A PPARC funded project

Accessing Wide Imaging Surveys from AstroGrid

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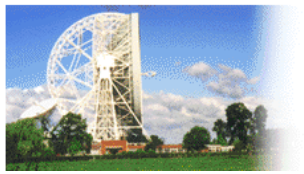

Overview

- The Virtual Observatory: what & why
- The UK VO: AstroGrid
- Accessing large imaging surveys and databases
- Example: doing science with AstroGrid

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The Virtual Observatory (VO)

- Collection of integrated astronomical data archives and software tools that utilize computer networks to create an environment in which research can be conducted

  (http://www.encyclopedia.com)

Thanks to Ohishi Masatoshi (NAOJ) for the pointer…

VO Goals

- Improving the quality, ease, speed and cost effectiveness of on-line astronomy
- Making comparison and integration of data from diverse sources seamless and transparent
- Removing data analysis barriers to multiwavelength analysis
- Enabling access and manipulation of large data sets

International Collaboration

- Similar efforts now in 15 countries:
  - UK, USA, Canada, France, Germany, Italy, Holland, Japan, Australia, India, China, Russia, Hungary, South Korea, ESO, Spain
- Active collaboration among projects
  - Standards, common demos
  - International VO roadmap being developed
  - Regular telecons over 10 timezones

Formal collaboration

International Virtual Observatory Alliance (IVOA)

The need for a VO

- Data volume doubles every year
- Increase of size and multiplex capabilities of new instruments (WFCAM, VISTA, …)
- By 2010 we will have **petabytes** of data
- Federation of the data is a must, but how?
- WWW becomes the best observatory:
  - Data on every part of the sky and every wavelength
  - The seeing is always great. Never cloudy.
  - As deep as the best instruments.

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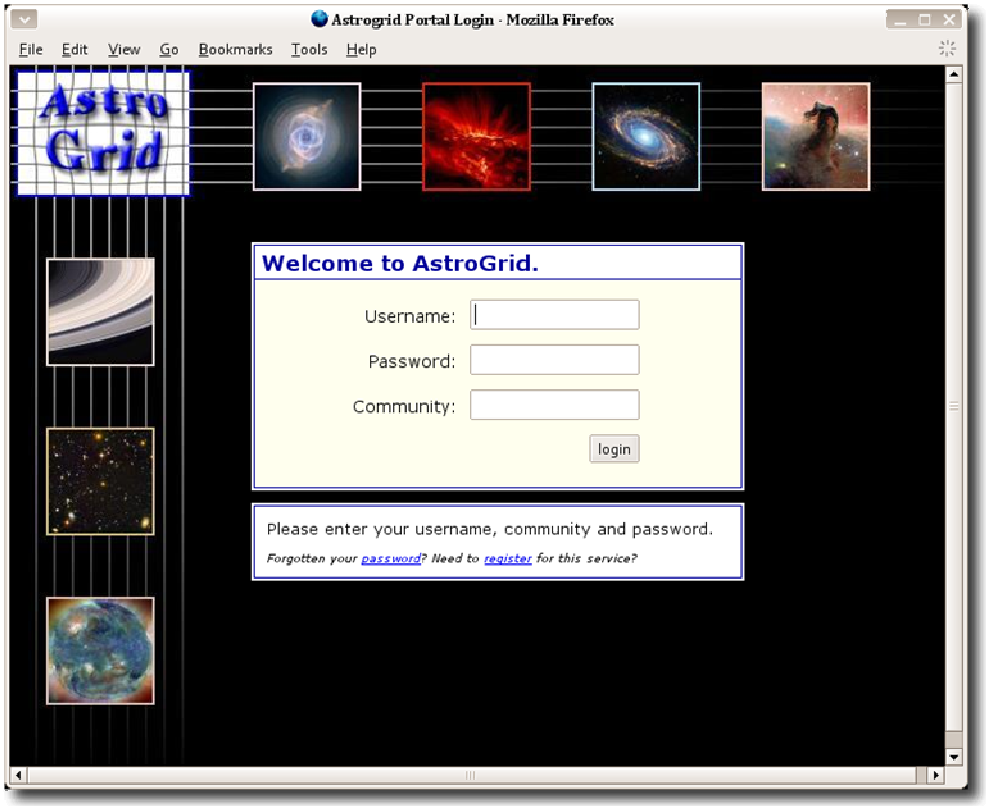
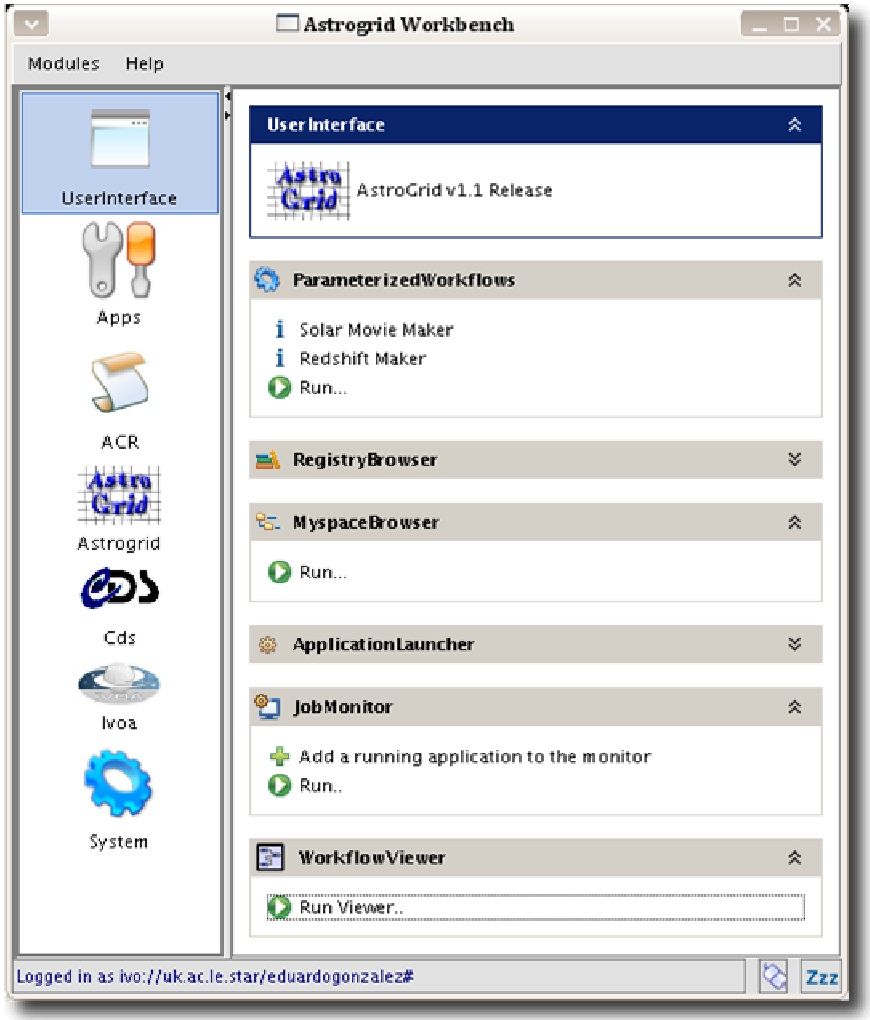
AstroGrid: the UK VO

- Astrogrid release 1.1:
  - http://www.astrogrid.org/release
- Access to imaging servers (e.g. WFS, SDSS), catalogues (e.g., WFS, 2MASS, SWIRE, FIRST, Vizier)
- Wide range of tools available:
  - X-matcher, SExtractor, SWARP, HyperZ, BPZ, GALAXEV, …

AstroGrid: the UK VO



Astrogrid Portal

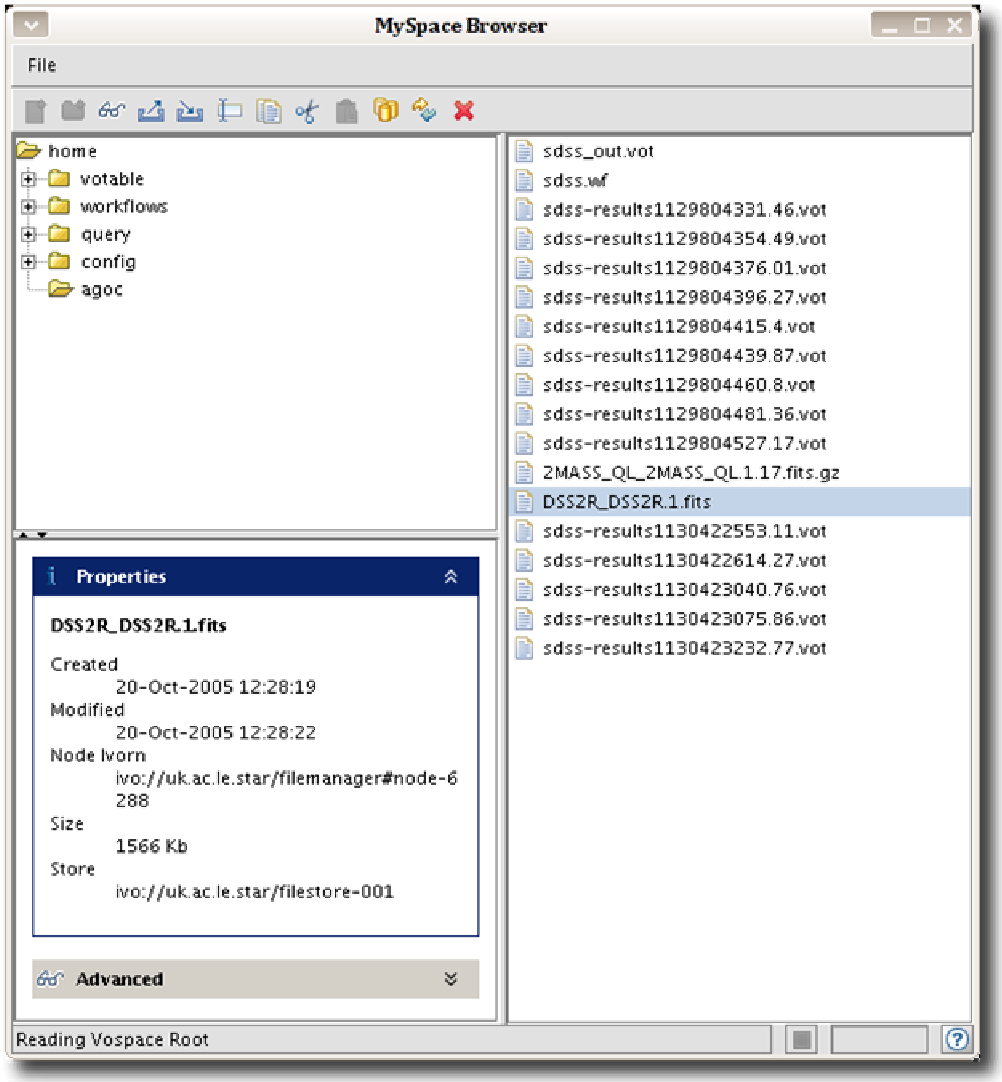


Astrogrid Workbench

AstroGrid: MySpace

- Virtual disk space where you can store results, temporary files, and new things like query files and workflow files, so you can adjust and re-run jobs on a later day.

