EURO-3D VO Widget

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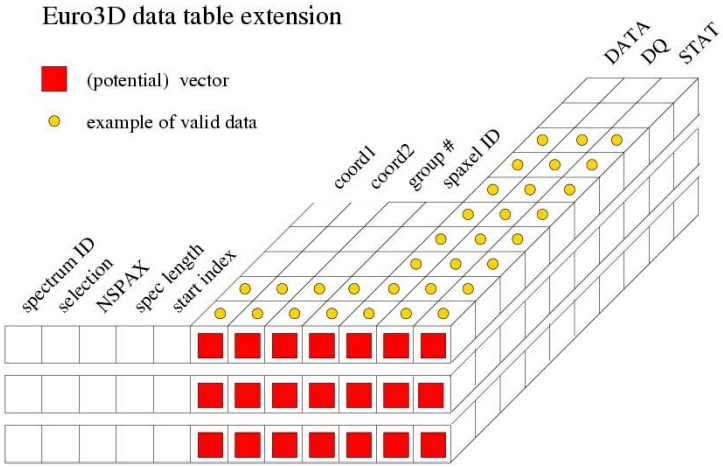
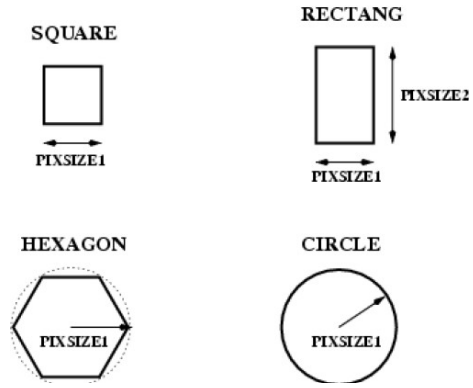
deals with the 3D Spectroscopy format to provide use of the VO tools using SAMP

EURO3D format

Euro3D

- **Definition in the frame of the "3D Spectroscopy Working Group"**
  - Supported by OPTICON (The Optical Infrared Coordination Network)
  - Defines a data format for Integral Field Spectroscopy.
- **Based on 2D images and associated tables**
  - Choice for no lost of information
  - The 2D images to store the spectra (one spectrum per row)
  - The tables would serve to store additional information on the spectra (e.g. their position)
- **Result is FITS file with extensions**
  - Primary header (with empty primary data array) [0]
  - Data table (containing position and spectral information) [1]
  - Group table (defining the Spaxel shapes) [2]

