



VO & NRAO

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NRAO: 4 telescopes, 3-D data



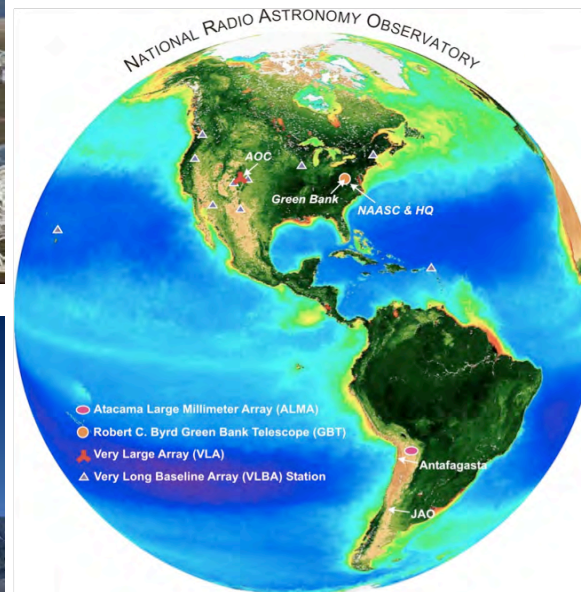
Jansky VLA

GBT



VLBA

ALMA



GBT and VLBA under threat (“divestiture” – NSF Portfolio Review)

Very 3-D

- E.g., VLA now compared to pre-expansion

Parameter	VLA	Jansky VLA	Factor
Frequency Coverage (1 – 50 GHz)	22%	100%	5
Continuum Sensitivity (1- σ , 1 hr.)	30 μ Jy	3 μ Jy	10
Maximum BW in each polarization	0.1 GHz	8 GHz	80
# of full-polarization spectral windows	2	64	32
# of frequency channels at max. BW	16	16,384	1024
Maximum number of freq. channels	512	4,194,304	8192
Finest frequency resolution	381 Hz	0.12 Hz	3180