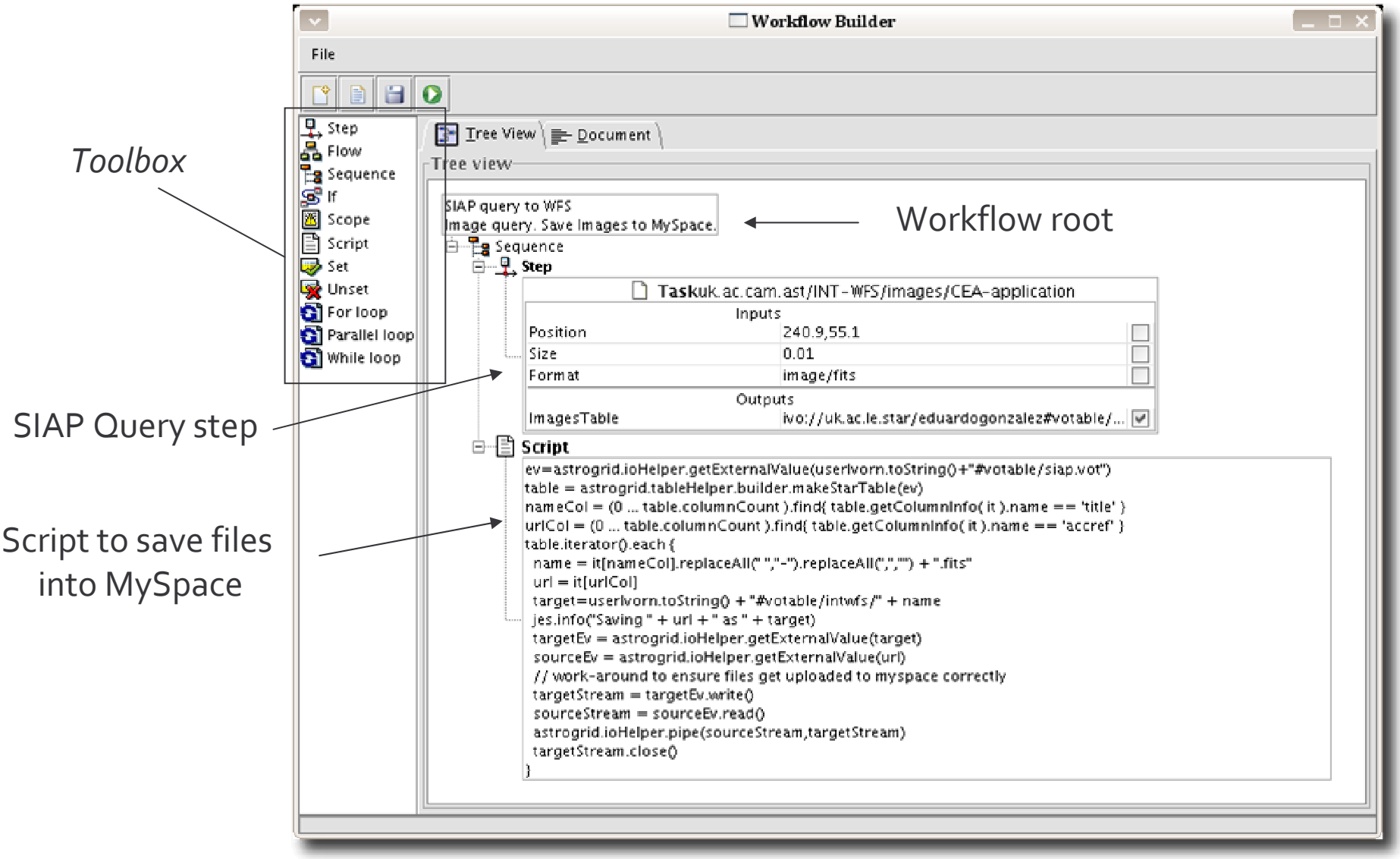
- Visible from any computer.



Astrogrid: Workflow

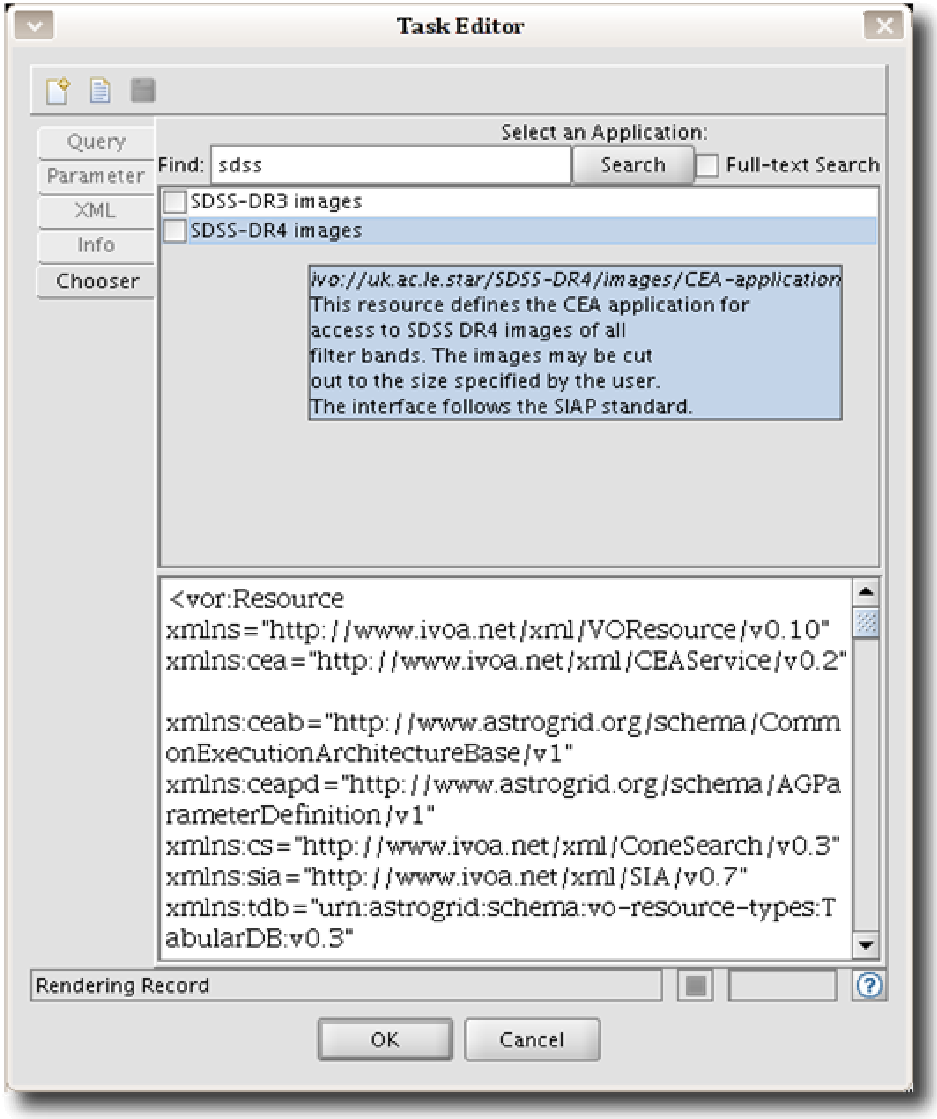
- User compose a complex series of tasks which can be run on sequence or parallel (or loops)
- Jobs are run remotely and asynchronously
- Results are stored in a virtual file system
- Queries and workflows can be re-used and shared
- AstroGrid is currently the only VO project with a workflow workbench where scientific workflows can be created and run.
- Workflows are constructed via discovery of relevant data and applications from the registry

