XMM-Newton CCF Release Note

XMM-CCF-REL-235

EPIC MOS Quantum Efficiency

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1 CCF components

Name of CCF	VALDATE	Blocks changed	XSCS flag
EMOS1_QUANTUMEF_0017.CCF	2000-01-01	QE_TOTAL	NO
EMOS2_QUANTUMEF_0017.CCF	2000-01-01	QE_TOTAL	NO

2 Changes

The EPIC-MOS Quantum efficiency has been adjusted by applying a multiplicative correction factor. This reduces the low energy QE by a maximum of 20% at the O edge.

3 Scientific Impact of this Update

The change to the overall quantum efficiency (QE) of the central CCDs of both MOS detectors has been made by increasing the depths of edges at the C, N and O energies. Ground calibration measurements below 1 keV had obvious systematic discrepancies with any plausible model of the CCD QE so the model initially adopted was informed mostly by physical measurements of the surface structure of the CCD. Cross-calibration with the most recent calibration of the EPIC-pn and RGS has provided strong evidence that this model required adjustment. Nitrogen and Oxygen are constituents of the surface layers of the CCDs and the level of increase of these depths is within the accuracy of physical measurements of the CCD structure. Carbon is not a natural layer on the CCD. It has been added to the QE model primarily because an additional edge at this energy is most compatible with the exisiting redistribution function. There is no evidence for a signicant change in these additional layers since launch and the new QE model is in fact marginally in better agreement with the ground calibration measurements.

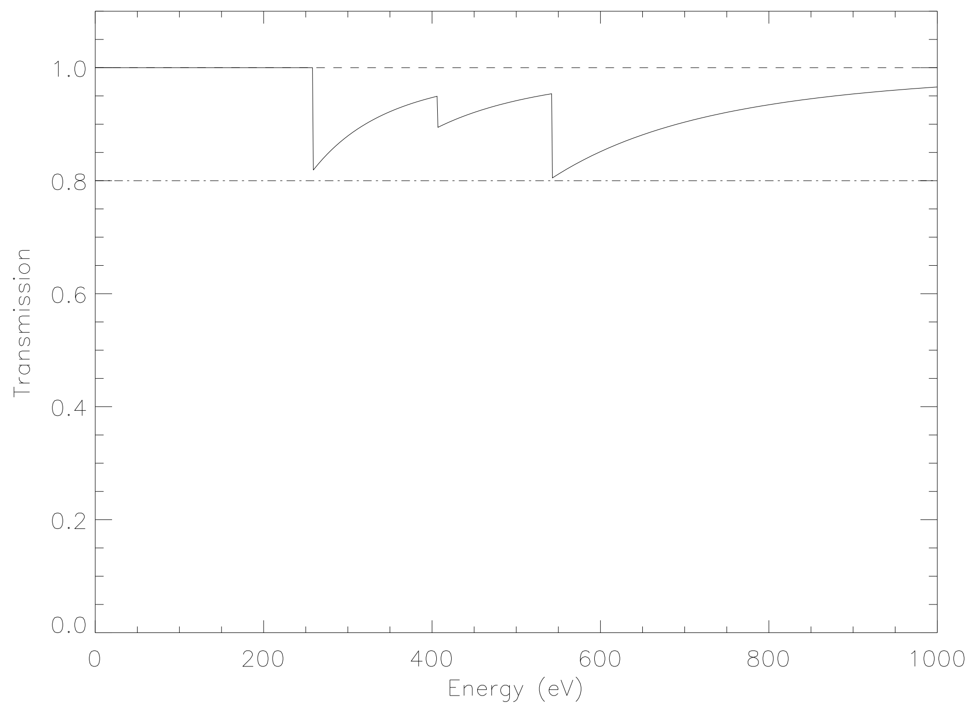

Figure 1: The form of the mathematical correction applied to the Quantum Efficiency

4 Estimated Scientific Quality

The multiplicative correction factor to the Quantum Efficiency is shown in Fig.1. The same factor was applied to both MOS1 and MOS2 as this correction was equally applicable to both detectors within the errors of the calibration data.

5 Expected Updates

Nothing forseen for these particular changes.

