

13th IACHEC meeting closure

Matteo Guainazzi, Kristin Madsen

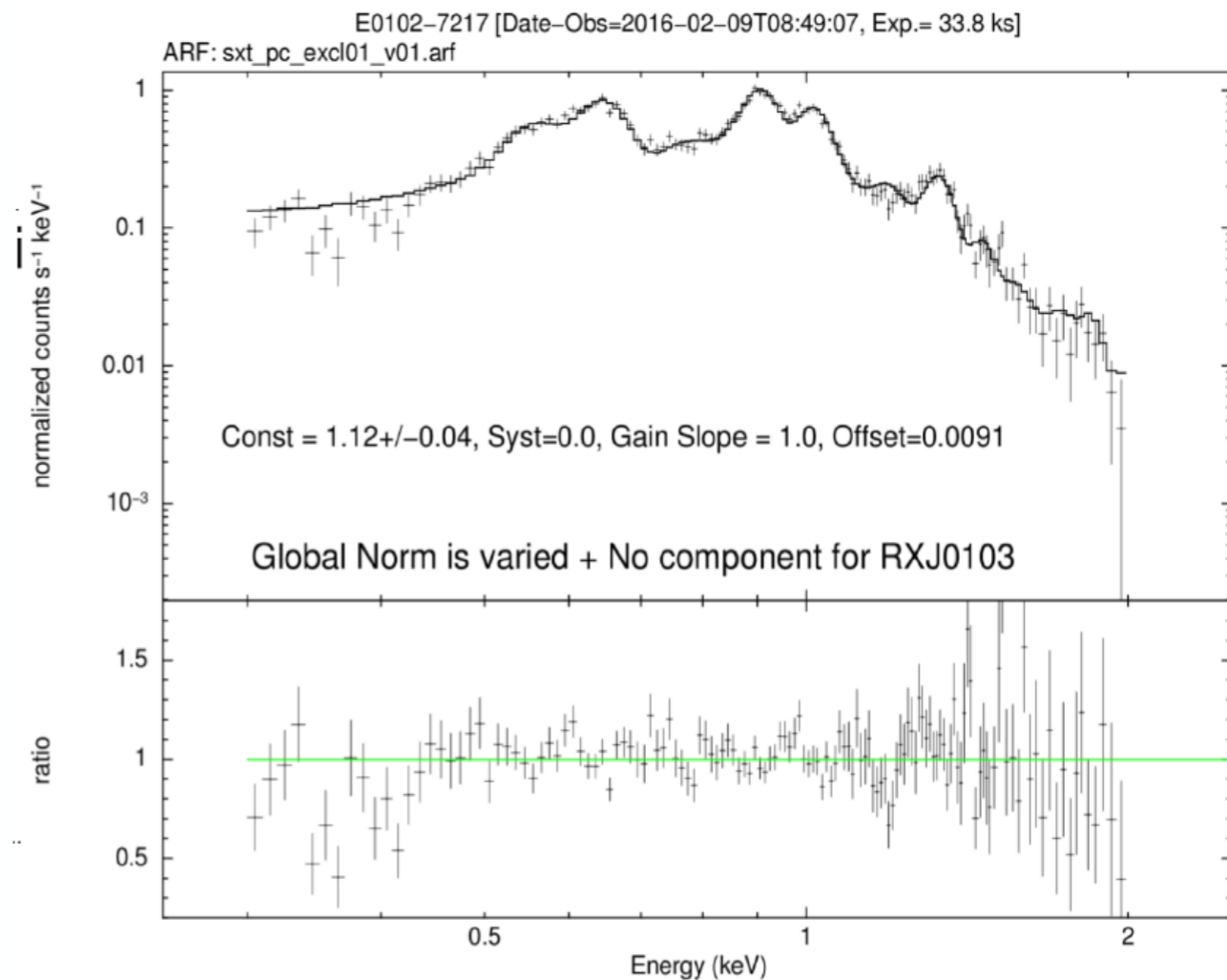
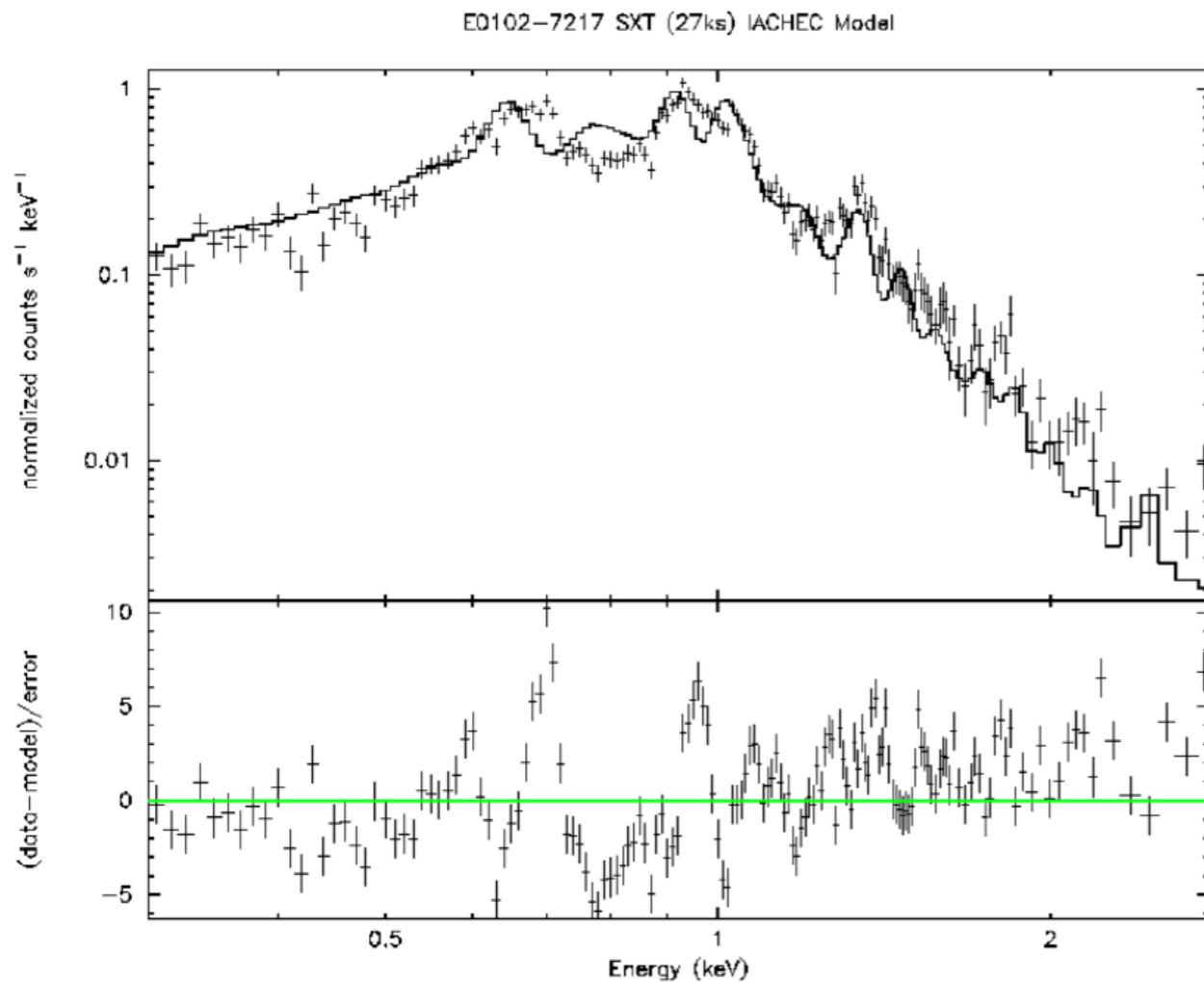


