



MULTIPLE MIRROR TELESCOPE OBSERVATORY

Smithsonian Astrophysical Observatory *and* Steward Observatory, University of Arizona

MMTO Technical Memorandum 84-5

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Subject: New Procedure to Update Flexure Coefficients

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Open-loop flexure data is used to predict how the images from each of the six telescopes will move in the focal plane, as the elevation angle of the telescope changes. The TCS computer uses the flexure data or coefficients to hold the stacked images together while tracking open-loop.

B. L. Ulich(1) reports that the flexure coefficients should be determined following any mechanical work on the telescope which might affect the flexure of any of the optics, yet the procedure for determining the coefficients here-to-fore took 3 hours of telescope time on the sky. As a result, the coefficients in use are usually old and inaccurate. This memo describes a new procedure which permits determining these coefficients in 10 minutes, thus permitting the coefficients to be determined as often as necessary.

The operator selects from the SAO catalog a set of 3 stars at roughly the same azimuth, and with elevation at 30°, 55°, and 75°. The operator performs an autostack on the first star to establish camera scale on the Grinnell image processing system. He then spreads the images out in a rectangular pattern using the secondary hand

1. MMTO Technical Memorandum 83-1, Jan. 22, 1983, B.L. Ulich

paddle. With new commands on the TCS computer, he positions a centroiding box over each image and commands the computer to measure the image positions. The image positions of star 2 and star 3 are measured in turn by positioning the centroiding boxes over the individual images. The computer now has the differential movement of each image as the OSS was moved between 3 known positions. The procedure must be performed twice, once on the East and once on the West.

The new procedure was tested January 22, 1984. To evaluate the success of the test, an autostack was performed on star 1, FWHM measured; the telescope was moved to star 3, and FWHM measurements repeated. Here are typical results:

Image	A	B	C	D	E	F	Stacked	
Star 1 (30°EL)							2.4 ^μ	AZ
							2.5	EL
Star 3 (75°EL)	2.2	1.8	2.1	2.0	1.9	2.1	2.2	AZ
	2.2	2.0	2.2	2.0	2.2	2.1	2.3	EL

These results show that there was no measureable degradation of the stack at ~ 2^μ seeing when moving the OSS from 30° EL to 75° EL. The same test, using coefficients manually determined in September 83, showed a visible separation of images in excess of several arc seconds on star 3.

The telescope was moved to the West using coefficients determined in the East. Image C was out of the stack by several arc seconds when approaching stars from higher elevations. Both C and D were out of the stack when approaching from lower elevations, a previously measured hysteresis effect.

Two different methods of correcting the flexure coefficients are provided:

- a. The corrections are made so that the coefficients take out mount pointing error.
- b. The average of the coefficients is subtracted from the coefficient from each telescope so that mount pointing is not corrected. This method helps maintain equal path lengths for each telescope, important for co-phasing.

Documentation has been released to the operators so that they can begin using this procedure immediately. The procedure will be revised in February so that the coefficients can be determined at any top box position angle.