XMM-Newton CCF Release Note

XMM-CCF-REL-218

RGS Cool Pixels

C. Gabriel

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1 CCF components

Name of CCF	VALDATE	EVALDATE	Blocks changed	XSCS flag
RGS1_COOLPIX_0001	2000-01-01T00:00:00		COOLPIX	NO
RGS2_COOLPIX_0001	2000-01-01T00:00:00		COOLPIX	NO

2 Changes

This is the first release of a new calibration file for making possible the removal of columns characterized by an anomalous large charge transfer inefficiency in the RGS chips. The effects of these anomalous columns are not easily seen and are only perceptible by a combination of large amounts of data and enough signal on the chip. Fig. 1 shows the effects both in space and energy plots on one of the affected columns, probably caused by charge traps in the column producing large CTI. The normal energy region selection, necessary for discrimination of the spectral orders, discards consequently a large part of the signal. Removal of such suspicious "cool" columns should clearly improve the quality of the spectrum.

Derivation of the "cool" columns set was performed by the RGS instrument group at SRON using all the Mkn421 data observed in the first 5 years of operations. The numbers of affected columns by the RGS1 and RGS2 instruments are 55 and 32, respectively.

A new function accessing these calibration data has been put in place, which is called from the SAS task rgsenergy, if the parameter "keepcool" is disabled (eg. set to "NO"). The flagged columns are then added to the flagged bad pixels and bad columns and handled in the same way. These changes are going to be effective with the release of SAS 7.0.

3 Scientific Impact of this Update

A general improvement in the spectral fitting quality can be expected, especially for the analysis of small wavelength scale effects. This could be checked using the RGS first order spectra from the Mkn421 observation 0099280201, taken in revolution 165. Using a simple absorbed power law model fits were conducted with and without flagging the cool columns. In the latter case the chisquare was reduced from 1.34/DoF to 1.11/DoF.

4 Estimated Scientific Quality

The inclusion of "cool" columns 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 "cool" columns were to a certain percentage recognized as "low count" columns in the past and have been consequently flagged as bad columns for certain periods of the XMM mission. So the total number of 87 columns which can be flagged through the inclusion of these new CCFs is an upper limit, and the number of flagged columns in addition to the defaults depends on the epoch of the observation,
- this new correction should be applied mainly for the study of small wavelength effects and it is therefore not implemented as a default choice,
- at the moment the SAS implementation does not allow the user to separate "cool columns" and "bad columns" for further quality selection, eg. the "NEXT to BADPIX" flagging (which is the default) applies to both types in the same way. Further studies should show if disentangling them is advisable.

5 Expected Updates

The evolution of "cool" columns should be monitored for establishment of periods of validity. This is considered difficult, however, due to the large amounts of data necessary to this purpose.

6 Test procedures

General checks:

- use FV (or another fits viewer) for file inspection. It should contain 1 binary extensions (COOLPIX)
- use the upgraded SAS (incl. rgsbadpix 2.18.2) for validating ingestion and use of the cool columns information. Compare results with parameter keepcool="yes" and ="no").

7 Summary of the test results

The fits viewer fv was used to inspect the 2 CCF files, wrt their structure, validity dates and contents of the extension. Everything OK.

rgsproc has been ran with and without the new correction on a Mkn421 dataset. Improvement of the spectral fitting was achieved, the columns were correctly flagged.

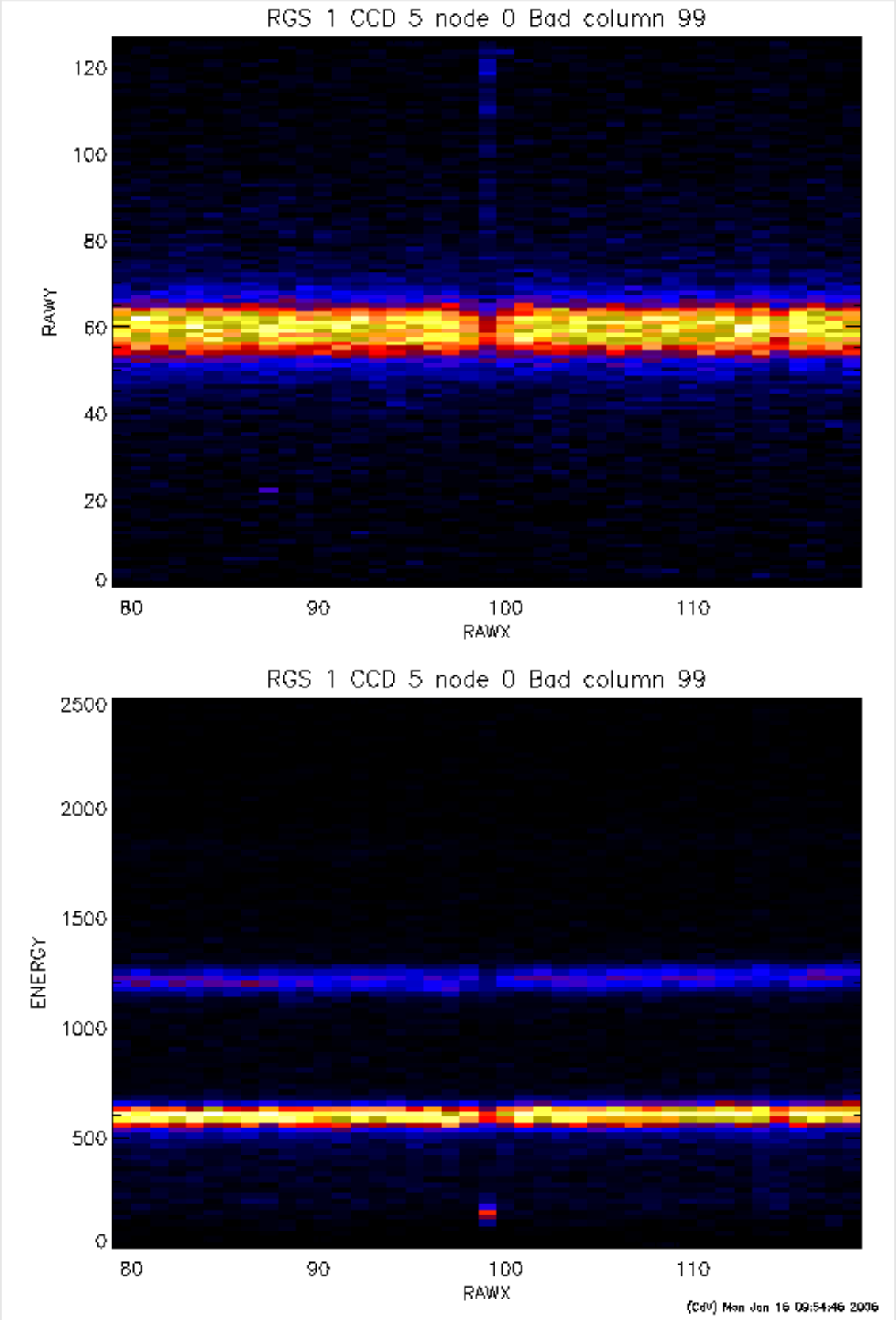

Figure 1: Spatial and energy plots detail, showing an affected column by large CTI