

XMM-Newton CCF Release Note

XMM-CCF-REL-206

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_CTL0017	1999-12-10T00:00:00	2000-07-15T12:00:00	CTIEXTENDED		NO
EMOS1_CTL0018	2000-07-15T12:00:01	2000-11-09T12:00:00	CTIEXTENDED		NO
EMOS1_CTL0019	2000-11-09T12:00:01	2001-04-18T00:00:00	CTIEXTENDED		NO
EMOS1_CTL0020	2001-04-18T00:00:01	2001-08-18T00:00:00	CTIEXTENDED		NO
EMOS1_CTL0021	2001-08-18T00:00:01	2001-09-26T22:00:00	CTIEXTENDED		NO
EMOS1_CTL0022	2001-09-26T22:00:01	2001-11-25T12:00:00	CTIEXTENDED		NO
EMOS1_CTL0023	2001-11-25T12:00:01	2002-05-16T05:00:00	CTIEXTENDED		NO
EMOS1_CTL0024	2002-05-16T05:00:01	2002-11-07T05:00:00	CTIEXTENDED		NO
EMOS1_CTL0025	2002-11-07T05:00:01	2003-11-09T18:00:00	CTIEXTENDED		NO
EMOS1_CTL0026	2003-11-09T18:00:01	2005-01-21T18:00:00	CTIEXTENDED		NO
EMOS1_CTL0027	2005-01-21T18:00:01	2005-07-24T01:00:00	CTIEXTENDED		NO
EMOS1_CTL0028	2005-07-24T01:00:01	2005-10-19T19:00:00	CTIEXTENDED		NO
EMOS1_CTL0029	2005-10-19T19:00:01		CTIEXTENDED		NO
EMOS2_CTL0017	1999-12-10T00:00:00	2000-07-15T12:00:00	CTIEXTENDED		NO
EMOS2_CTL0018	2000-07-15T12:00:01	2000-11-09T12:00:00	CTIEXTENDED		NO
EMOS2_CTL0019	2000-11-09T12:00:01	2001-04-18T00:00:00	CTIEXTENDED		NO
EMOS2_CTL0020	2001-04-18T00:00:01	2001-08-18T00:00:00	CTIEXTENDED		NO
EMOS2_CTL0021	2001-08-18T00:00:01	2001-09-26T22:00:00	CTIEXTENDED		NO
EMOS2_CTL0022	2001-09-26T22:00:01	2001-11-25T12:00:00	CTIEXTENDED		NO
EMOS2_CTL0023	2001-11-25T12:00:01	2002-05-16T05:00:00	CTIEXTENDED		NO
EMOS2_CTL0024	2002-05-16T05:00:01	2002-11-07T05:00:00	CTIEXTENDED		NO
EMOS2_CTL0025	2002-11-07T05:00:01	2003-11-09T18:00:00	CTIEXTENDED		NO
EMOS2_CTL0026	2003-11-09T18:00:01	2005-01-21T18:00:00	CTIEXTENDED		NO
EMOS2_CTL0027	2005-01-21T18:00:01	2005-07-24T01:00:00	CTIEXTENDED		NO
EMOS2_CTL0028	2005-07-24T01:00:01	2005-10-19T19:00:00	CTIEXTENDED		NO
EMOS2_CTL0029	2005-10-19T19:00:01		CTIEXTENDED		NO



2 Changes

A new set of CTI CCFs have been derived for the MOS taking into the account the latest measured degradation rate of the parallel CTI. This new set of CCFs covers the same first 6 time periods as the previous CTI CCFs (issue 8 to 13, see XMM-CCF-REL-124), but also establish new time periods. The previously latest time period before the operating temperature of the MOS CCDs was lowered from -100C to -120C (issue 14) is now divided into two time periods from 2001-11-25 to 2002-06-16 (rev. 360-446) and 2002-06-16 to 2002-11-07 (rev. 446-534), respectively. The new set now contains 5 post-cooling time periods, replacing the previously single post cooling period of issue 16 (see XMM-CCF-REL-159).

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

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, for all observations, although mainly for those performed in after cooling epochs (i.e. post revolution 534).

The new set of CTI CCFs are released together with a new set of ADU CONV CCFs (issues 29-41, see XMM-CCF-REL-207), since the new cti with old gains, and old cti with new gains may give unexpected results!

4 Estimated Scientific Quality

This issue assures 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 taking 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. 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.

5 Test procedures & results

The new CTI CCFs have been tested with the SASv6.5. The results are presented in Fig. 1 to Fig. 8.

6 Expected Updates

So far a common CTI model has been used for all columns of a single MOS CCD. In reality, the CTI differs slightly between different columns. Some MOS columns show significantly different CTI behaviour within different sections of the column.

