

XMM-Newton CCF Release Note

XMM-CCF-REL-217

RGS Background Spectra Templates

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1 CCF components

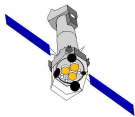
Name of CCF	VALDATE	EVALDATE	Blocks changed	XSCS flag
RGS1_TEMPLATEBCKGND_0003	2000-01-01T00:00:00	–	X100_P090_1_0.00... X100_P095_2_8.00	NO
RGS2_TEMPLATEBCKGND_0003	2000-01-01T00:00:00	–	X100_P090_1_0.00... X100_P095_2_8.00	NO

2 Changes

This is the second release of the RGS background spectra templates CCFs to be used by the SAS task `rgsbkgmodel`.

Each of these calibration files contain 64 extensions: 32 for first-order and 32 for second-order background spectra (note that the CCFs in the first release only had 32 [16+16] extensions). The first 32 extensions in the file correspond to an extraction region of 90% in PI (16 for first order, 16 for second order). The last 32 extensions correspond to an extraction region of 95% in PI (16 for first order, 16 for second order). Each of the 16 extensions groups contain the spectra derived from RGS blank fields within each of the 16 defined levels of background. The levels are defined by the count rate in an offset region of CCD 9. In all cases the spectra have been extracted from the full field of view (i.e. 100% of the cross dispersion PSF). This choice improves the signal-to-noise ratio of the templates, while the background can be properly scaled to the extraction area of any spectrum through the `BACKSCAL` column.

The names of the extensions in the file have been changed as to reflect the corresponding extraction regions used. They are now named `Xsss_Pppp_o.r.rr`, with `sss` being the size of the extraction



region in cross dispersion (100 in all cases), `ppp` the size of the extraction region in PI (090 or 095), `o` the order and `r.rr` the level (from 0.00 to 8.00).

These new background template spectra have been extracted with version 2.6 of the SAS task `rgsspectrum`. The new templates only differ from the previous ones in the values in the `BACKSCAL` and `QUALITY` columns. While in the previous versions of this task a single value of `BACKSCAL` was assigned to all the channels of each CCD node, the new version makes a more rigorous computation, deriving this quantity channel by channel. As a consequence of this, with the new version of `rgsspectrum` more pixels have a low value of `BACKSCAL` and are flagged as 'bad' in the extracted spectrum. Some analysis software (e.g. XSPEC) does not take into account the quality flags of the background, and this gives rise to a significant number of outliers in the background-subtracted spectrum. This problem has been solved by replacing the value of `BACKSCAL` in the channels with bad quality with the median for all the valid channels in the corresponding node.

3 Scientific Impact of this Update

The use of the background spectra templates is an alternative to the conventional analysis, in which the background is derived from the offset region in the spatial image. The method is fully described in in XMM-SOC-CAL-TN-0058. This new way of determining the background is especially important for analysing:

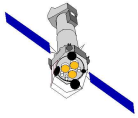
- extended objects leaving little or no background regions in the RGS spatial image,
- weak sources, for which an improvement of the signal to noise ratio could be essential.

The need for a new set of templates is twofold:

- For consistency, to use templates extracted with the last available version of `rgsspectrum`
- To include templates extracted with a PI extraction region of 95%, which will be the default as of SAS 7.0.

4 Estimated Scientific Quality

With the exception of pathological cases (less than a few percent) the establishment of the overall background spectrum in an observation using the background spectra templates (as done by the SAS task `rgsbkgmodel`) works very well, constituting a valid alternative for ANY observation, and the ONLY one for largely extended sources. A very good reproduction of the background obtained with the conventional analysis could be achieved in all the control cases tested so far, using different types of object with different levels of background.



5 Expected Updates

Further updates can be made in the future to improve the signal-to-noise ratio of the templates by adding more blank fields and/or to cope with software updates.

6 Test procedures

General checks:

- use `fv` (or another FITS viewer) for file inspection. It should contain 64 binary extensions, each with five columns: `CHANNEL`, `RATE`, `QUALITY`, `BACKSCAL` and `AREASCAL`.
- use the SAS task `cifbuild` to see if the CAL digests and creates correctly the calibration index file.

7 Summary of the test results

A full description of the method and results obtained, also using even these CCF files with the new SAS task `rgsbkgmodel` is given in the Calibration Technical Note XMM-SOC-CAL-TN-0058 "Templates for the RGS Background" [1].

General checks:

The fits viewer `fv` was used to inspect the two CCF files, wrt their structure and validity dates. Everything was OK.

The SAS task `cifbuild` was run successfully in order to check the ingestion of the files into the calibration index file.

References

[1] "Templates for the RGS Background", R. González-Riestra, XMM-SOC-CAL-TN-0058, October 2004