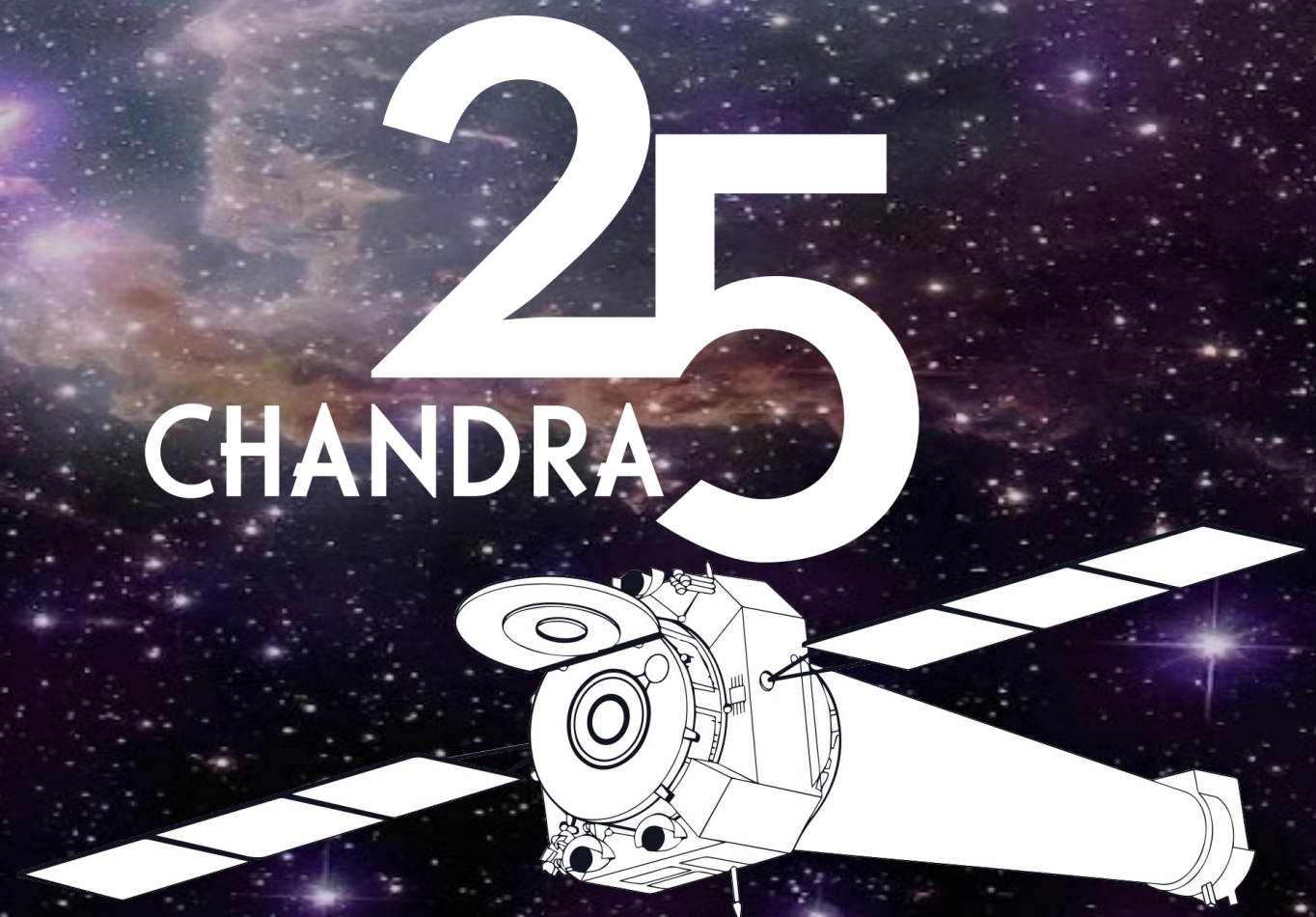


# SAOImageDS9 and Chandra

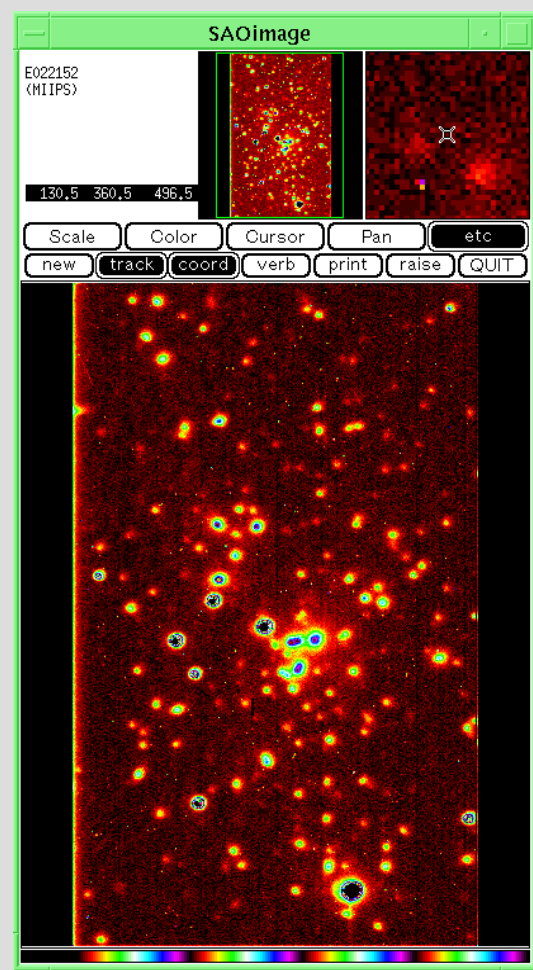
## 25 Years of Synergy

Kenny J. Glotfelty & Bill Joye for the Science Data Systems team  
Center for Astrophysics, MIT Kavli Institute.

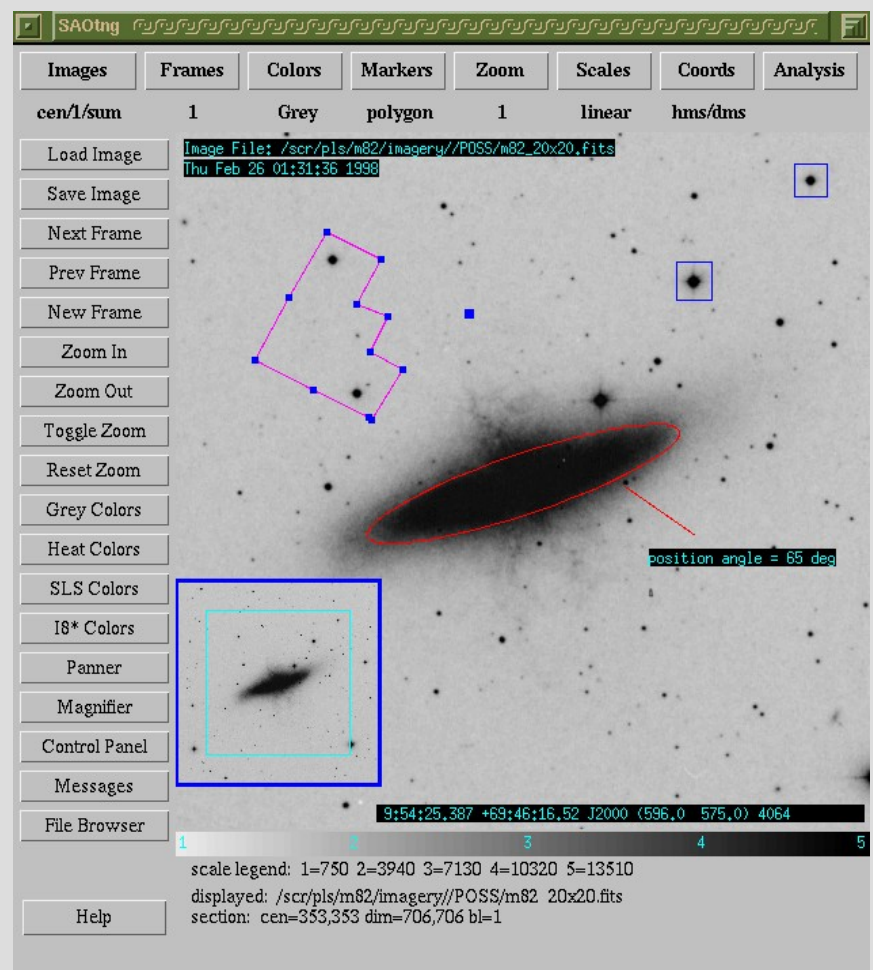


Both Chandra and SAOImageDS9 (DS9) are celebrating their 25<sup>th</sup> anniversaries this year. It is fitting that DS9 was also awarded the 2024 ADASS Software Prize. In this poster we share some of the highlights of the DS9 software prize talk with an emphasis on areas where Chandra and DS9 share a special synergy. We also spotlight some useful DS9 tips-and-tricks to help users get the most from this venerable application.

