Subject: TIGER LDB ’03 science data format (draft)
From: Marty Olevitch, Washington U. Physics Dept.
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This document describes the format of the TIGER/LDB ’03 science data stream.

Science data event type codes and sizes

Code	Type	Approx. Frequency	Size (wds)	Size (bytes)	Size (bits)	Desti-nation
1	Real data [1]	5 per sec avg	168	336	2688	`DL--`
2	Pedestal calibration [2]	80 per 20 min	168	336	2688	`DL-t`
3	Light calibration	80 per 20 min	168	336	2688	`DL-t`
5	Sensors housekeeping [3]	every 4 min	68	136	1088	`DLT-`
6	Misc housekeeping	every 15 min	55	110	880	`DLT-`
7	Scalers housekeeping	every 1 min	73	146	1168	`DLT-`
8	Reply event	occasionally	47	94	752	`DLT-`
9	High-priority SIP data [4]	1.25 per sec?	97	194	1552	`--T-`
10	Low-priority SIP data	?	97	194	1552	`--T-`
11	Parameters hskp	every 30 min	117	234	1872	`DLT-`
12	IRIDIUM data [5]	every 30 sec	126	252	2016	`--T-`
13	Slow TDRSS data	every 30 sec	126	252	2016	`--T-`
14	Anita event [6]	?	134 (max)	268 (max)	2144 (max)	`DLT-`

Destination codes	
`D`	stored on flight Disk
`L`	transmitted via Line-of-sight
`T`	transmitted via TDRSS
`t`	transmitted via TDRSS once per minute

NOTES

1. Type 1 real data events are stored on the science flight CPU disk, and transmitted in line-of-sight (LOS) mode. They are not transmitted via SIP. The more compressed types 9 and 10 events are transmitted via SIP instead.

2. All calibration events (types 2 and 3) are stored on the flight disk and transmitted in LOS mode. Once per minute, one light and one ped cal is transmitted via SIP.

3. Housekeeping events are both transmitted and stored on the flight disk as they are generated. Replies also.

4. High priority events are transmitted in preference to low priority events. Priority is determined by a simple sum of the signals in S1 and S2.

5. IRIDIUM events are generated by us every 30 seconds. However, the SIP only transmits the last one every 15 minutes. All of the unsent IRIDIUM events are saved on disk by the SIP, however.

6. The ANITA data event has a variable size. The amount listed in the table is the maximum. During flight, we plan to limit the value to 101 or 111 bytes.

A. DATA EVENTS - includes real and calibration data (types 1 - 3)
(does not include telemetered data)
Total size = 168 wds = 2688 bits

Word	Bits 16–12	Bits 12–0	Byte	
0	evt id pattern (bits 16–4)	type (bits 4–0)	0	`0xBEF0+type`
1	event number LSW		2	
2	event number MSW		4	
3	PC tick count LSW		6	
4	PC tick count MSW		8	
5	C0 4 lo	C0 pha 1	10	Aerogel Cerenkov - C0A
6	C0 4 m	C0 pha 2	12	
7	C0 4 hi	C0 pha 3	14	
8	C0 8 lo	C0 pha 5	16	
9	C0 8 m	C0 pha 6	18	
10	C0 8 hi	C0 pha 7	20	
11	C0 20 lo	C0 pha 9	22	C0B
12	C0 20 m	C0 pha 18	24	
13	C0 20 hi	C0 pha 19	26	
14	C0 24 lo	C0 pha 21	28	
15	C0 24 m	C0 pha 22	30	
16	C0 24 hi	C0 pha 23	32	
17	C0 13 lo	C0 pha 10	34	C0C
18	C0 13 m	C0 pha 11	36	
19	C0 13 hi	C0 pha 12	38	
20	C0 17 lo	C0 pha 14	40	
21	C0 17 m	C0 pha 15	42	
22	C0 17 hi	C0 pha 16	44	
23	C1 2 amp lo	C1 pha 1 regular	46	Plastic Cerenkov - C1A
24	C1 2 amp m	C1 pha 1 amplified	48	regular=1x; amplified=11x
25	C1 2 amp hi	C1 pha 2 regular	50	
26	C1 16 amp lo	C1 pha 3 regular	52	
27	C1 16 amp m	C1 pha 3 amplified	54	
28	C1 16 amp hi	C1 pha 16 regular	56	
29			58	

continued...

16 12 8 4 0

29	C1 18 amp lo	C1 pha 17 regular	58	C1A - continued
30	C1 18 amp m	C1 pha 17 amplified	60	
31	C1 18 amp hi	C1 pha 18 regular	62	
32	C1 20 amp lo	C1 pha 19 regular	64	
33	C1 20 amp m	C1 pha 19 amplified	66	
34	C1 20 amp hi	C1 pha 20 regular	68	
35	C1 22 amp lo	C1 pha 21 regular	70	C1B
36	C1 22 amp m	C1 pha 21 amplified	72	
37	C1 22 amp hi	C1 pha 22 regular	74	
38	C1 24 amp lo	C1 pha 23 regular	76	
39	C1 24 amp m	C1 pha 23 amplified	78	
40	C1 24 amp hi	C1 pha 24 regular	80	
41	C1 5 amp lo	C1 pha 4 regular	82	
42	C1 5 amp m	C1 pha 4 amplified	84	
43	C1 5 amp hi	C1 pha 5 regular	86	
44	C1 7 amp lo	C1 pha 6 regular	88	
45	C1 7 amp m	C1 pha 6 amplified	90	
46	C1 7 amp hi	C1 pha 7 regular	92	
47	C1 9 amp lo	C1 pha 8 regular	94	C1C
48	C1 9 amp m	C1 pha 8 amplified	96	
49	C1 9 amp hi	C1 pha 9 regular	98	
50	C1 11 amp lo	C1 pha 10 regular	100	
51	C1 11 amp m	C1 pha 10 amplified	102	
52	C1 11 amp hi	C1 pha 11 regular	104	
53	C1 13 amp lo	C1 pha 12 regular	106	
54	C1 13 amp m	C1 pha 12 amplified	108	
55	C1 13 amp hi	C1 pha 13 regular	110	
56	C1 15 amp lo	C1 pha 14 regular	112	
57	C1 15 amp m	C1 pha 14 amplified	114	
58	C1 15 amp hi	C1 pha 15 regular	116	
59			118	

continued...

