LATEST NEWS ON XMM-NEWTON CALIBRATIONS AND OPERATIONS

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[with contributions by: Pedro Calderon, Ignacio de la Calle, Konrad Dennerl, **Michael Freyberg**, Rosario Gonzalez-Riestra, Aitor Ibarra, Frank Haberl, **Andy Pollock**, **Andy Read**, Pedro Rodriguez-Pascual, Simon Rosen, Richard Saxton, Maria Santos-LLeo, **Steve Sembay**, Michael Smith, **Martin Stuhlinger**, Antonio Talavera, Mike Watson]

Main calibration changes over the last year

- Implementation of the variable boresight (as of SASv12)
- `ELLBETA` PSF as default in the SAS (as of SASv12)
- Improved rejection of soft X-ray noise in EPIC-pn (`epnoise` in SASv12)
- Correction for X-Ray Loading in EPIC-pn Timing Mode exposures (`epreject` in SASv12)
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- Correction to the RGS λ-scale via correlation with the Solar Angle (SASv13)
- Refinement of the RGS response (SASv13)
- Novel software for the calibration of EPIC-MOS gain/CTI

[SASv12 = 23rd May 2012, post SAS-12; SASv13 = 1st April 2013; post SASv13]

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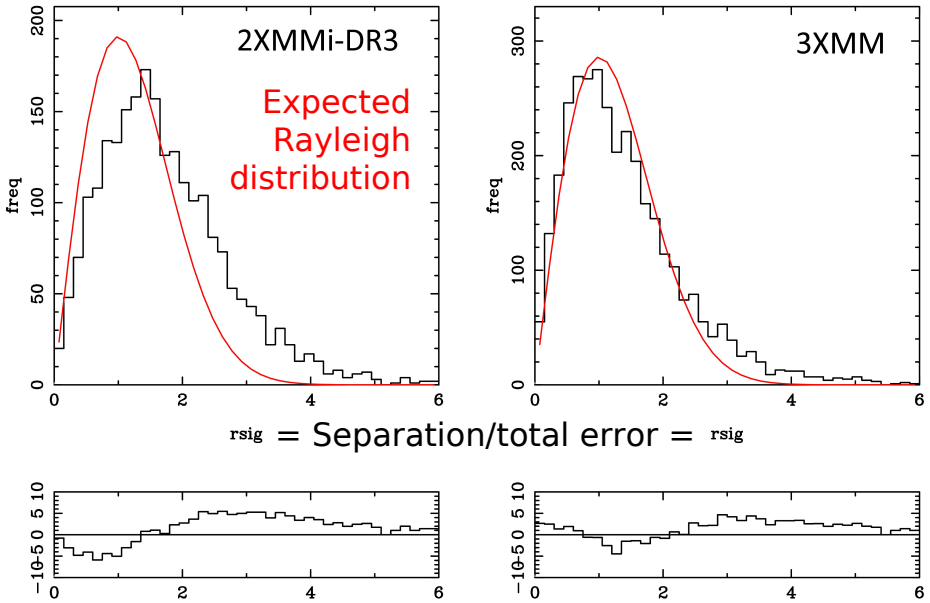
[**Bold** = discussed in this presentation]

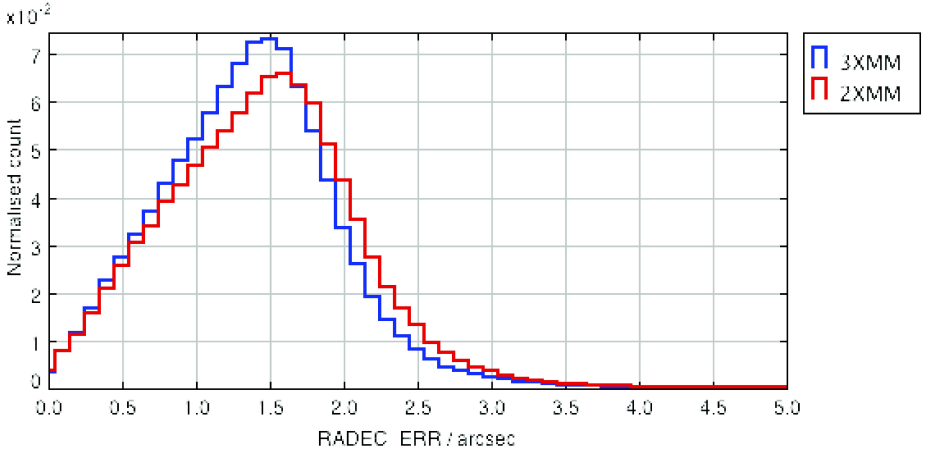
Astrometry

(Courtesy M.Watson, A.Read, S.Rosen. **Preliminary** 3XMM results)

