IBIS Response Tuning with the Crab

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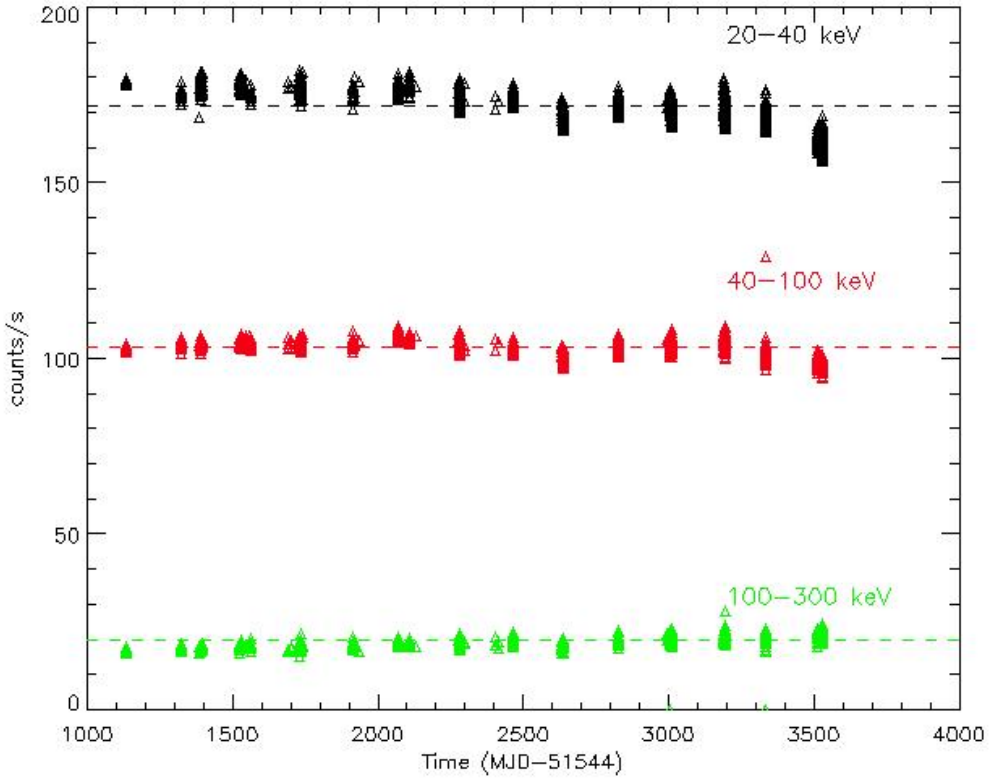
Long term Crab light curves



"Raw" count rates from imaging data obtained with OSA-8. Systematic deviations are appearing that are corrected post-facto in the response (but only for spectra).

Need periodic re-calibration once/year (*time dependent* responses to account for systematic deviations)

Post-facto Response Correction

Obtained by using Crab observations: performed regularly (2 times/year)

Currently Response matrices are *time* dependent and also *software* dependent: e.g. for improved version of energy correction package

