

XMM-CCF-REL-164

EPIC-pn spectral response

R. D. Saxton

Mar 26 2004

1 CCF components

Name of CCF	VALDATE	Blocks changed	XSCS flag
EPN_QUANTUMEF_0014.CCF	2000-01-01	FRACTION_CHANNEL, FRACTION_ENERGY	NO
EPN_REDIST_0008.CCF	2000-01-01	EBOUNDS, BINNEDPLEBOUNDS	NO

2 Changes

This release is dedicated to improving the calculation of the EPIC-pn Small Window mode response. This has been engineered by a reworking of the SW mode redistribution function (*calpnalgo* V2.44.1), the pattern fractions in channel and energy space (EPN_QUANTUMEF_0014.CCF) and the channel energy bounds (EPN_REDIST_0008.CCF). These changes are paralleled by the pn canned matrices (MPE Version 6.6) available from http://xmm.vilspa.esa.es/external/xmm_sw_cal/calib/epic_files.shtml.

The applicable spatial region for SW mode pattern fractions has been extended to include RAW-Y=137–140; an area that was erroneously excluded from previous releases.

The energy pattern fractions for Timing mode have been set to zero for the single pixel only and double pixel only events. This is because the Timing mode fractions have only been calibrated for single plus double (pattern 0 to 4) spectra.

3 Scientific Impact of this Update

This update, in conjunction with the accompanying redistribution changes, results in greater consistency between the single and double pixel event spectra below 1 keV and in particular around the Oxygen edge. The change in channel energies and the resulting modification of the RMF of all modes at low energies, introduced by the accompanying

software (*calpna* V2.44.1), will modify the response matrices for *all* modes at low energies. This will be most noticeable for very soft sources where flux changes of the order of 10%–20% may be visible below 0.3 keV.

Occasional crashes from tasks attempting to access pattern fractions ,for SW mode data, in pixels with RAW-Y=137–140 will no longer occur.

Effective area files produced by *arfgen* from pn Timing mode single or double pixel event only spectra will now be zeroed to reflect the current calibration status for this mode.

4 Estimated Scientific Quality

In Figure 1 we show the residuals to a combined fit of the singles and doubles spectra from a high signal-to-noise observation of 3C273 (0126700301). The spectra are consistent to within $\sim 5\%$.

5 Expected Updates

6 Test procedures

Test 1: The response matrix generation tasks *arfgen* and *rmfgen* have been tested by producing single and double pixel event spectra of a bright source and ensuring that they produce compatible residuals to the fit of a standard spectral model.

Test 2: The pattern fractions in the CCF can be tested by running the task *epatplot* on events from a bright source.

7 Test results

Test 1: Figure 1 shows that the singles and doubles spectra are reasonably consistent.

Test 2: The events from 3C273 follow the predicted pattern fraction curve (Fig 2).

8 XSCS flag justification

This CCF is not among the 29 CCFs listed at http://xmm.vilspa.esa.es/~xmmdoc/calpv/Oper_CCFs.html as being deliverable, upon update, to the XSCS, as XMM-Newton Operational CCFs.

9 Compatibility issues

The use of the CCF elements `EPN_QUANTUMEF_0014.CCF` and `EPN_REDIST_0008.CCF` should improve the agreement between SW mode single and double pixel spectra when used with the current SAS (V5.4.1). For best results, though, they should be used in conjunction with a SAS which contains the package *calpna* with version 2.44.1 or later.

