

IACHEC Heritage Working Group (HWG)

Activities during the last 12 months

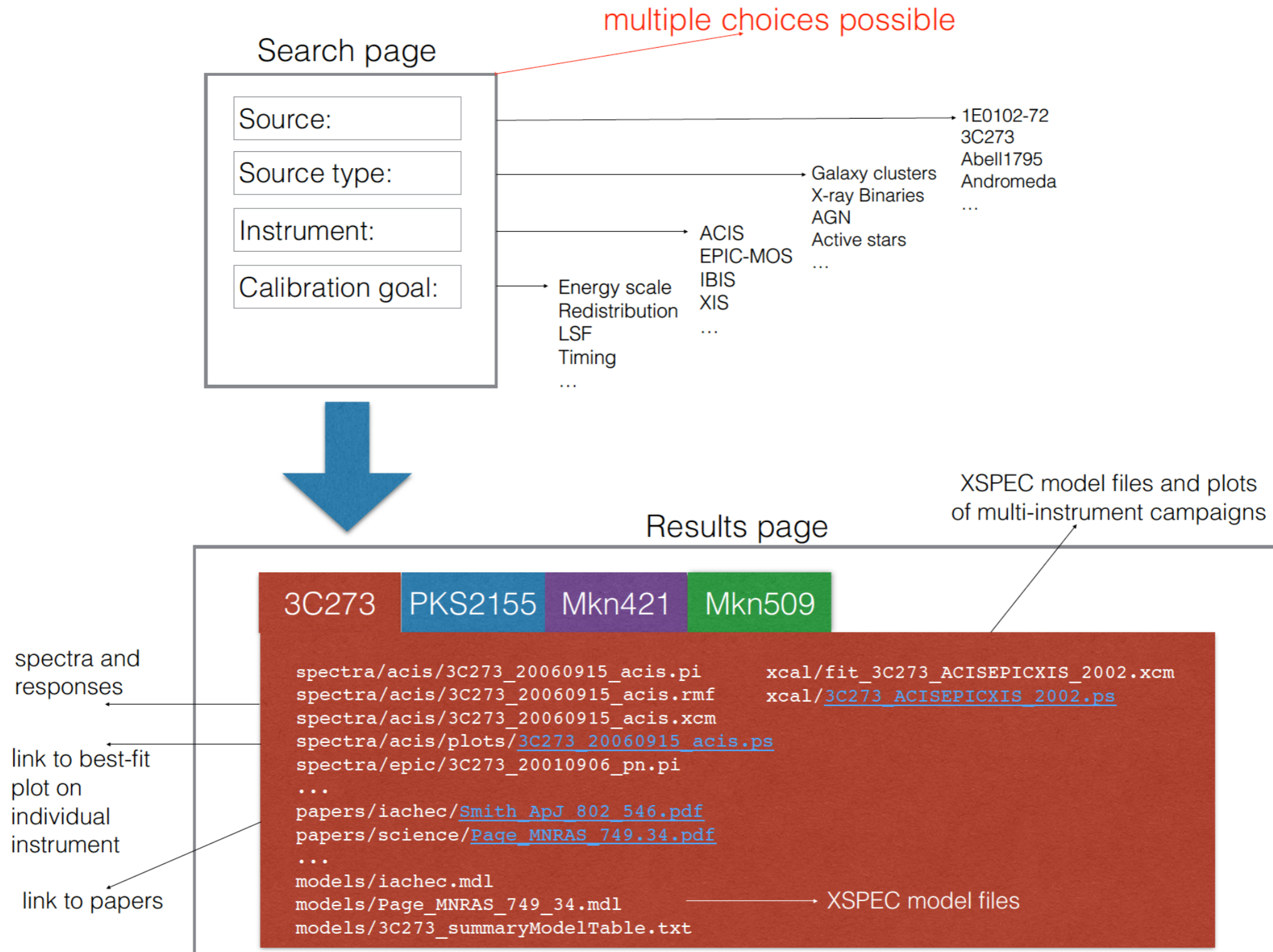
Plan for the following 12 months

Matteo Guainazzi (SCI-S/ESA, ESTEC, Noordwijk, The Netherlands)

Outline

- IACHEC calibration source database
- Data analysis best practise
- Repository of calibration documents
- Message to the editorial boards of refereed journals
- IACHEC knowledge database
- Future activities

IACHEC calibration source database



IACHEC Calibration Source Database (ICSD)

- No activities in 2016/7 due to lack of resources
- Good news: post-doctoral researcher hired in March 2017 on shared INTEGRAL/AHEAD funding at IAPS/Rome, partly devoted to the implementation of the ICSD
- Work to be started soon!
- [M.Guainazzi](#): prepare a requirement document to be circulated and discussed by the HWG ([April 30, 2017](#))

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X-ray spectral analysis: best practise

Item	Photoelectric absorption model	Photoelectric absorption cross-sections	Elemental abundances
	tbnew (XSPEC) hot+amol (SPEX)	Verner & Yakovlev (1995)	Lodders & Palme (2009)

*this is not lodd in XSPEC!