*"... singing together in perfect harmony",
P.Kretschmar]*

Scope of the IACHEC

Courtesy S.Chandra

1. Provide a forum where calibration teams meet, openly present issues and achievements, and discuss possible solutions



Evolution of attendance

IACHEC year	Number of participants	Number of talks
2006 (Iceland)	36	26
2007 (California)	35	30
2008 (Germany)	36	26
2009 (Japan)	35	34
2010 (Massachusetts)	45	50
2011 (Italy)	44	38
2012 (California)	40	29
2013 (UK)	36 (+6 seq.ed)	48 (20 plenary)
2014 (Virginia)	51	54 (24 plenary)
2015 (RPC)	57 + 37 students	45 (25 plenary)
2018 (Italy)	52	50 (30 plenary)

Scope of the IACHEC

1. Provide a forum where calibration teams meet, openly present issues and achievements, and discuss possible solutions
2. Define calibration standard and procedures

The IACHEC aims to provide standards for high energy calibration and supervise cross calibration between different missions. This goal is reached through working groups, where IACHEC members cooperate to define calibration standards and procedures. The scope of these groups is primarily a practical one: a set of data and results (eventually published on refereed journals) will be the outcome of a coordinated and standardized analysis of references sources ("high-energy standard candles"). Past, present and future high-energy mission can use these results as a calibration reference.

[IACHEC web page]

"When does a standard become a standard?" [J.Nevalainen]

"When does a standard become a standard?" [J.Nevalainen]

- An IACHEC "standard candle" is such when:

"When does a standard become a standard?" [J.Nevalainen]

- An IACHEC "standard candle" is such when:
 - A. an astrophysical model is defined;

"When does a standard become a standard?" [J.Nevalainen]

- An IACHEC "standard candle" is such when:
 - A. an astrophysical model is defined;
 - B. its (cross-)calibration scope is identified;

"When does a standard become a standard?" [J.Nevalainen]

- An IACHEC "standard candle" is such when:
 - A. an astrophysical model is defined;
 - B. its (cross-)calibration scope is identified;
 - C. these are published in a refereed journal (A&A, SPIE, JATIS, PASJ ...) together with applications and results

"When does a standard become a standard?" [J.Nevalainen]

- An IACHEC "standard candle" is such when:
 - A. an astrophysical model is defined;
 - B. its (cross-)calibration scope is identified;
 - C. these are published in a refereed journal (A&A, SPIE, JATIS, PASJ ...) together with applications and results
- IACHEC Standard Candles: 1E0102-72, 3C273, cool clusters, Crab, G21.5-0.9, PKS2155-304

"When does a standard become a standard?" [J.Nevalainen]

- An IACHEC "standard candle" is such when:
 - A. an astrophysical model is defined;
 - B. its (cross-)calibration scope is identified;
 - C. these are published in a refereed journal (A&A, SPIE, JATIS, PASJ ...) together with applications and results
- IACHEC Standard Candles: 1E0102-72, 3C273, cool clusters, Crab, G21.5-0.9, PKS2155-304
- To-be IACHEC Standard Candles: Capella, N132D, RXJ1856-3754

