XMM-Newton CCF Release Note

XMM-CCF-REL-278

Update of EPIC MOS CTI

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February 16, 2012

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_0058	1999-12-10T00:00:00	2000-07-15T12:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0059	2000-07-15T12:00:01	2000-11-09T12:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0060	2000-11-09T12:00:01	2001-04-18T00:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0061	2001-04-18T00:00:01	2001-08-18T00:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0062	2001-08-18T00:00:01	2001-09-26T22:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0063	2001-09-26T22:00:01	2001-11-25T12:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0064	2001-11-25T12:00:01	2002-05-16T05:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0065	2002-05-16T05:00:01	2002-11-07T05:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0066	2002-11-07T05:00:01	2003-11-09T18:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0067	2003-11-09T18:00:01	2005-01-21T18:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0068	2005-01-21T18:00:01	2005-07-24T01:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0069	2005-07-24T01:00:01	2005-10-19T19:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0070	2005-10-19T19:00:01	2006-08-12T23:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0071	2006-08-12T23:00:01	2007-09-05T21:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0072	2007-09-05T21:00:01	2010-01-18T10:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS1_CTI_0073	2010-01-18T10:00:01		CTI_EXTENDED CTI_COLUMN		NO

Name of CCF	VALDATE (start of val. period)	EVALDATE (end of validity period)	List of Blocks changed	CAL VERSION	XSCS flag
EMOS2_CTI_0059	1999-12-10T00:00:00	2000-07-15T12:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0060	2000-07-15T12:00:01	2000-11-09T12:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0061	2000-11-09T12:00:01	2001-04-18T00:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0062	2001-04-18T00:00:01	2001-08-18T00:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0063	2001-08-18T00:00:01	2001-09-26T22:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0064	2001-09-26T22:00:01	2001-11-25T12:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0065	2001-11-25T12:00:01	2002-05-16T05:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0066	2002-05-16T05:00:01	2002-11-07T05:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0067	2002-11-07T05:00:01	2003-11-09T18:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0068	2003-11-09T18:00:01	2005-01-21T18:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0069	2005-01-21T18:00:01	2005-07-24T01:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0070	2005-07-24T01:00:01	2005-10-19T19:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0071	2005-10-19T19:00:01	2006-08-12T23:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0072	2006-08-12T23:00:01	2007-09-05T21:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0073	2007-09-05T21:00:01	2010-01-18T10:00:00	CTI_EXTENDED CTI_COLUMN		NO
EMOS2_CTI_0074	2010-01-18T10:00:01		CTI_EXTENDED CTI_COLUMN		NO

2 Changes

A new set of CTI CCFs have been derived for the MOS taking into account the latest measured degradation rate of the parallel CTI. This new set of CCFs covers the same time periods as the previous CTI CCFs (MOS1 issue 44–57, MOS2 issue 45–58, see XMM-CCF-REL-257). The previously latest epoch (MOS1 issue 57, MOS2 issue 58) has been divided into two new epochs.

The serial CTI is also updated, even though it remains nearly constant since cooling.

The new set of CTI CCFs resets the values of MOS1 issues 58-70 and MOS2 issues 59-71 to the values of corresponding epochs of the penultimate release (MOS1 issue 30-42, MOS2 issue 31-43), as detailed analyses showed that the column offsets for single columns at certain epochs were slightly better than in the latest release.

3   Scientific Impact of this Update

The use of this set of CCFs will improve the MOS energy scale reconstruction and also marginally the energy resolution, mainly for all observations later than revolution >1600.

The new set of CTI CCFs are released together with a new set of ADUCONV CCFs (MOS1 issues 70-85, MOS2 issues 71-86, see XMM-CCF-REL-279), since using the new CTI CCFs with the old ADUCONV CCFs, or the old CTI CCFs with new ADUCONV CCFs, may give unexpected results!

4   Estimated Scientific Quality

This issue ensures that the MOS energy scale remains within 5 eV at 2keV, and 10 eV 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 tested with the SASv11.0. The results are presented in Fig. 1 to Fig. 8.

