XMM-Newton CCF Release Note

XMM-CCF-REL-152

EPIC MOS pattern fractions

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1 CCF components

Name of CCF	VALDATE	Blocks changed	XSCS flag
EMOS1_QUANTUMEF_0015.CCF	2000-01-01	FRACTION_CHANNEL	NO
EMOS2_QUANTUMEF_0015.CCF	2000-01-01	FRACTION_CHANNEL	NO

2 Changes

Timing mode channel pattern fractions have been calculated by convolving the pattern fraction array in channel space for imaging mode by the energy pattern fractions relevant to Timing mode. Previously the pattern fractions for Timing mode were spurious (see SPR-2422).

Keywords have been added to each CCD extension, QE_CCCn, to describe the ratio of large pattern pixels (see SPR-2421 for the use of these values in pile-up studies). The added keywords are the same for each CCD:

```
LRG_1325= 8.34000000000000E+00 / Ratio of large events to Pattern 13-25 events
LRG_SIZ0= 3.41600000000000E+00 / Coeff 1
LRG_SIZ1= -1.10900000000000E+00 / Coeff 2
LRG_SIZ2= 6.91510000000000E-01 / Coeff 3
LRG_SIZ3= -6.51300000000000E-02 / Coeff 4
LRG_SIZ4= 1.89640000000000E-03 / Coeff 5
```

The coefficients, **LRG_SIZn**, give the average size of large events as a function of energy and are to be used in the formula:

$$Size = LRG\_SIZ0 + LRG\_SIZ1 * E + LRG\_SIZ2 * E^2 + LRG\_SIZ3 * E^3 + LRG\_SIZ4 * E^4$$

3 Scientific Impact of this Update

With this more accurate description of the channel fractions, the task *epatplot* may be used to investigate pile-up issues with MOS timing mode observations. However, in testing it was seen that, in some cases, the fit is far from perfect at the low-energy end. It is suspected that this is due to background, which scales with the relatively large area which has to be used for extracting MOS timing mode spectra. This is expected to be resolved by allowing the task *epatplot* to perform background subtraction before the comparison with the pattern fraction model takes place.

4 Estimated Scientific Quality

An observation of the soft spectrum BL Lac source, PKS 2155-304, was used to investigate the fidelity of the timing mode pattern fractions. The fit is good (Fig. 1.), however, to achieve this fit it was necessary to restrict the source extraction region to the central RAW-X row. Including a wider region causes the low-energy curve to deviate significantly from the model, suggesting that background subtraction is important.

5 Expected Updates

Nothing forseen for these particular changes.

6 Test procedures and results

The analyses of section 4 show that the pattern fractions are sufficiently accurate for performing pile-up checks in Timing mode. The effect on the generated redistribution function should be small. To check this we have refit an observation of NGC 5548, where MOS-1 is in Timing mode and MOS-2 in Small Window mode. A combined spectral fit of these data gives agreement to 10% from 0.3 to 9 keV (Fig. 2) which is consistent with the matrices produced with the previous CCF (Fig 3.)

7 Comments

New Cal package calls are needed to access the Large pixel keywords.