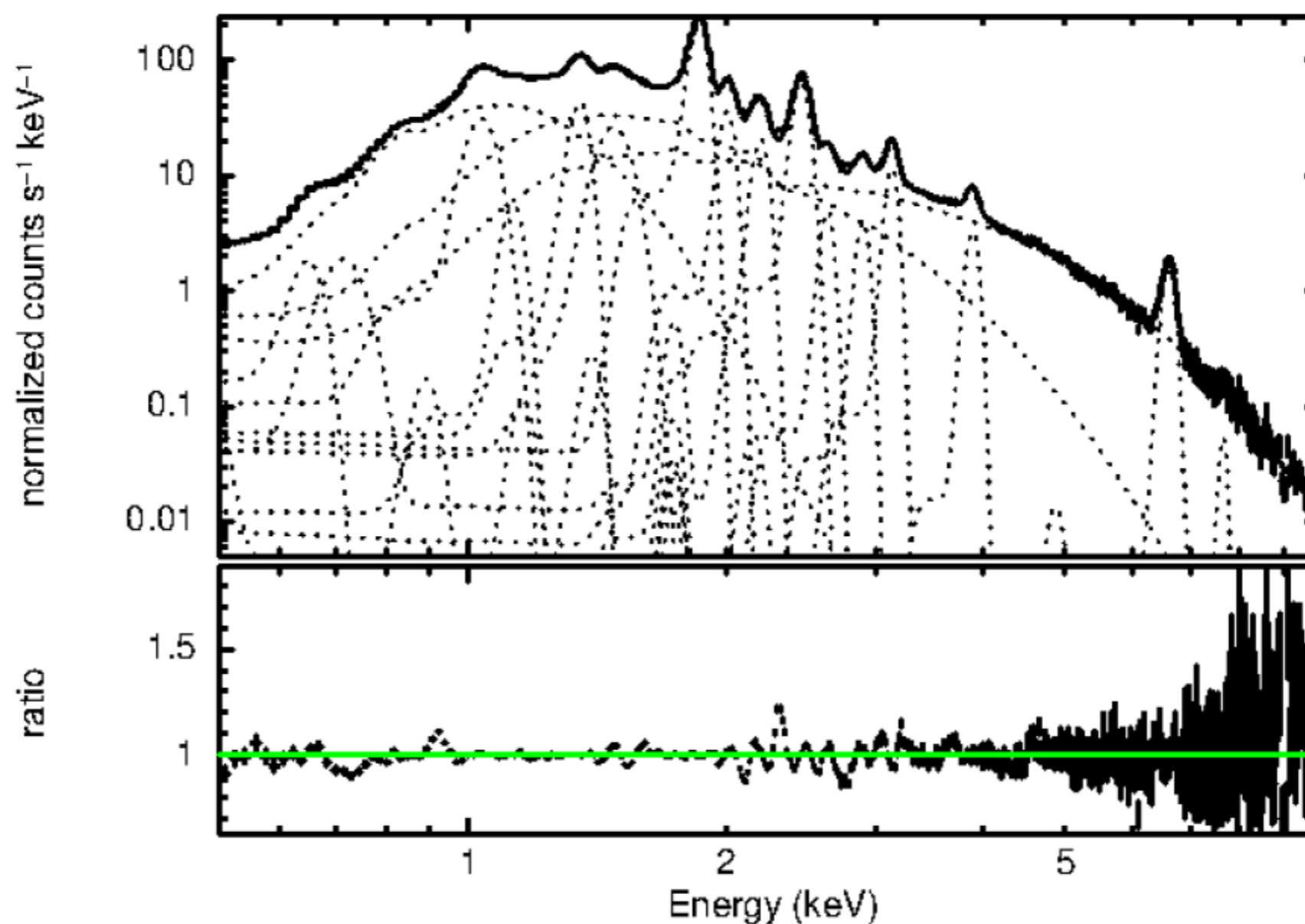
IACHEC paper status

green = progress

Paper	Status last year	Status this year
C/X blazar sample	wrapping up	wrapping up
Crab	advanced draft	in preparation
3C273 (INTEGRAL)	-	to be started
3C273 (NICER)	-	to be started
3C273 (NuSTAR)	-	to be started
G21.5-0.9	-	to be started
N132D	not discussed	in preparation
Concordance Project	-	submitted/in preparation
MMS (galaxy clusters)	to be started	in preparation
RXJ1856-3754	-	under consideration
Timing (Crab)	-	under consideration
Crab phase-resolved	-	under consideration

- In the spirit of IACHEC
 - MOS1 small window spectrum
 - model tbabs * (3 brems + 15 gaus)

Cas A (2007-07-25) – MOS1 (P0-12)



Scope of the IACHEC

1. Provide a forum where calibration team meet, openly - present issues and achievements, and discuss possible solutions
2. Define calibration standard and procedures
3. Support missions in study/development for the definition of the ground-based and in-flight calibration plans



