spectrum-Roentgen-Gamma (SRG) Data Center (10 machines; 200 TB); may disappear after launch in April 2019.
- Performed some testing of OSA11.
- 12 PhD theses based on INTEGRAL; Current PhD expected to defend in 2018 December.
- Several awards were give to Russian scientists based on INTEGRAL (see slides).
- PU: What impact will the launch of SRG have on INTEGRAL? SG: The same people are working on both missions, and will continue working on INTEGRAL.

5 Discussion Items

5.1 OSA 11

OSA 11 Release — CF (viewgraphs)

- Released on 19 Oct 2018; Catalog v41 released June 2018
- ISGRI calibration is major improvement; includes important JEM-X and SPI updates.
- LUT2 now time-dependent; RMF and ARF (combined) in 256 channels; automatic log rebinning of response files with parameters in analysis command;
- No signal below 25 keV in latter part of the mission; the threshold evolves over the mission lifetime; discontinuity where the calibration changes (currently rev 1626).
- User manuals for IBIS, SPI, and JEM-X were updated; ISDC will not update inter-calibration documents.
- OSA downloads: 20 binary; 9 source; 18 test data; 10 catalog bundle; 326 pulls of docker image, but probably around 100 people pulled this.
- Calibration files: 200 more revs by January 2019; plant 100 per month; possibly all completed within 2019; done by Volodymyr Savchenko only, and funding is not secured; no manpower to prepare ISGRI calibration document; catalog v42 planned for March 2019 (released on 2018 Dec 19).
- ISDC to CDCI and OSA to ODA: presentation of online data analysis (details in slides).
- Processing lineage for every data element is traced and stored in a non-sequential DB.
- For a legacy archive sequential and non-sequential DB should be combined, but it isn't clear what can or cannot be achieved.
- Help to incorporate JEM-X and SPI analysis is very welcome.
- PU: Great tool, probably will become the main way to analysis INTEGRAL data. Good for common users, not for detailed analysis; it is easy to find 511 keV line if not careful. EK: Warnings about usage that can be made in documentation.
- Some discussion about visibility within CDCI system followed.
- JPR: This is based on complex technologies; what about maintenance and support? CF: Swiss support cannot be guaranteed; ESA support could guarantee the long-term preservation of the system.

- AM: the limit of 50 scw makes the system useless for any study that requires more time like extragalactic studies. CF: it is possible to process several chunks of 50 scws and then combine them. JPR: we have a system in Toulouse to analyse data online, but it is a lot less complex than the system you have implemented, but we can work/think about incorporating SPI analysis within CDCI. What could be done is to use the ISGRI map as initial input for the SPI analysis. ME: we need to see how we can combine these efforts with ESA's plans to work on the legacy archive. PU: we could decide together to devote some resources to make more progress on this.

Action 21–14 on PL	**Due: TBD**
Paris will lead the writing of an ISGRI calibration report.	

OSA 11 testing — AL (viewgraphs)

- Position of W line at 59.4 keV calibration line: several tracks show an evolution of line energy during one revolution.
- CF: line energy often changes in ways that are unpredictable; using it for a correction can lead to incorrect results.
- AL: we used to use the 60 keV line for calibration; now we'll use the 511 keV.
- Some events in OSA11 have been found with NULL energy; this was never seen in 10.2.
- Results on BH MAXI J1820+070 show good agreement between ISGRI and SPI
- Cyclotron absorption line in Her X-1: ISGRI is good; JEM-X is not, which raises an issue with spectral analysis.
- Possible to get PIF for JEM-X? SB: it is possible; NL has been working on it.
- ISDC cannot do extensive tests of JEM-X because of lack to manpower.

5.2 Cross-mission Calibration — JPR (viewgraphs)

- Used Band model on the Crab: Fit is much better, and systematics down to 0.5%.
- SPI/Toulouse team recommends to use this model from now on for cross-calibration work.
- SPI/NuSTAR: shape is very similar; difference in normalisation is 12-16% on Cyg X-1, but 20% on MAXI J1820+070 (source during the simultaneous observations is very stable).
- JPR and EJ available to help with cross-calibration efforts.
- Discussion about the use of the Band model in replacement of the broken power-law.
- DT: Wouldn't it be a good idea to use the pulsed and non-pulsed emission separately? If you put all the information we now have on the pulse fo the Crab, the differences between instruments is much larger than 10%. JPR: using the pulsar is good in theory, but in practice there are few counts.

