

IBIS team @IAPS 17 October 2018+
Bologna, Milano and Palermo



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Funding and Support

- Calibration (and operations support from INAF-IAPS Roma, IASF-Palermo and OAS/Bologna)

Funding INAF + ASI (INAF for Staff members)

INAF/IBIS 7+3.5 Permanent staff, expected to remain for duration of mission +3 postdoc for science ASI/IBIS Funded

Agreement ASI/INAF still on going and expiring in August 2019

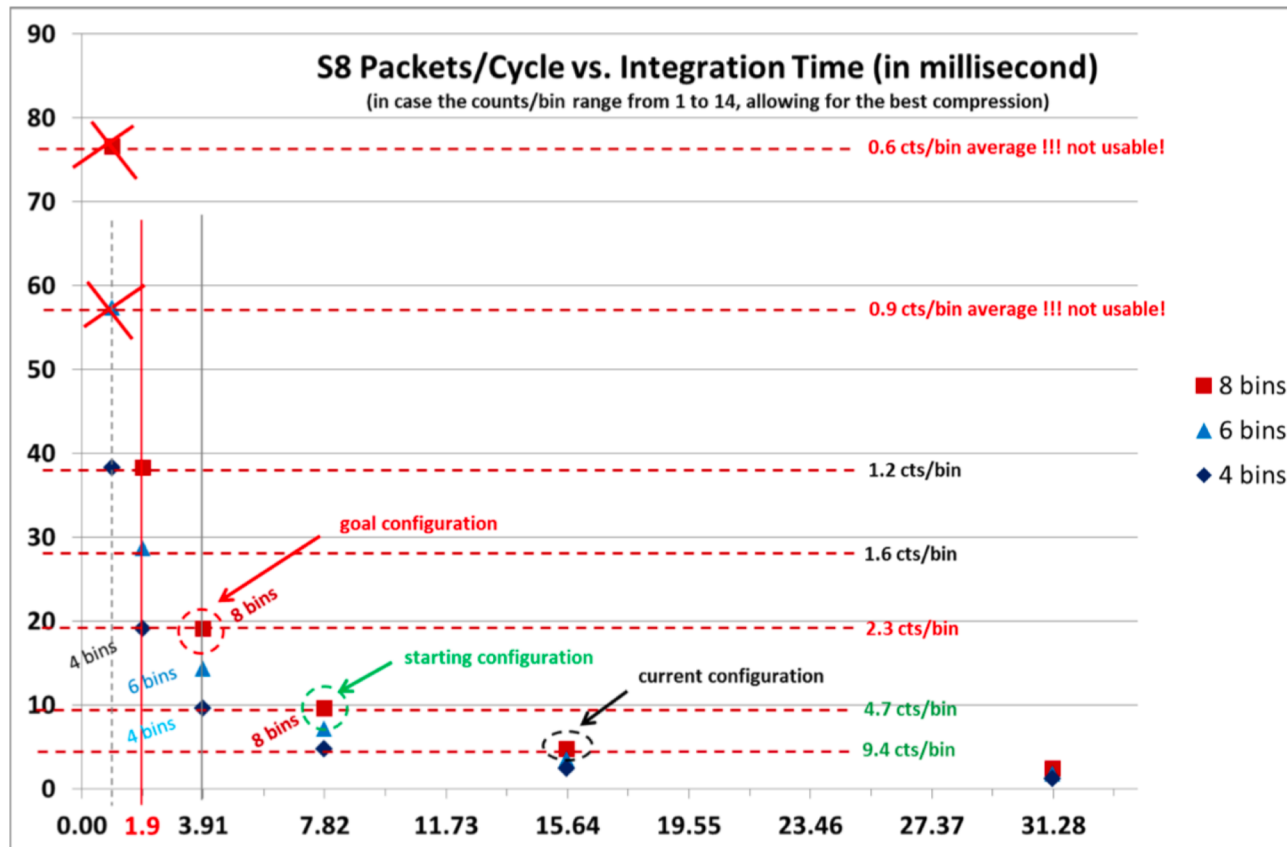
****contract for people well behind the end 2019****

ASI just asked for IBIS request to cover the period **2019-2022**,

No discussion about post operation ...

IBIS new OCR

Motivated by the recent PiCsIT S8 analysis and to get a better scientific output, the team has analyzed the possibility to improve the time resolution for Spectral timing data with PiCsIT.



