

XMM-Newton CCF Release Note

XMM-CCF-REL-172

Improving pn Window mode CTI correction and refining the long term CTI correction for all pn Modes

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	CAL VERSION	XSCS flag
EPN_CTL0013	2000-01-01T00:00:00	CTI-HIGH_ADD_PAR	3.169	NO
EPN_CTL0013	2000-01-01T00:00:00	LONG_TERM_CTI	3.169	NO

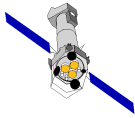
2 Changes

The EPN_CTL0013.CCF improves an under-correction of the CTI of 2-3 % for the pn Small Window mode at energies between 550 and 700 eV where O-lines are found in supernova remnants. In addition, in this CCF the Large Window mode CTI was adjusted to the Small Window mode CTI for energies below 500 eV.

In addition the long term CTI behaviour of all modes is now modeled with an additional quadratic term in order to tail off the time dependence.

2.1 CTI-HIGH_ADD_PAR

The values of the column SW_PAR that take special CTI behaviour in Small Window mode into account have been refined by determining the Oxygen line positions of 1E0102 and N132D observations from the single and double pixel event spectra for different modes.



The values of the column LW_PAR have been refined adjusting the LW mode spectra of zeta Puppis to the SW spectra.

2.2 LONG_TERM_CTI

The long term behaviour is now modeled with an additional quadratic term in order to tail of the time dependence.

3 Scientific Impact of this Update

The change will reduce residuals around 500 eV for the Small Window mode. In addition the slightly increasing over-correction with time for all modes has now disappeared.

4 Estimated Scientific Quality

Line energies measured for Oxygen lines in spectra from 1E0102 and N132D were found to be systematically lower by 10-15 eV in SW mode as compared to other readout modes. The changed CTI parameters of EPN_CTI_0013.CCF remove this discrepancy.

5 Test procedures & results

MPE re-processed all the 1E0102 and N132D observations with the new EPN_CTI_0013.CCF and determined the Oxygen line positions again from the single and double pixel event spectra. Figure 1 shows the the positions (relative to the expected values for the He-like triplet and a pair of lines near 660 eV; i.e. two data points per spectrum). The upper panel is using the old EPN_CTI_0012.CCF and the lower the new EPN_CTI_0013.CCF, in both cases derived from single-pixel event spectra. For better comparison the same scale is used. There is now agreement between SW and the other modes. A similar plot for the double spectra (not shown) demonstrates the same improvement.

Since the Large Window mode CTI correction is based on the Small Window mode CTI correction every change in the Small Window mode requires also the adjustment of the Large Window mode to that new situation. That does not mean that Large and Small Window mode data have been in disagreement with the EPN_CTI_0012.CCF. The Large Window mode CTI was adjusted to the Small Window mode for energies below 0.5 keV using a zeta Puppis observation.

For the long term CTI refinement all available CALCLOSED data have been processed and the Al-K and Mn-K lines have been fitted with Gaussians in order to determine the line positions. Figure 3 shows the line positions of the internal calibration source for old EPN_CTI_0012.CCF (black) and new EPN_CTI_0013.CCF (red) for Mn-K(alpha) and Al-K. The Al-K position is not

