1.3 Energy Scale and Spectral Redistribution Function

1.3.1 Energy Scale and Spectral Resolution

1.3.1.1 Purpose

The purpose of this section is to present the correct response from incident X-ray energy to detected pulse height for the ACIS flight instrument. Also presented is the spectral resolution of the ACIS flight devices.

1.3.1.2 Measurements

The XRCF energy scale and spectral resolution results presented here have been based on phase I telemetry data.

XRCF phase I was performed with the ACIS flight instrument, but without the High Resolution Mirror Assembly or the gratings. The full ACIS focal plane was illuminated with X-rays from either the Electron-Impact Point Source or the Double Crystal Monochrometer.

During XRCF phase I, the detector electronics temperature was 13° C and the focal plane temperature was $-110°$ C.

ACIS was run in the full frame timed exposure mode, with a 3.34 second exposure time. During most science runs, six of the CCDs were read out simultaneously. A single science run included a number of TRW IDs, and in a few cases multiple energies as well. Subarrays of various sizes were used to avoid telemetry saturation.

Table 1.4 describes each of the science runs used in this section.

1.3.1.3 Data Processing

The ACIS FEP processing mode was timed exposure faint 3x3 with an event threshold of 38 ADU for the front illuminated devices and 20 ADU for the back illuminated devices. The split threshold was 13 ADU for all measurements.

Science Run	Source	Energy eV	FI Window Rows	BI Window Rows	CCDs	TRW IDs
69	EIPS O-K	525	500	156	s0 s2 s4-5	
70	EIPS O-K	525	250	78	s0-5	I-IAS-EA-2.001 - 2.006
71	EIPS O-K	525	250	78	i0-3 s2-3	I-IAI-EA-1.001 - 1.004
72	EIPS Si-K	1740	56	50	s0 s2 s4-5	I-IAS-EA-2.013 - 2.018
75	EIPS Si-K	1740	56	50	i0-3 s2	I-IAI-EA-1.009 - 1.012
77	EIPS Fe-K	6399	46	46	i0-3 s3	
78	EIPS Fe-K	6399	46	46	i0-1 i3 s3	I-IAI-EA-1.025 - 1.028
83	EIPS Fe-K	6399	46	46	i0-2 s2-3	I-IAI-EA-1.028
84	EIPS Fe-K	6399	46	46	s0-5	I-IAS-EA-2.037 - 2.042
91	EIPS Cu-K	8040	30	30	i0-3 s2-3	I-BND-BU-2.004
92	EIPS Cu-K	8040	20	30	i0-3 s2-3	I-IAI-EA-1.029 - 1.032
93	EIPS Cu-K	8040	20	30	s0-5	I-IAS-EA-2.043 - 2.048
96	EIPS C-K	277	1024	512	s0-5	I-BND-BU-2.037
97	EIPS C-K	277	512	1024	s0-5	I-IAS-EA-2.049 - 2.050
100	EIPS Ti-K	4509	28	24	s0-5	I-IAS-EA-2.032, 2.034
104	EIPS Ti-K	4509	28	24	i0-3 s2-3	I-IAI-EA-1.024
111	EIPS Al-K	1487	24	20	s0-5	I-IAS-EA-2.029 - 2.031
112	EIPS Al-K	1487	24	20	i0-3 s2-3	I-IAI-EA-1.017 - 1.020
114	EIPS Si-K	1740	28	26	i0-3 s2	I-IAI-EA-5.003 - 5.004
115	EIPS O-K	525	250	78	i0-3 s2-3	I-IAI-EA-5.001 - 5.002
116	EIPS O-K	525	250	78	s0-5	I-IAS-EA-2.101 - 2.106
117	EIPS O-K	525	250	78	i0-3 s2-3	I-IAI-EA-1.101 - 1.104
120	EIPS Ti-K	4509	28	24	s0-5	I-IAS-EA-2.131 - 2.132, 2.134
122	EIPS Ti-K	4509	28	24	s0-5	I-IAS-EA-2.133, 2.135 - 2.136
123	EIPS Ti-K	4509	28	24	i0-3 s2-3	I-IAI-EA-1.121 - 1.124
128	DCM	1380	1024	1024	i3 s1 s3	I-IAI-EA-1.204 - 1.206
131	DCM	1770	512	512	i3 s1 s3	I-IAI-EA-1.213 - 1.215
132	DCM	4500	1024	1024	i3 s1 s3	I-IAI-EA-1.222 - 1.224
149	DCM	2035	1024	1024	i0-3 s2-3	I-IAI-EA-1.225

Table 1.4: XRCF Phase I ACIS Science Run Descriptions

The ACIS BEP processing mode was timed exposure Faint mode with a window filter. The size of the windows varied depending on the flux rate, from as tiny as 20 rows to as many as the full 1024. In all cases, the windowing was split into two strips, one toward the top of the CCD and one toward the bottom of the CCD. Because of the differences in the quantum efficiency of the front illuminated devices from the back illuminated devices, different window sizes were used for the front illuminated and back illuminated devices. The window sizes used in each data set are listed in Table 1.4.