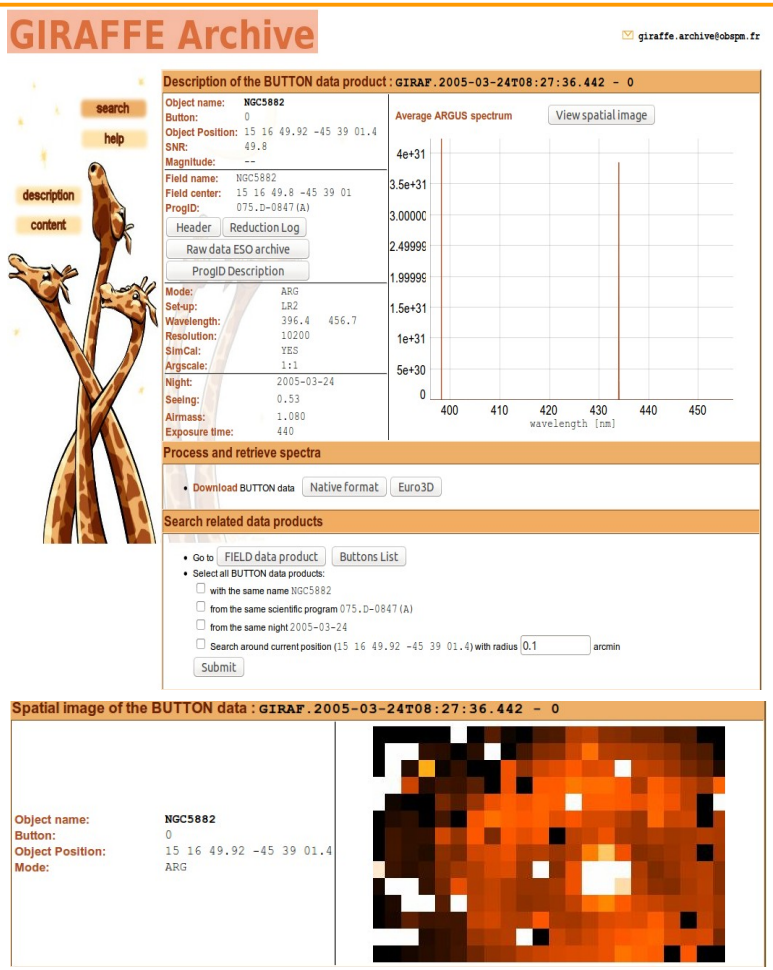


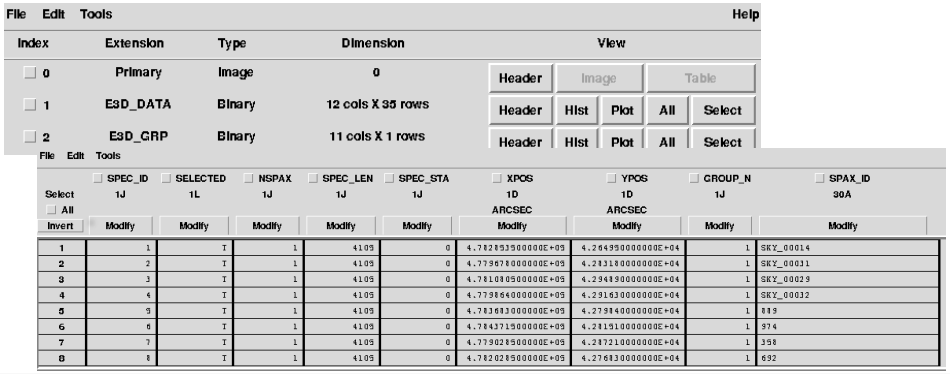


E3D fiber shape

The GIRAFFE database (1/2)

- **Royer F., Jegouzo I., Tajahmady F., Normand J. and Chilingarian I. http://giraffe-archive.obspm.fr**
- **Contains the reduced spectra observed with the intermediate and high resolution multi-fiber spectrograph installed at VLT/UT2 (ESO).**
- **In multi-object configuration and the different integral field unit configurations**
  - Produces 1D spectra and 3D spectra.
  - Provide access to flux spatial image for IFU and ARGUS button mode
- **Use standard output**
  - SSA for 1D spectra
  - EURO3D cube





3D in the VO: The VO-PARIS EURO3D client

- **Developed by Chilingarian et al. (2008) to deal with 3D spectroscopi datasets.**
  - http://voplus.obspm.fr/~chil/Euro3D
  - Java application
- **Using SAMP between Aladin and VOSpec,**
  - Selection and visualization capabilities, spatially and spectroscopically
  - Input in Euro3D (e.g. output format)
  - Native GIRAFFE format
- **No flux spatial image**

