SPI vs Compton comparison

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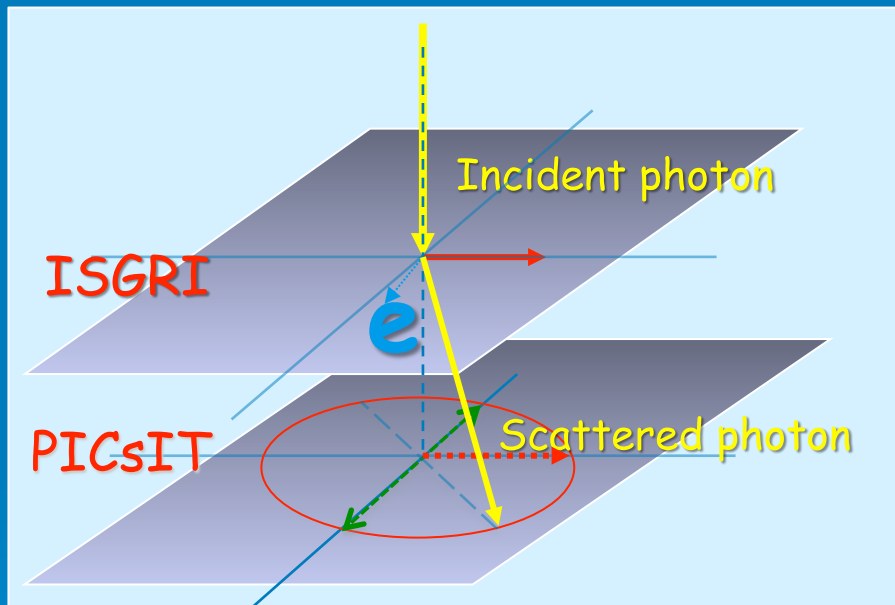
Plan

1. The IBIS/Compton telescope data analysis.

2. Spurious event substraction : Sco X-1

3. Comparison SPI/Compton : the Crab

4. The different Cygnus X-1 data

5. Comparison SPI/Compton : Cygnus X-1

6. Conclusions

The IBIS/Compton mode data analysis

The IBIS/Compton telescope

Incident photon

ISGRI

e⁻

PICsIT

Scattered photon

• The IBIS telescope is a coded mask telescope which could be used as a Compton telescope.

• The Compton mode events are ISGRI and PICSIT events in temporal coincidence, within a window $\tau_W \approx 3.8$ µs.

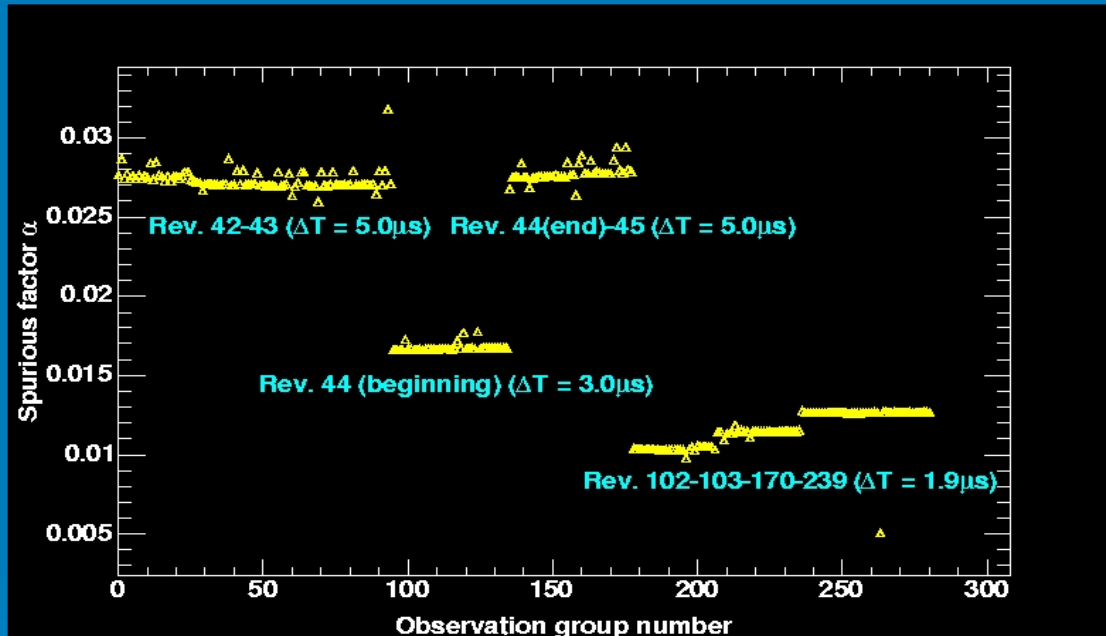• Within this window, chance coincidence, called hereafter "spurious events", may also occur.

