The Schrödinger’s cat

Or, “On the IACHEC Heritage Working Group”

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IACHEC Heritage Working Group (HWG) Chair

IACHEC

International Astrophysical Consortium for High Energy Calibration

Scope of the WG

Preserve the IACHEC corpus of knowledge, know-how and best practices for the benefit of future missions and the community at large

- provide a platform for the discussion of experiences coming from operational missions
- facilitate the usage of good practices for the management of pre- and post-flight calibration data and procedures, and the maintenance and propagation of systematic uncertainties (the latter task in strict collaboration with the "Systematic uncertainties" IACHEC Working Group)
- document the best practices in analysing high-energy astronomical data as a reference for the whole scientific community
- ensure the usage of homogeneous data analysis procedures across the IACHEC calibration and cross-calibration activities
- consolidate and disseminate the experience of operational missions on the optimal calibration sources for each specific calibration goal

from the WG charter …

Otherwise: we do the dirty jobs for you that you don't have time to do because you are busy analysing data

IACHEC source data repository

https://iachecdb.iaps.inaf.it

- Concept: a single repository of the data used in IACHEC papers
- Funded over ~2 years by AHEAD, working prototype available
- Requirements and interface iterated at three IACHEC meetings
- Database never populated. The project has not taken-off
- Solution discussed in spring: HEASARC to take over?
  - Actions on M. Guainazzi and K. Madsen to follow-up

Status of the discussion with HEASARC

- Counterpart at HEASARC: K. Arnaud and M. Corcoran
- Possible implementation: a “virtual mission” with a “source observation table”
  - Unclear if IACHEC members could directly upload data
    - HEASARC “Point-of-Contact” would be needed/in charge
  - Being discussed internally at HEASARC
  - Iteration on the requirements among the IACHEC members prior to delivering them to HEASARC for implementation

Synopsis of the main requirements (abridged)

https://wikis.mit.edu/confluence/download/attachments/61572873/ISDRD_v1.0_20180619.pdf

- Access: browser + **`wget`**(-like) protocol
- Users must register to access the database
- Accessible products: spectra, light curves, responses and exposure maps, data analysis procedures (scripts), documents, graphical products (as defined by the WG)
- Querying per source, instrument, WG, paper authors
- Download of single tar file with all source files, file class (see above), or individual files

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Repository of calibration documentation

https://wikis.mit.edu/confluence/display/iachec/IACHEC+Heritage+Working+Group

- Concept: single repository of calibration documents for past and operational missions
- Entries for most missions
  - Some still missing
- Simple-minded interface - no underlying database allowing smart searches
- Inhomogeneous
- Not up-to-date (~2018)

Dashboard › IACHEC › ... › IACHEC Heritage Working Group

IACHEC Heritage Working Group

26 Added by Eric D Miller, last edited by Koji Mori on Apr 26, 2018 23:56 (view change)

The last meeting of the IACHEC **Heritage Working Group** was held on the *2nd of March 2016* (11th IACHEC). The outcome of the discussion is summarized in the following documents:

- Heritage Working Group Charter
- Summary of the 1st Working Group meeting at the 9th IACHEC
- Introduction to and summary of the 2nd Working Group meeting at the 10th IACHEC
- Introduction to and summary of the 3rd Working Group meeting at the 11th IACHEC
- Summary of the 4th Working Group meeting at the 12th IACHEC
- List of actions
- *On the in-flight calibration plans of modern X-ray observatories* (JATIS paper, accepted version, 29 December 2015)

