

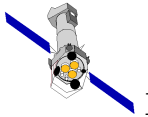
XMM-Newton CCF Release Note

XMM-CCF-REL-363

Update of EPIC MOS CTI

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1 CCF components

Name of CCF	VALDATE (start of val. period)	EVALDATE (end of validity period)	List of Blocks changed	CAL VERSION	XSCS flag
EMOS1_CTI_0099	2017-06-10T17:00:01		CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0103	2017-06-10T17:00:01		CTI_EXTENDED CTI_COLUMN		NO

2 Changes

A new epoch of CTI/ADU CONV CCF has been defined for the MOS taking into account the latest measured drop of reconstructed line energies in the monitoring of the on-board calibration lines.

The new epoch CCF partially replaces the previous most recent epoch for times of rev. 3206 onward (MOS1 issue 98, MOS2 issue 102). The epoch start is identical for MOS1 and MOS2.

The serial CTI approximates the linear CTI model within the single epochs to the long term evolution, as it remains nearly constant since cooling. Only for MOS1 CCD4, the serial CTI model uses two different long term evolutions to address the additional noise after a partial damage due to a micro-meteorite impact on 2012-12-11.

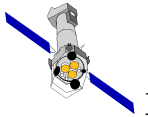
As there are no changes seen in the recent parallel CTI trends, and the fading on-board calibration source does only allow few CTI measurements over larger time ranges, especially for MOS1, the parallel CTI is calculated using still the start date 2014-05-28T21:00:01 of the previous last recent epoch (MOS1 issue 98, MOS2 issue 102) to get a better determination of the current parallel CTI trend slope.

The column offset table is calculated individually for the new epoch.

3 Scientific Impact of this Update

The use of this set of CCFs will improve the MOS energy scale reconstruction for all observations later than revolution >3206.

The new CTI CCFs are released together with a new ADU CONV CCFs (MOS1 issue 111, MOS2 issue 115, see XMM-CCF-REL-364), since using the new CTI CCFs with the old ADU CONV CCFs, or the old CTI CCFs with new ADU CONV CCFs, may give unexpected results!



4 Estimated Scientific Quality

This issue ensures that the MOS energy scale remains within 5 eV at 1.5 keV, and 10 eV at 6 keV for most sources (not too bright), for all observations (see a more detailed discussion in XMM-CCF-REL-124).

It is recalled that since SASv5.4 the MOS parallel CTI is modelled with the simple formula of the CTI loss per transfer:

- $CTIY(E, t) = (A + B * t) * E^\alpha$

where A is a constant, B the degradation rate (slope), α a power index (all 3 parameters take different values for different CCDs and different time periods), E the event energy in ADUs and t the time since launch. Note that the serial CTI is also modelled with the same formula but is mostly constant since launch. Since SASv7.0, the energy correction uses an additional offset term:

- $E_{corr} = E + RAWY * CTIY + RAWX * CTIX - OFFSET(RAWX, RAWY)$

This algorithm allows an energy scaling of the CTI that fits very well the Mn and Al lines of the internal calibration source.

5 Test procedures & results

The new CTI CCFs have been evaluated and tested with the SASv17.0. The evolution of the MOS1/MOS2 parallel and serial CTI are presented in Fig. 1 and Fig. 2.

Plots of the line monitoring are presented in the accompanying release note XMM-CCF-REL-364 of the corresponding updated MOS ADU CONV CCFs.

6 Expected Updates

None.

