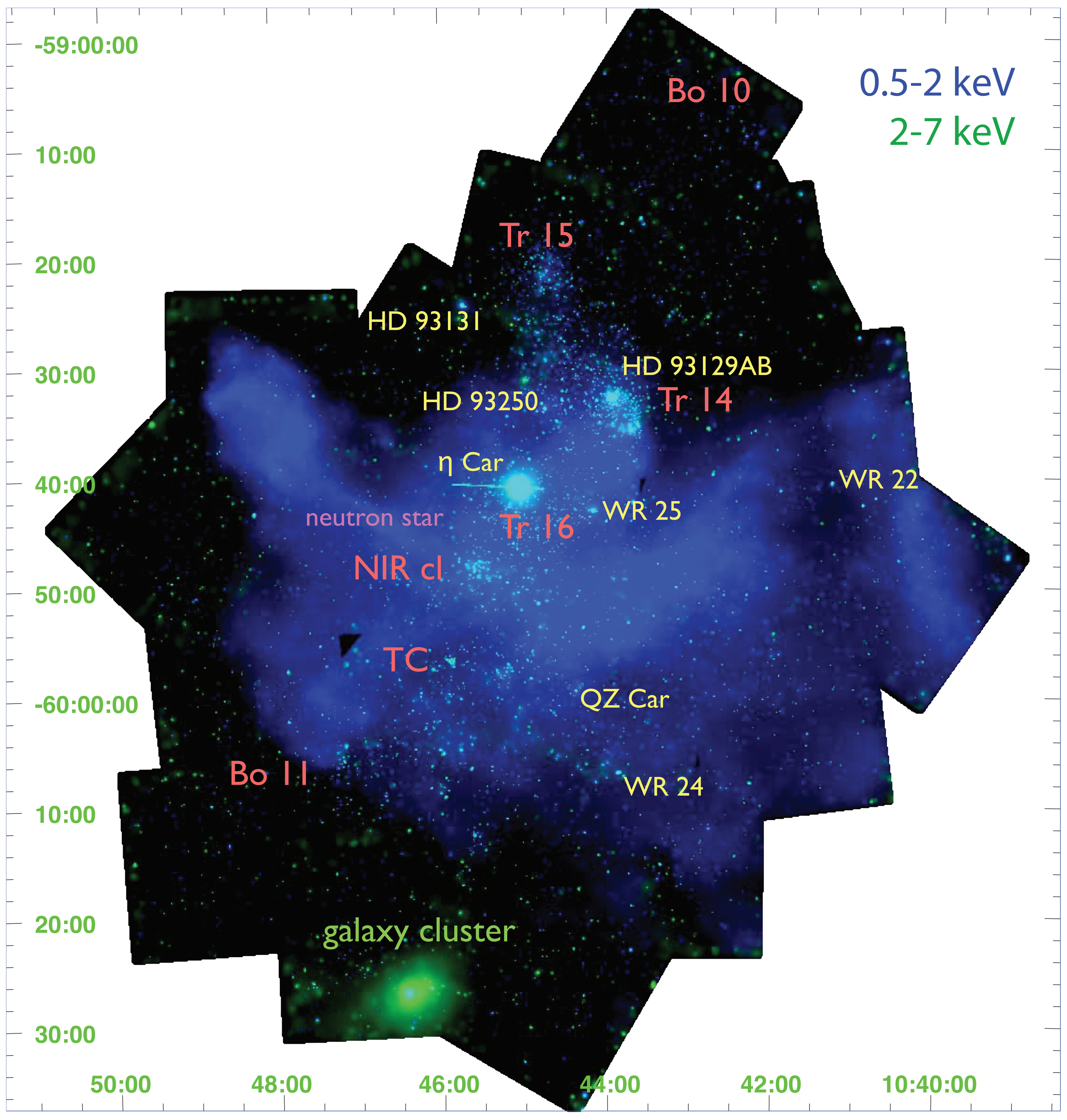
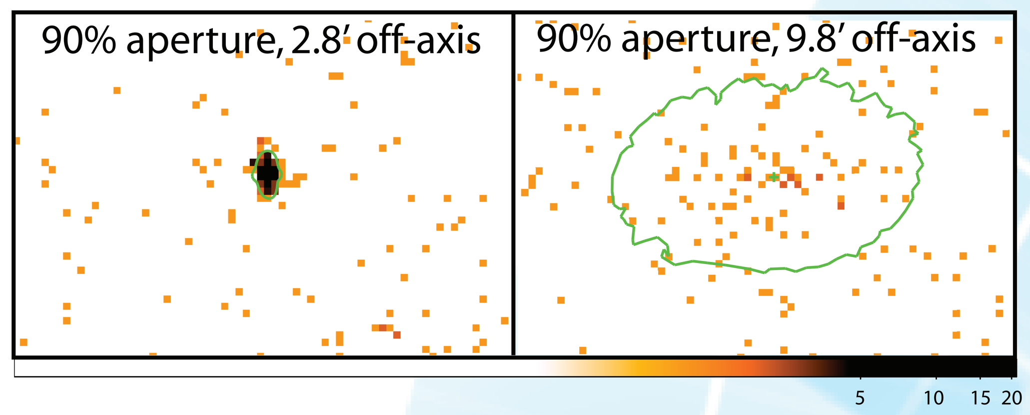


