ACIS Memo # 164

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To: ACIS Team
From: Catherine Grant
Subject: Gain Change in ACIS CCDs during OAC Phase 2
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This note presents preliminary analysis of the temporal variability of the ACIS FI CCD gain. The data used was taken at -100 C in event histogram mode while ACIS was viewing the external calibration source (See Table 1). One objective of this analysis is to determine if the decline in CCD gain over time is a smoothly decreasing funciton or if sharper drops occur in conjunction with other spacecraft events such as radiation belt passage.

Table 1: Event Histogram Data of External Calibration Source during OAC Phase 2

Sci. Run	Obs. ID	Array[1]	GMT Date	
190	1299	I	247-248	(4-5 Sep 99)
191	62393	S	248	(5 Sep 99)
192	151	S	248-249	(5-6 Sep 99)
	— Two Radiation Belt Passages —			
209	1167	I	252	(9 Sep 99)
210	1244	I	252	(9 Sep 99)
217	62410	S	253	(10 Sep 99)
218	1246	S	253	(10 Sep 99)
225	62405	S	253	(10 Sep 99)
226	62404	S	253-254	(10-11 Sep 99)
	— One Radiation Belt Passage —			
238	62424	S	255-256	(12-13 Sep 99)

[1] S Array: S0, S1, S3, S4, S5
I Array: I0, I1, I2, I3, S2

The external calibration source produces three strong K-α lines of Al (1.49 keV), Ti (4.5 keV) and Mn (5.9 keV). In this note only the Mn-Kα line of chip S0 is examined. A fuller analysis of the entire focal plane is in progress. A single Gaussian was fit to the Mn-Kα line for each histogram. The Mn-Kα centroid in ADU and FWHM in eV as a function of time are shown in Figure 1 for each quadrant of the S0 chip. Table 2 shows the mean and standard deviation of the Mn-Kα peak

Table 2: Mean and Standard Deviation of Mn-Kα Peak Value

Dates	Quad A Mean (ADU)	Quad B Mean (ADU)	Quad C Mean (ADU)	Quad D Mean(ADU)
1) 247-249	1538.7 ± 0.8	1507.2 ± 0.5	1450.7 ± 0.7	1448.4 ± 0.8
	— Two Radiation Belt Passages —			
2) 252-254	1518.1 ± 1.2	1484.3 ± 0.9	1428.7 ± 1.3	1425.6 ± 1.8
	— One Radiation Belt Passage —			
3) 255-256	1507.3 ± 3.2	1475.6 ± 1.1	1418.0 ± 2.9	1414.5 ± 1.8
1) - 2)	20.6 ± 1.4	22.9 ± 1.0	22.0 ± 1.5	22.8 ± 2.0
2) - 3)	10.8 ± 3.4	8.7 ± 1.4	10.7 ± 3.2	11.1 ± 2.5

value for the three groups of data separated by radiation belt passages. All three are consistent with little or no gain change within a single orbit.

As a further check for time trends in the data, each group was fit to a linear function. These results, shown in Table 3, are again consistent with little or no gain change within a single orbit with the exception of group 3. At the beginning of group 3 the focal plane was warmed up from -120 C to -100 C. While the first 6000 frames were not included in this analysis, the steep drop in peak ADU seen during group 3 could be caused by the temperature change.

Table 3: Change of Mn-Kα Peak Value during a Single Orbit

Dates	Quad A Slope (ADU/day)	Quad B Slope (ADU/day)	Quad C Slope (ADU/day)	Quad D Slope (ADU/day)
1) 247-249	+0.8 ± 0.4	+0.7 ± 0.2	+0.6 ± 0.3	+0.9 ± 0.4
2) 252-254	+1.2 ± 1.0	+1.2 ± 0.6	+0.4 ± 1.2	+3.6 ± 0.6
3) 255-256	–20.0 ± 11.7	–5.9 ± 3.3	–18.6 ± 9.1	–11.5 ± 3.8

