FOS Calibration Plan for Cycle 5

A. Koratkar, C. Keyes, M. Dahlem, J. Hayes, J. Christensen and S. Martin
Space Telescope Science Institute

Instrument Science Report CAL/FOS-135
May 1995

This instrument report describes, in detail, the FOS Cycle 5 calibration program in terms of specific objects and observations. After the deployment of COSTAR, an extensive calibration program was carried out during SMOV and Cycle 4, and the performance of the FOS post COSTAR has been characterized in detail. In Cycle 5, most of the calibration program is developed to produce an updated measure of the Cycle 4 calibration observations. Thus in Cycle 5, we expect to maintain the routine calibration situation for the FOS. Our calibration program is divided into two parts: (1) a set of monitoring tests which aim to check the stability of the instrument performance. (2) a set of specific tests designed to maximize the instrumental performance. In Table 1 we provide a list of the calibration tests which are being performed in Cycle 5. In Tables 2 and 3 we provide a quick overview of all the detector/disperser combinations that will be wavelength, flat field and photometrically calibrated. The total spacecraft time required for the calibration program in Cycle 5 will be 127 orbits of external time and 256 orbits of internal occultation/parallel time.

The routine monitoring proposals are designed to monitor those aspects of the FOS performance that are known to show time variations. The focus test is conducted only once during the cycle because we know that the variations in the FOS focus are not large and do not affect the photometric accuracy of the data dramatically. The high voltage settings for the diode arrays are also checked once a cycle. Since the FOS detectors are affected by external magnetic fields the location of spectra on the photocathode and the FOS internal background observations will be conducted once every month. Similarly, the stability of the internal wavelength calibrations will be checked once every month. Some FOS detector/disperser combinations have shown temporal variations in their flat field structure during previous cycles. Hence several, though not all flat fields will be monitored as frequently as every 2 months; the rest only once in the cycle. The absolute photometric calibration of some spectral elements have shown some temporal variations during Cycle 4. We will monitor these aspects of the FOS sensitivity also once every 2 months. Flat field and photometry observations are closely coordinated to eliminate duplications as certain photometric observations provide serendipitous flat fields and vice versa.

The special calibrations proposals are designed to characterize those aspects of the FOS performance which have been specially requested by Cycle 5 GOs.

A summary description of each program is given that includes proposal number, primary targets (if any), detectors, apertures and spectral elements used. A description of target acquisition techniques if required is also given. Also provided are the scientific justification, a description of the observations and the calibration accuracies expected.

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A summary description of each program is given that includes proposal number, primary targets (if any), detectors, apertures and spectral elements used. A description of target acquisition techniques if required is also given. Also provided are the scientific justification, a description of the observations and the calibration accuracies expected.

Table 2: FOS/BL Calibration Chart

	G130H	G190H	G270H	G400H	G570H	G780H	G160L	G650L	PRISM
4.3	F S	F S	F S	F S			F S		F S
1.0	F S	F S	F S	F S			F S		S
0.5	S	S	S	S			S		
0.3	λ_e F S	λ_e F S	λ_e F S	λ_e F S	λ		λ F S	λ	λ
0.25x2.0									
1.0-PAIR									
0.5-PAIR									
0.25-PAIR	λ S	λ S	S	S	λ		λ F S		
0.1-PAIR			λ	λ				λ	λ
2.0-BAR									
0.7x2.0-BAR									

Table 3: FOS/RED Calibration Chart

	G130H	G190H	G270H	G400H	G570H	G780H	G160L	G650L	PRISM
4.3		F S	F S	F S	F S	F S	F S	F S	F S
1.0		F S	F S	F S	F S	F S	F S	S	S
0.5		S	S	S	S	S	S	S	
0.3		λ_e F S	λ_e F S	λ_e F S	λ_e F S	λ_e S	λ F S	λ S	λ
0.25x2.0									
1.0-PAIR									
0.5-PAIR									
0.25-PAIR		λ F S	λ F S	S	F S	S	λ S	S	λ
0.1-PAIR				λ	λ F	λ		λ	
2.0-BAR									
0.7x2.0-BAR									

λ: internal source wavelength calibration ONLY
λ_e: external source and internal source wavelength calibration
F: flat field calibration
S: photometric (inverse sensitivity) calibration

Proposal ID 6163: FOS Cycle 5: Focus, X-pitch, Y-pitch

Purpose: The observations in this proposal will be used to verify the focus, X-pitch, Y-pitch and determine their stability throughout the cycle, since the FOS focus is sensitive to external magnetic fields.