XARM is the recovery mission of Hitomi

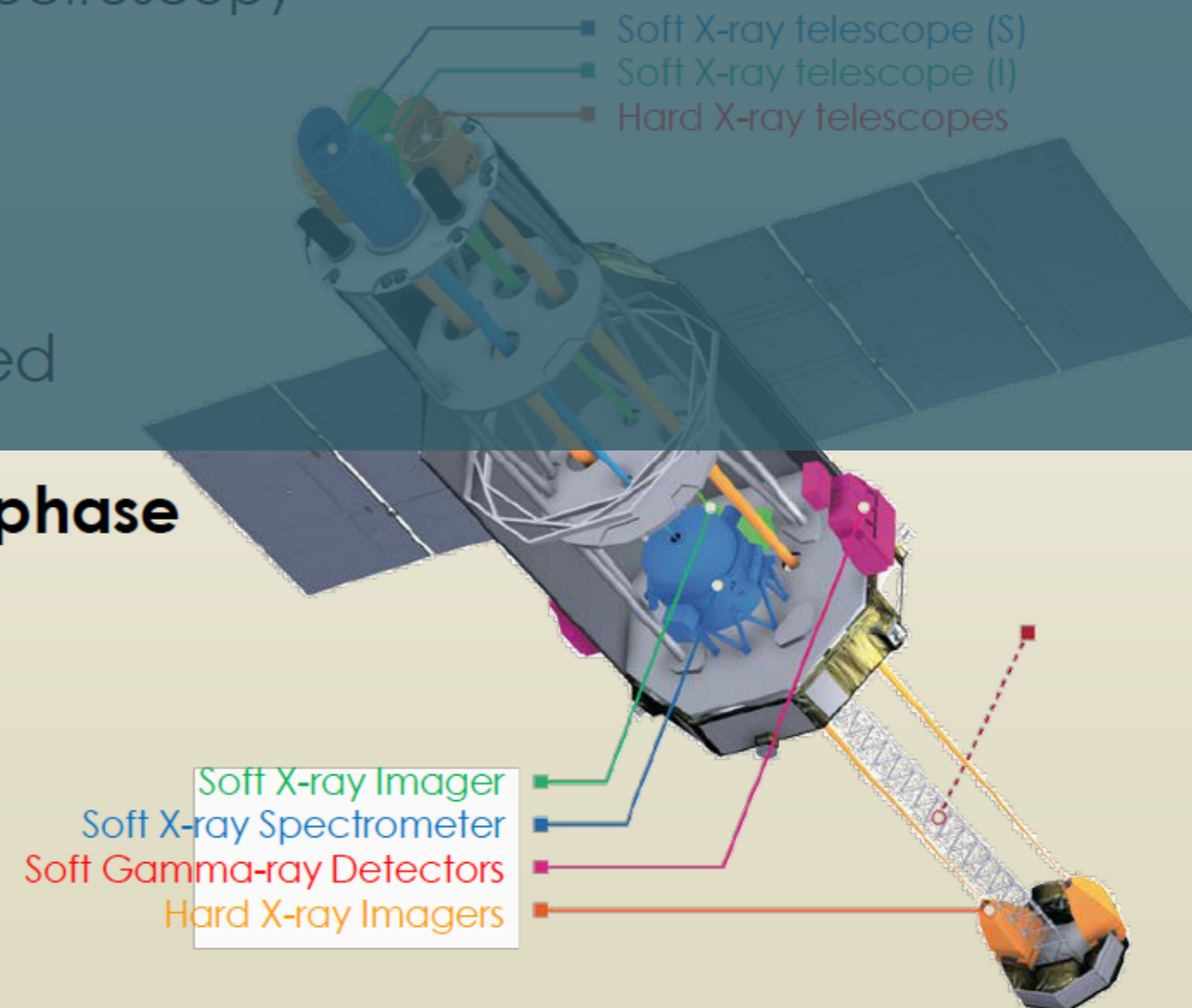
ASTRO-H/Hitomi Mission

- X-ray observation in 0.3 ~ 600 keV
 - ✓ High resolution spectroscopy
 - ✓ Wide FOV Imaging
 - ✓ Hard X-ray Imaging spectroscopy
 - ✓ Super sensitive gamma-ray spectroscopy
- 2003 NeXT project
- 2005~ ASTRO-H mission
- 2016.2.17 Launch
- 2016.3.26 lost communication
- 2016.4.28 Operation terminated

Objects observed during check-out phase

- Perseus Cluster of galaxies
- N132D
- IGR J16318-4848
- RX J1856.5-3754
- G21.5-0.9
- Crab

(so call, IACHEC objects!!)