Data analysis summary

➢ Event selection

➢ Spurious events correction

➢ Uniformity correction*

➢ Coded mask deconvolution*

* similar to ISGRI data analysis

Spurious correction

"SPURIOUS EVENTS"

⬇

1 ISGRI event + 1 independent PICSIT event detected during the coincidence window
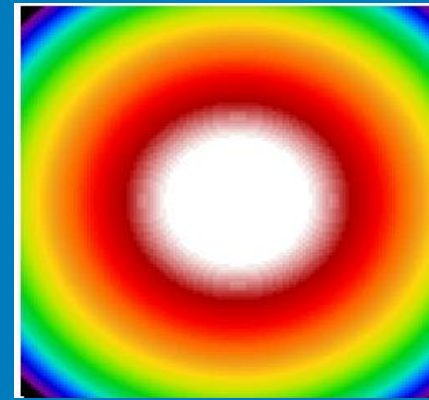
⬇

False source detection

1. We compute the spurious events contribution: $N_{SPUR}/N_{ISGRI} \sim \tau_W N_{PICSIT}$

2. We compute "fake" spurious events, composed of one ISGRI single event randomly associated to one PiCsIT single event.

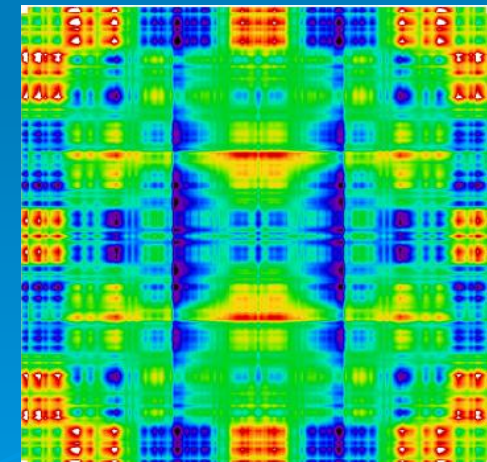3. We build sky image with these events that we subtract from the Compton ones.
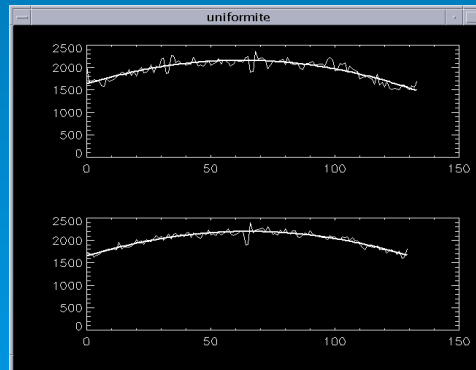
Compton imaging: Non-uniformity corrections
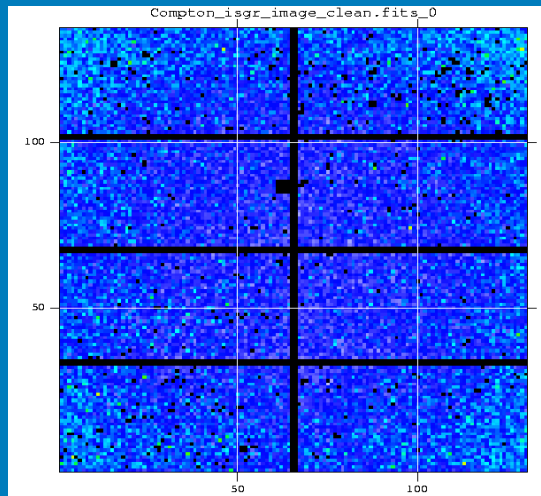
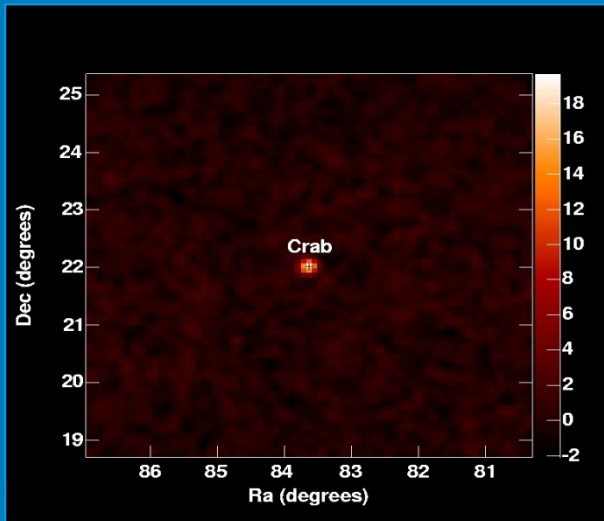Compton/ISGRI image

