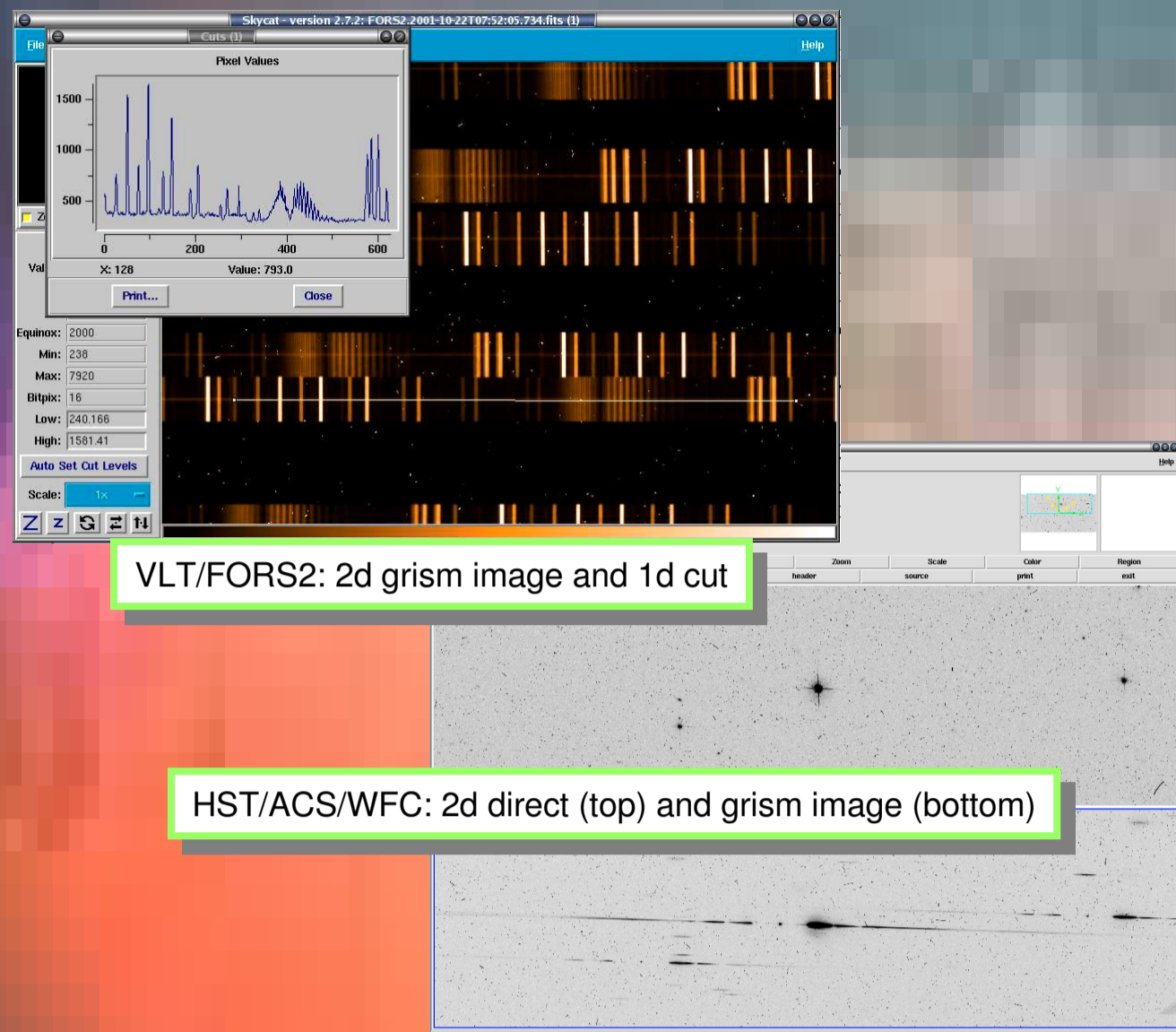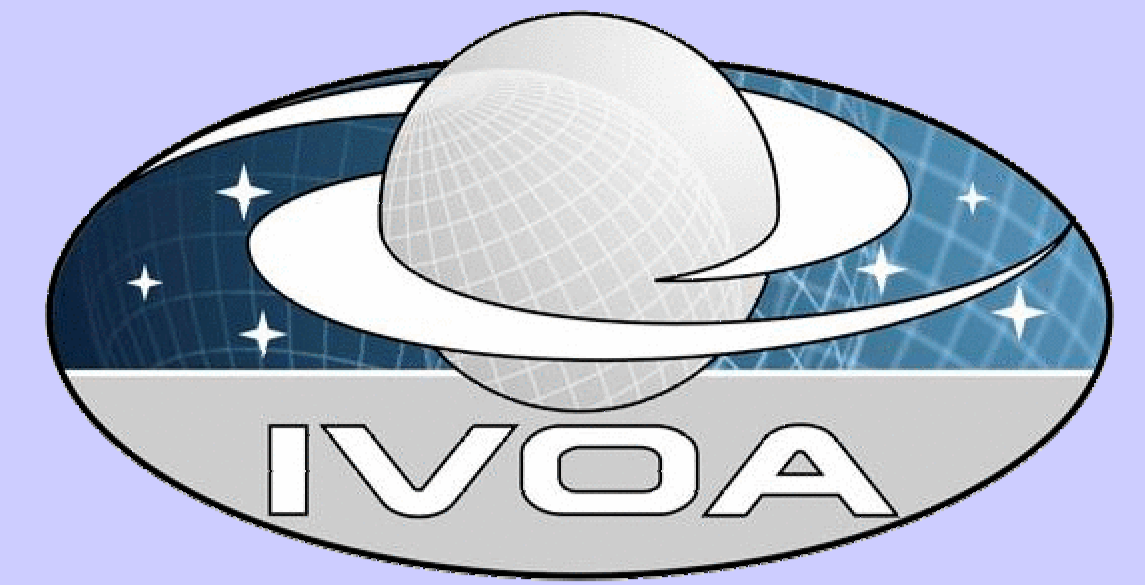# Survey among Spectral Data Providers and Consumers