6 Test procedures and results

The MOS data from observations of the SNR 1E0102 were compared with a detailed spectral model recently derived from high resolution RGS data. The result of folding the model through the MOS response, with no renormalistion, is shown in the next two figures. The adjusted QE (CCF 0017) clearly gives a better fit to the model around the

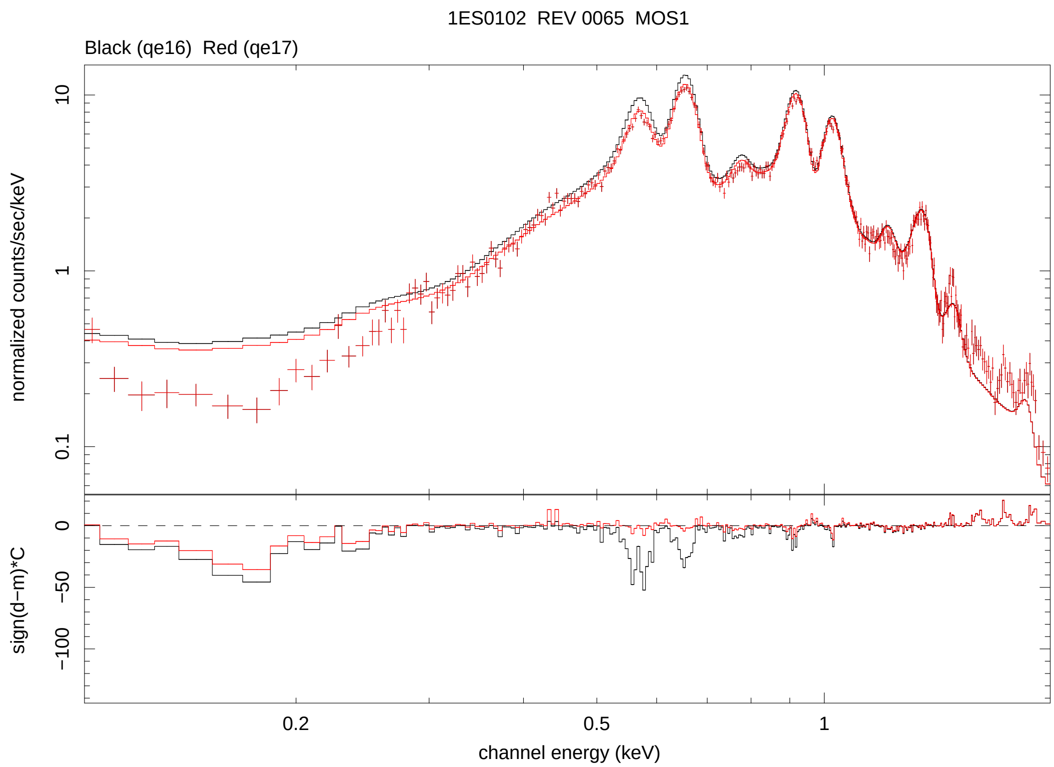

Figure 2: The MOS1 spectrum of the SNR 1E0102 compared with a model derived from RGS data folded through the MOS response. The black line is with QE CCF 0016 and the red line is with QE CCF 0017. The model has not been renormalised.

Oxygen lines than the QE in CCF 0016. Discrepancies in the fit at lowest and highest energies in the energy band shown may due to uncertainties in the model parameters and the RGS calibration at the extreme ends of the detector passband.

The effect of the QE adjustment was also compared to the cross-calibration with the EPIC-pn. MOS1, MOS2 and pn data from 117 broad band AGN were spectrally fit and fluxes derived in selected energy bands. Figs. 4 and 5 show the distribution of these fluxes. The effect of the QE change is to increase the MOS fluxes below 1 KeV leaving a generally energy-independent offset in the derived fluxes between the MOS cameras and the pn of around 5–10%. This makes the broad band spectral slope more consistent between the cameras. With the previous calibration, MOS produced lower fluxes than pn at low energies and higher fluxes at higher energies.

