INTEGRAL - IUG #26, 1-2 Dec 2021

P. Ubertini presentation
On behalf of the IBIS Team

IBIS status,calibration report and IACHEC activity

IBIS STATUS, Recent activities

ISGRI counting rate during IBIS activation perigee:

-flux increase (≈7%) in the initial scws, need to rise the activation perigee in order to protect the instrument, Veto system also affected (P.L. request)

PiCsIt, Spectral timing tests: better scientific output from short duration transient events up to MeV

Test was performed in orbit 2338 (13:05oz on 4th March 2021) during SPI Annehaling (IBIS=180 pkt/cycle), in consultation with ISOC &ESOC.

It lasted ~7200 s with 3.9ms and for ~ 3600 s with 1.9s time resolution. Real-time data checked also for TLM share: S8 pkt increased from 10 pkt/cycle to 20 pkt/cycle with integration time fixed at 3.9 and to 40pkt/cycle using 1.9s, **as expected.**

-As IBIS TLM share we had for the 3.9ms test a total of ~ **136/146** pkt/cycle and a total of **156/166** pkt/cycle for 1.9 ms

As reference, for 7.8ms, same revolution, total of 126/136 pkt/cycle

We have also investigated the scientific content of S8 for rev. 2338 and confirm it work as expected in terms of counting rate and resolution

We suggested to go for 3.9 ms as integration time. This would be "Innovative" for INTEGRAL for the MM Science and, in general for transients detected at energy > than 300 keV. This should also allow to include PiCsIt data in the IPN with a better SPI/ACS time resolution.

To maintain a safe pkts configuration and transmit S1 and S5 as before, we would need to disable the S7.0/7.1.

Veto:

-Increase of the Soft High limit at 9.71 Volt permanently in the Data base

-update of calibration curve parameter

Compton:

-time window tests during Crab Observations executed and analysis undergoing (P. L.)

-Test 1, reduce time window from 3.8 to 3.3µs

-Test2,increase time window from 3.8 to 4.28µs

A preliminary test report has been issued by P.L.

OSA11.2:

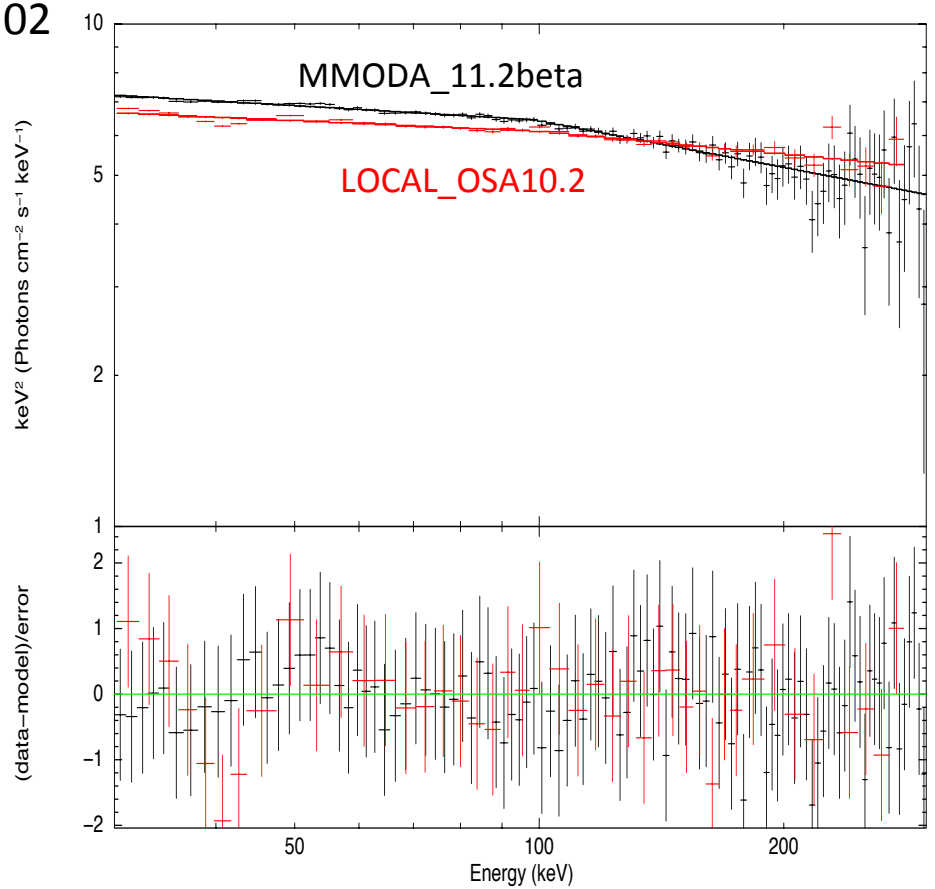
-team testing the new version before validation, see later

