XMM-Newton CCF Release Note

XMM-CCF-REL-159

EPIC MOS CTI since CCD cooling

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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_0016	2002-11-07T05:00:00		CTI_EXTENDED		NO
EMOS2_CTI_0016	2002-11-07T05:00:00		CTI_EXTENDED		NO

2 Changes

A new set of MOS CTI parameters has been derived for the MOSs, since the cooling of the detectors (revolution 533), taking into the account the now measured degradation rate of the parallel CTI.

The MOS CCD temperature was lowered from -100C (since the launch) down to -120C, in order to mitigate the effects of the CTI degradation on the energy resolution. As a result the parallel CTI was reduced by a factor 2 to 3 depending on the CCD, at this new operating temperature. Initial values were put in the CCF issue 15, but without any time-dependent degradation rate. This issue 16 now includes the degradation rate of the parallel CTI for all CCDs. The serial CTI remains constant since launch.

3 Scientific Impact of this Update

The use of this CCF will improve the MOS energy scale reconstruction and also marginally the energy resolution, for all observation acquired after revolution 533, compared to issue 15.

4 Estimated Scientific Quality

This issue allows to keep the MOS energy scale within 5 eV at 2keV and 10 eV for most sources (not too bright), for observations after revolution 533 (see a more detailed discussion in XMM-CCF-REL-124).

It is recalled that since SAS 5.4 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 taking different values, for different CCDs and differents 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. Then :

- $E_{corr} = E + RAWY * CTIY + RAWX * CTIX$

This algorithm allows an energy-scaling of the CTI that fits very well the Mn and Al lines of the internal calibration source, as can be seen figures 1 & 2.

5 Test procedures & results

The new CTI CCFs have been tested with the SAS 5.4.

6 Expected Updates

Further updates could be necessary if the slope of the degradation rate increase with time as expected with radiation damages.

A major revision of the MOS ADUCONV CCFs (gain) is expected by December 2003. They cover the same time periods as the MOS CTI CCFs and are adjusted to give the best energy scale for the three main emission lines of the calibration sources.

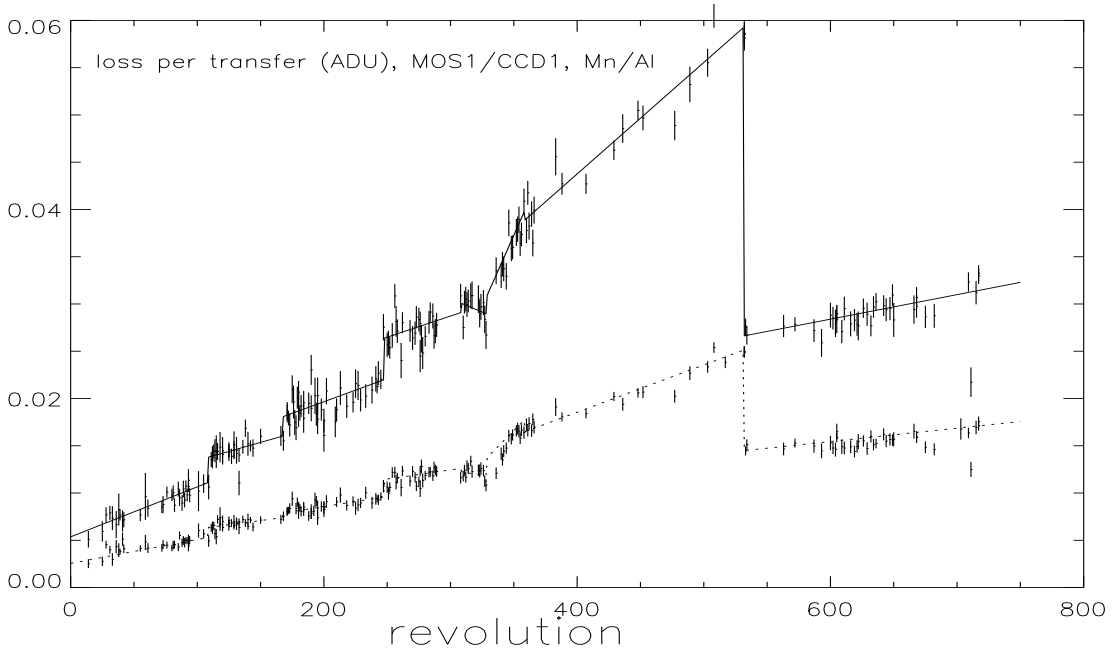

Figure 1: MOS1 transfer losses since launch at Mn and Al energies, for the central CCD, overlayed with the CTI model as parametrized in the new set of CCFs since cooling (rev 533). Note that the low values in rev 711 is due to the onset of a large solar flare, where radiation decrease the temporaily the CTI

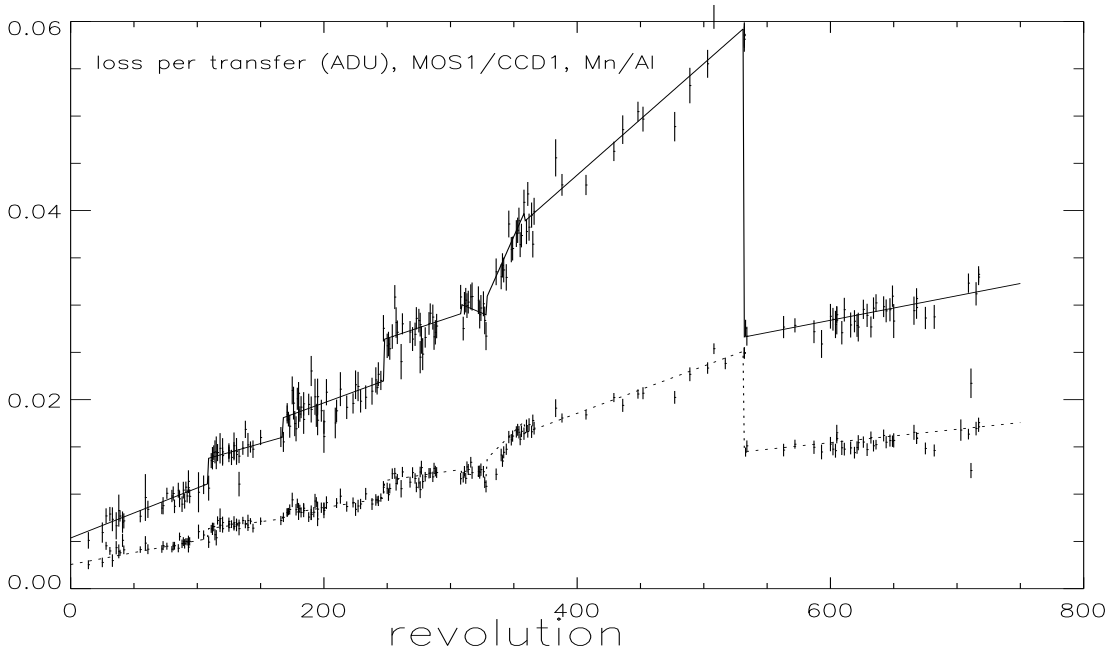

Figure 2: MOS2 transfer losses since launch at Mn and Al energies, for the central CCD, overlayed with the CTI model as parametrized in the new set of CCFs since cooling (rev 533).