XMM-Newton CCF Release Note

XMM-CCF-REL-347

RGS Bad Pixels - advisory extended segments

C. Gabriel

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1 CCF components

Name of CCF	VALDATE	EVALDATE	Blocks changed	XSCS flag
RGS1_BADPIX_0035	2016-05-11T23:00:00	—	BADPIX	NO

2 Changes

This release adresses an issue concerning bad segments, motivated by the RGS Diagnostic Trend Analysis Report - 2015-2016 (XMM-CAL-TN-0209). Flagging of further extensions to the two areas with increased offsets ("hot spots"), on both upper parts of CCD 1 in RGS1 (each one corresponding to a readout node), proves necessary. We have initiated the process to mask the larger area of the spots through uploading hot segments, so that the corresponding data are not transmitted down anymore. In the meanwhile, until that happens, we can already flag these larger areas through a number of "advisory" hot segments, so that they these areas are not taking into account when processing the data. Basically we will have two masked spots of 39 by 16 pixels. Each of them in the most left and right upper areas of CCD 1. We will therefore complete through advisory hot segments the areas to be fully masked in the future. This extended advisory masking will have for reasons of simplicity the same starting date as the former RGS1_BADPIX_0034, revolution 3008, starting on the late evening of May 11, 2016. RGS1_BADPIX_0035 contains these extended bad pixel masking, for correct handling of the data when processing, including a correct calculation of the efficient areas.

3 Analysis

As part of the continuous monitoring of the RGS instruments, offset maps are produced, as the averages of the diagnostic images over three consecutive revolutions. They are then taken into the

ODF data for the offset subtraction. The hot spot on the C side of the detector is clearly seen in Fig. 1, left side, showing the averaged offset map corresponding to year 2016. The hot spots are attributed to stress produced in CCD1 at the bond places.

We have performed also an analysis of all the "hot stuff" found by running the bad pixel/column finding software (SAS task `rgsbadpixfind`) over the science data, and construct bad pixel maps. On the right side of Fig. 1 we have such a map corresponding to RGS1 - CCD 1 - C readout side, for the period between May and December 2016, i.e. after the upload of the extended region, masking the hot spot also between rows 9 and 16. It is clearly seen that, the masking produced the desired effect of avoiding fake hot columns below the spot (real high signal hot segments together with portions of increased signal further below the columns due to eg. fixed pattern noise fake with a certain probability a hot column). However, we see also that there are now some not masked segments to the right of the spot giving rise to new columns being misidentified as hot. The evolution of the hot spots, growing slowly both in vertical as in horizontal direction, is the reason for now extending the spot by 8 columns to the right, and so fully masking the spot area.

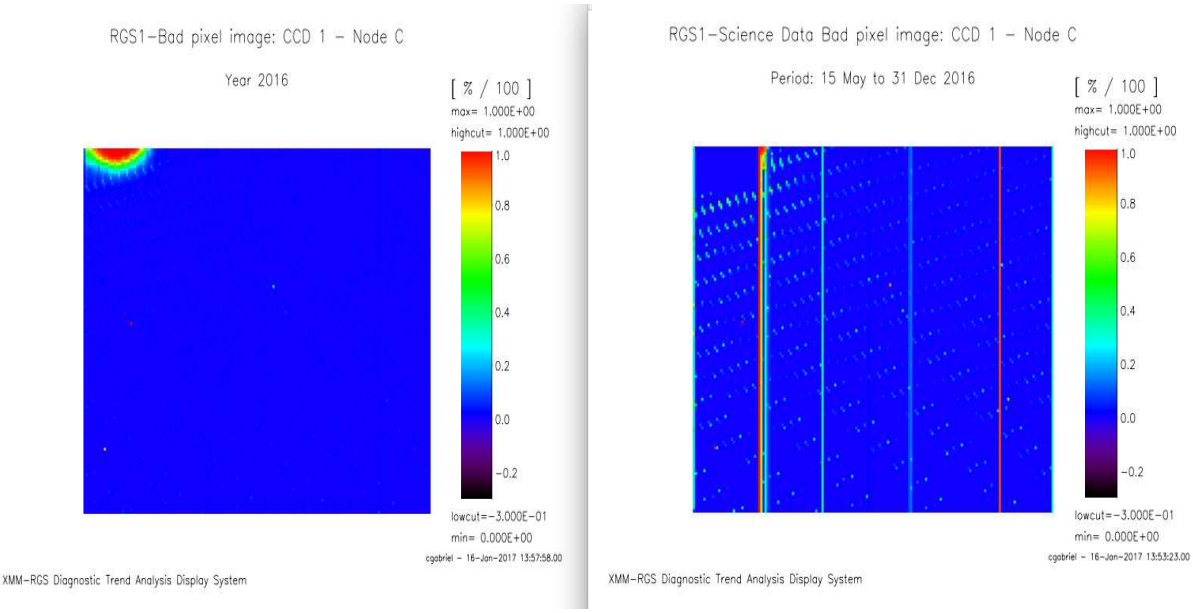

Figure 1: Left: RGS1 - CCD1 - C side offset map averaged over all data from year 2016, showing the "hot spot". Right: RGS1 - CCD1 - C side bad pixel map obtained with science data after the last upload, extending the masked area horizontally, has taken place.