Uniformity map

Uniformity map deconvolved

Uniformity profiles

Image deconvolution
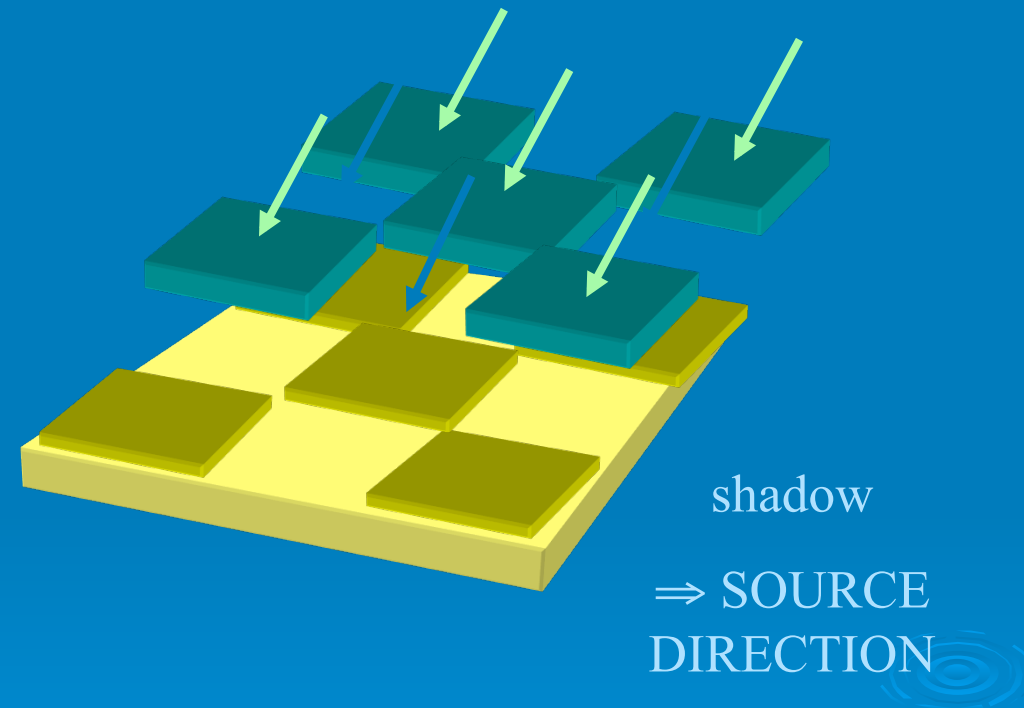
200-800 keV T=300 ks

Shadowgram deconvolution

shadow

$\Rightarrow$ SOURCE DIRECTION

Spurious events substraction: Sco X-1

Sco X-1

F_ν (2003-2009)
in 10^{-3} count/s
~ 3 Ms

300-400 keV   : -3,2 ± 1,7
400-600 keV   : -2,8 ± 2,3
600-1000 keV : 1,4 ± 3,1
1000-2000 keV : 5,4 ± 2,9

Total 0,8 ± 2,0 (0,4 σ)