Description: A good instrumental focus is the first stage of the data acquisition process and thus impacts all FOS observations. The FOS focus will be determined by obtaining spectra with the 0.1-PAIR aperture, G190H, and the Pt-Ne lamp at various voltages until the maximum voltage is 23.86 kV (blue detector) or 22.8 kV (red detector). Once an optimal HV setting for the focus is determined and updates made to the PDB, a series of spectra at three different X-Bases will be made to determine the corresponding X-Pitch. Additionally, measurements with the TALEDs through the 0.1-PAIR aperture will be used to determine the Y-Pitch. This program may result in an instruction flow change to the detector high voltage setting, the X-pitch value, and the Y-pitch value. The focus will be checked once in a given cycle.

Primary External Targets: N/A

Target Acquisition Technique: N/A

Detectors: Blue and Red

Apertures: 0.1-PAIR

Dispersers: G190H

Fraction of GO/GTO Programs Supported: 100%

Resources:

Duration (orbits): 4

Author: S. Martin

Manpower Required: 0.05 Full Time Employee(FTE)

Special Requirements: These observations MUST occur during non-SAA impacted orbits. Although this uses the internal lamp, the observation sequence requires NON INT exposure, therefore the test requires pointed external time.

Accuracy: The observations are to verify that the FOS focus has not changed. Thus this proposal aims to maintain the present FOS focus. Small changes in the FOS focus do not affect the photometric quality of the data dramatically.

Accuracy Requirement: Maintain the present FOS focus

Products: S. Martin with the help of J. Skapik will be in-charge of data reduction. The analysis will require about 15 days and may lead to an Instructional Management Database (IMDB) update which will occur within two weeks of the observations. There are no reference files to be delivered. Results of this test will be described in an Instrument Science Report (ISR) within a month of the final analysis.

Proposal ID 6165: FOS Cycle 5: Discriminator Test

Purpose: The observations in this proposal will be used to verify the stability of the high voltage settings for each diode.

Description: Noise and gain are known to be temperature sensitive, and it is therefore likely that some fraction of the channels will experience some change in their optimal discriminator settings on orbit. Hence, the stability of these settings has to be verified. This internal test must be run once per cycle. The FOS high voltage will be brought to approximately one-half the nominal operating voltage followed by a 60S wait to allow the high voltage to stabilize. Then observations will be obtained of the INTFLAT lamp.

Primary External Targets: N/A

Target Acquisition Technique: N/A

Detectors: Blue and Red

Apertures: N/A

Dispersers: N/A

Fraction of GO/GTO Programs Supported: 100%

Resources:

Duration (orbits): 12 occultation/parallel orbits.

Author: S. Martin

Manpower Required: 0.05 FTE

Special Requirements: The detector high voltage will be set to a non-nominal value. Overlight protection will have to be disabled.

Accuracy: If the diodes are not maintained at their optimal high voltage settings, the resultant data tends to look like a noisy diode and compromises the observations. Thus this test is conducted to verify the discriminator settings for each FOS diode.

Accuracy Requirement: Maintain/verify the discriminator settings

Products: S. Martin will be in-charge of data reduction. The analysis will require about 1 month and will lead to an IMDB update which will occur within two months of the observations. There are no reference files to be delivered. Results of this test will be described in an ISR within a month of the final analysis.

Proposal ID 6166 and 6236: FOS Cycle 5: Location of Spectra and Wavelength Calibration

Purpose: The observations in this proposal will be used to monitor both the Y location of spectra and the wavelength scale for all reasonable aperture/disperser/detector combinations. This proposal has the highest priority because our ability to acquire spectra and minimize photometric calibration errors depends on our knowledge of Y-base values.