The flight software telemetry packets were converted to FITS format average bias files and ERV format event lists using PSCI (for a description of the formats and the PSCI program see http://acis.mit.edu/ttools/psci.html).

The average bias and the ERV format event lists were combined and converted to ARV format event lists using an IDL script. The IDL script subtracted the delta overclock value and the average bias values for each pixel of each event.

Each ARV format event list was then summarized using an IDL script. This IDL script fit a gaussian to the main peak of the spectrum. Only events in ACIS grade bit map 0x1d05 0x0047 0x0004 0x0047 0x1133 0x0003 0x1100 0x0000 0x1d04 0x0000 0x0004 0x0000 0x0000 0x0003 0x0000 0x0000 (ASCA grades 02346) were considered. Using the fit parameters, the position of the peak, full width half max of the peak (defined to be 2.35 times the fitted sigma), and total number of counts under the peak are determined. The number of counts under the peak is taken to be $\sqrt{2\pi}\sigma N_{max}$, where N_{max} is the number of counts in the peak channel. The IDL script computes the flux in counts per centimeter squared per second assuming a frame time of 3.34 seconds and an input window size. All of these values are written to a text format file.

Finally, the text format summary files are read by another IDL script which uses the peak location and peak width values at each energy to tabulate and plot the linear energy scale and spectral resolution values. This script also applies a pileup correction and the filter efficiency to the counts under the peak. See Section 1.4 for a description of pileup.

1.3.1.4 Results

The slope, intercept, and RMS deviation of a linear fit of the energy scale of the ACIS flight devices are listed in Table 1.5. Pulse height as a function of energy is fit to the relation $PH(ADU) = Slope \times Energy(eV) + Intercept$.

CCD	Quadrant A			Quadrant B			Quadrant C			Quadrant D		
	Slope ADU/eV	Intercept ADU	RMS eV	Slope ADU/eV	Intercept ADU	RMS eV	Slope ADU/ev	Intercept ADU	RMS eV	Slope ADU/eV	Intercept ADU	RMS eV
i0	0.2636	0.81	3.75	0.2573	0.65	4.03	0.2662	0.77	3.52	0.2582	0.60	4.06
i1	0.2622	0.38	3.50	0.2559	-0.09	3.97	0.2596	0.36	4.34	0.2616	0.07	3.80
i2	0.2731	-0.98	3.10	0.2839	-1.07	3.35	0.2825	0.07	3.59	0.2745	0.43	3.67
i3	0.2582	1.19	4.68	0.2588	1.25	4.65	0.2542	1.25	4.51	0.2592	1.09	4.55
s0	0.2725	-0.12	4.69	0.2677	-0.54	3.35	0.2574	0.13	4.02	0.2565	-0.34	3.40
s1	0.2359	-22.00	14.80	0.2182	-27.07	22.37	0.2234	-24.86	20.23	0.2297	-25.33	18.84
s2	0.2602	0.03	3.75	0.2715	0.15	5.27	0.2640	-0.51	4.25	0.2692	-0.54	6.33
s3	0.2262	-17.33	11.16	0.2158	-19.88	13.99	0.2186	-19.65	13.18	0.2273	-22.80	13.66
s4	0.2328	-1.09	3.80	0.2272	-0.58	6.16	0.2301	-0.72	5.76	0.2391	-0.96	4.55
s5	0.2534	-0.16	3.09	0.2576	-0.13	3.18	0.2601	0.18	2.70	0.2114	0.46	4.32

Table 1.5: Energy Scale for ACIS Flight Devices

The residual errors from the linear energy scale fit for the front illuminated devices are shown in Figure 1.5. The residual errors from the linear energy scale fit for the back illuminated devices are shown in Figure 1.6. Note that Figure 1.5 and Figure 1.6 are on different vertical scales. Random errors for the line center locations are much less than 1 eV.

