Palomar Laser Launch Telescope Flexure

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v1.0; 4/20/07

1. December 6, 2006 Flexure Measurements

The flexure of the Palomar laser launch telescope (LLT) was measured on 6 December 2006 (UT), a night with clear sky and terrible seeing. The Hale telescope was pointed towards 16 locations in the sky for which we had clearance for laser projection. We projected the laser at each location, and approximately centered the LGS on the AO acquisition camera field by manually adjusting the uplink tip/tilt (UTT) mirror. An acquisition camera image was then recorded to allow residual position offsets to be accounted for in the analysis.

Analysis consisted of fitting a Gaussian to the LGS to measure it's position to a fraction of a pixel, and adding the equivalent offset to the UTT mirror values. This correction was typically only on the order of 3-5". The resulting UTT mirror offsets versus sky position are shown in Figure 1, while the total UTT mirror offset versus zenith angle is plotted in Figure 2.

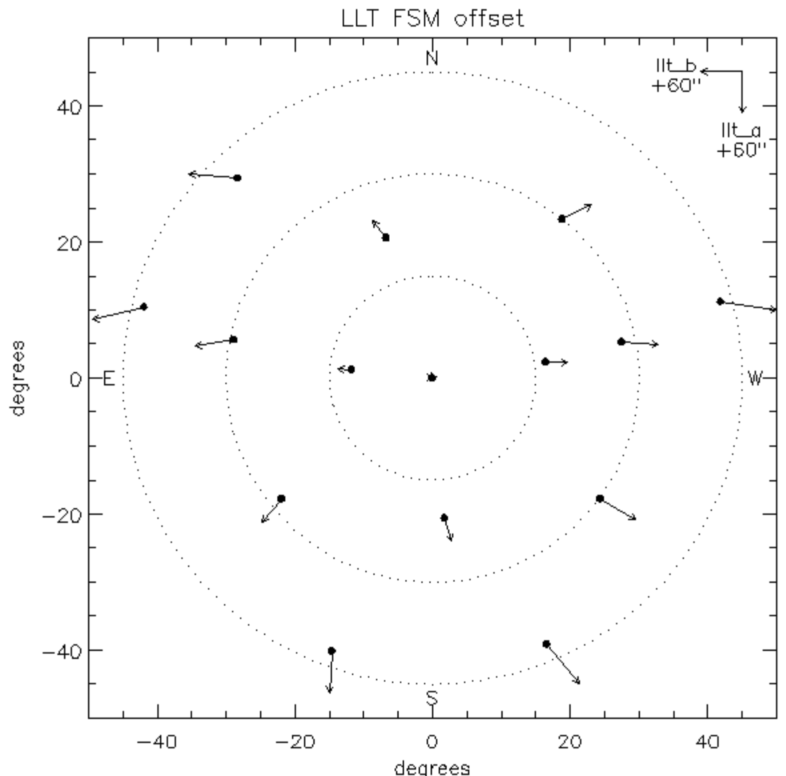

Figure 1: UTT mirror offsets required to center the LGS on the AO acquisition camera, as a function of position on the sky (displayed in a polar projection centered on zenith). The length and direction of a 60" offset in each UTT mirror axis in indicated by the vectors in the upper right corner.

It is important to note that we have not in fact directly measured flexure of the LLT with this experiment. Rather, we have measured flexure somewhere in the BTO-LLT system, which can be compensated for by driving the UTT mirror by up to 80" at 45º elevation to return the laser to boresight with the Hale telescope. While I believe the most likely cause is flexure of the LLT truss, primary, or secondary support structure, this is not proven.

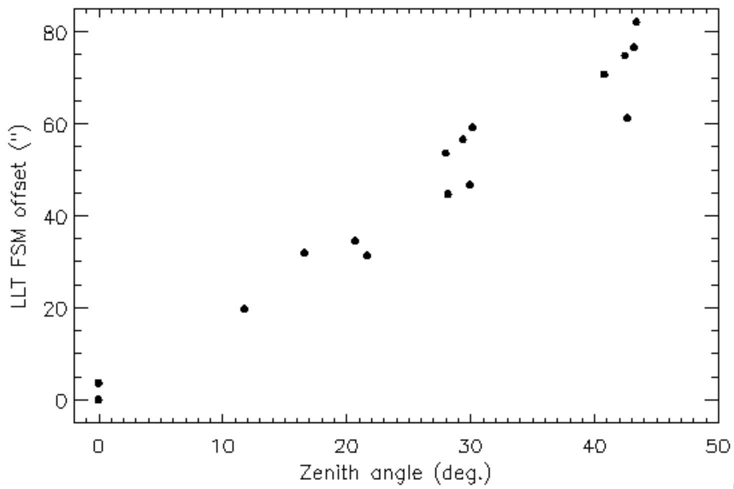

Figure 2: Total UTT mirror offsets required to center the LGS on the AO acquisition camera, as a function of zenith angle.

2. Consequences for laser launch telescope alignment.

If the flexure recorded in these data is in fact in the launch telescope, then compsenating it through a tilt of the UTT mirror (conjugate to the LLT pupil) causes a translation of the laser at the focal plane of the telescope. The LLT has an unvigneted field of view of 94" radius, limited by a field stop of diameter 20mm located near the LLT focus, and a stop at the LLT lens of diameter 25mm[1]. Thus, we must initially center the laser in these field stops to better than ~10" in order to avoid vigneting the laser at 45º elevation.

[1] Chris Shelton email dated August 14, 2006 3:57:27 PM PDT.