

XMM-Newton CCF Release Note

XMM-CCF-REL-0247

EPIC canned response matrices

I. de la Calle

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1 Purpose

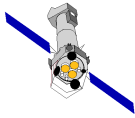
The generated EPIC canned response matrix files (RMFs) are described and published on a dedicated web page at http://xmm2.esac.esa.int/external/xmm_sw_cal/calib/epic_files.shtml and allow the user to load them (together with source and background spectra of EPIC observations and related ancillary matrices) into spectral analysis packages like XSPEC for model fitting.

RMFs can also be created by the users with help of the XMM-Newton Science Analysis Software (SAS). The method using SAS is described in the SAS User's Guide and Data analysis threads: RMFs are automatically adjusted to the spectra under study with respect to energy and pattern selection.

The canned RMFs are nevertheless published for the following reasons:

- Mainly in the early years of the XMM-Newton mission, computer resources at users' institutes were frequently rather slow with respect to the generation of RMFs. This situation probably has improved for many users over the years but might still be present for some of them.
- Canned RMFs are useful for users preparing XMM-Newton observing proposals, e.g. when simulating expected source spectra, without having to fully process data with the SAS.
- The concept of providing standard canned matrices allows calibration developments to proceed independently of SAS releases.
- The source spectra produced as part of the pipeline processing of the Survey Science Centre are associated with a set of specific standard RMFs.

Although no ready-made MOS RMFs are provided as of SAS 6.5 (for reasons explained in the web pages 'Update 2005-12-15' at http://xmm2.esac.esa.int/external/xmm_sw_cal/calib/epic_files_updates.shtml),



for the purposes of the feasibility study of XMM-Newton proposals, a limited set of MOS response files have been made available since SAS 7.1.0. These files are available for the full frame mode and the current epoch, for:

- MOS1 and MOS2
- pattern 0 and pattern 0-12
- on-patch, wings of patch and off-patch positions

More details on the generation of the canned response matrices can be found in:

- *Generation of Canned pn Response Matrices, XMM-SOC-Procedure 03-01-0003-0001, 2007*
<http://xmm2.esac.esa.int/CCB/SOPH/Procedures/03/Attachments/01-0003-0001.pdf>

The matrices are provided at: http://xmm2.esac.esa.int/external/xmm_sw_cal/calib/epic_files.shtml

2 Changes

Response matrices have been generated for the latest SAS public release, i.e. version 8.0.0.

3 Scientific Impact of this Update

The matrices will allow the general user to spectrally analyze observations with corresponding filter/mode/pattern/location and observing epoch settings. Further details are given on the web page describing the canned matrices and in the SAS Manual and SAS threads.

4 Estimated Scientific Quality

In agreement with Scientific Quality reported for the corresponding public SAS release.

5 Test procedures & results

The canned response matrices have been created with the validated SAS 8.0.0 version. A test has been carried out using data from the BL Lac objects 1ES0347-121 (0094381101) and MS02057+3509 (0084140501) to evaluate the impact of the canned response matrices on spectral data analysis. The

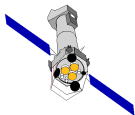


Table 1: EPIC-pn: Comparisson of best fit model parameters for the case in which a SAS generated or canned response matrice is used.

pn	Gal. N_H 10^{20} cm^{-2}	Local N_H 10^{20} cm^{-2}	$F_{2-10keV}$ $10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}$	Γ	χ^2/dof (dof)
SAS RMF	3.64	< 0.4	3.00 ± 0.01	$1.82^{+0.02}_{-0.01}$	1.09(633)
Canned RMF	3.64	0.5 ± 0.3	2.99 ± 0.01	1.84 ± 0.02	1.11(633)

Table 2: EPIC-MOS: Comparisson of best fit model parameters for the case in which a SAS generated or canned response matrice is used.

MOS	Gal. N_H 10^{20} cm^{-2}	Local N_H 10^{20} cm^{-2}	$F_{2-10keV}$ $10^{-12} \text{ erg cm}^{-2} \text{ s}^{-1}$	Γ	χ^2/dof (dof)
SAS RMF	6.28	7.2 ± 1.8	$3.46^{+0.06}_{-0.12}$	2.34 ± 0.07	1.13(146)
Canned RMF	6.28	7.5 ± 1.8	$3.46^{+0.07}_{-0.08}$	2.35 ± 0.07	1.14(146)

test involved spectral fitting using the standard generated SAS response matrice and the canned response matrice. The validity of the canned response matrices has been assessed by comparisson of the best fit model parameters. The model used is a power law convolved with galactic (fix) and local absorption (free).

- pn: 1ES0347-121 Small Window observation. The correspondant canned response matrice has been used (epn_sw20_sY9_v7.0.rmf). Table 1 summarises the results.
- MOS: MS02057+3509 Full Frame observation. The correspondant canned response matrice has been used (m1_onpatch_pall_2008-07-28.rmf). Table 2 summarises the results.

The test concludes that, for the cases considered, the use of EPIC canned response matrices does not introduce any systematic difference in the determination of the best fit parameters.

6 Expected Updates

These matriced will be updated in the future after every public SAS release and/or after major changes in the EPIC calibration.