The calibration team is currently working on a column dependent CTI which can take into account different CTI behaviour of the individual columns as well as different behaviour of sections within a single column.

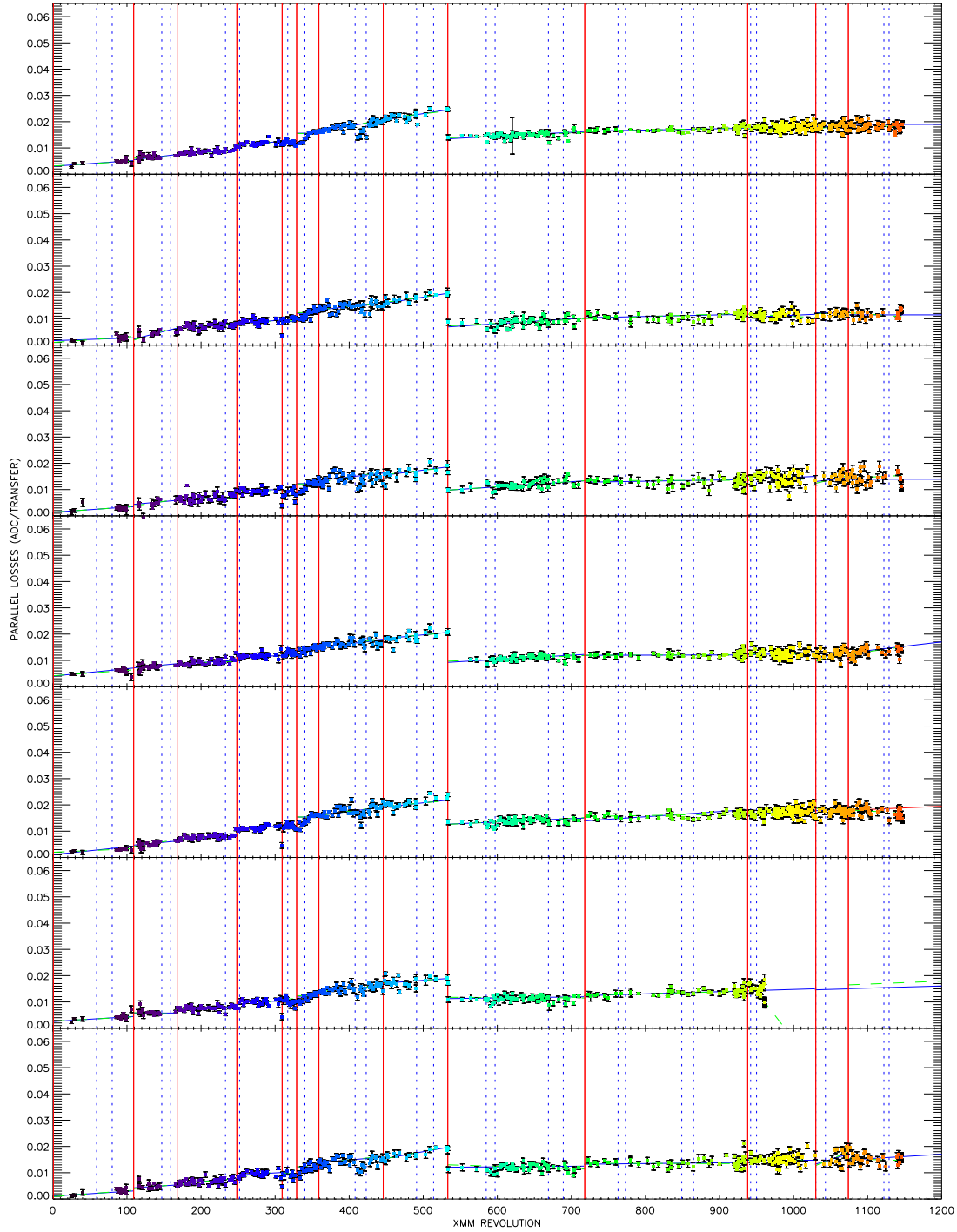


Figure 1: MOS1 parallel transfer losses since launch at 1.5 keV, the energy of the Al calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.