Distribution of normalised position separations between XMM-Newton and SDSS for 2XMM-DR3 and 3XMM



Distribution of statistical positional errors (as produced by the SAS task `emldetect`)



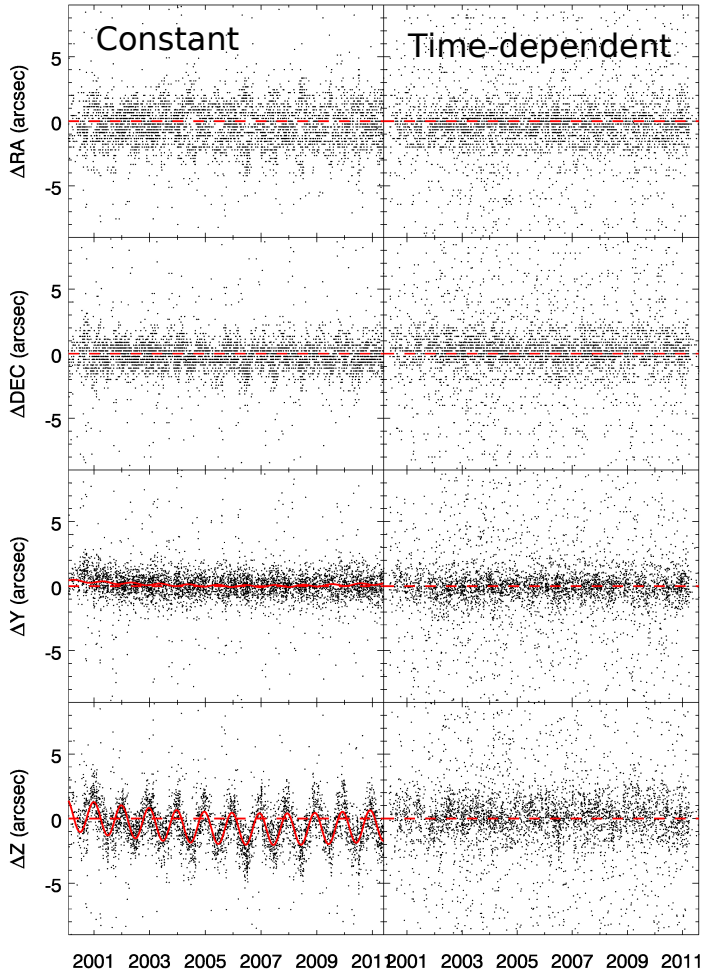
Main improvements:

- `ELLBETA` PSF (Read et al., 2011, A&A, 534, 34)
- Various astrometry improvements with SASv12
- Time-dependent boresight (Talavera et al., 2012, XMM-CCF-REL-286)
- Correction to the `ELLBETA` centroiding and the SAS handling of the plate scale (SASv13)

