XMM-Newton CCF Release Note

XMM-CCF-REL-119

OM PSF

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	CAL VERSION	XSCS flag
OM_PSF1DRB_0006	2000-01-01T00:00:00	PSF-U		No
		PSF-B		No
		PSF-V		No
		PSF-UVW1		No
		PSF-UVM2		No
		PSF-UVW2		No

2 Changes

This CCF file provides new measurement of OM PSF. For the U, B and V filters, the PSF is stored for different count to framerate ratios (CFRR). Since most of the sources in the UV filters are relatively faint, only a single PSF (so CFRR independent) in UVW1, UVM2, UVW2 is available now. Moreover, we have no enough data to derive the UVW2 PSF accurately, new UVW2 PSF is copied from UVM2 PSF as an approximation.

3 Scientific Impact of this Update

The current PSF were generated from Ground Calibration data. This new PSF has been derived from in-flight data, taking coincidence loss and CFRR into account. This update will improve the accuracy of the OM photometry, both for UV and optical filters.

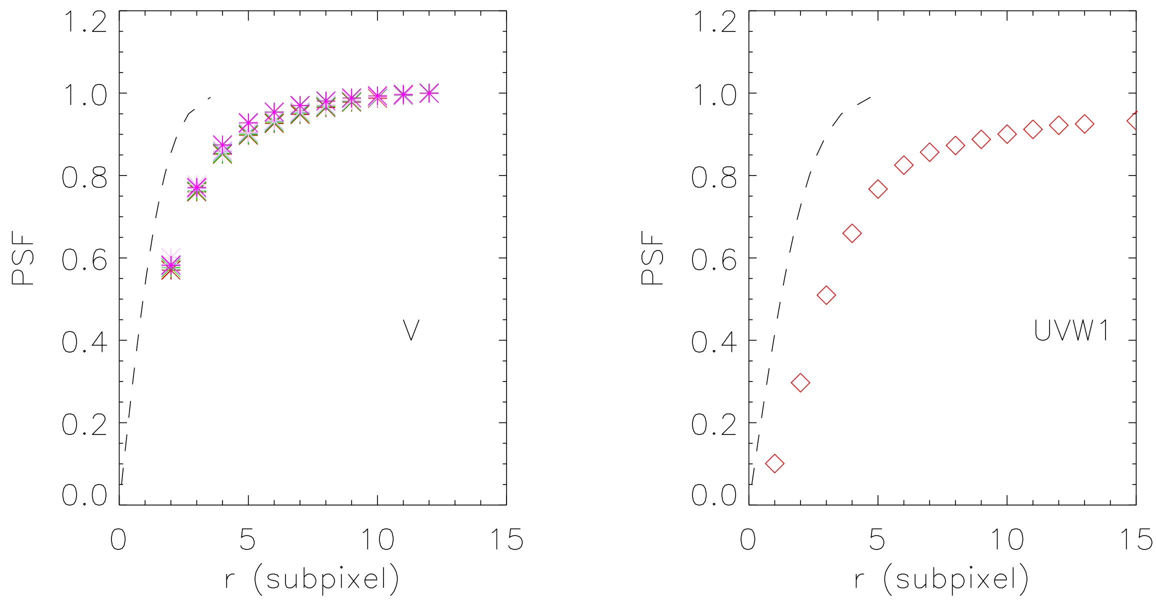

Figure 1: Growth curves as a function of radius for V and UVW1 filters. The dashed lines are the old PSFs, and the symbols are from the new PSF. For OM, one subpixel is about 0.48 arcsec. The different symbols in the V filter represent the different cfrr groups.

4 Estimated Scientific Quality

The growth curves have been updated significantly using in-flight observations. In figure 1, we show the growth curves as a function of radiu s for V and UVW1 filters from old CCF (or current CCF) and the new one. The growth curves for U, B and UVM2, UVW2 are similar to that for V, and UVW1, respectively.

From Figure 1, we can see that the current PSF from pre-flight observation is very narrow. This is because that the accuracy of this pre-flight PSF is hampered by the uneven illumination of the detector and the change in PSF width originating in the CSL collimator.

While this new CCF is stable and sufficiently good, we cannot make a field position dependent PSF with our data. Therefore, this new PSF is field position independent. Updates are expected once we have more data and a better understanding of OM large scale sensitivity variations.

5 Test Procedures

This new CCF has been extensively tested using SAS version 5.3.3 at xvsas01.vilspa.esa.es. Several datasets in Rev 196, 202, 268, 338, including default image mode, Full frame low resolution mode, have been run through SAS omichain tasks. No error message has been detected.

