XMM-Newton CCF Release Note
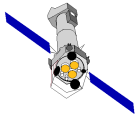
XMM-CCF-REL-198

PN Spatial Gain

M.J.S. Smith

October 14, 2005

1 CCF Components

Name of CCF	VALDATE	EVALDATE	Blocks Changed	XSCS Flag
EPN_ADUCONV_0108.CCF	2000-01-01T00:00:00	2000-08-10T10:00:00	GAIN-HIGH	NO
EPN_ADUCONV_0109.CCF	2000-06-11T03:00:00	2000-06-29T02:49:00	GAIN-HIGH	NO
EPN_ADUCONV_0110.CCF	2000-07-01T08:07:00	2000-07-03T12:00:00	GAIN-HIGH	NO
EPN_ADUCONV_0111.CCF	2000-07-03T22:16:00	2000-07-05T15:00:00	GAIN-HIGH	NO
EPN_ADUCONV_0112.CCF	2000-07-05T22:30:00	2000-07-07T15:54:00	GAIN-HIGH	NO
EPN_ADUCONV_0113.CCF	2000-07-08T11:50:00	2000-07-10T03:16:00	GAIN-HIGH	NO
EPN_ADUCONV_0114.CCF	2000-07-10T17:00:00	2000-07-13T12:16:00	GAIN-HIGH	NO
EPN_ADUCONV_0115.CCF	2000-07-26T04:58:00	2000-07-28T04:32:46	GAIN-HIGH	NO
EPN_ADUCONV_0116.CCF	2000-07-29T00:59:00	2000-08-02T00:22:00	GAIN-HIGH	NO
EPN_ADUCONV_0117.CCF	2000-08-02T20:19:00	2000-08-04T11:42:00	GAIN-HIGH	NO
EPN_ADUCONV_0118.CCF	2000-08-04T20:11:00	2000-08-07T00:58:00	GAIN-HIGH	NO
EPN_ADUCONV_0119.CCF	2000-08-10T10:00:00	2000-10-31T23:00:00	GAIN-HIGH	NO
EPN_ADUCONV_0120.CCF	2000-10-31T23:00:00	2000-11-07T21:22:00	GAIN-HIGH	NO
EPN_ADUCONV_0121.CCF	2000-11-03T21:38:00	2000-11-05T16:00:00	GAIN-HIGH	NO
EPN_ADUCONV_0122.CCF	2000-11-05T21:31:00	2000-11-07T16:00:00	GAIN-HIGH	NO
EPN_ADUCONV_0123.CCF	2000-11-07T21:22:00	2000-12-13T20:48:00	GAIN-HIGH	NO
EPN_ADUCONV_0124.CCF	2000-12-13T20:48:00	2000-12-14T11:07:00	GAIN-HIGH	NO
EPN_ADUCONV_0125.CCF	2000-12-14T11:07:00	2000-12-15T14:02:00	GAIN-HIGH	NO
EPN_ADUCONV_0126.CCF	2000-12-15T14:02:00	2001-06-03T04:30:00	GAIN-HIGH	NO
EPN_ADUCONV_0127.CCF	2000-12-15T16:56:00	2000-12-19T14:05:00	GAIN-HIGH	NO
EPN_ADUCONV_0128.CCF	2000-12-19T16:41:00	2000-12-21T14:19:00	GAIN-HIGH	NO
EPN_ADUCONV_0129.CCF	2000-12-21T16:39:00	2000-12-25T13:18:00	GAIN-HIGH	NO
EPN_ADUCONV_0130.CCF	2001-01-08T12:47:00	2001-01-08T15:53:00	GAIN-HIGH	NO
EPN_ADUCONV_0131.CCF	2001-05-14T14:30:00	2001-05-14T20:30:00	GAIN-HIGH, OFFSET_GAIN	NO
EPN_ADUCONV_0132.CCF	2001-05-22T05:00:00	2001-05-22T16:30:00	GAIN-HIGH, OFFSET_GAIN	NO
EPN_ADUCONV_0133.CCF	2001-05-23T07:15:00	2001-05-23T21:00:00	GAIN-HIGH, OFFSET_GAIN	NO
EPN_ADUCONV_0134.CCF	2001-05-26T08:05:00	2001-05-26T15:00:00	GAIN-HIGH, OFFSET_GAIN	NO
EPN_ADUCONV_0135.CCF	2001-06-03T04:30:00	2001-07-26T14:00:00	GAIN-HIGH, OFFSET_GAIN	NO
EPN_ADUCONV_0136.CCF	2001-07-26T14:00:00		GAIN-HIGH, OFFSET_GAIN	NO
EPN_ADUCONV_0137.CCF	2001-07-29T04:50:00	2001-08-02T04:00:00	GAIN-HIGH, OFFSET_GAIN	NO
EPN_ADUCONV_0138.CCF	2001-08-12T03:50:00	2001-08-16T03:50:00	GAIN-HIGH, OFFSET_GAIN	NO