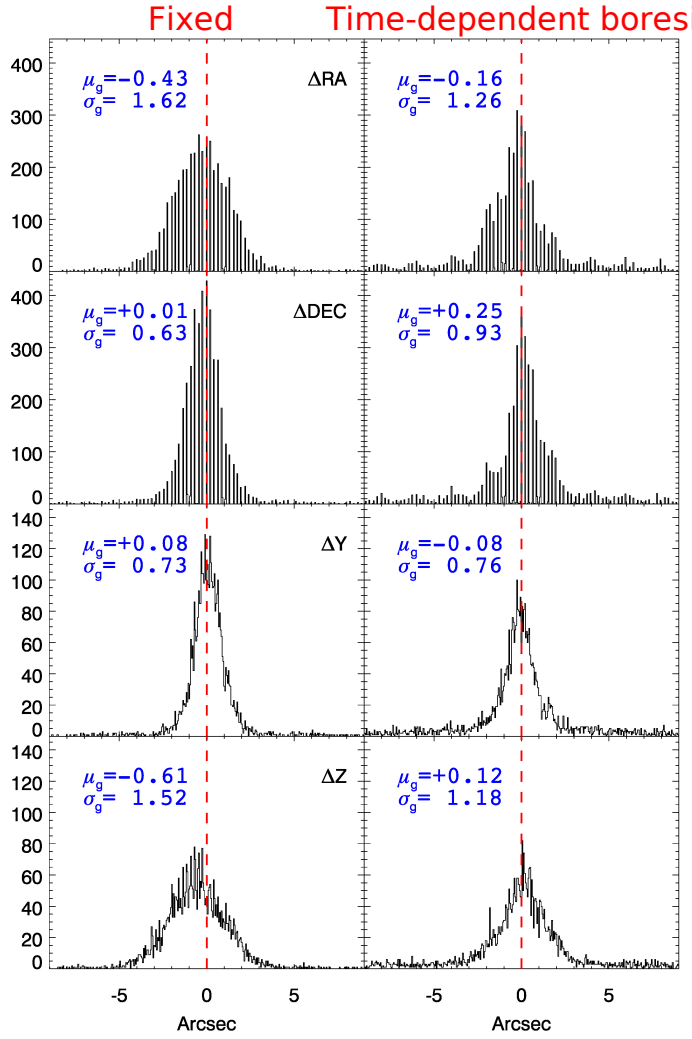
Time-dependent boresight

(Talavera et al., 2012, XMM-CCF-REL-286)

Empirical correction to the seasonal dependency of the star tracker vs. instrument axis alignment



EPIC positional offsets



RGS λ-scale

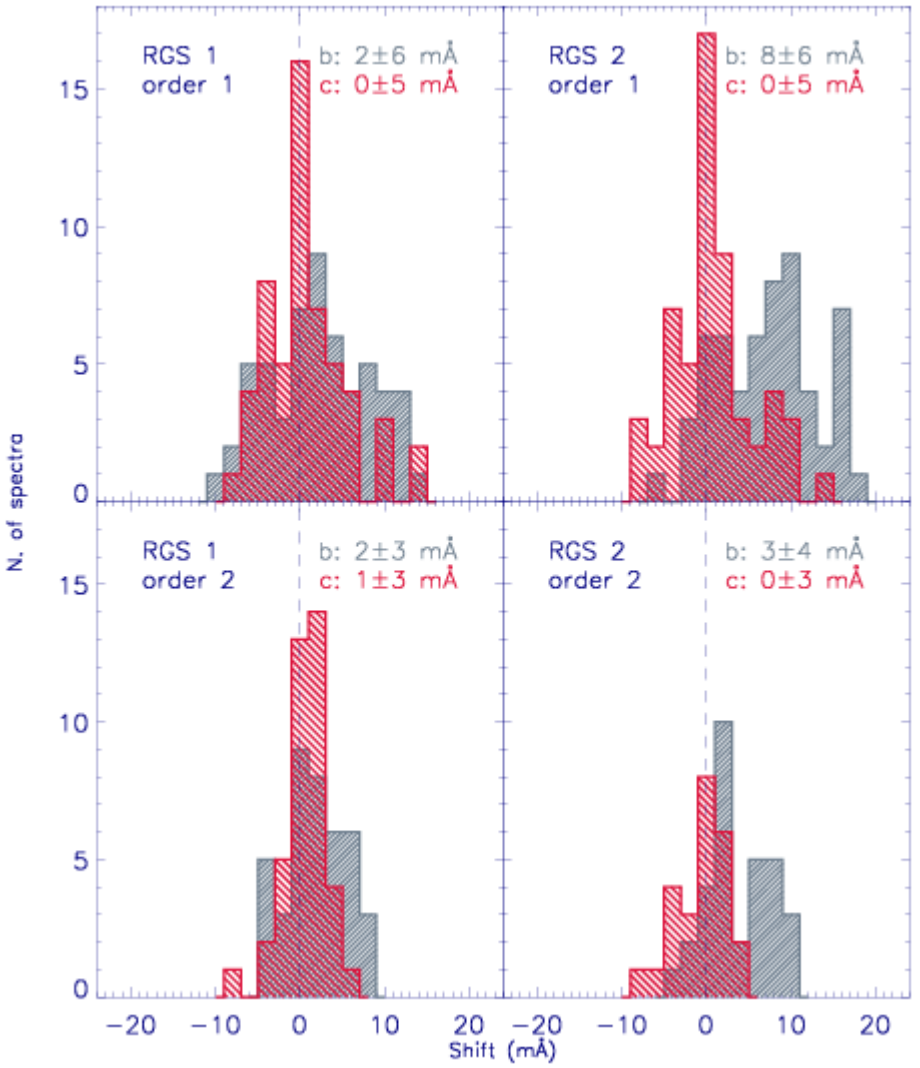
(Gonzalez-Riestra, 2012, XMM-CCF-REL-0290)

