



K1DM3 Design Note

Earthquake Response When Retracted With Compliant Pivot

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INTRODUCTION

The Keck I Deployable Tertiary Mirror (K1DM3) is being designed with a compliant pivot so that it will not interfere with the kinematic mounts when in the deployed position. Original plans were to include a structure (pocket) at the top of the tower against which the swingarm would bear and lock. This would, therefore, restrict the module to park in only one position. The concern of eliminating the pocket was the effect of stability of the assembly and its response to earthquake.

ANALYSIS

The model used for the retracted position for response to shock, vibration, and earthquake loads was modified to allow for a compliant pivot. The previous analysis assumed a rigid pivot which only allowed rotation about the pivot axis. Displacements at the pivot normal to the pivot axis were removed and linear springs were added in these two directions. The model is shown in Figures 1 and 2. Figure 2 better shows the springs and the direction of motion they resist.

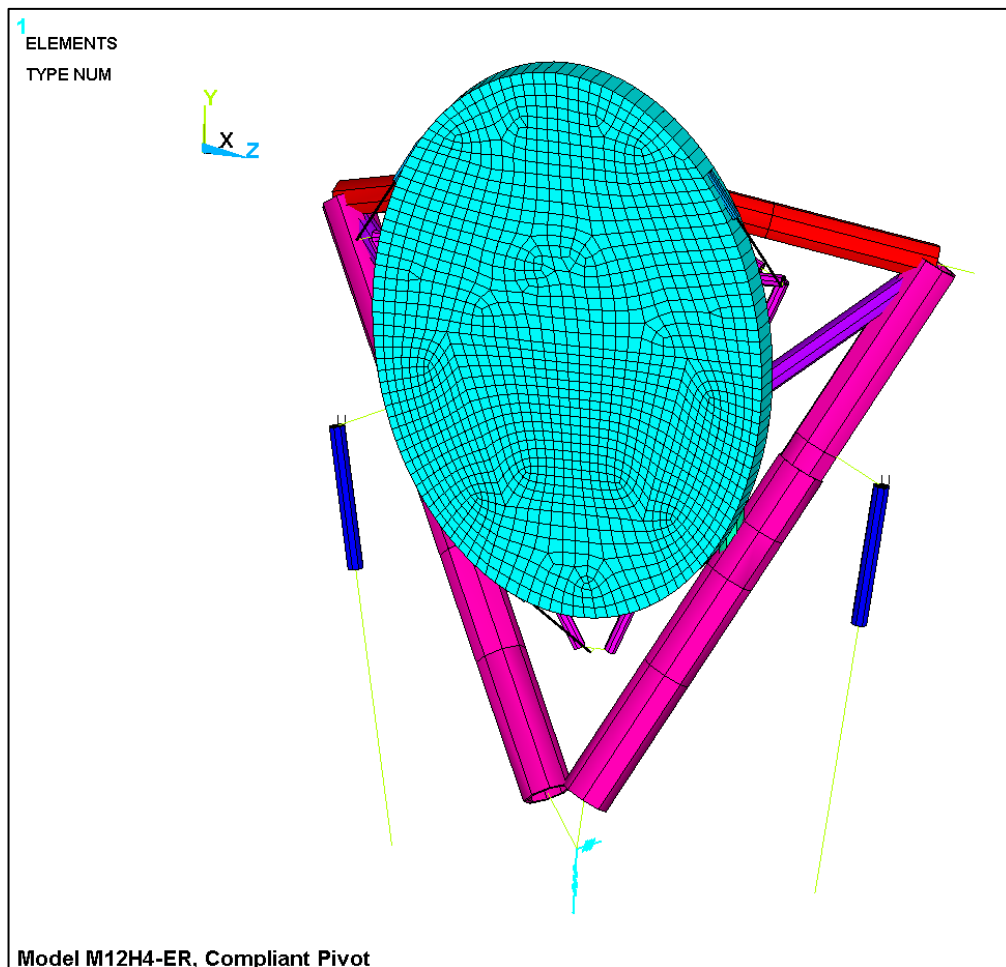


Figure 1. FEA model of mirror and swingarm in the retracted position

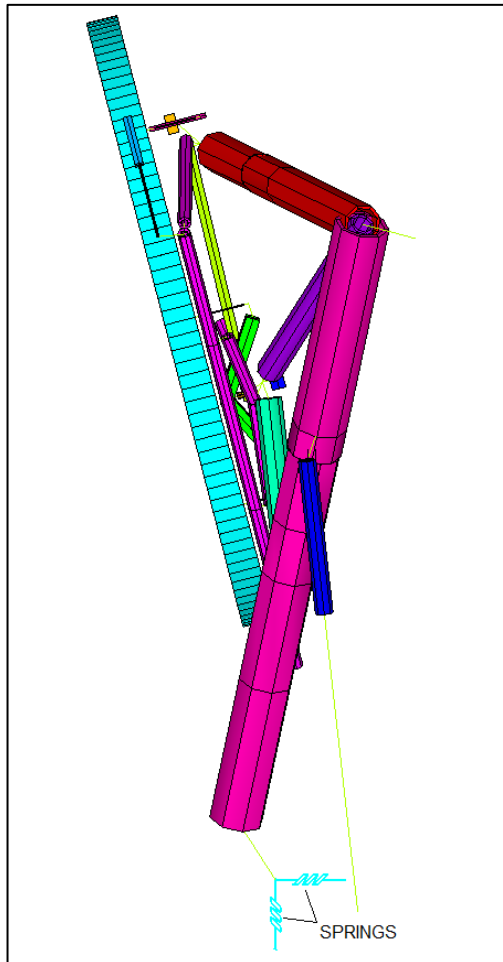


Figure 2. Compliance at pivot represented as springs in plane of the major axis

The spring constant used was 110 N/mm. As before, the model was run for 5G earthquake¹ for excitation in X, Y, and Z directions. Peak stresses in the mirror range from 400 to 600 psi depending on load case. The maximum loads encountered in the axial and lateral flexure rods were 139 and 346 pounds, respectively. These loads are lower than what was encountered previously with a rigid pivot.

Worst case estimates for static motion (due to the compliance of the pivot and the U-joints in the actuators) may be as much as 4 mm at the far end of the mirror.

¹ The K1DM3 requirements document specifies 2G's