THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY

GEOTAIL Spacecraft Mission
Energetic Particles and Ion Composition Instrument
(EPIC)
Ground-Based Data Conversions and Corrections

Version 1.8a

June 28, 2013

Abstract

This document describes the steps for data conversions and corrections within the ground-based data processing for the EPIC instrument on the GEOTAIL spacecraft.

Change History

Date of Change	Description of Change
16 November 2010	Figure 9: Corrected ICS North and South Ion head angles (for angular distance from spacecraft spin plane to center line of sensor) from 23° to 22.5°; and updated ICS North and South Ion head Sun Shade angles (for angular distance from spacecraft spin plane to edge of sun shade) from unknown to 13.7° and 9.9°, respectfully.
17 October 2012	Section 4.3 Addition of text referencing the flux reduction due to background correction given in Tables A7 and A8. Tables A7 Table that lists the Energy channel differential flux reduction if background correction is applied. Tables A8 Table that lists the Electron Detector integral flux reduction if background correction is applied.

Table of Contents

List of Tables

List of Figures

1 Introduction

This document presents an overview of the EPIC instrument of the GEOTAIL spacecraft mission and a description of the ground-based data conversions and corrections for this instrument. A more complete description of the instrument and spacecraft is provided in the following references:

Geotail Prelaunch Report, April 1992, ISAS SES Data Center, document SES-TD-92-007SY.

Williams, D. J., R. W. McEntire, C. Schlemm II, A. T. Y. Lui, G. Gloeckler, S. P. Christon, and F. Gliem, Geotail Energetic Particles and Ion Composition Instrument, *J. Geomag. Geoelect*., *46*, 39-57, 1994.

A more complete description of the instrument operation and telemetry is provided in the following reference:

EPIC Instrument User's Manual, C. E. Schlemm II, JHU/APL, 12 August 1993.

2 EPIC Instrument

The Energetic Particles and Ion Composition (EPIC) particle experiment/instrument is composed of two separate science subsystems, known as the Ion Composition Subsystem (ICS) and the Supra-Thermal Ion Composition Spectrometer (STICS), plus a common data processing unit (DPU), which sends commands to and receives data from the two subsystems. A summary of the EPIC instrument is given in Table 1.

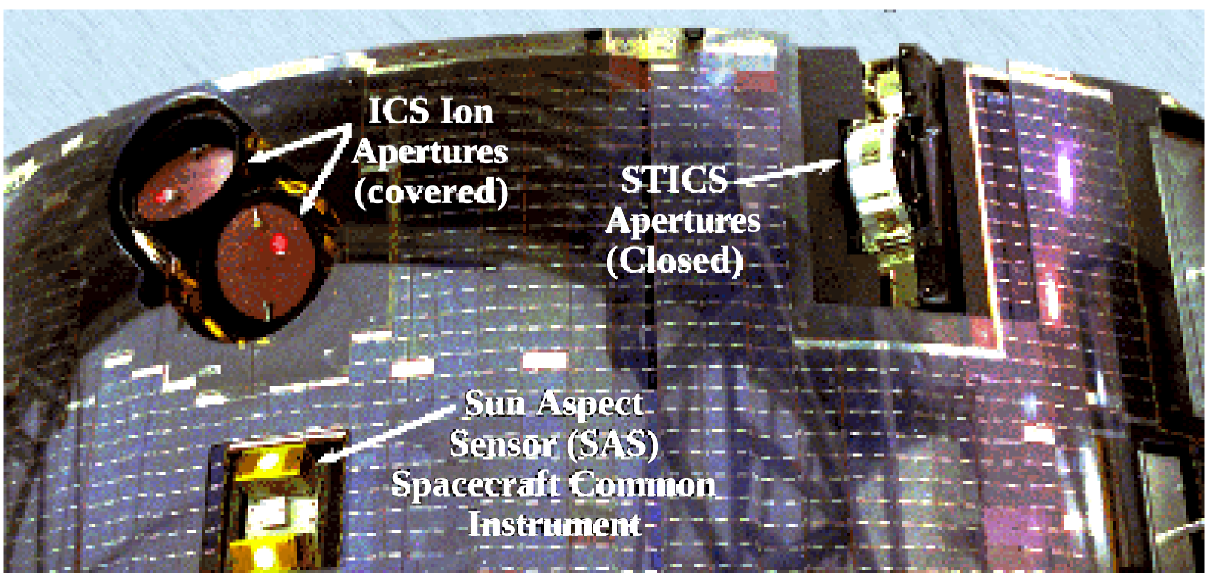

Figure 1 - EPIC Instrument, side view on Geotail spacecraft

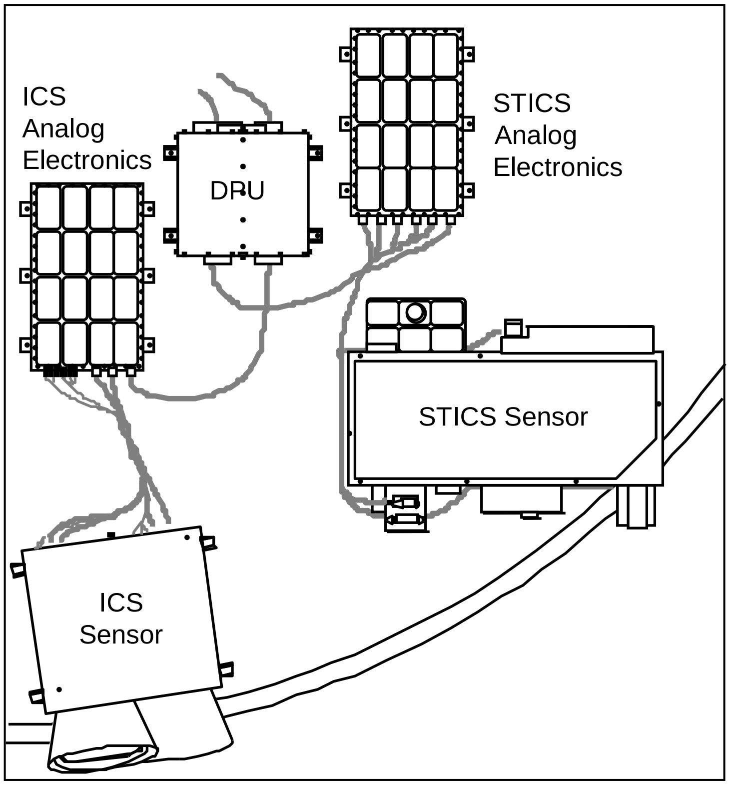

Figure 2 - Diagram of EPIC Instrument, top view within Geotail spacecraft

Table 1 - Summary of main EPIC characteristics

	STICS	ICS
Sensors:	Electrostatic analyzer x time-of-flight x E	Time-of-flight x E
Energy Range:	**Ions:** 10 to 230 keV/e (M/Q) 30 to 230 keV/e (M and M/Q) ΔE/E = 5%	**Ions:** >10 keV (Integral) >20 keV (Velocity) >30 keV to 3 MeV (M) **Electrons:** >30 keV (Integral) >100 keV (Integral)
Ion Species:	H through Fe	H through Fe
Resolution: Mass:	Resolves all major ion species. Charge states of major ion species.	Resolves all major ion species.
Angular: Polar:	**Ions:** 6 equal 26.7° polar sectors (+80° to -80°†)	**Ions:** 2 equal 30° polar sectors (-38° to -8°; +8° to +38°†) **Electrons:** 1 polar 60° sector (-30° to +30°†)
Azimuth:	16 equal 22.5° azimuthal sectors	16 equal 22.5° azimuthal sectors
Time:	3 sec/energy step†† 24 sec/8-point spectrum††	0.2 sec to 96 sec
Geometry Factor:	**Ions:** 0.05 cm^2sr	**Ions:** < 0.006 to 0.2 cm^2 sr **Electrons:** ~0.1 cm^2 sr
EPIC S/C Interfaces: Data Rate:	2560 bps	

†with respect to the spin plane
††assumes a nominal 3 seconds/spin

2.1 *ICS Subsystem*

The ICS subsystem consists of an ion sensor, an electron sensor and an analog electronics pre-processing unit. The ion sensor is comprised of an identical pair of Time-of-Flight (TOF) telescopes, each composed of a front foil followed by a solid-state detector and preceded by a front collimator with a sweeping magnet to reject electrons, which measure mass and energy properties of energetic ions with energies of less than 50 keV to 5 MeV. The electron sensor consists of a thin foil/solid state detector electron telescope, which measures electrons with energies greater than 30 keV. The channels of ICS are summarized in Table 3.

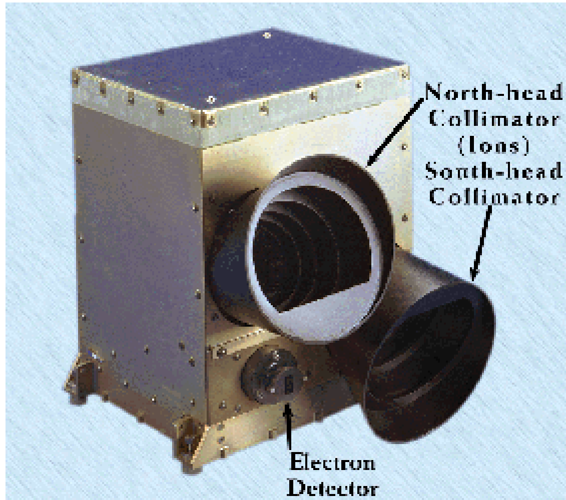

Figure 3 - ICS Sensor

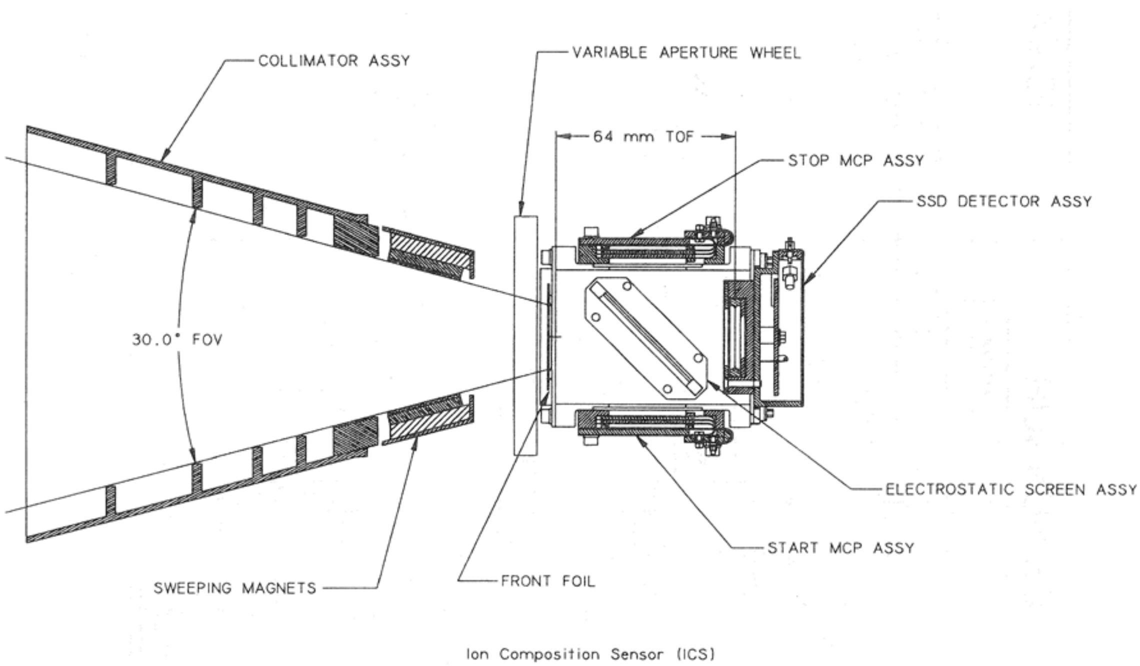

Figure 4 - Schematic Diagram of an ICS TOF Telescope

Incident ions pass through the collimator, aperture, and front foil, and stop in the rear SSD. Secondary electrons from the surface of the front foil (or SSD) are accelerated into the inside of the head (which floats at 1000 V), reflected at the screen assembly and mapped onto the start (or stop) MCP.

2.2 *STICS Subsystem*

The ICS subsystem consists of an ion sensor and an analog electronics pre-processing unit. The STICS ion sensor is composed of a quadrispherical deflection system (for the selection of particles of the desired energy per charge) followed by three sets of Time-of-Flight (TOF) telescopes with solid-state detectors. Particles are deflected by the E-field of the deflection system as they pass between the DPPS. The STICS sensor measures the 3-dimensional distribution functions of suprathermal ions in the energy range of ~10 to 230 keV/e; it determines the mass, charge state, and mass per charge of ions, their arrival directions both in and out of the ecliptic plane, and their energy spectra. The channels of STICS are summarized in Table 3.

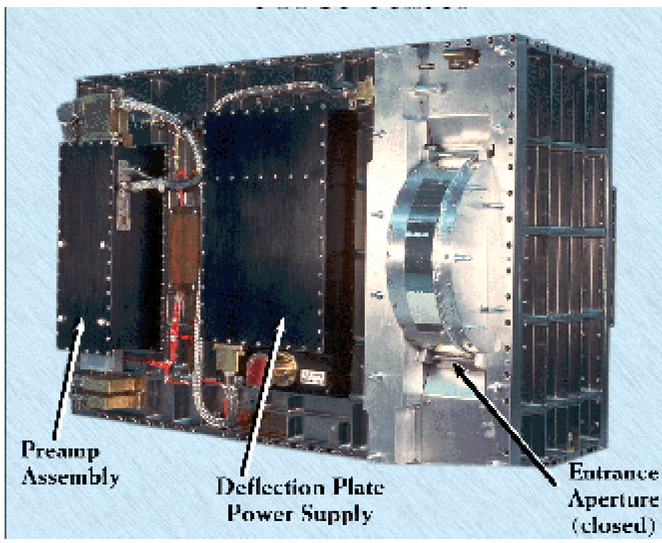

Figure 5 - STICS Sensor

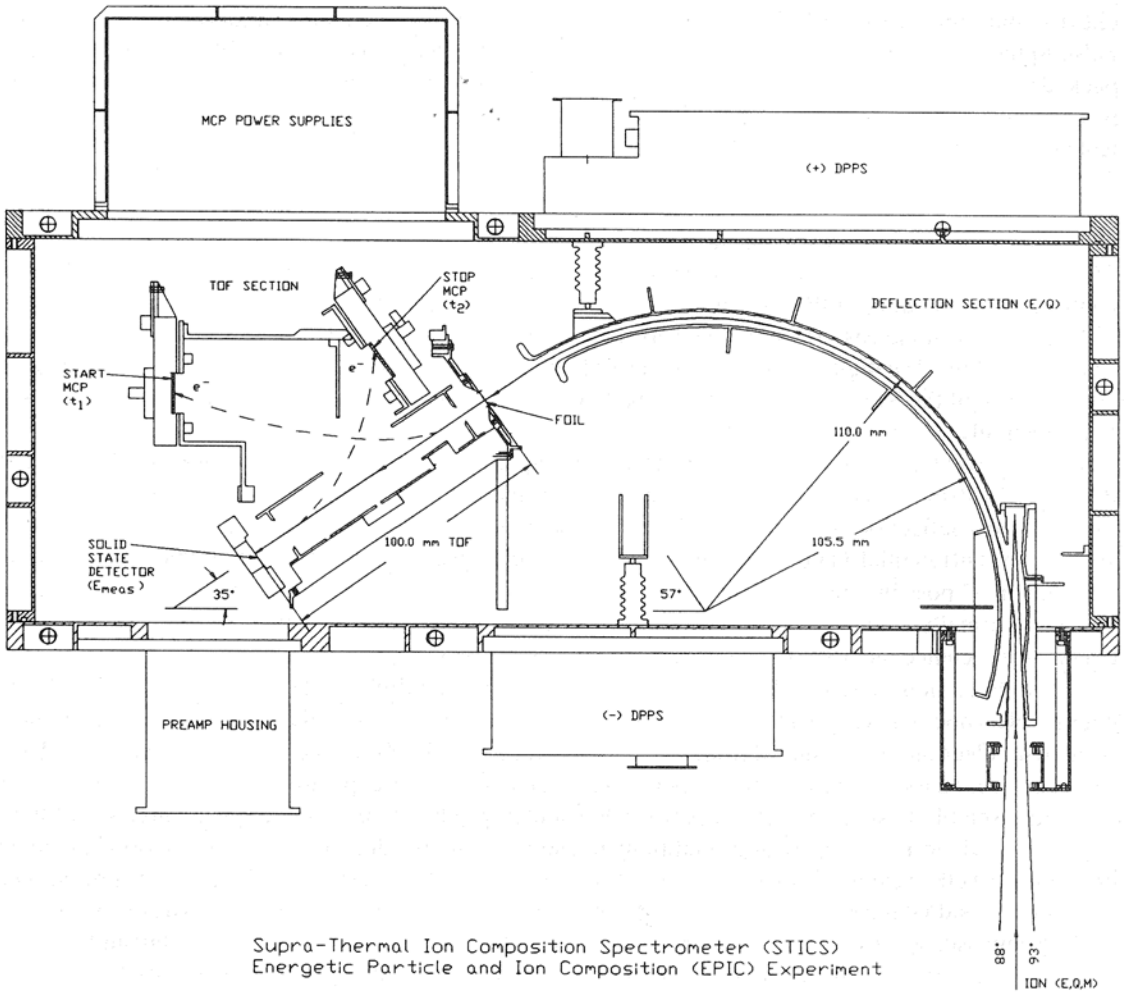

Figure 6 - Schematic Diagram of STICS Sensor

This view is cut through the sensor in the s/c spin plane. Ions enter through the aperture, pass through the electrostatic E/Q analyzer, penetrate the TOF telescope front foil and stop in the back SSD, where mapped to the start (or stop) MCP by electrostatic optics.

2.3 *DPU Subsystem*

The DPU provides the interface between the ICS and STICS subsystems and the Geotail spacecraft. It handles all command processing, telemetry formatting, analog interfaces, power switching, alarm monitoring, and mechanical device control for the instrument.

3 Derived Parameters

The EPIC instrument records two types of science information provided by the sensor subsystems and a third type derived from the sensor information by the DPU. Pulse Height Analysis

(PHA) Event data, the first science information type, consists of energy, time-of-flight (TOF), and telescope head information for a limited number of "valid" events. Engineering Rates data, the second science information type provided by the sensor subsystems, consists of the counts of various sub-events (stops, starts, energies, etc.) taken over a defined time period.

Science Rates data, the derived science information type, is obtained from the valid event data by classifying each event and binning it in accumulation counters which are periodically read and saved as count rates; this categorizing of rates counters is made according to particle species, energy range, time-of-flight and/or charge state. Figure 7 and Figure 8 show the count rates binning counters of ICS and STICS, respectively.