AstroGrid: Workflow

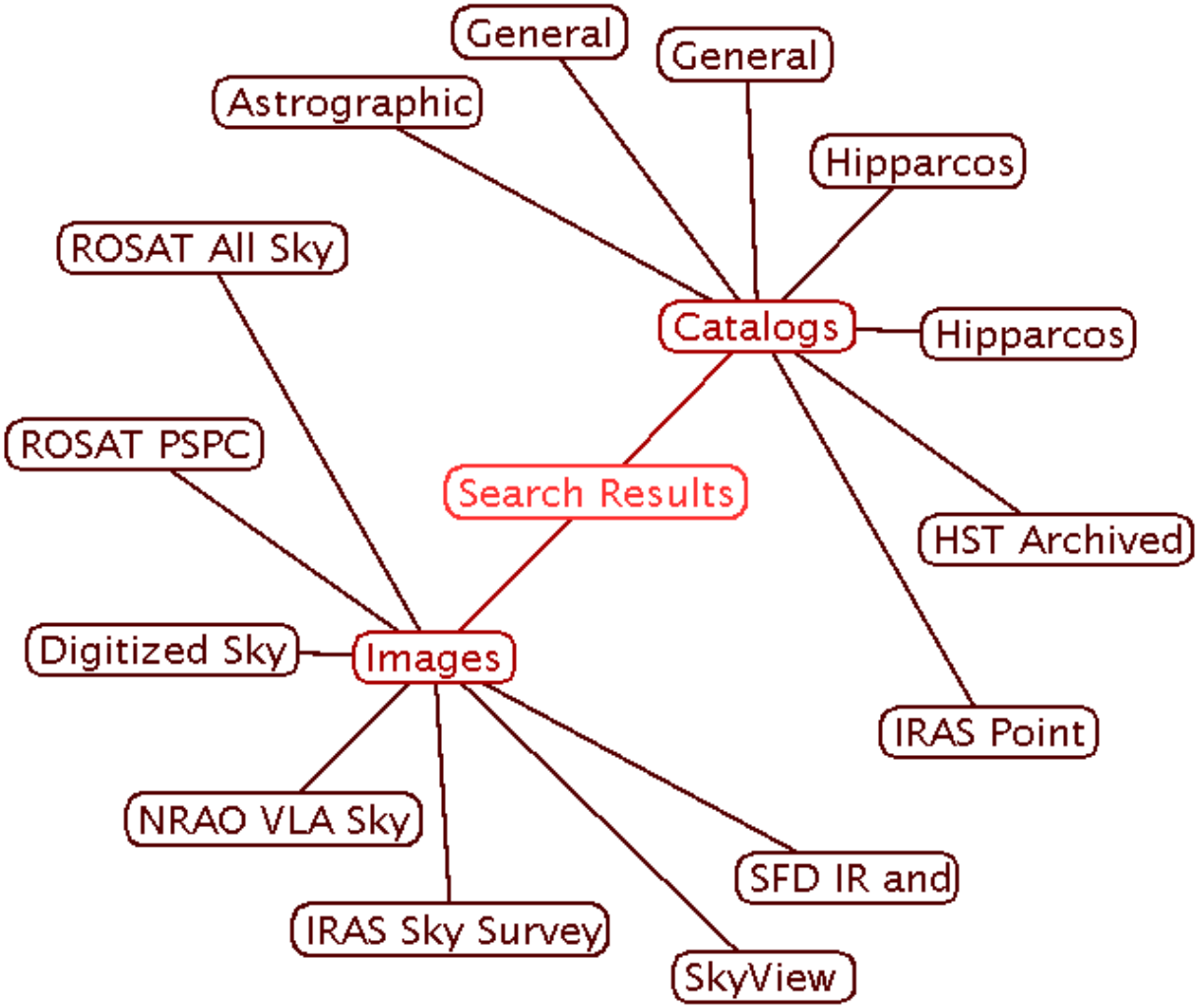


Finding Information : the Registry

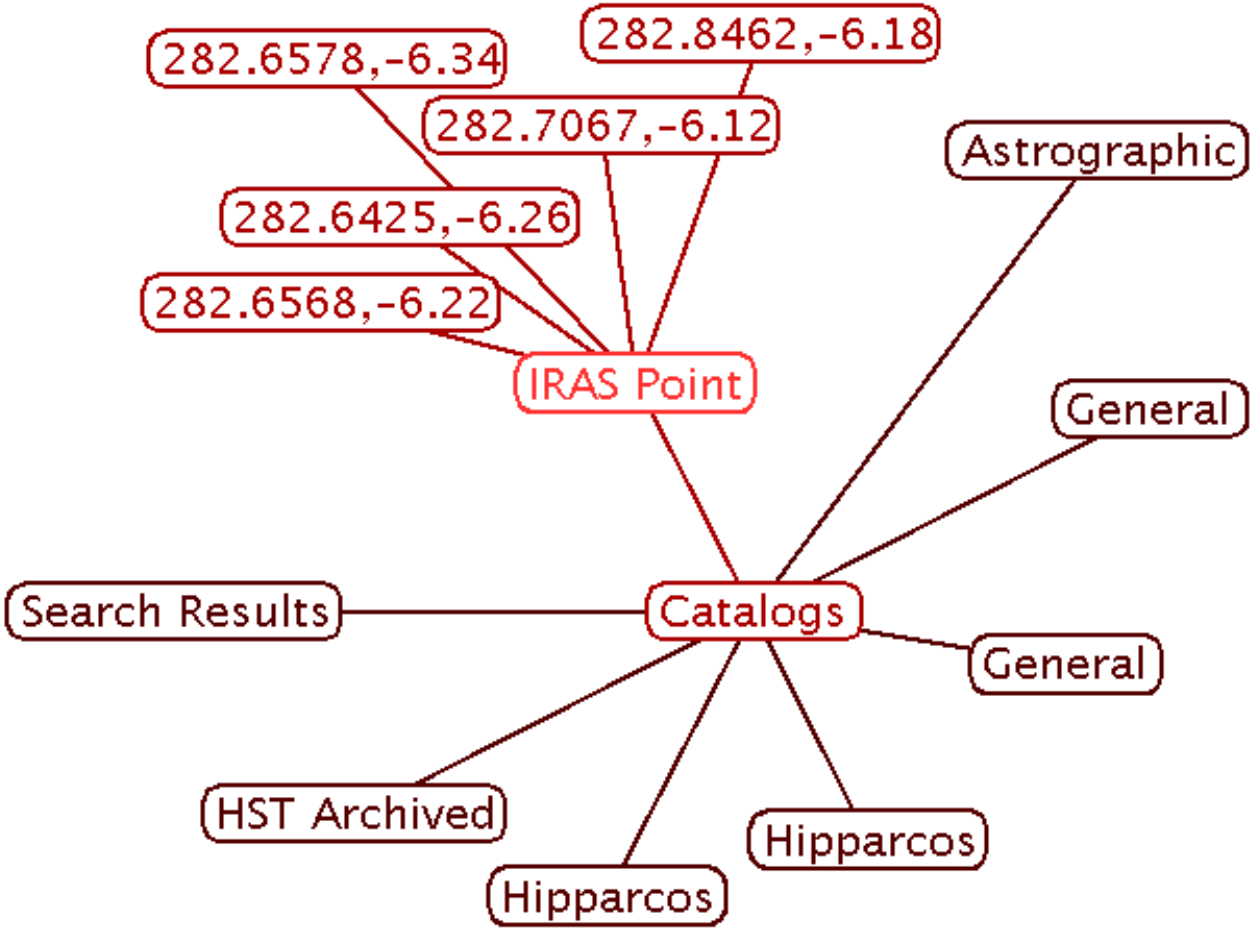
- How do you find the data you require?
- How do you decide which resource (data, application, information, disk, ...) to use?
- The registries are the yellow pages for astronomical resources
- All VO registries harvesting each other: thus querying any one returns full list of globally held resources.
- AstroGrid access all astronomical resources



Finding Information: AstroScope



Finding Information: Astroscope



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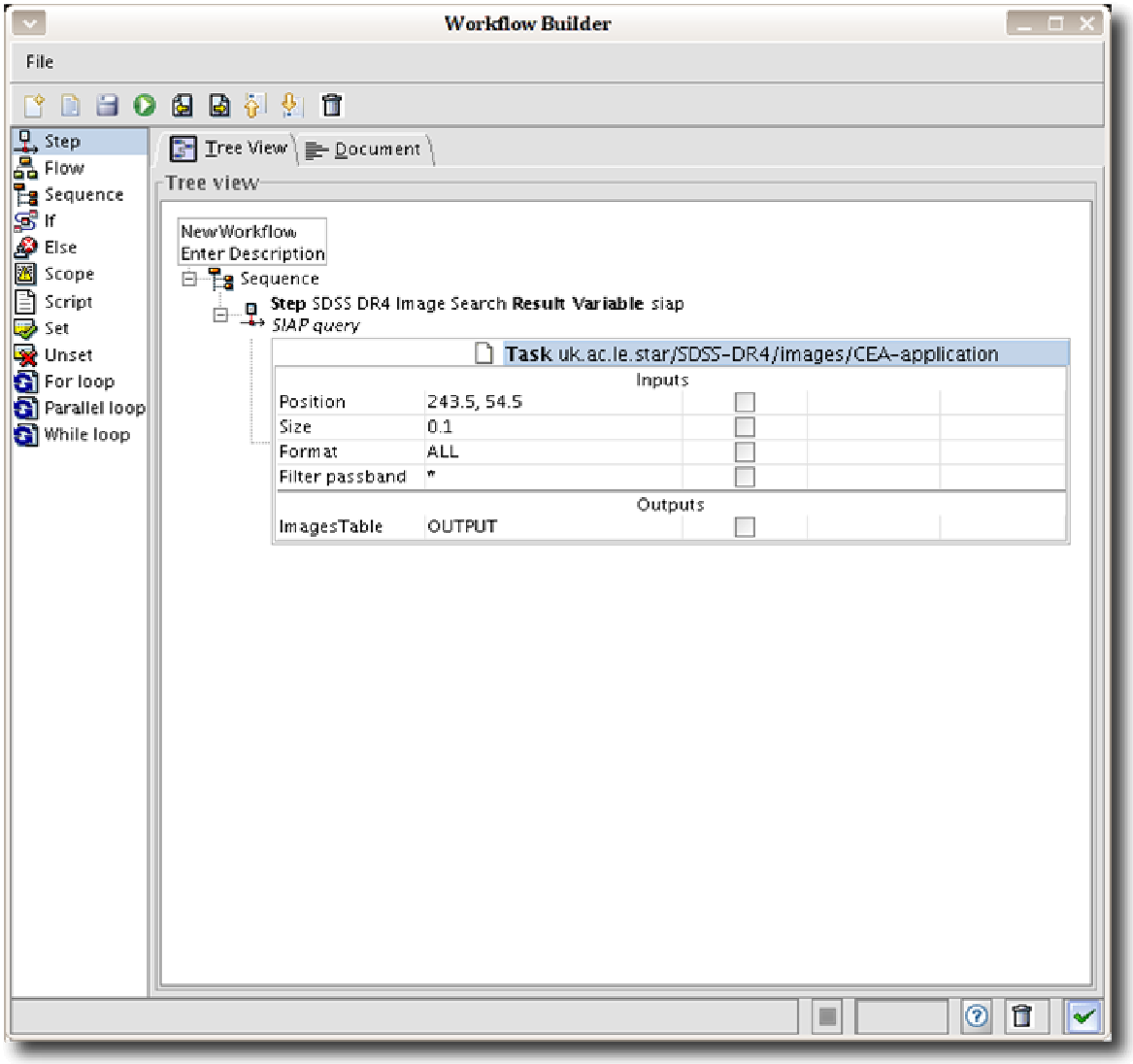
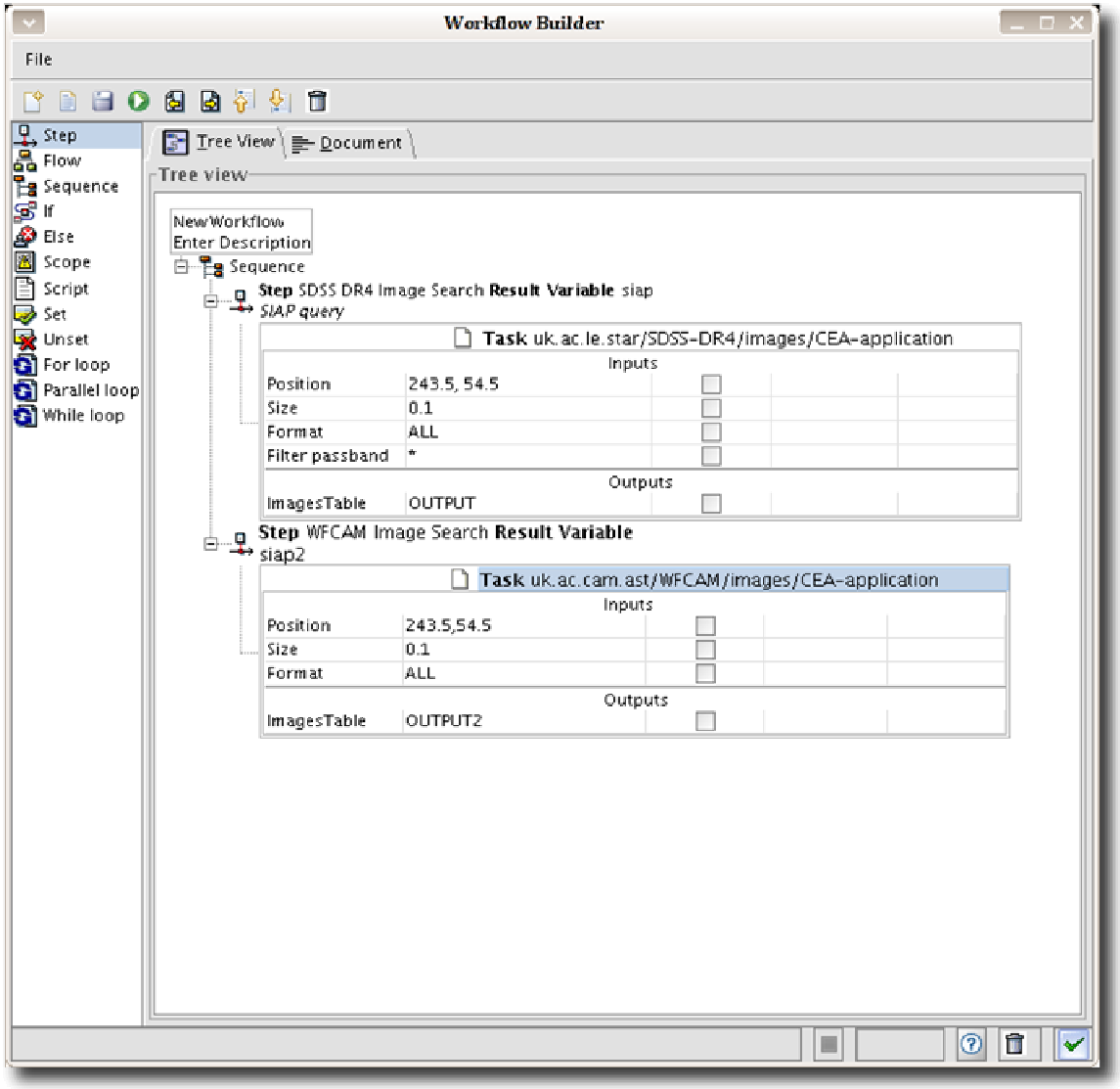
Simple Image Access Protocol (SIAP): accessing images from Wide Field Surveys

- SIAP is a protocol for retrieving image data from a variety of astronomical image repositories through a **uniform interface**.
- The service returns a list of candidate images.
- For each candidate image an access reference URL may be used to retrieve the image.