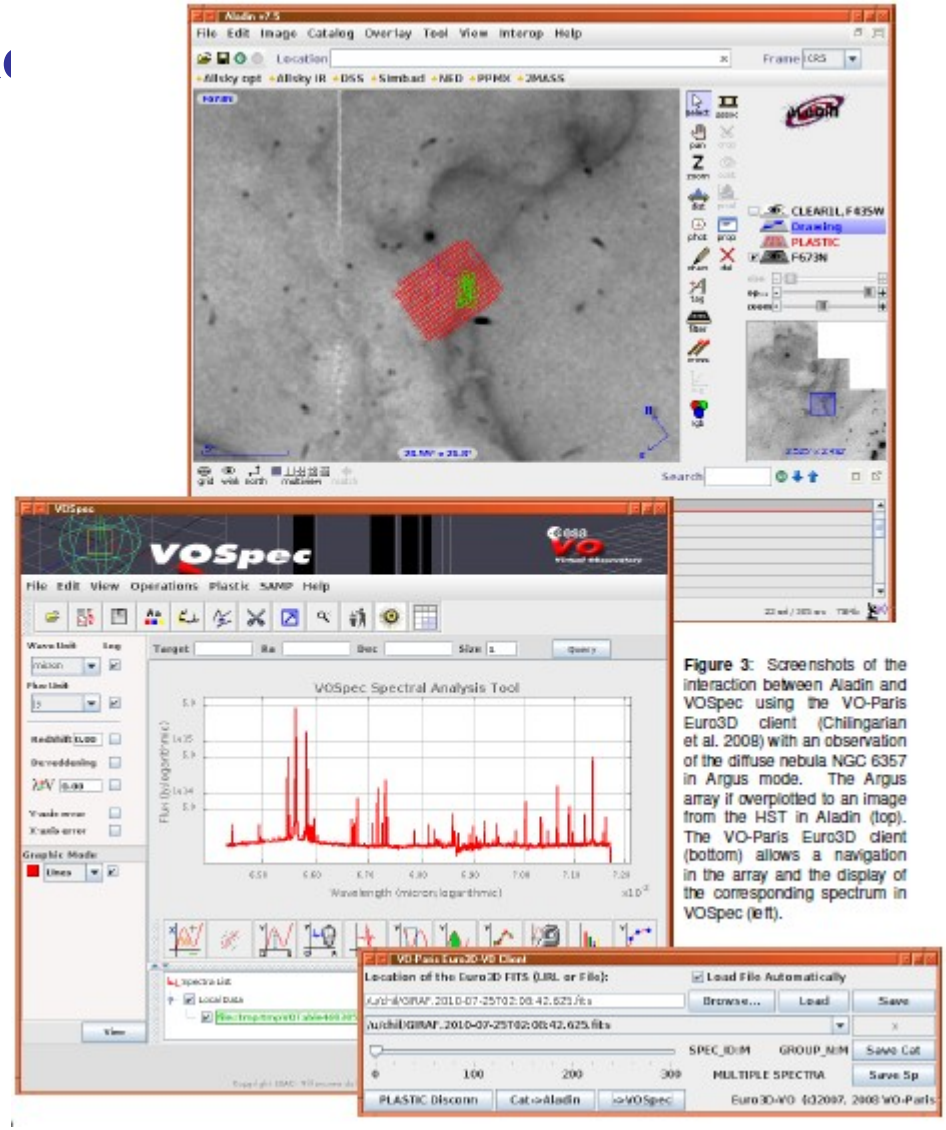
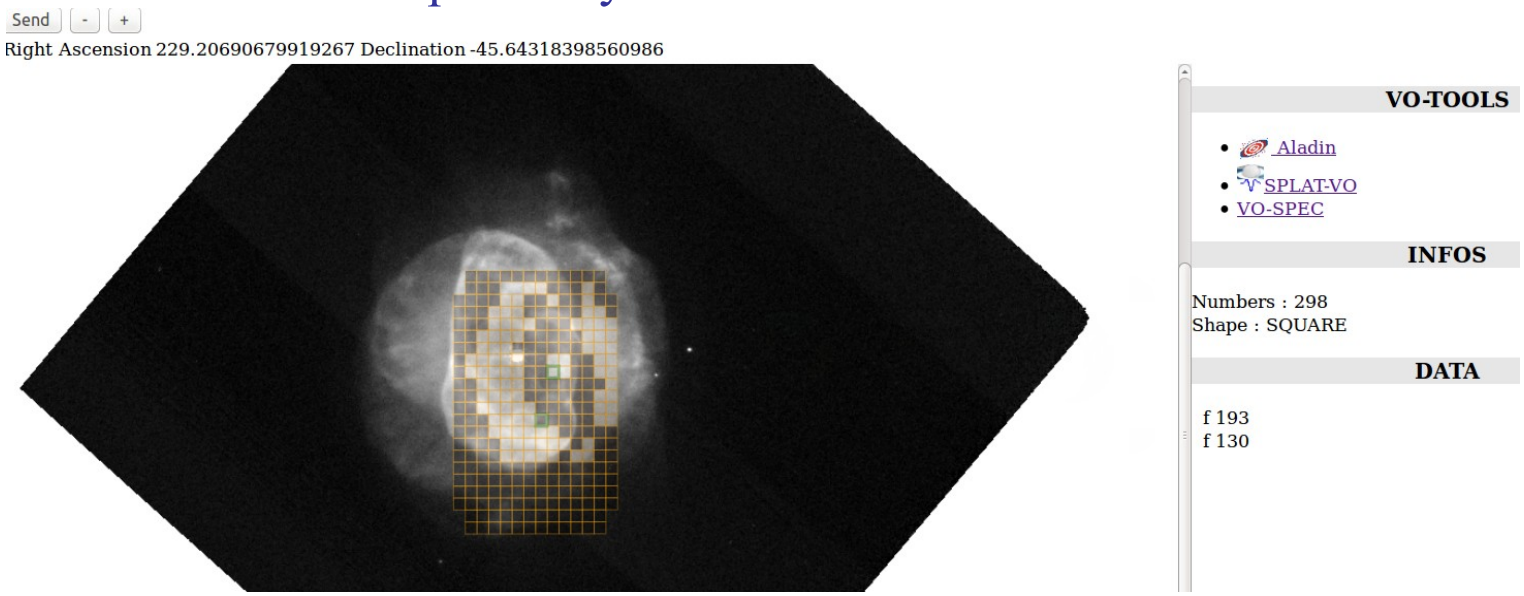