A *csmoothed* Chandra image of the Great Nebula in Carina: 38 ACIS-I ObsIDs, 22 pointings. The ~1.4 square-degree field includes several crowded massive young stellar clusters and famous massive stars. The poster background shows the project-level exposure map.

THE CARINA VERY LARGE PROJECT

We have recently completed our first very large-scale AE analysis---the 14,000 point sources and extensive diffuse emission in the Carina star-forming complex. New AE capabilities arising from that experience are presented here.



One point source observed at very different off-axis angles. It may be advantageous to ignore the right-hand extraction when estimating some source properties due to its high background and large PSF.

OVERLAPPING POINTINGS

* Starting with two archival pointings (Tr14, Tr16), 20 VLP pointings were chosen to achieve contiguous coverage of a large field with unconstrained observatory roll angles.

* Most regions of the sky fall at similar off-axis angles in all their observations. However, some regions were unavoidably observed both nearly on-axis **and** far off-axis. (Yellow dots show some examples.)

* The Chandra PSF, and thus AE's point source extraction aperture, grow with off-axis angle (figure at left). If the extractions of a specific source involve a large range of aperture sizes, then **ignoring some of the extractions** can sometimes improve estimates of source properties.

* AE can ignore high-background extractions to **maximize source detection significance.**

* AE can ignore extractions with broad PSFs to **minimize source position uncertainty.**

* To avoid bias, all extractions are used for photometry and spectral analysis.

ACIS Extract Takes On the Carina Complex

Since Y2002 the publicly-available ACIS Extract (AE) software package has significantly automated the extraction of point-like and diffuse sources, and provided a simple analysis strategy for projects that involve multiple overlapping observations.

http://www.astro.psu.edu/xray/docs/TARA/ae_users_guide.html

Support has been provided by the ACIS PI (Gordon Garmire) and by GO programs led by several Chandra observers.