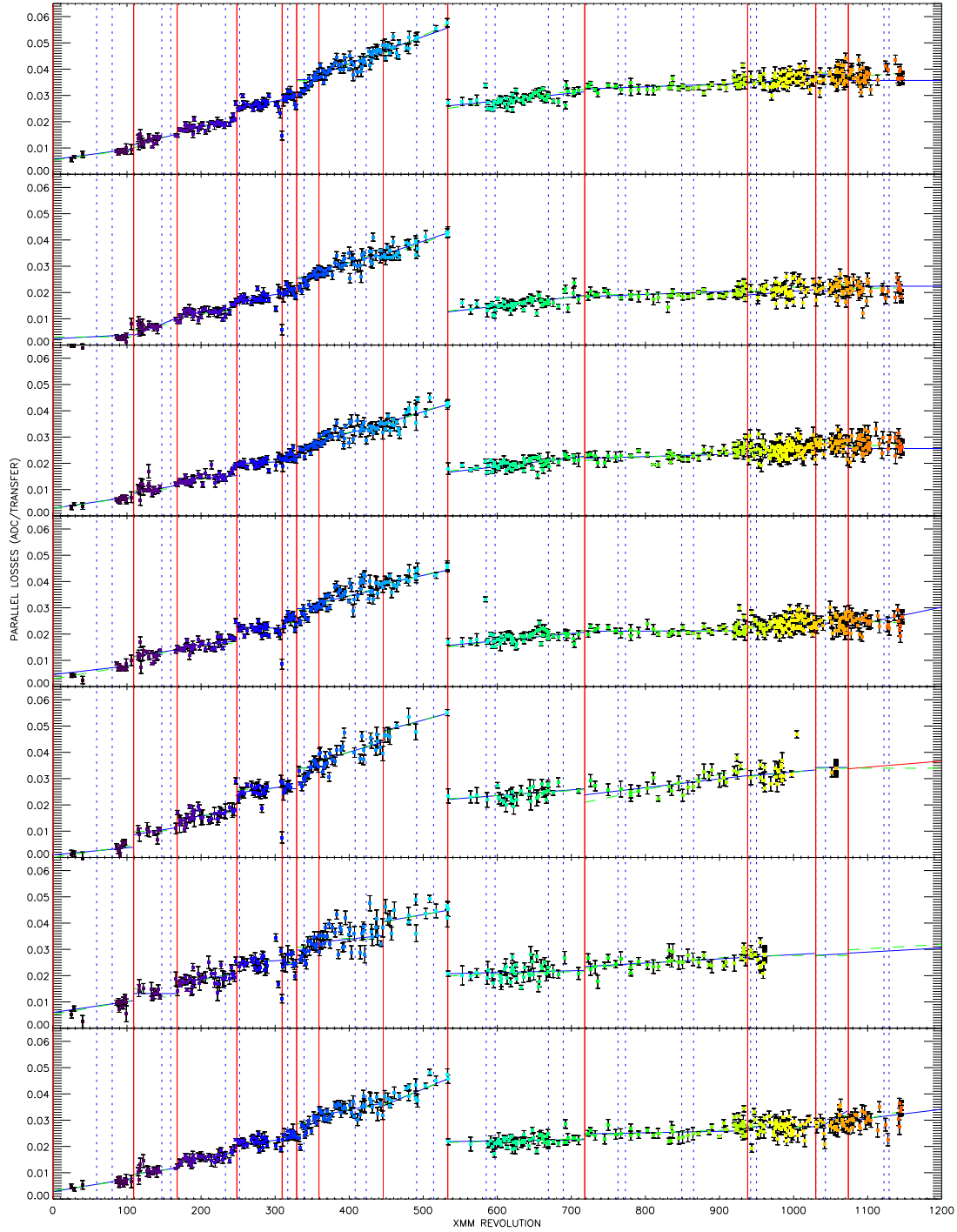


Figure 2: MOS1 parallel transfer losses since launch at 5.9 keV, the energy of the Mn $K\alpha$ calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.