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

- Chandra
- *Hitomi* (in-flight calibration plan)
  - SXS + SXT-S
    - Kelley, R. L. et al. "The Astro-H high resolution soft x-ray spectrometer", JATIS, in press
    - de Vries, C. et al. "Calibration sources and filters of the soft x-ray spectrometer instrument on the Hitomi spacecraft" , JATIS 4(1), 011204 (2017).
    - Leutenegger, M. A. et al. "In-flight verification of the calibration and performance of the ASTRO-H (Hitomi) Soft X-ray Spectrometer", JATIS 4(2), 021407 (2018)
    - Eckart, M. E. et al. "Ground calibration of the Astro-H (Hitomi) soft x-ray spectrometer", JATIS 4(2), 021406 (2018).
    - Iizuka, R. et al. "Ground-based x-ray calibration of the Astro-H/Hitomi soft x-ray telescopes", JATIS 4(1), 011213 (2018).
    - Porter, F. S. et al. "In-flight performance of the soft x-ray spectrometer detector system on Astro-H", JATIS 4(1), 011218 (2018)
    - Okajima, T. et al. "First peek of ASTRO-H Soft X-ray Telescope (SXT) in-orbit performance", Proc. of SPIE, 99050Z (2016)
    - Kilbourne, C. A. et al. "In-flight calibration of Hitomi Soft X-ray Spectrometer (1) Background" , PASJ, Volume 70, Issue 2, 1 March 2018, 18
    - Maeda, Y., et al. "In-flight calibration of the Hitomi Soft X-ray Spectrometer. (2) Point spread function", PASJ, Volume 70, Issue 2, 1 March 2018, 19
    - Tsujimoto, M., et al. "In-flight calibration of Hitomi Soft X-ray Spectrometer. (3) Effective area", PASJ, Volume 70, Issue 2, 1 March 2018, 20
  - SXI + SXT-I
    - Nakajima, H., et al. "In-orbit performance of the soft X-ray imaging system aboard Hitomi (ASTRO-H) ", PASJ, Volume 70, Issue 2, 1 March 2018, 21
    - Tanaka, T., et al. "Soft X-ray Imager aboard Hitomi (ASTRO-H)", JATIS 4(1), 011211 (2018).
  - HXI
  - SGD
  - Timing
    - Terada Y., et al. "Time Assignment System and Its Performance aboard the Hitomi Satellite", JATIS 4(1), 011206, (2017)
- Integral
  - JEM-X
    - Brandt S., et al., "JEM–X inflight 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
    - Sturner, S.J. et al. 2003, "Monte Carlo simulations and generation of the SPI response", A&A 411, L81-L84 (2003)
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    - F. Lebrun, "The ISGRI CdTe gamma camera In-flight behavior", IEEE Trans.Nucl.Sci. 52 (2005) 3119-3123 astro-ph/0411411
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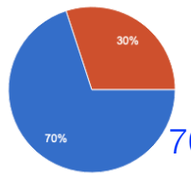
    - Quadrini, E.M. et al.,"IBIS Veto System: Background rejection, instrument dead time and zoning performance", A&A 411, L153-L157 (2003)
    - Natalucci, L. et al., "Systematic effects induced on IBIS detectors by background and inhomogeneity of the spatial response", A&A 411, L209–L213 (2003)
- NuSTAR
  - 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 (RaMCaF)", N. Brejnholt et al2011, 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/Si 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
- Suzaku (list of suzaku memo)
  - XIS
    - Koyama et al. "X-Ray Imaging Spectrometer (XIS) on Board Suzaku", PASJ, 2007, 59, S23
    - Yamada, S. et al. "Data-Oriented Diagnostics of Pileup Effects on the Suzaku XIS", PASJ, 2012, 64, 53
  - HXD
    - Kouzu, T., et al., "Spectral Variation of the Hard X-ray Emission from the Crab Nebula with the Suzaku Hard X-ray Detector", PASJ 65 74 (2013)
    - Yamada, S., et al. "The calibration improvement on GSO scintillators in the Suzaku Hard X-ray Detector" PASJ 63, S645-S656 (2011)
    - Fukazawa, Y., et al., "Modeling and Reproducibility of Suzaku HXD PIN/GSO Background", PASJ 61 S17-S34 (2009)
    - Terada, Y., et al., "In Orbit Timing Calibration of the Hard X-Ray Detector on Board Suzaku",PASJ 60, S25-S34 (2008)
    - Kokubun, M., et al., "In-Orbit Performance of the Hard X-ray Detector on Board Suzaku", PASJ 59, S53–S76 (2007)
    - Fukazawa, Y., et al., "Inflight calibration and performance of the Hard X-ray Detector (HXD) onboard Suzaku", Proceedings of SPIE, Vol. 6266, pp.75-86 (2006)
    - Terada, Y., et al., "Development of a Monte Carlo Simulator for the Astro-E2 Hard X-ray Detector (HXD-II)", IEEE TNS Vol. 52, Issue 4, pp. 902-909 (2005)
  - HXD-WAM
    - Yamaoka, K., et al., "Design and In-Orbit Performance of the Suzaku Wide-Band All-Sky Monitor", PASJ 61, ppS35-S53 (2009)
    - Yamaoka, K., et al., "In-orbit performance of the Suzaku wide-band all-sky monitor", Proceedings of SPIE, Vol. 6266, pp. 626643-1-626643-12 (2006)
    - Ohno, M., et al., "Preflight Calibration and Performance of the Astro-E2/HXD-II Wide-Band All-Sky Monitor", IEEE TNS Vol. 52, Issue 6, Part 2, pp. 2758-2764 (2005)
- Swift (in-flight calibration plan)
- XARM
  - Resolve (formally SXS)
  - Xtend (formally SXI)
- XMM-Newton:
  - EPIC public calibration documents
  - RGS public calibration documents
  - telescopes' calibration documents

Way forward

- A virtual meeting is deemed not efficient to resume activities: defer the discussion to the first face-to-face IACHEC meeting

- Identify *one new activity* and *one highest-priority past activity* to be updated

- Identify a small pool (3-4) of IACHEC scientists willing to actively work in the HWG



70% of responders are willing to increase their involvement in the HWG

- A new Chair would help (but nobody has volunteered so far)

- In the meantime, some knowledge transmission to future mission still possible parasitically through XRISM/*Athena*