Description: In this cycle the two separate monitoring programs (Part 1: location of spectra, and Part 2: internal wavelength calibration) have been combined to minimize the number of turn on and off of the internal calibration lamps.

Part 1: The primary objective of the first part of this proposal is to determine and monitor the Y-base measurements corresponding to the Y location of spectra for each aperture/disperser/detector combination every month using the 0.3" aperture, and the internal Pt-Ne lamps and TALEDs. The observations will map the face of the photocathode using 24 y-steps and 1 x-step. Although the ideal technique is to obtain Y-base maps for each aperture/disperser/detector combination, the amount of time to perform such measurements is prohibitive. Hence, Y-base maps will be obtained to determine the locations of spectra and the coarse aperture location for the 0.3" aperture for all grating settings in both the FOS detectors. Y-bases for all the other apertures will be measured once with the G190H or G400H to determine the location of spectra for the single and paired apertures and both detectors. The small number of observations should suffice and the difference in the location of the spectra should be solely due to the single versus the paired apertures. This test has to be conducted once every month because previous cycles have shown that the locations of the spectra have drifted with time.

Part 2: The second part of this proposal is to monitor the stability of the FOS wavelength scale. ACCUM mode measurements of the Pt-Ne lamp will be obtained with both FOS detectors for all standard gratings with the 0.3" circular and either the 0.1" or 0.25" paired apertures. The observations taken through the smallest circular (0.3") aperture will be used to determine accurate wavelength scales for all disperser/detector combinations. The WAVECAL lamp has a fairly constant output, so that these data are a secondary monitor of any changes in the FOS internal sensitivity.

The visits in this program have been structured into groups no longer than approximately 25 minutes to facilitate scheduling as interleavers in occultation. It is necessary to conduct this program many times during the cycle since we know from previous cycles that the location of the spectra has drifted with time, and to check the stability of the FOS wavelength scale. The complete program can be scheduled as an interleaver observation and should be repeated every month for a total of 194 occultation periods. Due to the restrictions in RPS2 the program had to be divided into two separate proposals one for the FOS red detector (6166) and one for the FOS blue detector (6236).

Primary Targets: N/A

Target Acquisition Technique: N/A

Detectors: Blue and Red

Apertures:

Part 1: 0.3" circular, 1.0" circular, 0.5" circular, 1.0-PAIR, 0.5-PAIR, 0.25-PAIR, 0.1-

PAIR, 0.25″×2.0″ SLIT, 2.0-BAR and 0.25×2.0-BAR

Part 2: 0.3" circular, 0.1-PAIR or 0.25-PAIR

Dispersers:

Part 1: G130H, G190H, G270H, G400H, G570H, G160L, G650L, PRISM (Blue side and 0.3″ circular)

G190H, G270H, G400H, G570H, G780H, G160L, G650L, PRISM (Red side and 0.3″ circular)

G190H (Blue side, and 1.0″ circular, 0.5″ circular, 1.0-PAIR, 0.5-PAIR, 0.25-PAIR, 0.1-PAIR, 0.25″×2.0″ SLIT, 2.0-BAR and 0.25×2.0-BAR apertures)

G400H (Red side, and 1.0″ circular, 0.5″ circular, 1.0-PAIR, 0.5-PAIR, 0.25-PAIR, 0.1-PAIR, 0.25″×2.0″ SLIT, 2.0-BAR and 0.25×2.0-BAR apertures)

Part 2: G130H, G190H, G270H, G400H, G570H, G160L, G650L, PRISM (Blue side and 0.3″ circular)

G190H, G270H, G400H, G570H, G780H, G160L, G650L, PRISM (Red side and 0.3″ circular)

G270H, G400H, G650L, PRISM (Blue side, 0.1-PAIR)

G130H, G190H, G570H, G160L (Blue side, 0.25-PAIR)

G400H, G570H, G780H, G650L (Red side, 0.1-PAIR)

