XMM-Newton CCF Release Note

XMM-CCF-REL-199

OM Grisms Calibration: Update

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1 CCF components

Name of CCF	VALDATE	EVALDATE	List of Blocks changed	XSCS flag
OM_GRISMCAL_0003	2000-01-01T00:00:00	—	FLUX_GRISM1	NO
		—	FLUX_GRISM2	NO
		—	WAVELENGTH_GRISM1	NO

2 Changes

The first issue of the OM grisms calibration was based on spectra processed with IDL routines. In the release of this calibration we announced that a new issue based on data fully processed with SAS would be the next step.

Here it is. The main change in this version is that the calibration of the grisms is now derived from spectra extracted by SAS. The absolute flux calibration for both grisms has been updated. Also the wavelength scale for the UV grism.

2.1 Wavelength calibration

Due to a change in the algorithm that computes the reference point for the wavelength scale in SAS processing, a shift is produced in the wavelength scale. This affects mainly the UV grism spectra because its zero order (the reference point) can be very bright and affected by several effects.

We have re extracted the spectra of the F-type stars used in the previous calibration, and we have defined a new dispersion relation as

$$L = 991.778 + 1.8656X + 0.0007713X^2$$

for GRISM1 (UV), where L is the wavelength in Å and X the distance in pixels to the centroid of the zero order in the undistorted, rotated grism image.

The dispersion relation for GRISM2 (Visible) has not been modified.

2.2 Flux calibration

Selected spectra of the spectrophotometric standard stars GD153 and HZ2 have been reprocessed with SAS 6.5, using the newly derived wavelength scale for the UV grism and the same than before for the Visible one. With these new spectral extractions we have defined new Inverse Sensitivity Functions (ISF) for each grism.

The ISF is defined as:

$$CalibratedFlux = Observed\_spectrum\_count\_rate \times ISF$$

therefore

$$ISF = Standard\_flux/OM\_spectrum\_count\_rate$$

Both ISFs have been obtained by averaging the ISFs computed individually for the standard stars GD153 and Hz2.

The flux calibration is defined in the ranges 1800 - 3600 Å, and in 3000 - 6000 Å, for GRISM1 and GRISM2 respectively, in 50 Å steps. The standard deviation of the average of individual functions obtained from each star is provided as the error of the ISF.

3 Scientific Impact of this Update

These calibrations allow SAS, and individual users to convert the count rates measured in images obtained with the OM grisms into a flux distribution as a function of wavelength. Since these new calibrations are fully obtained through SAS, we have now a fully coherent system.

4 Estimated Scientific Quality

4.1 Wavelength calibration

The internal accuracy of the dispersion relations is 2 Å in GRISM1 and 10 Å in GRISM2.

When the dispersion relation is applied to any extracted spectrum, the main source of error is the determination of the reference point (the zero order centroid). This can introduce shifts in the wavelength scale of up to 10 Å in GRISM1 and up to 20 Å in GRISM2.

4.2 Flux calibration

A first level verification of the flux calibration is obtained by applying the ISF to the spectra of the standard stars used to derive it. This provides a consistency test. The fluxes obtained for the standard stars GD153 and HZ2 agree within better than 5% for GRISM1 and GRISM2.

5 Expected Updates

Now that the wavelength and flux calibrations of the OM grisms have been coherently derived from spectra obtained throughout SAS, we have accomplished a major update.

Future updates will be issued as necessary from the monitoring of the calibration with time. We have not detected up to now a loss of sensitivity that would lead us to a time dependent correction.

The flux calibration we present here (as it was the case with the previous one) does not include coincidence losses in the detector, an effect very important, well understood and corrected in OM aperture photometry performed with SAS. We assume that spectra obtained with the OM grisms have in general low count rates and therefore are not affected by coincidences.

The spectra used in the derivation of the calibration were extracted from sources located at the standard boresight used in XMM observations. Therefore, possible variations across the detector (particularly in wavelength due to grisms distortions), when we work on field or multi-object spectroscopy, are not included.

A separate document will provide a detailed explanation of all steps followed in the derivation of the calibrations as well as extensive testing.