Wavelength shifts (average shift per spectrum , in mÅ)			
	a	**b**	**c**
RGS1 1st order	5 ± 7	2 ± 6	0 ± 5
RGS2 1st order	9 ± 7	8 ± 6	0 ± 5
RGS1 2nd order	4 ± 3	2 ± 3	1 ± 3
RGS2 2nd order	5 ± 3	3 ± 4	0 ± 3

a: SAS 12 before 26/9/2012 : Fixed Boresight

b: SAS 12 after 26/9/2012 : Time-depedend Boresight

c: SAS 13: Variable Boresight +Heliocentric velocity correction + Solar Angle correction

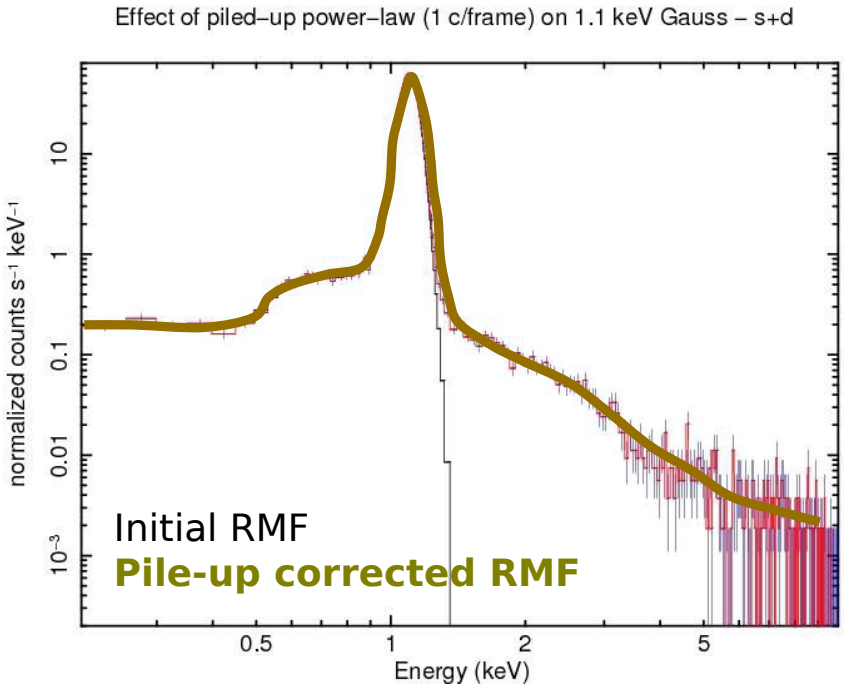


EPIC pile-up correction

(Courtesy R.Saxton, N.Schartel, I.de la Calle)

EPIC pile-up correction scheme in SASv13, based on the “added event” method

- Start from an event file
- Add one new event into each frame
  - in PSF-weighted pixels
  - with a trial PI channel
  - with pattern chosen from calibrations
- Calculate what happens to the event
- Produce a distribution of the output event PIs for each input PI
- Option in `rmfgen`