	16	12	8	4	0		
59	S1 4 lo	S1 pha 1				118	S1
60	S1 4 m	S1 pha 2				120	
61	S1 4 hi	S1 pha 3				122	
62	S1 8 lo	S1 pha 5				124	
63	S1 8 m	S1 pha 6				126	
64	S1 8 hi	S1 pha 7				128	
65	S2 4 lo	S2 pha 1				130	S2
66	S2 4 m	S2 pha 2				132	
67	S2 4 hi	S2 pha 3				134	
68	S2 8 lo	S2 pha 5				136	
69	S2 8 m	S2 pha 6				138	
70	S2 8 hi	S2 pha 7				140	
71	S3 4 lo	S3 pha 1				142	S3
72	S3 4 m	S3 pha 2				144	
73	S3 4 hi	S3 pha 3				146	
74	S3 8 lo	S3 pha 5				148	
75	S3 8 m	S3 pha 6				150	
76	S3 8 hi	S3 pha 7				152	
77	S4 4 lo	S4 pha 1				154	S4
78	S4 4 m	S4 pha 2				156	
79	S4 4 hi	S4 pha 3				158	
80	S4 8 lo	S4 pha 5				160	
81	S4 8 m	S4 pha 6				162	
82	S4 8 hi	S4 pha 7				164	
83						166	

continued...

16 12 8 4 0

83	HBX C 4 lo	HBX C pha 1	166	Hodo bottom X (coarse)
84	HBX C 4 m	HBX C pha 2	168	
85	HBX C 4 hi	HBX C pha 3	170	
86	HBX C 8 lo	HBX C pha 5	172	
87	HBX C 8 m	HBX C pha 6	174	
88	HBX C 8 hi	HBX C pha 7	176	
89	HBX C 12 lo	HBX C pha 9	178	
90	HBX C 12 m	HBX C pha 10	180	
91	HBX C 12 hi	HBX C pha 11	182	
92	HBX F 2 lo	HBX C pha 13	184	
93	HBX F 2 m	HBX C pha 14	186	
94	HBX F 2 hi	HBX F pha 1	188	Hodo bottom X (fine)
95	HBX F 6 lo	HBX F pha 3	190	
96	HBX F 6 m	HBX F pha 4	192	
97	HBX F 6 hi	HBX F pha 5	194	
98	HBX F 10 lo	HBX F pha 7	196	
99	HBX F 10 m	HBX F pha 8	198	
100	HBX F 10 hi	HBX F pha 9	200	
101	HBX F 14 lo	HBX F pha 11	202	
102	HBX F 14 m	HBX F pha 12	204	
103	HBX F 14 hi	HBX F pha 13	206	
104	HBY C 4 lo	HBY C pha 1	208	Hodo bottom Y (coarse)
105	HBY C 4 m	HBY C pha 2	210	
106	HBY C 4 hi	HBY C pha 3	212	
107	HBY C 8 lo	HBY C pha 5	214	
108	HBY C 8 m	HBY C pha 6	216	
109	HBY C 8 hi	HBY C pha 7	218	
110	HBY C 12 lo	HBY C pha 9	220	
111	HBY C 12 m	HBY C pha 10	222	
112	HBY C 12 hi	HBY C pha 11	224	
113	HBY F 2 lo	HBY C pha 13	226	
114	HBY F 2 m	HBY C pha 14	228	
115			230	

continued...

	16	12 8 4 0		
115	HBY F 2 hi	HBY F pha 1	230	Hodo bottom Y (fine)
116	HBY F 6 lo	HBY F pha 3	232	
117	HBY F 6 m	HBY F pha 4	234	
118	HBY F 6 hi	HBY F pha 5	236	
119	HBY F 10 lo	HBY F pha 7	238	
120	HBY F 10 m	HBY F pha 8	240	
121	HBY F 10 hi	HBY F pha 9	242	
122	HBY F 14 lo	HBY F pha 11	244	
123	HBY F 14 m	HBY F pha 12	246	
124	HBY F 14 hi	HBY F pha 13	248	
125	HTX C 4 lo	HTX C pha 1	250	Hodo top X (coarse)
126	HTX C 4 m	HTX C pha 2	252	
127	HTX C 4 hi	HTX C pha 3	254	
128	HTX C 8 lo	HTX C pha 5	256	
129	HTX C 8 m	HTX C pha 6	258	
130	HTX C 8 hi	HTX C pha 7	260	
131	HTX C 12 lo	HTX C pha 9	262	
132	HTX C 12 m	HTX C pha 10	264	
133	HTX C 12 hi	HTX C pha 11	266	
134	HTX F 2 lo	HTX C pha 13	268	
135	HTX F 2 m	HTX C pha 14	270	
136	HTX F 2 hi	HTX F pha 1	272	Hodo top X (fine)
137	HTX F 6 lo	HTX F pha 3	274	
138	HTX F 6 m	HTX F pha 4	276	
139	HTX F 6 hi	HTX F pha 5	278	
140	HTX F 10 lo	HTX F pha 7	280	
141	HTX F 10 m	HTX F pha 8	282	
142	HTX F 10 hi	HTX F pha 9	284	
143	HTX F 14 lo	HTX F pha 11	286	
144	HTX F 14 m	HTX F pha 12	288	
145	HTX F 14 hi	HTX F pha 13	290	
146			292	

continued...