Action 21–15 on EK	**Due: Jan 2018**
Discuss with CF how to present the cross-calibration results and OSA11 results on the web.	

5.3 Allocating Observing Time — GB (viewgraphs)

- GB presented the model of objective allocation of observing time.
- EK posed the question of merging panels 2 and 3.

$$T^i_{\rm alloc} = \sum_k \left[w_{\rm req} t^i_{\rm req}(k) + w_N n_i(k) \right] f_k T_{\rm avail} \qquad (4)$$

For example, if we had the above three categories of Normal, TOO and DDT, reserved 20% of the overall budget as DDT, and split the rest into 50% for normal and 30% for TOO proposals, this would give allocating fractions of $f_{\rm norm} = 0.5$, $f_{\rm too} = 0.3$ such that

$$\begin{aligned} T^i_{\rm alloc} \quad = \quad & 0.5\, T_{\rm avail} \left[w_{\rm req} t^i_{\rm req}({\rm norm}) + w_N n_i({\rm norm}) \right] + \\ & 0.3\, T_{\rm avail} \left[w_{\rm req} t^i_{\rm req}({\rm too}) + w_N n_i({\rm too}) \right] \end{aligned} \qquad (5)$$

Figure 1: Illustration of the application of Eq. (4) for computing allocation per panel.

- WH emphasised that it is very important to look at the science return, times have changed and it is more and more difficult to keep support for the mission, nucleosynthesis is incremental science and at this stage is not so important. An approach based on taking into account the scientific output in terms of the allocated time should be considered further.
- After discussion about how to allocate time, the consensus was that Eqs (4)/(5) is the best option (Eq (5) is an application of Eq (4). See fig. 1).
- Conclusion: keep 3 separate panels and apply Eq (4) to define time allocation.
- WH and EvdH thanked GB explicitly for this initiative.

Action 21–16 on GB	**Due: May 2019**
Oversee implementation of computation of time allocation per panel in TAC software.	

5.4 Interfacing with the community, and 2019 INTEGRAL conference

Idea to have a session at the INTEGRAL conference to work on interfacing with the community was proposed by GB/EK and discussed. It was agreed that this would be good.

Action 21–17 on CF/EK	**Due: Dec 2018 (Closed)**
Propose a solution to include discussion session at 2019 INTEGRAL conference.	

5.5 Archive

- As mentioned by ME, work on Legacy archive will begin at ESAC in January 2019.
- PU: two approaches: online real time analysis, and images, light curves, and spectra already made. I would vote for the live archive, but it requires a lot of support.
- CF: explains the concept of lineage with an example of a google search for INTEGRAL light curve that would bring the user to the place where you can either find the light curve, or compute it.
- RD: with time interests change, but the need to reanalyse the data from a legacy mission is important.
- PU: results have to be considered per instrument because they are quite different; also there are 15 years of data for some sources.
- CDCI cannot cope with the spectrometer data. The OMC already has a very good archive and web page linked from the CDCI page.

5.6 Catalogue

- PU: there will be a meeting about the catalogue in the next weeks.
- There is discussing of using machine learning to extract new sources because we expect about 5000 excesses (compared to 1000 the last time this was done).
- Some testing has been done and results are promising. Machine learning is very good and requires little human time.
- AL: The number of new sources is decreasing. Let's discuss this in Geneva.

6 AOB

- PU/AL propose to give out the Revnivstev prize at the Geneva conference. Candidates should be proposed for early career scientists for the prize.
- LH: MoUs and LoIs with LIGO and VIRGO for coming observations seasons. PU: have engaged interaction with the VIRGO team who plan to have much more sensitive detection abilities based on software improvements. If only 2/3 detectors see a signal these will not be released publicly.
- PU: Suggestion to have a 2020 workshop in Chia Laguna. CF: we should work together in organising conferences. ME: good if community organises conferences, and thus good to keep both the ESA-sponsored and community-organised conferences.

Action 21–18 on IUG members	**Due: Jan 2019**
Propose early career scientist candidates to PU for Revnivstev prize.	

Action 21–19 on PU	**Due: Jan 2019**
Send email to begin discussion towards a MoU with LIGO/VIRGO.	

Action 21–20 on PL	**Due: Jan 2019**
Contact EGO direction on behalf of the IUG to ask about MoU.	

7 Next Meeting

Next meeting will be in June 2019. It could be at ESTEC or ESOC. EK will send a doodle to fix the date and place.