Chandra X-ray Center

CIAO 3.3 Release Notes

Return to: Version History

CIAO 3.3 has been patched to CIAO 3.3.0.1. The CIAO 3.3.0.1 patch contains a PIMMS effective area file upgrade required for Cycle 8 proposal planning.

CALDB version 3.2.1 was released on 15 December 2005. Information on the changes in this release is in the How CALDB 3.2.1 Affects Your Analysis section of these release notes.

The CIAO 3.3 software release includes three new tools useful for reprojecting files with different coordinate WCS (`reproject_aspect`, `reproject_image`, and `reproject_image_grid`). It also includes a new tool for extracting ACIS spectra – `specextract` – which automatically uses the most appropriate response tool to create the RMF and replaces most of the functionality of the `psextract` and `acisspec` scripts. CIAO 3.3 includes several improvements and bug fixes, most notably significant changes to the region library which fix a number of problems in the calculation of region areas. Additionally, error calculation changes in `dmextract` and `dmgroup` improve the compatibility of the output files with XSpec.

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How CALDB 3.2.1 Affects Your Analysis

CALDB 3.2.1 was released on 15 December 2005. This release contains a number of calibration improvements.

Note that there is no compatibility problem if you upgrade to CALDB 3.2.1, but continue to use CIAO 3.2.2.

HRMA Effective Area (version N0007)

- It has been noted that a statistically significant residual exists in fitting certain broad band continuum sources (e.g. blazars) that is due to the depth of the iridium M−edges in the HRMA effective area relative to what these instrumental spectra exhibit at 2.1 keV. Until now, no contamination layer has been included in the HRMA model, though it has long been suspected that there must be some non−zero level of hydrocarbon accumulation on the mirror elements, given their history. It has been found that a 22A overlayer of 1g/cm^3 hydrocarbon will minimize the Ir M−edge residuals for a

group of these continuum, not heavily piled–up sources.

The new file will affect all Chandra configurations except for those with HRC–S, wherein the HRMA effective area upgrade has been counterbalanced by the new HRC–S QE, so as to produce no net change in the LETGS effective areas.

This plot shows the percent difference between the current (N0006) and new (N0007) HRMA files:
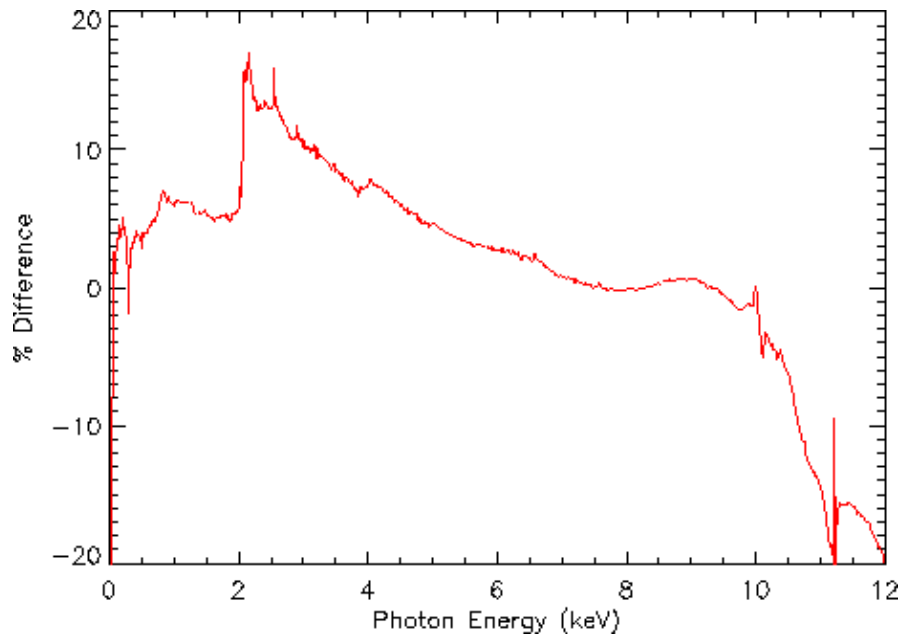
Users working in the 1 – 6 keV range will see a 5–10% change in spectral fitting that uses an ARF file created with the new HRMA effective area. The CALDB 3.2.1: HRMA Effective Area why topic shows a sample analysis with the new and old HRMA files.