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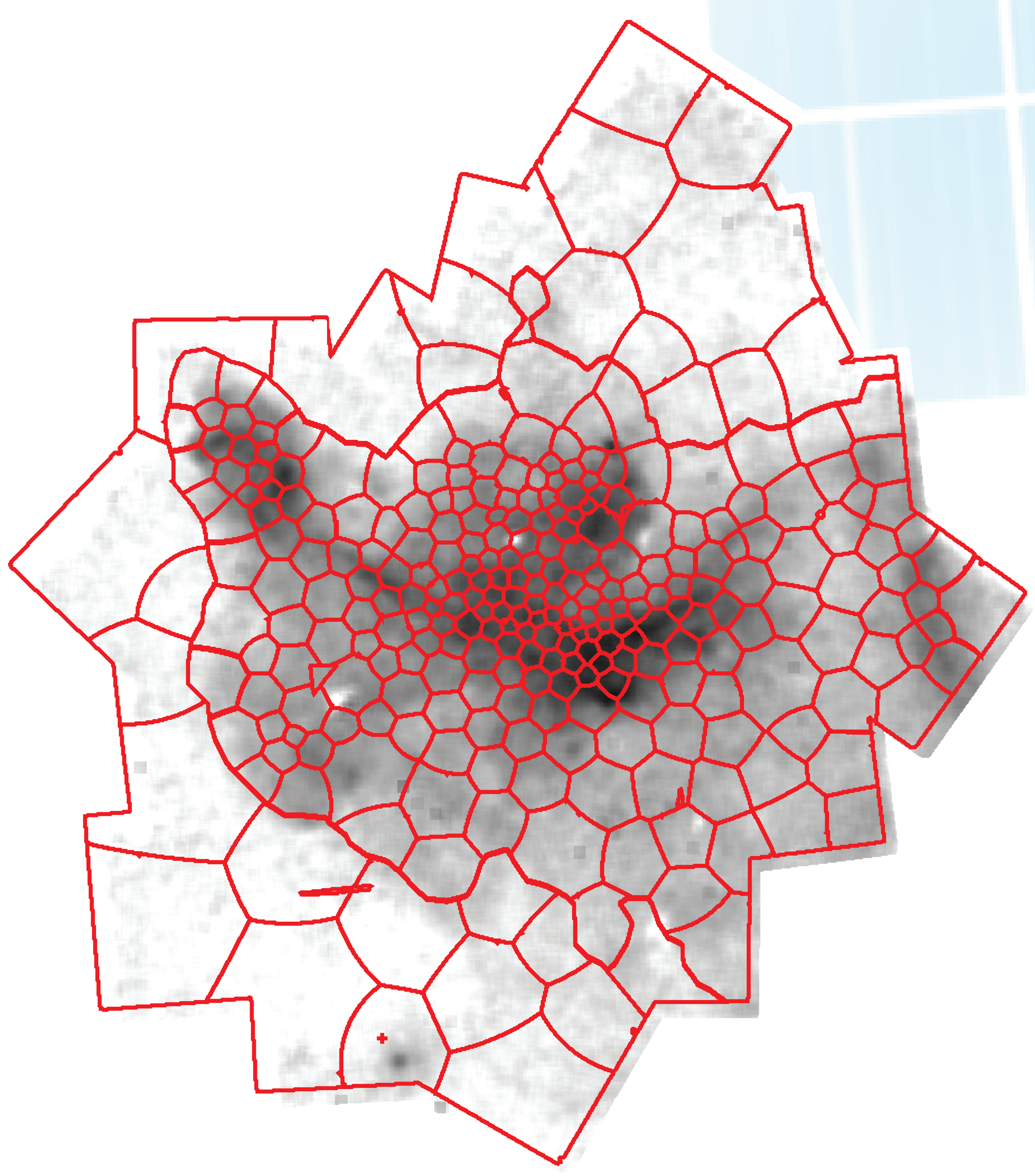
SPATIAL VARIATION OF DIFFUSE EMISSION

* Using the WVT Binning algorithm (Diehl & Statler 2006), the field is segmented into regions that produce diffuse spectra of similar quality (figure at lower left).

* AE extracts spectra from each region and drives automated XSPEC fitting (Arnaud 1996).

* Maps are constructed for each model parameter (figure at lower-right).



Tesselated (Diehl & Statler 2006) image of soft diffuse emission (point sources masked, adaptively smoothed).

DIFFUSE SURFACE BRIGHTNESS

* For both point-like and diffuse sources, *CIAO* requires separate extractions for each ObsID.

* Standard extraction tools alone (*dmextract, mkwarf*) are **not adequate** for diffuse regions spanning multiple pointings. These tools do not understand that, for a specific ObsID, some portions of the region are **not observed**---ACIS may only partially cover the region and/or parts of ACIS may be masked to remove point sources, readout streaks, etc.

* For each ObsID, AE estimates the observed detector area by integrating a masked exposure map, and appropriately normalizes the ARF.

* Merging single-ObsID extractions is most convenient if the ARFs are recast so that the spectra are in **units of surface brightness** instead of flux. (See S 5.14 of the AE manual.)

Within spectral modeling tools (XSPEC, Sherpa), integrating the model produces an average surface brightness rather than a flux.

The geometric area is relevant only when converting from surface brightness to flux.

* Instrumental background is modeled using the ACIS Stowed Dataset (Hickox & Markevitch, 2006, Section 4.1.3). Celestial background is modeled by simultaneously fitting an off-target spectrum.

In the map below, hue encodes the Fe abundance in each diffuse region, and brightness encodes the abundance uncertainty. Blue hues=>enhanced Fe; bright color=>well constrained estimate.