OSA TESTs ON GALACTIV SOURCEs by M. Fiocchi & J.. Rodi

Crab Rev 1515

Broken powerlaw model, Err_syst=0.02

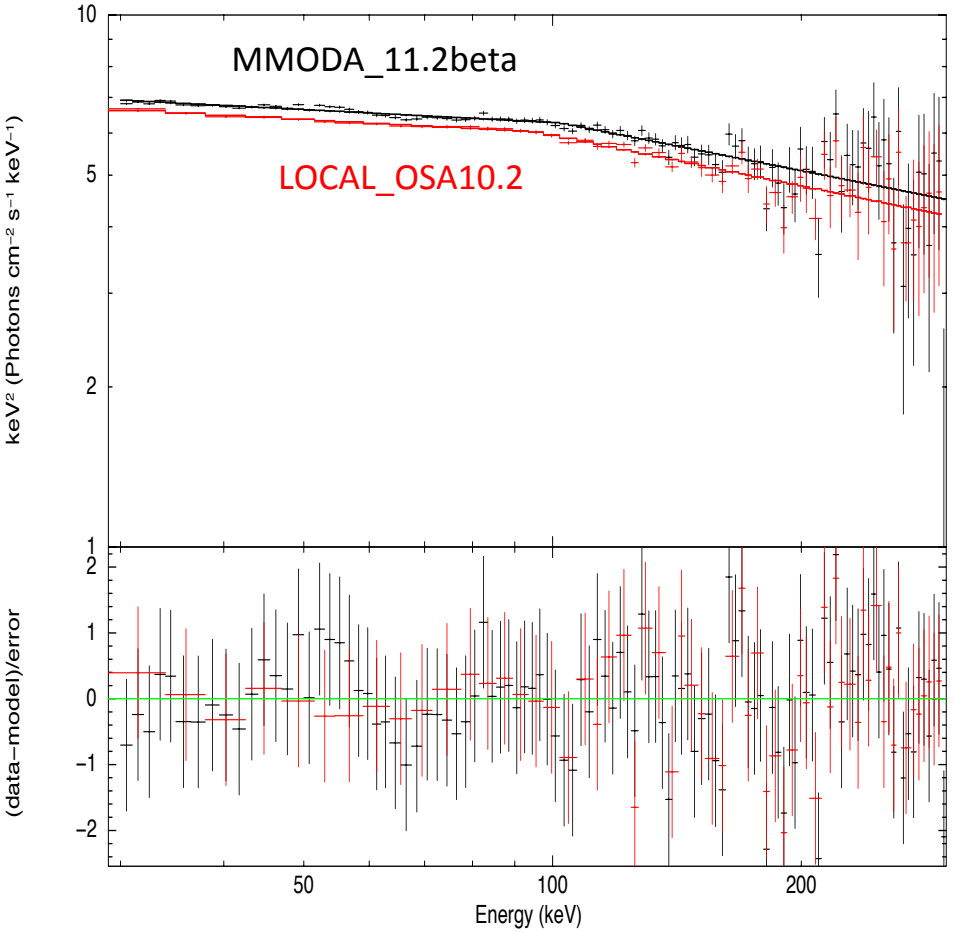
	MMODA Osa11 beta	LOCAL OSA10.2
Exposure (s)	**1,248x10^5**	**1,248x10^5**
Gamma1	2.10±0.02	2.08±0.03
E_{break} (keV)	102±14	96±15
Gamma2	2.30±0.08	2.31±0.06
F 30-200 keV (10^{-8} erg cm^{-2} s^{-1})	2.0±0.1	1.9±0.1
Chi^2	0.64	0.66



Crab Rev 1662

Broken powerlaw model, Err_syst=0.02

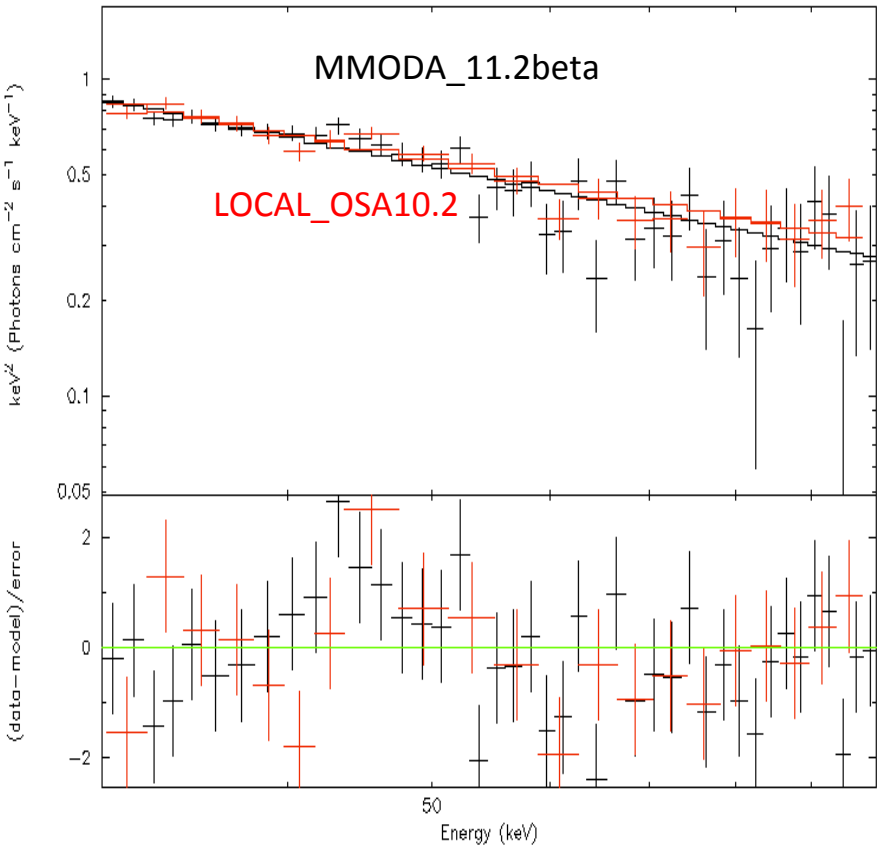
	MMODA Osa11_beta	LOCAL Osa 11
Exposure (s)	**$1{,}123\times10^5$**	**$1{,}123\times10^5$**
Gamma1	2.08±0.02	2.08±0.03
E_{break} (keV)	98±18	101±28
Gamma2	2.30±0.07	2.16±0.06
F 30-200 keV (10^{-8} erg cm^{-2} s^{-1})	1.9±0.1	1.8±0.1
Chi^2_{red}	0.56	0.62