To apply the new effective are file, re–run any analyses using the tools `mkarf`, `mkgarf`, and `mkwarf`, including the scripts which call those tools (`specextract`, `psextract`, `fullgarf`, and `acisspec`).

For instructions on how to continue using the v6 file, read the "How can I tell CIAO to use a different HRMA effective area file?" FAQ.

For further details on this file, refer to the CALDB 3.2.1: HRMA Effective Area why topic and the Improving the Relative Accuracy of the HETGS Effective Area memo [http://space.mit.edu/ASC/calib/heg_meg/meg_heg_report.pdf] (23 pp, PDF).

HRC–I RMF

- The intrinsic energy resolution of the HRC is poor compared with the ACIS, but it does have some ability to discriminate between hard and soft spectra. Using observations of HR1099 carried out with the HRC–I/LETG at various locations on the detector, the calibration team has constructed a response matrix for the HRC–I.

  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. If unavoidable, work in channel space ("`analysis channel`" in *Sherpa*), not energy space ("`analysis energy`").

More information on this file is available from the why topic and the HRC–I RMF calibration page.

ACIS Gain for –120 GRADED Mode Observations

- The gain for the back–illuminated (BI) chips – ACIS–S1 and S3 – has been upgraded to match the BI gains from the `acisD2000-01-29gain_ctiN0005.fits` file. Note that S1 and S3 aren't yet CTI corrected in any processing, so these gains are uncorrected, despite the "`gain_cti`" in the filename. The new gain files are:

```
acisD2000-01-29gainN0005.fits
acisD2000-07-04gainN0005.fits
acisD2000-07-06gainN0005.fits
acisD2000-08-12gainN0005.fits
```

The old S1 gains in particular are very bad for order sorting; significant improvement is seen with the new file.

Since there are no FEF files appropriate for use with this gain, response files for the *back–illuminated chips only* should be created with `mkacisrmf` *not* `mkrmf`. When doing so, set the `gain` parameter to the name of the gain file used in processing the data, which is recorded in the `GAINFILE` header keyword of the event file:

```
unix% dmkeypar acis_evt2.fits GAINFILE echo+
acisD2000-08-12gainN0005.fits

unix% pset mkacisrmf \
      gain=$CALDB/data/chandra/acis/bcf/gain/acisD2000-08-12gainN0005.fits
```

Responses for the *front–illuminated chips* should still be created by running `mkrmf`.

How CIAO 3.3 and CALDB 3.2.0 Affect Your Analysis

Some tool changes and calibration files released in CIAO 3.3 and CALDB 3.2.0 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.

Note that there is no compatibility problem if you upgrade to CALDB 3.2.0, but continue to use CIAO 3.2.2.

ACIS –120 C Calibration Files (version N0005)

- The ACIS N0005 suite includes:

  ♦ new time–dependent CTI corrections (for all FI chips)
  ♦ new higher–spatial density T_GAIN corrections (for all chips)
  ♦ modified BI chip ideal responses (for S1 and S3)
  ♦ corrections to the CTI, response, and gain calibration (for S2)

  These files are applicable to *–120 C data only*.

  If you are *beginning a new analysis*, reprocess your data with `acis_process_events` to apply the newest calibration. You will then be able to use `mkacisrmf` to create any RMF files necessary for your analysis.

- *Imaging Data*

  If you *have an analysis in progress*, use the information in this section to evaluate whether or not the calibration updates will significantly impact your results. Applying the new calibration means, in most cases, redoing your entire analysis from the level=1 event file, and some users may not benefit

from the updates.

You may want to repeat portions of the analysis with the version 5 ACIS calibration if it deals with any of the following conditions:

♦ *data on the ACIS–S2 (ccd_id=6) chip and you intend to use `mkacisrmf` to create response file(s).*

The detector gain has been updated for the S2 chip only. Changes with respect to CALDB 3.1.0 vary from −3.2% to +0.5% with the largest shifts at the lowest PHA values. In general changes are about −0.5% for most PHA's. If you elect to rederive the RMF you ***must*** reprocess the event file with `acis_process_events` so that the CTI and gain corrections are compatible with the `P2_RESP` file used by `mkacisrmf`.

♦ *data that falls within +/−50 columns from column 512 (`chipx=512`) on ANY front–illuminated ACIS chips (I0–3, S0, S2, S4–5).*

This is to address the apparent gain sag noticed in the version 4 ACIS calibration suite. Detector gain can be off by 2–5% in the 4–6 keV range: the amount of shift is energy dependent, and gets worse with increasing energy.

