

ACIS Flickering Pixels still a small Problem

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Introduction

- The presence of flaring or flickering pixels in CCDs has been known for some time. Dr. Y. Tsuboi noticed the presence of flaring pixels as a problem while working on data from the Orion Trapezium in June of 2000. Dr. Miyaji Takamitsu developed a computer code to identify the flaring pixels based on the observation that they occurred in sequential frames of data and in the same pixel of the CCD. The CXC implemented software to remove the flaring pixels into the CXC pipeline in creating event 2 files. The downside to the method used was that it removed valid counts from bright sources, since the PSF of *Chandra* is so small on-axis bright sources placed counts into a single pixel quite frequently. The recommended procedure was to use the event 2 files for source searching, but to go back to event 1 files for photometry of bright sources to get around the loss of counts from the removal of sequential events in a single pixel by the flaring pixel software. In a careful analysis of faint sources in the CrA Dark Cloud, we have found that there are flickering pixels as well as flaring pixels. The good news is that they are not very common so are not of great concern except when faint sources or flaring sources are important to the science. One of us (A. B.) found that some faint sources in CrA had two or even three events in the same pixel within just a few frames. This was deemed to be highly unlikely, so a software program was created to search for this phenomenon over the entire data set.

Detection method

- The method for identifying the flickering pixels is straightforward. First the tool fv is run on the data fits file and the file is saved as a table. A FORTRAN program is then run to look for events that occur within a few frames of each other in the same pixel of the same CCD. A table of these events is then created and written to a file. This program can either be run on an evt1 file, in which case all flaring pixels are tabulated, or on an evt2 file to find just the flickering pixels. The word ‘flickering’ is used to denote pixels that fall below the event threshold for one or several frames before reappearing. Flaring pixels usually appear in successive frames with progressively less energy in each frame. They may last for up to ten frames. Flickering pixels also decrease in energy with time, and they are not just above the event threshold. Some examples of both flaring and flickering pixels are given in the following tables. Data from the CDF-N ObsID 2234 was used, since there were no bright sources in this field. If there are bright sources (average of one count/20 frames or brighter) it is important to remove these sources using the command dmcop “filename[events][exclude sky=region(sourcelist.reg)]” nobrightsource file to remove the sources. Table I shows the output of the program run on the evt1 file, where the flaring pixels dominate the events. Notice how some flares last many exposures with the energy decreasing for each exposure. Table II shows the output of the program run on the evt2 file, where the flaring pixels have been removed. What is left are the flickering pixel events, which skip one or several exposures. Figure 1 compares the distribution of

- the flaring pixels to the flickering pixels. There are only 215 flaring plus flickering pixels detected in the 165 ks exposure, with 48 flickering pixels found in the evt2 file. Figure 1 tabulates all of the flares, so one pixel may appear several times in this plot if the flare lasts for more than two exposures.
- The BI chip S3 was evaluated for flickering pixels in the data set ObsID2979, an 88ks observation of the lensing system APM 08279+5255. A total of 34 flaring and flickering pixels were detected during this observation in S3, but only 2 flickering pixels were present in the event 2 file, so it appears that flickering pixels are less of a problem for the back illuminated CCDs. The region of the bright lensing source was removed before the analysis was attempted.

Conclusion

- Although flickering pixels can slip past the CXC software filter and appear in event 2 files, they constitute only a tiny fraction of all events. On the other hand, if sources as small as five events are important, they should be checked for the presence of flickering pixels, since two or more of the five events could be a flickering pixel. The frequency in the S3 chip is much lower, with only two flickering pixels detected in an 88 ks observation.

Figure1. The distribution of flickering pixels in evt1 and evt2 files.