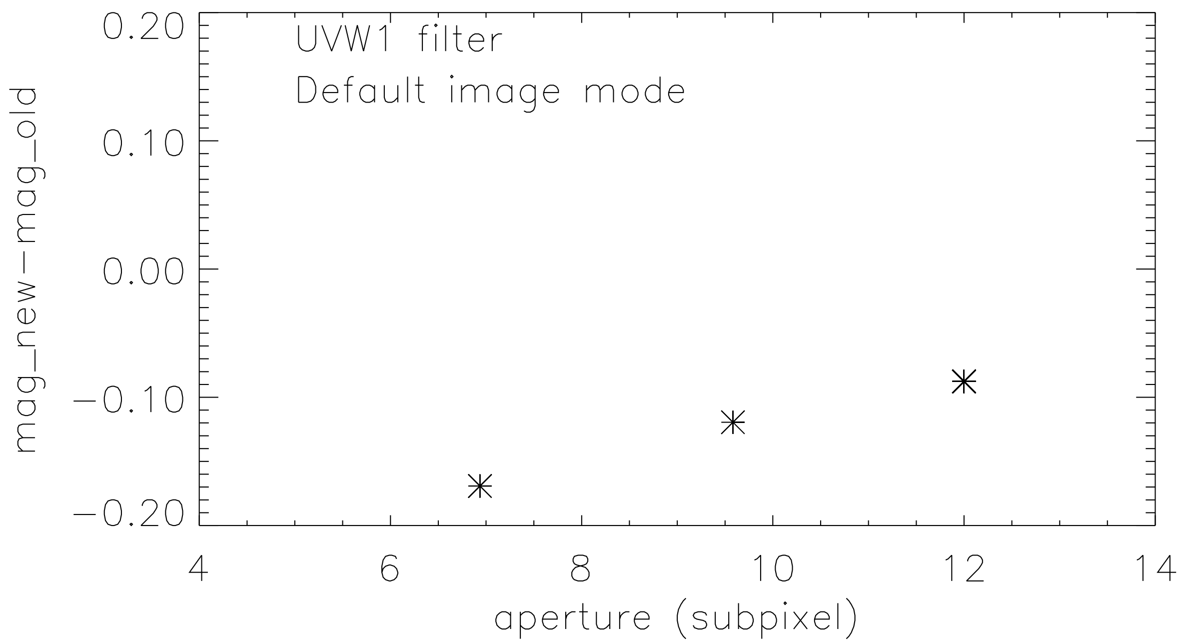

Figure 2: The magnitude difference between the new PSF and the old PSF as a function of aperture radius using the latest SAS 5.3.3

In order to check the influence of the new PSF on the final photometry, in next section, we compared the magnitude derived from the current (om_psf1drb_0004.CCF) and new (om_psf1drb_0006.CCF) PSF as a function of the aperture radius.

6 Summary of the test results

For the UV filters, SAS measures counts within a 12 subpixel aperture (e.g. 6 arcsec), then applies coincidence loss correction and aperture correction to get counts with a radius of 35 subpixel. Here we show the results for UVW1 filter from an observation in rev. 196. This is a default image mode. Figure 2 shows the magnitude difference between psf1drb_0006 (new PSF) and psf1drb_0004 (old one) as a function of aperture radius. We can see, for a 12 subpixel aperture, the magnitudes derived from the new PSF are about 0.085 mag brighter. Because the current UV PSF is much narrow and reaches 100% with a 5 subpixel aperture, no aperture correction is needed if one uses a 12 subpixel aperture. On the contrary, the new UV PSF is much wider and extends to 35 subpixels, an aperture correction is needed, which makes the objects brighter. Figure 2 also shows that the aperture correction term depends on the aperture radius used.

We should point out, due to a bug in SAS v5.3, the UV magnitudes derived from SAS5.3 are about 0.17 mag fainter. This can be seen in Figure 3, where I compared the magnitude derived with SAS 5.3.3 and SAS 5.3 using new UV PSF. This bug has been fixed in the latest SAS 5.3.3.