To better follow the time profile of a GRB we need to use a shorter integration time still maintaining 8 bins (energy channels) histograms. We verified with R. Southworth this would be possible to test using a few hours of observation in the new PiCsIT configuration that need only a TC to modify the time resolution from **15.94 ms** to **7.82ms**.

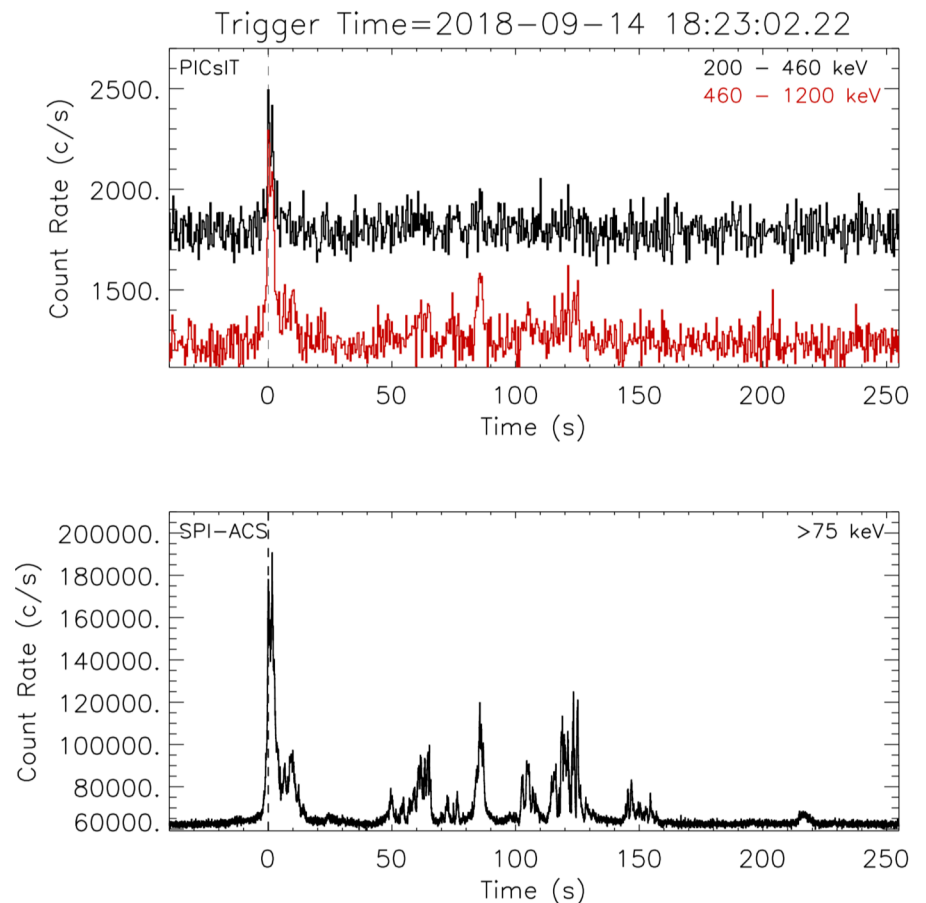
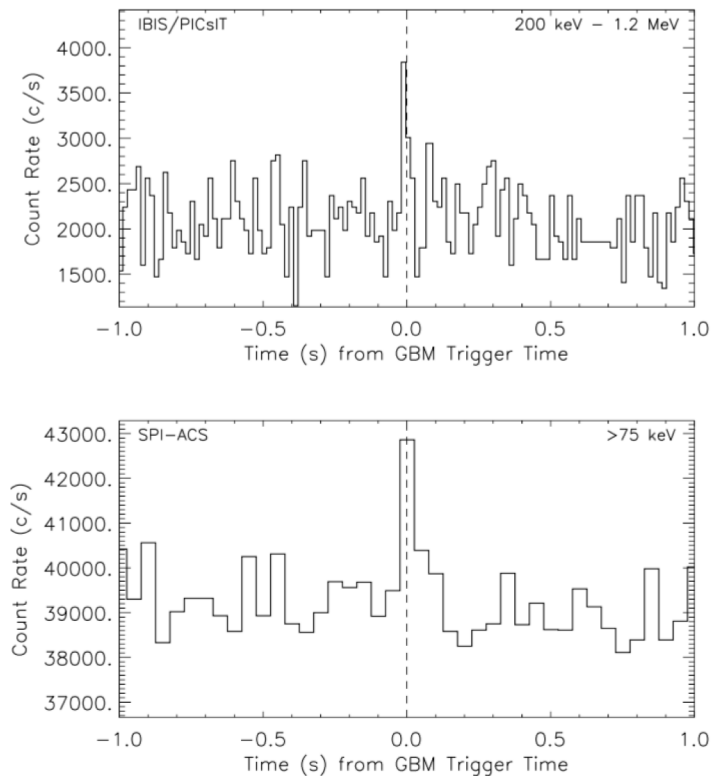


Fig. 1.— *INTEGRAL* light curves for IBIS/PICsIT (top) in the 200 keV – 1.2 MeV range and SPI-ACS (bottom) above 75 keV.

