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User Interfaces to HST Data: StarView and the World Wide Web

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Abstract. This paper describes two approaches for user interfaces to the *Hubble Space Telescope* (*HST*) archive. StarView is a custom interface with many interactive features for the serious archive user. An experimental World Wide Web (WWW) interface is also described, which supports some of the basic features of StarView available via standard WWW clients such as NCSA Mosaic.

1. Basic Features

There is a set of core features we provide to *HST* archive users in the user interfaces. These are: Forms-based catalog queries, for ease of use and to cover different areas of interest effectively; coordinate lookup of target names via SIMBAD[1] and NED[2], to insure completeness in searching for *HST* exposures by target; preview of public datasets (images and spectra), to be able to make some judgment of data quality before actually retrieving the data; and submission of retrieval requests to the archive (registered users only). Beyond these, additional features are supported in StarView.

2. StarView

StarView is the primary user interface to the *HST* archive (Williams 1993; Long 1994). It runs as a client software package on SunOS and VMS currently, supporting both CRT and X/Motif displays. Over 35 forms have been developed by archive scientists for catalog queries in a number of areas, such as: completed and planned science exposures; proposal information and abstracts; *HST* instrument and calibration parameters; and astrometry and engineering parameters. In addition, it is possible to build custom queries simply by choosing catalog field names from a list. Filtering and sorting operations are used to navigate this list of over 3000 fields to find those of interest. An automatic query generation facility then turns this chosen set of database fields into a reasonable SQL query (Silberberg 1994).

[1] http://cdsweb.u-strasbg.fr/Simbad.html

[2] http://www.ipac.caltech.edu/ipac/projects/ned.html

Using the cross correlation function, a list of targets—RA, Dec, and a description—is provided to StarView. The catalog is then searched for matching records of any of the targets in the list using a fuzzy join by RA and Dec. For any set of query results, from pre-defined forms, custom queries, or cross correlated queries, the values can be exported to an ASCII file or FITS ASCII table for use outside of StarView. Try it out on: *stdatu.stsci.edu* (UNIX)[3] or *stdata.stsci.edu* (VMS).[4] Use account: `guest`, password: `archive`. Enter `starview` for the CRT version and `xstarview` for X/Motif. We do not recommend running `xstarview` across the Internet—get the distributed client version instead. Please send mail to *archive@stsci.edu* for more information.

3. World Wide Web

An experimental WWW interface was developed in September 1994 to explore the many aspects of making archive information available on the Internet using standard protocols and methods. It was shown at the conference.

We started with the NCSA httpd server and GSQL, which is a simple gateway to SQL databases. GSQL was greatly modified, primarily to support the processing of search constraints on input and the formatting of astronomical values on output. Pieces of StarView code, StarView utilities, and additional programs and scripts were integrated via the Common Gateway Interface (CGI)[5].

Two primary search screens were implemented: Completed *HST* Exposures and Planned *HST* Exposures. HTML Fill-Out Forms[6] are used whereby the user can enter a set of search constraints. The subsequent search results screen contains hypertext links to related proposal information and to the preview datasets. Individual datasets can be selected and submitted for retrieval from the archive.

By integrating a diverse set of programs, tools, and scripts, the basic features listed in Section 1 are supported. There are efficiency issues with the support of the FITS preview data. Another issue is security, in protecting the user account information that is needed for dataset retrieval.

This WWW interface is experimental, and is not publicly available.

4. Experiences

4.1. StarView

We have a large investment in our custom, full-featured interface. The user can be given immediate feedback on any function, there are pop-up dialogs for options and warnings, pull-down menus, etc. StarView can deal with compli-

[3] rlogin://guest@stdatu.stsci.edu/

[4] rlogin://guest@stdata.stsci.edu/

[5] http://hoohoo.ncsa.uiuc.edu/cgi/

[6] http://www.ncsa.uiuc.edu/SDG/Software/Mosaic/Docs/fill-out-forms/overview.html

cated input and data interaction, for example, taking a long list of targets to cross-correlate with the *HST* catalog.

Many changes can be accomplished by editing ASCII configuration files. These include changes to the form definition files defining the screen layout, the data definition files describing the details of the catalogs, help files, etc. Such changes are often done by the archive scientists and support staff without software code modifications. Still, major enhancements require C++/C code changes by the developers.

4.2. World Wide Web

Anyone who has surfed the *Web* can see that it is quite easy to make data available via the WWW. Pretty pictures, movies, sound files, even video snapshots of an office or a fishtank are just a hypertext link away. User interface clients are freely available for all the major platforms (UNIX, VMS, Windows, Macintosh, etc), making it easy to support your intended audience without distributing software.

However, the stateless nature of the WWW architecture, using HTTP and HTML, requires one to rethink how to present a complex catalog or archive system to the end user. Tricks can be used to maintain state, but essentially every mouse click is a new transaction to be processed. This translates directly to issues of database loading. For example, StarView displays records from the database as soon as the first record is found. The user can then get more records or cancel once sufficient additional records have been seen. But in the case of the WWW, the HTTP connection will go away after each transaction, so it is necessary to complete the query and return all of the results (up to some maximum record count).

The current version of HTML provides limited control of form presentation and interaction. Proposed enhancements, such as HTML 2.0[7] and the Common Client Interface (CCI)[8] for NCSA Mosaic, are attempting to deal with some of the issues of improved formatting and interaction.

5. Future Plans

StarView continues to be maintained and enhanced to support the *HST* archive. We plan to look at better ways of supporting catalog navigation and custom queries, possibly with more graphical techniques. Access to other catalogs and sky survey data, which will be useful to researchers, is also being investigated.

Further assessment of WWW access to the *HST* archive is planned. More experimentation and thought is needed to address issues of performance, loading of database servers, security for retrievals, and user support. We have already incorporated ideas from the WWW into StarView, such as using the HTTP protocol to serve files easily and quickly to the StarView client.

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[7] http://www.hal.com/users/connolly/html-spec/index.html

[8] http://yahoo.ncsa.uiuc.edu/mosaic/cci/cciTalk.html

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