

ACIS Memo # 197
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To: ACIS Team
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Subject: Flight experience with bakeouts
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There were two occasions during OAC in which the ACIS focal plane was substantially warmed up; the first was a bakeout to room temperature on the morning of 1999:256, the second was a dark current test taken at -60 degrees on day 1999:262. This memo will list the relevant CTI data and the change in CTI associated with each event. All CTI data is listed in units of 10^{-5} . The influence of the particle background rate on the measured CTI will also be discussed.

1 Bakeout to Room Temperature

There are two observations that can be used to measure the CTI change due to the bakeout. These are ObsID 62428 and 62418, taken before and after the room temperature bakeout, both at a temperature of -100C.

Time history:

1999:254:1656	Rad belt passage (ACIS-S+NONE)
1999:255:0900	ObsID 62428 -100C faint mode on s2,s3
1999:256:0907	Bakeout to room temperature
1999:257:0256	ObsID 62418 -100C faint mode on s2,s3
1999:257:0857	Rad belt passage (ACIS-S+NONE)

There were other observations at other temperatures in this time period, however none of them are repeated both before and after the bakeout without an intervening radiation belt passage. Table 1 lists the CTI and background data from the room temperature bakeout. Below is a summary of the CTI change.

CTI **increase** from room temperature bakeout:

FI CCD:	7.02 ± 0.09	$(32.3\% \pm 0.5\%)$
BI CCD:	0.05 ± 0.03	$(9.1\% \pm 5.5\%)$

The reject rates indicate that the particle background was lower during the second observation which will produce a higher measured CTI. A linear extrapolation of the CTI/background detrending factor at -120C and -110C to this data at -100C yields an expected FI CTI increase due to the

Table 1: CTI and background data from room temperature bakeout

ObsID	CTI	Error	Rej.Rate	Error
S2:				
62428	20.47	0.08	175.55	0.50
62418	27.49	0.04	170.89	0.24
S3:				
62428	0.55	0.03	78.10	0.27
62418	0.60	0.01	75.08	0.13

background alone of ~ 0.30 , much smaller than the measured increase. Applying the detrending factors at -120C or -110C directly would yield an even smaller expected increase. Alternatively, one could hypothesize that the effects of the particle background on the fractional change in CTI should be independent of temperature. This would yield an expected FI CTI increase of 0.05 - 0.20, still much smaller than the measured change.

2 Dark Current Test at -60C

Time history:

1999:260:0034	Rad belt passage (ACIS-S+HETG)
1999:260:1904	ObsID 62535 -110C faint mode on s2,s3
1999:261:1501	ObsID 62534 -110C faint mode on s2,s3 warmed to -60C, cooled back down
1999:262:1046	cold boot
1999:262:1226	ObsID 1304 -110C faint mode on s2,s3
1999:262:1518	Rad belt passage (HRC-S+NONE)
1999:263:0151	ObsID 1306 -110C faint mode on s2,s3
1999:264:1652	ObsID 1310 -110C I-array faint mode
1999:265:0424	ObsID 1311 -110C S-array faint mode
1999:265:0729	Rad belt passage (HRC-S+NONE)

The data used here extends beyond a radiation belt passage because the ACIS detector was in the protected HRC-S position. CTI and background data from the individual observations are listed in Table 2. Below is a summary of the CTI change.

CTI **decrease** from dark current test at -60C:

FI CCD:	0.94 ± 0.04	$(4.5\% \pm 0.2\%)$
BI CCD:	0.04 ± 0.02	$(3.8\% \pm 1.9\%)$

The reject rates indicate the particle background was higher during the second set of observations which will produce a lower measured CTI. A linear correlation of CTI and s3 higher energy reject rates for ExtCalSrc observations taken from September 1999 through January 2000 (T=-110C) yields a detrending factor of -5.62×10^{-7} CTI / (s3 amp_rej cts/frame). The measured

Table 2: CTI and background data from dark current test at -60C

ObsID	CTI	Error	Rej.Rate	Err
S2 before:				
62535	21.00	0.05	174.06	0.50
62534	21.03	0.05	171.71	0.46
Mean	21.02	0.04	172.79	0.34
S2 after:				
1304	20.04	0.03	174.24	0.33
1306	20.05	0.03	178.31	0.34
1310	20.06	0.06	170.50	0.56
1311	20.33	0.06	168.83	0.62
Mean	20.08	0.02	174.63	0.20
S3 before:				
62535	1.05	0.03	75.07	0.28
62534	1.07	0.03	74.49	0.25
Mean	1.06	0.02	74.75	0.19
S3 after:				
1304	1.02	0.02	76.04	0.18
1306	1.00	0.02	77.73	0.18
1310	1.06	0.02	73.41	0.24
1311	0.99	0.03	73.77	0.26
Mean	1.02	0.01	75.75	0.10

background increase of 1 count/frame yields an expected FI CTI decrease of ~ 0.06 , which is much smaller than the measured decrease.