



CIAO 3.4 Release Notes

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The CIAO 3.4 webpages are no longer actively updated. CIAO 3.4 users should check the [CALDB 3 website](#) for compatible calibration updates.

There are CIAO patches for Mac OS X 10.4 on PowerPC; refer to the [CIAO 3.4.1 and 3.4.1.1 Release Notes](#) for information.

The CIAO 3.4 and CALDB 3.3.0 releases primarily consist of changes related to the CTI corrections. The CTI-adjustment algorithm included in [acis_process_events](#) now accommodates the newly calibrated serial CTI on the back-illuminated CCDs. This is in addition to the continued support for parallel CTI. This CIAO release also contains two new tools for working with HRC data ([hrc_build_badpix](#), [hrc_dtfstats](#)) and the ability to update WCS in non-Chandra images ([reproject_aspect](#), [wcs_match](#), [wcs_update](#)). Significant work has been done on the tool [psf_project_ray](#), which has four new parameters. Plus bug fixes to the Data Model library and several CIAO tools.

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How CALDB 3.5.0 Affects Your Analysis

This section of the release notes describes how the CALDB 3.5.0 release (08 September 2008) will affect your analysis. The changes are arranged by instrument and grating configuration.

(CALDB 3.5.0 is the first public release since CALDB 3.4.5.)

ACIS Imaging and Grating Data

• Time-dependent ACIS Gain (TGAIN) Files for -120 C Data

There are new time-dependent ACIS Gain (TGAIN) files for 01 May 2008 - 31 July 2008 (Epoch 34):

```
acisD2008-02-01t_gainN0005.fits
acisD2008-02-01t_gainN0006.fits
acisD2008-05-01t_gainN0002.fits
acisD2008-05-01t_gain_biN0002.fits
```

The files are applicable to **-120 C focal plane temperature only**. The `acisD2008-05-01t_gain[_bi]N0002.fits` files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

- ◆ ACIS-I3 aimpoint: version N0006 files showing T_GAIN energy shifts
- ◆ ACIS-S3 aimpoint: no CTI correction applied
- ◆ ACIS-S3 aimpoint: with CTI correction applied

The differences in these figures are attributed to whether the T_GAINs are derived from CTI-corrected data or non-CTI data.

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The `DATE-OBS` header keyword records the observation start date.

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.

ACIS -110 C Grating Data

• Order-sorting (OSIP) Files for the Back-illuminated Chips (S1, S3)

New order-sorting files for the back-illuminated chips S1 and S3 at -110 C have been made available to correspond to the ACIS -110C GAIN file released in CalDB 3.4.3 (March 2008):

```
acisD1999-09-16osipN0007.fits
acisD2000-08-11osipN0007.fits
```

The file `acisD2000-08-11osipN0007.fits` has the identical data set in the OSIP table extension, but is effective for the -110 C recalibration period (UTC) 2000-08-11T00:00:00 through 2000-08-12T22:00:00. Grating observations taken during this period should use the new OSIP data as well.

Beginning a new analysis

If you are beginning a new analysis, reprocess your data with `acis_process_events` to apply the newest calibration. The reprocessing will also ensure that the same OSIP files are applied to the data (via `tg_resolve_events`) and to the response files (via `mkgarf`).

Analyses in progress

If you have an analysis in progress, use this information to evaluate whether or not the calibration updates will significantly impact your results.

- ◆ Chip S1: the previous OSIP had an acceptance region artificially broadened for the older, poorer S1 gain function. Applying the new OSIP in conjunction with the gain released in CALDB 3.4.3 markedly improves analysis of data on chip S1.
- ◆ Chip S3: changes in the order sorting are within the noise.

Applying the new calibration means redoing your entire analysis from the level=1 event file, as shown in the [Create a New Level=2 Event File thread](#), including creating a new PHA2 file. You will also have to remake any spectra and response files (ARF, RMF) used in your analysis.

Users who do not reprocess their data need to be sure to use the same OSIP file that was applied to the data when creating gARFs. The CIAO software will automatically pick up the most recent applicable file, which may be different than the one used by `tg_resolve_events`.

The file name is recorded in the `evt1a.fits` or `evt2.fits` file header:

```
unix% dmkeypar acis_evt2.fits OSIPFILE echo+
acisD1999-09-16osipN0006.fits
```

This file is not the same as the new file, `acisD1999-09-16osipN0007.fits`. Set this filename in the `osipfile` parameter:

```
unix% pset mkgarf osipfile=$CALDB/data/chandra/acis/cpf/osip/acisD1999-09-16osipN0006.fits
```

How CALDB 3.4.5 Affects Your Analysis

This section of the release notes describes how the CALDB 3.4.5 release (23 June 2008) will affect your analysis. The changes are arranged by instrument and grating configuration.

(CIAO 3.4.4 was not released to the public.)

ACIS Imaging and Grating Data

• Time-dependent ACIS Gain (TGAIN) Files for -120 C Data

There are new time-dependent ACIS Gain (TGAIN) files for 01 February 2008 - 31 April 2008 (Epoch 33):

```
acisD2007-11-01t_gainN0005.fits
acisD2007-11-01t_gainN0006.fits
acisD2008-02-01t_gainN0002.fits
acisD2008-02-01t_gain_biN0002.fits
```

The files are applicable to **-120 C focal plane temperature only**. The `acisD2008-02-01t_gain[_bi]N0002.fits` files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

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- ◆ ACIS-I3 aimpoint: version N0005 files showing T_GAIN energy shifts
- ◆ ACIS-I3 aimpoint: version N0006 files showing T_GAIN energy shifts

Note that the plots of the I3 files are identical. The same CTI-corrected T_GAIN data for the FI chips exist in both.

- ◆ ACIS-S3 aimpoint: no CTI correction applied
- ◆ ACIS-S3 aimpoint: with CTI correction applied

The differences in these figures are attributed to whether the T_GAINs are derived from CTI-corrected data or non-CTI data.

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The DATE-OBS header keyword records the observation start date.

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.

How CALDB 3.4.3 Affects Your Analysis

This section of the release notes describes how the CALDB 3.4.3 release (31 March 2008) will affect your analysis. The changes are arranged by instrument and grating configuration.

ACIS Imaging and Grating Data

• Time-dependent ACIS Gain (TGAIN) Files for -120 C Data

There are new time-dependent ACIS Gain (TGAIN) files for 01 November 2007 - 31 January 2008 (Epoch 32):

```
acisD2007-08-01t_gainN0005.fits
acisD2007-08-01t_gainN0006.fits
acisD2007-11-01t_gainN0002.fits
acisD2007-11-01t_gain_biN0002.fits
```

The files are applicable to **-120 C focal plane temperature only**. The acisD2007-11-01t_gain[_bi]N0002.fits files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

- ◆ ACIS-I3 aimpoint: version N0005 files showing T_GAIN energy shifts
- ◆ ACIS-I3 aimpoint: version N0006 files showing T_GAIN energy shifts

Note that the plots of the I3 files are identical.

- ◆ ACIS-S3 aimpoint: no CTI correction applied
- ◆ ACIS-S3 aimpoint: with CTI correction applied

The differences in these figures are attributed to whether the T_GAINs are derived from CTI-corrected data or non-CTI data.

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The DATE-OBS header keyword records the observation start date.

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.

• Time-dependent ACIS Gain (TGAIN) Files for -110 C Data

A TGAIN correction for the back-illuminated chips (S1 and S3) at **the -110 C focal plane temperature** has been derived. This file is a flat correction based on the -120 C gains used for the two BI chips. The corresponding gain file is also included in this release:

```
acisD1999-09-16t_gainN0005.fits
acisD1999-09-16gainN0006.fits
```

These plots illustrate the degree of change the -110 C file (red plot) will produce in comparison with the -120 C Epoch 1, 2, and 3 files.

