CRYOGENIC KINEMATIC TIP TILT PISTON DETECTOR HEAD ASSEMBLY FOCUS STAGE FOR INTEGRAL FIELD SPECTROGRAPH

UCLA College | Physical Sciences Physics & Astronomy

- User credentials: James Larkin, Nathan Magari, Eric Wang - UCLA Infrared Lab
- JPE positioners used: 3x CLA 2601 on a cryogenic kinematic tip tilt piston stage

[1] Wright et al., "Liger at W.M. Keck Observatory: overall design and science drivers," SPIE Conference Series 13096, July 2024.

The experiment

Infrared focal plane arrays (FPAs) for applications in astronomical instrumentation require precise positioning to achieve the best focus. At the UCLA Infrared Lab, we are assembling a three-mirror anastigmat (TMA) camera for an infrared integral-field spectrograph (IFS). This optical assembly will be part of a next-generation workhorse instrument for W. M. Keck Observatory called Liger which has an imager and a lenslet/slicer IFS [1]. Cryogenic linear actuators from JPE allow us to precisely position the TMA testing apparatus and the detector itself.

The alignment of the mirrors in the TMA must be done in a warm clean room environment before testing with an interferometer in a cryogenic chamber at 77 K to determine if further adjustments are needed. To test alignment, retro-reflecting spheres are mounted with their centers coincident to the location of the Focal Plane Array (FPA) detector plane in the final assembly. The tip/tilt angles and the piston of the Invar detector mount and retro-reflecting spheres are controlled in a cryogenic environment with three CLA2601 actuators mounted to an aluminum support frame. The detector mount is connected to the support frame by an intermediate copper flexure for thermal conductivity and constant force springs to provide a preload and maintain constant contact with the actuators.

Being able to control the position of the retro-reflecting spheres and the FPA detector while at cryogenic operational temperature is important for the alignment and characterization of the optics as well as the commissioning and operation of the Liger instrument, and this is made possible with JPE cryo-linear actuators.

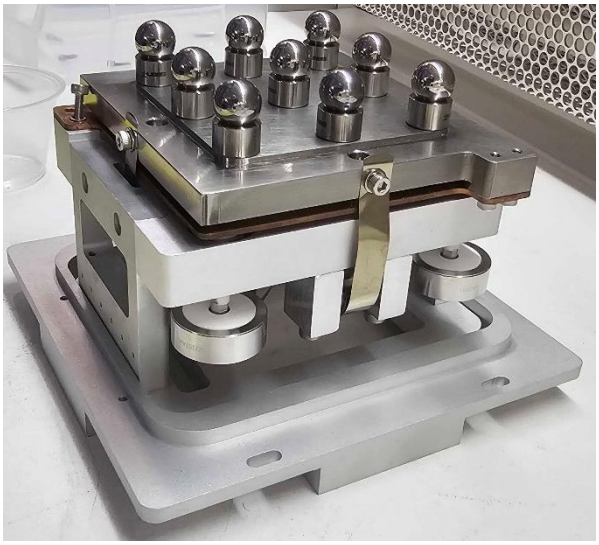


Figure 1: This is the IFS detector head assembly with two of the three actuators shown in the tip/tilt/piston stage visible behind the detector/retro-sphere mount plate. A Teledyne H4RG-15 Detector will be installed after the alignment tests have been completed.

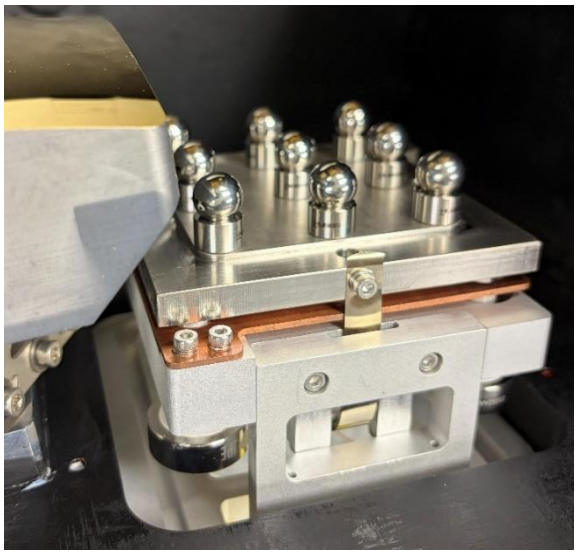


Figure 2: The IFS detector installed in the Camera TMA. An array of 9 high precision retro-spheres is mounted on the front surface for alignment. To the left of the detector is the secondary mirror in the TMA with a gold coating visible on the front surface.

Inspired by JPE CTTPS Cryo Tip / Tilt / Piston Stage
https://www.jpe-innovations.com/cryo-uhv-products/cryo-tip-tilt-piston-stages/

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