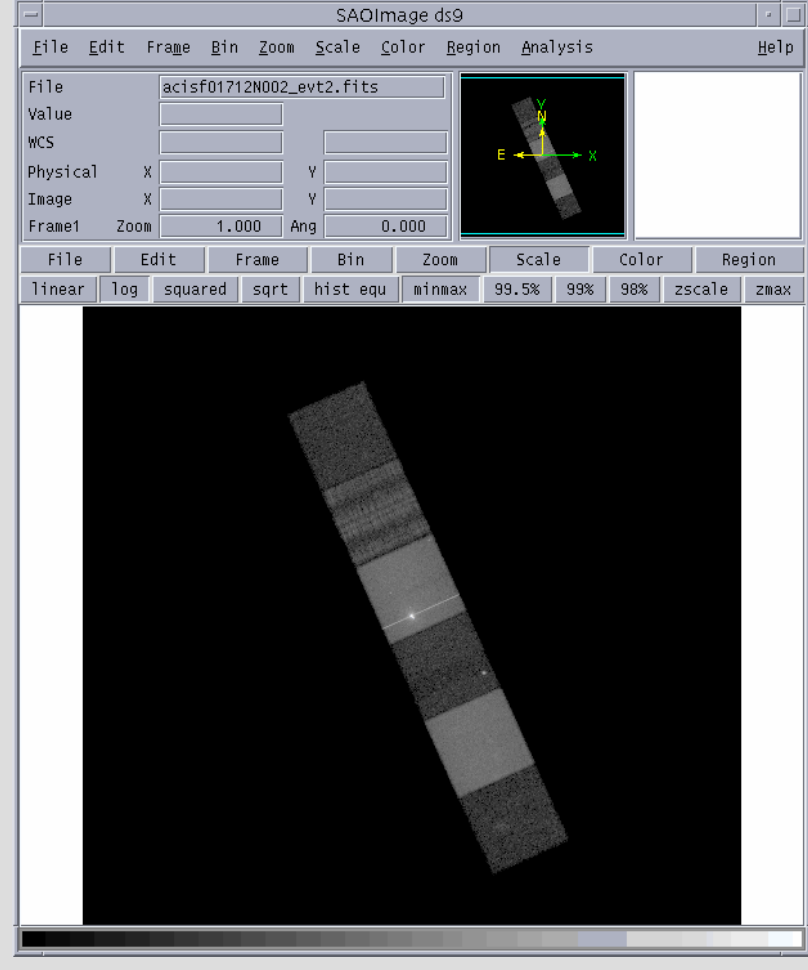
### History



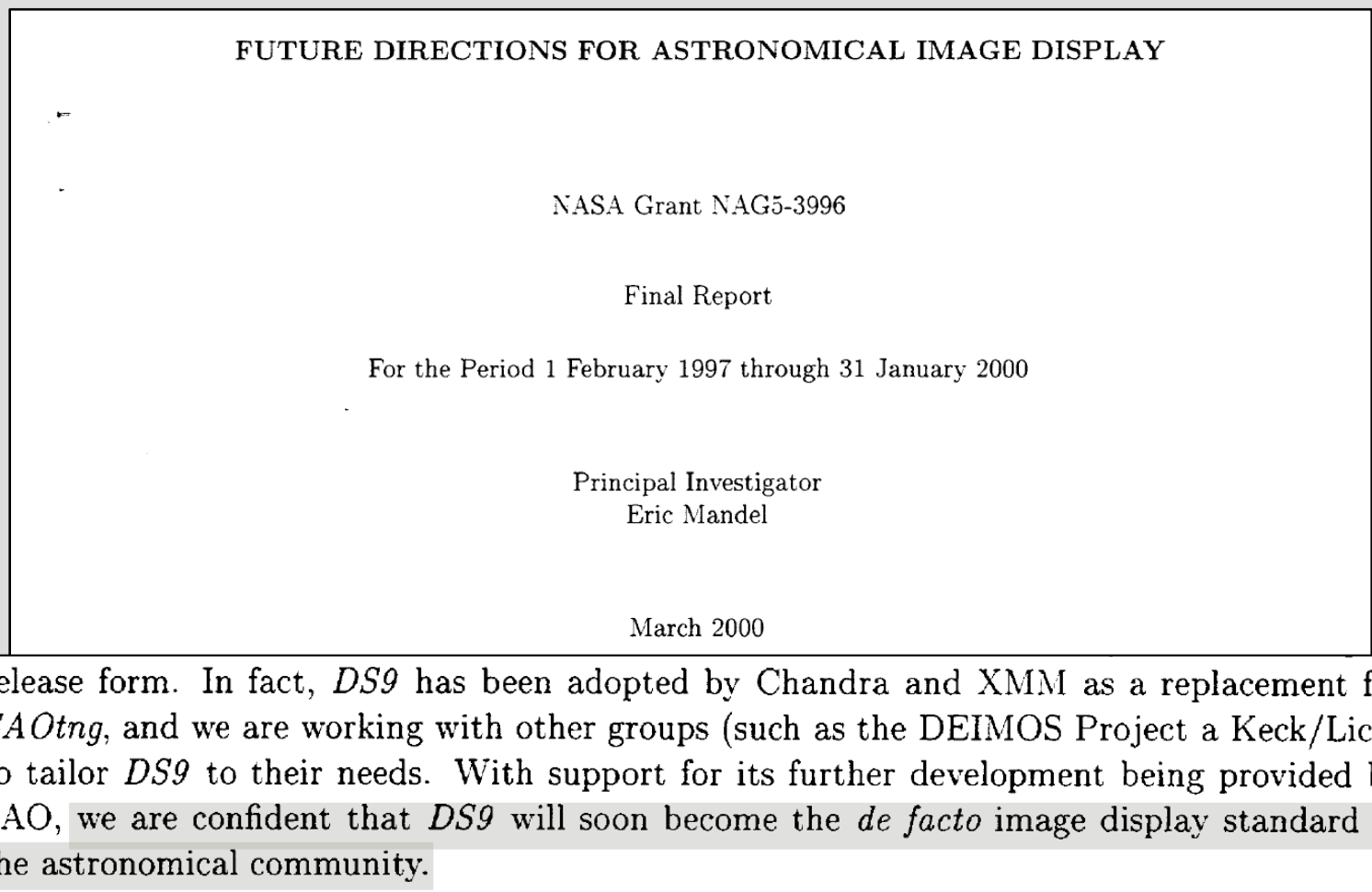
SAOImage was first released in 1990. Written by Mike Van Hilst, this was one of the first X11 applications.



SAOtng was released in 1995. While not as popular as SAOImage, it was more customizable and could be controlled externally using XPA.



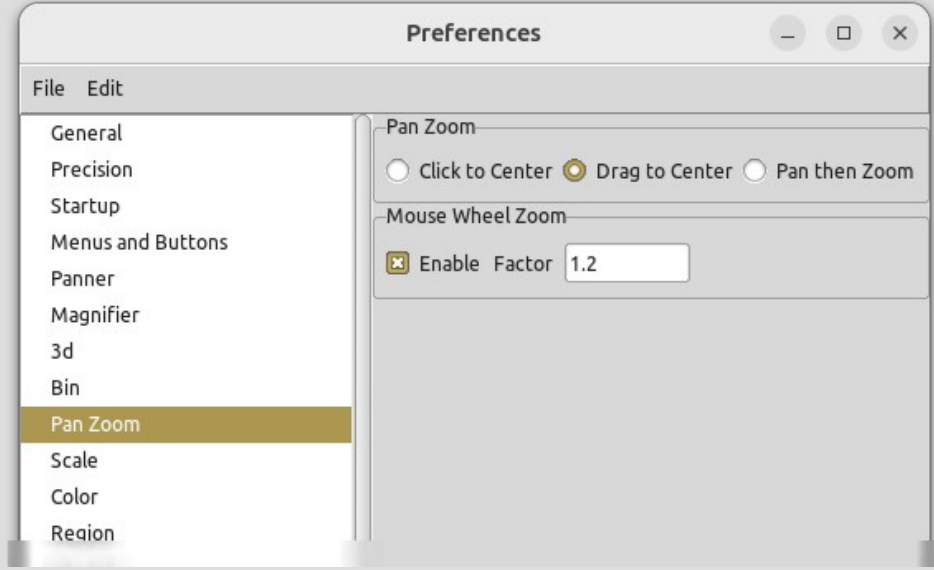
SAOImageDS9 was first released in 1999 building upon the lessons learned with TNG. It became an instant success.



release form. In fact, *DS9* has been adopted by Chandra and XMM as a replacement for *SAOtng*, and we are working with other groups (such as the DEIMOS Project a Keck/Lick) to tailor *DS9* to their needs. With support for its further development being provided by SAO, we are confident that *DS9* will soon become the *de facto* image display standard in the astronomical community.

