MIPS Campaign F
MIPS Team
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Abstract
Campaign F was designed to confirm that focus move and to continue with the calibration of the 24 micron array. However, due to the very rapid cooling of the telescope, backgrounds were low at both 70 and 160 microns. The 160 micron array was working as expected, including the expected loss of readout 3. However, the 70 micron array shows a fixed pattern offset on Side B that had not been seen before in ground test, nor in the previous data obtained on orbit.

1. Focus Determination
A figure similar to that in the Campaign E summary is shown in Figure 1.

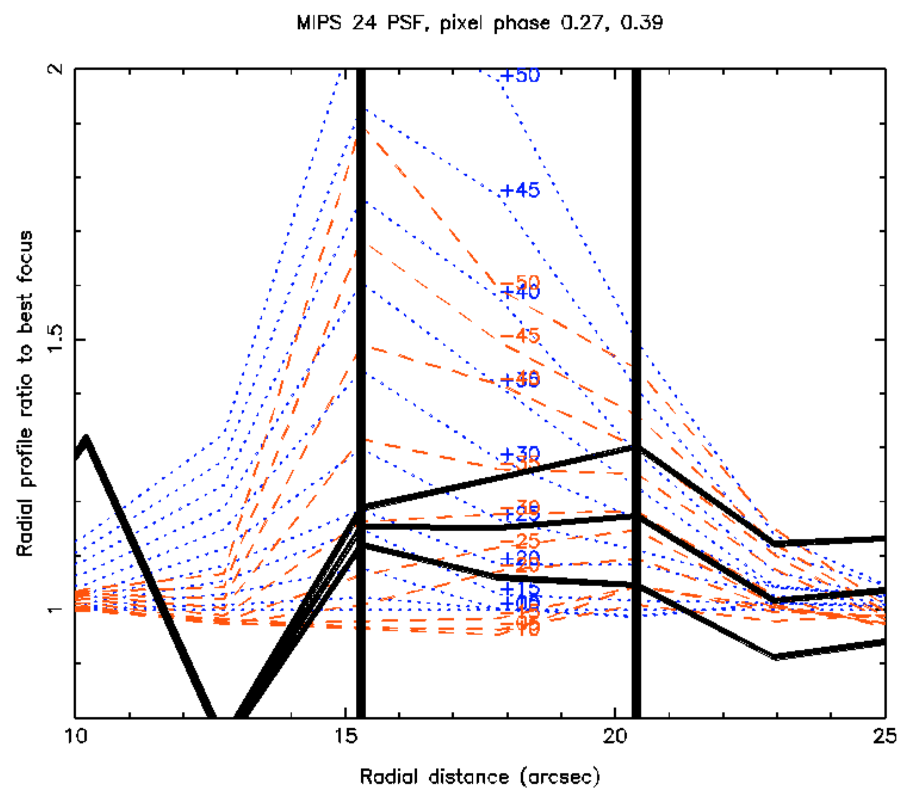

Figure 1. Ratio of Observed to Predicted PSF at 24 Microns. The predicted image is from STinyTim. Both images have been averaged radially. The second dark ring falls between the two heavy vertical lines, and the ratio in that region is what we use to determine focus (other measures of focus use intrinsically bright regions in the image and are less effective for a nearly diffraction limited image). The set of "horizontal" heavy black lines show the data (center) and an estimate of the range permitted by systematic errors (top and bottom). Predictions from STinyTim are in red for negative defocus and blue for positive.

Figure 2 compares the focus determination between Campaigns E (before) and F (after) the focus move.

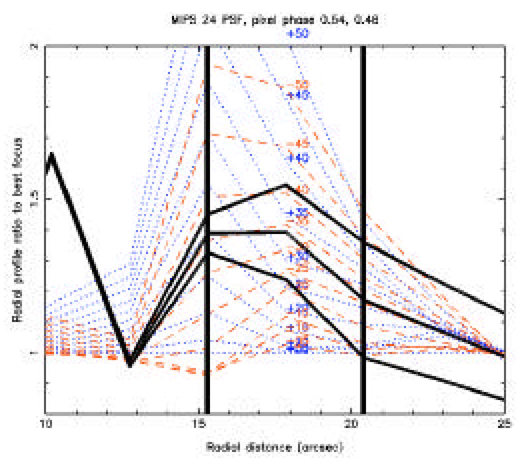

Figure 2. Focus Determinations. Campaign E is to the left and Campaign F to the right. The data indicate an improvement with the adopted focus move. However, in both positions, the 24 micron images are extremely close to perfect diffraction-limited ones.

