

GCMS Data Processing Commentary

This document describes, with examples, the process of extracting the GCMS data from its raw (telemetry) format to a more useful processed format: e.g., converting the raw numbers to the more useful counts per second form.

The level (Stage) of data processing represents:

Stage	Description
0	Raw telemetry data contained in a binary formatted fixed record length file. The fixed record length used by the binary file is not the same as any of the record lengths of the GCMS data types serially packed and transmitted in this file.
1	The raw data converted to ASCII text format.
1-2	The Stage 1 data converted to counts per integration period (c/ip) format.
2	The Stage 1-2 data converted to counts per second (c/s) format. This data is corrected for the known data system counter overflow condition where this condition is obvious.
3	The Stage 2 data fully corrected for known instrumental and data system effects: 1) the counter system data overflow condition, 2) applying well defined empirical methods to correct the data for pulse pile-up and non-paralyzed counter system dead time corrections and 3) corrections resulting from the calibration of the spare instrument using selected species of interest.

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At the time of the initial data submissions to the PSA (ESA's Planetary Science Archives) and the PDS (NASA's Planetary Data System) only the Stage 1 and 2 data processing has been completed. The Stage 0 and intermediate Stage 1-2 data files will not be archived. The Stage 3 data files will be submitted at a later date.

This document does not detail the conversion from the telemetry file to the Stage 1 processed files. The archived Stage 1 files contain all of the data from the telemetry file and organize the data by the source of the data: e.g., mass sweep data, housekeeping (instrument health) types 1 or 2 files, etc. The details of converting the raw serially packed variable record lengths binary formatted telemetry file involve pushing the file values through the probe interface simulator hardware. This information is contained in documentation written and submitted during the Huygens Probe mission development, design and testing period.

All Stage 1 processed data table files can be identified by the text “_STG1.TAB” in the file name. All GCMS data tables contain as their first line the column labels needed to identify the data in that column. The label file sharing the base file name with the table file contains additional information relative to the content of the data table. The GCMS mass scan data in these Stage 1 processed data files consists of only numerical values ranging from 0 – 255.

GCMS Data Processing Commentary

Rules governing the GCMS data value coded and telemetered to Earth.

GCMS Counter Data (counts per integration period) (integration period is 4.592 ms)	Value Telemetered
0 - 127	The data value
Greater than 127	<p>The low 7 bits of the square root of the data value. (A number between 0 and 127.) Bit 8 is set to “1” to flag this data as square root compressed.</p> <p>The GCMS counter system (electron multiplier and counter electronics) have an exceptionally large dynamic range. Thus valid count rates greater than 16129 (127^2) c/ip (3,512,412 c/s) sometimes are observed. Then we have a counter overflow condition that is not flagged by the data system. The data processor/user must manually examine the data to determine if this overflow is present. However, the behavior of counting systems at very high count rates is non-linear and, generally, only poorly understood.</p>

Rules for Processing the Stage 1 (raw) data to Stage 2 (counts per second) data.

These data conversion rules apply to the data in all of the data tables included with this document. Text and background color have been added to the tables to emphasize where the conversion and correction rules may apply. Masses are referred to as ‘A’, ‘B’ or ‘C’.

Column	Label	Description	If RMn < 128	If RMn >= 128
1	ABS_T	Absolute Time (Clock Tics)	<p>Black text identifies data requiring no additional processing. Blue text identifies square root compressed data. Red text or background identifies counter overflow data.</p>	
2	Rel_T	Relative Time (seconds)		
<i>Stage 1 Processed (raw) Data</i>				
4	RMA	Raw Mass A Data	Stage 1 Data for mass “n”	
5	RMB	Raw Mass B Data		
6	RMC	Raw Mass C Data		

GCMS Data Processing Commentary

Column	Label	Description	If RMn < 128	If RMn >= 128
<i>Stage 1-2 (intermediate) Processing</i>				
8	IPMA	Mass A Counts (c/ip)	Counts per integration period IPMn = RMn	Counts per integration period IPMn = (RMn - 128)^2
9	IPMB	Mass B Counts (c/ip)		
10	IPMC	Mass C Counts (c/ip)		
<i>Stage 2 Processed Data – No Data Corrections Required</i>				
12	MA	Mass A Counts (c/s)		Counts per second Mn = IPMn/0.004592
13	MB	Mass B Counts (c/s)		
14	MC	Mass C Counts (c/s)		
<i>Manually Corrected Stage 1-2 processed Data</i>				
16	CIPMA	Corrected Mass A Counts (c/ip)	<u>Counter Overflow</u> never yields RMn < 128!	User intervention required! Corrected Counts per integration period. CIPMn = (RMn)^2
17	CIPMB	Corrected Mass B Counts (c/ip)		
18	CIPMC	Corrected Mass C Counts (c/ip)		
<i>Manually Corrected Stage 2 processed Data</i>				
20	CMA	Corrected Mass A Counts (c/s)	Counts per second CMn = IPMn/0.004592	Corrected Counts per second CMn = CIPMn/0.004592
21	CMB	Corrected Mass B Counts (c/s)		
22	CMC	Corrected Mass C Counts (c/s)		

GCMS Data Processing Commentary

Case 1: Residual Gas Pump-down after GCMS Instrument Power On.

The data table in this example presents data from a GCMS in-flight checkout test demonstrating the easily identifiable presence of counter overflow occurring after instrument turn on with the ion-pumps remaining off. This is done to observe the residual gases background before the instrument's ion pumps are activated and the resulting pump down. The counter overflow is obvious because the process of residual gas background pump-down is well understood and exhibits a 'smooth' (exponential) behavior.

Black text represents data that requires no adjustment (i.e., values less than 128.)

Blue text indicates data that has been square rooted prior to the transfer of the low 7 bits of the value to the data system.

Red text or a 'pink' background indicates data that is user identified as exhibiting the counter data buffer overflow condition.

The data in this table is also presented in graphic form for the three masses identified as 'A', 'B' and 'C'. The counter data overflow problem is 'obvious' from the plots. The **uncorrected data is plotted using the blue line with dots**. The values identified during data processing as exhibiting the overflow condition, the **corrected data, are plotted using the red line**.

ABS_T in 'tics' REL_T in sec.		Values from telemetry.			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2			(Stage 1-2) / 0.004592			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2 Counter overflow: c = (Raw)^2			(Stage 1-2) / 0.004592		
Time		Stage 1 data (Raw)			Stage 1-2 data (c/ip)			Stage 2 data (c/s)			Stage 1-2 data corrected for counter overflow (c/ip)			Stage 2 data corrected for counter overflow (c/s)		
ABS_T	Rel_T	RMA	RMB	RMC	IPMA	IPMB	IPMC	MA	MB	MC	CIPMA	CIPMB	CIPMC	CMA	CMB	CMC
34945	0.000	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
35005	0.938	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
35064	1.859	185	192	213	3249	4096	7225	707534.8	891986.0	1573389.0	3249	36864	45369	707534.8	8027874.6	9880008.7
35124	2.797	182	190	212	2916	3844	7056	635017.4	837108.0	1536585.0	2916	36100	44944	635017.4	7861498.3	9787456.4
35184	3.734	180	182	207	2704	2916	6241	588850.2	635017.4	1359103.0	2704	33124	42849	588850.2	7213414.6	9331228.2
35245	4.688	177	176	200	2401	2304	5184	522865.9	501742.1	1128920.0	2401	30976	40000	522865.9	6745644.6	8710801.4
35304	5.609	174	168	195	2116	1600	4489	460801.4	348432.0	977569.6	2116	28224	38025	460801.4	6146341.5	8280705.6
35364	6.547	172	163	191	1936	1225	3969	421602.8	266768.2	864329.2	1936	26569	36481	421602.8	5785932.1	7944468.6
35424	7.484	171	159	186	1849	961	3364	402656.8	209277.0	732578.3	1849	25281	34596	402656.8	5505444.3	7533972.1
35484	8.422	169	154	181	1681	676	2809	366071.4	147212.5	611716.0	1681	23716	32761	366071.4	5164634.1	7134364.1
35544	9.359	170	151	178	1764	529	2500	384146.3	115200.3	544425.0	1764	22801	31684	384146.3	4965374.6	6899825.8
35604	10.297	168	146	174	1600	324	2116	348432.1	70557.4	460801.3	1600	21316	30276	348432.1	4641986.1	6593205.6
35664	11.234	167	144	171	1521	256	1849	331228.2	55749.1	402656.7	1521	20736	29241	331228.2	4515679.4	6367813.6
35724	12.172	165	141	167	1369	169	1521	298127.2	36803.1	331228.2	1369	19881	27889	298127.2	4329486.1	6073388.5
35784	13.109	165	138	164	1369	100	1296	298127.2	21777.0	282229.9	1369	19044	26896	298127.2	4147212.5	5857142.9
35852	14.172	164	136	161	1296	64	1089	282230.0	13937.2	237151.5	1296	18496	25921	282230.0	4027874.6	5644817.1
35908	15.047	163	132	157	1225	16	841	266768.3	3484.3	183144.5	1225	17424	24649	266768.3	3794425.1	5367813.6
35968	15.984	162	129	154	1156	1	676	251742.2	217.7	147212.5	1156	16641	23716	251742.2	3623911.1	5164634.1
36027	16.906	161	255	151	1089	16129	529	237151.6	3512412.9	115200.3	1089	16129	22801	237151.6	3512412.9	4965374.6
36087	17.844	160	251	148	1024	15129	400	222996.5	3294642.9	87108.0	1024	15129	21904	222996.5	3294642.9	4770034.8
36148	18.797	161	249	144	1089	14641	256	237151.6	3188371.1	55749.1	1089	14641	20736	237151.6	3188371.1	4515679.4
36208	19.734	159	247	142	961	14161	196	209277.0	3083841.5	42682.9	961	14161	20164	209277.0	3083841.5	4391115.0
36268	20.672	159	244	140	961	13456	144	209277.0	2930313.6	31358.8	961	13456	19600	209277.0	2930313.6	4268292.7
36327	21.594	157	241	136	841	12769	64	183144.6	2780705.6	13937.2	841	12769	18496	183144.6	2780705.6	4027874.6
36388	22.547	158	240	133	900	12544	25	195993.0	2731707.3	5444.2	900	12544	17689	195993.0	2731707.3	3852134.1
36447	23.469	157	237	133	841	11881	25	183144.6	2587325.8	5444.2	841	11881	17689	183144.6	2587325.8	3852134.1
36507	24.406	157	234	128	841	11236	0	183144.6	2446864.1	0.0	841	11236	16384	183144.6	2446864.1	3567944.3
36567	25.344	155	231	254	729	10609	15876	158754.4	2310322.3	3457317.1	729	10609	15876	158754.4	2310322.3	3457317.1
36627	26.281	155	231	250	729	10609	14884	158754.4	2310322.3	3241289.2	729	10609	14884	158754.4	2310322.3	3241289.2
36687	27.219	153	228	248	625	10000	14400	136106.3	2177700.3	3135888.5	625	10000	14400	136106.3	2177700.3	3135888.5
36747	28.156	153	225	247	625	9409	14161	136106.3	2048998.3	3083841.5	625	9409	14161	136106.3	2048998.3	3083841.5
36816	29.234	153	224	243	625	9216	13225	136106.3	2006968.6	2880008.7	625	9216	13225	136106.3	2006968.6	2880008.7
36872	30.109	152	221	241	576	8649	12769	125435.5	1883493.0	2780705.6	576	8649	12769	125435.5	1883493.0	2780705.6
36931	31.031	152	220	238	576	8464	12100	125435.5	1843205.6	2635017.4	576	8464	12100	125435.5	1843205.6	2635017.4
36991	31.969	152	218	236	576	8100	11664	125435.5	1763937.3	2540069.7	576	8100	11664	125435.5	1763937.3	2540069.7
37051	32.906	151	216	233	529	7744	11025	115200.3	1686411.1	2400914.6	529	7744	11025	115200.3	1686411.1	2400914.6
37111	33.844	150	214	231	484	7396	10609	105400.7	1610627.2	2310322.3	484	7396	10609	105400.7	1610627.2	2310322.3
37171	34.781	150	213	230	484	7225	10404	105400.7	1573388.5	2265679.4	484	7225	10404	105400.7	1573388.5	2265679.4
37231	35.719	149	211	228	441	6889	10000	96036.6	1500217.8	2177700.3	441	6889	10000	96036.6	1500217.8	2177700.3
37291	36.656	148	208	225	400	6400	9409	87108.0	1393728.2	2048998.3	400	6400	9409	87108.0	1393728.2	2048998.3

