Subject: TIGER LDB Level 0 science data format, revision 3
From: Marty Olevitch, Washington U. Physics Dept.
Date: 4 June 2002

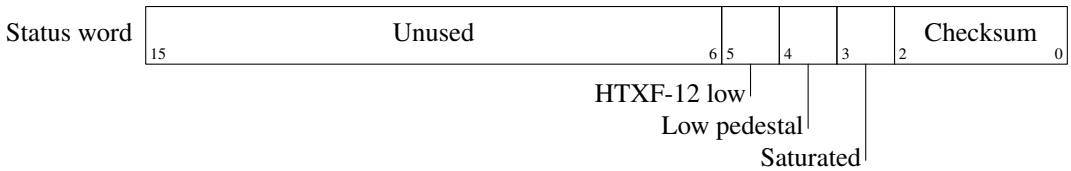
This document describes the format of the TIGER/LDB Level 0 science data stream.

Science data event type codes and sizes

Code	Type	Approx. Frequency	Size (wds)	Size (bytes)	Size (bits)
1	Real data	5 per sec avg	177	354	2832
2	Pedestal calibration	occasionally	177	354	2832
3	Light calibration	occasionally	177	354	2832
4	Critical scalars hskp	occasionally	26	52	416
5	Sensors housekeeping	occasionally	70	140	1120
6	Misc housekeeping	occasionally	63	126	1008
7	Scalars housekeeping	occasionally	78	156	1248
8	Reply event	occasionally	56	112	896
12	Slow ARGOS hskp	every 30 sec	27.5	55	440

Status word format

Each event in the level 0 data includes a *status word*. It has the following format:



Checksum status values		Low pedestal limits	
0	OK	17	S, H
1	Bad	23	C0
2	Unverifiable (previous event unavailable)	17	C1 regular
3	Unverifiable (previous event short)	220	C1 amplified
4	Unverifiable (argos hsk)		

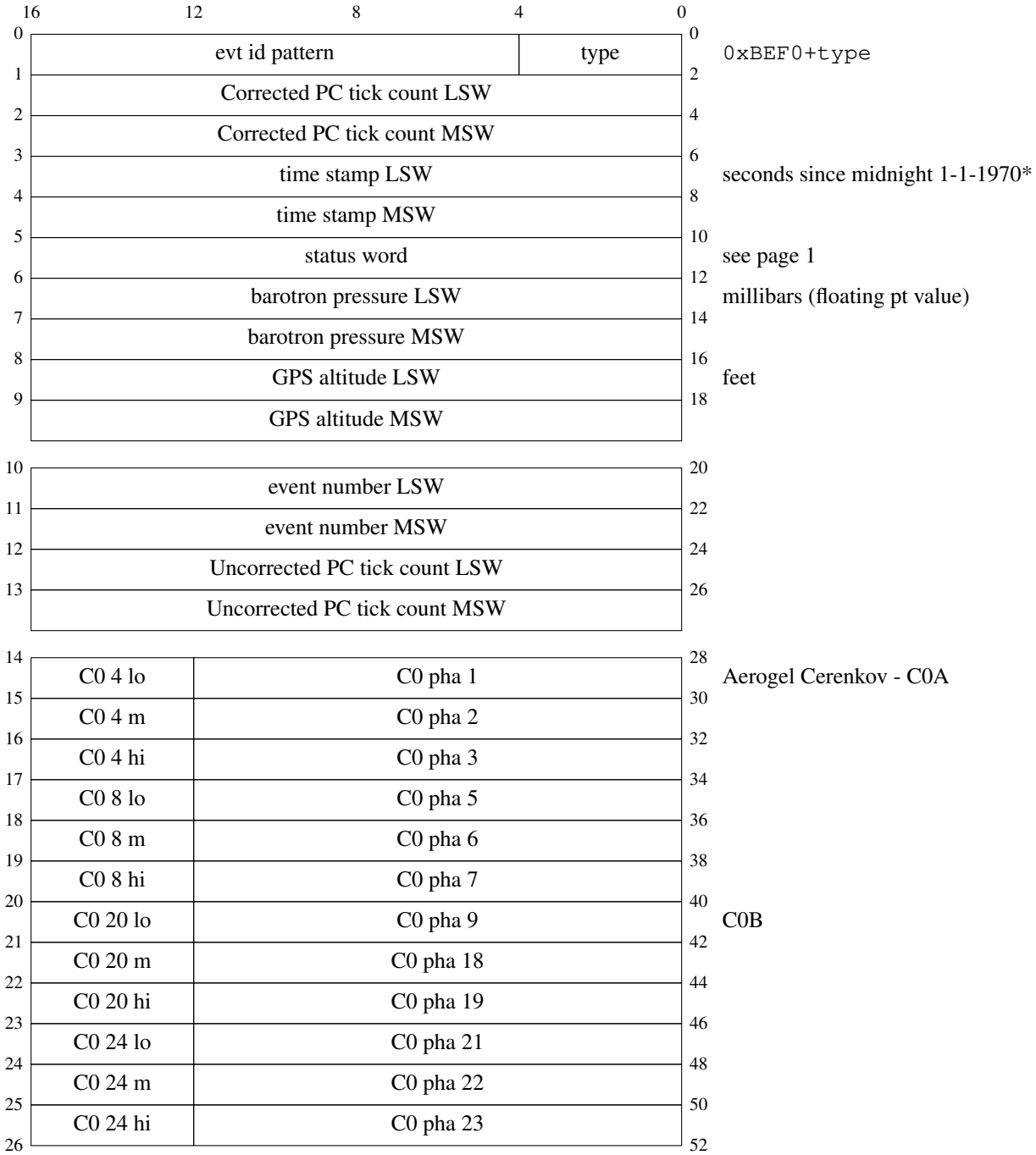
Due to a bug in the acquisition software, the checksum is unverifiable for all housekeeping events, an argos hsk event, or if the previous event is either missing or shorter in length than the current event. I recommend ignoring the checksum flag and assuming that all level0 data have good checksums.*

A ‘‘saturated’’ event has at least one channel at maximum (4095). This does not include amplified C1 channels, which may be saturated. A ‘‘low pedestal’’ event has at least one channel below a minimum. A separate bit is provided for our ‘‘problem’’ hodo tube, HTXF-12, which was almost always below pedestal.

* See my report ‘‘TIGER LDB ’01 checksum problems, revision 3’’, dated 4 June, 2002.

Data events (types 1, 2, and 3)

A. DATA EVENTS - includes real and calibration data (types 1 - 3)
Total size = 177 wds = 2832 bits



* Use the standard C library routines in the ctime() family to convert the time value to an ascii or other representation.

continued...

16	12	8	4	0		
26	C0 13 lo	C0 pha 10		52	Aerogel Cerenkov (cont.) - C0C	
27	C0 13 m	C0 pha 11		54		
28	C0 13 hi	C0 pha 12		56		
29	C0 17 lo	C0 pha 14		58		
30	C0 17 m	C0 pha 22		60		
31	C0 17 hi	C0 pha 16		62		
32	C1 2 amp lo	C1 pha 1 regular		64	Plastic Cerenkov - C1A	
33	C1 2 amp m	C1 pha 1 amplified		66	regular=1x; amplified=11x	
34	C1 2 amp hi	C1 pha 2 regular		68		
35	C1 16 amp lo	C1 pha 3 regular		70		
36	C1 16 amp m	C1 pha 3 amplified		72		
37	C1 16 amp hi	C1 pha 16 regular		74		
38	C1 18 amp lo	C1 pha 17 regular		76		
39	C1 18 amp m	C1 pha 17 amplified		78		
40	C1 18 amp hi	C1 pha 18 regular		80		
41	C1 20 amp lo	C1 pha 19 regular		82		
42	C1 20 amp m	C1 pha 19 amplified		84		
43	C1 20 amp hi	C1 pha 20 regular		86		
44	C1 22 amp lo	C1 pha 21 regular		88	C1B	
45	C1 22 amp m	C1 pha 21 amplified		90		
46	C1 22 amp hi	C1 pha 22 regular		92		
47	C1 24 amp lo	C1 pha 23 regular		94		
48	C1 24 amp m	C1 pha 23 amplified		96		
49	C1 24 amp hi	C1 pha 24 regular		98		
50	C1 5 amp lo	C1 pha 4 regular		100		
51	C1 5 amp m	C1 pha 4 amplified		102		
52	C1 5 amp hi	C1 pha 5 regular		104		
53	C1 7 amp lo	C1 pha 6 regular		106		
54	C1 7 amp m	C1 pha 6 amplified		108		
55	C1 7 amp hi	C1 pha 7 regular		110		
56				112		

continued...