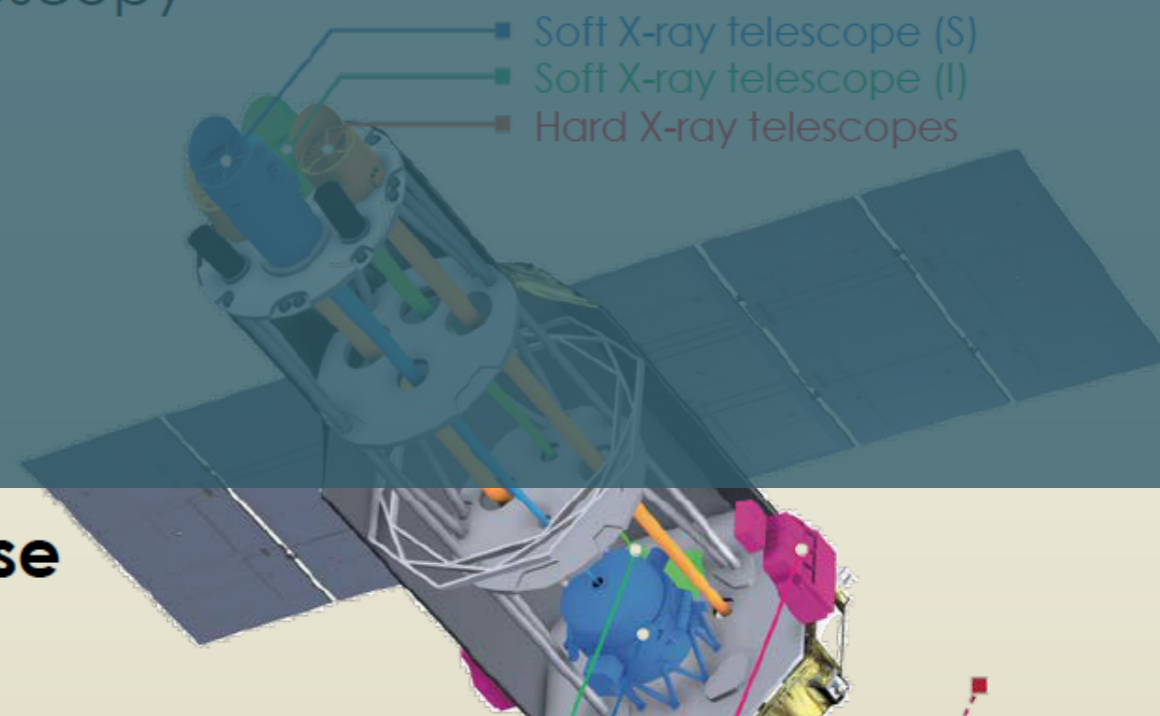




XARM is the recovery mission of Hitomi

ASTRO-H/Hitomi Mission

- X-ray observation in 0.3 ~ 600 keV
 - ✓ High resolution spectroscopy
 - ✓ Wide FOV Imaging
 - ✓ Hard X-ray Imaging spectroscopy
 - ✓ Super sensitive gamma-ray spectroscopy
- 2003 NeXT project
- 2005~ ASTRO-H mission
- 2016.2.17 Launch
- 2016.3.26 lost communication
- 2016.4.28 Operation terminated



Objects observed during check-out phase

- Perseus Cluster of galaxies
- M132D

Papers discussed/to discuss the comparison/consistency with IACHEC (Crab and G21.5-0.9) [Tsujiimoto]

- G21.5-0.9
- Crab
(so call, IACHEC objects!!)

Hard X-ray Imagers



Background: 1d

- During/after commissioning of all cameras:
defined mixture of cameras with closed and (open) filter, high and low gain (TBC)
- as predefined set of commands (macro)
- similar to calibration source: one after another CLOSED filter during survey
- joint SRG background study for L2: eROSITA + ART-XC

Clusters of galaxies: 2d

- Are more subject of cross-calibration with other missions
than actual eROSITA calibration (scientific like cluster T, not gain/CTI)
- eROSITA advantage: no chip gaps, large FOV!
- Preferred targets (1 low-T, 1 high-T): **IACHEC recommendation**
A1795, A2029 (Coma (center to be defined), A1835, A2052, A2199)
- work to be expected, e.g.: derive T for eROSITA
(7 temperatures should be the same within errors), XMM, Chandra
determine differences and re-iterate (effective area, vignetting, EEF, RMF),...
contribute to calibration parameters