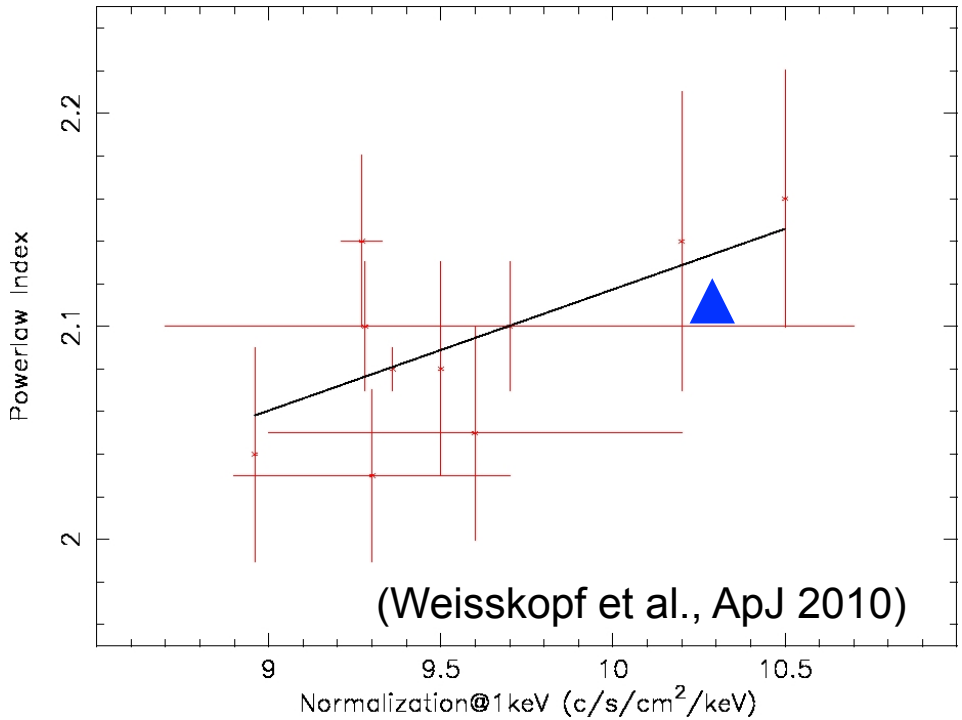
The response correction is performed once a year as it is observed that the instrument response changes by > ~2% on this time scale

Latest responses delivered for OSA 8 in March; now used with OSA-9

Reference Crab Model

- Crab model for post-facto correction:
- Broken power law, E_{break} =100 keV, $norm_{100keV}=6.2\times10^{-4}$