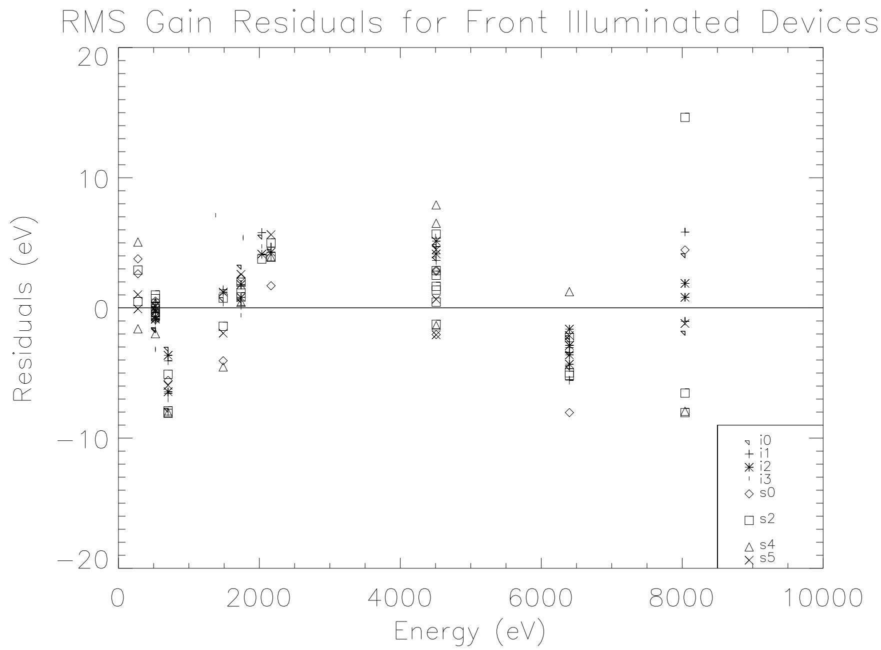

Figure 1.5: Linear Energy Scale Residuals for the Front Illuminated Devices

The FWHM for the ACIS flight devices is shown in Figure 1.7. In Figure 1.7 the points for the front illuminated devices are the average of the four quadrants, while the points for the back illuminated devices show each quadrant separately. The values for the front illuminated devices are listed in Table 1.6. The values for the back illuminated devices are listed in Table 1.7. The "NA" indicates that a data point is not available. The 277 eV measurement was made only for the S-array. Many of the DCM energies were taken with only i3, s1 and s3 on. One of the DCM sets was taken with only the I-array.

The spectral resolution as a function of energy for the front illuminated devices is shown as a solid line in Figure 1.7 and is described by

$$FWHM(E) = \sqrt{(FWHM_0)^2 + 2.35^2 Fano \times w \times E} \tag{1.4}$$

Note that here we treat $FWHM_0$ as an empirical parameter. In the simplest model for spectral resolution (see section 1.1) one expects

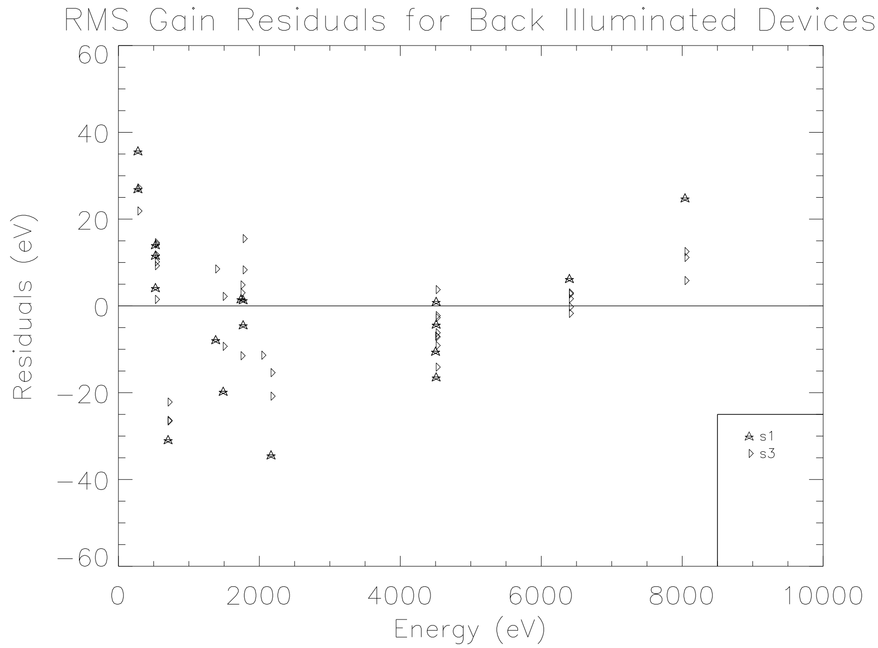

Figure 1.6: Linear Energy Scale Residuals for the Back Illuminated Devices

Energy	277	525	1380	1487	1740	1770	2035	4500	4509	6399	8040
Source	C-K	O-K	DCM	Al-K	Si-K	DCM	DCM	DCM	Ti-K	Fe-K	Cu-K
i0	NA	50.8	NA	73.7	83.7	NA	81.8	NA	120.4	145.9	169.5
i1	NA	50.9	NA	73.3	83.1	NA	80.7	NA	119.9	145.1	169.7
i2	NA	53.7	NA	77.8	89.4	NA	85.6	NA	128.7	155.2	179.1
i3	NA	49.6	67.0	71.8	81.8	77.4	79.7	114.5	118.6	144.0	168.2
s0	45.8	54.9	NA	77.3	86.7	NA	NA	NA	123.5	149.8	175.7
s2	39.6	52.0	NA	74.6	84.6	NA	82.7	NA	122.6	149.0	172.2
s4	37.3	49.8	NA	69.5	78.9	NA	NA	NA	111.3	134.9	159.9
s5	38.8	48.4	NA	69.2	79.3	NA	NA	NA	113.3	137.3	161.4