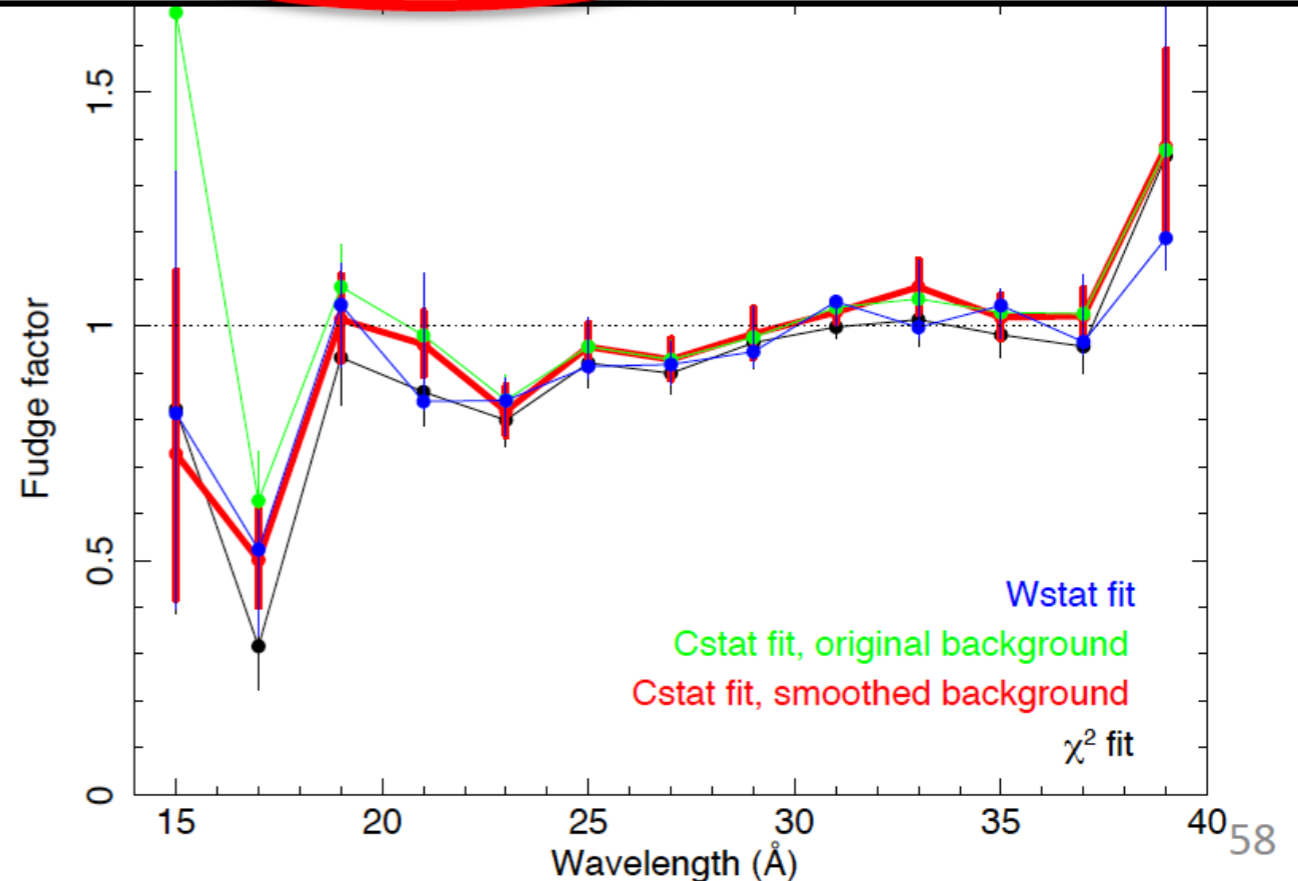
Scope of the IACHEC

1. Provide a forum where calibration team meet, openly present issues and achievements, and discuss possible solutions
2. Define calibration standard and procedures
3. Support mission in study/development for the definition of the ground-based and in-flight calibration plans
4. Represent an *autoritas* on calibration, inter-calibration, and cross-calibration, but also of technical and statistical knowledge in the analysis of data in general

