FOS Entrance Aperture Transmittance for Point Sources

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I have performed a calculation, for each of the FOS apertures, of the throughput efficiency, *i.e.* the fraction of light incident on the OTA focal plane from a *point source* that is passed by the aperture (with the image centered on the aperture). Defined as such, these efficiencies do not include the losses due to primary and secondary mirror reflectivity and dust scattering, nor do they account for the losses due to diffraction of light to points outside the collimator radius by the smaller apertures. Included are: OTA mirror wavefront error (at high, middle and low spatial frequencies) per PE metrology, pointing jitter (.007 arcsec, RMS), astigmatism at the 3.6 arcmin off-axis distance of the FOS apertures, *nominal* FOS aperture geometry and dimensions, and the effective limitation of the large aperture heights by the 1.43 arcsec diode height. Although lab measurements of the aperture sizes show some variations from the nominal areas, especially in the case of the A4 lower aperture on the red side, these measurements are affected by diffraction losses at the collimator and yield no information concerning the actual shapes of the apertures (see CAL/FOS-019).

The calculations were performed using a program originally devised by D. Schroeder (Beloit College) and adapted by Chris Burrows (STScI), who also provided the astigmatism correction information. The output of this program, which computes the encircled energy within a given radius, was used to numerically integrate the OTA PSF over the clear aperture areas to obtain the efficiency estimates.

The results are tabulated below, and plotted in the accompanying figure. The sharp drop in throughput in the FUV is due to the "micro-roughness scattering" referred to by R. Brown in the STScI Newsletter of Jan. 1986, where he includes this effect in a calculation of the OTA efficiency for point sources. The gradual drop toward the red, especially for the small apertures, is due to broadening of the OTA PSF with increasing wavelength. The occultation aperture (C3 and C4) throughput estimates indicate the fraction of light from a point source centered on the 0.3 arcsec occultation bar that "leaks" out into the surrounding clear aperture.

These aperture efficiencies will soon be incorporated into the FOS simulator program, which is being upgraded to permit proper handling of both point and diffuse sources.

FOS APERTURE TRANSMITTANCE ESTIMATES

Wavelength (Angstroms)	A4 0.1- PAIR	A3 .25- PAIR	B2 0.3	B1 0.5	A2 0.5- PAIR	B3 1.0	C1 1.0- PAIR	A1 4.3	C2 .25x2	C3 .7x2- BAR	C4 2.0- BAR
1150.	0.356	0.507	0.517	0.568	0.578	0.619	0.628	0.706	0.550	0.087	0.063
1216.	0.383	0.533	0.544	0.597	0.606	0.646	0.655	0.725	0.578	0.084	0.062
1300.	0.415	0.563	0.573	0.631	0.639	0.677	0.685	0.746	0.608	0.081	0.061
1400.	0.449	0.594	0.604	0.665	0.673	0.710	0.716	0.769	0.639	0.079	0.061
1500.	0.478	0.620	0.630	0.694	0.702	0.737	0.743	0.789	0.666	0.076	0.061
1600.	0.504	0.643	0.653	0.718	0.727	0.761	0.766	0.807	0.689	0.075	0.060
1800.	0.544	0.681	0.690	0.755	0.765	0.797	0.803	0.836	0.727	0.074	0.060
2000.	0.574	0.711	0.719	0.782	0.793	0.824	0.831	0.859	0.755	0.072	0.059
2500.	0.616	0.761	0.768	0.824	0.835	0.870	0.874	0.898	0.802	0.070	0.059
3000.	0.629	0.791	0.798	0.847	0.858	0.896	0.900	0.920	0.829	0.069	0.058
3500.	0.618	0.803	0.813	0.863	0.872	0.911	0.916	0.935	0.843	0.067	0.057
4500.	0.572	0.815	0.823	0.876	0.885	0.924	0.931	0.951	0.856	0.071	0.059
6328.	0.552	0.817	0.823	0.875	0.895	0.930	0.936	0.960	0.859	0.079	0.064
8000.	0.531	0.800	0.818	0.869	0.880	0.927	0.938	0.962	0.844	0.083	0.067
9000.	0.503	0.757	0.789	0.863	0.875	0.925	0.932	0.962	0.822	0.091	0.075

FOS POINT SOURCE APERTURE THROUGHPUT ESTIMATES