Table 1.6: Average FWHM (eV) for Front Illuminated Devices

$$FWHM_0 = 2.35 \times \sigma \times w \tag{1.5}$$

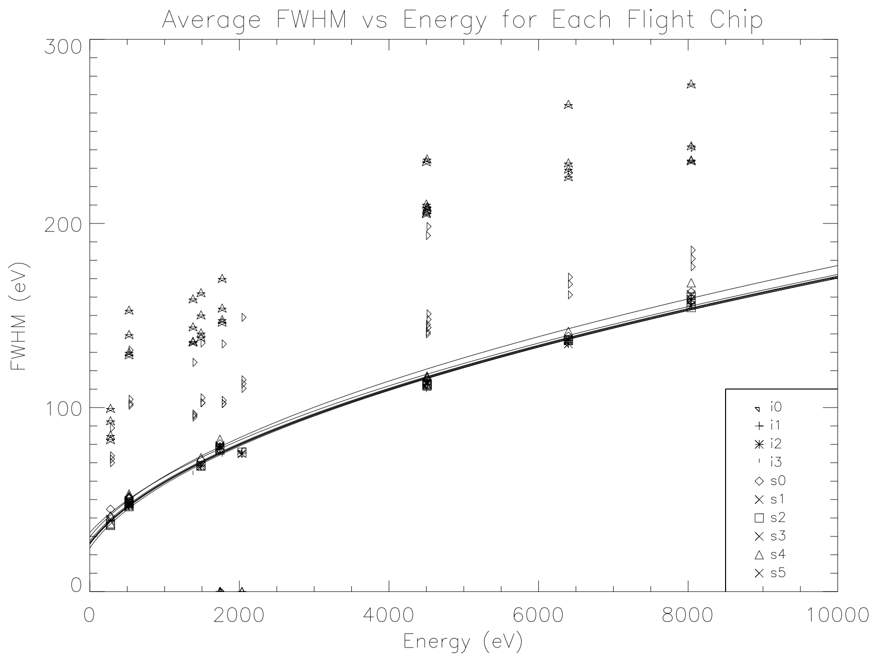

Figure 1.7: Average FWHM versus Energy

	Energy	277	525	1380	1487	1740	2035	4500	4509	6399	8040
	Source	C-K	O-K	DCM	Al-K	DCM	DCM	DCM	Ti-K	Fe-K	Cu-K
s1	A	92.8	139.6	143.8	150.3	154.0	NA	205.9	209.0	232.8	242.1
	B	82.6	128.6	135.9	140.5	147.8	NA	205.3	208.6	225.3	234.5
	C	84.9	130.1	135.5	138.2	146.4	NA	210.5	207.5	229.5	234.0
	D	99.5	152.9	159.0	162.3	170.1	NA	233.5	235.0	264.6	275.8
s3	A	73.7	104.5	96.5	105.3	103.9	115.0	141.0	147.4	167.0	180.9
	B	72.1	101.3	95.8	102.6	102.2	110.4	145.1	150.8	170.8	185.5
	C	70.0	102.1	94.9	102.5	102.1	112.9	140.0	143.6	161.3	176.5
	D	89.0	131.2	124.5	135.1	134.5	149.0	193.5	199.4	227.7	241.3

Table 1.7: FWHM (eV) for Back Illuminated Devices

The expected value of $Fano \times w$ in silicon detectors at -120 ° C is $0.135 \times 3.73 = 0.504$.

$FWHM_0$ and $Fano \times w$ for each quadrant of each front illuminated device is shown in Table 1.8.

Chip	$FWHM_0$	$Fano \times w$
i0	26.56	0.516
i1	26.49	0.517
i2	26.02	0.513
i3	23.77	0.514
s0	32.09	0.519
s2	25.88	0.509
s4	29.73	0.552
s5	27.56	0.518

Table 1.8: Average Front Illuminated Devices $FWHM_0$ and $Fano \times w$

1.3.1.5 CSR Energy Scale Linearity and Spectral Response Valid Data Summary

In addition to the data taken at XRCF, spectral resolution data was collected at CSR. These sets were taken with laboratory electroics identical in design to the flight DEA, but with gains different from the flight electronics. These data should be useful for future analyses of energy scale linearity and spectral response function shape. The data sets are listed in Tables 1.9 through 1.18.

The column labeled "Directory" is the location of the dataset from /ohno/di/database on the local CSR network.

In the column labeled "Rejected Frames" the letter "b" following the number indicates that the majority of the rejected frames were rejected due to pixels above the event threshold in the overclock region. The letter "n" following the number indicates that the majority of the rejected frames were rejected due to standard deviation of the overclocks exceeding the noise threshold.

The column labeled "Counts per Frame" contains the total number of G02346 events under the main peak for the data set.

Each data set included has been checked for by visual inspection of the data products and for consistency with other data sets.

