The Chandra Source Catalog: User Interfaces

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Chandra Source Catalog Data Access

http://cxc.harvard.edu/csc/

Graphical User Interface (GUI): *CSCview*

The *CSCview* data retrieval interface is available for browsing the Chandra Source Catalog (CSC) and downloading tables of quality-assured source properties and data products. *CSCview* is a GUI application with design features reminiscent of a web browser, with various tabbed pages and a standardized menu bar with common options available in *File*, *Edit*, *View*, and *Help* menus (however the tabs are not independent of one another). It is a Java applet which runs in a Java-enabled web browser, requiring Java version 1.5 or higher.

CSCview has five distinct faces split amongst four tabs: the Catalog tab, the Query tab (consisting of two separate entry forms), the Results tab, and the Products tab.

Users are provided with the full list of CSC source properties in the CSCview Query tab for constructing queries to the catalog. Source properties are selected from the list and entered into the appropriate fields in the query form to specify the set of data which should be returned for each source located in the search, as well as to enter optional search criteria for refining the search results (in the form of Boolean logic statements). The catalog may be searched on any of the given source properties, not just position. After a query is submitted in the Query tab, a table of search results is returned in the Results tab, in which each row corresponds to a source and each column a source property requested in the Query tab. In the Results tab, the table of search results may be saved to a tab-delimited text file, and the CSC data products available for each of the sources may be selected. These data products include Chandra Level=3 event files, light curves, energy spectra, images, background and sensitivity maps, among others, all of which are processed with the CIAO (Chandra Interactive Analysis of Observations) software. After making data products selections in the Results tab, they may be downloaded through the Products tab, either to a single tar file, or with a download script. The download script is a text file consisting of a list of Wget commands, one for each data product, to be executed on the Unix command line for a batch download.
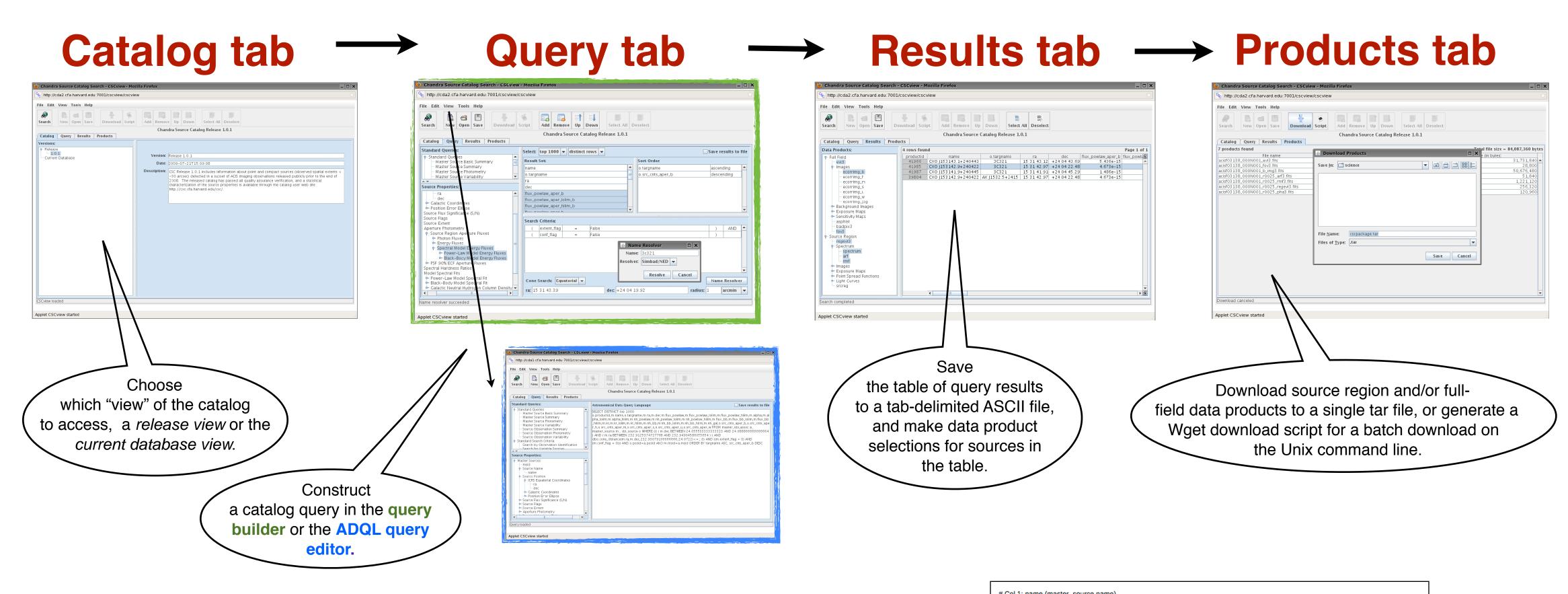
Command Line Interface (CLI)

