ACIS Update

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The ACIS instrument continued to perform well over the past year conducting the vast majority of GO observations with *Chandra*. There were only a few interruptions to the scheduled observations due to anomalies with the ACIS instrument. The most serious of these was the unexpected power off of the side A of the Digital Processing Assembly (DPA) on 11 January 2015. Side A of the DPA had spontaneously turned off on two occasions earlier in the mission. For each of those occurrences, the most likely explanation for the anomaly was a single event upset (SEU) that resulted in a spurious power off command to the electronics. An examination of the telemetry from the January 2015 event showed that this anomaly was consistent with the previous anomalies. Based on this conclusion, the ACIS instrument team prepared real-time command procedures to restore the ACIS instrument to its nominal configuration to conduct science observations. The recovery to the nominal configuration was completed 18.5 hours after the anomaly was detected and science observations resumed soon afterward. Side A of the DPA has functioned nominally since the recovery.

The charge-transfer inefficiency (CTI) of the FI and BI CCDs is increasing at the expected rate. The contamination layer continues to accumulate on the ACIS optical-blocking filter. A new calibration file (labelled N0009) to model the absorption due to the contamination layer was released by the CXC calibration group in the 4.6.2 release of the *Chandra* Calibration Database (CALDB) on 9 July 2014. This calibration file significantly improves the accuracy of the model for data acquired after mid-2013. If GOs are analyzing data since that time and the response at low energies is important for their analysis, they should be using the contamination model in CALDB 4.6.2 or later. Analysis of calibration observations of 1E0102-7219 in March 2015 show that the N0009 contamination model is still accurately predicting the growth of the contamination layer near the aimpoints on the S3 and I3 CCDs. However, these observations indicate that the contamination layer might be growing faster near the bottom and top edges of the S3 CCD. This preliminary result will need to be confirmed with calibration observations of other sources. Observations of A1795 are in the schedule for April 2015. GOs who have analyses sensitive to the low energy response at the top and bottom of the S3 CCD should monitor the CXC calibration web pages for future updates to the contamination file.

The control of the ACIS focal plane (FP) temperature continues to be a major focus of the ACIS Operations Team. As the *Chandra* thermal environment continues to evolve over the mission, some of the components in the Science Instrument Module (SIM) close to ACIS have been reaching higher temperatures, making it more difficult to maintain the desired -119.7 °C at the focal plane. GOs can increase the probability that the FP temperature will be cold and stable for their observation by reducing the number of operational CCDs, which reduces the power dissipation in the FP, thereby resulting in a lower FP temperature. GOs can select CCDs that are "required" or "optional" for their observation. Starting in Cycle 16, GOs were encouraged to select 4 or fewer required CCDs for their observations to keep the FP and the electronics cooler, if their science objectives can be met with that arrangement. Starting in Cycle 14, GOs were not allowed to select "Y" for 6 CCDs in the RPS forms when they submit their proposal. If a GO requires 6 CCDs for their observation, they are to select 5 CCDs as "Y" and one CCD as "OFF1" at the time of proposal submission. If the proposal is selected, the GO may work with their User Uplink Support Scientist and change the "OFF1" to a "Y" if the sixth CCD is required. GOs are still allowed to select 5 CCDs as required when they submit their proposals. GOs should be aware that requesting 6 CCDs increases the likelihood of a warm FP temperature and/or may increase the complexity of scheduling the observation. GOs should review the updated material in the Proposers' Observatory Guide on selecting CCDs.

GOs who are new to ACIS are encouraged to read the Proposers' Guide and the help pages on the RPS form on selecting an energy filter. The RPS forms request two quantities: the "Lower Energy Threshold" and the "Energy Filter Range." The first parameter sets the minimum energy an event must have to be selected for inclusion in the telemetry. The second parameter sets the range of energies starting from the lower energy threshold that are to be included. For example, if the lower energy threshold is set to 0.3 keV and the energy filter range is set to 12.0 keV, ACIS will select events with energies between 0.3 and 12.3 keV for inclusion in the telemetry. GOs should be advised that the onboard estimate of the energy of an event is not as accurate as the estimate after the data have been processed on the ground. Therefore it is wise to select an energy range that is slightly broader to be more inclusive such that events are included in telemetry and then a more restrictive filter may be applied by the GO when they analyze their data. The only exception to this is if the energy filter is needed to reduce the count rate to prevent telemetry saturation. In such cases, the GO might want to be more restrictive with the energy filter.

ACIS allows the GO to set two energy filters. The first filter discussed above applies to all events from all CCDs. In addition, ACIS also allows the GO to specify another energy filter in a spatial window. For example, a GO could specify a lower energy threshold of 0.3 keV and an energy filter range of 12.0 keV for all CCDs and specify another energy filter with a lower energy threshold of 1.0 keV and an energy filter range of 5.0 keV. ACIS would only accept events with energies between 1.0 and 6.0 keV inside the region defined by the spatial window but it would accept events with energies between 0.3 keV and 12.3 keV for all regions outside of the spatial region. But GOs should be careful since the energy filters are combined as a logical "AND." The candidate X-ray event must satisfy both filters in order to be accepted, therefore the filters should be consistent with each other to provide the energies that the GO desires. In the example above, the global energy filter accepts events between 0.3 keV and 12.3 keV and the energy filter in the spatial window accepts events with energies between 1.0 and 6.0 keV. Therefore, the energy filter in the spatial window will reject events if the energy is between 0.3 and 1.0 keV and if the energy is between 6.0 and 12.3 keV. If a GO were to specify a global energy filter with a lower energy threshold of 0.3 keV and an energy filter range of 12.0 keV and an energy filter in the spatial window with a lower energy threshold of 1.0 keV and an energy filter range of 12.0 keV, the events with energies between 12.3 keV and 13.0 keV in the region defined by the spatial window would not be accepted into telemetry because their energies are outside of the range specified by the global filter. If the GO has any questions about this, they should discuss their observation with their User Uplink Support Scientist.