6 Test procedures

In order to test the validity of the calibration, not only the standard stars used to derive it, GD153 and HZ2, but several more, as HZ43, GD50, BD+33 2642, G93-48, LTT9491 and BPM16274, have been reprocessed with the last SAS version and this calibration.

The SAS extracted and calibrated spectra have been compared with standard fluxes or values in the literature for these stars.

7 Summary of the test results

Fluxes obtained with SAS and this calibration agree in general within 10% with the ones given in the literature. For standard stars we have agreements in the range of 5% in the UV grism and 10% in the Visible grism. In very noisy spectra, or in the shortest wavelength of the UV and the longest one in the Visible, discrepancies can reach 20% level.

Figures 1 and 2 show respectively the comparison of catalogue fluxes and OM extracted data calibrated with the ISF's in this CCF for the standard stars GD153 and HZ2. All spectra shown have been extracted automatically with *omgchain* using default parameters. Note that large emission/absorption features are due to field sources whose zero order contaminates the spectrum or the background extraction region.

References

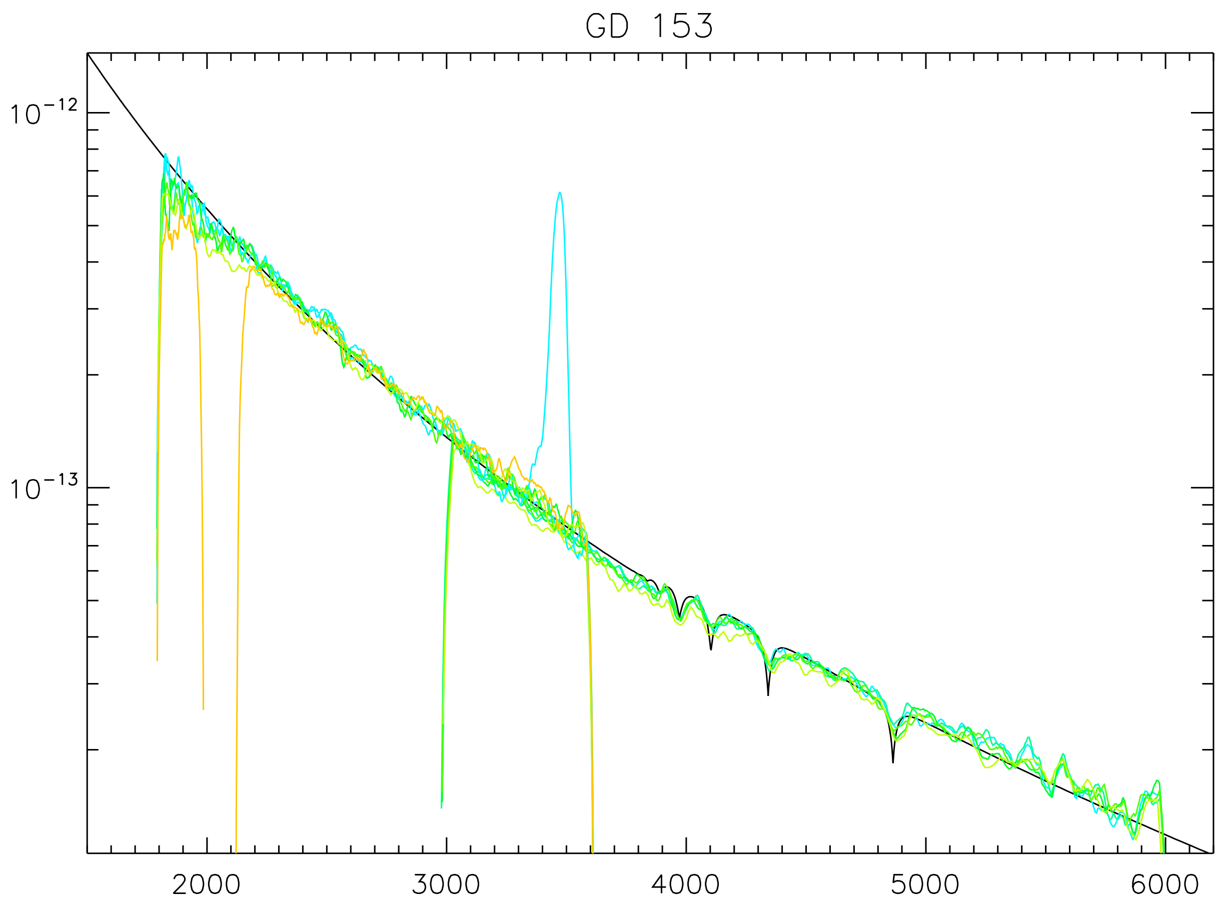

Figure 1: Comparison between catalogue and XMM-Newton OM Grism spectra of the standard white dwarf GD153