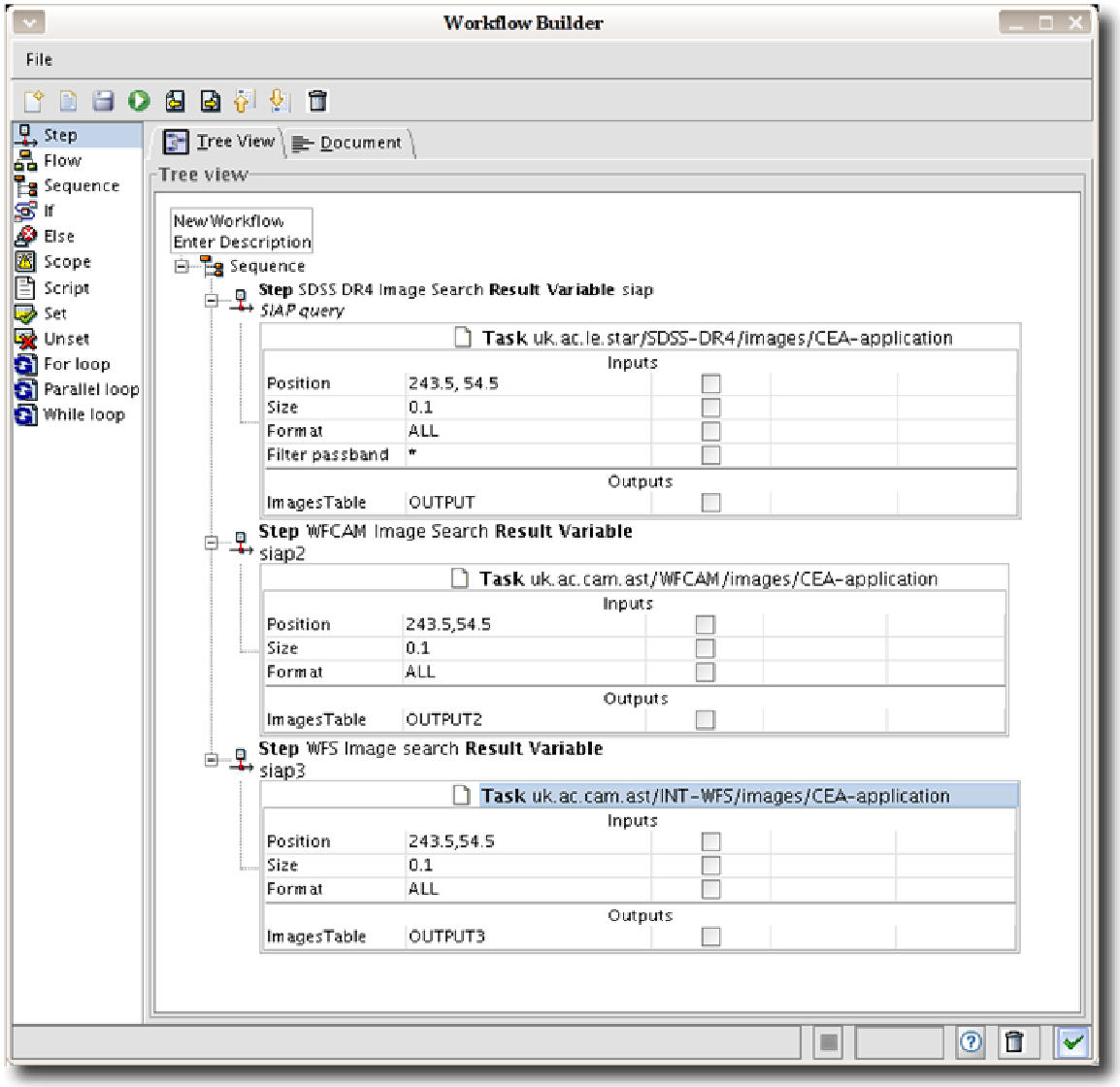
Simple Image Access Protocol (SIAP): accessing SDSS images …



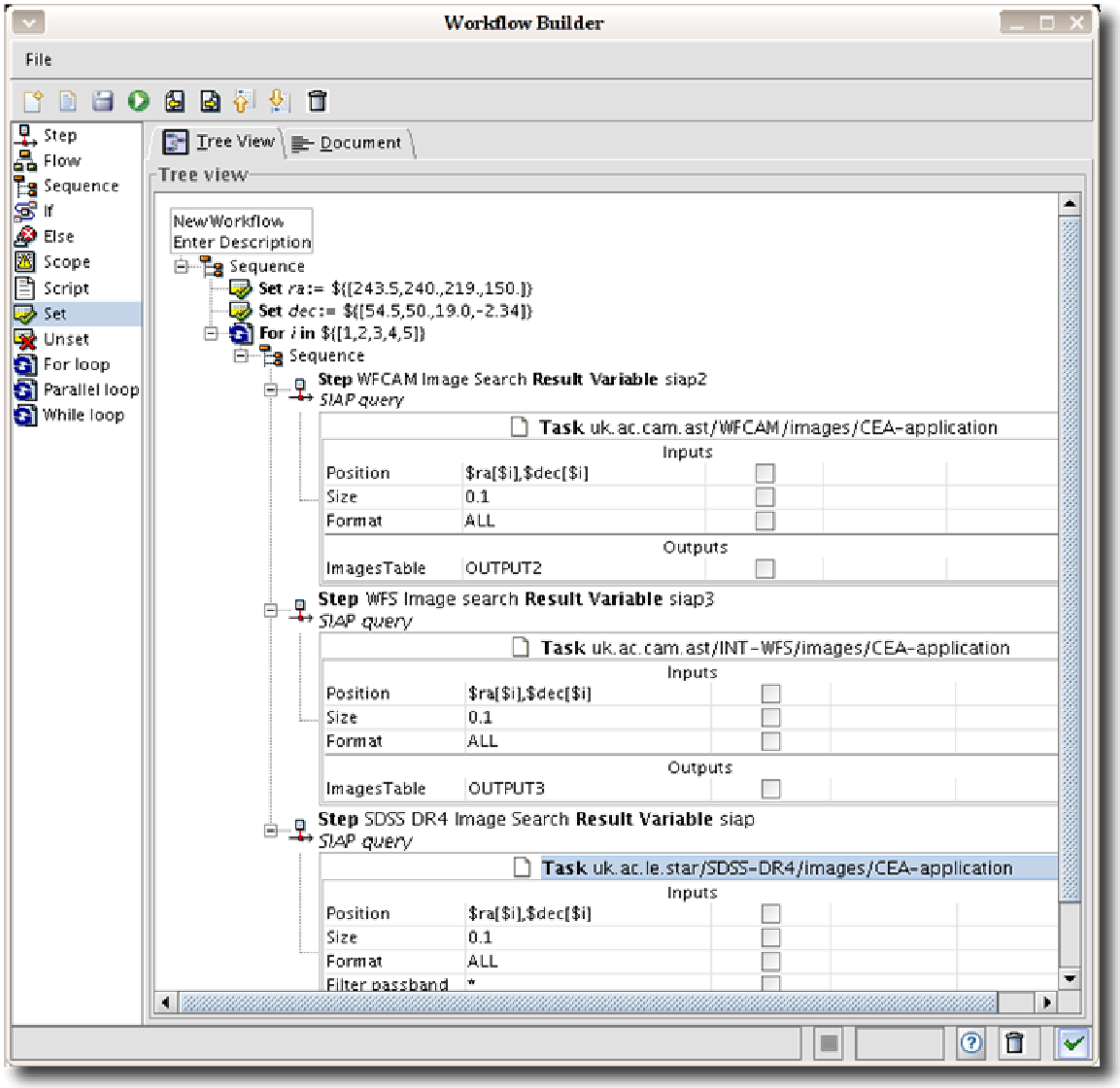
Simple Image Access Protocol (SIAP): … and WFCAM images …

