Calibration of the \textit{XMM-Newton} RGS after SASv7.0.0

European Space Astronomy Centre

Mallorca 26-27 October 2006

SRON Utrecht & XMM-SOC@ESAC
Broad RGS themes

- Review of RGS with SAS v7.0.0 and its CCFs
- Schedule for new CCFs: 2007-01-31
- RGS pile-up
- The WHIM story
- Operational plans: single-node readout and “multiple-pointing”
New RGS CCFs with SAS v7.0.0

- RGS QUANTUMEF
- RGS CTI
- RGS COOLPIX
- RGS EXAFS
- RGS ADUCONV

- **RGS EFFAREACORR**

- **RGS background templates**
RGS EFFAREACORR with SAS v7.0.0

Randall Smith, GSFC

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A.M.T. Pollock
XMM-Newton SOC

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RGS EFFAREACORR with SAS v7.0.0

⇒ new fudged RGS\%_EFFAREACORR_0004

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Why RGS1_TEMPLATEBCKGND_003.CCF & RGS2_TEMPLATEBCKGND_003.CCF

- consistent use of `rgsspectrum` v2.6
  - new BACKSCAL per channel, not per CCD node
  - new QUALITY per channel
    - ⇒ more low BACKSCAL values
    - ⇒ more 'bad' QUALITY channels

- XSPEC takes no account of background QUALITY
  - ⇒ outliers in the background-subtracted spectrum
  - ⇒ replace BACKSCAL(QUALITY=1) with node median(BACKSCAL(QUALITY=0))

- SAS v7.0.0 PI extraction regions ⇒ 90% & 95%

- 100% cross-dispersion
  - ⇒ 64 extensions such as X100_P095_1_8.00
RGS with SAS v7.0.0

- How do you judge?
- We have reached the stage for quantitative statistical tests
  - C-statistic
- RGS physical test harness
  - SNR 1ES0102-7219 is constant
  - HR1099 spectrum is bremsstrahlung continuum (and weak lines)
  - Procyon spectrum is lines (and weak continuum)
  - Crab
RGS A(t) from SNR observations

SNR 1ES0102–7219 RGS fluxed spectrum

OVIII Lyα

CVI Lyα

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SNR 1ES0102-7219 with RGS SASv6.5

CVI Lyα 33.734Å

OVIII Lyα 18.967Å

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SNR 1ES0102-7219 in SAS

Counts

Channel

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do it better with rgsregions…
RGS vs EPIC statistics

24 XMM blazar observations

Relative normalisation

XMM revolution

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Zeta Puppis flux vs revn 0.3keV – 2.0keV

Jenny Carter, Leicester

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No change in O-absorption in Mkn421
Contamination history

Prospects for an improved RGS effective area: 
\[ \text{RGS\_EFFAREACORR} = \exp(-C \times T) \times \text{Polynomial}(T) \]

C-layer increase of about 20 nm/year

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RGS $\lambda$ from HR1099 continuum
XCal from Procyon lines

Procyon RGS fluxed spectrum

Flux (cm$^{-2}$ s$^{-1}$ Å$^{-1}$)

Wavelength (Å)

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Procyon with SAS v7.0.0
0190_0123940101 : RGS1=1 RGS2=0.98 MOS1=1.01 MOS2=1.10 pn=1.13

Procyon with SASv7.0.0

channel wavelength (Angstrom)
normalized counts/sec/Angstrom
Spatial variations in the Crab

Mori et al., Chandra

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Curved Crab spectrum

- **red**: sum of individual Chandra spectra pixels
- **purple**: 2-8 keV range fit to red curve
- **blue**: Kuiper et al.
- **orange**: Mori’s fit to total spectrum
RS Oph RGS pile-up

RGS1 original

RGS1 corrected

RGS2 original

RGS2 corrected

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The WHIM story
  • Everyone friends now
  • (RGS was right)

Operational plans
  • single-node readout
    • a few remaining details
  • “multiple-pointing” for AO7
    • ⇒ implementation plan with 2006-12-31 deadline (Muñoz & Metcalfe)