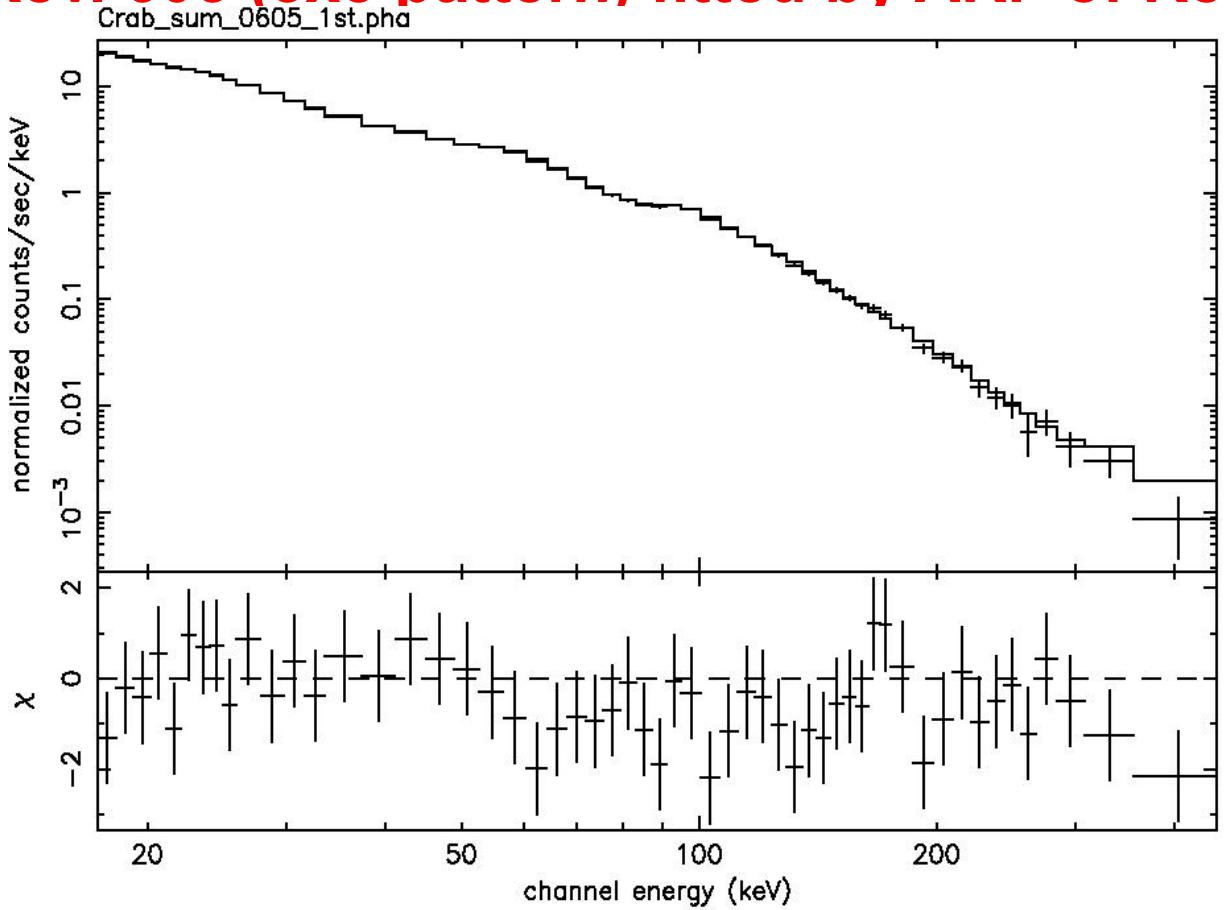
  $\Gamma_1=2.11$, $\Gamma_2=2.23$



Eploiting the evidence from the SPI data for a spectral curvature of the Crab

Relatively good agreement with previous absolute measurements of Crab Nebula plus pulsar

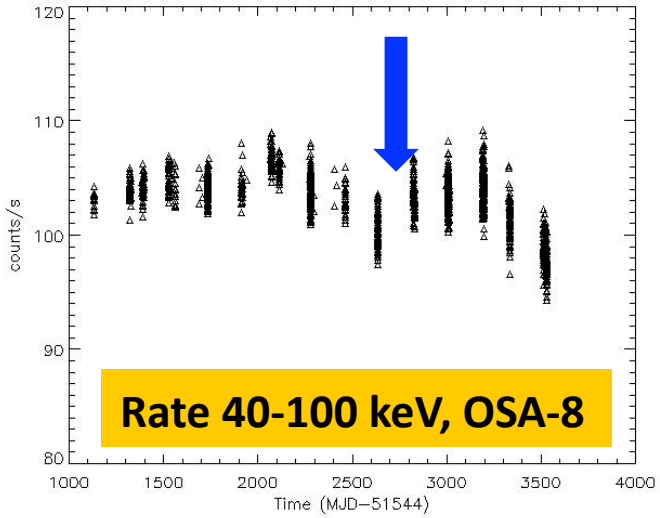
Crab Rev. 605 (5x5 pattern) fitted by ARF of Rev. 666



Crab observations are also used to test performance of the correction.

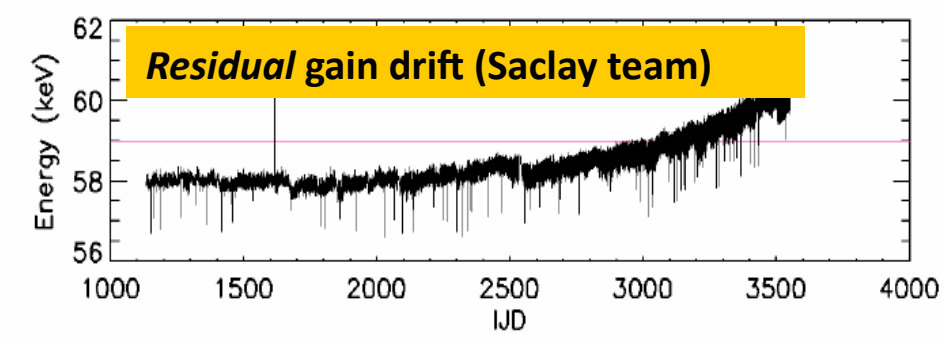
Errors with 2% syst, χ^2_r=0.98 ***No change in spectral parameters and normalization***

