

**ACIS Memo #169**  
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To: ACIS Team  
From: Catherine Grant  
Subject: Time History of CTI for S2 and S3  
Date: 20 September 1999

This memo presents a time history of CTI change for the S2 and S3 ACIS CCDs. All the data were taken in faint mode of the external calibration source. The eventlist and bias map are products of PSCI (<http://acis.mit.edu/ttools/psci>). The grade selection done on-board rejected ACIS grades 24, 66, 107, 214 and 255. No additional grade selection was applied on the ground. In similar analysis done by Gregory Prigozhin, the event and split thresholds were set higher than standard levels, however he confirms that using standard thresholds is best. The events were bias and delta overclock corrected in IDL at MIT. The Mn-K $\alpha$  line (5.9 keV) was used to measure the CTI. Each node of each CCD was divided into five groups of 200 rows each to produce a spectrum of center pixel values in ADU. The Mn-K $\alpha$  line in each spectrum was fit to a Gaussian profile. A linear fit was performed on the Gaussian centroid versus row number relationship. The CTI is then calculated from the results of the linear fit as

$$CTI = -(slope/intercept)$$

The measured CTI for the external calibration source measurements is shown in Table 1. Figure 1 shows the time history of CTI measured at -110 C for both S2 and S3. Of particular interest are the measurements from day 260 through day 263. In both these cases, the measured CTI does not significantly change during passage through the radiation belts. During the passage on 260, ACIS was in the focus position, while during the passage on 262-263, ACIS was in the next-in-line position. A small drop in CTI is seen from Obs ID 62534 to 1304 (day 262), however between these observations the focal plane temperature was increased to -60 C for CTI and dark current measurements and then cooled back down to -110 C. The dependence of CTI on focal plane temperature is presented in my previous memo (ACIS memo #168, 19 Sept).