G190H, G270H, G160L, PRISM (Red side, 0.25-PAIR)

Fraction of GO/GTO Programs Supported: 100%

Resources:

Duration (orbits): 194 occultation orbits

Author: A. Koratkar

Manpower Required: 0.2 FTE

Special Requirements: None

Accuracy:

Part 1: The Y-location of the spectra on the photocathode affect both the Binary acquisition strategy and the FOS photometric accuracy. The scatter in the location of the blueside spectra seem to be time dependent and the 1σ accuracy we hope to achieve is ± 10 YBASE units. The scatter in the location of spectra on the redside spectra is random and the 1σ accuracy we hope to achieve is ± 20 YBASE units. These accuracies will allow a 1σ binary acquisition accuracy of 0.08″ for the FOS Blue detector and 0.12″ for the FOS Red detector. The photometric accuracy in the 4.3″ and the 1.0″ apertures is affected the most because the size of the aperture is ≥ to the size of the diode array and not all the photons in the point spread function are collected. Further, this is not a simple matter of losing a percentage of light, but the effect is also wavelength dependent. On average a YBASE uncertainty of 20 YBASES leads to ≤ 3% photometric uncertainty in the 1.0″

aperture. The loss could be larger for extended objects.

Part 2: The dominant error in the wavelength accuracy for a typical FOS spectrum is due to the filter grating wheel non-repeatability of the order of 0.35 diodes. The FOS spectra have a limiting accuracy of 0.03 diodes if there is no motion of the filter grating wheel.

Accuracy Requirement: ± 15 YBASE units for Blueside, ± 25 YBASE units for Redside, 0.1 diodes

Accuracy Goal: ± 10 YBASE units, 0.03 diodes

Products:

Part 1: A. Koratkar will be in-charge of data reduction and subsequent Project Database (PDB) updates for the location of spectra. The analysis of Part 1 of the proposal will require about 2.5 months throughout the cycle. The PDB updates will be made at least twice during the cycle and more often if required. There are no reference files to be delivered for the location of spectra part of the proposal. Results of Part 1 will be described in an ISR within a month of the final analysis.

Part 2: M. Dahlem will be in-charge of data reduction and subsequent Calibration Database System (CDBS) updates for the internal wavelength calibration. The analysis of Part 2 of the proposal will require about 2.5 months throughout the cycle. The analysis of the internal wavelength calibration will lead to an update of the CDBS. There are wavelength calibration reference files (CCS6) to be delivered. Results of Part 2 will be described in an ISR within a month of the final analysis.

Proposal ID 6167: FOS Cycle 5: Dark Monitoring

Purpose: The observations in this proposal will be used to measure the internal background as seen by the FOS, as a function of position on the sky, the South Atlantic Anomaly (SAA) and electromagnetic interference (EMI) sources.

Description: In this program measurements of the instrumental background (dark) will be obtained as internal observations with the FOS in the standard IMAGE mode. The observations will also be used to verify the dark count model used in the calibration pipeline. These data will also allow us to verify the instrumental noise, the derived limiting magnitude, and enable us to determine which channels should be disabled. This test will be conducted every month for a total of twelve different epochs during Cycle 5.

The observations in this program consist of eight sets of four exposures per epoch. An individual set of exposures is specified to be grouped WITHIN 4 DAYS; all observations in such a set should be scheduled on the same calendar, if possible. The visits in this program have been structured into groups no longer than approximately 30 minutes to facilitate scheduling as interleavers in occultation. The complete program can be scheduled as an interleaver observation and should be repeated every month for a total of 48 occultation periods.

Primary External Targets: N/A

Target Acquisition Technique: N/A

Detectors: Blue and Red

Apertures: N/A

Dispersers: N/A

Fraction of GO/GTO Programs Supported: 100%

Resources:

Duration (orbits): 48 occultation orbits

Author: J. Hayes

Manpower Required: 0.1 FTE

Special Requirements: The observations in this program consist of eight sets of four exposures per epoch. An individual set of exposures is specified to be grouped WITHIN 4 DAYS; all observations in such a set should be scheduled on the same calendar, if possible.