Figure 3: Screenshots of the interaction between Aladin and VOSpec using the VO-Paris EuroD3D client (Chilingarian et al. 2008) with an observation of the diffuse nebula NGC 6357 in Argus mode. The Argus array if overplotted to an image from the HST in Aladin (top). The VO-Paris Euro3D client (bottom) allows a navigation in the array and the display of the corresponding spectrum in VOSpec (left).

3D in the VO: The EURO3D widget

- **Web app**
- **Objective : to project eurod3d flux spatial image on best resolution spatial image**
- **Constraints**
  - Deal with transparency
  - Use VO
  - Provides an access to fiber information
  - Provides access to spectra by fiber



The widget: architecture

- **Prototype for validating arch**
- **Build using CGI/ javascript**
- **Step by step**
  - 1) Extract data with cgi script
  - 2) Get high resolution image with SIA
  - 3) Rendering the spatial image with the fibers
  - 4) Interaction using the VO

The widget: extract data from the E3D file

- Using a perl cgi
- FITS --> cfitsio --> xml or json
- Extract central position, fibers shape, fibers central positions, fibers sum of flux.

cra	229.207846922318
cdec	-45.6502057573788
sra	0.00296025861226212
sdec	0.00333910377152478
shape	"SQUARE"
size1	0.519999980926514
maxflux	4.58988850052942e+23
⊞ fibres	[Object { x=229.208154132125, y=-45.651578280787, flux=248259.189078154, more... }, Object { x=229.208360765927, y=-45.6515784824695, flux=166396.402378261, more... }, Object { x=229.20856739973, y=-45.6515786841519, flux=163965109578883000, more... }, 295 more...]