2. Calibration at 24 Microns

Detailed investigations were carried out of the uniformity of photometry over the 24 micron field of view. The uniformity is within the 4% specification, but there is a small variation in the y coordinate. See Figure 3.

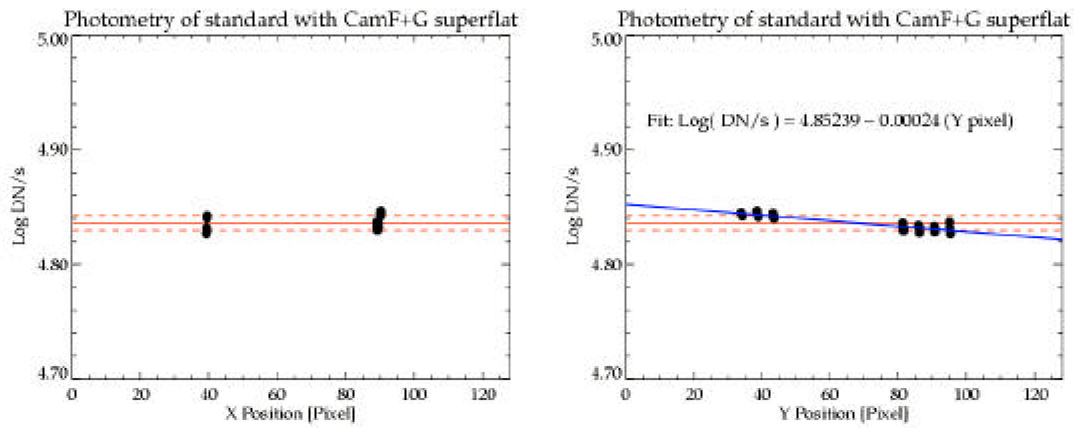

Figure 3. Photometric Variability over the 24 Micron Array. There is a systematic variation at about the 1.5% level with y position.

This effect has been traced to another small anomaly in the flight SUR fitting procedure. It is small enough that it can be corrected in ground processing. An alternative would be to ignore the first array readout after reset, but this approach would significantly reduce the dynamic range, which is based on the difference of the first two accepted readouts of the array.

Figure 4 shows the uniformity as a function of scan mirror angle. There is a slight effect, less than 1%.

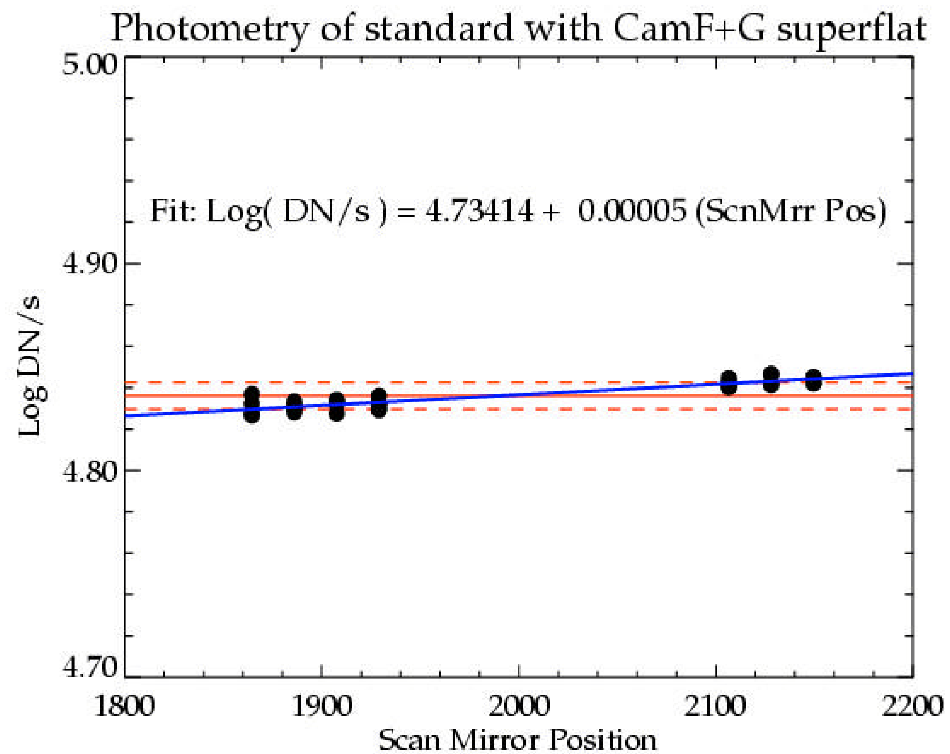

Figure 4. Photometric signal vs. Scan Mirror Position.

