XMM-Newton CCF Release Note

XMM-CCF-REL-417

Evolution of the RGS CTI (2025)

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	XSCS flag
RGS1_CTI_0020	2024-12-21T00:00:00	CTI CTI_EXTENDED XCTI CTIY1-9	NO
RGS2_CTI_0021	2024-12-21T00:00:00	CTI CTI_EXTENDED XCTI CTIY1-9	NO

2 Changes

Last update of the RGS Charge Transfer Inefficiency (CTI) values was done in October 2024 [1], and was based on data taken in May 2024.

As detailed in [2] it has been recently noticed that when these data were taken the temperature of both instruments was -108.25 C, above the usual operational temperature of -109.84 C.

Further investigations have shown that this was due to an incorrect recovery of the intruments after failures on April 8th and March 3rd 2024 for RGS1 and RGS2, respectively. Temperatures were back to the nominal values at the start of the 2024 Winter eclipse season. It was felt that it was necesssary to update the CTI CCFs with data taken at the nominal instruments temperature.

The following procedure has been followed:

- The validity date of the current CCFs (#0018 and #0019, for RGS1 and RGS2, respectively)

has been modified to reflect the exact dates of the start of the high temperature period, see [2], resulting in CCFs #0019 and #0020.

- A new set of calibration observations at the nominal operating temperature has been obtained in May 2025.
- J. de Plaa (SRON) has used these new calibration observations of Mkn 421 to derive updated values of the CTI for the current epoch. The validity date of this CCFs has been set to the start of the 2024 Winter eclipse season, December 21st 2024.

Serial CTI is derived from on-axis observations of Mkn 421 (rev. 4669). Observations of this target displaced ±1.5 arcmin off-axis in the cross-dispersion direction (rev. 4663) are used to derive the Parallel CTI. A description of the method used is given in [3].

Figures 1 and 2 show the evolution of Serial and Parallel CTIs since the beginning of the mission. It must be noted that no interpolation in time is done, instead a constant value is used during the validity period of each CCF.

3 Scientific Impact of this Update

The values of the RGS CCDs CTI are used to compute the energy (PI) of each detected event. The regular monitoring of these parameters is important to verify the correct placement of the extraction masks in the Wavelength/PI plane, the separation of the spectral orders and the separation of the first order from the system peak at long wavelengths.

4 Test procedures & results

- The fits viewer `fv` has been used to inspect the new CCFs, their structure, validity dates and contents.
- The SAS task `cifbuild` has been run to confirm that the right CCFs version is selected.
- The observation of RXJ1856-3754 taken in March 2025 has been processed with the last SAS version using the new CCFs. Output files have been compared with the result of the processing with the current CCFs (see Fig. 3).

5 Expected Updates

These CCFs should be revised regularly to evaluate the degradation due to radiation. Observations of a bright continuum source off axis in the cross-dispersion direction must be performed every two years to monitor the parallel CTI.