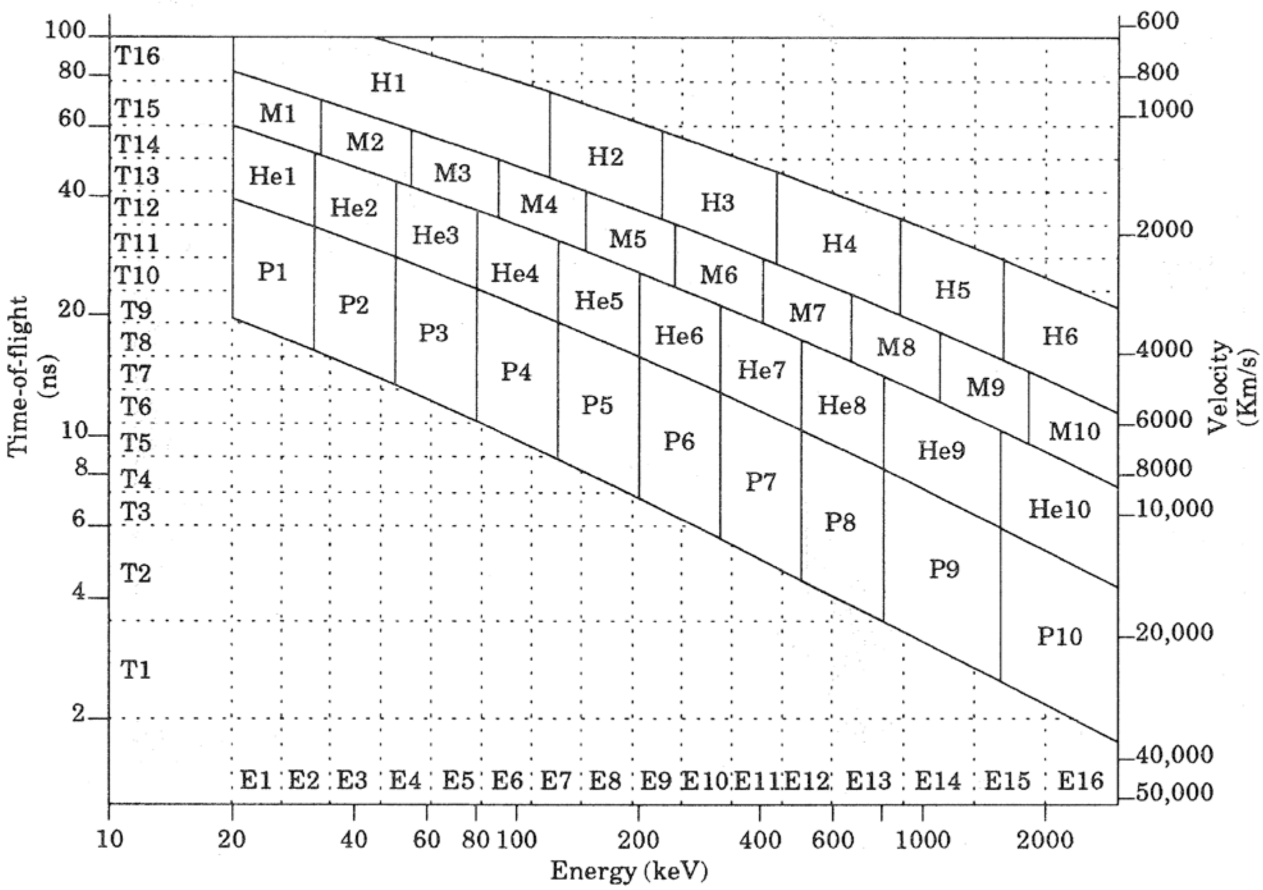

Figure 7 - ICS Energy - Time-of-Flight Diagram

Location of the 36 ICS species channels in the space of measured TOF vs. measured energy. In addition the location of the 16 single-parameter TOF (energy) channels is shown on the vertical (horizontal) axis.

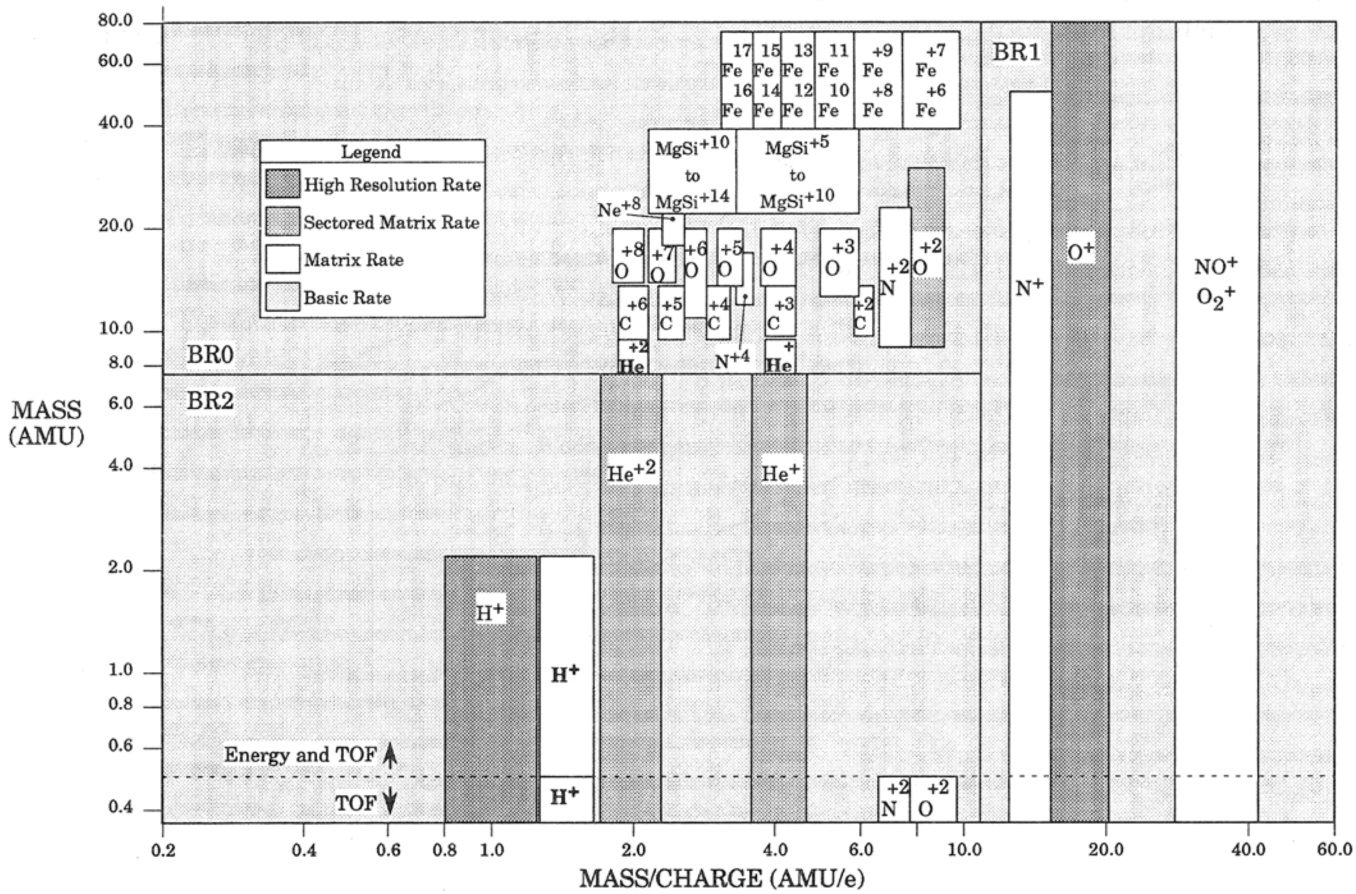

Figure 8 - STICS Mass - Mass/charge Diagram

STICS rate channel coverage in mass and mass/charge space. Shaded regions show the HR, SMR, BR and MR groups

To conserve on-board storage space and transmission bandwidth the Science Rates data is compressed to 8-bit quantities after read-out from the accumulation counters. Either of two selectable log compression methods is used, which are referred to as compression Code A or C; the compressed rate values are summarized in Table 2 as are the corresponding decompressed mid-point Science Rates count values that are used in ground-based processing.

Table 2 - Codes A and C Compression and Decompression Values

On-board Measured Science Rates Counts		Compressed Rate Value for Telemetry	Ground-based Decompressed Science Rates Counts Values	
A Code	C Code		A Code	C Code
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5

On-board Measured Science Rates Counts		Compressed Rate Value for Telemetry	Ground-based Decompressed Science Rates Counts Values	
A Code	C Code		A Code	C Code
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9
10	10	10	10	10
11	11	11	11	11
12	12	12	12	12
13	13	13	13	13
14	14	14	14	14
15	15	15	15	15
16	16	16	16	16
17	17	17	17	17
18	18	18	18	18
19	19	19	19	19
20	20	20	20	20
21	21	21	21	21
22	22	22	22	22
23	23	23	23	23
24	24	24	24	24
25	25	25	25	25
26	26	26	26	26
27	27	27	27	27
28	28	28	28	28
29	29	29	29	29
30	30	30	30	30
31	31	31	31	31
32 - 33	32 - 33	32	33	33
34 - 35	34 - 35	33	35	35
36 - 37	36 - 37	34	37	37
38 - 39	38 - 39	35	39	39
40 - 41	40 - 41	36	41	41
42 - 43	42 - 43	37	43	43
44 - 45	44 - 45	38	45	45
46 - 47	46 - 47	39	47	47
48 - 49	48 - 49	40	49	49
50 - 51	50 - 51	41	51	51
52 - 53	52 - 53	42	53	53
54 - 55	54 - 55	43	55	55
56 - 57	56 - 57	44	57	57
58 - 59	58 - 59	45	59	59
60 - 61	60 - 61	46	61	61
62 - 63	62 - 63	47	63	63
64 - 67	64 - 67	48	66	66
68 - 71	68 - 71	49	70	70
72 - 75	72 - 75	50	74	74
76 - 79	76 - 79	51	78	78
80 - 83	80 - 83	52	82	82
84 - 87	84 - 87	53	86	86
88 - 91	88 - 91	54	90	90
92 - 95	92 - 95	55	94	94
96 - 99	96 - 99	56	98	98
100 - 103	100 - 103	57	102	102
104 - 107	104 - 107	58	106	106
108 - 111	108 - 111	59	110	110
112 - 115	112 - 115	60	114	114
116 - 119	116 - 119	61	118	118
120 - 123	120 - 123	62	122	122
124 - 127	124 - 127	63	126	126
128 - 135	128 - 135	64	132	132
136 - 143	136 - 143	65	140	140
144 - 151	144 - 151	66	148	148

On-board Measured Science Rates Counts		Compressed Rate Value for Telemetry	Ground-based Decompressed Science Rates Counts Values	
A Code	C Code		A Code	C Code
152 - 159	152 - 159	67	156	156
160 - 167	160 - 167	68	164	164
168 - 175	168 - 175	69	172	172
176 - 183	176 - 183	70	180	180
184 - 191	184 - 191	71	188	188
192 - 199	192 - 199	72	196	196
200 - 207	200 - 207	73	204	204
208 - 215	208 - 215	74	212	212
216 - 223	216 - 223	75	220	220
224 - 231	224 - 231	76	228	228
232 - 239	232 - 239	77	236	236
240 - 247	240 - 247	78	244	244
248 - 255	248 - 255	79	252	252
256 - 271	256 - 271	80	264	264
272 - 287	272 - 287	81	280	280
288 - 303	288 - 303	82	296	296
304 - 319	304 - 319	83	312	312
320 - 335	320 - 335	84	328	328
336 - 351	336 - 351	85	344	344
352 - 367	352 - 367	86	360	360
368 - 383	368 - 383	87	376	376
384 - 399	384 - 399	88	392	392
400 - 415	400 - 415	89	408	408
416 - 431	416 - 431	90	424	424
432 - 447	432 - 447	91	440	440
448 - 463	448 - 463	92	456	456
464 - 479	464 - 479	93	472	472
480 - 495	480 - 495	94	488	488
496 - 511	496 - 511	95	504	504
512 - 543	512 - 543	96	528	528
544 - 575	544 - 575	97	560	560
576 - 607	576 - 607	98	592	592
608 - 639	608 - 639	99	624	624
640 - 671	640 - 671	100	656	656
672 - 703	672 - 703	101	688	688
704 - 735	704 - 735	102	720	720
736 - 767	736 - 767	103	752	752
768 - 799	768 - 799	104	784	784
800 - 831	800 - 831	105	816	816
832 - 863	832 - 863	106	848	848
864 - 895	864 - 895	107	880	880
896 - 927	896 - 927	108	912	912
928 - 959	928 - 959	109	944	944
960 - 991	960 - 991	110	976	976
992 - 1023	992 - 1023	111	1008	1008
1024 - 1087	1024 - 1087	112	1056	1056
1088 - 1151	1088 - 1151	113	1120	1120
1152 - 1215	1152 - 1215	114	1184	1184
1216 - 1279	1216 - 1279	115	1248	1248
1280 - 1343	1280 - 1343	116	1312	1312
1344 - 1407	1344 - 1407	117	1376	1376
1408 - 1471	1408 - 1471	118	1440	1440
1472 - 1535	1472 - 1535	119	1504	1504
1536 - 1599	1536 - 1599	120	1568	1568
1600 - 1663	1600 - 1663	121	1632	1632
1664 - 1727	1664 - 1727	122	1696	1696
1728 - 1791	1728 - 1791	123	1760	1760
1792 - 1855	1792 - 1855	124	1824	1824
1856 - 1919	1856 - 1919	125	1888	1888
1920 - 1983	1920 - 1983	126	1952	1952
1984 - 2047	1984 - 2047	127	2016	2016

On-board Measured Science Rates Counts		Compressed Rate Value for Telemetry	Ground-based Decompressed Science Rates Counts Values	
A Code	C Code		A Code	C Code
2048 - 2175	2048 - 2175	128	2112	2112
2176 - 2303	2176 - 2303	129	2240	2240
2304 - 2431	2304 - 2431	130	2368	2368
2432 - 2559	2432 - 2559	131	2496	2496
2560 - 2687	2560 - 2687	132	2624	2624
2688 - 2815	2688 - 2815	133	2752	2752
2816 - 2943	2816 - 2943	134	2880	2880
2944 - 3071	2944 - 3071	135	3008	3008
3072 - 3199	3072 - 3199	136	3136	3136
3200 - 3327	3200 - 3327	137	3264	3264
3328 - 3455	3328 - 3455	138	3392	3392
3456 - 3583	3456 - 3583	139	3520	3520
3584 - 3711	3584 - 3711	140	3648	3648
3712 - 3839	3712 - 3839	141	3776	3776
3840 - 3967	3840 - 3967	142	3904	3904
3968 - 4095	3968 - 4095	143	4032	4032
4096 - 4351	4096 - 4351	144	4224	4224
4352 - 4607	4352 - 4607	145	4480	4480
4608 - 4863	4608 - 4863	146	4736	4736
4864 - 5119	4864 - 5119	147	4992	4992
5120 - 5375	5120 - 5375	148	5248	5248
5376 - 5631	5376 - 5631	149	5504	5504
5632 - 5887	5632 - 5887	150	5760	5760
5888 - 6143	5888 - 6143	151	6016	6016
6144 - 6399	6144 - 6399	152	6272	6272
6400 - 6655	6400 - 6655	153	6528	6528
6656 - 6911	6656 - 6911	154	6784	6784
6912 - 7167	6912 - 7167	155	7040	7040
7168 - 7423	7168 - 7423	156	7296	7296
7424 - 7679	7424 - 7679	157	7552	7552
7680 - 7935	7680 - 7935	158	7808	7808
7936 - 8191	7936 - 8191	159	8064	8064
8192 - 8703	8192 - 8703	160	8448	8448
8704 - 9215	8704 - 9215	161	8960	8960
9216 - 9727	9216 - 9727	162	9472	9472
9728 - 10239	9728 - 10239	163	9984	9984
10240 - 10751	10240 - 10751	164	10496	10496
10752 - 11263	10752 - 11263	165	11008	11008
11264 - 11775	11264 - 11775	166	11520	11520
11776 - 12287	11776 - 12287	167	12032	12032
12288 - 12799	12288 - 12799	168	12544	12544
12800 - 13311	12800 - 13311	169	13056	13056
13312 - 13823	13312 - 13823	170	13568	13568
13824 - 14335	13824 - 14335	171	14080	14080
14336 - 14847	14336 - 14847	172	14592	14592
14848 - 15359	14848 - 15359	173	15104	15104
15360 - 15871	15360 - 15871	174	15616	15616
15872 - 16383	15872 - 16383	175	16128	16128
16384 - 17407	16384 - 17407	176	16896	16896
17408 - 18431	17408 - 18431	177	17920	17920
18432 - 19455	18432 - 19455	178	18944	18944
19456 - 20479	19456 - 20479	179	19968	19968
20480 - 21503	20480 - 21503	180	20992	20992
21504 - 22527	21504 - 22527	181	22016	22016
22528 - 23551	22528 - 23551	182	23040	23040
23552 - 24575	23552 - 24575	183	24064	24064
24576 - 25599	24576 - 25599	184	25088	25088
25600 - 26623	25600 - 26623	185	26112	26112
26624 - 27647	26624 - 27647	186	27136	27136
27648 - 28671	27648 - 28671	187	28160	28160
28672 - 29695	28672 - 29695	188	29184	29184

