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IBIS/ISGRI

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AIM/APC-FACe Paris

Man power

- Temporary CNES contracts
  - From 4 (present) to 3 FTEs in May
  - Present team probably completely renewed within 2 months → loss of experience
  - CNES help: one position already opened (in advance) till the end of the month
- Permanent people (CEA) less available → much longer development time (e.g. Fantomask)

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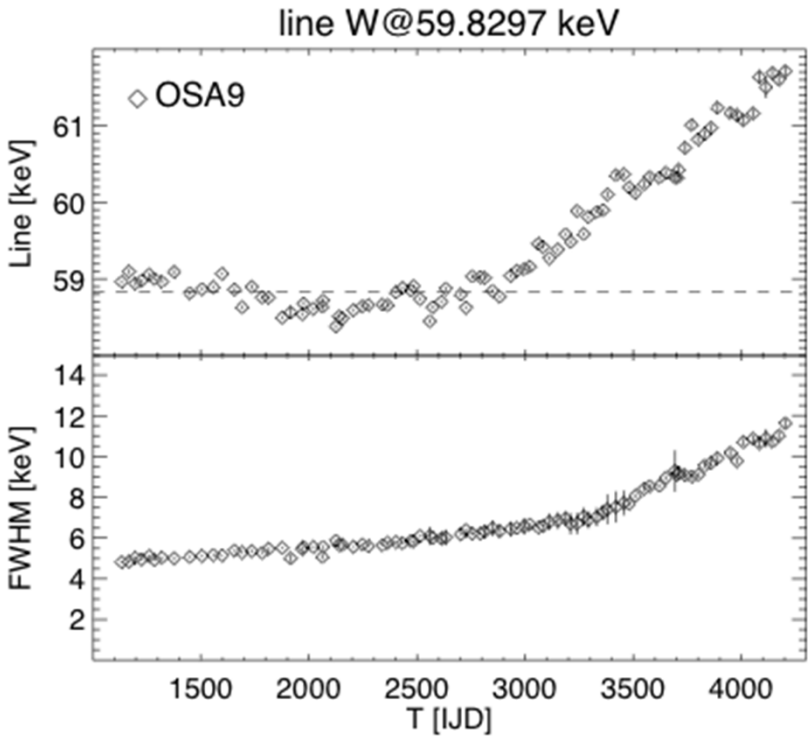
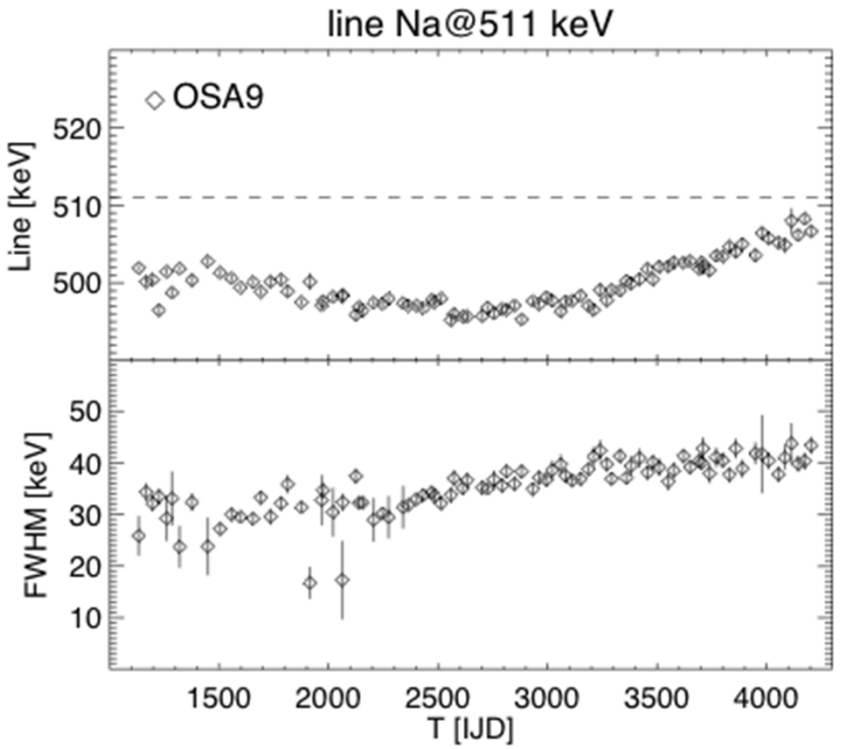
Spectral drift Calibration Status

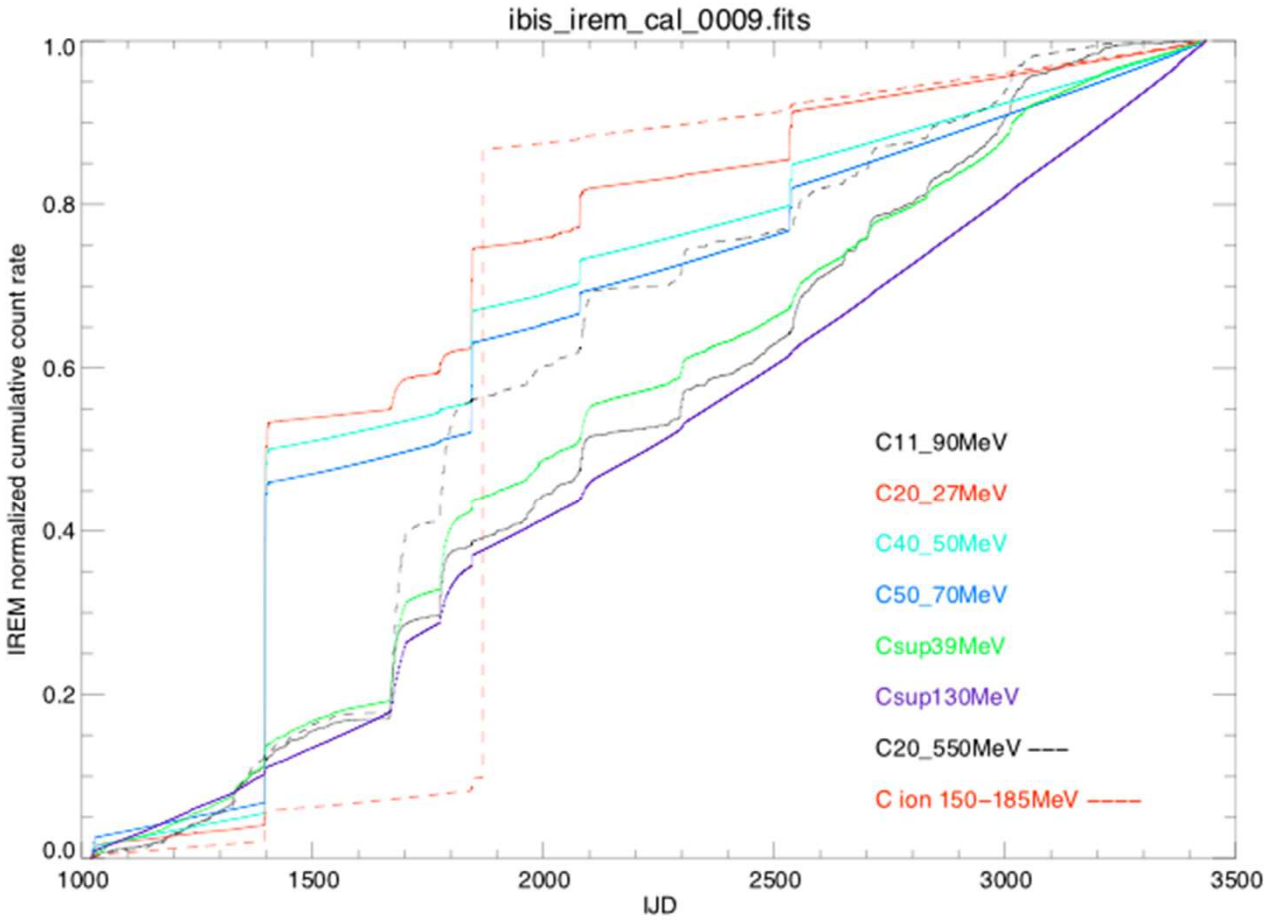
Reminder: OSA 9





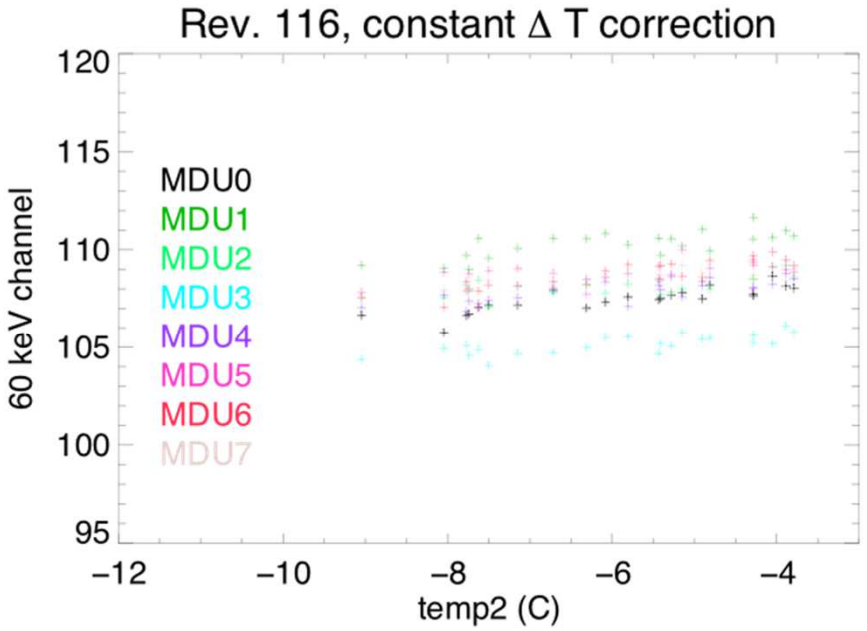
Reminder OSA9

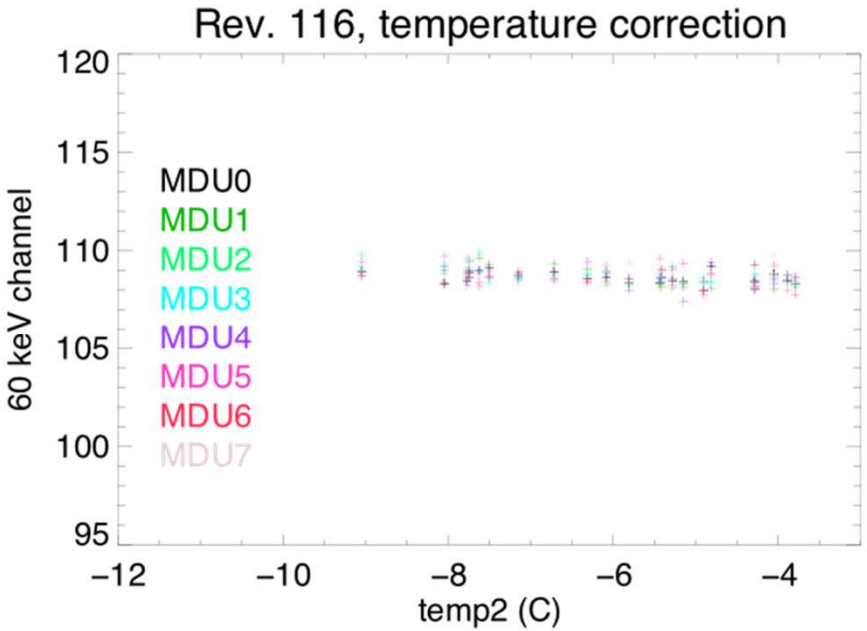
IREM counters used to describe the gain



OSA 10

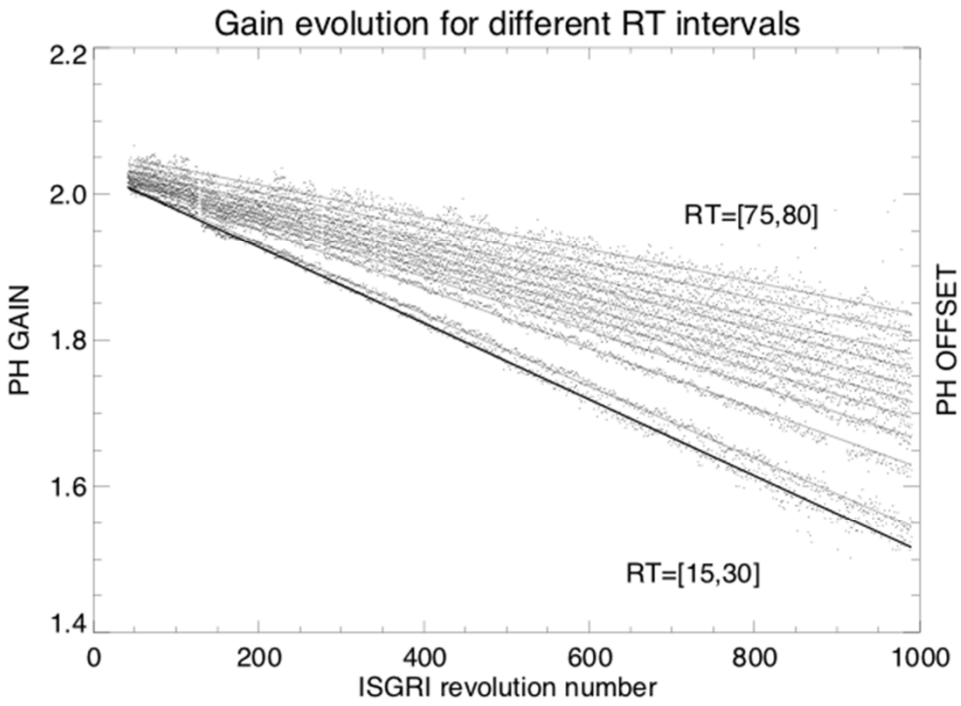
New temperature correction per MDU, using the temperature from thermal probes on the MDU frame (temp2)

