

XMM-Newton CCF Release Note

XMM-CCF-REL-228

pn modified Timing mode response matrix

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1 Purpose

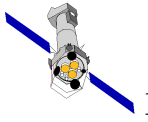
Using the EPIC-pn CCD camera in Timing mode, in which data are read out continuously, telemetry constraints do not allow full use of the capabilities for very bright sources because currently randomly distributed data gaps are introduced by the on-board data handling electronics. As an alternative a modification of the Timing mode in which data from soft X-ray events are not transmitted to Earth is available called "the modified Timing mode". The mode has first been used by XMM-Newton for the following observations of the Galactic Black Hole binary Cygnus X-1 in autumn 2004:

- 0202760201
- 0202760301
- 0202760401
- 0202760501

More details on the modified Timing mode can be found in:

- *Bright source x-ray spectroscopy with XMM-Newton: a modified EPIC-pn Timing mode*, Kendziorra et al, *SPIE*, Volume 5488, pp. 613-622 (2004). (see XMM-SOC-CAL-TN-0073)
- *EPIC-pn observations of Cygnus X-1*, Wilms et al., *ESA SP-604*, January 2006
http://xmm.esac.esa.int/external/xmm_science/workshops/x-ray-symposium/172094_jw_cygx1.pdf

Currently the SAS can not provide response matrices for the modified Timing mode.



However we provide a canned matrix at the calibration portal in the response matrix section at: http://xmm.esac.esa.int/external/xmm_sw_cal/calib/epic_files.shtml

This matrix allows to perform spectral analysis of the data of the modified Timing mode. Note that the matrix includes already an ARF and can only be used for a spectrum that has been extracted from columns 20-35 and 39-54 in order to assure correct normalization.

2 Changes

Using all available Timing mode data in standard setting simulating a higher lower threshold pattern fractions have been determined for a lower threshold of 2.8 keV. The response matrix contains also the ARF in that case.

3 Scientific Impact of this Update

The matrix will allow the general user to spectrally analyze the mentioned observations. In order to perform a correct analysis a spectrum needs to be extracted with the following expression *expression=" FLAG.eq.0 .AND. PI.GE.300 .AND. P.LE.10000 .AND. (PATTERN.GE.0 .AND. PATTERN.LE.4) .AND. (RAWX IN [20:35] .OR. RAWX IN [39:54])*

The modified Timing mode gives the possibility to observe (very) bright (up to 1 Crab) sources without the caveat of entering counting mode. This is especially important regarding time series analysis and the study of iron line variability, since the mode provides uninterrupted data streams.

4 Estimated Scientific Quality

The observations mentioned in section 1 show gain shifts due to imperfect CTI calibration of the Timing mode for very high photon rates. This is not been taken into account by the response matrix provided at the SOC. Currently work is ongoing to model the CTI/Gain for very bright sources for the Timing and Burst mode. Corrections need to be applied on a column by column basis and should not be averaged over the whole CCD. The resulting shifts around 6 keV for the above mentioned observations are around 100-200 eV. A preliminary matrix also taking the special CTI situation for the above mentioned observations into account is provided by the PI of the observations on request. Please send an email to joern.wilms@sternwarte.uni-erlangen.de.

5 Test procedures & results

The matrix has been tested on all in section 1 mentioned observations.

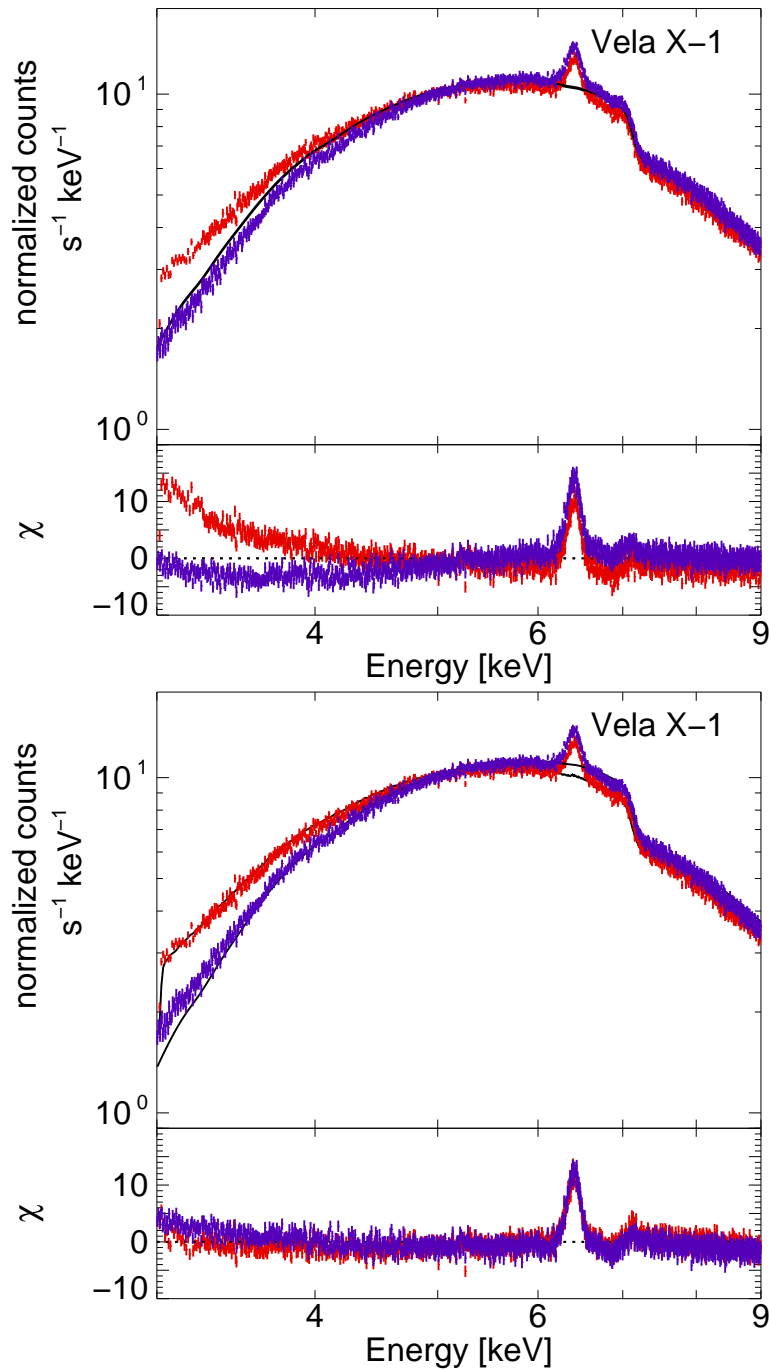
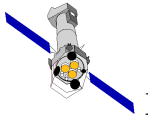


Figure 1: Upper: Standard Timing mode (purple), versus simulated modified Timing mode (red) both using the standard response matrix. Lower: same but using the new modified matrix for the modified Timing mode (red).

6 Expected Updates

This matrix will be completed in the future by other matrices for other lower thresholds and other extraction regions.