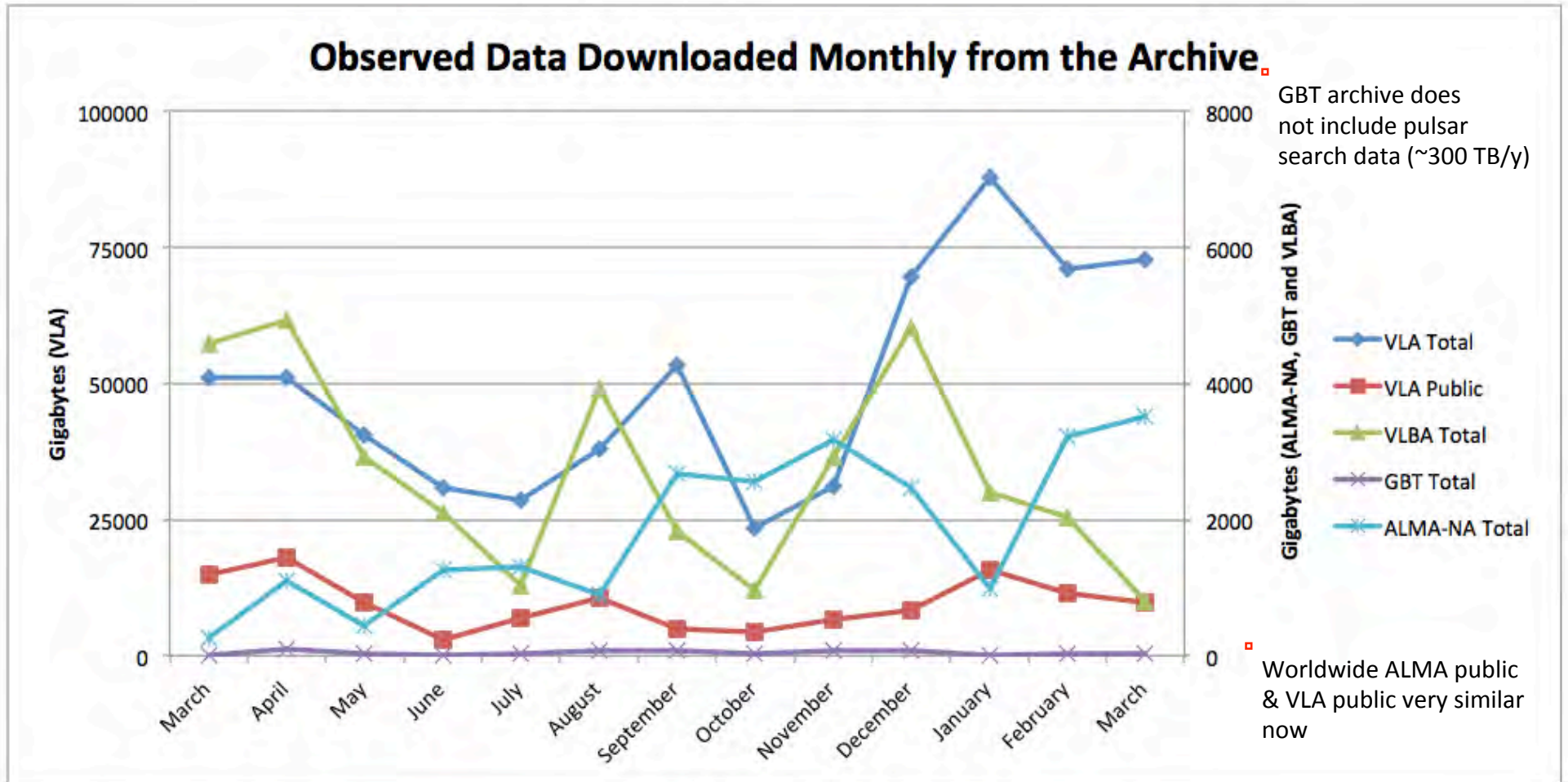
Image Data

- Common axes: RA, Dec, frequency/velocity, polarization
 - Rare: time
 - Starting to commonly have multiple “spectral windows” with varying #chan, resolution
 - Typically represented as multiple image cubes (often have different intents for the various spectral windows)
- Typical: 1000^3 (Gpix), Possible: $> 10,000^3$ (Tpix), (x1-4 polarizations)
 - GB → TB image sizes, Mb → Gb network pipes
 - Server-side cutouts/subregions are important!