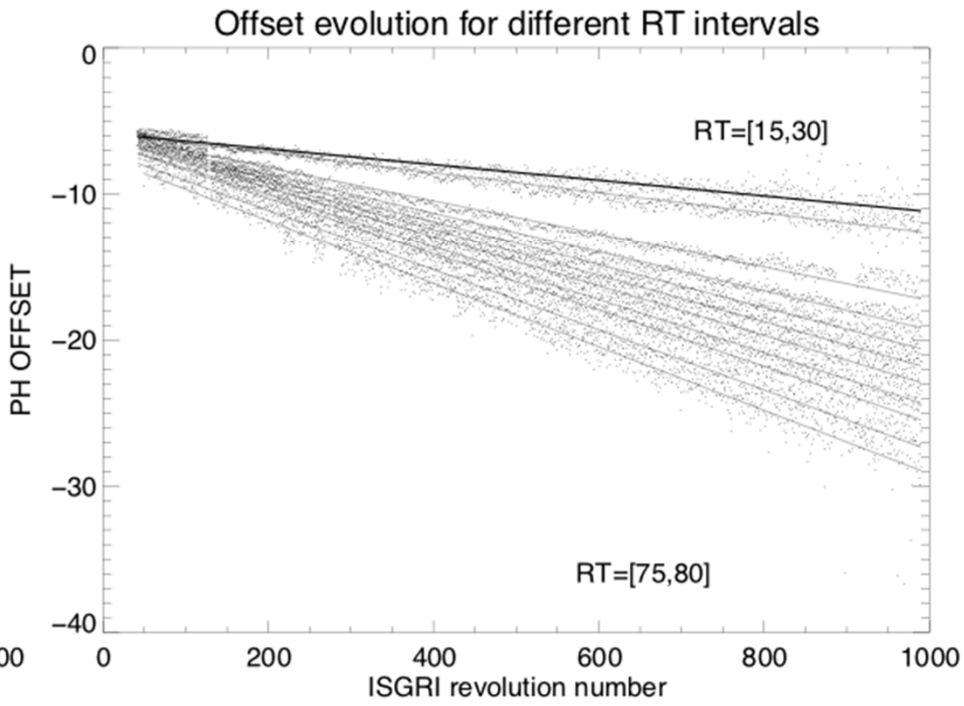




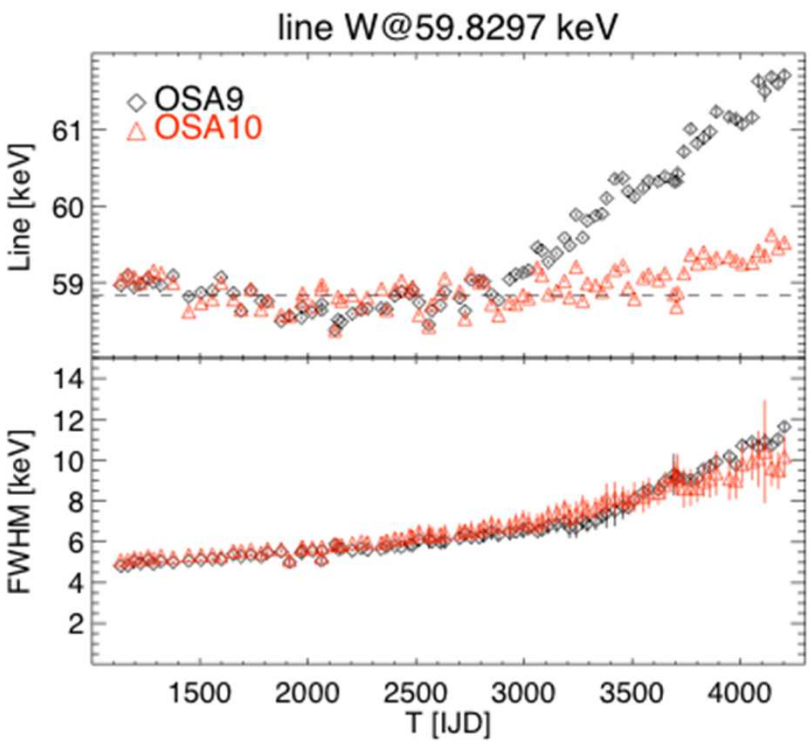
OSA 10

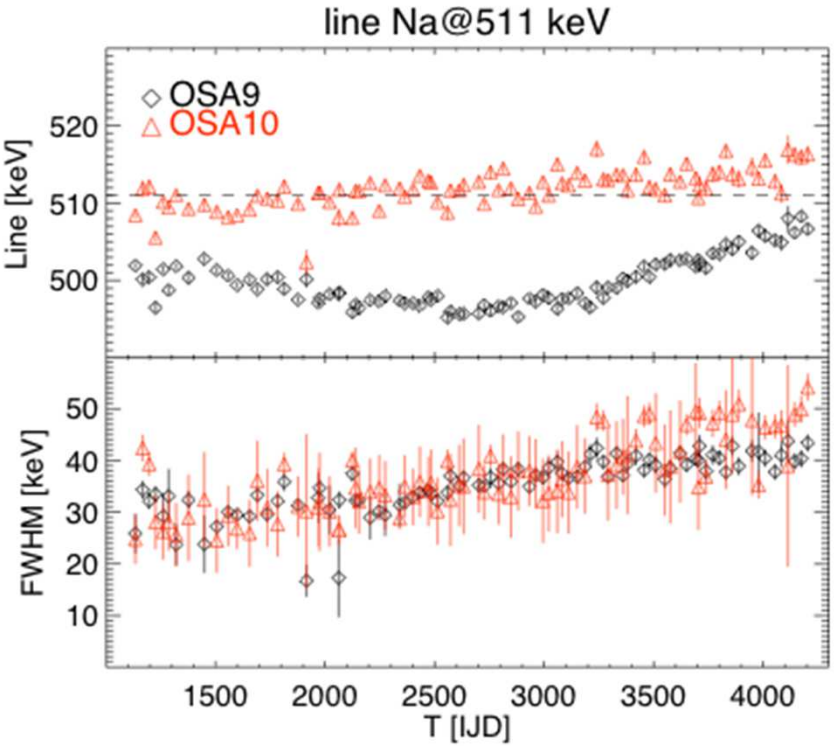
Linear description of gain/offset
Laws based on revolutions 42-990





OSA 10


line W@59.8297 keV
OSA9
OSA10
Line [keV]
61
60
59
FWHM [keV]
14
12
10
8
6
4
2
1500
2000
2500
3000
3500
4000
T [IJD]

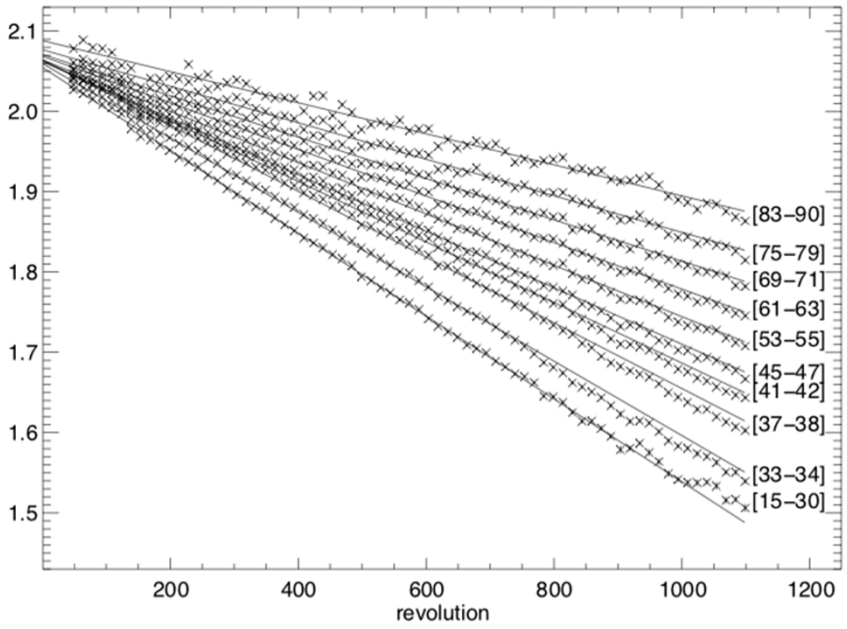

line Na@511 keV
OSA9
OSA10
Line [keV]
520
510
500
FWHM [keV]
50
40
30
20
10
1500
2000
2500
3000
3500
4000
T [IJD]

OSA 10 - update

Offset not linear trend for latest revolutions

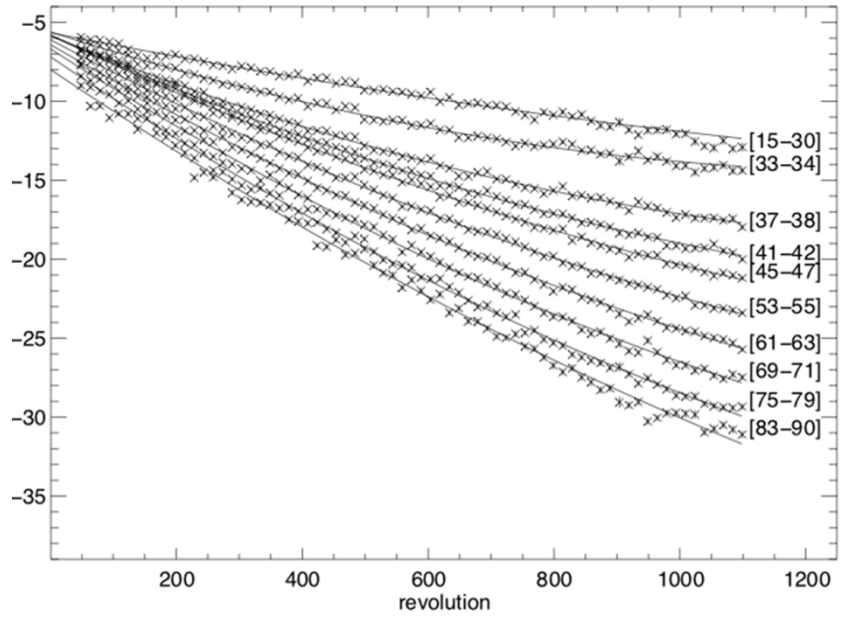
Extending the data base up to revolution 1106, we now use a quadratic fit for the offset