DS9 was initially funded by a NASA Applied Information Systems Research Program grant. In the final report, Eric Mandel provided a prophetic assessment of DS9's impact on the astronomical community.

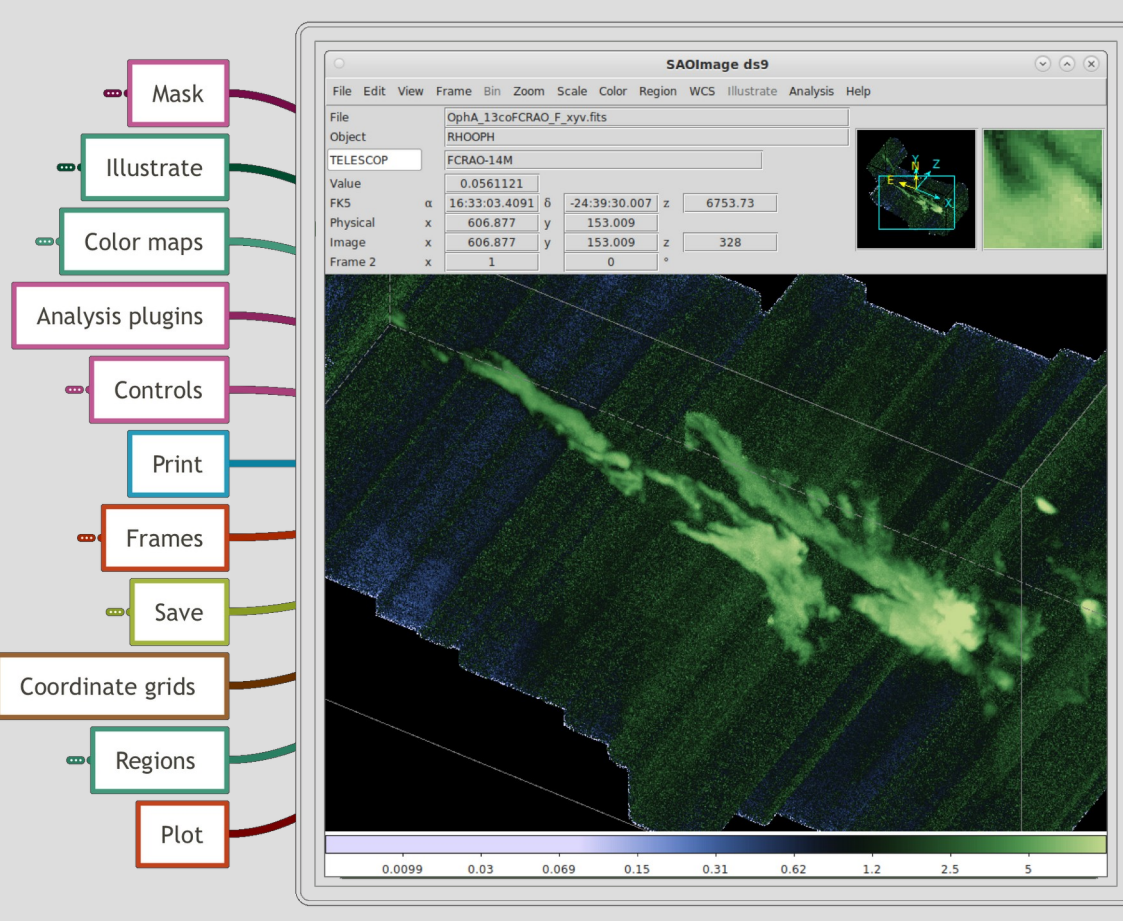
### Tip: Click & Drag to Pan



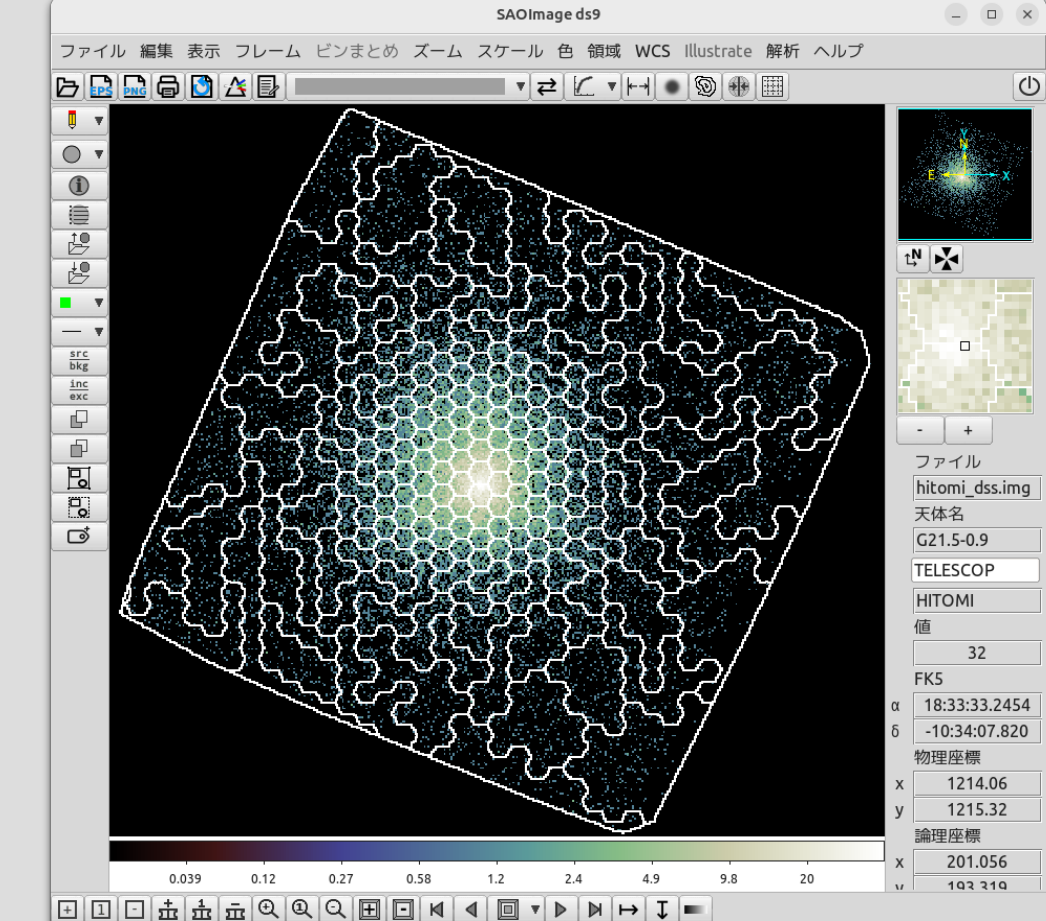
Ever wish you could drag your image in DS9 like Google Maps? You can! Goto Edit, then Preferences, Pan Zoom, and select Drag to Center.

You can find other interesting options in the Preferences such as the Magnifier zoom level.

