ACIS Memo #170
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To: ACIS Team
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Subject: Hot Pixels in FI devices
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1 Introduction

This memo describes analysis used to identify hot pixels that have developed since launch. Dark current data at -90° (September 10, 1999) and -60° (September 19, 1999) was utilized for this work.

2 Analysis

A hot pixel is simply a pixel that, after overclock correction, exceeds a certain value. One technique used to locate hot pixels is to utilize the difference histograms generated in standard dark current analysis. Dark current is calculated by histograming the difference of a long (typically 9.9 s) and short (typically 3.3 s) bias frame. The centroid of a gaussian fit to the profile is a measure of the dark current. Hot pixel identification follows by defining any pixel with a value 10σ above the centroid as hot.

One concern in using this method for flight-data analysis is that a high-side tail should exist in the profiles, due to particle-background-induced charge not fully removed from the bias map. To gauge how severe a problem this might be in masking real hot pixels, we examined dark current data taken at -90° on September 19, 1999. The tails do not extend above 40 ADU for any of the FI chips. When we tabulate the number of hot pixels at -60°, then, a lower threshold of 40 ADU is employed to avoid the possibility of including pixels that have residual charge. At -60° the gaussians used to fit the FI dark current data have widths of about 2.6 ADU; thus, the 40 ADU threshold corresponds to a $\sim 15\sigma$ lower threshold for a hot pixel.

3 Results

Table 1 lists the number of hot pixels found in all ACIS devices when the focal plane temperature is at -60°. For each array, data was taken using nominal clock voltages and clocks set to ± 5 V. The first column corresponds to the nominal clocks, the second column to the other clock levels. There is a marked decrease in the number of hot pixels in FI devices[1] observed when the clocks are switched from the nominal levels to ± 5 V.

Hot pixel locations for the I-array are shown in Figures 1 and 2, while those for the S-array are shown in Figures 3–5. The maps are orientated so that the CCD pixel (1,1) is the in the lower left corner; quadrants

[1]The nominal operating levels for the BI chips are ± 5 V, so no change in the number of hot pixels is observed, as expected.

Chip	Nominal Clocks Hot Pixels	Clocks at ±5 V Hot Pixels
I0	1266	672
I1	1217	663
I2	1568	813
I3	1440	814
S0	1686	937
S1	15114	15224
S2–I	2390	1435
S2–S	2072	1226
S3–I	8777	8049
S3–S	7937	7804
S4	1993	1378
S5	1549	855

Table 1: Number of hot pixels present at T = -60°on September 19, 1999. Refer to §2 for details on the identification of a hot pixel. Notice the decrease in hot pixels when the clock levels are switched from their nominal values to ±5 V.

A–D are situated left to right, and charge is clocked out of the device top to bottom. Here, we only display the hot pixels maps from the data obtained with the clocks operated at their nominal values.