an Activity of the IVOA Data Access Layer (DAL) Working Group

Markus Dolensky[1], Doug Tody[2]
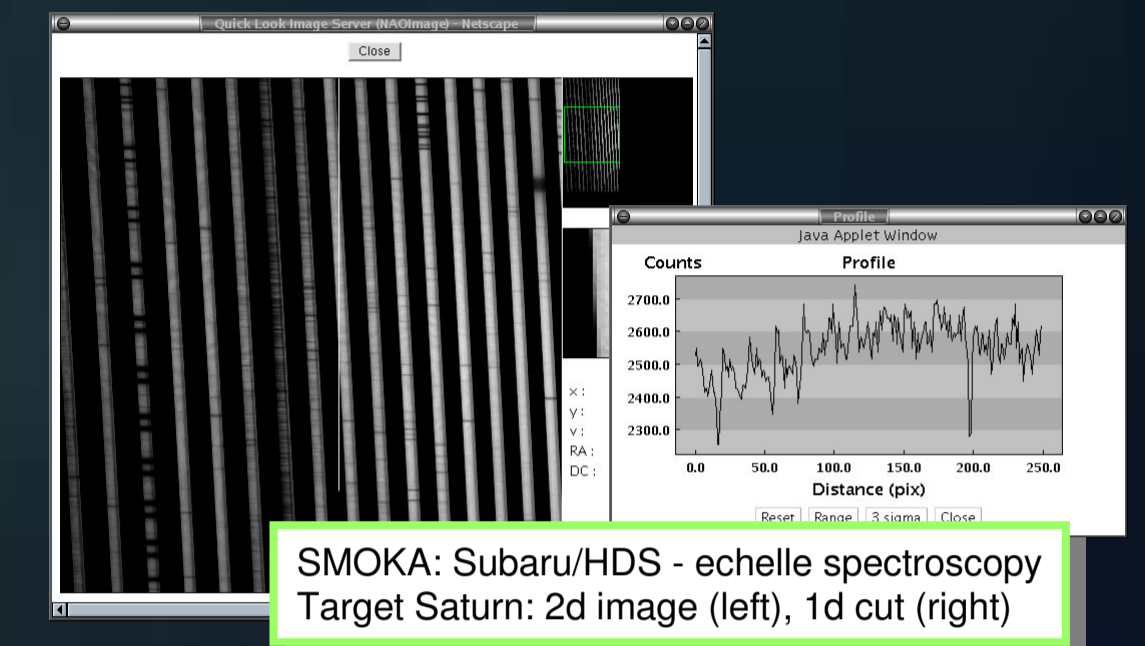
[1]European Southern Observatory
[2]National Radio Astronomy Observatory