GWs related activity @IAPS

- For IBIS/PiCsIT a software has been developed to perform real-time analysis of the Spectral Timing data for detecting GRB in view of joint gravitational wave-electromagnetic events during the upcoming LIGO/VIRGO observation runs
- We have access to telemetry stream and are currently installing the OSA software to generate the standard real-time data packets

NEW REQUEST

To avoid missing of peculiar events, we should **have S8 pkts during slews!**

Cross-Calibration/ IACHEC

- IACHEC meeting in Avigliano Umbro, Italy 9-12 April 2018
- Presentation by V. Savchenko (IBIS/ISGRI calibration)

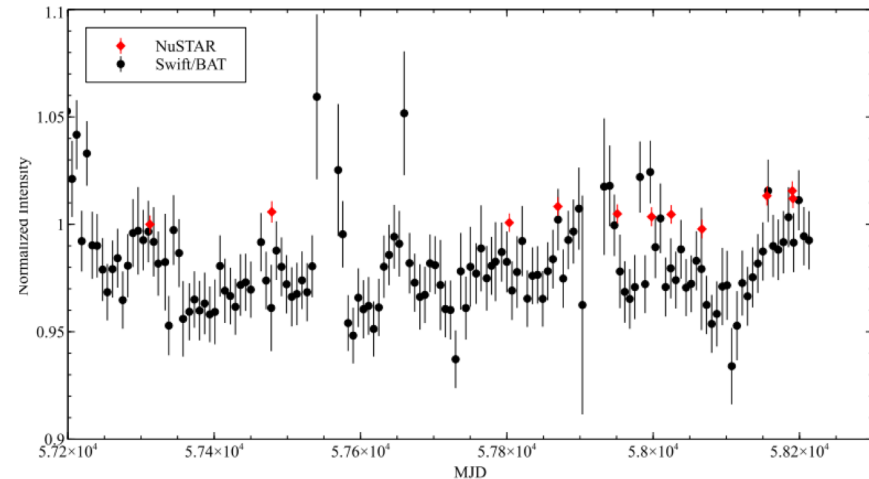


Some topics relevant to INTEGRAL:

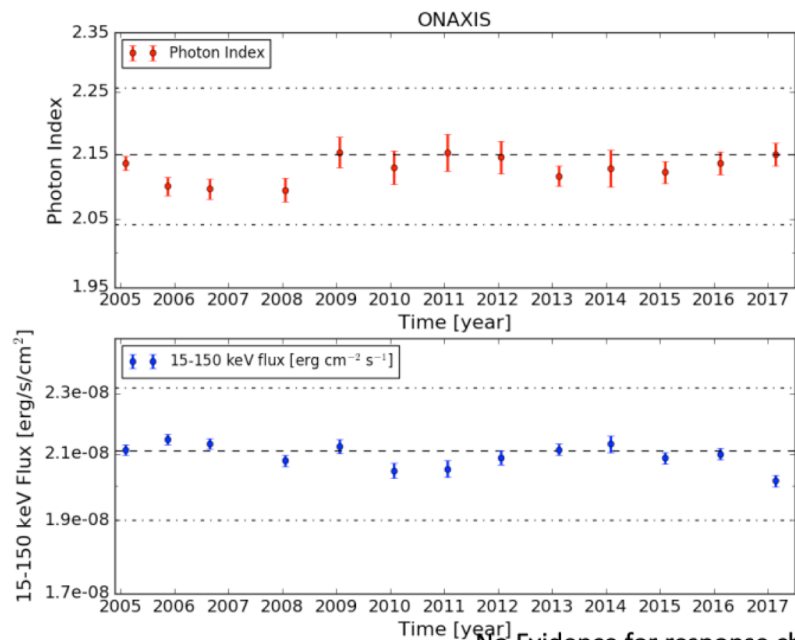
- Agreed procedure for handling of coordinated observations data analysis
- Crab observation campaigns and data analysis
- 3C273 and Crab cross-calibration papers
- Issues in Swift/NuSTAR joint analysis of bright sources
- IACHEC/AHEAD cross-calibration database
- **J. Rodi responsible for the cross-calibration database**