Accuracy: The FOS is affected by the geo-magnetic field and thus the instrumental background needs to be properly quantified. The error due to an incorrect background file is insignificant in the case of strong sources (number of source counts ≥ number of background counts), but causes substantial errors in the derived flux and spectral shape of weaker sources (number of source counts < number of background counts).

Accuracy Requirement: 10%

Accuracy Goal: 5%

Products: J. Hayes will be in-charge of data reduction. The analysis will require about three months. A CDBS update will occur within three months of the final observations if required. There are background reference files (CCS8, BACHFILE) to be delivered. Results of this test will be described in an ISR within a month of the final analysis.

Proposal ID 6202: FOS Cycle 5: Spectral Flat Field Calibration

Purpose: The observations in this proposal will be used to monitor some of the FOS detector/disperser combinations that have shown temporal variations in their flat field structure during previous cycles.

Description: Some FOS detector/disperser combinations have shown temporal variations in their flat field and need to be monitored to achieve good FOS data calibration accuracy. This set of observations will produce additional flat field calibrations appropriate to the Cycle 5 time period. At two epochs during Cycle 5, high S/N spectra will be obtained for G191 B2B, which has a relatively featureless spectrum and which has been the primary target for earlier flat field observations. On each epoch observations are made through the 1.0" aperture and the 4.3" or 0.3" apertures and all usable detector/disperser combinations. These observations also double as inverse sensitivity measurements and must be scheduled in the designated time period. On four other occasions three red side spectral elements will be monitored with the 1.0" aperture in the companion proposal 6203. This proposal will provide a contemporaneous flat field for the PODPS pipeline calibration of Cycle 5 data.

Primary External Targets: G191-B2B

Target Acquisition Technique: ACQ/PEAK for a pointing accuracy of 0.04"

Detectors: Blue and Red

Apertures: 4.3", 1.0" circular and 0.3" circular, 0.25-PAIR, and 0.1-PAIR

Dispersers: G130H, G190H, G270H, G400H, G160L, PRISM (Blue)

G190H, G270H, G400H, G570H, G780H, G160L, G650L, PRISM (Red)

Fraction of GO/GTO Programs Supported: 100%

Resources:

Duration (orbits): 22

Author: C. Keyes

Manpower Required: 0.15 FTE

Special Requirements: It is imperative that these observations be scheduled in the requested time frame, in order to coordinate with all other FOS flat field and inverse sensitivity observations.

Accuracy: FOS superflats show that there are few strong features (greater than 5% deviation from unity). The typical flat field deviations are of the order of 1-2% about the mean value of unity. The flat field corrections are only intended to remove photocathode granularity typically on the scale of 10 pixels or less. Higher precision requires simultaneous flat field calibration observations, so that the science target illuminates the same portion of the photocathode as the calibration observations. There is some time dependence which needs to be quantified.

Accuracy Requirement: 2% deviation from the mean value of unity

Accuracy Goal: 1% deviation from the mean value of unity

Products: C. Keyes will be in-charge of data reduction. The analysis will require about three months. A CDBS update will occur within 3 months after the final observations. There are flat field reference files (FLnHFILE) to be delivered. Results of this test will be described in an ISR within a month of the final analysis.

Proposal ID 6203: FOS Cycle 5: Photometric Monitor

Purpose: The observations in this proposal will be used to determine the absolute photometric calibration of both FOS detectors, and to determine the aperture throughputs. Many of the observations in this program also provide simultaneous flat fields.

Description: These measurements will determine the full photometric re-calibration of the FOS for Cycle 5 and determine the stability of the instrument. A measurement of the absolute sensitivity of both FOS detectors will be performed using a UV standard star. All the highest priority gratings (6 blue detector and 8 red detector-grating combinations) will be used with the 4.3" and 1.0" apertures. To assure registration of the spectrum on the diode array, the stars will be observed at 3 Y-bases with an 8-10 micron separation. Most of the spectra will be obtained in the 4.3" and 1.0" aperture, however, one star (BD+28D4211) also will be observed with all usable dispersers through the 4.3", 0.5", 0.3", and 0.25-PAIR apertures to calibrate aperture throughputs. Measurements of aperture throughput ratios will be made for both detectors with all usable spectral elements for the single apertures expected to be most commonly used in Cycle 5. A multi-stage peakup of the standard star should provide excellent centering in the small apertures.