4U1700 -377 Rev 1512

Powerlaw model, Err_syst=0.02

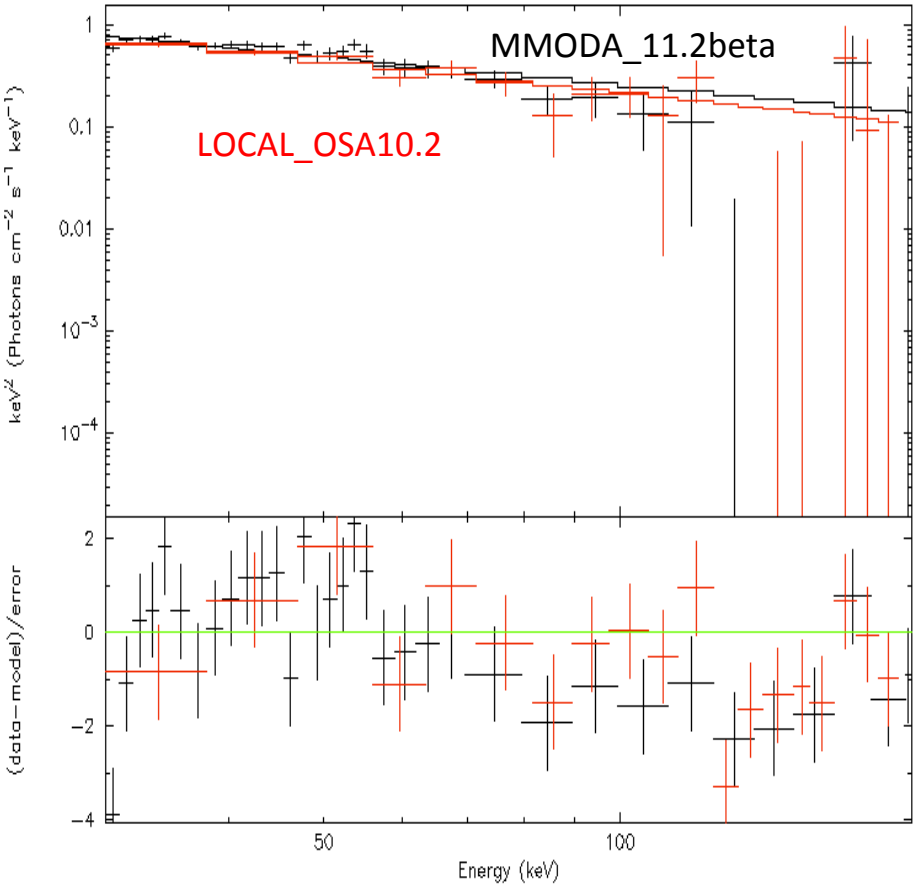
	MMODA Osa11_beta	LOCAL OSA10.2
Exposure	**8.501×10^4**	**8.501×10^4**
Gamma1	3.0±0.1	3.0±0.1
Flux 30-100 keV (10^{-10} erg cm^{-2} s^{-1})	9.9±2.0	10.0±2.1
Chi^2_{red}	1.1	1.1



4U 1700-377 Rev 1665

Powerlaw model, Err_syst=0.02

	MMODA Osa11_beta	LOCAL Osa 11
Exposure (s)	**$6{,}332\times10^4$**	**$5{,}455\times10^4$**
Gamma1	2.9±0.1	3.0±0.1
Flux 30-100 keV ($_{10}^{-10}$ erg cm^{-2} s^{-1})	9.1±2.0	8.1±2.3
Chi^2_{red}	1.3	1.3