Comparison SPI/ Compton: the Crab
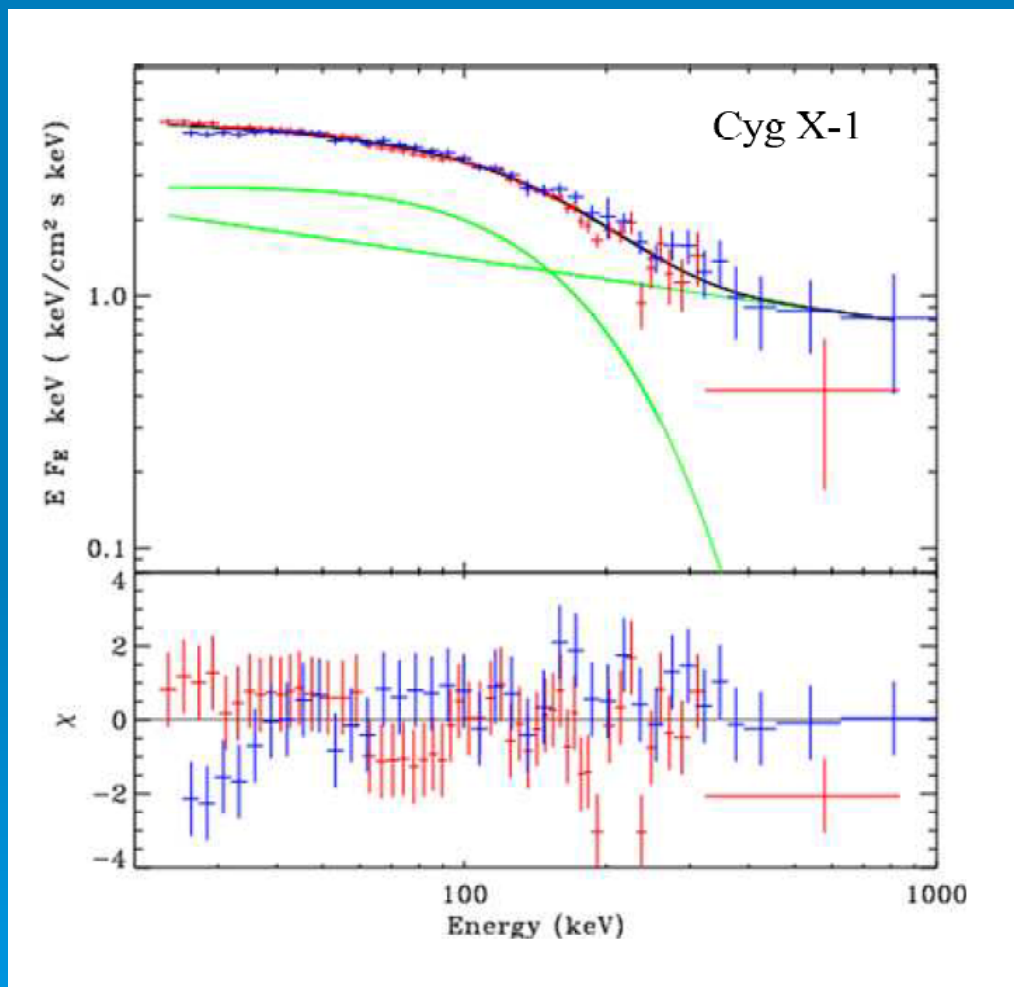
Comparaison Compton vs SPI : the Crab (2003 – 2009)
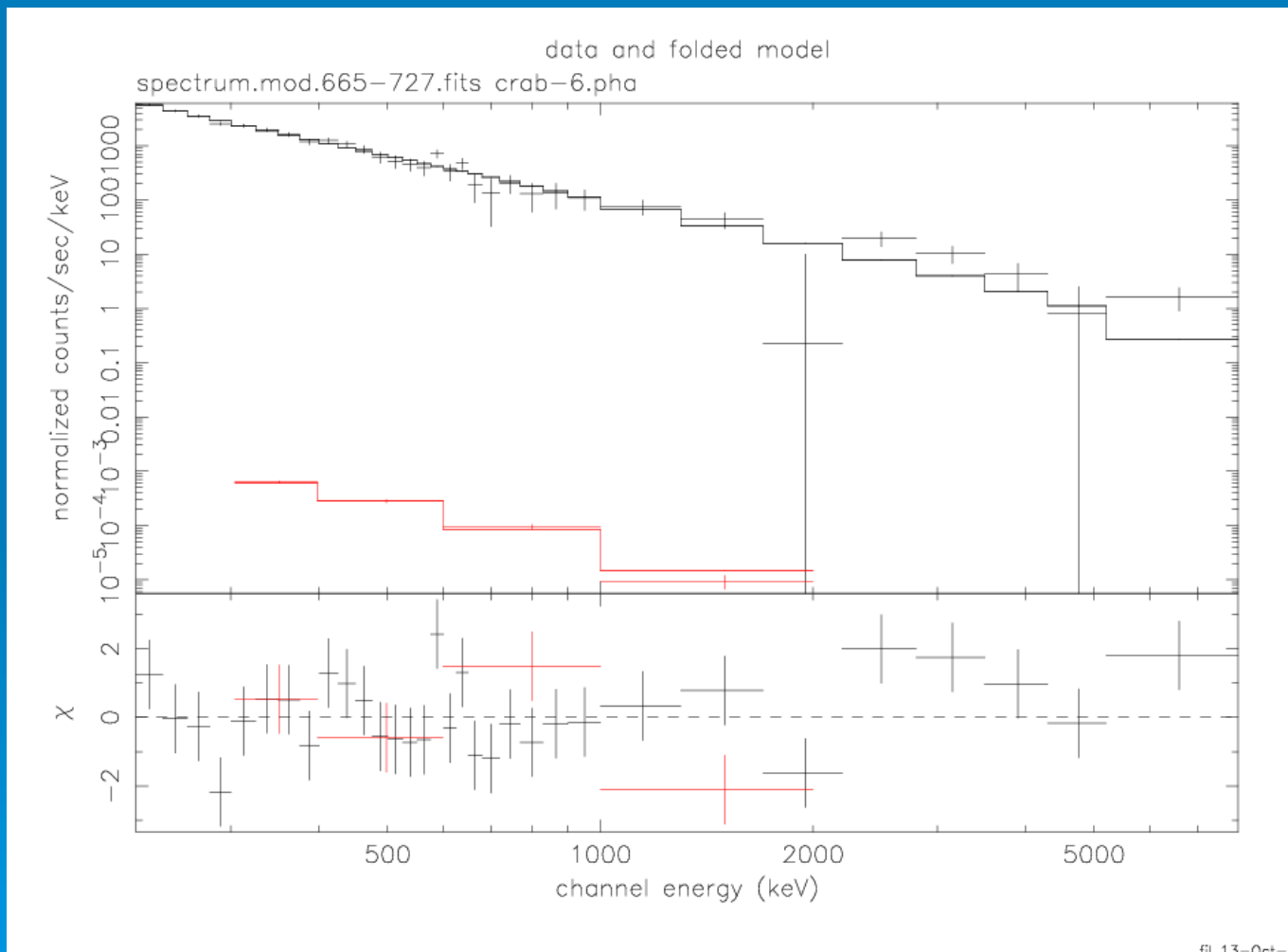
$\alpha = -2.2 \pm 0.05$