Gain, revolutions 42-1106



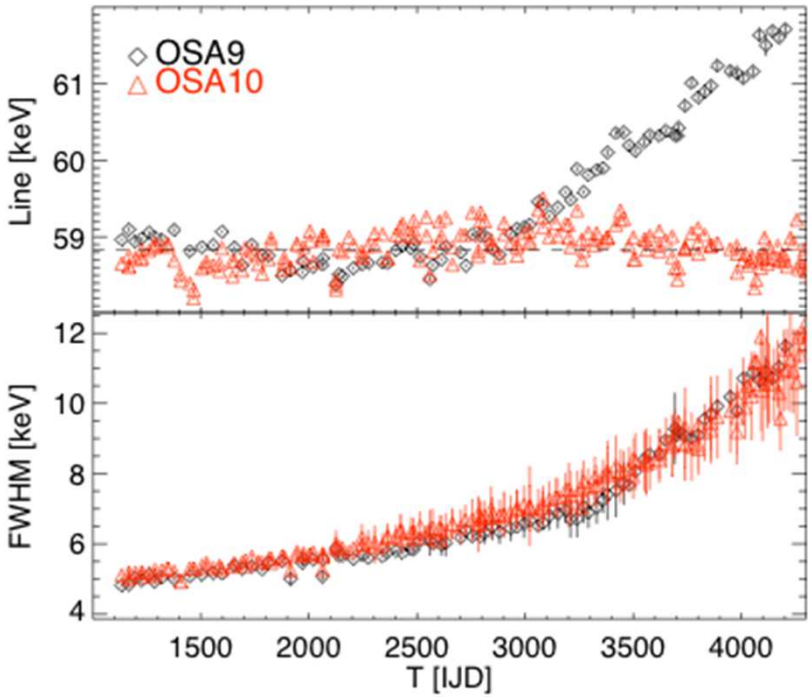
Linear fit for the gain

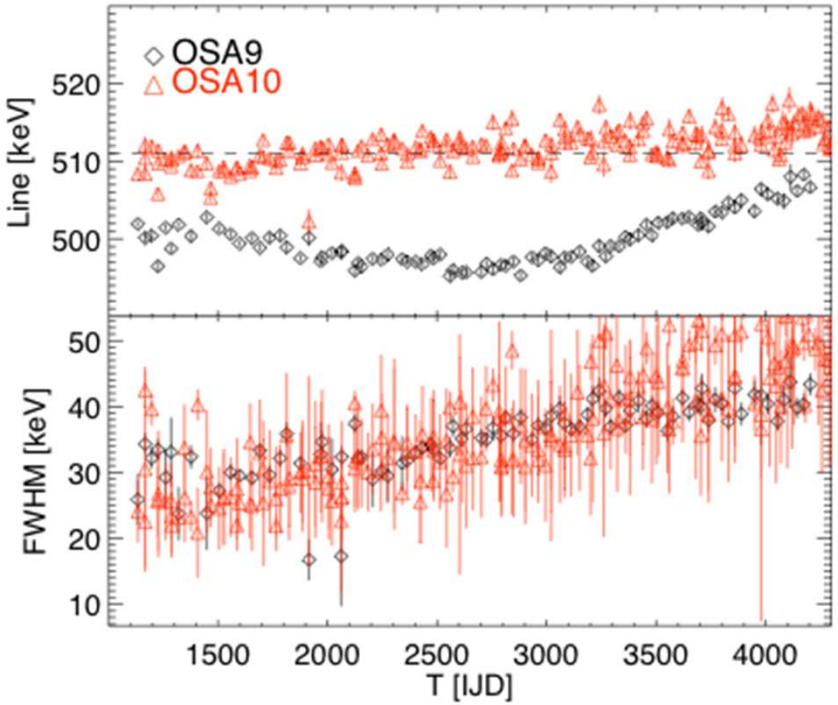
Offset, revolutions 42-1106



Quadratic fit for the offset

OSA 10 energy correction, final updated version





Conclusions I – energy correction

- Energy correction has been updated:
  New offset evolution now described with second order function
- W and Na lines stable along the mission

- Update and final verification of the C code ongoing before delivery

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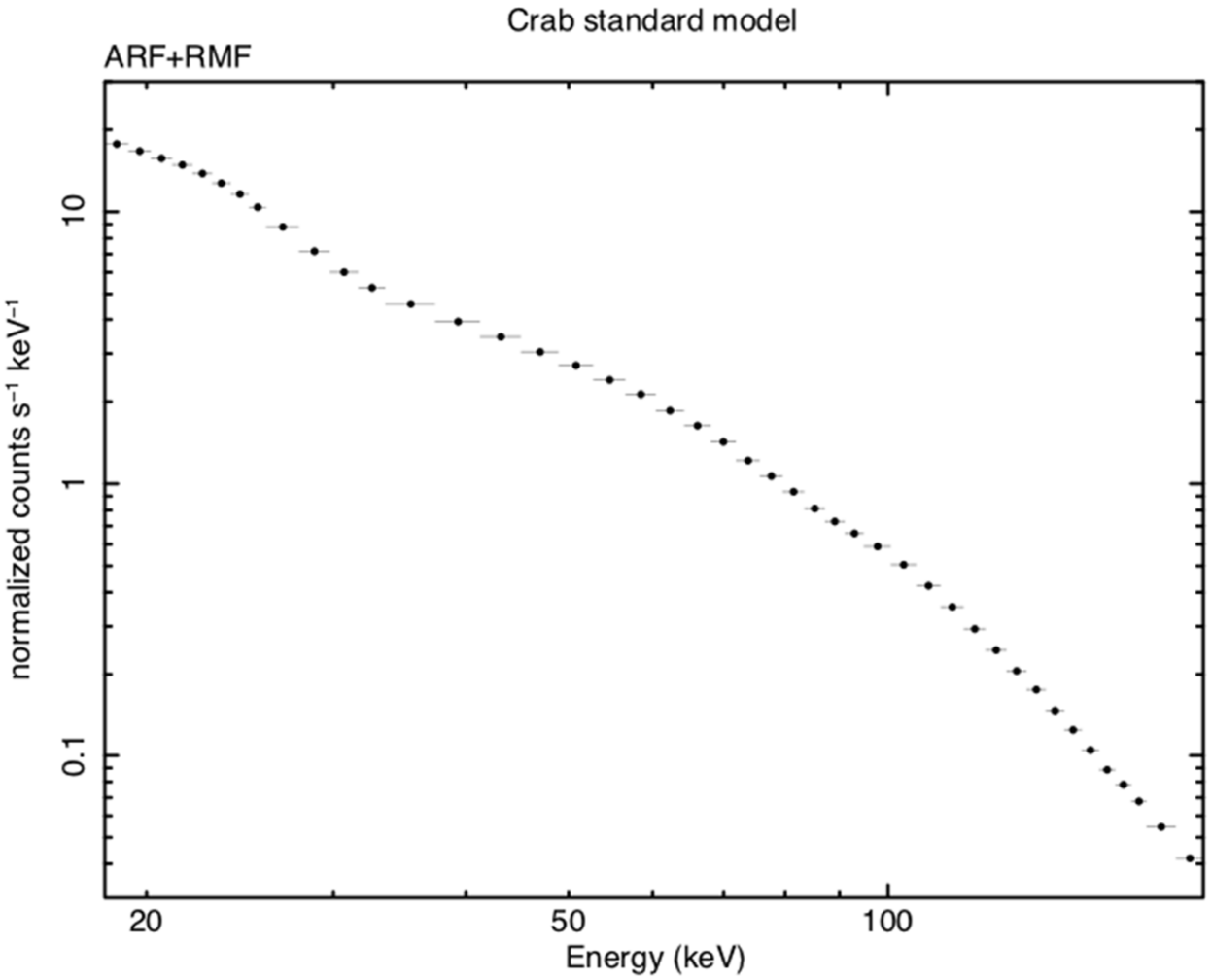
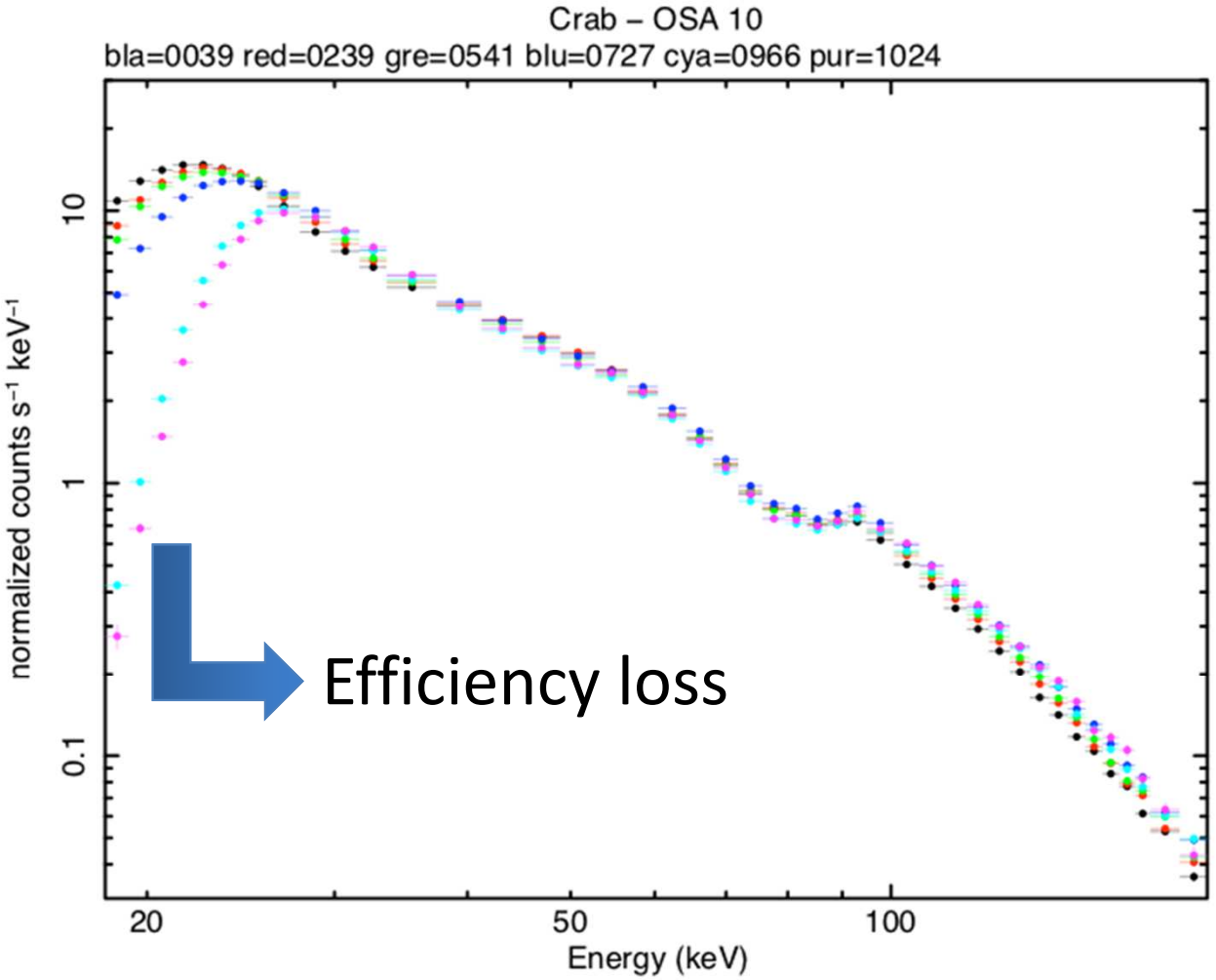
Photometry
Low threshold (LT) drift correction