Reprocess the data with `acis_process_events` to apply the newest calibration.

♦ *data that falls on either of the back–illuminated ACIS chips (S1, S3).*

Upgrades have been made to the back–illuminated chip calibration in the `P2_RESP` file used by `mkacisrmf`. Mostly spectral fits below 2 keV will be improved by this upgrade. This image shows a comparison between a fit with the n0004 suite and the n0005 suite.

It is only necessary to re–run `mkacisrmf` to pick up this calibration update. Users ***do not*** need to reprocess the event file in this case.

Note that while new CTI data for all ACIS chips were included in this release, users will notice minimal changes in the output RMFs.

• *Grating Data (ACIS/HETG and ACIS/LETG)*

The improvement in gain will improve order–sorting, in principle. However, our default order–sorting regions are already large enough to compensate for current gain residuals, but at the expense of some additional background. A future update of the CALDB will include new order–sorting tables ("OSIP" files) made from the new CCD response. ***For CIAO 3.3, there is no need to reprocess HETG or LETG data collected with ACIS.***

HRC–I Gain Maps

• For the first time, gain correction maps are available for HRC–I data and make it possible to obtain an HRC–I RMF.

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

For more information, refer to the Gain Response of the HRC webpage and to the HRC–I RMF webpage .

HRC–S Gap Lookup

• A first iteration of corrections for the known non–linearity in the HRC–S/LETG spatial wavelength scale is now available. It will improve the performance of the LETGS, but does not account fully for

all the systematic errors in the dispersion relation. The RMS deviation of the wavelength differences drop from 0.014 A (0.010 A over just the central plate) prior to the correction, to 0.010 A (0.006 A over the central plate).

Users must reprocess the data with `hrc_process_events` to apply the new calibration; it will automatically be picked up by the tool.

Applying GTI Filters in asphist

- The `asphist` tool usage has been modified to associate the good time interval (GTI) filter with the event file rather than the aspect solution. For example,

```
unix% asphist pcad_asol.fits asphist_7.fits \
     evtfile="acis_evt2.fits[ccd_id=7]" dtffile=""
```

shows the preferred way of specifying the good–time filter by specifying the chip. (Due to telemetry saturation, each chip may have a different exposure.) The old CIAO 3.2.2 syntax was:

```
unix% asphist "pcad_asol.fits[@acis_evt2.fits[ccd_id=7]]" asphist_7.fits \
     acis_evt2.fits dtffile=""
```

In prior versions of CIAO, a large number of GTI records would cause slight underestimates of the duration, since the filtering does not interpolate times in aspect records, but drops whole records. Applying the filter from the events and reading all the aspect records results in a rigorous interpolation of time intervals and determination of exposure time.

Users analysing data with hundreds (or thousands) of GTIs should re–run `asphist` – and any subsequent processing, such as `mkexpmap` – to obtain more accurate results. This often occurs for ACIS in CC–mode, but also affects TE–mode observations (ObsID 214, an ACIS–S observation of Cas A, has > 1900 GTIs).

Header Keyword in PHA files Created by dmextract

- The `POISSERR` keyword is linked to the error parameter setting. For error="gaussian", the PHA output file has `POISSERR=TRUE` and a `STAT_ERR` column *is not* created. For error="gehrels", the header in the PHA output file is set to `POISSERR=FALSE` and a `STAT_ERR` column *is* created.

The error values themselves are not affected by this. The change was made to eliminate a warning seen when fitting the data in XSpec:

```
Warning : file 1 has both POISSERR=T and STAT_ERR
Using Poisson errors
```

Improvements in Region Area Calculation

- A number of bugs have been fixed in the calculation of the areas of composite regions. For a complete list, see the Libraries: regionlib section of these release notes.

Users working with regions that may have been affected by the bug fixes should compare the previous results to those in CIAO 3.3.

SIM Offsets in Event Processing Tools

- CIAO 3.3 contains a fix for how `DTHETA` in the aspect solution files is used by `acis_process_events`, `hrc_process_events`, and `tg_resolve_events`. Previously,

the tools were rotating around the Z–axis instead of the X–axis. In almost all cases the angles are very, very small, so the coordinate error introduced by this bug was much less than one pixel, and can be entirely neglected.

Users who reprocess their data may see a small change in coordinate values.

