Cooling the ACIS DH and fid lights: Test results

Aspect correction pipeline

A yaxx pipeline has been developed in order to determine a corrected aspect solution file for ACIS DH cooling calibration observations. The pipeline then applies the corrected solution to event data and generates products to allow evaluation of the corrected solution. The pipeline is almost entirely automated in order to expedite processing of subsequent calibration observations.

Obsid 9593 (report)

For the first CDF-S observation (obsid 9593), correction terms are applied to the aspect solution DY and DZ columns

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dy_corr = dy_corr_coeff * (-61.1 - temp_dh)
dz_corr = dz_corr_coeff * (-61.1 - temp_dh)
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where temp_dh is the average of 1CBAT and 1CBBT and the *_corr_coeff values were determined from the sharp change when the ACIS DH was reheated about 2 hours before the end of the observation. After applying the correction the aspect solution appeared smooth at the time of reheating. The size of the correction was no more than 0.15 arcsec.

The corrected aspect solution was used with acis_process_events to generate a corrected event file for purposes of validation. For each detected source the original and corrected events were compared as an image and by time history plots sky(x) vs. time and sky(y) vs. time. Given the relatively low number of counts in the sources (max of 450) and small correction, no obvious effect is visible. However, a quadratic fit to the time history data did show a marginally significant improvement in the corrected event data. As a final test, the radial distribution of corrected source events within 1.5 arcsec of the centroid were compared to the same for a reference CDF-S observation (obs 2409) using a 2-sided K-S test. In all cases the corrected radial distributions for obs 9593 were statistically consistent with those for obs 2409. In addition, applying the correction made a marginal improvement in the K-S probability.

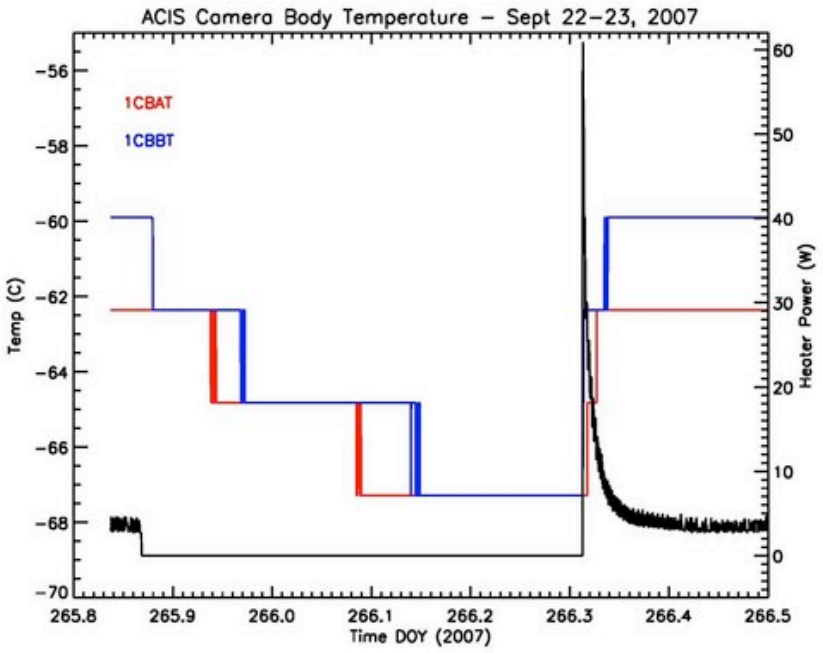
Given the slight improvement in the event distribution and clear benefit in the aspect solution, it is recommended that the corrected aspect solution be used for SAP ACIS processing and archived.

The processing details and plots are available in the report from the yaxx processing pipeline. From the report link one can click on each of the sources in the table to see the effect of aspect correction for each source.