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ABS_T	Rel_T	RMA	RMB	RMC	IPMA	IPMB	IPMC	MA	MB	MC	CIPMA	CIPMB	CIPMC	CMA	CMB	CMC
37351	37.594	149	207	223	441	6241	9025	96036.6	1359102.8	1965374.6	441	6241	9025	96036.6	1359102.8	1965374.6
37411	38.531	149	206	221	441	6084	8649	96036.6	1324912.9	1883493.0	441	6084	8649	96036.6	1324912.9	1883493.0
37471	39.469	148	204	221	400	5776	8649	87108.0	1257839.7	1883493.0	400	5776	8649	87108.0	1257839.7	1883493.0
37531	40.406	147	203	218	361	5625	8100	78615.0	1224956.4	1763937.3	361	5625	8100	78615.0	1224956.4	1763937.3
37590	41.328	146	201	217	324	5329	7921	70557.5	1160496.5	1724956.4	324	5329	7921	70557.5	1160496.5	1724956.4
37651	42.281	146	200	215	324	5184	7569	70557.5	1128919.9	1648301.4	324	5184	7569	70557.5	1128919.9	1648301.4
37711	43.219	146	198	213	324	4900	7225	70557.5	1067073.2	1573388.5	324	4900	7225	70557.5	1067073.2	1573388.5
37780	44.297	146	197	212	324	4761	7056	70557.5	1036803.1	1536585.4	324	4761	7056	70557.5	1036803.1	1536585.4
37835	45.156	145	195	210	289	4489	6724	62935.5	977569.7	1464285.7	289	4489	6724	62935.5	977569.7	1464285.7
37895	46.094	146	195	208	324	4489	6400	70557.5	977569.7	1393728.2	324	4489	6400	70557.5	977569.7	1393728.2
37955	47.031	143	192	208	225	4096	6400	48998.3	891986.1	1393728.2	225	4096	6400	48998.3	891986.1	1393728.2
38015	47.969	144	191	206	256	3969	6084	55749.1	864329.3	1324912.9	256	3969	6084	55749.1	864329.3	1324912.9
38075	48.906	145	190	204	289	3844	5776	62935.5	837108.0	1257839.7	289	3844	5776	62935.5	837108.0	1257839.7
38134	49.828	145	191	203	289	3969	5625	62935.5	864329.3	1224956.4	289	3969	5625	62935.5	864329.3	1224956.4
38195	50.781	143	189	202	225	3721	5476	48998.3	810322.3	1192508.7	225	3721	5476	48998.3	810322.3	1192508.7
38255	51.719	144	188	201	256	3600	5329	55749.1	783972.1	1160496.5	256	3600	5329	55749.1	783972.1	1160496.5
38315	52.656	143	187	200	225	3481	5184	48998.3	758057.5	1128919.9	225	3481	5184	48998.3	758057.5	1128919.9
38375	53.594	142	186	198	196	3364	4900	42682.9	732578.4	1067073.2	196	3364	4900	42682.9	732578.4	1067073.2
38435	54.531	142	184	195	196	3136	4489	42682.9	682926.8	977569.7	196	3136	4489	42682.9	682926.8	977569.7
38494	55.453	140	175	186	144	2209	3364	31358.9	481054.0	732578.4	144	2209	3364	31358.9	481054.0	732578.4
38554	56.391	93	168	177	93	1600	2401	20252.6	348432.1	522865.9	93	1600	2401	20252.6	348432.1	522865.9
38614	57.328	83	162	171	83	1156	1849	18074.9	251742.2	402656.8	83	1156	1849	18074.9	251742.2	402656.8
38674	58.266	64	158	164	64	900	1296	13937.3	195993.0	282230.0	64	900	1296	13937.3	195993.0	282230.0
38743	59.344	58	154	159	58	676	961	12630.7	147212.5	209277.0	58	676	961	12630.7	147212.5	209277.0
38799	60.219	26	150	155	26	484	729	5662.0	105400.7	158754.4	26	484	729	5662.0	105400.7	158754.4
38859	61.156	21	146	152	21	324	576	4573.2	70557.5	125435.5	21	324	576	4573.2	70557.5	125435.5
38919	62.094	25	144	149	25	256	441	5444.3	55749.1	96036.6	25	256	441	5444.3	55749.1	96036.6
38979	63.031	18	143	146	18	225	324	3919.9	48998.3	70557.5	18	225	324	3919.9	48998.3	70557.5
39039	63.969	12	142	144	12	196	256	2613.2	42682.9	55749.1	12	196	256	2613.2	42682.9	55749.1
39099	64.906	11	140	143	11	144	225	2395.5	31358.9	48998.3	11	144	225	2395.5	31358.9	48998.3
39159	65.844	7	140	142	7	144	196	1524.4	31358.9	42682.9	7	144	196	1524.4	31358.9	42682.9
39219	66.781	7	125	141	7	125	169	1524.4	27221.3	36803.1	7	125	169	1524.4	27221.3	36803.1
39763	75.281	4	55	89	4	55	89	871.1	11977.4	19381.5	4	55	89	871.1	11977.4	19381.5
39823	76.219	3	41	59	3	41	59	653.3	8928.6	12848.4	3	41	59	653.3	8928.6	12848.4
39883	77.156	3	35	61	3	35	61	653.3	7622.0	13284.0	3	35	61	653.3	7622.0	13284.0
39943	78.094	2	38	70	2	38	70	435.5	8275.3	15243.9	2	38	70	435.5	8275.3	15243.9
40003	79.031	5	46	53	5	46	53	1088.9	10017.4	11541.8	5	46	53	1088.9	10017.4	11541.8
40062	79.953	8	30	58	8	30	58	1742.2	6533.1	12630.7	8	30	58	1742.2	6533.1	12630.7
40122	80.891	3	50	47	3	50	47	653.3	10888.5	10235.2	3	50	47	653.3	10888.5	10235.2
40182	81.828	4	35	56	4	35	56	871.1	7622.0	12195.1	4	35	56	871.1	7622.0	12195.1