16	12	8	4	0		
56	C1 9 amp lo	C1 pha 8 regular		112	Plastic Cerenkov (cont.) - C1C	
57	C1 9 amp m	C1 pha 8 amplified		114		
58	C1 9 amp hi	C1 pha 9 regular		116		
59	C1 11 amp lo	C1 pha 10 regular		118		
60	C1 11 amp m	C1 pha 10 amplified		120		
61	C1 11 amp hi	C1 pha 11 regular		122		
62	C1 13 amp lo	C1 pha 12 regular		124		
63	C1 13 amp m	C1 pha 12 amplified		126		
64	C1 13 amp hi	C1 pha 13 regular		128		
65	C1 15 amp lo	C1 pha 14 regular		130		
66	C1 15 amp m	C1 pha 14 amplified		132		
67	C1 15 amp hi	C1 pha 15 regular		134		
68	S1 4 lo	S1 pha 1		136	S1	
69	S1 4 m	S1 pha 2		138		
70	S1 4 hi	S1 pha 3		140		
71	S1 8 lo	S1 pha 5		142		
72	S1 8 m	S1 pha 6		144		
73	S1 8 hi	S1 pha 7		146		
74	S2 4 lo	S2 pha 1		148	S2	
75	S2 4 m	S2 pha 2		150		
76	S2 4 hi	S2 pha 3		152		
77	S2 8 lo	S2 pha 5		154		
78	S2 8 m	S2 pha 6		156		
79	S2 8 hi	S2 pha 7		158		
80	S3 4 lo	S3 pha 1		160	S3	
81	S3 4 m	S3 pha 2		162		
82	S3 4 hi	S3 pha 3		164		
83	S3 8 lo	S3 pha 5		166		
84	S3 8 m	S3 pha 6		168		
85	S3 8 hi	S3 pha 7		170		
86				172		

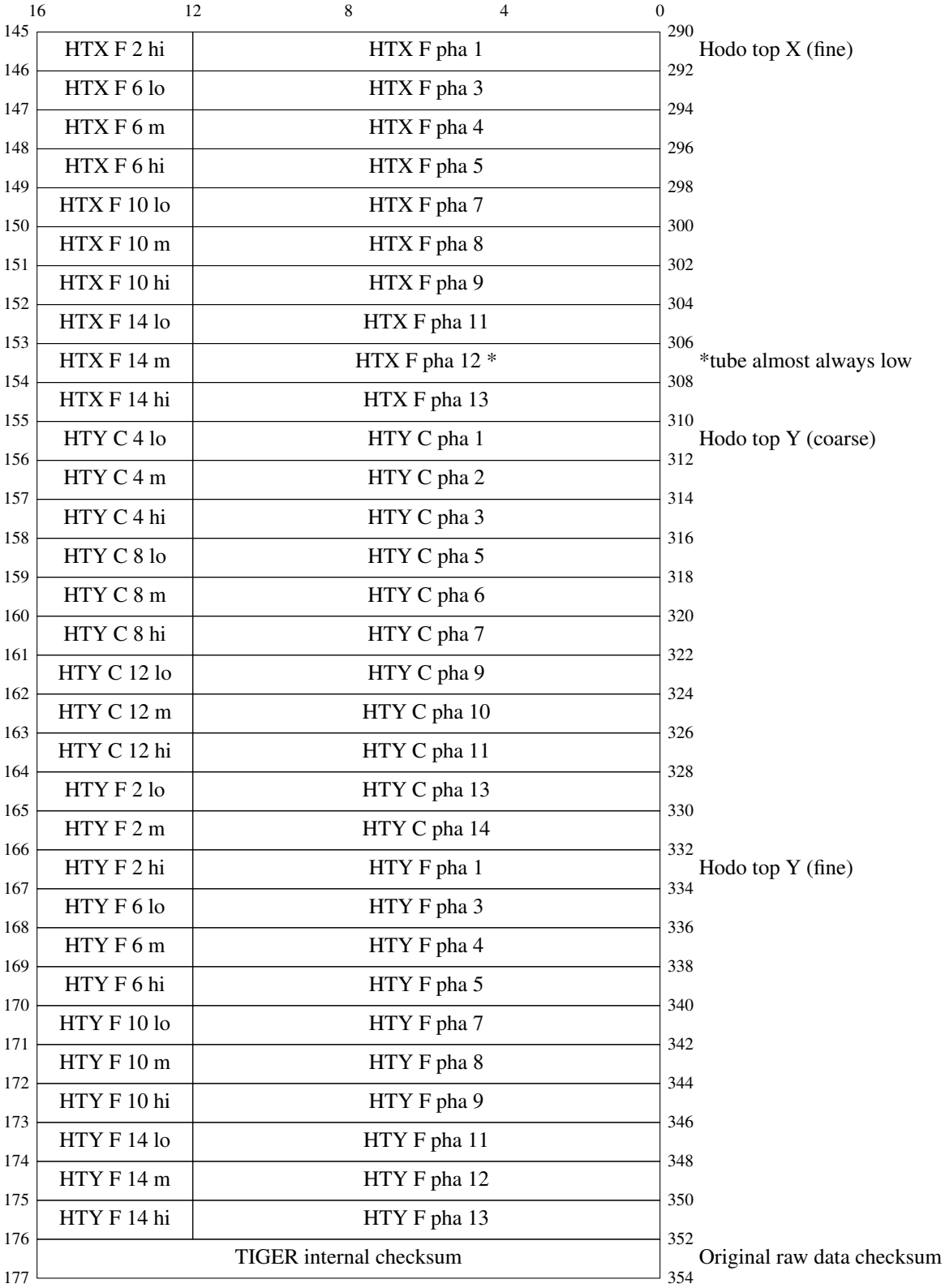
continued...

16	12	8	4	0		
86	S4 4 lo	S4 pha 1		172	S4	
87	S4 4 m	S4 pha 2		174		
88	S4 4 hi	S4 pha 3		176		
89	S4 8 lo	S4 pha 5		178		
90	S4 8 m	S4 pha 6		180		
91	S4 8 hi	S4 pha 7		182		
92	HBX C 4 lo	HBX C pha 1		184	Hodo bottom X (coarse)	
93	HBX C 4 m	HBX C pha 2		186		
94	HBX C 4 hi	HBX C pha 3		188		
95	HBX C 8 lo	HBX C pha 5		190		
96	HBX C 8 m	HBX C pha 6		192		
97	HBX C 8 hi	HBX C pha 7		194		
98	HBX C 12 lo	HBX C pha 9		196		
99	HBX C 12 m	HBX C pha 10		198		
100	HBX C 12 hi	HBX C pha 11		200		
101	HBX F 2 lo	HBX C pha 13		202		
102	HBX F 2 m	HBX C pha 14		204		
103	HBX F 2 hi	HBX F pha 1		206	Hodo bottom X (fine)	
104	HBX F 6 lo	HBX F pha 3		208		
105	HBX F 6 m	HBX F pha 4		210		
106	HBX F 6 hi	HBX F pha 5		212		
107	HBX F 10 lo	HBX F pha 7		214		
108	HBX F 10 m	HBX F pha 8		216		
109	HBX F 10 hi	HBX F pha 9		218		
110	HBX F 14 lo	HBX F pha 11		220		
111	HBX F 14 m	HBX F pha 12		222		
112	HBX F 14 hi	HBX F pha 13		224		
113				226		

continued...