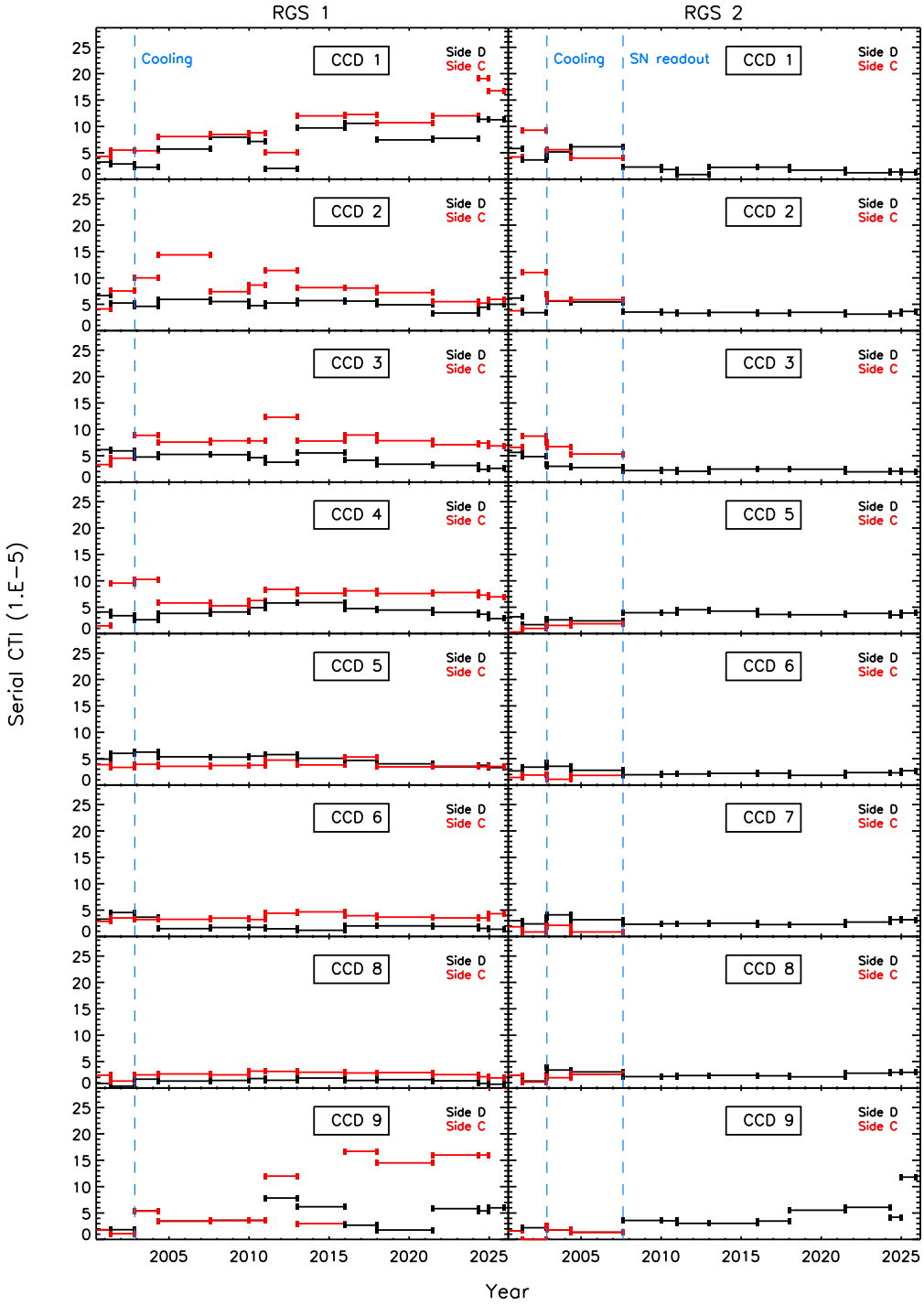

Figure 1: Evolution of the RGS Serial CTI since 2001 (left RGS1, right RGS2). RGS2 started to be read through a single node (C) in August 2007. Since then, the serial CTI for RGS2 (formerly) node D is simply the negative of the node C values. Errors are of the order of 5×10^{-6}. The horizontal lines mark the validity periods of the different CCF versions. The vertical lines show the times of the instruments cooling (November 2002) and the change to Single Node Readout for RGS2 (August 2007).