Tools

acis_build_badpix

- The `outbias` parameter has been changed to be a hidden parameter.
- The `kernel` parameter has been removed; tool output defaults to FITS format.

acis_classify_hotpix

- Bug fix: updates to recognize level 1.5 (`evt1a.fits`) files.
- The tool will exit with an error message if the `READMODE` header keyword in the input event file has a value of `CONTINUOUS`; the hot pixel tools should not be used on continuous–clocking mode data.

acis_find_hotpix

- Bug fix: updates to recognize level 1.5 (`evt1a.fits`) files.
- The tool will exit with an error message if the `READMODE` header keyword in the input event file has a value of `CONTINUOUS`; the hot pixel tools should not be used on continuous–clocking mode data.

acis_process_events

- Bug fix: `acis_process_events` assumes that the aspect files given in the `acaofffile` and `alignmentfile` parameters are arranged in chronological order. If the files are not in order, the tool will generate a warning.
- Bug fix: the tool now correctly applies the CTI adjustment to CC–mode data. The Continuous Clocking Mode why topic has details on working with CC–mode data.
- Bug fix: if you reprocess your data with a new bad pixel file, `acis_process_events` will update the `BPIXFILE` header keyword with that filename.
- The tool has been modified to disable the use of STATUS bits 12 and 13 (of 0–31) in ACIS event data files. This change affects only TIMED GRADED mode observations. One or both of these bits used to be set to "1" if one or more of the pixels at the corners of a 3 pixel x 3 pixel event island was identified as bad. Since this functionality is already included through the use of the `acis_process_events` parameter `badpixfile`, the use of bits 12 and 13 was redundant.
- A correction was made to the split threshold file modifications for CC–mode data introduced in CIAO 3.2.2.
- The tool will print a warning if there are no events in the input file.

acis_run_hotpix

- The tool will exit with an error message if the `READMODE` header keyword in the input event file has a value of `CONTINUOUS`; the hot pixel tools should not be used on continuous–clocking mode data.
- Bug fix: updates to recognize level 1.5 (`evt1a.fits`) files.
- The `kernel` parameter has been removed; tool output defaults to FITS format.
- The `pbkfile` parameter has been changed to be an automatic (not hidden) parameter, and its default was changed from "NONE" to "".
- Bug fix: temporary files are cleared when `acis_run_hotpix` exits on an error.

aconvolve

- Several new kernels have been added to the tool: mexhat, power, exp, beta/lorentz, and sinc. See the `aconvolve` help file for details.
- Fixed problem where rotational parameters in input image were not being copied to output.

asphist

- The tool usage has been modified to associate the good time interval (GTI) filter with the event file rather than the aspect solution. For example,

```
unix% asphist pcad_asol.fits asphist_7.fits \
      evtfile="acis_evt2.fits[ccd_id=7]" dtffile=""
```

shows the preferred way of specifying the good–time filter by specifying the chip. (Due to telemetry saturation, each chip may have a different exposure.) The old CIAO 3.2.2 syntax was:

```
unix% asphist "pcad_asol.fits[@acis_evt2.fits[ccd_id=7]]" asphist_7.fits \
      acis_evt2.fits dtffile=""
```

In prior versions of CIAO, a large number of GTI records (as often occurs for ACIS in CC–mode) would cause slight underestimates of the duration, since the filtering does not interpolate times in aspect records, but drops whole records. Applying the filter from the events and reading all the aspect records results in a rigorous interpolation of time intervals and determination of exposure time.
- The kernel parameter has been removed; tool output defaults to FITS format.

axbary

- The case of two parameter names has been changed: "orbitFile" is now "orbitfile" and "refFrame" is "refframe".
- There is a new version of tai-utc.dat which includes the 2006 leap second.

destreak

- Bug fix: the tool no longer ignores non–zero status bit events. Instead, these events should be ignored by using the mask parameter. In general, events already flagged as "bad" for other reasons should not be considered as candidate streak events. For example, the new default value – mask="[status=0,grade=0,2:4,6]" – ensures that destreak will consider only events with good grades and zero status as potential streak events.