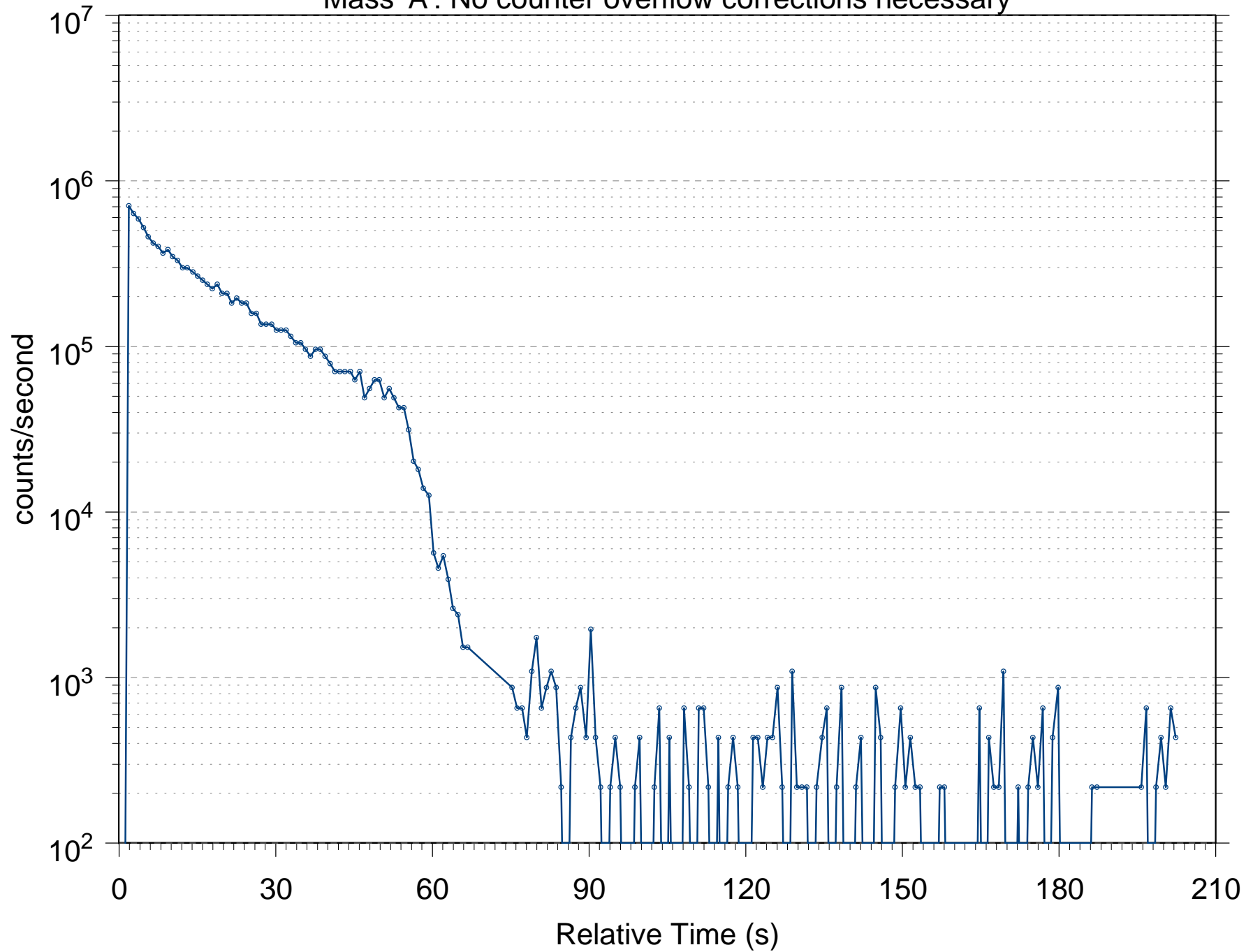
ABS_T in 'tics' REL_T in sec.		Values from telemetry.			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2			(Stage 1-2) / 0.004592			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2 Counter overflow: c = (Raw)^2			(Stage 1-2) / 0.004592		
Time		Stage 1 data (Raw)			Stage 1-2 data (c/ip)			Stage 2 data (c/s)			Stage 1-2 data corrected for counter overflow (c/ip)			Stage 2 data corrected for counter overflow (c/s)		
ABS_T	Rel_T	RMA	RMB	RMC	IPMA	IPMB	IPMC	MA	MB	MC	CIPMA	CIPMB	CIPMC	CMA	CMB	CMC
40242	82.766	5	28	47	5	28	47	1088.9	6097.6	10235.2	5	28	47	1088.9	6097.6	10235.2
40302	83.703	4	33	60	4	33	60	871.1	7186.4	13066.2	4	33	60	871.1	7186.4	13066.2
40362	84.641	1	22	36	1	22	36	217.8	4790.9	7839.7	1	22	36	217.8	4790.9	7839.7
40422	85.578	0	43	35	0	43	35	0.0	9364.1	7622.0	0	43	35	0.0	9364.1	7622.0
40482	86.516	2	29	44	2	29	44	435.5	6315.3	9581.9	2	29	44	435.5	6315.3	9581.9
40542	87.453	3	24	49	3	24	49	653.3	5226.5	10670.7	3	24	49	653.3	5226.5	10670.7
40602	88.391	4	33	52	4	33	52	871.1	7186.4	11324.0	4	33	52	871.1	7186.4	11324.0
40671	89.469	2	31	34	2	31	34	435.5	6750.9	7404.2	2	31	34	435.5	6750.9	7404.2
40727	90.344	9	29	38	9	29	38	1959.9	6315.3	8275.3	9	29	38	1959.9	6315.3	8275.3
40786	91.266	2	28	50	2	28	50	435.5	6097.6	10888.5	2	28	50	435.5	6097.6	10888.5
40847	92.219	1	29	30	1	29	30	217.8	6315.3	6533.1	1	29	30	217.8	6315.3	6533.1
40906	93.141	0	20	40	0	20	40	0.0	4355.4	8710.8	0	20	40	0.0	4355.4	8710.8
40966	94.078	1	33	40	1	33	40	217.8	7186.4	8710.8	1	33	40	217.8	7186.4	8710.8
41026	95.016	2	23	33	2	23	33	435.5	5008.7	7186.4	2	23	33	435.5	5008.7	7186.4
41086	95.953	1	26	41	1	26	41	217.8	5662.0	8928.6	1	26	41	217.8	5662.0	8928.6
41146	96.891	0	19	28	0	19	28	0.0	4137.6	6097.6	0	19	28	0.0	4137.6	6097.6
41206	97.828	0	22	41	0	22	41	0.0	4790.9	8928.6	0	22	41	0.0	4790.9	8928.6
41266	98.766	1	26	40	1	26	40	217.8	5662.0	8710.8	1	26	40	217.8	5662.0	8710.8
41326	99.703	2	16	38	2	16	38	435.5	3484.3	8275.3	2	16	38	435.5	3484.3	8275.3
41386	100.641	0	22	18	0	22	18	0.0	4790.9	3919.9	0	22	18	0.0	4790.9	3919.9
41446	101.578	0	28	28	0	28	28	0.0	6097.6	6097.6	0	28	28	0.0	6097.6	6097.6
41506	102.516	1	24	38	1	24	38	217.8	5226.5	8275.3	1	24	38	217.8	5226.5	8275.3
41566	103.453	3	21	33	3	21	33	653.3	4573.2	7186.4	3	21	33	653.3	4573.2	7186.4
41634	104.516	0	27	45	0	27	45	0.0	5879.8	9799.7	0	27	45	0.0	5879.8	9799.7
41690	105.391	2	26	29	2	26	29	435.5	5662.0	6315.3	2	26	29	435.5	5662.0	6315.3
41750	106.328	0	8	33	0	8	33	0.0	1742.2	7186.4	0	8	33	0.0	1742.2	7186.4
41810	107.266	0	31	35	0	31	35	0.0	6750.9	7622.0	0	31	35	0.0	6750.9	7622.0
41870	108.203	3	20	35	3	20	35	653.3	4355.4	7622.0	3	20	35	653.3	4355.4	7622.0
41930	109.141	1	15	25	1	15	25	217.8	3266.6	5444.3	1	15	25	217.8	3266.6	5444.3
41990	110.078	0	14	20	0	14	20	0.0	3048.8	4355.4	0	14	20	0.0	3048.8	4355.4
42050	111.016	3	16	34	3	16	34	653.3	3484.3	7404.2	3	16	34	653.3	3484.3	7404.2
42109	111.938	3	17	22	3	17	22	653.3	3702.1	4790.9	3	17	22	653.3	3702.1	4790.9
42169	112.875	1	18	32	1	18	32	217.8	3919.9	6968.6	1	18	32	217.8	3919.9	6968.6
42229	113.813	0	19	29	0	19	29	0.0	4137.6	6315.3	0	19	29	0.0	4137.6	6315.3
42289	114.750	2	13	24	2	13	24	435.5	2831.0	5226.5	2	13	24	435.5	2831.0	5226.5
42349	115.688	0	18	31	0	18	31	0.0	3919.9	6750.9	0	18	31	0.0	3919.9	6750.9
42409	116.625	1	18	32	1	18	32	217.8	3919.9	6968.6	1	18	32	217.8	3919.9	6968.6
42469	117.563	2	20	28	2	20	28	435.5	4355.4	6097.6	2	20	28	435.5	4355.4	6097.6
42529	118.500	1	9	28	1	9	28	217.8	1959.9	6097.6	1	9	28	217.8	1959.9	6097.6
42597	119.563	0	9	26	0	9	26	0.0	1959.9	5662.0	0	9	26	0.0	1959.9	5662.0