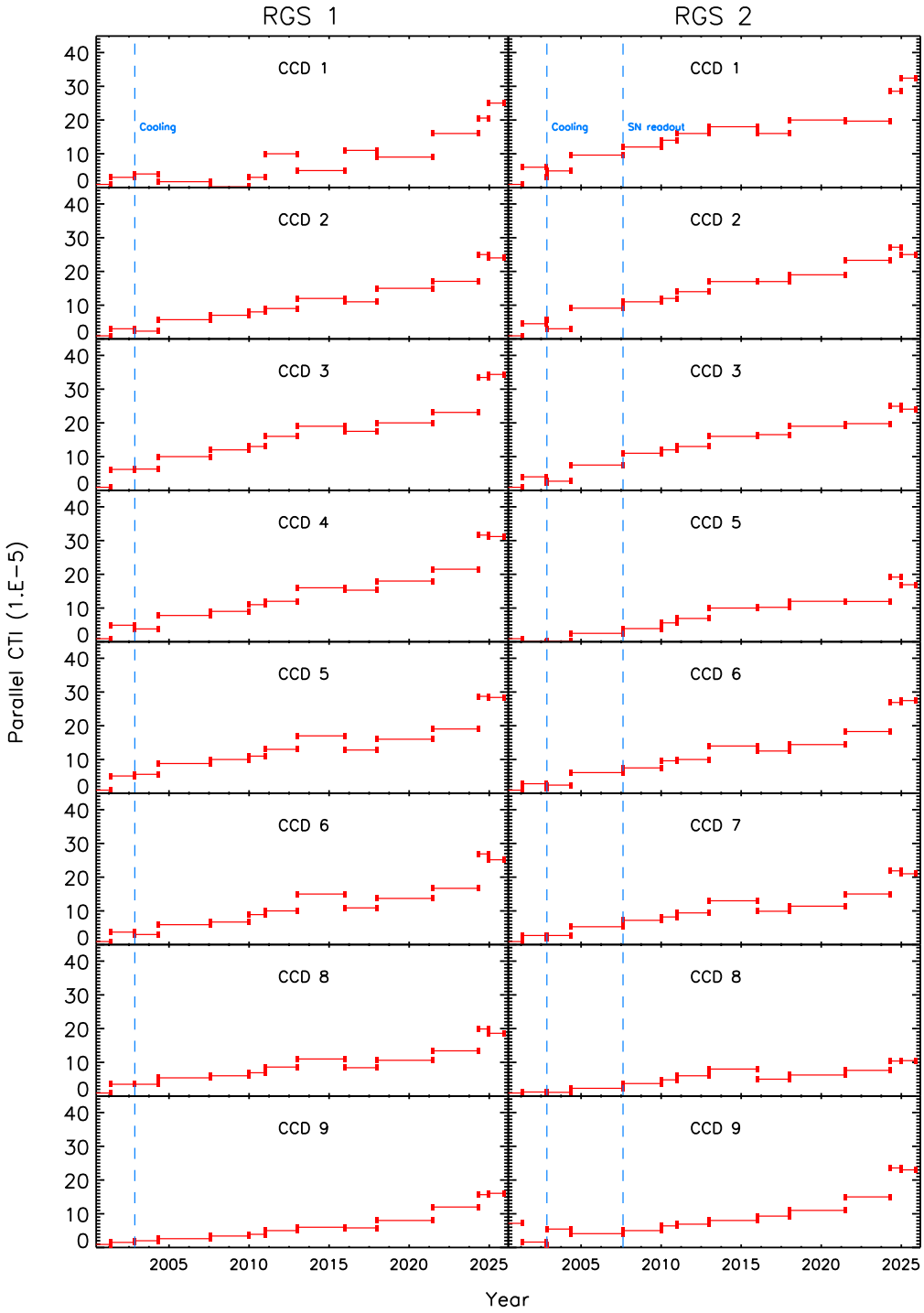

Figure 2: Evolution of the RGS Parallel CTI since 2001 (left RGS1, right RGS2). The points represented are the CTI values far from the chips edges. Errors are of the order of 5×10^{-6}. The horizontal lines mark the validity periods of the different CCF versions. The vertical lines show the times of the instruments cooling (November 2002) and the change to Single Node Readout for RGS2 (August 2007).