Crab model

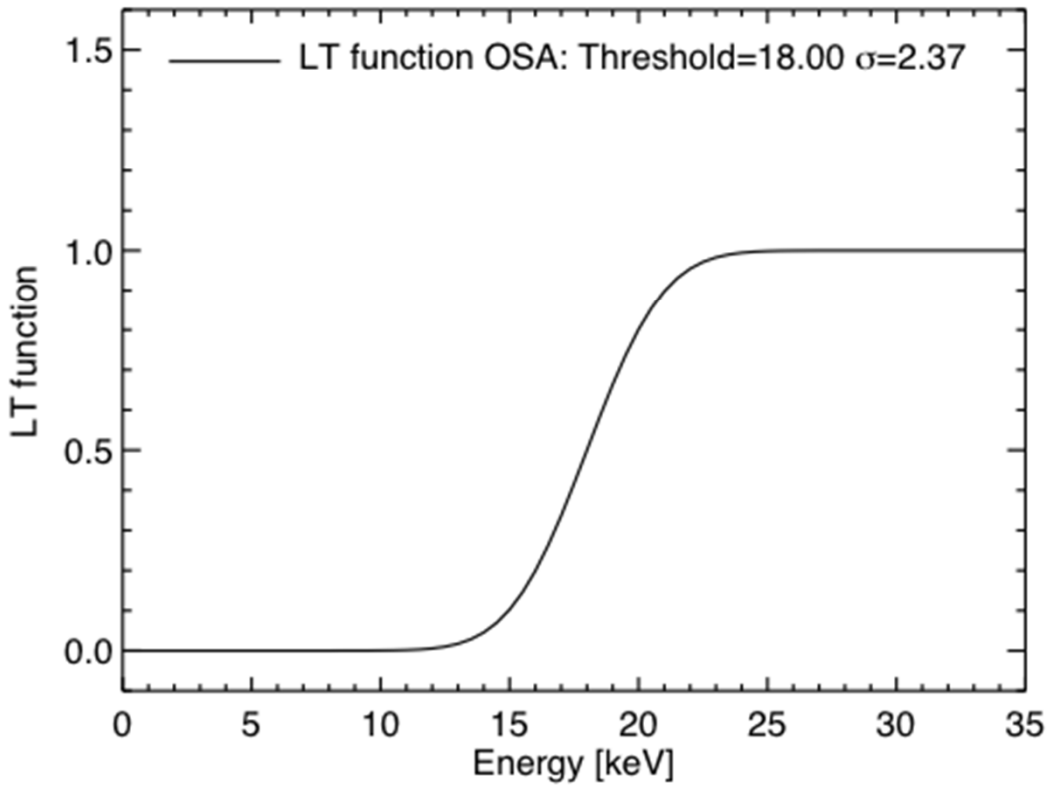

Crab standard model
ARF+RMF
normalized counts s⁻¹ keV⁻¹
10
1
0.1
20
50
100
Energy (keV)

No correction



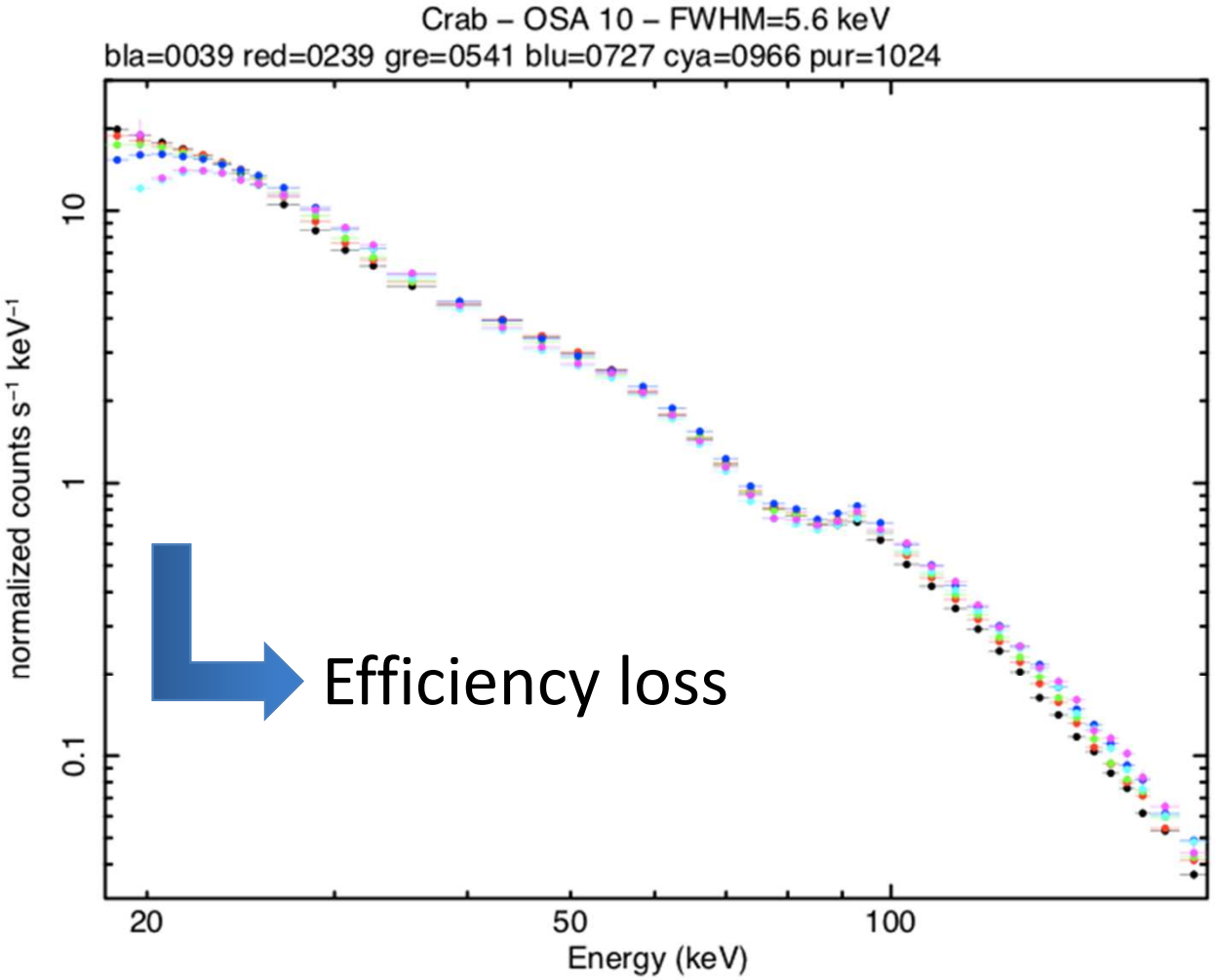
LT efficiency function

$$LT(E) = 0.5[1 + erf(\frac{E - E_{\mathrm{LT}}}{\sqrt{2}\sigma})]$$



Two main parameters: LT position E_{LT} and resolution σ

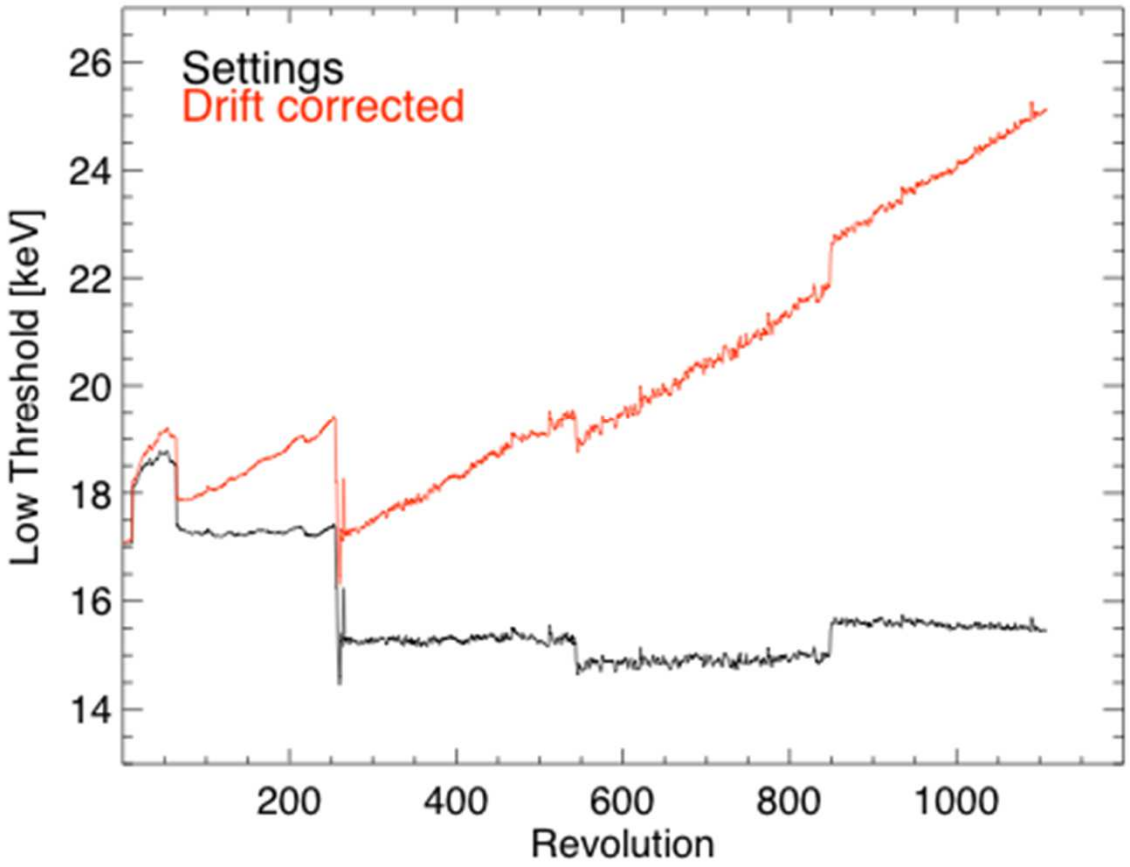
With correction: resolution constant



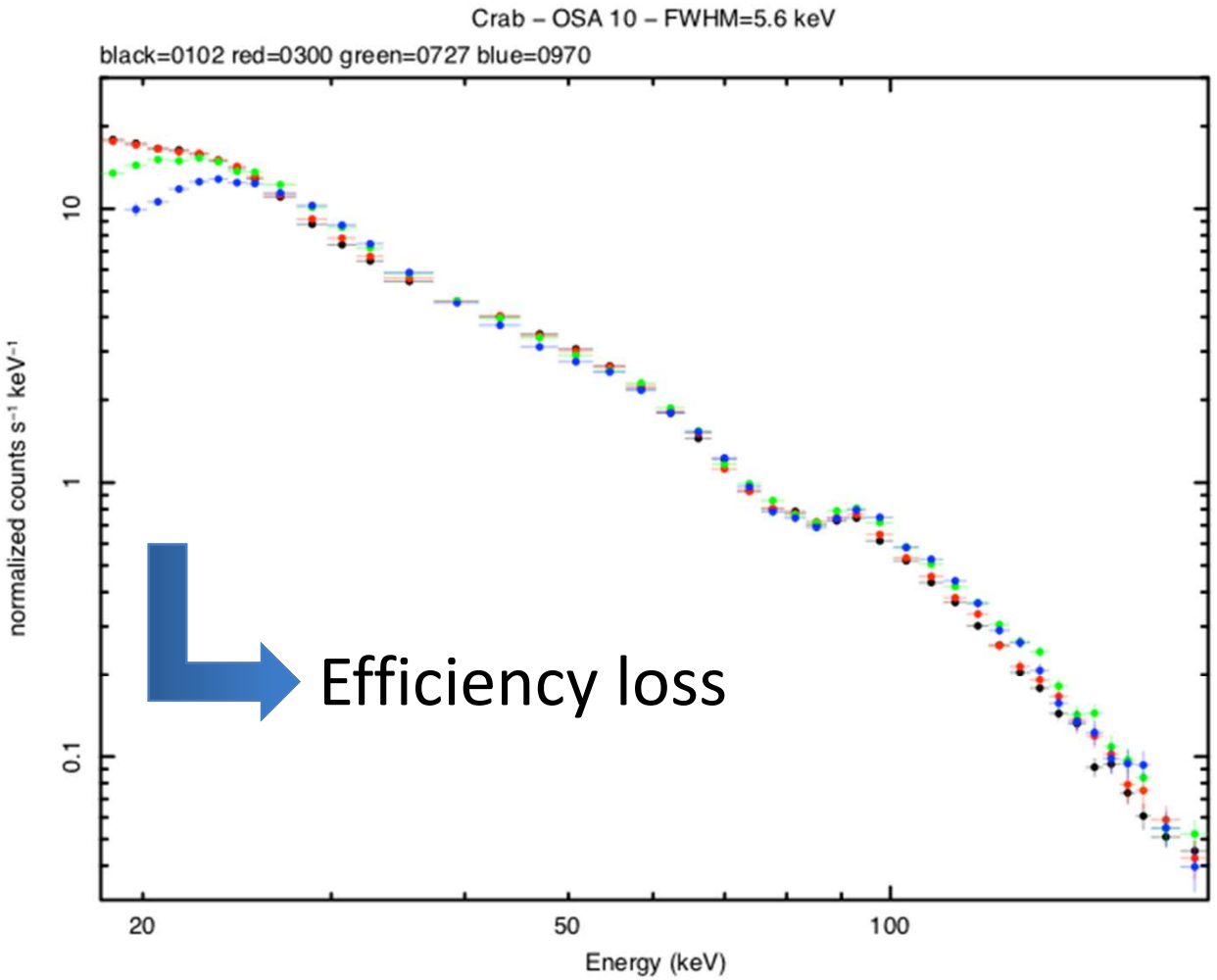
LT efficiency function: position

16384 pixels => 16384 E_{LT} read in the context files and corrected from the energy drift:

$$\overline{E_{\mathrm{LT}}} = \frac{1}{N_{\mathrm{valid}}} \sum_{i \in \mathrm{valid\ pixels}} E_{\mathrm{LT_i}} \ \text{where valid} = \mathrm{all} - \mathrm{dead\ pixels}$$



