ACIS Extract : A Tool for Automated Source Extraction and Spectral Fitting

Introduction

ACIS Extract (AE) is a computer program that can assist the observer in performing the many tasks involved in analyzing the properties of large numbers of point & diffuse sources observed with the ACIS instrument on Chandra. AE is written in IDL but uses CIAO & ds9 whenever possible.

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Point Source Extraction with ACIS Extract

* Correlations between data & PSFs help refine source positions.

* Extraction regions are contours of local PSF (Fig. 1a).

* PSF fraction is usually 90%, but is adjusted down for crowding (Fig. 1a).

* Iterative algorithm to
  - mask the point sources using expected surface brightness & local background (Fig. 1b)
  - extract local background spectrum for each source.

* Source position error, photometry, variability, & significance are computed (Tables 1&2).

* ARFs and RMFs are generated by CIAO.

* Automated spectral fitting.

* Adaptively smoothed light curves and median energy time series (Fig 2).

Figure 1 -- Observation of M17. (a) Event data with point source extraction regions. (b) Masked exposure map.

Figure 2 -- COUP source. (black) binned, adaptively smoothed light curves. (red) median energy time series.

Diffuse Extraction with ACIS Extract

* Masked data set from the AE point source extraction (above) is a good starting point for diffuse extraction.

* Observer supplies diffuse extraction regions and specifies background regions (Fig. 3).

* Weighted ARFs and RMFs are generated by CIAO.

* AE produces the same source properties and tables as in the point source case.

* Spectral parameters and regions can be used to make maps (Fig. 4).

Figure 3 -- Observation of 30 Doradus.
(a) Observer-supplied diffuse region files shown over masked & smoothed data.
(b,c) Model spectral parameters displayed as maps.

Other Features

* ARFs are adjusted for the extracted PSF fraction at 5 energies.

* Background spectra are scaled by ratio of exposures rather than by ratio of geometric areas.

* Sources spanning chip gaps are properly extracted.

* Spectral fitting scripts support C-statistic and χ^2.

* Better Spectral Grouping: groups defined by a target S/N ratio in **background-subtracted** bins; energy range (i.e. first & last bin edges) are precisely controlled by observer.

* Multiple observations are easily accommodated (e.g. in Chandra Deep Field).

* Recipe for stacking spectra is available.

* Recipe for annular extraction of piled-up sources is available.

* Distributions of source properties are plotted.

* Source properties for entire catalog are collated into a large FITS table.

WHERE'S THE CODE?

ACIS Extract, with a detailed User's Guide: http://www.astro.psu.edu/xray/docs/TARA/ae_users_guide.html

ACIS Extract was released on the CXC's Contributed Software Webpage and announced to the ``chandra-users'' e-mail exploder on 11 Feb 2003.
Version 3.90 was released in October, 2005.