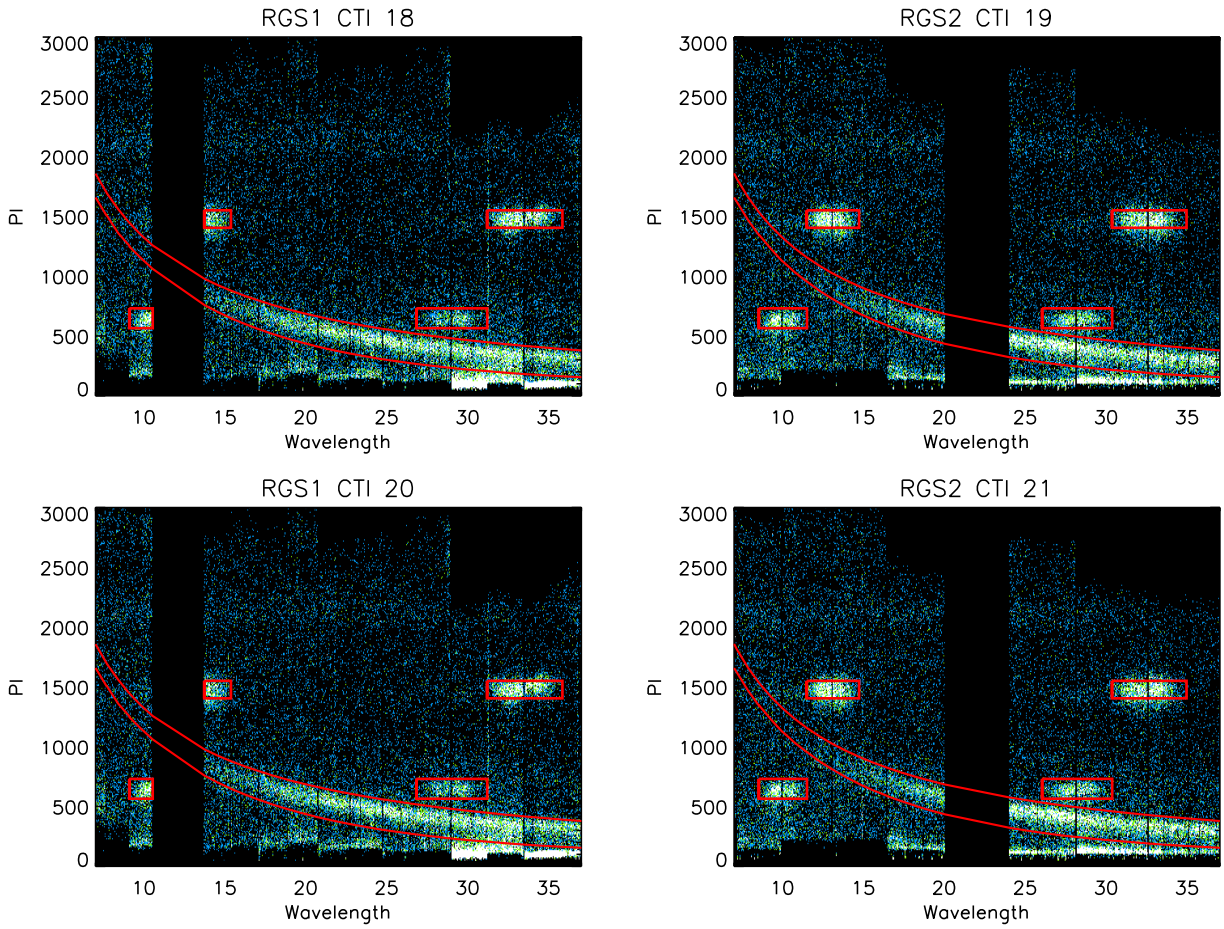

Figure 3: Result of processing the observation of RXJ1856-3754 taken in rev. 4634 (March 2025) with the current CCFs (top) and the new ones (bottom). The red lines show the default (95%) PI extraction regions for first order. Rectangles mark the position of the calibration lamps.

6 References

[1] "Evolution of the RGS Gain and CTI (2024b)", R. González-Riestra and J. de Plaa, XMM-CCF-REL-412, October 2024
(https://xmmweb.esac.esa.int/docs/documents/CAL-SRN-0412-1-1.pdf)

[2] "RGS CTI: Change of Validity Dates', R. González-Riestra and C. de Vries and J. de Plaa, XMM-CCF-REL-416, June 2025
(https://xmmweb.esac.esa.int/docs/documents/CAL-SRN-0416-1-1.pdf)

[2] "Calibration and in-orbit performance of the reflection grating spectrometer onboard XMM-Newton", de Vries, C. et al, 2015. A&A 573, A128
(2015A&A...573A.128D)