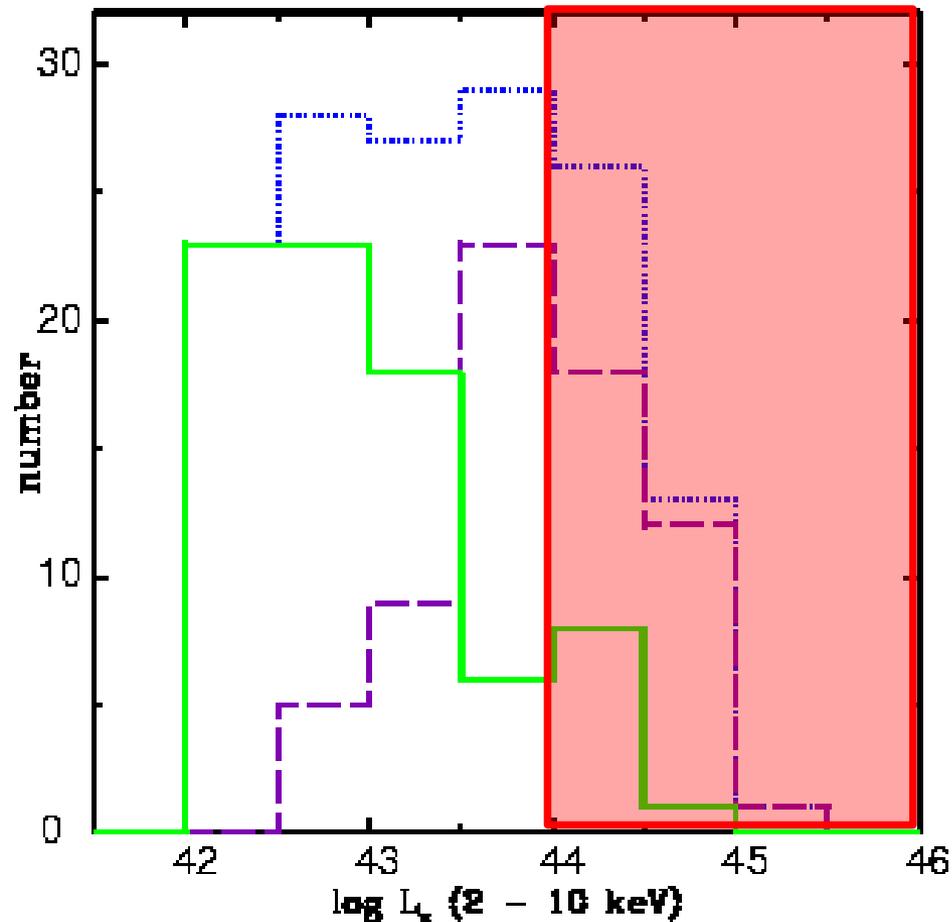


Virtual Observatories for the ELT And the Richard Gibson Bank Observatory

- *VO Science*
- *Tools for ELT*
- *Data analysis*
- *Case preparation*
- *Multi-● comparisons*
- *Planet-hunting - ALMA, Spitzer*
- *Stellar populations - JWST, X-ray*
- *SNe - eMERLIN, SKA*
- *Data transport and data access*

First VO Science refereed paper

- 31 new QSO2 in GOODS fields (HDFN, CDFS)
- 9 known previously
- Optical continuum obscured, soft X-rays absorbed



- Previously known AGN2
- New AGN2
- Total AGN2 in GOODS
- $L_x > 10^{37} W$
- QSO2 candidates

- X-ray power/redshift relation

Data selection: AVO-Aladin tool

2MASS

ESO-WFI

Chandra

VLT-ISAAC

HST-ACS

DSS

My Data

Data Tree

- GOODS-WFI
 - DEEP2C-FV-Preview 38.1 'x37.3' 2000-10-2
 - DEEP2C-FV 8.2 'x8.2' 2000-10-26
- GOODS-ACIS
 - ACISMEDFSW000 1.2 "x1.2" 1999-10-14
- GOODS-ISAAC
 - 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