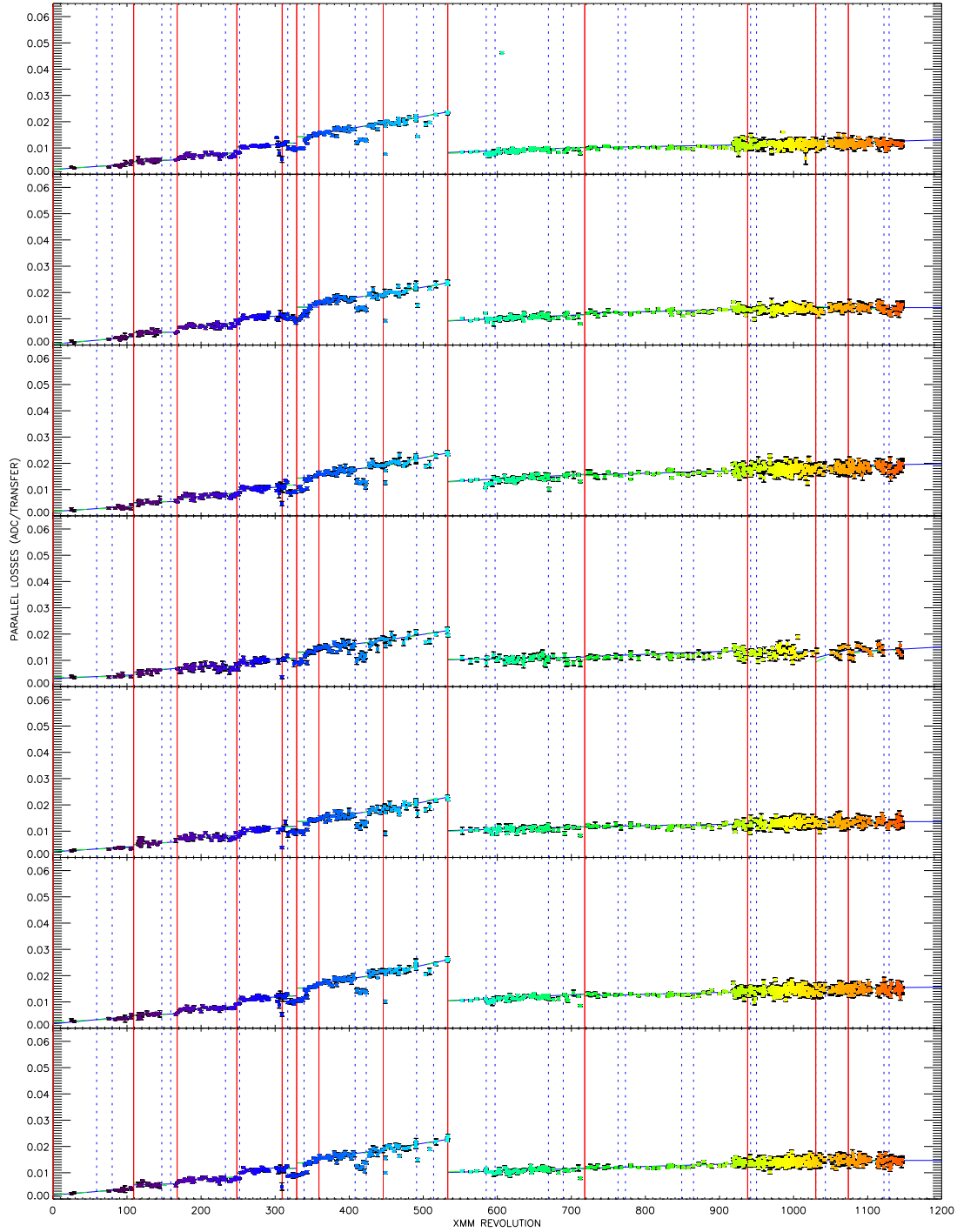


Figure 3: MOS2 parallel transfer losses since launch at 1.5 keV, the energy of the Al calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.