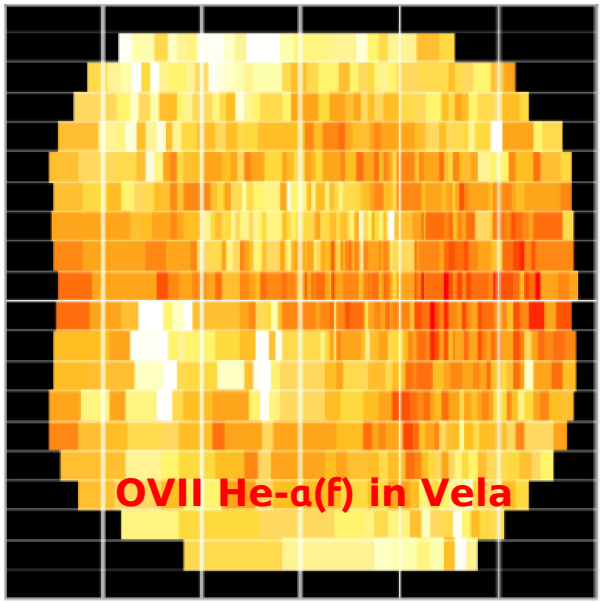


Method currently tested on the XMM-Newton cross-cal[on] blazar sample for inclusion in SASv13

Pixel-by-pixel CTI variation correction in EPIC-pn

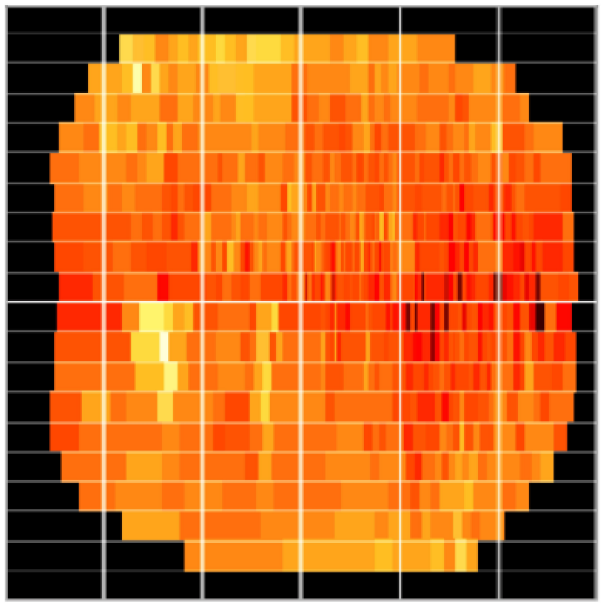
(Dennerl & Saxton, 2012, XMM-CCF-REL-0283)

Refinement of the CTI variation over the CCD on a pixel-by-pixel basis (`espatialcti`)



`espatialcti`

$<E_{OVII(f)}>$= 566.5±2.5 to **562±1** eV
[nominal 561 eV]



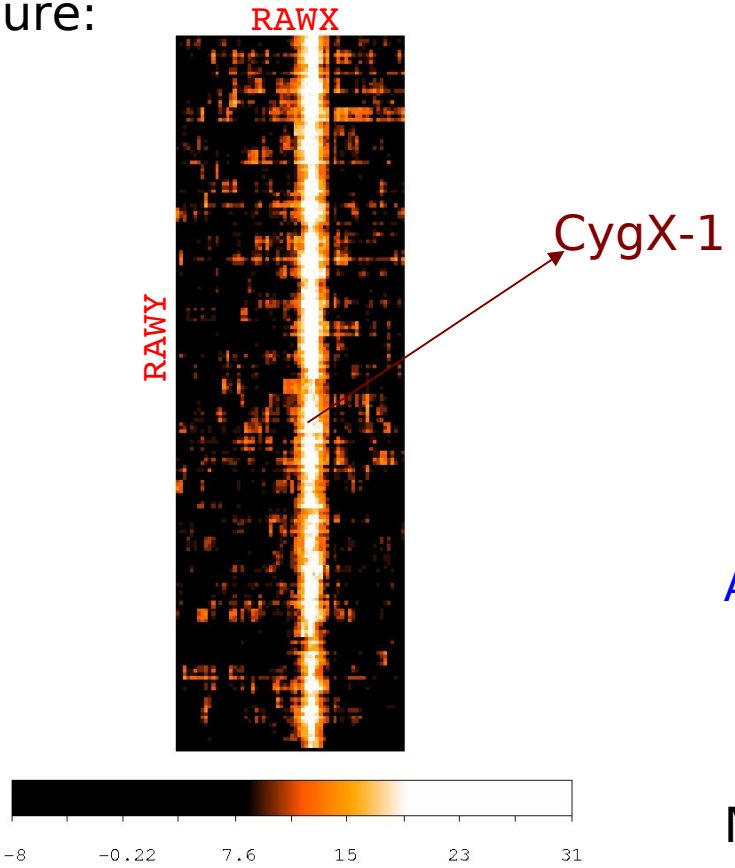
	0.6 keV	1.5 keV	5.9 keV
FF singles	4% (Fig. 1,2)	9% (Fig. 3)	12% (Fig. 4)
eFF singles		10% (Fig. 5)	8% (Fig. 6)
FF doubles		20% (Fig. 7)	3% (Fig. 8)

