XMM-Newton CCF Release Note

XMM-CCF-REL-352

EPIC filter-wheel closed data

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	Change in CAL HB
EMOS1_FWC_0002.CCF	2000-01-01	EVENTS, EXPTIME	NO
EMOS2_FWC_0002.CCF	2000-01-01	EVENTS, EXPTIME	NO
EPN_FWC_0002.CCF	2000-01-01	EVENTS, EXPTIME	NO

2 Change

The EPIC CCD cameras on board XMM-Newton are equipped with a filter wheel system and 6 different filter setups. One of these is a CLOSED filter. Exposures taken with the filter wheel in the CLOSED position are dominated by the instrumental background and can be used to model and subtract the internal instrumental background.

Filter Wheel Closed (FWC) event lists exist and are available through the SOC web pages for EPIC-pn and EPIC-MOS and for the different EPIC modes. This CCF extends the FWC data currently available (see CAL-SRN-0344) by adding events from revolutions made between 2016-02-24 and 2017-02-27 (rev. 3154).

An example of the EPIC-pn FF FWC CCF light curve, in bins of 100s, is shown in Fig. 1. The filter expression used to create this light curve was (FLAG==0 && PATTERN<= 4) and it shows the evolution of the non-sky background from early in the mission until revolution 3154 (2017-02-27).

The INSTRUME keyword is now set correctly in the PRIMARY header of the three camera CCF files. It was left blank in the previous release.

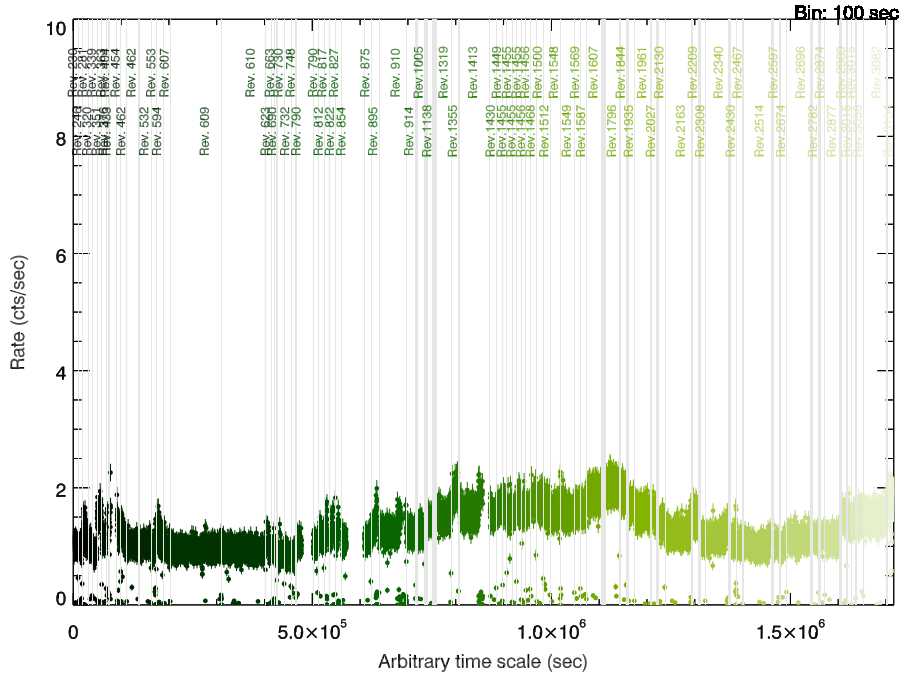

Figure 1: Sections of the EPIC-pn FF FWC events displayed in a 100s bin light curve. The figure represents the count rate, over the whole field of view and full energy range, extracted between revolutions 266 and 3154 (2001-05-22 to 2017-02-27). The X-axis times are arbitrary in the sense that the time origin corresponds to the time of the first available observation, and since the time gaps between observations are removed, the X-axis values only provide an approximation of the cumulative exposure duration. The width of the time gaps between exposures that is actually plotted is proportional to the real time gap that has been removed, i.e. some of the grey bands that mark the gaps are wider than others.

3 Scientific impact of this update

This CCF can be used by a SAS task to generate an event file containing the expected instrumental background or quiescent particle background (QPB) for a given observation and camera. It will do this by extracting the FWC data, for the given EPIC camera, from times closest to the observation date. The generated FWC event file may be used to provide EPIC science exposure images with the QPB subtracted and to provide a better background subtraction for spectra and time series. With this release observations made up until 2017-02-27 are fully supported.

An example of the improvement which may be gained in image contrast by subtracting the QPB is shown for the supernova remnant, SN 1006, in Fig. 2.

4 Estimated scientific quality

The quality of results which can be derived from this FWC CCF release can be gauged by comparing with the data found in the out-of-FOV regions of science observations. In Fig 3 the spectra extracted from the FWC (pink) and SN 1006-1 science (grey) EPIC-pn, out-of-FOV events are compared. Ideally the spectra would be identical and the ratio equal to 1 across all energies (blue curve). However, the out-of-field data from the science exposure is contaminated by flux from the extended source SN 1006-1, hence at low energies the agreement is not as expected, but at higher energies where there is no contribution from SN 1006-1, the spectra agree to within 10% consistent with the previous CCF release.

5 Test procedure and results

Tests were run as part of the annual release of the FWC repository. For testing, an IDL code that handles files from the FWC respository is checked against the SAS task *evqpb*.

The test involves comparing the results obtained from the analysis of a science observation when using the FWC repository files direclty against those obtained when running the SAS task *evqpb* in conjunction with the draft CCF files.