Primary External Targets: BD+28D4211, G191-B2B, BD+75D325

Target Acquisition Technique: ACQ/PEAK for a pointing accuracy of 0.04"

Detectors: Blue and Red

Apertures: 4.3" square, 1.0" circular, 0.5" circular, 0.3" circular, 0.25-PAIR

Dispersers: G130H, G190H, G270H, G400H, G160L, PRISM (Blue side)

G190H, G270H, G400H, G570H, G780H, G160L, G650L, PRISM (Red side)

Fraction of GO/GTO Programs Supported: 100%

Resources:

Duration (orbits): 48

Author: C. Keyes

Manpower Required: 0.1 FTE

Special Requirements: None

Accuracy: The dominant error in the photometry is due to miscentering of the target in the aperture, and the aperture size. The other sources of error are (1) decline in the FOS sensitivity, (2) flat fields, (3) change in telescope focus, (4) location of spectra, (5) thermal breathing, (6) jitter, (7) GIM, and (8) calibration system offsets. The internal repeatability of the FOS is 1-2%. The photometric calibration of a typical FOS spectrum is accurate to ~5-10% for the large apertures depending on the many factors given above and progressively worse for the smaller apertures.

Accuracy Requirement: 5% for the large apertures and 15% for the small apertures

Accuracy Goal: 3% for the large apertures

Products: C. Keyes will be in-charge of data reduction. The analysis will require about one month. The CDBS update will occur within one month of the final observations. There are inverse sensitivity reference files (IVnHFILE) to be delivered. Results of this test will be described in an ISR within a month of the final analysis.

Proposal ID 6204: FOS Cycle 5: Wavelength Calibration: Internal/External Offsets and Scattered Light

Purpose: The observations in this program will be used to determine the wavelength offsets between the internal and external light sources and to determine the scattered light properties of the FOS. The two tests (calculation of offsets and scattered light) have been put together to save expensive target acquisition time and make the total calibration program more time efficient. The observations will simultaneously compare the FOS and GHRS wavelength scales.

Description:

Part 1: The observations in the first part of this proposal will determine the FOS wavelength scale for all commonly used disperser/detector combinations. In this test, we will obtain spectra of external and internal wavelength calibration sources, and compare the resulting channel versus wavelength relationships to search for any offset between the two. The external objects, as well as the internal Pt-Ne lamp, will be observed through the 0.3" aperture, in the standard FOS ACCUM mode. The primary velocity target, NGC 6833, has insufficient lines in the G130H spectral region, so a second target (HD 207757) is required for this grating. Both sources are observed with sufficient RED and BLUE spectral elements in order to place all observations on the same velocity system. Internal sources make up a small fraction of the exposure time and must be acquired at the same time as the external sources, so they can NOT be scheduled as parallel observations. Derived wavelength offsets can be applied to the polynomial fit of pixel number versus wavelength determined from the lines in the internal Pt/Cr-Ne lamp.

Part 2: This part of the test will determine the impact of light from wavelengths longer than 3000 Å scattered off the FOS UV gratings. HD 207757 will be observed with the FOS UV gratings, which will be compared with HRS Side 1 observations. Since HRS Side 1 is insensitive to wavelengths long-ward of approximately 2000 Å, any additional light detected in the FOS observations is attributable to longer-wavelength continuum light scattered off the FOS gratings. The object will also be observed throughout the visible with FOS/BL to provide a direct instrumental comparison between total detected long-wavelength counts and scattered long-wavelength counts. This will allow us to test our scattered light simulator in STSDAS. The observations with GHRS will allow us to compare the FOS and GHRS wavelength scales.