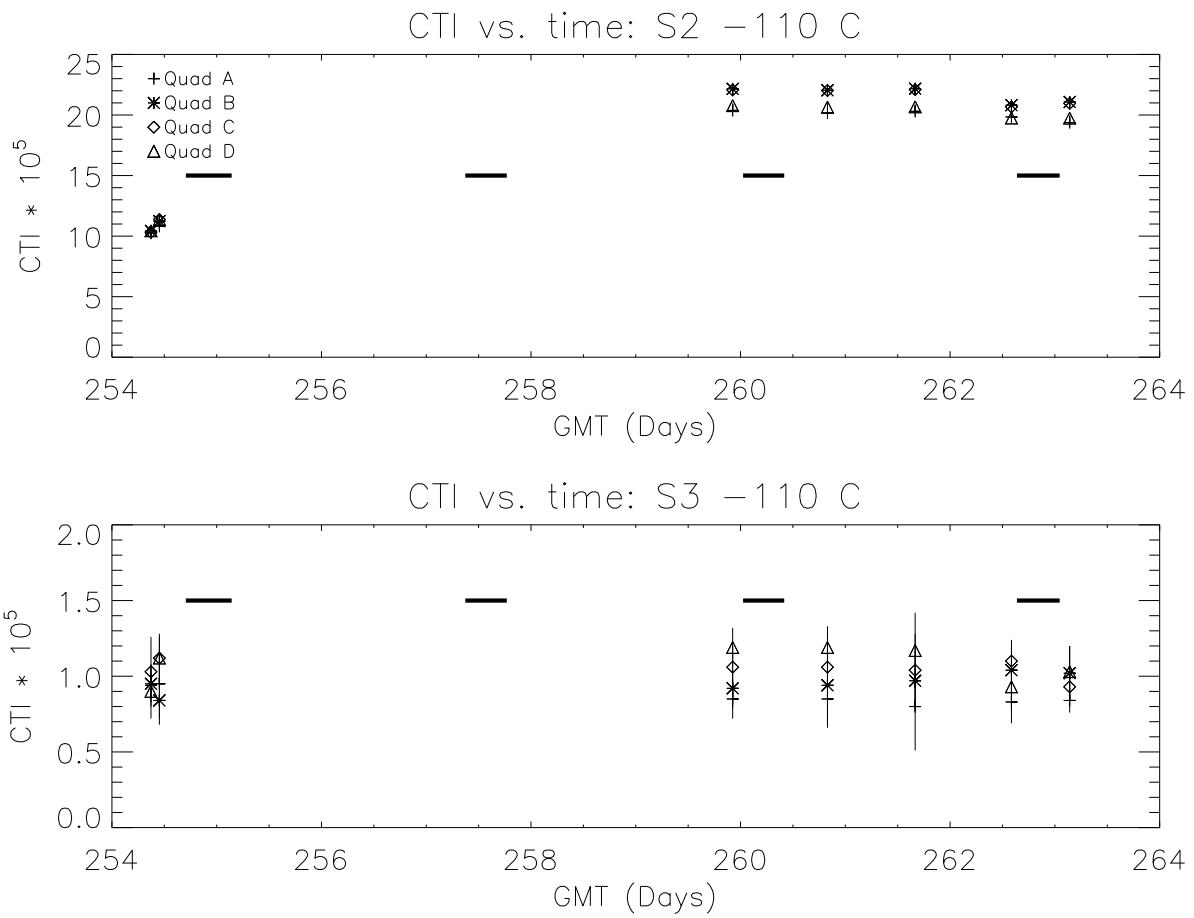


Figure 1: CTI measurements at Mn-K $\alpha$  (5.9 keV) for -110 C .