$F_{1keV} = 16.03 \pm 4.5$

Cste C/SPI = 0.44

1896 Sw

$X^2_r = 1.37$ (33 dof)

Compton mode and SPI are consistent in the 300 - 2000 keV range provided a normalisation factor of 0.44 ...
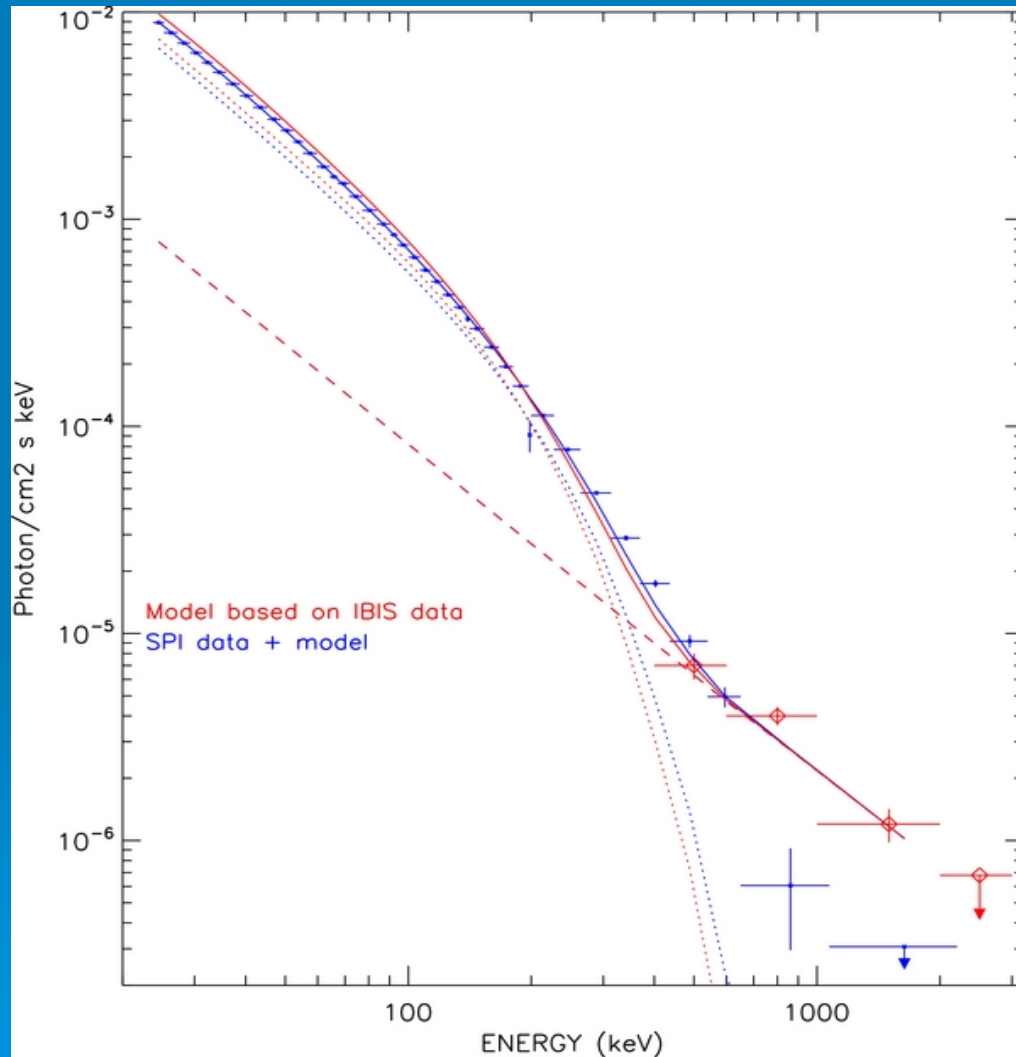
The different Cygnus-X1 data