Status

Data Distribution

VLA scale >10x other telescopes! Dominated by proprietary downloads



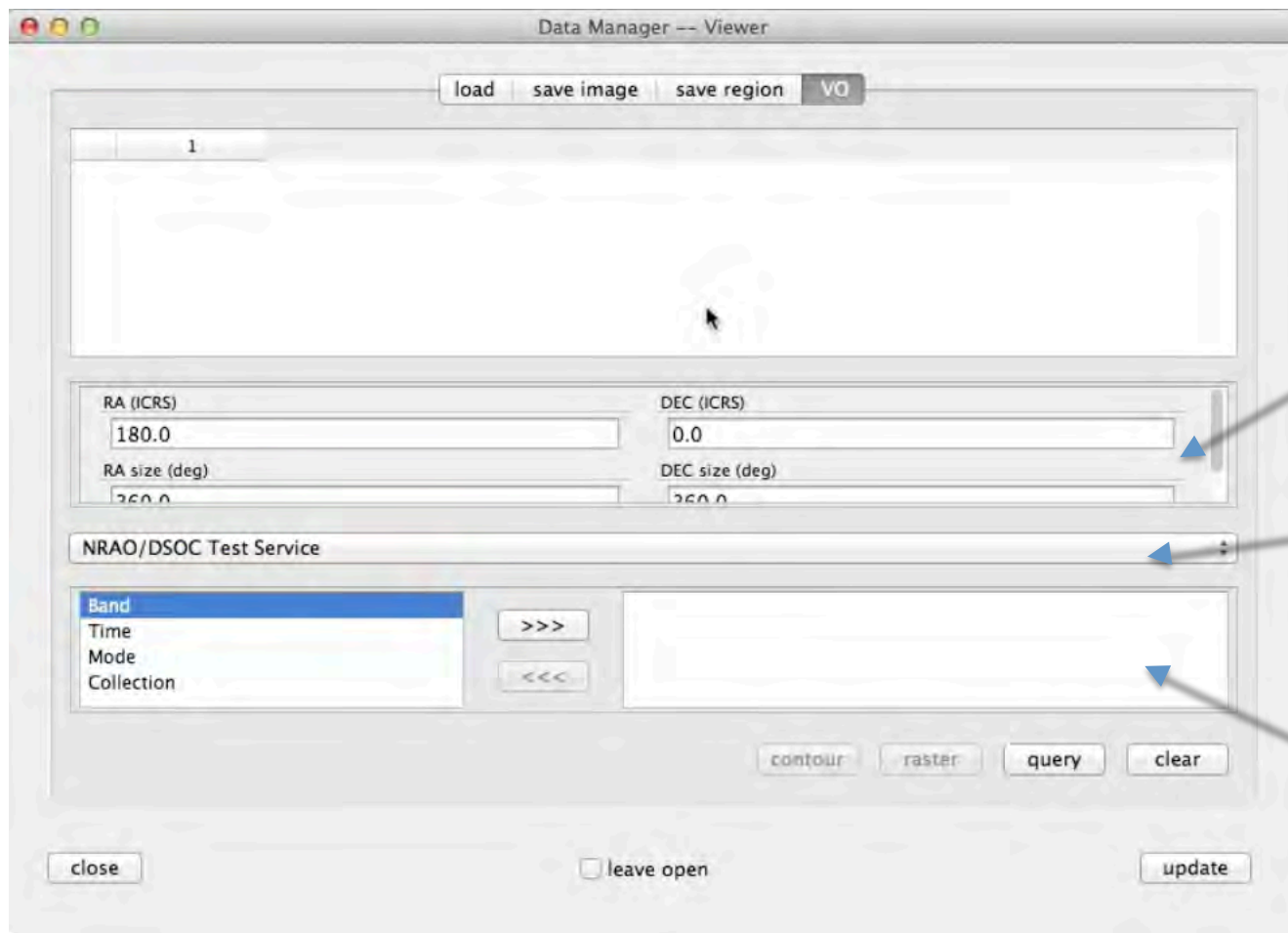
VO Initiatives @ NRAO

- NRAO has hosted VO activity for a long time (Tody)
- But: has not integrated it into software tools in a serious way until now
- CASA viewer
 - CASA has a large user base (2000 downloads per year)
 - Integrating 3D VO image access into viewer
 - Also Python VO binding
 - Expect release in v4.3 (~November)
- NRAO Archive
 - Being reworked for a number of reasons
 - Building on top of VO and ALMA Archive software
 - More for software reuse practicalities than philosophical reasons
 - Prototype release 1 October

Issues

- Our limited experience is that each service has it's own peculiarities.
 - We're handling this by specializing for each supported service.
- ***We are very concerned about VO protocol/API instabilities***
 - At some point you have to stop trying to achieve model perfection and build the user base
 - NRAO/ALMA brings hundreds/thousands of users (observers/survey users)
 - We will not rewrite our software multiple times unless changes extraordinarily well motivated

CASA Viewer Data Manager



Spatial Selection

Service Selection

Meta Data Selection

Results from test service

The screenshot shows the 'Data Manager -- Viewer' application window. At the top, there are buttons for 'load', 'save image', 'save region', and 'VO'. Below these is a table with the following data:

	access_estsize	access_format	assoc_id	calib_level	dataset_length	em_bandpass	em_max
1	29557	image/fits		2	7077888	0.2128020...	0.2130082...
2	27535	image/fits		2	4235000	0.2123695...	0.2125363...
3	13809	image/fits		2	23855104	0.2159594...	0.2159595...
4	32497	image/fits		2	6815744	0.2160354...	0.2164683...

