VO Science Applications

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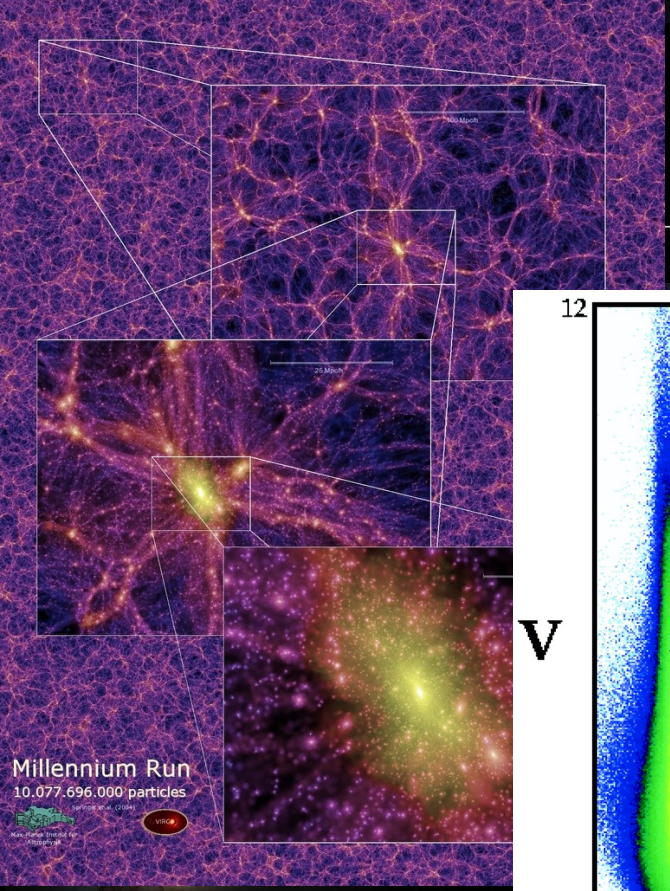
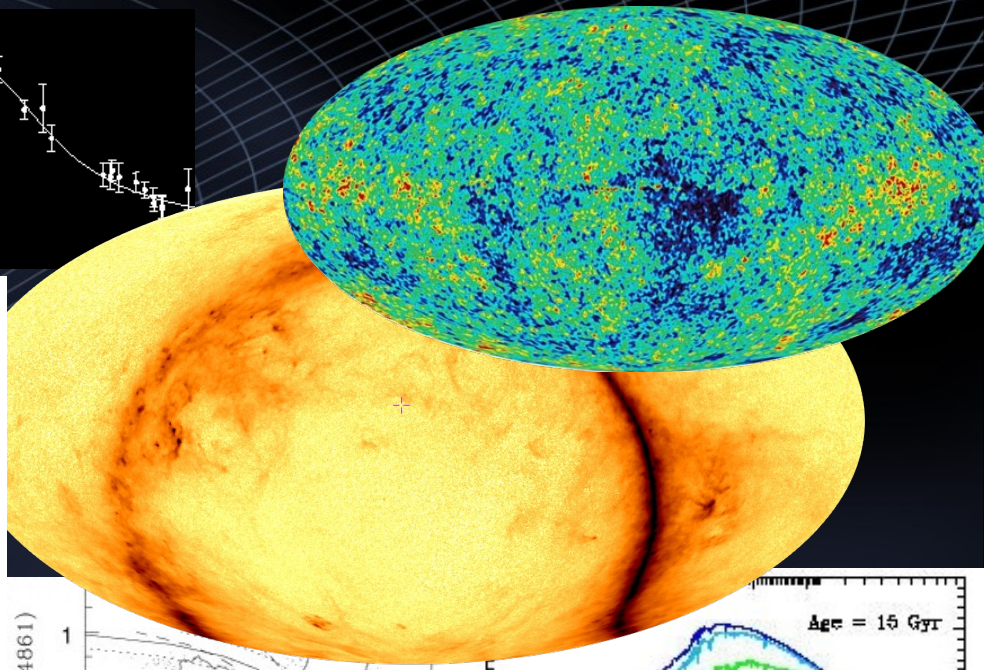
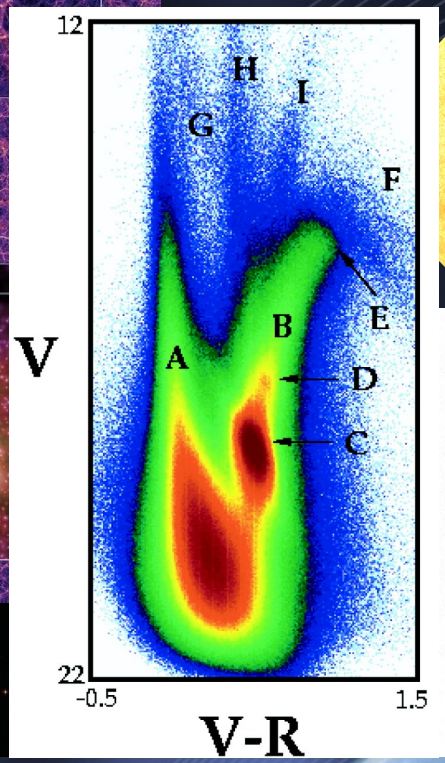
VO for doing Astronomy

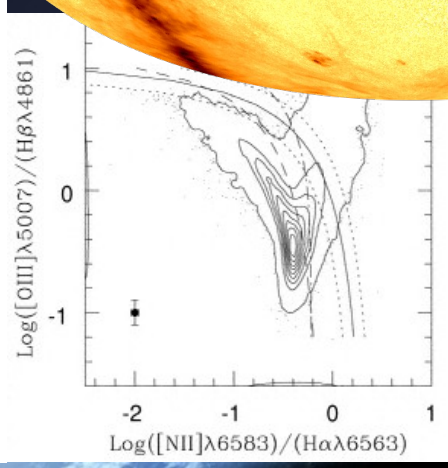
- Essential for imminent data volumes and rates
- Multi-λ science requires
  - Data from different telescopes
  - Analysis tools
  - on-line services
  - archived information

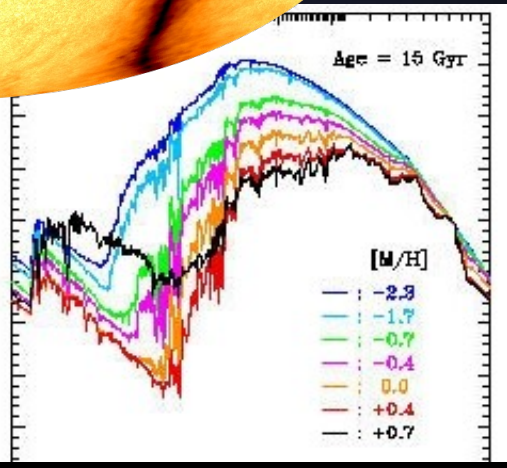
  to be *readily compatible*
- VO = framework for interoperable systems
- VO Vision: *All Astronomy resources as if they were on your desktop*


Millennium Run
10.077.696.000 particles




12
22
-0.5
1.5
V
V-R
A
B
C
D
E
F
G
H
I


Log([OIII]λ5007)/(Hβλ4861)
Log([NII]λ6583)/(Hαλ6563)
1
0
-1
-2
-1
0
1


Age = 15 Gyr
[M/H]
-2.3
-1.7
-0.7
-0.4
0.0
+0.4
+0.7


Messier 81
X-Ray (ROSAT)
Ultraviolet (ASTRO-1)
Visible (Robert Gendler)
Infrared (IRAS)
Radio (VLA)

Astronomy Data interoperability

- Images (multi-band, mosaics, cutouts, FT)
- Catalogues
- Spectra
- Time series
- Spatial Information
  - Sky regions, slits, FoV, etc.
- Simulation data – many kinds
- Multi-d data sets
  - Data cubes, irregularly spaced data

Science Driven
e.g. AVO Science Reference Mission

- Circumstellar disks: from pre-Main Sequence stars to stars harbouring planets
- Intermediate Velocity Clouds
- Which Star will go Supernova next?
- Initial Mass Function within 1kpc: Planetary to Stellar Masses
- Initial Mass Function for Massive Stars
- Contributions of Low and Intermediate Mass Stars to the ISM
- Galaxy Formation and Evolution from z=10 to 0.1
- Build-up of Supermassive Black Holes
- Formation and Evolution of Galaxy Clusters
- Correlation of CMB, radio/mm and optical/NIR Galaxy Surveys

We need (1)

- Visual browsing of data and distributed information
- Visualizing heterogeneous data
  - Combining Multi-wavelength data taking into account different:
    - Units
    - coverage
    - Resolutions/PSF, observing technique

We need (2)

- Multi-wave cutouts of individual sources
- Generate and visualize SEDs from image, and spectral and catalogue data
  - Taking into account different
    - Beams/apertures (extended sources)
    - Backgrounds
    - Photometric systems
- Time axis:
  - Light-curves
  - Multi-epoch imaging

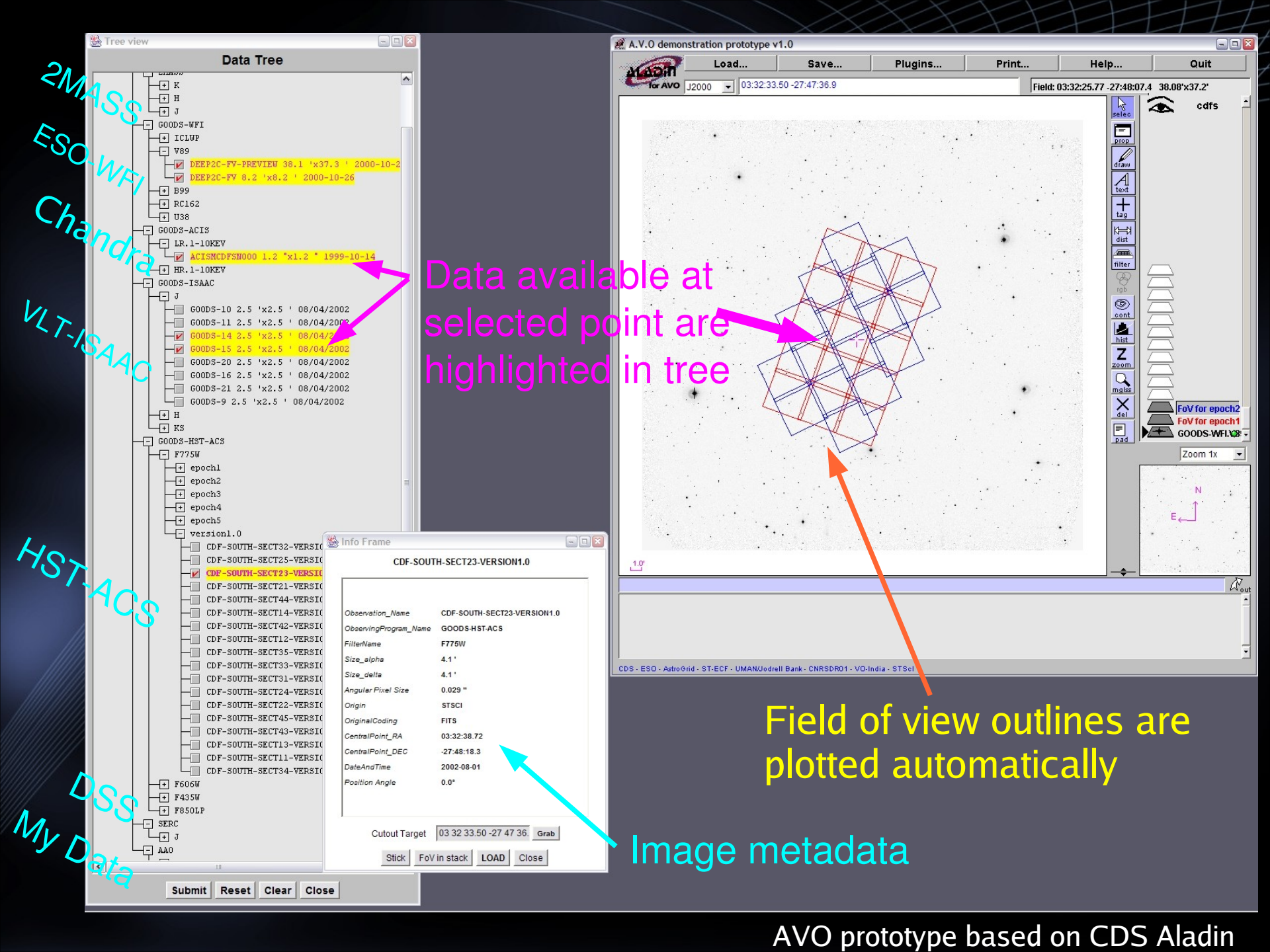
We need (3)

- Compare observations with models
  - Virtual observations of models
  - Projection of models to observed parameter space
  - Spectral fitting/classification
  - Colour-colour visualization Tool
  - Astronomy functionality alongside visualization
    - Reproject data, correct for extinction, calulate luminosities etc.
    - Visualization requirements $\in$ Analysis requirements