16	12	8	4	0	
113	HBY C 4 lo	HBY C pha 1		226	Hodo bottom Y (coarse)
114	HBY C 4 m	HBY C pha 2		228	
115	HBY C 4 hi	HBY C pha 3		230	
116	HBY C 8 lo	HBY C pha 5		232	
117	HBY C 8 m	HBY C pha 6		234	
118	HBY C 8 hi	HBY C pha 7		236	
119	HBY C 12 lo	HBY C pha 9		238	
120	HBY C 12 m	HBY C pha 10		240	
121	HBY C 12 hi	HBY C pha 11		242	
122	HBY F 2 lo	HBY C pha 13		244	
123	HBY F 2 m	HBY C pha 14		246	
124	HBY F 2 hi	HBY F pha 1		248	Hodo bottom Y (fine)
125	HBY F 6 lo	HBY F pha 3		250	
126	HBY F 6 m	HBY F pha 4		252	
127	HBY F 6 hi	HBY F pha 5		254	
128	HBY F 10 lo	HBY F pha 7		256	
129	HBY F 10 m	HBY F pha 8		258	
130	HBY F 10 hi	HBY F pha 9		260	
131	HBY F 14 lo	HBY F pha 11		262	
132	HBY F 14 m	HBY F pha 12		264	
133	HBY F 14 hi	HBY F pha 13		266	
134	HTX C 4 lo	HTX C pha 1		268	Hodo top X (coarse)
135	HTX C 4 m	HTX C pha 2		270	
136	HTX C 4 hi	HTX C pha 3		272	
137	HTX C 8 lo	HTX C pha 5		274	
138	HTX C 8 m	HTX C pha 6		276	
139	HTX C 8 hi	HTX C pha 7		278	
140	HTX C 12 lo	HTX C pha 9		280	
141	HTX C 12 m	HTX C pha 10		282	
142	HTX C 12 hi	HTX C pha 11		284	
143	HTX F 2 lo	HTX C pha 13		286	
144	HTX F 2 m	HTX C pha 14		288	
145				290	

continued...

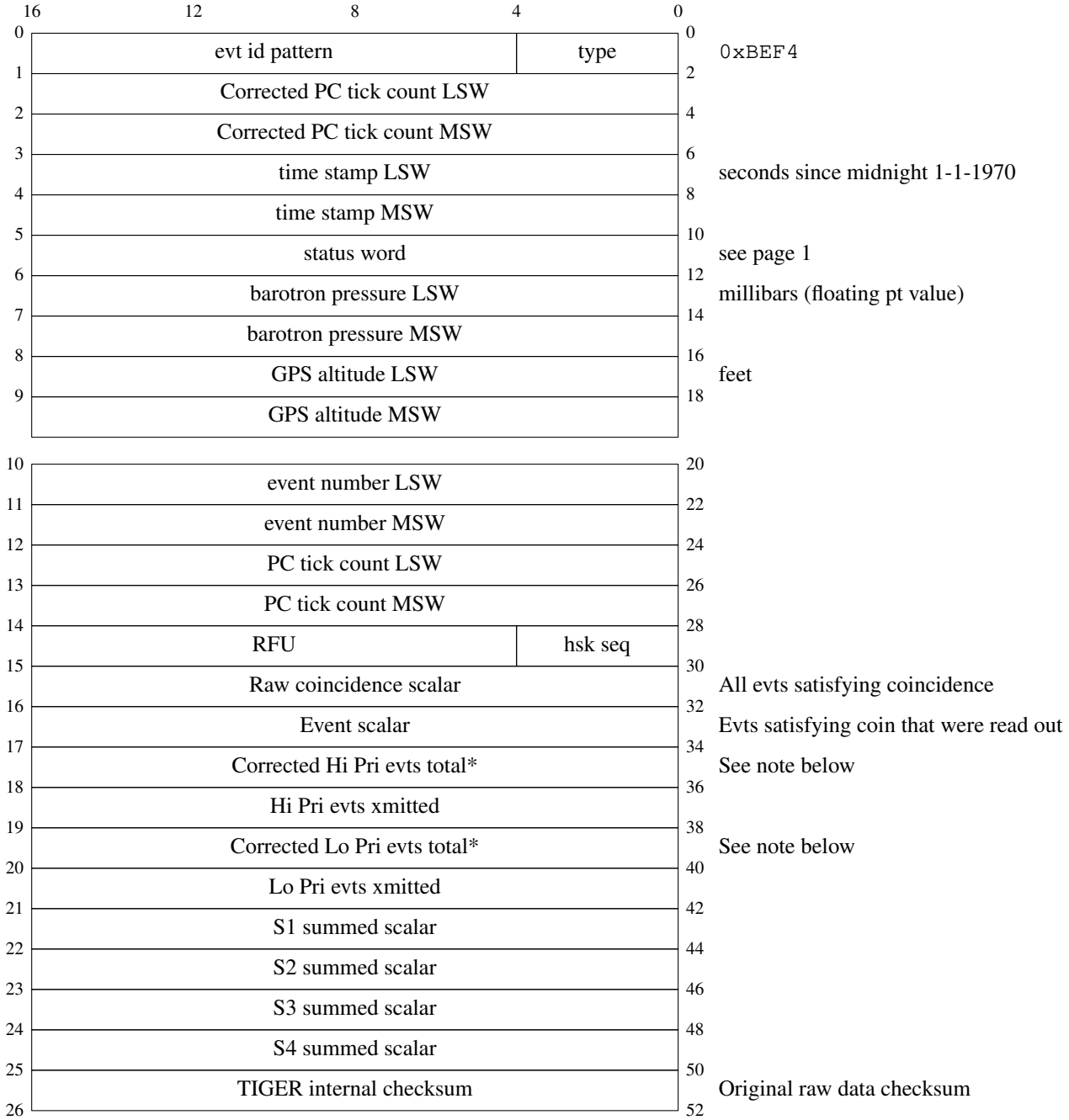


16	12	8	4	0		
145	HTX F 2 hi	HTX F pha 1			290	Hodo top X (fine)
146	HTX F 6 lo	HTX F pha 3			292	
147	HTX F 6 m	HTX F pha 4			294	
148	HTX F 6 hi	HTX F pha 5			296	
149	HTX F 10 lo	HTX F pha 7			298	
150	HTX F 10 m	HTX F pha 8			300	
151	HTX F 10 hi	HTX F pha 9			302	
152	HTX F 14 lo	HTX F pha 11			304	
153	HTX F 14 m	HTX F pha 12 *			306	*tube almost always low
154	HTX F 14 hi	HTX F pha 13			308	
155	HTY C 4 lo	HTY C pha 1			310	Hodo top Y (coarse)
156	HTY C 4 m	HTY C pha 2			312	
157	HTY C 4 hi	HTY C pha 3			314	
158	HTY C 8 lo	HTY C pha 5			316	
159	HTY C 8 m	HTY C pha 6			318	
160	HTY C 8 hi	HTY C pha 7			320	
161	HTY C 12 lo	HTY C pha 9			322	
162	HTY C 12 m	HTY C pha 10			324	
163	HTY C 12 hi	HTY C pha 11			326	
164	HTY F 2 lo	HTY C pha 13			328	
165	HTY F 2 m	HTY C pha 14			330	
166	HTY F 2 hi	HTY F pha 1			332	Hodo top Y (fine)
167	HTY F 6 lo	HTY F pha 3			334	
168	HTY F 6 m	HTY F pha 4			336	
169	HTY F 6 hi	HTY F pha 5			338	
170	HTY F 10 lo	HTY F pha 7			340	
171	HTY F 10 m	HTY F pha 8			342	
172	HTY F 10 hi	HTY F pha 9			344	
173	HTY F 14 lo	HTY F pha 11			346	
174	HTY F 14 m	HTY F pha 12			348	
175	HTY F 14 hi	HTY F pha 13			350	
176	TIGER internal checksum				352	Original raw data checksum
177					354	

END OF DATA EVENT

Critical scalars housekeeping (type 4)