Below the table are input fields for RA (ICRS) (180.0), DEC (ICRS) (0.0), RA size (deg) (360.0), and DEC size (deg) (360.0). A dropdown menu is set to 'NRAO/DSOC Test Service'. A collection list shows 'Collection' and 'alma,jvla,vla'. At the bottom, there are buttons for 'contour', 'raster', 'query', 'clear', 'close', 'leave open', and 'update'.

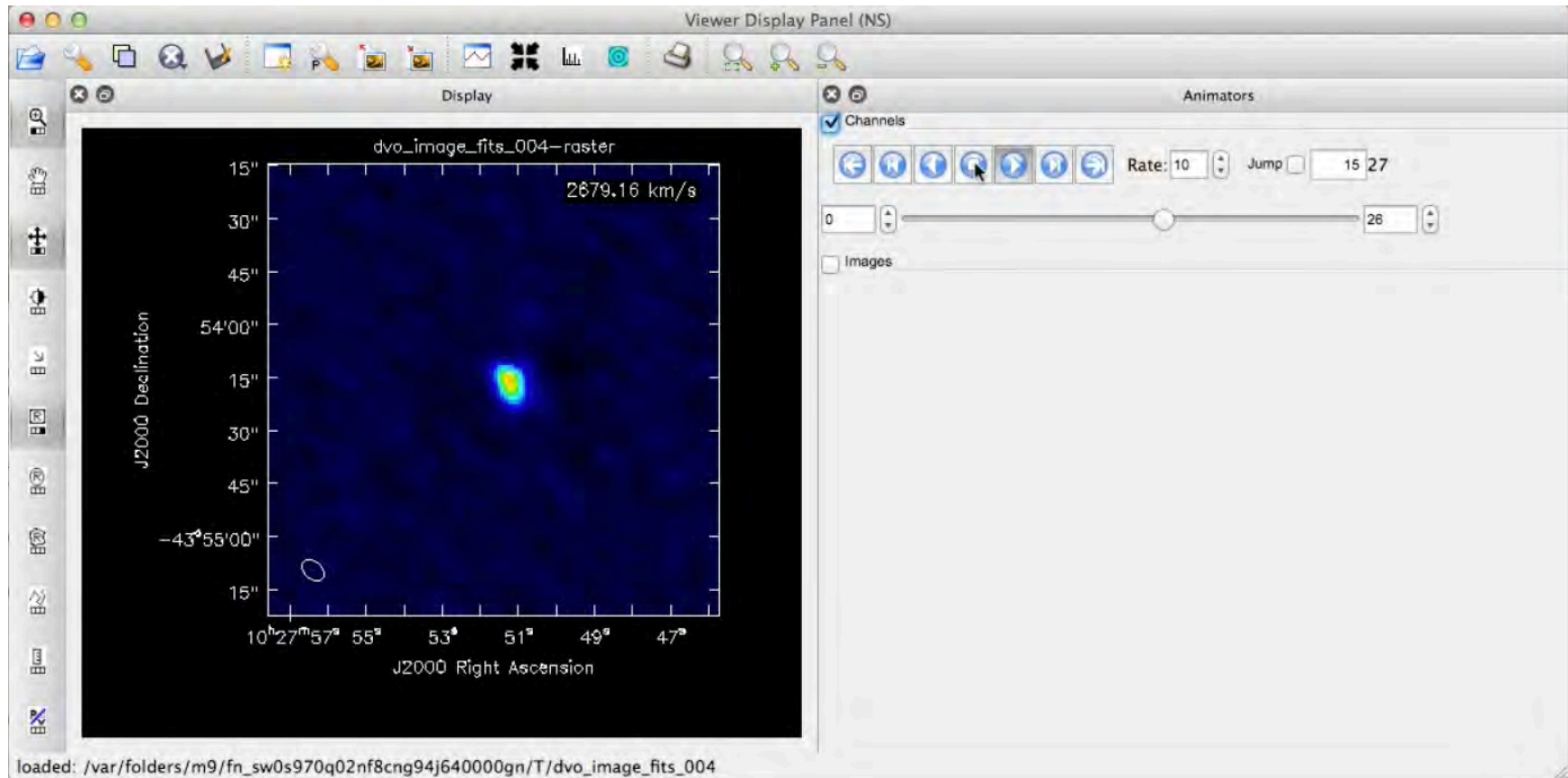
Loading an Image

The screenshot shows the 'Data Manager -- Viewer' application window. At the top, there are tabs for 'load', 'save image', 'save region', and 'VO'. Below the tabs is a table with the following data:

	em_bandpass	em_max	em_min	em_res_power	em_resolution	im_naxes	im_naxis	im_n
35	0.0013630...	0.0013630...	0.0013630...	21465.439...	0.0000000...	2	220 220	1
36	0.0026680...	0.0026730...	0.0026630...	7196.8520...	0.0000003...	3	128 128 27	1
37	0.0026760...	0.0026808...	0.0026711...	7175.3520...	0.0000003...	2	53 53	1
38	0.0026270...	0.0026360...	0.0026181...	7309.0671...	0.0000003...	2	53 53	1