The data products in each directory are summarized in Table 1.19. See MIT ACIS memo PS-71 dated 4 May 1995, by J. Woo (which can be found at http://acis.mit.edu/ttools/acis-analysis.html) for a detailed description of the file formats.

Chip	Target/Energy eV	Directory	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w203c4r/I0	al/1487	w203c4r/beavis/al/03jan97/2213	547	2b	3.277	4564.4
w203c4r/I0	cl/2622	w203c4r/beavis/cl/05jan97/0895	546	4b	3.277	2383.6
w203c4r/I0	v/4949	w203c4r/beavis/v/05jan97/0931	495	5b	3.277	4746
w203c4r/I0	v/4949	w203c4r/beavis/v/05jan97/1150	49	0n	3.276	4745.6
w203c4r/I0	fe/6399	w203c4r/beavis/fe/03jan97/2249	570	5b	3.277	4139.6
w203c4r/I0	co/6925	w203c4r/beavis/co/05jan97/1017	626	4b	3.277	3815.6
w203c4r/I0	ni/7471	w203c4r/beavis/ni/05jan97/1210	645	4b	3.277	3333.6
w203c4r/I0	ni/7471	w203c4r/beavis/ni/05jan97/1255	100	0n	3.277	3338
w203c4r/I0	zn/8630	w203c4r/beavis/zn/05jan97/1312	642	2b	3.277	2648.4
w203c4r/I0	zn/8630	w203c4r/beavis/zn/05jan97/1359	245	0n	3.277	2679.6
w203c4r/I0	ge/9875	w203c4r/beavis/ge/30dec96/2200	596	2b	3.277	2020.8
w203c4r/I0	ge/9875	w203c4r/beavis/ge/30dec96/2250	596	2b	3.277	2011.2

Table 1.9: w203c4r/I0 CSR Spectral Resolution Data Sets

Chip	Target/Energy eV	Directory	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w193c2/I1	al/1487	w193c2/butthead/al/22nov96/1819	646	2b	3.277	4577.2
w193c2/I1	p/2015	w193c2/butthead/p/27nov96/2228	174	1b	3.277	1705.2
w193c2/I1	cl/2622	w193c2/butthead/cl/25nov96/1921	648	1n	3.277	2425.6
w193c2/I1	cl/2622	w193c2/butthead/cl/25nov96/2002	324	0n	3.277	2422.8
w193c2/I1	v/4949	w193c2/butthead/v/22nov96/2001	644	6b	3.277	4806.4
w193c2/I1	fe55/5894	w193c2/butthead/fe55/30nov96/1214	594	1b	3.297	3360.8
w193c2/I1	fe/6399	w193c2/butthead/fe/22nov96/1913	644	1b	3.277	4170
w193c2/I1	co/6925	w193c2/butthead/co/29nov96/2002	644	2n	3.277	3840
w193c2/I1	co/6925	w193c2/butthead/co/29nov96/2041	97	2n	3.277	3836
w193c2/I1	ni/7471	w193c2/butthead/ni/29nov96/2300	150	0n	3.277	3426.8
w193c2/I1	ni/7471	w193c2/butthead/ni/29nov96/2323	643	3b	3.279	3404.8
w193c2/I1	zn/8630	w193c2/butthead/zn/22nov96/2050	633	6b	3.278	2501.6
w193c2/I1	zn/8630	w193c2/butthead/zn/22nov96/2141	490	2b	3.279	2496.8
w193c2/I1	ge/9875	w193c2/butthead/ge/25nov96/2027	635	5b	3.278	1982.4
w193c2/I1	ge/9875	w193c2/butthead/ge/25nov96/2108	650	NA	3.277	1983.6
w193c2/I1	ge/9875	w193c2/butthead/ge/25nov96/2148	191	1n	3.276	1998.8

Table 1.10: w193c2/I1 CSR Spectral Resolution Data Sets

Chip	Target/Energy eV	Directory	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w158c4r/I2	al/1487	w158c4r/butthead/al/03nov96/1340	569	5b	3.277	3822.8
w158c4r/I2	al/1487	w158c4r/butthead/al/05nov96/0938	70	0n	3.279	3752.4
w158c4r/I2	si/1740	w158c4r/butthead/si/05nov96/1241	572	7b	3.322	1693.6
w158c4r/I2	cl/2622	w158c4r/butthead/cl/03nov96/0844	668	6b	3.277	2408.4
w158c4r/I2	cl/2622	w158c4r/butthead/cl/03nov96/0950	299	1b	3.277	2416.4
w158c4r/I2	cl/2622	w158c4r/butthead/cl/05nov96/0955	99	0n	3.277	2370.4
w158c4r/I2	fe55/5894	w158c4r/butthead/fe55/27oct96/1921	788	4b	3.277	2820.8
w158c4r/I2	fe/6399	w158c4r/butthead/fe/03nov96/1416	646	4b	3.277	4259.2
w158c4r/I2	co/6925	w158c4r/butthead/co/03nov96/1250	99	1b	3.277	3800
w158c4r/I2	co/6925	w158c4r/butthead/co/03nov96/1301	646	4b	3.277	3813.6
w158c4r/I2	ni/7471	w158c4r/butthead/ni/03nov96/1032	591	6b	3.278	3229.6
w158c4r/I2	ni/7471	w158c4r/butthead/ni/03nov96/1108	136	4b	3.277	3229.2
w158c4r/I2	zn/8630	w158c4r/butthead/zn/03nov96/1527	516	4b	3.278	2474.8
w158c4r/I2	zn/8630	w158c4r/butthead/zn/03nov96/1558	647	3b	3.278	2469.6
w158c4r/I2	ge/9875	w158c4r/butthead/ge/03nov96/1121	659	6b	3.277	1952.4
w158c4r/I2	ge/9875	w158c4r/butthead/ge/03nov96/1158	651	NA	3.277	1963.2
w158c4r/I2	ge/9875	w158c4r/butthead/ge/03nov96/1234	184	1b	3.277	1966.8