On-board Measured Science Rates Counts		Compressed Rate Value for Telemetry	Ground-based Decompressed Science Rates Counts Values	
A Code	C Code		A Code	C Code
29696 - 30719	29696 - 30719	189	30208	30208
30720 - 31743	30720 - 31743	190	31232	31232
31744 - 32767	31744 - 32767	191	32256	32256
32768 - 34815	32768 - 36863	192	33792	34816
34816 - 36863	36864 - 40959	193	35840	38912
36864 - 38911	40960 - 45055	194	37888	43008
38912 - 40959	45056 - 49151	195	39936	47104
40960 - 43007	49152 - 53247	196	41984	51200
43008 - 45055	53248 - 57343	197	44032	55296
45056 - 47103	57344 - 61439	198	46080	59392
47104 - 49151	61440 - 65535	199	48128	63488
49152 - 51199	65536 - 73727	200	50176	69632
51200 - 53247	73728 - 81919	201	52224	77824
53248 - 55295	81920 - 90111	202	54272	86016
55296 - 57343	90112 - 98303	203	56320	94208
57344 - 59391	98304 - 106495	204	58368	102400
59392 - 61439	106496 - 114687	205	60416	110592
61440 - 63487	114688 - 122879	206	62464	118784
63488 - 65535	122880 - 131071	207	64512	126976
65536 - 69631	131072 - 147455	208	67584	139264
69632 - 73727	147456 - 163839	209	71680	155648
73728 - 77823	163840 - 180223	210	75776	172032
77824 - 81919	180224 - 196607	211	79872	188416
81920 - 86015	196608 - 212991	212	83968	204800
86016 - 90111	212992 - 229375	213	88064	221184
90112 - 94207	229376 - 245759	214	92160	237568
94208 - 98303	245760 - 262143	215	96256	253952
98304 - 102399	262144 - 294911	216	100352	278528
102400 - 106495	294912 - 327679	217	104448	311296
106496 - 110591	327680 - 360447	218	108544	344064
110592 - 114687	360448 - 393215	219	112640	376832
114688 - 118783	393216 - 425983	220	116736	409600
118784 - 122879	425984 - 458751	221	120832	442368
122880 - 126975	458752 - 491519	222	124928	475136
126976 - 131071	491520 - 524287	223	129024	507904
131072 - 139263	524288 - 589823	224	135168	557056
139264 - 147455	589824 - 655359	225	143360	622592
147456 - 155647	655360 - 720895	226	151552	688128
155648 - 163839	720896 - 786431	227	159744	753664
163840 - 172031	786432 - 851967	228	167936	819200
172032 - 180223	851968 - 917503	229	176128	884736
180224 - 188415	917504 - 983039	230	184320	950272
188416 - 196607	983040 - 104856	231	192512	1015808
196608 - 204799	104857 - 117963	232	200704	1114112
204800 - 212991	117964 - 131071	233	208896	1245184
212992 - 221183	131072 - 144178	234	217088	1376256
221184 - 229375	144179 - 157285	235	225280	1507328
229376 - 237567	157286 - 170392	236	233472	1638400
237568 - 245759	170393 - 183499	237	241664	1769472
245760 - 253951	183500 - 196607	238	249856	1900544
253952 - 262143	196608 - 209714	239	258048	2031616
262144 - 278527	209715 - 235928	240	270336	2228224
278528 - 294911	235929 - 262143	241	286720	2490368
294912 - 311295	262144 - 288357	242	303104	2752512
311296 - 327679	288358 - 314571	243	319488	3014656
327680 - 344063	314572 - 340786	244	335872	3276800
344064 - 360447	340787 - 367000	245	352256	3538944
360448 - 376831	367001 - 393215	246	368640	3801088
376832 - 393215	393216 - 419429	247	385024	4063232
393216 - 409599	419430 - 471858	248	401408	4456448
409600 - 425983	471859 - 524287	249	417792	4980736

On-board Measured Science Rates Counts		Compressed Rate Value for Telemetry	Ground-based Decompressed Science Rates Counts Values	
A Code	**C Code**		**A Code**	**C Code**
425984 - 442367	524288 - 576715	250	434176	5505024
442368 - 458751	576716 - 629144	251	450560	6029312
458752 - 475135	629145 - 681573	252	466944	6553600
475136 - 491519	681574 - 734002	253	483328	7077888
491520 - 507903	734003 - 786431	254	499712	7602176
≥ 507904	≥ 786432	255	516096	8126464

The EPIC instrument science information is provided to the spacecraft which multiplexes it with other instruments' information as telemetry for transmission to ground stations. The NASA-provided ground system receives this telemetry data, separates out the EPIC data and provides it, along with spacecraft attitude and ephemeris data, to the EPIC instrument team. EPIC ground-based processing then demultiplexes and organizes the instrument telemetry data and stores it as original measurements (compressed by the on-board DPU) into Level 1 files as 2 PHA channels (one each for STICS and ICS) and 139 Engineering and Science Rates channels (51 STICS and 88 ICS). These channels are shown in the Table 3 along with descriptive information.

The data within the Level 1 files has not been converted or corrected from its original state on the spacecraft. The next section details the processing steps of conversion and corrections that may be applied to the Level 1 data to yield measures of the original ambient conditions encountered by the instrument.

EPIC Sensor Elevation Angles

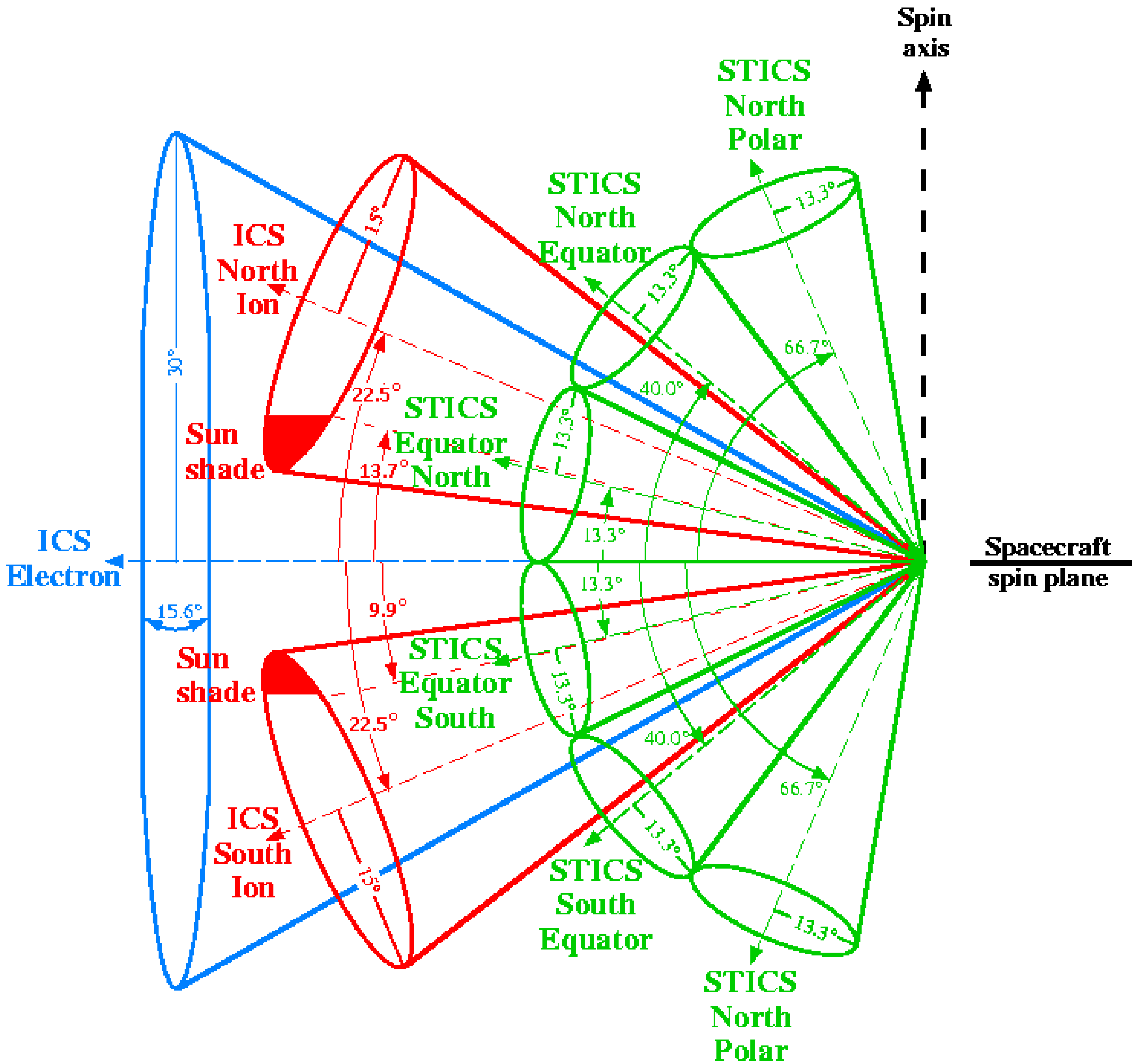

Figure 9 - EPIC Sensors Elevation Field-of-view Geometries

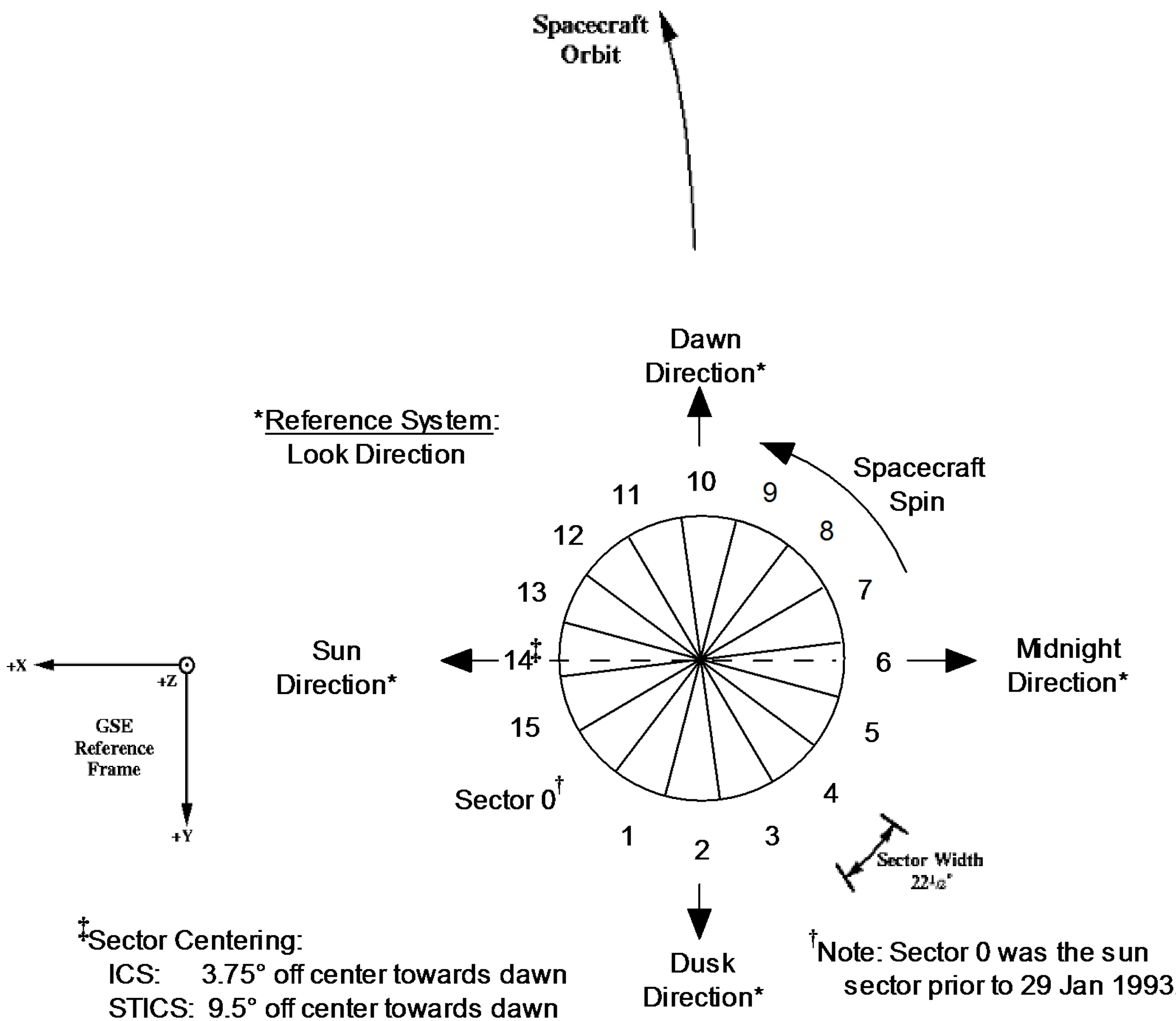

Figure 10 - Geotail Spacecraft and EPIC Sensors Azimuth Geometries

Table 3 - ICS and STICS PHA and Science Rates Channels

Channel Name	Channel Number	Sensor Type (code)	Data Type	The Number of				Energy Pass Band † [keV or keV/e †]	
				Heads	Heads Summed	Sectors Summed	Spins Summed	Low ††	High ††
I_PHA	1	ICS (-1)	PHA	3 ††	2	1	16	n/a	
S_PHA	2	STICS (-2)	PHA	4 ††	2	1	16	n/a	
I_DCR ions	3	ICS (1)	Engineering Rates	2	1	1	16	n/a	
I_FSR ions	4	ICS (1)	Engineering Rates	2	1	1	2	n/a	
I_RSR ions	5	ICS (1)	Engineering Rates	2	1	1	16	n/a	
I_SSD ions	6	ICS (1)	Engineering Rates	2	1	1	16	n/a	
I_TCR ions	7	ICS (1)	Engineering Rates	2	1	1	16	n/a	
I_MDCR ion	8	ICS (1)	Engineering Rates	1	1	1	32	n/a	
I_MFSR ion	9	ICS (1)	Engineering Rates	1	1	1	16	n/a	
I_UFSR ion	10	ICS (1)	Engineering Rates	1	1	1	16	n/a	
I_URSR ion	11	ICS (1)	Engineering Rates	1	1	1	16	n/a	
ED1 e-	12	ICS (1)	Engineering Rates	1	1	2	1	38.0*	∞
ED2 e-	13	ICS (1)	Engineering Rates	1	1	1	16	110.0	∞
E0 energ	14	ICS (1)	Science Rates	2	1	4	32	n/a	
E1 energ	15	ICS (1)	Science Rates	2	1	1	2	45.9	52.7
E2 energ	16	ICS (1)	Science Rates	2	1	1	16	52.7	61.5
E3 energ	17	ICS (1)	Science Rates	2	1	1	2	61.5	73.7
E4 energ	18	ICS (1)	Science Rates	2	1	1	2	73.7	89.3
E5 energ	19	ICS (1)	Science Rates	2	1	1	16	89.3	110.2
E6 energ	20	ICS (1)	Science Rates	2	1	1	16	110.2	137.4
E7 energ	21	ICS (1)	Science Rates	2	1	1	16	137.4	173.1
E8 energ	22	ICS (1)	Science Rates	2	1	1	16	173.1	220.0
E9 energ	23	ICS (1)	Science Rates	2	1	1	16	220.0	281.5
E10 energ	24	ICS (1)	Science Rates	2	1	1	16	281.5	362.9
E11 energ	25	ICS (1)	Science Rates	2	1	1	16	362.9	471.4
E12 energ	26	ICS (1)	Science Rates	2	1	1	16	471.4	615.9
E13 energ	27	ICS (1)	Science Rates	2	1	1	16	615.9	913.2
E14 energ	28	ICS (1)	Science Rates	2	1	1	32	913.2	1352.3
E15 energ	29	ICS (1)	Science Rates	2	1	1	32	1352.3	2013.9
E16 energ	30	ICS (1)	Science Rates	2	1	1	32	2013.9	3005.4
E17 energ	31	ICS (1)	Science Rates	2	1	4	32	n/a	
E_B2 energ	32	ICS (1)	Science Rates	2	2	1	1	52.7	61.5
E_B5 energ	33	ICS (1)	Science Rates	2	2	1	1	89.3	110.2
T0 TOF	34	ICS (1)	Science Rates	2	1	4	32	n/a	
T1 TOF	35	ICS (1)	Science Rates	2	1	1	32	2.0	3.5
T2 TOF	36	ICS (1)	Science Rates	2	1	1	32	3.5	6.0
T3 TOF	37	ICS (1)	Science Rates	2	1	1	32	6.0	7.2
T4 TOF	38	ICS (1)	Science Rates	2	1	1	32	7.2	8.8
T5 TOF	39	ICS (1)	Science Rates	2	1	1	32	8.8	10.7
T6 TOF	40	ICS (1)	Science Rates	2	1	1	16	10.7	12.9
T7 TOF	41	ICS (1)	Science Rates	2	1	1	32	12.9	15.7
T8 TOF	42	ICS (1)	Science Rates	2	1	1	16	15.7	19.0
T9 TOF	43	ICS (1)	Science Rates	2	1	1	16	19.0	23.0
T10 TOF	44	ICS (1)	Science Rates	2	1	1	16	23.0	27.8
T11 TOF	45	ICS (1)	Science Rates	2	1	1	2	27.8	33.7
T12 TOF	46	ICS (1)	Science Rates	2	1	1	16	33.7	40.9
T13 TOF	47	ICS (1)	Science Rates	2	1	1	16	40.9	49.5
T14 TOF	48	ICS (1)	Science Rates	2	1	1	32	49.5	60.0
T15 TOF	49	ICS (1)	Science Rates	2	1	1	16	60.0	77.0
T16 TOF	50	ICS (1)	Science Rates	2	1	1	32	77.0	100.0
T17 TOF	51	ICS (1)	Science Rates	2	2	1	32	n/a	
T_B14 TOF	52	ICS (1)	Science Rates	2	2	1	1	49.5	60.0

Channel Name	Channel Number	Sensor Type (code)	Data Type	The Number of				Energy Pass Band [keV or keV/e †]	
				Heads	Heads Summed	Sectors Summed	Spins Summed	Low ††	High ††
H1 Z>20	53	ICS (1)	Science Rates	2	1	1	32	395.0	619.0
H2 Z>20	54	ICS (1)	Science Rates	2	1	1	32	619.0	838.0
H3 Z>20	55	ICS (1)	Science Rates	2	1	1	32	838.0	1202.0
H4 Z>20	56	ICS (1)	Science Rates	2	1	1	32	1202.0	1772.0
H5 Z>20	57	ICS (1)	Science Rates	2	1	1	32	1772.0	2728.0
H6 Z>20	58	ICS (1)	Science Rates	2	1	1	32	2728.0	4405.0
HE1 He	59	ICS (1)	Science Rates	2	1	1	16	53.4	70.0
HE2 He	60	ICS (1)	Science Rates	2	1	1	2	70.0	95.8
HE3 He	61	ICS (1)	Science Rates	2	1	1	16	95.8	135.0
HE4 He	62	ICS (1)	Science Rates	2	1	1	16	135.0	194.0
HE5 He	63	ICS (1)	Science Rates	2	1	1	16	194.0	280.8
HE6 He	64	ICS (1)	Science Rates	2	1	1	16	280.8	407.4
HE7 He	65	ICS (1)	Science Rates	2	1	1	16	407.4	595.5
HE8 He	66	ICS (1)	Science Rates	2	1	1	16	595.5	888.7
HE9 He	67	ICS (1)	Science Rates	2	1	1	32	888.7	1631.4
HE10 He	68	ICS (1)	Science Rates	2	1	1	32	1631.4	3052.9
M1 CNO	69	ICS (1)	Science Rates	2	1	1	16	165.4	186.5
M2 CNO	70	ICS (1)	Science Rates	2	1	1	16	186.5	221.4
M3 CNO	71	ICS (1)	Science Rates	2	1	1	16	221.4	275.2
M4 CNO	72	ICS (1)	Science Rates	2	1	1	16	275.2	360.2
M5 CNO	73	ICS (1)	Science Rates	2	1	1	16	360.2	493.5
M6 CNO	74	ICS (1)	Science Rates	2	1	1	16	493.5	697.2
M7 CNO	75	ICS (1)	Science Rates	2	1	1	32	697.2	1016.2
M8 CNO	76	ICS (1)	Science Rates	2	1	1	32	1016.2	1522.0
M9 CNO	77	ICS (1)	Science Rates	2	1	1	32	1522.0	2315.7
M10 CNO	78	ICS (1)	Science Rates	2	1	1	32	2315.7	3565.3
P1 p+	79	ICS (1)	Science Rates	2	1	1	16	45.9	58.1
P2 p+	80	ICS (1)	Science Rates	2	1	1	2	58.1	77.3
P3 p+	81	ICS (1)	Science Rates	2	1	1	16	77.3	107.4
P4 p+	82	ICS (1)	Science Rates	2	1	1	16	107.4	154.3
P5 p+	83	ICS (1)	Science Rates	2	1	1	16	154.3	227.5
P6 p+	84	ICS (1)	Science Rates	2	1	1	16	227.5	341.6
P7 p+	85	ICS (1)	Science Rates	2	1	1	16	341.6	522.5
P8 p+	86	ICS (1)	Science Rates	2	1	1	16	522.5	813.5
P9 p+	87	ICS (1)	Science Rates	2	1	1	32	813.5	1560.8
P10 p+	88	ICS (1)	Science Rates	2	1	1	32	1560.8	3005.4
SM ions	89	ICS (1)	Science Rates	2	1	4	32	n/a	
ZM ions	90	ICS (1)	Science Rates	2	1	4	32	n/a	
S_DCR ions	91	STICS (2)	Engineering Rates	3	1	16	1	n/a	
S_FSR ions	92	STICS (2)	Engineering Rates	3	1	16	1	n/a	
S_RSR ions	93	STICS (2)	Engineering Rates	3	1	16	1	n/a	
S_SSD ions	94	STICS (2)	Engineering Rates	3	1	16	1	n/a	
S_TCR ions	95	STICS (2)	Engineering Rates	3	1	16	1	n/a	
S_MDCR ion	96	STICS (2)	Engineering Rates	1	1	16	1	n/a	
S_MFSR ion	97	STICS (2)	Engineering Rates	1	1	16	1	n/a	
S_UFSR ion	98	STICS (2)	Engineering Rates	1	1	16	1	n/a	
S_URSR ion	99	STICS (2)	Engineering Rates	1	1	16	1	n/a	
MPF	100	STICS (2)	Engineering Rates	1	1	16	1	n/a	
MPR	101	STICS (2)	Engineering Rates	1	1	16	1	n/a	
Diagnostic	102	STICS (2)	-	1	1	16	1	n/a	
HR0 H+	103	STICS (2)	Science Rates	6	1	1	1	9.38	212.14
HR10 O+1	104	STICS (2)	Science Rates	6	1	1	1	9.38	212.14
HR11 FSRs	105	STICS (2)	Science Rates	6	1	1	1	9.38	212.14
SMR0 He+1	106	STICS (2)	Science Rates	3	1	2	1	9.38	212.14

