XMM-Newton CCF Release Note

XMM-CCF-REL-100

PSF of the X-ray telescopes

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1 CCF components

| Name of CCF	VALDATE	List of Blocks changed	CAL VERSION	XSCS flag
XRT1_XPSF_0005.CCF	2000-01-01	KING_PARAMS	SAS v5.3	NO
XRT2_XPSF_0005.CCF	2000-01-01	KING_PARAMS	SAS v5.3	NO
XRT3_XPSF_0003.CCF	2000-01-01	KING_PARAMS	SAS v5.3	NO

2 Changes

A new extension, KING_PARAMS, has been added to the CCF files XRT_XPSF to characterise the point spread function (PSF) of the telescopes as a King function. This follows work performed on the two MOS telescopes in Milan [1] and on the PN, in Leicester, using a similar method. This parameterisation was originally encoded into the XRTn_XENCIRCEN files but has been recoded here to make them more accessible for the SAS.

The KING_PARAMS extension contains the columns ENERGY, THETA, PARAMS which give the King model parameters, core radius and slope, as a function of photon energy and off-axis angle [2].

3 Scientific Impact of this Update

This note describes the first release of the King function parameters which describe the PSF. These parameters are used by the SAS to calculate the encircled energy and correct the EPIC effective area files (ARF) for losses due to photons scattered out of the source box. The encircled energy values themselves were previously released in the XRTn_XENCIRCEN files [3]. The structure of
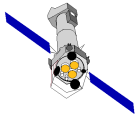
these files, however, didn't allow the off-axis dependency of the PSF to be fully characterised. The present implementation remedies this problem and allows the SAS to calculate the encircled energy more efficiently.

4   Estimated Scientific Quality

The parameters have been calculated by fitting a King function to the radial profiles of in-orbit celestial point sources. These fits have been made as a function of photon energy and off-axis angle on available calibration sources. For the MOS telescopes the work is reasonably complete except for higher energy photons at large off-axis angles (see Figure 18 of [1]). The parameterisation of the PN PSF has only been performed on-axis so far. In reality the encircled energy of the XRT telescopes is rather insensitive to the off-axis angle (see Figures 33-36 of [1]). This means that the use of the on-axis PN PSF is unlikely to produce large errors in the returned encircled energy fractions for sources at off-axis angles $\leq$ 10 arcminutes. The PSF is currently unmeasured for off-axis angles greater than 12 arcminutes.

References

[1] S. Ghizzardi. *In-flight calibration of the on-axis and near off-axis PSF for the Mos-1 and Mos-2 cameras.* EPIC-MCT-TN-011.

[2] Christian Erd, Phillipe Gondoin, David Lumb, Rudi Much, Uwe Lammers, Giuseppe Vacanti and Richard Saxton. *Calibration Access and Data Handbook.* XMM-PS-GM-20, issue 2.2.

[3] D. Lumb. *EPIC Spectral Response Distribution.* XMM-CCF-REL-84.