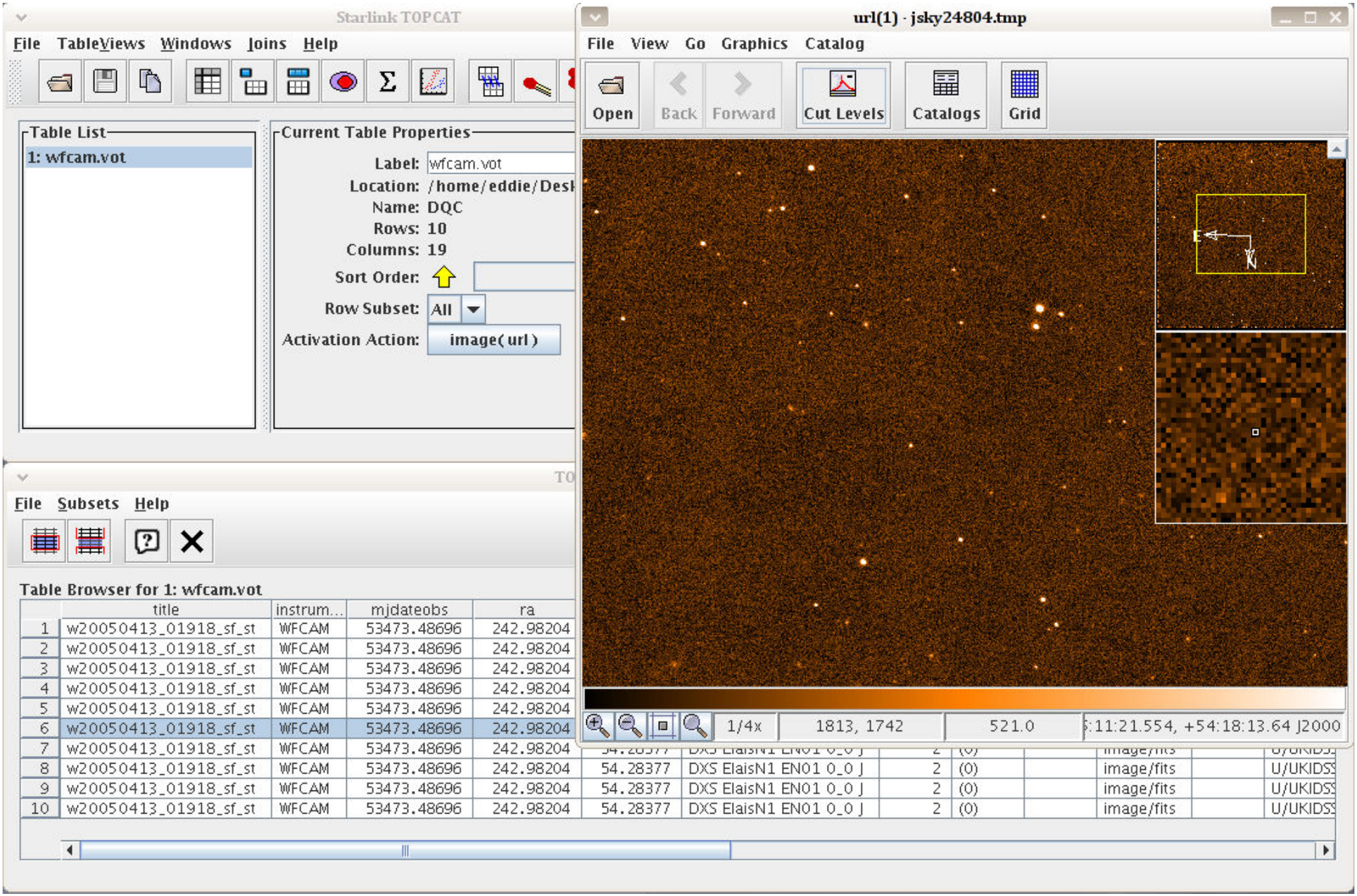


Simple Image Access Protocol (SIAP): … and WFS images



Simple Image Access Protocol (SIAP): multiple searches




Starlink TOPCAT
File TableViews Windows Joins Help
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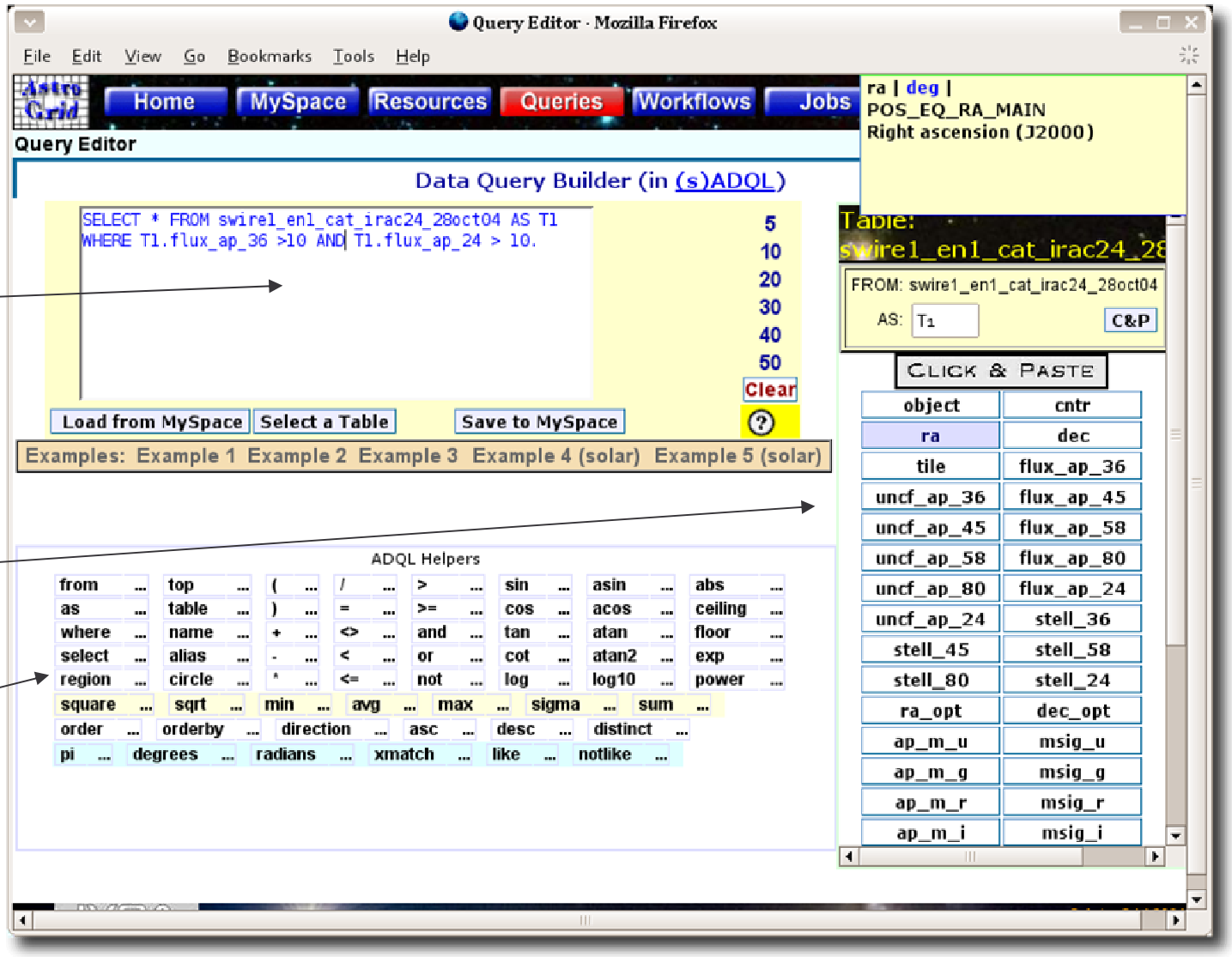
Catalogue Query



ADQL Query

Table Column Information

ADQL Helpers

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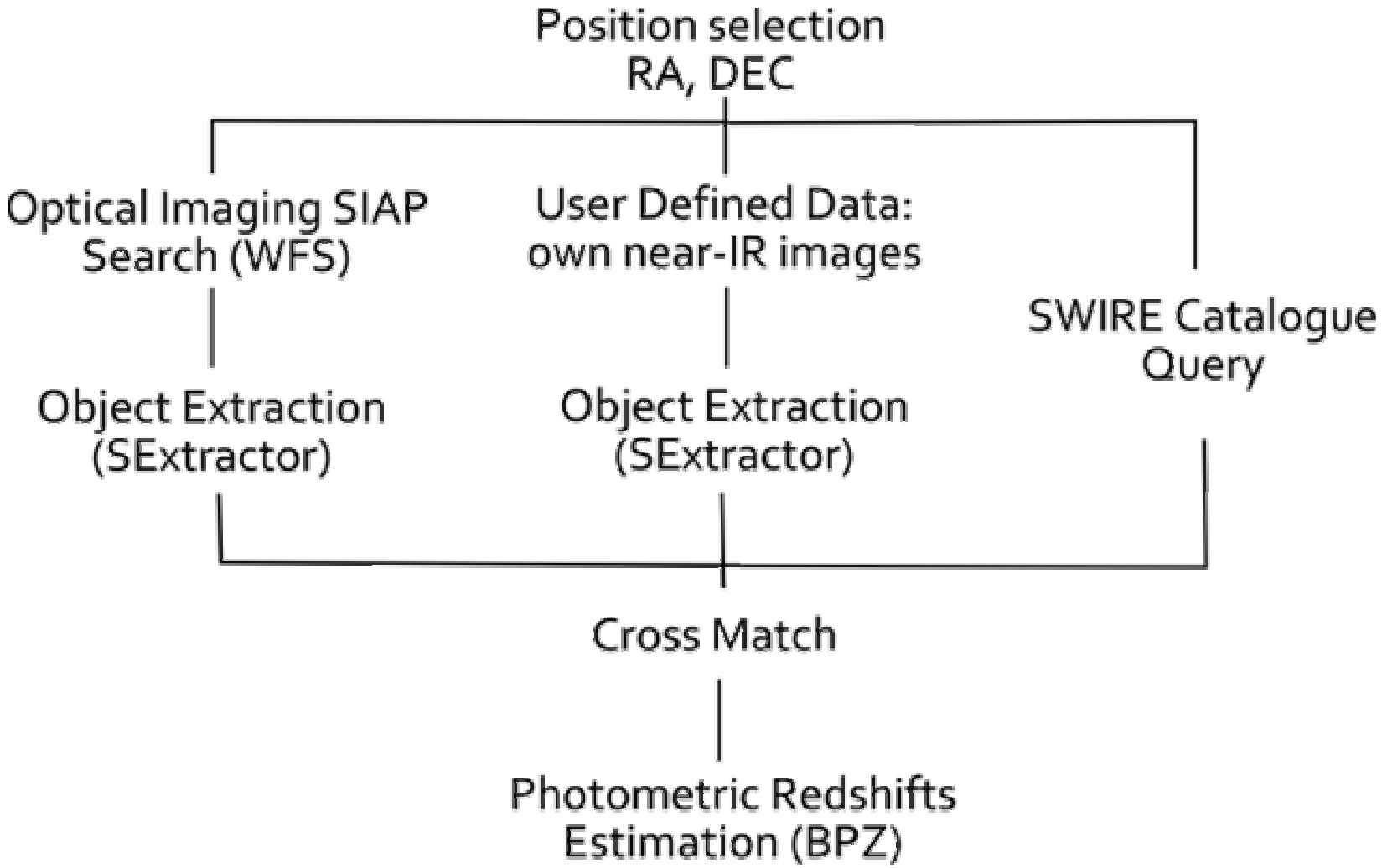
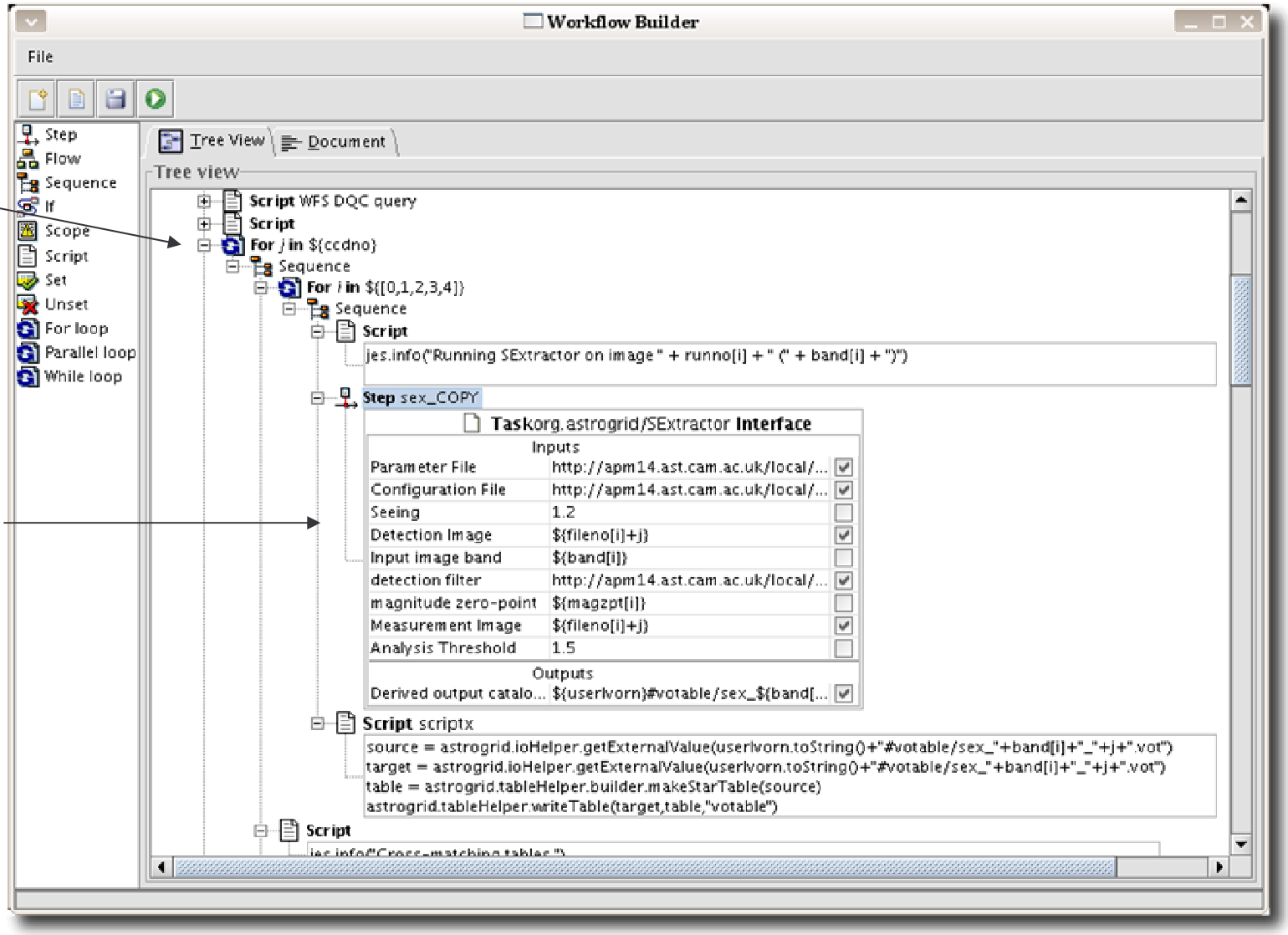
Defining a workflow