The same date corresponding to the years 2015 and 2016 respectively for the node D side (Fig. 2 , shows the effects of the evolution of the hot spot on the D side. Several columns have a larger probability to be misidentified as hot, due to the larger size of the hot spot, which is not fully masked anymore. Extending the advisory masked area also to 39 columns and 16 pixels, ie. symmetric to the C side, should avoid losing data due to this misidentification.

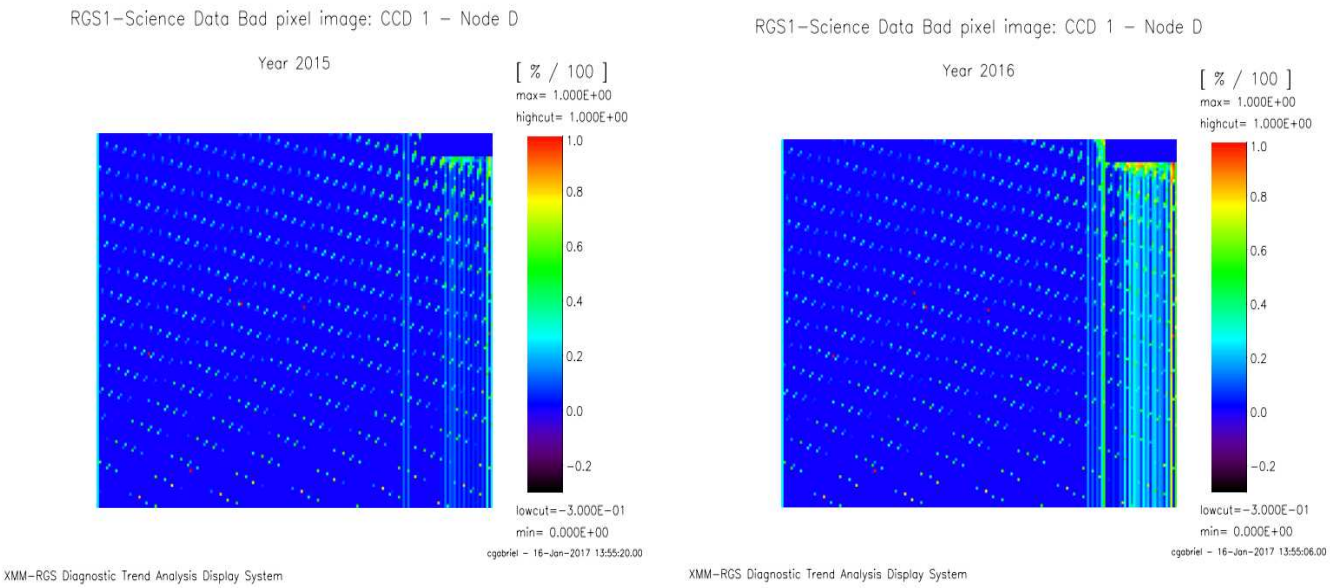

Figure 2: RGS1 - CCD1 D readout side science bad pixel maps corresponding to data from 2015 on the left and 2016 on the right.

4 Scientific Impact of this Update

The start date of validity is set for simplicity to the late evening of May 11 2016. when the new bad pixel tables, including the extended hot spot on the C side, started to be uploaded to the instrument. For data taken after this, we also extend the advisory hot spot masking.

5 Estimated Scientific Quality

The inclusion of the extended hot segment in this CCF will reduce the number of fake hot columns, both to the right of the spot on the C side, as to the left of and below the spot on the D side.

6 Expected Updates

Further analysis of bad pixels with diagnostic and science data should lead to updates, although this is expected to happen very infrequently.

7 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.
- check that the differences between RGS1_BADPIX_0034 and _0035 are exclusively the extensions of the advisory ("H") segments corresponding to the hot spots in RGS1 CCD1 C and D readout side.

8 Summary of the test results

The fits viewer fv was used to inspect both 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 and not covered by this CCF in order to check the correct selections. Selections were correctly done.

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

`fdiff` (FTOOLS) has been used to check that the differences to the former valid bad pixel CCF file (RGS1_BADPIX_0034) are only the new introduced hot advisory segments.

Finally, an observation taken in July 2016 has been reduced with SAS 16, with and without the inclusion of the new RGS CCF. While the RGS2 data was identical, a reduction of hot stuff (two "hot columns" less) in RGS1 CCD 1 could be seen.