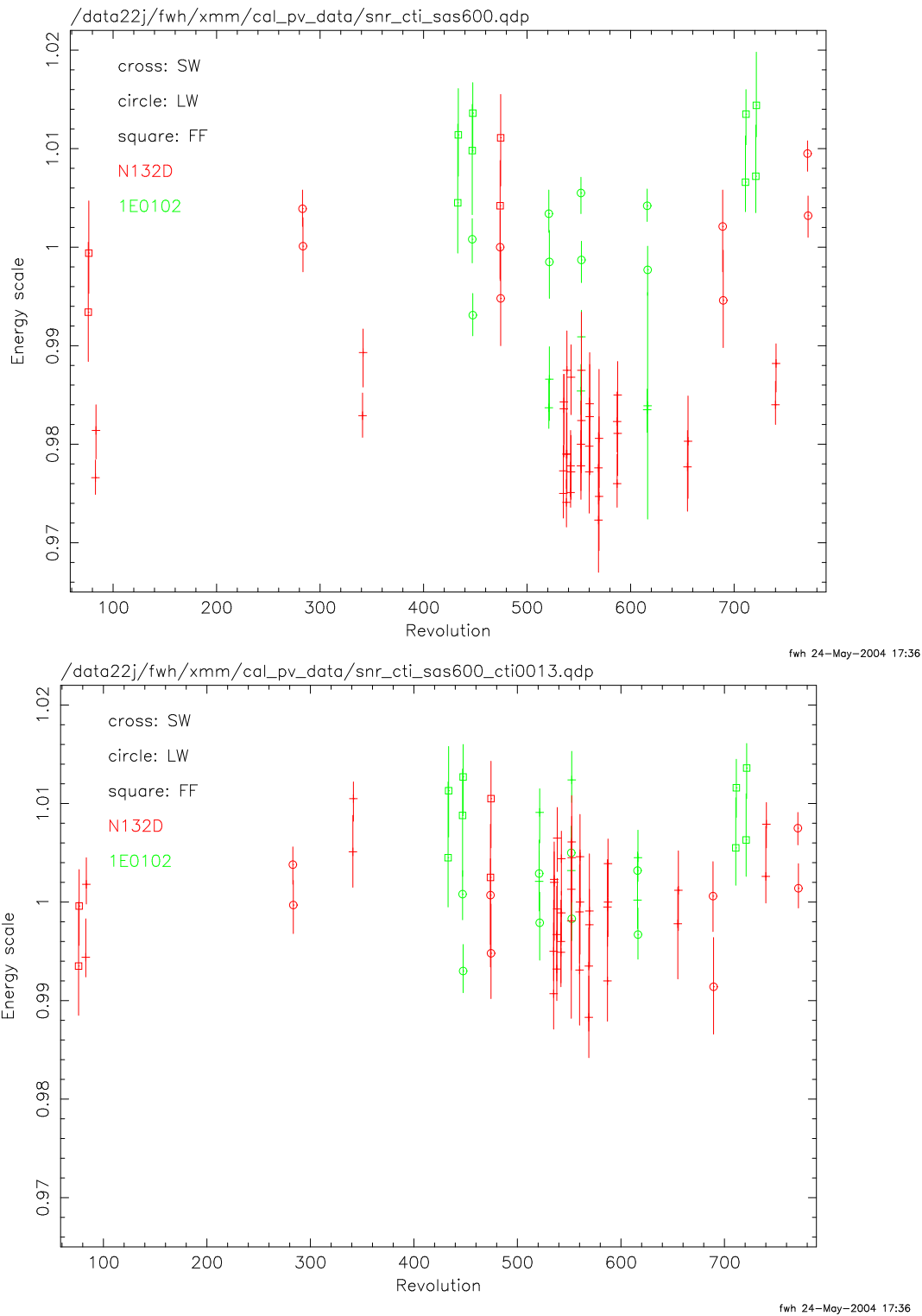
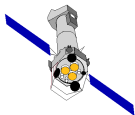
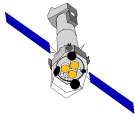


Figure 1: Positions relative to the expected values for the He-like triplet and a pair of lines near 660 eV. The upper panel is using the old EPN_CTL0012.CCF and the lower the new EPN_CTL0013.CCF. For better comparison the same scale is used.



expected to be at the reference value of 1486 eV, because the Partial Event Effect shifts the center of the line position to lower energies. This is later corrected by the detector response matrix. For Mn-K however the line should be spot on the 5896 eV, since the energy calibration after launch was fixed to that value with a reference measurement of revolution 23. The slight not time dependent over-correction of the Mn-K line position should be improved.

6 Expected Updates

For Small Window mode further improvements may be possible in a next iteration after the line shapes (redistribution below 500 eV) are adjusted.

For all modes the Mn-K energy position should be refined, since the absolute energy position was probably defined for a non nominal operation temperature.

