COR-1B pre- and post-environmental measurements on SCIP bench, February–June 2005

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This report covers the COR-1B internal alignment measurements made before and after the vibration of the SCIP-B bench, and after thermal vacuum testing (TVAC). The pre-vibration measurements were made on February 02, 2005, the post-vibration measurements were made on March 10, and the post-thermal measurements were made on June 10.

The measurements are made by illuminating the diffuser window in the COR-1 door, and imaging the shadow of the occulter and focal plane mask. Figure 1 is representative of the data.

The region within the occulter penumbra is fitted to extrapolate the positions of the inner and outer penumbral edges. Figure 2 shows the radial distances of the two edges as a function of position angle, relative to the center of a circle fitted to each. There is no discernable difference in Figure 2 between the measurements pre- or post-vibration. This means that the focal plane mask and the occulter did not shift position relative to each other enough to bring the occulter shadow out from behind the focal plane mask shadow.

There are some differences in the post-TVAC curves, particularly for the outer penumbral edge position. However, the critical parameter is the inner edge position, which is where any signatures of an occulter-mask misalignment would appear. The post-TVAC inner edge positions, relative to their respective origins, are consistent with the earlier measurements.

However, there is a shift in the origin of the shadow on the detector after TVAC testing, by about 1.15 pixels (15.5 μm), mostly along the i axis. This is demonstrated in Table 1. It had been established earlier that the i axis on the FPA is equivalent to the vertical direction (i. e. perpendicular to the SCIP bench).

The focal plane mask has an alignment margin of 250 μm. This 1.15 pixel shift is only 6% of the available margin. Since the shape of the inner edge of the focal plane mask shadow does not change, the instrument boresight did not change within the measurement errors.

There is a significant difference in the post-TVAC test from the earlier measurements, in that the background subtraction was not entirely successful. This is a known problem in the current version of the flight software, and may introduce some extra noise which affects the measurement of the outer edge. To further demonstrate that the only change in the post-TVAC data is a shift of the pattern, the post-vibration data was rescaled to the brightness levels of the post-TVAC data, and subtracted from the post-TVAC image. The result is shown in Figure 3. A problem with the occulter-to-mask alignment would show up as a small discrete area of increased difference at the inner penumbral edge, which is not seen.

The conclusion is that COR-1B passed the internal alignment test.

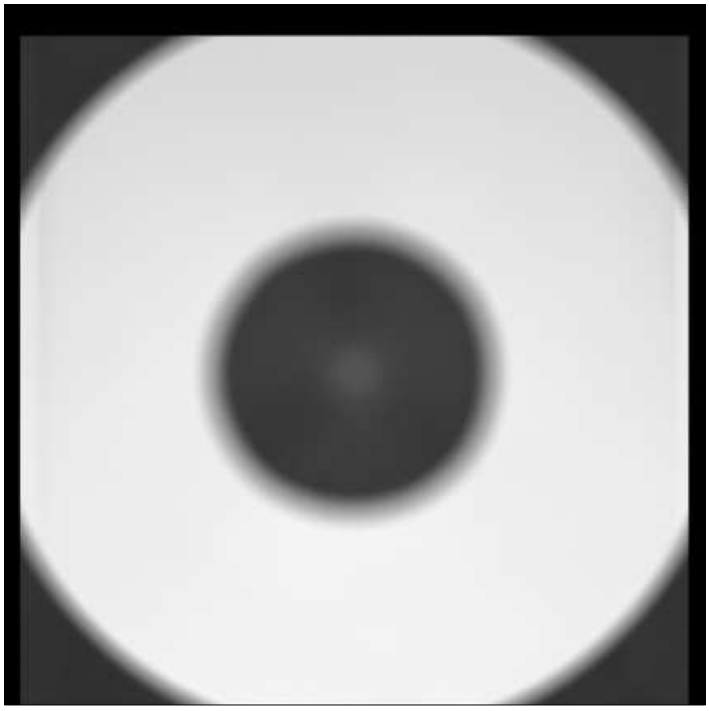

Figure 1: Instrument flat field.