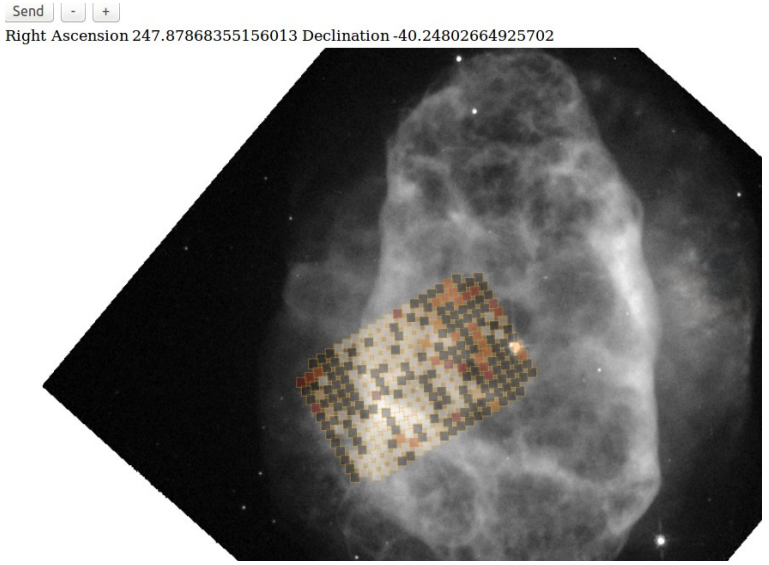
The widget: get the image through SIA

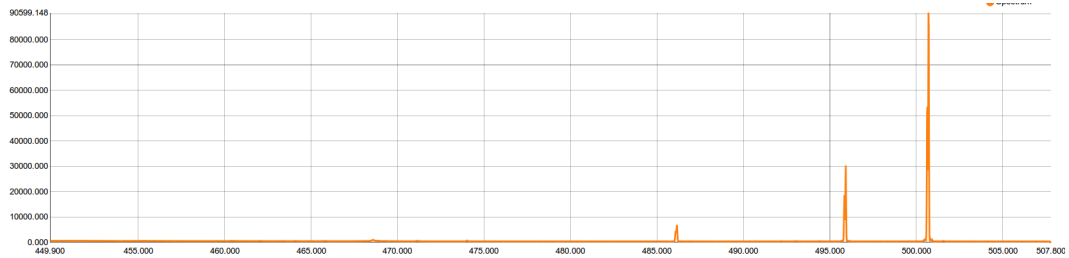
- **Using JQUERY**
  - http://jquery.com/
  - JQUERY FOUNDATION
  - "AS IS" Licence
- **AJAX request**
  - Using stsci Simple Image ACCESS
- **No votable.js :)**
  - So use JQUERY for parsing votable in JS

```
<VOTABLE version="1.1">
    <DESCRIPTION>STScI Hubble Legacy Archive SIAP</DESCRIPTION>
    <RESOURCE type="results">
        <INFO name="QUERY_STATUS" value="OK"></INFO>
        <PARAM datatype="char" name="INPUT:POS" value="229.207847,-45.650206" arraysize="*" unit="deg">
        <PARAM datatype="double" name="INPUT:SIZE" value="0.000000" unit="deg">
        <PARAM datatype="char" name="INPUT:FORMAT" value="image/png" arraysize="*">
        <PARAM datatype="char" name="INPUT:imagetype" value="best" arraysize="*">
        <PARAM datatype="char" name="INPUT:inst" value="wfpc2-pc" arraysize="*">
        <PARAM datatype="int" name="INPUT:hrcmatch" value="0">
        <PARAM datatype="double" name="INPUT:zoom" value="1.000000">
        <PARAM datatype="double" name="INPUT:autoscale" value="99.500000" unit="%">
        <PARAM datatype="int" name="INPUT:asinh" value="1">
        <PARAM datatype="char" arraysize="*" name="refframe" ucd="VOX:STC_CoordRefFrame" value="ICRS">
        <PARAM datatype="char" arraysize="3" name="projection" ucd="VOX:WCS_CoordProjection" value="TAN">
        <TABLE>
            <FIELD ID="URL" name="URL" datatype="char" ucd="VOX:Image_AccessReference" arraysize="*">
                <DESCRIPTION>Link to data</DESCRIPTION>
            </FIELD>
            <FIELD ID="RA" name="RA" datatype="double" unit="deg" ucd="POS_EQ_RA_MAIN">
                <DESCRIPTION>RA (J2000)</DESCRIPTION>
            </FIELD>
            <FIELD ID="DEC" name="DEC" datatype="double" unit="deg" ucd="POS_EQ_DEC_MAIN">
                <DESCRIPTION>Dec (J2000)</DESCRIPTION>
            </FIELD>
            <FIELD ID="Level" name="Level" datatype="int" ucd="PRODUCT_LEVEL">
                <DESCRIPTION>Processing level: 1=exposure 2=combined 3=mosaic 4=color 5=HLSP</DESCRIPTION>
            </FIELD>
            <FIELD ID="Target" name="Target" datatype="char" ucd="TARGET_NAME" arraysize="*">
                <DESCRIPTION>Proposal target name</DESCRIPTION>
            </FIELD>
            <FIELD ID="Detector" name="Detector" datatype="char" ucd="INST_ID" arraysize="*">
                <DESCRIPTION>Detector</DESCRIPTION>
            </FIELD>
            <FIELD ID="Aperture" name="Aperture" datatype="char" ucd="INST_APERT" arraysize="*">
                <DESCRIPTION>Instrument aperture or slit</DESCRIPTION>
            </FIELD>
            <FIELD ID="Spectral_Elt" name="Spectral_Elt" datatype="char" ucd="MAIN_FILTER" arraysize="*">
                <DESCRIPTION>Filter or spectral element name</DESCRIPTION>
            </FIELD>
            <FIELD ID="NExposures" name="NExposures" datatype="int" ucd="NUM_EXPOSURES">
                <DESCRIPTION>Number of exposures combined in this image</DESCRIPTION>
            </FIELD>
```