Plots of the line monitoring are presented in the accompanying release note XMM-CCF-REL-279 of the corresponding updated MOS ADUCONV CCFs.
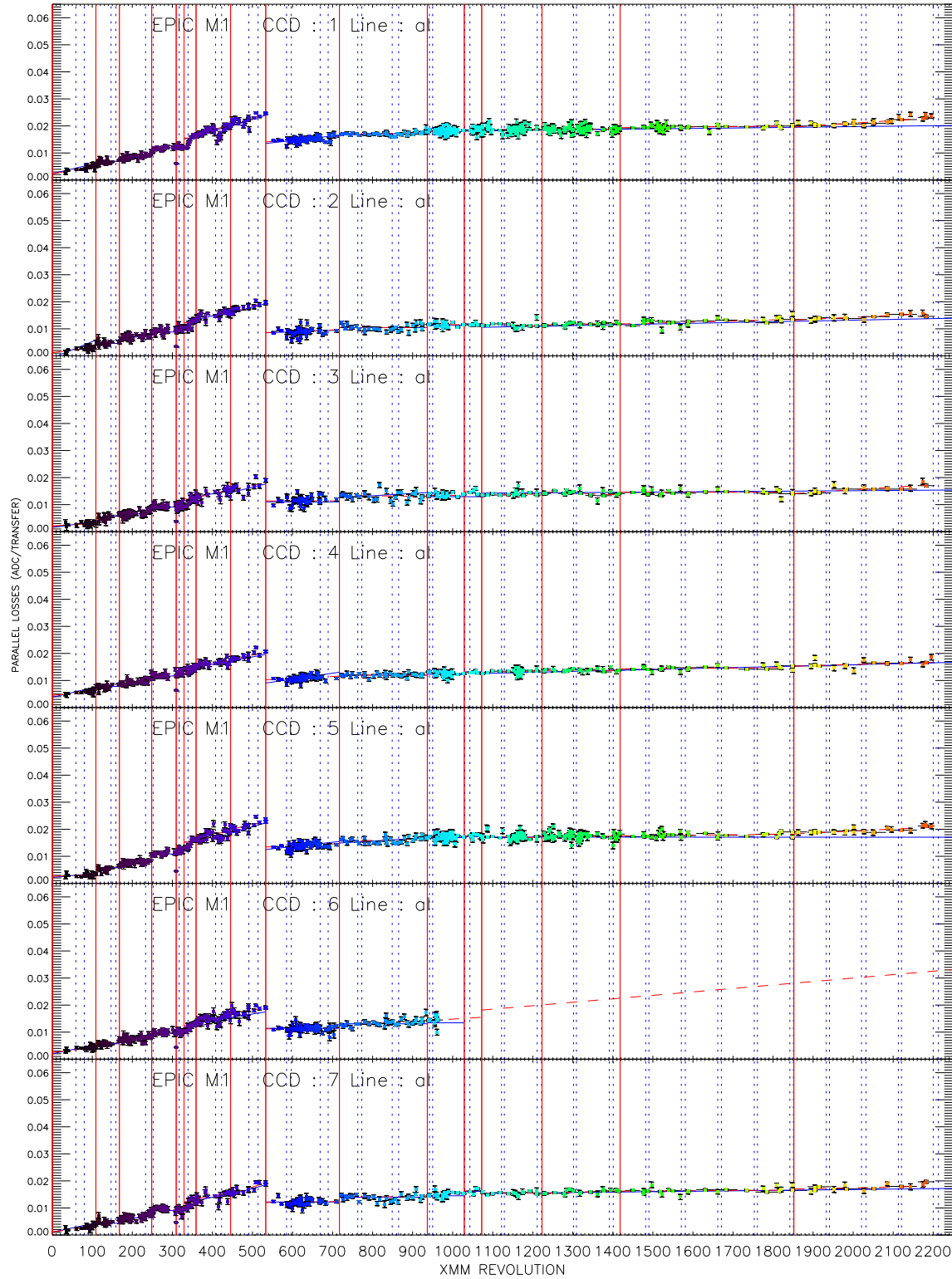
6   Expected Updates

None.

