The Multimission Archive at the Space Telescope Science Institute in the context of VO activities

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\textbf{Abstract.} In the past year, the Multimission Archive at the Space Telescope Science Institute (MAST) has taken major steps in making MAST’s holdings available using VO-defined protocols and standards, and in implementing VO-based tools. For example, MAST has implemented the Simple Cone Search protocol, and all MAST mission searches may be returned in the VOTable format, allowing other archives to use MAST data for their VO applications. We have made many of our popular High Level Science Products available through Simple Image Access Protocol (SIAP), and are implementing the VO Simple Spectral Access Protocol (SSAP). The cross correlation of VizieR catalogs with MAST missions is now possible, and illustrates the integration of VO services into MAST. The user can easily display the results from searches within MAST using the plotting tool VOPlot. MAST also participates in the NVO registry service. Thus, the user can harvest MAST holdings simultaneously with data from many other surveys and missions through the VO DataScope Data Inventory Service.

1. Introduction

The Multimission Archive at Space Telescope Science Institute is NASA’s UV-optical science archive center. It contains the Hubble Space Telescope archive plus more than a dozen additional active, planned, and legacy mission datasets. The total MAST data volume exceeds 20 Terabytes, making it one of the most significant astronomical collections available on-line.

MAST is an important node in the upcoming virtual observatory and we are continually improving our data discovery and retrieval abilities. MAST has taken major steps in making its holdings available using VO-defined protocols and standards, and in implementing VO-based tools. All MAST mission searches may be returned in the VOTable format, allowing other archives to use MAST data for their VO applications.
2. MAST Webservices

Currently, MAST provides three different forms of webservices, HTTP GET Requests, an RSS news service and dataset verifier SOAP service. Additional information can be found at [http://archive.stsci.edu/vo/mast_services.html](http://archive.stsci.edu/vo/mast_services.html). HTTP GET Requests allow search parameters to be included in the URL. As such, they can be called from within programs to automate data searches. Currently, MAST provides this service for Mission Searches, Simple Cone Searches and the Simple Image Access Protocol. The results are returned in VOTable XML format. The result of the Mission Searches can also be returned as Excel spreadsheet, and comma-separated values which can simplify ingesting results into user-written programs. Fig. 1 shows the VOTable returned for a positional search in the archived NICMOS images: the search radius is 0.5 arcsec and the search is restricted to data in gif-format.

The RSS news service offers to search a list of MASTs most recent news items and returns the result in RSS XML-format. The output can also be displayed in HTML.

MAST has one SOAP-based web service, which is accessed via the ADS. The web service allows users to enter a data set name and obtain a verification and link to the archival website of this dataset. More information about the ADEC naming conventions can be found at [http://archive.stsci.edu/pub_dsn.html](http://archive.stsci.edu/pub_dsn.html). The service can be accessed from the web form at:
http://ads.harvard.edu/ws/DataVerifier or, using the latest ADEC naming conventions:
http://vo.ads.harvard.edu/dv/DataVerifier.cgi (Fig. 2).

Figure 2. Example of the SOAP-based web service: enter the dataset names in the verification form and submit the request. The result contains the verification of the dataset name as well as links to these datasets.

3. **VOPlot at MAST**

Users may plot search results from any MAST mission or VizieR catalog search with the new JAVA-based graphical display tool called VOPlot (developed within
Figure 3. The galactic distribution of STIS high-resolution UV observations: the graphical display tool VOPlot is called from the result page of a MAST archive query.

the Indian VO project in collaboration with CDS). The example in Fig. 3 shows the galactic distribution of STIS UV observations with the Echelle gratings.

4. MAST and VizieR

Users may now search the entire set of 4000 VizieR catalogs and cross correlate the results with any MAST mission. This uses a VizieR web service which communicates using the VOTable standard. The example shows the result of a cross correlation between the Vega-type star catalogue and archived FUSE observations. Enter the catalog information at [http://archive.stsci.edu/vizier.php](http://archive.stsci.edu/vizier.php) and cross correlate it with the FUSE data in MAST. Fig. 4 shows how to navigate through the cross correlation. In addition, it provides a cutout of the returned information on the available FUSE datasets for Vega-type stars from the specified catalog.
Figure 4. Provide the catalog information for the cross correlation at [http://archive.stsci.edu/vizier.php](http://archive.stsci.edu/vizier.php). After choosing the cross-correlation option for the catalog of Vega-type stars, the FUSE mission was selected and the last page shows a pane of the resulting web table.