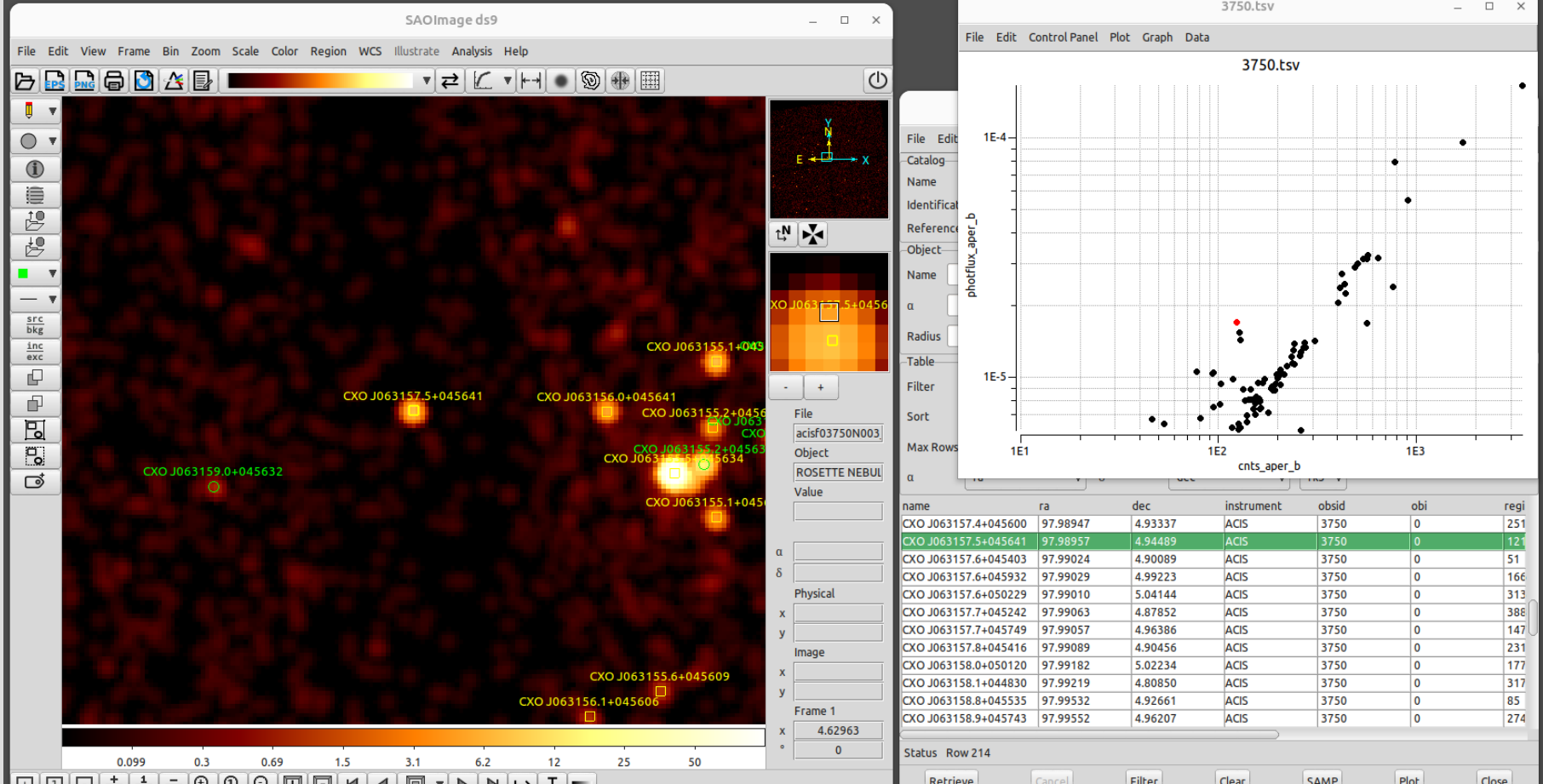
### Features



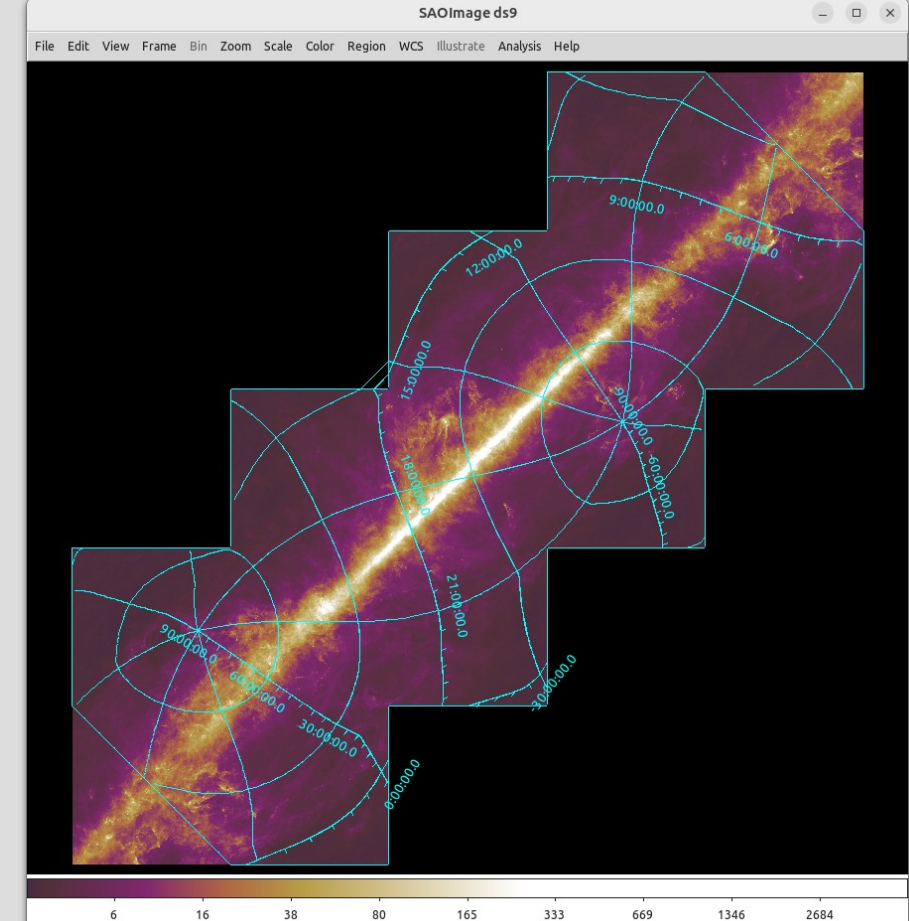
DS9 has too many features to fit on a poster. This 3D frame showing a 3D data cube lists just some of the highlights.



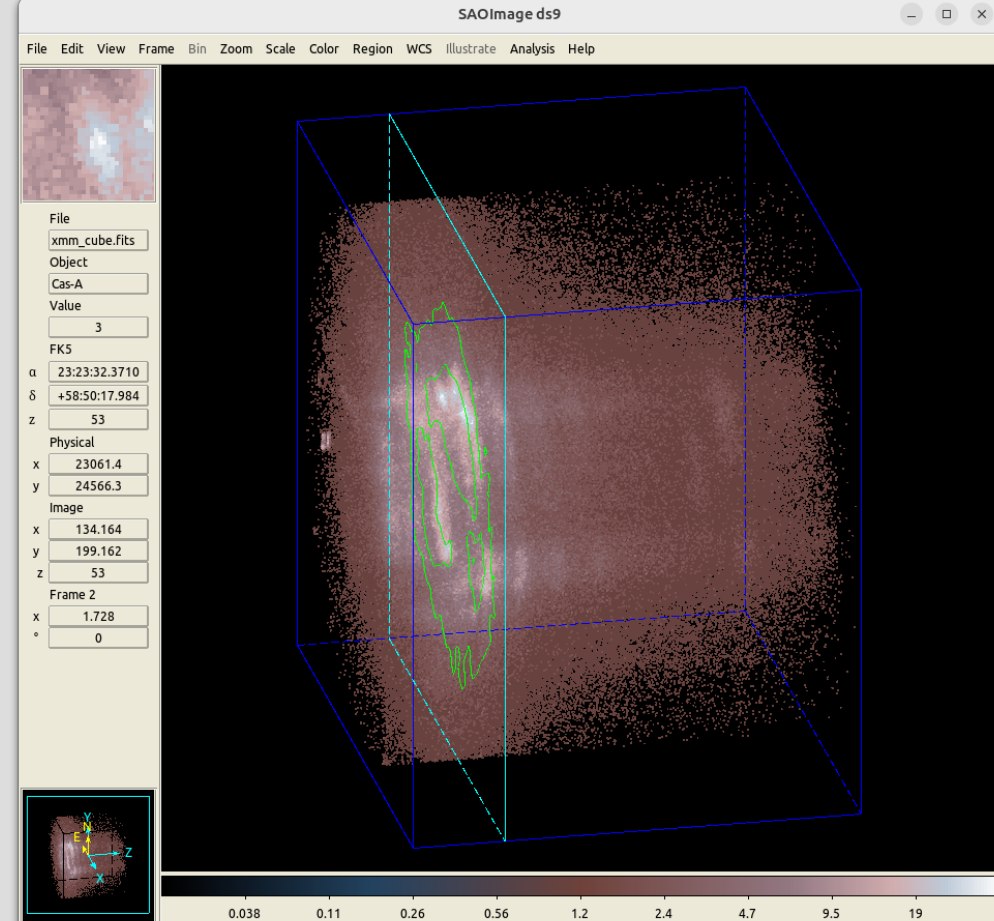
Advanced View mode, showing localization for Japanese language. Custom color map, and arbitrary keyword added to Info panel.