B. CRITICAL SCALARS HOUSEKEEPING (type 4) Total size = 26 wds = 416 bits

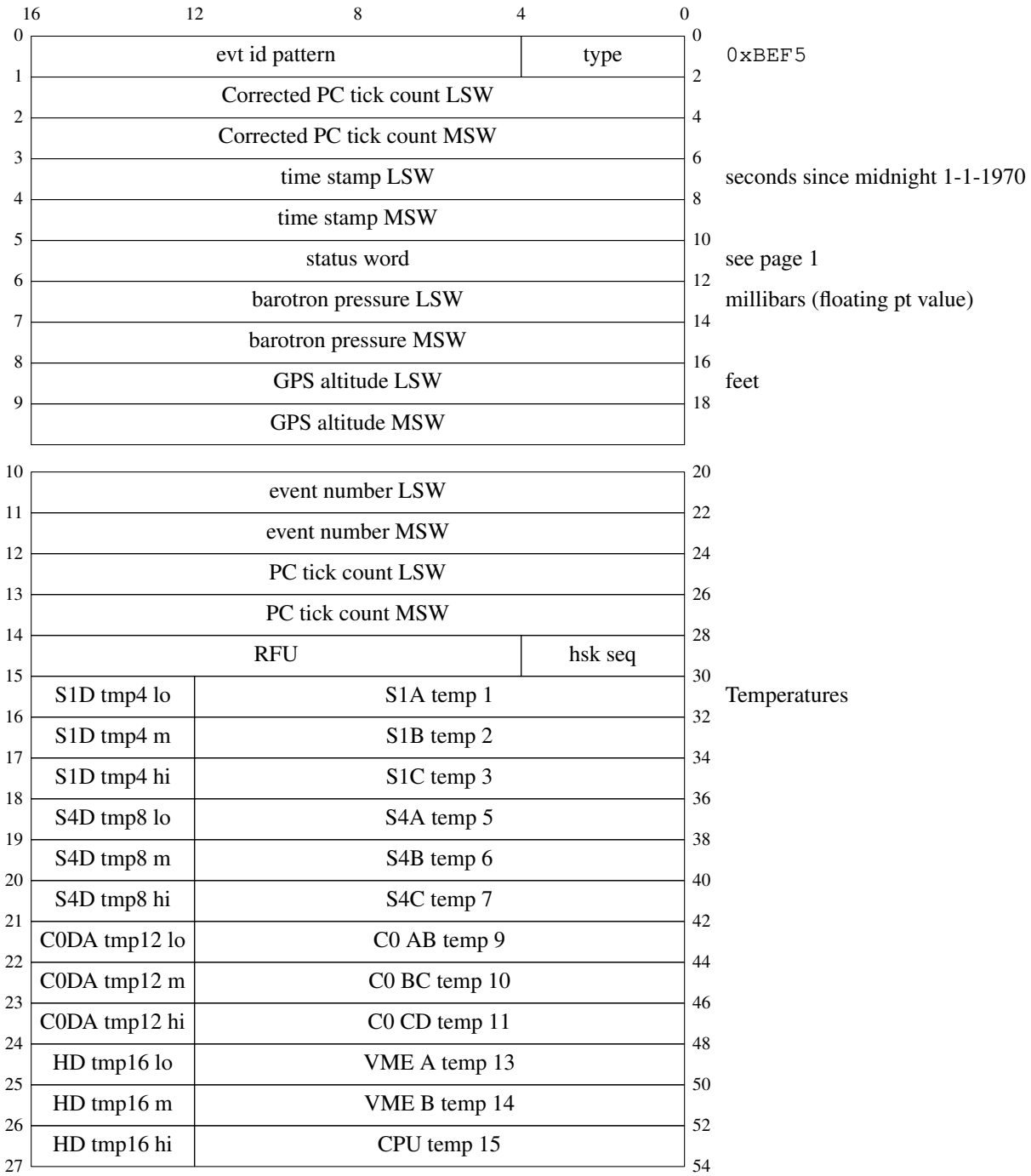


* With the raw data, there was a problem with the ‘‘Hi Pri evts total’’ and ‘‘Lo Pri evts total’’. When the priority detector was not in ‘‘fake’’ mode, the events going into these totals are counted twice. So the total was twice as much as expected. This has been corrected here in the level 0 data by dividing these values by 2.

END OF CRITICAL SCALARS (1 min) HOUSEKEEPING

Sensors (4 min) housekeeping (type 5)

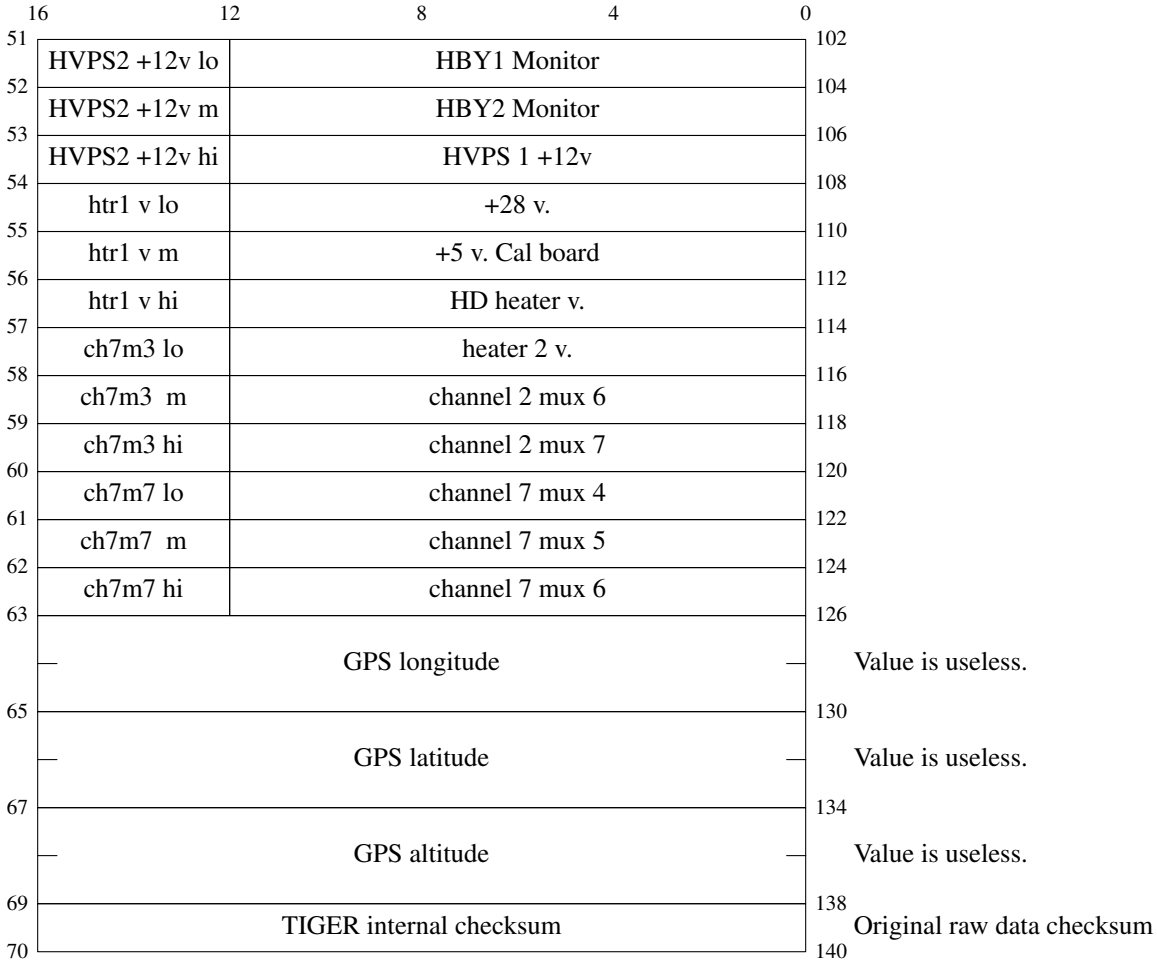
C. SENSORS (4 min) HOUSEKEEPING (type 5)
Total size = 70 wds = 1120 bits



continued...