Tables of catalog source properties may also be accessed non-interactively on the Unix command line with tools like cURL and Wget, using the ADQL (Astronomical Data Query Language) 2.0 query syntax supported by the CSCview GUI application. (CSCview is form-based, but converts the query to ADQL for execution. Users can write ADQL queries directly in CSCview via the *View->Query->Show Language* menu option in the Query tab.)

```
TERMINAL
unix% curl --form query='SELECT m.name, m.ra, m.dec,
m.flux_aper_b FROM master_source m WHERE
dbo.cone_distance(m.ra,m.dec,83.77333,-5.68464)<=10'
'http://cda/csccli/getProperties'

unix% wget -O out.file 'http://cda.cfa.harvard.edu/
csccli/getProperties?query=SELECT m.name, m.ra, m.dec,
m.flux_aper_b FROM master_source m WHERE
dbo.cone_distance(m.ra,m.dec,83.77333,-5.68464)<=10'
```

Catalog tab → Query tab → Results tab → Products tab

Choose which "view" of the catalog to access, a *release view* or the *current database view*.

Construct a catalog query in the **query builder** or the **ADQL query editor**.

Save the table of query results to a tab-delimited ASCII file, and make data product selections for sources in the table.

Download source region and/or full-field data products to a single tar file, or generate a Wget download script for a batch download on the Unix command line.
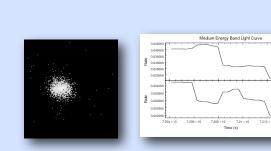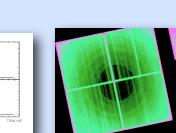
The CSC Level=3 (L3) data products available for download through the Products tab include the following:
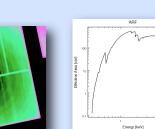
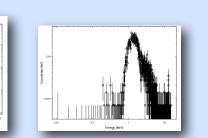Full-field files: *events | background | exposure map | sensitivity map | aspect histogram | bad pixel | field of view*

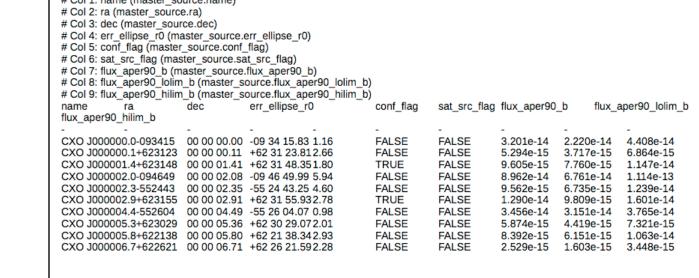Source region files: *events | PHA | ARF | RMF | exposure map | PSF | light curve | region*

The Chandra L3 data products output by the CSC observation processing pipelines contain higher-level information than the corresponding L2 outputs, including more precise source detection and characterization (fluxes, morphology), plus cross-correlation with other catalogs. However, some L3 files are identical or very similar to their familiar L1 and L2 counterparts (or to the file output of CIAO threads which use L1 and L2 files). For example, the L3 events file is the same as the L2 events file except that it undergoes an additional step of processing, background flare filtering. These files may be analyzed with the CIAO software in the usual ways; see the CSC threads for details (http://cxc.harvard.edu/csc/threads).

