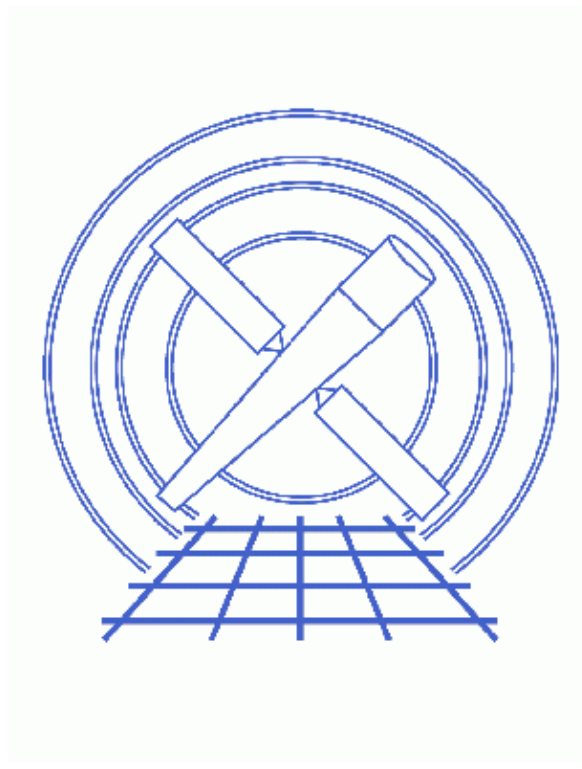


Add Grating Spectra and Average ARFs



CIAO 3.4 Science Threads

Table of Contents

- *Get Started*
- *Downloading add_grating_spectra*
- *Run add_grating_spectra*
- *Summary*
- *Parameter files:*
 - ◆ *add_grating_spectra*
- *History*

Add Grating Spectra and Average ARFs

CIAO 3.4 Science Threads

Overview

Last Update: 4 Feb 2008 – `add_grating_orders` updated to v3.4 (several broken Unix "tail" commands were replaced with the tool `dmkeypar`)

Synopsis:

`add_grating_spectra` is a script which lets the user add two grating spectra and average their associated ARFs. The output spectrum can be grouped if desired. It can be used, for example, to add up spectra of sources from different observations.

Purpose:

To generate and group two coadded grating spectra and ARFs.

Read this thread if:

you are working with ACIS/HETG, ACIS/LETG, or HRC/LETG observational data and would like to add the grating orders.

Related Links:

- [Analysis Guide for Chandra High Resolution Spectroscopy](#): an in-depth discussion of grating analysis.

Proceed to the [HTML](#) or [hardcopy \(PDF: \[A4\]\(#\) / \[letter\]\(#\)\)](#) version of the thread.

Get Started

Sample ObsIDs used: 459 (HETG/ACIS–S, 3C 273); 2463 (HETG/ACIS–S, 3C 273)

File types needed: `evt1`; `flt1`; `asol1`

To run this thread, you need two [PHA](#) grating spectra and the corresponding [ARFs](#):

```
unix% ls
2463_MEG_1.arf          459_MEG_1.arf
2463_MEG_1_NONE.pha    459_MEG_1_NONE.pha
```

Both observations must have been taken with the same instrumental configuration:

- ACIS–HETG–HEG

- ACIS–HETG–MEG
- ACIS–LETG–LEG
- HRC–LETG–LEG

The files used here were created with the [Extract Coadded and Grouped Nth–Order Source & Background Spectra and ARFs](#) thread.

Downloading add_grating_spectra

The most recent version of add_grating_spectra is 3.2.0 (09 December 2004):

```
unix% grep version_ `which add_grating_spectra`  
version_str="3.4"  
version_date="04 February 2008"
```

Please check that you are using the most recent version before continuing. If you do not have the script installed or need to update to a newer version, please refer to the [Scripts page](#).

Run add_grating_spectra

The script executes the following tools in order:

1. [dmtcalc](#): to rename columns and perform math on them in temporary PHA and ARF files.
2. [dmpaste](#): to merge the final columns into the output PHA and ARF files.
3. [dmgroup](#): to group the final PHA file.
4. [dmhedit](#): to update header keywords of the output files.