Figure 1: MOS1 parallel transfer losses since launch at 1.5 keV, the energy of the Al calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.
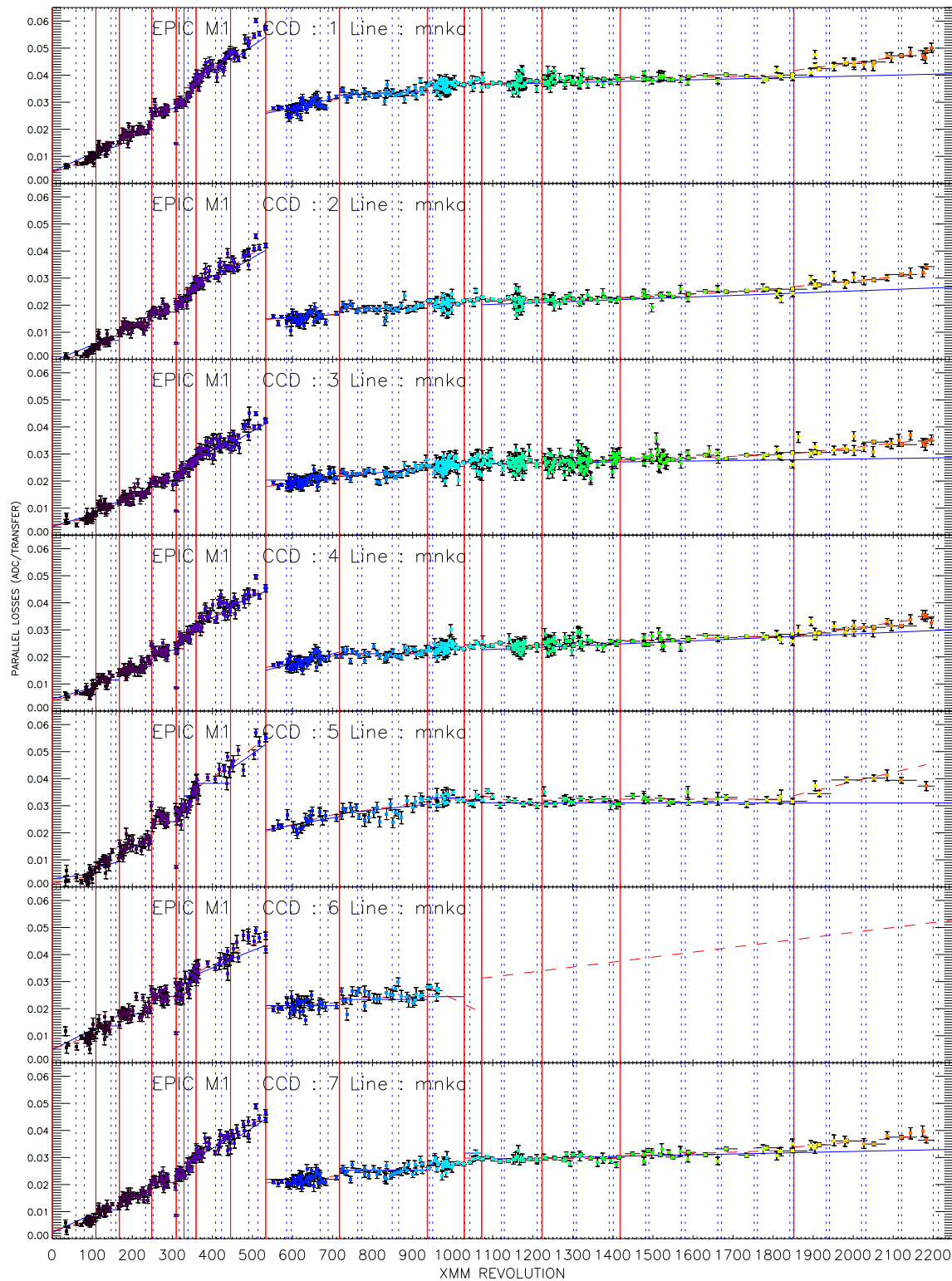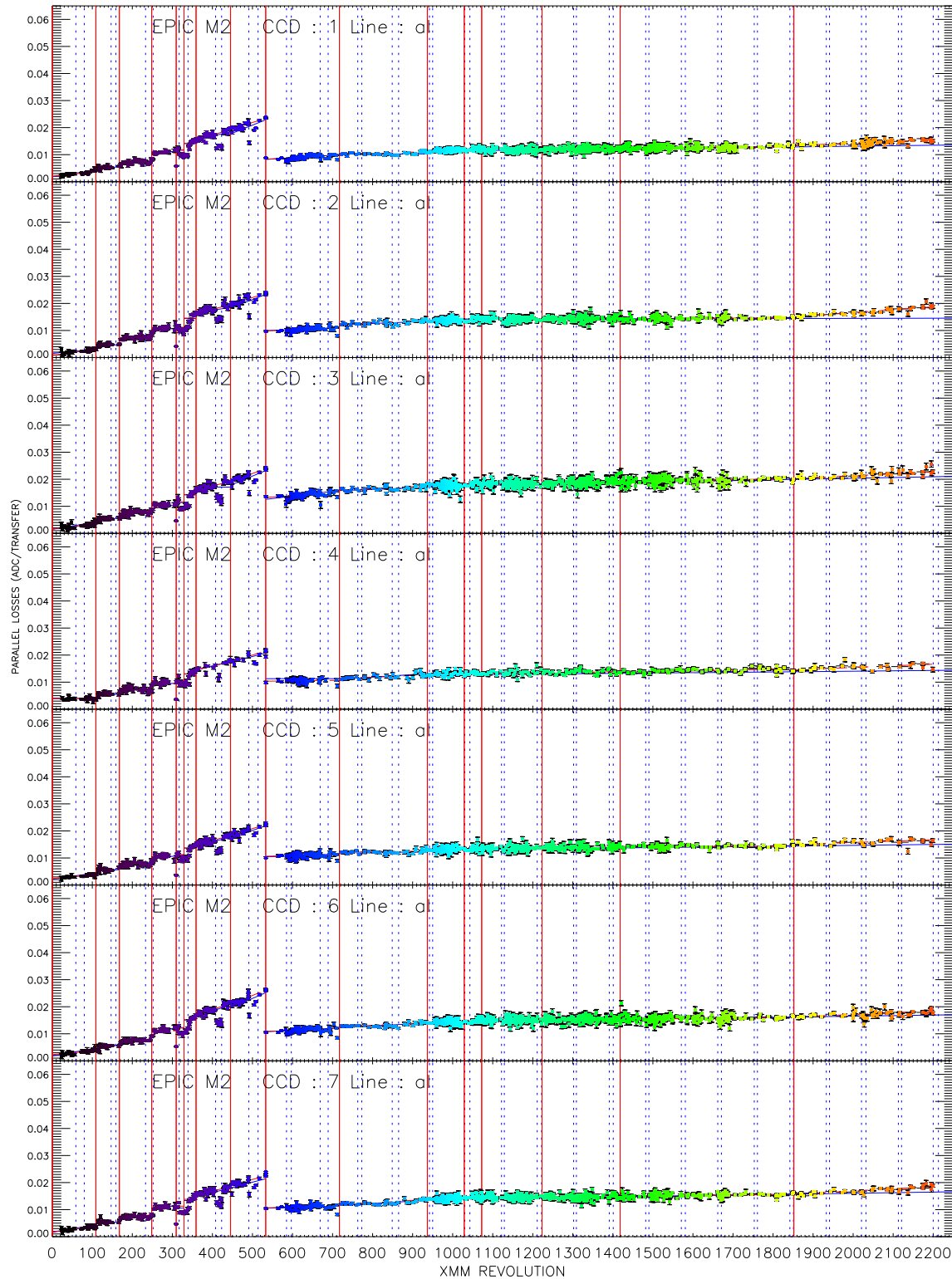