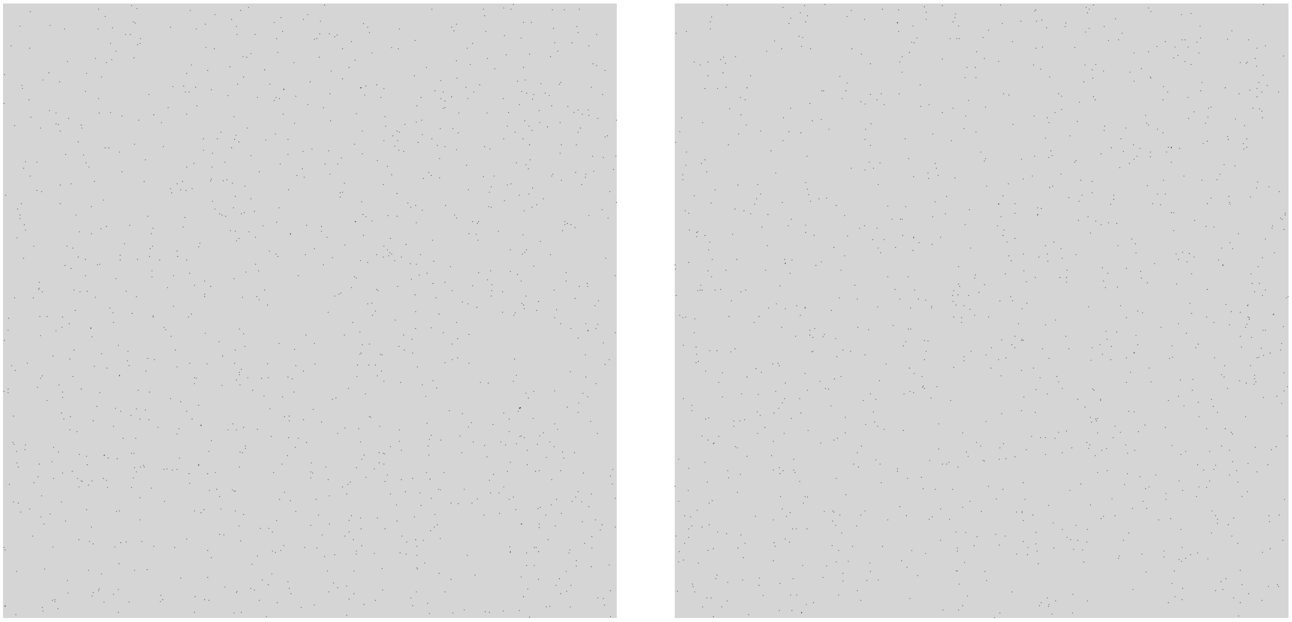

Figure 1: Hot pixels in I0 and I1.

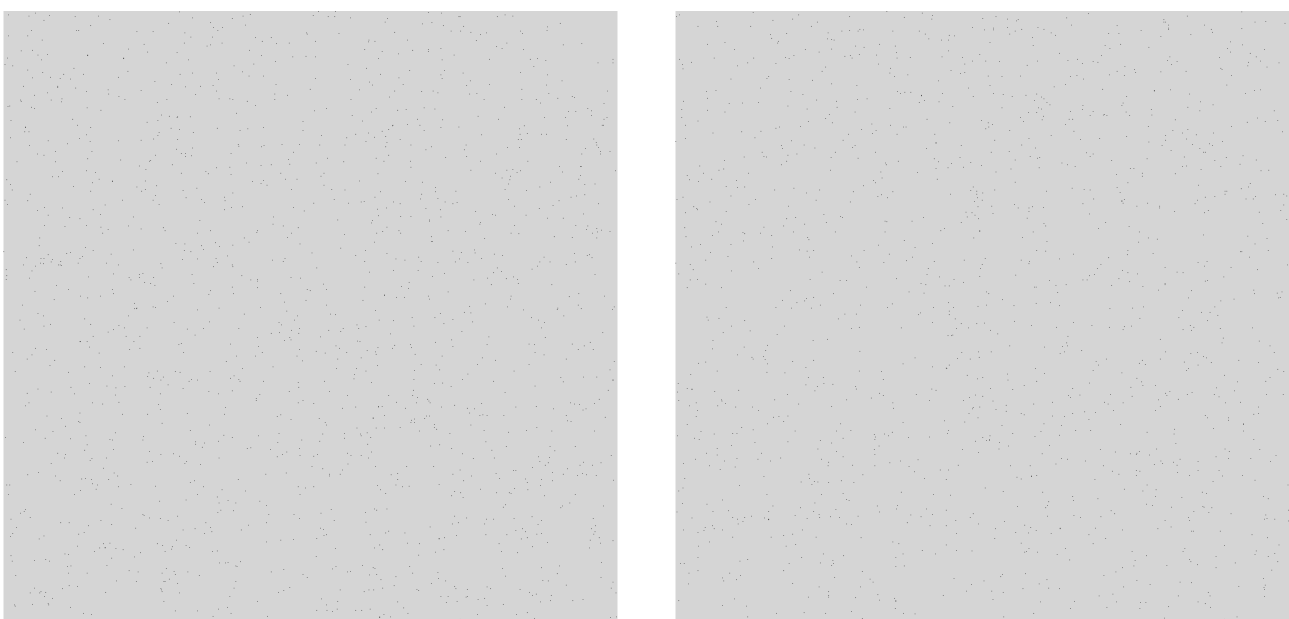

Figure 2: Hot pixels in I2 and I3.

