SMOV Report III: FOS Baseline Sensitivity

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Abstract

Spectrophotometric standard BD+28°4211 was observed following the Servicing Mission (SM) with the 4.3 aperture and several representative detector/disperser combinations. The observations were compared with Cycle 3 measures obtained with identical target acquisition and observational setups. Measured FOS/BLUE and FOS/RED count rates were higher in the post-SM observations by approximately 7% and 5% respectively. The increase in post-SM instrumental sensitivity is consistent with predictions based upon HST secondary mirror re-positioning in the post-SM time period. FOS instrumental sensitivity appears to have been unaffected by any SM-related activities.

Introduction

FOS instrumental sensitivity has been checked in the time period after the Servicing Mission (SM) and prior to COSTAR deployable optical bench (DOB) deployment for comparison with pre-SM values. Observations of spectrophotometric standard BD+28°4211 were made in SMOV Sensitivity Baseline proposal 4259 for comparison with measures of the same star made in Cycle 3 Spectrophotometric Monitor proposal 5046. In order to minimize sources of uncertainty in this test, special care has been taken to use nearly identical target acquisition procedures and instrumental setups for the sets of observations compared.

Observations and Analysis

SMOV observations were made of spectrophotometric standard star BD+28°4211 on December 22, 1993 with the 4.3 aperture. Separate target acquisitions were used for each detector and data were acquired with four representative spectral elements (FOS/BLUE: G130H, G190H, G270H, and G160L; FOS/RED: G190H, G270H, G400H, and G650L) . The standard FOS-calibration high-precision four-stage ACQ/PEAK sequence (0.03 arcsec accuracy) was used. Due to uncertainties concerning the need for a possible PDB update of Y-bases, an identical set of additional SMOV FOS Baseline measures was executed on December 23, 1993. The Cycle 3 measures were acquired in September, 1993.

Baseline observations were made with only those gratings for which Y-bases were checked in the time period after the SM and prior to the sensitivity observations. No changes were made in PDB Y-base positions prior to the Baseline measures (see A. Koratkar et al,

CAL/FOS-116 for a more complete discussion of SMOV Y-base determinations). Therefore the same Y-bases were employed for both the Cycle 3 and the Baseline observations.

The HST secondary mirror was displaced a total of 26 microns in the normal HST desorption-correction direction in two separate moves after the SM but before the baseline sensitivity measures were made (H. Hassan, private communication). No other changes in the positioning of the secondary mirror occurred between the epochs of FOS sensitivity measures to be compared here. Based upon previous FOS experience (R. Bohlin, private communication) we expect an approximate 6% INCREASE in FOS instrumental sensitivity as a result of the 26 micron secondary mirror re-positioning.

We further note that telescope "breathing" can contribute up to an additional ±3% uncertainty in the comparison of otherwise identical observations (R. Bohlin, private communication).

All the observations utilized in this test were obtained in the standard FOS calibration quarter-stepped IMAGE mode that obtains 3 spectra for each disperser which are separated by 21.4 Y-base units (approximately 0.12 arcsec) on the photocathode. The three separate spectra, which appear as separate groups in the output *.c5h* background-subtracted, paired-pulse corrected data products, were summed for each observation on a pixel-by-pixel basis with no re-binning.

Results

The IRAF routine *imstat* was used to evaluate the mean count rate per second over all 2064 pixels in the each summed spectrum. Table 1 presents the comparison of these mean values. Additionally, *imstat* means were obtained in several bins within each spectrum chosen to avoid zero-order or dead diode contributions. No substantial color dependence or difference from the 2064-pixel mean results presented in Table 1 was detected for these smaller bins.

As expected, the Baseline measures are all clearly larger than the Cycle 3 values. Indeed, the FOS/BLUE measures range from 5.2 to 8.4 percent larger than relevant Cycle 3 measures and the FOS/RED values range from 4.8 to 8.1 percent larger than Cycle 3. Simple means of all eight data points for each detector yield SMOV values 7.1 and 6.0 percent larger than Cycle 3 for FOS/BLUE and FOS/RED, respectively.

These results are clearly consistent with our expectations based upon the work of Bohlin. There is no evidence for any change in FOS sensitivity as a result of Servicing Mission activities.

References

Bohlin, R., private communication, December, 1994.
Hassan, H., private communication, December, 1994.
Koratkar, A., Taylor, C., Kinney, A., and Keyes, C., "SMOV Report I: Location of FOS Spectra,", CAL/FOS-116, January, 1994.

Table 1 : Cycle 3 - SMOV Sensitivity Comparison

FOS/RED	September		December 22			December 23		
grating	count rate	mean	count rate	mean	% chg	count rate	mean	% chg
G400H	668.9		719.7			732.4		
	680.8		724.6			736.1		
	686	678.57	723.4	722.57	6.48%	732.9	733.8	8.14%
G270H	1387		1466			1488		
	1404		1470			1491		
	1403	1398	1460	1465.33	4.82%	1483	1487.33	6.39%
G190H	955.1		1022			1020		
	968.3		1023			1026		
	970.7	964.7	1015	1020	5.73%	1023	1023	6.04%
G650L	453.5		478.3			479.8		
	453.1		475.4			476.7		
	448.1	451.57	467.5	473.73	4.91%	468.1	474.87	5.16%
			average change			5.96%		
FOS/BL	September		December 22			December 23		
grating	count rate	mean	count rate	mean	% chg	count rate	mean	% chg
G130H	227.4		249.9			251		
	232.8		250.4			251.6		
	235.1	231.77	250	250.1	7.91%	251.4	251.33	8.44%
G160L	799.1		866.3			867.7		
	811.5		866			854.2		
	824.6	812	861.6	864.63	6.48%	840.3	854.07	5.18%
G270H	904.8		972.8			970.9		
	911.4		975.6			978.5		
	909.1	908.43	973.1	973.83	7.20%	980.9	976.77	7.52%
G190H	536.1		573.8			580.1		
	544		580.4			584		
	545.5	541.87	582	578.73	6.80%	584.3	582.8	7.55%
			average change			7.14%		