ABS_T in 'tics' REL_T in sec.		Values from telemetry.			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2			(Stage 1-2) / 0.004592			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2 Counter overflow: c = (Raw)^2			(Stage 1-2) / 0.004592		
Time		Stage 1 data (Raw)			Stage 1-2 data (c/ip)			Stage 2 data (c/s)			Stage 1-2 data corrected for counter overflow (c/ip)			Stage 2 data corrected for counter overflow (c/s)		
ABS_T	Rel_T	RMA	RMB	RMC	IPMA	IPMB	IPMC	MA	MB	MC	CIPMA	CIPMB	CIPMC	CMA	CMB	CMC
42654	120.453	0	16	17	0	16	17	0.0	3484.3	3702.1	0	16	17	0.0	3484.3	3702.1
42713	121.375	2	13	30	2	13	30	435.5	2831.0	6533.1	2	13	30	435.5	2831.0	6533.1
42773	122.313	2	19	24	2	19	24	435.5	4137.6	5226.5	2	19	24	435.5	4137.6	5226.5
42833	123.250	1	19	14	1	19	14	217.8	4137.6	3048.8	1	19	14	217.8	4137.6	3048.8
42893	124.188	2	10	17	2	10	17	435.5	2177.7	3702.1	2	10	17	435.5	2177.7	3702.1
42953	125.125	2	23	27	2	23	27	435.5	5008.7	5879.8	2	23	27	435.5	5008.7	5879.8
43013	126.063	4	19	25	4	19	25	871.1	4137.6	5444.3	4	19	25	871.1	4137.6	5444.3
43073	127.000	1	17	22	1	17	22	217.8	3702.1	4790.9	1	17	22	217.8	3702.1	4790.9
43133	127.938	0	13	30	0	13	30	0.0	2831.0	6533.1	0	13	30	0.0	2831.0	6533.1
43193	128.875	5	14	10	5	14	10	1088.9	3048.8	2177.7	5	14	10	1088.9	3048.8	2177.7
43253	129.813	1	18	19	1	18	19	217.8	3919.9	4137.6	1	18	19	217.8	3919.9	4137.6
43313	130.750	1	22	18	1	22	18	217.8	4790.9	3919.9	1	22	18	217.8	4790.9	3919.9
43373	131.688	1	24	33	1	24	33	217.8	5226.5	7186.4	1	24	33	217.8	5226.5	7186.4
43433	132.625	0	16	16	0	16	16	0.0	3484.3	3484.3	0	16	16	0.0	3484.3	3484.3
43492	133.547	1	9	20	1	9	20	217.8	1959.9	4355.4	1	9	20	217.8	1959.9	4355.4
43561	134.625	2	10	20	2	10	20	435.5	2177.7	4355.4	2	10	20	435.5	2177.7	4355.4
43617	135.500	3	18	19	3	18	19	653.3	3919.9	4137.6	3	18	19	653.3	3919.9	4137.6
43677	136.438	0	17	17	0	17	17	0.0	3702.1	3702.1	0	17	17	0.0	3702.1	3702.1
43737	137.375	1	7	38	1	7	38	217.8	1524.4	8275.3	1	7	38	217.8	1524.4	8275.3
43797	138.313	4	11	39	4	11	39	871.1	2395.5	8493.0	4	11	39	871.1	2395.5	8493.0
43857	139.250	0	17	21	0	17	21	0.0	3702.1	4573.2	0	17	21	0.0	3702.1	4573.2
43917	140.188	0	11	29	0	11	29	0.0	2395.5	6315.3	0	11	29	0.0	2395.5	6315.3
43977	141.125	1	11	22	1	11	22	217.8	2395.5	4790.9	1	11	22	217.8	2395.5	4790.9
44037	142.063	2	11	17	2	11	17	435.5	2395.5	3702.1	2	11	17	435.5	2395.5	3702.1
44096	142.984	0	11	24	0	11	24	0.0	2395.5	5226.5	0	11	24	0.0	2395.5	5226.5
44156	143.922	0	10	17	0	10	17	0.0	2177.7	3702.1	0	10	17	0.0	2177.7	3702.1
44216	144.859	4	12	19	4	12	19	871.1	2613.2	4137.6	4	12	19	871.1	2613.2	4137.6
44276	145.797	2	12	21	2	12	21	435.5	2613.2	4573.2	2	12	21	435.5	2613.2	4573.2
44336	146.734	0	10	21	0	10	21	0.0	2177.7	4573.2	0	10	21	0.0	2177.7	4573.2
44396	147.672	0	23	20	0	23	20	0.0	5008.7	4355.4	0	23	20	0.0	5008.7	4355.4
44456	148.609	1	19	16	1	19	16	217.8	4137.6	3484.3	1	19	16	217.8	4137.6	3484.3
44524	149.672	3	9	23	3	9	23	653.3	1959.9	5008.7	3	9	23	653.3	1959.9	5008.7
44581	150.563	1	14	24	1	14	24	217.8	3048.8	5226.5	1	14	24	217.8	3048.8	5226.5
44640	151.484	2	9	14	2	9	14	435.5	1959.9	3048.8	2	9	14	435.5	1959.9	3048.8
44701	152.438	1	10	23	1	10	23	217.8	2177.7	5008.7	1	10	23	217.8	2177.7	5008.7
44760	153.359	1	16	26	1	16	26	217.8	3484.3	5662.0	1	16	26	217.8	3484.3	5662.0
44820	154.297	0	13	24	0	13	24	0.0	2831.0	5226.5	0	13	24	0.0	2831.0	5226.5
44880	155.234	0	10	15	0	10	15	0.0	2177.7	3266.6	0	10	15	0.0	2177.7	3266.6
44940	156.172	0	18	13	0	18	13	0.0	3919.9	2831.0	0	18	13	0.0	3919.9	2831.0
45000	157.109	1	9	14	1	9	14	217.8	1959.9	3048.8	1	9	14	217.8	1959.9	3048.8

ABS_T in 'tics' REL_T in sec.		Values from telemetry.			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2			(Stage 1-2) / 0.004592			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2 Counter overflow: c = (Raw)^2			(Stage 1-2) / 0.004592		
Time		Stage 1 data (Raw)			Stage 1-2 data (c/ip)			Stage 2 data (c/s)			Stage 1-2 data corrected for counter overflow (c/ip)			Stage 2 data corrected for counter overflow (c/s)		
ABS_T	Rel_T	RMA	RMB	RMC	IPMA	IPMB	IPMC	MA	MB	MC	CIPMA	CIPMB	CIPMC	CMA	CMB	CMC
45060	158.047	1	12	10	1	12	10	217.8	2613.2	2177.7	1	12	10	217.8	2613.2	2177.7
45120	158.984	0	8	15	0	8	15	0.0	1742.2	3266.6	0	8	15	0.0	1742.2	3266.6
45180	159.922	0	19	21	0	19	21	0.0	4137.6	4573.2	0	19	21	0.0	4137.6	4573.2
45240	160.859	0	22	21	0	22	21	0.0	4790.9	4573.2	0	22	21	0.0	4790.9	4573.2
45300	161.797	0	14	16	0	14	16	0.0	3048.8	3484.3	0	14	16	0.0	3048.8	3484.3
45360	162.734	0	17	20	0	17	20	0.0	3702.1	4355.4	0	17	20	0.0	3702.1	4355.4
45419	163.656	0	13	24	0	13	24	0.0	2831.0	5226.5	0	13	24	0.0	2831.0	5226.5
45488	164.734	3	19	15	3	19	15	653.3	4137.6	3266.6	3	19	15	653.3	4137.6	3266.6
45544	165.609	0	11	8	0	11	8	0.0	2395.5	1742.2	0	11	8	0.0	2395.5	1742.2
45604	166.547	2	17	22	2	17	22	435.5	3702.1	4790.9	2	17	22	435.5	3702.1	4790.9
45664	167.484	1	5	22	1	5	22	217.8	1088.9	4790.9	1	5	22	217.8	1088.9	4790.9
45724	168.422	1	20	18	1	20	18	217.8	4355.4	3919.9	1	20	18	217.8	4355.4	3919.9
45784	169.359	5	9	27	5	9	27	1088.9	1959.9	5879.8	5	9	27	1088.9	1959.9	5879.8
45844	170.297	0	20	21	0	20	21	0.0	4355.4	4573.2	0	20	21	0.0	4355.4	4573.2
45904	171.234	0	26	25	0	26	25	0.0	5662.0	5444.3	0	26	25	0.0	5662.0	5444.3
45964	172.172	1	18	16	1	18	16	217.8	3919.9	3484.3	1	18	16	217.8	3919.9	3484.3
46024	173.109	0	11	22	0	11	22	0.0	2395.5	4790.9	0	11	22	0.0	2395.5	4790.9
46084	174.047	1	11	25	1	11	25	217.8	2395.5	5444.3	1	11	25	217.8	2395.5	5444.3
46144	174.984	2	18	19	2	18	19	435.5	3919.9	4137.6	2	18	19	435.5	3919.9	4137.6
46203	175.906	1	13	13	1	13	13	217.8	2831.0	2831.0	1	13	13	217.8	2831.0	2831.0
46264	176.859	3	8	13	3	8	13	653.3	1742.2	2831.0	3	8	13	653.3	1742.2	2831.0
46323	177.781	0	14	14	0	14	14	0.0	3048.8	3048.8	0	14	14	0.0	3048.8	3048.8
46384	178.734	2	15	17	2	15	17	435.5	3266.6	3702.1	2	15	17	435.5	3266.6	3702.1
46453	179.813	4	16	24	4	16	24	871.1	3484.3	5226.5	4	16	24	871.1	3484.3	5226.5
46509	180.688	0	14	22	0	14	22	0.0	3048.8	4790.9	0	14	22	0.0	3048.8	4790.9
46568	181.609	0	19	4	0	19	4	0.0	4137.6	871.1	0	19	4	0.0	4137.6	871.1
46629	182.563	0	13	24	0	13	24	0.0	2831.0	5226.5	0	13	24	0.0	2831.0	5226.5
46688	183.484	0	8	15	0	8	15	0.0	1742.2	3266.6	0	8	15	0.0	1742.2	3266.6
46749	184.438	0	12	17	0	12	17	0.0	2613.2	3702.1	0	12	17	0.0	2613.2	3702.1
46808	185.359	0	17	14	0	17	14	0.0	3702.1	3048.8	0	17	14	0.0	3702.1	3048.8
46868	186.297	1	5	10	1	5	10	217.8	1088.9	2177.7	1	5	10	217.8	1088.9	2177.7
46928	187.234	1	16	15	1	16	15	217.8	3484.3	3266.6	1	16	15	217.8	3484.3	3266.6
47472	195.734	1	12	28	1	12	28	217.8	2613.2	6097.6	1	12	28	217.8	2613.2	6097.6
47532	196.672	3	4	23	3	4	23	653.3	871.1	5008.7	3	4	23	653.3	871.1	5008.7
47592	197.609	0	21	14	0	21	14	0.0	4573.2	3048.8	0	21	14	0.0	4573.2	3048.8
47652	198.547	1	6	17	1	6	17	217.8	1306.6	3702.1	1	6	17	217.8	1306.6	3702.1
47712	199.484	2	11	20	2	11	20	435.5	2395.5	4355.4	2	11	20	435.5	2395.5	4355.4
47772	200.422	1	9	17	1	9	17	217.8	1959.9	3702.1	1	9	17	217.8	1959.9	3702.1
47832	201.359	3	10	9	3	10	9	653.3	2177.7	1959.9	3	10	9	653.3	2177.7	1959.9
47892	202.297	2	10	15	2	10	15	435.5	2177.7	3266.6	2	10	15	435.5	2177.7	3266.6

