

AXIS-SVO Data Centre Creation

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Abstract We present the process followed to create the AXIS-SVO Data Centre at the Instituto de Física de Cantabria under the standards of the Virtual Observatory using the publication tools elaborated by the ESA-VO team at the European Space Astronomy Centre (ESAC). The current content of this Data Centre is a sample of optical spectra which are part of the AXIS-XMS sample, based on observations of the XMM-Newton x-ray observatory.

1 Motivation

The x-ray group at the IFCA (CSIC-UC) institute is leading the AXIS (An XMM International Survey [1]) project which constitutes the backbone of the XMM-Newton X-ray follow-up and identification (XID) programme performed by the XMM Survey Science Centre (SSC). The AXIS project includes both imaging and spectroscopic observational runs in ground-based resources and thus, among the data compiled, there are optical images and spectra for the serendipitous sources found in the XMM observations. As a result of this programme, an X-ray medium flux sample (AXIS-XMS) with almost 300 sources and 600 optical spectra has been compiled, and the data published through the traditional ways (journal and Vizier catalogues). The next step to make these data more accessible to the scientific community is therefore their publication under the Virtual Observatory (VO [2]).

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2 The AXIS-XMS sample

The AXIS [4] sample comprises 36 XMM-Newton extragalactic fields (with galactic latitude greater than 20 deg) selected according to quality criteria (high exposure time, lack of background contamination, absence of bright extended sources). In addition, a visual screening was performed so as to eliminate problematic sources (sources in gaps or in bad areas). The sample contains 1434 unique sources and covers a total solid angle of almost 4.8 deg^2 .

From these 36 fields, a subsample of 25 fields were selected to build the X-ray Medium Sensitivity Survey, extending over a solid angle of 3.3 deg^2 . Using these 25 fields we defined 3 flux-limited subsamples in three different energy bands (“Soft”, “Hard” and “XID”) with a total of 319 sources (see details in [5]). There are optical images (g,r,i) done at the INT (WFC) telescope down to a limiting magnitude of $r \text{ } 23 - 24$ for all the fields, providing a unique and reliable candidate counterpart for almost all the sources. In addition to this, optical long-slit spectroscopy was performed permitting an identification fraction of $\sim 90\%$.

The sample numbers can be seen in Table 1.

Table 1 XMS subsamples: energy bands, number of sources and identification fraction

Sample Name	Band (keV)	Flux Lim. (10^{-14} cgs)	Number of sources (unique)	Number of iden- tifications (fraction)
XMS-S (soft)	0.5-2	1.5	211 (1)	202 (96%)
XMS-H (hard)	2.-10	3.3	160 (20)	134 (84%)
XMS-X (XID)	0.5-4.5	2.0	285 (56)	264 (93%)
XMS-U (Ultra Hard)	4.5-7.5	–	71 (82)	61 (86%)

Fig. 1 Access to the public
AXIS web pages.



2.1 Current publication status

In addition to the sample publication in the papers [4] and [5], the XMS samples are being made publicly available through a collection of web pages at [12] (see Fig. 1).

However this mechanism was primarily intended to work inside the collaboration and it is therefore not optimised for scientific community access.

2.2 The Virtual Observatory

The Virtual Observatory could be defined as the concept of Virtual Research (transparent access to distributed data available worldwide) applied to Astronomy. These new methodology lets the astronomers to discover, access and analyse astronomical data distributed in the large databases of the telescopes or the Data centres, without the need of local download of the scientific and technical resources (data and tools). From this point of view, the advantages of making our samples available from the Virtual Observatory are numerous:

- Access to multiwavelength astronomy
- Data centres interoperability
- (Remote) Access to large amounts of astronomical data

Taking all this into account, we decided to start the VO process creating the IFCA AXIS-SVO Data Centre to publish the almost 600 optical spectra we have compiled so far.

3 AXIS-SVO Data Centre creation

The AXIS-SVO Data Centre was first registered under the EURO-VO Data Centre Alliance (DCA) census, as a new member of the European community of data centres on January 2008. From this point it started a non-trivial process to insert there our (spectral) data, following the steps that will be described now.

3.1 Selection of publication tool

The first approach to the publication tools (software packages that help the data centre manager to make the data available to the VO), was made using the Saada application[6]. This software has the advantage of the automatic creation of a database starting from a collection of FITS files given by the user. However after some problems experienced with the version change and the lack of documentation, we decided to move onto a new tool: the DALToolKit[8] from the ESAVO centre[7].

The DALToolKit development tool proved to be a powerful tool able to create a database from a list of FITS files with almost any interaction of the user and, once installed, provides the final user with a web form where source positions can be entered, and the spectral data in the selected area retrieved in the form of VOTables.