VO Tools

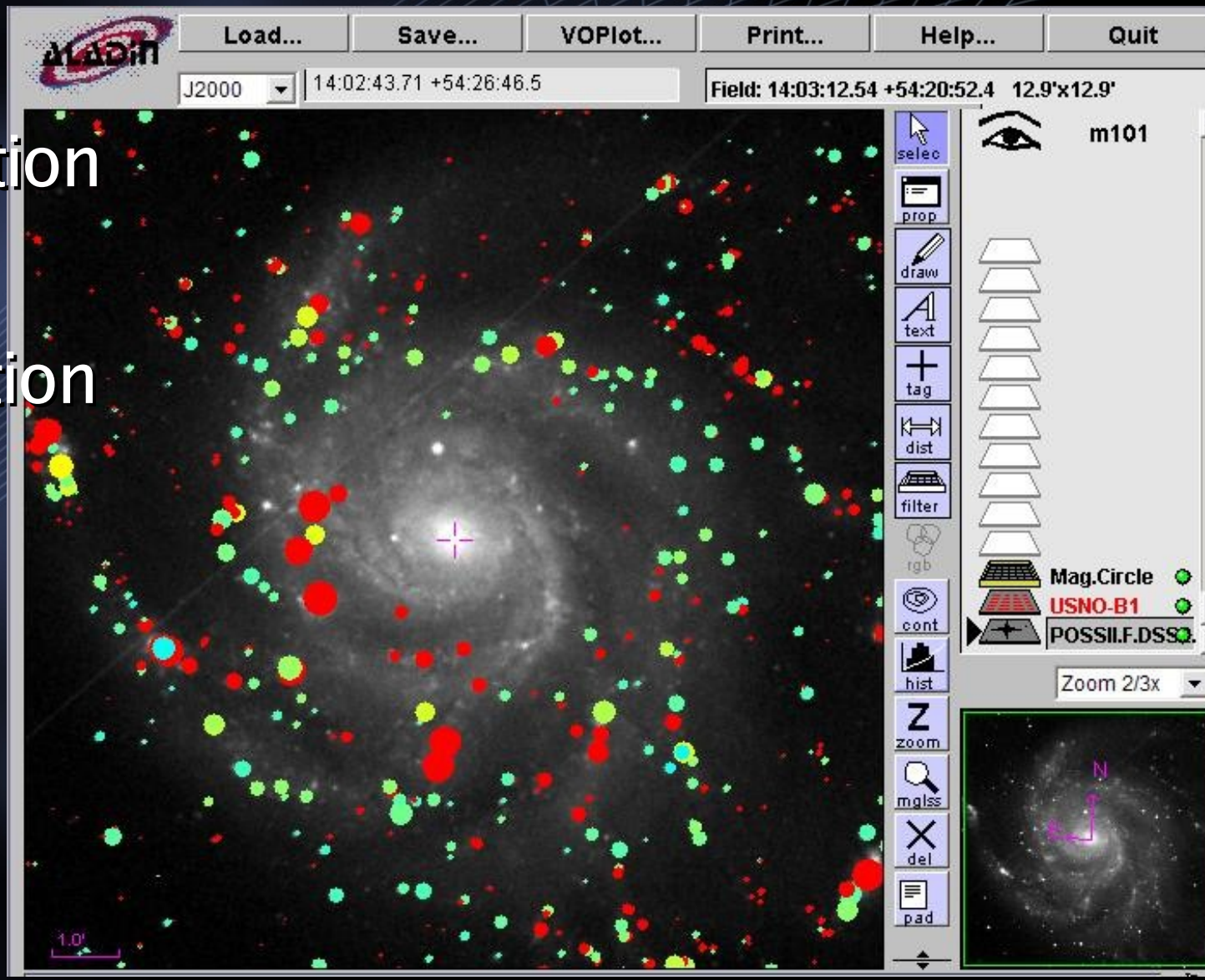
- Prototypes
  - VO-enabled existing tools & new tools
- Services
  - VO-enabled with *'translation layer'*
  - New services
- Applications Infrastructure
  - Make tools accessible
  - Build your own customized system from VO components

A brief tour of some of the VO tools available now


2MASS
ESO-WFI
Chandra
VLT-ISAAC
HST-ACS
DSS
My Data
Tree view
Data Tree
GOODS-WFI
ICLWP
V89
DEEP2C-FV-PREVIEW 38.1 'x37.3 ' 2000-10-2
DEEP2C-FV 8.2 'x8.2 ' 2000-10-26
B99
RC162
U38
GOODS-ACIS
LR.1-10KEV
ACISMCDFSN000 1.2 "x1.2 " 1999-10-14
HR.1-10KEV
GOODS-ISAAC
J
GOODS-10 2.5 'x2.5 ' 08/04/2002
GOODS-11 2.5 'x2.5 ' 08/04/2002
GOODS-14 2.5 'x2.5 ' 08/04/2002
GOODS-15 2.5 'x2.5 ' 08/04/2002
GOODS-20 2.5 'x2.5 ' 08/04/2002
GOODS-16 2.5 'x2.5 ' 08/04/2002
GOODS-21 2.5 'x2.5 ' 08/04/2002
GOODS-9 2.5 'x2.5 ' 08/04/2002
H
KS
GOODS-HST-ACS
F775W
epoch1
epoch2
epoch3
epoch4
epoch5
version1.0
CDF-SOUTH-SECT23-VERSIO
F606W
F435W
F850LP
SERC
J
AAO
Submit
Reset
Clear
Close
Info Frame
CDF-SOUTH-SECT23-VERSION1.0
Observation_Name CDF-SOUTH-SECT23-VERSION1.0
ObservingProgram_Name GOODS-HST-ACS
FilterName F775W
Size_alpha 4.1 '
Size_delta 4.1 '
Angular Pixel Size 0.029 "
Origin STSCI
OriginalCoding FITS
CentralPoint_RA 03:32:38.72
CentralPoint_DEC -27:48:18.3
DateAndTime 2002-08-01
Position Angle 0.0°
Cutout Target
03 32 33.50 -27 47 36.
Grab
Stick
FoV in stack
LOAD
Close
Data available at selected point are highlighted in tree
A.V.O demonstration prototype v1.0
Load...
Save...
Plugins...
Print...
Help...
Quit
J2000
03:32:33.50 -27:47:36.9
Field: 03:32:25.77 -27:48:07.4 38.08'x37.2'
cdfs
FoV for epoch2
FoV for epoch1
GOODS-WFI
Zoom 1x
CDS - ESO - AstroGrid - ST-ECF - UMAN/Jodrell Bank - CNRSDR01 - VO-India - STScI
Field of view outlines are plotted automatically
Image metadata
AVO prototype based on CDS Aladin

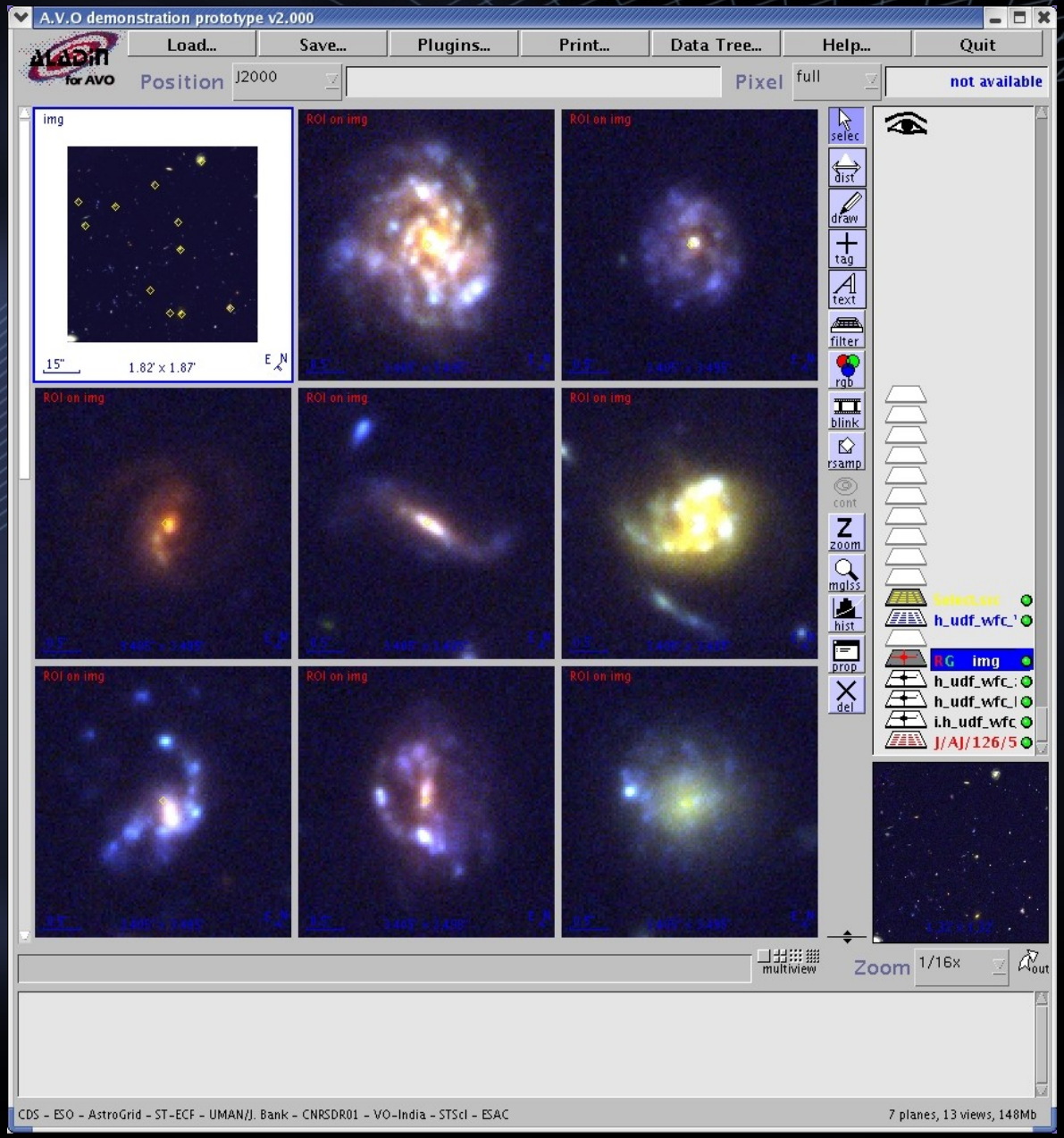
Catalogues

- Manipulation
- X-match
- Visualization
- Direct links to:



CDS Aladin

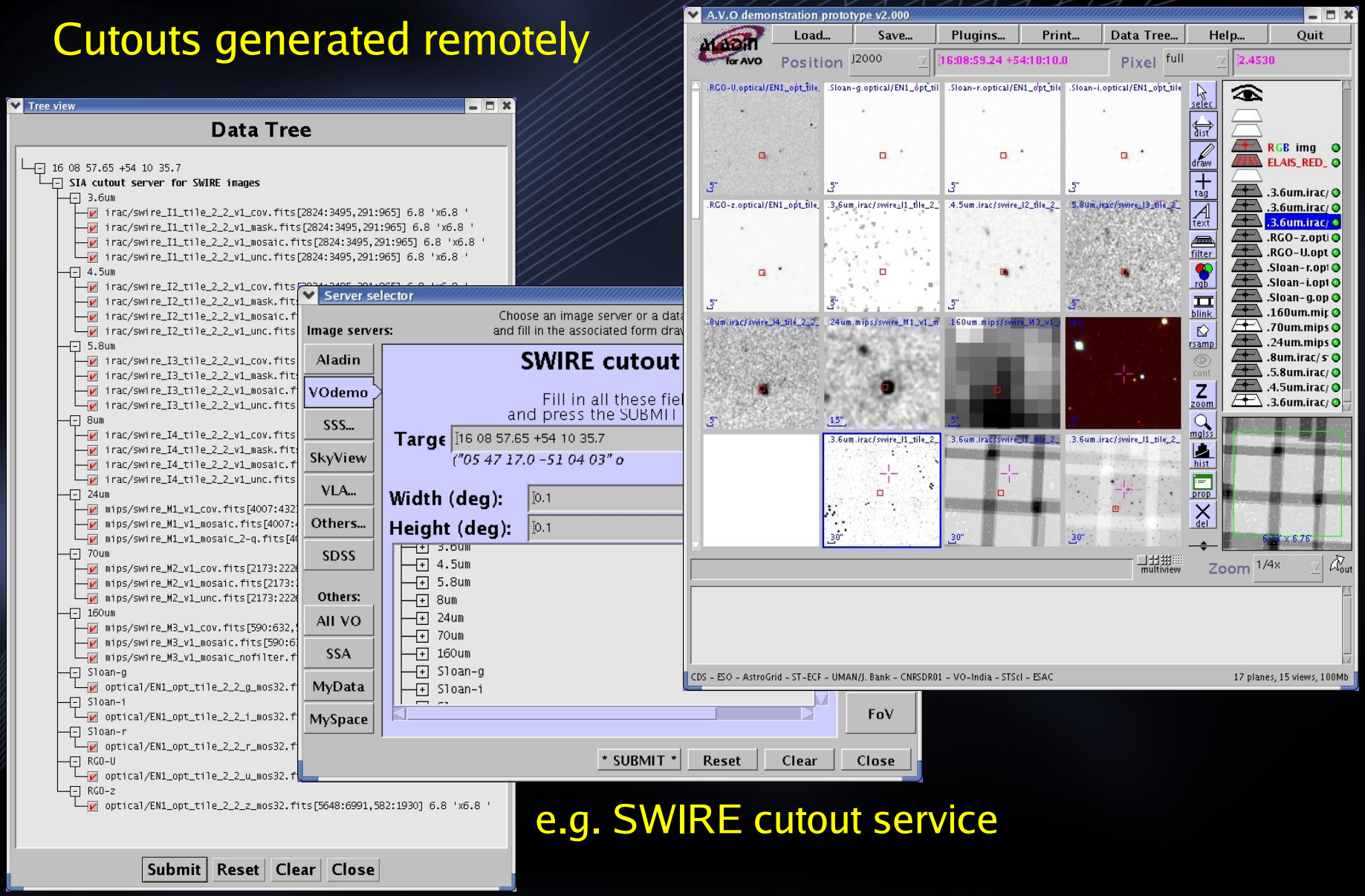
Image Cutout Tool



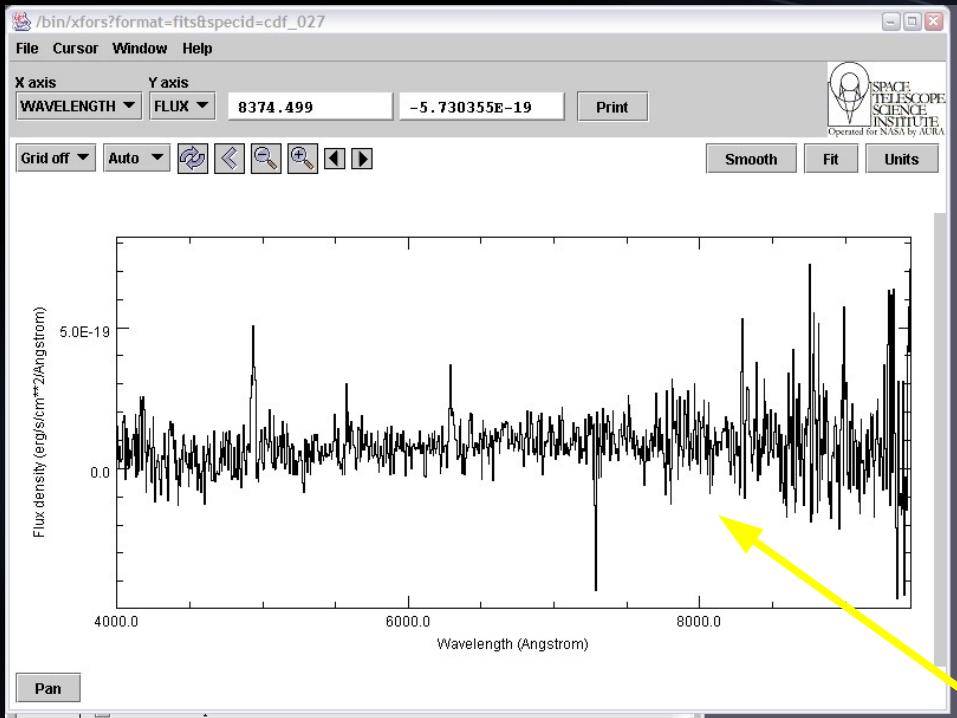
AVO prototype based on CDS Aladin

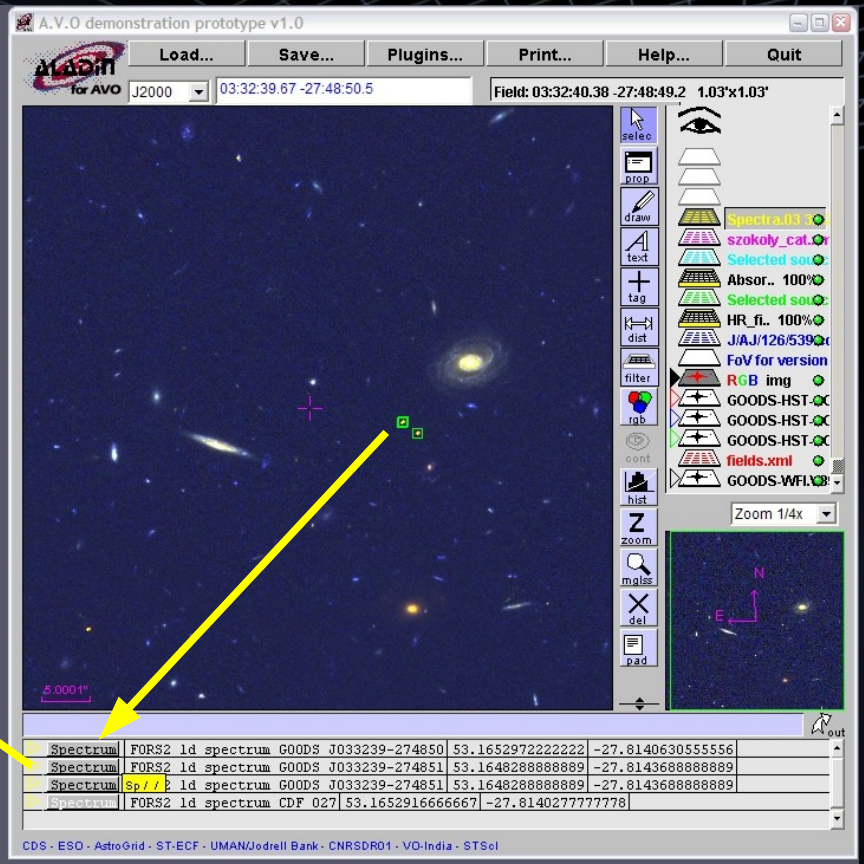
Image Cutout *Services*

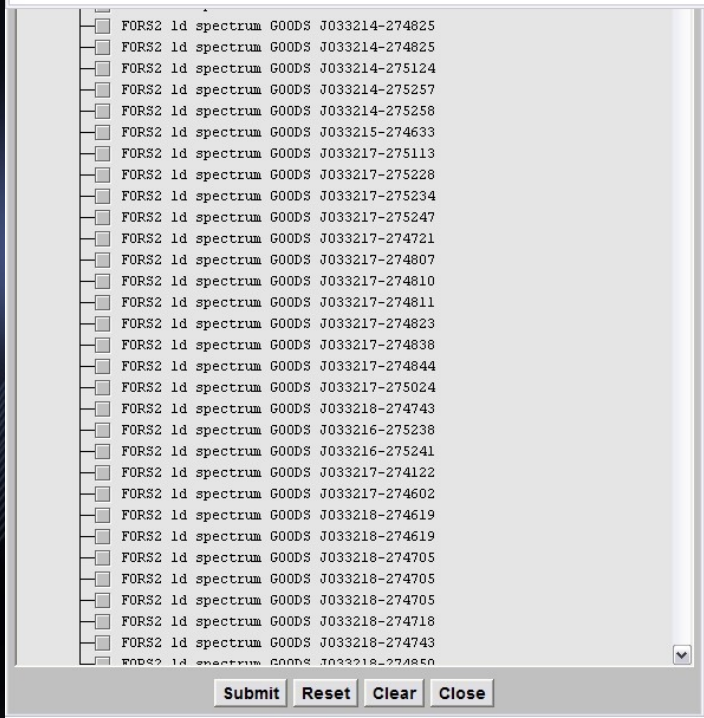
Cutouts generated remotely



e.g. SWIRE cutout service







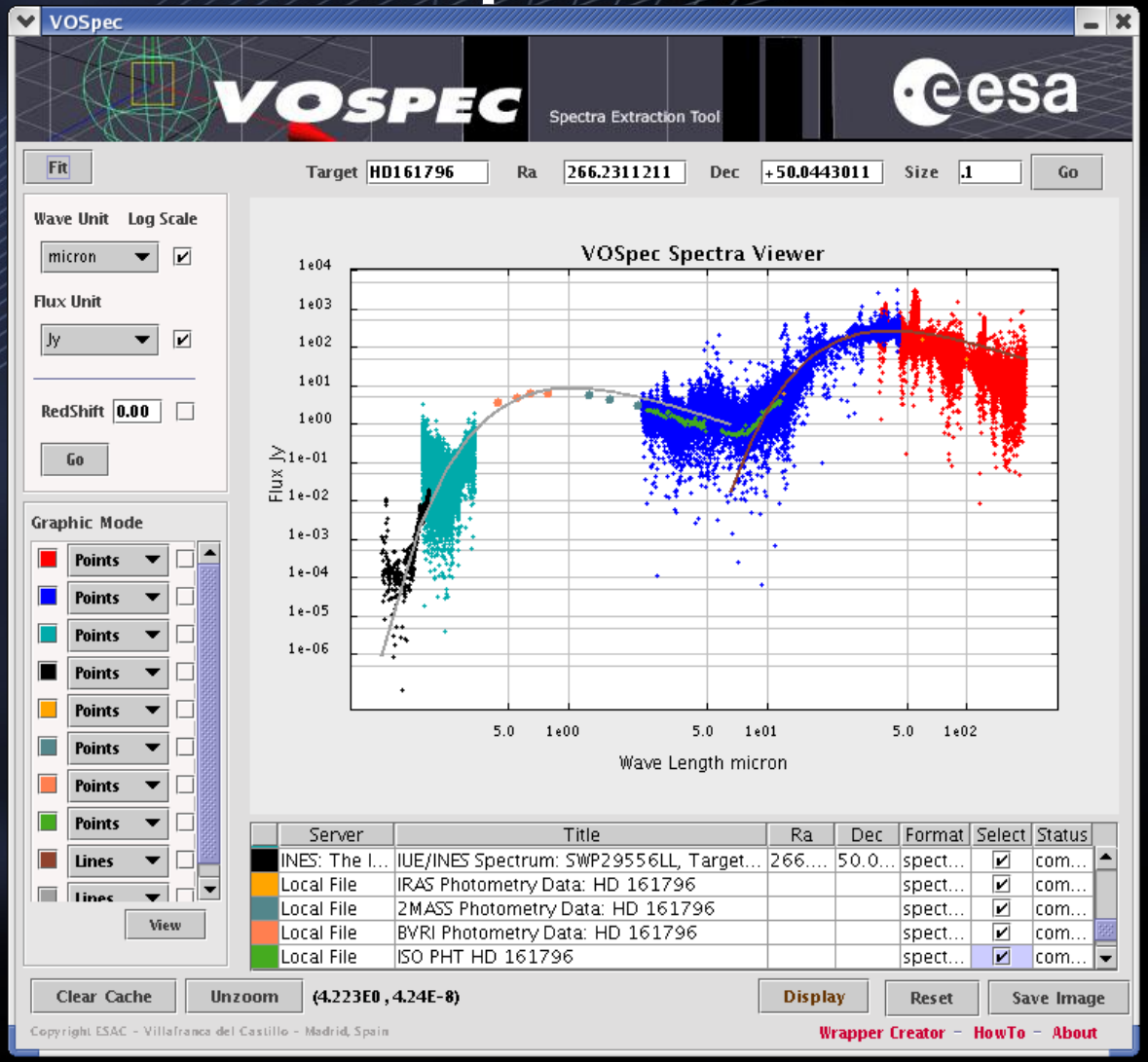
Simple Spectrum Access

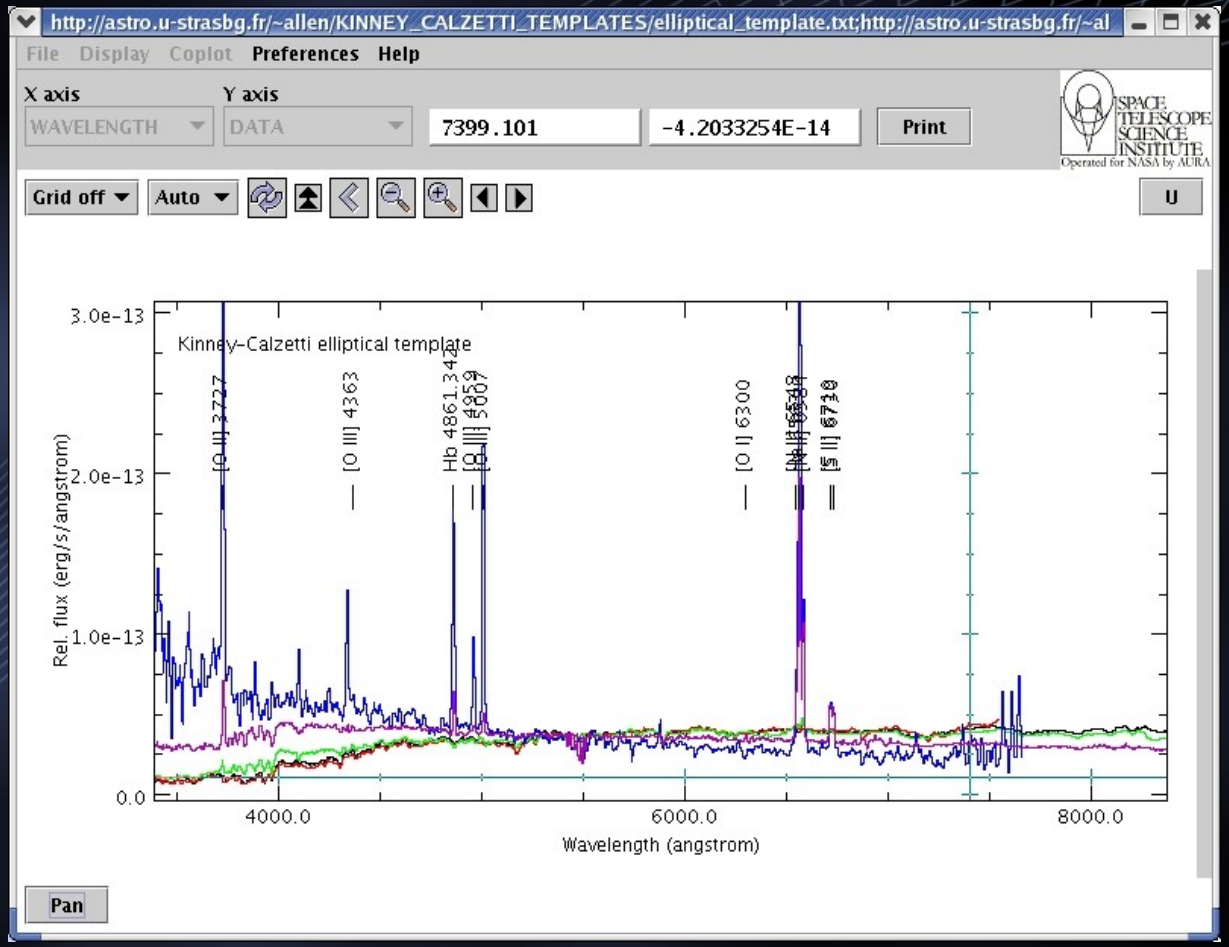
Image / Spectrum / Catalog interoperability

STScI Specview & AVO prototype

Multi-archive spectra

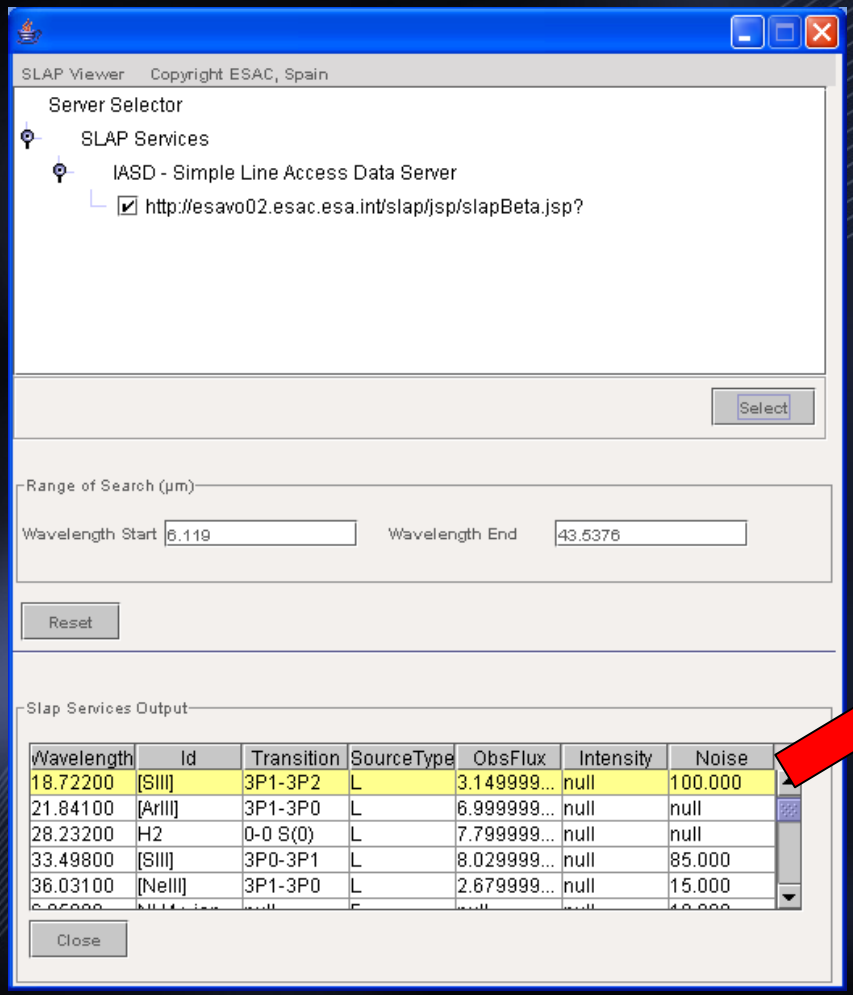
- SSA servers
- Registry
- Unit interop.