SPI data (νFν):
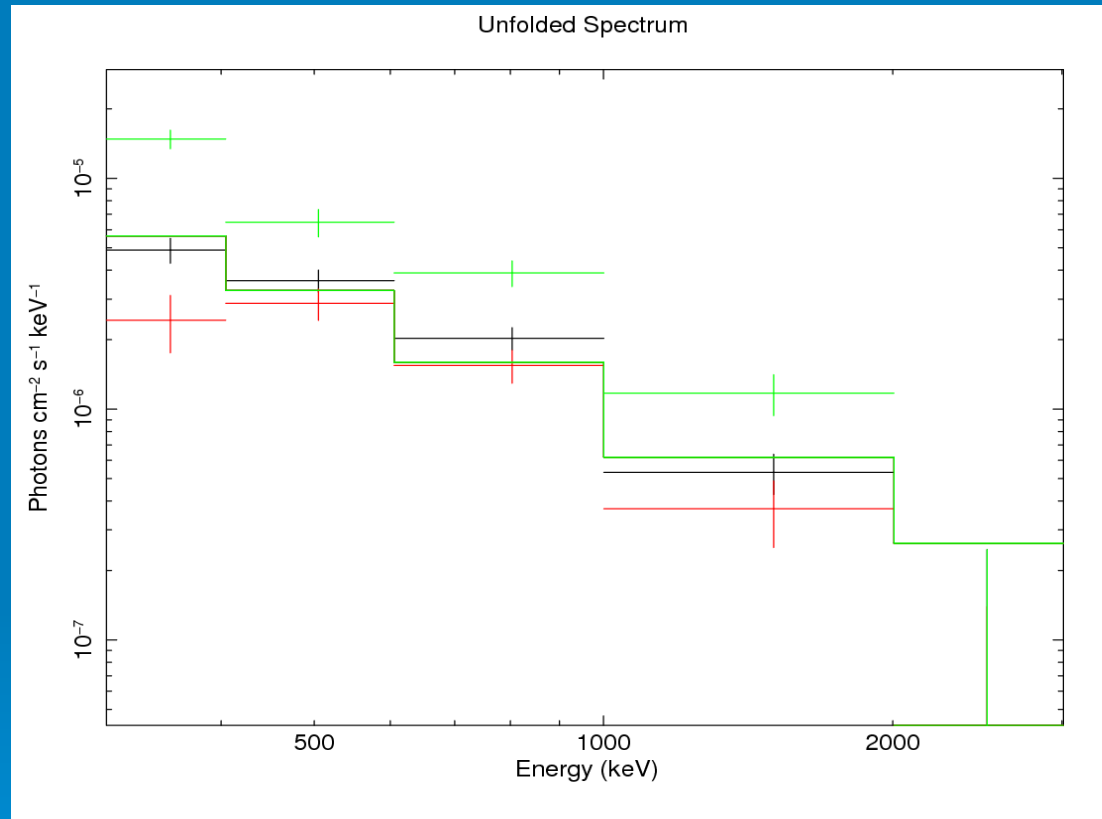# Bouchet (2010) from Malzac (2006)

Red : ISGRI
Blue : SPI

SPI data (Fν): Jourdain (2012)