Channel Name	Channel Number	Sensor Type (code)	Data Type	The Number of				Energy Pass Band † [keV or keV/e †]	
				Heads	Heads Summed	Sectors Summed	Spins Summed	Low ††	High ††
SMR1 He+2	107	STICS (2)	Science Rates	3	1	2	1	9.38	212.14
SMR2 O+2	108	STICS (2)	Science Rates	3	1	2	1	9.38	212.14
BR0 CNOFe	109	STICS (2)	Science Rates	3	1	2	1	9.38	212.14
BR1 O&NO	110	STICS (2)	Science Rates	3	1	2	1	9.38	212.14
BR2 H&He	111	STICS (2)	Science Rates	3	1	2	1	9.38	212.14
MR0 C+3	112	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR1 C+4	113	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR2 C+5	114	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR3 C+6	115	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR4 N+1	116	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR5 N+4	117	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR6 N+2	118	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR7 N+2ZM	119	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR8 BHE2	120	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR9 BHE1	121	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR10 BH+ZM	122	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR11 O+2ZM	123	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR12 O+3	124	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR13 O+4	125	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR14 O+5	126	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR15 O+6	127	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR16 O+7	128	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR17 O+8	129	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR18 Ne+8	130	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR19 MgSiL	131	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR20 MgSiH	116	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR21 Fe+6	133	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR22 Fe+8	134	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR23 Fe+10	135	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR24 Fe+12	136	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR25 Fe+14	137	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR26 Fe+16	138	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR27 NO&O2	139	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR28 BH+tr	140	STICS (2)	Science Rates	1	1	16	1	9.38	212.14
MR29 C+2	141	STICS (2)	Science Rates	1	1	16	1	9.38	212.14

Table 3 - ICS and STICS PHA and Science Rates Channels, version 2.14

† Energy pass band values are in units of keV for ICS Sensor channels and in units of keV/e for STICS channels.

†† a) STICS Sensor energy values change, or step, with each successive spin in a cyclic manner; see Table 4 - STICS DV Values for exact values of this cycle; values given are the arithmetic mid point of the DV step low and high energy limits for the lowest and highest DV steps.

b) ICS Sensor energy low and high values change with aperture position; values given are for the open aperture position. See Table A 4 for energy band pass values for foil aperture position.

* On 8 Mar 1993 the threshold for electron detector channel ED1 was raised from 34 keV to 38 keV

Table 4 - STICS DV Values

DV Step†	Energy Bands [keV/e]		
	E/Q Low	E/Q Mid	E/Q High
0	7.42	7.51	7.60
1	8.29	8.39	8.49
2 ††	**9.27**	**9.38**	**9.49**
3	10.36	10.48	10.60
4	11.58	11.72	11.86
5	12.95	13.10	13.25
6 ††	**14.47**	**14.64**	**14.81**
7	16.18	16.37	16.56
8	18.08	18.30	18.52
9	20.21	20.45	20.69
10 ††	**22.59**	**22.86**	**23.13**
11	25.26	25.56	25.86
12	28.23	28.57	28.91
13	31.56	31.94	32.32
14 ††	**35.28**	**35.70**	**36.12**
15	39.44	39.91	40.38
16	44.09	44.61	45.13
17	49.27	49.86	50.45
18 ††	**55.09**	**55.74**	**56.39**
19	61.58	62.31	63.04
20	68.83	69.65	70.47
21	76.94	77.85	78.76
22 ††	**86.00**	**87.02**	**88.04**
23	96.14	97.28	98.42
24	107.46	108.74	110.02
25	120.12	121.55	122.98
26 ††	**134.27**	**135.87**	**137.47**
27	150.10	151.88	153.66
28	167.79	169.78	171.70
29	187.55	189.78	192.00
30 ††	**209.65**	**212.14**	**214.60**
31	234.35	237.14	239.90

† Points among which the STICS sensor can be configured to cycle, or step.

†† The STICS sensor has cycled from launch to the present primarily among these 8 steps in order of highest to lowest DV Step. The exception is that, from 2005-325 02:12:00 to 2007-057 17:13:18, STICS stepped among all 32 steps in order of highest to lowest DV Step.

4 EPIC Science Rate Data Conversion

Calibrated scientific data is derived from the EPIC telemetry Science Rates data by applying the following sequential ground-based processing steps:

Step	Operation	Units of or resulting from the operation
1.	Conversion to count rate	[compressed counts] to [counts per second (cps)]
2.	Correction for sector dead-time (optional)	*unit independent*
3.	Correction for background (optional)	in [cps]
4.	Correction for R vs. R (optional)	*unit independent*
5.	Correction for efficiency (optional)	*unit independent*
6.	Conversion to integral flux	[cps] to [$(cm^2$ sec $sr)^{-1}$]
7.	Conversion to differential flux	[$(cm^2$ sec $sr)^{-1}$] to [$(cm^2$ sec sr $keV)^{-1}$]

These processing steps are basically performed as a sequence in the above order. Conversion from counts to count rate is required to be first and the sector dead-time correction second. The correction for background, an offset operation (i.e. a subtraction), is required to be performed next. The remaining corrections and conversions are scaling operations (i.e. multiplications or divisions) and hence can be performed in any order.

Depending upon the desired calibrated results, the sequence of apply the processing steps may be stopped at any point. Specifically, by stopping at any point along processing steps 1 through 5, count rate data is produced; by stopping at processing step 6, integral flux data is produced; and by completing processing step 7, differential flux data is produced.

The correction processing steps, 2 through 5, may be optionally skipped in the calibration sequence. While contributing useful and important adjustments, they may not be desired in the final results.

Certain correction processing steps are not applicable in certain situations. For example, corrections for background and for R vs. R are only applicable for ICS channels and not for STICS channels. In such cases, attempts by a user to apply these corrections in data processing are ignored within the calibration processing steps.

For shorthand notation, these conversion and correction steps are selected for use in the processing sequence through the use of a 12-character field referred to as CALSTEPS (short-hand notation for calibration steps). Currently only the first left-most six and ninth character positions are employed; the seventh, eighth and two right-most characters are reserved for future use. Each of the above discussed seven conversion and correction steps is assigned a position within CALSTEPS, as outlined in the next sections, by which to control its use. A value of "0" (or space) in a particular position indicates that the corresponding conversion or correction operation should not be performed while a value of "1" generally indicates that it should be performed; in some cases values of "1" or "2" are used to chose between several options for corrections. As an example, a CALSTEPS value of "111111001" indicates that all seven conversion and correction steps should be performed while a value of "100000000" indicates that only the count rate conversion should be performed.

4.1 *Conversion to Count Rate*

Summary

Conversion

$$\text{Count Rate} = \text{Counts} \;/\; (\text{Sector Period}_{S/C} \;*\; \text{Sectors Summed}_{Number} \;*\; \text{Spins Summed}_{Number}) \quad (1)$$

where

Sector Period$_{S/C}$ is

- the general EPIC sector period for the Geotail spacecraft, which is nominally 3/16 seconds

Sectors Summed$_{Number}$ is

- the number of adjacent sectors during which the DPU accumulates counts for the particular channel of interest

Spins Summed$_{Number}$ is

- the number of successive spins during which the DPU accumulates counts for the particular channel of interest

Options:

CALSTEPS field position 1: N x x x x x x x x x ,

where N = 0 causes no count rate conversions to be applied to the data

$\neq$ 0 causes count rate conversions to be applied to the data

Details

The binned counts of the Science Rates data are generally accumulated by the DPU over 16 equally divided periods, called sectors, of a spin of the Geotail spacecraft. The nominal spin period of the Geotail spacecraft has been approximately 3 seconds since launch. The exact spin period has varied over the mission and is recorded in the attitude data files distributed by the NASA Geotail project. For use by EPIC ground data processing, daily spin period values are stored in the file SPIN_PERIOD.DAT; the content of this file is given in Table A 3, which is a compressed file that shows spin period transitions.

A count rate is derived from the binned counts by dividing the counts value by the nominal sampling interval during which the counts observations were accumulated. This sampling interval is the product of the general EPIC sector period, the number of adjacent sectors that are summed by the EPIC DPU for the channel and the number of successive spins that are summed by the DPU for the channel. Note that the adjustment of this general sector period to the actual sector period is described in the next section, Correction for Sector Dead Time.

The number of sectors summed for ICS and STICS channels varies from 1 to 16, and the number of spins summed varies from 1 to 32. See Table 3 for values.

4.2 *Conversion for Sector Dead Time (optional)*

Summary

Correction

$$\text{Count Rate}_{\text{DeadT\_Cor}} = \text{Count Rate} * \text{Sector Dead-time Factor} \quad (2)$$

where

Sector Dead-time Factor depends upon

- Sensor type: ICS versus STICS
- Channel type: Engineering versus Science
- Sector number: Zeroth versus non-zeroth (i.e., 1-15)

Options:

CALSTEPS field position 4: x x x N x x x x x ,

where N = 0 causes no sector dead-time corrections to be applied to the data

= 1 causes sector dead-time corrections to be applied to the data

= 2 causes sector dead-time corrections to be applied to the data and applies a weighting factor to be applied to the 0th, or first, sector

Details

The sector dead-time correction compensates for periods within a sector during which counts do not contribute to the DPU accumulations. This loss occurs when the DPU makes no accumulations in rate counters because it is busy performing initialization tasks at the beginning of each sector (the primary reason) or when accumulations in rate counters are subsequently lost due to a reset of the accumulators. This time loss for observations, or dead time, for a sector proportionally lowers the final count total for that sector. A correction for this loss is achieved by multiplying the observed counts by a factor that is proportional to the ratio of the time length of a sector, T_{Sector}, divided by the difference of the T_{Sector} and the dead time, $T_{Dead\text{-}time}$, for the sector:

$$\text{Sector Dead-time Correction} \propto \frac{T_{Sector}}{(T_{Sector} - T_{Dead\ time})} \quad (3)$$

where

T_{Sector} is the time of the sector

$T_{Dead\ time}$ is the dead time of the sector

The exact value of the sector dead time depends upon whether the data channel belongs to the ICS or STICS sensor, whether the data channel is an Engineering or Science channel, and whether the sector is the 0^{th}, or first, sector of the spin. Values for dead times are given in Table 5. See Appendix B for an e-mail message from TUB detailing dead time information for STICS.

Table 5 - ICS and STICS Dead-time Values

Sensor type	Channel type	Dead times (msec) Sector 0	Dead times (msec) Sectors 1-15	0^{th} Sector Weighting Factor
ICS	Engineering	0.4	0.4	1.0
ICS	Science	34.6	18.2	1.0
STICS	Engineering	0.4	0.4	1.0
STICS	Science	130.0	18.2	1.08

The exact application of the sector dead time correction depends upon how many adjacent sectors are summed by the DPU.

If the sector does not include the 0^{th} sector, then for single-, double- or four-summed sectors,

$$\text{Sector Dead-time Correction} = \frac{T_{Sector}}{(T_{Sector} - T_{Dead\ time})} \quad (4a)$$

For the 0^{th} single-summed sector,

$$\text{Sector Dead-time Correction} = \frac{T_{Sector}}{\dfrac{(T_{Sector} - T_{Dead\ time})}{\text{Wt Factor}_{0\text{-sector}}}} \quad (4b)$$

where

$\text{Wt Factor}_{0\text{-sector}}$ is the weighting factor for the 0^{th} sector

The 0^{th} sector weighting factor, 0-sector, is stored in and read from the EPIC CALIBRATION data file. To date since launch this weighting factor has been 1.08 for STICS and 1.0 for ICS for Science Rates and 1.0 for both sensor for Engineering Rates (see Table 5).

For double-summed or four-summed sectors that include the 0^{th} sector and for 16-summed sectors, which always includes the 0^{th} sector,

$$\text{Sector Dead-time Correction} = \frac{N_{SS} * T_{Sector}}{\left[\dfrac{(T_{Sector} - T_{0\text{-Dead time}})}{\text{Wt Factor}_{0\text{-Sector}}} + (N_{SS} - 1)(T_{Sector} - T_{Dead\ time}) \right]} \quad (4c)$$

where

N_{SS} is the number of sectors that are summed by the DPU

$T_{0\text{-Dead time}}$ is the sector dead time for 0^{th} sector

$T_{Dead\ time}$ is the sector dead time for non-0^{th} sectors

For double-summed or four-summed sectors that do not include the 0th sector, the Sector Dead-time Correction reverts to that of Equation 4a.

During execution of the EPIC_TABULAR computer program, the application of the sector dead-time correction to data conversion calculations is controlled by setting to a non-zero value the 4th digit, from the left, within the Calsteps field. A digit value of one results in a normal correction while a digit value of two results in a correction weighted by a factor of 1.08.

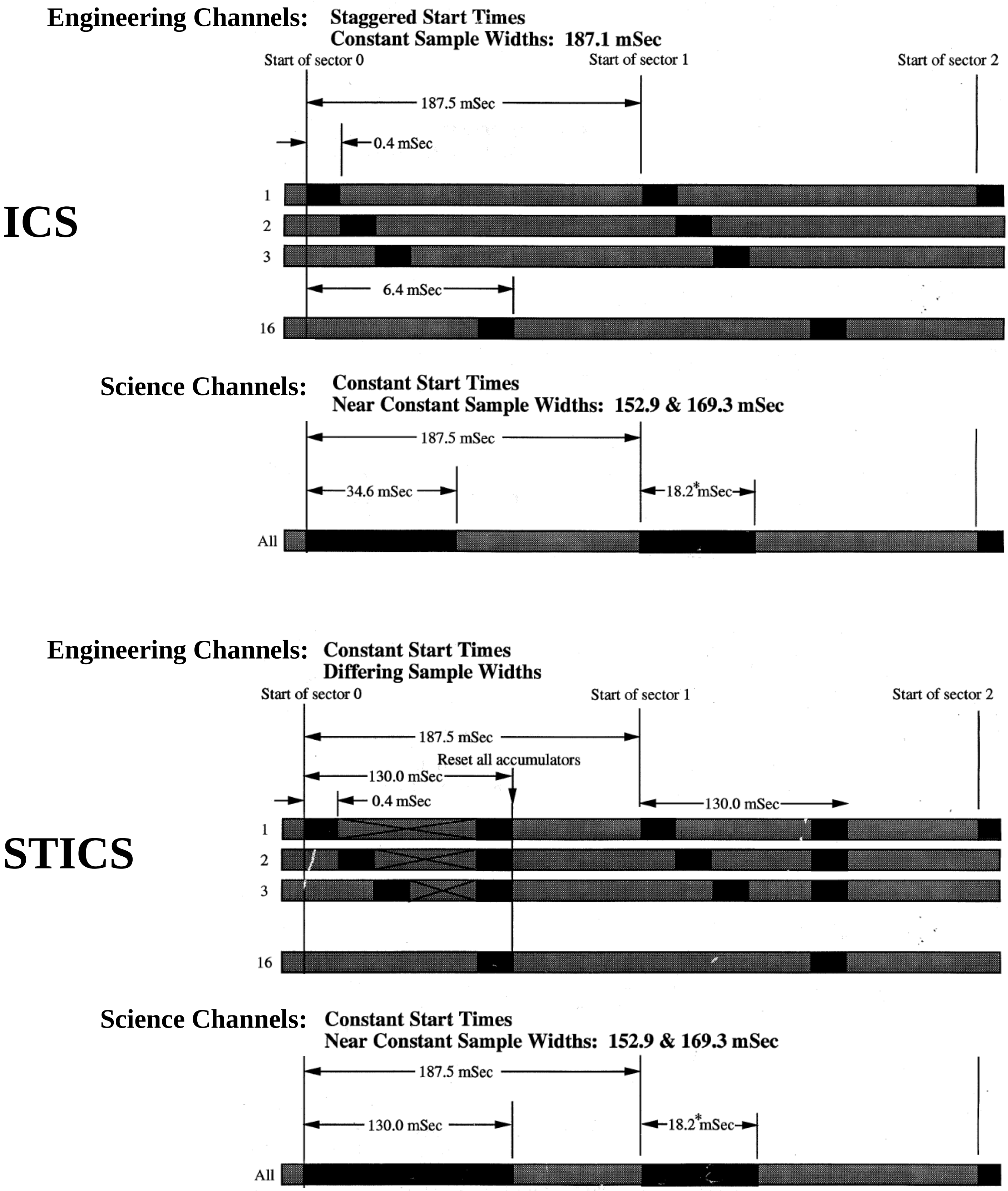

Figure 11 - ICS and STICS Subsystems Sector Timing and Dead Times

4.3 ***Correction for Background (optional)***

Summary

Correction

$$\text{Count Rate}_{\text{BGnd\_Cor}} = \text{Count Rate - Background Rate}_{\text{ICS}} \quad (5)$$

where

Background RateICS depends upon
- Sensor type: ICS only
- Head: ICS north (#0) or south (#1)
- Channel; i.e., species & energy band (ICS Energy and ED channels only)

Options:

CALSTEPS field position 2: x N x x x x x x x ,

where N = 0 causes no background subtraction corrections to be applied to the data
= 1 causes background subtraction corrections to be applied to the data in which resultant negative count rates may occur.
= 2 causes background subtraction corrections to be applied to the data in which resultant negative count rates are set to zero.