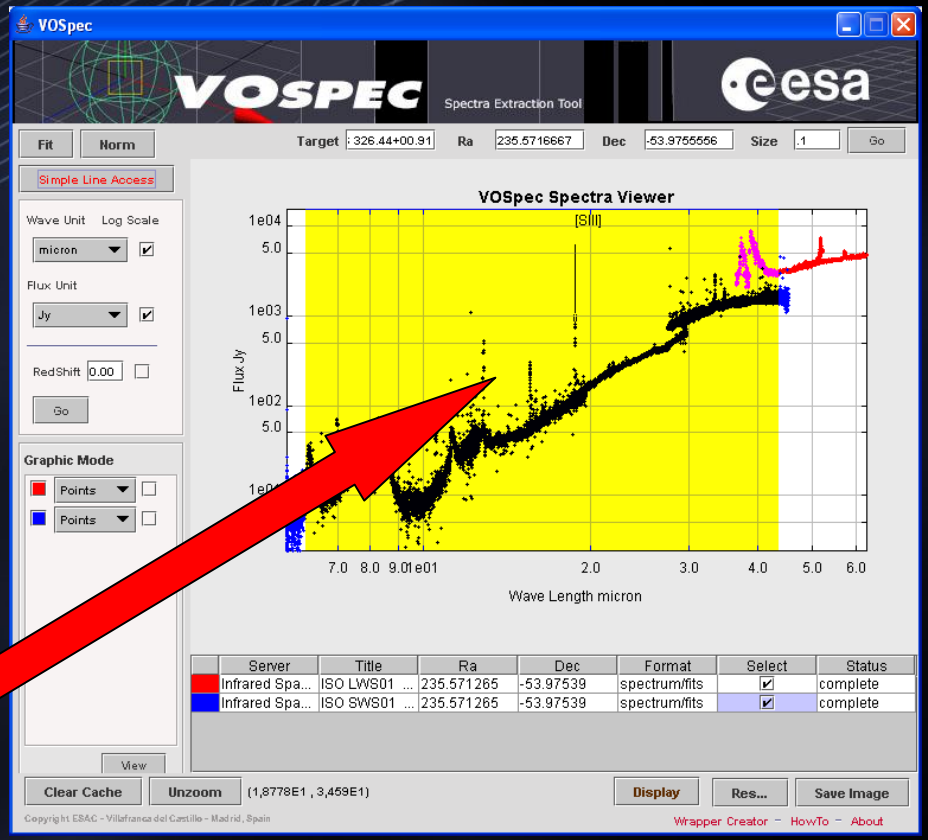




Line lists integrated into the tool

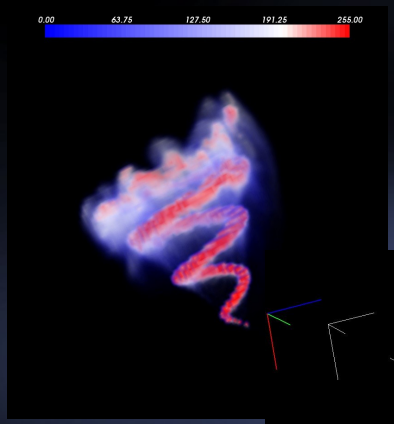
Line lists from a Service

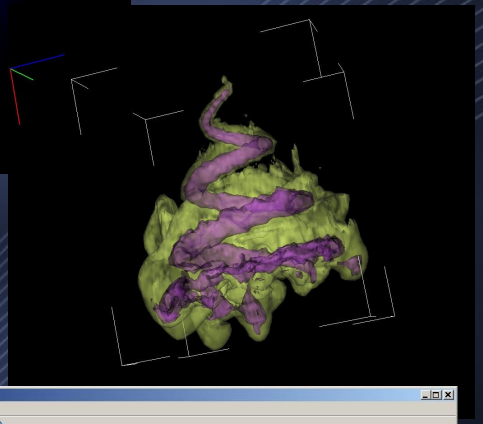




ESA VOSpec & Spectral Line Access Protocol (SLAP) Service

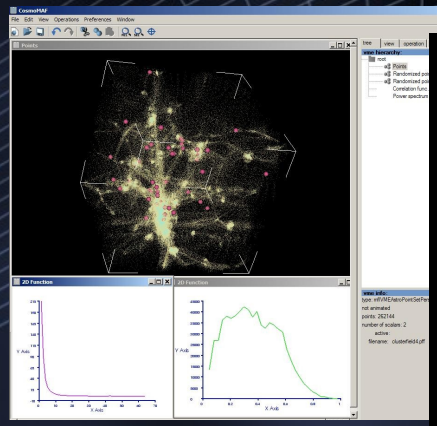
VisIVO : Visualization tools

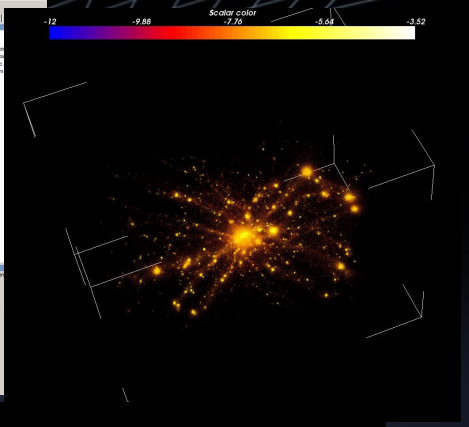


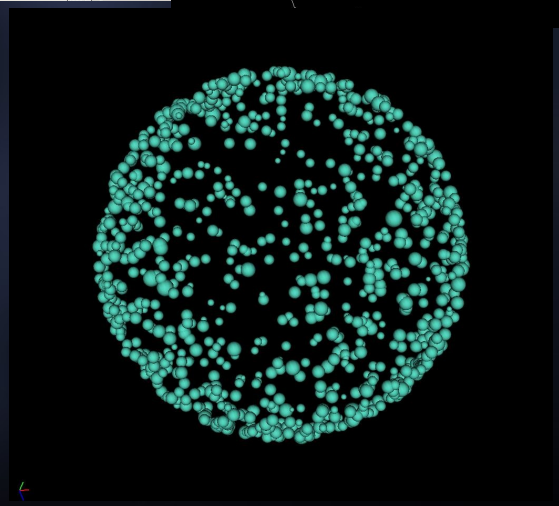


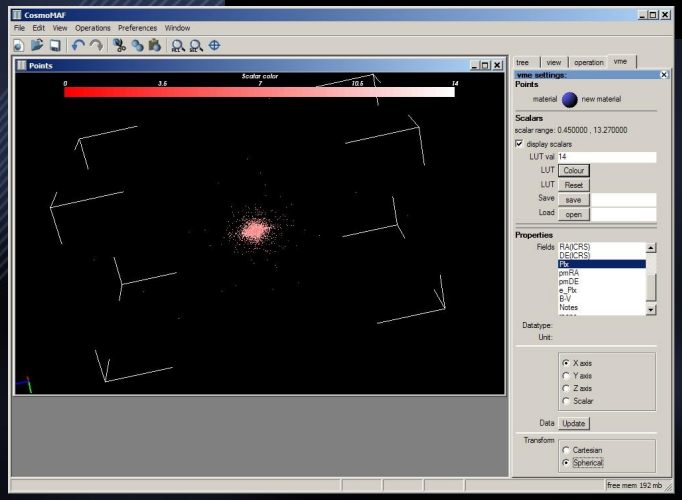
Grid based data:

- Isosurfaces
- Volume rendering





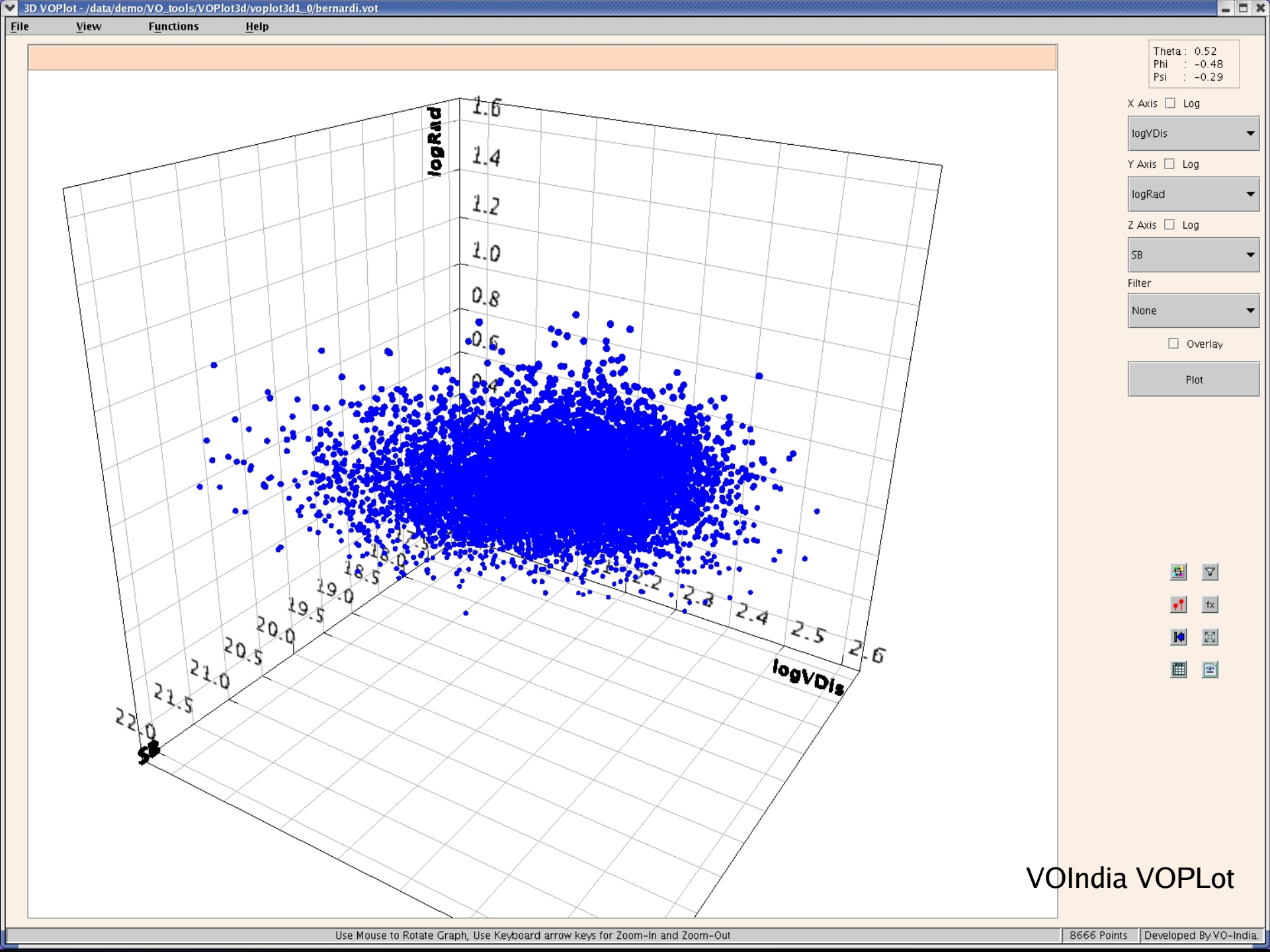




Point like data:

- Pixels
- Scalar quantities with colours
- Scalar quantities with variable size and shape glyphs

