Membrane Mirror Calibration: On Summit Performance and Control Units vs. Volts

Experiment #1: August 3, 2003, On Summit Performance

Purpose: To measure the stroke of the membrane mirror in the dome environment for comparison with sea-level measurements

Procedure: This experiment was performed in the UH88" dome. The inside dome temperature was 46F and the barometric pressure was 618.1 millibars. The membrane mirror (with the small cone) was mounted in its holder and on an elevation stage. As in previous experiments, a white box was used as a movable screen to find the focus closest to the mirror. The membrane was being driven by a 4V square wave. The minimum focal length was measured as a function of driving voltage and as a function of frequency.

Results: The resulting data and IDL plotting script are given in the file "membrane.summit.idl.txt" at irtfweb.ifa.Hawaii.edu/~msc/membrane. The frequency response data is plotted in membranesummit2.ps. Unfortunately, there is no comparison data of the membrane stroke vs. driving voltage at the same frequency as was used on the summit. Thus, the best estimate of the difference in stoke at the summit is by using the frequency response data. They are compared in the plot membrane_summit_hilo.ps. We find a significant shift in resonant frequency from 1930Hz at sea level to 1800Hz at the summit. We also find that the stroke is significantly less. At the summit, the minimum focal length is 70% (plus or minus about 2%) greater than at sea level. This was determined by shifting the sea level response curve to best match the summit response curve.

Experiment #2: Oct 14, 2003, Calibrating control units vs. volts

Purpose: To know what focal length the membrane mirror has when we are controlling the AO system.

Procedure: The minimum focal length of the membrane mirror was measured the same way as described above. The Zygo was used to illuminate the membrane, the iris being wide open. The voltage was measured across the speaker pins (which is where we connect the function generator when we're doing other tests) with an oscilloscope and a 10x 10Mohm probe. The quoted voltage is from 0V to the peak of the sine curve. Since the membrane was being driven by the AO control system, the frequency was 1900Hz.

Results: The results are summarized in the file 'membrane.units.idl.txt', and plotted in units_volts.ps and units_stroke.ps. Since the membrane was not being driven by a sine wave, and the quoted focal length does not take into account any distance from the membrane to the 0 point, this data should not be used as an absolute caibration of units vs. stroke. Rather, it is included here since we took the data and as a general guide as to what stroke to expect. These focal lengths are likely to be accurate to about 5cm. As expected, we find a linear relationship between control units and applied voltage. There

is no DC offset and the slope is approximately 6.75e-5. As we also previously observed between voltage and stroke, we find a power law relationship between the control units and stroke, with a power law index of –1.35.