Comparison methods

Method	χ^2	Cstat (data bg)	Wstat	Cstat (Model bg)
Statistic	1188	1405	1154	1161
Dof/range	1102	1136 \pm 48	1102	1135 \pm 48
# evaluations	3084	2888	12873	3527
F (17 Å)	0.32 \pm 0.10	0.63 \pm 0.10	0.52(-0.18,+0.09)	0.50 \pm 0.10
F (27 Å)	0.90 \pm 0.05	0.93 \pm 0.04	0.92 \pm 0.04	0.93 \pm 0.04
F (37 Å)	0.96 \pm 0.06	1.03 \pm 0.06	0.97(-0.03,+0.14)	1.02 \pm 0.06

- χ^2 & Cstat with data bg:
→ bias
- Wstat: unstable,
asymmetric errors, 4 x
more model evaluations;
bias?



Our own biased priority list for next year

Our own biased priority list for next year

- Advise projects on how to make the right use of cross-cal results (NuSTAR Crab absolute flux measurements, concordance)

Our own biased priority list for next year

- Advise projects on how to make the right use of cross-cal results (NuSTAR Crab absolute flux measurements, concordance)
- More "primary standards"

Our own biased priority list for next year

- Advise projects on how to make the right use of cross-cal results (NuSTAR Crab absolute flux measurements, concordance)
- More "primary standards"
- Include the work on "secondary standards" in the activity of the WGs (INS, ThSNR already plans for this)

Our own biased priority list for next year

- Advise projects on how to make the right use of cross-cal results (NuSTAR Crab absolute flux measurements, concordance)
- More "primary standards"
- Include the work on "secondary standards" in the activity of the WGs (INS, ThSNR already plans for this)
- Prepare background templates and/or analytical recipes thereof

Our own biased priority list for next year

- Advise projects on how to make the right use of cross-cal results (NuSTAR Crab absolute flux measurements, concordance)
- More "primary standards"
- Include the work on "secondary standards" in the activity of the WGs (INS, ThSNR already plans for this)
- Prepare background templates and/or analytical recipes thereof
- Push projects to implement rigorous statistical data analysis methods in the mission's projects software (LHEASOFT, CIAO, SAS)

Our own biased priority list for next year

- Advise projects on how to make the right use of cross-cal results (NuSTAR Crab absolute flux measurements, concordance)
- More "primary standards"
- Include the work on "secondary standards" in the activity of the WGs (INS, ThSNR already plans for this)
- Prepare background templates and/or analytical recipes thereof
- Push projects to implement rigorous statistical data analysis methods in the mission's projects software (LHEASOFT, CIAO, SAS)
- Commitment to review/publish yearly the cross-calibration status (JN)

Our own biased priority list for next year

- Advise projects on how to make the right use of cross-cal results (NuSTAR Crab absolute flux measurements, concordance)
- More "primary standards"
- Include the work on "secondary standards" in the activity of the WGs (INS, ThSNR already plans for this)
- Prepare background templates and/or analytical recipes thereof
- Push projects to implement rigorous statistical data analysis methods in the mission's projects software (LHEASOFT, CIAO, SAS)
- Commitment to review/publish yearly the cross-calibration status (JN)
- Several actions on pushing for funding laboratory measurements (HEAD, AHEAD, Athena Decadal WP ...)

Many thanks to:

Lorella Grasselli (I Ciclamini)

Lorenzo Natalucci (INAF)

Elisa Polini (Symposia SRL)

Silvia Zampieri (INAF)

... and the whole staff at "I Ciclamini"

Thanks to:



This project is funded by
the European Union



for their generous sponsorship

Many thanks to:

Lorella Grasselli (I Ciclamini)

Lorenzo Natalucci (INAF)

Elisa Polini (Symposia SRL)

Silvia Zampieri (INAF)

... and the whole staff at "I Ciclamini"

Thanks to:



This project is funded by
the European Union



for their generous sponsorship



See you all in
Shonan Village in
May 2019!