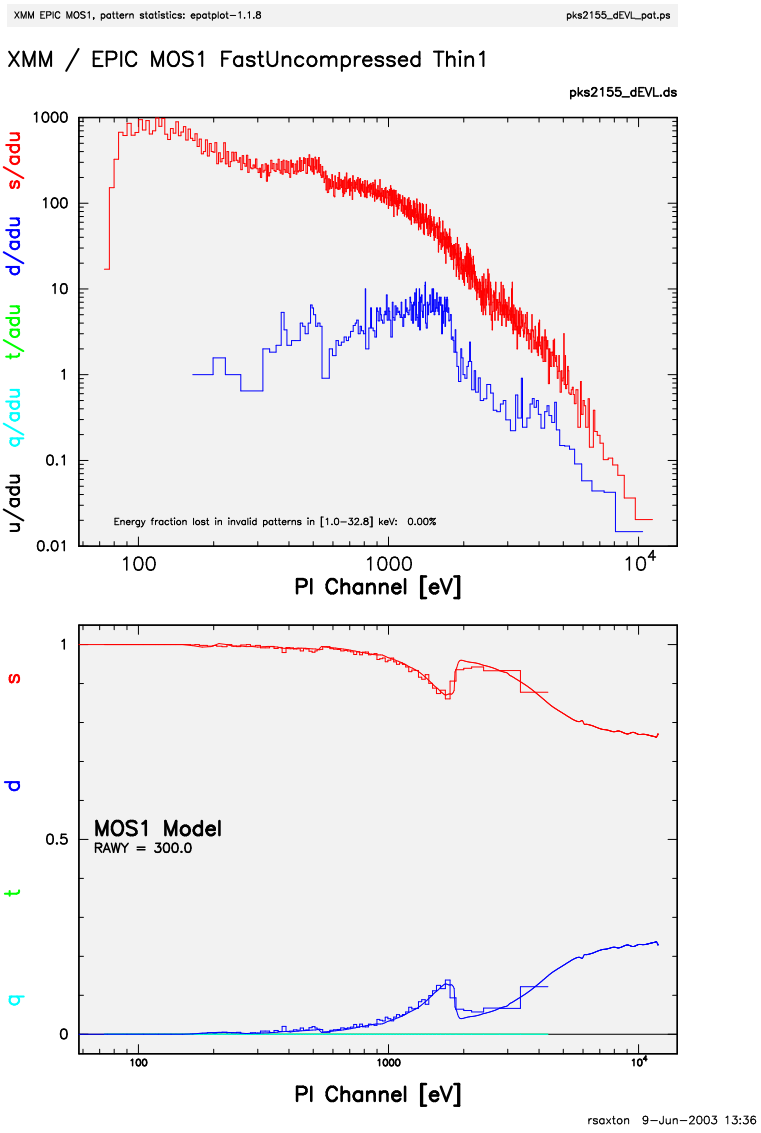

Figure 1: An *epatplot* comparison of the pattern fractions from a Timing mode observation of PKS 2155-304