Fid light position and magnitude shifts

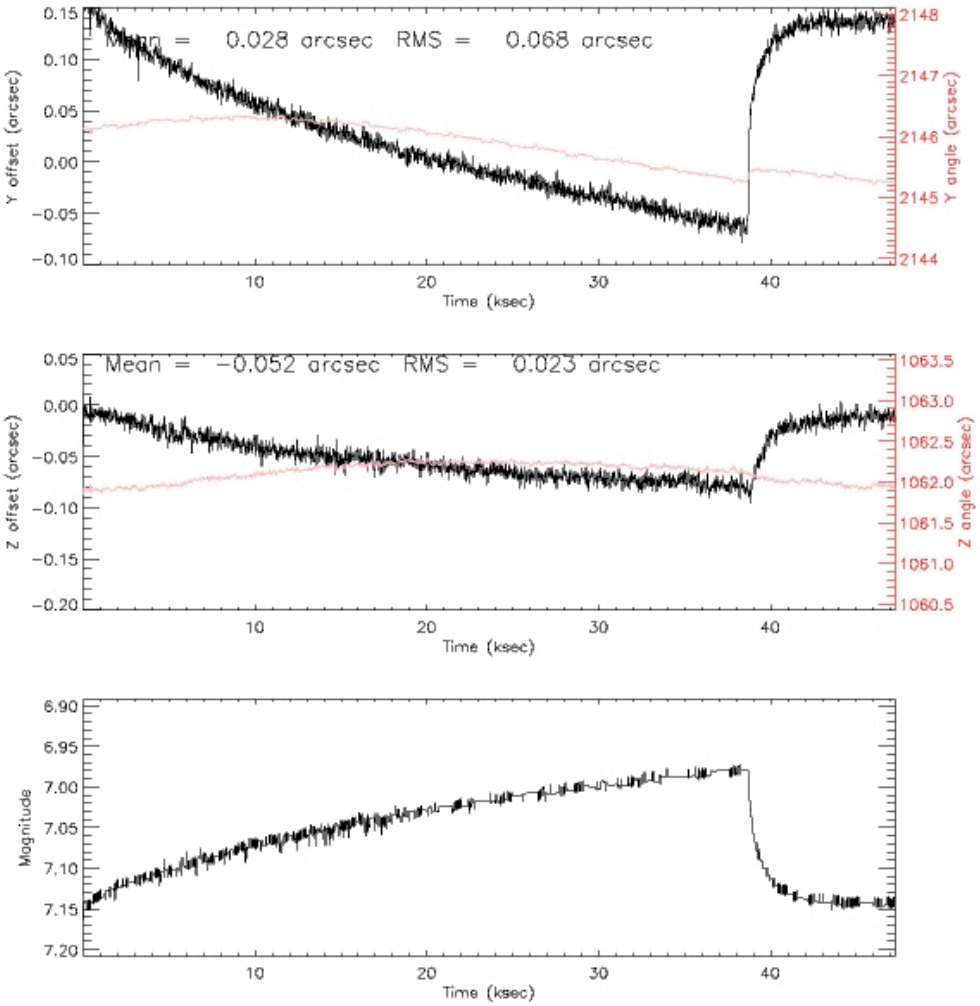
Obsid 9593

During obsid 9593 the ACIS DH temperature cooled slowly from about -60 C to -67 C. Approximately 2 hours before the observation end the DH heater was repowered and the temperature rose quickly back to -60 C.



