



ACIS Time-dependent Gain

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Summary

The tool `acis_process_events` includes a time-dependent gain (TGAIN) adjustment. This adjustment is necessary because the "effective gains" of the detectors are drifting with time as the result of an increasing CTI.

There is TGAIN calibration data for the entire ACIS detector (chips I0–3 and S0–5) at the –120 C focal plane temperature.

There is also TGAIN calibration data for the ACIS–S1 and S3 back-illuminated chips at the –110 C focal plane temperature.

If the data have gone through Reprocessing III, a TGAIN correction has been applied. Repro III started with DS 7.6.7. In some cases, there may be a new TGAIN available, requiring the user to reprocess the data.

The observation date and focal plane temperature are recorded in the header of the event file:

```
unix% dmkeypar acis_evt2.fits DATE-OBS echo+
2008-01-19T20:41:39

unix% dmkeypar acis_evt2.fits FP_TEMP echo+
153.60722351
```

What Analyses are Affected?

Users interested in CCD spectroscopy should apply the gain adjustment. Grating spectroscopy benefits as well, in the form of improved order sorting. It is not necessary to apply this adjustment if you are only doing timing or imaging analysis, but it will not have a negative effect, either.

Determine the Size of the Adjustment

The `show_tgain_corr` script displays the size of the time-dependent gain correction – i.e. how much the energy or PHA value of an event changes – for a given source location. The most recent version of the `show_tgain_corr` script is v1.6 (16 April 2007):

```
unix% grep Id `which show_tgain_corr`
% $Id: show_tgain_corr,v 1.6 2007/04/16 16:39:17 egalle Exp $
```

`show_tgain_corr` calls a helper script named `show_tgain_corr.sl`. The most recent version of that script is v1.7 (13 Sept 2007):

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```
unix% grep Id $ASCDS_CONTRIB/share/slsh/local-packages/show_tgain_corr.sl
% $Id: show_tgain_corr.sl,v 1.7 2007/09/13 10:44:01 egalle Exp $
```

Note that `$ASCDS_CONTRIB/share/slsh/local-packages/` is the default path in the standard CIAO scripts installation. If you do not have the scripts installed or need to update to a newer version, please refer to the [Scripts page](#). To run `show_tgain_corr`, supply an ACIS chip number and the desired location in chip coordinates, e.g.

```
unix% show_tgain_corr 3 962 964
unix% show_tgain_corr 7 221 532
```

These commands create a plot of the adjustment in energy for an on-axis source observed with [chip I3](#) and [chip S3](#), respectively. The plot compares the newest TGAIN files to the previous default versions.

The script includes options to plot in PHA and to store the output as a PS or GIF file; the help file for the script (`ahelp show_tgain_corr`) has more information.

Improvements in Calibration

- **CALDB 3.5.0:** New time-dependent gain calibration files for 01 May 2008 – 31 July 2008 (Epoch 34) were added in CALDB 3.5.0 (08 September 2008). The [CALDB 3.5.0 section](#) of the CIAO release notes explains how the files will affect your analysis.
- **CALDB 3.4.5:** New time-dependent gain calibration files for 01 February 2008 – 31 April 2008 (Epoch 33) were added in CALDB 3.4.5 (23 June 2008). The [CALDB 3.4.5 section](#) of the CIAO release notes explains how the files will affect your analysis.
- **CALDB 3.4.3:** New time-dependent gain calibration files for 01 November 2007 – 31 January 2008 (Epoch 32) were added in CALDB 3.4.3 (31 March 2008).

A TGAIN correction for the back-illuminated chips (S1 and S3) at the –110 C focal plane temperature has also been released for the first time.

The [CALDB 3.4.3 section](#) of the CIAO release notes explains how the files will affect your analysis.

- **CALDB 3.4.2:** New time-dependent gain calibration files for 01 August 2007 – 31 October 2007 (Epoch 31) were added in CALDB 3.4.2 (14 Dec 2007). The [CALDB 3.4.2 section](#) of the CIAO release notes explains how the files will affect your analysis.
- **CALDB 3.4.1:** New time-dependent gain calibration files for 01 May 2007 – 31 July 2007 (Epoch 30) were added in CALDB 3.4.1 (14 Sept 2007). The [CALDB 3.4.1 section](#) of the CIAO release notes explains how the files will affect your analysis.
- **CALDB 3.4.0:** New time-dependent gain calibration files for 01 August 2006 – 31 October 2006 (Epoch 28) were added in CALDB 3.4.0 (16 May 2007). The [CALDB 3.4.0 section](#) of the CIAO release notes explains how the files will affect your analysis.
- **CALDB 3.3.0:** As a result of the new ACIS –120 C BI chip CTI corrections in CALDB 3.3.0 (18 December 2006), the –120 C BI T_GAIN corrections had to be adjusted. The new time-dependent gain corrections were released in CALDB 3.3.0 as well. Only calibration for the BI chips (S1, S3) has changed in these files; calibration for the FI chips is identical to the v5 files. The [How CIAO 3.4 and CALDB 3.3.0 Affect Your Analysis](#) section of the CIAO release notes explains how the files will affect your analysis.
- **CALDB 3.2.2:** New time-dependent gain corrections for the May 2005 – November 2005 time period (Epochs 23 and 24) were released in CALDB 3.2.2 (15 May 2006). *Note that unless you are fitting a spectra with oxygen emission lines, the gain refinement is unlikely to have an effect on the spectrum larger than the uncertainties in determining the gain.*

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The How CALDB 3.2.2 Affects Your Analysis section of the CIAO 3.3.0.1 release notes explains how the new calibration will affect your analysis.

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URL:
<http://cxc.harvard.edu/ciao3.4/why/acistgain.html>
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