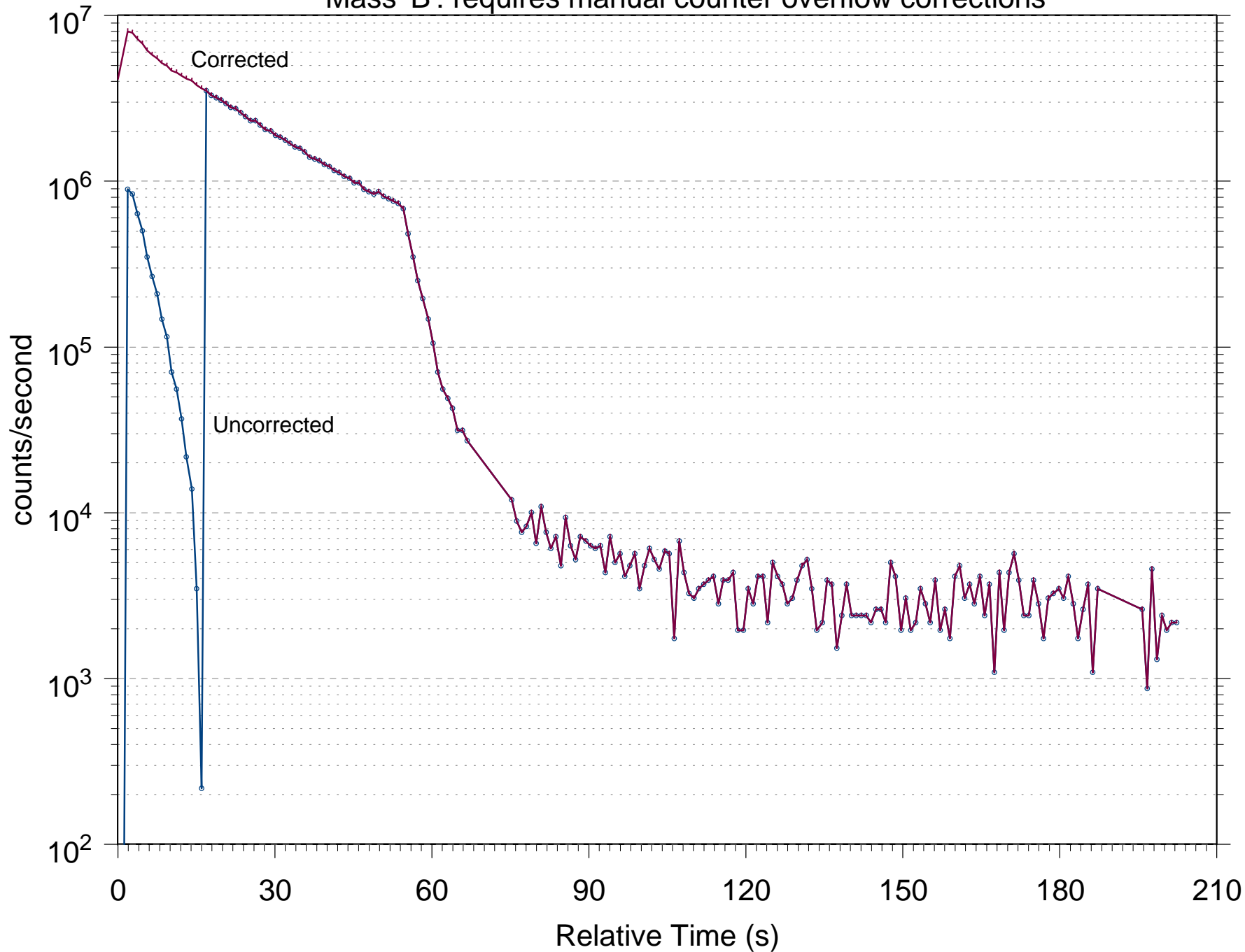
GCMS Data Processing Example

Mass 'A': No counter overflow corrections necessary



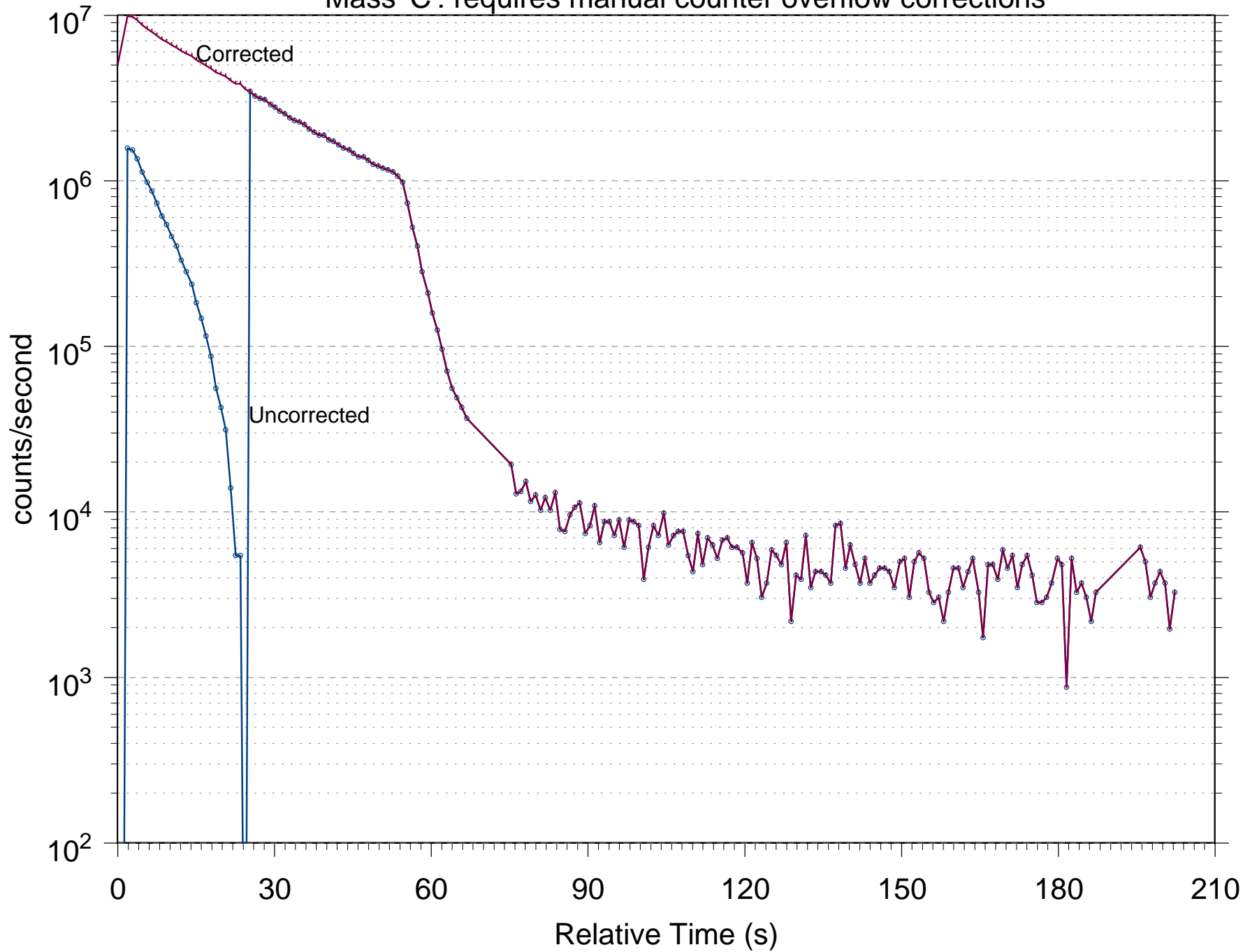
GCMS Data Processing Example

Mass 'B': requires manual counter overflow corrections



GCMS Data Processing Example

Mass 'C': requires manual counter overflow corrections



GCMS Data Processing Commentary

Case 2: Monitoring GCMS Data during Titan Entry – Smooth species profiles might not be observed.

The following table presents data from the Titan Descent exhibiting the counter overflow condition and demonstrating the difficulties in identifying this condition. The processing guide, above, describing data handling applies to this data example. As before the masses are referenced as ‘A’, ‘B’ and ‘C’.

Black text represents data requiring no adjustment (i.e., values less than 128) and there are no such data in this example.

Blue text indicates data that has been square rooted prior to the transfer of the low 7 bits of the value to the data system.

Red text or a ‘**pink**’ **background** indicates data that is user identified as suffering from the counter data buffer overflow condition.

The identification of the counter overflow data condition is especially difficult with this data. Presenting the data from the table in graphic form assists the user in determining the presence of the counter overflow problem. In the plots below the **blue line with dots presents the data as uncorrected** and the **red line displays the corrected data** identified by the user. The difficulty is that no data bit explicitly identifies the counter overflow condition. The data ‘compression’ method dictates that the data range of 128 – 139 must indicate counter overflow. Otherwise data values 140 – 255 must be interpreted by the data processor/user as either ‘normal’ or ‘overflow’ values.

The Mass ‘A’ plot below presents the data assuming that no overflow has occurred. But, is the ‘dip’ at 173 s an indication of overflow? Is the dip a transitory effect resulting from some instrument or spacecraft component operation? Did the ‘dip’ result because the probe is swinging under the parachute causing the gas flow through the GCMS to affect the data?

The Mass ‘B’ and ‘C’ plots below present the data as **uncorrected (blue)** and **corrected (red)**. Upon examination, it appears that the points at 181, 188 and 203 s indicate overflow and need to be corrected. We expect the signals to vary smoothly as we descend into the atmosphere. Should the point at 196 s be corrected and then the plot will show one peak? If we had passed through a cloud then we expect 1 peak. Should we not correct the point as 196 s and show two peaks? What if aerosol particles had entered the heated inlet system and the adsorbed gases volatilized? What if liquid droplets had entered the heated inlet system and vaporized? Other?

Additional work in the laboratory with the spare flight instrument is required before we will better understand the operation and behavior of the GCMS instrument and its data system and how to fully ‘process’ and ‘correct’ the data.

