MIT
Center for Space Research   Chandra X-Ray Center

MEMORANDUM
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To:	Martin Elvis, SDS Group Leader
From:	Glenn E. Allen, SDS ACIS Scientist
Subject:	Assigning Times to Events in the Read-Out Streaks
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URL:	http://space.mit.edu/CXC/docs/docs.html#readcorr
File:	/nfs/cxc/h2/gea/sds/docs/memos/memo_acis_read_corr_times_1.3b.tex

Jonathan McDowell has created a tool called "acis_read_corr" that can be used to identify events in the ACIS read-out streaks of bright sources. Some of the events in the streak of an observation are classified as events associated with the observed source. The rest of the streak events are classified as background events. It is possible to use acis_read_corr to help make images that do not exhibit the read-out streak. Furthermore, the tool assigns times to the streak events (both the "source" and "background" events in the streak). Since the time resolution of the streak events (40 μs) is much better than the time resolution of events in continuous-clocking–mode observations (2.85 ms), it is possible to perform higher-quality timing analyses with the streak event data if there are a sufficient number of streak events. This memo describes how times should be assigned to events in the read-out streaks.

1 Read-Out Streak Times

The following formulae can be used to determine the times associated with events in the read-out streak of any ACIS timed-exposure–mode observation. The formulae apply to all standard timed-exposure–mode observations including observations with or without pre-flushes, observations in interleaved mode, and observations that use subarrays or spatial windows.

If event i is an event in the read-out streak of an ACIS timed-exposure–mode event data file and if $\mathrm{CHIPY}_i > \mathrm{CHIPY}_{\mathrm{src}}$, then the time associated with the event is given by

$$\begin{aligned}\mathrm{TIME}_i &= \mathrm{TIME}_{\mathrm{frame}} + \left(1 - \mathrm{TIMEPIXR}\right) \times \mathrm{EXPTIME} + \\ &\quad \left(\mathrm{CHIPY}_i - \mathrm{CHIPY}_{\mathrm{src}}\right) \times 40\ \mu\mathrm{s}.\end{aligned} \tag{1}$$

If $\mathrm{CHIPY}_i = \mathrm{CHIPY}_{\mathrm{src}}$, then

$$\mathrm{TIME}_i = \mathrm{TIME}_{\mathrm{frame}}. \tag{2}$$

If $\mathrm{CHIPY}_i < \mathrm{CHIPY}_{\mathrm{src}}$, then

$$\begin{aligned}\mathrm{TIME}_i &= \mathrm{TIME}_{\mathrm{frame}} - \mathrm{TIMEPIXR} \times \mathrm{EXPTIME} + \\ &\quad \left(\mathrm{CHIPY}_i - \mathrm{CHIPY}_{\mathrm{src}}\right) \times 40\ \mu\mathrm{s}.\end{aligned} \tag{3}$$

Here $\mathrm{TIME}_{\mathrm{frame}}$ is the frame time associated with an event i in the event file (i.e. the value in the column "TIME"). This time is the time associated with the mid point of the static exposure time (i.e. $\mathrm{TIME}_{\mathrm{frame}} = \mathrm{TIME}_0 + 0.5 \times \mathrm{EXPTIME}$). The keywords TIMEPIXR and EXPTIME may be found in the header of the event data file (e.g. TIMEPIXR = 0.5 and EXPTIME = 3.20000 s). The value of CHIPY_i is the CHIPY location of the streak event on the ACIS CCD and the value of $\mathrm{CHIPY}_{\mathrm{src}}$ is the CHIPY location of the source on the CCD at the appropriate time. If $\mathrm{CHIPY}_i < \mathrm{CHIPY}_{\mathrm{src}}$, the streak events occur just before the beginning of the start of the frame and the appropriate time to use to determine $\mathrm{CHIPY}_{\mathrm{src}}$ is $t = \mathrm{TIME}_{\mathrm{frame}} - \mathrm{TIMEPIXR} \times \mathrm{EXPTIME}$. If $\mathrm{CHIPY}_i > \mathrm{CHIPY}_{\mathrm{src}}$, the streak events occur just after the end of the frame and the appropriate time to use to determine $\mathrm{CHIPY}_{\mathrm{src}}$ is $t = \mathrm{TIME}_{\mathrm{frame}} + \left(1 - \mathrm{TIMEPIXR}\right) \times \mathrm{EXPTIME}$.