Extracting Objects

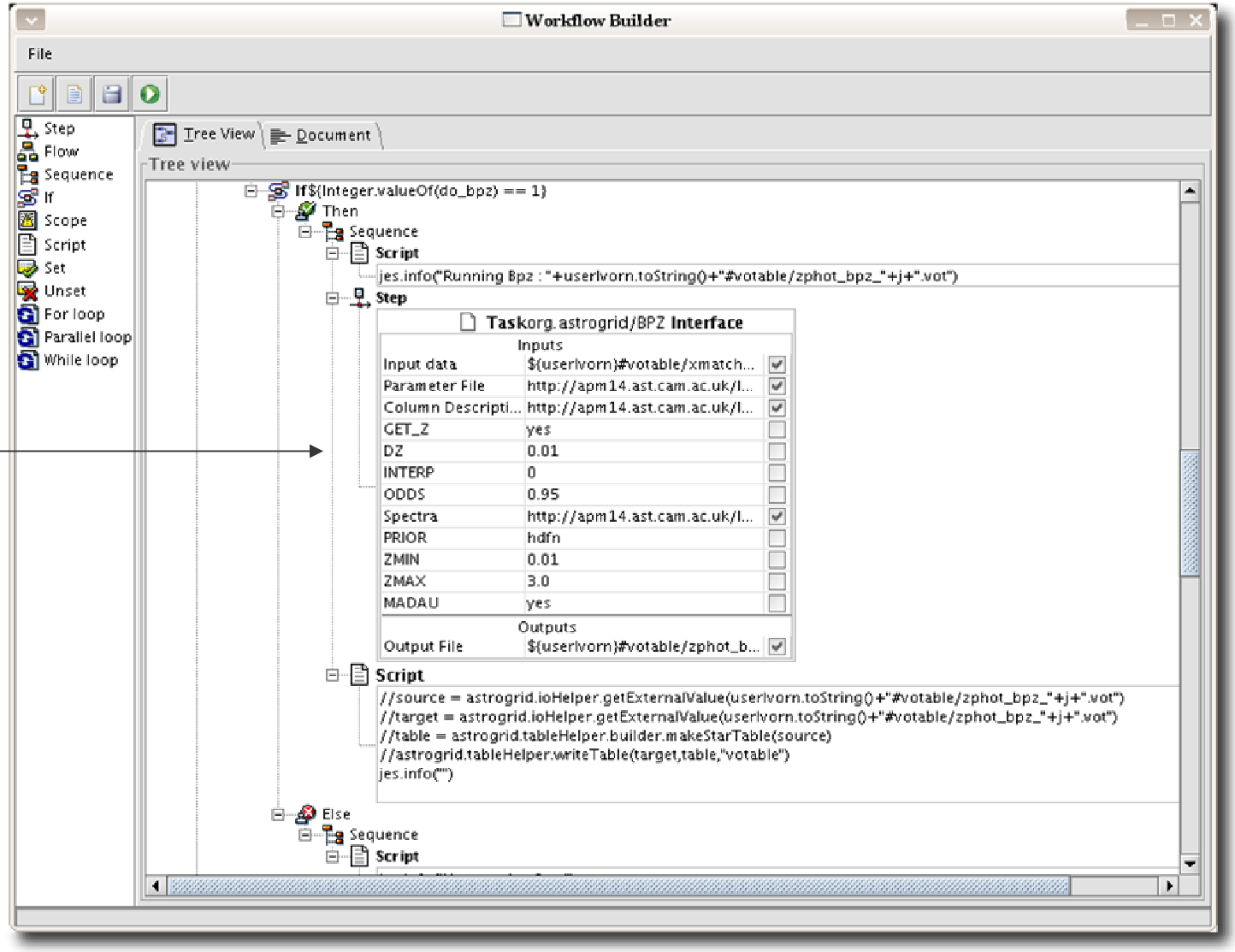
for loop
(different filters and Chips)