Below the table are input fields for RA (ICRS) (180.0), DEC (ICRS) (0.0), RA size (deg) (360.0), and DEC size (deg) (360.0). A dropdown menu is set to 'NRAO/DSOC Test Service'. A collection list shows 'alma,jvla,vla' selected. At the bottom, there are buttons for 'contour', 'raster', 'query', and 'clear'. A progress indicator shows '14% (of 1.7MB) complete'. At the very bottom, there are 'close', 'leave open' (checkbox), and 'update' buttons.

Viewer Window



CASA Viewer Forward Plan

- Currently addressing infrastructure to make this easily distributable and more widely testable
- Next Features
 - Adding “cutout” mode (server side sub-selection)
 - Cube Access Mode
 - Select a subregion of an image for download
 - Unified with capability already in viewer
 - User Interface improvements
 - Unit support in query fields, clean up response fields etc
 - Query based on region selected in current image

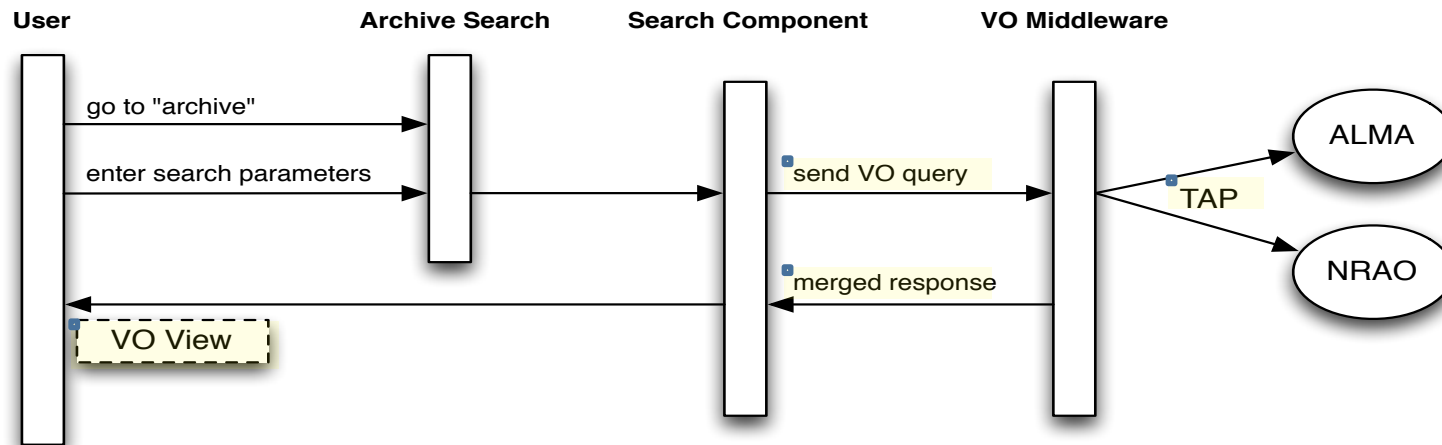
Aiming to have initial version available for CASA 4.3 (~Nov)

