XMM-Newton CCF Release Note

XMM-CCF-REL-147

EPIC MOS fixed-offset

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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 VERS.	XSCS flag
EMOS1_DARKFRAME_0010	2003-07-29T01:00:00		OFFSET_CCD6		NO
EMOS1_DARKFRAME_0010	2003-07-29T01:00:00		OFFSET_CCD7		NO
EMOS2_DARKFRAME_0010	2003-07-29T01:00:00		OFFSET_CCD1		NO

2 Changes

Three MOS CCDs show a long-term decreasing trend of their offset levels: MOS1 CCD6 and CCD7 and MOS2 CCDs, in the three modes full-frame, large-window and small window, that amouts to about 1 ADU in two years. Therefore it is time to update the on-board fixed-offset tables, and reflect this change in the OFFSET extensions of the DARKFRAME CCFs.

The fixed-offset level is reduced by 1 ADU for these 3 CCDs, by subtracting 1 ADU to the column offsets.

A previous small error in MOS2 CCD1 has been also corrected for the LW window mode. The CCF was not reflecting properly the on-board fixed-offset table: columns 457 to 460 were patched to 4095 instead of 458 to 461.

3 Scientific Impact of this Update

The change of on-board fixed-offset tables has a minor impact on the energy scale of the events, as a local background (measured from the outer 5x5 pixels) subtraction is performed. A direct correction for singles and doubles and using the average ENERGYE4 for tri- and quadri pixel events.(see the CCDBKG item in emenergy)

The main effect is due to a threshold change that a wrong offset implies. When the fixed-offset is too high, compared to the actual CCD offset, (as it the case), some doubles could be lost, and have their energy underestimated by 25 ADUs (MOS low energy thershold). On the oppposite, if the fixed-offset were to be too low, some noise could be introduced that could transform single in doubles and gain energy by 25 ADUs.

However the fixed-offset tables are not used to change the energy of the events because this is already done on-board.

Hence the only reason to reflect this change in the OFFSET extension of the CCFs is to get the right number of 'truncated' events whose ENERGYE1 is 4095 in output of the camera head (flagged as REJECTED_BY_GATTI) As the offsets for these events were already subtracted in the EDU, their final ENERGYE1 depends on position and they can be identified properly only if the offsets are known. The light curve built from those 'truncated' events is used to identify flares in the data and to optimise the GTIs for source detection in the PPS.

4 Estimated Scientific Quality

The update of the on-board offset tables (refined values by 1 ADU) is driven by the need to reconstruct the right energy for all events more precisely with their right pattern, as explained above.

And the main reason to reflect the change of MOS on-board fixed-offset tables in the DARKFRAME CCFs is to reconstruct the right number of truncated events used for the flare screening in the PPS.

5 Test procedures & results

A functional test of the new DARKFRAME CCFs was performed with SAS version 5.4.1 at VilSpa and run successfully.

6 Note on CCF structure

Note that in the OFFSET_CCD extensions, the names of the table ROW_OFFSET and COLUMN_OFFSET are inverted by error, probably since the origin of this CCF. The first table that contains 610 values per mode (4 overscan columns on both sides patched to 4095 ADUs, so 602 columns really read-out). It gives the column offsets, while it is named ROW_OFFSET. The second table contains 602 values (per mode) and gives the row offsets, while it is named COLUMN_OFFSET in the CCF.

However this naming error is not problem, as the CAL (Calibration Access Layer) of the SAS reads the right values, the first table as column offsets and the second one as row offsets. This "feature" just ought to be documented in the CAL properly to avoid misunderstanding in the future.

7 Expected Updates

Further updates might take place if the long-term decreasing trend of the MOS CCD offset levels continue for these CCDs and/or others.