With LT correction (constant width)



LT efficiency function: resolution

$$LT(E) = 0.5[1 + erf(\frac{E - E_{\mathrm{LT}}}{\sqrt{2}\sigma})]$$

- Resolution = ? :
  - In OSA9: FWHM = 5.6 = FWHM(W line)
  - In OSA10: FWHM (W line) ≠ constant
  - But applying W line resolution gives efficiency loss

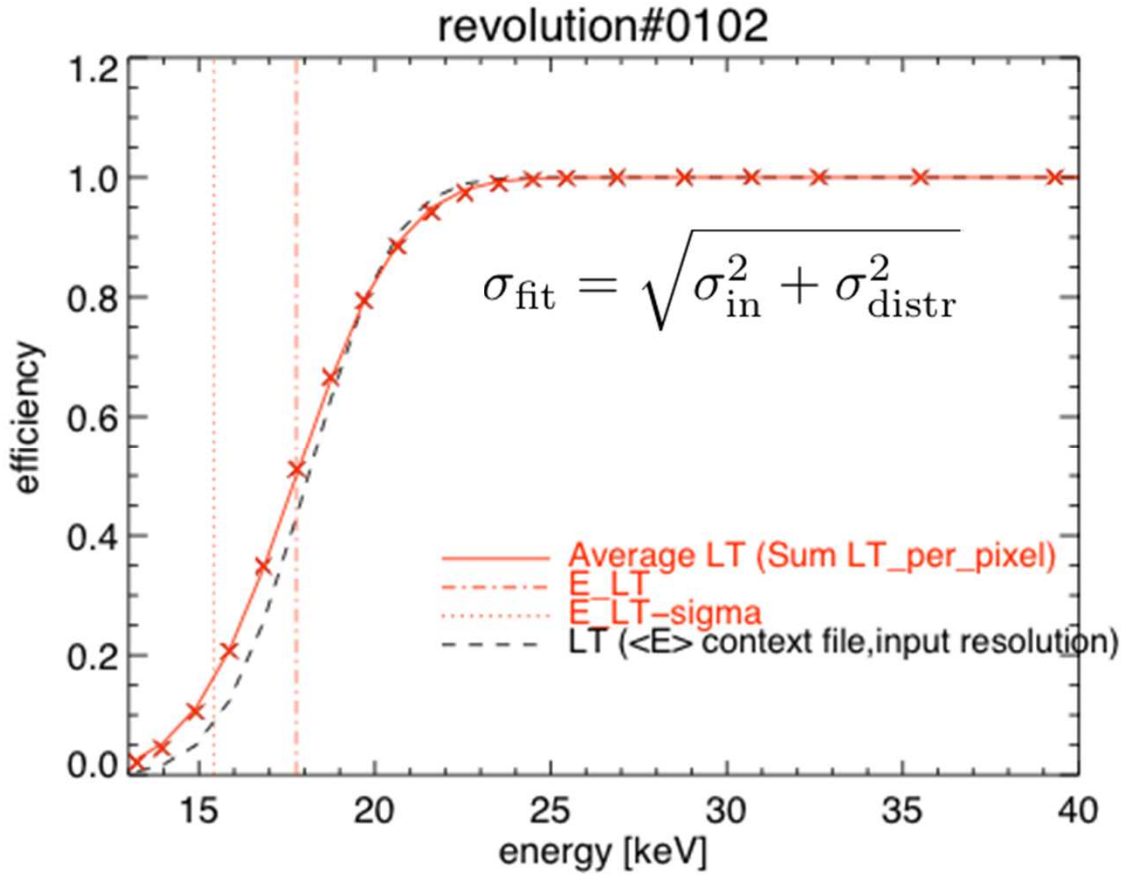
LT efficiency function

$$LT(E) = 0.5[1 + erf(\frac{E - E_{\mathrm{LT}}}{\sqrt{2}\sigma})]$$

- Study of Crab spectrum:
  2727 ScWs spread in 71 revolutions (39 to 1096)
- Average LT(E)=Spectrum_NoLT/Spectrum_WithLT
- Fit:
  - $E_{LT,fit}$ > average E_{LT} from context files
  - Fitted resolution > input resolution
- Impact of the pixel validity map?
- E_{LT} distribution => $\sigma_{out}=\sqrt{\sigma_{in}^2+\sigma_{distr}^2}$?

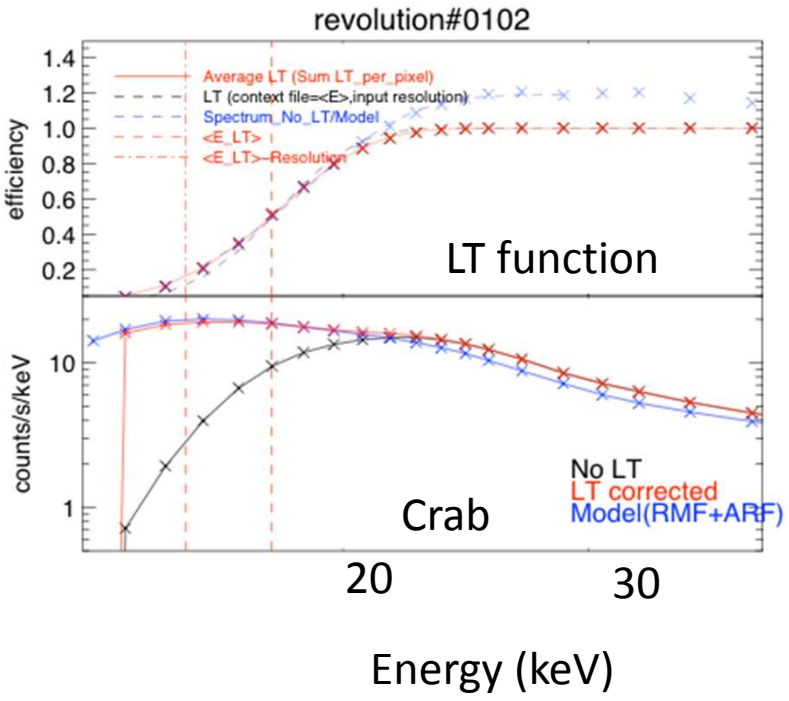
Build the average LT function (per revolution) from context (3D)

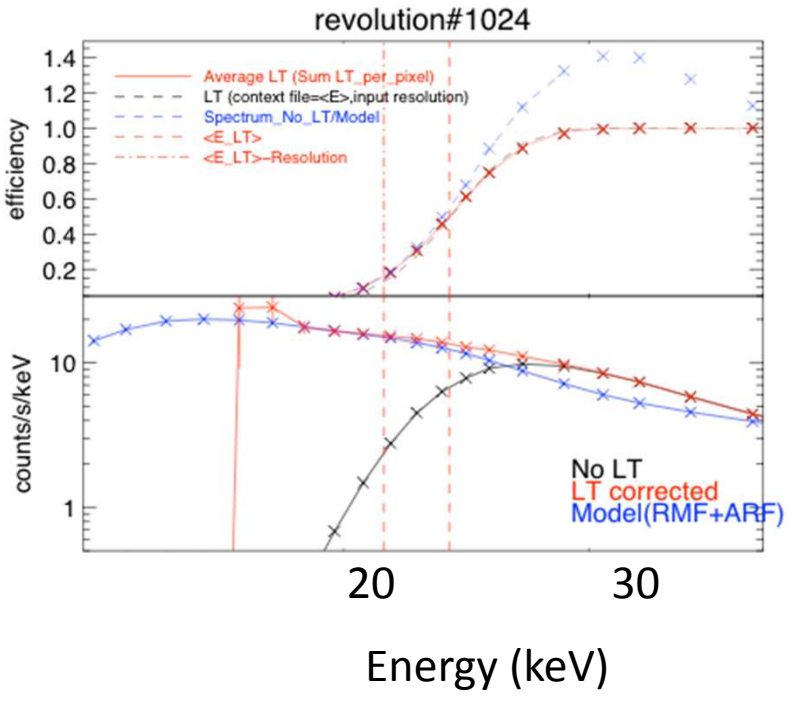
$$\overline{LT(E)} = \frac{1}{N_{\text{valid}}} \sum_{i \in \text{valid pixels}} LT(E)_i$$



