FOS WAVELENGTH CALIBRATION EXPOSURE TIMES
(Laboratory Calibration Plan 13G)

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The FOS wavelength calibration strategy is based on reference template spectra for the smallest apertures (Sirk and Bohlin 1986a and 1986b). The most accurate wavelength scales for the larger apertures are obtained by cross-correlating the internal Pt-Ne-Cr lamp spectra from the larger aperture with the small aperture template spectrum after the later is broadened by the appropriate aperture width.

The recommended exposure times for the small aperture template spectra are in Table 1. These spectra need to be obtained infrequently throughout the mission. The exposure times are in seconds and are the sum of the time for each quarter step of the standard operating mode. To do both apertures of a pair, double the listed time. The exposure durations are based on the requirement to obtain about 30000 counts in the peaks of the brightest lines. This criterion provides sufficient number of lines above the faint line threshold of 300 total counts to ensure accurate wavelength calibrations. In the case of the 0.1-Pair of apertures on the red side, the lower aperture is 1.7 times larger than the upper aperture, so that peak counts may exceed 50,000 in the lower 0.1 aperture.

Exposure times for the larger apertures are calculated using aperture area ratios of the smallest apertures to the larger apertures. The ratios are from the aperture areas as viewed by the 1.43 arcsec high diode array, as calculated in Lindler, Bohlin, and Hartig (1985).

For an arbitrary aperture and disperser combination, exposure times recommended for precise wavelength calibration in conjunction with routine science observations are in Tables 2 and 3 for the blue and red Digicons, respectively. For the exposure times that would exceed 30 sec, the integration time is reduced by a factor of up to 2.5, since the quality of a spectrum used for cross-correlation can be less than the quality of a reference template spectrum without compromising accuracy. For the larger apertures with the brightest lines, the constraint is to not exceed the 16 bit count capacity of 65,536. Since the FOS counting

electronics saturate at 80,000 counts per sec, the shortest exposure time needed is 0.5 sec per quarter step, or 2 sec total exposure time.

If the flight Digicon detectors are not the same as those quoted in Tables 2 and 3, these exposure times will need to be updated.

REFERENCES

Lindler, D. J., Bohlin, R. C., and Hartig, G. F. 1985, *FOS Entrance Aperture Sizes* CAL/FOS–019, ST ScI.

Sirk, M., and Bohlin, R. 1986a, *FOS Wavelength Calibration* CAL/FOS–026, ST ScI.

Sirk, M., and Bohlin, R. 1986b, *FOS Entrance Aperture Offsets* CAL/FOS–029, ST ScI.

Table 1

FOS Small Aperture Template Spectra–Direct Lamp

Recommended Exposure Times for Wavelength Calibration Template Spectra

Aperture	G130H	G190H	G270H	G400H	G570H	G780H	G160L	G650L	PRISM[b]
				Blue Tube					
0.1-Pair	160[a]	26[a]	30	8	100[c]	–	110	14	2/35
0.3	150	24	3	2	11[c]	–	12	2	2/4
				Red Tube					
0.1-Pair	–	90[a]	145	18	4	6	120[a]	90[d]	4[ad]/50[ad]
0.3	–	83	16	2	2	2	110	10[d]	3[d]/44[d]

[a]To keep template calibration exposures under three minutes, the 0.25-Pair apertures are used to reduce exposure times by a factor of 0.12.

[b]Due to the non–linear dispersion of the prism, two exposures made without moving the filter–grating wheel are required. A long exposure is necessary to provide adequate counts in the UV, and a short exposure prevents counter overflow in the red due to blended lines caused by the low dispersion.

[c]In the case of G570H, one very bright line at 5208Å will have a peak of $\approx$ 45,000 counts.

[d]Use the cross–strapped calibration lamp to reduce the high count rates.

Table 2

FOS Blue Tube (F-07) Direct Lamp

Recommended Exposure Times for Wavelength Calibration

for all Apertures and Dispersers

Aperture	G130H	G190H	G270H	G400H	G570H	G160L	G650L	PRISM
0.1-Pair	530[a]	87[a]	30	8	40[a]	42[a]	14	2
0.25-Pair	64[a]	26	4	2	12	13	2	2
0.5-Pair	30[a]	6	2	2	3	3	2	2
1.0-Pair	8	2	2	2	2	2	2	2
0.3	60[a]	24	3	2	11	12	2	2
0.5	30[a]	8	2	2	4	4	2	2
1.0	11	2	2	2	2	2	2	2
0.25×2.0	24	4	2	2	2	2	2	2
0.7×2.0-Bar	11	2	2	2	2	2	2	2
2.0×2.0-Bar	4	2	2	2	2	2	2	2

[a]These exposures have been reduced by up to a factor of 2.5 from the optimum to avoid integration times that are unnecessarily longer than 30 sec.

Table 3

FOS Red Tube (F–08) Direct Lamp

Recommended Exposure Times for Wavelength Calibration

for all Apertures and Dispersers

Aperture	G190H	G270H	G400H	G570H	G780H	G160L	G650L[b]	PRISM[b]
0.1-Pair	300[a]	58[a]	18	4	6	400[a]	36[a]	31
0.25-Pair	36[a]	17	2	2	2	48[a]	11	4
0.5-Pair	20	4	2	2	2	28	2	2
1.0-Pair	5	2	2	2	2	7	2	2
0.3	33[a]	16	2	2	2	45[a]	10	3
0.5	27	5	2	2	2	30[a]	3	2
1.0	6	2	2	2	2	9	2	2
0.25×2.0	14	3	2	2	2	19	2	2
0.7×2.0-Bar	6	2	2	2	2	8	2	2
2.0×2.0-Bar	2	2	2	2	2	3	2[c]	2[c]

[a]These exposures have been reduced by up to a factor of 2.5 to avoid long integration times.

[b]Use the cross–strapped (blue) calibration lamp.

[c]Cross-correlation technique not recommended for the best wavelength calibration.