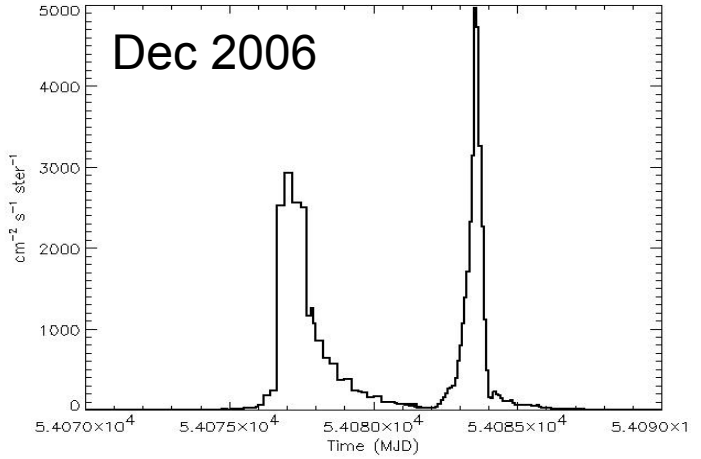
A change of trend in most recent data



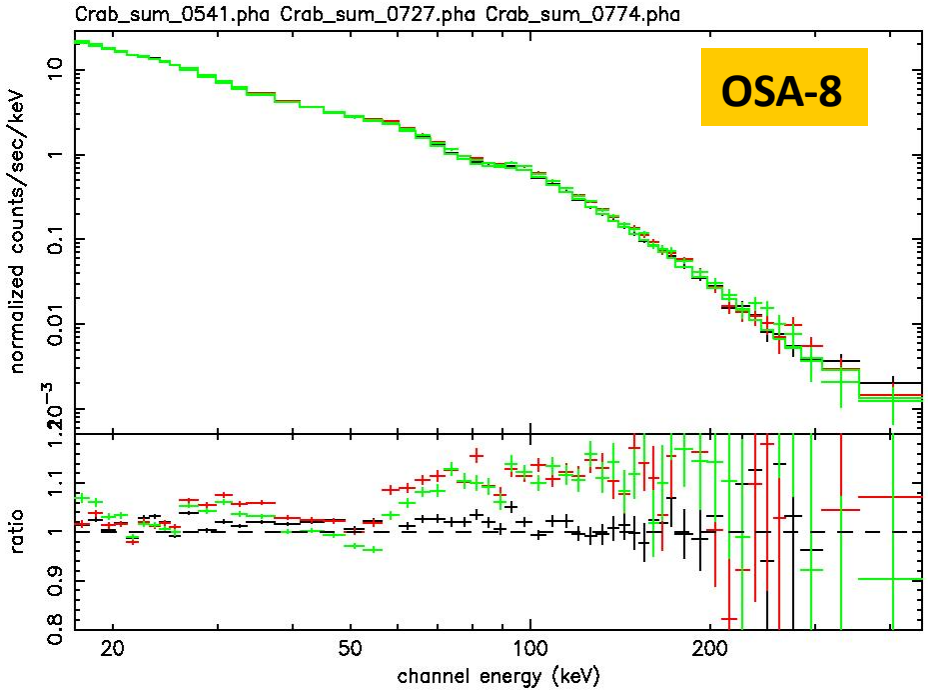
- Changing trend in the count rates visible from ~IJD 2500
- Effect, visible in OSA-8 is also present in OSA-9 (email from G.Bélanger)
- A big proton flare occurred starting at IJD 2531 (related to this?)