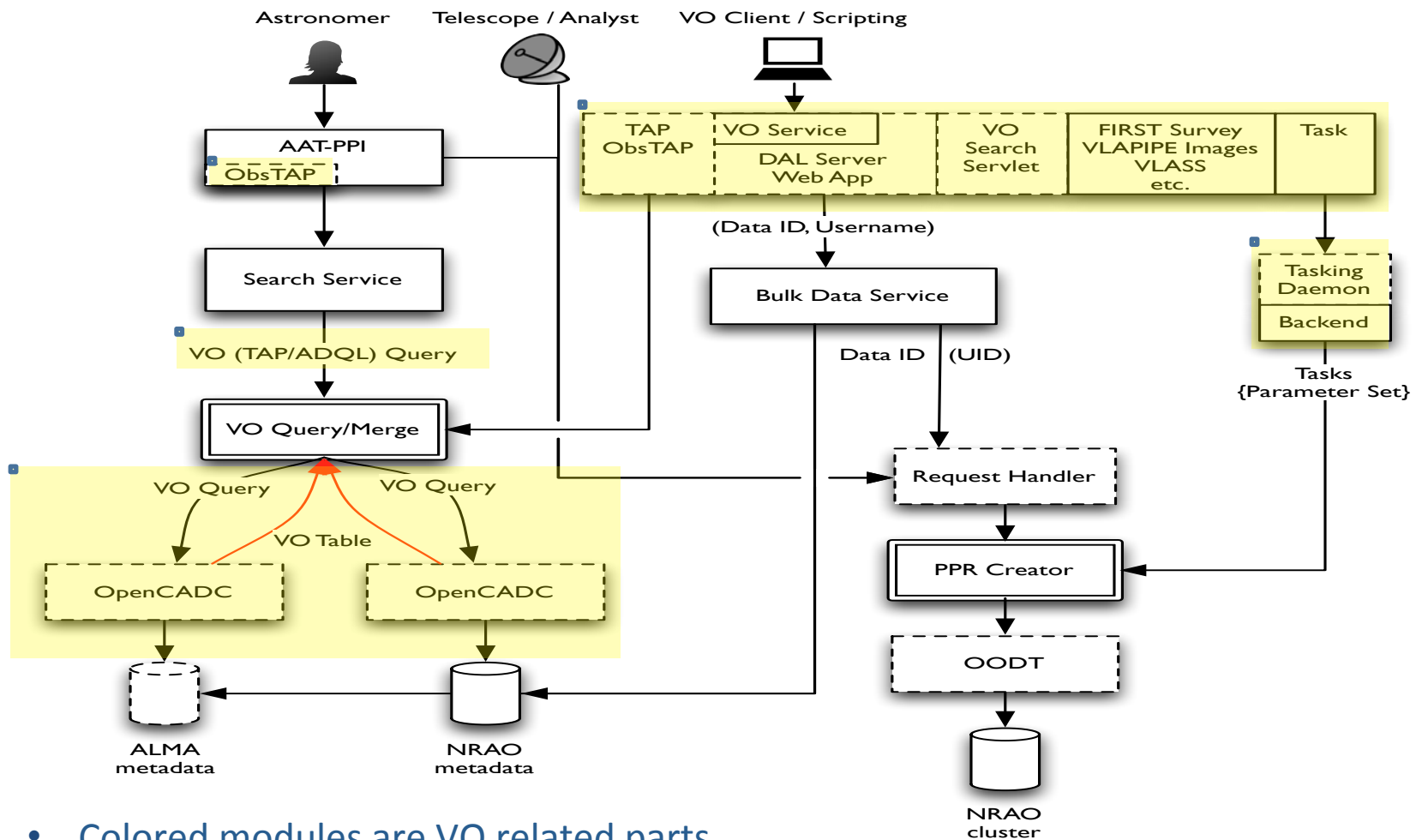
VO-enabled Archive

- Access to the archive system via VO protocols
- Reduces the overall system development effort while ensuring VO standards compliance
- Interoperability with other astronomical archives and with external applications is enhanced
- Standardize large parts of the archive infrastructure across NRAO and ALMA
- Other external astronomical archives adopted a VO enabled archive architecture

VO-enabled Web Query Subsystem

- A user will enter search parameters in a Web page to execute a search.
- The results of the search will be presented to the user by VOView.
- This part of the functionality will be provided by a Search page.
- The user may select results from the Search page and request to download them.





- Colored modules are VO related parts

VOView search page

- Search Service to retrieve metadata that satisfies the user's query.
- The search page will integrate the VOView table visualization component to display the results from the Search Service.

Archive Search

Position

Source name

Coordinate System:

Latitude

Longitude

Arc Min

FWHM

Query Type

Observation

Telescope

Energy

Data Type

Project

Hello, Joe User

My Data My Jobs Search Reset

Preview

Project > Observation > Science Products

Please select item(s) to show detail: Details

Preview	Collection	Obs. ID	RA (J2000.0)	Dec. (J2000.0)	Start Date	Instrument	Int. Time	Target Name	Filter	Cal.	Obs. Type	
<input type="checkbox"/>	CFHT	1298982	14:03:10.25	+54:20:27.5	2011-05-01 00:57	CFHT1L	30.000	ZM1324	I		1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1304894	14:03:09.15	+54:20:27.5	2011-05-22 10:01	WIRCam	200.000	NGC457	Brg.WCS305	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1298981	14:03:02.30	+54:20:27.5	