XMM-Newton CCF Release Note

XMM-CCF-REL-155

OM Astrometry

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1 CCF components

Name of CCF	VALDATE	EVALDATE	List of Blocks changed	XSCS flag
OM_ASTROMET_0011	2000-01-01T00:00:00	—	FILTER-V	NO
		—	FILTER-U	NO
		—	FILTER-B	NO
		—	FILTER-UVW1	NO
		—	FILTER-UVW2	NO
		—	FILTER-UVM2	NO
		—	FILTER-WHITE	NO
		—	FILTER-MAGNI	NO
		—	FILTER-GRISM1	NO
		—	FILTER-GRISM2	NO
		—	POLYNOM_MAP	NO
		—	POLYNOM_MAP2	NO

2 Changes

The new distortion map is based in observations of the G153 field. The U filter was used and the positions of 813 stars were measured. The old map was based in a LMC field with only 230 sources.

Since the main source of distorsion is the detector fiber taper, this map can be applied to all filters, as it was the case with the previous one based in V filter. Tests made, e.g. for the UVW1 filter, indicate that the map is adecuate for all filters.

The previous map had been obtained by fitting the measured offset (distorted position minus linear position, or detector minus sky positions) as a polynomial function of the linear (sky) position. However, SAS needs to convert the measured detector position into undistorted one so as to assign

proper astronomical coordinates. Therefore what is needed is a function of the measured detector (distorted) position and this is how the new distortion map OM_ASTROMET_0010 has been built.

Another function performed by SAS using the ASTROMET contents is to correct the observed OM images, which are affected by distortion, into real sky images. To achieve this, *omatt* SAS task builds up the final image pixel by pixel, where these pixels are traced back from their distorted position by a time comsuming iterative algorithm. A set of polynomial coefficients giving the distorted position as a function of the linear one (as it was done -erroneously- in previous versions) would allow us to speed up the process by direct computation of the polynomial for each point. Therefore, a new table POLYNOM_MAP2 has been added for this purpose into OM_ASTROMET_0011. It contains the polynomial coefficients of the transformation from linear sky position to distorted OM image space as a function of linear position. In other words, it is the inverse transformation of POLYNOM_MAP table.

3 Scientific Impact of this Update

Since the distortion is now much better mapped, the astrometry for the whole field of view is better now. The reconstructed positions have now an error around 1.6 pixels (rms) while the errors (distortion) in the distorted image are 27.0 pixels (rms).

The addition of the new table POLYNOM_MAP2, has no scientific impact on the processed data. It just decreases the computing time.

4 Estimated Scientific Quality

The improvement in the pointing reconstruction accuracy that can be achieved with this distortion map is from 10% to 20%. For the UVW1 filter we have measured 0.8".

The new table does not affect the quality. It will be used to build up faster the linearized sky image which is not used for photometric analysis, not for astrometry. This is a cosmetical feature of SAS *omichain*.

5 Expected Updates

No more observations will be performed. This map can be considered as final. However, monitoring of the instrument in the long term may indicate that some adjustement is necessary in the future.

Field	New map	Old map
	(rms error in pixels)	(rms error in pixels)
G153	1.61	2.43
3C273	3.04	3.1
LMC	1.75	1.9
EXO	1.03	1.27

Table 1: Note. The old map was based on the LMC field

Filter:	U RA Dec	B RA Dec	UVW1 RA Dec
old map	1.1" 1.2"	1.2" 1.6"	
new map	1.0" 0.9"	1.1" 1.3"	0.8" 0.8"

Table 2: Pointing reconstruction accuracy

6 Test procedures

The tests in this section and in the next one refer to OM_ASTROMET_0010 whose contents is exactly the same than OM_ASTROMET_0011, except for the new table which has been verified internaly for consistency. An estimation of the computing time savings will be provided in a forthcoming revision of this release note.

The map has been verified for internal consistency, by comparing corrected positions of a number of stars in different fields with their sky values.

Then, SAS 5.4 was used to reprocess the G153 field, and the final positions, RA and Dec. were cross-correlated with the USNO catalogue.

7 Summary of the test results

Table 1 gives a comparison between old and new distortion maps for several fields.

Table 2 shows the errors in the coordinates determined by SAS (cross correlation with USNO catalogue) using the new map

References