VLT/FORS2: 2d grism image and 1d cut

HST/ACS/WFC: 2d direct (top) and grism image (bottom)

Rationale & Scope

At the IVOA meeting in Cambridge in May, one of the highest priority projects identified for the DAL working group was to define a Simple Spectral Access (SSA) protocol for accessing 1D spectra and SEDs.

To help plan this effort a little survey was conducted among potential data providers and consumers. The results are summarized below. The survey is not complete but hopefully captures the major aspects. Further feedback is welcome.
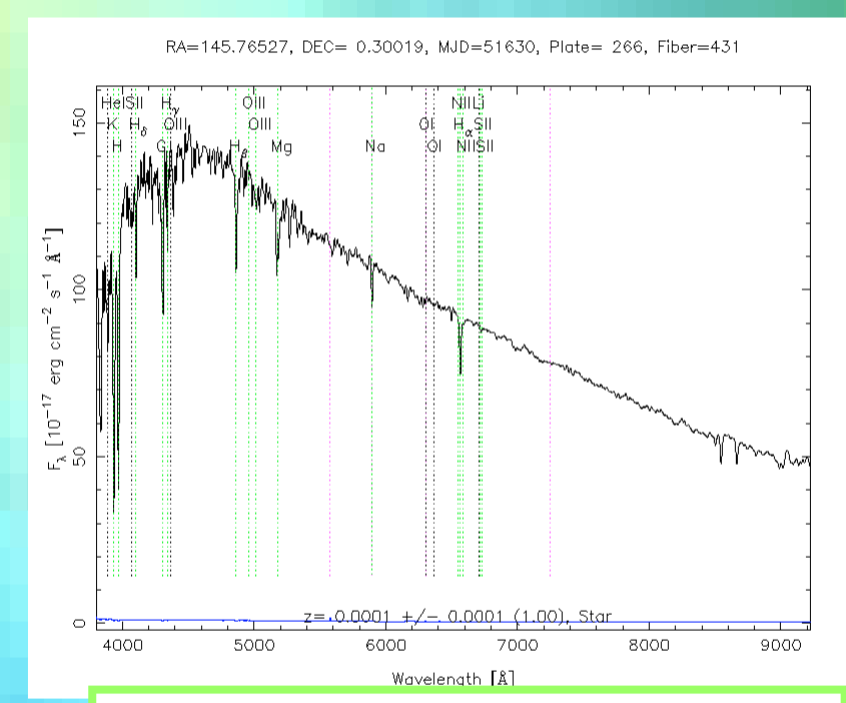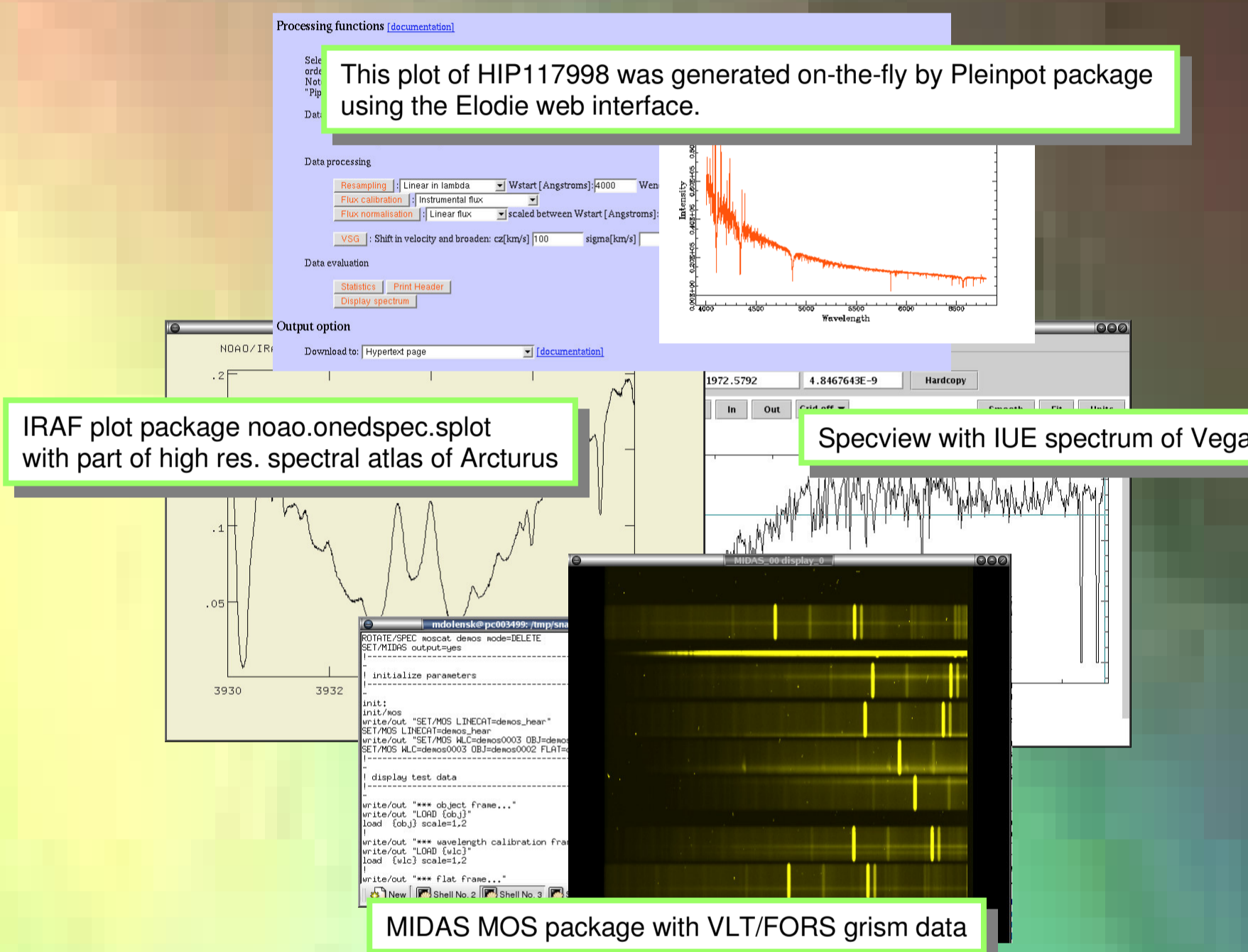
SMOKA: Subaru/HDS - echelle spectroscopy
Target Saturn: 2d image (left), 1d cut (right)

This plot of HIP117998 was generated on-the-fly by Pleinpot package using the Elodie web interface.