OSA TESTs ON EXTRAGALACTIC SOURCES by A. Malizia & M. Molina

3C 273 calibration campaign (2015 & 2018)

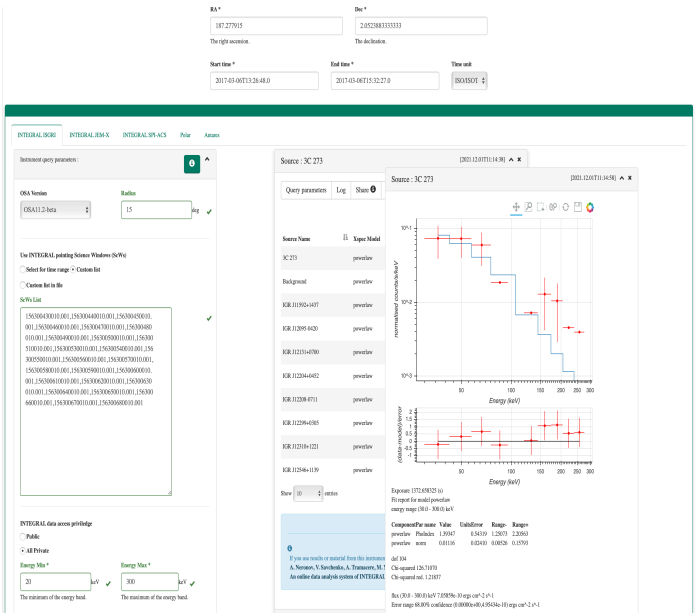
Observations chosen in order to compare OSA 10.2 vs OSA 11.2beta (2015) and OSA11.1 vs OSA11.2beta (2018)

2015 (25 scws)

IMAGE and Spectrum using radius **15**

	Significance	Exposure(*)
OSA 10.1 (local)	6.7	~16200
OSA 10.2 (ISDC)	8	~16200
OSA11.2 beta	8	~13700

(*) from isgri_query_mosaic.fits[5]



Screenshot from MMODA website confi our analysis with OSA 11.2 beta.

Spectrum [30 – 300 keV]

	Exposure (*)	Rate	Γ	F_{20-100} (ergs/ cm^2/s)
OSA 10.1 (local)	3.363e+04 sec	1.097 +/- 1.967e-01	1.79 [1.05 - 2.86]	9.5083e-11
OSA 10.2 (ISDC)	4102 sec	2.717 +/- 5.52e-01	1.56 [0.64 – 2.70]	2.25e-10
OSA 11.2beta	1373 sec	4.330 +/- 1.093	1.39 [0.50 - 2.62]	3.0e-10

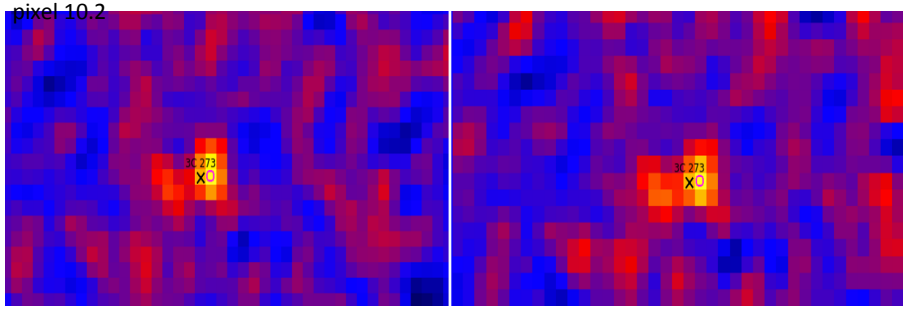
(*) from XSPEC

2018 (49 scws)

Comparison between OSA 11 (on nasarc and on ISDC) and OSA11.2beta on ISDC site. Search radius increased to 30 in order to check if the discrepancy between exposures is due to the presence of scw where the source is off-axis. Observation analysed is always the 3C273 -2018

OSA11 sign. brightest pixel 11.7 pixel 10.2

OSA11.2beta sign. brightest



The black cross is referred to position of 3C in the catalogue used (default), the magenta circle is instead the optical position of the source which is exactly in the brightest pixel.

SPECTRUM radius=**30** [30 – 300 keV]

	Expo	Rate	Γ	F_{20-100} (ergs/cm^2/s)
OSA 11 (nasarc)	6.287e+04 sec	1.56 +/- 2.182e-01	2.22 [1.65 - 3.32]	1.347e-10
OSA 11(ISDC)	2424 sec	5.756 +/- 1.11	1.55 [0.92 - 2.34]	3.6423e-10
OSA 11.2beta	4410 sec	2.67 +/- 7.07e-01	1.72 [1.15 - 2.53]	3.4281e-10

IMAGE and Spectrum using radius **15**

	Significance	Exposure (*)
OSA 11(ISDC)	11.7	~20800
OSA11.2beta	10.2	~22550

(*) from isgri_query_mosaic.fits[5]

Spectrum [30 – 300 keV]