16	12	8	4	0	
27				54	
C1-14 tmp20 lo		Belly band temp 17			Temperatures (cont.)
28				56	
C1-14 tmp20 m		HBX HVPS 1 temp 18			
29				58	
C1-14 tmp20 hi		C0-2 PMT base temp 19			
30				60	
+5 CPU volt lo		inside temperature 21			
31				62	
+5 CPU volt m		outside temperature 22			
32				64	
+5 CPU volt hi		+28 v. current			
33				66	
HD Pressure lo		PHA-1 +5 voltage			
34				68	
HD Pressure m		PHA-1 +6 voltage			
35				70	
HD Pressure hi		PHA-1 -6 voltage			
36				72	
HVPS Cur lo		PHA-2 +5 voltage			
37				74	
HVPS Cur m		PHA-2 +6 voltage			
38				76	
HVPS Cur hi		PHA-2 -6 voltage			
39				78	
S2B mon lo		S1A HV Monitor			HVPS voltages for detector PMTs (0-2v)
40				80	
S2B mon m		S1B Monitor			
41				82	
S2B mon hi		S2A Monitor			
42				84	
C0B mon lo		S3 Monitor			
43				86	
C0B mon m		S4 Monitor			
44				88	
C0B mon hi		C0A Monitor			
45				90	
HTX2 mon lo		C1A Monitor			
46				92	
HTX2 mon m		C1B Monitor			
47				94	
HTX2 mon hi		HTX1 Monitor			
48				96	
HBX2 mon lo		HTY1 Monitor			
49				98	
HBX2 mon m		HTY2 Monitor			
50				100	
HBX2 mon hi		HBX1 Monitor			
51				102	

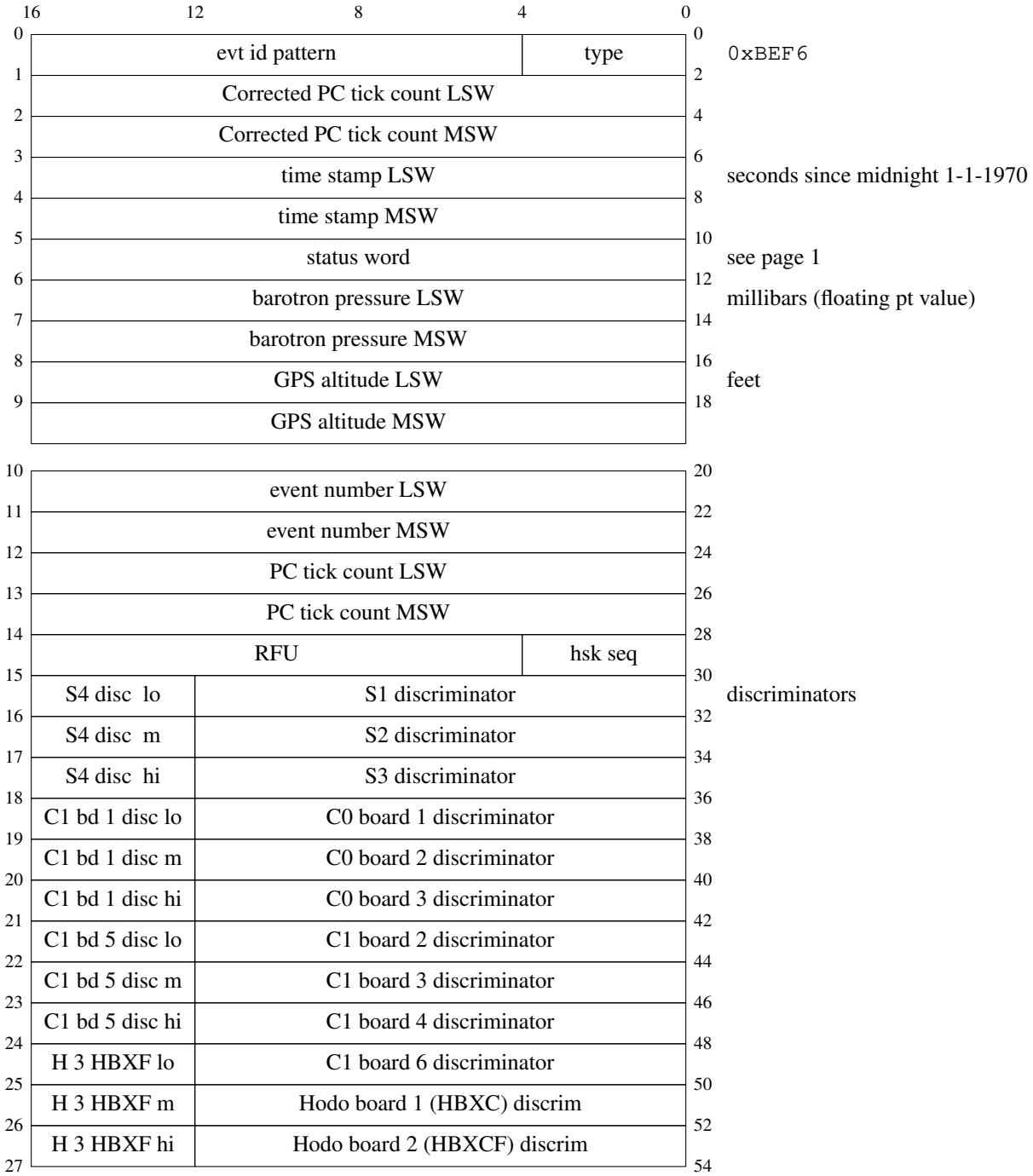
continued...



END OF SENSORS (4 min) HOUSEKEEPING

Misc housekeeping (type 6)

D. MISC HOUSEKEEPING (type 6)
Total size = 63 wds = 1008 bits

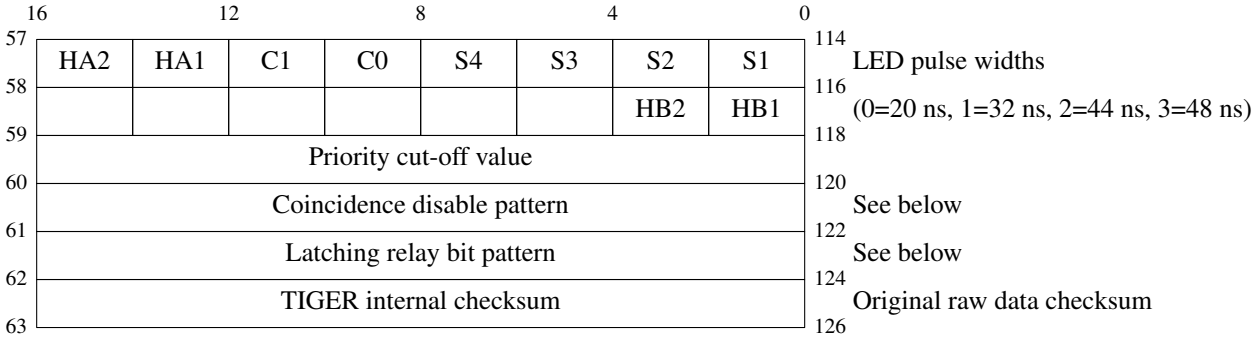


continued...