Characteristics of Data

Columns/data items:
  * wavelength (better fravergy: frequency, wavelength, energy)
  * flux (magnitude, flux, flux density, counts)
  * flux error
  * quality flag
  * variance arrays
  * photon events
  * antenna temperature vs. frequency (e.g. SWAS spectra)

Further features:
  * number: ~100 K - 1 Mio. spectra/data provider; often only several
    100s in very specific catalogs
  * size: few KBs - few MBs/spectrum
  * wavelength/energy ranges: gamma, X-ray, UV, optical, IR, radio
  * resolution: 20 - 45.000; 1.000.000 in case of a solar spectrum
  * linear and non-linear/irregularly sampling (for instance in energy
    domain)
  * often with WCS
  * stellar parameters: e.g.: Teff, log(g), [Fe/H]
  * noise
  * masks (coded aperture mask data, INTEGRAL)
  * observation dependent transfer matrix to convert counts to phys. units
  * spectral features (SLOAN): emission, absorption lines and
    parameters, emission redshift params. cross-correlation parameters
  * time resolved spectral information (XTE, BATSE, Swift, HETE)

IRAF plot package noao.onedspec.splot
with part of high res. spectral atlas of Arcturus

Specview with IUE spectrum of Vega

MIDAS MOS package with VLT/FORS grism data

Name of Application/Package

Tools for Spectra:
  * aXe
  * MIDAS-MOS
  * NOAO/IRAF-Specplot
  * Pleinpot
  * Specview