SExtractor in action

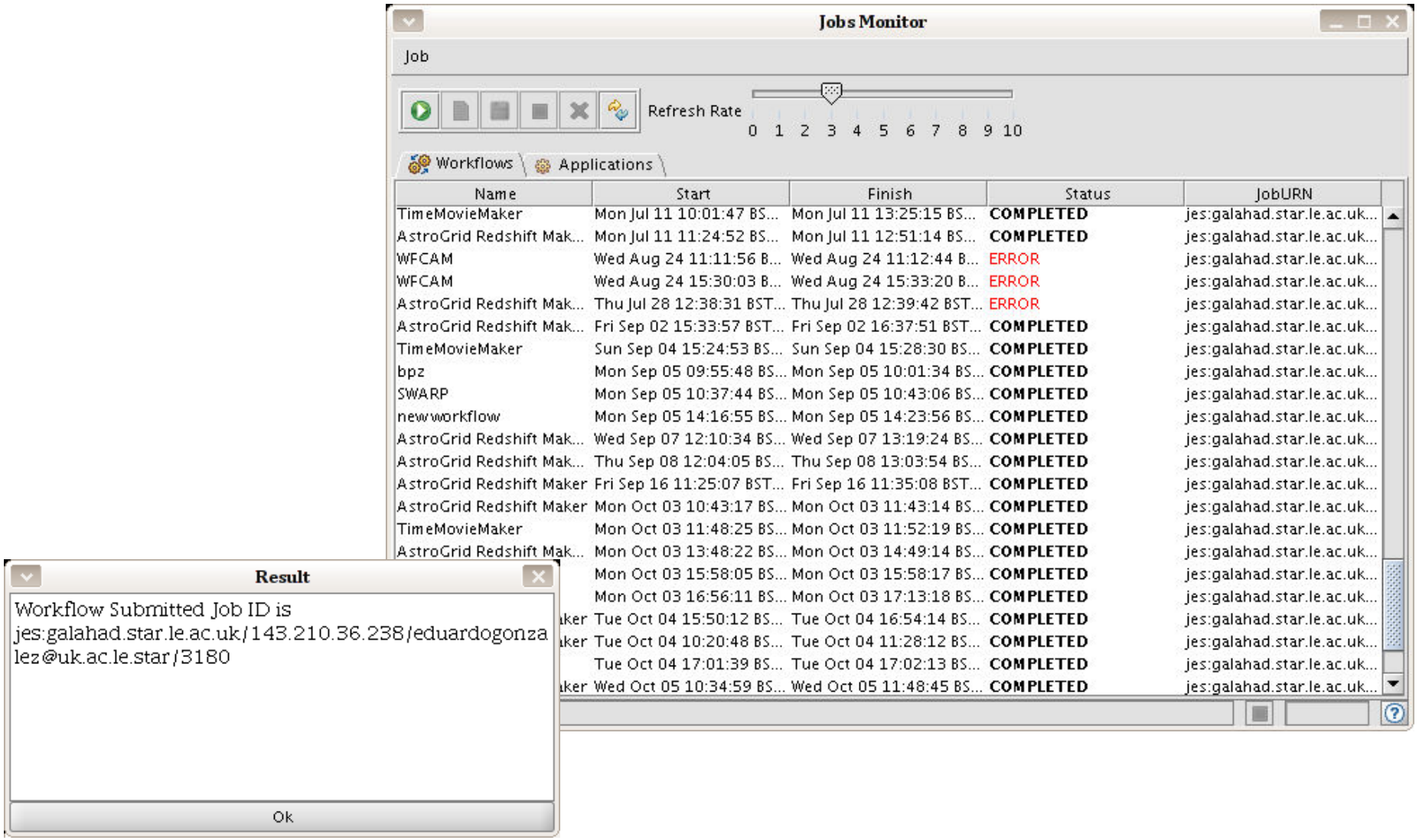


Photometric Redshifts

BPZ step

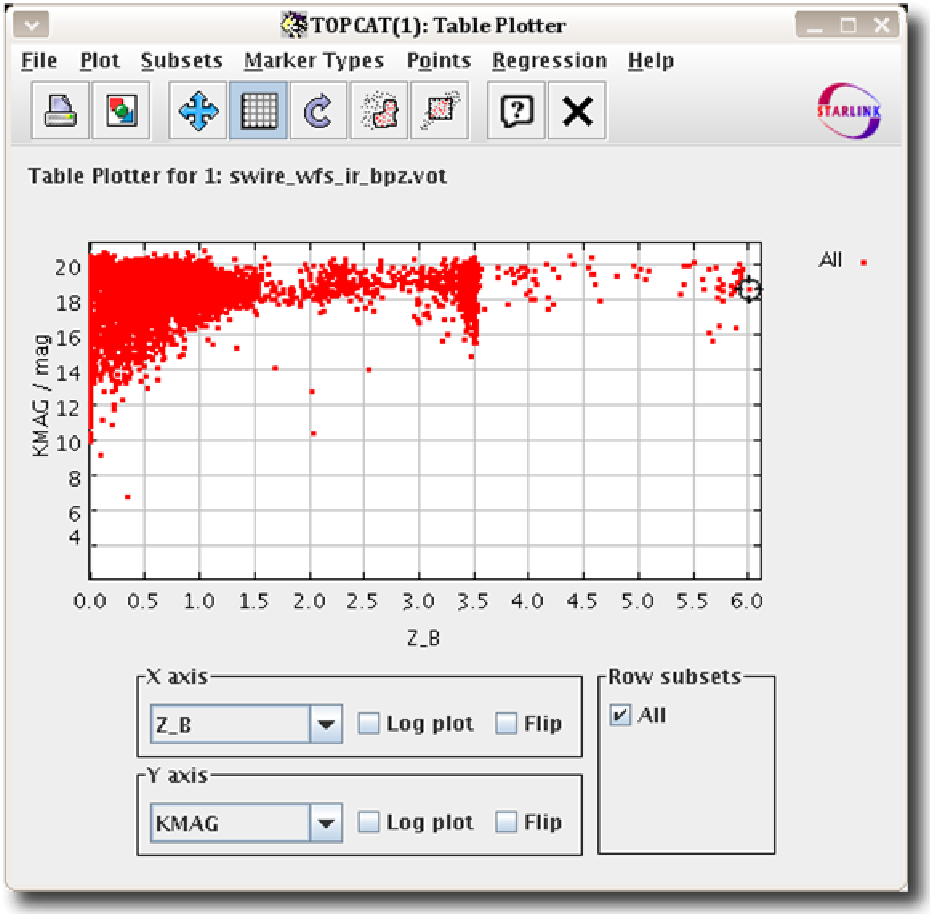


Job submission



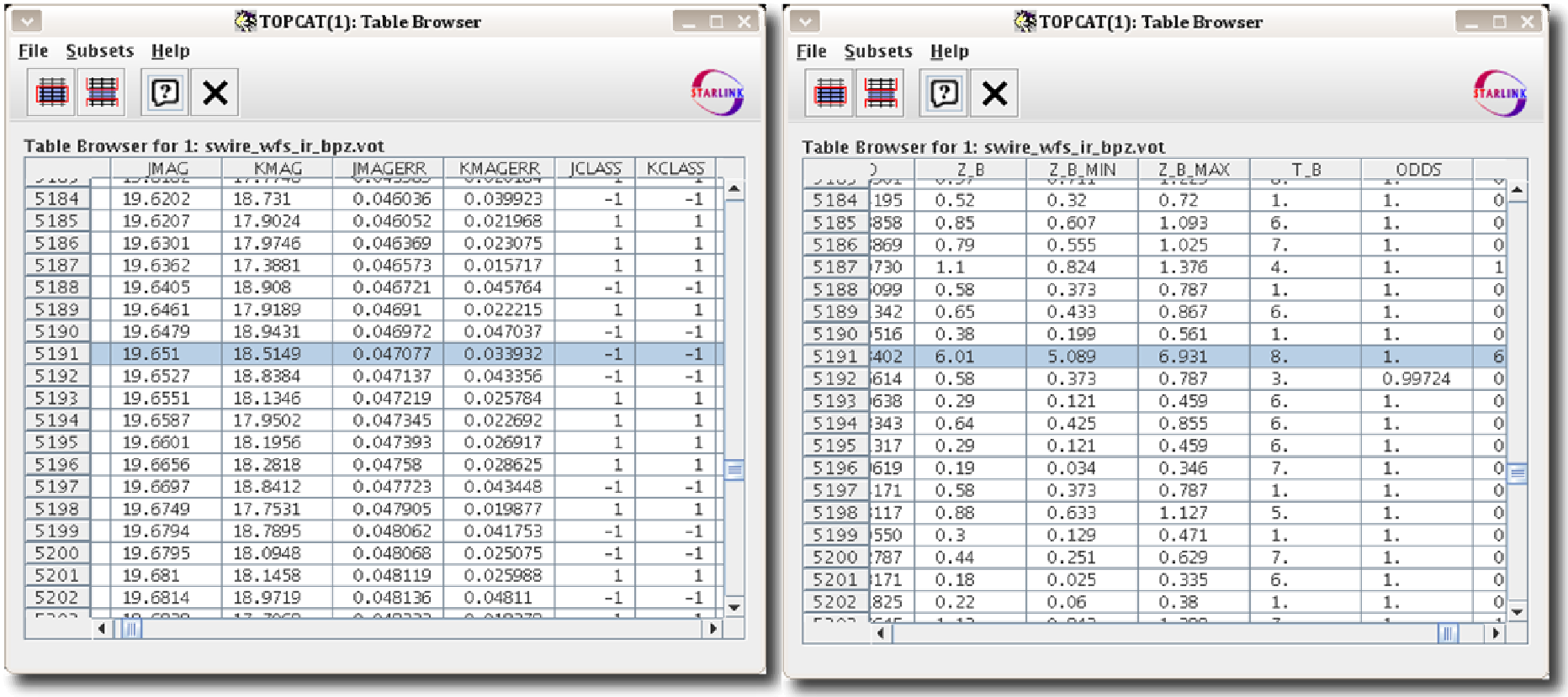
Looking at the candidates

- The redshift distribution shows very few objects at z~5-6.
- Unsurprisingly most of those are **point-like** in the images and are best fitted by a **QSO template** SED.
- Using TOPCAT the selection in the graph highlights the row in the table and displays image.



http://www.starlink.ac.uk/topcat

Looking at the candidates



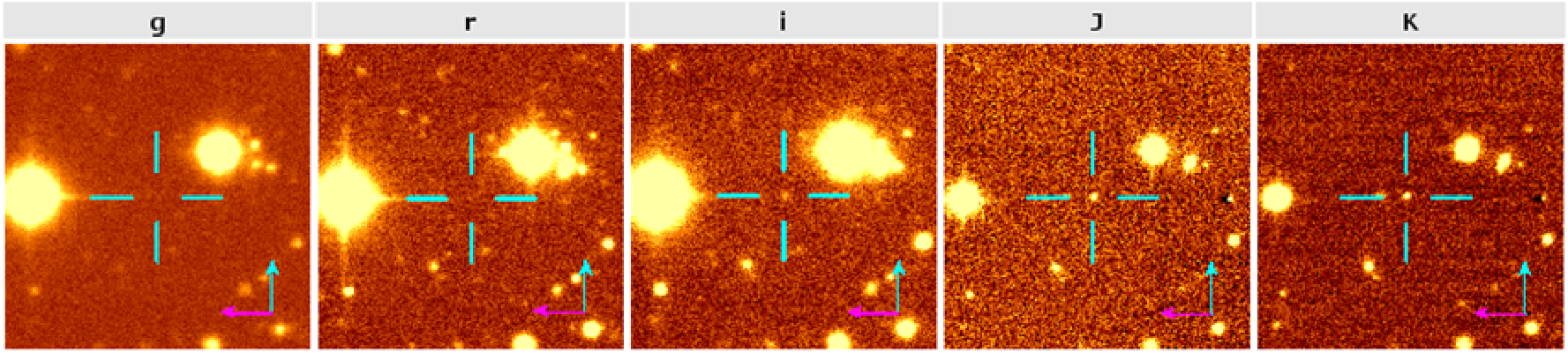
The selection of one point in the previous magnitude vs photoz diagram trigers a selection of the correspondent row in the table.

But also triggers a custom action… in this case a URL showing the postage stamps…