Table 2: Improvement of the spatial homogeneity of the absolute energy scale, determined by $1-\sigma_{\rm after}/\sigma_{\rm before}$.

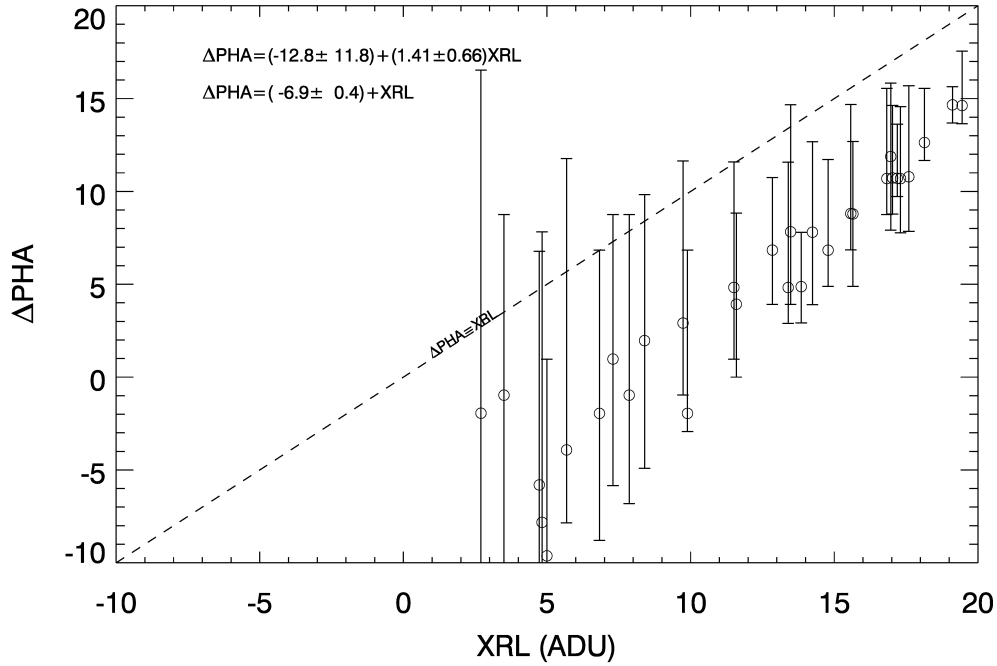
X-Ray Loading correction in EPIC-pn Timing Mode

(Guainazzi & Smith, 2012, XMM-CCF-REL-296)

XRL in EPIC-pn Fast modes: *ubiquitous* source contamination during the "dark field" (offset map) prior to each EPIC-pn exposure:



XRL Spectral impact calibration

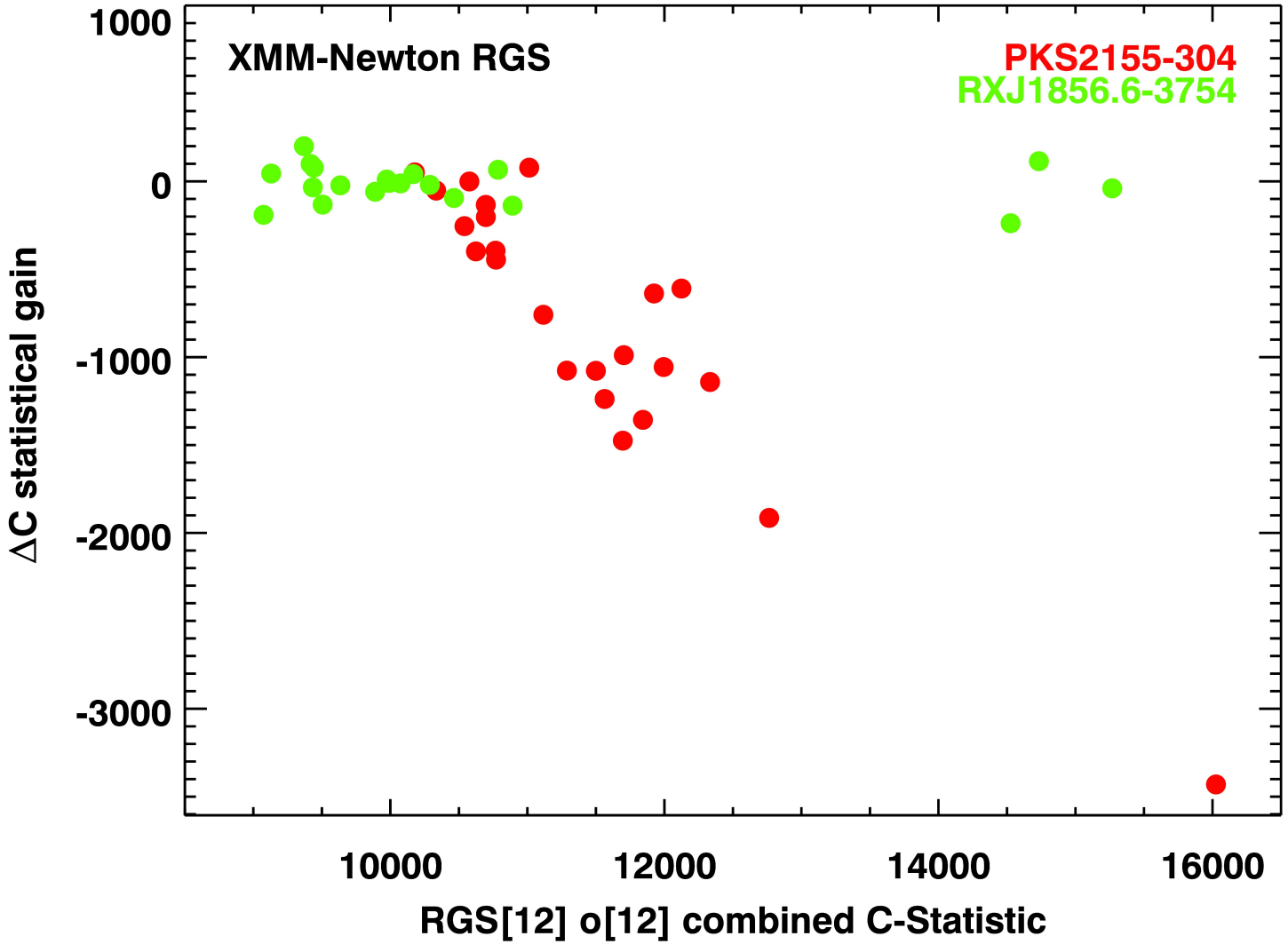


As of *May 2012* EPIC-pn Burst and Timing Mode offset maps are calculated in CLOSED filter to prevent XRL

More on the re-calibration of EPIC-pn Timing Mode energy scale in the **CCD Working Group**