	Exposure (*)	Rate	Γ	$F_{20\text{-}100}$ (ergs/cm^2/s)
OSA 11(ISDC)	2424 sec	5.756 +/- 1.11	1.55 [0.92 - 2.34]	3.6423e-10
OSA11.2beta	4410 sec	2.67 +/- 7.07e-01	1.72 [1.15 - 2.53]	3.4281e-10

(*) from XSPEC

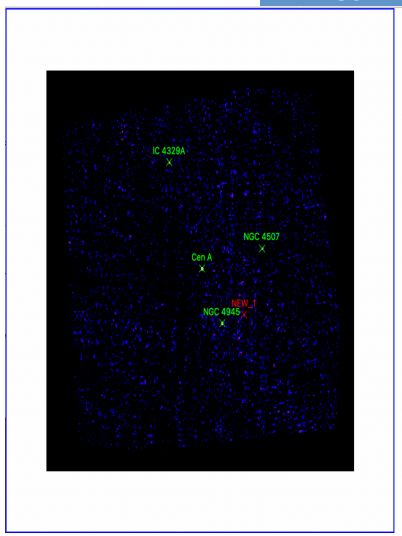
CEN A ✓

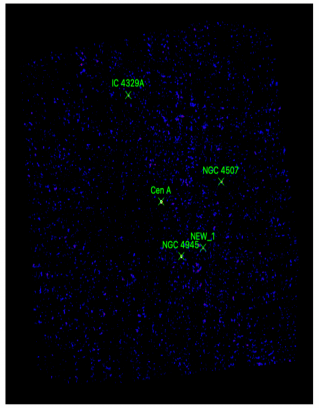
Test 1: rev 1491, 57 scws. Test da fare con OSA10.2 e OSA11.2 beta (da MMODA)

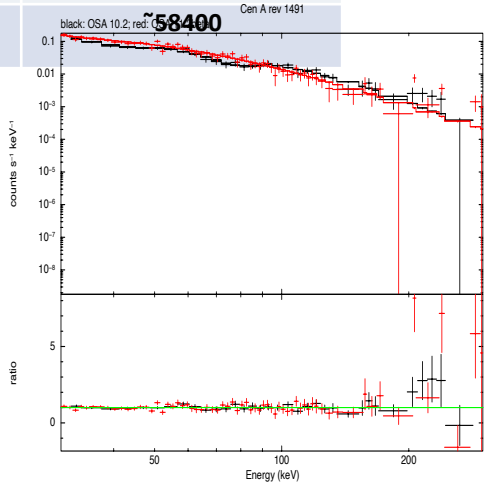
IMAGE and Spectrum using radius

	Significance		Exposure(*)
	cen a new_1	ic 4329	
OSA 10.2 (ISDC)	55.6	11.7	~67900
		.8	~58400

(*) from isgri_query_mosaic.fits[5]







Spectrum [30 – 300 keV]

	Expo	Rate	Γ	F_{20-100} (ergs/cm^2/s)
OSA 10.2 (ISDC)	1.36e+05 sec	4.549 +/- 1.087e-01	1.81 [1.72 – 1.91]	3.432e-10
OSA 11.2 BETA	1.369e+05 sec	3.683 +/- 9.728e-02	1.83 [1.75 – 1.92]	3.785e-10

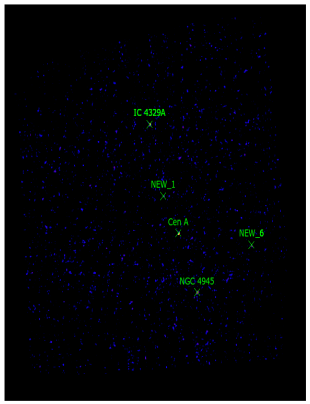
CEN A ✓

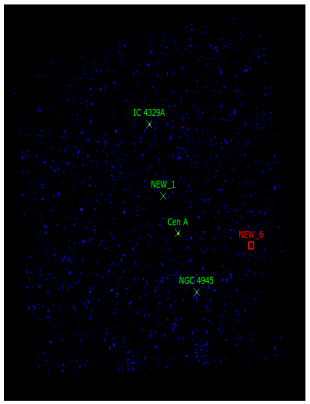
Test 1: rev 2176, 44 scws. Test da fare con OSA11.1 e OSA11.2 beta (da MMODA)

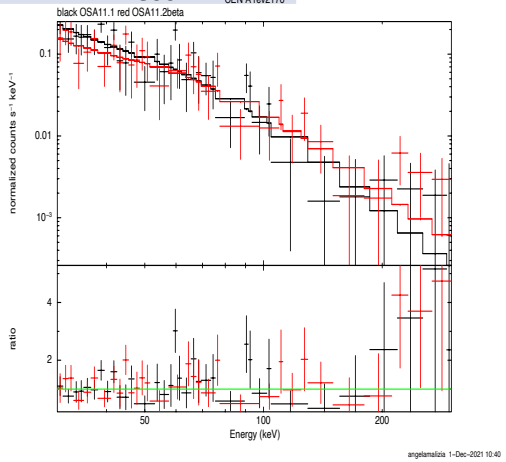
IMAGE and Spectrum using radius

	Significance			Exposure(*)
	cen a new_6	ic 4329		
OSA 11.1 (ISDC)	18	11	6	~16800
OSA11.2 beta	17	11	5	~17800