2011-04-18 12:59	WIRCam	200.000	NGC457	Brg.WCS305	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1299007	14:03:12.60	+54:20:27.5	2011-04-18 13:54	WIRCam	200.000	NGC457	Ks.WCS302	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1298998	14:03:17.40	+54:20:27.5	2011-04-18 13:43	WIRCam	200.000	NGC457	Brg.WCS305	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1299003	14:03:02.30	+54:20:27.5	2011-04-18 13:55	WIRCam	200.000	NGC457	Ks.WCS302	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1299008	14:03:22.80	+54:21:27.5	2011-04-18 13:58	WIRCam	200.000	NGC457	Ks.WCS302	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1298995	14:03:19.15	+54:19:57.5	2011-04-18 13:41	WIRCam	200.000	NGC457	Brg.WCS305	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1299017	14:03:15.15	+54:19:57.5	2011-04-18 13:41	WIRCam	200.000	NGC457	Ks.WCS302	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1299007	14:03:12.60	+54:20:27.5	2011-04-18 13:54	WIRCam	200.000	NGC457	Ks.WCS302	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1299013	14:03:16.00	+54:21:27.5	2011-04-18 13:54	WIRCam	200.000	NGC457	Ks.WCS302	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1299018	14:03:12.60	+54:20:27.5	2011-04-18 13:54	WIRCam	200.000	NGC457	Ks.WCS302	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1301973	14:03:12.60	+54:20:27.5	2011-05-10 11:01	WIRCam	200.000	NGC457	Brg.WCS305	1	ACQUIRE
<input type="checkbox"/>	Preview	CFHT	1301003	14:03:12.60	+54:20:27.5	2011-05-10 11:01	WIRCam	200.000	NGC457	Ks.WCS302	1	ACQUIRE
<input type="checkbox"/>	Preview	CFHT	1302969	14:03:19.40	+54:19:57.5	2011-05-18 11:01	WIRCam	200.000	NGC457	Brg.WCS305	1	OBJEC
<input type="checkbox"/>	Preview	CFHT	1302947	14:03:02.30	+54:20:27.5	2011-05-18 05:42	WIRCam	200.000	NGC457	Brg.WCS305	1	OBJEC