Fid light position residuals and magnitudes

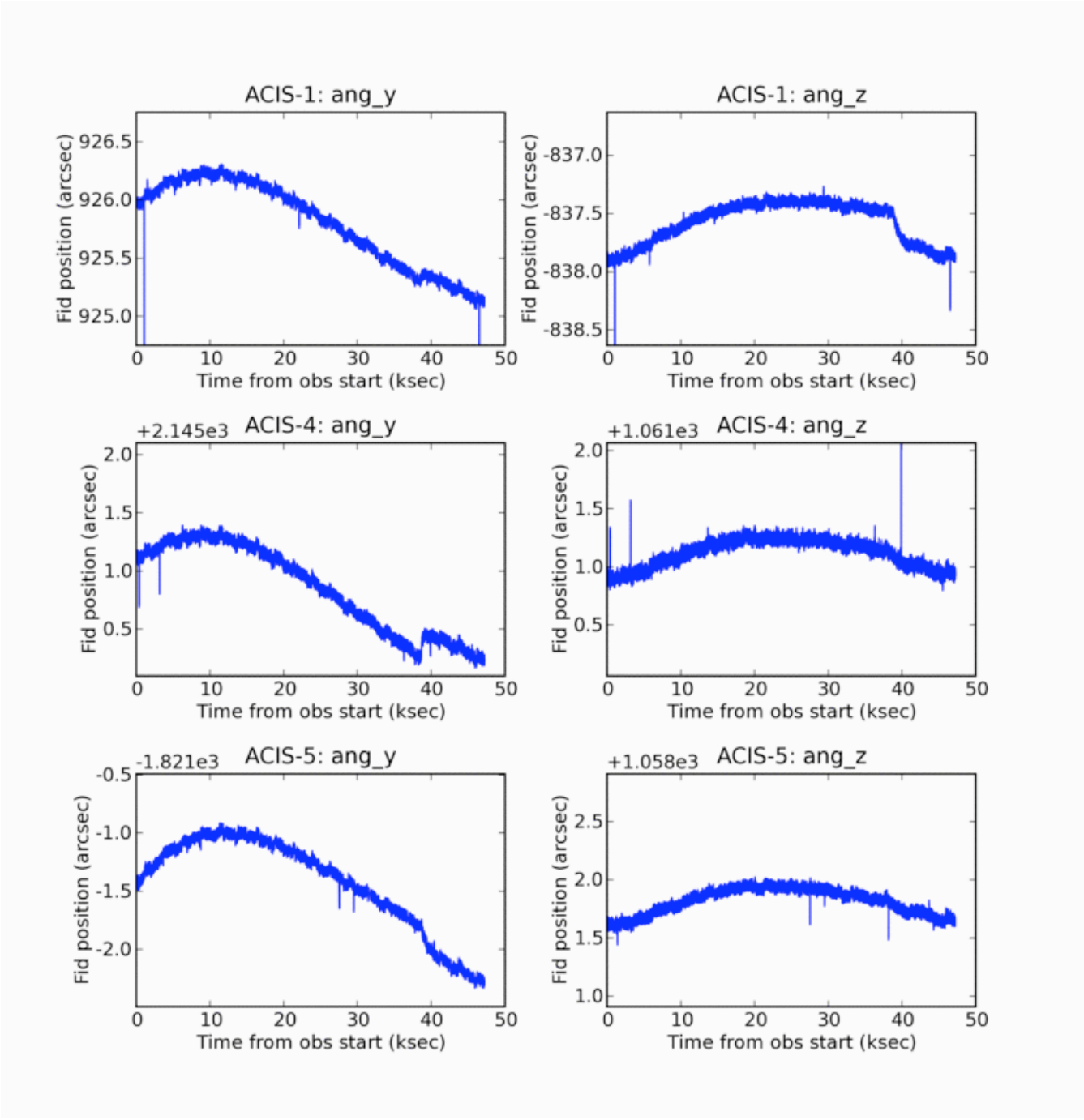
The fid light positions and magnitudes shifted as expected in response to the temperature change. This can be clearly seen in the aspect V&V plot for fid light ACIS-5. The plots below show the residuals (black) from the common-mode motion of all three fids and the image centroids (pink) for the fid light. The magnitude plot shows the temperature dependence of the fid light brightness. This may actually be the best estimator of the fid mount plate temperature.



Absolute fid light positions

The plot belows shows the fid positions versus time for all three fid lights. The jump around 39 ksec is evident.

The distance in Y between fids 4 and 5 is about 194 mm. For a 6 C temperature change and a CTE of aluminum 6061 of 23 ppm/degC, this gives a predicted position shift of 0.0268 mm or 0.53 arcsec. The measured shift is about 0.50 arcsec, so it does appear that the DH is contracting as expected.



TomAldcroft - 25 Sep 2007

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