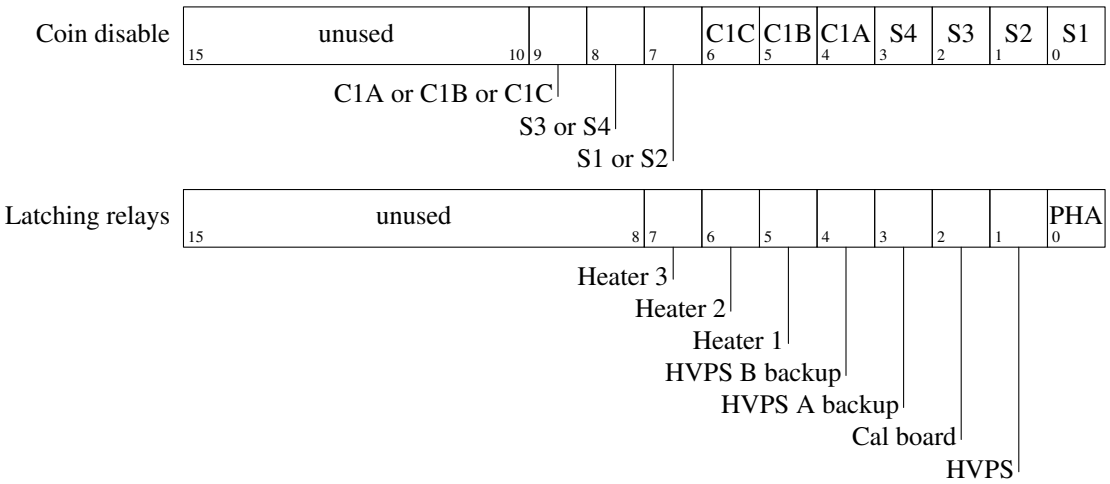
16	12	8	4	0
27	H 7 HBYF lo	Hodo board 4 (HBXFYC) discrim		54
28	H 7 HBYF m	Hodo board 5 (HBYC) discrim		56
29	H 7 HBYF hi	Hodo board 6 (HBYCF) discrim		58
30	H 11 HTXFYC lo	Hodo board 8 (HTXC) discrim		60
31	H 11 HTXFYC m	Hodo board 9 (HTXCF) discrim		62
32	H 11 HTXFYC hi	Hodo board 10 (HTXF) discrim		64
33	S1A dac lo	Hodo board 12 (HTYC) discrim		66
34	S1A dac m	Hodo board 13 (HTYCF) discrim		68
35	S1A dac hi	Hodo board 14 (HTYF) discrim		70
36	S3 dac lo	S1B external dac		72
37	S3 dac m	S2A external dac		74
38	S3 dac hi	S2B external dac		76
39	C1A dac lo	S4 external dac		78
40	C1A dac m	C0A external dac		80
41	C1A dac hi	C0B external dac		82
42	HTX1 dac lo	C1B external dac		84
43	HTX1 dac m	HBX1 external dac		86
44	HTX1 dac hi	HBX2 external dac		88
45	LED1 dac lo	HTX2 external dac		90
46	LED1 dac m	HBY1 external dac		92
47	LED1 dac hi	HBY2 external dac		94
48	SPARE1 lo	LED2 external dac		96
49	SPARE1 m	LED3 external dac		98
50	SPARE1 hi	LED4 external dac		100
51	SPARE5 lo	SPARE2		102
52	SPARE5 m	SPARE3		104
53	SPARE5 hi	SPARE4		106
54	H amp lo	S LED amplitude		108
55	H amp m	C0 LED amplitude		110
56	H amp hi	C1 LED amplitude		112
57				114

external dacs

continued...