- ◆ [S3 aimpoint](#)
- ◆ [S3 midpoint](#)
- ◆ [S1 midpoint](#)

Users working with ACIS data taken at -110 C on ACIS-S1 or S3 should reprocess to apply the TGAIN calibration to the data.

Creating RMFs: if the -110 C TGAIN is applied to the data, users *must* use the tool [mkacisrmf](#) when creating RMFs for S1 and S3, otherwise the response file will be wrong. RMFs for the front-illuminated chips should still be made with the tool [mkrmf](#). The [mkacisrmf why topic](#) and [thread](#) have details on how to run the tool.

How CALDB 3.4.2 Affects Your Analysis

This section of the release notes describes how the CALDB 3.4.2 release will affect your analysis. The changes are arranged by instrument and grating configuration.

ACIS Imaging Data

• Time-dependent ACIS Gain (TGAIN) Files

There are new time-dependent ACIS Gain (TGAIN) files for 01 August 2007 - 31 October 2007 (Epoch 31):

```
acisD2007-05-01t_gainN0005.fits
acisD2007-05-01t_gainN0006.fits
acisD2007-08-01t_gainN0002.fits
acisD2007-08-01t_gain_biN0002.fits
```

The files are applicable to **-120 C data only**. The `acisD2007-08-01t_gain[_bi]N0002.fits` files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

- ◆ [ACIS-I3 aimpoint](#): version N0005 files
- ◆ [ACIS-I3 aimpoint](#): version N0006 files.

As shown in both of the figures above, the T_GAIN correction at the I3 aimpoint is currently diminishing with time.

- ◆ ACIS-S3 aimpoint: no CTI correction applied
- ◆ ACIS-S3 aimpoint: with CTI correction applied

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The DATE-OBS header keyword records the observation start date.

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.

ACIS Grating Data

• Time-dependent ACIS Gain (TGAIN) Files

There are new time-dependent ACIS Gain (TGAIN) files for 01 August 2007 - 31 October 2007 (Epoch 31):

```
acisD2007-05-01t_gainN0005.fits
acisD2007-05-01t_gainN0006.fits
acisD2007-08-01t_gainN0002.fits
acisD2007-08-01t_gain_biN0002.fits
```

The files are applicable to **-120 C data only**. The `acisD2007-08-01t_gain[_bi]N0002.fits` files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

- ◆ ACIS-I3 aimpoint: version N0005 files
- ◆ ACIS-I3 aimpoint: version N0006 files.

As shown in both of the figures above, the T_GAIN correction at the I3 aimpoint is currently diminishing with time.

- ◆ ACIS-S3 aimpoint: no CTI correction applied
- ◆ ACIS-S3 aimpoint: with CTI correction applied

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The DATE-OBS header keyword records the observation start date.

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.

How CALDB 3.4.1 Affects Your Analysis

This section of the release notes describes how the CALDB 3.4.1 release will affect your analysis. The changes are arranged by instrument and grating configuration.

ACIS Imaging Data

• Time-dependent ACIS Gain (TGAIN) Files

There are new time-dependent ACIS Gain (TGAIN) files for 01 May 2007 - 31 July 2007 (Epoch 30):

```
acisD2007-02-01t_gainN0005.fits
acisD2007-02-01t_gainN0006.fits
```

```
acisD2007-05-01t_gainN0002.fits  
acisD2007-05-01t_gain_biN0002.fits
```

The files are applicable to **-120 C data only**. The `acisD2007-05-01t_gain[_bi]N0002.fits` files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

Epoch 30

- ◆ ACIS-I3 aimpoint: version N0005 files
- ◆ ACIS-I3 aimpoint: version N0006 files

In both of the above figures it is apparent that the T_GAIN correction at the I3 aimpoint is diminishing over Epochs 28 - 30.

- ◆ ACIS-S3 aimpoint: no CTI correction applied
- ◆ ACIS-S3 aimpoint: with CTI correction applied

In the S3 case, the general trends with energy and Epoch number are the same for the CTI and non-CTI cases by comparison, but with clear differences between them in specific values particularly above 5 keV. This is normal for recent epochs with T_GAIN corrections.

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The DATE-OBS header keyword records the observation start date.

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.

• ACIS Blank-Sky Background Files

The newest versions of the ACIS blank-sky background files are now available in the CALDB.

This set of ACIS background files includes:

- ◆ files for -120 C data on ACIS-5 or ACIS-7 with CTI_APP = P P P P P B P B P P header keyword value (i.e. parallel and serial CTI applied to the back-illuminated chips)
- ◆ CTI-corrected files for ACIS-8 (ACIS-S4).
- ◆ upgrades to the files for chips 1-3, 5-7, and 8 with ACIS-S in the focal plane. These files include the newest CTI and TGAIN corrections.

The non-CTI-corrected background files for these chips have the TGAIN applied. This matches how observational data at -120 C without the CTI-correction would be processed.

The Using the ACIS "Blank-Sky" Background Files thread contains instructions on how to select a file and match it to a specific observation.

ACIS Grating Data

• Time-dependent ACIS Gain (TGAIN) Files

There are new time-dependent ACIS Gain (TGAIN) files for 01 May 2007 - 31 July 2007 (Epoch 30):

```
acisD2007-02-01t_gainN0005.fits  
acisD2007-02-01t_gainN0006.fits
```

```
acisD2007-05-01t_gainN0002.fits
acisD2007-05-01t_gain_biN0002.fits
```

The files are applicable to **-120 C data only**. The `acisD2007-05-01t_gain[_bi]N0002.fits` files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

Epoch 30

- ◆ ACIS-I3 aimpoint: version N0005 files
- ◆ ACIS-I3 aimpoint: version N0006 files

In both of the above figures it is apparent that the T_GAIN correction at the I3 aimpoint is diminishing over Epochs 28 - 30.

- ◆ ACIS-S3 aimpoint: no CTI correction applied
- ◆ ACIS-S3 aimpoint: with CTI correction applied

In the S3 case, the general trends with energy and Epoch number are the same for the CTI and non-CTI cases by comparison, but with clear differences between them in specific values particularly above 5 keV. This is normal for recent epochs with T_GAIN corrections.

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The DATE-OBS header keyword records the observation start date.

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.

• ACIS Blank-Sky Background Files

The newest versions of the ACIS blank-sky background files are now available in the CALDB.

This set of ACIS background files includes:

- ◆ files for -120 C data on ACIS-5 or ACIS-7 with CTI_APP = P P P P P B P B P P header keyword value (i.e. parallel and serial CTI applied to the back-illuminated chips)
- ◆ CTI-corrected files for ACIS-8 (ACIS-S4).
- ◆ upgrades to the files for chips 1-3, 5-7, and 8 with ACIS-S in the focal plane. These files include the newest CTI and TGAIN corrections.

The non-CTI-corrected background files for these chips have the TGAIN applied. This matches how observational data at -120 C without the CTI-correction would be processed.

The Using the ACIS "Blank-Sky" Background Files thread contains instructions on how to select a file and match it to a specific observation.

HRC-I Imaging and Grating Data

• HRC-I Degap

A new gap lookup table, `hrcid1999-07-22gaplookupN0003.fits`, is needed to improve the off-aimpoint gap map solution for HRC-I at certain locations.