Table 1: CTI Measurements at Mn-K $\alpha$  of External Calibration Source

Obs. ID	GMT Date	FP Temp	Quad A CTI	Quad B CTI	Quad C CTI	Quad D CTI
— S2 —						
62411	252 (9 Sept)	-99.5	19.31 $\pm$ 1.10	20.90 $\pm$ 0.72	20.16 $\pm$ 29	20.42 $\pm$ 0.70
62401	254 (11 Sept)	-109.0	10.24 $\pm$ 0.25	10.43 $\pm$ 0.14	10.33 $\pm$ 0.16	10.44 $\pm$ 0.31
62430	254 (11 Sept)	-109.2	10.81 $\pm$ 0.19	11.23 $\pm$ 0.31	11.37 $\pm$ 0.23	11.38 $\pm$ 0.29
62428	255 (12 Sept)	-99.6	21.30 $\pm$ 0.57	22.78 $\pm$ 0.82	22.00 $\pm$ 0.38	22.54 $\pm$ 0.85
62425	255 (12 Sept)	-118.9	7.89 $\pm$ 0.12	8.11 $\pm$ 0.05	8.27 $\pm$ 0.14	8.22 $\pm$ 0.06
62418	257 (14 Sept)	-99.3	31.61 $\pm$ 4.99	29.17 $\pm$ 0.39	31.82 $\pm$ 4.78	28.33 $\pm$ 0.45
62537	259 (16 Sept)	-109.2	20.38 $\pm$ 0.13	22.16 $\pm$ 0.23	22.07 $\pm$ 0.29	20.77 $\pm$ 0.20
62535	260 (17 Sept)	-109.0	20.16 $\pm$ 0.18	22.04 $\pm$ 0.28	22.02 $\pm$ 0.28	20.66 $\pm$ 0.32
62534	261 (18 Sept)	-109.2	20.30 $\pm$ 0.18	22.17 $\pm$ 0.24	22.10 $\pm$ 0.22	20.67 $\pm$ 0.21
62533	261 (18 Sept)	-104.3	31.01 $\pm$ 0.44	34.33 $\pm$ 1.10	34.32 $\pm$ 0.74	34.00 $\pm$ 1.28
62532	261 (18 Sept)	-89.7	59.98 $\pm$ 2.50	58.74 $\pm$ 0.21	59.21 $\pm$ 0.55	55.32 $\pm$ 1.30
62531	261 (18 Sept)	-79.7	63.81 $\pm$ 1.50	61.97 $\pm$ 2.76	65.90 $\pm$ 1.25	61.50 $\pm$ 2.47
62530	261-262 (18-19 Sept)	-69.6	65.38 $\pm$ 5.39	59.04 $\pm$ 2.21	65.28 $\pm$ 4.86	60.17 $\pm$ 2.27
62529	262 (19 Sept)	-59.4	51.22 $\pm$ 12.08	47.34 $\pm$ 1.96	48.68 $\pm$ 2.66	47.27 $\pm$ 2.03
1304	262 (19 Sept)	-109.4	19.84 $\pm$ 0.19	20.81 $\pm$ 0.28	20.67 $\pm$ 0.29	19.75 $\pm$ 0.26
1306	263 (20 Sept)	-109.2	19.38 $\pm$ 0.25	21.08 $\pm$ 0.22	20.96 $\pm$ 0.36	19.74 $\pm$ 0.24
— S3 —						
62411	252 (9 Sept)	-99.5	0.49 $\pm$ 0.16	0.37 $\pm$ 0.27	0.41 $\pm$ 0.22	0.44 $\pm$ 0.14
62401	254 (11 Sept)	-109.0	0.94 $\pm$ 0.08	0.95 $\pm$ 0.12	1.03 $\pm$ 0.23	0.90 $\pm$ 0.18
62430	254 (11 Sept)	-109.2	0.95 $\pm$ 0.23	0.84 $\pm$ 0.16	1.12 $\pm$ 0.14	1.12 $\pm$ 0.16
62428	255 (12 Sept)	-99.6	0.48 $\pm$ 0.10	0.52 $\pm$ 0.13	0.58 $\pm$ 0.12	0.55 $\pm$ 0.10
62425	255 (12 Sept)	-118.9	1.26 $\pm$ 0.17	1.36 $\pm$ 0.14	1.25 $\pm$ 0.22	1.54 $\pm$ 0.13
62418	257 (14 Sept)	-99.3	0.46 $\pm$ 0.03	0.58 $\pm$ 0.14	0.70 $\pm$ 0.08	0.60 $\pm$ 0.08
62537	259 (16 Sept)	-109.2	0.85 $\pm$ 0.13	0.92 $\pm$ 0.13	1.06 $\pm$ 0.14	1.19 $\pm$ 0.13
62535	260 (17 Sept)	-109.0	0.85 $\pm$ 0.19	0.94 $\pm$ 0.24	1.06 $\pm$ 0.18	1.19 $\pm$ 0.14
62534	261 (18 Sept)	-109.2	0.80 $\pm$ 0.29	0.97 $\pm$ 0.20	1.04 $\pm$ 0.24	1.17 $\pm$ 0.25
62533	261 (18 Sept)	-104.3	0.48 $\pm$ 0.09	0.66 $\pm$ 0.13	0.67 $\pm$ 0.06	0.74 $\pm$ 0.05
62532	261 (18 Sept)	-89.7	0.58 $\pm$ 0.05	0.35 $\pm$ 0.03	0.50 $\pm$ 0.09	0.29 $\pm$ 0.14
62531	261 (18 Sept)	-79.7	0.45 $\pm$ 0.20	0.74 $\pm$ 0.17	0.64 $\pm$ 0.10	0.44 $\pm$ 0.11
62530	261-262 (18-19 Sept)	-69.6	1.05 $\pm$ 0.12	1.02 $\pm$ 0.13	1.21 $\pm$ 0.14	1.08 $\pm$ 0.12
62529	262 (19 Sept)	-59.4	2.48 $\pm$ 0.15	1.96 $\pm$ 0.08	2.35 $\pm$ 0.05	2.69 $\pm$ 0.25
1304	262 (19 Sept)	-109.4	0.83 $\pm$ 0.14	1.04 $\pm$ 0.15	1.10 $\pm$ 0.14	0.93 $\pm$ 0.16
1306	263 (20 Sept)	-109.2	0.84 $\pm$ 0.08	1.02 $\pm$ 0.18	0.93 $\pm$ 0.09	1.03 $\pm$ 0.17

Note: All CTI values are multiplied by  $10^5$