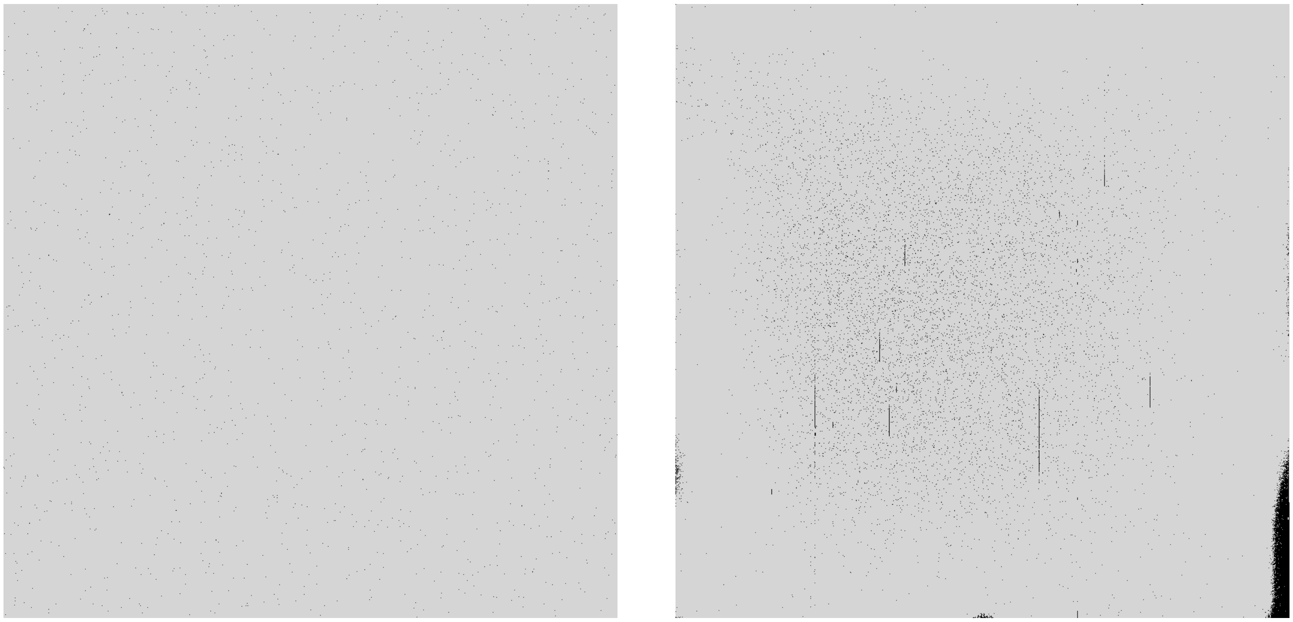

Figure 3: Hot pixels in S0 and S1.

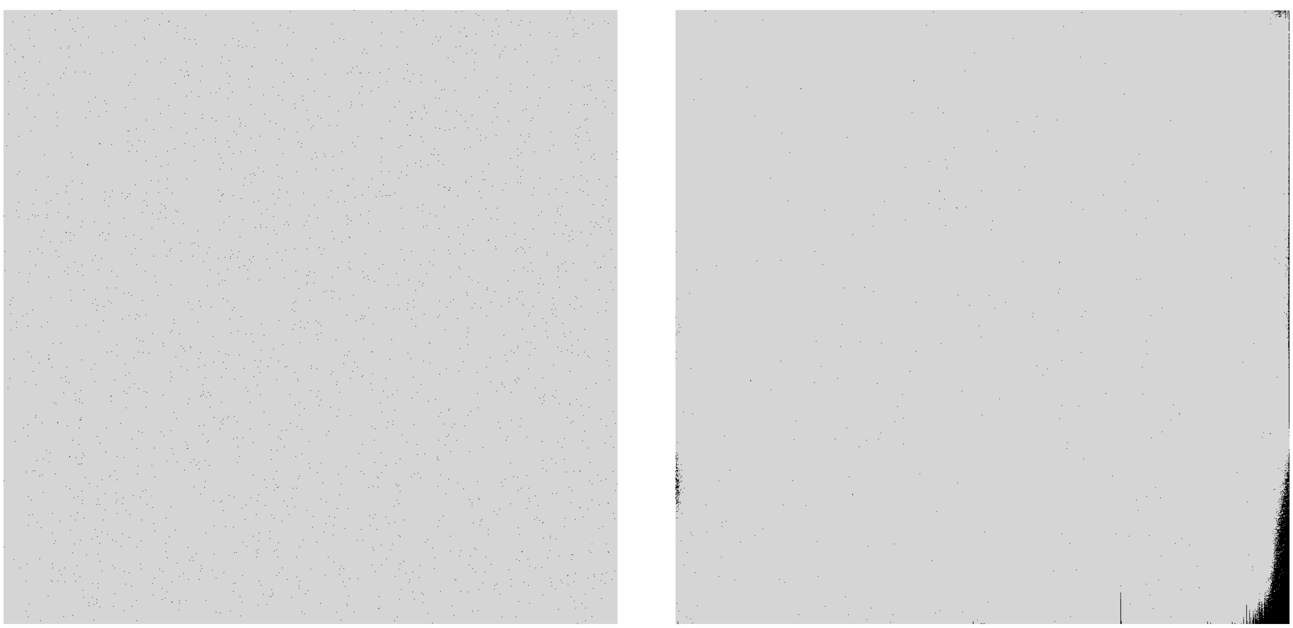

Figure 4: Hot pixels in S2 and S3.

Figure 5: Hot pixels in S4 and S5.