XMM-Newton CCF Release Note

XMM-CCF-REL-315

Astrometry: time variable boresight update

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	CAL VERSION	XSCS flag
XMM_BORESIGHT_0024	2000-01-01T00:00:00	OM_ANGVAR EMOS1_ANGVAR EMOS2_ANGVAR EPN_ANGVAR RGS1_ANGVAR RGS2_ANGVAR		No

2 Changes

The XMM-Newton Time Variable Boresight was implemented in 2012. It is described in the release notes XMM-CCF-REL-286 and XMM-CCF-REL-290.

After two years of successful use of the Time Variable Boresigh, it has been decided to update the offsets to be applied to the Euler angles as a function of time.

We have analyzed the astrometry offsets derived from the pipeline PPS sources lists for the EPIC and OM instruments using all data obtained by XMM-Newton and processed with the standard pipeline. This analysis shows a slight deviation in the more recent offsets with respect to the trend predicted in the current fit, contained in XMM_BORESIGHT_0023.CCF.

As we did before we have modeled the offsets variation with time by means of a long term variation plus a periodic (nearly one year) oscillation (Talavera & Rodríguez-Pascual [1])

As explained in XMM-CCF-REL-290, the same offsets obtained for EPIC can be used to process

Table 1: Best-fit parameters implemented in this CCF.

Instrument/coordinate	P_1	P_2	P_3	P_4	P_5	P_6	P_7
EPIC/Y	0.64	-5.2×10^{-4}	1.4×10^{-7}	-9.2×10^{-12}	0.16	–20.2	365.6
EPIC/Z	0.91	-2.1×10^{-3}	7.8×10^{-7}	-8.9×10^{-11}	1.40	2.23	363.0
OM/X	–1.51	9.8×10^{-4}	-9.2×10^{-8}	0.0	–1.16	4.07	361.9
OM/Y	–2.43	2.2×10^{-3}	-2.4×10^{-7}	0.0	0.85	–2.99	362.6

RGS data.

$$\Delta = (P_1 + P_2 \times T + P_3 \times T^2) + P_4 T^3 + P_5 \times \cos[2\pi \times (T - P_6)/P_7)]$$

where Δ is the measured offset and T is the time in Julian days elapsed since January 1, 2000. The new best-fit parameters are given in Tab.1. Note that the long term component for the EPIC is fitted now with a third order polynomial, while for OM the polynomial remains of second order.

3 Scientific Impact of this Update

The release notes XMM-CCF-REL-286 and XMM-CCF-REL-290 explain in detail the improvements in the astrometry achieved with the Time Variable Boresight.

Now we have made a small adjustment to compensate for the deviation observed in the measured offsets with respect to the predicted trend. This deviation is very small for OM, less than 0.5 arc sec in both Euler angles in the most recent observations, as it is shown in Fig. 1 However for the EPIC and RGS the deviation is larger, of the order of 1-2 arc sec in the Θ Euler angle (Z coordinate), reaching 3 arc sec by 2016. (See Fig.2)

4 Estimated Scientific Quality

The quality of the corrections can be assessed by comparing the catalog offsets obtained with the constant and the new variable boresight. This comparison was presented in the previous release notes, XMM-CCF-REL-286 and XMM-CCF-REL-290.

5 Test procedures

The concept of time variable boresight and its implementation were intensively tested in their first issue. At that time more than 4000 observations obtained since the beginning of the XMM-Newton