2 Changes

A parameter of the gain model code has been updated in order significantly to improve the homogeneity of the PN (at least at higher energies). The 768 old values in the 7th row of the GAIN-HIGH extensions have been multiplied by 768 correction factors. These factors were derived by K. Dennerl (MPE) from the ratio of the measured centroids of the Mn-Kα line of each CCD column and its nominal value. The same gain model parameters are in use throughout the mission, and thus the GAIN-HIGH blocks are identical in all issues of this new release of EPN_ADUCONV CCFs.
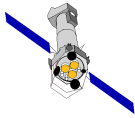
Besides this change in gain model parameters, two modifications to the CCFs have been made possible due to the use of keywords which were not yet implemented at the time of release of the old CCF issues:

1. The large number of EPN_ADUCONV CCFs covering the mission is due to the changes in uploaded fixed offset tables as reflected in the OFFSET_GAIN block (see e.g. [1]). These changes mainly occurred in periods of switching to-and-fro between pairs of fixed offset table versions due to manual commanding and re-planning of observations. The use of the EVALDATE keyword makes it possible to define both the start and end of validity of a particular CCF (see [2]), thus allowing in the case of the EPN_ADUCONV CCFs a substantial reduction of the number of issues covering the mission.

2. Where applicable, the BPT_CODE keyword value has been added to the OFFSET_GAIN extension. This allows the SAS to check whether the correct offset table is being used for a given observation by comparing certain housekeeping parameters in the PAH.fits file with the associated BPT_CODE value. Details may be found in [3].

3   Scientific Impact and Estimated Scientific Quality

The improvement in overall homogeneity of the PN energy scale at higher energies is illustrated in Figures 1 and 2, where results with the old and new gain model parameters are compared at Mn-Kα.

4   Test Procedures and Results

The correct functionality of the CCFs was verified with *epproc* and *epchain* on several observations (SAS version 6.5.0). As an additional check that the gain parameters are correctly included in the new issues, the column-wise energy scale at Mn-Kα was analysed for observation 0094800301 (Rev 0281, Full Frame CalClosed), with results as expected.

The *cifbuild* task was used to check the correct VALDATE and EVALDATE values. This was done by creating two CIFs for each period in which a particular offset table was in use, one from the set of old CCFs and one from the set of old and new CCFs. For each of these periods it was then verified that the EPN_ADUCONV CCF CIF members contain an identical OFFSET_GAIN table.