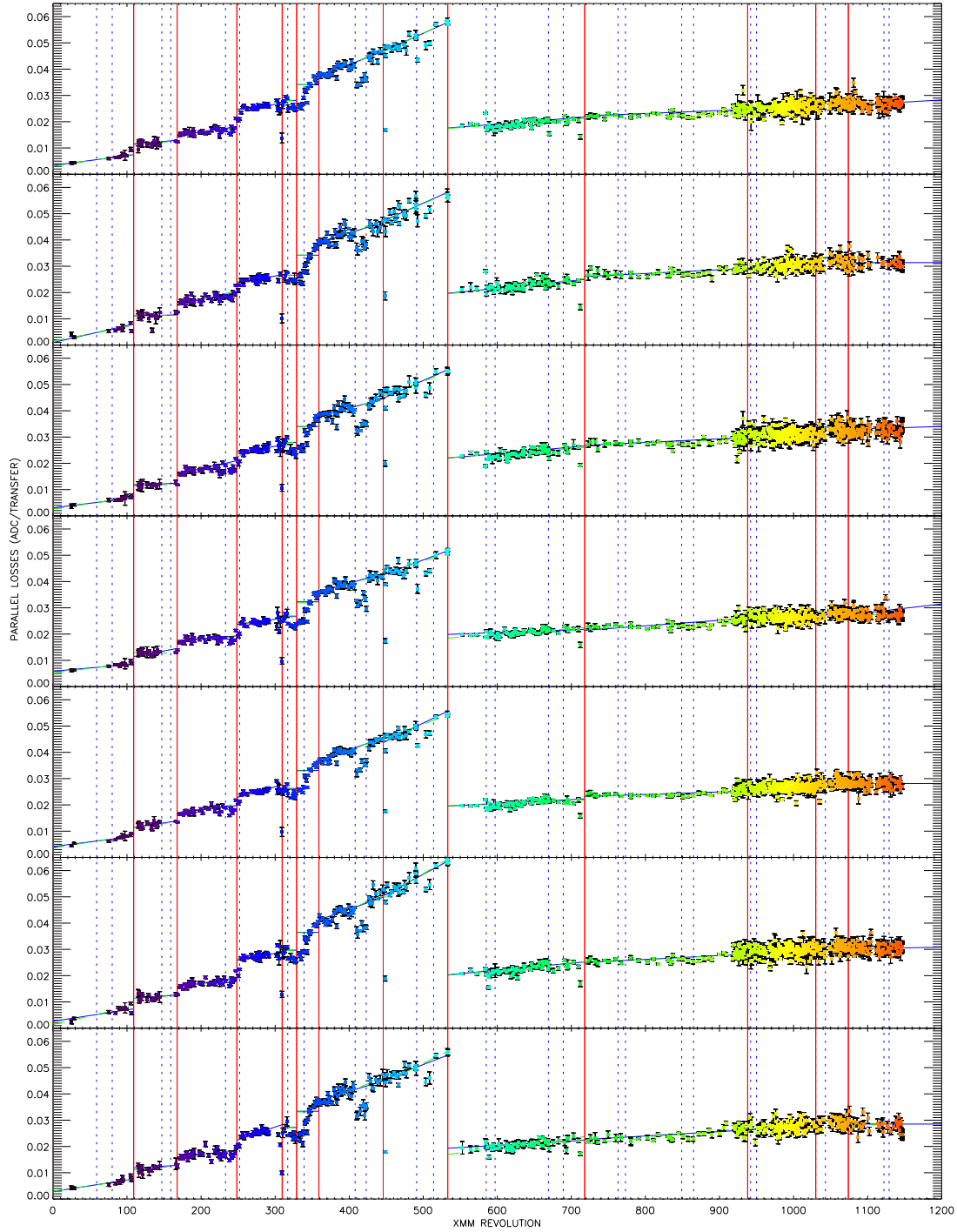


Figure 4: MOS2 parallel transfer losses since launch at 5.9 keV, the energy of the Mn $K\alpha$ calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.