A *CSCview* save file containing a table of search results returned in the Results tab is output in a format which is an extension of RDB: it consists of columns of tab-separated data values beneath a header commented by '#', with a single line of dashes between the column titles and column data values. The header lists the names of the CSC source properties contained in the columns of the table. This file may easily be converted to a CIAO-compatible form by following instructions provided on the CSC website (http://cxc.harvard.edu/csc/threads/convert).
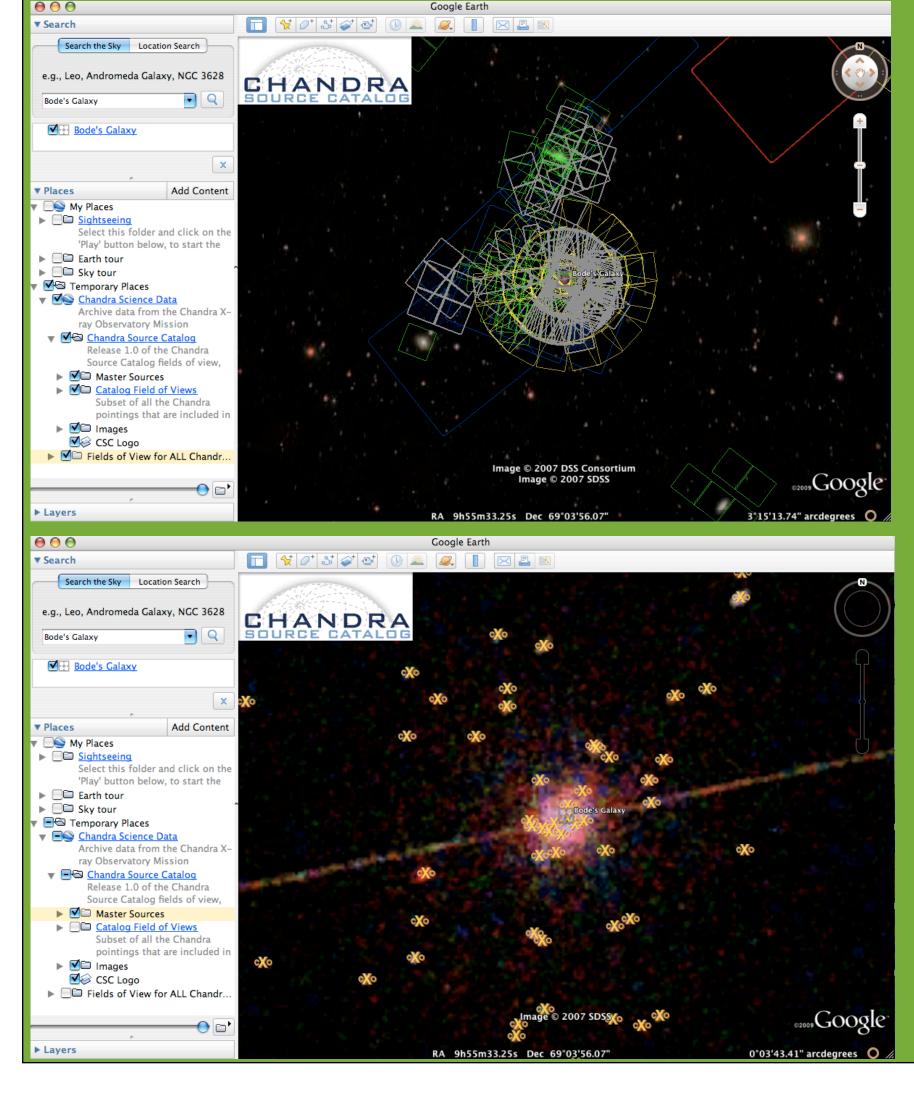

http://cxc.harvard.edu/csc/

Refer to the CSC website for high-level descriptions of each source property and data product included in the catalog, as well as step-by-step CSCview and data analysis tutorials ("threads"), help documents, answers to FAQs, How & Why topics, catalog science requirements and specifications, catalog organization and data processing, and a thorough summary of the catalog statistical characterization.

CSC Interface to Sky in Google Earth

The CSC interface to Sky in Google Earth allows you to view the footprint of each Chandra observation on the sky, as well as the Chandra ACIS imaging fields of view included in Release 1.0 of the CSC, for comparison. It is possible that a source was observed by Chandra, but that the portion of the observation in which it resides is not included in the catalog (i.e., it lies on a so-called CSC Rel. 1.0 "dropped chip"). To find out if a source is included in the catalog, simply download the CSC KML to your Google Earth *My Places* folder, and then search the sky on source name or position to see if a CSC Rel. 1.0 field of view overlaps that region of sky. You can also search by Chandra ObsID by making the appropriate selection from the list provided in the Chandra Science Data folder.

