XMM-Newton CCF Release Note

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Support to FF mode special gain correction

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	Change in CAL HB
EPN_CTI_0021	2000-01-01T00:00:00	CTI-HIGH_ADD_PAR	YES

2 Changes

A new column (`FF_PAR`) has been added to the `CTI-HIGH_ADD_PAR` extension of the EPIC-pn CTI CCF. This column contains the 16 parameters of a special gain correction function to be applied to pn exposures in Full Frame Mode. The function is analogous to that used to parameterize the special gain correction function in Small Window and Large Window modes. The CTI losses in the EPIC-pn window modes originate during two phases, the first in the fast-shift from the image to the frame-store area, and the second in the (normal) slow-shift during read-out to the CAMEX (XMM-SOC-CAL-TN-0081, Sect.4).

The fast-shift CTI losses are modeled as energy-dependent fraction of the slow-shift CTI losses. This correction function is

$$f(E) = \xi \times \left(a_0 - a_{11} \times \exp\left[-\left(\frac{E-a_{12}}{a_{13}}\right)2\right]\right) \times \left(b_0 - b_{11} \times \exp\left[-\left(\frac{E-b_{12}}{b_{13}}\right)2\right]\right) \times \left(c_0 - c_{11} \times \exp\left[-\left(\frac{E-c_{12}}{c_{13}}\right)2\right]\right) \times \left(d_0 - d_{11} \times \exp\left[-\left(\frac{E-d_{12}}{d_{13}}\right)2\right]\right) \quad (1)$$

where the coefficients a, b, c, and d are stored in the CCF, and ξ is a mode-dependent factor. This structure had been implemented in July 2002.

Special gain correction functions for modes others than Full Frame are defined relatively to the Full Frame mode. The new extension is required to allow for changes in the Full Frame gain, without simultaneously changing the special gain correction functions for the other modes.

3 Scientific impact of this update

In `EPN_CTI_0021` the parameters in the `FF_PAR` extension are set to dummy values, which yield no correction.

4 Estimated scientific quality

See Section above.

5 Test procedure and results

SASv9.0 and earlier versions do not support this correction. The new extension is transparent to the users. This has been proven on a pn Full Frame exposure of MS 0737.9+7441 (Obs.#0123100201)[1]. Spectra extracted from event lists reduced with SASv8.0 using CCF#20 and #21 yield indistinguishable results, as expected.

6 Expected Updates

The new extension will be filled with calibrated numbers once the calibration is completed.

[1]This source was chosen, because it is one of the brightest pile-up free sources (0.35–10 keV count rate: 4.719 ± 0.017 s^{-1}) in 2XMM. It could be therefore chosen as a testbed when the real correction is implemented.