Table 1.11: w158c4r/I2 CSR Spectral Resolution Data Sets

Chip	Target/Energy eV	Directory	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w215c2r/I3	al/1487	w215c2r/beavis/al/06jan97/2044	550	0n	3.277	4578.8
w215c2r/I3	cl/2622	w215c2r/beavis/cl/06jan97/2002	547	2b	3.277	2423.6
w215c2r/I3	ti/4509	w215c2r/beavis/ti/11jan97/1109	561	6b	3.329	5134.8
w215c2r/I3	v/4949	w215c2r/beavis/v/06jan97/2212	497	3b	3.277	4760.4
w215c2r/I3	v/4949	w215c2r/beavis/v/10jan97/2250	25	0n	3.277	4717.2
w215c2r/I3	fe/6399	w215c2r/beavis/fe/06jan97/2136	564	6b	3.277	4187.6
w215c2r/I3	fe/6399	w215c2r/beavis/fe/10jan97/2233	25	0n	3.277	4148.4
w215c2r/I3	co/6925	w215c2r/beavis/co/06jan97/0106	622	0n	3.277	3788.4
w215c2r/I3	co/6925	w215c2r/beavis/co/10jan97/2258	25	0n	3.277	3815.6
w215c2r/I3	ni/7471	w215c2r/beavis/ni/06jan97/0056	100	0n	3.277	3342
w215c2r/I3	ni/7471	w215c2r/beavis/ni/06jan97/2356	648	2b	3.277	3371.6
w215c2r/I3	zn/8630	w215c2r/beavis/zn/06jan97/2254	645	4b	3.277	2580.4
w215c2r/I3	zn/8630	w215c2r/beavis/zn/10jan97/2150	299	1b	3.277	2678.8
w215c2r/I3	ge/9875	w215c2r/beavis/ge/06jan97/1812	598	1b	3.277	1925.6
w215c2r/I3	ge/9875	w215c2r/beavis/ge/06jan97/1922	596	4b	3.277	1984
w215c2r/I3	ge/9875	w215c2r/beavis/ge/12jan97/1359	74	1b	3.277	1954

Table 1.12: w215c2r/I3 CSR Spectral Resolution Data Sets

Chip	Target/Energy eV	Directory	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w168c4r/S0	o/525	w168c4r/beavis/o/15dec96/1247	595	5b	7.149	3372
w168c4r/S0	al/1487	w168c4r/beavis/al/14dec96/1914	574	1b	3.277	4483.2
w168c4r/S0	al/1487	w168c4r/beavis/al/20dec96/2018	542	4b	3.277	4524
w168c4r/S0	cl/2622	w168c4r/beavis/cl/14dec96/2027	545	4b	3.277	2347.6
w168c4r/S0	cl/2622	w168c4r/beavis/cl/20dec96/2059	546	1b	3.277	2376.4
w168c4r/S0	v/4949	w168c4r/beavis/v/21dec96/1052	499	1b	3.277	4701.6
w168c4r/S0	v/4949	w168c4r/beavis/v/21dec96/1732	98	2b	3.277	4772.8
w168c4r/S0	fe/6399	w168c4r/beavis/fe/14dec96/2119	573	1b	3.274	4135.6
w168c4r/S0	co/6925	w168c4r/beavis/co/21dec96/1136	611	5b	3.278	3735.2
w168c4r/S0	co/6925	w168c4r/beavis/co/21dec96/1651	100	0n	3.277	3678.4
w168c4r/S0	ni/7471	w168c4r/beavis/ni/21dec96/1219	647	0n	3.277	3203.2
w168c4r/S0	ni/7471	w168c4r/beavis/ni/21dec96/1401	147	2b	3.277	3213.6
w168c4r/S0	zn/8630	w168c4r/beavis/zn/21dec96/1420	647	2b	3.277	2587.6
w168c4r/S0	zn/8630	w168c4r/beavis/zn/21dec96/1814	456	3b	3.277	2653.6
w168c4r/S0	ge/9875	w168c4r/beavis/ge/14dec96/2212	398	0n	3.277	1947.6
w168c4r/S0	ge/9875	w168c4r/beavis/ge/21dec96/0909	592	9b	3.277	1927.2
w168c4r/S0	ge/9875	w168c4r/beavis/ge/21dec96/0956	647	3b	3.277	1900.8