References

[1] XMM-CCF-REL-90, XMM-Newton CCF Release Note, EPIC PN Energy Scale
[2] XMM-SAS *cifbuild* documentation at http://xmm.vilspa.esa.es/sas/current/doc/cifbuild/index.html
[3] XMM-Newton Calibration Access and Data Handbook, XMM-PS-GM-20, Issue 3.1, section 4.3.2.
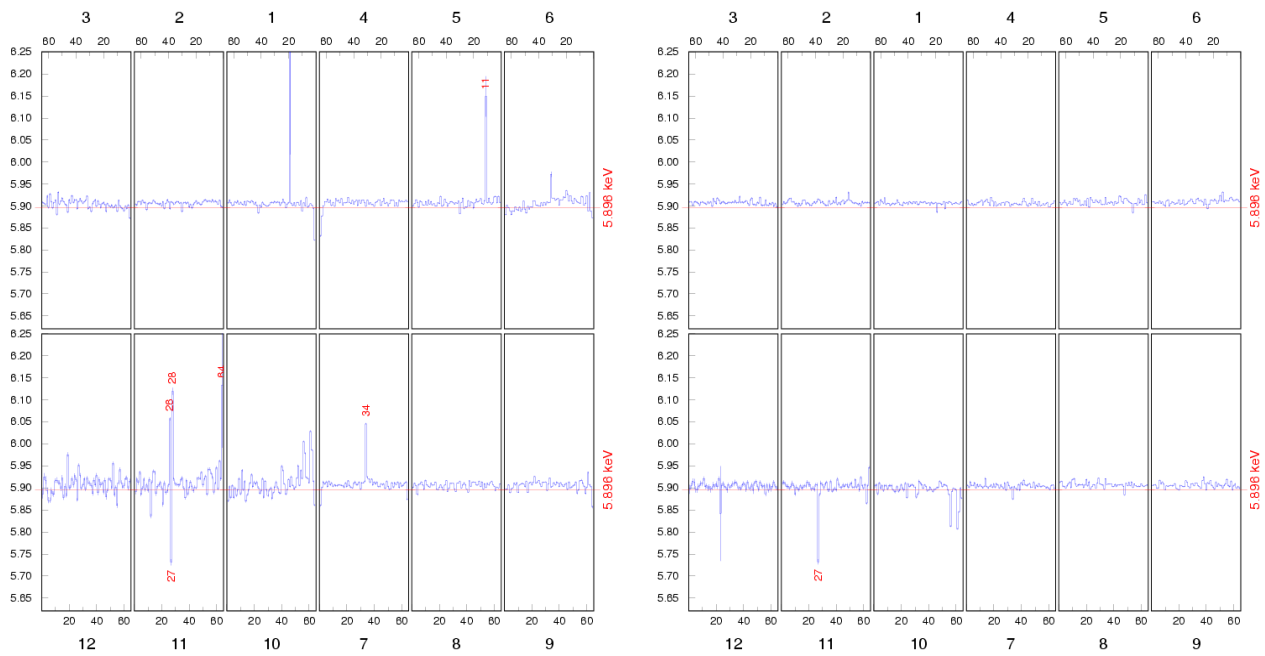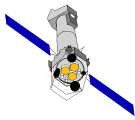
Figure 1: Column-wise mean values of the line centroids at Mn-Kα for all CCDs (Full Frame CalClosed, revolution 80). Left shows the results with the old CCFs, right shows the results with the improved gain model parameters. There is a significant improvement in the overall homogeneity. Plots provided by K. Dennerl (MPE).
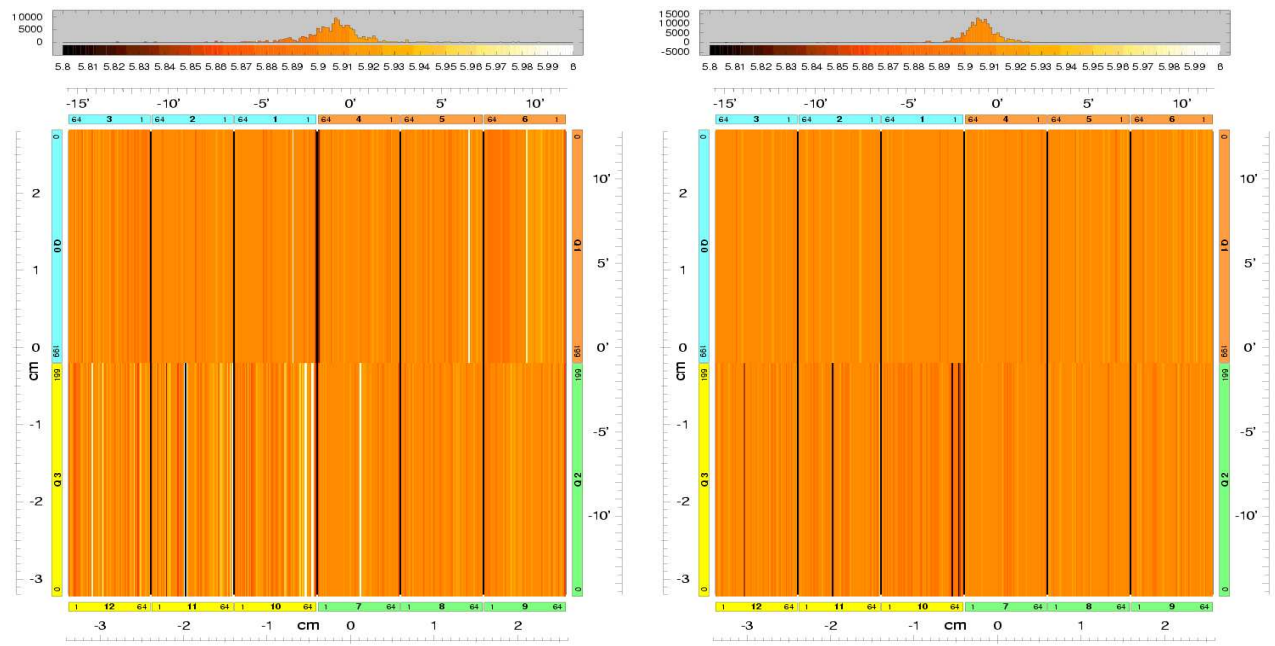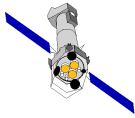
Figure 2: Image depicting the column-wise mean of the line centroids at Mn-Kα for all CCDs (Full Frame CalClosed, revolution 80). The colour coding is shown at top, with energies in keV. Left shows the results of the old CCFs, right shows the results with the improved gain model parameters. The improvement in the overall homogeneity is clearly evidenced by the narrower distribution of line centroids. Plots provided by K. Dennerl (MPE).