Crab calibration analyses [1/2]

NuSTAR results for Crab calibration campaigns:
24 observations, nominal (focused) and *straylight* (shown) (Kristin K. Madsen)



Swift/BAT long-term gain and response stability (Craig Markwardt)



No Evidence for response changes over time

Crab calibration analyses [2/2]

Update on timing calibration with Crab pulsar (Lucien Kuiper):

- Confirmed that timing signals from the X-ray and gamma-ray instruments are found to be ahead of the radio signal by $\sim 0.2\text{-}0.4 \mu\text{s}$.
- The distribution of this time difference for a given instrument differs significantly from other instrument's, with a possible energy dependence

Update on spectral calibration (Lorenzo Natalucci):

- Analysis of cross-cal “historical data”: 14 nearly simultaneous epochs (2005-2016). Emphasis on the hard band ($>10 \text{ keV}$)
- On board:
NuSTAR, INTEGRAL/IBIS & SPI, RXTE/PCA, Suzaku/XIS and HXD,
Swift/BAT and Fermi/GBM
- Consistent results for all observations, considering the assumptions in the calibration of the different instruments. Cross-cal matrix available
- INTEGRAL data analysis to be upgraded to new OSA-11 release

3C273 campaign

3C273 multi-instrument campaign: performed yearly. Cross-cal paper in progress (K. Madsen lead)

Results IBIS/NuSTAR/XMM (analysis by M.Molina & coll)

IBIS & NuSTAR

Year	Γ	$C_{\text{FPMA/ISGRI}}$	$C_{\text{FPMB/ISGRI}}$	$F_{\text{ISGRI}}^{20-40\text{keV}}$ ($10^{-11}\text{erg cm}^{-2}\text{s}^{-1}$)	$F_{\text{FPMA}}^{20-40\text{keV}}$ ($10^{-11}\text{erg cm}^{-2}\text{s}^{-1}$)	$F_{\text{FPMB}}^{20-40\text{keV}}$ ($10^{-11}\text{erg cm}^{-2}\text{s}^{-1}$)	$\Delta\chi^2$
2012	1.669±0.003	0.995 ^{+0.07} _{-0.06}	1.024 ^{+0.07} _{-0.06}	6.49	6.46	6.65	0.994
2015	1.739±0.012	1.196 ^{+0.411} _{-0.244}	1.211 ^{+0.416} _{-0.247}	3.74	4.47	4.53	1.012
2016	1.608±0.005	1.069±0.06	1.087±0.06	11.73	12.54	12.75	1.094
2017	1.677±0.007	0.861 ^{+0.09} _{-0.07}	0.88 ^{+0.09} _{-0.08}	6.62	5.70	5.84	1.055

NuSTAR & EPIC-pn

Year	Γ	$C_{\text{FPMA/XMM}}$	$C_{\text{FPMB/XMM}}$	$F_{\text{XMM}}^{2-10\text{keV}}$ ($10^{-11}\text{erg cm}^{-2}\text{s}^{-1}$)	$F_{\text{FPMA}}^{2-10\text{keV}}$ ($10^{-11}\text{erg cm}^{-2}\text{s}^{-1}$)	$F_{\text{FPMB}}^{2-10\text{keV}}$ ($10^{-11}\text{erg cm}^{-2}\text{s}^{-1}$)	$\Delta\chi^2$
2012	1.667±0.02	1.095±0.02	1.115±0.02	6.926	7.588	7.724	0.987
2015	1.693±0.01	1.019±0.01	1.023±0.01	6.15	6.27	6.30	1.021
2016	1.567±0.01	1.093±0.01	1.113±0.01	12.95	14.17	14.42	1.131
2017	1.541±0.01	1.10±0.01	1.114±0.01	6.53	7.18	7.27	1.116

- IBIS and NuSTAR flux normalisation and slope consistent at ~10% level (uncertainty mostly limited by statistics)
- epic-PN spectra harder than NuSTAR in the 2017 observation
- epic-PN flux normalisation lower than NuSTAR (~10%)

Urgent IBIS related to do list

- Implement the 8ms OCR ESA/ESOC
- Full real time data display at IAPS IAPS
- Implement Advocate GW scientists scheme ISDC

To increase the INTEGRAL appeal:

- Release to ISDC PICsIT Timing SW IAPS
- Release to ISDC IBIS Compton Mode SW SACLAY
- ...more?