DS9 supports catalogs. Conditional markers show variable sources in green, non-variable in yellow. Linked view lets users select a source in the Plot, Table, or Image windows and it be highlighted in the others.



HEALPIX all sky data can be displayed with differing coordinate grids.



3D frames can include contours that are generated on each slice through the data.

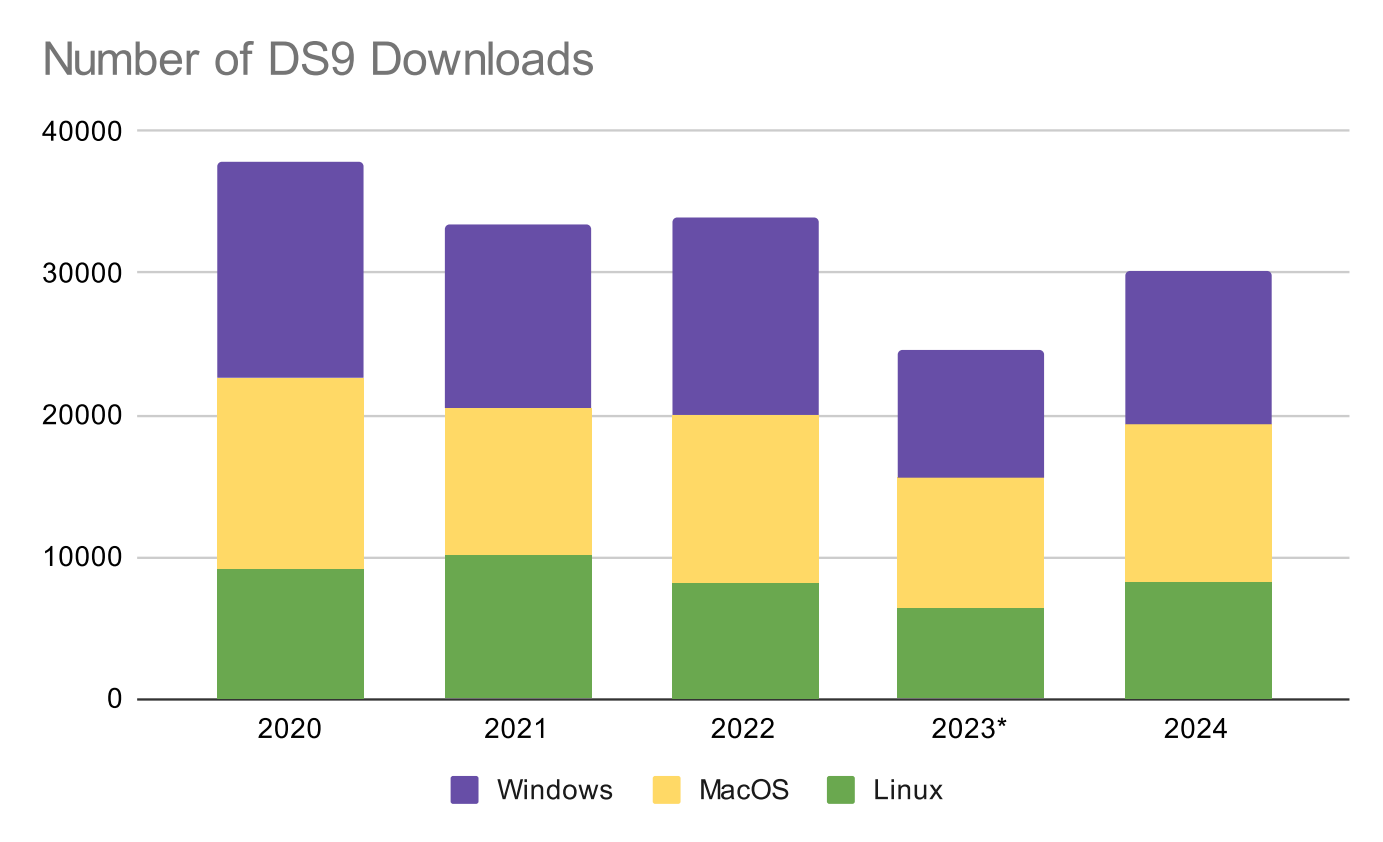
### Tip: Keyboard Short Cuts

Have you ever taken a screenshot of DS9 and noticed that the magnifier panel is blank and that the coordinates are missing?

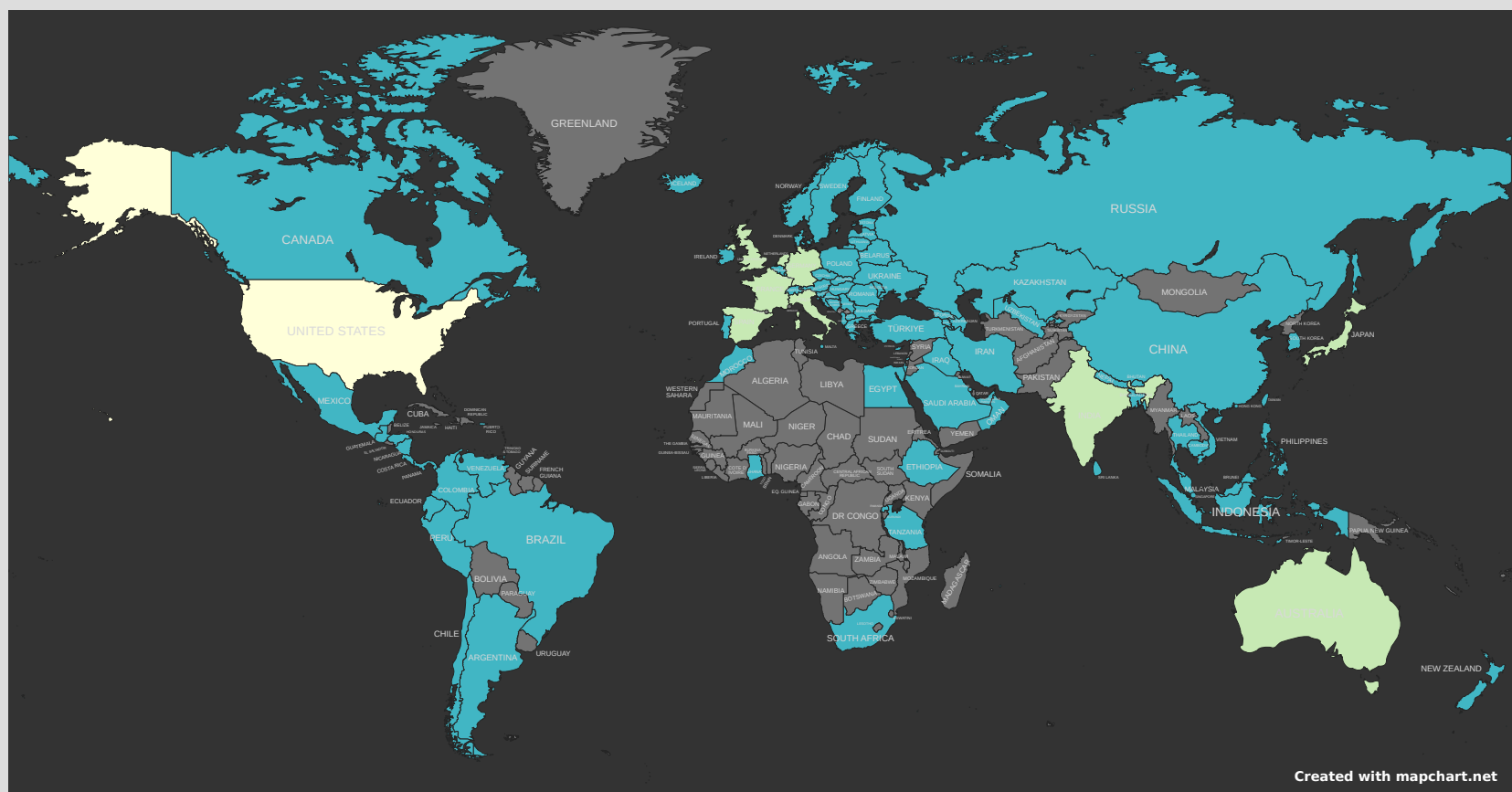
Pressing "f" will freeze the display and then you can take a screenshot. Pressing "f" again will toggle back to update-mode.