- but probably the effect is not a *true* instrumental effect: this is being investigated





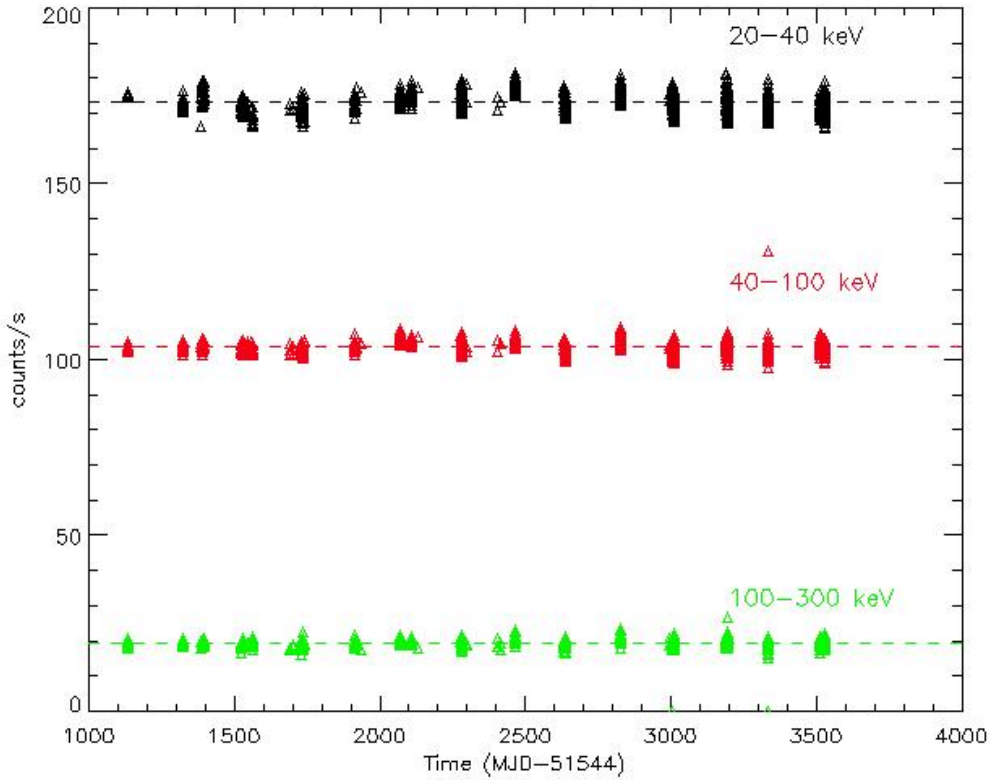
Spectra changes after March 2007



Rev. 541
Rev. 666
Rev. 774

The fit of the Crab data of Rev. 666 and Rev. 774 with the Rev.541 response. A major change occurs between March 2007 and March 2008.