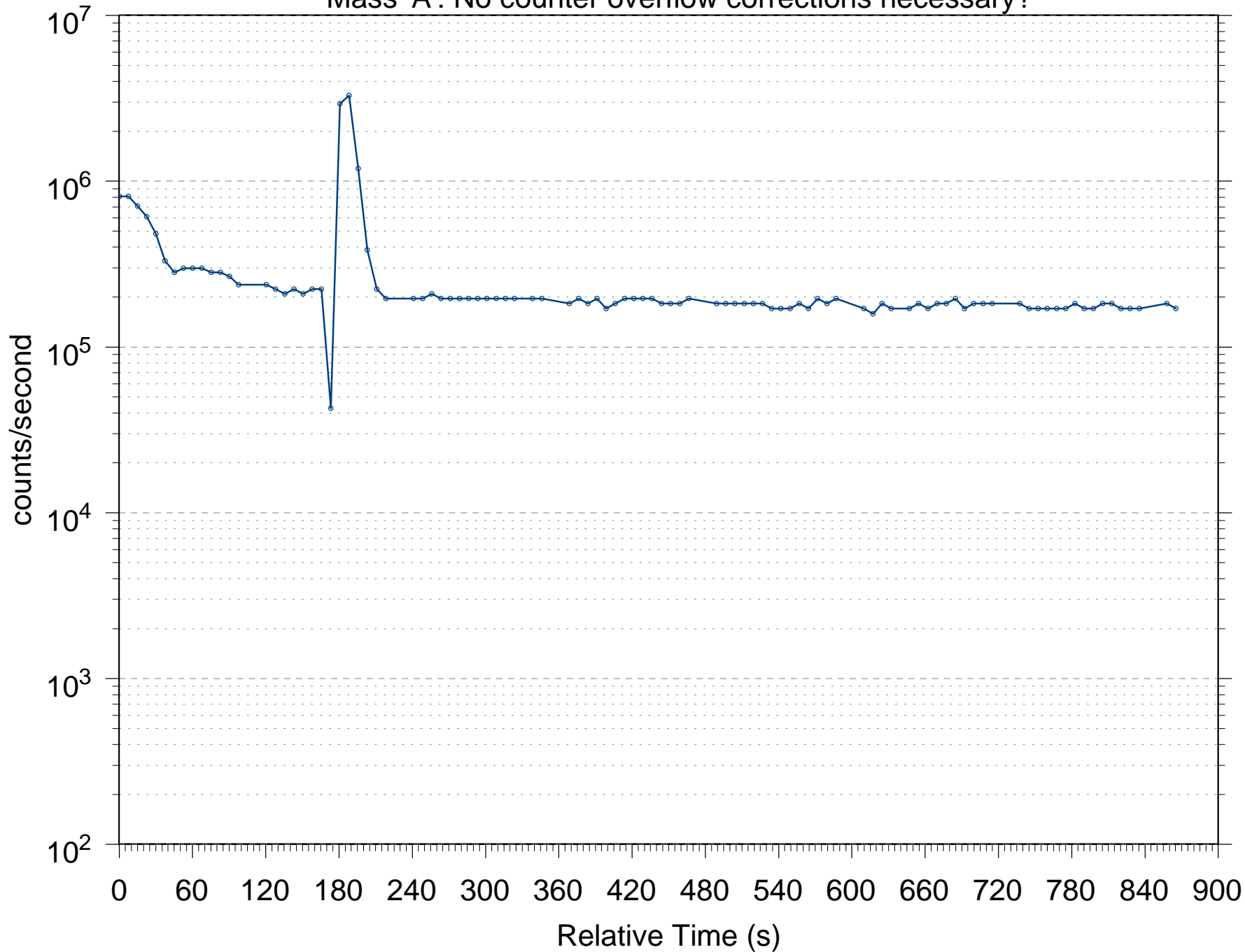
ABS_T in 'tics' REL_T in sec.		Values from telemetry.			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2			(Stage 2) = (Stage 1-2) / 0.004592			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2 Counter overflow: c = (Raw)^2			(Stage 2) = (Stage 1-2) / 0.004592		
Time		Stage 1 data (Raw)			Stage 1-2 data (c/ip)			Stage 2 data (c/s)			Stage 1-2 data corrected for counter overflow (c/ip)			Stage 2 data corrected for counter overflow (c/s)		
ABS_T	Rel_T	RMA	RMB	RMC	IPMA	IPMB	IPMC	MA	MB	MC	CIPMA	CIPMB	CIPMC	CMA	CMB	CMC
8540438	0.000	189	190	213	3721	3844	7225	810322.3	837108.0	1573388.5	3721	36100	45369	810322.3	7861498.3	9880008.7
8540917	7.484	189	190	212	3721	3844	7056	810322.3	837108.0	1536585.4	3721	36100	44944	810322.3	7861498.3	9787456.4
8541402	15.063	185	188	210	3249	3600	6724	707534.8	783972.1	1464285.7	3249	35344	44100	707534.8	7696864.1	9603658.5
8541881	22.547	181	180	204	2809	2704	5776	611716.0	588850.2	1257839.7	2809	32400	41616	611716.0	7055749.1	9062717.8
8542366	30.125	175	165	190	2209	1369	3844	481054.0	298127.2	837108.0	2209	27225	36100	481054.0	5928789.2	7861498.3
8542845	37.609	167	135	160	1521	49	1024	331228.2	10670.7	222996.5	1521	18225	25600	331228.2	3968858.9	5574912.9
8543329	45.172	164	128	151	1296	0	529	282230.0	0.0	115200.3	1296	16384	22801	282230.0	3567944.3	4965374.6
8543809	52.672	165	129	150	1369	1	484	298127.2	217.8	105400.7	1369	16641	22500	298127.2	3623911.1	4899825.8
8544295	60.266	165	130	151	1369	4	529	298127.2	871.1	115200.3	1369	16900	22801	298127.2	3680313.6	4965374.6
8544774	67.750	165	131	153	1369	9	625	298127.2	1959.9	136106.3	1369	17161	23409	298127.2	3737151.6	5097778.7
8545258	75.313	164	130	152	1296	4	576	282230.0	871.1	125435.5	1296	16900	23104	282230.0	3680313.6	5031358.9
8545738	82.813	164	129	150	1296	1	484	282230.0	217.8	105400.7	1296	16641	22500	282230.0	3623911.1	4899825.8
8546222	90.375	163	254	146	1225	15876	324	266768.3	3457317.1	70557.5	1225	15876	21316	266768.3	3457317.1	4641986.1
8546702	97.875	161	252	146	1089	15376	324	237151.6	3348432.1	70557.5	1089	15376	21316	237151.6	3348432.1	4641986.1
8548148	120.469	161	245	138	1089	13689	100	237151.6	2981054.0	21777.0	1089	13689	19044	237151.6	2981054.0	4147212.5
8548629	127.984	160	244	136	1024	13456	64	222996.5	2930313.6	13937.3	1024	13456	18496	222996.5	2930313.6	4027874.6
8549113	135.547	159	242	135	961	12996	49	209277.0	2830139.4	10670.7	961	12996	18225	209277.0	2830139.4	3968858.9
8549592	143.031	160	241	134	1024	12769	36	222996.5	2780705.6	7839.7	1024	12769	17956	222996.5	2780705.6	3910278.7
8550077	150.609	159	242	135	961	12996	49	209277.0	2830139.4	10670.7	961	12996	18225	209277.0	2830139.4	3968858.9
8550556	158.094	160	242	135	1024	12996	49	222996.5	2830139.4	10670.7	1024	12996	18225	222996.5	2830139.4	3968858.9
8551040	165.656	160	240	133	1024	12544	25	222996.5	2731707.3	5444.3	1024	12544	17689	222996.5	2731707.3	3852134.1
8551520	173.156	142	237	129	196	11881	1	42682.9	2587325.8	217.8	196	11881	16641	42682.9	2587325.8	3623911.1
8552004	180.719	244	139	163	13456	121	1225	2930313.6	26350.2	266768.3	13456	19321	26569	2930313.6	4207534.8	5785932.1
8552484	188.219	251	144	198	15129	256	4900	3294642.9	55749.1	1067073.2	15129	20736	39204	3294642.9	4515679.4	8537456.4
8552968	195.781	202	224	229	5476	9216	10201	1192508.7	2006968.6	2221472.1	5476	9216	10201	1192508.7	2006968.6	2221472.1
8553448	203.281	170	148	172	1764	400	1936	384146.3	87108.0	421602.8	1764	21904	29584	384146.3	4770034.8	6442508.7
8553932	210.844	160	246	139	1024	13924	121	222996.5	3032230.0	26350.2	1024	13924	19321	222996.5	3032230.0	4207534.8
8554411	218.328	158	241	131	900	12769	9	195993.0	2780705.6	1959.9	900	12769	17161	195993.0	2780705.6	3737151.6
8555860	240.969	158	238	130	900	12100	4	195993.0	2635017.4	871.1	900	12100	16900	195993.0	2635017.4	3680313.6
8556339	248.453	158	237	129	900	11881	1	195993.0	2587325.8	217.8	900	11881	16641	195993.0	2587325.8	3623911.1
8556824	256.031	159	237	129	961	11881	1	209277.0	2587325.8	217.8	961	11881	16641	209277.0	2587325.8	3623911.1
8557303	263.516	158	237	129	900	11881	1	195993.0	2587325.8	217.8	900	11881	16641	195993.0	2587325.8	3623911.1
8557787	271.078	158	238	128	900	12100	0	195993.0	2635017.4	0.0	900	12100	16384	195993.0	2635017.4	3567944.3
8558266	278.563	158	237	130	900	11881	4	195993.0	2587325.8	871.1	900	11881	16900	195993.0	2587325.8	3680313.6
8558751	286.141	158	237	130	900	11881	4	195993.0	2587325.8	871.1	900	11881	16900	195993.0	2587325.8	3680313.6
8559230	293.625	158	236	128	900	11664	0	195993.0	2540069.7	0.0	900	11664	16384	195993.0	2540069.7	3567944.3
8559714	301.188	158	237	255	900	11881	16129	195993.0	2587325.8	3512412.9	900	11881	16129	195993.0	2587325.8	3512412.9
8560194	308.688	158	236	128	900	11664	0	195993.0	2540069.7	0.0	900	11664	16384	195993.0	2540069.7	3567944.3
8560679	316.266	158	236	255	900	11664	16129	195993.0	2540069.7	3512412.9	900	11664	16129	195993.0	2540069.7	3512412.9
8561159	323.766	158	236	255	900	11664	16129	195993.0	2540069.7	3512412.9	900	11664	16129	195993.0	2540069.7	3512412.9

