INTEGRAL User Group Meeting 20

ESTEC, 21-22 February 2018 **Minutes from May 7, 2018**

Attendants

Sören Brandt	DTU Space	SB
Volker Beckmann	CNRS / IN2P3	VB (from 11:30 Feb 21)
Guillaume Bélanger	ESA, ESAC	GB
Brad Cenko (remotely)	NASA	BC (Feb 21)
Luigi Colangeli	ESA, ESTEC	LC (Feb 22 AM)
Roland Diehl	MPE Garching	RD
Albert Domingo	INTA Madrid	AD
Matthias Ehle	ESA, ESAC	ME
Carlo Ferrigno	ISDC	CF
Diego Götz	CEA	DG
Sergei Grebenev	IKI Moscow	SG
Lorrain Hanlon	UCD	LH
Erik Kuulkers	ESA, ESTEC	EK
Philippe Laurent	CEA/APC	PL
Alexander Lutovinov	IKI Moscow	AL
Angela Malizia	INAF Bologna	AM
Jean-Pierre Roques	IRAP Toulouse	JPR
Norbert Schartel	ESA, ESAC	NS (Feb 21)
Diego Torres	ICE, CSIC	DT
Pietro Ubertini	INAF Roma	PU
Ed van den Heuvel	Univ. Amsterdam	EvdH
Peter von Ballmoos	IRAP Toulouse	PvB

1 Welcome, Agenda, Actions, Recommendations

1.1 Welcome and Agenda

PvB and EK welcomed the attendants and introduced the agenda. RD requested a 15-minute presentation on SPI activities at MPE.

EK introduced new members for US replacements of Niels Gehrels. LH will be taking over from PvB as the new IUG chair from July 2018. On behalf of the IUG, PU and EK thanked PvB for all his excellent work done as chairperson.

1.2 Actions

Action 19–1 on PU: Verify if IBIS reaction to IREM can be disabled (due 1 April 2017).

PU reported the following:

1. The IREM automatism can be disabled.
2. The TC to disable is G823 by setting the parameter G8800=0.
3. The state of IREM automatism can be verified through the HK1 parameter G8040.
4. Automatism is enabled by IASW activation flight control procedure (FCP) FCP_IBIS1/2_0073 [step 7].

Therefore, if the plan is to have IREM always disabled, it is necessary to disable the automatism after reactivation of the IASW, or to modify step 7 of the FCP. Any such change should go through usual channel of OCR change request submission, and the IBIS Operation Manager, Giovanni La Rosa, should be contacted before proceeding with implementation.

SB stated that JEM-X turned off the IREM protection because the JEM-X is a much better monitor than IREM, and therefore has been using its own internal measurements for radiation monitoring.

PK (by email): *The question at the last IUG Meeting was not how to disable IREM but to disable the IBIS reaction to IREM. IREM crashes are the main recurring anomaly affecting IBIS and OMC. This reaction to IREM has been disabled for SPI and JEM-X. It was discussed if IBIS and OMC could also disable their reaction to IREM without undue risk.*

Action 19–2 on MM: Verify if OMC reaction to IREM can be disabled (due 1 April 2017).

AD explained that IREM warnings are critical for the safety of OMC because there isn't another protection mechanism (confirmed by email by Miguel Mas Hesse in the afternoon).

Action 19–3 on RS: Prepare Technical Note on options for Eclipse Entry handling when array currents approach critical threshold (due end 2017).

On-going. Updated info will be supplied in advance of the MEOR.

All action items from previous IUG meeting are hereby closed.

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.

A report should be written by the instrument teams in collaboration with the ISDC.

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

2 Mission Status Report (viewgraphs)

ME introduced himself as new Mission Manager, with a few slides about his professional background, and then reported on status of mission and changes at ISOC. He also reported on a few slides from MOC provided by Richard Southworth.

2.1 Operations

- The SPACON merger between XMM, INTEGRAL, and Gaia—which will give priority to Gaia operations—is almost complete.
- Every day there will be 2 hours that are dedicate to Gaia. During this time, only urgent matters from the other missions will be addressed.
- No impact on TOO reaction is expected. PL requested a report on the impact on instrument operations.