Primary External Targets: NGC 6833 and HD207757

Target Acquisition Technique: ACQ/PEAK for a pointing accuracy of 0.04", ACQ with GHRS

Detectors: Blue and Red FOS detectors and the GHRS side 1

Apertures: the FOS 0.3" circular, and the GHRS 0".25

Dispersers: G130H, G190H, G270H, G400H, (Blue side)

G190H, G270H, G400H, G570H, G780H (Red side)

G140L (GHRS)

Fraction of GO/GTO Programs Supported: 100% of the programs will be affected by the wavelength calibration part of the proposal, ~60% by the scattered light part of the proposal.

Resources:

Duration (orbits): 21 external orbits

Author: M. Dahlem, C. Keyes and A. Koratkar

Manpower Required: 0.25 FTE

Special Requirements: For the wavelength calibration part of the proposal, the internal sources make up a small fraction of the exposure time and must be acquired at the same time as the external sources, so they can NOT be scheduled as parallel observations.

In the time between the individual exposure pieces for the scattered light test, the FOS filter grating wheel MUST NOT be moved. This includes the homing of the instrument that would occur if a non-FOS observation is inserted in the time between the pieces. This restriction also applies to the internal WAVE observations - the filter grating wheel MUST NOT be moved between the external and internal observations. Internal Pt/Cr-Ne lamp observations must immediately follow each external observation.

Accuracy:

Part 1: The wavelength calibration accuracy is affected by the errors in the zero point of the wavelength scale. These offsets can be calculated to ±0.2 diodes for the FOS. In a typical FOS observation, which is not accompanied by a wavelength calibration, the wavelength error is dominated by the non-repeatability of the filter-grating wheel. The error is of the order of 0.35 diodes. In a FOS observation accompanied by a wavelength calibration, with no filter-grating wheel motion the wavelength accuracy is roughly 0.1 diodes.

Part 2: The scattered light in the FOS is due to grating scatter and is a major source of photometric error for red objects which are observed in the UV gratings. A full correction for scattered light requires an understanding of the spectral energy distribution of the target across the FOS wavelength sensitivity range. A model prediction exists and needs to be verified.

Accuracy Requirement: 0.2 diodes for wavelength calibration

Accuracy Goal: 0.1 diodes for wavelength calibration

Products: M. Dahlem, C. Keyes and A. Koratkar will be in-charge of data reduction and subsequent CDBS updates. The analysis will require about 2 months for the wavelength calibration and 3 months for the scattered light calibration. Wavelength offsets found between internal and external sources will need to be incorporated into the dispersion coefficients used by the PODPS pipeline. The analysis of the wavelength calibration data will thus lead to an CDBS update which will occur within 2 months after the final observations. There are wavelength calibration reference files (CCS6) to be delivered. Results of this analysis will be described in an ISR within two months of the execution of the test. The scattered light part of the proposal will not lead to any database update, and therefore there are no reference files to be delivered. The analysis will lead to testing of the present scattered light model. Results of this test will be described in an ISR within a month of the final analysis.

Proposal ID 6205: FOS Cycle 5: Location of the 1.0" aperture and the FOS PSF

Purpose: The observations in this proposal will be used to determine the location of the FOS 1.0" circular aperture, the PSF in the FOS focal plane, and to determine the amount of light scattered by a nearby bright object into the FOS 1.0" aperture.

Description: This proposal has a high priority because the stability in the location of the apertures will be checked by comparing with Cycle 4 observations of the location of the 1.0" aperture, since this technique provides the most precise (V2,V3) locations. Further the observations can also be simultaneously used to determine the amount of light scattered into the FOS 1.0" aperture by a nearby target, which is important for a number of proposals that are and will be using the FOS to observe faint sources close to very bright targets. The location of the 1.0" aperture and the amount of light scattered into the 1.0" aperture will be determined by performing a raster step and dwell sequence in the FOS aperture along two perpendicular directions in the aperture to find the maximum throughput for the aperture out to 3.0". This test has to be conducted for both the RED and BLUE detectors. This test will be conducted once during Cycle 5.