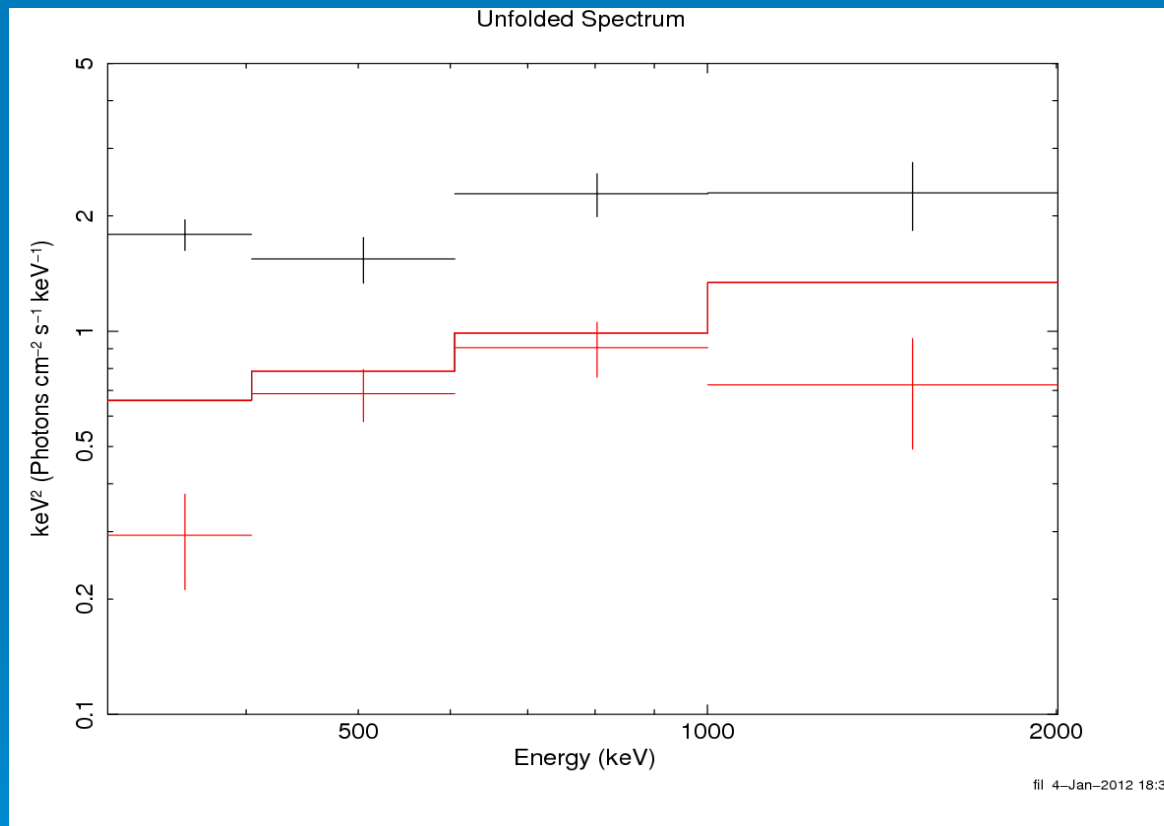Red : IBIS
Blue : SPI

Compton data (Fν): 2003 – 2009

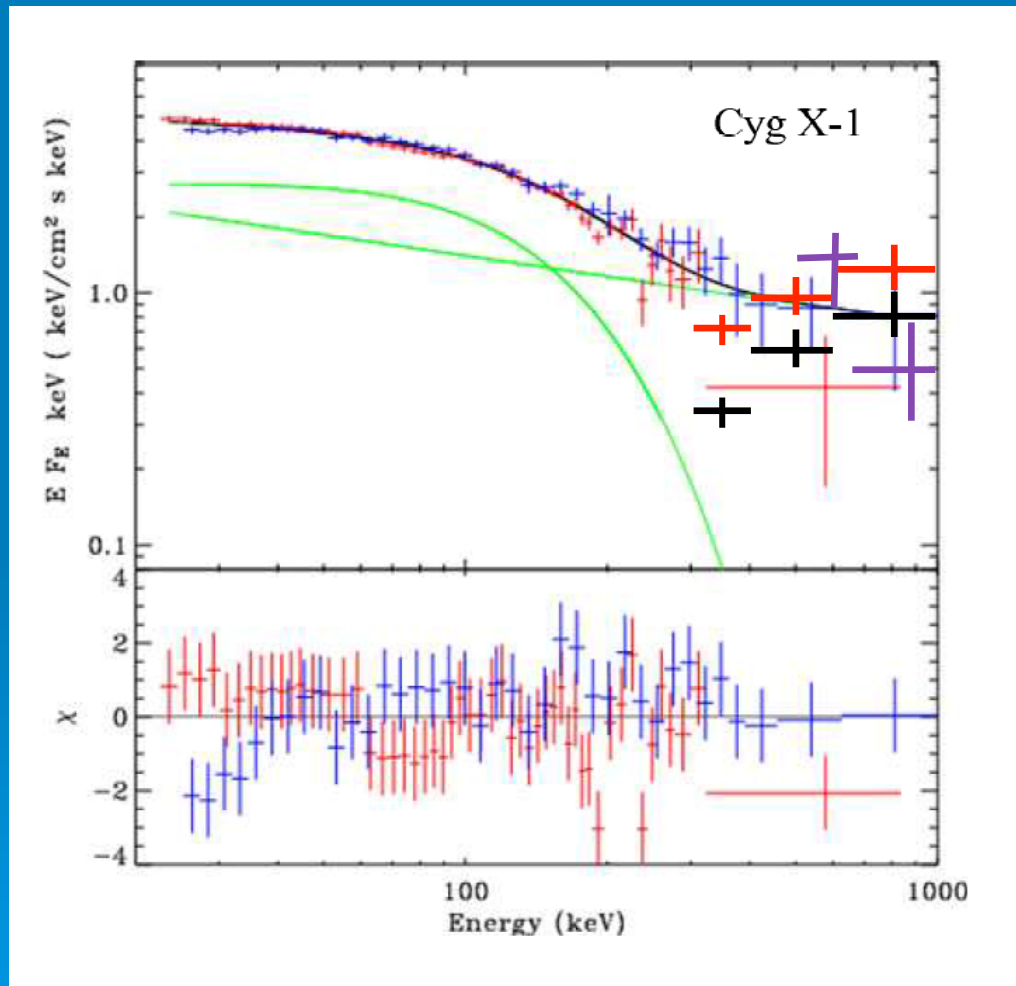Green : 03/08 – 12/09 (L11)
Black : 03/03 – 12/09
Red   : 03/03 – 12/07