Table 1.13: w168c4r/S0 CSR Spectral Resolution Data Sets

Chip	Target/Energy eV	Directory	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w140c4r/S1	al/1487	w140c4r/butthead/al/20jan97/2041	647	2b	3.277	5247.6
w140c4r/S1	cl/2622	w140c4r/butthead/cl/20jan97/2131	647	1b	3.277	2819.2
w140c4r/S1	v/4949	w140c4r/butthead/v/24jan97/2106	650	0n	3.277	4092.8
w140c4r/S1	fe55/5894	w140c4r/butthead/fe55/24jan97/1901	645	3b	3.277	2444.8
w140c4r/S1	fe/6399	w140c4r/butthead/fe/23jan97/0752	649	1b	3.277	4294.4
w140c4r/S1	co/6925	w140c4r/butthead/co/24jan97/2157	649	1b	3.277	2689.6
w140c4r/S1	co/6925	w140c4r/butthead/co/28jan97/0916	321	4b	3.277	2720.8
w140c4r/S1	ni/7471	w140c4r/butthead/ni/28jan97/1003	646	4b	3.277	4086.4
w140c4r/S1	ni/7471	w140c4r/butthead/ni/28jan97/1051	649	1b	3.277	4068.8
w140c4r/S1	zn/8630	w140c4r/butthead/zn/28jan97/1147	640	8b	3.277	3149.6
w140c4r/S1	zn/8630	w140c4r/butthead/zn/28jan97/1234	648	2b	3.277	3197.2
w140c4r/S1	ge/9875	w140c4r/butthead/ge/23jan97/0837	646un	nun	0un	3004un
w140c4r/S1	ge/9875	w140c4r/butthead/ge/23jan97/0920	644un	nun	0un	3008.4un

Table 1.14: w140c4r/S1 CSR Spectral Resolution Data Sets

Chip	Target/Energy eV	Directory	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w182c4r/S2	al/1487	w182c4r/butthead/al/21dec96/1948	561	10b	3.277	4655.2
w182c4r/S2	cl/2622	w182c4r/butthead/cl/21dec96/2029	634	6b	3.277	2390.8
w182c4r/S2	cl/2622	w182c4r/butthead/cl/21dec96/2115	315	4b	3.277	2392.4
w182c4r/S2	v/4949	w182c4r/butthead/v/02jan97/1321	521	4b	3.277	5554
w182c4r/S2	fe/6399	w182c4r/butthead/fe/21dec96/2146	627	5n	3.277	4386.4
w182c4r/S2	co/6925	w182c4r/butthead/co/02jan97/1503	644	4b	3.277	3538
w182c4r/S2	co/6925	w182c4r/butthead/co/02jan97/1802	149	1b	3.277	4058.4
w182c4r/S2	ni/7471	w182c4r/butthead/ni/02jan97/1548	642	8b	3.277	3430.8
w182c4r/S2	ni/7471	w182c4r/butthead/ni/02jan97/1755	148	2b	3.277	3455.2
w182c4r/S2	zn/8630	w182c4r/butthead/zn/02jan97/1631	645	3b	3.277	2708
w182c4r/S2	zn/8630	w182c4r/butthead/zn/02jan97/1718	519	3b	3.277	2707.2
w182c4r/S2	ge/9875	w182c4r/butthead/ge/02jan97/1234	639	9b	3.277	2118.8
w182c4r/S2	ge/9875	w182c4r/butthead/ge/02jan97/1359	645	5b	3.277	2096

Table 1.15: w182c4r/S2 CSR Spectral Resolution Data Sets

Chip	Target/Energy eV	Directory	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w134c4r/S3	f/677	w134c4r/butthead/f/03feb97/1151	587	0n	7.148	5260
w134c4r/S3	al/1487	w134c4r/butthead/al/01feb97/1941	646	2b	3.277	5342.4
w134c4r/S3	cl/2622	w134c4r/butthead/cl/01feb97/2024	649	1b	3.277	2907.6
w134c4r/S3	v/4949	w134c4r/butthead/v/05feb97/1840	646	4b	3.277	4664
w134c4r/S3	fe/6399	w134c4r/butthead/fe/01feb97/2110	648	2b	3.277	3615.6
w134c4r/S3	fe/6399	w134c4r/butthead/fe/05feb97/1811	100	0n	3.277	3603.6
w134c4r/S3	co/6925	w134c4r/butthead/co/05feb97/1923	641	2b	3.277	4505.6
w134c4r/S3	ni/7471	w134c4r/butthead/ni/05feb97/1457	644	2b	3.277	4457.2
w134c4r/S3	zn/8630	w134c4r/butthead/zn/05feb97/1547	647	1b	3.277	3623.2
w134c4r/S3	zn/8630	w134c4r/butthead/zn/05feb97/1825	99	0n	3.277	3618.8
w134c4r/S3	ge/9875	w134c4r/butthead/ge/01feb97/2152	647	3b	3.277	1733.2
w134c4r/S3	ge/9875	w134c4r/butthead/ge/05feb97/1638	649	1b	3.277	3394.8
w134c4r/S3	ge/9875	w134c4r/butthead/ge/05feb97/1749	100	0n	3.277	3453.6