(*) from isgri_query_mosaic.fits[5]





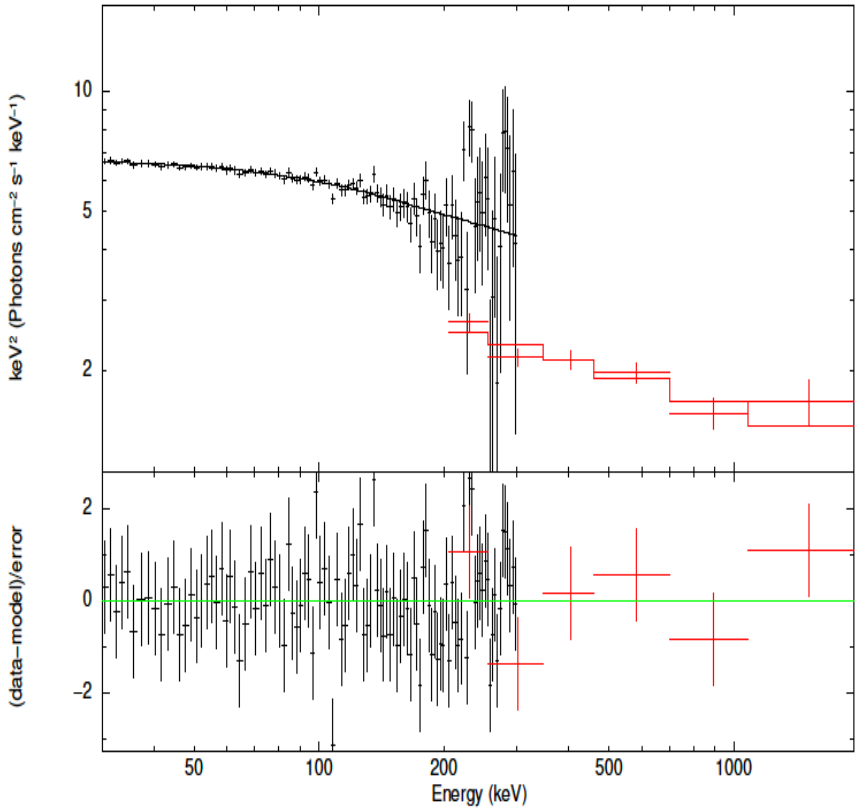


Spectrum [30 – 300 keV]

	Expo	Rate	Γ	F_{20-100} (ergs/cm^2/s)
OSA 11.1 (ISDC)	1.463e+04 sec	5.686 +/- 4.862e-01	1.78 [1.47 - 2.13]	3.7136e-10
OSA 11.2 BETA	1.12e+04 sec	5.19 +/- 4.963e-01	1.59 [1.24 - 1.98]	3.9748e-10

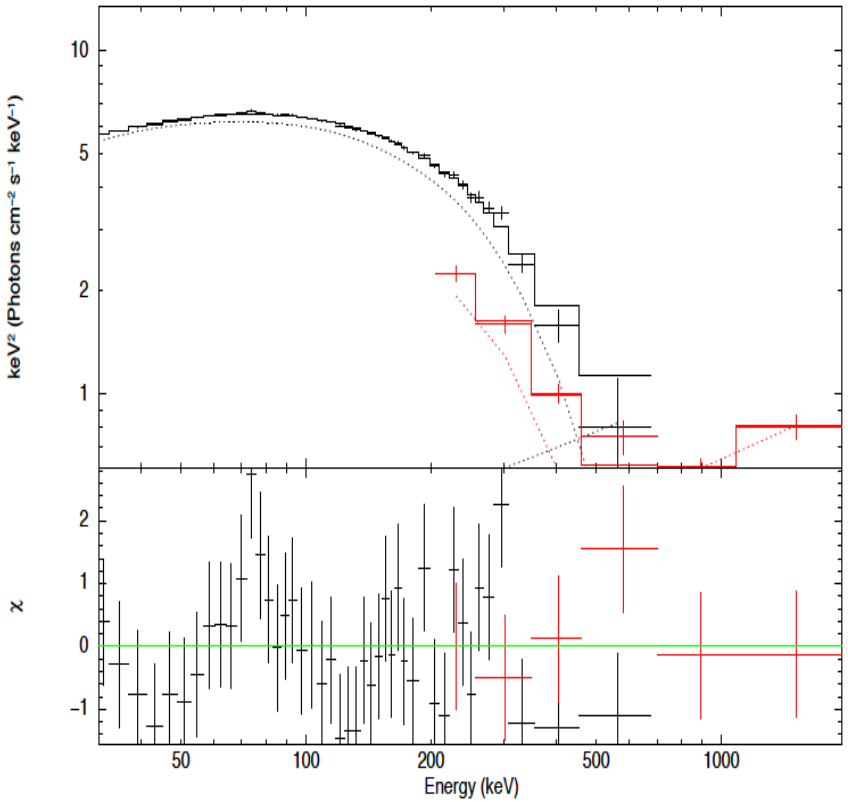
IBIS Crab Spectrum

- ISGRI data: rev's 834-839
- PICsIT data: rev's 39-1794 (~10 Ms)
- Fit to GRB Model:
  - Γ_1= -1.96
  - Γ_2= -2.30
  - E_c= 422 keV
  - Cross Norm = 0.52
- PICsIT 5% sys err
- Similar to Jourdain & Roq