- The Integral ToO procedure at MOC is effectively independent of SPACON presence, just 2 changes to note since the merger of the SPACON team with Gaia: 1) In case of RPOS (re-plan of currently executing revolution) a super alarm will be raised, alerting the SPACON even if they are working on Gaia; and 2) in case the SPACON is not available to load and start the new TL the Ops Analyst can and will do this. ToO capability will be maintained unchanged at MOC.
- At the time of last update of these minutes, MOC has planned around 10 revolutions with ToO activities, including 1 RPOS, without any problems or issues related to the merger. I am not aware of any issues in doing this.
- There is an approximate 15% reduction in propellant usage thanks to new reaction wheel biasing technique. The fuel consumption for the disposal manoeuvre and the resulting earlier predicted end of propellant has been fully mitigated by the new fuel saving mechanism.
- Power budget looks good until well after 2020.
- ISOC is currently putting in place a Helpdesk user feedback page/mechanism.

Action 20–2 on Richard Southworth **Due: Next IUG**
Report about impact on ToOs of SPACON merger.

2.2 Legacy Archive

- EXPRO contract has been setup with ISDC for performing a study on the final legacy archive at ESAC.
- PU commented that the definition of the products maybe not be so simple.
- CF commented that it is very important to maintain operability of the software, not necessarily in the same format as it exists today, in order for the user to be able to answer questions they may have in the future which cannot be foreseen at this stage.
- JPR emphasised that, as CF mentioned, while it is true for IBIS, it is even more important for SPI. Looking at a new source, for example, if there is something in the data.
- RD specified that we need both the products of what was done before, as well as the ability to do new analyses.

2.3 Catalogue

- PL said that financial support is needed for this effort.
- PU said that it is a very large effort to produce a catalogue that needs many teams collaborating together.

2.4 OSA 11

- Proposal on the table for expanding testing with more people.
- JPR, CF, PL all agree that if increasing the boards, controls, and testers is useless because the number of people doing the work is not enough.
- EK: Offers to help instrument teams are typically met with a request for funding.
- PU: We need to deliver OSA 11. The difficulty is not money; it's a political issue. We knew INTEGRAL could not survive on legacy science, and we have reinvented the mission as an important player in the new science of Gravitational Waves (GW) follow-ups. Why are we late with OSA 11; that's because we are struggling with all the work related to GW events, and the papers, and the press releases, etc, like everyone else. When the beta version is working, then we can distribute to more testers.

- PL agreed: Let's run all basic testing, and then release to additional testers.

2.5 Extension

- SPC in March seeking indicative approval of operations until end 2020.
- MEOR in June and then SPC again in November to seek confirmation of 2019/2020 and indicative approval of operations for 2021/2022.
- All to support EK for building best possible extension case addressing future science with INTEGRAL.
- We are not looking at cost savings: we are at the limit for providing TOO support and services associated with an observatory-type mission that INTEGRAL is.
- Suggestion for thinking about this: what does the community lose if INTEGRAL is turned off.
- It's the community that must be doing the lobbying; not ESA.
- ME thanked everyone for the wonderful work on GW event, which the ESA Director General mentioned as the science highlight of 2017.
- PvB mentioned that INTEGRAL had sky coverage on GW triggers 6 out of 7 times, which is a very important point to make for extension case.

3 Project Scientist Status Report (viewgraphs)

3.1 AO-15 and AO-16

- EK reviewed the results of the AO-15 call for proposals and TAC meeting.
- AO-16 opens on Monday March 5 and closes on Friday April 13.
- As last year we have 300 ksec of XMM time, 150 ksec of Swift time, and 100 ks of NuSTAR time to be granted by the INTEGRAL TAC.

3.2 Funding and Extension Case

- Funded until the end of 2018; seeking confirmation for funding until the end of 2019 and 2020; asking for 2021 and 2022; re-entry in 2029.
- LIGO is out during 2018, operational in 2019, and likely offline in 2020 again.
- Strong GW events will be made public; details will be discussed with in April.
- ISOC/ISDC is developing automated online mechanisms for checking visibilities and fast follow-up of GW and High Energy Neutrino (HEN) events.
- In AO-14 there were 3 TOOs on GW and 2 TOOs on HEN events.
- DG and SB wondered if there are defined restrictions for PIs in applying for INTEGRAL time related to follow-ups of such events. EK to clarify in AO-16 Overview Document.
- Everyone to send to EK new INTEGRAL-related PhD theses: important for extension case.