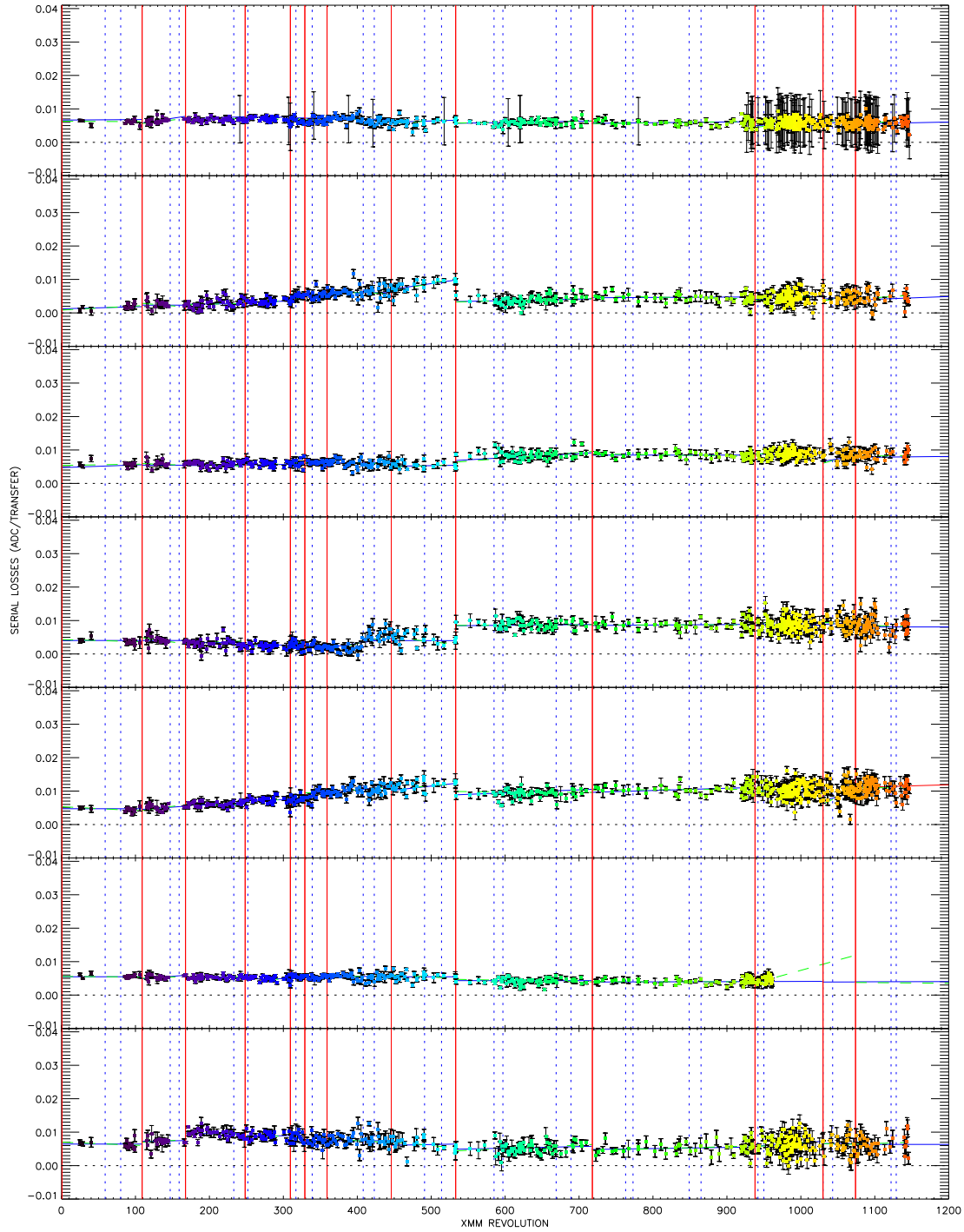


Figure 5: MOS1 serial transfer losses since launch at 1.5 keV, the energy of the Al calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.