Application to the IACHEC 3C273/PKS2155-304 papers

Madsen et al., 2017, AJ, 153, 2

We also tested the dependence of the flux and slope for different choices of abundance and/or cross-section, as well as choice of photoelectric absorption model. For abundances we tested Anders & Grevesse (1989) and Lodders & Palme (2009), for cross-sections Balucinska-Church & McCammon (1992), and for photoelectric model `tbabs` and `tbnew`³. Using the EPIC and XIS spectra as reference, and fitting them in their nominal calibrated energy bandpass, the 3C 273 results are essentially indistinguishable, while the fluxes/slope/column densities from the PKS 2155-304 spectral analysis are minimally affected by less than a fraction of percent, 0.01, and 10^{19} cm^{-2} , respectively.

More tests on best practices

- Further tests in future IACHEC papers:
 - steep sources (WD/INS WG?)
 - high-resolution spectroscopic data

Repository of calibration documents in the IACHEC Wiki

Library of ground-based and in-flight calibration documents:

- [Chandra](#)
 - Integral
 - JEM-X
 - Brandt S., et al., "[JEM-X in-flight performance](#)", A&A 411, L243–L251 (2003)
 - Loffredo G., et al., "[X-ray facility for the ground calibration of the X-ray monitor JEM-X on board INTEGRAL](#)", A&A 411, L239–L242 (2003)
 - Frontera, F., et al. 1997, "[Ground and On-Board Calibration Design of the JEM-X Detector](#)" Proc. of the 2nd INTEGRAL Workshop, 16-20 September 1996, St. Malo, France. Edited by C. Winkler, T. J.-L. Courvoisier, and Ph. Durouchoux, European Space Agency, 1997., p.663
 - Pareschi, G. et al. 1997, "[Hard x-ray calibration facility design for JEM-X detector on board INTEGRAL](#)" SPIE Proceedings Vol. 3114
 - SPI
 - Roques, J. et al. 2003, "[SPI/INTEGRAL in-flight performance](#)", A&A 411, L91–L100 (2003)
 - Schanne, S. et al 2001, "[The space-borne INTEGRAL-SPI gamma ray telescope: test and calibration campaigns](#)", IEEE, Trans. Nucl. Sci., p.478 - 482 vol.1
 - Lonjou, V. et al. 2005, "[Characterization of the in-flight degradation of the INTEGRAL/SPI detectors](#)", Nucl. Inst. Meth. A, 554, 320–330
 - Schanne et al. 2003, "[Calibration of the spectrometer aboard the INTEGRAL satellite](#)", Proceedings of the SPIE, Volume 4851, pp. 1132-1143 (2003)
 - Attie, D. et al. 2003, "[Integral/SPI ground calibration](#)", Astronomy and Astrophysics, v. 411(no.1); p. L71-L79
 - Sturmer, S.J. et al. 2003, "[Monte Carlo simulations and generation of the SPI response](#)", A&A 411, L81-L84 (2003)
 - IBIS
 - Caballero, I. et al., "[INTEGRAL IBIS/ISGRI energy calibration in OSA 10](#)", Proc.Conf "An INTEGRAL view of the high-energy sky (the first 10 years)" October 15-19, 2012, Paris, France
 - R. Terrier et al., "[In flight calibration of the ISGRI camera](#)", Astron.Astrophys. 411 (2003) L167-L172
 - F. Lebrun, "[The ISGRI CdTe gamma camera In-flight behavior](#)", IEEE Trans.Nucl.Sci. 52 (2005) 3119-3123 astro-ph/0411411
 - Malaguti, G., Di Cocco, G. & Stephen, J.B, "[In-flight calibration requirements for the PICsIT high-energy imaging detector](#)" Proc. SPIE 3765, EUV, X-Ray, and Gamma-Ray Instrumentation for Astronomy X, 42 (October 22, 1999)
 - Quadriani, E.M. et al., "[IBIS Veto System: Background rejection, instrument dead time and zoning performance](#)", A&A 411, L153-L157 (2003)
