XMM-Newton CCF Release Note

XMM-CCF-REL-130

RGS Bad Pixels

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1 CCF components

Name of CCF	VALDATE	EVALDATE	Blocks changed	XSCS flag
RGS1_BADPIX_0012	2000-01-01T22:00:00	2001-06-12T23:00:00	BADPIX	NO
RGS1_BADPIX_0013	2001-06-13T00:00:00	2002-11-13T23:00:00	BADPIX	NO
RGS1_BADPIX_0014	2001-08-14T22:00:00	2001-09-20T21:00:00	BADPIX	NO
RGS1_BADPIX_0015	2002-11-13T23:30:00	—	BADPIX	NO
RGS1_BADPIX_0016	2002-11-27T21:00:00	—	BADPIX	NO
RGS2_BADPIX_0012	2000-01-01T22:00:00	2001-06-12T23:00:00	BADPIX	NO
RGS2_BADPIX_0013	2001-06-13T00:00:00	2002-11-03T23:00:00	BADPIX	NO
RGS2_BADPIX_0014	2001-08-14T22:00:00	2001-09-20T21:00:00	BADPIX	NO
RGS2_BADPIX_0015	2002-11-04T00:00:00	—	BADPIX	NO

2 Changes

This release comprises two fundamental issues concerning bad pixels:

- a number of so-called "low count" columns was established by an analysis performed at SRON with science data. Those columns are due to hot / warm pixels / segments by which on-board processing already removes the events, but no removal registration is done. As a result a number of spectroscopy channels have a lower effective area than expected, and produce "outliers" in the spectral fitting results,

- in November 2002 the operational temperature of the RGS CCDs was decreased from -80C to -110C. This was performed mainly to reduce the effects of radiation damages occurred since XMM-Newton launch. As a result a drastic reduction of hot pixels / columns was observed.

1
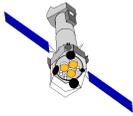
Since the "low count" columns we want to flag as "advisory hot columns" (eg. not to be uploaded but to be taken as bad in the data analysis) correspond to those observed disturbed permanently since the beginning of the mission, a whole set of CCFs covering all periods has to be released.

3   Scientific Impact of this Update

The CCFs with indices 0012, 0013 and 0014 cover the whole period from begin of the mission to the time the RGS instruments were cooled down, so they should replace completely all the RGS BADPIX CCFs previously released. They contain for each period in time the same bad pixels / columns they had in the former valid releases with the adding of the "low count" columns as advisory hot columns. They replace for an actual analysis date the CCFs with indices 0005, 0006, 0007 and 0008 (using the start and end of validity keywords we could reduce the number of files to 3 with following correspondence: 0012 for 0005, 0014 for 0007 and 0013 for 0006 and 0008). Please refer to the corresponding former Release Notes for details on the uploaded and advisory hot columns and pixels, which were already present in the CCFs 0005 to 0008.

Five "low count" columns in RGS1 and one in RGS2 are flagged in the new CCFs (0012 to 0014) as advisory hot columns. They have been determined using bright continuum source observations, distributed more or less uniformly through the whole operational phase. They flagged columns showed up as "low count" in all of the observations analysed. The effect of such a correction is made clear in the comparison of plots in Fig.1.
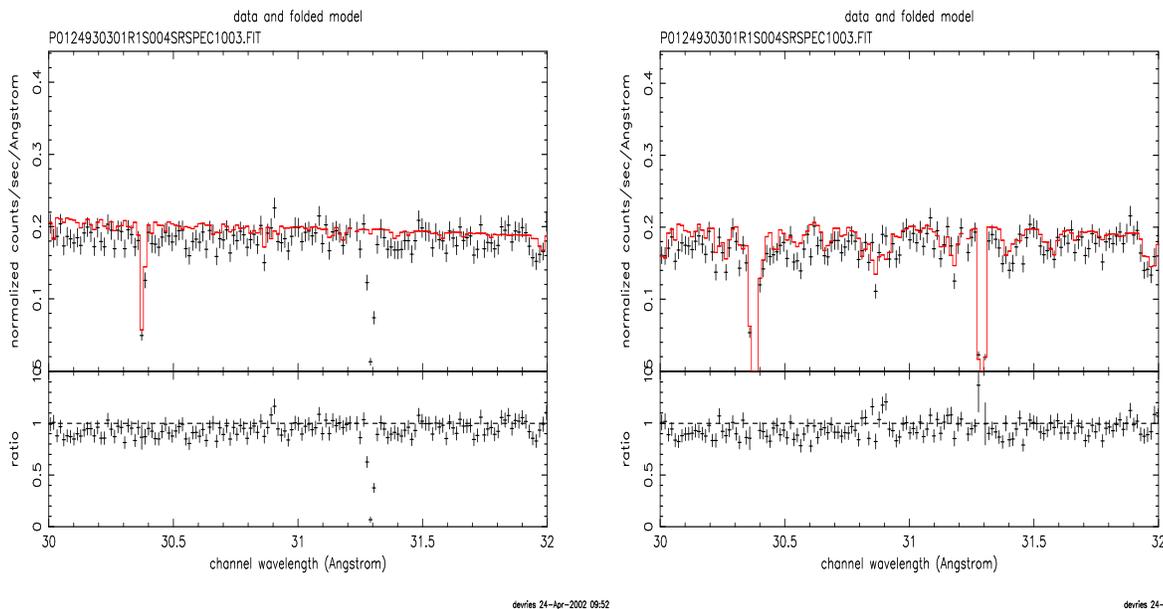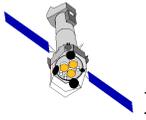