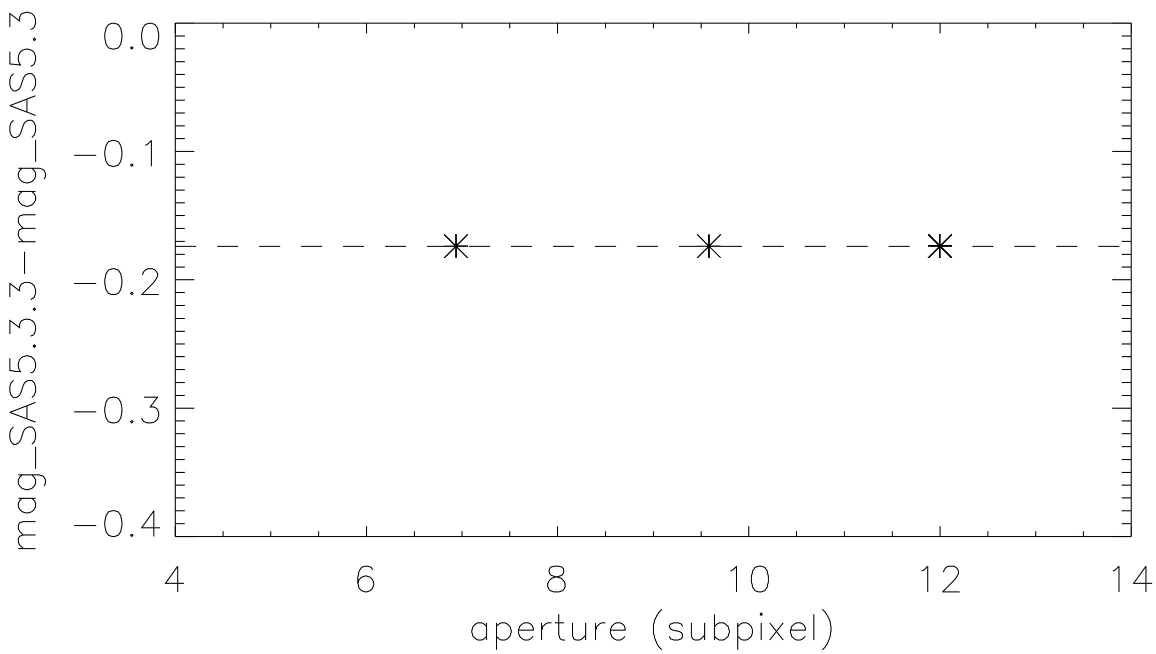

Figure 3: The magnitude difference in UV filters between SAS 5.3.3 and SAS 5.3 using new UV PSF.

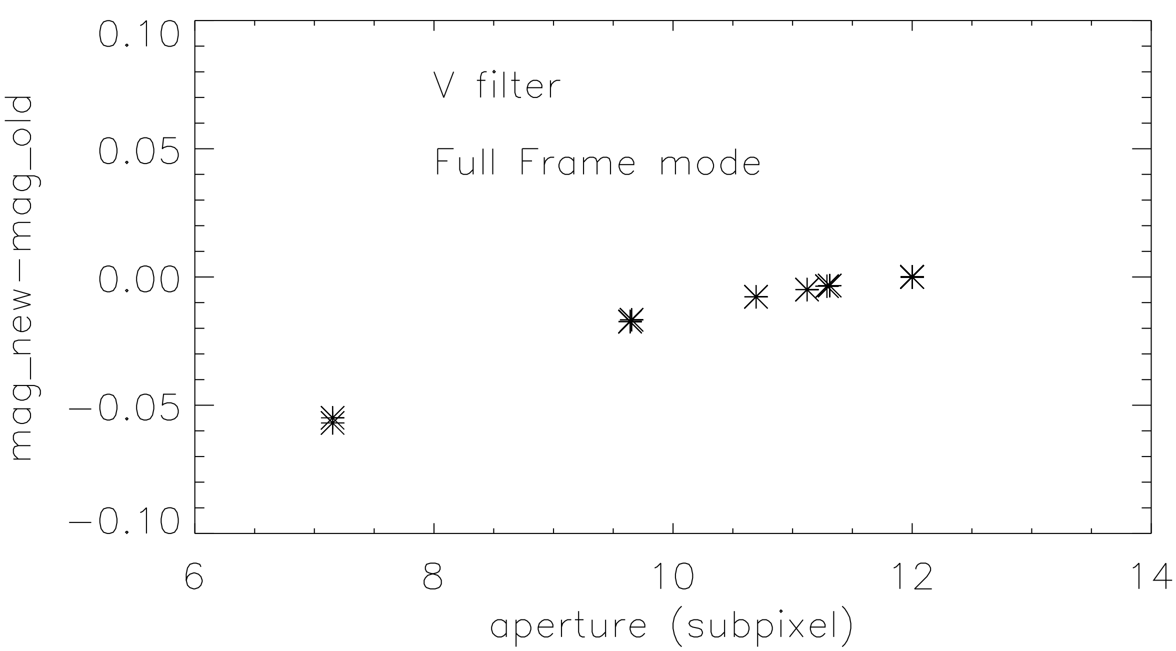

Figure 4: The magnitude difference in V filter between the new PSF and the old PSF as a function of aperture radius using the latest SAS 5.3.3

For the U, B, V filters, the default aperture is 12 subpixels. In the current SAS version, the aperture radius is independent of the brightness of the source, but it is reduced in the crowded fields. Here, we present a set of results from ODF 0134562201 in rev. 338. This is a low resolution full frame observation in V filter. Figure 4 show the magnitude difference between psf1drb_0006 and psf1drb_0004 as a function of aperture radius. For the majority of the stars where the default aperture (12 subpixels) is applied, no magnitude difference has been found. However, for the stars in the crowded field where a smaller aperture (< 12 subpixel) is applied the magnitudes from the old PSF are systematically fainter. The reason is clear. As I have explained above, the current optical PSF is narrow and reaches 100% at 4 subpixels, and the new PSF is wide and only reaches 100% flux at 12 subpixels (see Figure 1). Therefore, when one uses a small aperture radius ($4 < r < 12$ subpixels), no correction is needed for the current PSF, but an aperture correction is needed for the new PSF, which makes the objects brighter.

In summary, this CCF update has been made correctly and the test results are what we have expected.

7 Acknowledgements

Thanks to OM team members, especially Igor Antokhin(ULG) and Alice Breeveld (MSSL) for their inputs.