In this example, we are summing together the first–order MEG arms of HETG spectra and the corresponding gARFs:

```
unix% punlearn add_grating_spectra  
unix% pset add_grating_spectra pha1=2463_MEG_1_NONE.pha  
unix% pset add_grating_spectra pha2=459_MEG_1_NONE.pha  
unix% pset add_grating_spectra garf1=2463_MEG_1.arf  
unix% pset add_grating_spectra garf2=459_MEG_1.arf  
unix% pset add_grating_spectra gtype=BIN  
unix% pset add_grating_spectra gspec=10  
unix% pset add_grating_spectra root=3C273_summed  
unix% add_grating_spectra  
First input PHA spectrum (2463_MEG_1_NONE.pha):  
Second input PHA spectrum (459_MEG_1_NONE.pha):  
First input ARF (2463_MEG_1.arf):  
Second input ARF (459_MEG_1.arf):  
Root name for output files (3C273_summed):  
  
Input pha1 file is: 2463_MEG_1_NONE.pha (INSTRUMENT=ACIS-MEG, ORDER=1)  
Input pha2 file is: 459_MEG_1_NONE.pha (INSTRUMENT=ACIS-MEG, ORDER=1)  
Using ACIS-MEG grating ARF order 1: 2463_MEG_1.arf  
Using ACIS-MEG grating ARF order 1: 459_MEG_1.arf  
The root filename for the output files is: 3C273_summed  
  
Exposure(2463_MEG_1_NONE.pha) = 26686.9077228220  
Exposure(459_MEG_1_NONE.pha) = 38564.6089268890
```

Add Grating Spectra and Average ARFs – CIAO 3.4

```
New Exposure = 65251.5166497110

BACKSCUP(2463_MEG_1_NONE.pha) = 4.50
BACKSCDN(2463_MEG_1_NONE.pha) = 4.50
BACKSCUP(459_MEG_1_NONE.pha) = 4.50
BACKSCDN(459_MEG_1_NONE.pha) = 4.50
New BACKSCUP = 4.50
New BACKSCDN = 4.50

ACIS-MEG 3C273_summed_ACIS-MEG_1.pha will be grouped by 10 = .0500000000 Angstrom

The output spectrum is named      3C273_summed_ACIS-MEG_1_BIN10.pha
The Averaged Effective Area is named 3C273_summed_ACIS-MEG_1.arf
```

The content of the parameter file may be checked using `plist add grating spectra`.

Summary

The thread is now complete. The output containing the summed counts from both input PHA files is `3C273_summed_ACIS-MEG_1_BIN10.pha`; the averaged effective area is named `3C273_summed_ACIS-MEG_1.arf`.

To fit this data in *Sherpa*:

```
sherpa> data 3C273_summed_ACIS-MEG_1_BIN10.pha
sherpa> rsp[arfname](,3C273_summed_ACIS-MEG_1.arf,)
sherpa> instrument = arfname
```

See the [Fitting PHA Data with Multi-Component Source Models](#) thread for more information.

Parameters for `/home/username/cxcds_param/add_grating_spectra.par`

```
pha1 = 2463_MEG_1_NONE.pha First input PHA spectrum
pha2 = 459_MEG_1_NONE.pha Second input PHA spectrum
garf1 = 2463_MEG_1.arf First input ARF
garf2 = 459_MEG_1.arf Second input ARF
root = 3C273_summed Root name for output files
(gtype = BIN) Spectrum grouping type
(gspec = 10) Spectrum grouping specs (NONE,10,etc)
(clobber = no) Clobber existing output files?
(verbose = 0) Debug Level(0-5)
(mode = ql)
```

History

14 Dec 2004 updated for CIAO 3.2: created [Downloading add_grating_spectra](#) section

06 Dec 2005 reviewed for CIAO 3.3: no changes

Add Grating Spectra and Average ARFs – CIAO 3.4

01 Dec 2006 reviewed for CIAO 3.4: no changes

04 Feb 2008 `add_grating_orders` updated to v3.4 (several broken Unix "tail" commands were replaced with the tool `dmkeypar`)

URL: http://cxc.harvard.edu/ciao/threads/add_grating_spectra/

Last modified: 4 Feb 2008