3.3 Cross-calibration Efforts

- Results from combined calibration activities are generally not available. This needs to be followed up by various members of these cross-calibration activities.
- NICER and HXMT were launched in June 2017.
- DG said IBAS software is being updated based on OSA 11.
- Crab monitoring programme will be made into an ongoing calibration programme for AO-16 and beyond. CF emphasized this as an important effort.

- PU: inter-calibration should be done after release of OSA 11; observations of V404 Cyg allowed calibration between ISGRI and SPI up to 650 keV.
- AM: cross-calibration between XMM, NuSTAR and INTEGRAL showed good results.

3.4 Science Highlights

- Most important was GW170817 / GRB170817A (Savchenko et al. 2017, ApJ...848L..15S). (See viewgraphs for list of publications and GCNs based on GW and HEN events.)
- In 2015, 40 ATels; 11 on V404 Cyg. In general 2.5 ATels/month.
- Total of refereed papers published is now over 1110.
- Five PR stories over the last year: 3 on the GW; one on impact of solar flares; one about the 15 years of INTEGRAL. *IUG members are encouraged to send inputs for stories.*
- Infographic (high resolution poster) for the 15 years of the mission was produced.
- Movie of INTEGRAL orbital evolution from 2002 and 2017.
- DT asked what is meant by *community*. RD replied that counting the number of citations on INTEGRAL related papers gives a good measure of the size of the whole community.
- The new annual *Mikhail Revnivtsev Prize* for outstanding young scientists under 35 years of age was created. The first was awarded to Volodymyr Savchenko. *IUG members are encouraged to send inputs for candidates.*

4 Instruments and Ground Segment

4.1 JEM-X — SB (viewgraphs)

No additional losses of anodes. Some gain evolution; mostly in relation to temperature, which has increased by 1% to about 5% per degree. Calibration sources are too weak, and gain calibration is now done by hand. Improved light curve extraction software for OSA 11 release. Everything is running well. Only minor hiccup: funding requested wasn't awarded. Upside is that most people working on JEM-X are retired and work for free! Hence internal funding can cope with this. CF mentioned that software update has already been implemented into OSA 11 and works well. A test plan and additional testing would be appreciated.

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

JPR reported that the last annealing, which started on Jan 26, and is now complete. Something a little unusual happened with detector 12, and although it is nothing to worry about, a short anomaly report was produced. No anomalies for DFEE, PSD, DPE. Anti-Coincidence Shield (ACS) calibration not done since start of mission in Jan 2003. Concern that SPACONs are under pressure and that instrument knowledge is diffusing away with time. SPI has been put into safe mode up to 4 times per revolution: this needs to be addressed. Annealing ended recently; update on energy resolution will come when data are available.

RD reported on MPE's work on SPI support. Presented work on tracking resolution: paper has been published, and results are available online. This monitoring can be done in near-real time for each of the 19 detectors. Demonstrated the ability of group to monitor and support annealings and SPI operations and performance in general. Showed how data from past annealing and performance recovery can be used to formulate a maximum likelihood fit to make reliable predictions for when the next annealing should be done. Numbers from latest annealing give us confidence that instrument is working well.

ACS hardware provided by MPE. Calibration is ongoing. Andrea von Kienlin (AvK) was moved to Athena last year. There are 91 BGO blocks, and hence 91 front end electronics. MPE has monitored this system since launch. Different goals due to GW science: not just rejection but also as gamma-ray detector. AvK has a little bit of time to help with these efforts of ACS calibration. Evaluation of in-flight thresholds to determine energy response are ongoing. This effort of calibrating the energy response turned out to be a lot more work than first expected, but very good progress has been made, and will lead to a publication.

4.3 Ideas from Lunchtime Discussions — PvB

PvB introduced the idea of lunch time discussion about how to improve chances for extending INTEGRAL. What can we do to improve the visibility of the INTEGRAL mission, most importantly through mutli-messenger collaborations?