Refinement to RGS response

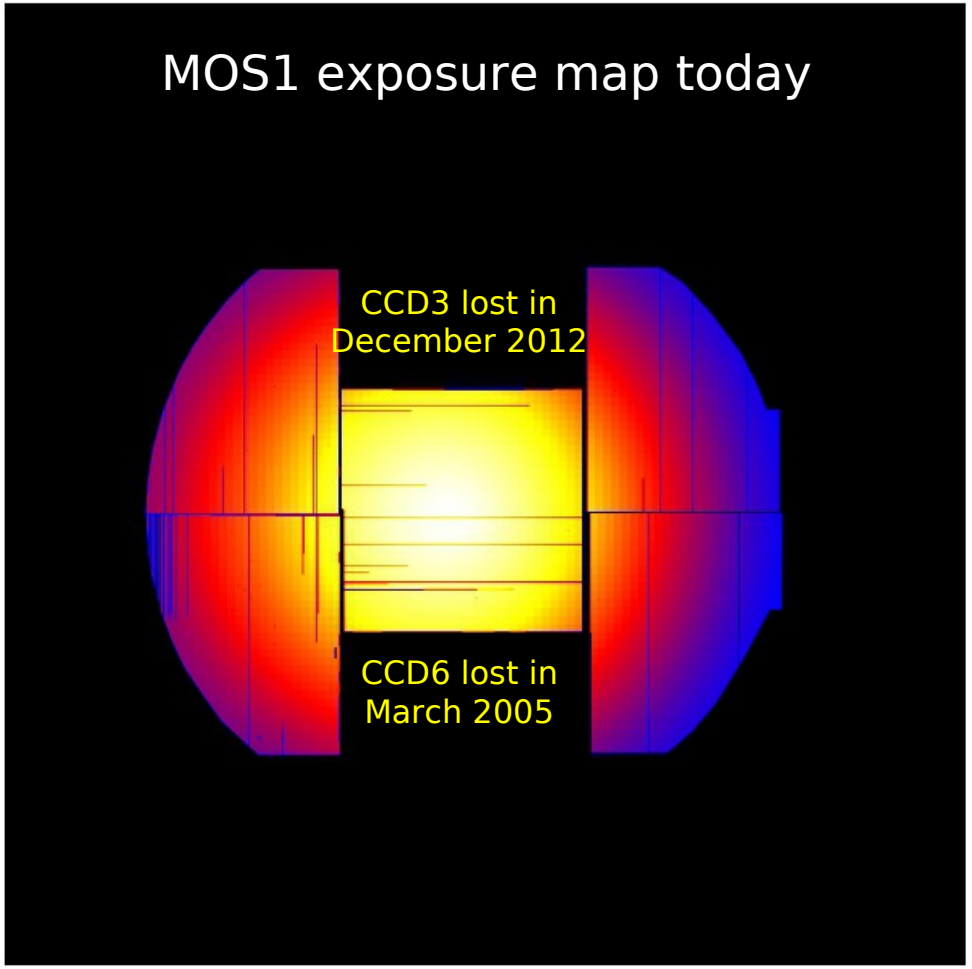
(Courtesy A.Pollock & A.Ibarra)



The MOS1-CCD3 event

(XMM-Newton SOC: http://xmm.esac.esa.int/external/xmm_news/items/MOS1-CCD3/index.shtml)

- Event registered in MOS1 at ~06:51UTC on 11th December 2012 (Rev.#2382)
- Bright flash of light causing data buffer overflow across the whole focal plane
- Likely micro-meteoroid impact
- CCD3 unusable for science since
- Several hot and defective columns in other CCDs (namely, #4 and #7) masked
- Integration time increased from 2.6s to 2.7s in Full Frame Mode to avoid frame time doubling
- Otherwise, nominal instrument operation, calibration accuracy and pipeline processing
- No measurable impact on MOS2, PN, RGS



Future work

- EPIC-MOS effective area refinement
  - Session IV, Thermal SNR WG, 26th March, 09:00-12:30: **S.Sembay, *"Trend analysis of EPIC-MOS 1ES0102 data"***
- EPIC cross-calibration refinement
  - Session V, Effective Area WG, 26th March, 14:00-17:30: **A.Read, *"XMM-Newton EPIC cross-calibration"***
- EPIC-pn Timing Mode energy scale
  - Session V, CCD WG, 26th March, 14:00-17:30: **M.Guainazzi, *"Novel scheme to calculate the energy scale in EPIC-pn Timing Mode"***
- RGS contamination
  - Session VIII, WD & INS WG, 27th March, 14:00-17:30: **A.Pollock, *"Variability or otherwise of RXJ1856-3754"***

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