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New observations of Capella from December 2005 - January 2006 and January 2007 were used to improve the degap solution for the CRSU=12-13 region, while including a slightly more optimized solution for other detector positions. The details of the refinements are presented in the memorandum HRC-I Degap Lookup from Capella Data - 2007
[http://hea-www.harvard.edu/%7Ejuda/memos/hrci_degap_lookup/capella/degap/2007/degap_lookup.html].

Users must reprocess the data with `hrc_process_events` to apply the new calibration, e.g. by following the Create a New Level=2 Event File thread. The correct file will automatically be chosen by the tool.

How CALDB 3.4.0 Affects Your Analysis

This section of the release notes describes how the CALDB 3.4.0 release will affect your analysis. The changes are arranged by instrument and grating configuration.

ACIS Imaging Data

• Time-dependent ACIS Gain (TGAIN) Files

There are new time-dependent ACIS Gain (TGAIN) files for 01 August 2006 - 31 October 2006 (Epoch 28) and 01 February 2007 - 30 April 2007 (Epoch 29):

```
acisD2006-08-01t_gainN0005.fits
acisD2006-08-01t_gainN0006.fits
acisD2006-11-01t_gain_biN0002.fits
acisD2006-11-01t_gainN0002.fits
acisD2006-11-01t_gainN0005.fits
acisD2006-11-01t_gainN0006.fits
acisD2007-02-01t_gain_biN0002.fits
acisD2007-02-01t_gainN0002.fits
```

The files are applicable to **-120 C data only**. The `acisD2007-02-01t_gain[_bi]N0002.fits` files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

Epoch 28

- ◆ ACIS-I3 aimpoint: 2006-08-01 v5 and 2006-11-01 v2 files
- ◆ ACIS-I3 aimpoint: 2006-08-01 v6 and 2006-11-01 v2 files

The changes introduced in these files is very small, nearly negligible.

- ◆ ACIS-S3 aimpoint: 2006-08-01 v5 and 2006-11-01 v2 files
- ◆ ACIS-S3 aimpoint: 2006-08-01 v6 and 2006-11-01 v2 files

The change in these files is 5% or less.

Epoch 29

- ◆ ACIS-I3 aimpoint: 2006-11-01 v5 and v2 files
- ◆ ACIS-I3 aimpoint: 2006-11-01 v6 and v2 files

The changes introduced in these files is relatively small (a few percent) at the I3 aimpoint, but not negligible.

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- ◆ ACIS-S3 aimpoint: 2006-11-01 v5 and 2007-02-01 v2 files
- ◆ ACIS-S3 aimpoint: 2006-11-01 v6 and 2007-02-01 v2 files

The only significant changes introduced by these updates occur for the CTI-corrected case above 8 keV; even then, the change is 5% or less.

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The DATE-OBS header keyword records the observation start date.

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.

• ACIS Blank-Sky Background Files

The newest versions of the ACIS blank-sky background files are now available in the CALDB. These files replace the outdated background files, which have been removed from CALDB 3.4.0.

There are several improvements in these files:

- ◆ The background data have been divided so that there is one chip per file. A unique background file is returned for each chip that contains data in the event file. Users should no longer see the "WARNING: 2 CALDB files found. Using the first" error when looking up a background file.
- ◆ The CTI-corrected files also have the time-dependent gain (TGAIN) correction applied.
- ◆ The background files have reasonable TSTART and TSTOP values in the header. This eliminates a CALDB lookup problem that was primarily seen when using CIAO response tools, e.g. via running `specextract`.
- ◆ There is no TIME column. The TIME column was previously removed before reprojecting the background file, and so was never used in analysis.
- ◆ The FILTER header keyword has been removed. Previous versions of the file had an incorrect filter value, which caused some CALDB lookups to fail.

The Using the ACIS "Blank-Sky" Background Files thread contains instructions on how to select a file and match it to a specific observation.

The `acis_bkgrnd_lookup` script has been updated to use a more accurate method of choosing the background file to match an observation. Users must upgrade to v1.12 of `acis_bkgrnd_lookup` in order to use the new background files. The script is available as part of the CIAO scripts package, `CIAO_scripts.tar`; see the script installation instructions for details.

ACIS Grating Data

• Time-dependent ACIS Gain (TGAIN) Files

There are new time-dependent ACIS Gain (TGAIN) files for 01 August 2006 - 31 October 2006 (Epoch 28) and 01 February 2007 - 30 April 2007 (Epoch 29):

```
acisD2006-08-01t_gainN0005.fits
acisD2006-08-01t_gainN0006.fits
acisD2006-11-01t_gain_biN0002.fits
acisD2006-11-01t_gainN0002.fits
acisD2006-11-01t_gainN0005.fits
acisD2006-11-01t_gainN0006.fits
acisD2007-02-01t_gain_biN0002.fits
```

`acisD2007-02-01t_gainN0002.fits`

The files are applicable to **-120 C data only**. The `acisD2007-02-01t_gain[_bi]N0002.fits` files are the new default processing files in the CALDB.

These plots illustrate the degree of change the new files will produce in comparison with the old files.

Epoch 28

- ◆ ACIS-I3 aimpoint: 2006-08-01 v5 and 2006-11-01 v2 files
- ◆ ACIS-I3 aimpoint: 2006-08-01 v6 and 2006-11-01 v2 files

The changes introduced in these files is very small, nearly negligible.

- ◆ ACIS-S3 aimpoint: 2006-08-01 v5 and 2006-11-01 v2 files
- ◆ ACIS-S3 aimpoint: 2006-08-01 v6 and 2006-11-01 v2 files

The change in these files is 5% or less.

Epoch 29

- ◆ ACIS-I3 aimpoint: 2006-11-01 v5 and v2 files
- ◆ ACIS-I3 aimpoint: 2006-11-01 v6 and v2 files

The changes introduced in these files is relatively small (a few percent) at the I3 aimpoint, but not negligible.

- ◆ ACIS-S3 aimpoint: 2006-11-01 v5 and 2007-02-01 v2 files
- ◆ ACIS-S3 aimpoint: 2006-11-01 v6 and 2007-02-01 v2 files

The only significant changes introduced by these updates occur for the CTI-corrected case above 8 keV; even then, the change is 5% or less.

Users working with ACIS data taken during this period may wish to reprocess to improve the TGAIN calibration in their data. The `DATE-OBS` header keyword records the observation start date.

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.

• MEG LSFARM Files

There are new +/- 1 MEG LSFARM files for use in creating ACIS/HETG grating RMFs (gRMFs). A very small error was identified in the derivation and calculation of the MEG LSF. The effect of the error was a broadening of the MEG LSF model by approximately 0.007 Å.

These calibration files may only be used with data that have been processed with chip pixel coordinate randomization turned off (check the `RAND_TG` header keyword). This has been the default in processing and recommendation for data analysis since CIAO 3.1/DS 7.3.0.

Refer to the Create Grating RMFs for ACIS-S Observations thread for instructions on making gRMFs.

• ACIS Blank-Sky Background Files

The newest versions of the ACIS blank-sky background files are now available in the CALDB. These files replace the outdated background files, which have been removed from CALDB 3.4.0.

There are several improvements in these files:

- ◆ The background data have been divided so that there is one chip per file. A unique background file is returned for each chip that contains data in the event file. Users should no longer see the "WARNING: 2 CALDB files found. Using the first" error when looking up a background file.
- ◆ The CTI-corrected files also have the time-dependent gain (TGAIN) correction applied.
- ◆ The background files have reasonable TSTART and TSTOP values in the header. This eliminates a CALDB lookup problem that was primarily seen when using CIAO response tools, e.g. via running `specextract`.
- ◆ There is no TIME column. The TIME column was previously removed before reprojecting the background file, and so was never used in analysis.
- ◆ The FILTER header keyword has been removed. Previous versions of the file had an incorrect filter value, which caused some CALDB lookups to fail.