The Widget: rendering

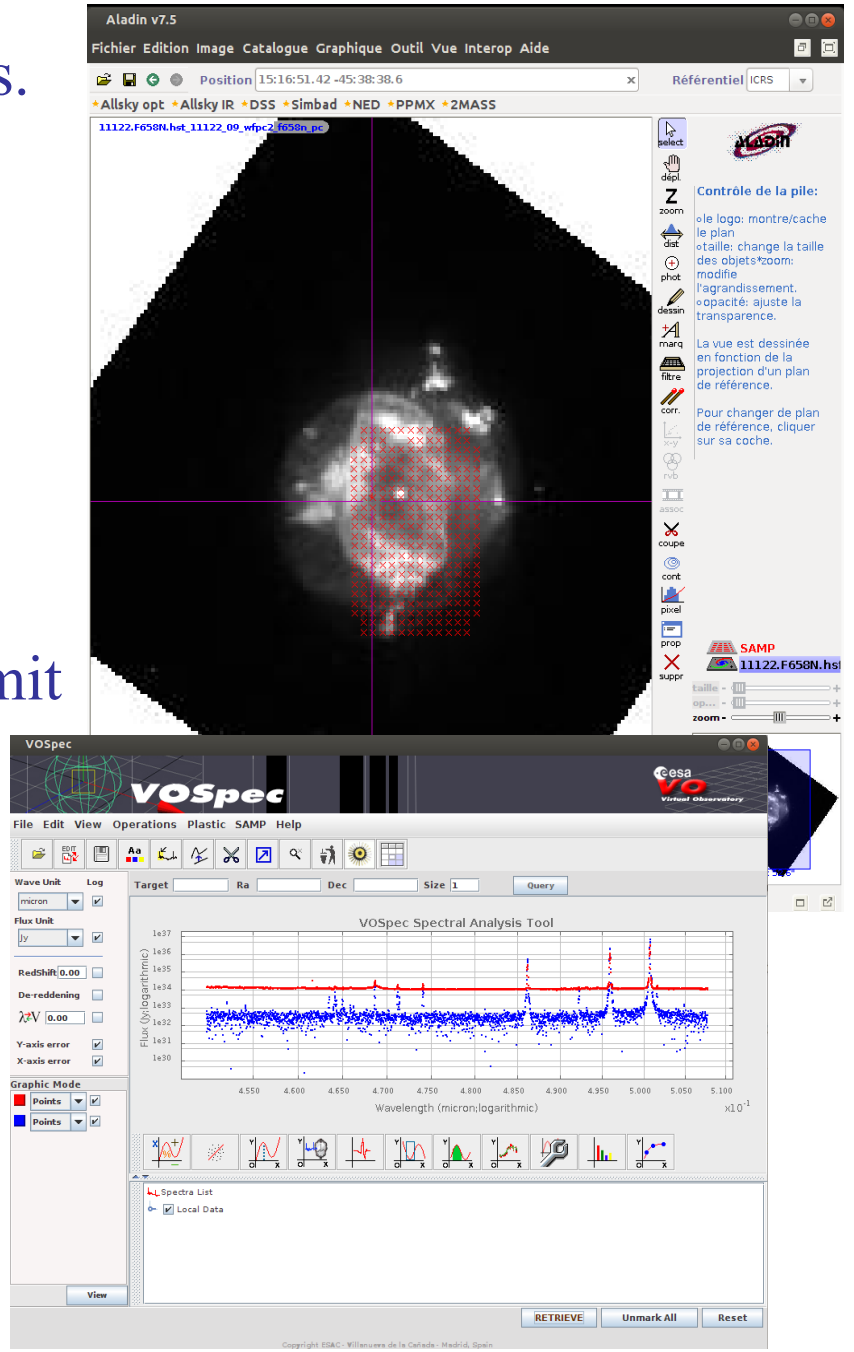
- **Based on d3.js, nvd3.js and wcs.js**
  - http://d3js.org/
    - Michael Bostock
    - BSD license
  - http://nvd3.org
    - Novus Partners
    - Apache Licence ("AS IS" Licence)
  - http://www.astrojs.org
- **Renders the SIA image using a canvas and overplot fibers layer with svg.**
  - Using CSS for position layers
  - Use wcs for project fiber positions in spatial image coordinates
  - Use d3 to build svg corresponding node, manipulating the DOM tree node and attributes of the page
  - Use d3 for dealing with transparency with select or selectAll methods
  - Use nvd3 for plotting selected spectrum data.
- **SVG makes it easy to associate events to a specific fiber**





The widget: interaction

- Based on samp.js and java web start apps.
  - Samp.js
    - M. Taylor
    - http://www.astrojs.org
    - Licence Please contribute
- Using MTYPE load.votable to transmit fibers positions to Aladin.
- Using MTYPE load.ssa-generic to transmit spectrum of selected fiber to VOSPEC.



Perspectives and evolution

- **Search for best resolution images.**
  - Use of Registries ?
- **Integrate it in the Giraffe db**
- **Using other MTYPE like**
  - Table.select.row-list
  - Table.hightlight.row
- **Build best color maps**
- **Test on other browser (for now only chrome and firefox)**