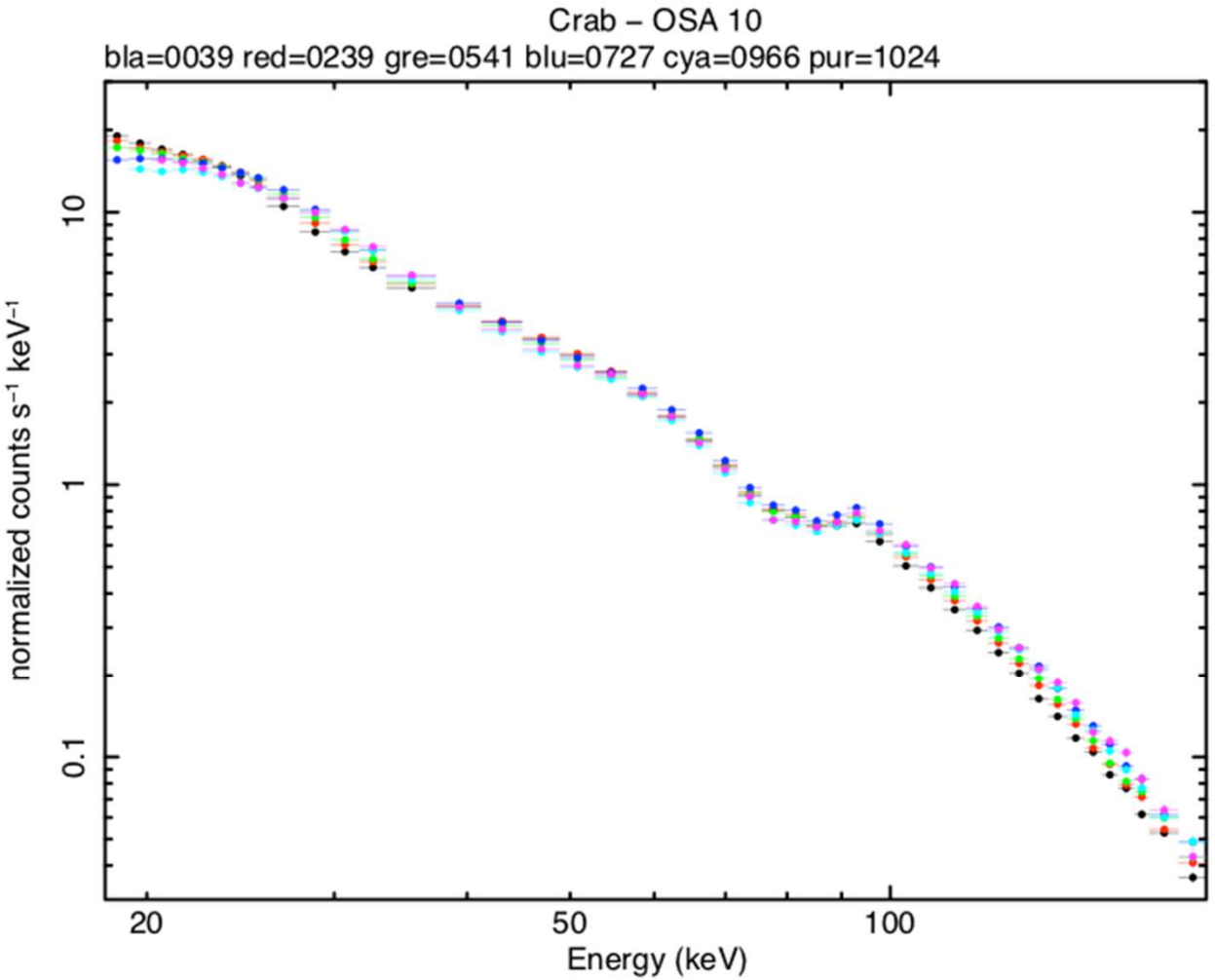
Energy efficiency function

$$\text{Best solution} : \sigma(revol) = (4.5 + 7\,10^{-4} \times revol)/2.36$$

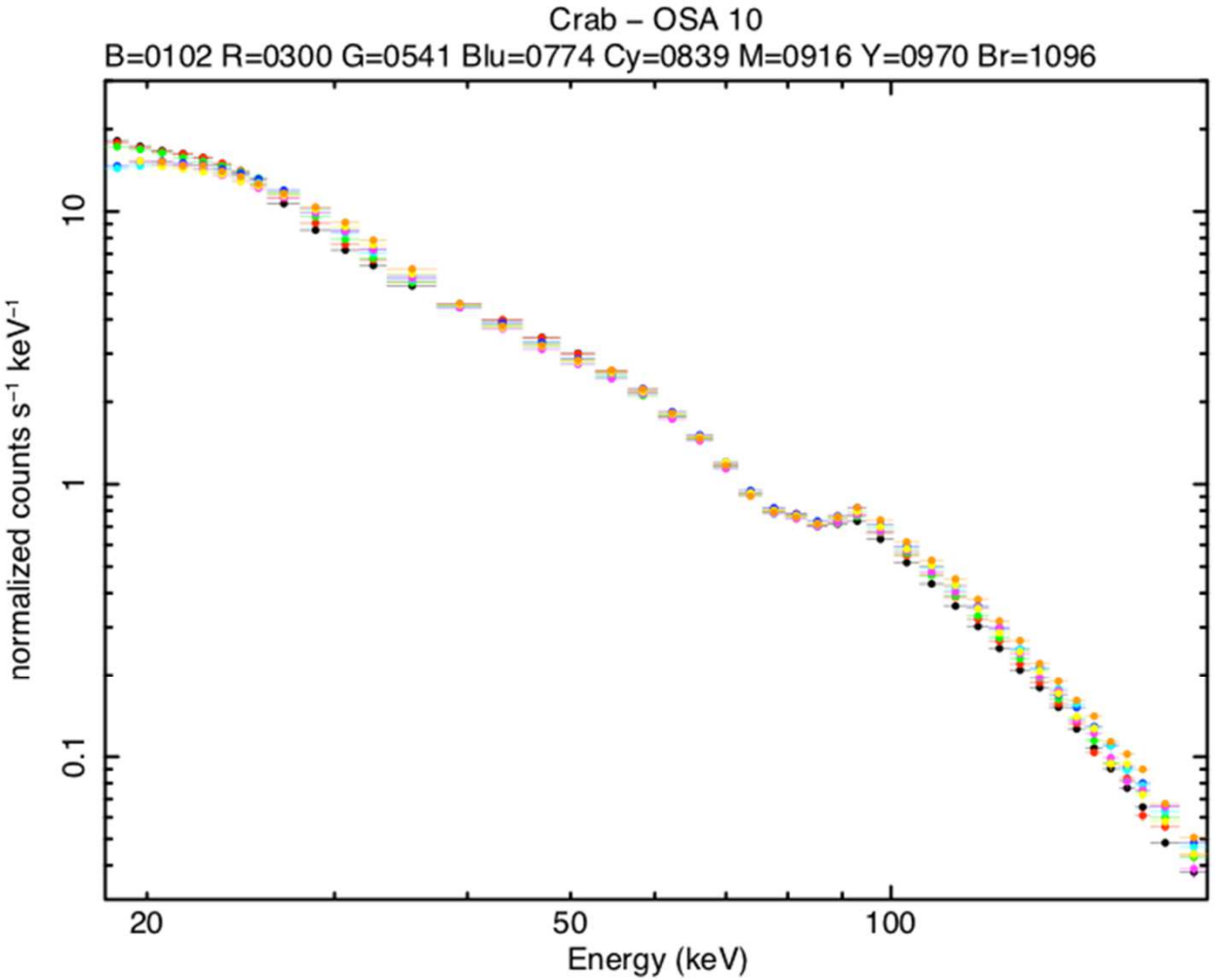




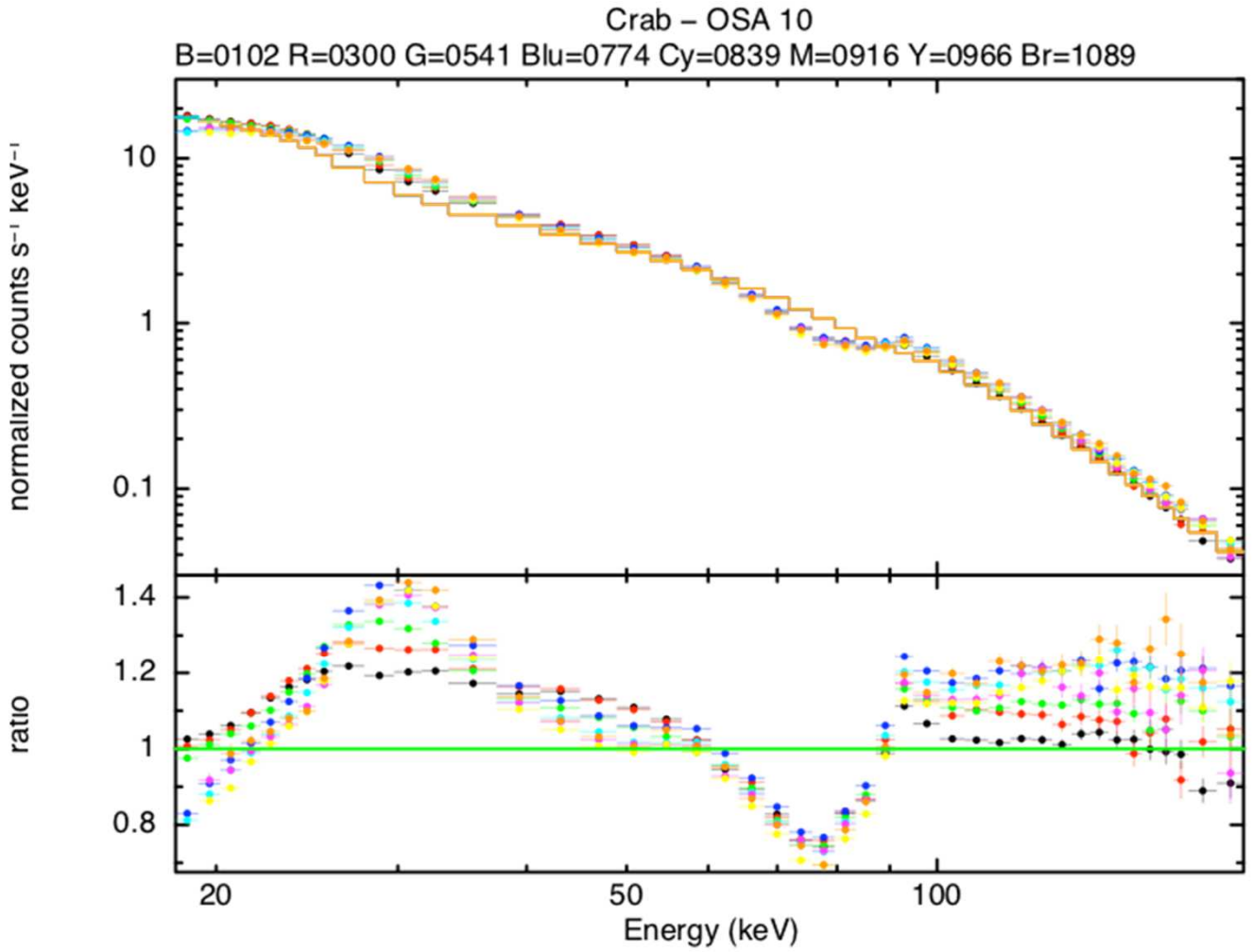
Crab spectra (energy and LT last correction)



Crab spectra (energy and LT last correction)



Crab spectra (energy and LT last correction)



OSA 10 delivery

- Within 1 week, delivery of new ibis_isgr_energy and ii_shadow_build
- Verification of C code before delivery to ISDC
- New energy calibration files to be delivered
- To do before delivery to users:
  - Verification of Nomex correction (with ISDC)
  - set of ARFs (work in collaboration with IBIS team in Rome)
  - Update of the IBIS user manual

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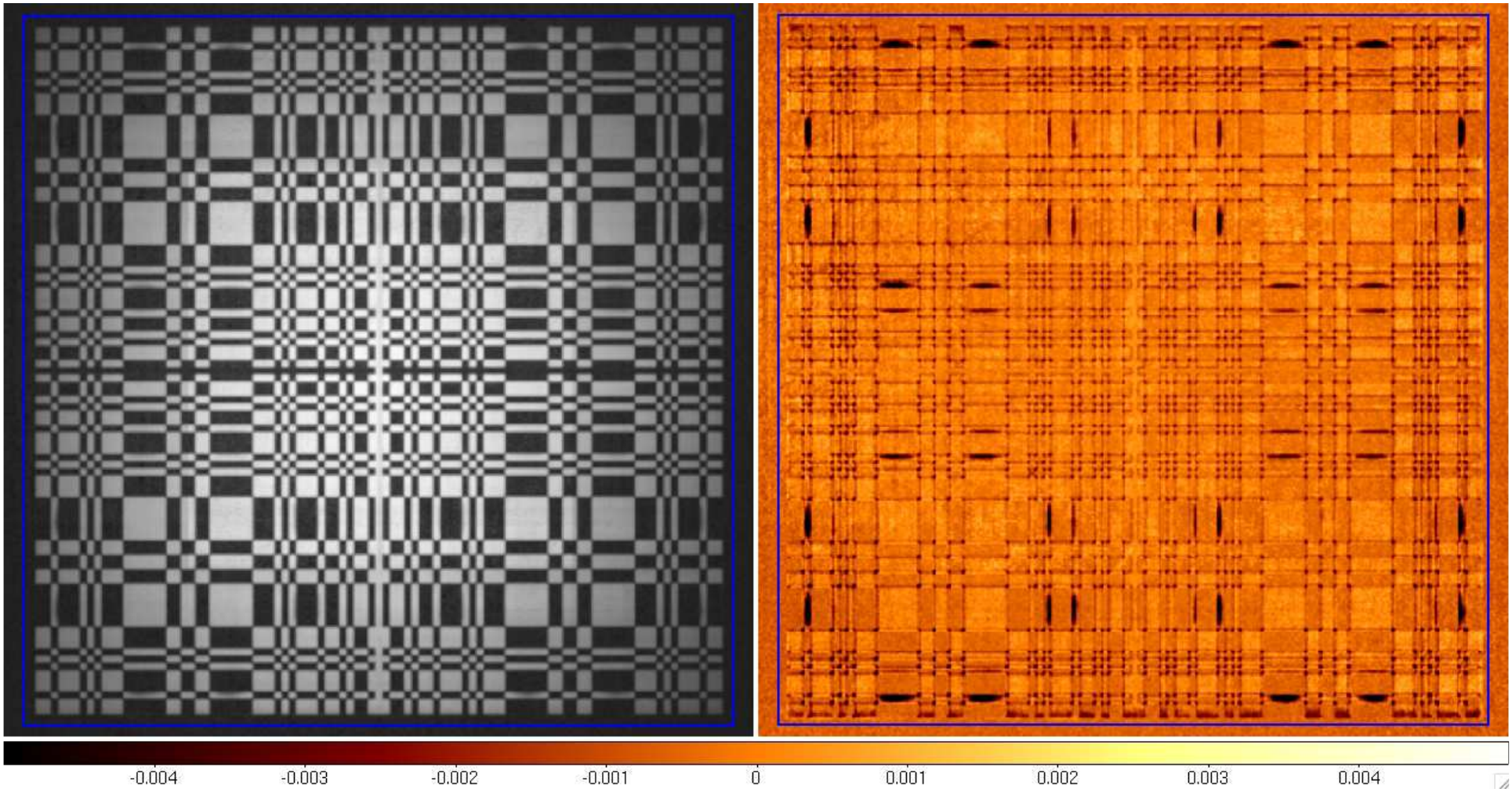
IBIS mask calibration and modeling