Tools for SEDs:
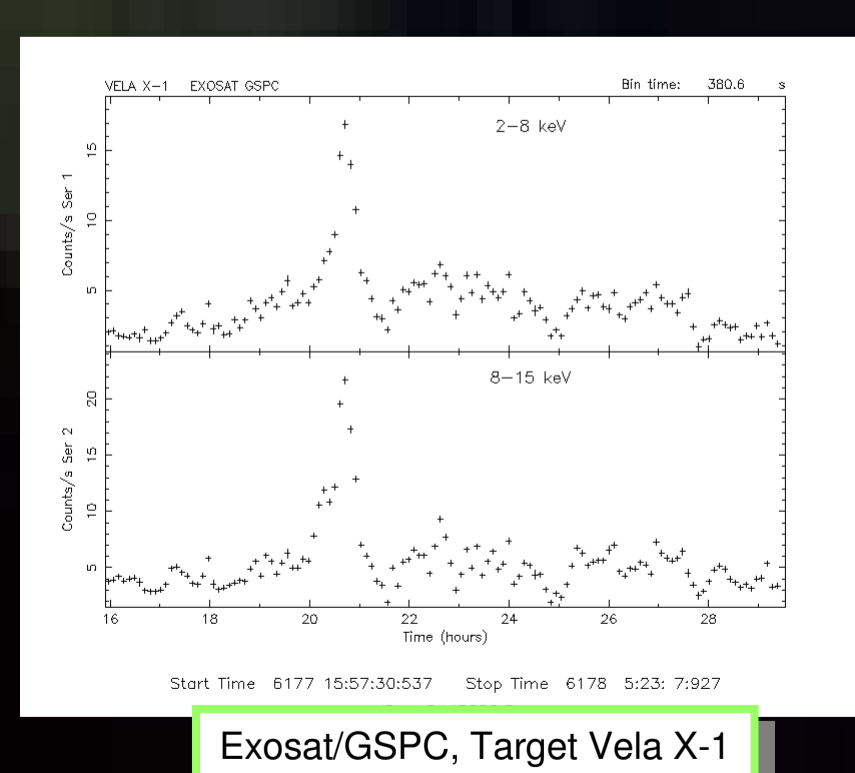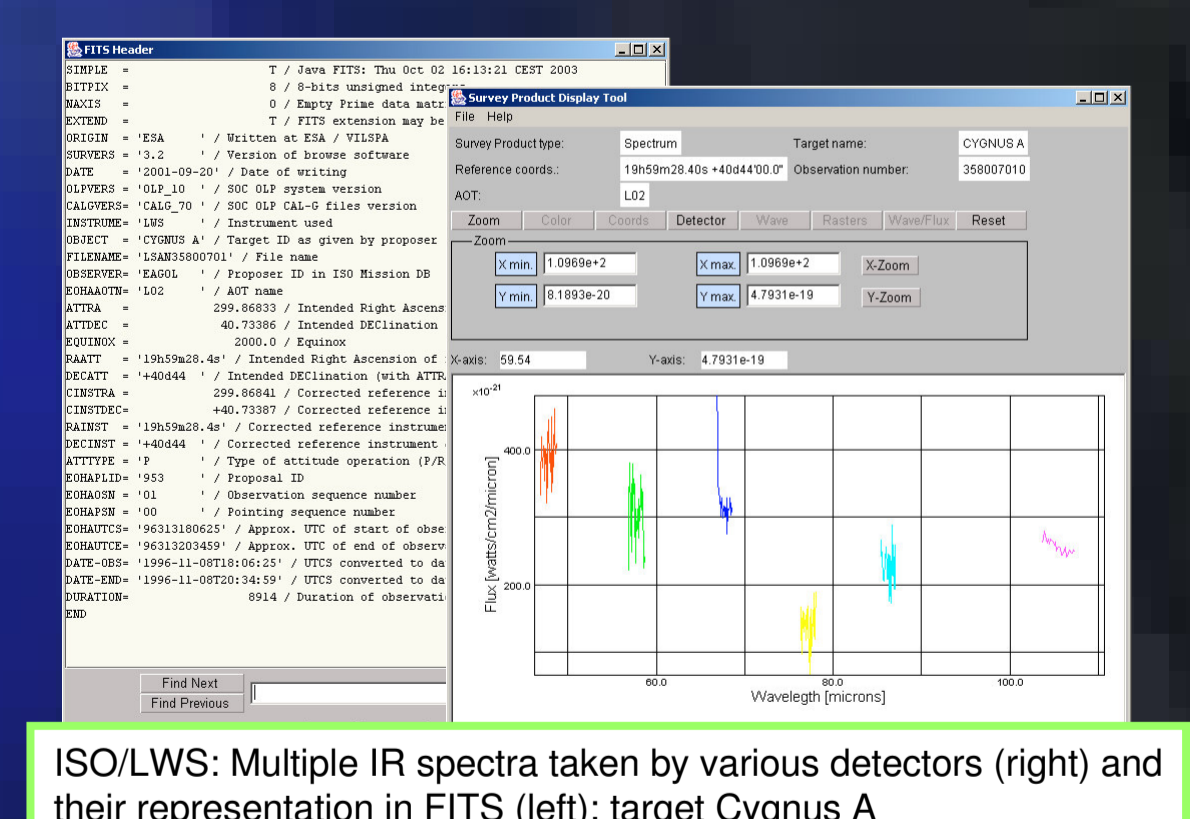