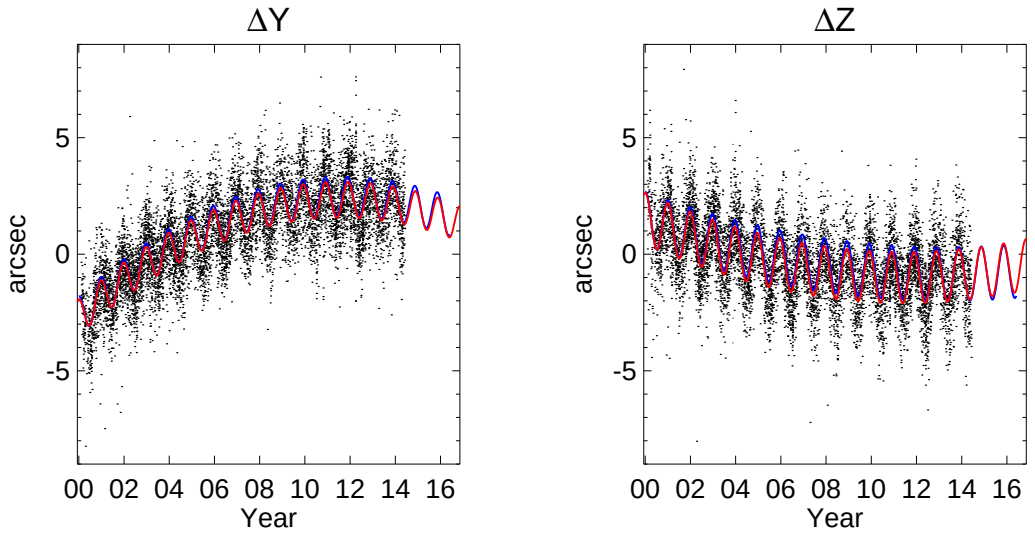

Figure 1: OM measured offsets and fit: in blue CCF_0023, in red CCF_0024

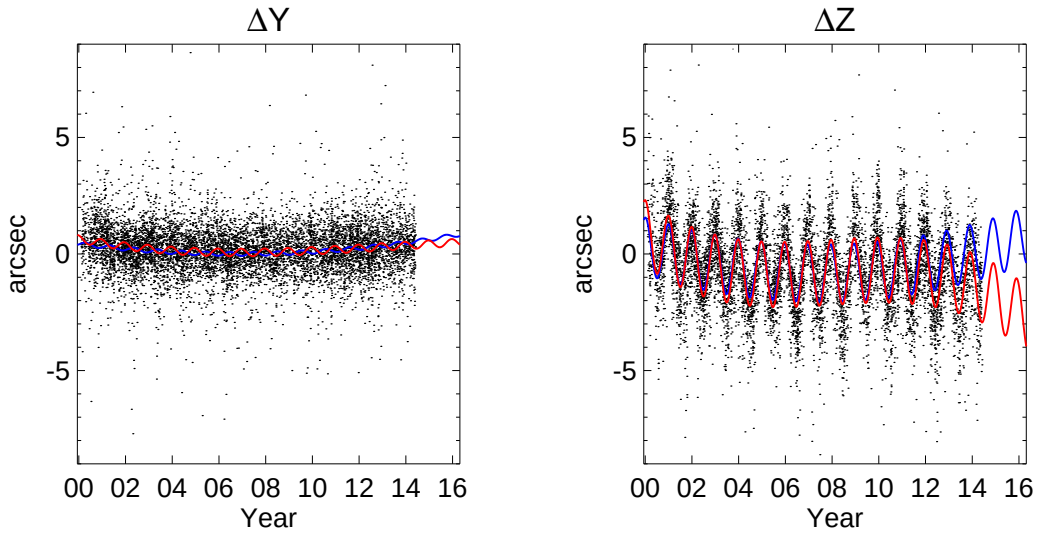

Figure 2: EPIC measured offsets and fit: in blue CCF_0023, in red CCF_0024

operational life were processed with SAS using the new concept CCF.

Since this new release implements just a small increment in the Euler angles offsets, we have processed only a couple of recent ODFs to confirm the normal functioning of the related SAS tasks.

6 Summary of the test results

As said before, the tests results can be seen in XMM-CCF-REL-286 and XMM-CCF-REL-290.

7 Expected updates

The fit to the long term trend observed in the measured offsets assumes an extrapolation beyond the available data. Therefore we need to continue monitoring the offsets in the future to confirm the trend or to modify the fit as we have done now.

References

[1] Talavera A., Rodríguez-Pascual P., 2011, XMM-SOC-TN-0041, available at:

`http://xmm2.esac.esa.int/~xmmdoc/CoCo/CCB/DOC/Attachments/INST-TN-0041-1-0.pdf`.