The Using the ACIS "Blank-Sky" Background Files thread contains instructions on how to select a file and match it to a specific observation.

The `acis_bkgrnd_lookup` script has been updated to use a more accurate method of choosing the background file to match an observation. Users must upgrade to v1.12 of `acis_bkgrnd_lookup` in order to use the new background files. The script is available as part of the CIAO scripts package, `CIAO_scripts.tar`; see the script installation instructions for details.

HRC-I Imaging and Grating Data

• HRC-I Gain Maps

New gain correction maps are available for HRC-I data. The most important change in determining the new gain map values is including a careful background subtraction when comparing the offset to aimpoint in the calibration data, in addition to excluding background-dominated channels from the comparison.

Users must reprocess the data with `hrc_process_events` to apply the new calibration, e.g. by following the Create a New Level=2 Event File thread. The correct file will automatically be chosen by the tool.

The details of the refinements are presented in the memorandum HRC-I Gain Correction (PS), by J. Posson-Brown and V. Kashyap. For more information, refer to the Gain Response of the HRC webpage.

HRC-S Grating Data

• HRC-S Quantum Efficiency (QE) File

HRC-S QE version 9 (`hrscD1999-07-22qeN0009.fits`) has been added to the CALDB. The LETGS calibration team has released refinements to the HRC-S QE in the region of the Oxygen K-edge which resolve certain instrumental structures at that point, enabling more accurate characterization of source spectra when using the LETG/HRC-S configuration.

Create a gARF by following the Compute LETG/HRC-S Grating ARFs thread and the new file will automatically be applied.

How the CALDB 3.3.0.1 Patch Affects Your Analysis

The CALDB 3.3.0.1 patch was released on 02 February 2007. All users should install this patch to have a properly functioning CALDB.

Caveat: ACIS -120C FEF for CTI-corrected ACIS data

- The CALDB 3.3.0.1 patch corrects an indexing problem that affects users who:
 - ◆ have -120 C TIMED mode data that were CTI-corrected by `acis_process_events` in CIAO 3.4 or version DS 7.6.10 of standard data processing, i.e. the `CTI_APP` keyword is present in the output file header.
 - ◆ GRADED mode data are not affected.
 - ◆ used `mkrmf` to create an RMF file, either standalone (with `acis_fef_lookup`) or via the `psextract` or `acispec` scripts.

The `specextract` tool is not affected, neither is the tool `mkacisrmf`.

An error in the CALDB index file caused an incorrect FEF file (`acisD2000-01-29fef_phaN0005.fits`) to be chosen during the analysis. You can check the event and RMF file header keywords to see if your data are affected:

```
unix% dmkeypar acis_1838_evt2.fits CTI_APP echo+
PPPPBPBPP

unix% dmkeypar acis_1838_evt2.fits ASCDSVER echo+
CIAO 3.4

unix% dmkeypar source.rmf FEFFILE echo+
/soft/ciao/CALDB/data/chandra/acis/cpf/feffs/acisD2000-01-29fef_phaN0005.fits
```

After applying the 3.3.0.1 patch to the CALDB, the version N0004 calibration file (`acisD2000-01-29fef_pha_ctiN0004.fits`) should be correctly selected as input to `mkrmf`.

NOTE: Users with -120 C ACIS imaging data or the zero-order of a grating observation taken in (V)FAINT mode are advised that they should be using `mkacisrmf` to create RMF files. `mkacisrmf` is fully calibrated for all ten ACIS chips in these modes. Refer to the Creating ACIS RMFs with `mkacisrmf` thread for more information.

How CIAO 3.4 and CALDB 3.3.0 Affect Your Analysis

Some tool changes and calibration files released in CIAO 3.4 and CALDB 3.3.0 affect analyses in progress, i.e. certain processing steps should be run again for greater accuracy. This section of the release notes describes those changes, as well as the affected tasks, **arranged by instrument and grating configuration**.

Reprocessing your data ensures that the newest calibration available is applied consistently through the analysis. Follow the Create a New Level=2 Event File thread if you know you want to reprocess and are not concerned about the details of the calibration changes.

CALDB 3.3.0 is required for the proper operation of CIAO 3.4. Likewise, do not update to CALDB 3.3.0, unless you are using CIAO 3.4.

Who Is Not Affected

- If your observation:
 - ◆ only uses the ACIS-I array (chips 0-3)
 - ◆ was **not** taken at the -120 C focal plane temperature
 then there is nothing in the CIAO 3.4 and CALDB 3.3.0 releases that affects your data analysis.

Also, if your data was processed with standard data processing version DS 7.6.10 or higher, **you do not need to reprocess**. CALDB 3.3.0 became part of SDP at DS 7.6.10. The software version used in processing is stored in the `ASCDSVER` header keyword.

ACIS Imaging Data (-120 C)

- A summary of how ACIS Imaging Data analyses are affected is followed by the specific calibration changes in this release.

Beginning a new analysis

If you are beginning a new analysis with data on a BI chip, reprocess your data with `acis_process_events` to apply the newest calibration.

New analyses on FI chips will automatically pick up the N0005 QEU file from the CALDB. No reprocessing is needed in order to use this file.

Analyses in progress

If you have an analysis in progress, use this information to evaluate whether or not the calibration updates will significantly impact your results.

These improvements will be most noticeable for users with high-count emission line data:

- ◆ Significantly more events on the BI chips after correcting for serial CTI. This is due to grade migration from the bad grades (1,5,7) to the good grades (0,2,3,4,6).
- ◆ ~15% improvement in the response function (RMF), enabling separation of close emission lines.
- ◆ Improvements to the ARF from the QEU updates are position-dependent and thus difficult to predict in a general sense. Users can compare new and old ARFs to see the changes.

Applying the new calibration means redoing your entire analysis from the level=1 event file, as shown in the Create a New Level=2 Event File thread. You will also have to remake any spectra and response files (ARF, RMF) used in your analysis.

Users who do not wish to pick up the new QEU file can set `ardlib.par` file to continue using the N0002 file:

```
unix% set calpath = $CALDB/data/chandra/acis/bcf/qe
unix% foreach d ( 0 1 2 3 4 5 6 7 8 9 )
foreach? @ d1 = $d + 1
foreach? pset ardlib AXAF_ACIS${d}_QEU_FILE="$${calpath}/acisD1999-09-16qeun0002.fits[AXAF_QEU${d}]"
foreach? end
```

Make sure to "punlearn" context="tools" or delete your ardlb.par file when you are done working with the N0002 QEU in order to access the newer file.

• ACIS N0006 Suite

The calibration files in the ACIS N0006 suite support the addition of serial and parallel CTI correction for the back-illuminated chips: ACIS-5 (S1) and ACIS-7 (S3). These files are applicable to **-120 C data only**.

The ACIS N0006 suite includes:

- ◆ new time-dependent CTI corrections
- ◆ new time-dependent gain (T_GAIN) corrections
- ◆ upgrades in the P2_RESP file used by mkacisrmf
- ◆ a new set of detector gains

Only calibration for the BI chips has changed in these files; calibration for the FI chips is identical to the N0005 files.

• ACIS QEU files

- ◆ **version N0006:** this file, `acisD2000-01-29qeuN0006.fits`, is for -120 C observations and only affects observations on the **BI chips**.

When the CTI correction is applied to the BI ACIS chips, a number of low-energy events are recovered, because their grades had migrated to BAD grades as a result of loss of charge at the readout. This presents a change in the QE uniformity (QEU) with the CTI correction as compared with the QEU without CTI correction. (For the FI chips, this effect is negligible due to their much-reduced low-energy QE.)