INAF, CINEA : visivo.cineca.it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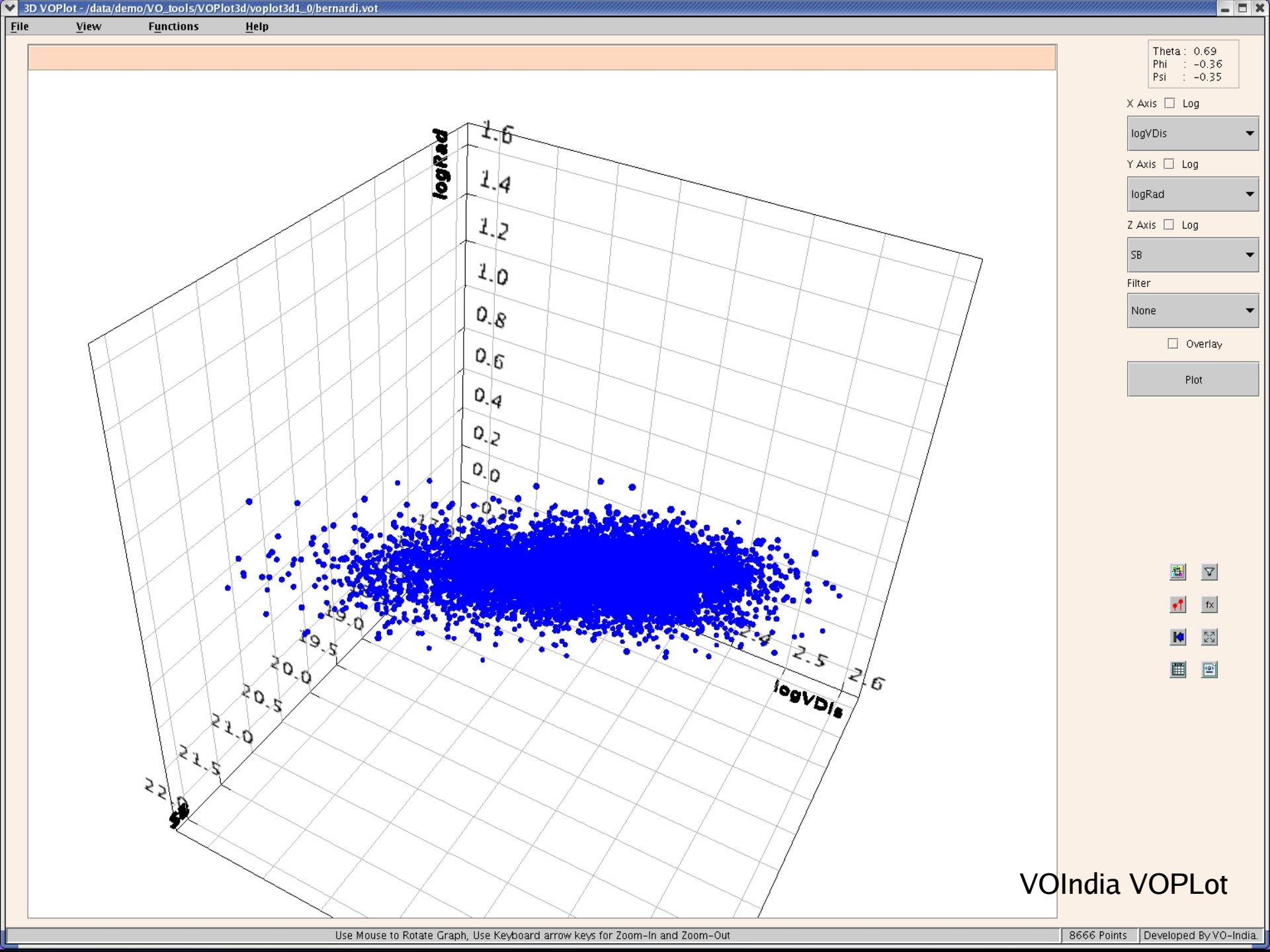
File
View
Functions
Help
Theta : 0.52
Phi : -0.48
Psi : -0.29
X Axis Log
logVDis
Y Axis Log
logRad
Z Axis Log
SB
Filter
None
Overlay
Plot
logRad
1.6
1.4
1.2
1.0
0.8
0.6
0.4
logVDis
2.2
2.3
2.4
2.5
2.6
SB
18.0
18.5
19.0
19.5
20.0
20.5
21.0
21.5
22.0
VOIndia VOPLot
Use Mouse to Rotate Graph, Use Keyboard arrow keys for Zoom-In and Zoom-Out
8666 Points
Developed By VO-India.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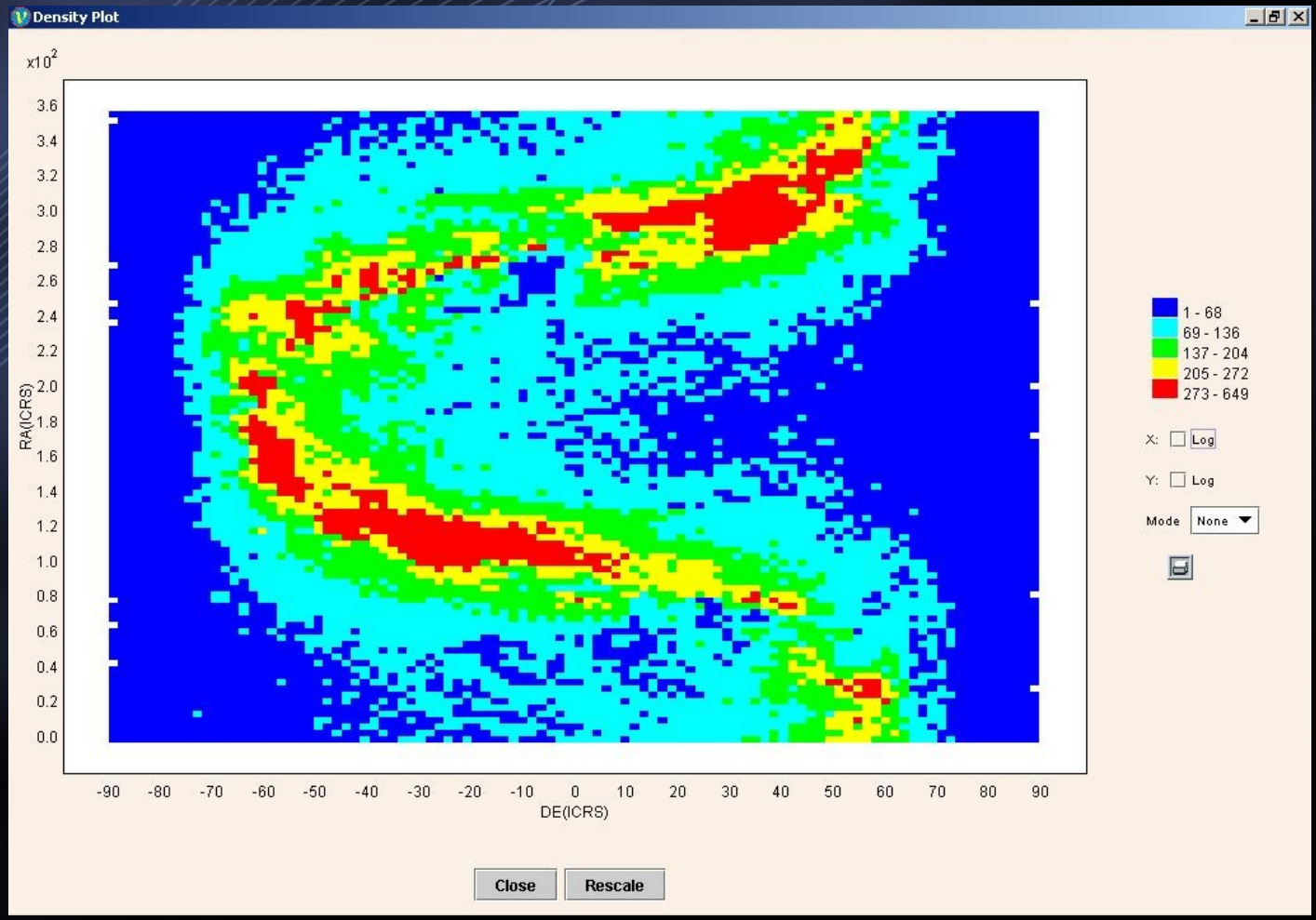
File
View
Functions
Help
Theta : 0.69
Phi : -0.36
Psi : -0.35
X Axis Log
logVDis
Y Axis Log
logRad
Z Axis Log
SB
Filter
None
Overlay
Plot
logRad
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
logVDis
2.4
2.5
2.6
19.0
19.5
20.0
20.5
21.0
21.5
22.0
SB
VOIndia VOPLot
Use Mouse to Rotate Graph, Use Keyboard arrow keys for Zoom-In and Zoom-Out
8666 Points
Developed By VO-India.

VO Mega-Plot density plot

- ~10^6 points



US-VO Website - Mozilla

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://us-vo.org/apps/ Search Print

Home Bookmarks Red Hat Network Support Shop Products Training

US National Virtual Observatory

search

Home | Registry | Tools | Data Access | Publish | Education | Software Library | Grid Computing | Architecture | Contact Us

News

VOEvent Workshop Report
NVO at the AAS, January 2005
VO Science Session at San Diego AAS Meeting
LSST Meeting
NVO News Archive

About

What is the NVO?
Who is Involved?
Science Objectives
NVO in Use

Community

NVO Meetings
International VO Alliance
NVO Summer School

Documents

Recent NVO Documents:
Quarterly Report, Jan-Mar 2005
NVO Advisory Committee Report
White Paper: NASA Universe Roadmap Project Plan Update
All NVO Documents
IVOA Documents

Acknowledging NVO

Supported by the National Science Foundation

Member of the International Virtual Observatory Alliance

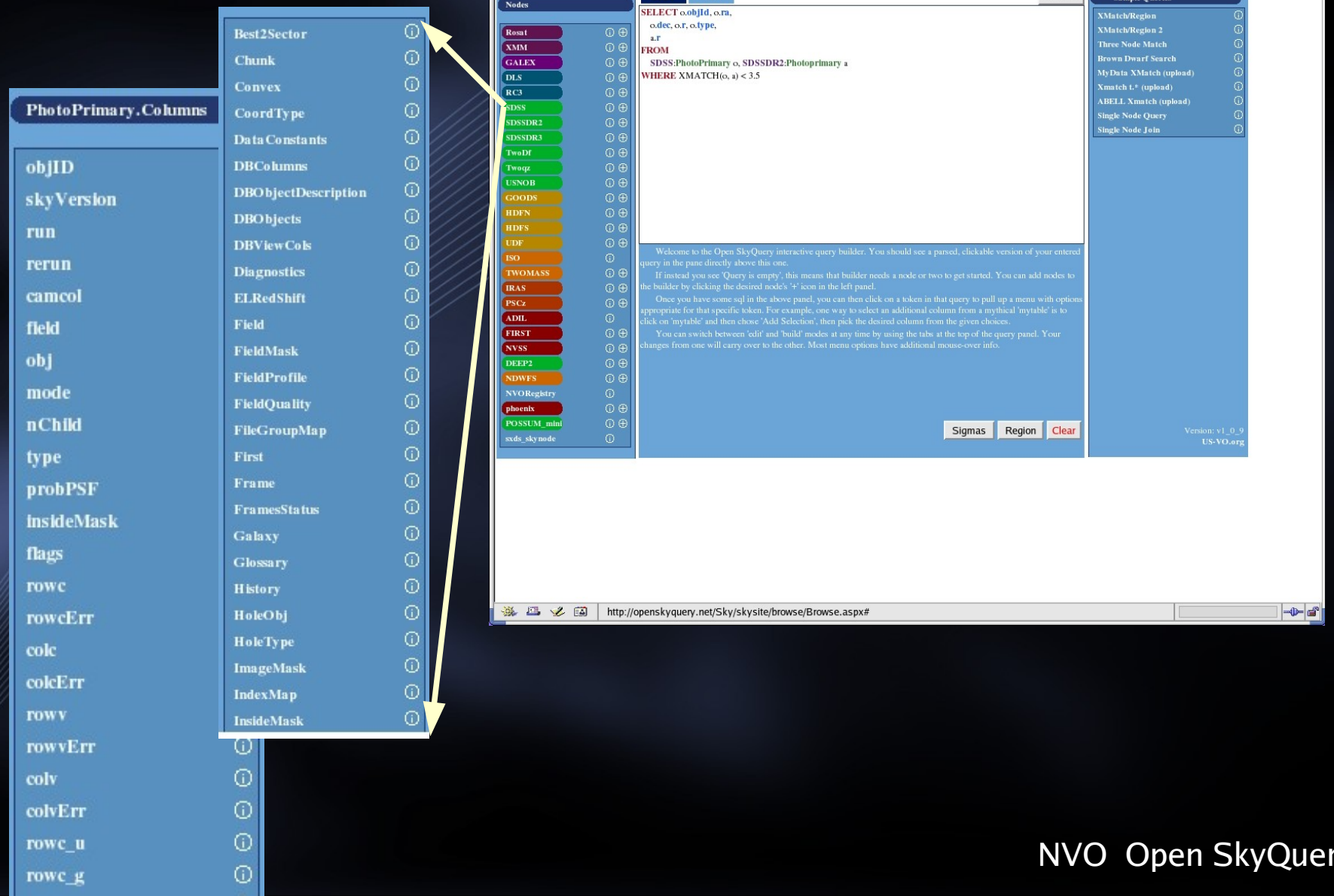
log in

NVO Core Applications

NVO's objective is to enable new science by greatly enhancing access to data and computing resources. In conjunction with the January 2005 meeting of the American Astronomical Society, NVO is releasing a first set of software tools and applications that make it easy to locate, retrieve, and analyze data from archives and catalogs worldwide.

