Summary of the FOS Working Session

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Abstract

A number of important calibration issues were discussed during the FOS working session. This article summarizes the issues and possible solutions recommended by the group.

I. Background Correction

Michael Rosa stated that the background caused by particle induced radiation in the FOS is larger by 30 percent and hence the calibration correction file in PODPS is also in error by this amount (for details see paper by Rosa on scattered light in this volume). Ron Lyons, who determined the current background model for the pipeline in SV, said that it was quite possible the background was underestimated because of the limited data available at the time of analysis of the SV data. The calibration error due to an incorrect background subtraction is largest for faint targets because of the low count rates in their spectra.

Recommendations: An improved model for the background should be constructed which will include all data obtained since the last background determination. Further, since the background model in the PODPS calibration pipeline also depends on the geomagnetic location of the spacecraft, it was suggested that a more sophisticated model for the magnetic field be employed. Since this model-generation process will take some time, an interim solution was also suggested: the pipeline background spectrum (.c7h file) should be scaled up by 30 percent and GO/GTOs and archive researchers should recalibrate their spectra accordingly.

II. Scattered Light

Scattered light in the FOS could be due to internal scattering as well as scattering off the grating, hence solving for an exact model would be very difficult. The G130H, G190H, G270H, G160L and the PRISM spectra (below 2500 Å) are substantially affected by scattered light. Scattered light is a major problem for red objects being observed in the short wavelength gratings because the scattered light photons may possibly dominate the blue photons dispersed by the gratings. Hence, observers who use the FOS to obtain ultraviolet spectra of galaxies should be very careful in their use of the data which may have severe contamination. A correction for scattered light will be difficult to derive and use.

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Investigation of solar type stars could be used to provide a crude characterization of the scattered light for solar system objects. John Caldwell presented data for 16 Cyg B and showed that it is possible to correct for a solar type star in the G190H spectral region (for details see paper by Cunningham and Caldwell on scattered light in this volume). To illustrate the complicated nature of the scattered light in the FOS, Melissa McGrath presented G130H spectral region data for solar system objects that indicated possible aperture-dependent structure in the scattered light. Comparison of an M-type stellar spectrum with a K-type stellar spectrum obtained in the Cycle 3 scattered light calibration program showed that the scattered light features were similar at the 90 percent level. This implied that it may be possible to characterize the nature of the scattered light.

Recommendations: The investigation of the three stars observed in the scattered light calibration program should be continued to investigate the possible characterization of scattered light and its dependence on the object color. Since it is possible that the wavelength dependence of scattered light is a function of the energy distribution in the source, it was determined that FOS archival spectra of elliptical galaxies and AGN should be compared with spectra of the same objects obtained by solar blind instruments like the GHRS, *HUT* and *IUE*. An interim solution, essentially that originally suggested by Kinney and Bohlin (FOS Instrument Science Report CAL/FOS-103, 1993) and Rosa (ECF Newsletter, August, 1993), was recommended to correct for scattered light in those gratings which have regions with no sensitivity to dispersed light. The procedure would be to average the number of counts in the region with no sensitivity in order to provide a more accurate measure of the scattered light, subtract from the .c5h file, and recalibrate the spectrum. For the G190H grating and solar type spectra the same technique can be used by determining the average counts to be subtracted from the 1500-1700Å region in which there is effectively no intrinsic light from the source.

III. Flat Field

The overall flat field correction generally has an accuracy of better than 3 percent, but flats for certain specific dispersers and certain spectral regions in others can be substantially poorer. The superflats, currently available only for FOS/BLUE, are the best flats in general. Tony Keyes and Buell Januzzi independently presented data which showed that flats have a dependence on aperture, time, and location on the photocathode (for details see papers by Keyes and Januzzi on flat fields in this volume). This indicated that location of the target in the aperture was an important factor for an accurate flat field correction.

Recommendations: Since any miscentering of the target in the aperture seems to lead to inaccurate flat field corrections, it was recommended that the spatial variability of the flats be determined in a Cycle 4 calibration program. This could be achieved by reconfiguring the Cycle 4 flat field proposal. To understand the impact of the flat field used in the data reduction process for a particular observation it was suggested that the target spectrum be compared with standard star spectra as well as other similar science observations taken as nearly contemporaneously as possible. Further, the flat used in calibration of the target spectrum should be compared with any other available flats for the instrumental configuration. Lastly, superflats are generally to be preferred.

IV. Grating Throughputs

Ralph Bohlin indicated that the red side grating throughputs on average are higher than the blue side grating throughputs. As expected, the low dispersion grating throughputs on average are higher than the high dispersion gratings. The PRISM throughput is the lowest.

V. Absolute Photometry (Inverse Sensitivity)

Observed standard star spectra used for inverse sensitivity measurement are good to 1 percent. The FOS/BLUE photometry is good to 1.6 percent and the FOS/RED photometry is good to 2.0 percent when corrections for the focus change and line cross-correlations are used. A 10 micron focus shift causes 3 percent flux change. The dominant error in photometry is the location of the target in the aperture. PRISM spectra show a steep curvature at the long wavelengths. From the beginning of 1991 through mid-1992 there was a 10 percent drop in sensitivity on the blue side and for a few gratings on the redside. This steep trend seems to have leveled off since mid-1992 (for details see paper by Bohlin in this volume, page 159).

Recommendations: Accurate spectrophotometry requires accurate target centering in the aperture employed. Ideally, pointings as accurate as those utilized in the FOS calibration program, for example 0.03 arcsec for the slit and 0.3 apertures, should be used.