Showing 15 rows

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```
cas-2794 — bash — 186x23
bash
Reading symbols for shared libraries .. done
Reading symbols for shared libraries ... done
Reading symbols for shared libraries .. done
Reading symbols for shared libraries . done
Reading symbols for shared libraries ... done
fetch url: "http://vaosa-vm1.aoc.nrao.edu/ivoa-dal/siapv2-vao/sync?REQUEST=accessData&FORMAT=image/fits&PubID=ivo%3A%2F%2Fnrao%2Fvo%23siav2model%3A366"
fetch out: "/var/folders/m9/fn_sw0s970q02nf8cng94j640000gn/T/dvo_image_fits_004"

Program exited normally.
(odbg) odysseus:cas-2794 drs$ casaviewer
fetch url: "http://vaosa-vm1.aoc.nrao.edu/ivoa-dal/siapv2-vao/sync?REQUEST=accessData&FORMAT=image/fits&PubID=ivo%3A%2F%2Fnrao%2Fvo%23siav2model%3A373"
fetch out: "/var/folders/m9/fn_sw0s970q02nf8cng94j640000gn/T/dvo_image_fits_004"
odysseus:cas-2794 drs$ casaviewer
fetch url: "http://vaosa-vm1.aoc.nrao.edu/ivoa-dal/siapv2-vao/sync?REQUEST=accessData&FORMAT=image/fits&PubID=ivo%3A%2F%2Fnrao%2Fvo%23siav2model%3A366"
fetch out: "/var/folders/m9/fn_sw0s970q02nf8cng94j640000gn/T/dvo_image_fits_004"
odysseus:cas-2794 drs$ casaviewer
fetch url: "http://vaosa-vm1.aoc.nrao.edu/ivoa-dal/siapv2-vao/sync?REQUEST=accessData&FORMAT=image/fits&PubID=ivo%3A%2F%2Fnrao%2Fvo%23siav2model%3A372"
fetch out: "/var/folders/m9/fn_sw0s970q02nf8cng94j640000gn/T/dvo_image_fits_004"
fetch url: "http://vaosa-vm1.aoc.nrao.edu/ivoa-dal/siapv2-vao/sync?REQUEST=accessData&FORMAT=image/fits&PubID=ivo%3A%2F%2Fnrao%2Fvo%23siav2model%3A374"
fetch out: "/var/folders/m9/fn_sw0s970q02nf8cng94j640000gn/T/dvo_image_fits_005"
fetch url: "http://vaosa-vm1.aoc.nrao.edu/ivoa-dal/siapv2-vao/sync?REQUEST=accessData&FORMAT=image/fits&PubID=ivo%3A%2F%2Fnrao%2Fvo%23siav2model%3A384"
fetch out: "/var/folders/m9/fn_sw0s970q02nf8cng94j640000gn/T/dvo_image_fits_006"
odysseus:cas-2794 drs$

fetch out: /var/folders/m9/fn_sw0s970q02nf8cng94j640000gn/T/dvo_image_fits_005
fetch url: http://vaosa-vm1.aoc.nrao.edu/ivoa-dal/siapv2-vao/sync?REQUEST=accessData&FORMAT=image/fits&PubID=ivo%3A%2F%2Fnrao%2Fvo%23siav2model%3A384
fetch out: /var/folders/m9/fn_sw0s970q02nf8cng94j640000gn/T/dvo_image_fits_006
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