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Wave Front Sensor Deflection
Gemini Extreme Adaptive Optics Coronography
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The first iteration of the Extreme AO Planet Imager instrument design assumed a fixed gravity vector. With regard to flexure in the design, the stiffness required in a fixed gravity environment can be much less than in a changing gravity vector environment. Stiffness considerations in the first iteration assumed this fixed gravity vector and were more focused on natural frequency than on flexure. The Gemini design won't have this luxury. It was expected (but previously un-quantified) that the flexure of the fixed gravity design would be unacceptable, and that the worst case flexure would probably be seen in the wavefront sensor stage assembly. This is shown in figure 1 below.

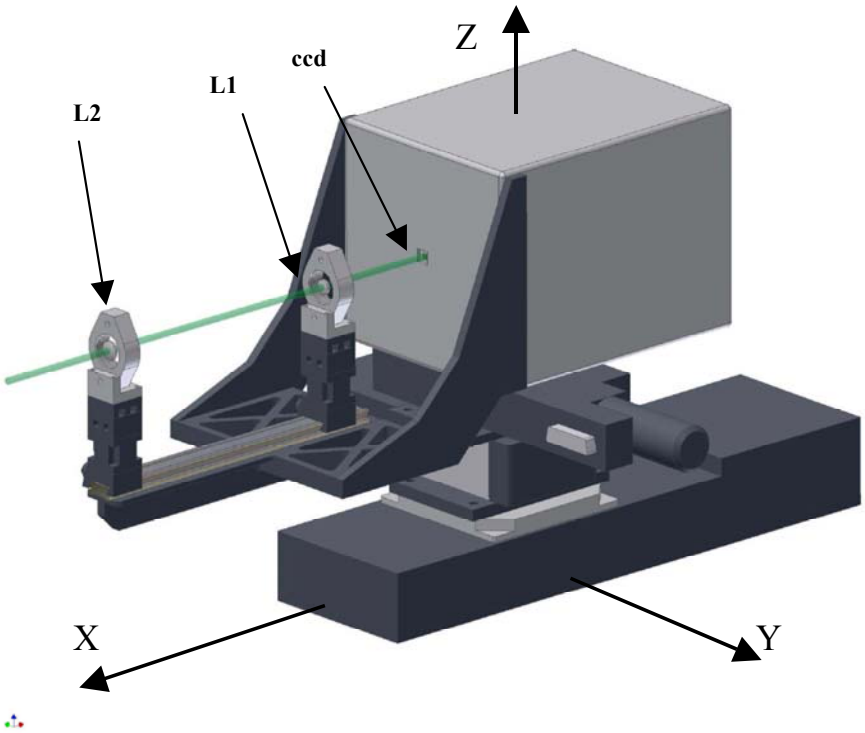

Figure 1: Wavefront Sensor Assembly

The choice was made in the optical design to control the beam position on the detector using three-axis motion control rather than a separate steering pair. This required moving the L1/ L2 relay (shown above) in concert with the CCD. The most direct and economical solution, pending no other complications, was a stack of commercial linear translation stages. This, however, resembles a column that becomes a cantilever when rotated.

Manufacturer specified torsional spring constants were used to examine deflections of each relay optic, as well as the ccd. This was done for 90 deg rotation of the gravity vector about either the X or Y axis. The results are shown below in Table 1.

Table 1: WFS Component Deflection

Flexure (micons, radians)			
	CCD	**L1**	**L2**
dx	-42	-42	-42
dz	22	52	114
dy	54	54	54
d-theta-y (rad)	3.34E-04	3.34E-04	3.34E-04
d-theta-x (rad)	5.18E-04	5.18E-04	5.18E-04

These are relatively large, non-common path flexure quantities and are assumed to be unacceptable. (However, how it propagates through the optical design is not part of this analysis.) Large flexure affirms the supposition that an off-the-shelf commercial hardware solution will probably be inadequate.

The following should be noted. It's assumed above that the center of gravity of the assembly can be made coincident with the z-axis, and therefore any yaw about the z-axis will be negligible. Also, other elements of the fixed gravity vector design that resemble a column-mounted component will receive similar examination.