Details

A correction to remove ambient background count rates can be applied to the ICS sensor ED and Energy channels; no corrections are applied to other ICS Rates channels or any STICS Rates channels. Values for these background count rate levels are empirically derived from observations taken during quiet periods and are stored for retrieval from the Calibration Data File. See Table A1 for the values of the background count rate levels in units of counts/sec; see Tables A7 and A8 for the corresponding values of the background count rate in units of flux the Energy channels and Electron Detector, respectively.

Within the EPIC software code, the background correction is alternately referred to as background subtraction.

4.4 *Correction for R vs. R "Dead Time" (optional)*

Summary

Correction

$$\text{Count Rate}_{\text{RvsR\_Cor}} = \text{Count Rate / UFSR-Based Correction Factor} \quad (6)$$

where

UFSR-Based Correction Factor depends upon

- Sensor type: ICS only
- ICS UFSR channel count rate

Options:

CALSTEPS field position 3: x x N x x x x x x ,

where N = 0 causes no R-vs-r correction to be applied to the data

= 1 causes R-vs-r correction to be applied to the data

Details

At high ion count rates the ICS AE experiences a decreased responsiveness relative to the incident ion population. This response has been empirically quantified, as a function of the ICS UFSR count rate, as follows:

$$\frac{\text{Events Rates}_{\text{Observed}}}{\text{Events Rates}_{\text{Real}}} = -8.172e^{-20} * X_{\text{UFSR}}^{3} + 3.556e^{-13} * X_{\text{UFSR}}^{2} - 7.016e^{-7} * X_{\text{UFSR}} + 1.004e^{-13} \quad (7)$$

where

X_{UFSR} is the observed count rate in the ICS UFSR channel

This equation, shown as the solid line, is plotted in Figure 12.

To reconstruct real count rates from observed count rates in ground-based processing, an observed count rate for a channel can be divided by the ratio of observe to real count rates, which is given by the right-hand side of Equation 7 as a function of the UFSR count rate. In applying this correction, a threshold in the UFSR count rate is automatically employed such that the correction is not used unless the UFSR count rate is greater than 1.0E+05.

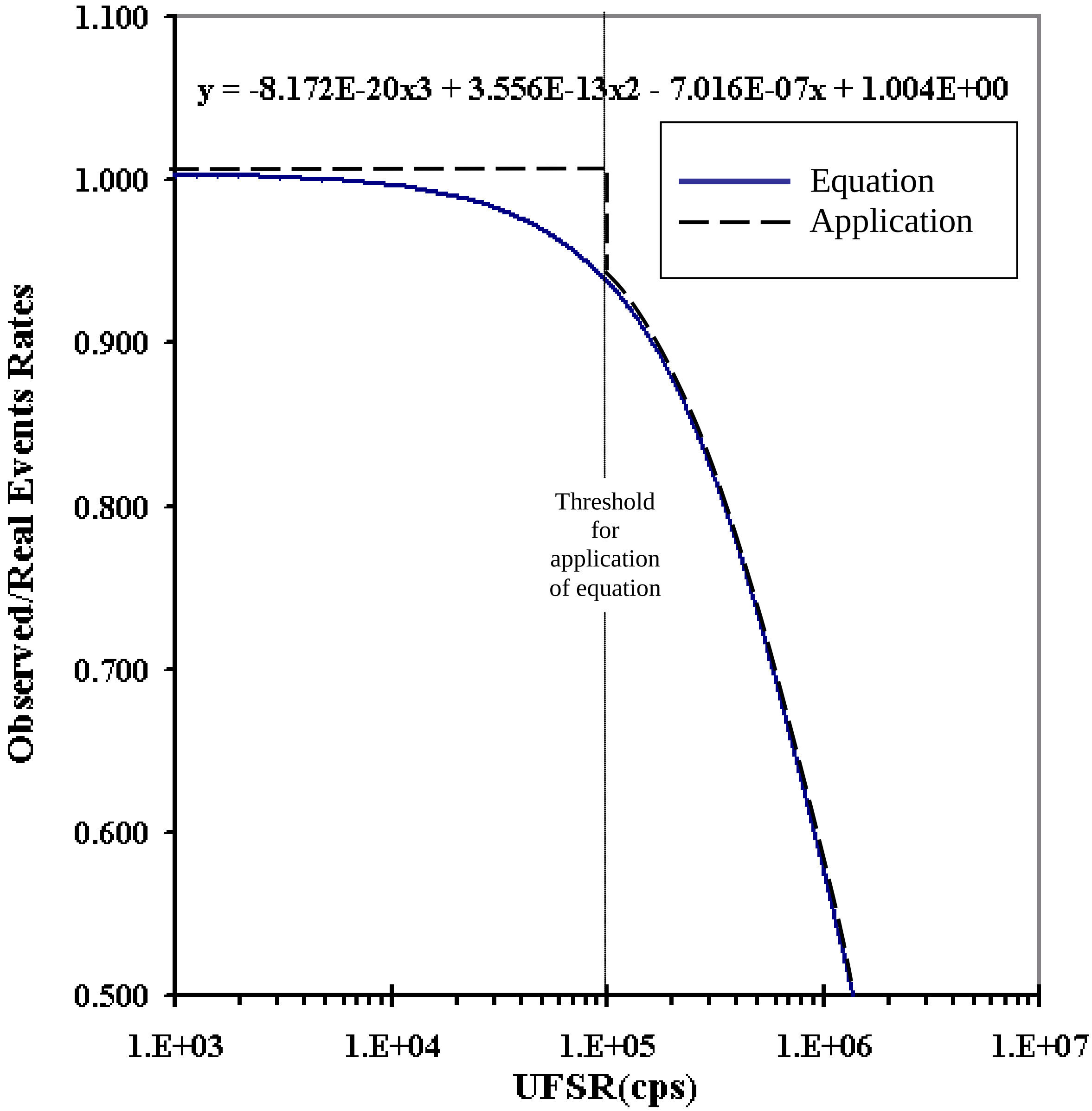

Figure 12 - ICS Science Channels R vs. R

The ratio of observed to real event count rates for ICS channel is shown as a function of ICS UFSR channel count rates. In application, a UFSR threshold is employed below which no corrections are made to data during processing.

4.5 *Correction for Efficiency (optional)*

Summary

Correction

Count Rate = Count Rate / Efficiency (8)

where

Efficiency depends upon

- Channel; i.e., species & energy band
- DV step (STICS only)
- Head (ion species only)
- Sector number: pre-sun sector, sun sector, post-sun sector, the set of remaining sectors (ICS only)
- Aperture position (ICS only)

Options:

CALSTEPS field position 6: x x x x x N x x x ,

where N = 0 causes no efficiency corrections to be applied to the data

= 1 causes efficiency corrections to be applied to the data

Details

The correction of count rates for sensor efficiency is achieved by dividing the observed count rate by the applicable efficiency value.

For the ICS sensor, efficiency values differ by channel (i.e., species and energy band), detector head, and aperture position. Efficiency is taken as 1.0 for all Engineering Rates channels and for the Energy, TOF and Electron Detector Science Rates channels. Efficiency also depends upon the sector of observation as distinguished by the sector before the sun sector (pre-sun sector), the sun sector, the sector after the sun sector (post-sun sector) and the set of the remaining sectors. The sun sector is defined within the telemetry data stream; for July 24, 1992 (launch date) through February 30, 2003, the sun sector was sector 0 and has been sector 14 since then to the present. So for most of the mission, efficiency values have depended upon whether the observations were in sectors 13, 14, 15 or 1-12. See Table A 1 for ICS efficiency values.

For the STICS sensor, efficiency values differ by channel (i.e., species and energy) and DV step, and detector head. Efficiency is taken as 0.5 for all Engineering Rates channels. See Table A 5 for STICS efficiency values.

4.6 *Conversion to Integral Flux*

Summary

Conversion

$$\text{Integral Flux} = \text{Count Rate} / (\text{Geometric Factor} / N_{Heads}) \quad (9)$$

where

Geometric factor depends upon

- Channel; i.e., species & energy band (ICS ion only)
- Head (ion species only_
- Aperture position (ICS only)

N_{Heads} is

- the number of polar heads:
  - STICS: 1, 3 or 6
  - ICS: Not applicable

Options:

CALSTEPS field position 5: x x x x N x x x x ,

where N = 0 causes no integral flux conversions to be applied to the data
= 1 causes integral flux conversions to be applied to the data
= 2 causes interpreted integral flux conversions to be applied to the data between the discontinuous DV steps (STICS only)

Details

The conversion of count rate to integral flux is achieved by dividing the observed count rate by the applicable geometric factor.

For the ICS sensor, the value of the geometric factor can differ among channels and between its two ion heads. The geometric factor also differs with the position of the three aperture positions - open, foil, and foil plus 10% grid. Values for the geometric factor are given in Table A 1 for the open aperture position. For the other two aperture positions, the geometric factor is a fixed percentage of that for the open position, independent of ICS channel. Specifically, the ratio of geometric factors of open and foil aperture positions has been 1.57 since launch; for foil to foil + 10% has been 7.0. See Table A 2 for these ratio values.

For the STICS sensor, the value of the geometric factor is the same for all channels. The value used to date for the mission has been the same value of 0.05 cm^2 sr for the combined aperture of the three polar heads the combined view of 160°. This corresponds to the telescope for the MR channels. For those channels that divide this polar coverage into three or six separate heads, the geometric factor is weighted by dividing it by the number of heads used, the N_{Heads} of Equation 7. For the HR channels, this value for the number of heads is six, while for the SMR and BR channels, this value is three.

The preceding STICS integral flux is the flux within the narrow energy bands of the DV steps (see Table 4 - STICS DV Values) for the STICS channels. These bands range in width from approximately 0.2 to 5.0 keV/e for DV steps 2 through 30, respectively. These discontinuous integral flux measurements fall with the broader energy range of approximately 9.2 to 215 keV/e as illustrated in Figure 13, below. A processing option is provided by which the integral flux is interpolated across this broader range.

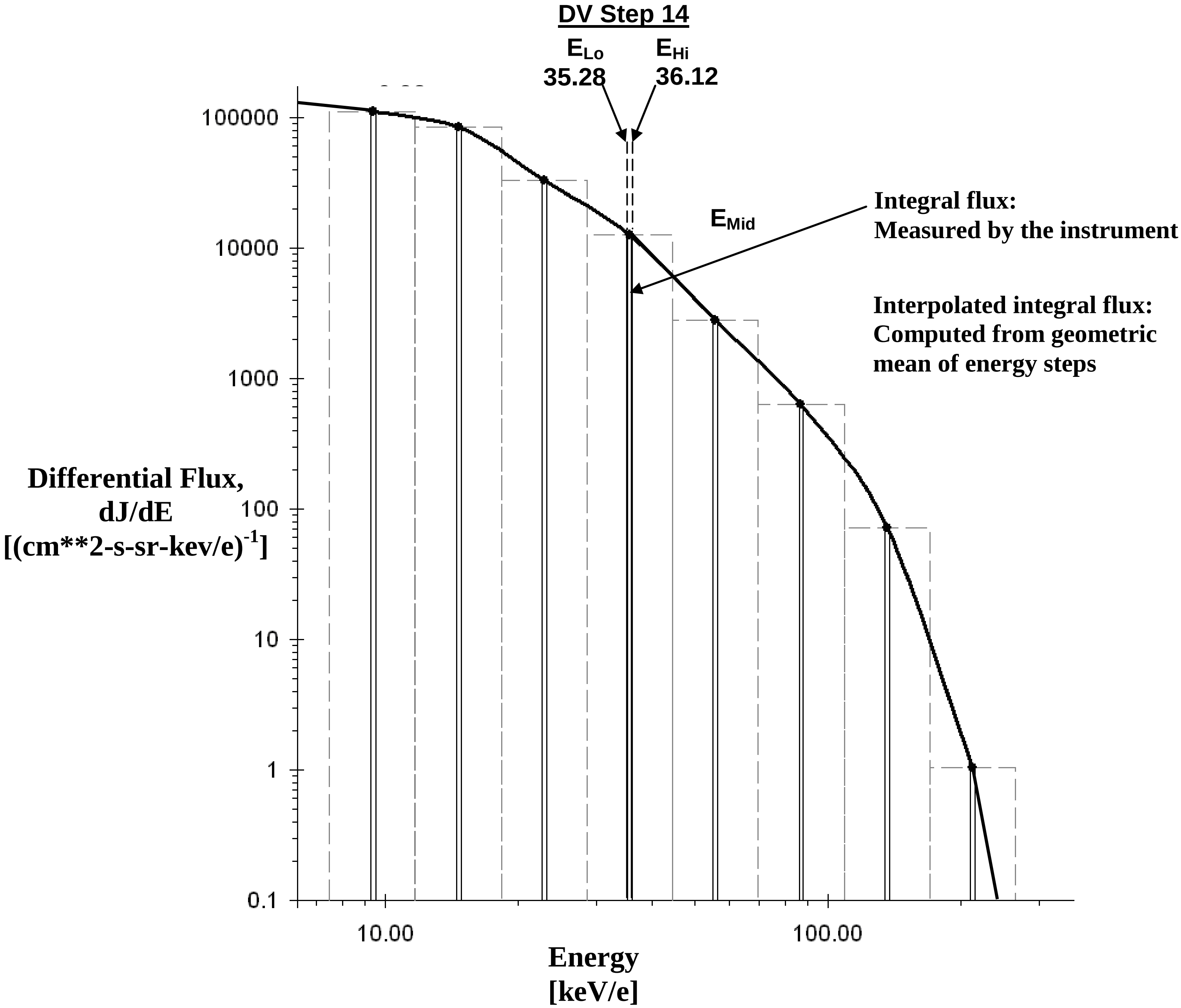

Figure 13 - STICS Interpreted Integral Flux

Roughly this interpolated integral flux is computed by multiplying the integral flux of each DV step by the ratio of the energy width separating each DV step to the energy width of the DV step.

$$\text{Integral Flux}_{\text{Interpolated}} = \text{Integral Flux} * \frac{D(E/Q)}{d(E/Q)} \qquad (10)$$

where

d(E/Q) is the difference of the high and low limits of a DV step

D(E/Q) is the difference of (a) the geometric mean of the energy mid points for a DV step and the next higher DV step, and (b) the geometric mean of the energy mid points for a DV step and the next lower DV step

Table 6 shows for each DV steps the values of D(E/Q), d(E/Q) and intermediate computational values for these pairs.

The ratio of D(E/Q) to d(E/Q) is, on average, 19.15; so the value of interpolated integral flux is approximately 19.15 times that of the sum of the integral flux for the 8 DV steps and covers the energy band of 7.49 to 265.07 keV/e. Option 2 for CALSTEPS position 5.

Table 6 - STICS DV energy values for interpolated integral flux

d(E/Q) is used for the calculation of differential flux and D(E/Q) is used for the calculation of integral flux. Differential channel FWHMX=0.0235; Integral channel D(E/Q)=0.4494.

DV Step, i	E_{Lo} [keV/e]	E_{Mid} [keV/e]	E_{Hi} [keV/e]	d(E/Q), E_{Lo} - E_{Hi}	Geometric Mean of $E_{i\,Mid}$ & $E_{i-1\,Mid}$	D(E/Q), Δ Geometric Mean	D(E/Q) / E_{Mid}	D(E/Q) / d(E/Q)
					7.49			
2	9.27	9.38	9.49	0.220		4.21	0.4488	19.14
					11.70			
6	14.47	14.64	14.81	0.344		6.58	0.4507	19.13
					18.28			
10	22.59	22.86	23.13	0.537		10.31	0.4502	19.20
					28.59			
14	35.28	35.70	36.12	0.839		16.00	0.4482	19.07
					44.59			
18	55.09	55.74	56.39	1.310		25.02	0.4492	19.10
					69.61			
22	86.00	87.02	88.04	2.045		39.16	0.4501	19.15
					108.77			
26	134.27	135.87	137.47	3.193		61.03	0.4488	19.11
					169.80			
30	209.65	212.14	214.63	4.985		95.27	0.4494	19.11
					265.07			

4.7 *Conversion to Differential Flux*

Summary

Conversion

$$\text{Differential Flux} = \text{Integral Flux / (Energy Band Width)} \quad (11)$$

where

Energy Band Width depends upon

- Channel; i.e., species & energy band (ICS only)
- Head (ICS ion only)
- Aperture position (ICS only)
- DV step (STICS only)

Options:

CALSTEPS field position 9: x x x x x x x x N ,

where N = 0 causes no differential flux conversions to be applied to the data
= 1 causes differential flux conversions to be applied to the data

Details

The conversion of integral flux to differential flux for a channel is accomplished by dividing integral flux (in units of $[cm^2 \text{ sec sr}]^{-1}$) by the energy interval (in units of keV for ICS and keV/e for STICS) over which the channel's count rate observations were made. This observation interval is referred to as the energy band width and is defined as the difference of the high and low boundary limits of the energy observations. See Table 3 for these limits.

For the ICS sensor, the energy band and width differ by channel and by head, although to date the band width has been identical for the north and south ion detector heads. More significantly, the energy boundaries shift upward, and the corresponding energy bands change, when the aperture position changes from the open to the foil or foil + 10% positions. This shift occurs because ions lose energy to the metal aperture foil as they penetrate it; consequently, while the sensor still detects ions of the same energy interval past the foil, the original ion energies correspond to a population of that was at a higher level.

For the STICS sensor, the energy band is the same for all channels but cycles among a set of values, which has been fixed since launch. A deflection voltage (DV) changes with each spin to produce the changes in energy band. See Table 4 for the DV steps.