On the left, Chandra Data Archive fields of view in the vicinity of Bode's Galaxy are shown; they are color-coded to distinguish between HRC and ACIS grating and no-grating observations.
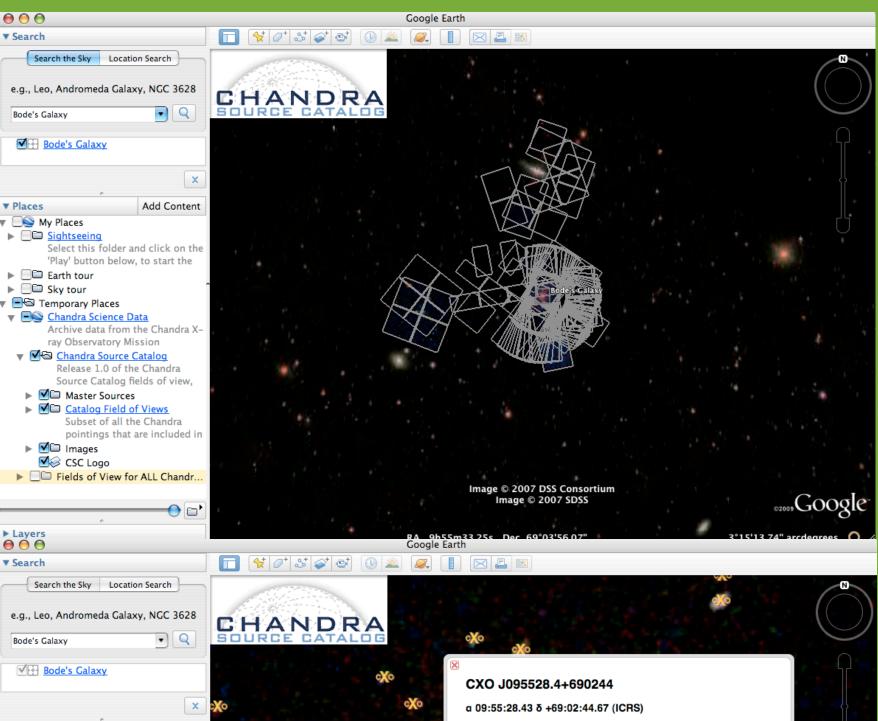
On the right, Chandra ACIS no-grating fields of view included in Release 1.0 of the CSC are shown.

Note: the currently available release of the catalog, Release 1.0, contains only point and compact sources extracted from Chandra ACIS imaging observations. Releases of the catalog in the near future will include point sources in HRC and grating observations, and in the longer term, very extended sources.

In the zoomed-in view of Bode's Galaxy, yellow "CXO" markers identify catalog sources; clicking on a marker pops-up a balloon listing key source properties.

Additional User interfaces:

CSC Limiting Sensitivity Service: an on-line tool which returns the limiting sensitivity (photons/s/cm²) in the CSC Broad band (0.5-7.0keV) at arbitrary user-specified locations. An ASCII file containing a list of R.A. & Dec source positions may be uploaded to the tool, which will output a table of sensitivity values for each source in the list (may be viewed in the web browser or written to a text file).

CSC-SDSS Cross-match Catalog: a catalog which contains the list of sources common to both the Sloan Digital Sky Survey Data Release 7(SDSS) and CSC Release 1.0, as well as a subset of SDSS and CSC source parameters for each. Users may query the Cross-match catalog to download tables of CSC and/or SDSS source properties for all sources in the catalog, or a subset of the sources as defined by optional user-specified search criteria.

IVOA-compliant Simple Cone Search Interface: an interface which allows VO portals (e.g., DataScope) and VO-aware tools (e.g., TOPCAT) to directly search for catalog sources near a user-specified position.

DS9 v. 5.6 (and higher) Catalog tool: a tool which can load and save CSC data in VOTable format, overlay CSC source positions on an uploaded image, and exchange tables of CSC source properties with other applications (e.g., TOPCAT) via a SAMP (Simple Application Messaging Protocol) connection.