# XMM-Newton CCF Release Note

XMM-CCF-REL-335

## EPIC Filter Transmission

M.J.S. Smith, M.J. Freyberg

September 19, 2016

## 1 CCF Components

| Name of CCF | VALDATE | EVALDATE | Blocks Changed | XSCS Flag |
|---|---|---|---|---|
| EMOS1_FILTERTRANSX_0015 | 1998-01-01T00:00:00 | | FILTER-CLOSED<br>FILTER-CALCLOSED | NO<br>NO |
| EMOS2_FILTERTRANSX_0015 | 1998-01-01T00:00:00 | | FILTER-CLOSED<br>FILTER-CALCLOSED | NO<br>NO |
| EPN_FILTERTRANSX_0019 | 1998-01-01T00:00:00 | | FILTER-CLOSED<br>FILTER-CALCLOSED | NO<br>NO |

## 2 Changes

A new block containing transmission data for the Closed filter wheel position has been added for each of the EPIC FILTERTRANSX CCFs. The already existing FILTER-CALCLOSED transmission values, which were previously set to unity (equivalent to FILTER-OPEN), have now been changed to be identical to the FILTER-CLOSED values.

In addition, an erroneous validity date of the EPN_FILTERTRANSX CCF has been corrected; this change affects the analysis of observations taken before February 2000.

## 3 Estimated Scientific Quality

The Closed filters consist of 1.050 mm of aluminium. The X-ray transmission values were obtained from Henke el al., 1993, available on-line through `http://henke.lbl.gov/optical_constants/`. While efficiently blocking soft X-rays, the Closed filter transmission becomes non-negligible towards

the high end of the effective EPIC (and especially EPIC-pn) band pass. At 11 keV, the transmission is $\sim 0.5\%$, increasing to $\sim 12\%$ at 15 keV.

It is therefore possible to detect hard emission of bright sources even when observed with the filter wheel in Closed or Cal-Closed positions (e.g. GRS 1915+105 in observation 0112920801, EPIC-pn exposure S003). Although no relevant science cases are foreseen, the analysis of filter wheel Closed data may have applications for calibration purposes. E.g., given a sufficiently bright source, the Au-L edge ($\sim 11.9$ keV) could be used to extend the energy scale calibration. In order to avoid pile-up, with a science filter such an observation would most likely require the EPIC-pn to be operated in Burst mode. However, at this energy a similar efficiency is obtained using the Closed filter combined with the EPIC-pn Full Frame mode; above $\sim 12.6$ keV the latter is in fact more efficient (see Fig.1).

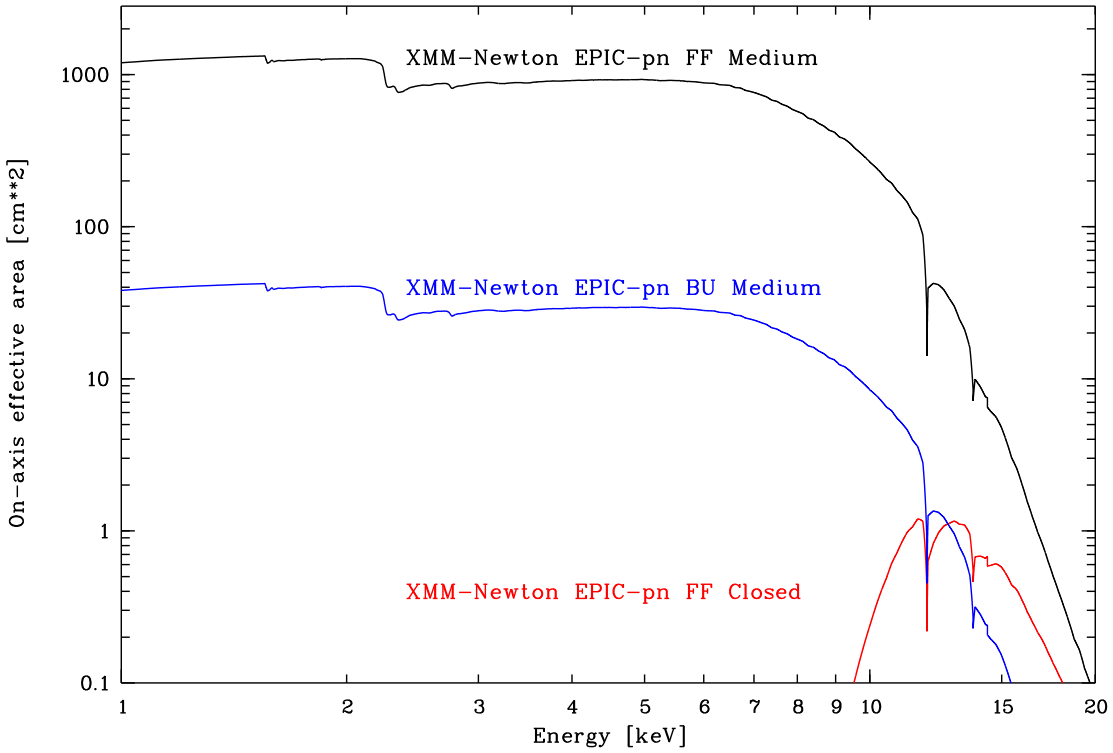


Figure 1: Comparison of EPIC-pn on-axis effective areas for three combinations of mode / filter: Full Frame mode / Medium filter (black), Burst mode / Medium filter (blue) and Full Frame mode / Closed filter (red). The curves combine the effects of telescope effective area, EPIC-pn quantum efficiency, respective mode efficiencies and filter transmissions. Above $\sim 12.6$ keV the Full Frame / Closed combination is more efficient than Burst / Medium.

# 4 Expected Updates

As more calibration data is analysed there may be further modifications to the transmission curves. There is provision for inclusion of spatial variations which may improve the Thick filter transmissions in particular.

## 5 Test Procedures and Summary of the Test Results

Functional testing with `calview`, `cifbuild` and `epproc`, `arfgen` and `rmfgen`.

Analysis of exposures taken with Closed filter using the previous CCF issue 18 resulted in errors such as (for `rmfgen`):

```
** rmfgen:  error (blockNotFound), Could not find block with qualified name
   '/ccf/pub/EPN_FILTERTRANSX_0018.CCF:FILTER-CLOSED' in dataset with name
   '/ccf/pub/EPN_FILTERTRANSX_0018.CCF'.
```

It has been verified that with the new CCF issues these errors no longer occur.

Verification that the added blocks do not affect the science filter configurations FILTER-THIN1, FILTER-MEDIUM and FILTER-THICK: effective areas determined by `arfgen` with the new CCFs are identical to those produced using the previous issue.

## 6 Reference

B.L. Henke, E.M. Gullikson, and J.C. Davis. X-ray interactions: photoabsorption, scattering, transmission, and reflection at E=50-30000 eV, Z=1-92, Atomic Data and Nuclear Data Tables Vol. 54 (no.2), 181-342 (July 1993).