Table 1.16: w134c4r/S3 CSR Spectral Resolution Data Sets

Chip	Target/Energy	Directory eV	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w457c4/S4	al/1487	w457c4/beavis/al/02dec96/1024	544	6b	3.277	4634.8
w457c4/S4	cl/2622	w457c4/beavis/cl/02dec96/1155	547	3b	3.277	2405.2
w457c4/S4	v/4949	w457c4/beavis/v/02dec96/0128	49	0n	3.277	4830.8
w457c4/S4	v/4949	w457c4/beavis/v/02dec96/0135	48	1b	3.285	4878.4
w457c4/S4	v/4949	w457c4/beavis/v/02dec96/1424	498	1b	3.277	4807.2
w457c4/S4	fe/6399	w457c4/beavis/fe/02dec96/1236	566	4b	3.277	4151.6
w457c4/S4	co/6925	w457c4/beavis/co/02dec96/1500	624	6b	3.277	3995.6
w457c4/S4	ni/7471	w457c4/beavis/ni/02dec96/1638	639	5b	3.278	3516.8
w457c4/S4	ni/7471	w457c4/beavis/ni/02dec96/1832	98	2b	3.277	3544.4
w457c4/S4	zn/8630	w457c4/beavis/zn/02dec96/1726	644	4b	3.277	2906
w457c4/S4	zn/8630	w457c4/beavis/zn/02dec96/1813	249	1b	3.277	2916
w457c4/S4	ge/9875	w457c4/beavis/ge/02dec96/1318	596	1n	3.277	2144.8
w457c4/S4	ge/9875	w457c4/beavis/ge/02dec96/1547	596	4b	3.277	2234.8

Table 1.17: w457c4/S4 CSR Spectral Resolution Data Sets

Chip	Target/Energy	Directory eV	Accepted Frames	Rejected Frames	Frame Time (seconds)	Counts per Frame
w201c3r/S5	al/1487	w201c3r/beavis/al/13dec96/0945	648	2b	3.277	4487.2
w201c3r/S5	cl/2622	w201c3r/beavis/cl/13dec96/1026	642	5b	3.278	2405.6
w201c3r/S5	v/4949	w201c3r/beavis/v/13dec96/1400	636	2b	3.277	4812.4
w201c3r/S5	fe/6399	w201c3r/beavis/fe/13dec96/1106	627	4b	3.278	4324
w201c3r/S5	co/6925	w201c3r/beavis/co/13dec96/1463	647	3b	3.277	3965.2
w201c3r/S5	ni/7471	w201c3r/beavis/ni/13dec96/1531	649	1b	3.277	3521.2
w201c3r/S5	ni/7471	w201c3r/beavis/ni/13dec96/1613	298	2b	3.277	3526
w201c3r/S5	zn/8630	w201c3r/beavis/zn/13dec96/1655	649	1b	3.277	2868.8
w201c3r/S5	zn/8630	w201c3r/beavis/zn/13dec96/1735	300	0n	3.277	2873.6
w201c3r/S5	ge/9875	w201c3r/beavis/ge/13dec96/1147	645	5b	3.277	2192
w201c3r/S5	ge/9875	w201c3r/beavis/ge/13dec96/1229	649	0n	3.277	2177.2

Table 1.18: w201c3r/S5 CSR Spectral Resolution Data Sets

Data File	Description
*_rt.evlist	ACIS RV format eventlist
*_rt_bias_avg.fits	mean bias frame
*_bias.000?.fits	sample bias frames
*_frame.000?.fits	sample data frames
*.mca.summary	ascii file summarizing the dataset
*.mca.data	IDL save file including average overclock level, average overclock noise, total number of events, peak location, peak width, and number of events under the peak as a function of frame number.
*.mca.spec	IDL save file including number of events as a function of energy, quadrant, and grade, and an image of the g02346 events under the peak in 32x32 pixel bins.
products/*g0234_img.fits	number density map of detected events in g0234.
products/*g0.qdp	for each quadrant, the pulse height histogram of g0 events.
products/*g0234.qdp	for each quadrant, the pulse height histogram of g0234 events.
products/*g0234_lightcv.qdp	for each quadrant, g0234 count rate as a function of frame number.
prodcuts/*pcf.qdp	for each quadrant, pulse height histograms of each grade.
products/*neighborhist*.qdp	for each quadrant, histograms of corner, top, bottom, left, and right pixel distributions of detected events.

Table 1.19: CSR Database Products