Word	16–12	12–0 (8, 4, 0)	Byte	
146	HTY C 4 lo	HTY C pha 1	292	Hodo top Y (coarse)
147	HTY C 4 m	HTY C pha 2	294	
148	HTY C 4 hi	HTY C pha 3	296	
149	HTY C 8 lo	HTY C pha 5	298	
150	HTY C 8 m	HTY C pha 6	300	
151	HTY C 8 hi	HTY C pha 7	302	
152	HTY C 12 lo	HTY C pha 9	304	
153	HTY C 12 m	HTY C pha 10	306	
154	HTY C 12 hi	HTY C pha 11	308	
155	HTY F 2 lo	HTY C pha 13	310	
156	HTY F 2 m	HTY C pha 14	312	
157	HTY F 2 hi	HTY F pha 1	314	Hodo top Y (fine)
158	HTY F 6 lo	HTY F pha 3	316	
159	HTY F 6 m	HTY F pha 4	318	
160	HTY F 6 hi	HTY F pha 5	320	
161	HTY F 10 lo	HTY F pha 7	322	
162	HTY F 10 m	HTY F pha 8	324	
163	HTY F 10 hi	HTY F pha 9	326	
164	HTY F 14 lo	HTY F pha 11	328	
165	HTY F 14 m	HTY F pha 12	330	
166	HTY F 14 hi	HTY F pha 13	332	
167	TIGER internal checksum		334	CRC of words 0 - 166
168			336	

END OF DATA EVENT

B. SENSORS (4 min) HOUSEKEEPING (type 5)

Total size = 68 wds = 1088 bits

Word	Bits 16–12	Bits 12–4	Bits 4–0	Byte	
0	evt id pattern		type	0	0xBEF5
1	event number LSW			2	
2	event number MSW			4	
3	PC tick count LSW			6	
4	PC tick count MSW			8	
5	RFU		hsk seq	10	
6	S1D tmp4 lo	S1A temp 1		12	Temperatures
7	S1D tmp4 m	S1B temp 2		14	
8	S1D tmp4 hi	S1C temp 3		16	
9	S4D tmp8 lo	S4A temp 5		18	
10	S4D tmp8 m	S4B temp 6		20	
11	S4D tmp8 hi	S4C temp 7		22	
12	C0DA tmp12 lo	C0 AB temp 9		24	
13	C0DA tmp12 m	C0 BC temp 10		26	
14	C0DA tmp12 hi	C0 CD temp 11		28	
15	HD tmp16 lo	VME A temp 13		30	
16	HD tmp16 m	VME B temp 14		32	
17	HD tmp16 hi	CPU temp 15		34	
18	C1-14 tmp20 lo	Belly band temp 17		36	
19	C1-14 tmp20 m	HBX HVPS 1 temp 18		38	
20	C1-14 tmp20 hi	C0-2 PMT base temp 19		40	
21	+5 CPU volt lo	temperature 21 (unassigned)		42	
22	+5 CPU volt m	temperature 22 (unassigned)		44	
23	+5 CPU volt hi	+28 v. current		46	
24	HD Pressure lo	PHA-1 +5 voltage		48	
25	HD Pressure m	PHA-1 +6 voltage		50	
26	HD Pressure hi	PHA-1 -6 voltage		52	
27	HVPS Cur lo	PHA-2 +5 voltage		54	
28	HVPS Cur m	PHA-2 +6 voltage		56	
29	HVPS Cur hi	PHA-2 -6 voltage		58	
30				60	

continued...

	16 … 12	12 … 8 … 4 … 0		
30	S2B mon lo	S1A HV Monitor	60	HVPS voltages for detector PMTs (0-2v)
31	S2B mon m	S1B Monitor	62	
32	S2B mon hi	S2A Monitor	64	
33	C0B mon lo	S3 Monitor	66	
34	C0B mon m	S4 Monitor	68	
35	C0B mon hi	C0A Monitor	70	
36	HTX2 mon lo	C1A Monitor	72	
37	HTX2 mon m	C1B Monitor	74	
38	HTX2 mon hi	HTX1 Monitor	76	
39	HBX2 mon lo	HTY1 Monitor	78	
40	HBX2 mon m	HTY2 Monitor	80	
41	HBX2 mon hi	HBX1 Monitor	82	
42	HVPS2 +12v lo	HBY1 Monitor	84	
43	HVPS2 +12v m	HBY2 Monitor	86	
44	HVPS2 +12v hi	HVPS 1 +12v	88	
45	htr1 v lo	+28 v.	90	
46	htr1 v m	+5 v. Cal board	92	
47	htr1 v hi	HD heater v.	94	
48	ch7m3 lo	heater 2 v.	96	
49	ch7m3 m	channel 2 mux 6	98	
50	ch7m3 hi	channel 2 mux 7	100	
51	ch7m7 lo	channel 7 mux 4	102	
52	ch7m7 m	channel 7 mux 5	104	
53	ch7m7 hi	channel 7 mux 6	106	
54			108	

continued...

