SPACE TELESCOPE SCIENCE INSTITUTE

INSTRUMENT SCIENCE REPORT

CAL-FOS-009

TITLE: FOS Firmware Target Acquisition: Preliminary

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ABSTRACT

FOS firmware target acquisition can find the position of a "star" to ~ 1 micron in the x-direction to an accuracy of at least 3 micron in the y-direction.

DISTRIBUTION:

ISB Bohlin, Koornneef, Macchetto
CSC Harms, ARC
SDAS Hier, UCSD
SOGS
IDT

A. Test Description

The FOS firmware target acquisiton was tested 6/24/84 at M^2C during the ambient calibration by H. Ford and R. Hier. The data are in the ambient calibration notebook, pages 40, 41, and 42, and the hardcopy output is labeled TA1 through TA11. The tests were made with the UV STOS and Argon lamp on the blue side using aperture B2(0.3" circular). We first established the count rate with the camera mirror and neutral density filters, obtaining the following results:

Light Source	Filter	Peak c/s/d, Camera Mode
Argon	N.D. #11(2.5%) + N.D. #12 (1.1%)	~ 40
"	N.D. #12 (1.1%)	1600

The tests were run with the N.D. #12 (1.1%) filter. We ran four manual Y-maps with 1/4 X-step, varying Y-base, Y-range, and the Y-step size from one map to the next. The first Y-map was used to accurately locate the X and Y positions of the aperture B2. The data from the next three aperture maps were used by the firmware to locate the aperture.

B. Test Results

1. Position of the aperture B2, based on hand reductions during the test.

Y-Base = -532
Y-Range = 30
Y-Step = 68 (16μ/step)
X center = 236.95 = -610 DACs relative to the center diode #256.
Y center = Step #18.4 = -272 DACs below center.

2. Firmware Positions of B2

Test No.	Y-B	Y-R	Y-S	Y-Step Size	Upper Edge X cent.	Upper Edge Y cent	Lower Edge X cent.	Lower Edge Y. cent
2	-532	10	68	8	-610	-374	-611	-167
3.	-448	8	16	16	-609	-373		
4.	-500	16	16	32	-609	-372	-610	-165

The scale conversion between DAC units and microns on the photocathode isn't known to better than one or two percent. If we assume 1 DAC unit = 1μ, the upper edge gives a maximum error of 2μ relative to the center of the 200μ tall diodes, for step sizes as large as 32μ. The lower edge gives errors of 3μ and 5μ. If we use a sequence of tests such as this to define the DAC to microns conversion, the Y-centering may be even more accurate than 2 or 3 microns.

The microprocessor processing time for 16 lines of data and filtering is ~ 48 seconds.

C. Test Summary

FOS firmware target acquisiton can find the X position of a "star" to ~ 1 micron and the Y-position to an accuracy of at least 3 microns.

D. Future Firmware Test Objectives

To completely understand the firmware target acquisiton, we need one additional day (12 hours) of testing in the Mechanical Laboratory. The test objectives should include the following:

1. Measure Y-center as a function of Y-Base and Y step size to see if there are any systematic errors and to find the largest Y step size which will give an accurate Y-center.

2. Measure Y-center accuracy as a function of light level.

3. Use measurements of aperture pairs and repeated measurements of small apertures to establish the DAC micron scale and the optical reduction factor from the focal plane to the photocathode.

4. Use measurements of the aperture pair A4 on the red side with variable window settings to test the firmware pattern recognition logic.