



# MULTIPLE MIRROR TELESCOPE OBSERVATORY

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MMTO Technical Memorandum 84-9

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Subject: More on Open-Loop Flexure Curves for MMT phasing.

- (1) On January 21 and February 13, 1984 we measured the MMT open-loop phasing curves for variable elevation. On both these observing runs we used the coalignment procedure (3c) described in our MMTO Technical Memorandum 84-1. In it the average position of the six MMT images on the top box TV is kept invariant. This was possible because of new software written by J. Montgomery to do both auto-stacking on the previous average position and to do pointing open-loop correction maintaining the same average position.
- (2) The attached figures show the amount of pathlength change introduced by the phasors at different elevations. The phase was always adjusted to that of telescope A, then the data were averaged so that the average pathlength of the six telescopes stayed constant. In the figures the circles refer to the measurements when going up, the crosses when going down. The data for January 21 are in the upper part of the graph. Those for February 13 are in the lower part.
- (3) It is to be noted that the variation for the February 13 data is very similar to that of the January 21 data. Between those two dates the wedges underneath the tertiaries were removed, the secondaries were replaced with the IR secondaries and back to the optical secondaries, and the beamcombiner optics were exchanged a number of times. The flexure behavior is very repeatable, being different only in details.
- (4) After drawing average curves through the data, we arrive at the following results for hysteresis, RMS and PTF variations:

(A) Hysteresis. Defined as the spacing between the upward and downward going values:

Telescope	Jan 21, 1984	Feb. 13, 1984	Average
A	+ 3.8 + 2.0 $\mu$ m	+ 0.2 + 2.5 $\mu$ m	+ 2.0 + 1.6 $\mu$ m
B	- 4.0 + 1.8 $\mu$ m	- 7.2 + 2.5 $\mu$ m	- 5.6 + 1.5 $\mu$ m
C	+ 8.8 + 4.3 $\mu$ m	- 0.7 + 2.9 $\mu$ m	+ 4.0 + 2.6 $\mu$ m
D	- 3.1 + 2.2 $\mu$ m	+ 4.3 + 1.8 $\mu$ m	+ 0.6 + 1.4 $\mu$ m
E	+ 4.0 + 2.9 $\mu$ m	+ 5.4 + 3.6 $\mu$ m	+ 4.7 + 2.3 $\mu$ m
F	- 6.3 + 3.8 $\mu$ m	- 2.0 + 1.4 $\mu$ m	- 4.1 + 2.0 $\mu$ m

The worst, and perhaps only, hysteresis exists for telescope B and even there it is quite small.

(B) RMS and PTP Variations

The RMS/PTP variations in  $\mu\text{m}$  are:

<u>Telescope</u>	<u>Jan. 21, 1984</u>	<u>Feb. 13, 1984</u>
A	4.5/17	4.5/14
B	3.6/13	4.7/14
C	7.6/22	5.8/16
D	4.1/13	3.1/9
E	5.4/16	7.0/18
F	7.9/20	2.9/9
Average	5.5/17	4.7/13

Included in these are a  $\sim 2 \mu\text{m}$  RMS error due to the precision of setting the white light fringe on the center of the star image. The remainder of the variation (typically  $5 \mu\text{m}$  RMS) may well be due to thermal changes in the Optical Support Structure. A  $5 \mu\text{m}$  RMS change would correspond to a  $0.08^\circ\text{C}$  change in the temperature, a change which would not be unlikely in these 1.5 hours duration runs.