Mask image

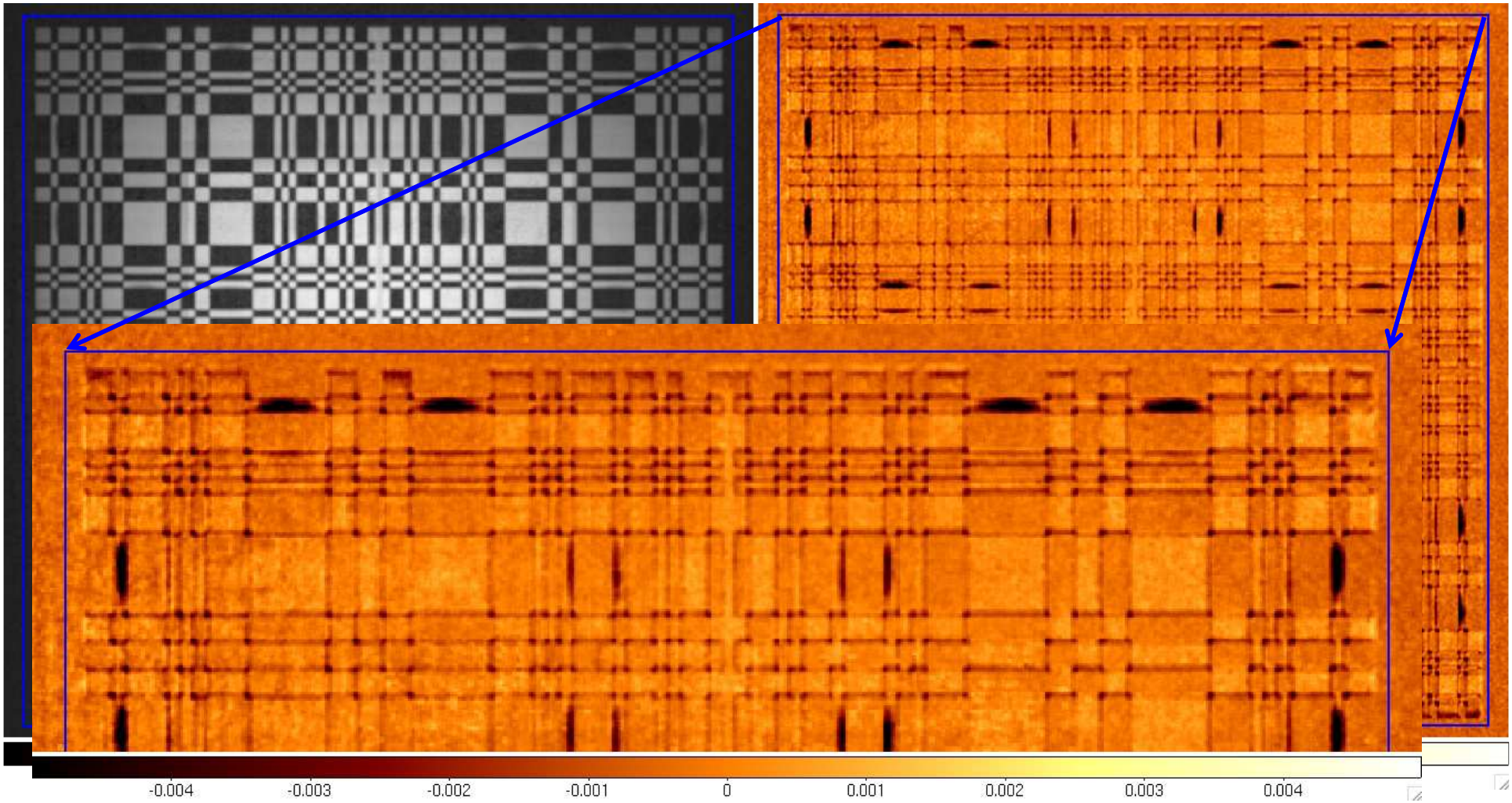
Mask defect image



(< rev 1096)

Mask image

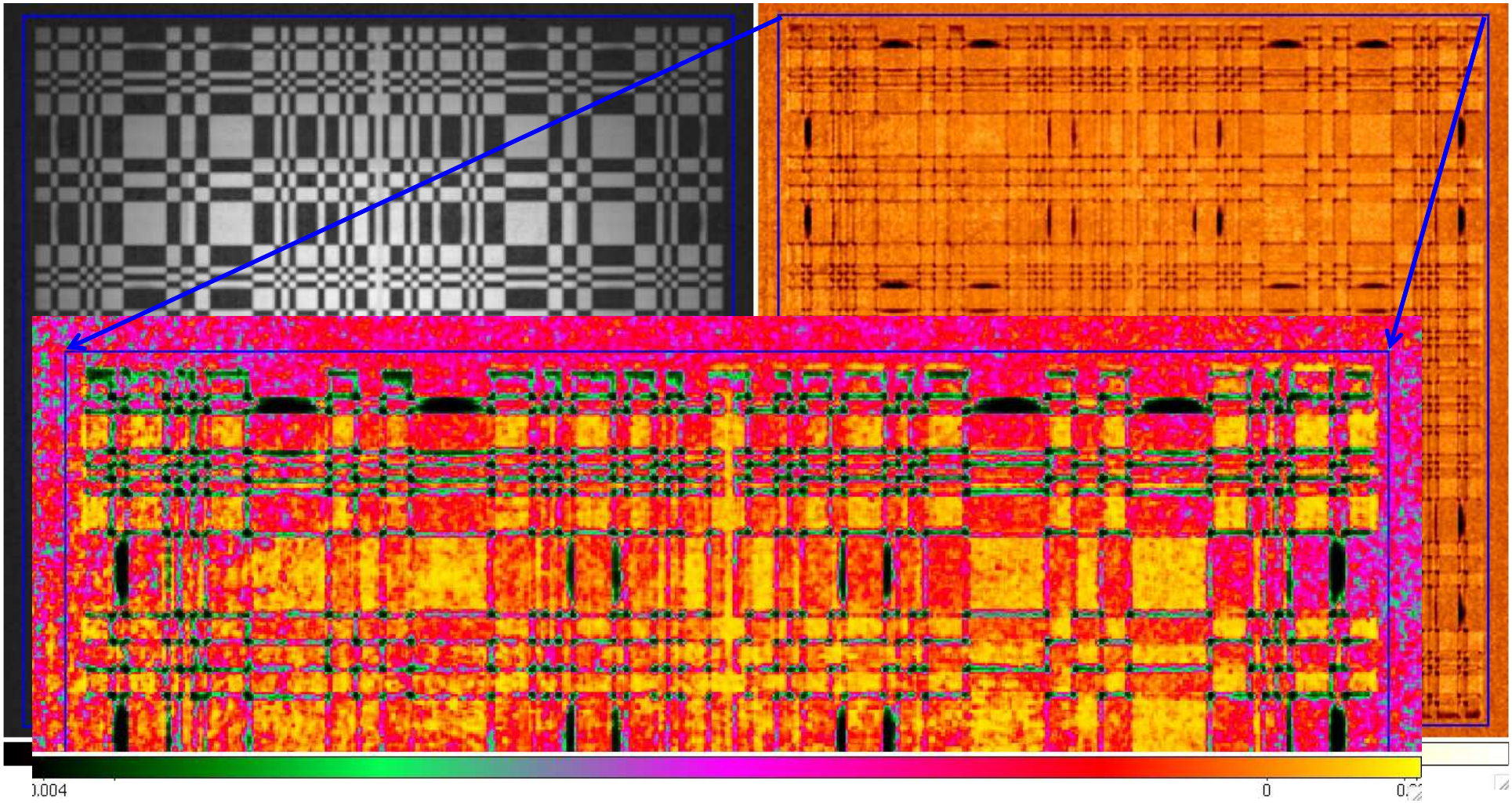
Mask defect image



(< rev 1096)

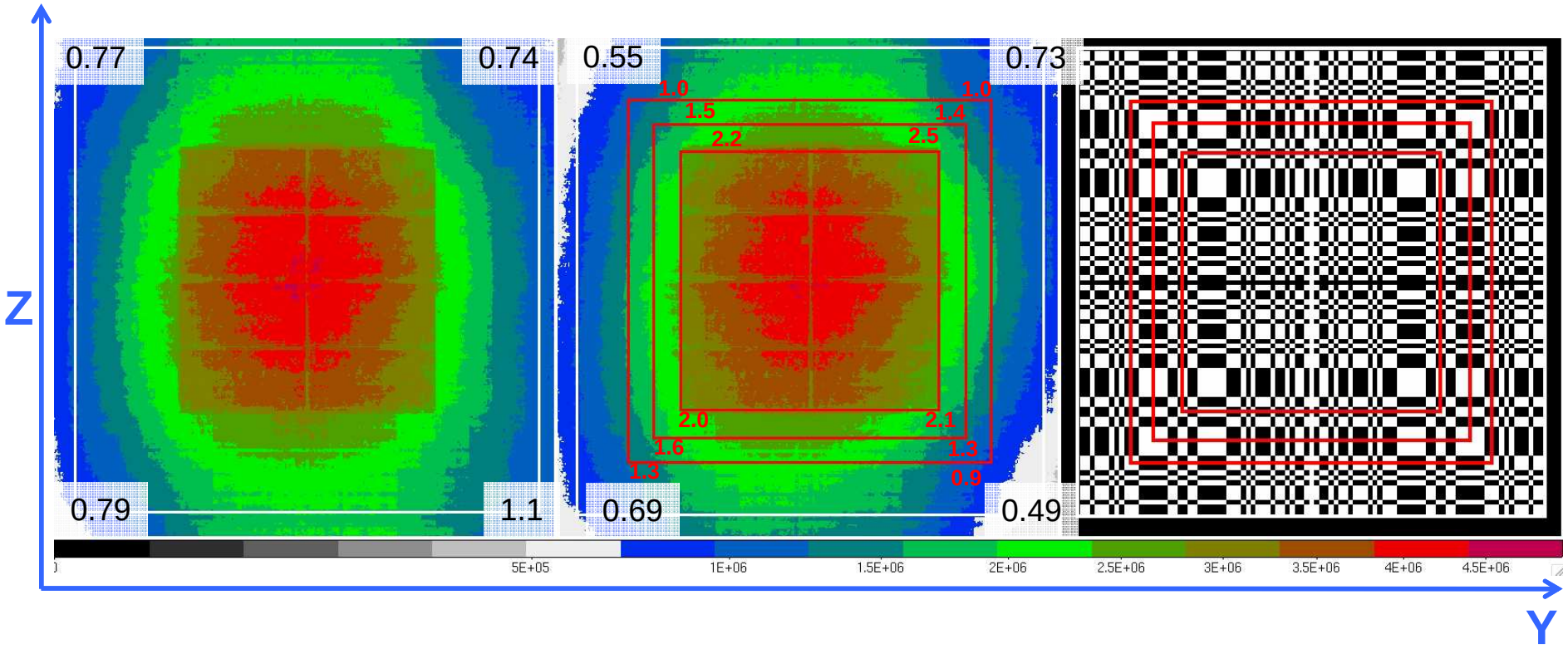
Mask image

Mask defect image



(< rev 1096)

Where we are with the mask exposure (Ms)