- ◆ **version N0005:** this file, `acisD2000-01-29qeuN0005.fits`, is for -120 C observations and only affects observations on the **FI chips** ACIS-S0, S4, and S5. (Note that few imaging observations use these chips.)

The currently released ACIS -120C QEU (version N0002) does not include calibrated uniformities for FI chips S0, S4 and S5; they have a QEU of 1.0. In the N0005 file, the uniformity of these chips is set equal the the uniformity pattern in chip S2.

• ACIS QE (version N0006)

Improvements at the Si-K edge on the order of 4% have been made for all ACIS chips in the new QE file. Unless you are looking at this energy/wavelength on the ACIS-S3 chip, however, you are unlikely to notice the change in the ARF due to this refinement.

ACIS Grating Data (-120 C)

- A summary of how ACIS Grating Data analyses are affected is followed by the specific calibration changes in this release.

Beginning a new analysis

If you are beginning a new analysis, reprocess your data with `acis_process_events` to apply the newest calibration. The reprocessing will also ensure that the same OSIP files are applied to the data (via `tg_resolve_events`) and to the response files (via `mkgarf`).

Analyses in progress

If you have an analysis in progress, use this information to evaluate whether or not the calibration updates will significantly impact your results.

- ◆ These improvements will be most noticeable for users with high-count emission line data:
 - ◇ Significantly more events on the BI chips after correcting for serial CTI. This is due to grade migration from the bad grades (1,5,7) to the good grades (0,2,3,4,6).
 - ◇ The QEU change on chips S0, S4, and S5 results in a few percent improvement to the gARF. The new OSIP files will affect the accuracy of the gARF, as well.
- Applying the new calibration means redoing your entire analysis from the level=1 event file, as shown in the Create a New Level=2 Event File thread, including creating a new PHA2 file. You will also have to remake any spectra and response files (ARF, RMF) used in your analysis.
- ◆ Users who do not reprocess their data need to be sure to use the same OSIP file that was applied to the data when creating gARFs. The CIAO software will automatically pick up the most recent applicable file, which may be different than the one used by `tg_resolve_events`.

The file name is recorded in the `evt1a.fits` or `evt2.fits` file header:

```
unix% dmkeypar acis_459_evt2.fits OSIPFILE echo+
acisD1999-09-16osipN0006.fits
```

(Note that this file is not the same as the new CTI-corrected N0006 file, `acisD2000-01-29osip_ctiN0006.fits`). Set this filename in the `mkgarf mkgarf` "param="osipfile parameter:

```
unix% pset mkgarf osipfile=$CALDB/data/chandra/acis/cpf/osip/acisD1999-09-16osipN0006.fits
```

- ◆ Users who do not wish to pick up the new QEU file can set `ardlib.par` file to continue using the N0002 file:

```
unix% set calpath = $CALDB/data/chandra/acis/bcf/qe
unix% foreach d ( 0 1 2 3 4 5 6 7 8 9 )
foreach? @ d1 = $d + 1
foreach? pset ardlib \
          AXAF_ACIS${d}_QEU_FILE="${calpath}/acisD1999-09-16qeun0002.fits[AXAF_QEU${d1}]"
foreach? end
```

Make sure to "punlearn" `context="tools"` or delete your `ardlib.par` file when you are done working with the N0002 QEU in order to access the newer file.

• ACIS N0006 Suite

The calibration files in the ACIS N0006 suite support the addition of serial and parallel CTI correction for the back-illuminated chips: ACIS-5 (S1) and ACIS-7 (S3). These files are applicable to **-120 C data only**.

The ACIS N0006 suite includes:

- ◆ new time-dependent CTI corrections
- ◆ new time-dependent gain (T_GAIN) corrections
- ◆ upgrades in the P2_RESP file used by `mkacisrmf`
- ◆ a new set of detector gains

Only calibration for the BI chips has changed in these files; calibration for the FI chips is identical to the N0005 files.

• ACIS OSIP tables

New ACIS order sorting and integrated probability (OSIP) tables have been developed from the ACIS -120 C P2_RESP file. (The older OSIP files were based on the ACIS FEF files.) The new OSIPs include the corrected gain function for ACIS-S1, which has been in the CALDB for some time. They also accurately specify the FRACEXPO column in the output gARF.

- ◆ **version N0006:** this file, `acisD2000-01-29osip_ctiN0006.fits`, is for -120 C observations that use both **FI and BI chips** which have the CTI correction applied. The calibration for the FI chips is identical to that in the N0005 file.
- ◆ **version N0005:** this file, `acisD2000-01-29osip_ctiN0005.fits`, is for -120 C observations that use **FI chips** which have the CTI correction applied.

The PIMMS Effective Area pages have examples of how the new files affect responses for HETG/ACIS-S and LETG/ACIS-S. Refer to the CALDB release notes for technical details on the files.

• ACIS QEU files

- ◆ **version N0006:** this file, `acisD2000-01-29qeuN0006.fits`, is for -120 C observations and only affects observations on the **BI chips**.

When the CTI correction is applied to the BI ACIS chips, a number of low-energy events are recovered, because their grades had migrated to BAD grades as a result of loss of charge at the readout. This presents a change in the QE uniformity (QEU) with the CTI correction as compared with the QEU without CTI correction. (For the FI chips, this effect is negligible due to their much-reduced low-energy QE.)

- ◆ **version N0005:** this file, `acisD2000-01-29qeuN0005.fits`, is for -120 C observations and only affects observations on the **FI chips** ACIS-S0, S4, and S5.

The currently released ACIS -120C QEU (version N0002) does not include calibrated uniformities for FI chips S0, S4 and S5; they have a QEU of 1.0. In the N0005 file, the uniformity of these chips is set equal to the uniformity pattern in chip S2. The QEU change results in a few percent improvement to the gARF.

• ACIS QE (version N0006)

Improvements at the Si-K edge on the order of 4% have been made for all ACIS chips in the new QE file. Unless you are looking at this energy/wavelength on the ACIS-S3 chip, however, you are unlikely to notice the change in the ARF due to this refinement.

HRC-S Imaging Data

• HRC-S RMF

An HRC-S RMF has been derived using data from the central plate (up to about 60 angstroms) and is intended for use on the central plate, since that is where imaging observations on the HRC-S are typically done. The RMF can be used on the other HRC-S plates, with the caveat that any error in the PI values (due to uncertainty in the gain correction map) will lead to error in the energy values output by the RMF. There is not currently a time-dependent gain map for the HRC-S, so a correction for the gain decline is not included.

The RMF can be used to calibrate hardness ratios or quantile color-color diagrams (QCCD) to distinguish between gross differences in the spectra.

We do not advocate using this RMF in spectral fits; the spectral response is not sufficiently constraining to achieve a good fit with reasonable errors.

More information on this file is available from the HRC RMF calibration page.

• **HRC Dead Time Corrections**

HRC deadtime corrections are determined as a function of time from detector total event and valid event counters (usually sampled every 2.05 seconds but may differ, depending on telemetry format) and written to a deadtime factor (dtf1) file. The average deadtime correction (DTCOR) for an observation is computed from the dtf1 file, filtered by the relevant good time intervals, and is applied to the corresponding ONTIME to compute the LIVETIME (and EXPOSURE) of the observation.