- PvB: Maybe the old approach of making ourselves smaller and trying to cut funds should be changed to a more ambitious programme of saying we are important and needed in the multi-messenger astronomy community, and therefore we should ramp up the budget instead of trying to cut funds.
- VB: Increase efforts to go to meetings, but instead of relying on individuals to represent only themselves and their work with INTEGRAL, make it systematic and more official in terms per representation.
- DT: Some of these meeting are closed and one needs invitation.
- PvB: It's easy to find ways to get invited; we need to organise our efforts to set up lists, keep track of meetings, and decide who's going to go there to represent INTEGRAL there.
- PL: Will make a presentation at the next KM3 meeting.
- DG: Received announcement for the GEMA meeting in Italy; could organise representation.
- AL: Will attempt to create an official link between INTEGRAL and Baikal project.
- PvB: Do more with Ligo and Virgo communities by going to their meetings. Upcoming face-to-face meeting between participants of electromagnetic counterparts and GW community should be attended to show interest and importance of role to be played by INTEGRAL.

Action 20–3 on AL **Due: End April**
To explore and report back on the possibility of connecting INTEGRAL to Baikal Project.

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

Action 20–5 on DG/PU **Due: End April**
To prepare INTEGRAL representation at GEMA meeting in Italy. Two oral papers will be presented at the Gemma meeting in Italy: 1) James Rodi, about PICSiT SGRB seen in coincidence with ACS, VETO and FERMI/GBM and 2) P. Ubertini about the INTEGRAL observation of GW counterpart and future perspectives.

4.4 IBIS — PU & PL (viewgraphs)

PU gave a short report on the status of IBIS. The cleanroom with several million euros of hardware is ready to be used with test flight model for testing and mass model calibration. Other missions/groups are using the facilities already. PL continued.

New PhD student in Saclay will work on Cygnus X-1; very useful for testing OSA 11 that will be *the last major calibration update* for ISGRI with new energy correction, response and background. ISGRI retains 95% good pixels, and background is exactly the same as that measured by the VETO. Alpha release has been in testing for a ∼month. Main changes are in ibis_igr_energy (disable drift correction; see slide 7 for details).

Spectrum of Crab is nice, but there are large variations in the response below 20 keV which are not understood. Spectrum of Cygnus X-1 is very nice. In general OSA 11 works very well, defects seen above 35 keV are not seen anymore. Plan to (one day) deliver Compton software for imaging and spectral analysis; works for very bright sources like the Crab, Cygnus X-1, and V404 Cyg.

Since launch, 5 or 6 postdocs from CNES have worked on the problem of ISGRI energy reconstruction. VS was the last one, and CNES stopped funding. Therefore, there will be no more work on this in Paris. PU offered a 3-year postdoc to VS in Rome, but chose the ISDC.

FRB 121102: there was a large multi-wavelength campaign with two full revolution of INTEGRAL data in Sept 2017. No detection at source which is located 8 degrees from the Crab. Also, no bright radio bursts were detected during the observations.

Collaborations: Virgo—starting a multi-messenger programme in France; Antares—neutrino telescope ed to the future KM3NET; HXMT—scientific agreement under discussion for the joint studies of Cyg X-1 and GRS 1915+105; Astrosat—joint polarimetric observations.

PU: When Volodymyr Savchenko (VS) took over the energy calibration of ISGRI, Rome started to work on other things, in particular on the analysis of PICsIT data, and plan to deliver working software for doing this kind of analysis.

4.5 ISDC — CF

4.5.1 OSA 11 (viewgraphs)

- Main changes are related to IBIS/ISGRI:
  - Energy reconstruction is completely revised.
  - Calibration files will be introduced as soon as they are ready; no need to update the software.
  - Preliminary results on tests are consistent and look good.
  - For spectra different from that of the Crab, fudging the ARF/RMF does not work (showed case of MAXI ... in revolution 1860).
  - VS will use the upcoming Crab calibration in 1927 and 1928 to have a longer baseline for the calibration of the last two years.
- Changes also for SPI and JEM-X:
  - SPI—Lorenzo Ducci introduced the PSD event selection in the 400-2200 keV range (650–2200 keV before May 2012);
  - JEM-X—New version of j_ima_iros used for images, light curves, and spectra.