Word	16 12 8 4 0	Byte	
54	GPS longitude	108	GPS values all floating point, except week no..
56	GPS latitude	112	
58	GPS altitude	116	
60	GPS Time of week	120	Seconds since Sunday midnight of current week
62	GPS/UTC offset	124	subtract from GPS time to get UTC time
64	GPS ‘‘cpu’’ time	128	seconds since midnight today
66	GPS week number	132	unsigned short value - week #1 is 6 Jan 1980
67	TIGER internal checksum	134	CRC of words 0 - 66
68		136	

END OF SENSORS (4 min) HOUSEKEEPING

C. MISC (15 min) HOUSEKEEPING (type 6)

Total size = 55 wds = 880 bits

Bit positions: 16, 12, 8, 4, 0

Word	Field	Field	Byte	
0	evt id pattern	type	0	0xBEF6
1	event number LSW		2	
2	event number MSW		4	
3	PC tick count LSW		6	
4	PC tick count MSW		8	
5	RFU	hsk seq	10	
6	S4 disc lo	S1 discriminator	12	discriminators
7	S4 disc m	S2 discriminator	14	
8	S4 disc hi	S3 discriminator	16	
9	C1 bd 1 disc lo	C0 board 1 discriminator	18	
10	C1 bd 1 disc m	C0 board 2 discriminator	20	
11	C1 bd 1 disc hi	C0 board 3 discriminator	22	
12	C1 bd 5 disc lo	C1 board 2 discriminator	24	
13	C1 bd 5 disc m	C1 board 3 discriminator	26	
14	C1 bd 5 disc hi	C1 board 4 discriminator	28	
15	H 3 HBXF lo	C1 board 6 discriminator	30	
16	H 3 HBXF m	Hodo board 1 (HBXC) discrim	32	
17	H 3 HBXF hi	Hodo board 2 (HBXCF) discrim	34	
18	H 7 HBYF lo	Hodo board 4 (HBXFYC) discrim	36	
19	H 7 HBYF m	Hodo board 5 (HBYC) discrim	38	
20	H 7 HBYF hi	Hodo board 6 (HBYCF) discrim	40	
21	H 11 HTXFYC lo	Hodo board 8 (HTXC) discrim	42	
22	H 11 HTXFYC m	Hodo board 9 (HTXCF) discrim	44	
23	H 11 HTXFYC hi	Hodo board 10 (HTXF) discrim	46	
24	S1A dac lo	Hodo board 12 (HTYC) discrim	48	
25	S1A dac m	Hodo board 13 (HTYCF) discrim	50	
26	S1A dac hi	Hodo board 14 (HTYF) discrim	52	
27	S3 dac lo	S1B external dac	54	external dacs
28	S3 dac m	S2A external dac	56	
29	S3 dac hi	S2B external dac	58	
30			60	

continued...

<table>
<tr><td></td><td colspan="2">16</td><td colspan="2">12</td><td colspan="2">8</td><td colspan="2">4 … 0</td><td></td><td></td></tr>
<tr><td>30</td><td colspan="2">C1A dac lo</td><td colspan="6">S4 external dac</td><td>60</td><td></td></tr>
<tr><td>31</td><td colspan="2">C1A dac m</td><td colspan="6">C0A external dac</td><td>62</td><td></td></tr>
<tr><td>32</td><td colspan="2">C1A dac hi</td><td colspan="6">C0B external dac</td><td>64</td><td></td></tr>
<tr><td>33</td><td colspan="2">HTX1 dac lo</td><td colspan="6">C1B external dac</td><td>66</td><td></td></tr>
<tr><td>34</td><td colspan="2">HTX1 dac m</td><td colspan="6">HBX1 external dac</td><td>68</td><td></td></tr>
<tr><td>35</td><td colspan="2">HTX1 dac hi</td><td colspan="6">HBX2 external dac</td><td>70</td><td></td></tr>
<tr><td>36</td><td colspan="2">HTY1 dac lo</td><td colspan="6">HTX2 external dac</td><td>72</td><td></td></tr>
<tr><td>37</td><td colspan="2">HTY1 dac m</td><td colspan="6">HBY1 external dac</td><td>74</td><td></td></tr>
<tr><td>38</td><td colspan="2">HTY1 dac hi</td><td colspan="6">HBY2 external dac</td><td>76</td><td></td></tr>
<tr><td>39</td><td colspan="2">C1 LED lo</td><td colspan="6">HTY2 external dac</td><td>78</td><td></td></tr>
<tr><td>40</td><td colspan="2">C1 LED m</td><td colspan="6">S LED external dac</td><td>80</td><td></td></tr>
<tr><td>41</td><td colspan="2">C1 LED hi</td><td colspan="6">C0 LED external dac</td><td>82</td><td></td></tr>
<tr><td>42</td><td colspan="2">SPARE3 lo</td><td colspan="6">H LED external dac</td><td>84</td><td></td></tr>
<tr><td>43</td><td colspan="2">SPARE3 m</td><td colspan="6">SPARE1</td><td>86</td><td></td></tr>
<tr><td>44</td><td colspan="2">SPARE3 hi</td><td colspan="6">SPARE2</td><td>88</td><td></td></tr>
<tr><td>45</td><td colspan="2">unused</td><td colspan="6">SPARE4</td><td>90</td><td></td></tr>
<tr><td>46</td><td colspan="2">unused</td><td colspan="6">SPARE5</td><td>92</td><td></td></tr>
<tr><td>47</td><td colspan="4">unused</td><td colspan="4">LED backup-on bits</td><td>94</td><td>See below</td></tr>
<tr><td>48</td><td>HA2</td><td>HA1</td><td>C1</td><td>C0</td><td>S4</td><td>S3</td><td>S2</td><td>S1</td><td>96</td><td>LED pulse widths</td></tr>
<tr><td>49</td><td></td><td></td><td></td><td></td><td></td><td></td><td>HB2</td><td>HB1</td><td>98</td><td>(0=20 ns, 1=32, 2=44, 3=48)</td></tr>
<tr><td>50</td><td colspan="8">Priority cut-off value</td><td>100</td><td></td></tr>
<tr><td>51</td><td colspan="8">Coincidence disable pattern</td><td>102</td><td>See below</td></tr>
<tr><td>52</td><td colspan="8">Latching relay bit pattern</td><td>104</td><td>See below</td></tr>
<tr><td>53</td><td colspan="8">Solid-state relay (SSR) bit pattern</td><td>106</td><td>See below</td></tr>
<tr><td>54</td><td colspan="8">TIGER internal checksum</td><td>108</td><td>CRC of words 0 - 53</td></tr>
<tr><td>55</td><td colspan="8"></td><td>110</td><td></td></tr>
</table>