Figure 2: MOS1 parallel transfer losses since launch at 5.9 keV, the energy of the Mn Kα calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.
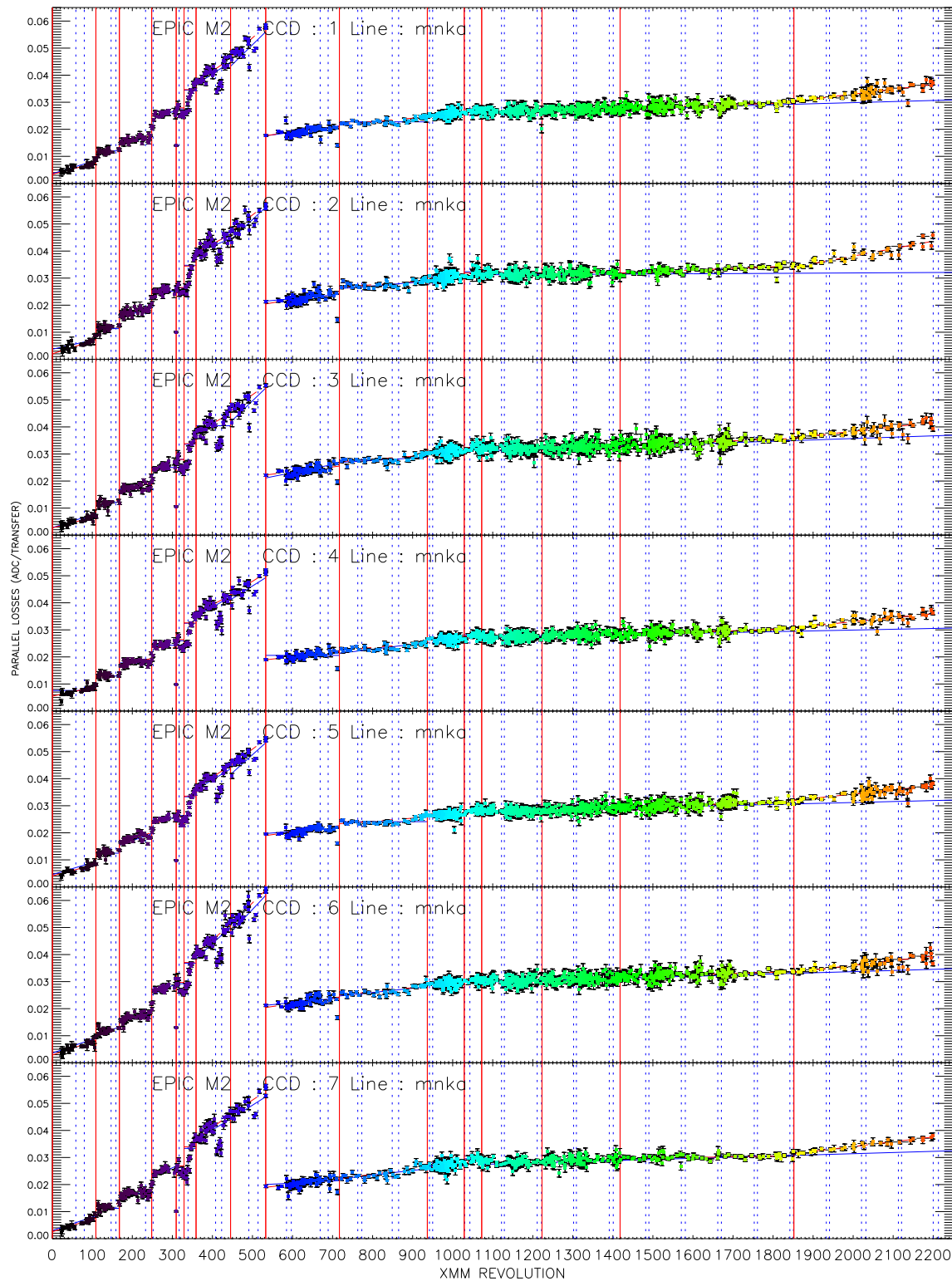
Figure 3: MOS2 parallel transfer losses since launch