Figure 1: Left: detail of a fitted spectrum without correcting for "low count" columns; right: same spectrum fitted taking them into acount

After cooling down the RGS instruments, the number of hot pixels decreased drastically. Hot columns and pixels were determined using the RGS diagnostic data of two revolutions after cooling. Results were:

RGS1 : one hot column and five hot pixels were found. Three hot columns have been uploaded so far, one of them being the one found still to be hot after the CCD cooling. From November 27, 2002, only this one hot column will be uploaded. This makes necessary the release of two CCF files, one covering the period between cooling of the CCDs and the operational change on Nov. 27, and the other one from that date on. Both contain the same number (5) of advisory hot pixels (instead of 28 hot pixels plus one hot segment, as prior to cooling). The "low count" columns cannot be included until a new analysis on this item is performed.

RGS2 : one hot column and two hot pixels were found. The hot column found is the same which has been uploaded continuously since September 2001. Therefore, no operational changes are needed and only one CCF is needed, valid from the time the cooling of the CCDs took place for this instrument. It contains the two advisory hot pixels instead of the 15 prior to cooling. Concerning "low count" columns the same comment applies as to RGS1. First checks on RGS2 data indicate that the "low count" columns have disappeared, as expected, due to cooling of the CCDs.

4 Estimated Scientific Quality

The inclusion of "low count" columns in the CCFs 0012 to 0014 should improve the quality of spectral fitting, since the effective area for the channels containing them will be properly calculated. These channels appeared so far very often as outliers in the fitted signal distributions, if a significant signal was expected.

Please take into account that:

- the "low count" columns are flagged as if they were hot. When the SAS rgsbadpix task runs (with parameter "withadvisory=yes", which is the default), it will check those advisory hot columns and issue a "discrepancy" warning that the column was not found hot in the telemetry.

- only the permanent "low count" columns have been flagged, eg the ones showing with a high frequency this disturbance. There is a number of affected columns showing this effect only from time to time, so that they cannot be flagged this way. They show up also as outliers in the spectral fits because of their reduced effective area.

5 Expected Updates

Updates could be expected after the analysis of bad pixels with science data post-cooling is done. "Low count" columns should be re-established, if any, as well as those hot pixels / columns which do not show up in diagnostic mode, but only in spectroscopy mode.
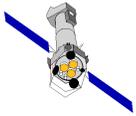
6   Test procedures

General checks:

- use FV (or another fits viewer) for file inspection. It should contain 2 binary extensions (BADPIX and BADPIX1)

- use the SAS task CALVIEW to see if the CAL digests and uses the new files.

7   Summary of the test results

The fits viewer fv was used to inspect all 9 CCF files, wrt their structure, validity dates and contents of the first extension (BADPIX). Everything OK.

The SAS task cifbuild was run several times using data corresponding to periods covered by the different CCFs in order to check the correct selections. Selections were correctly done.

Finally the SAS task calview was used to prove that all these calibration files are ingested correctly by the CAL, by pointing to the different Calibration Index Files and producing bad pixel plots.