- Other notable keyboard short cuts include:
- Tab and Shift+Tab to go Forward and Backward through multiple frames.
  - "c" to print the coordinates at the current cursor location
  - "s" and "b" to designate regions as Source and Background
  - "i" and "e" to designate regions as Include and Exclude

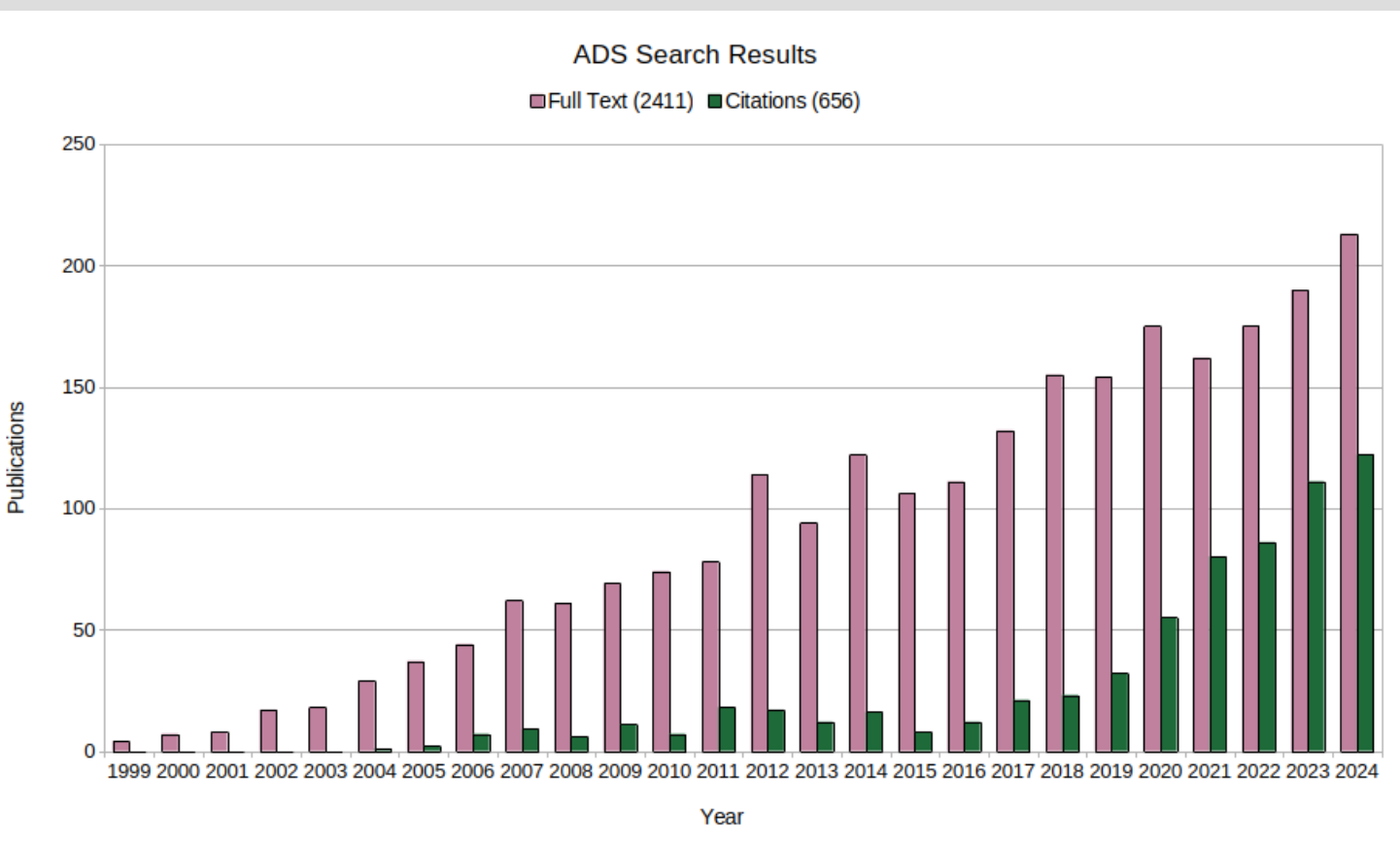
### Users



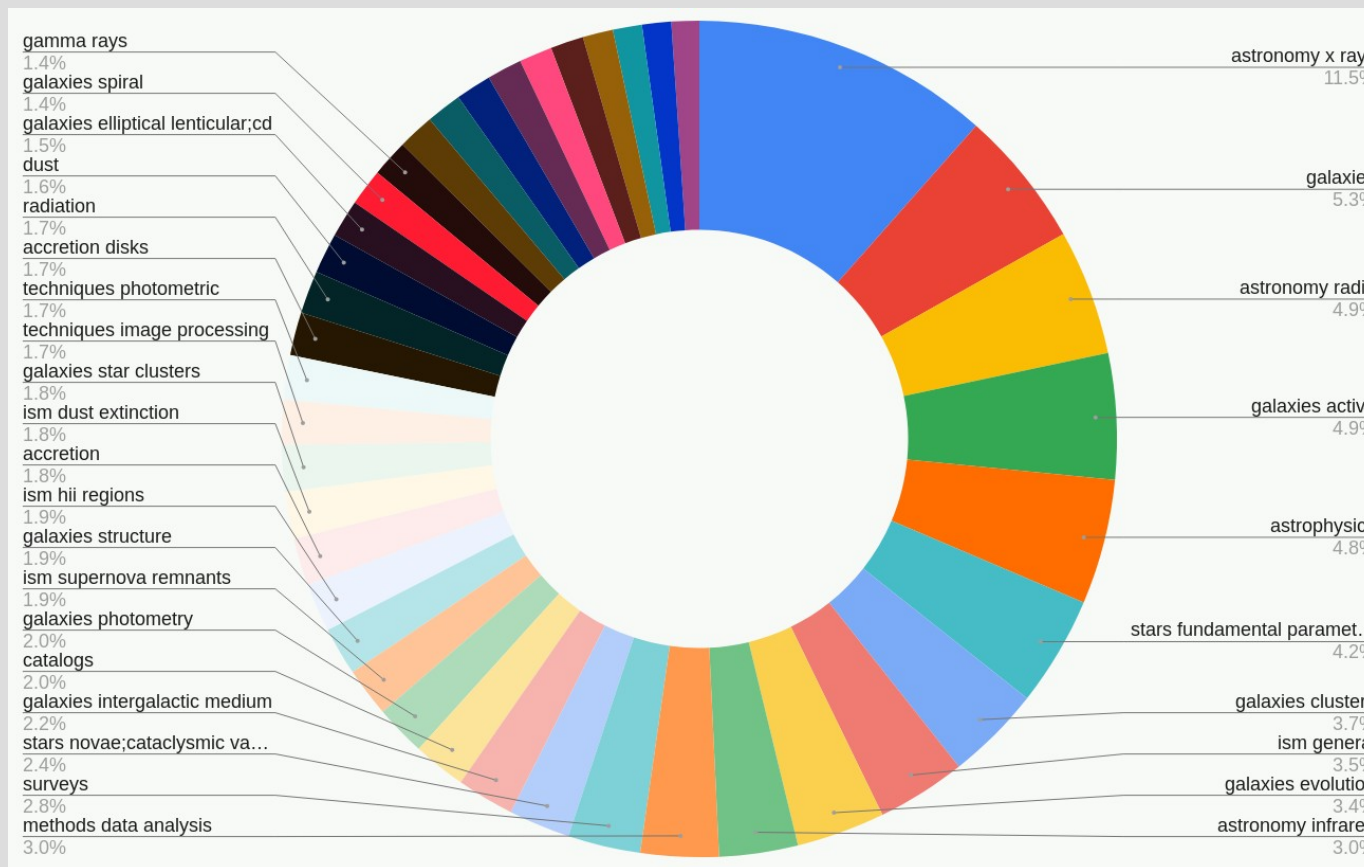
For the past 5 years, between 30,000 and 40,000 users have downloaded DS9. (2023 logs are partially missing). For reference: AAS membership is 7,700.