Table 7 - Acronyms and Abbreviations

Acronym	Expansion	Description
AE	analog electronics	the electronics component of an EPIC sensor subsystem
cps	counts per second	
EPIC	Energetic Particles and Ion Composition	Instrument
B	Background	ICS channel subgroup
BR	basic rates	STICS channel category
CALSTEP	Calibration steps	a 12-character string for selecting conversion and correction steps
CDHF	Central Data Handling Facility	GSFC processing facility for telemetry
DPU	data processing unit	the electronics component of EPIC
DV	deflection voltage	
e-	Electron	Atomic particle type
E	Energy	ICS channel group
ED	Electron Detector	ICS channel group
GSFC	Goddard Space Flight Center	NASA managing facility of the Geotail mission
H	heavies	ICS species group with Z > 20
HE	helium	ICS helium species group
HR	high resolution	STICS channel category
ICS	Ion Composition Subsystem	EPIC subsystem
ISTP	International Solar Terrestrial Program	NASA multi-mission program
He	helium	ICS helium species group
M	mediums	ICS CNO species group
MR	matrix rates	STICS channel category
P	Proton	Atomic particle type
PHA	pulse height analysis	Type of sensor measurement
SMR	singles matrix rates	STICS channel category
STICS	Supra-Thermal Ion Composition Spectrometer	EPIC subsystem
TOF	time of flight	
Z	atomic number	number of protons found in the nucleus of an atom
FSR	Front Singles Rates	A type of engineering rates measurement
RSR	Rear Singles Rates	A type of engineering rates measurement
DCR	Double Coincidence Rates	A type of engineering rates measurement
TCR	Triple Coincidence Rates	A type of engineering rates measurement
SSD	Solid State Detector	A type of engineering rates measurement
UFSR	Universal Front Singles Rates	A type of engineering rates measurement
URSR	Universal Rear Singles Rates	A type of engineering rates measurement
MFSR	Front Singles Rates	A type of engineering rates measurement
MDCR	Double Coincidence Rates	A type of engineering rates measurement
MPF		STICS …
MPR		STICS …
SM		ICS …
ZM		ICS …

Appendix

Table A 1 - ICS Calibration Vales, version 2.14

Channel Name	Energy Band Width [keV]		Background [sec^{-1}]		Efficiency																Geometric Factor [sr cm^2]	
					Open Aperture								Foil Aperture								Open Aperture	
					North				South				North				South					
	Low†	High†	North	South	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	North	South
I_DCR ions	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
I_FSR ions	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.9180	1.0170
I_RSR ions	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
I_SSD ions	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
I_TCR ions	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
I_MDCR ion	n/a		0		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
I_MFSR ion	n/a		0		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
I_UFSR ion	n/a		0		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
I_URSR ion	n/a		0		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
ED1 e- for launch to 1993 067 00:00	34.0	∞	44		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.1280	0.1280
for 1993 067 00:00 onward	38.0	∞	6																			
ED2 e-	110.0	∞	5		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.1280	0.1280
E0 energ	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
E1 energ	45.9	52.7	0.1039	6.7664	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0735	0.0766
E2 energ	52.7	61.5	0.8788	7.4986	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0773	0.0806
E3 energ	61.5	73.7	8.5000	5.0000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0808	0.0844
E4 energ	73.7	89.3	0.6689	0.3029	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0837	0.0877
E5 energ	89.3	110.2	0.1822	0.2489	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0860	0.0904
E6 energ	110.2	137.4	0.6737	0.6009	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0877	0.0925
E7 energ	137.4	173.1	1.1303	1.0288	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0887	0.0939
E8 energ	173.1	220.0	1.1300	0.9844	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0893	0.0948
E9 energ	220.0	281.5	0.9672	0.9414	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0896	0.0952
E10 energ	281.5	362.9	0.7856	0.7290	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0897	0.0952
E11 energ	362.9	471.4	0.6037	0.5844	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0898	0.0951
E12 energ	471.4	615.9	0.4676	0.4500	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0898	0.0948
E13 energ	615.9	913.2	0.4553	0.4654	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0899	0.0946
E14 energ	913.2	1352.3	0.2681	0.2880	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0945
E15 energ	1352.3	2013.9	0.1414	0.1659	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0946
E16 energ	2013.9	3005.4	0.0915	0.0863	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0899	0.0948
E17 energ	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000

Table A 1 - ICS Calibration Vales, version 2.14

Channel Name	Energy Band Width [keV]		Background [sec^{-1}]		Efficiency																Geometric Factor [$sr\ cm^2$]	
					Open Aperture								Foil Aperture								Open Aperture	
					North				South				North				South					
	Low†	High†	North	South	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	North	South
E_B2 energ	52.7	61.5	8.3774		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0790	0.0790
E_B5 energ	89.3	110.2	0.4712		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0882	0.0882
T0 TOF	n/a		0		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
T1 TOF	2.0	3.5	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T2 TOF	3.5	6.0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T3 TOF	6.0	7.2	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T4 TOF	7.2	8.8	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T5 TOF	8.8	10.7	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T6 TOF	10.7	12.9	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T7 TOF	12.9	15.7	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T8 TOF	15.7	19.0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T9 TOF	19.0	23.0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T10 TOF	23.0	27.8	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T11 TOF	27.8	33.7	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T12 TOF	33.7	40.9	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T13 TOF	40.9	49.5	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T14 TOF	49.5	60.0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T15 TOF	60.0	77.0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T16 TOF	77.0	100.0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0900	0.0950
T17 TOF	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
T_B14 TOF	49.5	60.0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.0930	0.0930
H1 Z>20	395.0	619.0	0	0	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.4600	0.0542	0.0591
H2 Z>20	619.0	838.0	0	0	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.0668	0.0726
H3 Z>20	838.0	1202.0	0	0	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.7600	0.0753	0.0820
H4 Z>20	1202.0	1772.0	0	0	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600	0.0821	0.0896
H5 Z>20	1772.0	2728.0	0	0	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.0868	0.0944
H6 Z>20	2728.0	4405.0	0	0	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.9800	0.0892	0.0954
HE1 He	53.4	70.0	0	0	0.0720	0.0540	0.0675	0.0900	0.0800	0.0600	0.0750	0.1000	0.0900	0.0900	0.0900	0.0900	0.1000	0.1000	0.1000	0.1000	0.0603	0.0649
HE2 He	70.0	95.8	0	0	0.1040	0.0780	0.0975	0.1300	0.1280	0.0960	0.1200	0.1600	0.1300	0.1300	0.1300	0.1300	0.1600	0.1600	0.1600	0.1600	0.0704	0.0760
HE3 He	95.8	135.0	0	0	0.1440	0.1080	0.1350	0.1800	0.1680	0.1260	0.1575	0.2100	0.1800	0.1800	0.1800	0.1800	0.2100	0.2100	0.2100	0.2100	0.0792	0.0848
HE4 He	135.0	194.0	0	0	0.1920	0.1440	0.1800	0.2400	0.2240	0.1680	0.2100	0.2800	0.2400	0.2400	0.2400	0.2400	0.2800	0.2800	0.2800	0.2800	0.0848	0.0906
HE5 He	194.0	280.8	0	0	0.2400	0.1800	0.2250	0.3000	0.2800	0.2100	0.2625	0.3500	0.3000	0.3000	0.3000	0.3000	0.3500	0.3500	0.3500	0.3500	0.0874	0.0936
HE6 He	280.8	407.4	0	0	0.2800	0.2100	0.2625	0.3500	0.3360	0.2520	0.3150	0.4200	0.3500	0.3500	0.3500	0.3500	0.4200	0.4200	0.4200	0.4200	0.0885	0.0946
HE7 He	407.4	595.5	0	0	0.3120	0.2340	0.2925	0.3900	0.3680	0.2760	0.3450	0.4600	0.3900	0.3900	0.3900	0.3900	0.4600	0.4600	0.4600	0.4600	0.0890	0.0948

Table A 1 - ICS Calibration Vales, version 2.14

Channel Name		Energy Band Width [keV]		Background [sec^{-1}]		Efficiency																Geometric Factor [$sr\ cm^2$]	
						Open Aperture								Foil Aperture								Open Aperture	
						North				South				North				South					
		Low†	High†	North	South	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	Pre-Sun Sector	Sun Sector	Post - Sun Sector	Other Sectors	North	South
HE8	He	595.5	888.7	0	0	0.3200	0.2400	0.3000	0.4000	0.3760	0.2820	0.3525	0.4700	0.4000	0.4000	0.4000	0.4000	0.4700	0.4700	0.4700	0.4700	0.0893	0.0947
HE9	He	888.7	1631.4	0	0	0.2880	0.2160	0.2700	0.3600	0.3440	0.2580	0.3225	0.4300	0.3600	0.3600	0.3600	0.3600	0.4300	0.4300	0.4300	0.4300	0.0897	0.0947
HE10	He	1631.4	3052.9	0	0	0.1840	0.1380	0.1725	0.2300	0.2160	0.1620	0.2025	0.2700	0.2300	0.2300	0.2300	0.2300	0.2700	0.2700	0.2700	0.2700	0.0899	0.0948
M1	CNO	165.4	186.5	0	0	0.3500	0.3500	0.3500	0.3500	0.4000	0.4000	0.4000	0.4000	0.3500	0.3500	0.3500	0.3500	0.4000	0.4000	0.4000	0.4000	0.0398	0.0521
M2	CNO	186.5	221.4	0	0	0.4000	0.4000	0.4000	0.4000	0.4500	0.4500	0.4500	0.4500	0.4000	0.4000	0.4000	0.4000	0.4500	0.4500	0.4500	0.4500	0.0575	0.0600
M3	CNO	221.4	275.2	0	0	0.4500	0.4500	0.4500	0.4500	0.5100	0.5100	0.5100	0.5100	0.4500	0.4500	0.4500	0.4500	0.5100	0.5100	0.5100	0.5100	0.0717	0.0689
M4	CNO	275.2	360.2	0	0	0.5200	0.5200	0.5200	0.5200	0.5800	0.5800	0.5800	0.5800	0.5200	0.5200	0.5200	0.5200	0.5800	0.5800	0.5800	0.5800	0.0802	0.0775
M5	CNO	360.2	493.5	0	0	0.6000	0.6000	0.6000	0.6000	0.6700	0.6700	0.6700	0.6700	0.6000	0.6000	0.6000	0.6000	0.6700	0.6700	0.6700	0.6700	0.0839	0.0849
M6	CNO	493.5	697.2	0	0	0.6800	0.6800	0.6800	0.6800	0.7500	0.7500	0.7500	0.7500	0.6800	0.6800	0.6800	0.6800	0.7500	0.7500	0.7500	0.7500	0.0855	0.0902
M7	CNO	697.2	1016.2	0	0	0.7600	0.7600	0.7600	0.7600	0.8300	0.8300	0.8300	0.8300	0.7600	0.7600	0.7600	0.7600	0.8300	0.8300	0.8300	0.8300	0.0870	0.0933
M8	CNO	1016.2	1522.0	0	0	0.8300	0.8300	0.8300	0.8300	0.8900	0.8900	0.8900	0.8900	0.8300	0.8300	0.8300	0.8300	0.8900	0.8900	0.8900	0.8900	0.0887	0.0946
M9	CNO	1522.0	2315.7	0	0	0.8900	0.8900	0.8900	0.8900	0.9400	0.9400	0.9400	0.9400	0.8900	0.8900	0.8900	0.8900	0.9400	0.9400	0.9400	0.9400	0.0898	0.0948
M10	CNO	2315.7	3565.3	0	0	0.9500	0.9500	0.9500	0.9500	0.9600	0.9600	0.9600	0.9600	0.9500	0.9500	0.9500	0.9500	0.9600	0.9600	0.9600	0.9600	0.0900	0.0947
P1	p+	45.9	58.1	0	0	0.0122	0.0068	0.0106	0.0152	0.0018	0.0010	0.0015	0.0022	0.0152	0.0152	0.0152	0.0152	0.0022	0.0022	0.0022	0.0022	0.0750	0.0780
P2	p+	58.1	77.3	0	0	0.0890	0.0500	0.0778	0.1112	0.0799	0.0450	0.0699	0.0999	0.1112	0.1112	0.1112	0.1112	0.0999	0.0999	0.0999	0.0999	0.0810	0.0840
P3	p+	77.3	107.4	0	0	0.0826	0.0465	0.0723	0.1033	0.1141	0.0642	0.0998	0.1426	0.1033	0.1033	0.1033	0.1033	0.1426	0.1426	0.1426	0.1426	0.0850	0.0900
P4	p+	107.4	154.3	0	0	0.0836	0.0470	0.0732	0.1045	0.1002	0.0564	0.0877	0.1253	0.1045	0.1045	0.1045	0.1045	0.1253	0.1253	0.1253	0.1253	0.0880	0.0930
P5	p+	154.3	227.5	0	0	0.0822	0.0463	0.0720	0.1028	0.1010	0.0568	0.0883	0.1262	0.1028	0.1028	0.1028	0.1028	0.1262	0.1262	0.1262	0.1262	0.0890	0.0950
P6	p+	227.5	341.6	0	0	0.0568	0.0320	0.0497	0.0710	0.0722	0.0406	0.0632	0.0903	0.0710	0.0710	0.0710	0.0710	0.0903	0.0903	0.0903	0.0903	0.0900	0.0950
P7	p+	341.6	522.5	0	0	0.0363	0.0204	0.0318	0.0454	0.0488	0.0274	0.0427	0.0610	0.0454	0.0454	0.0454	0.0454	0.0610	0.0610	0.0610	0.0610	0.0900	0.0950
P8	p+	522.5	813.5	0	0	0.0246	0.0138	0.0215	0.0307	0.0316	0.0178	0.0277	0.0395	0.0307	0.0307	0.0307	0.0307	0.0395	0.0395	0.0395	0.0395	0.0900	0.0950
P9	p+	813.5	1560.8	0	0	0.0155	0.0087	0.0136	0.0194	0.0251	0.0141	0.0220	0.0314	0.0194	0.0194	0.0194	0.0194	0.0314	0.0314	0.0314	0.0314	0.0900	0.0950
P10	p+	1560.8	3005.4	0	0	0.0068	0.0038	0.0060	0.0085	0.0138	0.0077	0.0120	0.0172	0.0085	0.0085	0.0085	0.0085	0.0172	0.0172	0.0172	0.0172	0.0900	0.0950
SM	ions	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000
ZM	ions	n/a		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0000	1.0000

† ICS Sensor energy low and high values change with aperture position; values given are for the open aperture position. See Table A3 for energy band pass values for foil aperture position.

Table A 2 - ICS Geometric Factor ratios, version 2.14

Aperture position comparison	Geometric Factor Ratio North	Geometric Factor Ratio South
Open to Foil	1.57	1.57
Foil to (Foil + 10%)	7.0	7.0

Table A 3 - Geotail Spacecraft Spin Period

Date: Year	Date: Day of Year	Date: Seconds of Day	Spin Period (sec)	Spin Period Delta (sec)
1992	214	0	3.151	n/a
1992	252	298.85	3.310	-0.159
1992	258	51961.84	5.333	-2.023
1992	259	52536.55	8.573	-3.240
1992	260	66553.30	3.623	4.950
1992	261	40187.68	3.019	0.604
1992	286	49171.72	3.020	-0.001
1992	312	63918.81	3.021	-0.001
1992	345	51850.03	3.022	-0.001
1993	8	77473.68	3.024	-0.002
1993	29	43166.22	3.025	-0.001
1993	29	47263.46	3.026	-0.001
1993	40	40857.98	3.027	-0.001
1993	66	49462.13	3.016	0.011
1993	112	47689.51	3.017	-0.001
1993	130	45956.16	3.018	-0.001
1993	208	50407.03	3.019	-0.001
1993	244	49734.34	3.016	0.003
1993	244	70752.93	3.019	-0.003
1993	258	52940.29	2.996	0.023
1993	259	66605.08	2.997	-0.001
1993	271	29221.95	2.998	-0.001
1993	319	47934.37	2.996	0.002
1994	14	46386.75	2.997	-0.001
1994	115	59259.67	3.008	-0.011
1994	204	57629.71	3.000	0.008
1994	262	47849.38	2.986	0.014
1994	290	48957.56	2.988	-0.002
1994	308	72603.88	2.951	0.037
1994	316	22264.43	2.963	-0.012
1994	316	51096.56	2.998	-0.035
1994	336	70131.68	2.999	-0.001
1995	50	86377.47	3.038	-0.039
1995	51	355.37	3.037	0.001

Date			Spin Period (sec)	Spin Period Delta (sec)
Year	Day of Year	Seconds of Day		
1995	57	86375.29	3.089	-0.052
1995	58	22949.20	3.117	-0.028
1995	62	54852.49	3.116	0.001
1995	354	53912.29	3.061	0.055
1996	60	72398.33	3.060	0.001
1996	341	61027.32	3.027	0.033
1997	126	326.21	3.023	0.004
1997	128	10121.28	3.027	-0.004
1997	140	24197.01	3.031	-0.004
1997	172	27005.36	3.047	-0.016
1998	56	71878.32	3.042	0.005
1998	57	77123.95	3.047	-0.005
1998	88	47133.13	3.043	0.004
1998	90	292.90	3.047	-0.004
1998	132	27890.30	3.046	0.001
1998	292	453.52	3.047	-0.001
1999	48	73777.11	3.044	0.003
1999	51	38701.61	3.047	-0.003
1999	59	53647.59	3.043	0.004
1999	59	72078.89	3.046	-0.003
2000	53	77376.15	3.047	-0.001
2000	204	40450.16	3.046	0.001
2000	205	47367.13	3.047	-0.001
2000	207	9.61	3.046	0.001
2002	4	71092	3.045	0.001
2003	44	77413.91	3.044	0.001
2004	48	222.98	2.993	0.051
2006	93	20.82	2.992	0.001

Table A 4 - ICS Energy Aperture-Position Band Pass, version 2.14

Channel Name	Energy Pass Band [keV]			
	Open Aperture Position, North and South Heads		Foil and Foil + 10% Grid Aperture Positions, North and South Heads	
	Low	High	Low	High
E0 energ	n/a		n/a	
E1 energ	45.9	52.7	75.6	83.4
E2 energ	52.7	61.5	83.4	93.3
E3 energ	61.5	73.7	93.3	106.8
E4 energ	73.7	89.3	106.8	123.5
E5 energ	89.3	110.2	123.5	145.2
E6 energ	110.2	137.4	145.2	172.5
E7 energ	137.4	173.1	172.5	207.3
E8 energ	173.1	220.0	207.3	251.6
E9 energ	220.0	281.5	251.6	309
E10 energ	281.5	362.9	309	385.8
E11 energ	362.9	471.4	385.8	490.9
E12 energ	471.4	615.9	490.9	634.4
E13 energ	615.9	913.2	634.4	929.6
E14 energ	913.2	1352.3	929.6	1361
E15 energ	1352.3	2013.9	1361	2024.3
E16 energ	2013.9	3005.4	2024.3	3003.8
E17 energ	n/a		n/a	
E_B2 energ	52.7	61.5	83.4	93.3
E_B5 energ	89.3	110.2	123.5	145.2
T0 TOF	n/a		n/a	
T1 TOF	2.0	3.5	2	3.5
T2 TOF	3.5	6.0	3.5	6
T3 TOF	6.0	7.2	6	7.2
T4 TOF	7.2	8.8	7.2	8.8
T5 TOF	8.8	10.7	8.8	10.7
T6 TOF	10.7	12.9	10.7	12.9
T7 TOF	12.9	15.7	12.9	15.7
T8 TOF	15.7	19.0	15.7	19
T9 TOF	19.0	23.0	19	23
T10 TOF	23.0	27.8	23	27.8
T11 TOF	27.8	33.7	27.8	33.7
T12 TOF	33.7	40.9	33.7	40.9
T13 TOF	40.9	49.5	40.9	49.5
T14 TOF	49.5	60.0	49.5	60
T15 TOF	60.0	77.0	60	77
T16 TOF	77.0	100.0	77	100
T17 TOF	n/a		n/a	
T_B14 TOF	49.5	60.0	49.5	60
H1 Z>20	395.0	619.0	1061.7	1226.3
H2 Z>20	619.0	838.0	1226.3	1407.7
H3 Z>20	838.0	1202.0	1407.7	1757.3
H4 Z>20	1202.0	1772.0	1757.3	2398.3
H5 Z>20	1772.0	2728.0	2398.3	3454.7
H6 Z>20	2728.0	4405.0	3454.7	5281.6
HE1 He	53.4	70.0	122.6	142.5
HE2 He	70.0	95.8	142.5	172.9