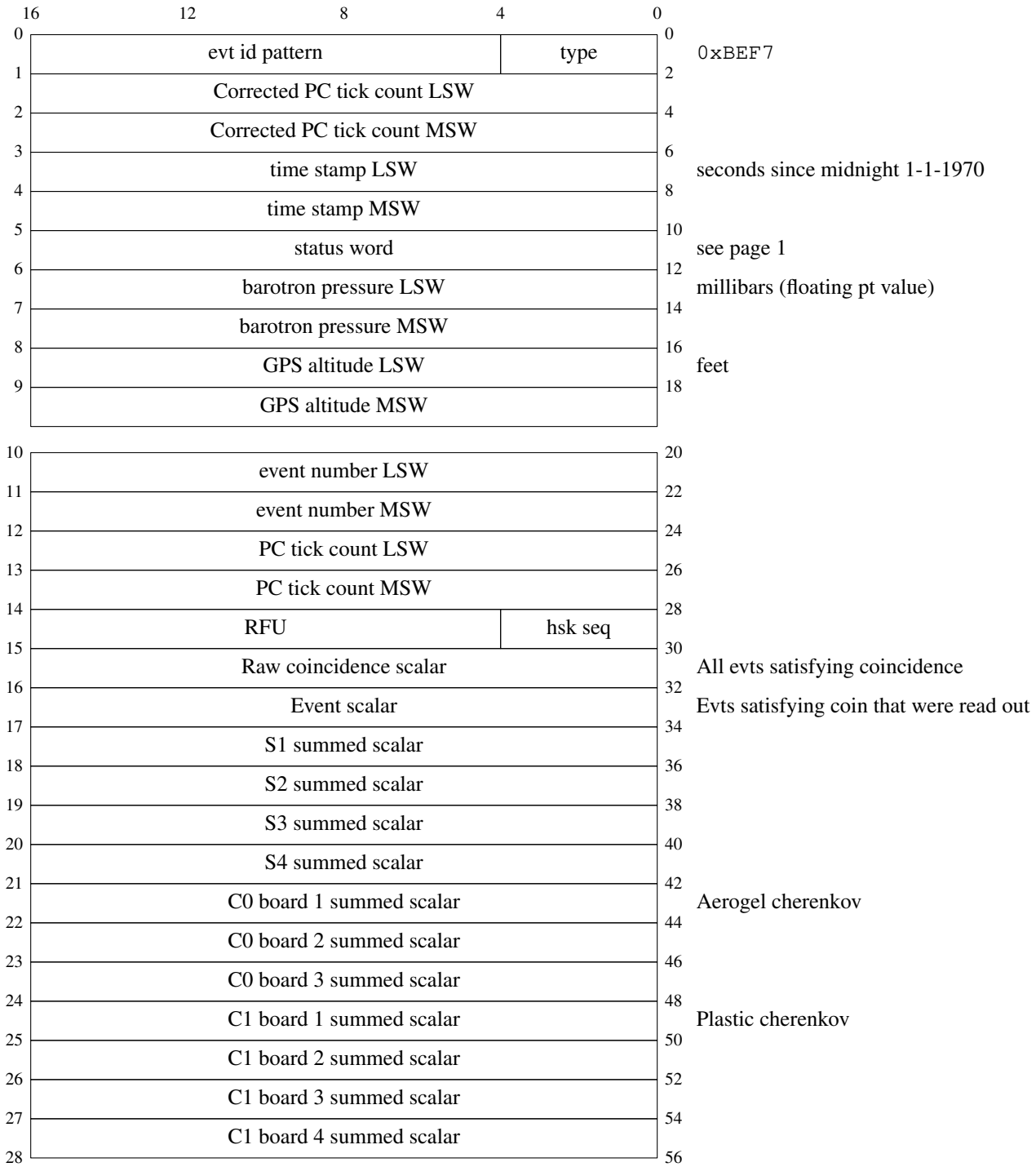


END OF MISC HOUSEKEEPING

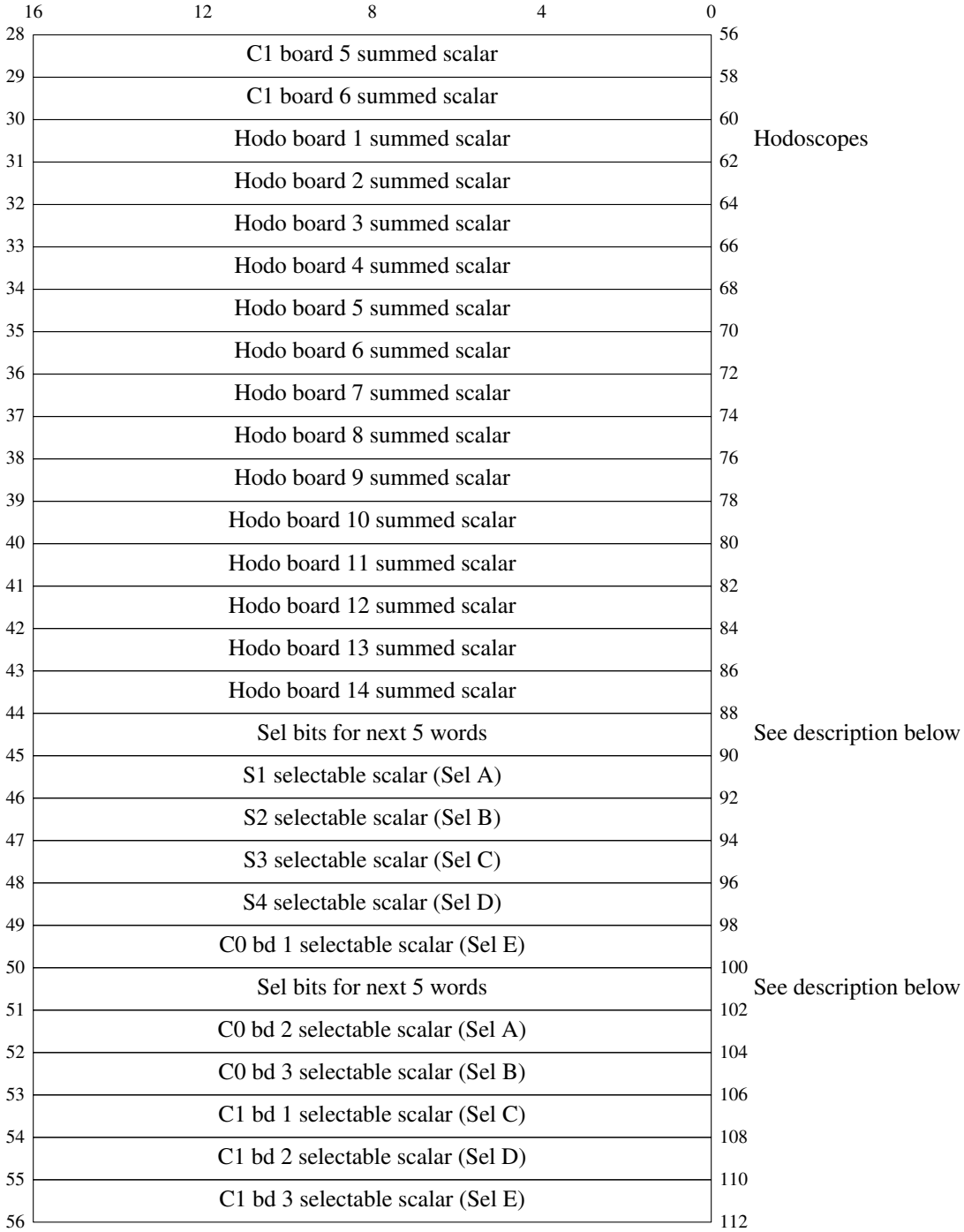


All scalars housekeeping (type 7)

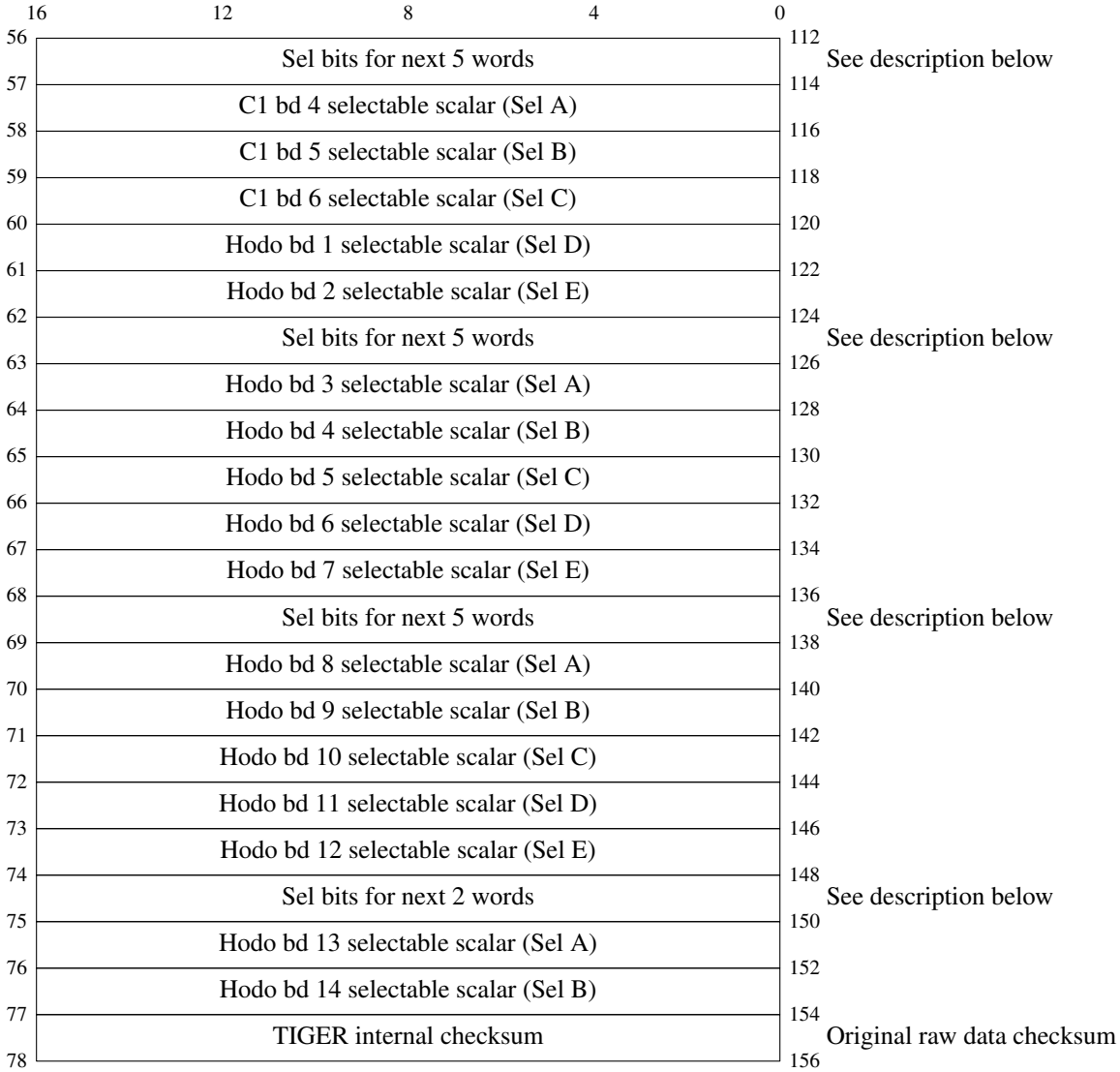
E. ALL SCALARS HOUSEKEEPING (type 7)
Total size = 78 wds = 1248 bits



continued...

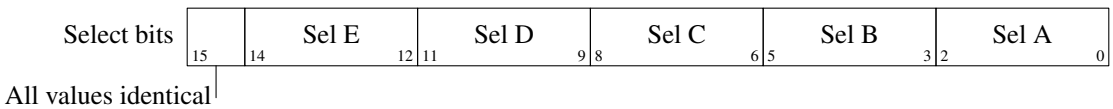

16
12
8
4
0
28
C1 board 5 summed scalar
56
29
C1 board 6 summed scalar
58
30
Hodo board 1 summed scalar
60
Hodoscopes
31
Hodo board 2 summed scalar
62
32
Hodo board 3 summed scalar
64
33
Hodo board 4 summed scalar
66
34
Hodo board 5 summed scalar
68
35
Hodo board 6 summed scalar
70
36
Hodo board 7 summed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

continued...



END OF ALL SCALARS 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 scalar is counting. If bit 15 is set, then all of the *Sel* values are identical.