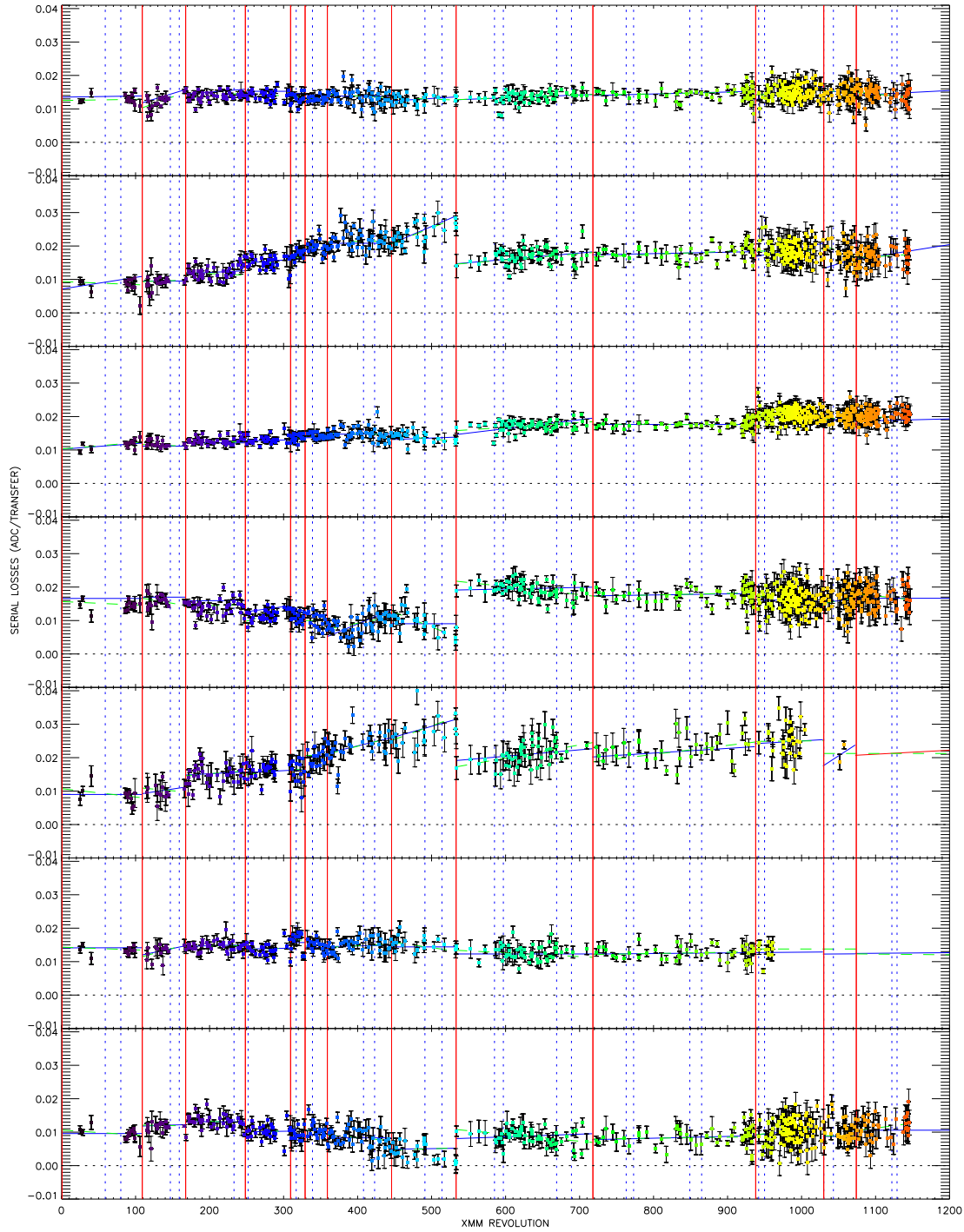


Figure 6: MOS1 serial transfer losses since launch at 5.9 keV, the energy of the Mn $K\alpha$ calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical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

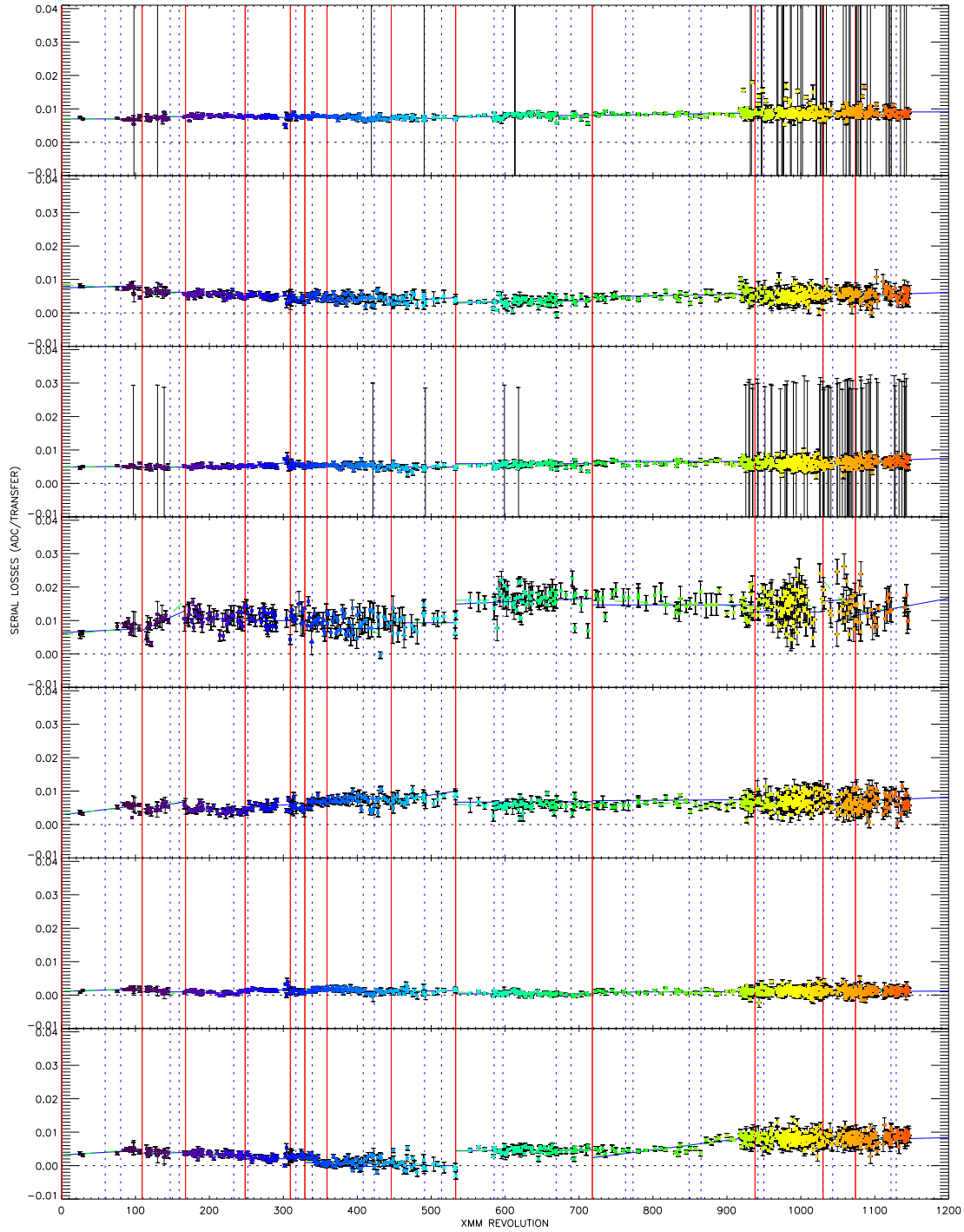


Figure 7: MOS2 serial transfer losses since launch at 1.5 keV, the energy of the Al calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical dashed lines.