END OF MISC (15 min) HOUSEKEEPING

Coin disable

15–10	9	8	7	6	5	4	3	2	1	0
unused				C1C	C1B	C1A	S4	S3	S2	S1
	C1A or C1B or C1C	S3 or S4	S1 or S2							

Latching relays

15–2	1	0
unused		
	HVPS B (bottom) backup	HVPS A (top) backup

Solid-state relays (SSR)

15–2	1	0
unused		PHA
	HVPS	

LED backup on (1=on, 0=off)

7–6	5	4	3	2	1	0
unused	C1	C0	S4	S3	S2	S1

D. ALL SCALERS (1 minute) HOUSEKEEPING (type 7)

Total size = 73 wds = 1168 bits

Word	16 … 4	4 … 0	Byte	
0	evt id pattern	type	0	0xBEF7
1	event number LSW		2	
2	event number MSW		4	
3	PC tick count LSW		6	
4	PC tick count MSW		8	
5	RFU	hsk seq	10	
6	Raw coincidence scaler		12	All evts satisfying coincidence
7	Event scaler		14	Evts satisfying coin that were read out
8	Hi Pri evts total		16	TDRSS telemetry events
9	Hi Pri evts xmitted		18	
10	Lo Pri evts total		20	TDRSS telemetry events
11	Lo Pri evts xmitted		22	
12	S1 summed scaler		24	
13	S2 summed scaler		26	
14	S3 summed scaler		28	
15	S4 summed scaler		30	
16	C0 board 1 summed scaler		32	Aerogel cherenkov
17	C0 board 2 summed scaler		34	
18	C0 board 3 summed scaler		36	
19	C1 board 1 summed scaler		38	Plastic cherenkov
20	C1 board 2 summed scaler		40	
21	C1 board 3 summed scaler		42	
22	C1 board 4 summed scaler		44	
23	C1 board 5 summed scaler		46	
24	C1 board 6 summed scaler		48	
25			50	

continued...

Word	16 · 12 · 8 · 4 · 0	Byte	
25	Hodo board 1 summed scaler	50	Hodoscopes
26	Hodo board 2 summed scaler	52	
27	Hodo board 3 summed scaler	54	
28	Hodo board 4 summed scaler	56	
29	Hodo board 5 summed scaler	58	
30	Hodo board 6 summed scaler	60	
31	Hodo board 7 summed scaler	62	
32	Hodo board 8 summed scaler	64	
33	Hodo board 9 summed scaler	66	
34	Hodo board 10 summed scaler	68	
35	Hodo board 11 summed scaler	70	
36	Hodo board 12 summed scaler	72	
37	Hodo board 13 summed scaler	74	
38	Hodo board 14 summed scaler	76	
39	Sel bits for next 5 words	78	See description below
40	S1 selectable scaler (Sel A)	80	
41	S2 selectable scaler (Sel B)	82	
42	S3 selectable scaler (Sel C)	84	
43	S4 selectable scaler (Sel D)	86	
44	C0 bd 1 selectable scaler (Sel E)	88	
45	Sel bits for next 5 words	90	See description below
46	C0 bd 2 selectable scaler (Sel A)	92	
47	C0 bd 3 selectable scaler (Sel B)	94	
48	C1 bd 1 selectable scaler (Sel C)	96	
49	C1 bd 2 selectable scaler (Sel D)	98	
50	C1 bd 3 selectable scaler (Sel E)	100	
51	Sel bits for next 5 words	102	See description below
52	C1 bd 4 selectable scaler (Sel A)	104	
53	C1 bd 5 selectable scaler (Sel B)	106	
54	C1 bd 6 selectable scaler (Sel C)	108	
55	Hodo bd 1 selectable scaler (Sel D)	110	
56	Hodo bd 2 selectable scaler (Sel E)	112	
57		114	

continued...

Word	Bits 16 – 0	Byte	
57	Sel bits for next 5 words	114	See description below
58	Hodo bd 3 selectable scaler (Sel A)	116	
59	Hodo bd 4 selectable scaler (Sel B)	118	
60	Hodo bd 5 selectable scaler (Sel C)	120	
61	Hodo bd 6 selectable scaler (Sel D)	122	
62	Hodo bd 7 selectable scaler (Sel E)	124	
63	Sel bits for next 5 words	126	See description below
64	Hodo bd 8 selectable scaler (Sel A)	128	
65	Hodo bd 9 selectable scaler (Sel B)	130	
66	Hodo bd 10 selectable scaler (Sel C)	132	
67	Hodo bd 11 selectable scaler (Sel D)	134	
68	Hodo bd 12 selectable scaler (Sel E)	136	
69	Sel bits for next 2 words	138	See description below
70	Hodo bd 13 selectable scaler (Sel A)	140	
71	Hodo bd 14 selectable scaler (Sel B)	142	
72	TIGER internal checksum	144	CRC of words 0 - 71
73		146	

END OF ALL SCALERS (1 minute) HOUSEKEEPING

The ‘‘sel bits’’ word in fast hsk events looks like this. Each *Sel* item gives a value from 0-7 corresponding to which pha channel the selectable scaler is counting. If bit 15 is set, then all of the *Sel* values are identical.

Select bits	15	14 – 12	11 – 9	8 – 6	5 – 3	2 – 0
	All values identical	Sel E	Sel D	Sel C	Sel B	Sel A

E. REPLY EVENT (type 8)

Total size = 47 wds = 752 bits

A reply event is generated at infrequent, but unpredictable times. It is sent whenever some sort of response is required from the flight software, such as after a command from the ground. It is simply a sequence of ascii bytes containing a message.