at 1.5 keV, the energy of the Al calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.
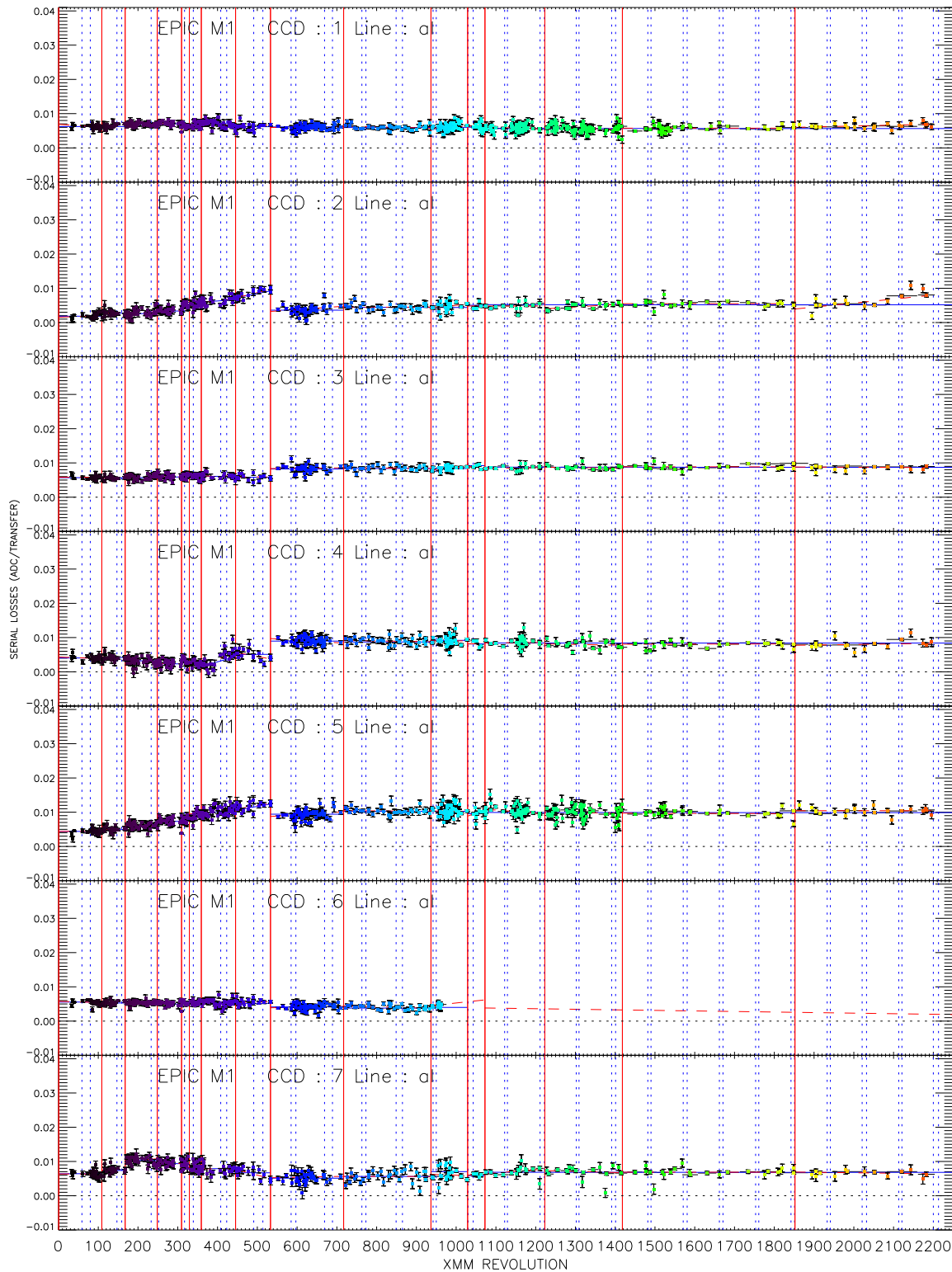
Figure 4: MOS2 parallel transfer losses since launch at 5.9 keV, the energy of the Mn Kα calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.
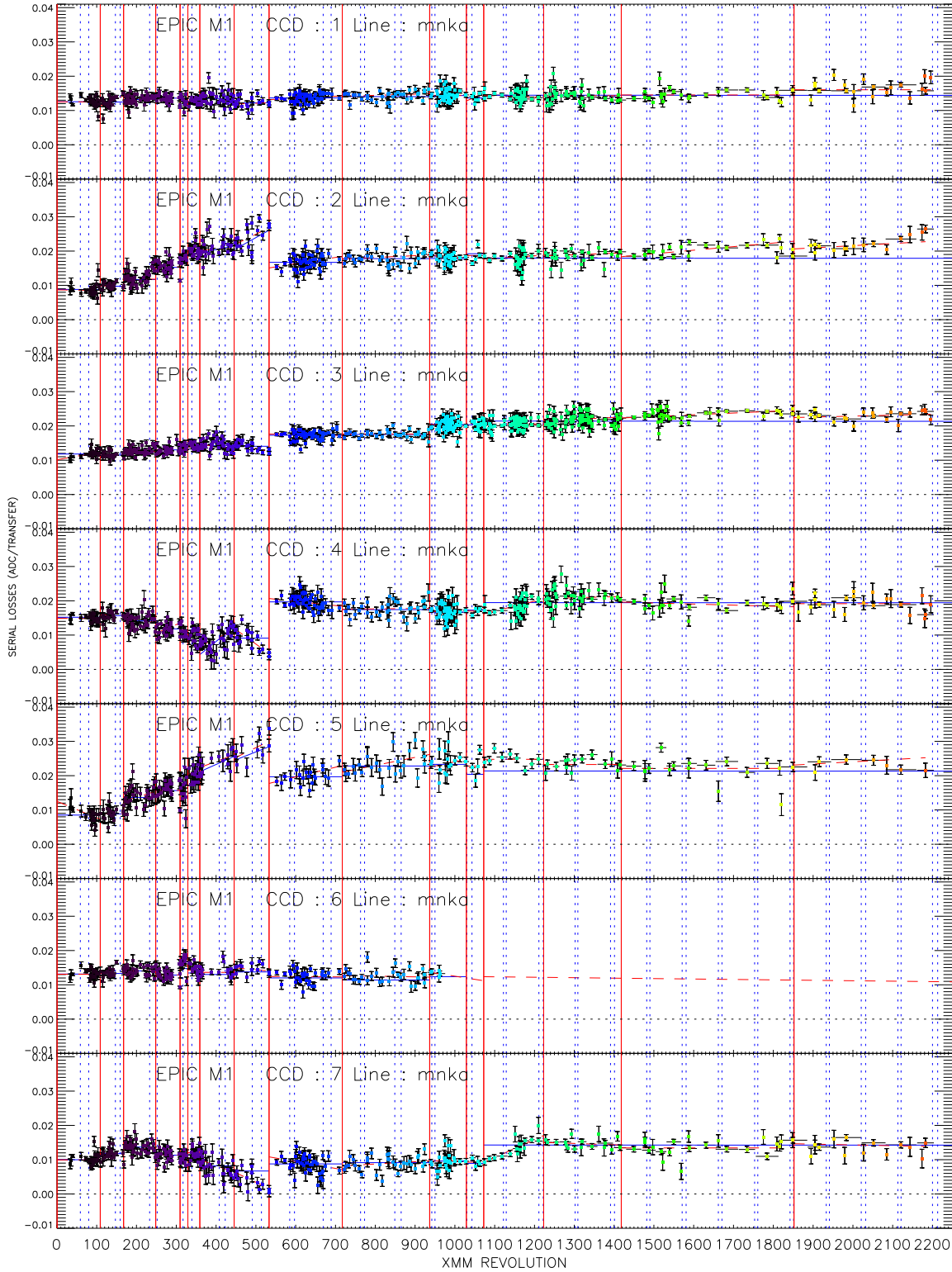
Figure 5: MOS1 serial transfer losses since launch at 1.5 keV, the energy of the Al calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.