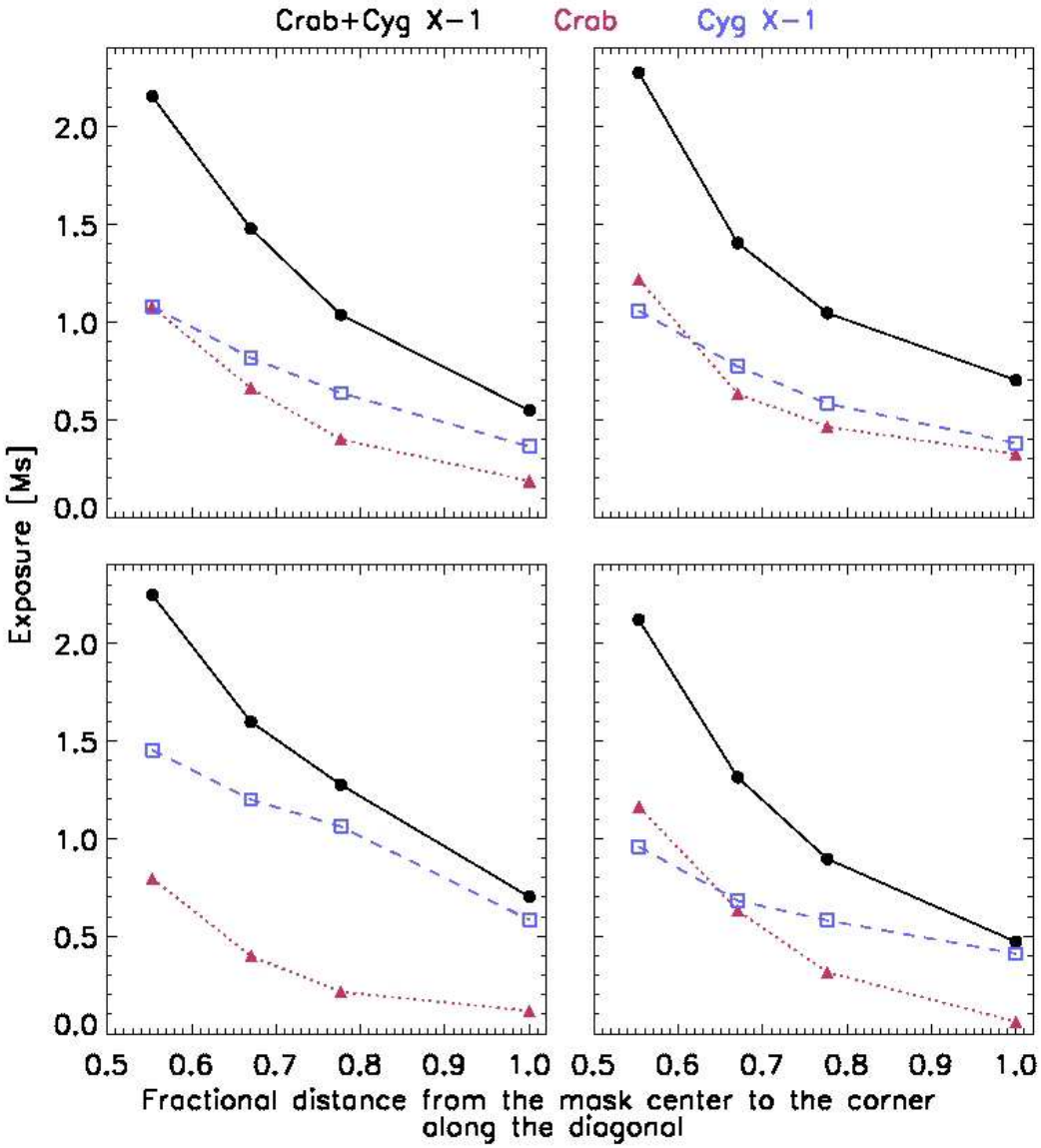


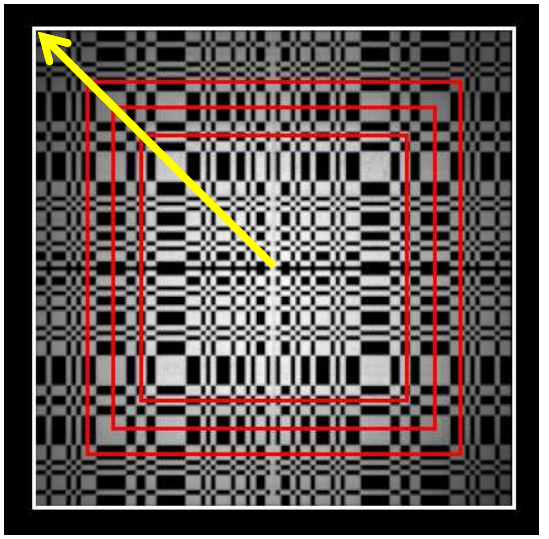
Effective exposure time computed
for good data (7019 scw, < rev 1096),
i.e. where Crab or Cyg X-1 > 5σ

Example mask image

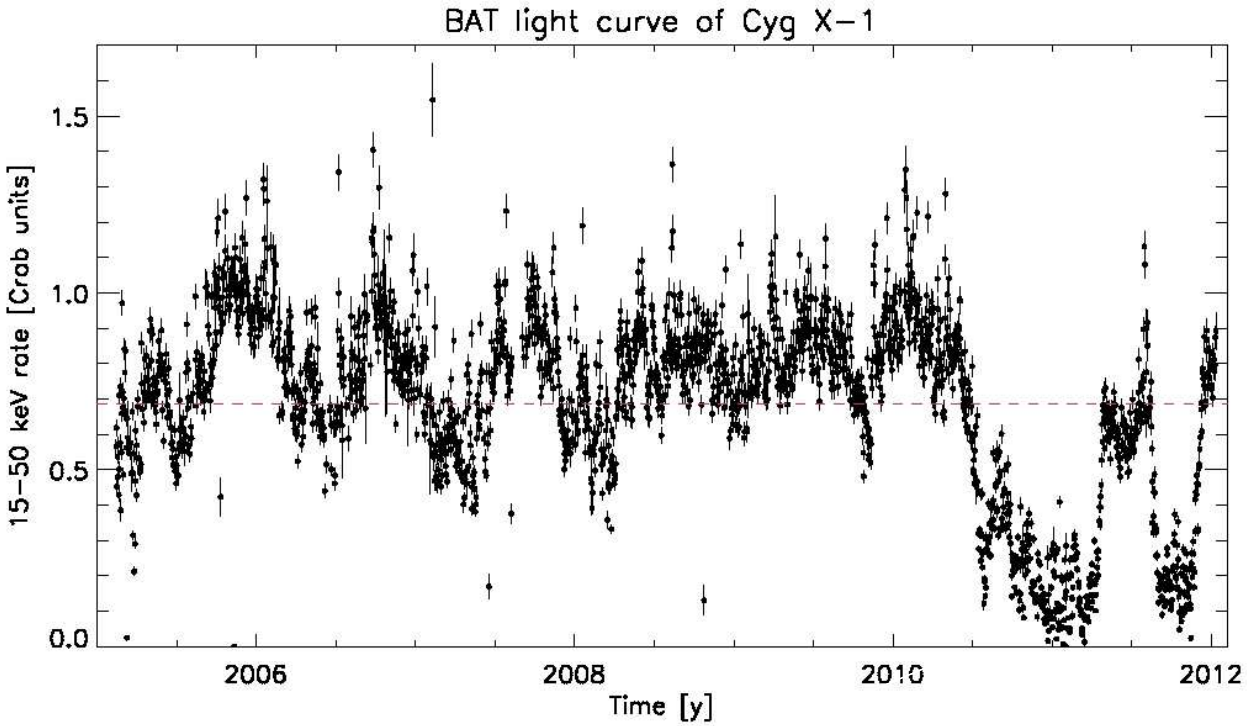
Effective exposure time computed
for all data (9227 scw, < rev 1096)

Corners exposure [Ms]

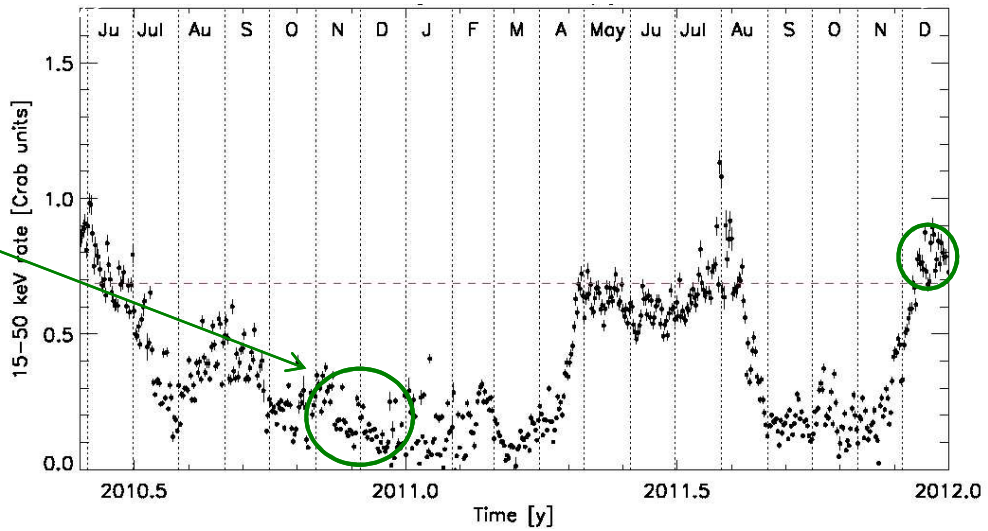




Cyg X-1 light curve

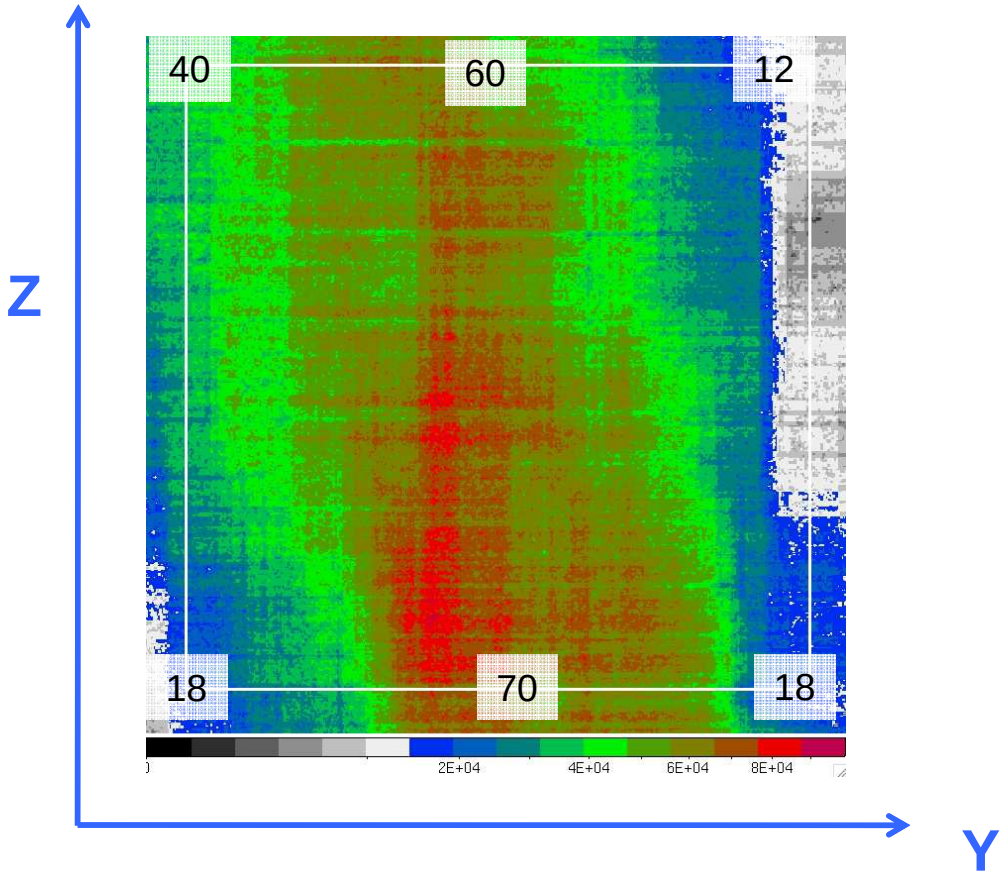


mask calibration:
Cyg X-1 flux dropped
to 20% of the average
2005-2010 flux



latest Cyg X-1
observations
(< 4° off-axis)

AO-8 GPS
contribution to the mask exposure [ksec]



Fantomask

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- An improved Ghost Buster with more precise exclusion zones that takes into account the source direction
  - Less ghosts
  - More sensitive area (small effect)
- Difficulties
  - Accuracy
  - Computing time
- Planning
  - Dévelopment: 2 FTE-months between February and May
  - Tests at the fall
  - Delivery: end 2012