Compton data (νFν): 2003 – 2009

Black : 03/08 – 12/09 (L11)
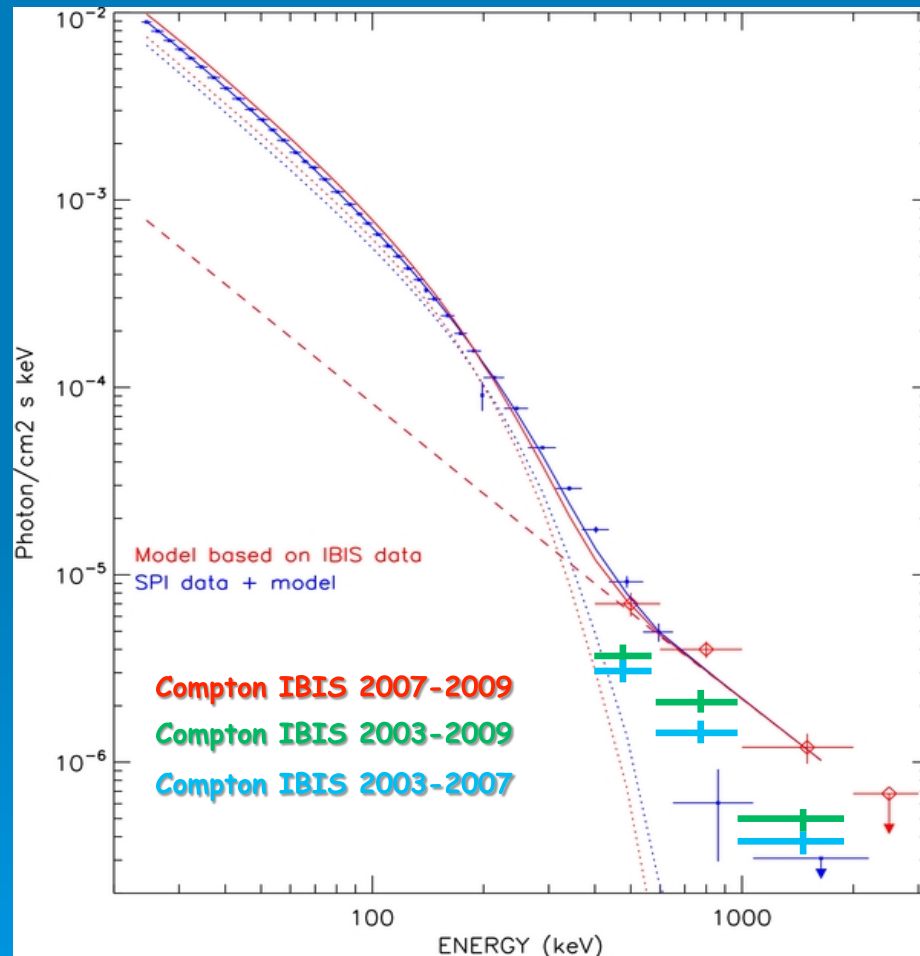**Red   : 03/03 – 12/07**

Comparison SPI/ Compton: Cygnus X-1

Compton vs SPI comparison ($\nu F\nu$): Bouchet vs Laurent

Blue : SPI (B. 2010)
Black : Compton
(03/03 – 12/07)
Red : Compton
(03/03 – 12/09)
Purple : SPI (J. 2012)

Compton vs SPI comparison (Fν): Jourdain vs Laurent

Valeur Fν (2003-2009)
en 10^{-6} ph/cm²/s/keV

300-400 keV   : 5,7 ± 0,7
400-600 keV   : 3,7 ± 0,4
600-1000 keV : 2,0 ± 0,2
1000-2000 keV : 0,5 ± 0,1

Conclusions

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- Sco X-1 : no strong systematic effect due to spurious events

- Crab : The Compton and SPI mean spectrum over 2003 – 2009 are consistent provided a constant factor Compton/SPI = 0.44

- Cygnus X-1 : Cross-calibration and/or MeV variability ? Work with SPI people on-going …