Latent images were also measured. Values of 0.7 to 0.8% were found for images at 30, 100, and 300% of the ADC saturation (the latter level would also saturate the arrays). The current photometry AOT design puts the latents within the Airy image, and could lead to small errors in photometry as a function of extraction procedure.

3. Focal Plane Survey

An initial focal plane survey was conducted at 24 microns. The results will be reported along with those for later surveys.

4. Far Infrared Arrays

The 160 micron array was out of saturation and appears to be operating as expected. The 70 micron array was also out of saturation in all scan mirror positions. The result is shown in Figure 5.

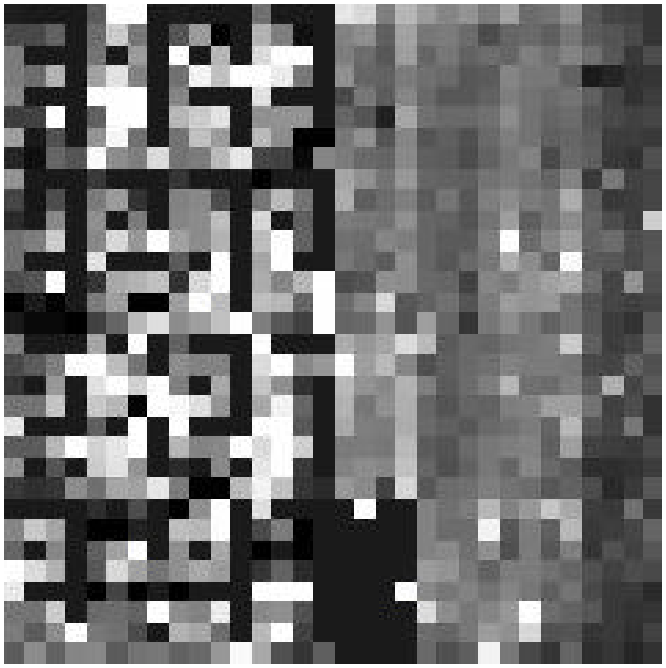

Figure 5. Operation of the 70 Micron Array. The scan mirror is in the "SED" position. Although this is the same measurement condition as the array images displayed in the reports for Campaigns D2 and E, that array now shows a fixed pattern of offsets on Side B. Many of the pixels on this side have been put below the negative rail of the ADC. Side A behaves as expected (except for the loss of readout 4,4).

Unlike previous campaigns, a strong fixed pattern of offsets has corrupted the outputs of Side B of the array. A separate report will be written about this anomaly. Briefly, a circuit analysis indicated that the issue might be a large resistance in the wire that conducts the Vcasn voltage to the Side B readouts. Vcasn controls the current to the readout output transistors. A single Vcasn line provides the voltage for all of Side B. If there were a large impedance in the line conducting it, then it would be susceptible to picking up the address signals that use lines in the same flat cable. Thus, the operating point of the output amplifiers would vary systematically with address, and the data show that is exactly what is happening. In addition, a large impedance in Vcasn will current-starve the outputs, leading to low gain, poor balance of the CTIA circuits, and slow recovery from transient signals (e.g., cosmic rays). All of these symptoms are seen.

Subsequently, laboratory experiments in Tucson verified that a high impedance in the Vcasn line can reproduce the symptoms.

We hypothesize that there is a "cold solder" joint on this line at the dewar vacuum shell that had a large increase in resistance as the vacuum shell cooled from ~ 29K for Campaign E to ~ 3.5K for Campaign F.

5. Summary

Focus was conducted successfully as judged by our results at 24 microns. Detailed examination of the photometric properties of the instrument indicates a small correction that will improve the uniformity over the field of view (already within specification without the correction). It may be desirable to redesign the photometry AOT to provide greater separation of primary and latent images, but the latents are < 1% so the improvements will be minor. With the vacuum shell cold, it appears that the Vcasn line has a large resistance, and as a result Side B of the 70 micron array is corrupted. The 160 micron array appears to be working as expected.