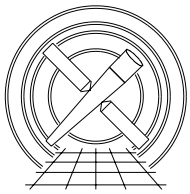

MIT Kavli Institute **Chandra X-Ray Center**

MEMORANDUM
May 18, 2009

To: Jonathan McDowell, SDS Group Leader
From: Glenn Allen, SDS ACIS Scientist
Subject: ACIS Event Data STATUS Bits
Revision: 2.3
URL: http://space.mit.edu/CXC/docs/docs.html#evtbits
File: /nfs/cxc/h2/gea/sds/docs/memos/memo_event_status_bits_2.3.tex

The column STATUS in an ACIS Level 1 event-data file (i.e. evt1.fits or evt1a.fits) provides a bit-encoded description of the "quality" of the events. If one or more of the bits is set to one for an event, then the event may have a problem and it is excluded from the Level 2 ACIS event-data file (i.e. evt2.fits). This memo describes the conditions for which a bit is set to one (Table 1), the tool which sets each bit (Table 2) and the conditions for which a bit is set to zero on input (Table 3).

1 STATUS bits

Table 1

STATUS Bit	Integer Representation[a]	Condition(s) for which the STATUS bit is set to one
0	1	The CHIPX and CHIPY coordinates of an event are invalid (e.g. the coordinates are outside a window, are on an inactive CCD, or are in the top-half of a CCD experiencing a "FEP0" problem).
1[b]	2	The pulse height of the central pixel of a 3 pixel × 3 pixel event island is less than the split threshold[c] or the pulse height of one or more of the eight pixels surrounding the central pixel is greater than (or greater than or equal to) the pulse height of the central pixel.

[a] This integer representation is appropriate for machines that use the "big-endian" convention for byte strings, where the first byte of the string is assumed to contain the highest-order bits.

[b] This bit is set only if the parameter doevtgrade = "yes." If doevtgrade = "no," then the bit is not unset in the output file if it is set in the input file.

[c] If the parameter `threshfile` specifies a valid event- and split-threshold file, then the information in the file is used for the split threshold instead of the value specified by the parameter `spthresh`. Otherwise, the value of the split threshold is set by the parameter `spthresh`.

Table 1 cont.

STATUS Bit	Integer Representation[a]	Condition(s) for which the STATUS bit is set to one
2	4	One or more of the nine pixels of a 3×3-pixel event island has a PHA value > 4095 after the bias and the delta overclock values have been subtracted.
3	8	The sum of the PHA values of the nine pixels of a 3×3-pixel event island that are $\geq$ the split threshold ≥ 32767 (i.e. $\gtrsim 130$ keV).
4	16	The CHIPX and CHIPY coordinates of an event are the coordinates of a pixel that is identified as "bad" in the associated bpix1.fits file.
5	32	The CHIPX and CHIPY coordinates of one or more of the outer eight pixels of a 3 pixel $\times$ 3 pixel event island are the coordinates of a pixel that is identified as "bad" in the associated bpix1.fits file.
6	64	The bias value associated with the CHIPX and CHIPY coordinates of an event = 4095. This condition occurs if the pixel is identified as "bad" or if the pixel is not on the active region of a sub array.
7	128	The bias value associated with the CHIPX and CHIPY coordinates of an event is unknown (e.g. telemetry was lost).
8	256	The bias value associated with the CHIPX and CHIPY coordinates of an event = 4094. This condition indicates that the pixel has a bias-parity error.
9	512	The overclock value associated with an event is unknown.
10	1024	The overclock value associated with an event is not in the nominally-expected range of overclock values.
11	2048	The mean PHA value of the four corner pixels of a 3×3-pixel event island < -4095.
12	4096	Bits 12 and 13 are used for TIMED GRADED mode observations to indicate the number of pixels that were included in the computation of the mean PHA value of the four corner pixels of a 3×3-pixel event island. Bits (12,13) have values of (0,0), (1,0), (0,1), or (1,1) to indicate that 4, 3, 2, or 1 pixels were used to compute the mean value of the corner pixels, respectively. Pixels are excluded from the computation if they are identified "bad" or have bias-parity errors. [Obsolete. The use of this bit has been discontinued.]
13	8192	See STATUS bit 12. [Obsolete. The use of this bit has been discontinued.]
14	16384	The mean value of the four corner pixels of a 3×3-pixel event island = 4095. This condition indicates that all four of the corner pixels are "bad" or have bias-parity errors.
15	32768	The event is associated with a horizontal "streak" on a CCD. Streaks are associated with spurious signals in the read-out electronics.

Table 1 cont.

STATUS Bit	Integer Representation[a]	Condition(s) for which the STATUS bit is set to one
16	65536	The event is identified as being part of a "cosmic-ray afterglow."
17–19	—	These bits were used (in conjunction with bit 16) to enumerate the number of consecutive frames (including the frame associated with an event) in which events have been reported at the same CHIPX and CHIPY location as the event. For example, if bits 16–19 are 1100, 1010, or 1111, the event is part of a sequence of 3, 5, or $\geq$ 15 events at the same CHIPX and CHIPY location. [Obsolete. The use of bits 17–19 has been discontinued.]
20	1048576	The CTI-adjustment algorithm (if used) did not converge.
21	2097152	An event in a read-out streak is identified as a source event.
22	4194304	An event in a read-out streak is identified as a background event.
23	8388608	The event is identified as a potential cosmic-ray background event. This bit can be set to one only for TIMED VFAINT mode data that was processed using the optional acis_process_events parameter check_vf_pha=yes.
24–31	—	Unused.

Table 2

STATUS Bit	Integer Representation[a]	Tool which sets the bit(s)
0	1	acis_format_events
1–5	—	acis_process_events
6–10	—	acis_format_events
11–13	—	?
14	16384	acis_process_events
15	32768	destreak
16–20	—	acis_process_events
21–22	—	acisreadcorr
23	8388608	acis_process_events
24–31	—	None

Table 3

STATUS Bit	Integer Representation[a]	Condition(s) for which the STATUS bit is set to zero on input
0	1	Never unset this bit on input.
1–3	—	?
4–5	—	Always unset these bits on input.
6–10	—	Never unset these bits on input.
11	2048	?
12–13	—	Always unset these bits on input.
14	16384	?
15	16384	Always unset this bit on input.
16–19	—	Always unset these bits on input.
20	1048576	Refer to the latest revision of the spec entitled "Adjusting ACIS Event Data to Compensate for CTI."
21–22	—	Always unset these bits on input.
23	8388608	Always unset this bit on input.