ABS_T in 'tics' REL_T in sec.		Values from telemetry.			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2			(Stage 2) = (Stage 1-2) / 0.004592			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2 Counter overflow: c = (Raw)^2			(Stage 2) = (Stage 1-2) / 0.004592		
Time		Stage 1 data (Raw)			Stage 1-2 data (c/ip)			Stage 2 data (c/s)			Stage 1-2 data corrected for counter overflow (c/ip)			Stage 2 data corrected for counter overflow (c/s)		
ABS_T	Rel_T	RMA	RMB	RMC	IPMA	IPMB	IPMC	MA	MB	MC	CIPMA	CIPMB	CIPMC	CMA	CMB	CMC
8562107	338.578	158	235	255	900	11449	16129	195993.0	2493249.1	3512412.9	900	11449	16129	195993.0	2493249.1	3512412.9
8562588	346.094	158	236	255	900	11664	16129	195993.0	2540069.7	3512412.9	900	11664	16129	195993.0	2540069.7	3512412.9
8564036	368.719	157	235	254	841	11449	15876	183144.6	2493249.1	3457317.1	841	11449	15876	183144.6	2493249.1	3457317.1
8564516	376.219	158	235	254	900	11449	15876	195993.0	2493249.1	3457317.1	900	11449	15876	195993.0	2493249.1	3457317.1
8565000	383.781	157	236	253	841	11664	15625	183144.6	2540069.7	3402656.8	841	11664	15625	183144.6	2540069.7	3402656.8
8565479	391.266	158	234	255	900	11236	16129	195993.0	2446864.1	3512412.9	900	11236	16129	195993.0	2446864.1	3512412.9
8565964	398.844	156	236	253	784	11664	15625	170731.7	2540069.7	3402656.8	784	11664	15625	170731.7	2540069.7	3402656.8
8566443	406.328	157	235	254	841	11449	15876	183144.6	2493249.1	3457317.1	841	11449	15876	183144.6	2493249.1	3457317.1
8566928	413.906	158	235	254	900	11449	15876	195993.0	2493249.1	3457317.1	900	11449	15876	195993.0	2493249.1	3457317.1
8567407	421.391	158	235	254	900	11449	15876	195993.0	2493249.1	3457317.1	900	11449	15876	195993.0	2493249.1	3457317.1
8567891	428.953	158	234	254	900	11236	15876	195993.0	2446864.1	3457317.1	900	11236	15876	195993.0	2446864.1	3457317.1
8568371	436.453	158	235	253	900	11449	15625	195993.0	2493249.1	3402656.8	900	11449	15625	195993.0	2493249.1	3402656.8
8568855	444.016	157	234	253	841	11236	15625	183144.6	2446864.1	3402656.8	841	11236	15625	183144.6	2446864.1	3402656.8
8569334	451.500	157	234	253	841	11236	15625	183144.6	2446864.1	3402656.8	841	11236	15625	183144.6	2446864.1	3402656.8
8569819	459.078	157	234	253	841	11236	15625	183144.6	2446864.1	3402656.8	841	11236	15625	183144.6	2446864.1	3402656.8
8570298	466.563	158	234	253	900	11236	15625	195993.0	2446864.1	3402656.8	900	11236	15625	195993.0	2446864.1	3402656.8
8571746	489.188	157	234	252	841	11236	15376	183144.6	2446864.1	3348432.1	841	11236	15376	183144.6	2446864.1	3348432.1
8572226	496.688	157	234	251	841	11236	15129	183144.6	2446864.1	3294642.9	841	11236	15129	183144.6	2446864.1	3294642.9
8572710	504.250	157	233	253	841	11025	15625	183144.6	2400914.6	3402656.8	841	11025	15625	183144.6	2400914.6	3402656.8
8573190	511.750	157	234	252	841	11236	15376	183144.6	2446864.1	3348432.1	841	11236	15376	183144.6	2446864.1	3348432.1
8573674	519.313	157	233	253	841	11025	15625	183144.6	2400914.6	3402656.8	841	11025	15625	183144.6	2400914.6	3402656.8
8574153	526.797	157	233	252	841	11025	15376	183144.6	2400914.6	3348432.1	841	11025	15376	183144.6	2400914.6	3348432.1
8574638	534.375	156	233	251	784	11025	15129	170731.7	2400914.6	3294642.9	784	11025	15129	170731.7	2400914.6	3294642.9
8575118	541.875	156	233	252	784	11025	15376	170731.7	2400914.6	3348432.1	784	11025	15376	170731.7	2400914.6	3348432.1
8575602	549.438	156	232	251	784	10816	15129	170731.7	2355400.7	3294642.9	784	10816	15129	170731.7	2355400.7	3294642.9
8576081	556.922	157	233	253	841	11025	15625	183144.6	2400914.6	3402656.8	841	11025	15625	183144.6	2400914.6	3402656.8
8576567	564.516	156	233	251	784	11025	15129	170731.7	2400914.6	3294642.9	784	11025	15129	170731.7	2400914.6	3294642.9
8577046	572.000	158	232	250	900	10816	14884	195993.0	2355400.7	3241289.2	900	10816	14884	195993.0	2355400.7	3241289.2
8577531	579.578	157	233	252	841	11025	15376	183144.6	2400914.6	3348432.1	841	11025	15376	183144.6	2400914.6	3348432.1
8578010	587.063	158	233	250	900	11025	14884	195993.0	2400914.6	3241289.2	900	11025	14884	195993.0	2400914.6	3241289.2
8579458	609.688	156	232	251	784	10816	15129	170731.7	2355400.7	3294642.9	784	10816	15129	170731.7	2355400.7	3294642.9
8579938	617.188	155	233	251	729	11025	15129	158754.4	2400914.6	3294642.9	729	11025	15129	158754.4	2400914.6	3294642.9
8580422	624.750	157	232	250	841	10816	14884	183144.6	2355400.7	3241289.2	841	10816	14884	183144.6	2355400.7	3241289.2
8580902	632.250	156	233	251	784	11025	15129	170731.7	2400914.6	3294642.9	784	11025	15129	170731.7	2400914.6	3294642.9
8581860	647.219	156	232	249	784	10816	14641	170731.7	2355400.7	3188371.1	784	10816	14641	170731.7	2355400.7	3188371.1
8582336	654.656	157	231	250	841	10609	14884	183144.6	2310322.3	3241289.2	841	10609	14884	183144.6	2310322.3	3241289.2
8582820	662.219	156	232	250	784	10816	14884	170731.7	2355400.7	3241289.2	784	10816	14884	170731.7	2355400.7	3241289.2
8583300	669.719	157	232	250	841	10816	14884	183144.6	2355400.7	3241289.2	841	10816	14884	183144.6	2355400.7	3241289.2
8583784	677.281	157	232	249	841	10816	14641	183144.6	2355400.7	3188371.1	841	10816	14641	183144.6	2355400.7	3188371.1
8584263	684.766	158	232	250	900	10816	14884	195993.0	2355400.7	3241289.2	900	10816	14884	195993.0	2355400.7	3241289.2

ABS_T in 'tics' REL_T in sec.		Values from telemetry.			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2			(Stage 2) = (Stage 1-2) / 0.004592			Raw < 128: c = Raw Raw > 127: c = (Raw-128)^2 Counter overflow: c = (Raw)^2			(Stage 2) = (Stage 1-2) / 0.004592		
Time		Stage 1 data (Raw)			Stage 1-2 data (c/ip)			Stage 2 data (c/s)			Stage 1-2 data corrected for counter overflow (c/ip)			Stage 2 data corrected for counter overflow (c/s)		
ABS_T	Rel_T	RMA	RMB	RMC	IPMA	IPMB	IPMC	MA	MB	MC	CIPMA	CIPMB	CIPMC	CMA	CMB	CMC
8584748	692.344	156	232	250	784	10816	14884	170731.7	2355400.7	3241289.2	784	10816	14884	170731.7	2355400.7	3241289.2
8585227	699.828	157	231	249	841	10609	14641	183144.6	2310322.3	3188371.1	841	10609	14641	183144.6	2310322.3	3188371.1
8585711	707.391	157	230	249	841	10404	14641	183144.6	2265679.4	3188371.1	841	10404	14641	183144.6	2265679.4	3188371.1
8586191	714.891	157	231	249	841	10609	14641	183144.6	2310322.3	3188371.1	841	10609	14641	183144.6	2310322.3	3188371.1
8587634	737.438	157	231	249	841	10609	14641	183144.6	2310322.3	3188371.1	841	10609	14641	183144.6	2310322.3	3188371.1
8588118	745.000	156	231	249	784	10609	14641	170731.7	2310322.3	3188371.1	784	10609	14641	170731.7	2310322.3	3188371.1
8588603	752.578	156	231	249	784	10609	14641	170731.7	2310322.3	3188371.1	784	10609	14641	170731.7	2310322.3	3188371.1
8589082	760.063	156	230	250	784	10404	14884	170731.7	2265679.4	3241289.2	784	10404	14884	170731.7	2265679.4	3241289.2
8589567	767.641	156	230	249	784	10404	14641	170731.7	2265679.4	3188371.1	784	10404	14641	170731.7	2265679.4	3188371.1
8590046	775.125	156	231	249	784	10609	14641	170731.7	2310322.3	3188371.1	784	10609	14641	170731.7	2310322.3	3188371.1
8590531	782.703	157	231	250	841	10609	14884	183144.6	2310322.3	3241289.2	841	10609	14884	183144.6	2310322.3	3241289.2
8591010	790.188	156	230	249	784	10404	14641	170731.7	2265679.4	3188371.1	784	10404	14641	170731.7	2265679.4	3188371.1
8591494	797.750	156	230	249	784	10404	14641	170731.7	2265679.4	3188371.1	784	10404	14641	170731.7	2265679.4	3188371.1
8591974	805.250	157	230	249	841	10404	14641	183144.6	2265679.4	3188371.1	841	10404	14641	183144.6	2265679.4	3188371.1
8592459	812.828	157	231	250	841	10609	14884	183144.6	2310322.3	3241289.2	841	10609	14884	183144.6	2310322.3	3241289.2
8592939	820.328	156	230	249	784	10404	14641	170731.7	2265679.4	3188371.1	784	10404	14641	170731.7	2265679.4	3188371.1
8593423	827.891	156	230	249	784	10404	14641	170731.7	2265679.4	3188371.1	784	10404	14641	170731.7	2265679.4	3188371.1
8593902	835.375	156	227	244	784	9801	13456	170731.7	2134364.1	2930313.6	784	9801	13456	170731.7	2134364.1	2930313.6
8595351	858.016	157	230	248	841	10404	14400	183144.6	2265679.4	3135888.5	841	10404	14400	183144.6	2265679.4	3135888.5
8595830	865.500	156	230	249	784	10404	14641	170731.7	2265679.4	3188371.1	784	10404	14641	170731.7	2265679.4	3188371.1