Figure 6: MOS1 serial transfer losses since launch at 5.9 keV, the energy of the Mn Kα calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.
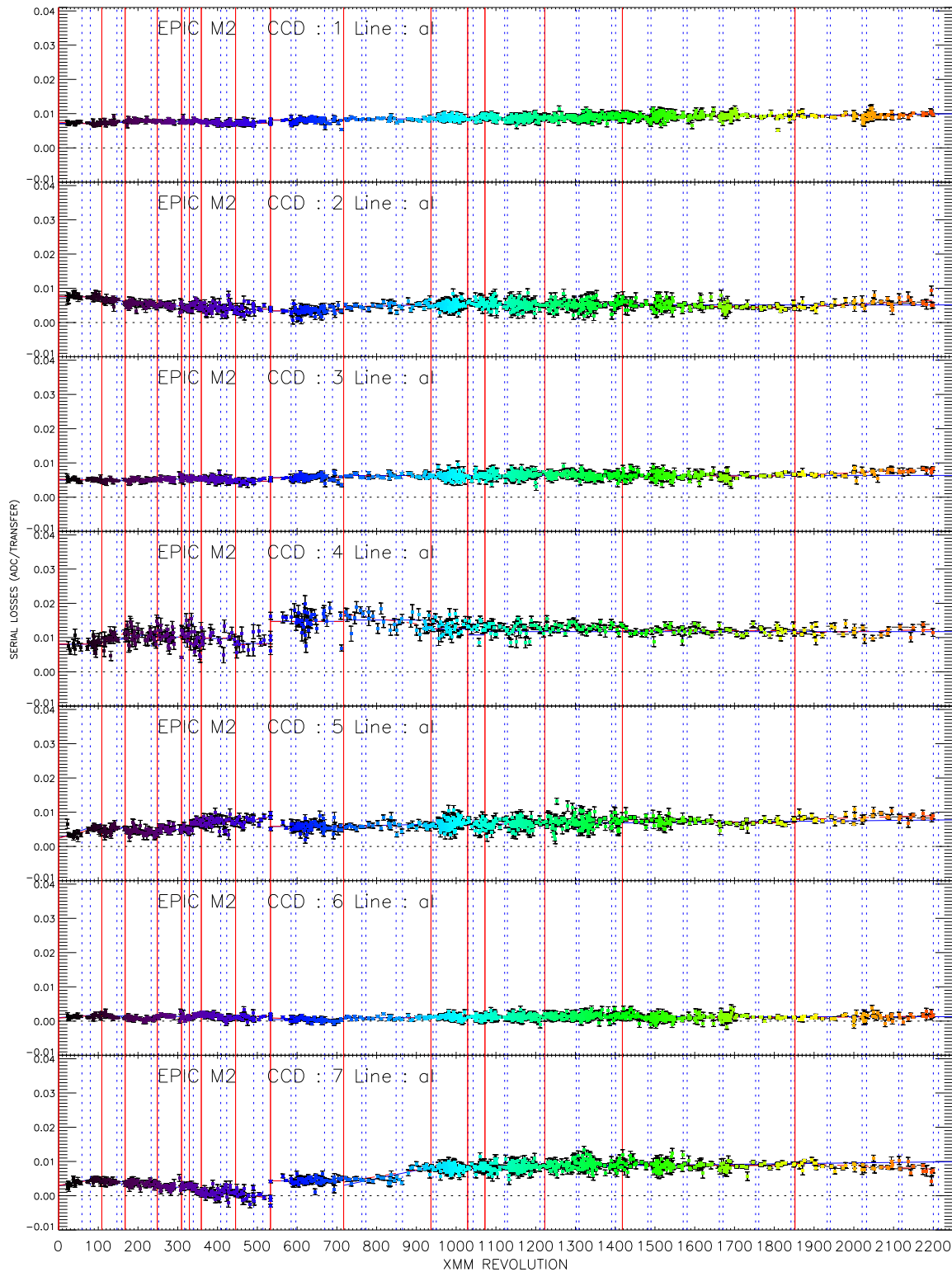
Figure 7: MOS2 serial transfer losses since launch at 1.5 keV, the