Channel Name	Energy Pass Band [keV]			
	Open Aperture Position, North and South Heads		Foil and Foil + 10% Grid Aperture Positions, North and South Heads	
	Low	High	Low	High
HE3 He	95.8	135.0	172.9	218.5
HE4 He	135.0	194.0	218.5	285.1
HE5 He	194.0	280.8	285.1	380.1
HE6 He	280.8	407.4	380.1	513.3
HE7 He	407.4	595.5	513.3	704.7
HE8 He	595.5	888.7	704.7	993.9
HE9 He	888.7	1631.4	993.9	1715.4
HE10 He	1631.4	3052.9	1715.4	3127.4
M1 CNO	165.4	186.5	377.7	405.9
M2 CNO	186.5	221.4	405.9	451.9
M3 CNO	221.4	275.2	451.9	521.1
M4 CNO	275.2	360.2	521.1	627.1
M5 CNO	360.2	493.5	627.1	788.3
M6 CNO	493.5	697.2	788.3	1029.3
M7 CNO	697.2	1016.2	1029.3	1399.4
M8 CNO	1016.2	1522.0	1399.4	1960.6
M9 CNO	1522.0	2315.7	1960.6	2820.8
M10 CNO	2315.7	3565.3	2820.8	4119.8
P1 p+	45.9	58.1	75.6	89.5
P2 p+	58.1	77.3	89.5	110.7
P3 p+	77.3	107.4	110.7	142.4
P4 p+	107.4	154.3	142.4	189.2
P5 p+	154.3	227.5	189.2	258.6
P6 p+	227.5	341.6	258.6	365.5
P7 p+	341.6	522.5	365.5	541.3
P8 p+	522.5	813.5	541.3	831.4
P9 p+	813.5	1560.8	831.4	1570.6
P10 p+	1560.8	3005.4	1570.6	3003.8

Table A 5 - STICS Efficiency, version 2.14

Channel Species	Polar Head	DV Step 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
HR0 H^+	0	0.008943	0.013686	0.020867	0.024526	0.028997	0.034146	0.040244	0.046341	0.053388	0.061518	0.070867	0.075339	0.080217	0.085366	0.090921	0.097832	0.105420	0.113550	0.122222	0.115854	0.109892	0.104201	0.098780	0.093767	0.088889	0.086043	0.083333	0.080759	0.078184	0.075745	0.073442	0.071138
	1	0.009491	0.014524	0.022146	0.026028	0.030774	0.036238	0.042709	0.049180	0.056658	0.065286	0.075209	0.079954	0.085131	0.090595	0.096491	0.103825	0.111878	0.120506	0.129710	0.122951	0.116624	0.110584	0.104832	0.099511	0.094334	0.091314	0.088438	0.085706	0.082974	0.080385	0.077941	0.075496
	2	0.006606	0.010109	0.015414	0.018116	0.021419	0.025223	0.029727	0.034231	0.039435	0.045441	0.052347	0.055650	0.059253	0.063057	0.067160	0.072265	0.077870	0.083875	0.090281	0.085577	0.081173	0.076969	0.072966	0.069262	0.065659	0.063557	0.061555	0.059654	0.057752	0.055950	0.054249	0.052547
	3	0.006593	0.010090	0.015385	0.018082	0.021379	0.025175	0.029670	0.034166	0.039361	0.045355	0.052248	0.055544	0.059141	0.062937	0.067033	0.072128	0.077722	0.083716	0.090110	0.085415	0.081019	0.076823	0.072827	0.069131	0.065534	0.063437	0.061439	0.059540	0.057642	0.055844	0.054146	0.052448
	4	0.005050	0.007728	0.011783	0.013849	0.016373	0.019281	0.022724	0.026167	0.030145	0.034736	0.040015	0.042540	0.045295	0.048202	0.051339	0.055241	0.059526	0.064116	0.069013	0.065417	0.062050	0.058837	0.055777	0.052946	0.050191	0.048585	0.047054	0.045601	0.044147	0.042770	0.041469	0.040168
	5	0.004992	0.007640	0.011649	0.013691	0.016188	0.019062	0.022466	0.025870	0.029803	0.034342	0.039561	0.042057	0.044781	0.047655	0.050756	0.054614	0.058850	0.063389	0.068230	0.064675	0.061346	0.058169	0.055144	0.052345	0.049622	0.048033	0.046520	0.045083	0.043646	0.042284	0.040998	0.039713
HR10 O^+ for launch to 1993 251 00:00	0	0.000120	0.000351	0.001043	0.001547	0.002292	0.003399	0.005036	0.006798	0.009158	0.012308	0.016599	0.020664	0.025632	0.031843	0.039521	0.048780	0.060185	0.074187	0.091463	0.101852	0.114047	0.126468	0.141147	0.156956	0.175023	0.184056	0.193089	0.203252	0.214544	0.224706	0.237127	0.249548
	1	0.000127	0.000373	0.001107	0.001642	0.002433	0.003607	0.005345	0.007214	0.009719	0.013062	0.017616	0.021930	0.027203	0.033794	0.041942	0.051769	0.063872	0.078732	0.097066	0.108091	0.121033	0.134215	0.149794	0.166571	0.185744	0.195331	0.204918	0.215703	0.227687	0.238472	0.251654	0.264836
	2	0.000088	0.000259	0.000771	0.001143	0.001693	0.002511	0.003720	0.005021	0.006764	0.009092	0.012261	0.015264	0.018934	0.023521	0.029193	0.036032	0.044457	0.054799	0.067561	0.075234	0.084242	0.093417	0.104260	0.115938	0.129283	0.135956	0.142628	0.150135	0.158476	0.165983	0.175158	0.184333
	3	0.000088	0.000259	0.000769	0.001141	0.001690	0.002506	0.003713	0.005012	0.006752	0.009074	0.012238	0.015235	0.018898	0.023477	0.029138	0.035964	0.044372	0.054695	0.067433	0.075092	0.084083	0.093240	0.104063	0.115718	0.129038	0.135698	0.142358	0.149850	0.158175	0.165668	0.174825	0.183983
	4	0.000068	0.000198	0.000589	0.000874	0.001294	0.001919	0.002844	0.003838	0.005171	0.006950	0.009373	0.011668	0.014473	0.017980	0.022316	0.027544	0.033984	0.041890	0.051645	0.057511	0.064397	0.071410	0.079699	0.088625	0.098827	0.103928	0.109028	0.114767	0.121143	0.126881	0.133894	0.140908
	5	0.000067	0.000196	0.000582	0.000864	0.001280	0.001897	0.002811	0.003795	0.005112	0.006871	0.009266	0.011536	0.014309	0.017776	0.022063	0.027231	0.033598	0.041415	0.051059	0.056858	0.063666	0.070600	0.078795	0.087620	0.097705	0.102748	0.107791	0.113464	0.119768	0.125441	0.132375	0.139309
for 1993 251 00:00 onward	0	0.000131	0.000383	0.001138	0.001688	0.002501	0.003708	0.005494	0.007416	0.009990	0.013427	0.018108	0.022542	0.027963	0.034738	0.043114	0.053215	0.065657	0.080931	0.099778	0.111111	0.124415	0.137965	0.153979	0.171224	0.190934	0.200788	0.210643	0.221730	0.234048	0.245134	0.258684	0.272235
	1	0.000139	0.000407	0.001208	0.001791	0.002654	0.003935	0.005831	0.007870	0.010602	0.014249	0.019217	0.023923	0.029676	0.036866	0.045755	0.056475	0.069679	0.085889	0.105891	0.117918	0.132037	0.146417	0.163412	0.181714	0.202630	0.213089	0.223547	0.235313	0.248385	0.260151	0.274531	0.288912
	2	0.000096	0.000283	0.000841	0.001247	0.001847	0.002739	0.004058	0.005478	0.007379	0.009918	0.013376	0.016651	0.020655	0.025659	0.031847	0.039308	0.048498	0.059781	0.073703	0.082074	0.091901	0.101910	0.113739	0.126477	0.141036	0.148315	0.155595	0.163784	0.172883	0.181072	0.191081	0.201090
	3	0.000096	0.000282	0.000839	0.001244	0.001844	0.002734	0.004050	0.005467	0.007365	0.009899	0.013350	0.016620	0.020616	0.025611	0.031786	0.039233	0.048406	0.059668	0.073563	0.081918	0.091726	0.101716	0.113523	0.126237	0.140768	0.148034	0.155299	0.163473	0.172555	0.180728	0.190718	0.200708
	4	0.000074	0.000216	0.000643	0.000953	0.001412	0.002094	0.003102	0.004187	0.005641	0.007582	0.010225	0.012729	0.015789	0.019615	0.024344	0.030048	0.037073	0.045698	0.056340	0.062739	0.070251	0.077902	0.086944	0.096682	0.107811	0.113376	0.118940	0.125200	0.132156	0.138416	0.146067	0.153718
	5	0.000073	0.000214	0.000635	0.000942	0.001396	0.002070	0.003067	0.004140	0.005577	0.007496	0.010109	0.012584	0.015610	0.019392	0.024068	0.029707	0.036652	0.045179	0.055701	0.062027	0.069454	0.077018	0.085958	0.095585	0.106588	0.112089	0.117590	0.123779	0.130656	0.136845	0.144409	0.151974
HR11 FSRs	0	0.008943	0.013686	0.020867	0.024526	0.028997	0.034146	0.040244	0.046341	0.053388	0.061518	0.070867	0.075339	0.080217	0.085366	0.090921	0.097832	0.105420	0.113550	0.122222	0.115854	0.109892	0.104201	0.098780	0.093767	0.088889	0.086043	0.083333	0.080759	0.078184	0.075745	0.073442	0.071138
	1	0.009491	0.014524	0.022146	0.026028	0.030774	0.036238	0.042709	0.049180	0.056658	0.065286	0.075209	0.079954	0.085131	0.090595	0.096491	0.103825	0.111878	0.120506	0.129710	0.122951	0.116624	0.110584	0.104832	0.099511	0.094334	0.091314	0.088438	0.085706	0.082974	0.080385	0.077941	0.075496
	2	0.006606	0.010109	0.015414	0.018116	0.021419	0.025223	0.029727	0.034231	0.039435	0.045441	0.052347	0.055650	0.059253	0.063057	0.067160	0.072265	0.077870	0.083875	0.090281	0.085577	0.081173	0.076969	0.072966	0.069262	0.065659	0.063557	0.061555	0.059654	0.057752	0.055950	0.054249	0.052547
	3	0.006593	0.010090	0.015385	0.018082	0.021379	0.025175	0.029670	0.034166	0.039361	0.045355	0.052248	0.055544	0.059141	0.062937	0.067033	0.072128	0.077722	0.083716	0.090110	0.085415	0.081019	0.076823	0.072827	0.069131	0.065534	0.063437	0.061439	0.059540	0.057642	0.055844	0.054146	0.052448
	4	0.005050	0.007728	0.011783	0.013849	0.016373	0.019281	0.022724	0.026167	0.030145	0.034736	0.040015	0.042540	0.045295	0.048202	0.051339	0.055241	0.059526	0.064116	0.069013	0.065417	0.062050	0.058837	0.055777	0.052946	0.050191	0.048585	0.047054	0.045601	0.044147	0.042770	0.041469	0.040168
	5	0.004992	0.007640	0.011649	0.013691	0.016188	0.019062	0.022466	0.025870	0.029803	0.034342	0.039561	0.042057	0.044781	0.047655	0.050756	0.054614	0.058850	0.063389	0.068230	0.064675	0.061346	0.058169	0.055144	0.052345	0.049622	0.048033	0.046520	0.045083	0.043646	0.042284	0.040998	0.039713
SMR0 He^+	0 / 1	0.005247	0.008322	0.013256	0.016054	0.019516	0.023566	0.028537	0.034061	0.040689	0.048421	0.057627	0.066096	0.075486	0.086532	0.099052	0.114885	0.133297	0.154653	0.179508	0.183007	0.185952	0.189635	0.193317	0.196999	0.200681	0.202522	0.202522	0.202522	0.204363	0.204363	0.204363	0.206205
	2 / 3	0.003800	0.006027	0.009600	0.011627	0.014133	0.017067	0.020667	0.024667	0.029467	0.035067	0.041733	0.047867	0.054667	0.062667	0.071733	0.083200	0.096533	0.112000	0.130000	0.132533	0.134667	0.137333	0.140000	0.142667	0.145333	0.146667	0.146667	0.146667	0.148000	0.148000	0.148000	0.149333
	4 / 5	0.002901	0.004601	0.007328	0.008875	0.010789	0.013028	0.015776	0.018830	0.022494	0.026768	0.031858	0.036539	0.041730	0.047837	0.054758	0.063511	0.073690	0.085496	0.099237	0.101170	0.102799	0.104835	0.106870	0.108906	0.110941	0.111959	0.111959	0.111959	0.112977	0.112977	0.112977	0.113995
SMR1 He^{++}	0 / 1	0.029642	0.035349	0.042161	0.050262	0.059468	0.067937	0.077879	0.089110	0.102366	0.118752	0.137715	0.159993	0.180245	0.183743	0.187793	0.191476	0.195158	0.198840	0.200681	0.202522	0.202522	0.202522	0.204363	0.204363	0.204363	0.206205	0.206205	0.206205	0.206205	0.206205	0.206205	0.206205
	2 / 3	0.021467	0.025600	0.030533	0.036400	0.043067	0.049200	0.056400	0.064533	0.074133	0.086000	0.099733	0.115867	0.130533	0.133067	0.136000	0.138667	0.141333	0.144000	0.145333	0.146667	0.146667	0.146667	0.148000	0.148000	0.148000	0.149333	0.149333	0.149333	0.149333	0.149333	0.149333	0.149333
	4 / 5	0.016387	0.019542	0.023308	0.027786	0.032875	0.037557	0.043053	0.049262	0.056590	0.065649	0.076132	0.088448	0.099644	0.101578	0.103817	0.105852	0.107888	0.109924	0.110941	0.111959	0.111959	0.111959	0.112977	0.112977	0.112977	0.113995	0.113995	0.113995	0.113995	0.113995	0.113995	0.113995
SMR2 O^{++}	0 / 1	0.006600	0.008879	0.011972	0.016156	0.021403	0.026512	0.032864	0.040873	0.050677	0.062414	0.077051	0.095139	0.114609	0.127589	0.142226	0.158796	0.176747	0.196078	0.215410	0.227838	0.238884	0.251312	0.265120	0.278928	0.292737	0.305164	0.305164	0.305164	0.305164	0.305164	0.305164	0.306545
	2 / 3	0.004780	0.006430	0.008670	0.011700	0.015500	0.019200	0.023800	0.029600	0.036700	0.045200	0.055800	0.068900	0.083000	0.092400	0.103000	0.115000	0.128000	0.142000	0.156000	0.165000	0.173000	0.182000	0.192000	0.202000	0.212000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000
	4 / 5	0.003649	0.004908	0.006618	0.008931	0.011832	0.014656	0.018168	0.022595	0.028015	0.034504	0.042595	0.052595	0.063359	0.070534	0.078626	0.087786	0.097710	0.108397	0.119084	0.125954	0.132061	0.138931	0.146565	0.154198	0.161832	0.168702	0.168702	0.168702	0.168702	0.168702	0.168702	0.169466
BR0 CNOFe	0 / 1	0.074979	0.092378	0.112952	0.125656	0.139464	0.156034	0.173985	0.193317	0.214029	0.225076	0.237503	0.249931	0.262358	0.276167	0.291356	0.305164	0.305164	0.305164	0.305164	0.305164	0.305164	0.306545	0.306545	0.307926	0.307926	0.307926	0.307926	0.307926	0.307926	0.307926	0.307926	0.307926
	2 / 3	0.054300	0.066900	0.081800	0.091000	0.101000	0.113000	0.126000	0.140000	0.155000	0.163000	0.172000	0.181000	0.190000	0.200000	0.211000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
	4 / 5	0.041450	0.051069	0.062443	0.069466	0.077099	0.086260	0.096183	0.106870	0.118321	0.124427	0.131298	0.138168	0.145038	0.152672	0.161069	0.168702	0.168702	0.168702	0.168702	0.168702	0.168702	0.169466	0.169466	0.170229	0.170229	0.170229	0.170229	0.170229	0.170229	0.170229	0.170229	0.170229
BR1 O & NO	0 / 1	0.000146	0.000429	0.001276	0.001892	0.002803	0.004156	0.006159	0.008313	0.011199	0.015051	0.020298	0.025269	0.031345	0.038940	0.048329	0.059652	0.073598	0.090721	0.111848	0.124551	0.139464	0.154653	0.172604	0.191936	0.214029	0.225076	0.236123	0.248550	0.262358	0.274786	0.289975	0.305164
	2 / 3	0.000106	0.000311	0.000924	0.001370	0.002030	0.003010	0.004460	0.006020	0.008110	0.010900	0.014700	0.018300	0.022700	0.028200	0.035000	0.043200	0.053300	0.065700	0.081000	0.090200	0.101000	0.112000	0.125000	0.139000	0.155000	0.163000	0.171000	0.180000	0.190000	0.199000	0.210000	0.221000
	4 / 5	0.000081	0.000237	0.000705	0.001046	0.001550	0.002298	0.003405	0.004595	0.006191	0.008321	0.011221	0.013969	0.017328	0.021527	0.026718	0.032977	0.040687	0.050153	0.061832	0.068855	0.077099	0.085496	0.095420	0.106107	0.118321	0.124427	0.130534	0.137405	0.145038	0.151908	0.160305	0.168702