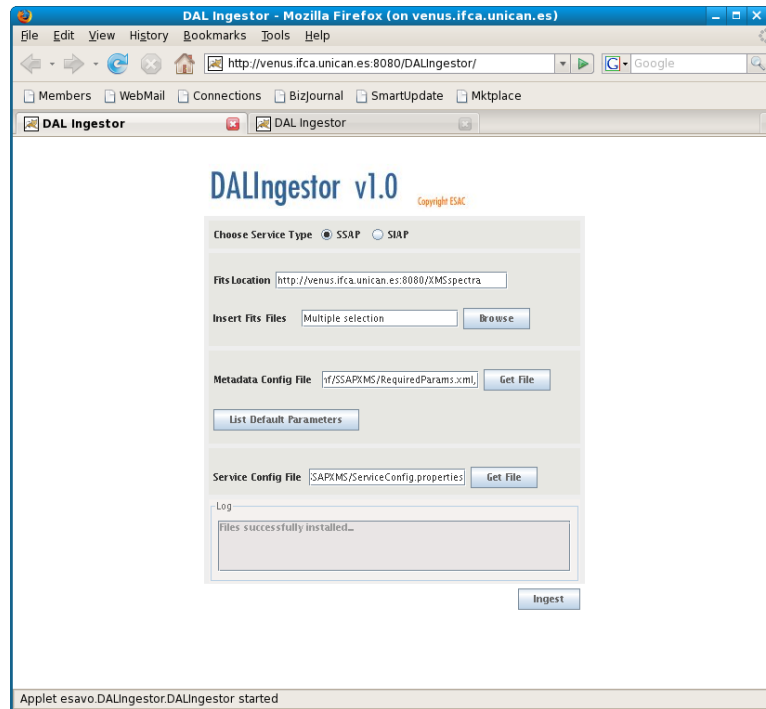


Fig. 2 DALIngestor web form to search for optical spectra based on source position.

3.2 Optical spectra standardisation

The first step, previous to the database creation, was the conversion of all the optical IRAF-like[9] spectra into a set of FITS files fulfilling the IVOA requirements for spectral data (FITS bintable with one column for the wavelength and one column for the fluxes, populated FITS headers, etc.)

Once this is done, the list of optical spectra can be ingested in a (free software) database through the application DALIngestor.

3.3 Server initialisation

The service must reside in a publicly available server, that the Data Centre is responsible of keeping always up and running with updated data. To start the sever, the DALToolKit package provides the user with a group of configuration files that must be adapted to the local parameters. Once this is done, the server can be compiled,

built and deployed using Apache Ant software[10]. After the server start process an web form is presented that allows the user to search the spectral resources based on sky positions (see Fig 2).

The retrieval of the data can be done in the form of a VOTable which enables the possibility of being ingested by spectral analysis tools such as ESAVO VOSpec[11] (see Fig. 3).

3.4 VO registry

The final step to make the resource available to the worldwide astronomical community is the Authority and Service (Simple Spectrum Access, SSAP) registration. To be able to create new Resources it is required to have an Authority type resource registered first. Once the new Authority ID has been accepted it is now then possible to create any type of resource inside this Authority domain.

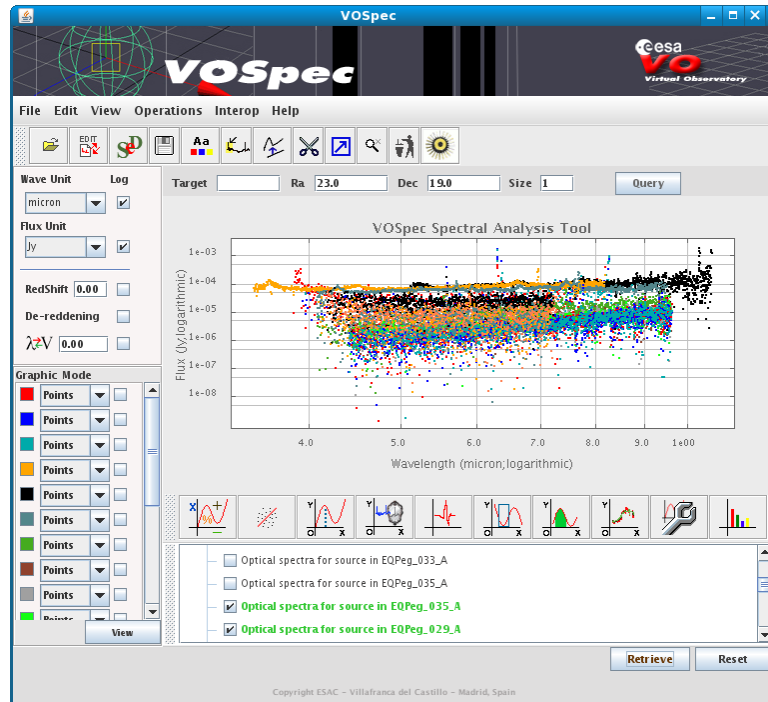


Fig. 3 VOSpec ingestion of spectral data from obtained through the AXIS-SVO service web form.

All this was done using one of the VO registries, the ESA-VO registry at <http://esavo.esa.int/registry/insert.jsp>.

At the end of this registration process, the optical spectral resource provided by the IFCA AXIS-SVO data centre can be discovered from the multiple VO resource locators and reached through the address <http://venus.ifca.unican.es:8080/SSAPXMS>.

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