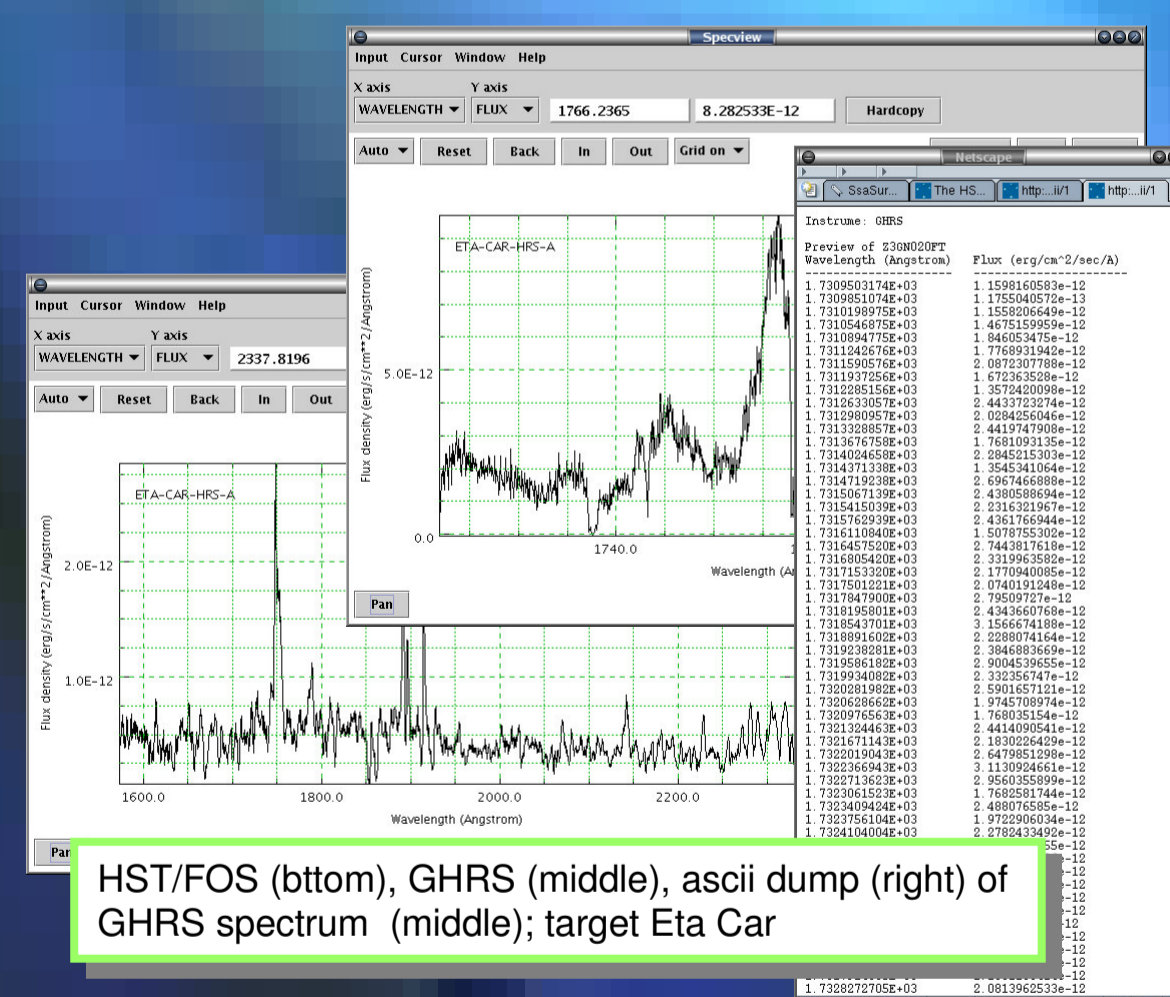 * NED (on-line)
  * AVO Prototype SED utility