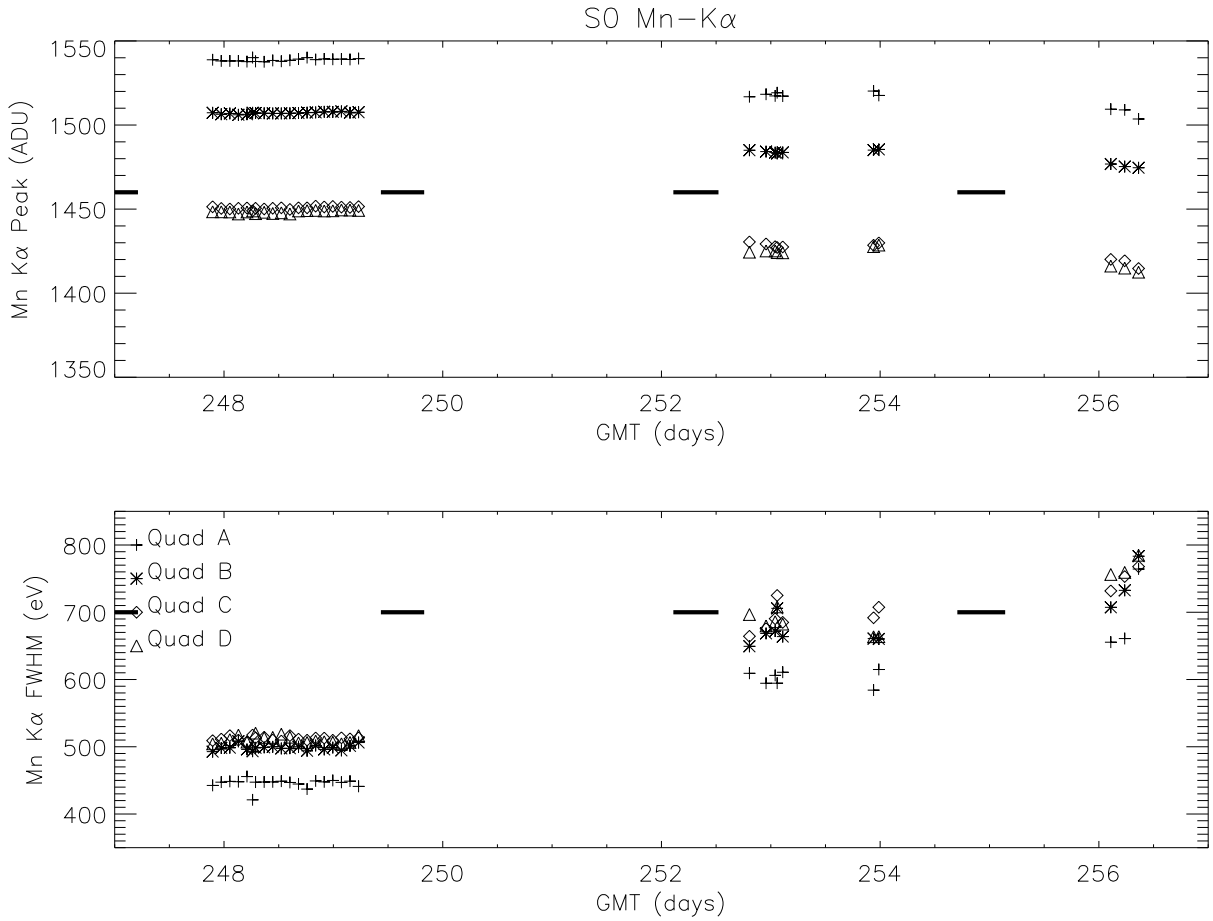

Figure 1: Time dependence of the Mn-Kα peak and FWHM for each quadrant of chip S0. Radiation belt passages are marked as a horizontal line.