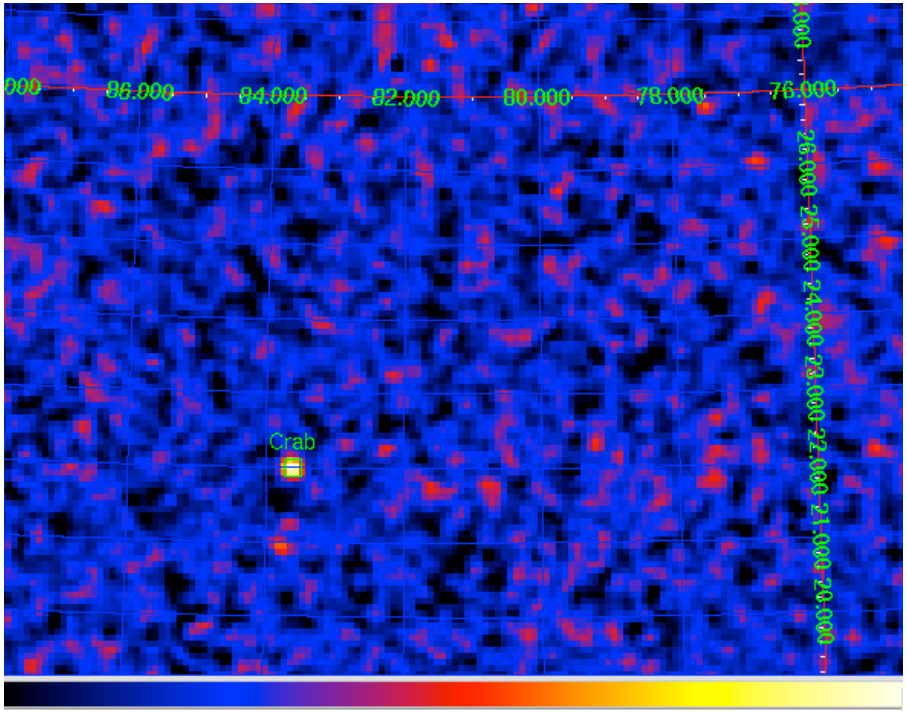
Long term Crab light curves (ARF corrected)



The previous "raw" light curve has been corrected with weight factors obtained by convolution of the Crab spectrum with the different ARFs.

Corrected data are accurate within ~2%

ISGRI High Energy Detection of the Crab emission



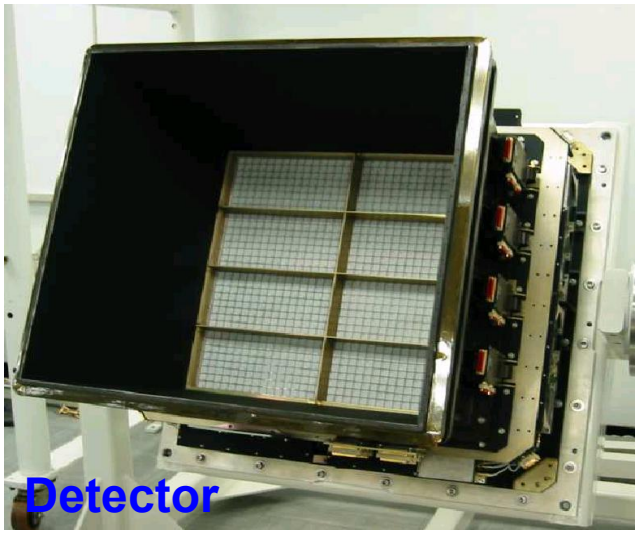
431-471 keV Exposure: 3 Ms
Significance ~ 10σ

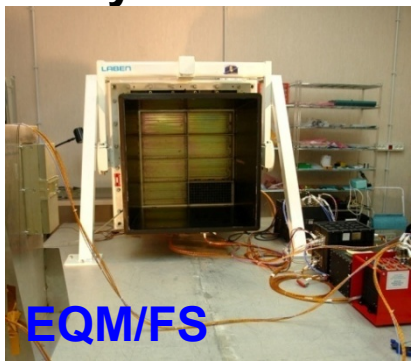
- **Crab is also detected in the 470-530 keV range (~4σ)**
- **Future work : try to ameliorate SNR up to energies > 500 keV to extend the high energy end of the in-flight calibration**

Thank you

IBIS status & performance summary

- In orbit since Oct 2002 (7.5 years)
- All subsystems (detectors, VETO, Modular Units and Electronics, DPE, On board Software, Cal Unit etc) are nominal
- No equipments have been lost, no usage of redundant parts
- No single failure or critical degradation
- Detector temperatures always within safe range
- Good supporting level from the Team, covering operations, S/W and calibration
- IBIS EQM model fully maintained/operated @ IASF-Roma





The fit of the Crab data of Rev. 839 with the Rev.774 response. Big change in only 6 months!

The main change seems a 4-5% loss in the effective area below 60 keV