7 Comments

None

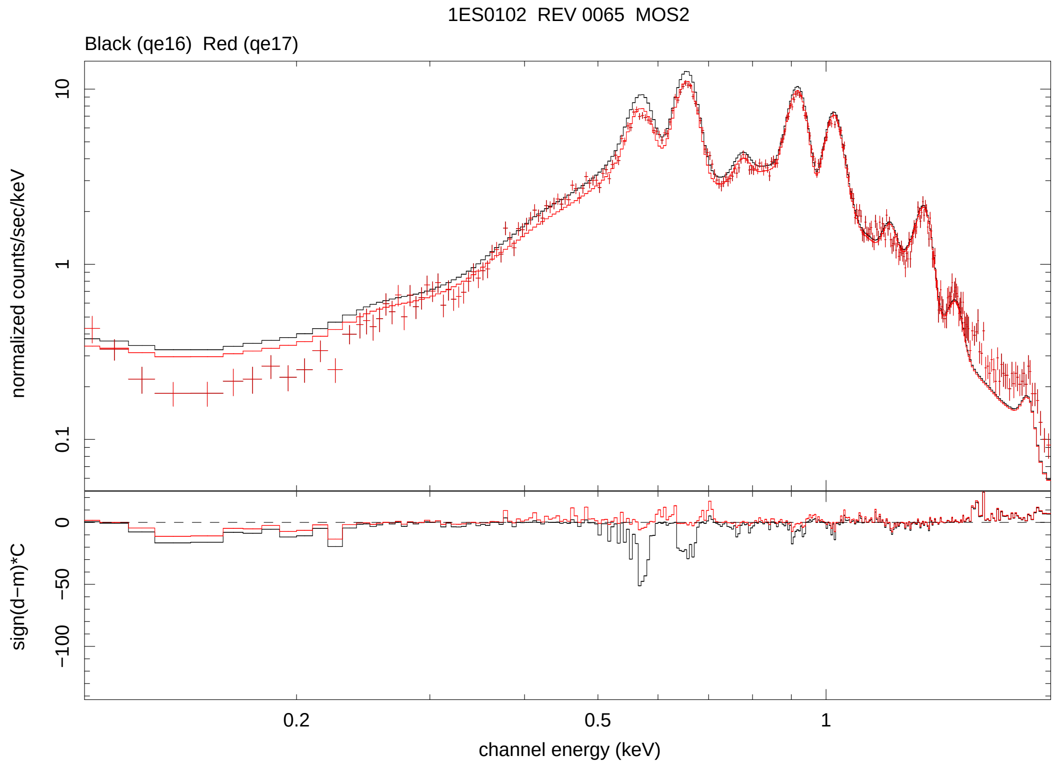

Figure 3: As previous figure, but for MOS2

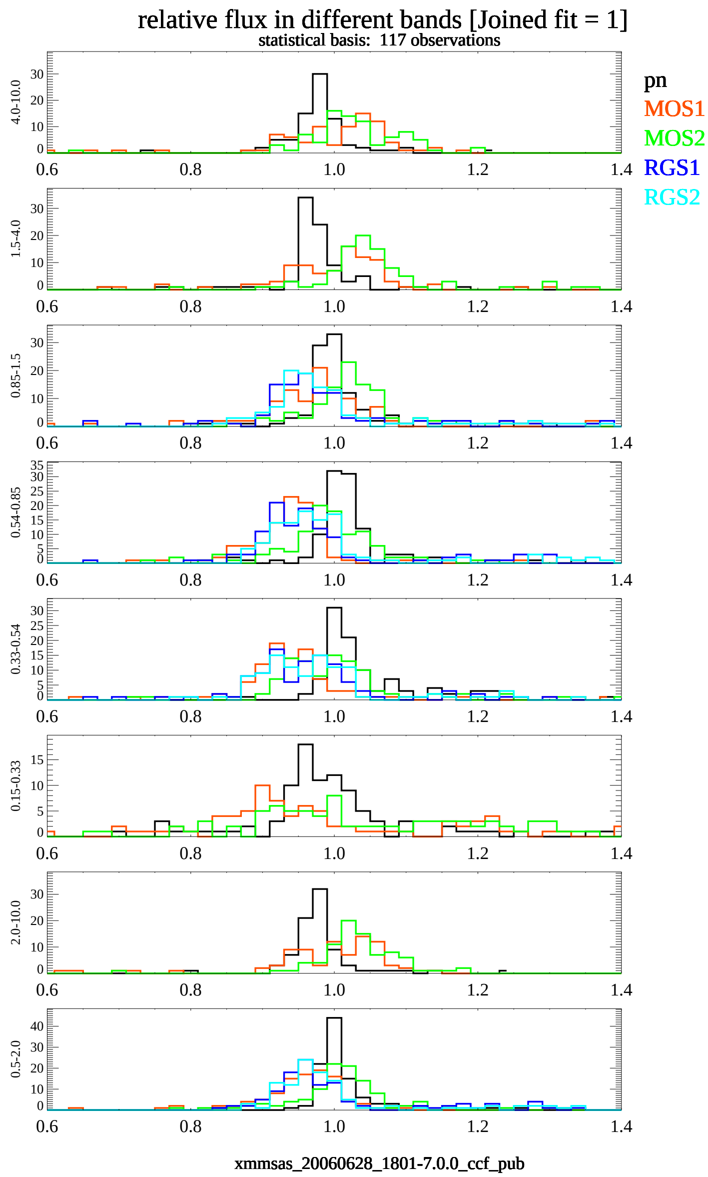

Figure 4: The relative normalisations of the XMM instruments after joint