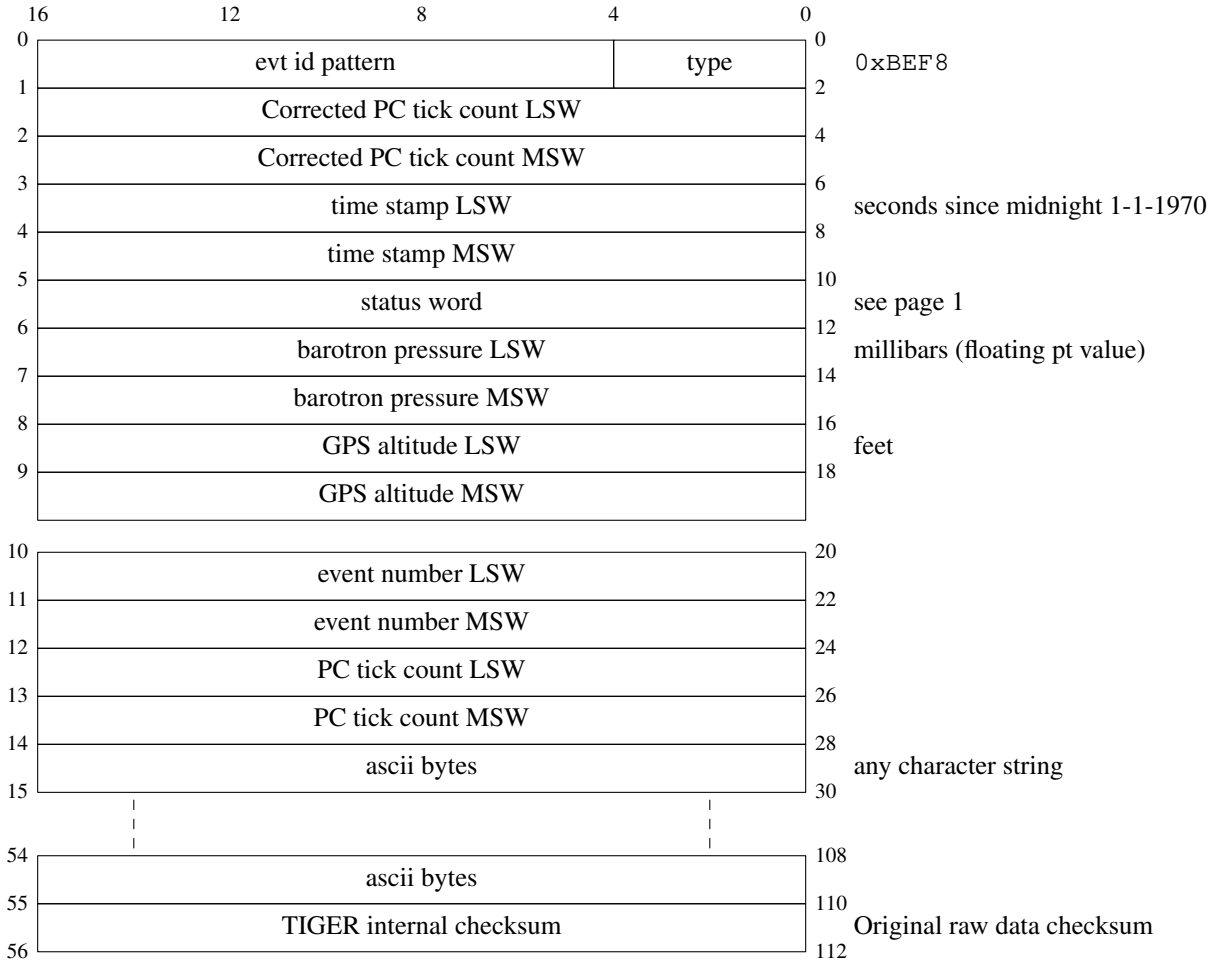


Replies (type 8)

F. REPLY EVENT (type 8)

Total size = 56 wds = 896 bits

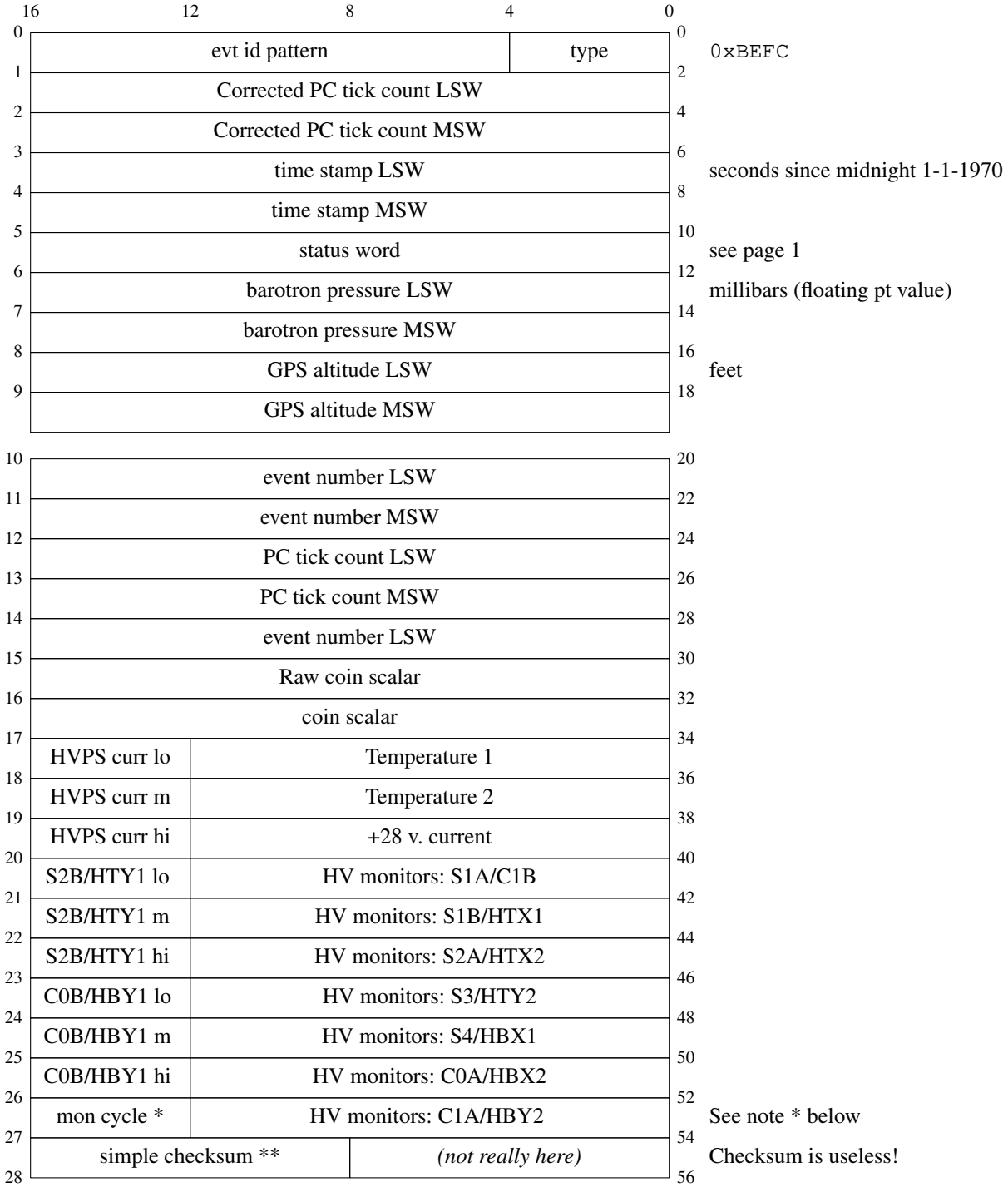
A reply event is generated at infrequent, but unpredictable times. It is sent whenever some sort of response is required from the flight software, such as after a command from the ground. It is simply a sequence of ascii bytes containing a message.



END OF REPLY EVENT

Slow ARGOS housekeeping (type12)

G. SLOW ARGOS HSK (type 12) Total size = 27.5 wds = 55 bytes = 440 bits



* ‘mon cycle’ tells which set of HV monitors is included: either the first 9 (mon cycle = 0) or the next 9 (mon cycle = 1). I.e. use the first HV item for mon cycle 0, and the second for mon cycle 1.

END OF SLOW ARGOS EVENT

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