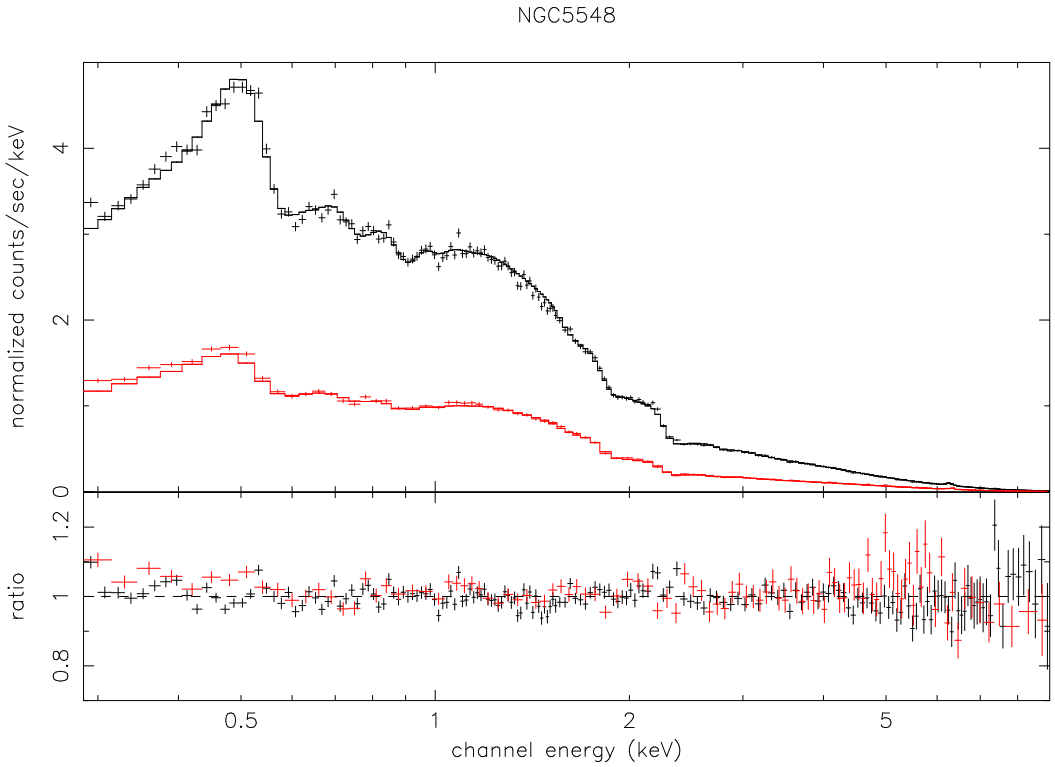

Figure 2: A combined fit of a MOS-1 Timing mode (black) and MOS-2 small window mode (red) observation of NGC5548, using matrices generated using EMOSn_QUANTUMEF_0015.CCF

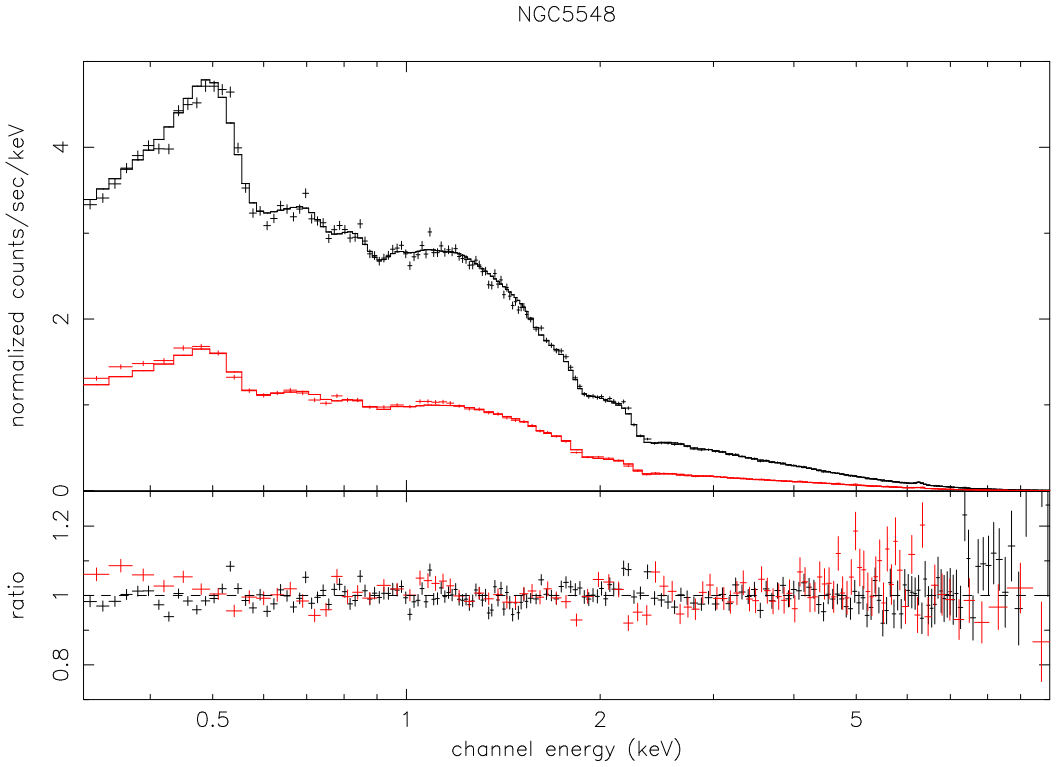

Figure 3: A combined fit of a MOS-1 Timing mode (black) and MOS-2 small window mode (red) observation of NGC5548, using matrices generated using the old CCF elements EMOSn_QUANTUMEF_0013.CCF