IBIS Cyg X-1 Spectrum

- ISGRI data: rev's 51 to 877 (~hard)
- PICsIT data: rev's 39-1794 (~hard)
- Fit to reflect*(comptt+po)
  - kT_e= 59 +/- 2 keV
  - τ= 1.05 +/- 0.03
  - Γ= 1.3 +/- 0.2 keV
  - Cross Norm = 0.52
- PICsIT 5% sys err
- Γ consistent w Rodriguez e



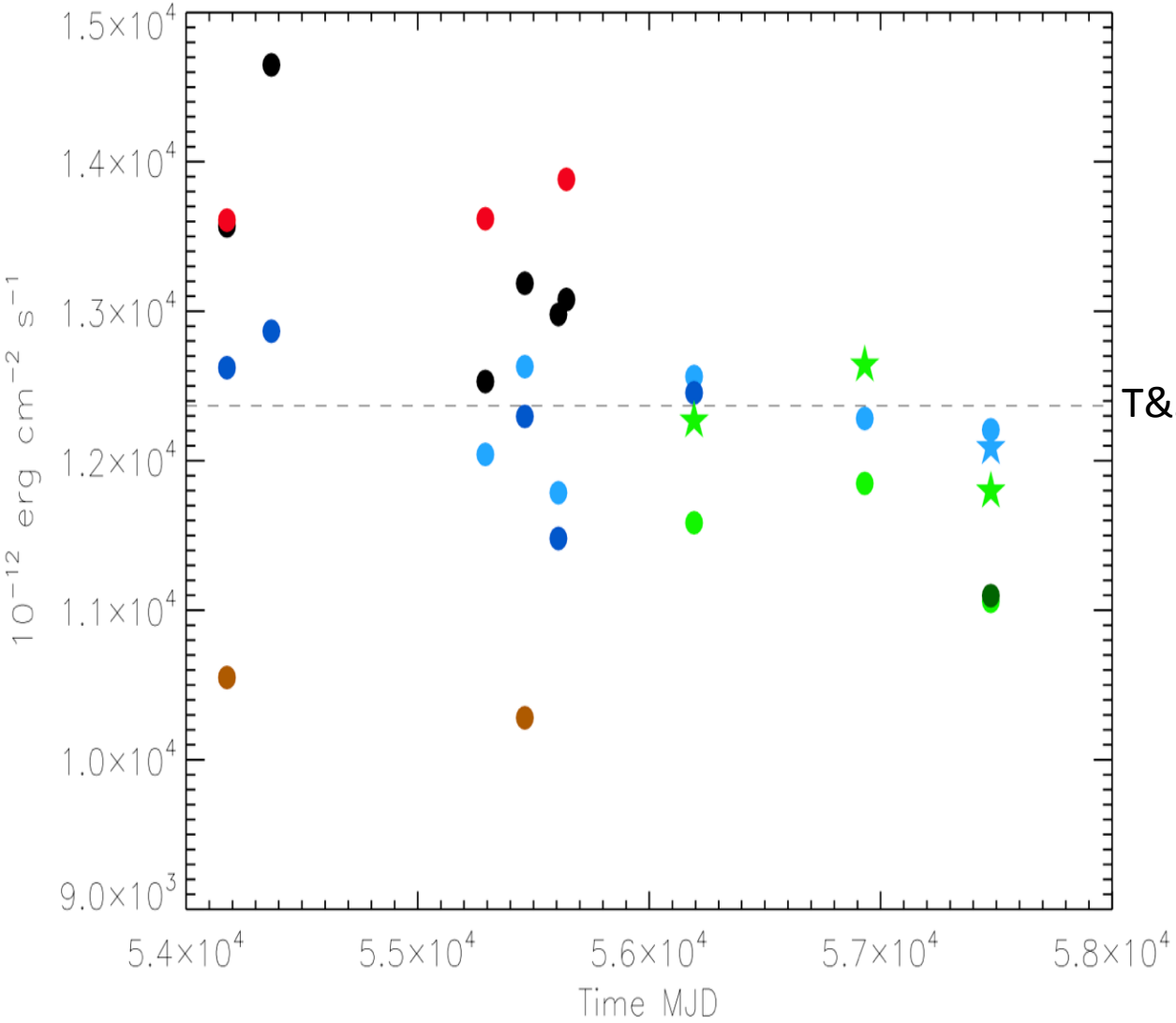
Cross calibration activities (IACHEC)