4.5.2 ISDC (viewgraphs)

- Funding for 2018 is 1 FTE. Funding for 2019 TBD. In addition to CF and EB, manpower 1/2 operator, 1/2 VS. ESA EXPRO contract under which ESA pays for a service (not staff) 1/2 VS.
- Signed MoUs with Antares and IceCube.
- 200 GRBs detected in ACS. Total of 41 ATels last year. NRT data are available within 3 hours. Public web-based ACS data service developed by VS is available.
- Revision 4 is planned following OSA 11 release (with all calibration maps for the entire mission). Very few TM gaps (less than 1%). Delay of ∼30 days for CONS data. IC files for JEM-X and OMC are regularly updated.
- Long term preservation of raw data is trivial: there are copies of all the data in many places around the world already. There is a pilot project towards an interface for online analysis, and preservation of the analysis scripts and results. Difference with HEAVENS is that this one is running OSA in the background with a backend that is independent of the frontend, and can be deployed anywhere else using dockers. The results are cached and over time, popular analyses/data become immediately available.
- VB raised concern about the resources needed to provide this service.
- AM mentioned the current general catalog is missing many INTEGRAL-detected sources.

Action 20–6 on CF	**Due: OSA11 Release**
Update general catalog to include missing newly detected sources.	

4.6 NASA GSFC — BC (viewgraphs)

Brad Cenko (with help from Julie McEnery and Steve Sturner) reported on downloads of INTEGRAL data from HEASARC, and publications (40% with US-based scientists), mostly through joint programmes with Fermi, Swift, and NuSTAR. GW event with INTEGRAL coverage has generated a tremendous amount of press. Also, multiwavelength observations of V404 Cyg led by INTEGRAL were extremely successful across the entire EM spectrum. Public release of data has had a very high impact: very good model for high impact sources that attract interest from outside of the high energy sub-community. Concluded by showing the cyclotron line energy in Her X-1 (Staubert et al. 2016) with all the HE missions.

4.7 OMC — AD (viewgraphs)

Hot pixels are below 0.1% of the detector; that's very low. New strategy for periodic calibration began in 2017 consisting of a narrow 3x3 dither in steps in 2 arcminutes. Up to now 8 such new calibrations have been analysed, and shows that we can get a flat-field accuracy better than 1% (based on 4 observations). Also allows better analysis to study the evolution. In 2018, flat-field matrices will be created, and ideally be able to work towards backward-calibration of past data.

4.8 RSDC — SG (viewgraphs)

Supports the archive of all public and Russian PI data, and has current OSA in addition to Russian software installed. Used by several Russian institutes and their scientists. Has 10 servers, 200 TB, and about 10 scientists with some shared responsibilities on SGR (Spectrum-Roentgen-Gamma). Produced 11 PhDs, 2 expected PhDs, and 5 DSc, with 320 INTEGRAL-related papers. (Note: Ilya Mereminskiy (one of the two expected) has successfully defended

his PhD theses on March 27, 2018.). Presentation of recent results, primarily on X-ray and X-ray novae with focus on JEM-X and IBIS/ISGRI data. ISGRI spectra cannot be produced with the current OSA because they contain very strange features. No data from the last two years can be analysed with current software. Director of Space Research Institute wrote to ESA Director of Science to express the importance of continuing support for the INTEGRAL mission.

5 Discussion Items

5.1 PI Funding and Support

- SPI is considered like an opportunity mission (JPR) by CNES and so is ISGRI (PL).
- JEM-X has only internal support mostly from retired staff and a few permanent staff.
- PU showed the group of staff and two new post-docs in Rome; these fellowships from ASI are mostly for follow-up activity related to GW. Angela Bazzano is now responsible for the ASI contract/budget (PU officially retired, maintaining the formal PI position).
- A grouped request for funds from ASI was made but turned down.
- Funding status should be summarised by each IUG member and sent to ME in time for the MEOR.

Action 20–7 on ME	**Due: End April**
Send request for letters summarising funding situation from each PI/institute	

5.2 OSA 11

- CF: As soon as tests are found to be satisfactory, OSA 11 can be released.
- PL: Mid-March finished testing in Paris.
- CF: Need several weeks from the end of testing for the release.

5.3 Cross-mission, Calibration, Multi-messenger

- AM: Project between Rome and Bologna has started with Lorenzo Natalucci to combine and compare INTEGRAL, XMM and NuSTAR data with the aim of cross-calibrating. This work is also done on 3C 273. In addition, continued work on unidentified sources is ongoing, with additional funding request. Very important for the quality of the catalog. New project started last year with colleagues from Observatory in Rome and Trieste on IRAM follow-ups of IBIS-selected AGN for a larger project on studying feedback called IBISCO (IBIS and CO). All 30 sources were observed at IRAM with a very good rate of detection. Proposal to map the gas in these galaxies has been approved: This bring INTEGRAL into a community where hard X-ray selected AGN are usually those selected by BAT instead of those selected by IBIS. Results will be presented at a dedicated workshop in Padova. Continuing work with Tony Bird to compile spectra for the collection of IBIS-detected AGN.
- DT asked how are defined unidentified INTEGRAL sources, which led to a short discussion with PU and AM. DT asked about running a blind search for pulsations on these sources, to which CF replied that it is not possible because these are very weak sources, i.e., 5 sigma in 10 Ms, and led to longish discussion about difficulty in detecting pulsations even in relatively bright sources, to which both PU and AM contributed.