  When using destreak on TIMED VFAINT mode data processed by acis_process_events with check_vf_pha=yes, make sure the mask parameter is set to allow non–zero status events to be considered as candidate streak events. Normally destreak should ignore the non–zero status events, but check_vf_pha flags them as potential cosmic rays and, in this case, such events should be kept to allow destreak to identify streaks most efficiently.
- The default value of the mask parameter has been changed to "[status=0,grade=0,2:4,6]". A new parameter, num_sigma, has been added; see the destreak ahelp file for details on its use. Also, the default value of the max_rowloss_fraction parameter has been changed from 2.0e-4 to 5.0e-5.
- Fix to satisfy the max_rowloss_fraction constraint for observations taken with a subarray.
- The clobber parameter is checked earlier in the processing.

dmappend

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

dmcoords

- Bug fix: HRC geometry is correctly initialized.
- Bug fix: fix for how DTHETA in the aspect solution files is used; DTHETA is now correctly set to SIM DISPLACE THETA X. In almost all cases, the coordinate error introduced by this bug was much less than one pixel, and can be entirely neglected.
- Bug fix: if the user supplies an `asolfile` and also sets the `displace` parameter, a warning is triggered.

dmcopy

- Bug fix: binning with `[bin x=::1,y=::1]` would separate the x and y axes, resulting in an image without a "sky" (x,y) column.

dmextract

- The parameter value "poisson" for calculating the statistical errors has been renamed to "gehrels" to reflect the Gehrels equation used with this option. The default setting for the error and bkgerror parameters is now error="gaussian".
- The POISSERR keyword is linked to the error parameter setting. For error="gaussian", the PHA output file has POISSERR=TRUE and a STAT_ERR column *is not* created. For error="gehrels", the header in the PHA output file is set to POISSERR=FALSE and a STAT_ERR column *is* created.
- The error calculation defaults to "gaussian" if the user specifies error="variance image", as this option is not yet implemented.
- In `ltc1` and `ltc2` modes, users can now supply the DTF file for HRC datasets in the `exp` parameter. For example:

```
unix% dmextract "hrc_evt.fits[bin time=::100]" ltc.fits op=ltc1 \
      exp=hrc_dtf.fits
```

The average DTF value within the time bin is then used to correct the exposure and count–rate values. Previously, the `exp` parameter was only used for images and radial profiles.
- `dmextract` now supports the "number of bins" syntax, e.g. `[bin x=1:1000:#20]`.
- Bug fix: NET_COUNTS is properly calculated when a background value is specified as a constant via the `bkg` parameter.
- Bug fix: input exposure map values that are == 1 are used in the calculations.
- Bug fix: the allowed string length for filters on the input file has been increased.
- Bug fix: `dmextract` will quit if it finds an existing output file and clobber is set to "no".

dmfilth

- Bug fix: improved error message when tool cannot read the source list.
- Bug fix: exit status value set to non–zero on error.

dmgroup

- If the `errcolumn` parameter is left blank (the default), the GRP_STAT_ERR column is calculated assuming SQRT(GRP_DATA).
- Bug fix: tool properly handles multiple groupings specified in a single `dmgroup` command, e.g.

```
binspec="21:61:41, 62:171:110, 172:548:377"
```

- Fixed problems with parsing binning specifications of the form "::#num" for the `tabspec` and `stopspec` parameters. Also corrected binning rules for the upper limit of floating point data (<max, not <=max).

dmhedit

- Bug fix: when adding a keyword to a file and the value of the keyword is 0, the default datatype for the keyword is set to integer type (not string type).

dmimgpick

- Bug fix: adjustments to the handling of locations near the edges of the image to avoid unnecessary "NaN" values.

dmmakepar

- Removed the obsolete `header_filter` parameter.

dmmerge

- The `kernel` parameter has been removed; tool output defaults to FITS format.
- The `outBlock`, `lookupTab`, and `columnList` parameters have been changed to be hidden parameters.
- Added a `verbose` parameter.

dmregrid

- Removed copying of subspace from first input image.

dmsort

- Change to buffer size which significantly increases speed.

dmstat

- The statistics calculated by `dmstat` are now written to the parameter file as well as the screen. A number of new parameters were created to record these values; see the `dmstat` help file for a complete list.