Table A 5 - STICS Efficiency, version 2.14

Channel Species	Polar Head	DV Step																															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
BR2 H & He	0 / 1	0.009114	0.013946	0.021265	0.024993	0.029550	0.034797	0.041011	0.047225	0.054405	0.062690	0.072218	0.076774	0.081745	0.086993	0.092654	0.099696	0.107429	0.115714	0.124551	0.118061	0.111986	0.106186	0.100663	0.095554	0.090583	0.087683	0.084921	0.082298	0.079674	0.077189	0.074841	0.072494
	2 / 3	0.006600	0.010100	0.015400	0.018100	0.021400	0.025200	0.029700	0.034200	0.039400	0.045400	0.052300	0.055600	0.059200	0.063000	0.067100	0.072200	0.077800	0.083800	0.090200	0.085500	0.081100	0.076900	0.072900	0.069200	0.065600	0.063500	0.061500	0.059600	0.057700	0.055900	0.054200	0.052500
	4 / 5	0.005038	0.007710	0.011756	0.013817	0.016336	0.019237	0.022672	0.026107	0.030076	0.034656	0.039924	0.042443	0.045191	0.048092	0.051221	0.055115	0.059389	0.063969	0.068855	0.065267	0.061908	0.058702	0.055649	0.052824	0.050076	0.048473	0.046947	0.045496	0.044046	0.042672	0.041374	0.040076
MR0 C^{+3}	1 - 5	0.022200	0.027700	0.034300	0.042400	0.052500	0.062600	0.074200	0.088000	0.104000	0.113000	0.120000	0.127000	0.136000	0.144000	0.153000	0.162000	0.170000	0.179000	0.188000	0.198000	0.208000	0.219000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.222000	0.223000	0.223000	0.223000
MR1 C^{+4}	1 - 5	0.038800	0.048000	0.058300	0.069100	0.082000	0.097200	0.110000	0.117000	0.124000	0.132000	0.141000	0.150000	0.158000	0.167000	0.175000	0.184000	0.194000	0.204000	0.215000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
MR2 C^{+5}	1 - 5	0.058400	0.069100	0.082000	0.097200	0.110000	0.117000	0.124000	0.132000	0.141000	0.150000	0.158000	0.167000	0.175000	0.184000	0.194000	0.204000	0.215000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
MR3 C^{+6}	1 - 5	0.077100	0.091400	0.107000	0.114000	0.121000	0.129000	0.137000	0.146000	0.155000	0.163000	0.172000	0.181000	0.190000	0.200000	0.211000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
MR4 N^{+}	1 - 5	0.000174	0.000465	0.001250	0.001860	0.002770	0.004110	0.006110	0.008270	0.011200	0.015100	0.020500	0.024900	0.030200	0.036700	0.044500	0.053000	0.063000	0.074800	0.089000	0.097600	0.107000	0.117000	0.129000	0.141000	0.155000	0.163000	0.171000	0.180000	0.190000	0.199000	0.210000	0.221000
MR5 N^{+4}	1 - 5	0.033000	0.040000	0.048100	0.057200	0.068000	0.080900	0.092700	0.102000	0.112000	0.122000	0.134000	0.147000	0.158000	0.167000	0.175000	0.184000	0.194000	0.204000	0.215000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
MR6 N^{+2}	1 - 5	0.006550	0.008850	0.012000	0.016200	0.021400	0.026000	0.031500	0.038300	0.046300	0.055000	0.065400	0.077800	0.090800	0.099600	0.109000	0.120000	0.131000	0.144000	0.156000	0.165000	0.173000	0.182000	0.192000	0.202000	0.212000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000
MR7 $N^{+2}ZM$	1 - 5	0.006550	0.008850	0.012000	0.016200	0.021400	0.026000	0.031500	0.038300	0.046300	0.055000	0.065400	0.077800	0.090800	0.099600	0.109000	0.120000	0.131000	0.144000	0.156000	0.165000	0.173000	0.182000	0.192000	0.202000	0.212000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000
MR8 BHE2	1 - 5	0.016100	0.019200	0.022900	0.027300	0.032300	0.036900	0.042300	0.048400	0.055600	0.064500	0.074800	0.086900	0.097900	0.099800	0.102000	0.104000	0.106000	0.108000	0.109000	0.110000	0.110000	0.110000	0.111000	0.111000	0.111000	0.112000	0.112000	0.112000	0.112000	0.112000	0.112000	0.112000
MR9 BHE1	1 - 5	0.002850	0.004520	0.007200	0.008720	0.010600	0.012800	0.015500	0.018500	0.022100	0.026300	0.031300	0.035900	0.041000	0.047000	0.053800	0.062400	0.072400	0.084000	0.097500	0.099400	0.101000	0.103000	0.105000	0.107000	0.109000	0.110000	0.110000	0.110000	0.111000	0.111000	0.111000	0.112000
MR10 BH+ZM	1 - 5	0.006600	0.010100	0.015400	0.018100	0.021400	0.025200	0.029700	0.034200	0.039400	0.045400	0.052300	0.055600	0.059200	0.063000	0.067100	0.072200	0.077800	0.083800	0.090200	0.085500	0.081100	0.076900	0.072900	0.069200	0.065600	0.063500	0.061500	0.059600	0.057700	0.055900	0.054200	0.052500
MR11 $O^{+2}ZM$	1 - 5	0.004780	0.006430	0.008670	0.011700	0.015500	0.019200	0.023800	0.029600	0.036700	0.045200	0.055800	0.068900	0.083000	0.092400	0.103000	0.115000	0.128000	0.142000	0.156000	0.165000	0.173000	0.182000	0.192000	0.202000	0.212000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000
MR12 O^{+3}	1 - 5	0.014200	0.017800	0.022100	0.027400	0.034000	0.042000	0.051700	0.063800	0.078700	0.088900	0.099000	0.110000	0.123000	0.137000	0.152000	0.162000	0.170000	0.179000	0.188000	0.198000	0.208000	0.219000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.222000	0.223000	0.223000	0.223000
MR13 O^{+4}	1 - 5	0.025000	0.031100	0.038500	0.047400	0.058500	0.072100	0.085000	0.094700	0.105000	0.117000	0.131000	0.146000	0.158000	0.167000	0.175000	0.184000	0.194000	0.204000	0.215000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
MR14 O^{+5}	1 - 5	0.038500	0.047500	0.058500	0.072100	0.085000	0.094700	0.105000	0.118000	0.131000	0.146000	0.158000	0.167000	0.175000	0.184000	0.194000	0.204000	0.215000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
MR15 O^{+6}	1 - 5	0.054300	0.066900	0.081800	0.091000	0.101000	0.113000	0.126000	0.140000	0.155000	0.163000	0.172000	0.181000	0.190000	0.200000	0.211000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
MR16 O^{+7}	1 - 5	0.072500	0.085200	0.094900	0.106000	0.118000	0.131000	0.146000	0.158000	0.167000	0.175000	0.185000	0.194000	0.204000	0.215000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000
MR17 O^{+8}	1 - 5	0.087100	0.097000	0.108000	0.120000	0.134000	0.149000	0.160000	0.168000	0.177000	0.186000	0.196000	0.206000	0.217000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000	0.223000

Table A 5 - STICS Efficiency, version 2.14

Channel Species	Polar Head	DV Step 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MR18 Ne^{+*}	1 - 5	0.081000	0.088200	0.096000	0.105000	0.114000	0.124000	0.133000	0.141000	0.149000	0.158000	0.168000	0.179000	0.189000	0.193000	0.193000	0.193000
MR19 MgSiL	1 - 5	0.089800	0.101000	0.112000	0.120000	0.130000	0.140000	0.151000	0.162000	0.175000	0.184000	0.184000	0.184000	0.184000	0.184000	0.184000	0.185000
MR20 MgSiH	1 - 5	0.049000	0.057300	0.064400	0.072400	0.081300	0.091400	0.103000	0.113000	0.122000	0.131000	0.141000	0.152000	0.164000	0.177000	0.184000	0.184000
MR21 Fe^{+6}	1 - 5	0.038900	0.047400	0.054300	0.062100	0.071100	0.081400	0.093200	0.104000	0.111000	0.120000	0.128000	0.138000	0.148000	0.159000	0.166000	0.166000
MR22 Fe^{+8}	1 - 5	0.056200	0.064300	0.073700	0.084300	0.096500	0.105000	0.113000	0.122000	0.131000	0.141000	0.151000	0.162000	0.166000	0.166000	0.166000	0.166000
MR23 Fe^{+10}	1 - 5	0.071700	0.082100	0.094000	0.104000	0.112000	0.120000	0.129000	0.139000	0.149000	0.160000	0.166000	0.166000	0.166000	0.166000	0.166000	0.166000
MR24 Fe^{+12}	1 - 5	0.087900	0.100000	0.108000	0.116000	0.124000	0.134000	0.144000	0.154000	0.166000	0.166000	0.166000	0.166000	0.166000	0.166000	0.166000	0.167000
MR25 Fe^{+14}	1 - 5	0.102000	0.110000	0.118000	0.127000	0.137000	0.147000	0.158000	0.166000	0.166000	0.166000	0.166000	0.166000	0.166000	0.166000	0.167000	0.167000
MR26 Fe+16	1 - 5	0.111000	0.119000	0.128000	0.138000	0.148000	0.159000	0.166000	0.166000	0.166000	0.166000	0.166000	0.166000	0.166000	0.167000	0.167000	0.167000
MR27 NO&O2	1 - 5	0.000001	0.000008	0.000053	0.000128	0.000311	0.000756	0.001830	0.002730	0.004060	0.006030	0.008960	0.011600	0.014900	0.019200	0.024800	0.030200
MR28 BH+tr	1 - 5	0.006600	0.010100	0.015400	0.018100	0.021400	0.025200	0.029700	0.034200	0.039400	0.045400	0.052300	0.055600	0.059200	0.063000	0.067100	0.072200
MR29 C+2	1 - 5	0.008020	0.010600	0.014000	0.018500	0.024200	0.029900	0.037000	0.045800	0.056100	0.066500	0.078900	0.093600	0.108000	0.115000	0.123000	0.130000
DCR ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
FSR ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
RSR ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SSD ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
TCR ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Channel Species	Polar Head	DV Step 16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MR18 Ne^{+*}	1 - 5	0.193000	0.193000	0.194000	0.194000	0.195000	0.195000	0.195000	0.195000	0.195000	0.195000	0.195000	0.195000	0.195000	0.195000	0.195000	0.195000
MR19 MgSiL	1 - 5	0.185000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000
MR20 MgSiH	1 - 5	0.184000	0.184000	0.184000	0.184000	0.185000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000	0.186000
MR21 Fe^{+6}	1 - 5	0.166000	0.166000	0.166000	0.166000	0.166000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000
MR22 Fe^{+8}	1 - 5	0.166000	0.166000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000
MR23 Fe^{+10}	1 - 5	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000
MR24 Fe^{+12}	1 - 5	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000
MR25 Fe^{+14}	1 - 5	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000
MR26 Fe+16	1 - 5	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000	0.167000
MR27 NO&O2	1 - 5	0.036700	0.044600	0.054300	0.061000	0.068500	0.077000	0.086500	0.097200	0.109000	0.118000	0.127000	0.137000	0.147000	0.159000	0.171000	0.184000
MR28 BH+tr	1 - 5	0.077800	0.083800	0.090200	0.085500	0.081100	0.076900	0.072900	0.069200	0.065600	0.063500	0.061500	0.059600	0.057700	0.055900	0.054200	0.052500
MR29 C+2	1 - 5	0.139000	0.147000	0.156000	0.165000	0.173000	0.182000	0.192000	0.202000	0.212000	0.221000	0.221000	0.221000	0.221000	0.221000	0.221000	0.222000
DCR ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
FSR ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
RSR ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SSD ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
TCR ions	0 / 1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2 / 3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	4 / 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Table A 5 - STICS Efficiency, version 2.14

Channel Species	Polar Head	DV Step																															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MDC ions	0 - 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MFSR ions	0 - 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
UFSR ions	0 - 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
URSR ions	0 - 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MPF	0 - 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MPR	0 - 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Diagnostic	0 - 5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Table A 6 - STICS Geometric Factors, version 2.14					
Polar Head					
0	1	2	3	4	5
0.05	0.05	0.05	0.05	0.05	0.05

Table A 7 - ICS Energy Channel Differential Flux Reduction Due to Background Correction			
ICS Channel	Energy Band [keV]	Flux reduction due to Subtracted Background [1/(cm**2-s-sr-kev)]	
		North Head	South Head
E3	61.50 to 73.70	8.623	4.856
	93.30 to 106.80	12.234	6.889
E4	73.70 to 89.30	0.221	0.221
	106.80 to 123.50	0.751	0.325
E5	89.30 to 110.20	0.101	0.132
	123.50 to 145.20	0.153	0.199
E6	110.20 to 137.40	0.282	0.239
	145.20 to 172.50	0.441	0.374
E7	137.40 to 173.10	0.356	0.307
	172.50 to 207.30	0.575	0.494
E8	173.10 to 220.00	0.269	0.221
	207.30 to 251.60	0.448	0.368
E9	220.00 to 281.50	0.175	0.160
	251.60 to 309.00	0.295	0.270
E10	281.50 to 362.90	0.107	0.094
	309.00 to 385.80	0.179	0.156
E11	362.90 to 471.40	0.062	0.056
	385.80 to 490.90	0.100	0.092
E12	471.40 to 615.90	0.036	0.033
	490.90 to 634.40	0.057	0.052
E13	615.90 to 913.20	0.017	0.016
	634.40 to 929.60	0.027	0.026
E14	913.20 to 1352.30	0.006	0.006
	929.60 to 1361.00	0.010	0.011
E15	1352.30 to 2013.90	0.002	0.002
	1361.00 to 2024.30	0.004	0.004
E16	2013.90 to 3005.40	0.001	0.001
	2024.30 to 3003.80	0.001	0.001

Table A 8 - ICS Electron Detector Integral Flux Reduction Due to Background Correction		
ICS Channel	**Energy Band [keV]**	**Flux reduction due to Subtracted Background [1/(cm**2-s-sr)]**
ED1	34 to infinity†	343.7
	38 to infinity†	46.8
ED2	110 to infinity	39.0

† ICS ED1 Threshold was raised at 00:00 UT on DoY 067 1993 from 34 to 38 keV

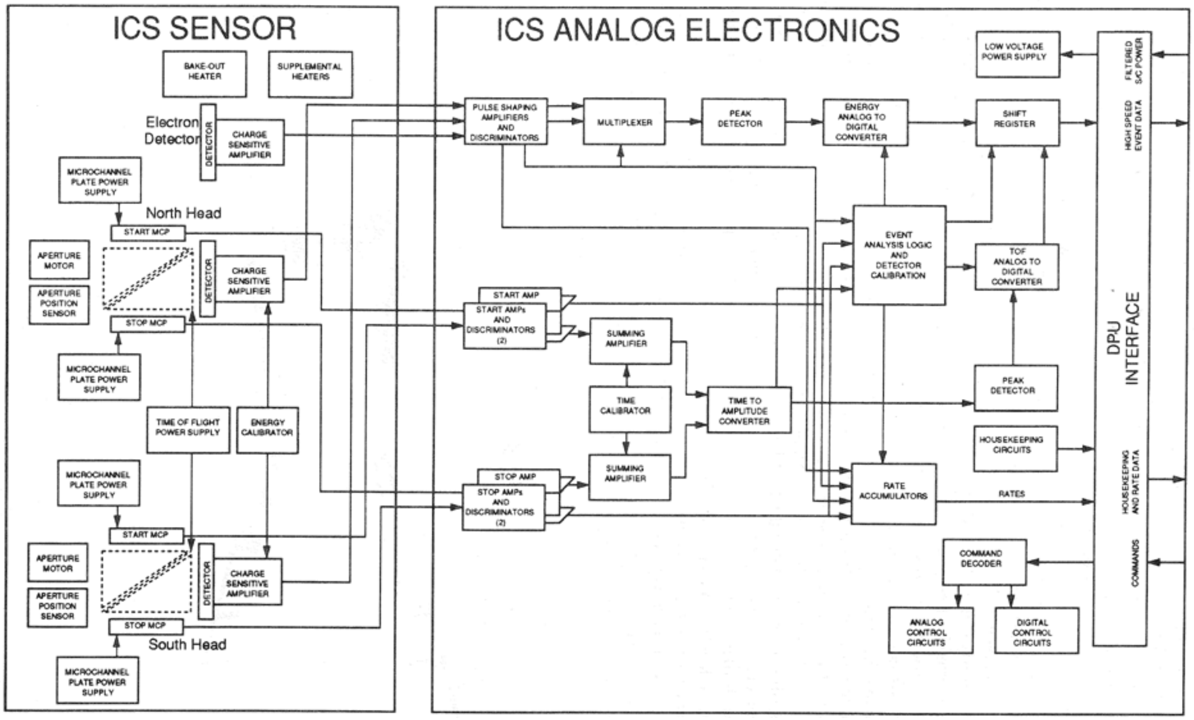

Figure A 1 - ICS Functional Block Diagram

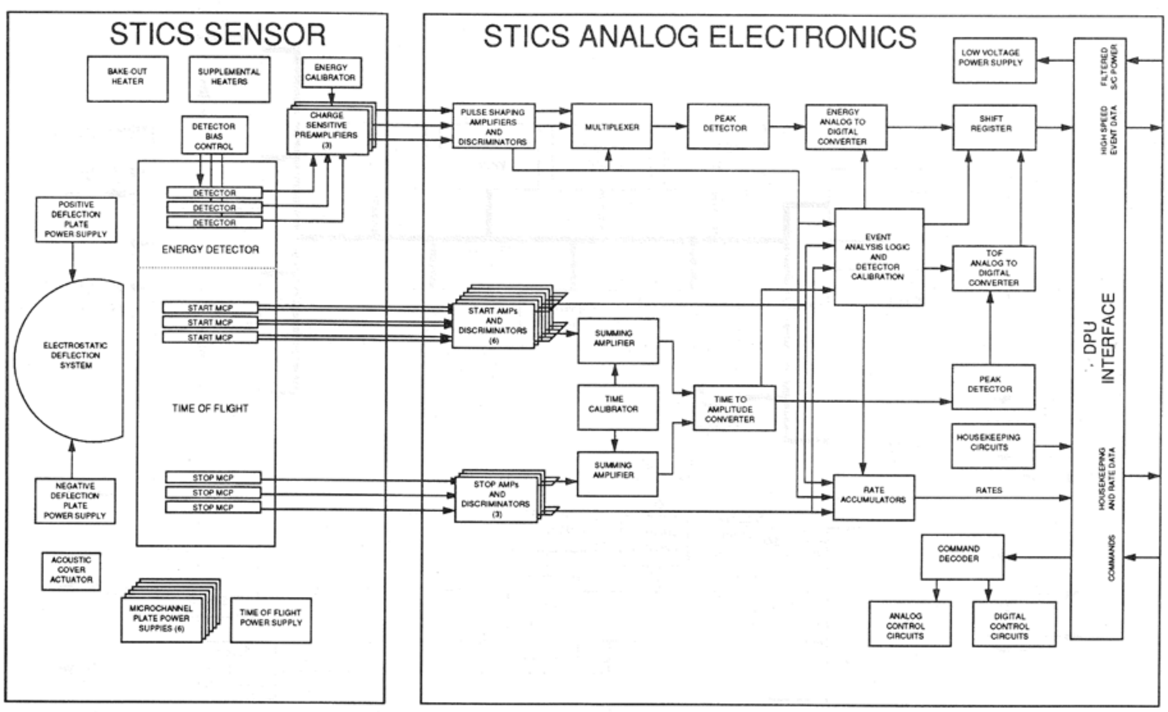

Figure A 2 - STICS Functional Block Diagram