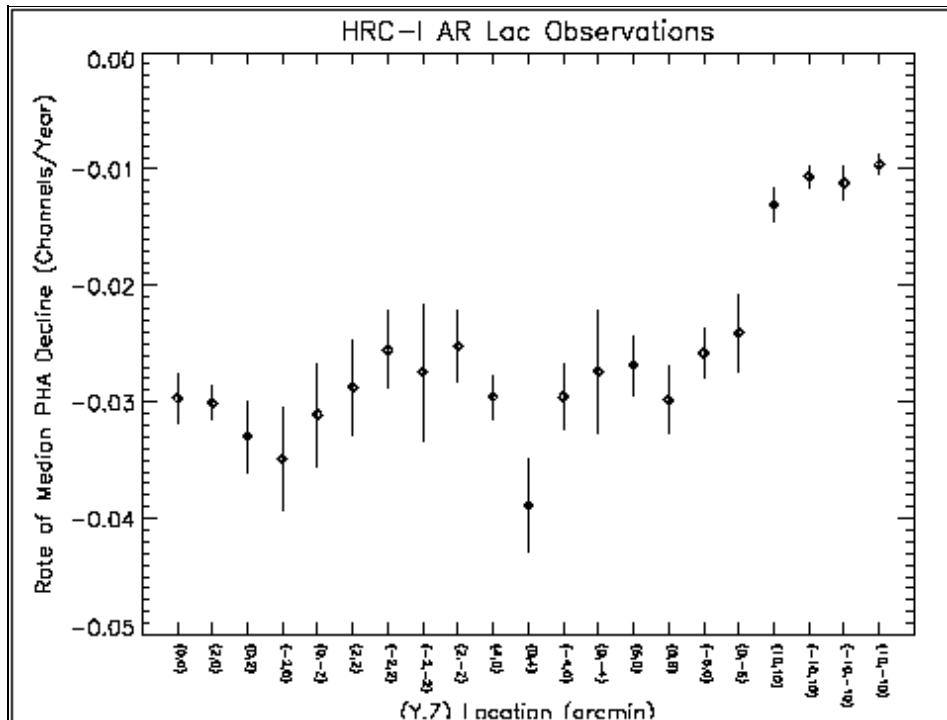
A bug in HRC standard processing led to the use of incorrect good time intervals (GTIs) in the calculation of DTCOR in the dtfstats file, and hence the LIVETIME and EXPOSURE. This bug was introduced in processing version 7.6.4 and resolved in 7.6.8. Users whose datasets were processed with these software versions (ASCDSVER header keyword) should follow the Computing Average HRC Dead Time Corrections thread to verify the deadtime corrections in the data.

HRC-I Imaging Data

• **HRC-I Time-dependent Gain Maps**

There are new time-dependent gain maps for the HRC-I, which correct for the temporal variations in PHA due to the gain decline, as well as correcting for the spatial dependence of PHA.

The following plot illustrates the rate of HRC-I gain decline (click for large PS version):



Users must reprocess the data with `hrc_process_events` to apply the new calibration. The correct file will automatically be chosen by the tool.

More information on these files is available from the Gain Response of the HRC calibration page.

• HRC Dead Time Corrections

HRC deadtime corrections are determined as a function of time from detector total event and valid event counters (usually sampled every 2.05 seconds but may differ, depending on telemetry format) and written to a deadtime factor (dtf1) file. The average deadtime correction (DTCOR) for an observation is computed from the dtf1 file, filtered by the relevant good time intervals, and is applied to the corresponding ONTIME to compute the LIVETIME (and EXPOSURE) of the observation.

A bug in HRC standard processing led to the use of incorrect good time intervals (GTIs) in the calculation of DTCOR in the dtfstats file, and hence the LIVETIME and EXPOSURE. This bug was introduced in processing version 7.6.4 and resolved in 7.6.8. Users whose datasets were processed with these software versions (ASCDSVER header keyword) should follow the Computing Average HRC Dead Time Corrections thread to verify the deadtime corrections in the data.

HRC Grating Data

• HRC Dead Time Corrections

This note is applicable to both HRC-S/LETG and HRC-I/LETG data.

HRC deadtime corrections are determined as a function of time from detector total event and valid event counters (usually sampled every 2.05 seconds but may differ, depending on telemetry format) and written to a deadtime factor (dtf1) file. The average deadtime correction (DTCOR) for an observation is computed from the dtf1 file, filtered by the relevant good time intervals, and is applied to the corresponding ONTIME to compute the LIVETIME (and EXPOSURE) of the observation.

A bug in HRC standard processing led to the use of incorrect good time intervals (GTIs) in the calculation of DTCOR in the dtfstats file, and hence the LIVETIME and EXPOSURE. This bug was introduced in processing version 7.6.4 and resolved in 7.6.8. Users whose datasets were processed with these software versions (ASCDSVER header keyword) should follow the Computing Average HRC Dead Time Corrections thread to verify the deadtime corrections in the data.

Tools

acis_build_badpix

- Pixels in columns adjacent to known bad columns are labeled with status bit 8.
- Labeling various bias status bits no longer excludes CHIPY=1.

acis_process_events

- `acis_process_events` can now apply the newly calibrated serial charge-transfer inefficiency (CTI) on the back-illuminated CCDs. This is in addition to the continued support for parallel CTI. Details on the CTI calibration updates are available in the [How CIAO 3.4 and CALDB 3.3.0 Affect Your Analysis section](#) of these releasenote and in the ACIS CTI Correction why topic.

Release Notes - CIAO 3.4

The tool adds both the CTI_APP and CTI_CORR to the output file header, in order to be backward-compatible with the CALDB.

- Bug fix: pixels identified as having bias values that are too high or too low are recorded in the STATUS column of the event file.
- The very faint pixel check is done after reading the bad pixel inputs, in order to take a new bad pixel file into account.
- Use of new grade file format with different extensions for graded vs. faint modes.
- Change to randomization truncation vs. rounding in the time-dependent gain algorithm. Corrects a mean -0.5 adu (about -2 eV) shift to the adjusted pulse heights.
- The chipx and chipy (or in CC-mode, chipy-targ) values are output to screen or logfile at `verbose=5`.

dmcoords

- Bug fix: interactive "SET" command not working on Mac OS X.

dmcopy

- Bug fix: an error is printed if the kernel name is not a valid option. (Bug fixed in the Data Model library.)
- The `dmcopy clobber` function would not recognize extended filename syntax (e.g. `outfile="out.txt[opt kernel=FITS]"`), and so did had trouble seeing existing output files when specified this way. (Bug fixed in the Data Model library.)

dmextract

- Bug fix: when creating a radial profile, `dmextract` includes a `COUNT_RATE_ERR` column in the output which is full of zeroes.
- Bug fix: when `dmextract` is run with `"opt=ltc1"`, the background exposure time in each bin is now calculated correctly.
- Corrected typo in error message.

dmgti

- The `kernel` parameter has been removed.
- Bug fix: uses the `TIMEPIXR` keyword to modify the start and stop times when creating GTI files.
- Bug fix: checks that the input virtual file syntax is valid.

dmkeypar

- Bug fix: `dmkeypar` will read data from array columns that are part of a vector. (Bug fixed in the Data Model library.)

dmclist

- Bug fix: tool no longer dies with a segmentation fault if any subspace descriptors are missing or empty. (Bug fixed in the Data Model library.)

dmmakereg

- Bug fix: The `dmmakereg` `param="wcsfile` parameter is now correctly used to convert regions such as `circle(10:58:2.0134,-52:26:41.6329,0.05')` into pixel coordinates. Prior to CIAO 3.4, the coordinates were converted into decimal degrees instead of applying the coordinate transformation given in the `wcsfile`.