  The parameter tools, such as `pget`, can be used to access these values. This means that it is no longer necessary to try to extract the calculated values from the screen output. For instance:

```
unix% set mean = `pget dmstat out_mean`
unix% set max = `pget dmstat out_max`
unix% set maxloc = `pget dmstat out_max_loc`
```

  get the mean, max value, and location of the max value from the parameter file. Further information is given in the "Accessing Statistics from the Parameter File" section of the `dmstat` help file.

hrc_process_events

- Bug fix: hrc_process_events assumes that the aspect files given in the acaofffile and alignmentfile parameters are arranged in chronological order. If the files are not in order, the tool will generate a warning.
- Changes to the CALDB lookup should eliminate some of the "WARNING: 2 CALDB files found. Using the first" messages.
- The kernel parameter has been removed; tool output defaults to FITS format.

mkacisrmf

- Bug fix: allowed values for the chantype parameter are enumerated in the parameter file: PHA or PI (case–sensitive). This will eliminate confusion in XSpec, which requires the CHANTYPE keyword to be in uppercase.

mkpsf

- Bug fix: when PSF library files were repixelated and rotated and a pixel happened to land right on the edge of the image, mkpsf would sometimes generate an invalid array index and segV.

regions

- Improvements and bug fixes in region calculations are listed in the Libraries: regionlib section of these release notes.

reproject_aspect

- **New Tool!**

  Modify the aspect solution file's RA, Dec, and roll or update WCS to minimize position differences between two source lists. reproject_aspect runs the new wcs_match and wcs_update tools in tandem to update aspect solution files in the simplest possible way.

reproject_events

- Randomization was not being applied when seed==0.

reproject_image

- **New Tool!**

  reproject_image maps an image in one WCS reference frame to the WCS in another image. If you do not have a reference image available, use reproject_image_grid instead.

reproject_image_grid

- **New Tool!**

  reproject_image_grid maps an image in one WCS reference frame to a specified WCS grid. If you have a reference image with the desired WCS, use reproject_image instead.

specextract

- **New Script!**

  Extract source and background ACIS spectra for point–like and extended sources and build associated WMAPs, ARFs and RMFs.

  This script is written in S–Lang and is distributed with the CIAO software, *not* the CIAO Scripts package.

  `specextract` is designed to replace the `psextract` and `acisspec` scripts currently distributed in the CIAO Scripts package. The major improvement over its predecessors is the ability to determine when `mkacisrmf` should be used in place of `mkrmf` (see the "Creating RMFs: mkrmf vs. mkacisrmf" section of the help file).

  Note that `specextract` *does not* offer the option to coadd spectra as `acisspec` does.

sso_freeze

- Bug fix: when input files are missing columns, the tool will exit properly instead of crashing.

stk_where

- **New Tool!**

  `stk_where` finds the location of an element within a stack. It is especially useful with the new `dmstat` parameter output.

tg_create_mask

- Bug fix: the parameter reported in the `tg_create_mask` screen output should now match the user input values.
- The `kernel` parameter has been removed; tool output defaults to FITS format.

tg_resolve_events

- Bug fix: `tg_resolve_events` assumes that the aspect files given in the acaofffile and alignmentfile parameters are arranged in chronological order. If the files are not in order, the tool will generate a warning.
- Bug fix: a level 1.5 event file may be used as input to `tg_resolve_events`, e.g. in order to adjust the mask regions.
- The `kernel` parameter has been removed; tool output defaults to FITS format.

tgdetect

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

tgextract

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

tgidselectsrc

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

tgmatchsrc

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

vtpdetect

- `vtpdetect` would crash if given a double datatype exposure map (standard exposure maps are float datatype).

wcs_match

- **New Tool!**

  `wcs_match` matches sources between two lists and computes astrometric corrections.

wcs_update

- **New Tool!**

  `wcs_update` updates the WCS keywords or the aspect solution either directly from output of `wcs_match` or from user values.

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.

acis_build_badpix

- The `outbias` parameter has been changed to be a hidden parameter.
- The `kernel` parameter has been removed; tool output defaults to FITS format.

acis_run_hotpix

- The `kernel` parameter has been removed; tool output defaults to FITS format.
- The `pbkfile` parameter has been changed to be an automatic (not hidden) parameter, and its default was changed from "NONE" to "".

asphist

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

axbary

- The case of two parameter names has been changed: "`orbitFile`" is now "`orbitfile`" and "`refFrame`" is "`refframe`".

destreak

- The default value of the `mask` parameter has been changed to `"[status=0,grade=0,2:4,6]"`. A new parameter, `num_sigma`, has been added; see the `destreak` ahelp file for details on its use. Also, the default value of the `max_rowloss_fraction` parameter has been changed from `2.0e-4` to `5.0e-5`.

