CYCLE 1 FOS CALIBRATION

A.L. Kinney and G.F. Hartig
June, 1989

ABSTRACTS

Aperture Locations   Priority 1

Aperture locations and sizes are measured in 4 phases (described in detail in *Aperture Locations and Sizes for the ST SIs* by Lupie, Bohlin, and Holm) in OV and in SV. A trimmed down version of the SV aperture location measurement will be done every 4 months on both the red and the blue sides in cycle 1 to verify repeatability and to measure any long-term drift in the aperture locations. This has the highest priority because all FOS observations depend on our knowledge of aperture location. Total spacecraft time is 9.1 hours.

one aper. per side

Y-Base Maps   Priority 1

Locations of spectra are measured in OV twice and in SV 7 times (once with a measurement at all apertures at two grating settings plus all grating settings using 2 apertures, and 6 times with one aperture at all grating settings). In cycle 1 we will do the trimmed down version of the spectral location test once every 3 months to verify repeatability and measure any long-term drift. This test has the highest priority because our ability to acquire spectra depends on our knowledge of Y-Base values. Total spacecraft time is 1.9 hours of **parallel** observations. Also tests FGW repeat.

Internal/External Wavelength Offsets and Line Spread Function Priority 2

Offsets between internal and external wavelength scales will be measured in SV for 3 gratings on the blue side and for 6 gratings on the red side. In cycle 1, 2 additional gratings will be measured on the blue and the red sides to fill in gaps in the coverage, and 2 gratings will be repeated on each side to verify stability. The test will be performed with all dispersers, using two different apertures, on three external sources. Any derived offsets can be applied to the polynomial fit of pixel number versus wavelength determined from the lines in the internal Pt-Ne lamp. Unresolved lines in planetary nebulae and in a dMe star will be used to determine the FOS + ST Line Spread Function. The internal sources make up only 5% of the exposure time and must be acquired at the same time as the external sources, so they cannot be scheduled as parallel observations. Total spacecraft time is 10.9 hours.

Flat Fields Priority 2

The diode-to-diode variations and photocathode non-uniformities of the FOS detectors will be determined for the 1.0" single aperture in SV. The flat field test will be run again in cycle 1 to verify stability and to fill in data for the paired apertures which lie on a different place on the photocathode. Two stars will be observed in each ~~reasonable~~ used detector/grating combination (a total of 14). The stars selected have fairly featureless spectra. The spectra will have any remaining stellar features extracted and will be averaged to form the pipeline spectral flat fields for the FOS. Total spacecraft time is 18.3 hours.

Absolute Photometric Calibration Priority 2

Absolute sensitivity of the FOS will be determined by observing 2 stars at 3 epochs, first in 3 apertures (1.0", 0.5", and 0.3") and then in 1 aperture (1.0"). In cycle 1, 3 stars will be observed at 3 epochs in the 1.0" aperture to establish the stability of the sensitivity, and one star will be observed at 1 epoch in the paired apertures since the paired apertures are not calibrated in SV. The paired apertures will be calibrated according to which ones are requested in GO programs. The stars will be observed in each reasonable detector/grating combination (a total of 14). The data will be averaged to form the pipeline response functions for the FOS. If all paired apertures are calibrated, total spacecraft time will be 36.0 hours.

Polarimetric Calibration Priority 2

By the end of SV only 4 grating settings will have polarimetric calibration; G130H and G160L on the blue side, and PRISM and G270H on the red side. Any other settings required by GOs in cycle 1 will require additional calibration.

The calibration will determine the locations of the polarization spectra, the transmission of the polarizer, the angles of the Wollaston prisms and waveplates in celestial coordinates, and the instrumental polarization. A large part of the polarization calibration can be done in parallel. Total spacecraft time depends on how many grating settings are requested by GOs. ~~(A first glance a GO programs shows only red side polarization requested.)~~ stet

Dark Count and Sky Measurement Priority 3

Internal dark and external sky measurements will be made in SV when other instruments are prime. Because these parallel observations require very complicated scheduling and commanding, we do not know how much of the SV program will be finished by the end of SV. The size of the cycle 1 Dark Count Measurement program depends on how much of the SV program is carried out.

The sky data will be obtained at high galactic latitude, low galactic latitude, and in the ecliptic plane. These observations will allow us to determine when sky measurements will be required for science data. The dark measurements will be obtained with a variety of SIs prime and during SAA passages. Some sky observations will be read from two different portions of the photocathode, to check if the dark count is position dependent. If it is not, then normal science dark measurements can be obtained by changing the Y-Base rather than closing the entrance aperture, thus allowing for more efficient observing. This program requires parallel observations.

OTA Point Spread Function Priority 3

& Scatt Lite

use SI aper

The OTA point spread function is measured in SV for the 0.3", 1.0-pair-A, and 1.0-pair-B apertures by taking spectra with the prism at distances of 1", 3", 5", 8", 12", 20", and 30" from the apertures in both the X and the Y direction. The OTA PSF will be measured in cycle 1 to verify repeatability for only the 0.3" single aperture. Total spacecraft time is 5.8 hours.

Occulting Aperture   Priority 3

The efficiency of the occulting apertures will be tested in SV and again in cycle 1 to verify stability of aperture size and location. *This test will be done only if GO programs require the use of the occulting apertures.* A bright star will be centered in the 0.3" single aperture and then placed behind the occulting bar of the 0.7 × 2. aperture and the unocculted light will be measured by obtaining spectra with the prism. This is performed once on the red side and once on the blue side. Total spacecraft time is 2.3 hours.

PERIOD Mode   Priority 4

The testing of PERIOD mode is in the delta SV plan. If the test is not carried out, and if there are GO programs requesting the use of this mode, then the PERIOD mode test will change to a priority 1 test.

only 1 suppl. GO prog

In order to verify the functionality of the PERIOD mode of FOS, a stable high-speed variable star with a well-measured period will be observed. The PERIOD mode constitutes a minority of FOS observations, but forms one of the features that is unique to the instrument. We propose to observe one of two standards - the Crab Pulsar or DQ-HER - using the synchronous time-resolved mode. Total spacecraft time is 1 hour for the Crab Pulsar and 2.3 hours for DQ-HER.

Pulse Height Analysis   Priority 4

The optimal discriminator settings will be determined in OV. Because both the noise and gain are known to be temperature sensitive, it is likely that some fraction of the channels will experience some change in their optimal discriminator threshold settings on orbit. The discriminator/noise test should be run twice in cycle 1 to verify the stability of those settings.

The FOS high voltage will be brought to approximately one-half the nominal operating voltage (12750 KV), with the REFDAC=250 and the trim focus current at 0. A 60s wait will allow the high voltage to stabilize. The command block YTDN will be run, with the INTFLAT as the source. Total time is 3.0 hours **parallel**.

- estimate brightness

~~observe~~
~~collect candid~~
- establishing standards
  update ~~[switching to white dwarf standard~~
  ~~[bootstrapping]~~

- observing plan
- take data
- compare data with standard
  for baseline cal.

- monitor for time changes
  model to correct for time changes

- improve process by bootstrapping
  [switching to white dwarf standard
  [FOS is a more precise spectrophotometer -
  re-set your absolute photometry

more precise spectrophotometer - no atmosphere