XMM-Newton CCF Release Note

XMM-CCF-REL-174

pn telescope effective area modification

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	CAL VERSION	XSCS flag
XRT3_XAREAEF_0009	2000-01-13T00:00:00	ONAXISXAREAEF	3.169	NO

2 Changes

XMM EPIC-pn observations with very high statistic show residuals at the Silicon edge around 1.8 keV and gold edge around 2.2 keV (see Figure 1). The gold edge feature can be explained by not perfect calibration of the telescope effective area.

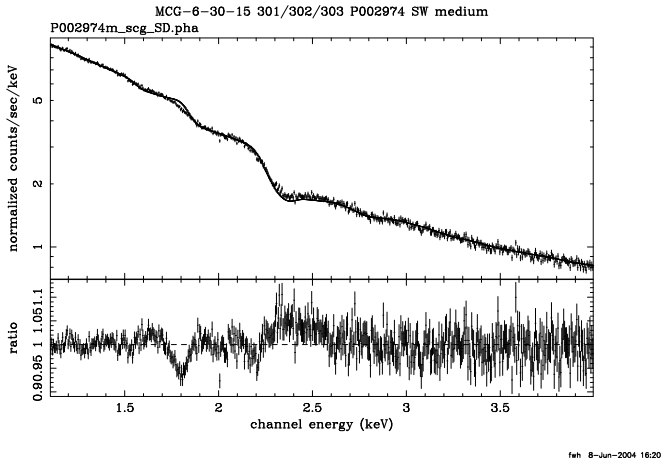

Figure 1: MCG–6-30-15 with features due to not perfect calibration at 1.8 and 2.2 keV

The effective area around the gold edge has been changed in order to improve the residuals around that edge in the pn-spectra.

2.1 ONAXISXAREAEF

Using the obtained in-orbit data on continuum sources (flat around the edges) is the best way to calibrate the effective mirror areas across the edges. Since the XRT areas were already once updated (based on MOS results) from CCF 0007 to 0008, a further update (now based on spectra with very high statistics from several sources) is justified. Such an update is not necessarily required for all 3 XRTs as they might not be identical at this level of accuracy (contamination can drastically alter the reflectivity at the edges).

New values delivered from MPE (F. Haberl) have been implemented. Figure 2 shows the history of telescope effective area changes.

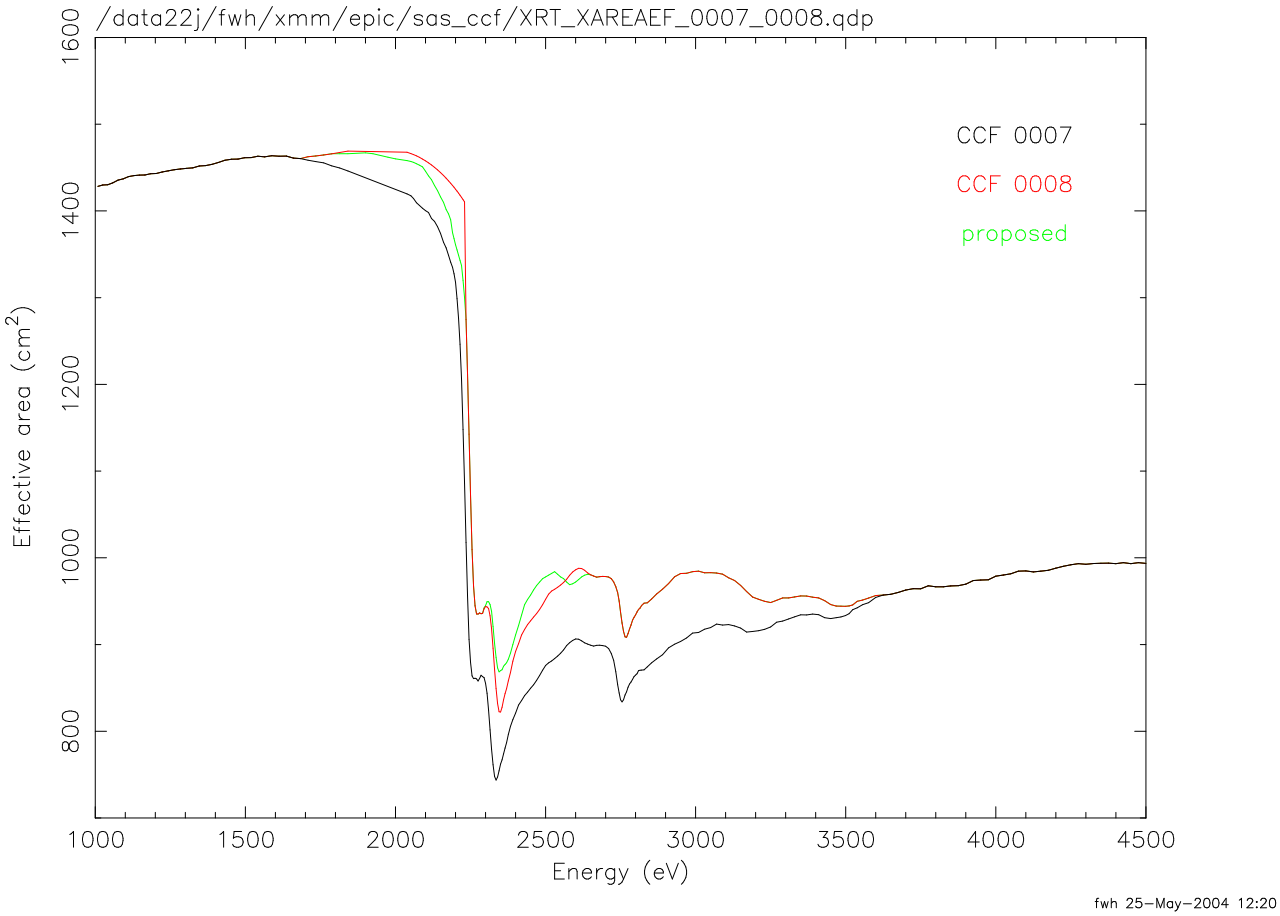

Figure 2: Effective area of the on telescope. Black: XRT3_XAREAEF_0007.CCF red: XRT3_XAREAEF_0008.CCF, green: XRT3_XAREAEF_0009.CCF