fits to 117 bright AGN, using the MOS QE CCF 0016.

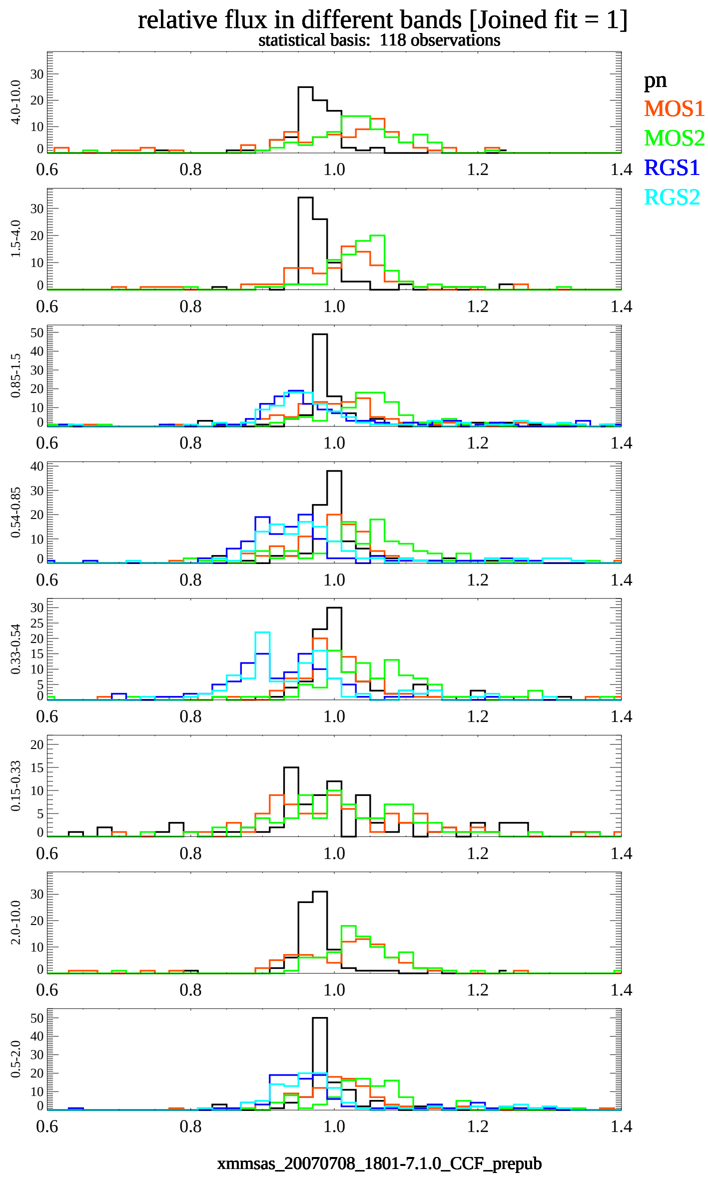

Figure 5: The relative normalisations of the XMM instruments after joint fits to 118 bright AGN, using the MOS QE CCF 0017.