- IACHEC «Pandemic report» published on arXiv (https://arxiv.org/abs/2111.01613)
- Virtual Fall meeting of IACHEC was held on 8-10 November 2021. Major calibration updates from NuSTAR and INTEGRAL/ISGRI were reported
- New calibration of NICER using Crab raster observations. Progress in NuSTAR/Nicer comparison
- Crab paper dataset was updated with Astrosat/CZTI, new Nustar calibration and OSA11 ISGRI data.
- G21.5-0.9 calibration model: planning more work to analyse multi-mission data and a new cross-cal paper.
- Forthcoming cross-cal project on PSRB1509-58 (timing data)

IACHEC

International Astrophysical Consortium for High Energy Calibration

Crab Flux history 25-80 keV



T&S value

PCA

PIN

Nustar

Astrosat/CZTI

SPI

ISGRI

BAT

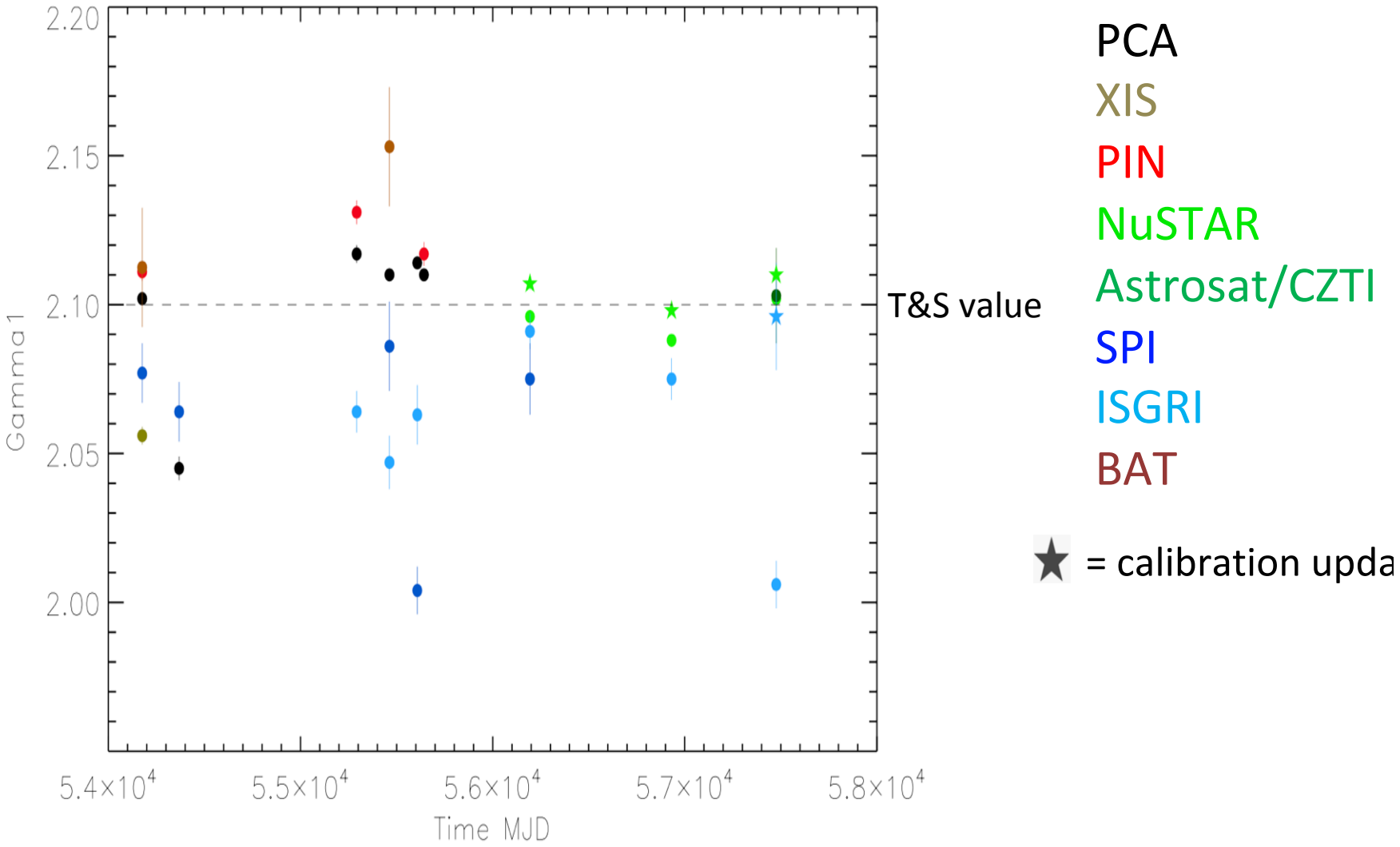
★ = calibration upda

https://iachec.org/wp-content/presentations/2021/

IACHEC

International Astrophysical Consortium for High Energy Calibration

Spectral slope (Γ, E<Ebreak)



https://iachec.org/wp-content/presentations/2021/