In 3 months, January through March 2024, DS9 was downloaded to 101 countries. USA was 35%. Australia, Japan, India, and countries in Europe made up the top 10.

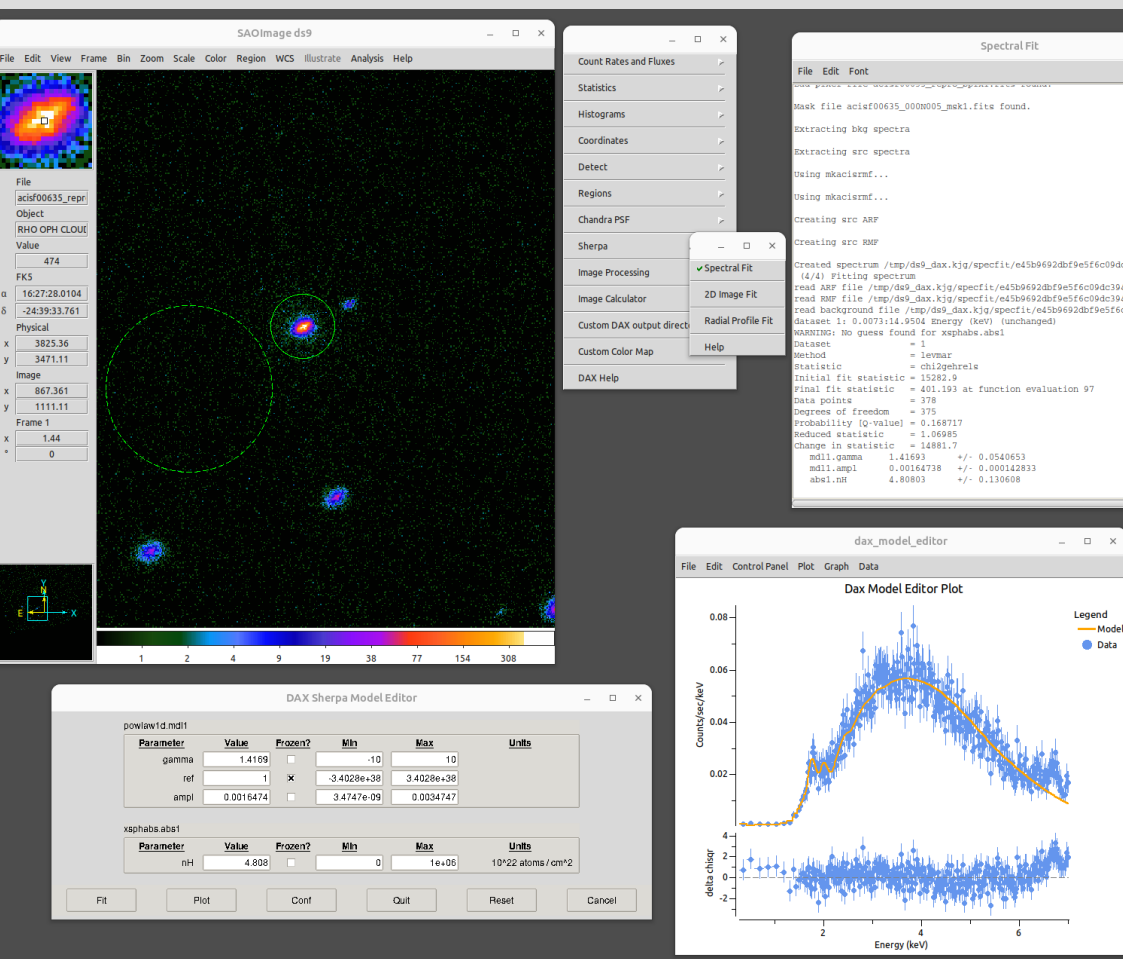


Software citations in the literature are notoriously sparse. Despite this, "DS9" appears in over 2,400 papers and Joye et al, 2024, is referenced over 650 times.

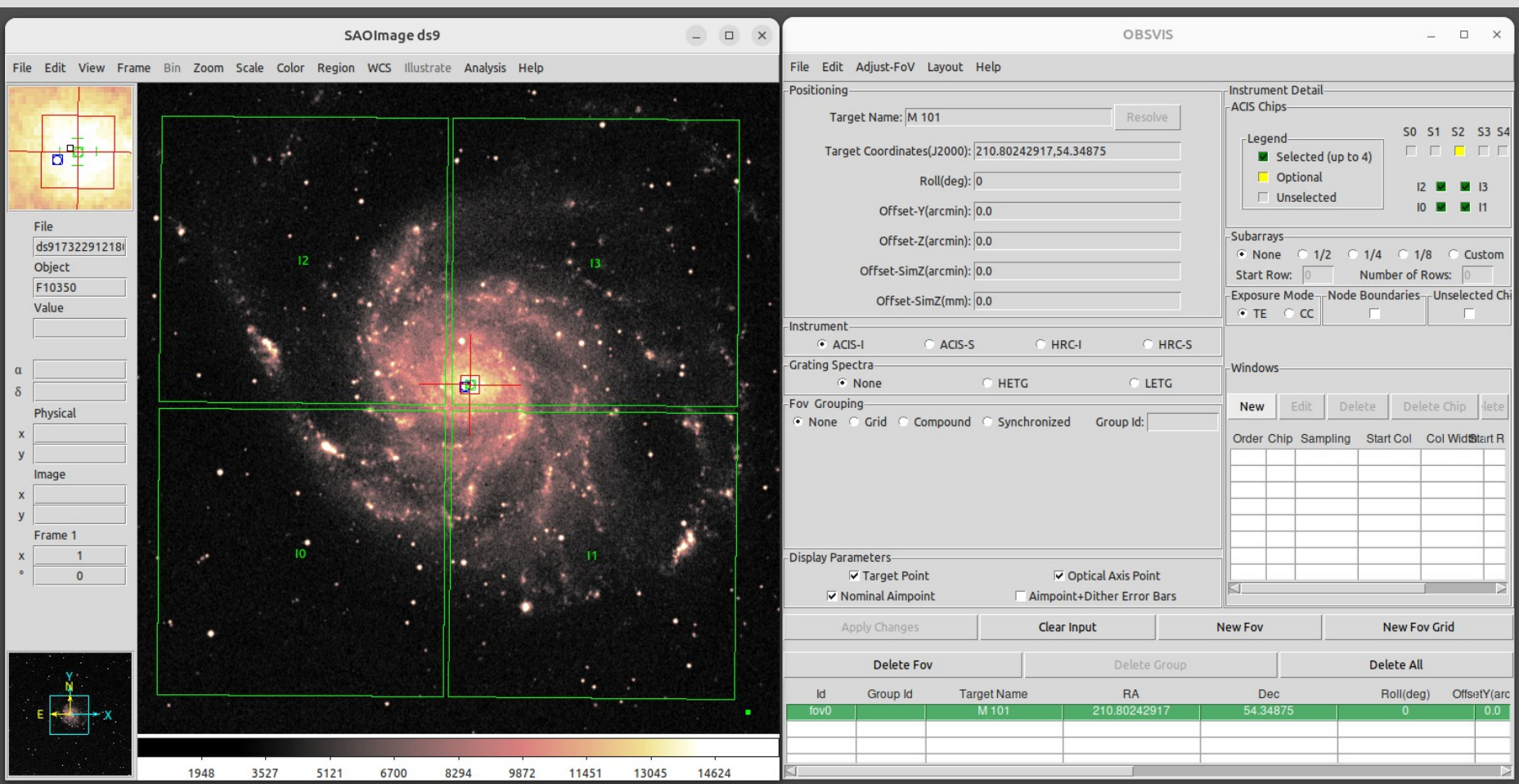


DS9 usage spans all astronomical cohorts and areas of study. DS9 is popular with X-ray astronomers since it is one of a few applications that can display event files.