3 Scientific Impact of this Update

The change will reduce residuals around the gold edge for all modes. Figure 2 shows spectra of the black hole candidate MCG–6-30-15 from revolutions 301+302+303 (merged) with old and new CCF which best illustrates the improvement.

Note that the still present residuals around the silicon edge have been modeled by a narrow absorption line in order to be able to adjust the residuals around the gold edge better.

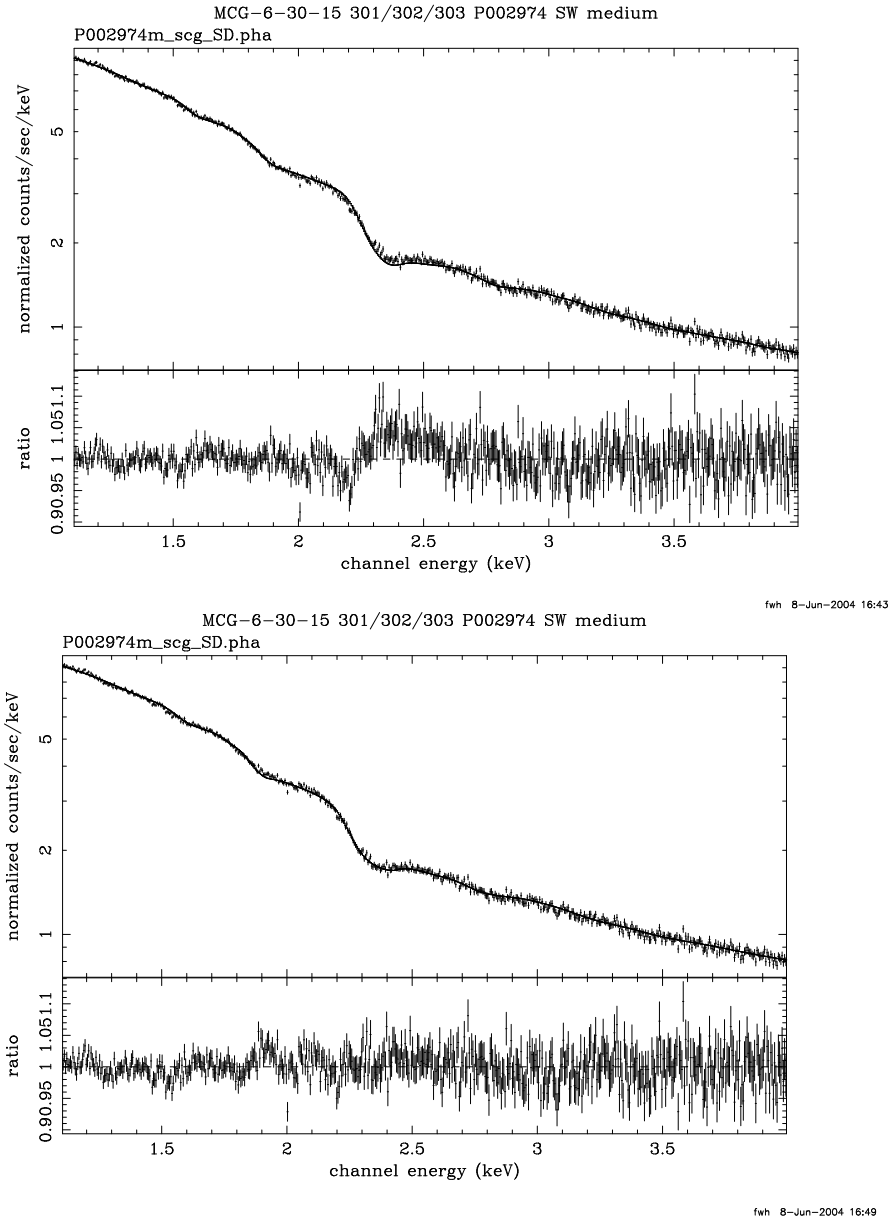

Figure 3: MCG–6-30-15: upper with XRT3_XAREAEF_0008.CCF lower: with XRT3_XAREAEF_0009.CCF

4 Estimated Scientific Quality

This change will improve the fitting quality for data with very high statistics, where the residuals for gold do appear of course stronger than for data with lower statistics. χ^2 values for MCG–6-30-15 improve as follows:

- single powerlaw: $\chi^2 = 1192/579 = 2.06$
- powerlaw+gauss (in order to model silicon feature): $\chi^2 = 872/577 = 1.51$
- powerlaw+gauss with new telescope effective area: $\chi^2 = 764/577 = 1.32$

5 Test procedures & results

The CCF has been tested on the MCG–6-30-15 data and on various other sources.

6 Expected Updates

The still present residuals around the silicon edge need to be understood can however not be improved further with the telescope effective area, since that feature seems to be related to the actual CCDs.