hrc_build_badpix

- **New Tool!**

`hrc_build_badpix` creates an observation-specific bad pixel file for HRC data. The [Creating a New Observation-Specific HRC Bad Pixel File](#) thread has details on when you need to use this tool, as well as examples of how to run it.

hrc_dtfstats

- **New Tool!**

`hrc_dtfstats` computes deadtime statistics from an HRC deadtime factor file and filters the records on good time intervals. The [Computing Average HRC Dead Time Corrections](#) thread has details on when you need to use this tool, as well as examples of how to run it.

mkacisrmf

- Bug fix: if any required ONTIMEn keywords are missing from the WMAP header, the tool uses the value of ONTIME.
- Changes to support looking up CALDB files with the new `CTI_APP` keyword.
- Corrected typo in error message and changed verbosity level for ONTIME warning.

mkarf

- The `mkarf` `param="obsfile` parameter is no longer redirected to the value of the `mkarf` `param="asphistfile` by default. The recommended input to this parameter is now a level 2 event file or similar FITS file.
- Two new hidden parameters have been added to `mkarf` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. Both of these are needed to compute the dead area efficiency factor; see the parameter descriptions in the `mkarf` `ahelp` file for more information. By default, the correction is "off", i.e. both parameters are set to "NONE".
- Changes to support looking up CALDB files with the new `CTI_APP` keyword.

mkexpmap

- Changes to support looking up CALDB files with the new `CTI_APP` keyword.

mkgarf

- Two new hidden parameters have been added to `mkgarf` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. Both of these are needed to compute the dead area efficiency

Release Notes - CIAO 3.4

factor; see the parameter descriptions in the `mkgarf` `ahelp` file for more information. By default, the correction is "off", i.e. both parameters are set to "NONE".

- The OSIP values used will appear as an additional column in the resulting ARF.
- Changes to support looking up CALDB files with the new `CTI_APP` keyword.

mkgrmf

- Changes to support looking up CALDB files with the new `CTI_APP` keyword.

mkinstmap

- Two new hidden parameters have been added to `mkinstmap` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. Both of these are needed to compute the dead area efficiency factor; see the parameter descriptions in the `mkinstmap` `ahelp` file for more information. By default, the correction is "off", i.e. both parameters are set to "NONE".
- Changes to support looking up CALDB files with the new `CTI_APP` keyword.

mkrmf

- Changes to support looking up CALDB files with the new `CTI_APP` keyword.
- No screen output is printed for `verbose=0`.

mkwarf

- Two new hidden parameters have been added to `mkwarf` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. Both of these are needed to compute the dead area efficiency factor; see the parameter descriptions in the `mkwarf` `ahelp` file for more information. By default, the correction is "off", i.e. both parameters are set to "NONE".
- A third new parameter is `asolfile`. If the aspect solution file(s) for the observation are provided in this parameter, the average `dy`, `dz`, and `dtheta` values are computed and are used to adjust the SIM alignment.
- Single-pixel resolution is used when looking up the QE and QEU (in detector coordinates) since calibration files are calibrated for individual columns. Previously, the tool "grouped" detector pixels into 32x32 pixel regions.

Changes to support looking up CALDB files with the new `CTI_APP` keyword.

- Theta and phi values are passed to `ardlib` in radians.

mtl_build_gti

- The `kernel` parameter has been removed.
- Bug fix: uses the `TIMEPIXR` keyword to modify the start and stop times when creating GTI files.
- Bug fix: checks that the input virtual file syntax is valid.

psf_project_ray

- Four new parameters have been added to `psf_project_ray`. `xblur`, `yblur`, and `ablur`, will apply an elliptical Gaussian randomization to the final sky positions of the rays; the `chip` and `detector` values are unchanged.

If a lightcurve is provided in the `lcfile` parameter, times are randomly assigned to the tool output based on the input lightcurve model.

reproject_aspect

- Bug fix: parameters for `wcs_match` and `wcs_update`, tools called by `reproject_aspect`, are cleared before the script is run.
- Previous bugs restricting use to Chandra images are fixed. The tool can now correctly update WCS in non-Chandra images.

specextract

- Bug fix: `specextract` will check that all input files exist before beginning the processing.
- The script now accepts a stack of output root names. The Using `specextract` to Extract ACIS Spectra and Response Files thread has an example of using this feature.

It is still possible to supply a root string; `specextract` will then name the files `<root>_src1`, `<root>_src2`, and so forth.

- Changes to support looking up CALDB files with the new `CTI_APP` keyword.
- Modified text of reprocessing warning.

tg_resolve_events

- Only the CALDB "osip" file or "none" are supported. An error is generated if `osipfile=CALDB` and a file cannot be resolved. Previously, the CALDB "IRMF" file would be used. This file is still present and supported by the `tg_resolve_events` interface, but its use is not recommended, nor will the file be updated. All calibration updates are now incorporated into the "osip" files.
- Changes to support looking up CALDB files with the new `CTI_APP` keyword.

wavdetect

- The `kernel` parameter has been removed from `wrecon`, which is called by `wavdetect`.

wcs_match

- Previous bugs restricting use to Chandra images are fixed. The tool can now correctly update WCS in non-Chandra images.

wcs_update

- Either a FITS table or an image may be used for the `wcsfile` parameter.
- Previous bugs restricting use to Chandra images are fixed. The tool can now correctly update WCS in non-Chandra images.

wrecon

- The `kernel` parameter has been removed.
- Fix for problem that `psfsize` reported was for blocked pixels not physical pixels.
- The `psfratio` is computed after a refinement to the centroid and size is done.

Parameter Files

Since some of the parameter files have new entries or default values, it is recommended that users delete all old parameter files before running CIAO 3.3. The FAQ on cleaning up parameter files has more information.

ardlib.par

- A new parameter, `AXAF_GAIN_FILE`, has been added to the parameter file.

dmgti

- The `kernel` parameter has been removed; tool output defaults to FITS format.

mkarf

- The `mkarf` `param="obsfile` parameter is no longer redirected to the value of the `mkarf` `param="asphistfile` by default. The recommended input to this parameter is now a level 2 event file or similar FITS file.
- Two new hidden parameters have been added to `mkarf` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. Both of these are needed to compute the dead area efficiency factor; see the parameter descriptions in the `mkarf` `ahelp` file for more information. By default, the correction is "off", i.e. both parameters are set to "NONE".

mkgarf

- Two new hidden parameters have been added to `mkgarf` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. Both of these are needed to compute the dead area efficiency factor; see the parameter descriptions in the `mkgarf` `ahelp` file for more information. By default, the correction is "off", i.e. both parameters are set to "NONE".

mkinstmap

- Two new hidden parameters have been added to `mkinstmap` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. Both of these are needed to compute the dead area efficiency factor; see the parameter descriptions in the `mkinstmap` `ahelp` file for more information. By default, the correction is "off", i.e. both parameters are set to "NONE".

mkwarf

- Two new hidden parameters have been added to `mkwarf` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. Both of these are needed to compute the dead area efficiency factor; see the parameter descriptions in the `mkwarf` `ahelp` file for more information. By default, the correction is "off", i.e. both parameters are set to "NONE".
- A third new parameter is `asolfile`. If the aspect solution file(s) for the observation are provided in this parameter, the average `dy`, `dz`, and `dtheta` values are computed and are used to adjust the SIM alignment.

mtl_build_gti

- The `kernel` parameter has been removed.

psf_project_ray

- Four new parameters have been added to `psf_project_ray`. `xblur`, `yblur`, and `ablur`, will apply an elliptical Gaussian randomization to the final sky positions of the rays; the chip and detector values are unchanged.

If a lightcurve is provided in the `lcfile` parameter, times are randomly assigned to the tool output based on the input lightcurve model.

wrecon

- The `kernel` parameter has been removed.