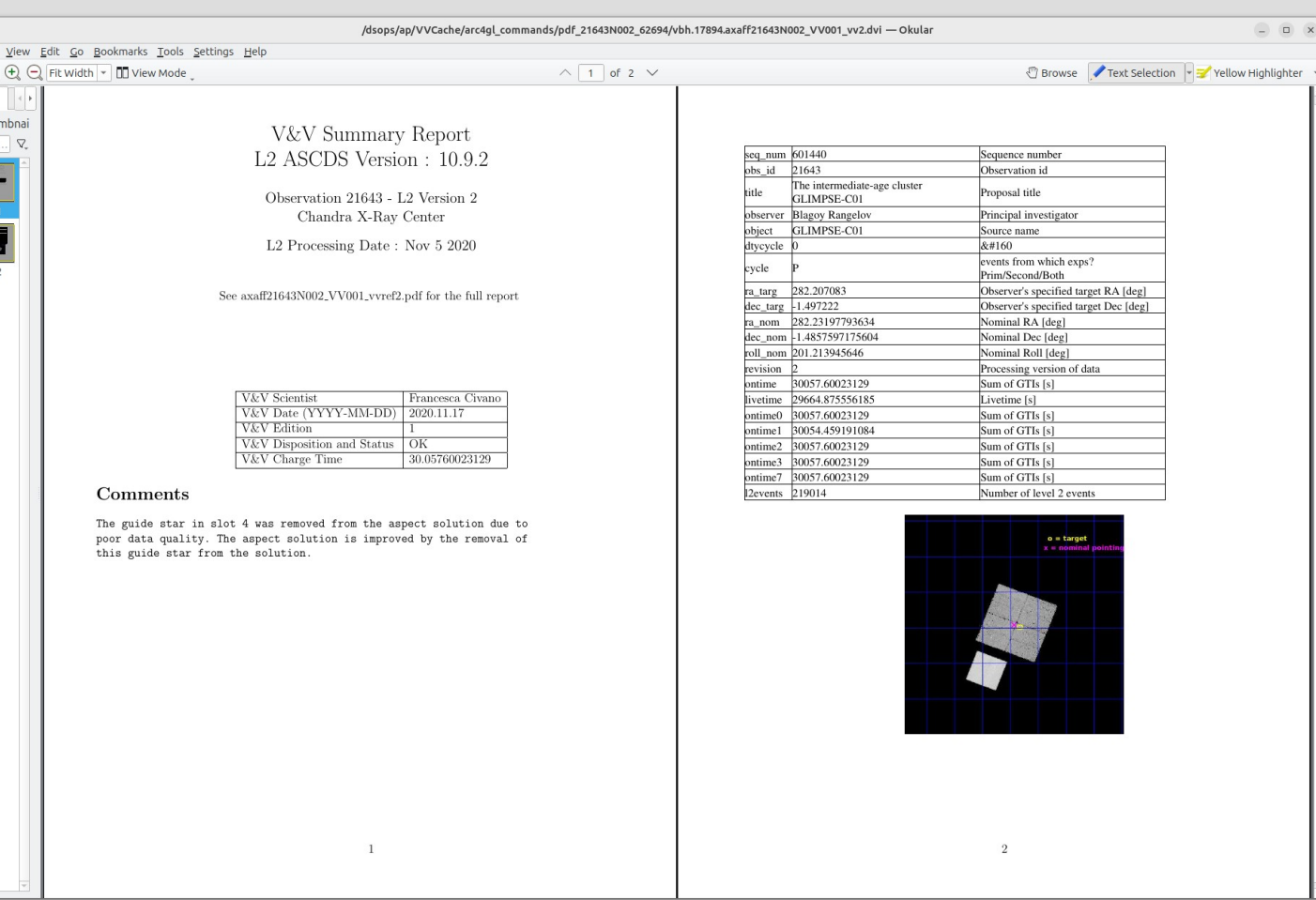
### Synergy with Chandra



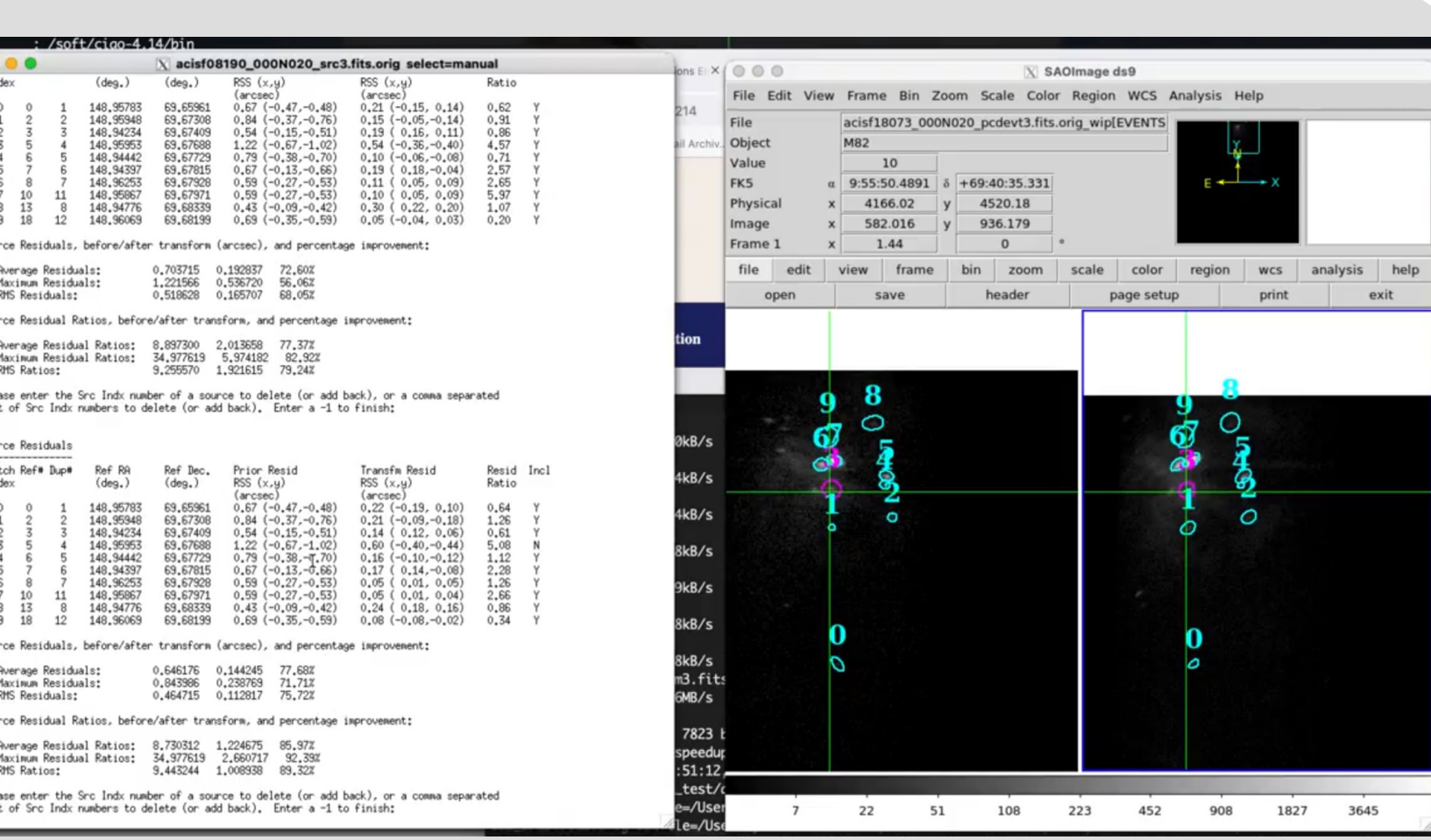
DS9 is included with Chandra's CIAO software. DAX, DS9 Analysis eXtensions, are a set of plugins that run CIAO commands directly in DS9.



ObsVis is the Chandra observation planning tool. ObsVis extends DS9 capabilities by using the built in Tcl/Tk interpreter.



Standard data processing of science data concludes with a Verification and Validation pipeline which uses DS9 to generate an annotated full-field image for the report.



DS9 is used as part of the Quality Assurance processing for the Chandra Source Catalog.