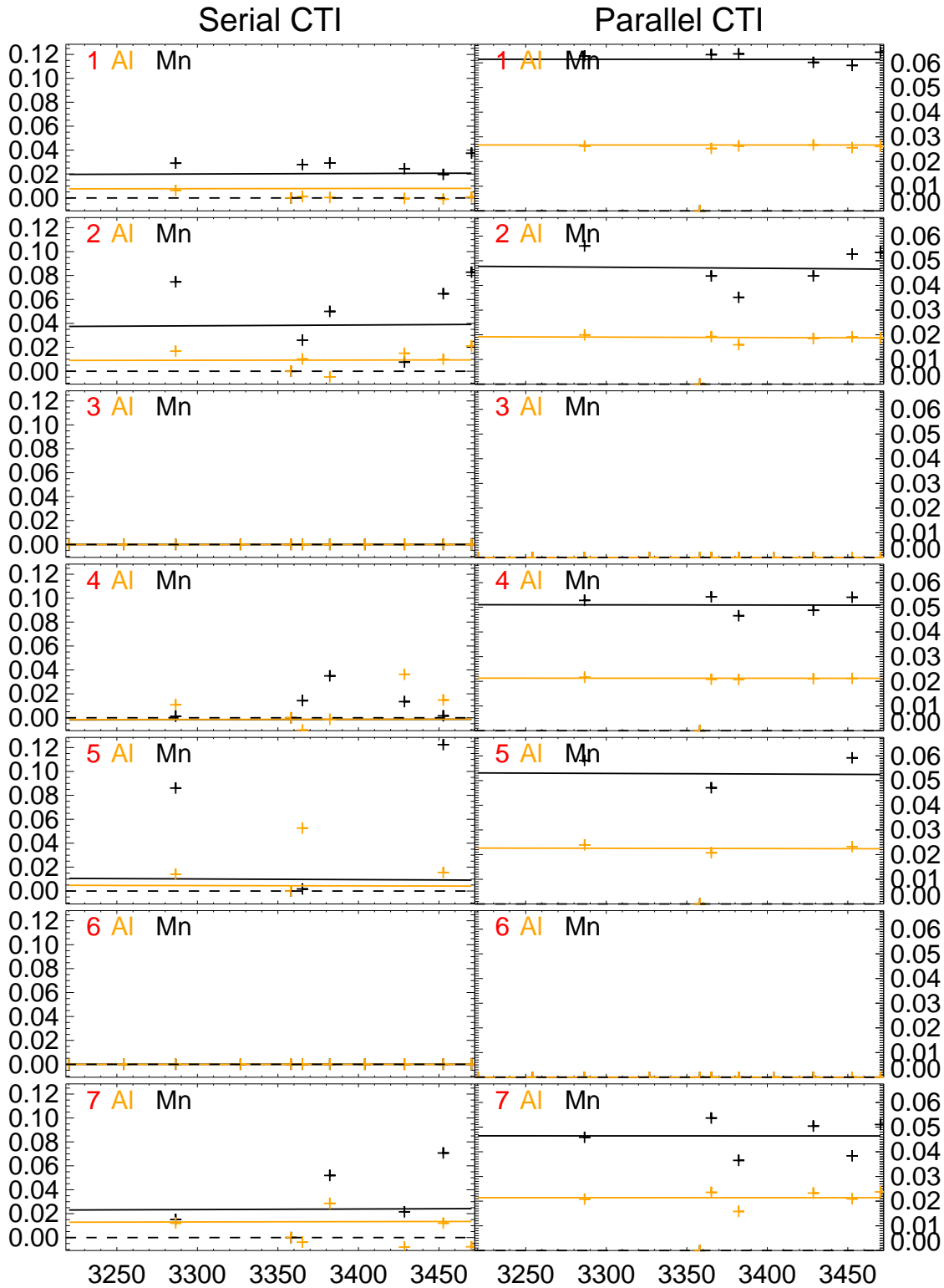
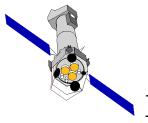


Figure 1: MOS1 serial and parallel transfer losses for the new defined epoch for CCD1 to CCD7 (top to bottom). In orange, the CTI of the Al calibration line at about 1.5 keV, in black, the CTI of the Mn K α calibration line at about 5.9 keV, overlaid with the CTI models as parametrised in the new CCF.