- JPR expressed concern about the fact that many cross-calibrations efforts have been organised but nothing has come of it. We are always ready, but would be nice to see results. EK who has organised these cross-calibrations should gather the results.
- PL showed spectra from HXMT for Her X-1 and Cyg X-3.

Action 20–8 on EK	**Due: End June**
Contact to gather results of the multiple cross-calibration efforts from teams involved.	

5.4 Preparing the Extension Case — LC (viewgraphs)

Luigi Colangeli is from the ESA Science Coordination Office.

Because of strain on the overall budget, in Nov 2017, unlike previous times, the extension of INTEGRAL operations was requested only for 2019. The reason is that the advisory structure recommends the missions in priority order of those that should be extended; Cluster and INTEGRAL were ranked last in 2016. We are preparing the next SPC to ask for confirmation and then further extension (see chart in slides that summarises the process). MEORs in early June 2018, proposals available to the WG in early Sept 2018. SPC will be in October; it's not mandatory for Project Scientist to present the case. Key question: what is the added science value derived from the extension?

RD—What about national funding status? The willingness of key institutions in member states to support the mission is critical. For additional science return, is unique energy range enough?

LC—Are we able to convince the people on the committee, *who are not experts*, of the science value of keeping the mission in orbit?

PU—We've presented extension cases many times. Major change due to role in GW follow-ups. Much stronger support than a few years ago. Should focus on this new science in case. LC—Yes, the role of the mission in GW and HEN event follow-ups is new and very positive. Reduction operational costs will lead to drop in scientific performance and negative impact as well as feedback from community.

A detailed discussion following LC's presentation. The following actions were defined:

Action 20–9 on EK	**Due: Before TAC Meeting**
Formulate statement in announcement for increased time for TOOs.	

Action 20–10 on EK	**Due: Before Extension**
Incorporate comments from discussion into reworked extension case.	

Action 20–11 on All IUG Members	**Due: Before Extension**
Transmit to each national delegates the conclusions from IUG discussions.	

Action 20–12 on EK	**Due: End March**
Send link to IUG members for feedback.	

6 INTEGRAL Conference

6.1 Switzerland in 2018 — CF & PvB (viewgraphs)

The last meeting of the AHEAD WP9 Assessment of gamma-ray experiment will be combined with the INTEGRAL conference. Suggested title for 12th conference: INTEGRAL looks AHEAD to Multi-Messenger Astrophysics. VB: If we want to have as many people as possible, it should be in Geneva. CF: HEAD money for WP9 meeting needs to be spent before the end of Feb, hence January. If the conference is organised before the semester, we can get a free room at the university. During the car show everything in Geneva is booked.

PvB explained that he organised a very successful conference on positron physics in Murren in the high mountains, and most people came probably *because* it was hard to get to in a beautiful place. CF: basically there are 3 options: Geneva, low mountains, high mountains. RD: the location defines the flavour of the conference.

Action 20–13 on EK	**Due: End April**
Decide on location for next conference.	

After considering various options, the decision was made to hold the INTEGRAL conference 2019 in Geneva at the *Campus Biotech* from 11 to 14 February 2019. This has not yet been announced.

6.2 Venice in 2017 — PU (viewgraphs)

Participants 450/500; student 200/250 (early/late); accompanying 100 EUR. Support for ∼15 people; ∼100 participants; total cost 40k. Also see amazing pie chart of national affiliation of participants.

7 AOB

PU showed the certificate for the Mikail Revnivtsev Prize funded by IAPS-INAF and IKI, the first of which was awarded to Volodymyr Savchnenko.

8 Next Meeting

The next IUG meeting will probably take place at ESAC, but this remains to be decided.

Action 20–14 on EK	**Due: End June**
Decide on location and date of next IUG.	