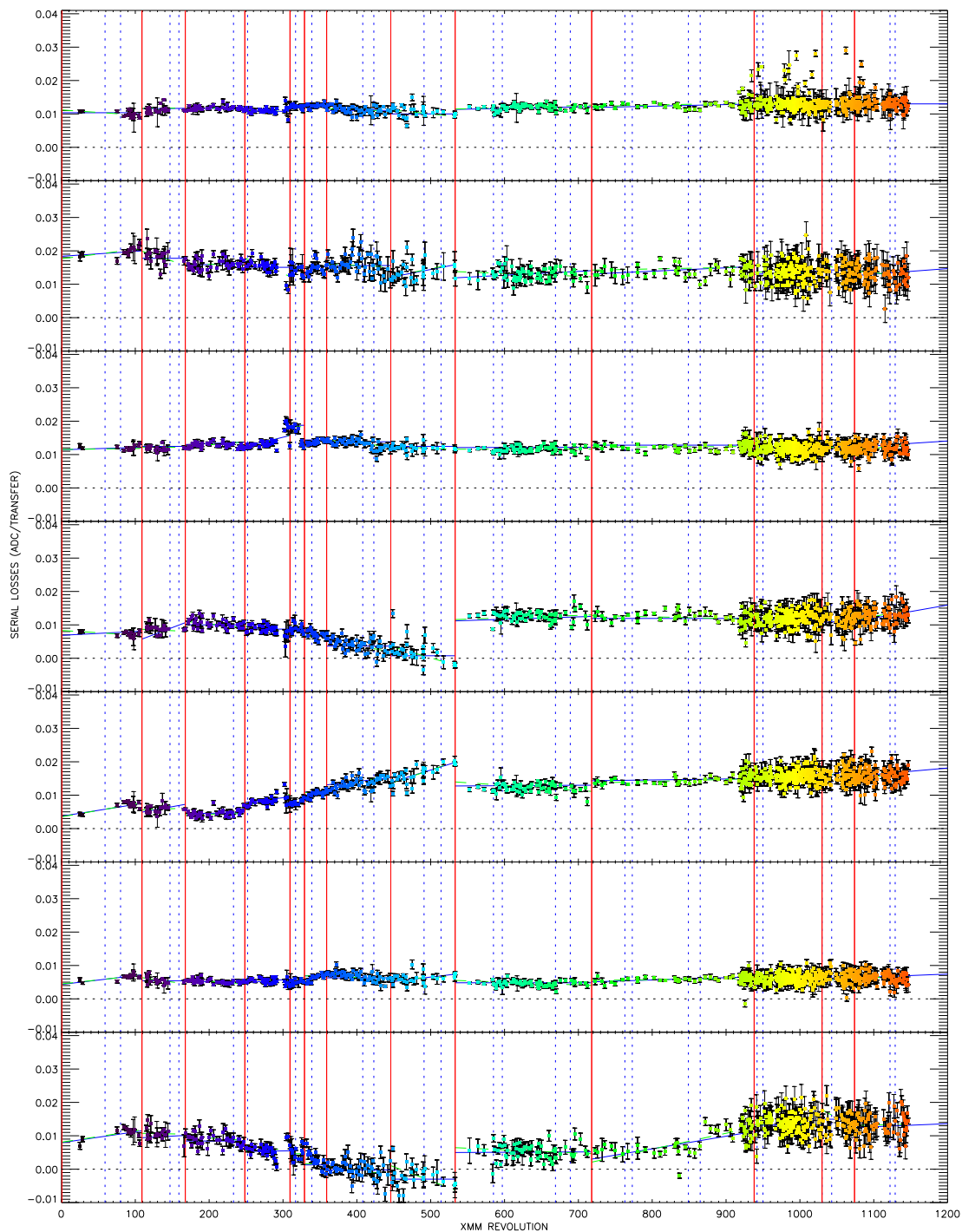


Figure 8: MOS2 serial transfer losses since launch at 5.9 keV, the energy of the Mn $K\alpha$ calibration line, for CCD1 to CCD7 (top to bottom), overlaid with the CTI models as parametrised in the new set of CCFs. The CCF epochs are indicated as solid vertical lines, the eclipse seasons as vertical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