Word	Bits 16–4	Bits 4–0	Byte	
0	evt id pattern	type	0	`0xBEF8`
1	event number LSW		2	
2	event number MSW		4	
3	PC tick count LSW		6	
4	PC tick count MSW		8	
5	ascii bytes		10	any character string
6	⋮		12	
45	ascii bytes		90	
46	TIGER internal checksum		92	CRC of words 0 - 45
47			94	

END OF REPLY EVENT

F. TELEMETRY DATA EVENTS - includes high- and low-priority data (types 9 and 10)
(does not include calibration or housekeeping events)
Total size = 97 wds = 1552 bits

Bit positions: 16 12 8 4 0

Word	Bits 16–12	Bits 12–0	Byte	
0	evt id pattern	type	0	0xBEF0+type
1	event number LSW		2	
2	event number MSW		4	
3	PC tick count LSW		6	
4	C0 4 lo	C0 pha 1	8	Aerogel Cerenkov - C0A
5	C0 4 m	C0 pha 2	10	
6	C0 4 hi	C0 pha 3	12	
7	C0 8 lo	C0 pha 5	14	
8	C0 8 m	C0 pha 6	16	
9	C0 8 hi	C0 pha 7	18	
10	C0 20 lo	C0 pha 9	20	C0B
11	C0 20 m	C0 pha 18	22	
12	C0 20 hi	C0 pha 19	24	
13	C0 24 lo	C0 pha 21	26	
14	C0 24 m	C0 pha 22	28	
15	C0 24 hi	C0 pha 23	30	
16	C0 13 lo	C0 pha 10	32	C0C
17	C0 13 m	C0 pha 11	34	
18	C0 13 hi	C0 pha 12	36	
19	C0 17 lo	C0 pha 14	38	
20	C0 17 m	C0 pha 15	40	
21	C0 17 hi	C0 pha 16	42	
22	C1 16 lo	C1 pha 1	44	Plastic Cerenkov - C1A
23	C1 16 m	C1 pha 2	46	(IMPORTANT: see note * on next page)
24	C1 16 hi	C1 pha 3	48	
25	C1 20 lo	C1 pha 17	50	
26	C1 20 m	C1 pha 18	52	
27	C1 20 hi	C1 pha 19	54	
28			56	

continued...

	16 – 12	12 – 0		
28	C1 24 lo	C1 pha 21	56	C1B
29	C1 24 m	C1 pha 22	58	
30	C1 24 hi	C1 pha 23	60	
31	C1 7 lo	C1 pha 4	62	
32	C1 7 m	C1 pha 5	64	
33	C1 7 hi	C1 pha 6	66	
34	C1 11 lo	C1 pha 8	68	C1C
35	C1 11 m	C1 pha 9	70	
36	C1 11 hi	C1 pha 10	72	
37	C1 15 lo	C1 pha 12	74	
38	C1 15 m	C1 pha 13	76	
39	C1 15 hi	C1 pha 14	78	
40	S1 4 lo	S1 pha 1	80	S1
41	S1 4 m	S1 pha 2	82	
42	S1 4 hi	S1 pha 3	84	
43	S1 8 lo	S1 pha 5	86	
44	S1 8 m	S1 pha 6	88	
45	S1 8 hi	S1 pha 7	90	
46	S2 4 lo	S2 pha 1	92	S2
47	S2 4 m	S2 pha 2	94	
48	S2 4 hi	S2 pha 3	96	
49	S2 8 lo	S2 pha 5	98	
50	S2 8 m	S2 pha 6	100	
51	S2 8 hi	S2 pha 7	102	
52			104	

* In the telemetered data, for C1 each 12-bit value consists of the most significant 11-bits followed by a bit indicating whether this is the amplified (if set) or regular (if clear) value.

	11 – 1	0
C1 telemetry	Most significant 11 bits of C1	Amplified

continued...