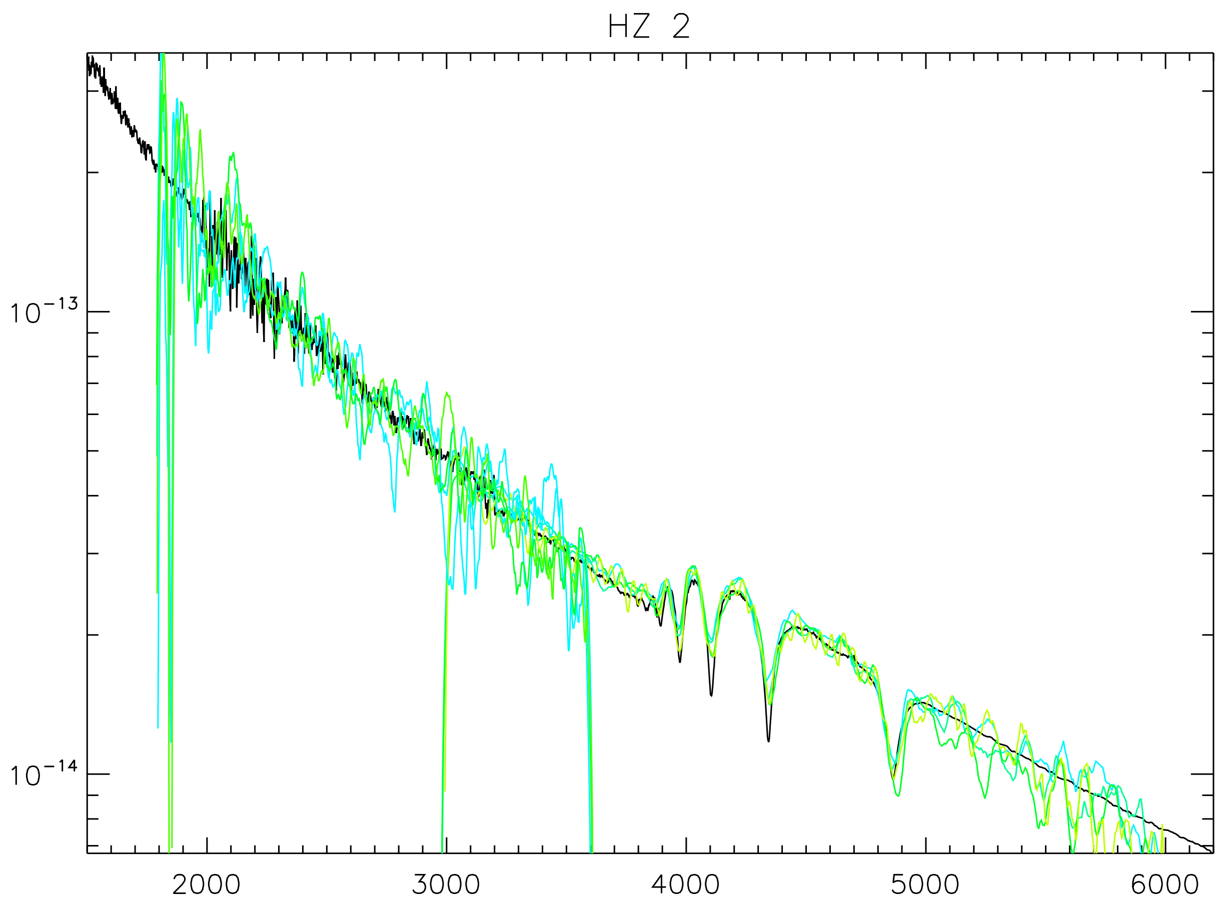

Figure 2: Comparison between catalogue and XMM-Newton OM Grism spectra of the standard white dwarf HZ2