dmappend

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

dmextract

- The parameter value "poisson" for calculating the statistical errors has been renamed to "gehrels" to reflect the Gehrels equation used with this option. The default setting for the error and bkgerror parameters is now error="gaussian".

dmmakepar

- Removed the obsolete `header_filter` parameter.

dmmerge

- The `kernel` parameter has been removed; tool output defaults to FITS format.
- The `outBlock`, `lookupTab`, and `columnList` parameters have been changed to be hidden parameters.
- Added a `verbose` parameter.

dmstat

- The statistics calculated by `dmstat` are now written to the parameter file as well as the screen. A number of new parameters were created to record these values; see the `dmstat` help file for a complete list.

hrc_process_events

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

mkacisrmf

- Bug fix: allowed values for the `chantype` parameter are enumerated in the parameter file: PHA or PI (case–sensitive). This will eliminate confusion in XSpec, which requires the CHANTYPE keyword to be in uppercase.

pixlib

- A new parameter – `obsfile` – has been added to `geom.par`. It gets the DATE-OBS from the specified file to support time–dependent calibrations. If the value is "NONE" (the default), then the latest files are used.

tg_create_mask

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

tg_resolve_events

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

tgdetect

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

tgextract

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

tgidselectsrc

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

tgmatchsrc

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

Data Model

Bug Fixes

- Bug fix: binning with `[bin x=::1,y=::1]` would separate the x and y axes, resulting in an image without a "sky" (x,y) column.
- Bug fix: if the virtual file that `readfile()` opened contained the whole vector virtual column, e.g.

```
f3 = readfile("evt2.fits[cols eqpos]");
f4 = readfile("evt2.fits[cols ra,dec]");
```

  then the data that were read would be incorrect.
- When breaking up a vector column, only the first column of the vector would be copied.
- Bug fix: if the value of a keyword was too long (~ > 510 characters), it could cause a SegV in the DM.
- Bug fix: a filtering problem occurred if the user filtered on the vector (`col_one,col_two`), but "col_two" came before "col_one" in the input file.

  This bug was discovered while working with the LETG/HRC–S background filtering files, as shown in the Apply the background filter section of the Obtain Grating Spectra from LETG/HRC–S Data thread.

ds9

CIAO 3.3 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 3.3 software).

```
unix% cd $ASCDS_INSTALL/ots/saord/ds9_dir
unix% mv ds9 ds9.4.0
unix% mv ds9.3.0.3 ds9
```

Sherpa

There was no development done on Sherpa for CIAO 3.3, other than this one bug fix.

Bug Fix

- The UserModel class was found to not release memory when it successfully finished calculating a user's model; an array containing model parameter values was not deallocated.

  The function has been updated to release the memory whether or not the model calculation is successfully completed.

  There has been no change to the interface to user models.

ISIS

ISIS has been upgraded to version 1.3.0.

Libraries

cfitsio

- Modified dependency on cfitsio. The copy of the library `libcfitsio.so` that is packaged with CIAO has been renamed to `libcxccfitsio.so`. This will eliminate the conflict on Mac OSX when CIAO and HEAsoft are used in the same window.

errlib

- Added additional HRC bad–chip warnings.

grouplib

- Fixed problems with parsing binning specifications of the form "`::#num`" for the `tabspec` and `stopspec` parameters in `dmgroup`. Also corrected binning rules for the upper limit of floating point data (<max, not <=max).

l1_asplib

- Fix for how `DTHETA` in the aspect solution files is used by `acis_process_events`, `hrc_process_events`, and `tg_resolve_events`. In almost all cases, the coordinate error introduced by this bug was much less than one pixel, and can be entirely neglected.
- `acis_process_events`, `hrc_process_events`, and `tg_resolve_events` assume that the aspect files given in the `acaofffile` and `alignmentfile` parameters are arranged in chronological order. If the files are not in order, the tool will generate a warning.

pixlib

- A new parameter – `obsfile` – has been added to `geom.par`. It gets the `DATE-OBS` from the specified file to support time–dependent calibrations. If the value is "NONE" (the default), then the latest files are used.
- Added support for a new aimpoint on HRC–S in imaging mode (HRC–S2). This change is back–compatible with the current CALDB.

psflib

- When PSF library files were repixelated and rotated and a pixel happened to land right on the edge of the image, `mkpsf` would sometimes generate an invalid array index and segV.