energy of the Al calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.
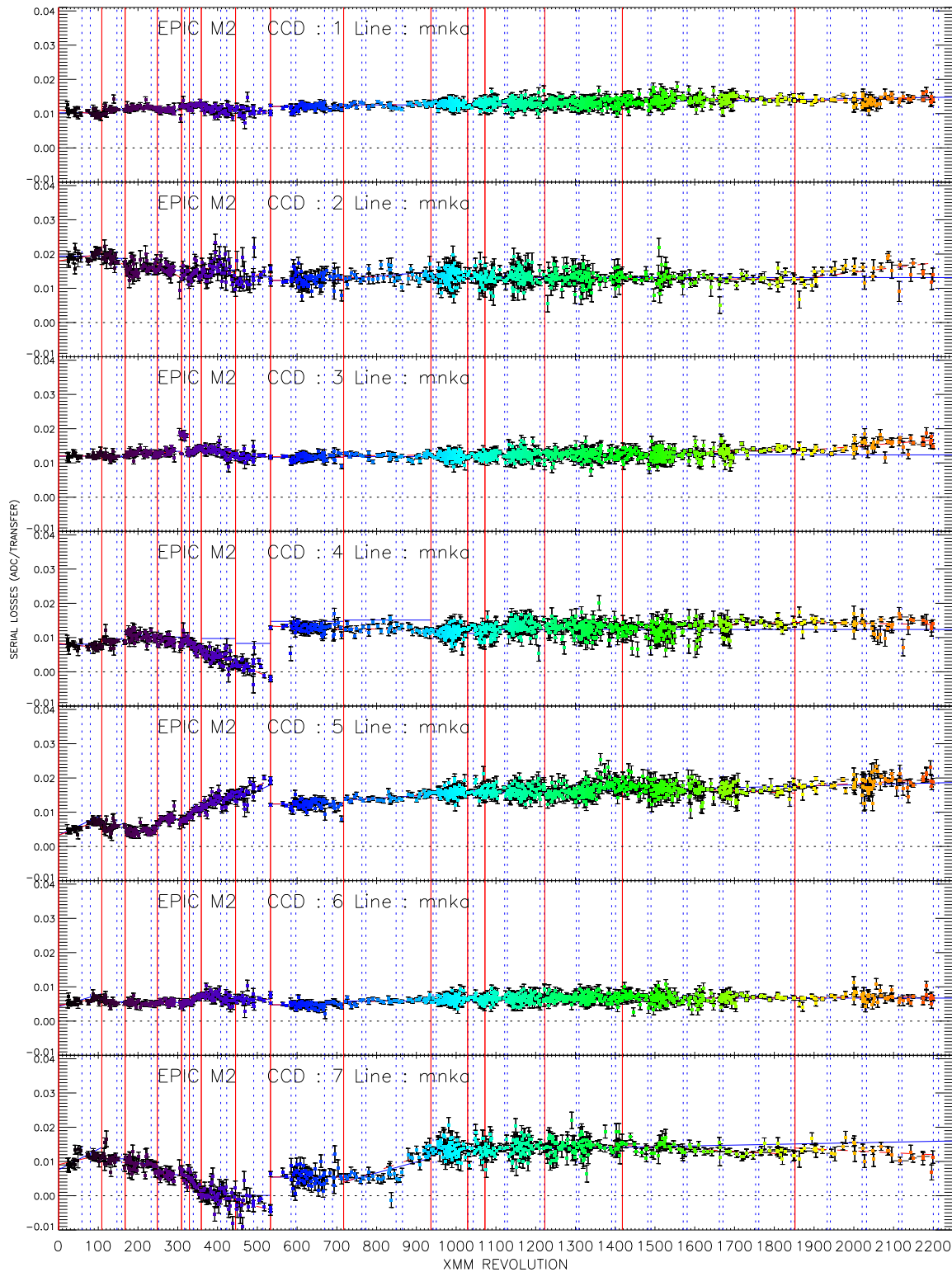
Figure 8: MOS2 serial transfer losses since launch at 5.9 keV, the energy of the Mn Kα calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.