Primary External Targets: STAR-073628-594316 (CVZ)

Target Acquisition Technique: ACQ/BINARY followed by ACQ/PEAK for an accuracy better than 0.08"

Detectors: Blue and Red

Apertures: 1.0" circular

Dispersers: N/A

Fraction of GO/GTO Programs Supported: 100%

Resources:

Duration (orbits): 12

Author: A. Koratkar, M. Dahlem and C. Keyes

Manpower Required: 0.1 FTE

Special Requirements: All observations in this program MUST occur in non-SAA impacted orbits.

Accuracy:

Accuracy Requirement: 0.1"

Accuracy Goal: 0.05"

Products: A. Koratkar and C. Keyes will be in-charge of data reduction. The analysis will require about 3 months.The analysis of the data obtained may lead to an PDB update which will occur within 3 months of the final observations. There are no reference files to be delivered. Results of this test will be described in an ISR within a month of the final analysis.

Proposal ID 6206 FOS Cycle 5: FOS Polarimetry Calibration

Purpose: The observations in this proposal will be used to determine the spectrophotometric calibration of the FOS for polarimetry using the UV gratings for the red detector, and determine the stability of the spectropolarimetric modes relative to Cycle 4 observations.

Description: The polarimetric calibrations are needed to establish a number of parameters that will be needed to determine the polarimetric capabilities of the FOS. This goal will be achieved by determining the locations of the polarization spectra, the transmission of the polarizer, the angles of the Wollaston prisms and wave plates in celestial coordinates, and the instrumental polarization. Since a number of parameters have to be determined in a sequence the proposal has been divided into three parts for ease.

Part 1: Measurements of the internal Pt-Ne lamps will be used to locate the two oppositely polarized spectra that occur with the polarimeter. The positions of the split spectra will be compared to those of spectra taken without the polarimeter. The data will be used to determine a wavelength scale for the most commonly used modes of the polarimeter.

Part 2: The instrumental polarization, flat-field corrections, and throughput of the polarimeter will be measured by observing the polarimetric and photometric standard BD+28D4211. Observations with the polarimeter will be taken at two roll angles separated by 45 degrees.

Part 3: The angles of the Wollaston and wave plates will be measured in celestial coordinates by observing the polarized standard BD+64D106 at two roll angles 45 degrees apart.

Primary External Targets: BD+28D4211 and BD+64D106

Target Acquisition Technique: ACQ/PEAK for a pointing accuracy of 0.04"

Detectors: Red

Apertures: 1.0" circular

Dispersers: G190H, G270H, G400H

Fraction of GO/GTO Programs Supported: ~5%

Resources:

Duration (orbits): 20 external orbits and 2 occultation/parallel orbits

Author: M. Dahlem and A. Koratkar

Manpower Required: 0.1 FTE

Special Requirements: The observations in Part 1 must precede those in Parts 2 and 3. At least two to three weeks should be allowed after the data from Part 1 are in hand before scheduling Parts 2 and 3. Observations in Part 1 can be done in parallel with another instrument prime. It is preferable for Part 2 to occur before Part 3, but it is not essential. Note that for the Y-base maps with the polarizer, the map is normally centered on the Y-base for the lower of the two polarization spectra. We have therefore broken the maps into two segments, one to be centered on the lower spectrum, and one to be centered on the upper. The lower will use the default Y-value, while the upper should be +750 Y-units from the lower. Polarimetric observations need to be taken as a single sequence of observations. Changes in background, position angle of the spacecraft, and other variables can all adversely affect the results. This test is stray light sensitive.

Results of this analysis will be described in an ISR within three months of the execution of the test.

Accuracy: The instrumental polarization due to COSTAR is ≤2% and is wavelength dependent.

Accuracy Requirement: ~0.5%

Accuracy Goal: ~0.2%

Products: R. Allen with the help of A. Koratkar and M. Dahlem will be in-charge of data reduction. The analysis will require about 4 months and may lead to a CDBS update which will occur within 4 months of the final observations. There are reference files (CCS4, RETHFILE) to be delivered. Results of this test will be described in an ISR within a month of the final analysis.