XMM-Newton CCF Release Note

XMM-CCF-REL-259

Spectra quality-related CCF constituent XMM_SPECQUAL

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	Change in CAL HB
XMM_SPECQUAL_0001	2000-01-01T00:00:00	EMOS1_SPQ	YES
XMM_SPECQUAL_0001	2000-01-01T00:00:00	EMOS2_SPQ	YES
XMM_SPECQUAL_0001	2000-01-01T00:00:00	EPN_SPQ	YES
XMM_SPECQUAL_0001	2000-01-01T00:00:00	RGS1_SPQ_BETA	YES
XMM_SPECQUAL_0001	2000-01-01T00:00:00	RGS1_SPQ_WAVE	YES
XMM_SPECQUAL_0001	2000-01-01T00:00:00	RGS2_SPQ_BETA	YES
XMM_SPECQUAL_0001	2000-01-01T00:00:00	RGS2_SPQ_WAVE	YES
XMM_SPECQUAL_0001	2000-01-01T00:00:00	GAINFIT_LIMIT	YES

2 Changes

The new CCF component XMM_SPECQUAL contains two sets extensions:

- extensions $instrument_SPQ* specify the ranges (in unbinned PI, dispersion or wavelength space) for which spectra are nominally calibrated according to the calibration status documents[1]
- extension GAINFIT_LIMIT contains the minimum and maximum values of the gain linear function parameters, which are consistent with the gain calibration systematic uncertainties

[1] Available at the XMM-Newton Calibration portal: http://xmm2.esac.esa.int/external/xmm_sw_cal/calib/index.shtml

2.1 $instrument_SPQ

Each of these extensions is a binary matrix, containing one row per instrument mode. Each row is constituted by two columns:

- NGROUPS
- SPE_FLAG, a series of NGROUPS pairs of integer numbers, corresponding to the range ("[minimum channel maximum channel]") in unbinned PI channels where the response matrix is *not* nominally calibrated

The goal of this extension is to allow the SAS spectral extractors to properly flag uncalibrated spectral channels.

2.2 GAINFIT_LIMIT

In this subsection, we refer to a "gain shift function" as a linear operator which shift the energies on which the response matrix is defined and the effective area curve to match. Without loss of generality, the algorithm is equivalent to the gain function in XSPEC Version 12 and later.

This extension contains one row per instrument and mode. For each row, six parameters are specified:

- the instrument identified (INSTRUMENT_ID)
- the mode identifier (MODE_ID)
- the minimum and maximum values of the gain shift function, which are consistent with the systematic uncertainties on the instrumental gain (GSLOP_MIN, GSLOP_MAX, GOFFS_MIN, GOFFS_MAX). The GSLOP_M* and GOFFS_M* parameters indicate the slope and the intercept of the linear relation, respectively.

The G*_M* parameters shall be used by the SAS redistribution matrix generator to populate keywords in the header of the redistribution matrix file. These keyword could be used by spectral analysis packages to restrict the range of gain fit parameters to values, which reflects our current knowledge of the systematic uncertainties on the instrumental gain[2]. Response matrices of instrument/modes, for which the G*_M* parameters above are not defined, shall not contain the corresponding redistribution matrix keywords.

[2] At the time this document is written, a possible implementation of how this keywords can be used in XSPEC is under discussion

3 Scientific impact of this update

These changes are intended to transfer information on the quality of the spectral calibration of the XMM-Newton X-ray cameras to spectral analysis software in a way fully transparent to the final user. They introduce only formal changes to the SAS scientific products, and therefore they are not expected to yield any impact on the scientific quality of the data as such.

4 Estimated scientific quality

See the previous subsection.

5 Test procedure and results

We have verified that the parameters of a spectral fit of Obs.# do not change if spectra with uncalibrated flagged channel are fit using redistribution matrices whose header bears the aforementioned `G*_M*` *keywords - Note: this test has not been performed yet, because the SAS package that should use this new CCF constituent does not exist.*

6 Expected Updates

The values of the parameters in these extensions will be changed whenever an improvement of the relevant calibration requires it.

Acknowledgments

Valuable comments by R. Saxton and S. Sembay contributed to ultimately shape this new CCF constituent.