# SIRTF Telescope Temperatures
# vs.
# 24μm Signals

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**Abstract**

The signals observed with the MIPS 24 micron array agree well with the predictions of the MIPS radiometric model and the telescope temperatures, over a range of 10,000 in telescope emission from a secondary temperature of 58K to 28K.

The goal of this report is to compare the backgrounds measured with MIPS at 24μm with the temperatures of the SIRTF telescope in MIPS Campaigns D1, D2, and E. As a first step, the radiometric model was correlated to fit the output signals to observations of a standard star and of various backgrounds. A "whole image" signal was derived for the star by measuring it to a large radius on the detector array. A good fit was achieved assuming that the detector gain is 1 (as opposed to the 0.85 estimated prior to launch), the quantum efficiency is 63% (preflight measurement 60%) and the instrument throughput 70% (preflight estimate 66%). The telescope was taken to be at the temperature of the secondary mirror, and the emissivity was adjusted to optimize the fit, arriving at a final value of 0.184. The results are shown in Figure 1.

The signals from the telescope should be small by the time of Campaign E. Although we believe the zodiacal light model is more accurate than this adjustment indicates, to improve the fit we arbitrarily increased the zodiacal brightness input in our most intensively observed field from 19 MJy/sr to 23 MJy/sr. In addition, we felt that the effective emissivity for the telescope in this band was likely to be close to 0.23. This value arises because the cold Lyot stop in the instrument is 10% oversized, and the areas seen beyond the edge of the telescope exit pupil should all be high emissivity. It is plausible that the somewhat lower emissivity in the fit arises because some of the signal from the telescope arises from surfaces that are colder than the secondary mirror. Therefore, in the new model, we fixed the emissivity of the telescope at 0.23 and divided it between the secondary temperature and the primary temperature (2K colder).

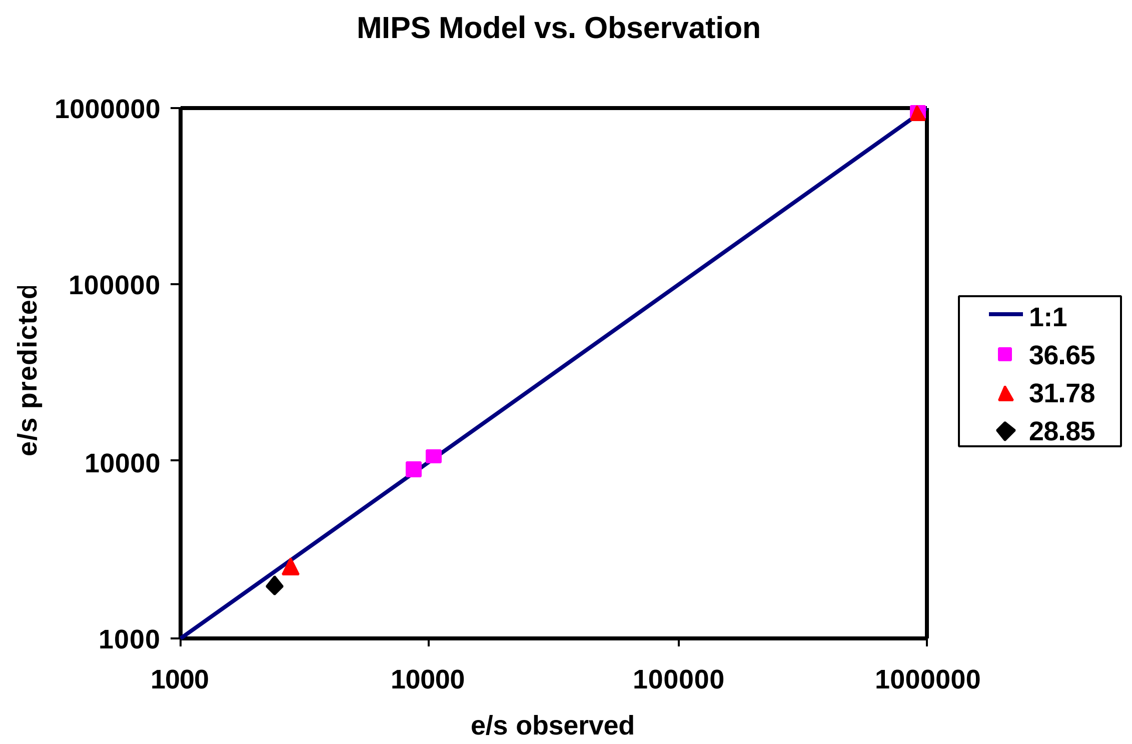


**Figure 1. Comparison of MIPS model with signals on a standard star and on the combination of telescope and sky background. The fit is excellent, although there is a slight tendency for the observed detector currents to exceed the predictions when the telescope is cold and not dominating the signal.**

Our emissivity estimate is consistent with that calculated for the initial IRAC data. The IRAC calculations were made before it was appreciated that the throughput was about a factor of two less than the prelaunch estimates, and hence a value that is about a factor of two too low was reported (W. Reach, private communication).

A good fit was found with a net emissivity of 10% at the lower temperature and 13% at the higher one. Although there is no direct measurement to constrain these values, they are plausible - implying that the secondary mirror as viewed by MIPS is a few per cent oversized, with other colder emitting areas including the secondary supports and the central baffle on the primary. The view past the edge of the secondary is taken to be black and at the temperature of the secondary. The results of the modeling are listed in Table 1. In addition, we have used the attenuation factor of 300 observed in the 24 micron dark position in Campaign D1 to estimate the background in Campaign C. In this latter campaign, we were unsaturated in the dark position at about 1000 DN/s. Applying a conversion of 5e/DN, we estimate we would have seen 1,500,000 e/s viewing through the telescope (where the data were hard saturated, given the well depth of 320,000 e).

| Table 1. Two-Temperature Model vs. Signal | | |
|---|---|---|
| **Campaign** | **Predicted** | **Observed** |
| C | 2,000,000 | ~ 1,500,000 |
| D1 | 8816 | 8800 |
| D2 | 2807 | 2800 |
| E | 2376 | 2400 |

The only artificial aspect to this model is the 20% increase in sky brightness. It is possible that this is an indication of excess wide-angle stray light reaching the array (the specification on stray light was for it to be less than 20%, although the predictions are that it would be much smaller), or that there is some warmer area in the telescope that is being viewed and that mysteriously gives a constant excess signal.

However, the basic conclusion is that a model that incorporates values extremely close to the prelaunch estimates succeeds in predicting the 24μm signal from the SIRTF telescope corresponding to the measured temperatures. This correlation holds at least over the range from 36.65 to 28.85K, and reasonably well up to 58K (the temperature of the secondary for Campaign C). Over this range, the telescope signal changed by about a factor of 60 according to the model, or a factor 10,000 including Campaign C data. I conclude that the radiation from the telescope is in good agreement with the measured temperatures.