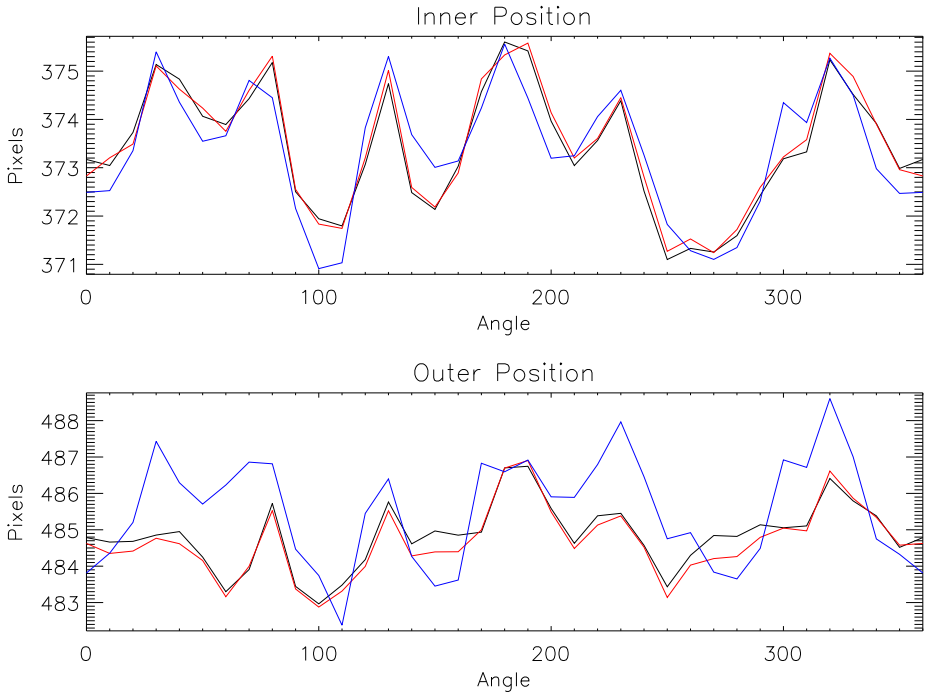

Figure 2: Radial distances of inner and outer penumbral edges. Black: pre-vibration, red: post-vibration, blue: post-TVAC.

Table 1: Origins and average radii of the inner and outer penumbral edges shown in Figure 2.

		i_0	j_0	radius
Pre-vibration	Inner	1067.44	1016.75	373.420
	Outer	1067.12	1015.86	484.834
Post-vibration	Inner	1067.58	1016.62	373.484
	Outer	1067.34	1015.82	484.673
Post-TVAC	Inner	1068.61	1017.01	373.378
	Outer	1068.73	1016.42	485.550

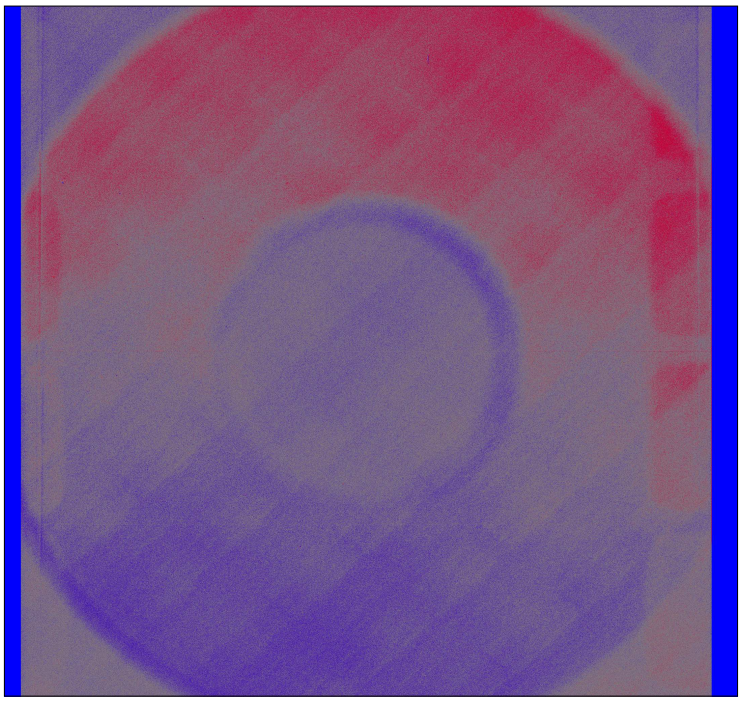

Figure 3: Difference image between post-vibe and post-TVAC data.