Reduced 1d spectrum from SLOAN survey
with annotated line features

Software Capabilities

  * reading various instrument dependent FITS and ASCII formats
  * overplotting of multiple arrays
  * various display options (labels, zoom, colors, log/linear scaling, ...)
  * physical unit conversion
  * model fitting capability
  * classification against standards
  * rebinning
  * quality filters

Storage Format

  * ASCII tables (catalogs, often highly processed data)
  * Database tables (e.g. Sloan)
  * FITS binary tables
  * FITS images; often used for raw data (CCD images) or stacks
    thereof; radio spectral image cubes

HST/FOS (bttom), GHRS (middle), ascii dump (right) of
GHRS spectrum (middle); target Eta Car

Is the data available online?

Yes. Data are generally on-line, but proprietary periods and restricted access depending on nationality may apply.

ISO/LWS: Multiple IR spectra taken by various detectors (right) and
their representation in FITS (left); target Cygnus A

Exosat/GSPC, Target Vela X-1

Conclusion

It turns out that a wide variety of spectroscopic data is readily available on-line. Data structures and qualitative aspects, however, vary substantially. A preliminary analysis shows that an SSA service will need to transform archived data into a common, well defined structure prior to delivery.

Credits

Many thanks to all who contributed to the survey. Special thanks to Ivo Busko Mike Fitzpatrick, Satoshi Honda, Stephen Kent, Tom McGlynn, Pedro Osuna Alcalaya, Benoit Pirenne, Ray Plante, Phillipe Prugniel, Enrique Solano, Alex Szalay, Francisco Valdes and Andreas Wicenec.

http://www.ivoa.net/twiki/bin/view/IVOA/SsaSurvey