Data Model

Bug Fixes

- Bug fix: combining the filtering stored in an external file with additional filters, e.g. `"evt2.fits[@range.txt,time=53307835.553:53307835.800]"`.
- Bug fix: reading data from array columns that are part of a vector.
- Data Model tools no longer die with a segmentation fault if subspace descriptors are missing or empty.
- Lines whose first character is a hash (#) are recognized as comments in a CIAO region file.
- Improved handling of `opt` tag:
 - ◆ option tag substrings of 3 or more characters are recognized, e.g. `sub = subspace` and `head = header`.
 - ◆ reports a warning that unrecognized options will be ignored.
- Region boundaries were being converted to the wrong data type for "rectangle" subspaces.
- Fix for open-ended subspace ranges in an input file. They were not getting transferred to the output file correctly; the min/max value was written in place of the open segment.
- Restored FITS ASCII table functionality (e.g. reading FITS file containing ASCII data tables).
- An input filename with a mismatched bracket, e.g. `"input.fits["`, will produce a parsing error.
- If bin range has not been specified, e.g. `"input.fits[bin x:::1,y:::1]"`, the Data Model prints an error message and exits.
- Fixes to three issues with rotation matrix keyword handling:
 - ◆ tolerance value for rotation angle check FTOL to 1.0E-3.
 - ◆ actively delete older CD-style keywords from file when writing PC-style keys so that files do not have both sets.
 - ◆ modify rotation angle calculation to perform better near +/- 90 deg, where errors in the cosine function become significant.
- Proper handling of FITS header keyword values which contain double quotes in a CONTINUE line.
- An error is printed if the kernel name is not a valid option.
- The Data Model had a problem determining the maximum size of a variable length array column when it is not specified in the TFORM keyword. It did not include the last row in the scan, so if that row was

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largest, the amount of space allocated to the buffer was not enough for the data.

- The `dmcopy clobber` function would not recognize extended filename syntax (e.g. `outfile="out.txt [opt kernel=FITS] "`), and so did had trouble seeing existing output files when specified this way.

Subspace Editing

- Users now have the capability to delete subspace keys for specified columns, e.g.

```
unix% dmcoppy "evt2.fits'[subspace -col1,-col2..]" evt2_subspace.fits
```

S-Lang 2.0 compatibility

- Upgraded to SLIRP 1.7.7 and regenerated Data Model S-Lang module so that it will work properly with S-Lang 2.

ds9

CIAO 3.4 contains ds9 v4.0b7, which runs on OS X 10.3 or higher.

If you are using OS X 10.2, you will need to customize your installation to use ds9 v3.0.3 (also packaged with the CIAO 3.4 software).

```
unix% cd $ASCDS_INSTALL/ots/saord
unix% mv ds9 ds9.4.0
unix% mv ds9.3.0.3 ds9
```

Sherpa

There was no development done on Sherpa for CIAO 3.4.

Libraries

hdrlib

- The `FP_TEMP` and `CTI_APP` header keywords will be propagated to output files.

libardlib

- If the gain interface is used, the name of the gain file will be added to the file history.
- For `verbose >= 2`, the expression used to query the CALDB will be printed to the screen.

libemap.h

- The `CYCLE` header keyword will get propagated to the output file.
- Added support for the new dead-area file format.

regionlib

- Included shapes will not be reported to overlap if their bounding boxes do not overlap.
- An output region definition will not begin with an excluded shape.
- Bug fix: fix for problem where if one region shape is partly off the edge of the image, the Data Model would not exclude all the regions in the file correctly.

rmflib

- Changes to support looking up CALDB files with the new `CTI_APP` keyword.
 - No screen output is printed for `verbose=0`.
-

Analysis Scripts

The CIAO contributed scripts package is available from the [Scripts page](#) and is considered a required part of the installation. The script installation instructions explain where the scripts should be unpacked within the CIAO directory tree.

acis_fef_lookup v1.19

- The script has been updated to support the `CTI_APP` keyword and will no longer exit if the `CTI_CORR` keyword is stored as an integer, rather than a boolean, in the file header.
- If the `chipid` is set to "none", `acis_fef_lookup` will not prompt for the `chipx` and `chipy` parameters.

acisspec v3.7

- Two new hidden parameters have been added to `mkwarf` - a tool called by `acisspec` - to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. By default, the correction is "off", i.e. both parameters are set to "NONE". See the parameter descriptions in the `mkwarf` help file for more information.

There is also a new `mkwarf asolfile` parameter which may be set before `acisspec` is run. Read the `mkwarf` help file for information on when you may want to do this.

These changes required that a `punlearn mkwarf` be removed from v3.7 of `acisspec`.

fullgarf v3.3.1

- Two new hidden parameters have been added to `mkgarf` - a tool called by `fullgarf` - to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. By default, the correction is "off", i.e. both parameters are set to "NONE". See the parameter descriptions in the `mkgarf` help file for more information.

The `fullgarf` script itself was not changed for CIAO 3.4.

merge_all v3.4

- Two new hidden parameters have been added to `mkinstmap` - a tool called by `merge_all` - to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. By default, the

correction is "off", i.e. both parameters are set to "NONE".

UPDATED in February 2007: Since `merge_all` runs `mkinstmap` with a merged event file, it IS NOT appropriate to try to apply the ACIS dead area correction while running this script. Users who wish to apply this calibration should use the step-by-step exposure maps threads, online at <http://cxc.harvard.edu/ciao/threads/imag.html>.

- The script has also been updated to not prompt the user for parameters that have been supplied on the command line.

psextract v3.4

- There were several parameter changes to `mkarf` - a tool called by `psextract` - in the CIAO 3.4 release.

The `mkarf obsfile` parameter should be set to the event file instead of the `asphist` file. This parameter change was made in v3.4 of `psextract`.

Two new hidden parameters have also been added to `mkarf` to allow the ACIS dead area correction to be taken into account: `pbkfile` and `dafile`. By default, the correction is "off", i.e. both parameters are set to "NONE". See the parameter descriptions in the `mkarf` help file for more information.

Documentation

Download pages

- There are known problems with the CIAO download pages in Internet Explorer on the Mac OS X platform. We recommend that you choose an alternate browser - such as Safari (distributed with Mac OS X) or Mozilla Firefox [<http://www.mozilla.org/products/firefox/>] - to avoid download problems.

Analysis Threads

- The CIAO Science Threads have been updated for the CIAO 3.4 release and a few new threads were added.

New Threads

- Creating a New Observation-Specific HRC Bad Pixel File
- Computing Average HRC Dead Time Corrections

Updated Threads

- Using the ACIS "Blank-Sky" Background Files
- Coadding Spectra and Weighted Responses
- Extracting Extended Source Spectra and Responses
- Merging Data from Multiple Imaging Observations
- Create an Image of Diffuse Emission
- Use `merge_all` Script to Compute ACIS Exposure Maps and Fluxed Images
- Step-by-Step Guide to Creating ACIS Spectra for Pointlike Sources
- Using `psextract` to Extract ACIS Spectra and Response Files for Pointlike Sources

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- Using specextract to Extract ACIS Spectra and Response File

Why Topics

- These Why Topics have been updated for the CIAO 3.4 release:
- ACIS CTI Correction
- ACIS Time-dependent Gain
- Creating ACIS RMFs with mkacisrmf

CALDB Website

- The Chandra Calibration Database website has been updated for the CALDB 3.3.0 release.
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URL:
http://cxc.harvard.edu/ciao3.4/releasenotes/ciao_3.4_release.html
Last modified: 9 January 2009

