XMM-Newton CCF Release Note

XMM-CCF-REL-216

A New Model for the RGS Effective Area

A.M.T. Pollock

June 29, 2006

1 CCF components

Name of CCF	VALDATE	List of Blocks changed	XSCS flag
RGS1_EFFAREACORR_0003	2001-01-01T00:00:00	EFFAREACORR	NO
RGS2_EFFAREACORR_0003	2001-01-01T00:00:00	EFFAREACORR	NO

2 Changes

The long-wavelength part of the RGS has been difficult to calibrate due to the scarcity of both suitable ground-based facilities and celestial X-ray standards. It has become clear that blazars have smooth spectra well characterised by power-laws subject to interstellar absorption that cover the whole RGS band. This is empirically supported by the fact that the RGS spectra calculated with earlier versions of the calibration can be corrected for interstellar absorption and power-law slope to reveal a universal form that reflects the shape of the effective area of the RGS instruments. It has also been discovered that the RGS sensitivity has been decreasing at wavelengths longer than about 25Å. Empirical effective area corrections have been derived using measurements of Mkn421 at five epochs during the mission and fitting a power-law models to the stable, well-calibrated part of the RGS waveband between 10 and 25Å. Using the Crab as a reference for both power-law slope and normalisation, the extrapolation of the resulting models to long and short wavelengths has been used in comparison with the observed spectra to define correction factors. Tabulations of these time and wavelength-dependent factors are available in the new RGS EFFAREACORR CCFs and used by SAS v7.0 to calculate RGS response matrices.

The CAL methods implemented in order to make this new CCF available are called

- `EffAreaCorr->realisticEffectiveAreaCurve(order,theta,phi)`
- `EffAreaCorr->epochInterpolation()`

3 Scientific Impact of this Update

Remains to be seen but anticipation is high.

4 Estimated Scientific Quality

This CCF should have a fundamental impact on the ability of observers to reconcile RGS and EPIC spectra.

5 Test procedures & results

During their construction, many new RGS RMFs have been calculated with precisely these CCFs. The overall quality of the new time-variable RGS effective-area corrections may be judged by the common RGS and EPIC spectral analysis of a sample of 24 blazar observations taken throughout the mission shown in Fig. 1. The normalisations are in agreement to within 10% throughout the mission although there are clear systematic trends which will be addressed within months.

6 Expected Updates

Refinements expected with 6 months once the latest Crab calibration data are understood.

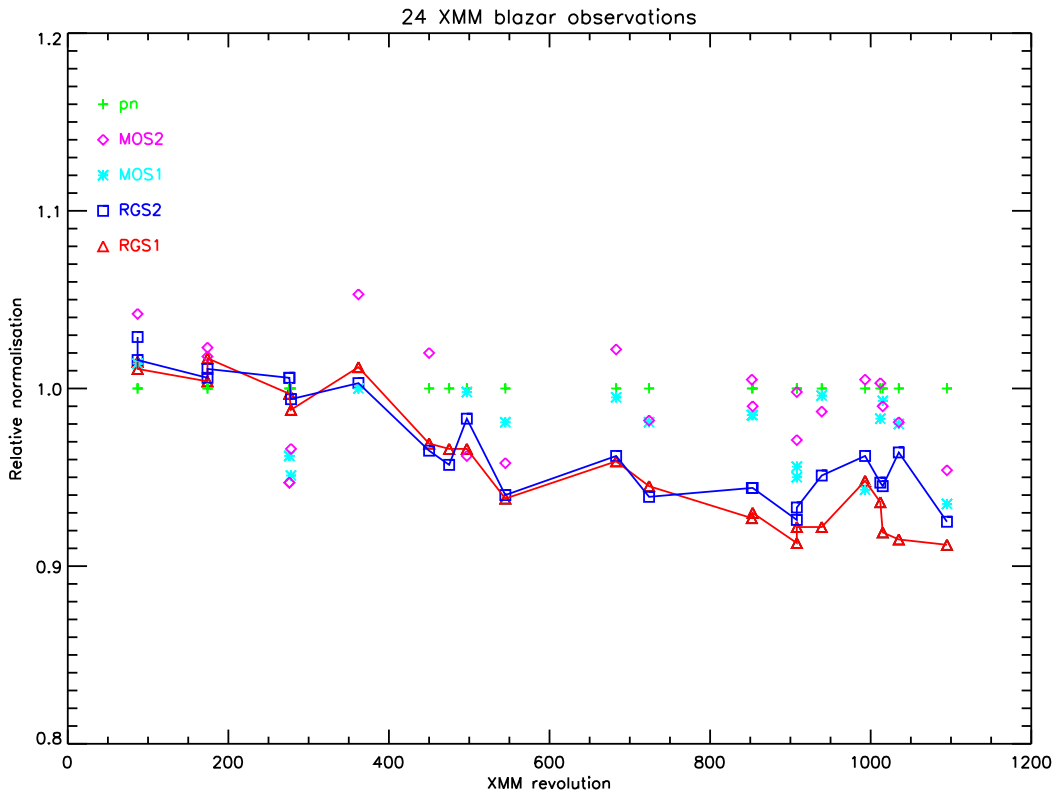

Figure 1: Comparison of the RGS and EPIC model normalisations of common absorbed power-law models fit to RGS1, RGS2, MOS1, MOS2 and pn.