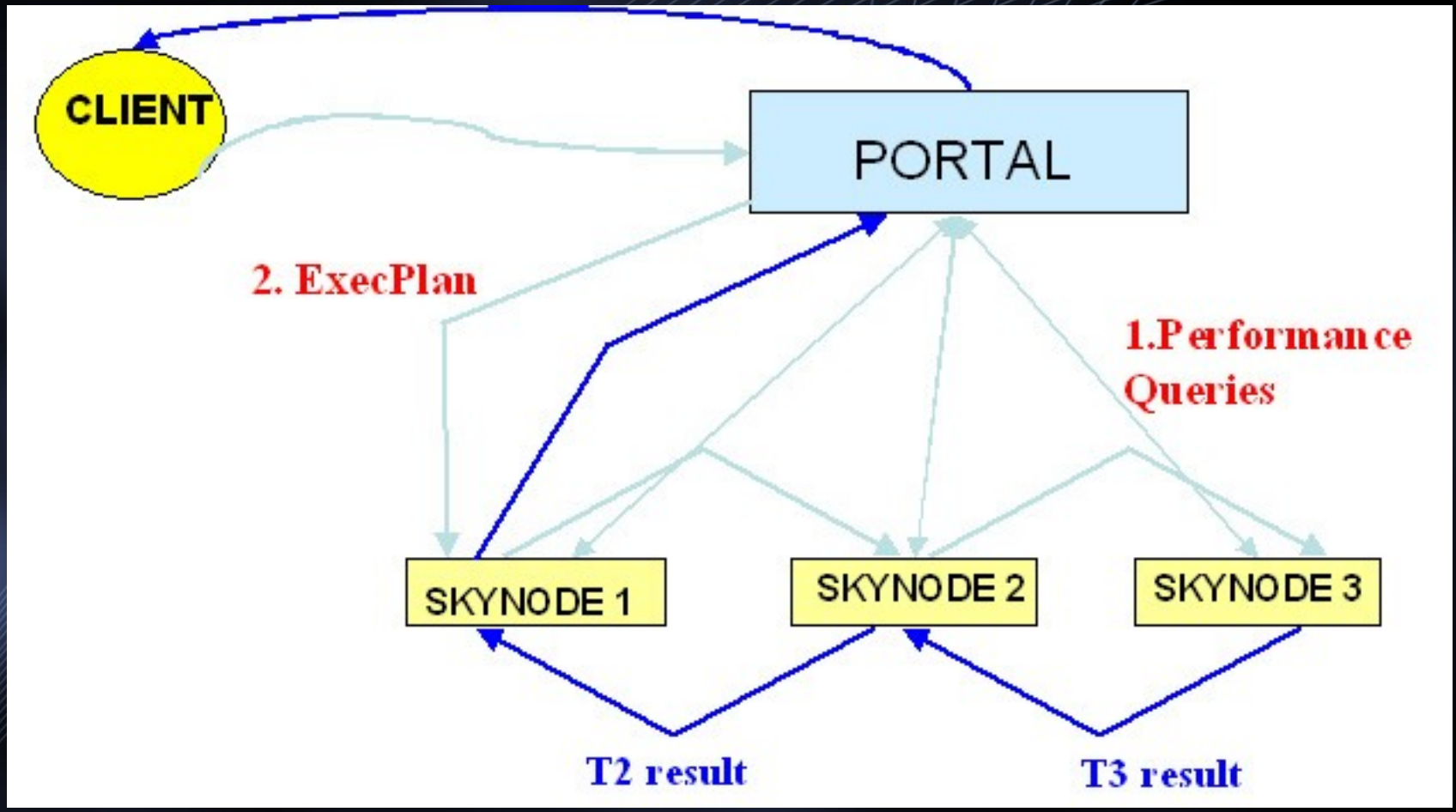
Title	Contact	Description
NVO Registry Portal at STScI	Gretchen Greene	Find source catalogs, observation logs, image archives, and other astronomical resources registered with the NVO.
DataScope	Thomas McGlynn	Discover and Explore Data in the Virtual Observatory
Open Sky Query	William O'Mullane	Cross match your data with numerous catalogues
Spectrum Services	Tamas Budavari	Search, plot, and retrieve SDSS, 2dF, and other spectra.
Web Enabled Source Identification with Cross Matching (WESIX)	Simon Krughoff	Upload images to SExtractor and cross-correlate the objects found with selected survey catalogs.
How to Publish to the NVO	Ray Plante	Find out how to make your data collection available to NVO users.

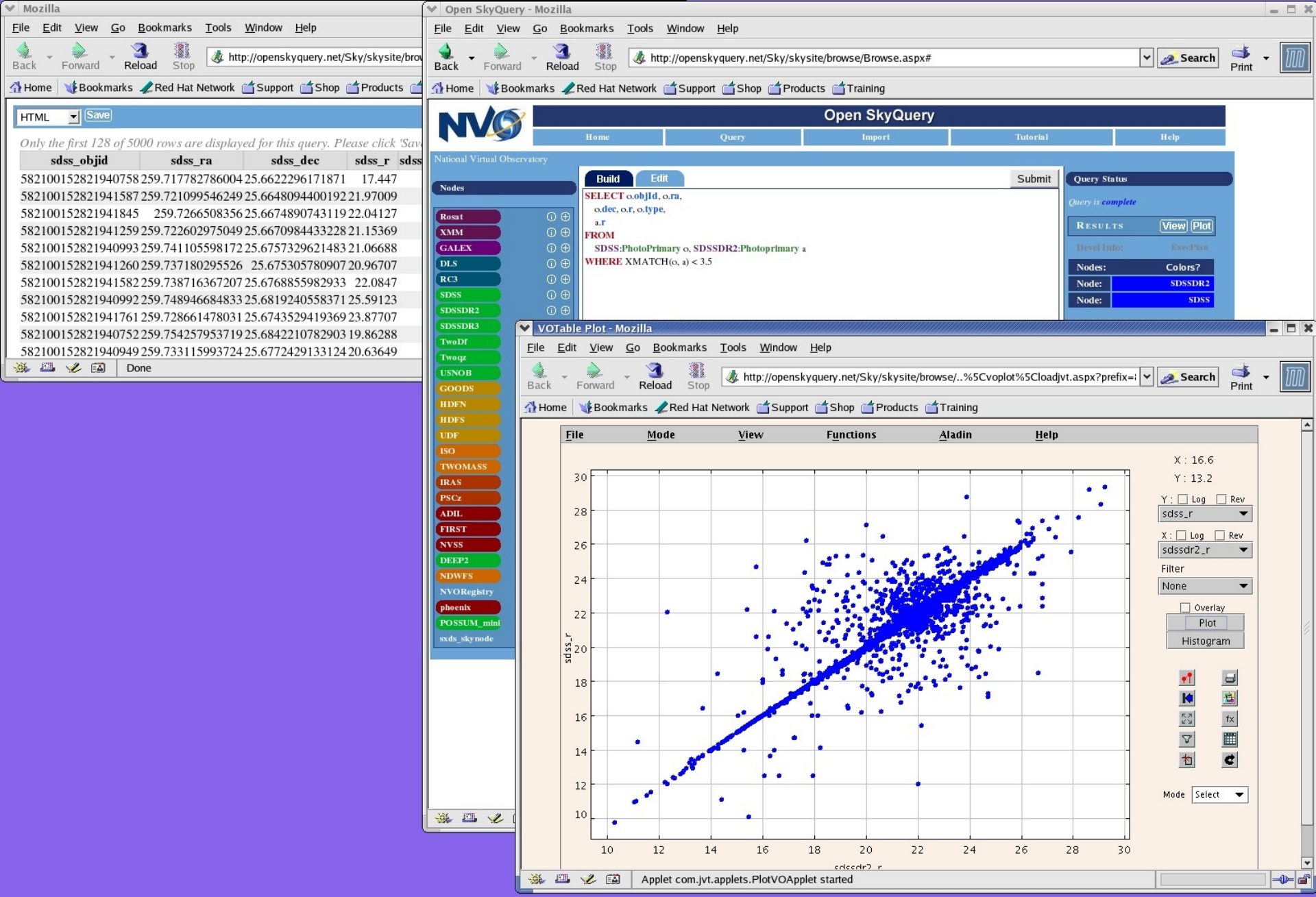
The NVO web site is a community-maintained collection with content control by the NVO Executive Committee. Content is judged by the extent to which it: (a) reflects an aspect of the Virtual Observatory, such as astronomy with federated data, (b) uses VO standards or software, or (c) exemplifies grid-based astronomical computing. If you would like a description of your project, data, or software included here, please write to web at us-vo.org with a short description of your work.



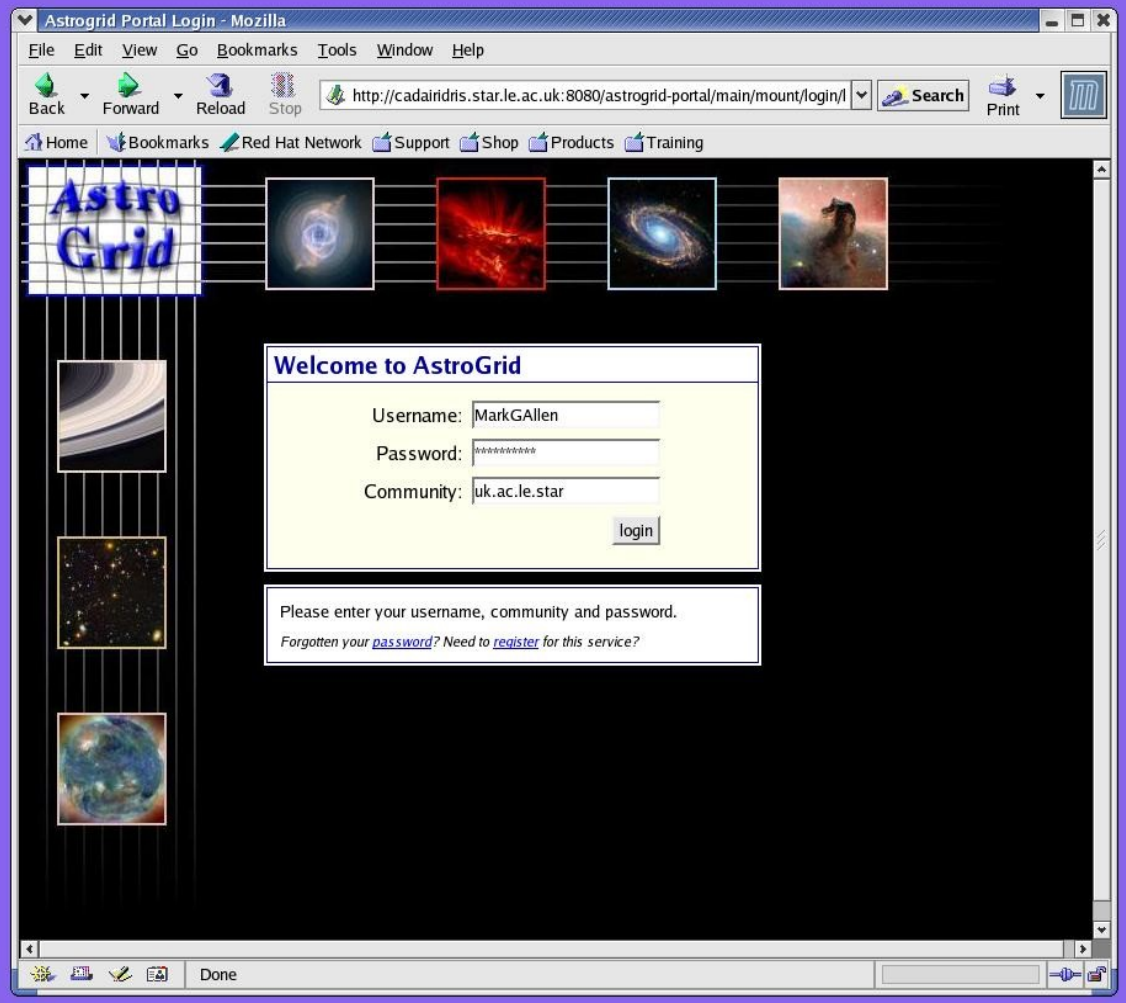
NVO Open SkyQuery

SkyQuery

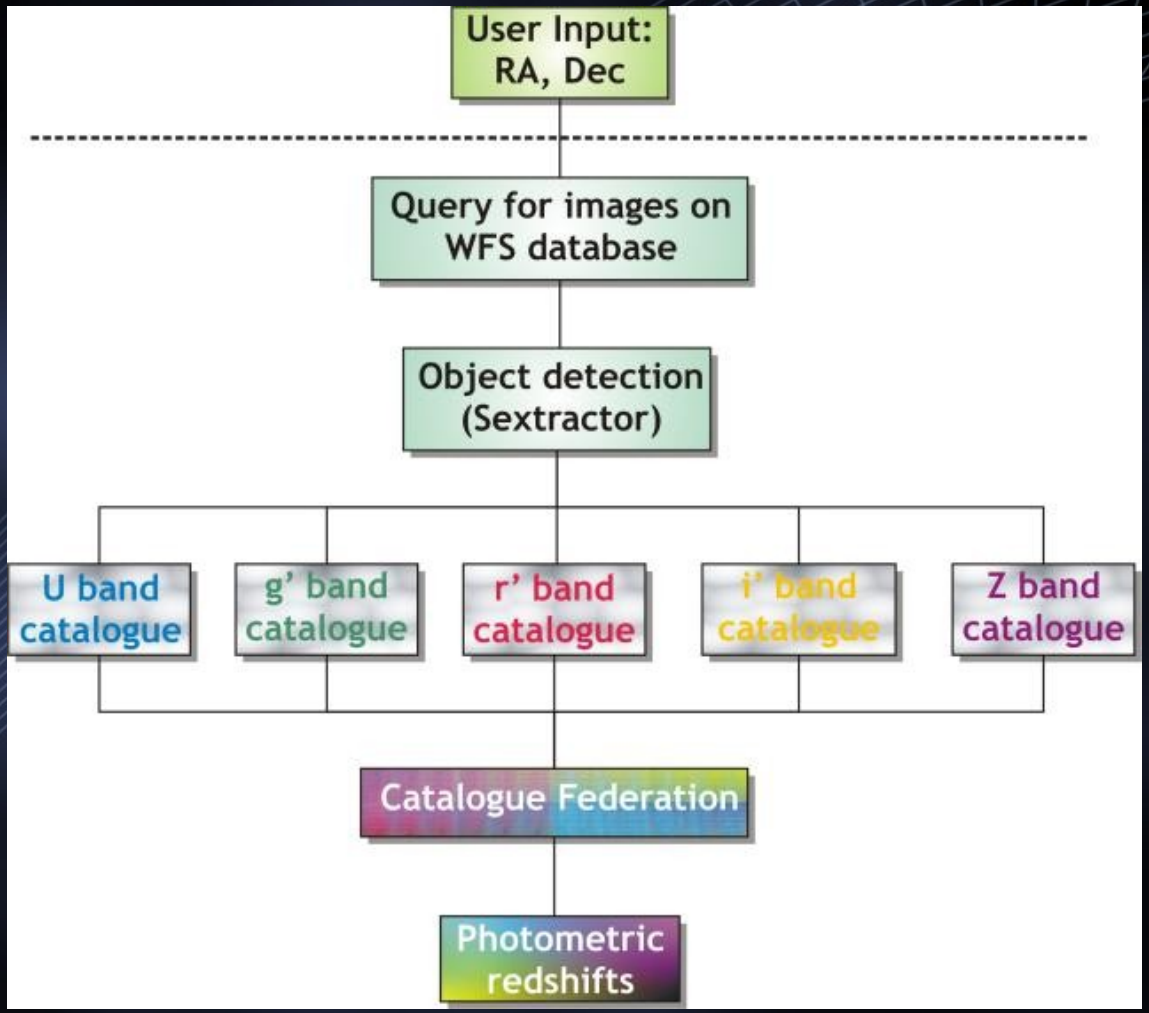

CLIENT
PORTAL
2. ExecPlan
1.Performance Queries
SKYNODE 1
SKYNODE 2
SKYNODE 3
T2 result
T3 result