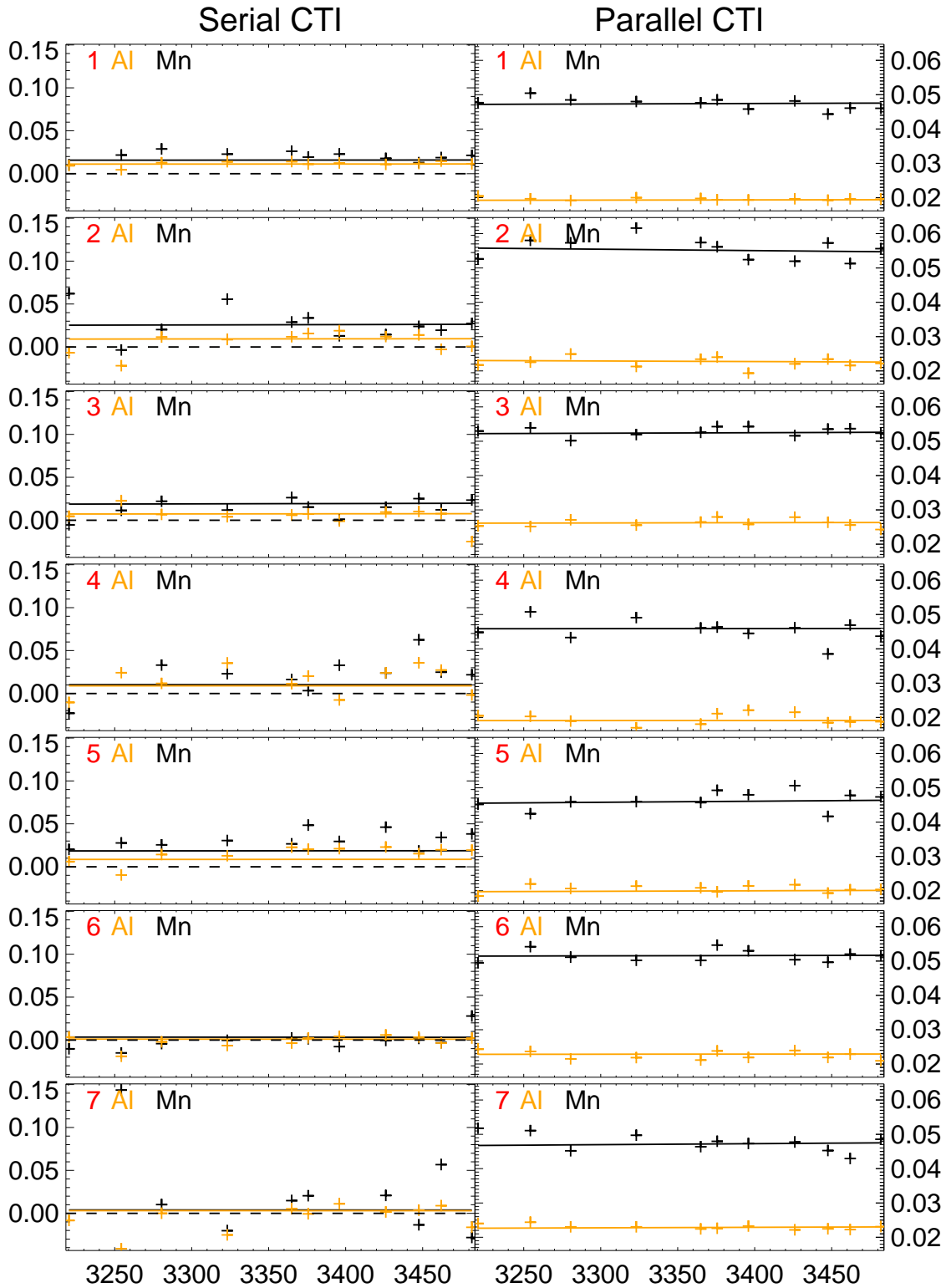
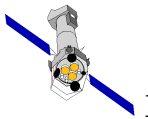


Figure 2: MOS2 serial and parallel transfer losses for the new defined epoch for CCD1 to CCD7 (top to bottom). In orange, the CTI of the Al calibration line at about 1.5 keV, in black, the CTI of the Mn K α calibration line at about 5.9 keV, overlaid with the CTI models as parametrised in the new CCF.