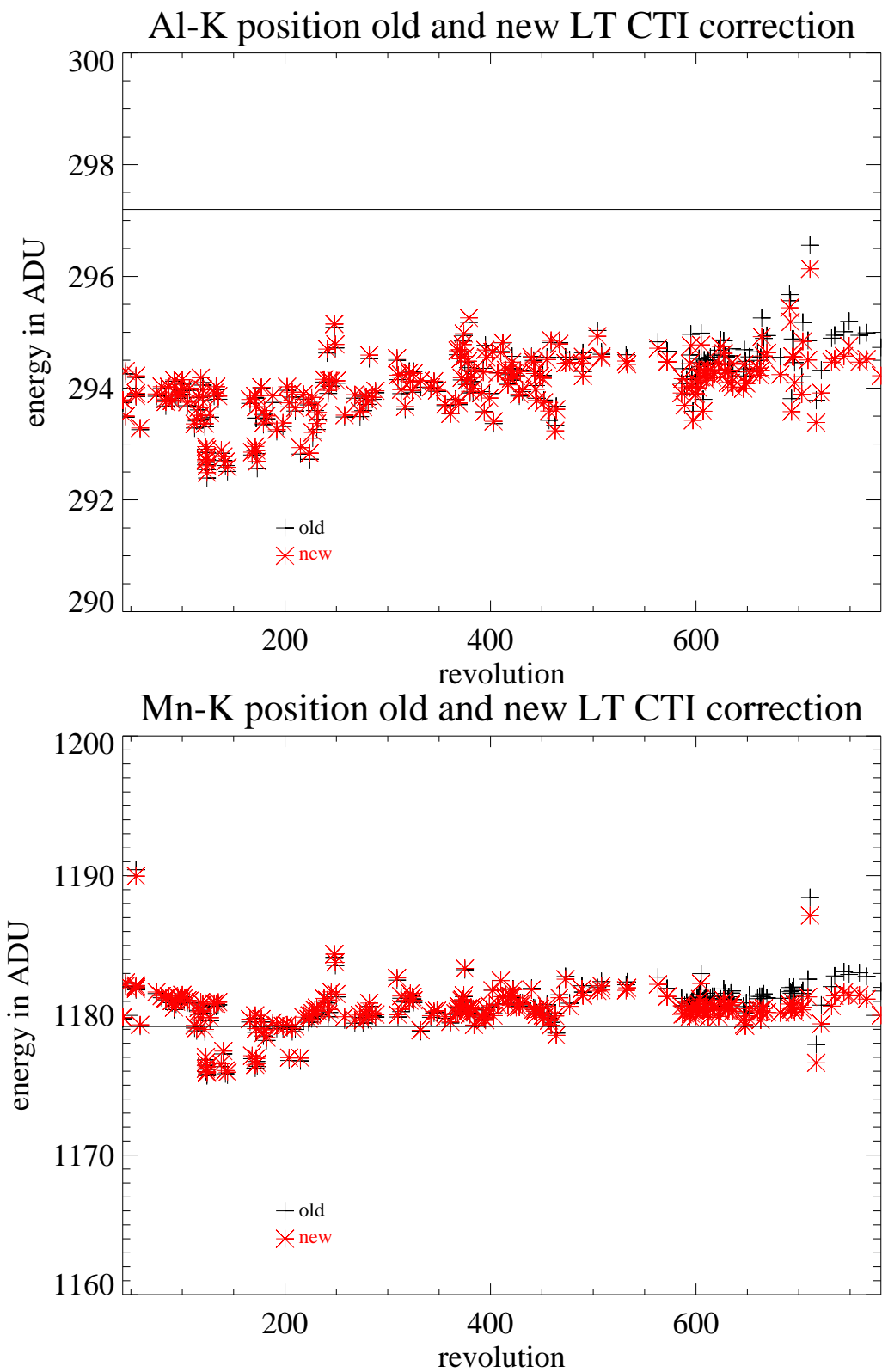
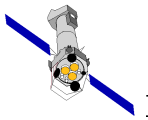


Figure 2: Linepositions of the internal calibration source for old EPN_CTI_0012.CCF (black) and new EPN_CTI_0013.CCF (red) for Mn-K(alpha) and Al-K.