 - Natalucci, L. et al., "[Systematic effects induced on IBIS detectors by background and inhomogeneity of the spatial response](#)", A&A 411, L209–L213 (2003)
 - NuSTAR
 - NuSTAR in-orbit calibration paper: "[Calibration of the NuSTAR High-energy Focusing X-ray Telescope](#)", K. K. Madsen et al, *ApJS*, 220, 8,2015
 - SPIE telescope articles:
 - "[In-flight PSF calibration of the NuSTAR hard X-ray optics](#)", H. An et al, 9144, 1, 2014
 - "[NuSTAR on-ground calibration: I. Imaging quality](#)", N. J. Westergaard, 8443, 2012
 - "[NuSTAR on-ground calibration: II. Effective area](#)", N. Brejnholt et al, 8443, 2012
 - "[Coatings for the NuSTAR mission](#)", F. Christensen et al, 8147, 2011
 - "[NuSTAR ground calibration: The Rainwater Memorial Calibration Facility \(RaMCoF\)](#)", N. Brejnholt et al 2011, 8147, 2011
 - "[First results from the ground calibration of the NuSTAR flight optics](#)", J. Koglin, 8147, 2011
 - "[Fabrication of the NuSTAR flight optics](#)", W. Craig et al, 8147, 2011
 - "[Optimizations of Pt/SiC and W/SiC multilayers for the Nuclear Spectroscopic Telescope Array](#)", K. K. Madsen et al, 7437, 16, 2009
 - "[Evaluation of epoxy for use on NuSTAR optics](#)", H. An et al, 7437, 2009
 - "[NuSTAR hard X-ray optics design and performance](#)", J. E. Koglin et al, 7437, 2009
 - "[Manufacture of Mirror Glass Substrates for the NuSTAR Mission](#)", W. Zhang et al, 7437, 2009
 - "[W/SiC and Pt/SiC multilayers for the NuSTAR hard X-ray telescope](#)", C. P. Jensen et al, 5900, 2005
 - SPIE detector articles:
 - "[Inflight performance and calibration of the NuSTAR CdZnTe pixel detectors](#)", T. Kitaguchi et al, 9144, 2014
 - "[Spectral calibration and modeling of the NuSTAR CdZnTe pixel detectors](#)", T. Kitaguchi et al, 8145, 2011
 - "[Development of focal plane detectors for the Nuclear Spectroscopic Telescope Array \(NuSTAR\) mission](#)", V. Rana et al, 7435, 2009
 - SPIE operations articles:
 - "[NuSTAR observatory science operations: on-orbit acclimation](#)", K. Forster et al, 9149, 2014
 - "[Highly automated on-orbit operations of the NuSTAR telescope](#)", B. Roberts et al, 9149, 2014
 - SPIE mast articles:
 - "[NuSTAR: System engineering and modeling challenges in pointing reconstruction for a deployable X-ray telescope](#)", D. I. Harp et al, 7738, 2010
- XMM-Newton:
 - [EPIC public calibration documents](#)
 - [RGS public calibration documents](#)
 - [telescopes' calibration documents](#)

Actions to fill the repository with documents of other past and operational missions

- [C.Markwardt](#): RXTE, Swift/BAT, NICER
- [Y.Terada](#): Suzaku
- [K.Kuntz](#): "Cubesat" missions
- ? : Swift/XRT
- ? : HXMT
- ? : MAXI
- ? : Astrosat

["?" = [M.Guainazzi](#) to find a "volunteer"

Offer to support the referee process

- The IACHEC offered support to the referee process on calibration- and cross-calibration-related issues
- Contacted members of the Editorial Boards of A&A, AJ, ApJ, MNRAS, PASA, PASJ
- Responses by D.Worrall (MNRAS) and A.Taam (A&A) → promise to discuss our offer in the Editorial Board
- If IACHEC members are contacted with a request of technical support, please let the IACHEC HWG know