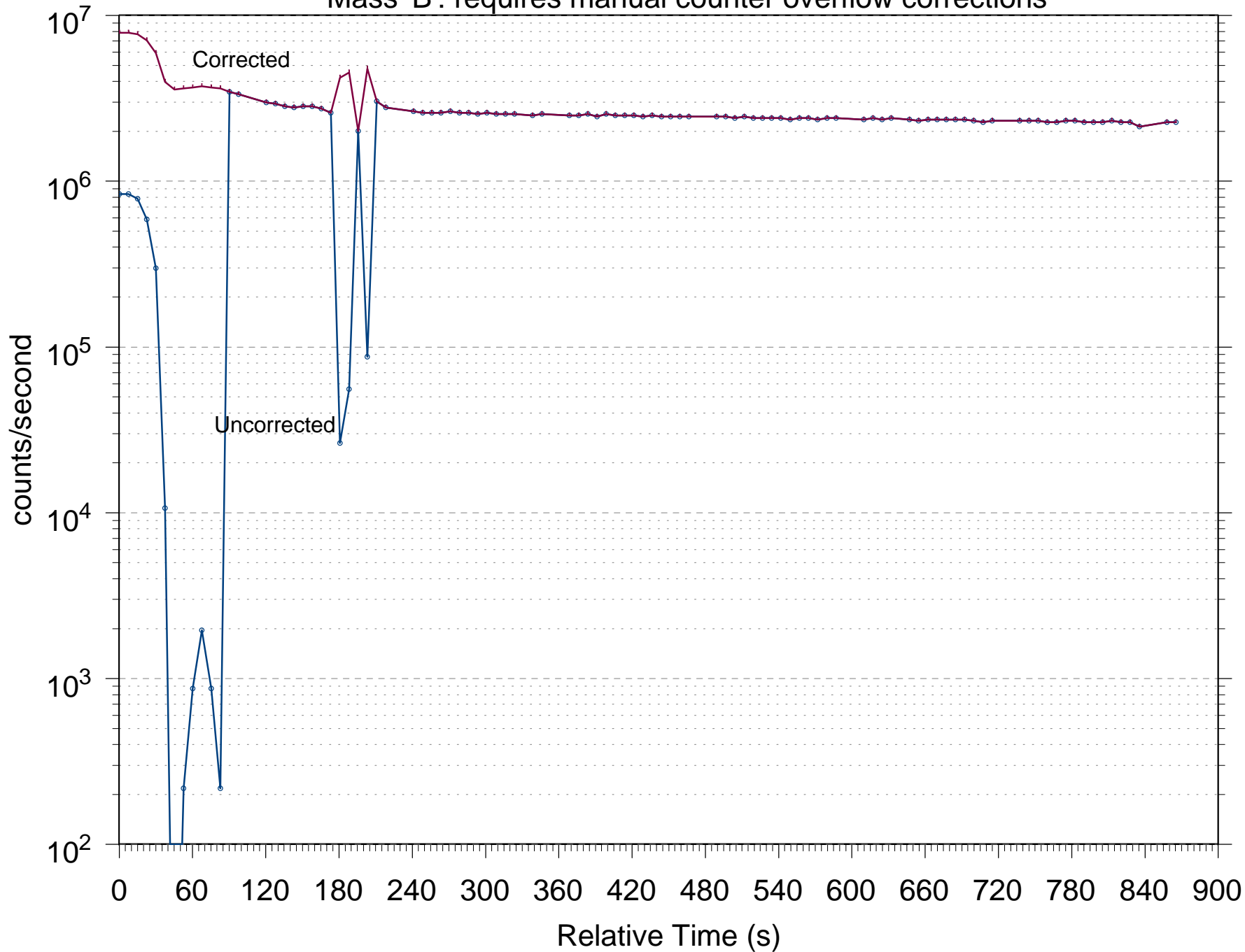
GCMS Data Processing Example

Mass 'A': No counter overflow corrections necessary?



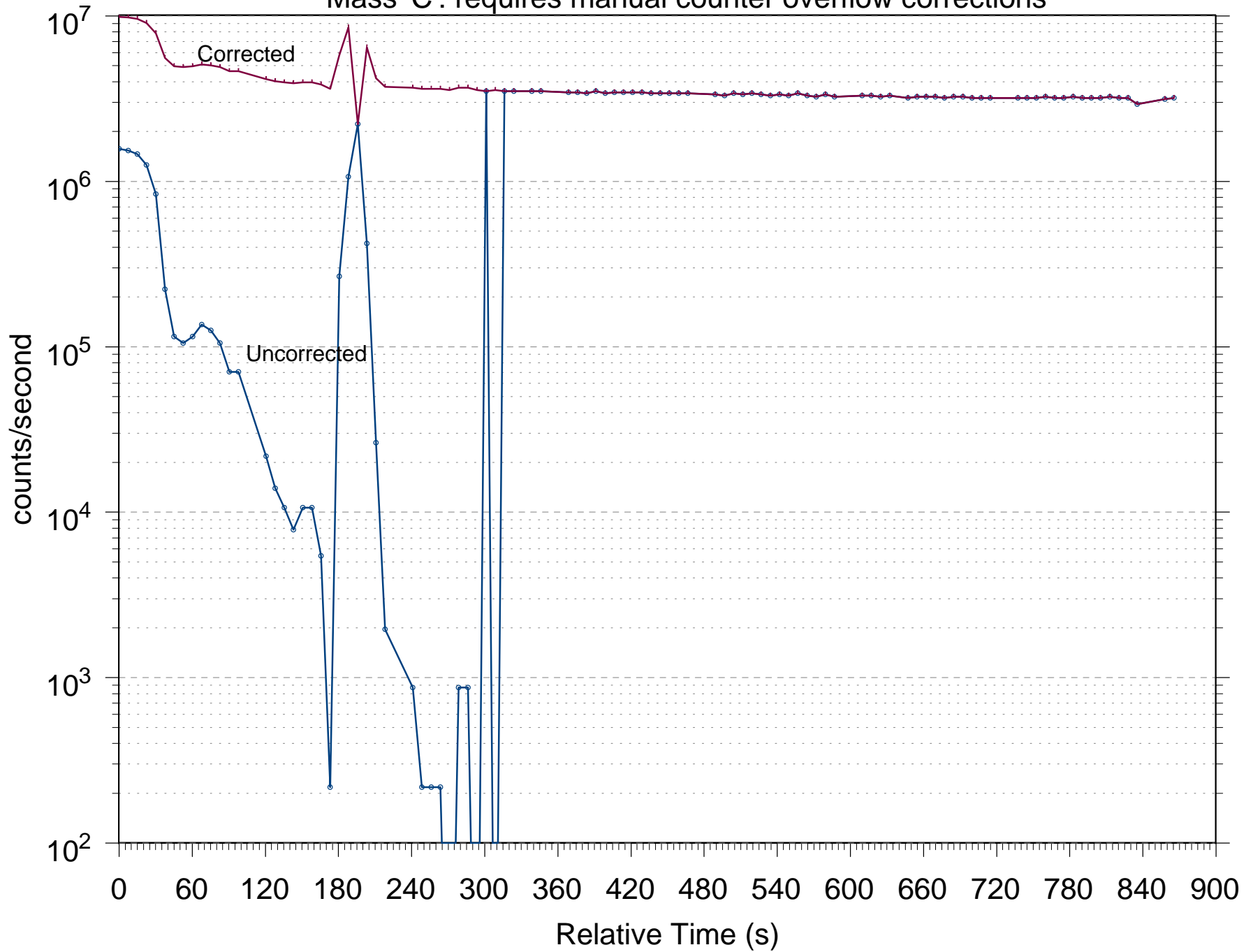
GCMS Data Processing Example

Mass 'B': requires manual counter overflow corrections



GCMS Data Processing Example

Mass 'C': requires manual counter overflow corrections



Work in progress: When will we deliver Stage 3 processed data?

The counting system ‘dead time’ correction (standard form shown below) is an ongoing analytical exercise. The following tentative ‘correction factor’ provides a reasonable fit with this data. However, other counting system factors also impact the data ‘corrections’ and this work requires many further refinements.

$$n = n_0 / (1 - n_0 \tau)$$

n = real count rate

n₀ = observed count rate

τ = ‘correction factor’ ~ 2.09 x 10⁻⁸ for the instrument flown to Titan

Additional work is required to resolve the uncertainties related to the behavior of the counting system. The behavior of counting systems at very high count rates is non-linear, is a function of the complete system (multiplier, pre-amplifier, amplifier and all associated electronics) and is not fully understood. Laboratory work with the spare instrument is required before we believe that we understand the GCMS counter overflow problem. The issue of species detection and this instrument’s detection efficiencies are not yet fully understood. Laboratory “calibration” work with the “spare” unit, identical to the one used at Titan, will be performed in the laboratories at Goddard. As these efforts are completed, currently planned for late 2006 or early 2007, these calibration data will be used to develop the corrected and definitive ‘Stage 3’ dataset for submission to the data archives. The calibration data will also be archived.