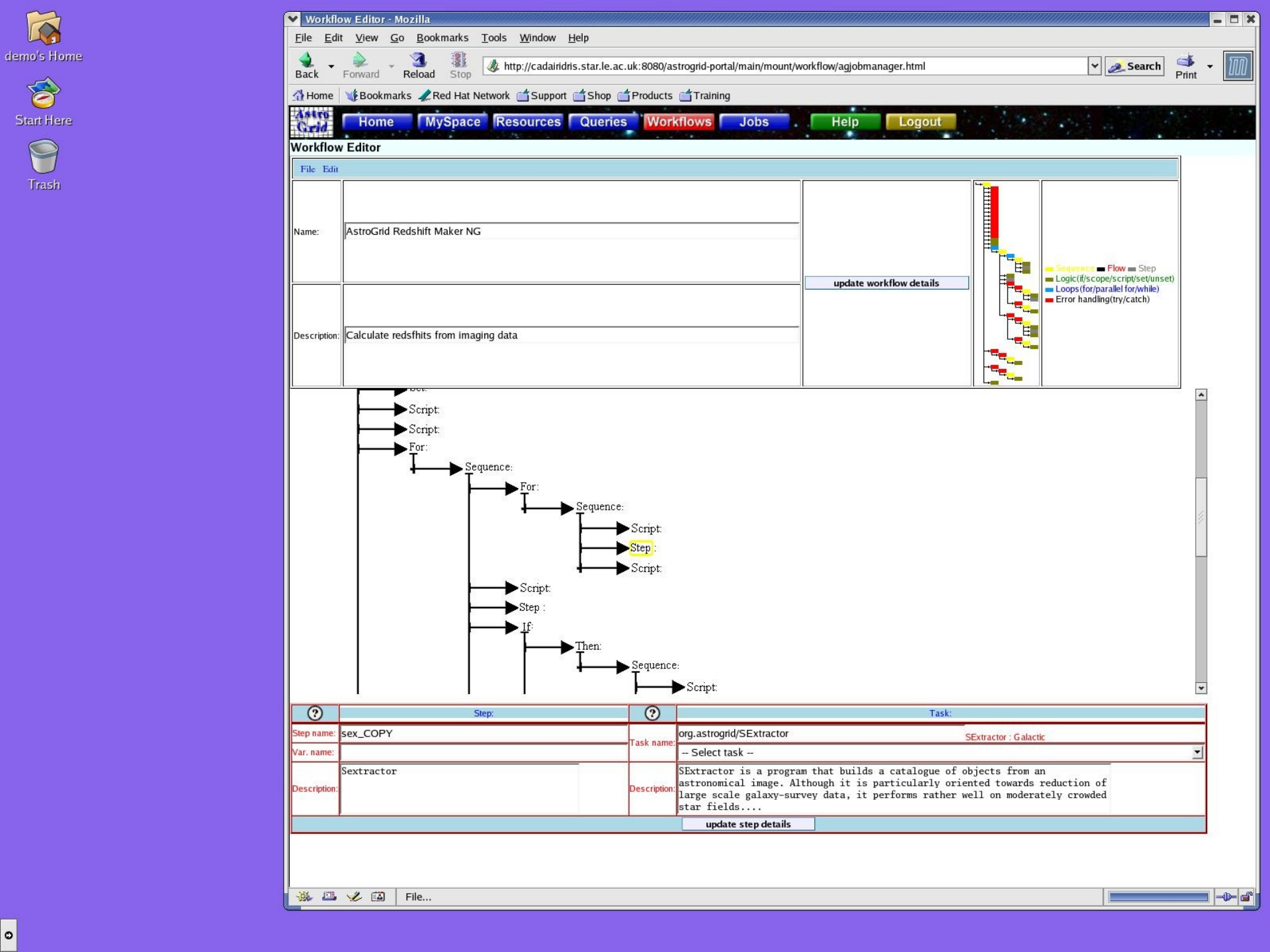


NVO Open SkyQuery & VOPlot

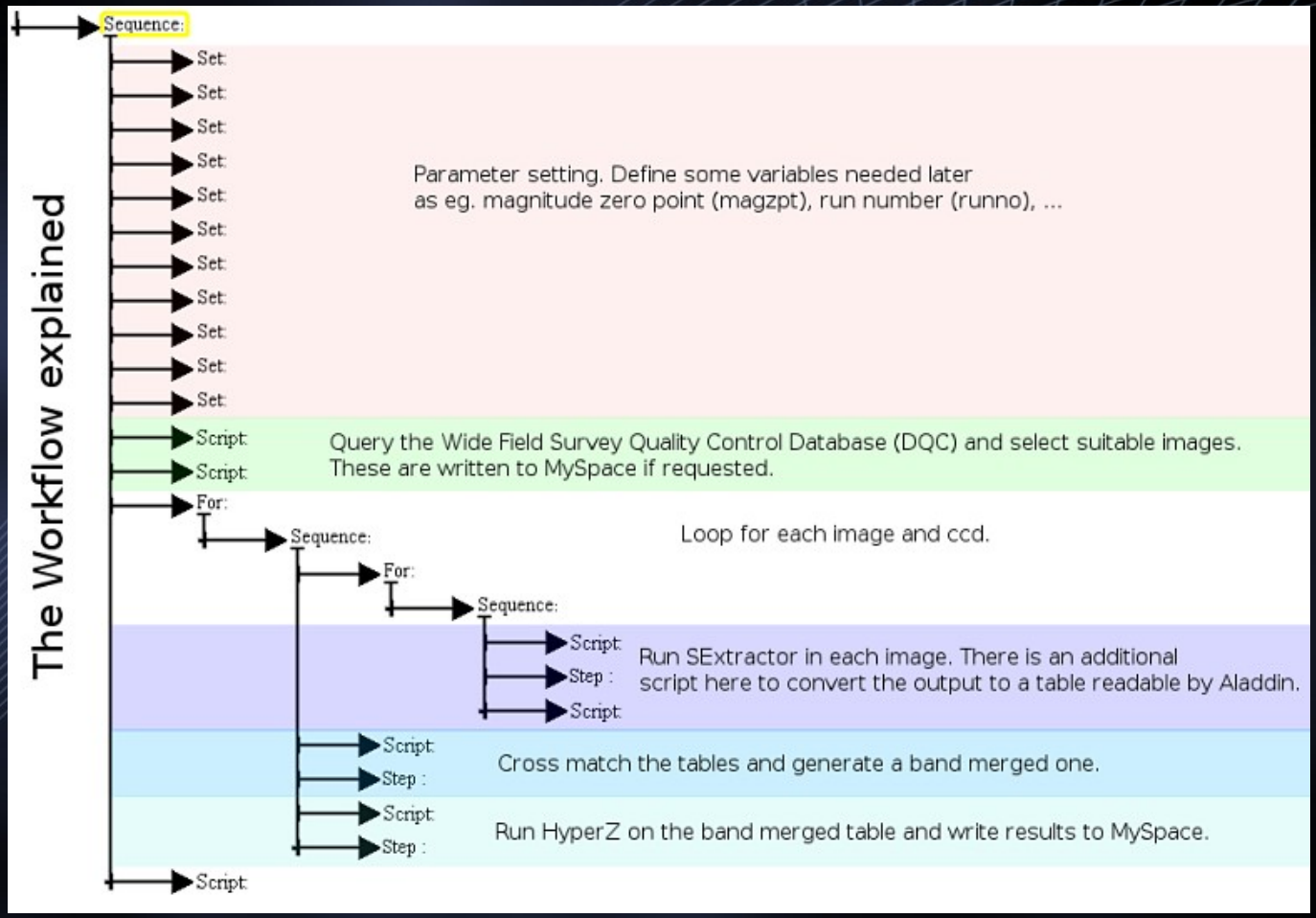


AstroGrid : scaling up VO processing into WorkFlows


User Input:
RA, Dec
Query for images on
WFS database
Object detection
(Sextractor)
U band
catalogue
g' band
catalogue
r' band
catalogue
i' band
catalogue
Z band
catalogue
Catalogue Federation
Photometric
redshifts

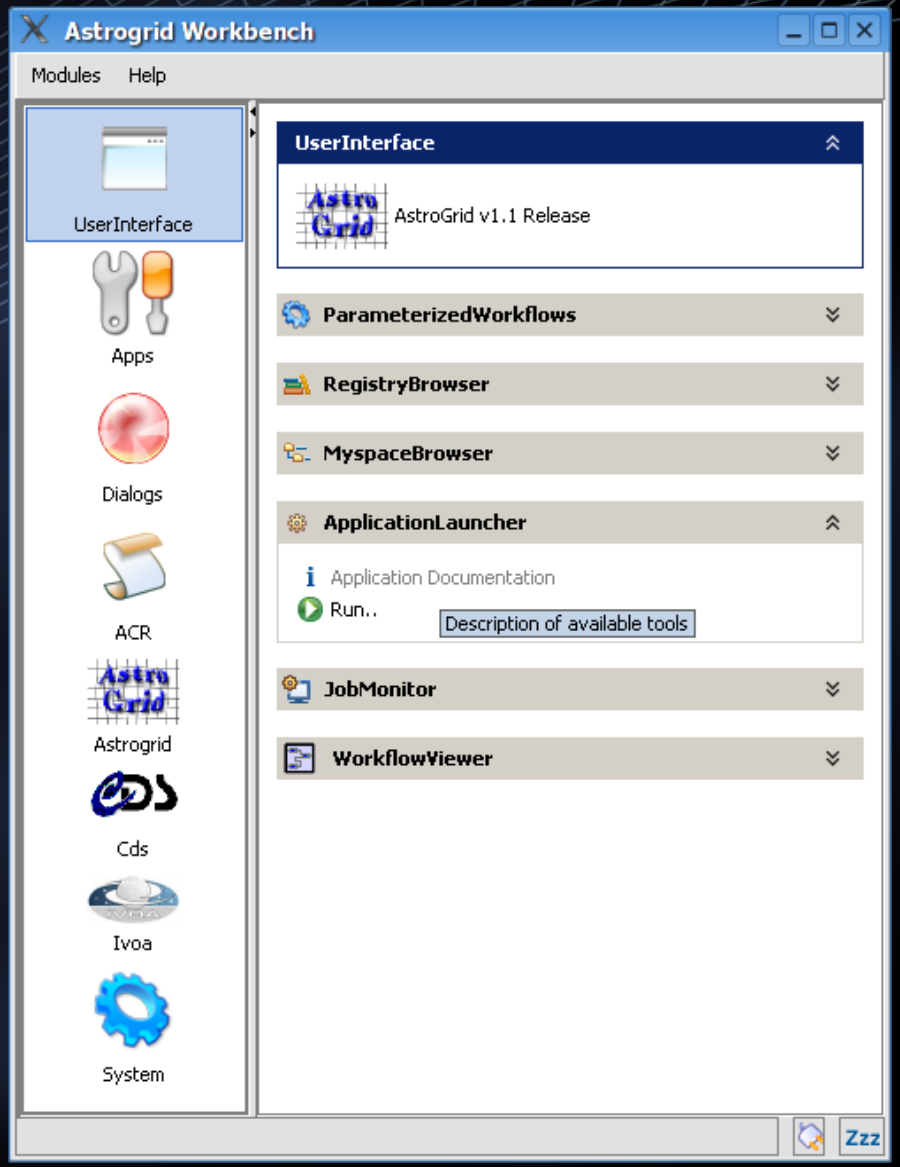

demo's Home
Start Here
Trash
Workflow Editor - Mozilla
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
http://cadairidris.star.le.ac.uk:8080/astrogrid-portal/main/mount/workflow/agjobmanager.html
Search Print
Home Bookmarks Red Hat Network Support Shop Products Training
Home MySpace Resources Queries Workflows Jobs Help Logout
Workflow Editor
File Edit
Name: AstroGrid Redshift Maker NG
update workflow details
Description: Calculate redsfhits from imaging data
Sequence Flow Step
Logic(if/scope/script/set/unset)
Loops(for/parallel for/while)
Error handling(try/catch)
Script:
Script:
For:
Sequence:
For:
Sequence:
Script:
Step :
Script:
Script:
Step :
If:
Then:
Sequence:
Script:
Step:
Step name: sex_COPY
Var. name:
Description: Sextractor
Task:
Task name: org.astrogrid/SExtractor
SExtractor : Galactic
-- Select task --
Description: SExtractor is a program that builds a catalogue of objects from an astronomical image. Although it is particularly oriented towards reduction of large scale galaxy-survey data, it performs rather well on moderately crowded star fields....
update step details
File...