regionlib

- A number of bugs have been fixed in CIAO 3.3 in the calculation of the areas of composite regions:
- Bug fix: added error checking to make sure that |r1| > |r2| for annuli (other shapes already take the absolute value of radii into consideration).
- Bug fix: the area of regions with multiple shapes close together may be double–counted.
- Bug fix: when computing the area of the product (logical AND, e.g. A*B) of two regions, the region library would return an incorrect value if the bounding boxes of the two regions did not overlap at any point. A similar problem existed when excluding one region from another and the bounding boxes did not overlap (logical NOT, e.g. A–B).
- The bounding was calculated incorrectly for the `pie` shape if angle1==angle2 (e.g. a circle).
- Basic support was added for version 4 of the ds9 region files, which have a slightly different format than the version 3 files. Users working with more complicated files, such as "composite" regions, may encounter problems.

  Note that the file coordinate system (here `"physical"`) is only printed once in the new file, not at the beginning of every region definition.

  Old (v3):

```
# Region file format: DS9 version 3.0
# Filename: wresp_0921_evt2.fits[EVENTS]
global color=green font="helvetica 10 normal" select=1 edit=1 move=1 delete=1 in
clude=1 fixed=0 source
physical;ellipse(3868.625,4004.125,4.272175,3.60101,147.60056)
physical;ellipse(3928.3611,4282.3333,6.024213,4.747131,118.04667)
physical;ellipse(3960.9444,4035.3222,3.761969,2.861008,38.675421)
```

  New (v4):

```
# Region file format: DS9 version 4.0
# Filename: wresp_0921_evt2.fits[EVENTS]
global color=green font="helvetica 10 normal" select=1 highlite=1 edit=1 move=1
delete=1 include=1 fixed=0 source
physical
ellipse(3868.625,4004.125,4.272175,3.60101,147.60056)
ellipse(3928.3611,4282.3333,6.024213,4.747131,118.04667)
ellipse(3960.9444,4035.3222,3.761969,2.861008,38.675421)
```

- ASCII files can now be written to stdout or stderr by using "−" (a hyphen), `"stdout"`, or `"stderr"` as the output file name. For instance, to find the limits of a chip from the fov.fits file:

```
unix% dmmakereg region="bounds(region(1838_fov.fits[ccd_id=1]))" out=- ker=ascii
# Region file format: DS9 version 3.0
global color=blue font="helvetica 10 normal" select=1 edit=1 move=1...
```

```
physical;Rectangle(6023.840000,4170.330000,7135.560000,5279.310000) #
```

stacklib

- Bug fix: the `stk_delete_num` function didn't check for indices less than 0, leading to a SEGV.
- The stack library does not completely initialize stacks when creating empty stacks, leading to bogus results.

tcdlib

- Several new kernels have been added to the tool: mexhat, power, exp, beta/lorentz, and sinc. See the `aconvolve` help file for details.
- Changed the way the `lib:` kernels are constructed. Previously, they were all integrated over pixels (11x11 grid); for large kernels this was overkill. Now at a certain size/radius (currently 10) the kernels are only evaluated at the center value.

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_expmap v3.3

- The `acis_expmap` script has been updated for the new `asphist` tool syntax. The GTI filter is attached to the event file instead of the aspect solution file(s).

acisspec v3.5

- A small syntax change was made to coincide with the `dmgroup` error calculation changes in CIAO 3.3. The output files should be unaffected.

fullgarf v3.3.1

- The `fullgarf` script has been updated for the new `asphist` tool syntax. The GTI filter is attached to the event file instead of the aspect solution file(s).

merge_all v3.3

- The `merge_all` script has been updated for the new `asphist` tool syntax. The GTI filter is attached to the event file instead of the aspect solution file(s).

psextract v3.3

- The `psextract` script has been updated for the new `asphist` tool syntax. The GTI filter is attached to the event file instead of the aspect solution file(s).

Documentation Updates

Download pages

- The registration page bug in the Safari browser has been fixed. When users of this browser register and download the installation files, the cookies which store user information are now set properly by the registration page. This means that you should not be prompted to register again if you wish to download files for more than one platform or return to the download pages at a later time.
- 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 are in the process of being updated for the CIAO 3.3 release. Please check the "Last Update" information at the top of each thread to see if it has been reviewed yet.

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URL:
http://cxc.harvard.edu/ciao3.4/releasenotes/ciao_3.3_release.html
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