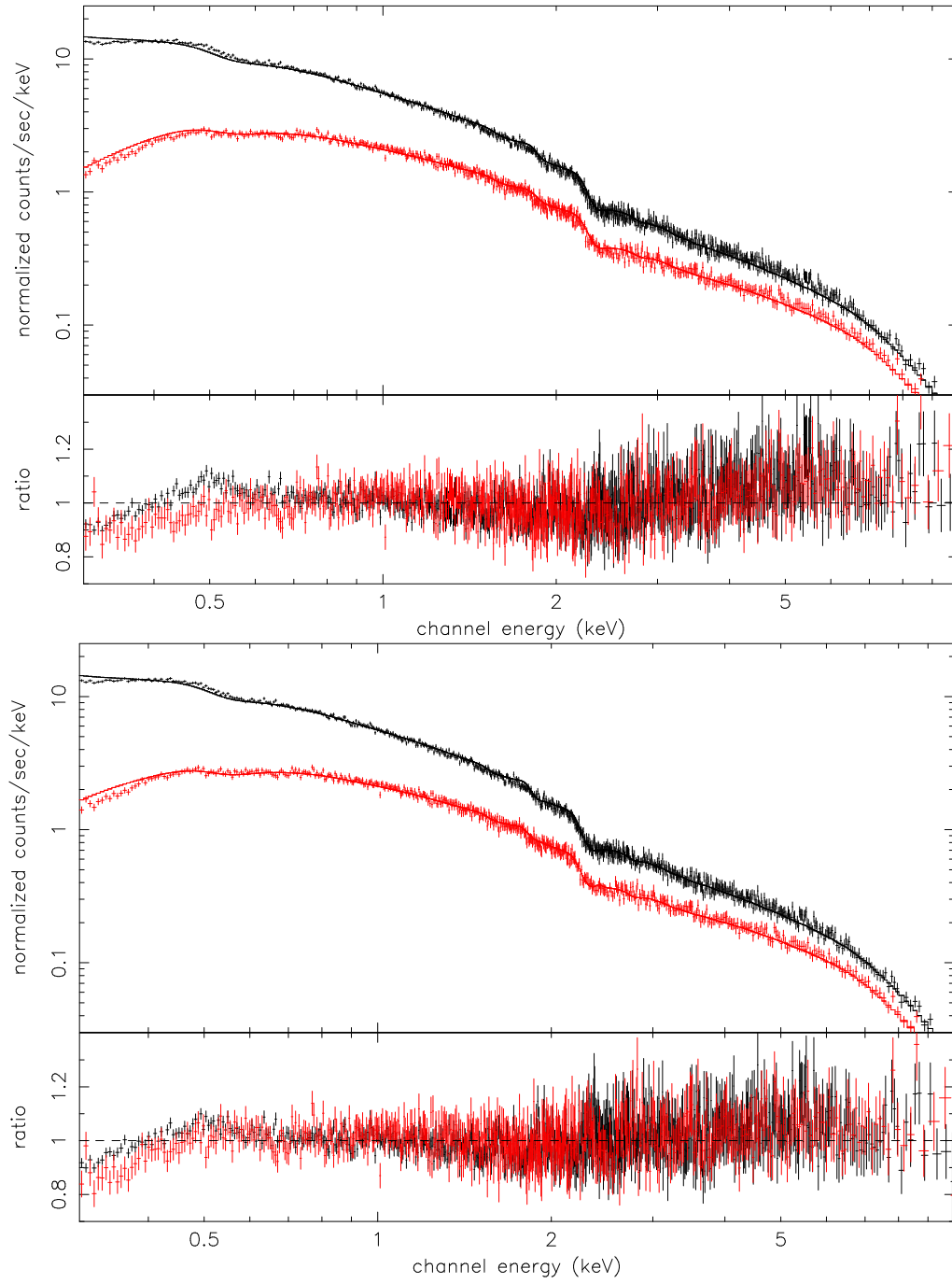


Figure 1: The residuals to a joint fit of an absorbed power-law plus soft emission component to the single and double pixel event spectra from an SW mode observation of 3C273. Top panel: SAS 5.4.1, EPN_QUANTUMEF_0012.CCF and EPN_REDIST_0007.CCF; Bottom panel: *calpnalگو* V2.44.1 and EPN_QUANTUMEF_0014.CCF, EPN_REDIST_0008.CCF.

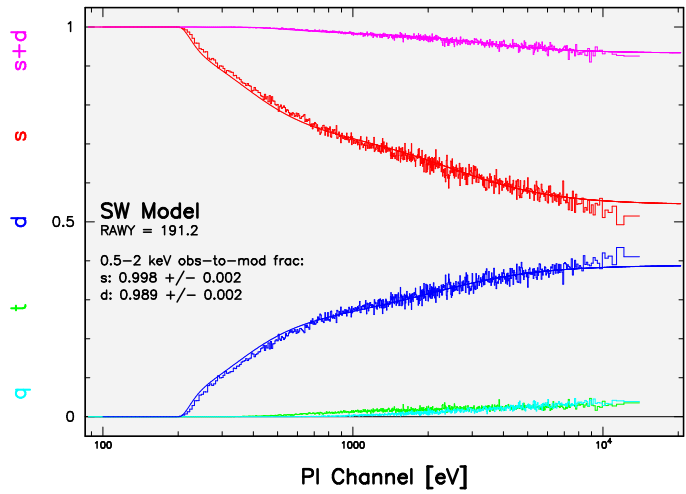
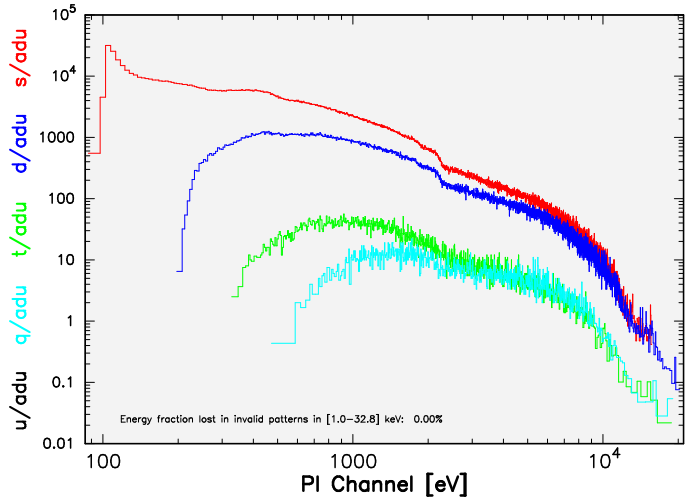


Figure 2: Comparison of the pattern fractions in small window mode with the model prediction