IACHEC knowledge database

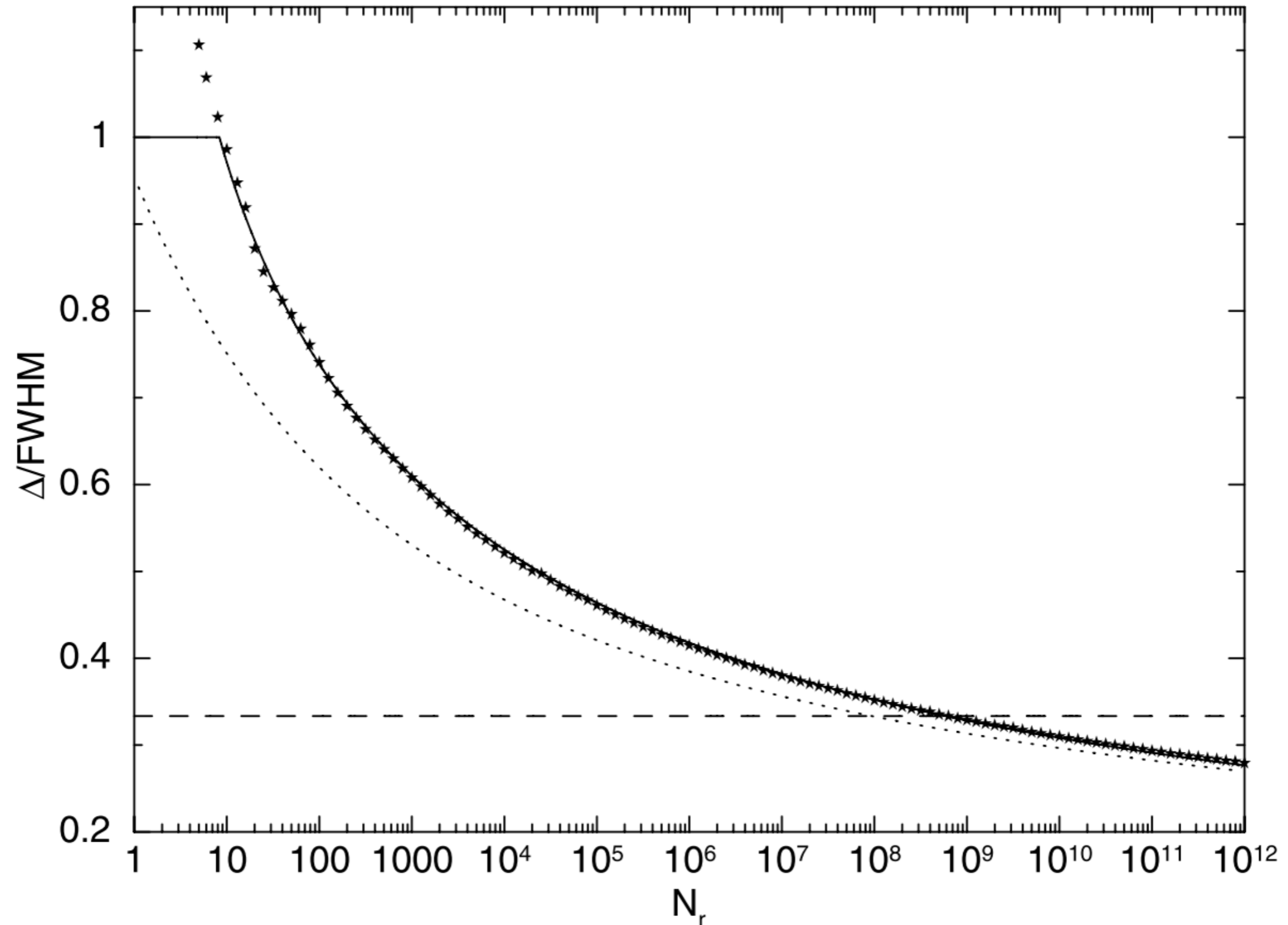
- The HWG will launch a survey to build up a small "knowledge database" of the IACHEC members
- Survey to be launched in **April 2017** (under review by the HWG)

New future activities

- Promote an "Optics calibration Working Group" - [M.Guainazzi](#) to collect suggestions on potentially interested colleagues, and convey a first teleconference in **~6 months**
- Invite J.Kaastra to the next IACHEC meeting to present his (and J.Bleeker's) "optimal spectral binning scheme" - schedule a ~1 hours discussion on this topic
- [R.Petre](#): verify with the *Hitomi* science management if the *Hitomi* calibration plan (and/or its content) can be published, and in which form

The Kaastra & Bleeker optimal binning scheme

Kaastra & Bleeker, 2016, A&A, 587, 151



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