The Workflow explained

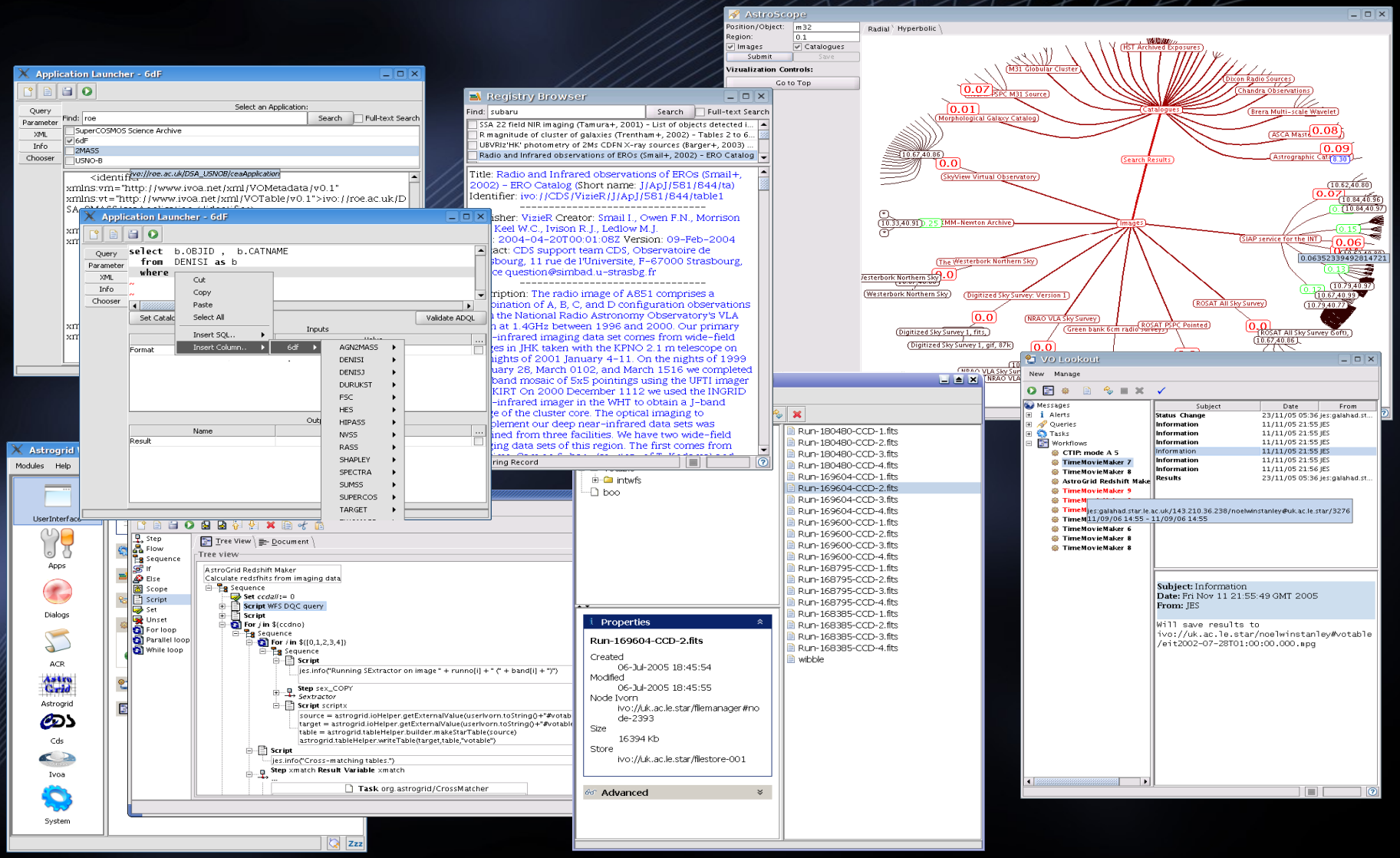


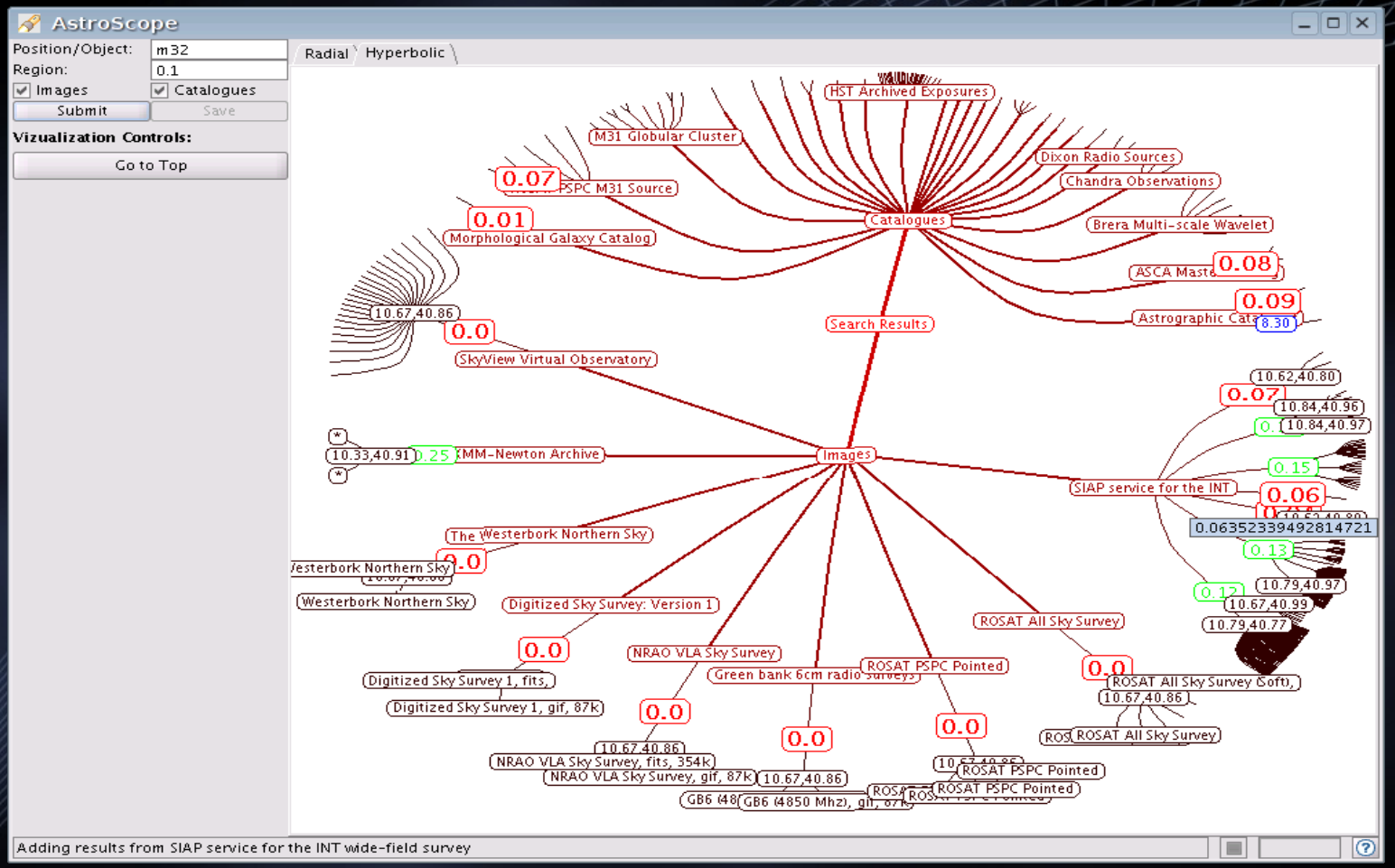
Workbench

- Launcher
- Lists a suite of GUI Applications
- Also exposes some of the basic functions of the ACR
  - good for experimentation



Workbench UI




AstroScope
Position/Object:
m32
Region:
0.1
Images
Catalogues
Submit
Save
Vizualization Controls:
Go to Top
Radial
Hyperbolic
HST Archived Exposures
M31 Globular Cluster
Dixon Radio Sources
Chandra Observations
0.07
PSPC M31 Source
Catalogues
Brera Multi-scale Wavelet
0.01
Morphological Galaxy Catalog
0.08
0.09
Search Results
10.67,40.86
0.0
SkyView Virtual Observatory
10.62,40.80
0.07
10.84,40.96
10.84,40.97
10.33,40.91
0.25
XMM-Newton Archive
Images
0.15
SIAP service for the INT
0.06
0.063523394928147 21
The Westerborn Northern Sky
0.13
0.0
Westerborn Northern Sky
10.79,40.97
0.12
10.67,40.99
Digitized Sky Survey: Version 1
ROSAT All Sky Survey
10.79,40.77
0.0
0.0
NRAO VLA Sky Survey
ROSAT PSPC Pointed
Digitized Sky Survey 1, fits,
Green bank 6cm radio surveys
0.0
ROSAT All Sky Survey (Soft),
Digitized Sky Survey 1, gif, 87k
10.67,40.86
0.0
0.0
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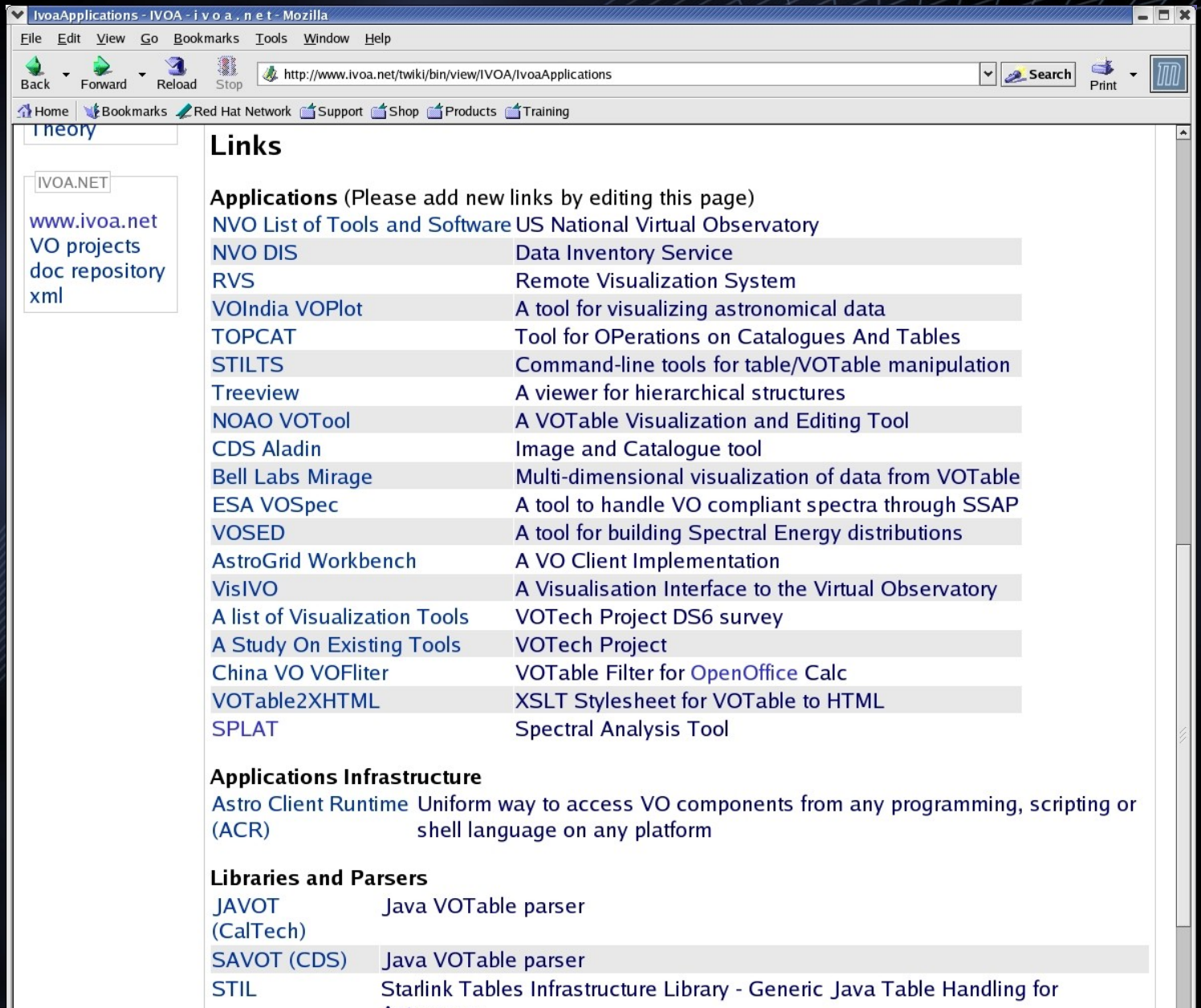
10.67,40.86
ROSAT All Sky Survey
NRAO VLA Sky Survey, fits, 354k
ROSAT PSPC Pointed
NRAO VLA Sky Survey, gif, 87k
10.67,40.86
ROSAT PSPC Pointed
GB6 (4850 Mhz), gif, 87k
Adding results from SIAP service for the INT wide-field survey

IVOA Applications Interest Group

- Announcements of new tools
- Discussion on VO tools
- Suggestions for enhancements
- Feedback to IVOA working groups on standards etc.
- www.ivoa.net - Community - Applications

Working list of applications – add your own!



Links

Applications (Please add new links by editing this page)

NVO List of Tools and Software	US National Virtual Observatory
NVO DIS	Data Inventory Service
RVS	Remote Visualization System
VOIndia VOPlot	A tool for visualizing astronomical data
TOPCAT	Tool for OPerations on Catalogues And Tables
STILTS	Command-line tools for table/VOTable manipulation
Treeview	A viewer for hierarchical structures
NOAO VOTool	A VOTable Visualization and Editing Tool
CDS Aladin	Image and Catalogue tool
Bell Labs Mirage	Multi-dimensional visualization of data from VOTable
ESA VOSpec	A tool to handle VO compliant spectra through SSAP
VOSED	A tool for building Spectral Energy distributions
AstroGrid Workbench	A VO Client Implementation
VisIVO	A Visualisation Interface to the Virtual Observatory
A list of Visualization Tools	VOTech Project DS6 survey
A Study On Existing Tools	VOTech Project
China VO VOFliter	VOTable Filter for OpenOffice Calc
VOTable2XHTML	XSLT Stylesheet for VOTable to HTML
SPLAT	Spectral Analysis Tool

Applications Infrastructure

Astro Client Runtime (ACR)	Uniform way to access VO components from any programming, scripting or shell language on any platform

Libraries and Parsers

JAVOT (CalTech)	Java VOTable parser
SAVOT (CDS)	Java VOTable parser
STIL	Starlink Tables Infrastructure Library - Generic Java Table Handling for

Summary

- VO tools are ready for doing science
  - Varying levels of stability and maturity
- VO services are rapidly coming online
  - Data centres implementing translation layers
  - Specialized services uptake of VO standards
- Workflows and Grid capabilities
  - First steps are promising