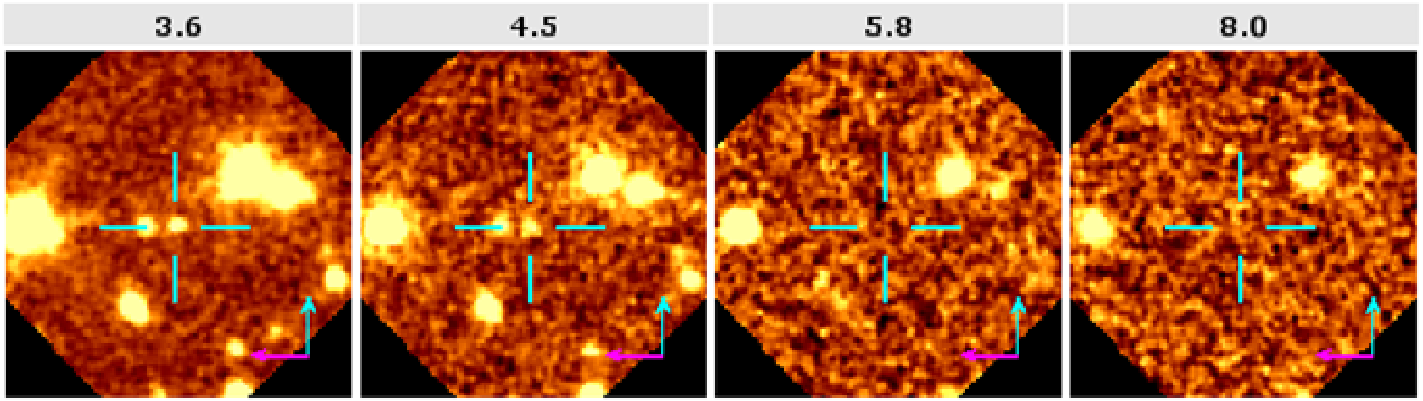
Mozilla Firefox

File Edit View Go Bookmarks Tools Help

WFS + IR



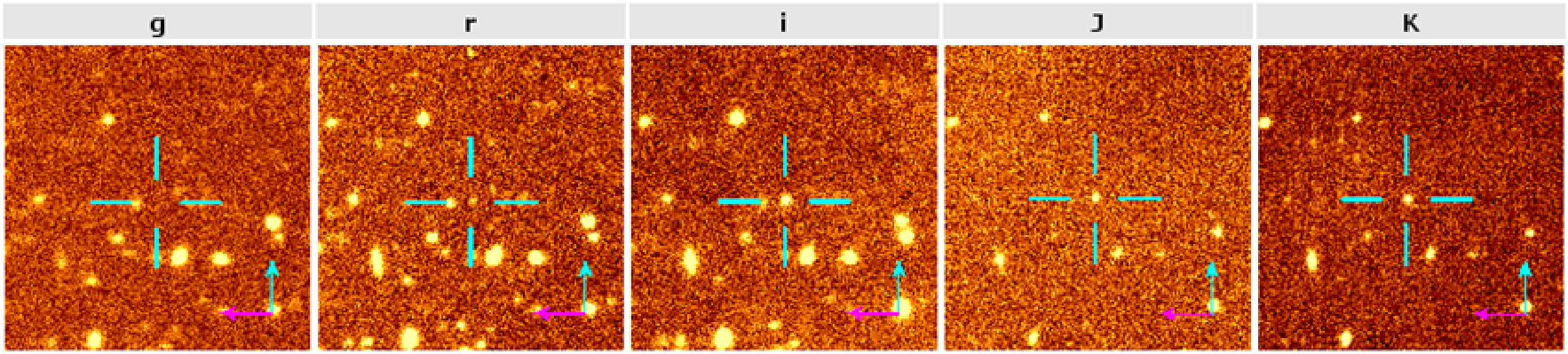
IRAC



Mozilla Firefox

File Edit View Go Bookmarks Tools Help

WFS + IR



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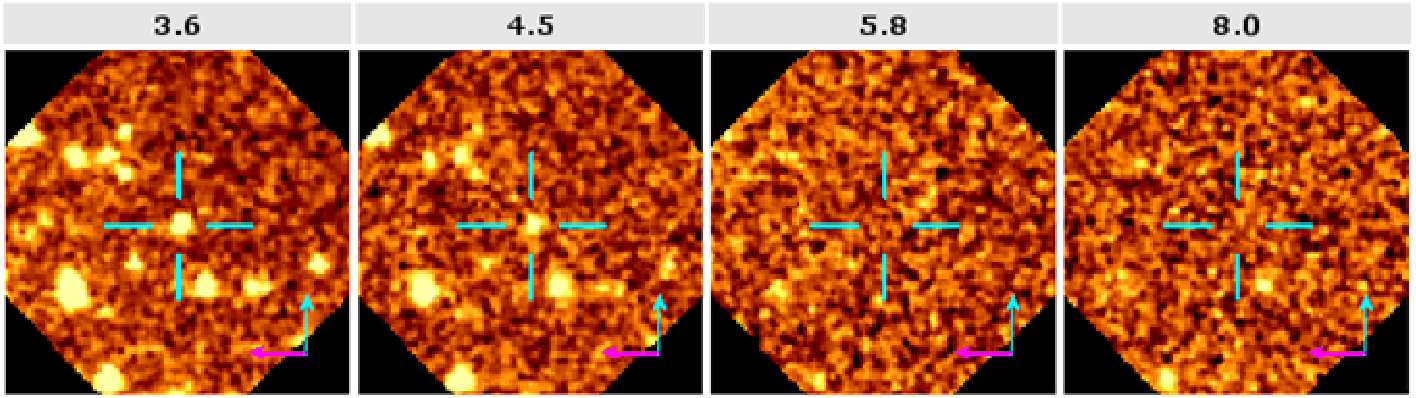
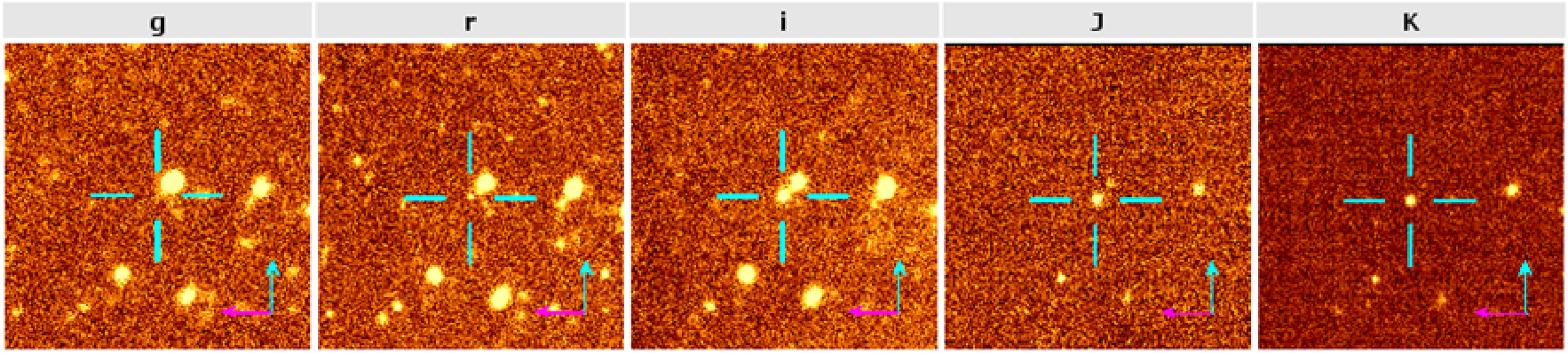


Mozilla Firefox

File Edit View Go Bookmarks Tools Help

WFS + IR



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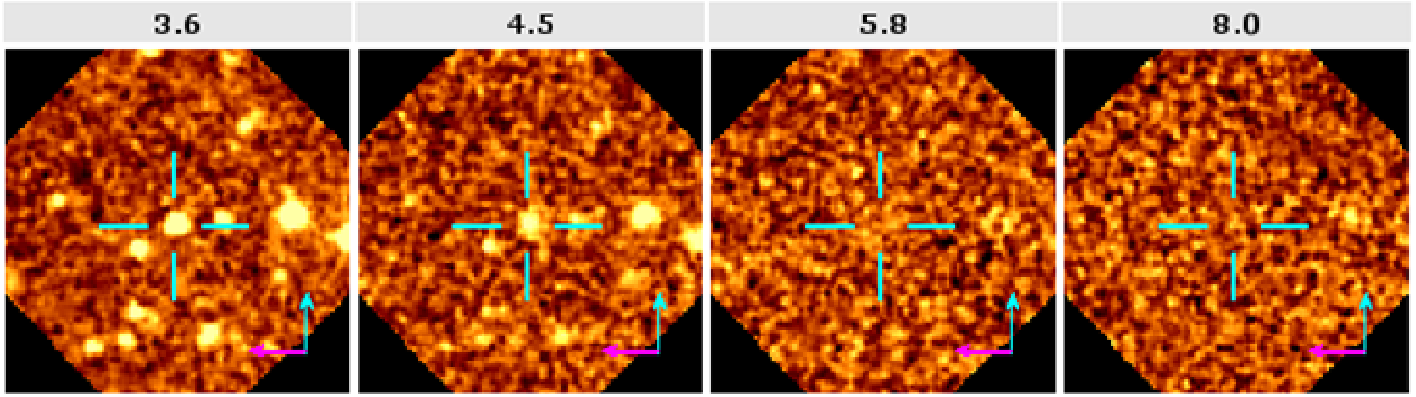
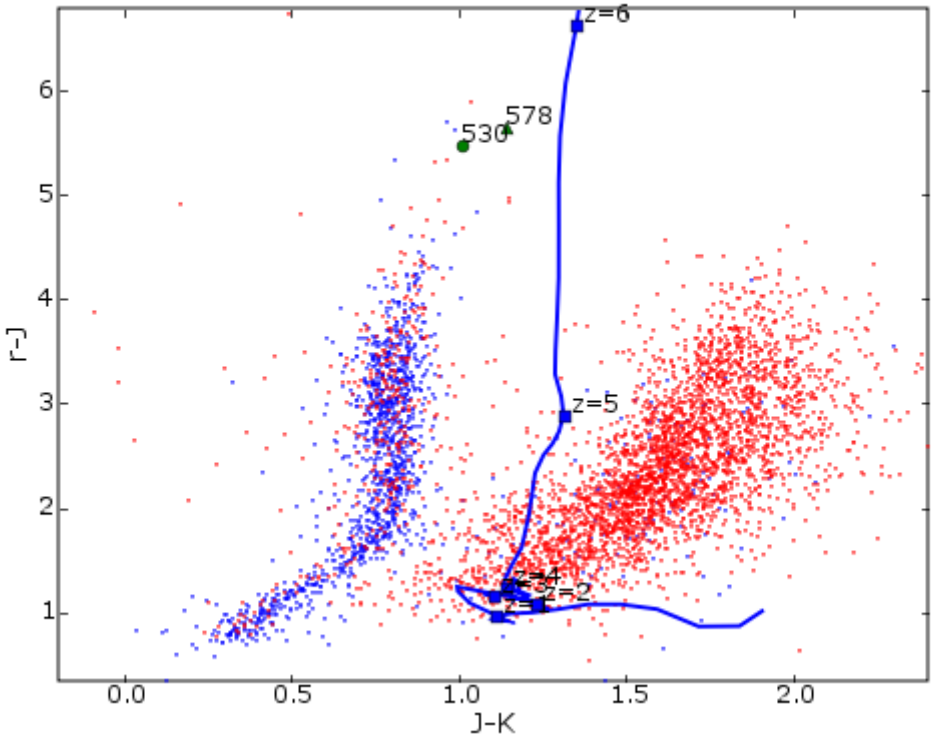
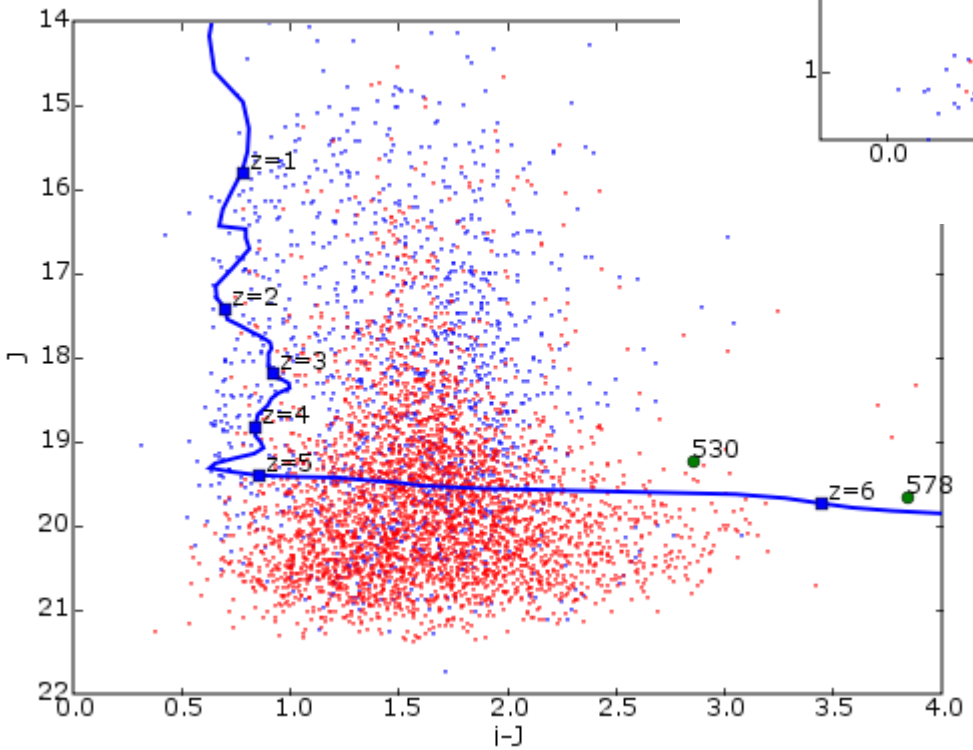


QSO SED Tracks





Summary

- The VO and tools developed as part of it are opening a new analysis methodology in the era of "data expansion".
- AstroGrid is an active member of the VO and already delivers a functional system capable of accessing and analysing a wide range of survey data.
- Anybody is welcome to try the system and submit their feedback (http://www.astrogrid.org)