In particular, for the science observation used (obsid 0555630101; rev 1594: Source SN 1006-1) two things are checked:

- that the revolutions drawn from the FWC respository to build the FWC event file corresponding to the science observations are identical when extracting files directly from the FWC respository (IDL code) as when using the SAS task *evqpb* in conjunction with the draft CCF files.
- that the derived FWC spectra is identical when extracting it directly from the FWC

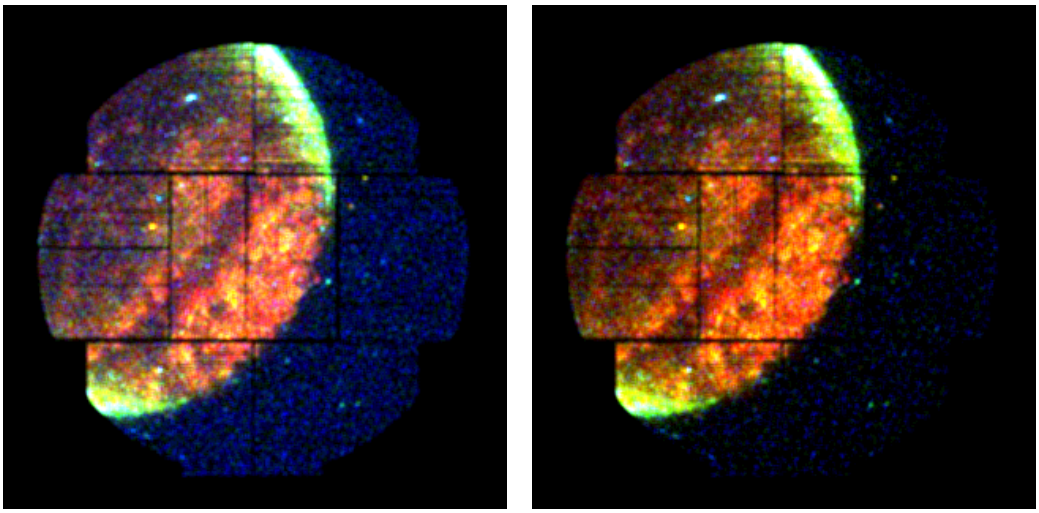

Figure 2: A MOS-2 image of SN 1006 from observation 0555630101 before (left) and after (right) correction for the QPB.

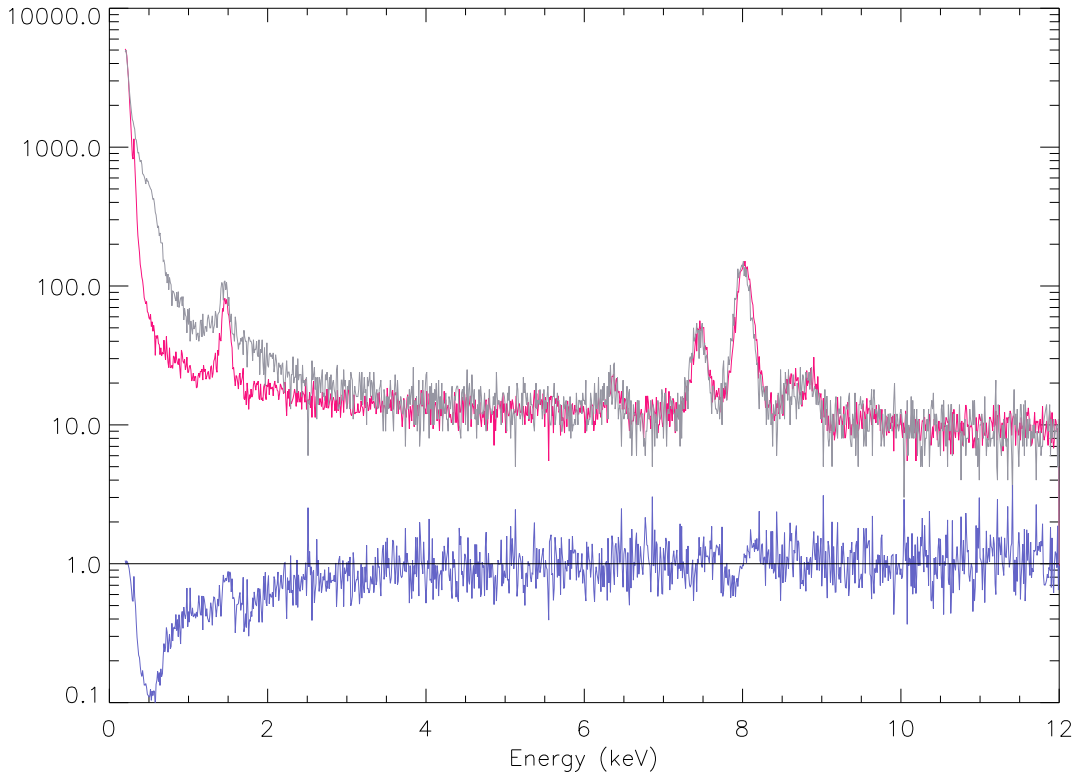

Figure 3: Comparison of the spectrum of events from the out-of-field-of-view, EPIC-pn, SN 1006-1 science exposure 0555630101 (grey) and the spectrum derived from the EPIC-pn FWC data for this observation and the same spatial region (pink). The blue curve gives the ratio FWC / observation.

respository (IDL code) as when using the SAS task *evqpb* in conjunction with the draft CCF files.

6 Future changes

This set of CCFs will continue to be updated periodically to include the most recent FWC data.

7 References

delaCalle et al. 2016, CAL-SRN-0344.