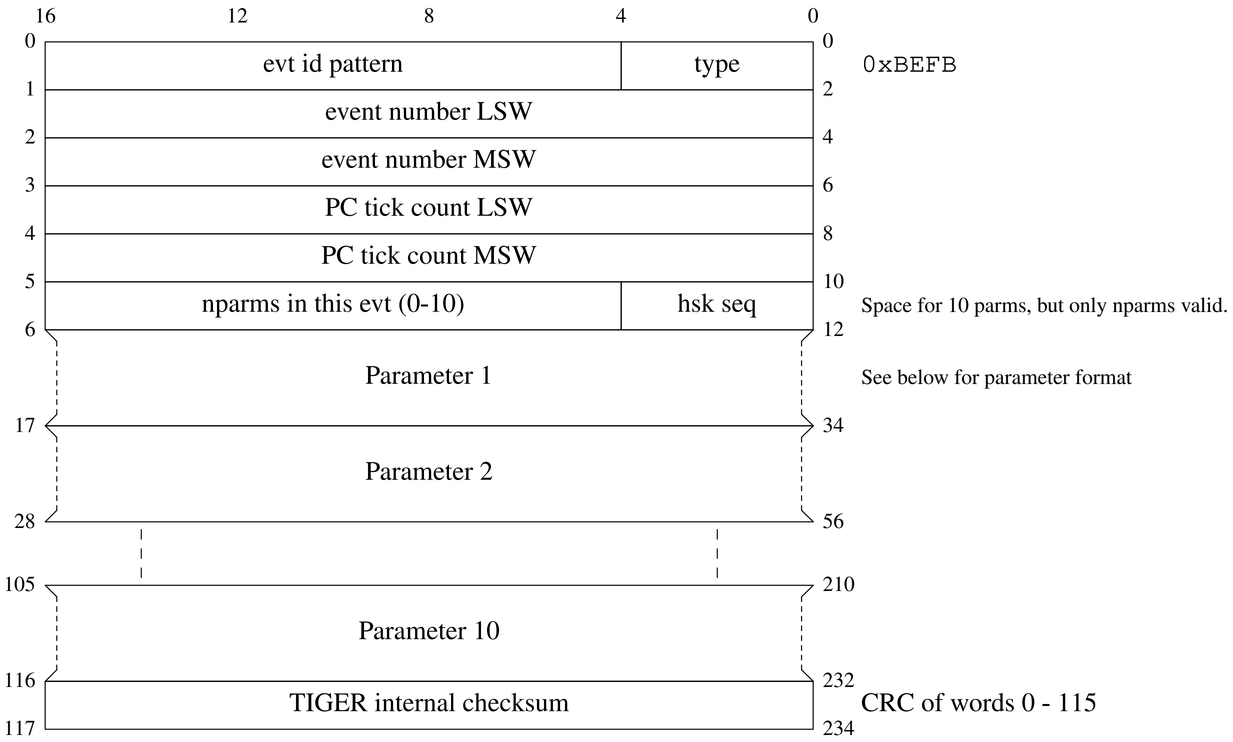
	16 – 12	12 – 8 – 4 – 0		
52	S3 4 lo	S3 pha 1	104	S3
53	S3 4 m	S3 pha 2	106	
54	S3 4 hi	S3 pha 3	108	
55	S3 8 lo	S3 pha 5	110	
56	S3 8 m	S3 pha 6	112	
57	S3 8 hi	S3 pha 7	114	
58	S4 4 lo	S4 pha 1	116	S4
59	S4 4 m	S4 pha 2	118	
60	S4 4 hi	S4 pha 3	120	
61	S4 8 lo	S4 pha 5	122	
62	S4 8 m	S4 pha 6	124	
63	S4 8 hi	S4 pha 7	126	
64	pha no. (0-13)	Hodo bottom X coarse #1	128	Hodo bottom X
65	pha no. (0-13)	Hodo bottom X coarse #2	130	
66	pha no. (0-13)	Hodo bottom X coarse #3	132	
67	pha no. (0-13)	Hodo bottom X fine #1	134	
68	pha no. (0-13)	Hodo bottom X fine #2	136	
69	pha no. (0-13)	Hodo bottom X fine #3	138	
70	pha no. (0-13)	Hodo bottom X fine #4	140	
71	pha no. (0-13)	Hodo bottom X fine #5	142	
72	pha no. (0-13)	Hodo bottom Y coarse #1	144	Hodo bottom Y
73	pha no. (0-13)	Hodo bottom Y coarse #2	146	
74	pha no. (0-13)	Hodo bottom Y coarse #3	148	
75	pha no. (0-13)	Hodo bottom Y fine #1	150	
76	pha no. (0-13)	Hodo bottom Y fine #2	152	
77	pha no. (0-13)	Hodo bottom Y fine #3	154	
78	pha no. (0-13)	Hodo bottom Y fine #4	156	
79	pha no. (0-13)	Hodo bottom Y fine #5	158	
80			160	

continued...

Word	Bits 16–12	Bits 12–0 (8, 4, 0)	Byte	
80	pha no. (0-13)	Hodo top X coarse #1	160	Hodo top X
81	pha no. (0-13)	Hodo top X coarse #2	162	
82	pha no. (0-13)	Hodo top X coarse #3	164	
83	pha no. (0-13)	Hodo top X fine #1	166	
84	pha no. (0-13)	Hodo top X fine #2	168	
85	pha no. (0-13)	Hodo top X fine #3	170	
86	pha no. (0-13)	Hodo top X fine #4	172	
87	pha no. (0-13)	Hodo top X fine #5	174	
88	pha no. (0-13)	Hodo top Y coarse #1	176	Hodo top Y
89	pha no. (0-13)	Hodo top Y coarse #2	178	
90	pha no. (0-13)	Hodo top Y coarse #3	180	
91	pha no. (0-13)	Hodo top Y fine #1	182	
92	pha no. (0-13)	Hodo top Y fine #2	184	
93	pha no. (0-13)	Hodo top Y fine #3	186	
94	pha no. (0-13)	Hodo top Y fine #4	188	
95	pha no. (0-13)	Hodo top Y fine #5	190	
96	TIGER internal checksum		192	CRC of words 0 - 95
97			194	

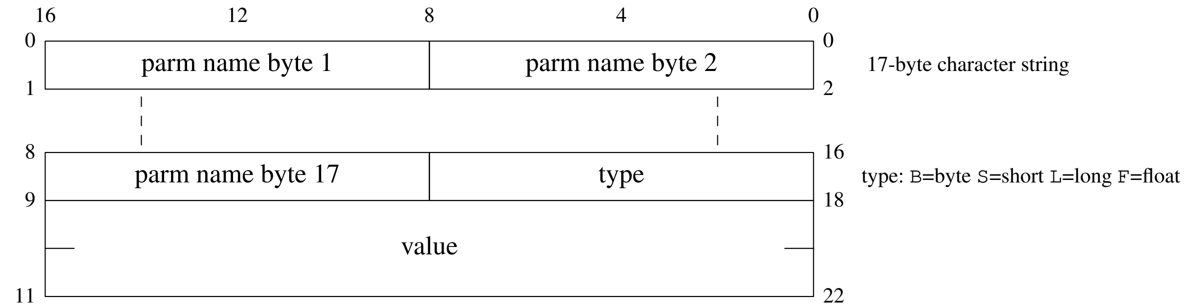
END OF TELEMETRY DATA EVENT

G. PARAMETERS (30 minute) HOUSEKEEPING (type 11)
Total size = 117 wds = 1872 bits



END OF PARAMETER HSK EVENT

Each parameter has the following format:

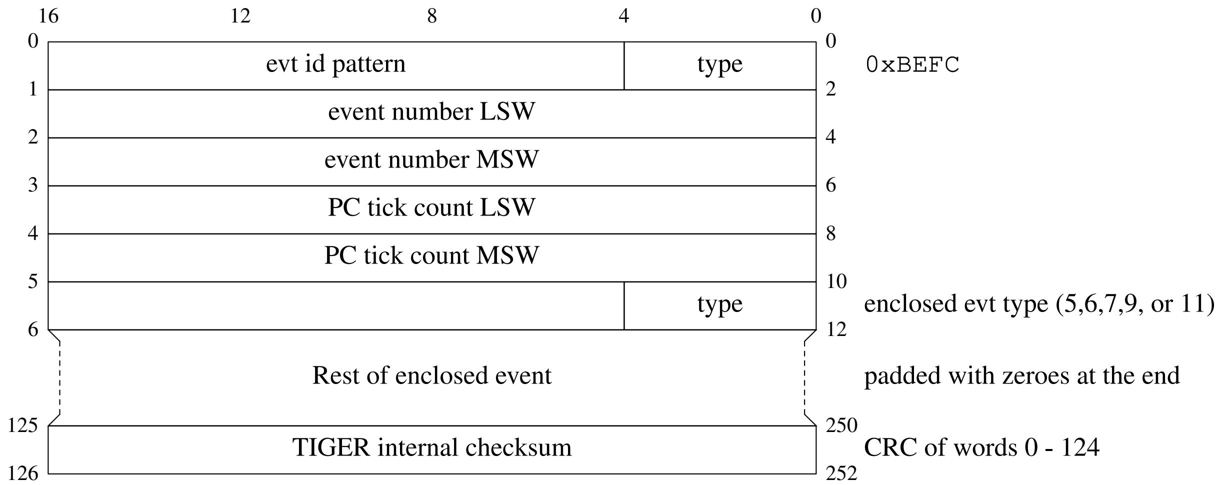


It is defined by the following C struct:

```
#define NAMESIZE 17          // max length of parameter name
struct parm {
    char name[NAMESIZE];     // name of parameter
    char type;               // type (PARM_FLOAT, PARM_LONG, PARM_SHORT,
                             // or PARM_BYTE)
    union {                  // value of parameter
        float F;
        unsigned long L;
        unsigned short S;
        unsigned char B;
    } val;
};
```

H. IRIDIUM EVENTS - (type 12)

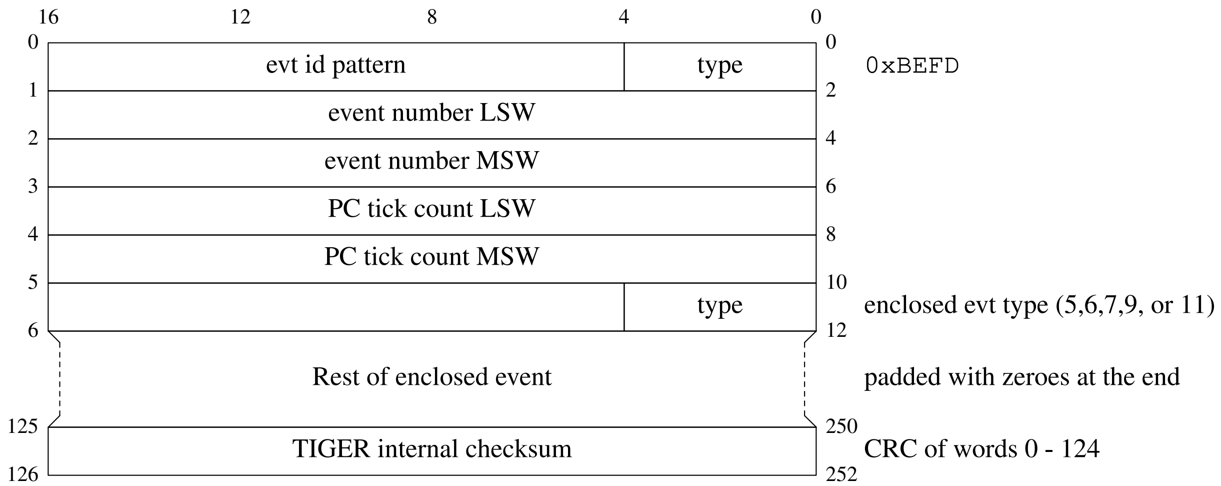
Total size = 126 wds = 2016 bits



END OF IRIDIUM EVENT

H. SLOW TDRSS EVENTS - (type 13)

Total size = 126 wds = 2016 bits



END OF SLOW TDRSS EVENT

The IRIDIUM and SLOW TDRSS events have identical formats. They each enclose one of the regular TIGER events; either a sensors hsk (type 5), misc hsk (type 6), scalers hsk (type 7), high-priority TDRSS event (type 9), or a parameters hsk (type 11). The entire enclosed event is included, including its checksum. The only change is that the `bef` part of the the event id word is missing. Just the type item from that word is there.

E. ANITA EVENT (type 14)
Total size = 134 wds = 2144 bits

An ANITA event is data generated by the piggy-back ANITA experiment and simply forwarded by TIGER in our high-rate TDRSS data. The internal format is a matter for the ANITA team and beyond the scope of this document.

Word	Bits 16–8	Bits 8–4	Bits 4–0	Byte	
0	evt id pattern	evt id pattern	type	0	0xBEFE
1	event number LSW			2	
2	event number MSW			4	
3	PC tick count LSW			6	
4	PC tick count MSW			8	
5	no. data bytes following*	data		10	max nbytes = 255*
6	...	...		12	
132	data	data		264	
133	TIGER internal checksum			266	CRC of words 0 - 132
134				268	

END OF ANITA EVENT

* This value should be an odd number.

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