TripleSpec Pupil Alignment

**Pupil Mask Description**

The TripleSpec system has a cold pupil stop located at an image conjugate of the telescope's secondary mirror. The stop defines the outer edge of the secondary mirror illumination as well as masks the central obscuration of the secondary. Figure 1 shows this mask installed in TripleSpec. The vanes that hold the central obscuration mask are not meant to align with the telescope spider vanes, but are simply supports for the central obscuration mask that will occult a tiny portion of the pupil. The central obscuration mask includes a small hole to aid in system alignment. The two screws shown retain the mask in place. Extended edges on the base provide a reference for setting the position of the pupil using gauge blocks. The optical model for TripleSpec provides guidance for positioning the stop within the mechanical models. Recommended gauge blocks are xxx” for offset in the “long” direction and yyy” for offset in the “short” direction.

**Pupil Mask Alignment**

Ultimately, the conjugate image of the physical pupil mask, as relayed by the first off axis paraboloid in the TripleSpec system, must be in focus at and centered upon the telescope's secondary mirror. Warm alignment was established by presuming that the mechanical placement of the pupil mask was correct and making a small adjustment to the tilt of the first off axis paraboloid to center the image of the pupil mask on the instrument's primary axis. In practice this was accomplished by

1. Placing a precision flat reference plate on the dewar's front mounting plate.
2. Auto-collimating a laser off the front surface reflection from this plate.
3. Centering the auto-collimated laser on the instrument's primary axis (the center of rotation when mounted on the Nasmyth focus).
4. Letting the laser reflect off the first off-axis paraboloidal mirror and fall upon the pupil mask.
5. Shimming the tilt of the first off-axis paraboloid so that the laser passed through the center reference hole in the pupil mask.

The required tilt adjustment for the first off-axis paraboloidal mirror was xxx arcminutes.

**Cold Validation of Pupil Alignment**

With the system at operating temperature, images from the slit viewer provided the feedback necessary to map the location of the conjugate image of the pupil mask. A point source placed within the acceptance of the mask at the distance of the telescope secondary mirror will fully illuminate the slit viewer focal plane. At the distance of the conjugate image a point source moved across the mask image will produce a sharp transition from a dark to a fully-illuminated focal plane. Figure 2 summaries the observations of this test. We located the position of the dewars opto-mechanical axis at a position 23' 3" from the dewar's front face (corresponding roughly to the secondary mirror's distance at the telescope) by visually auto-collimating off of the dewar's entrance window (which was verified to be parallel to the dewar's Nasmyth mounting surface). Relative to this reference system we mapped the extent of the projected pupil mask with a point source, locating the exterior edges of the stop as well as the edges of the central obscuration, and even identifying the transmission through the alignment hole in the center of the pupil mask.

1. The central alignment hole and the auto-collimated axis positions were coincident to 2% of the secondary diameter.
2. The outer edge of the mask subtended a 29" diameter, well matched to the secondary mirror.
3. The pupil stop image was in sharp focus as revealed by the sharp transition in the detection of the point source when it was moved across the pupil mask image's edge (marked ½ power width).
Put shell out until a.m. empty at 577 lbs.

23 3"
from dewar face

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