Data available at selected point are highlighted in tree

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

Image metadata

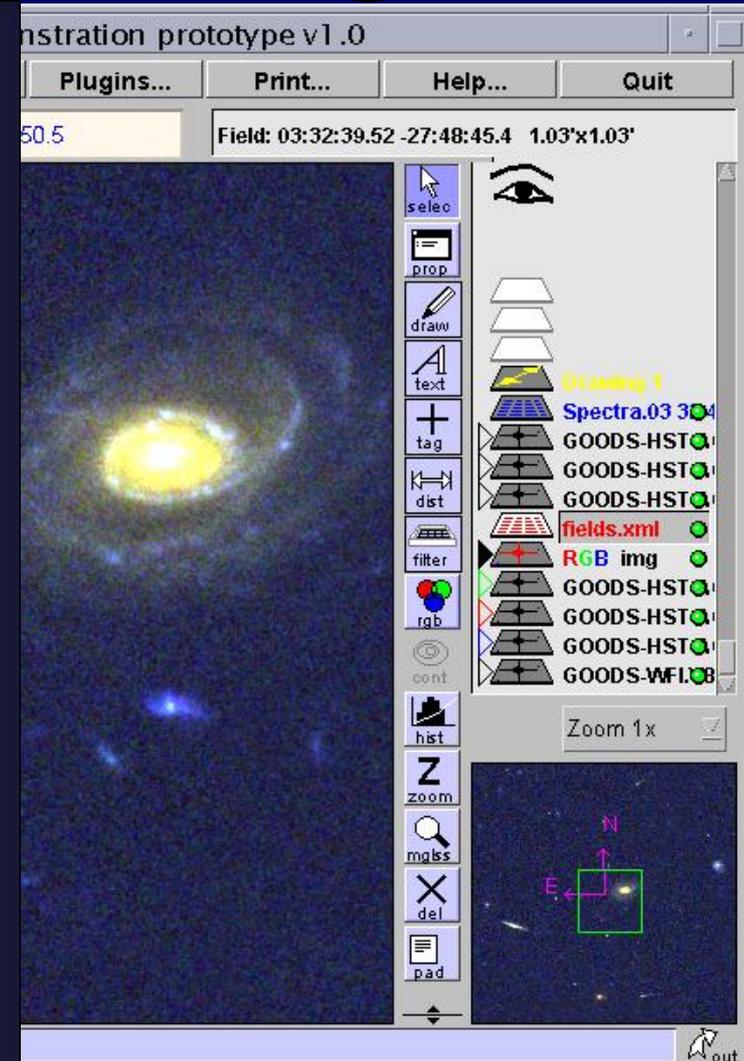
A.V.O demonstration prototype v1.0

Field: 03:32:25.77 -27:48:07.4 38.08"x37.2"

Automatic display of instrument footprint

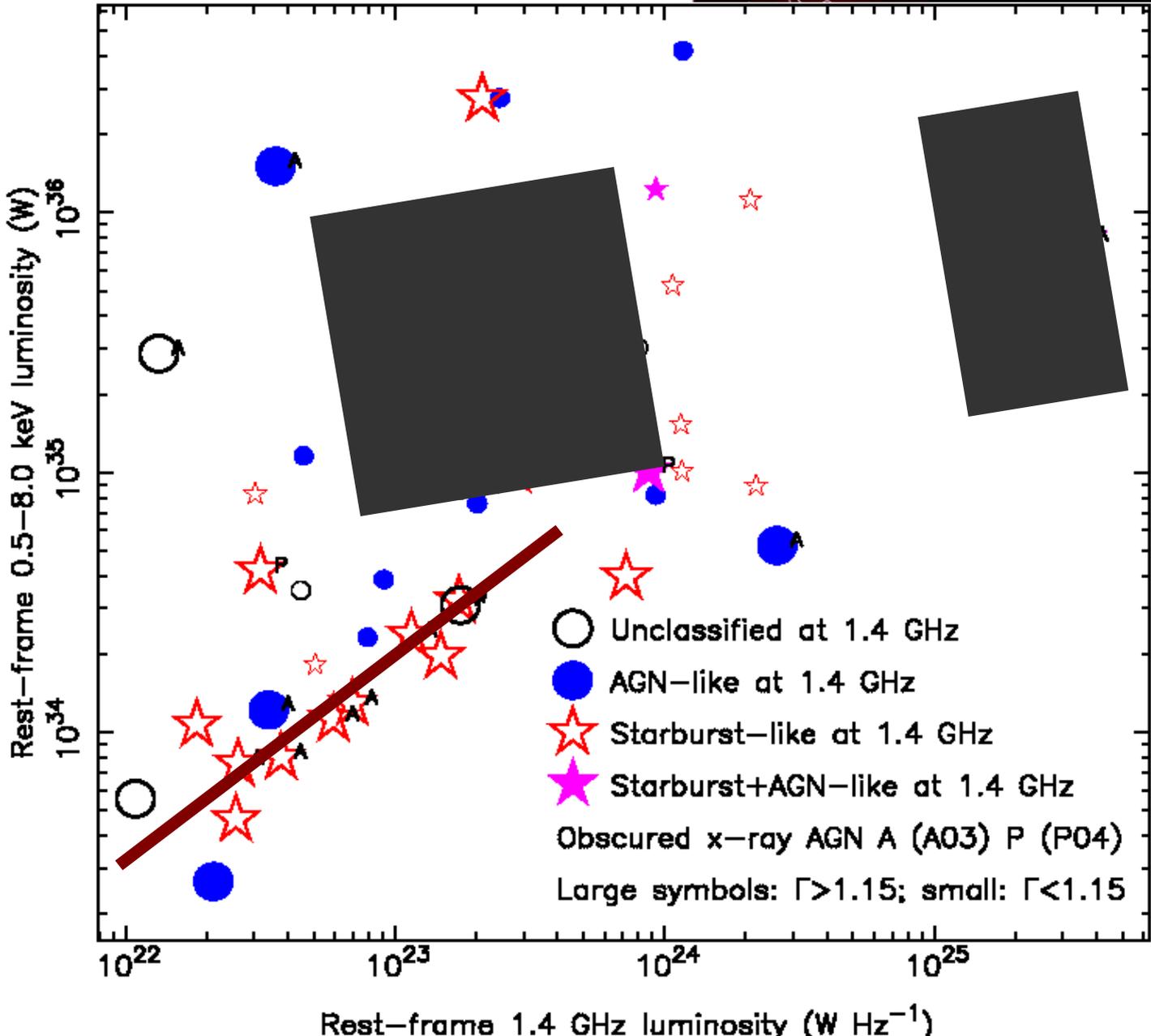
Automatic display of instrument footprint

Spectral viewer/modelfitting



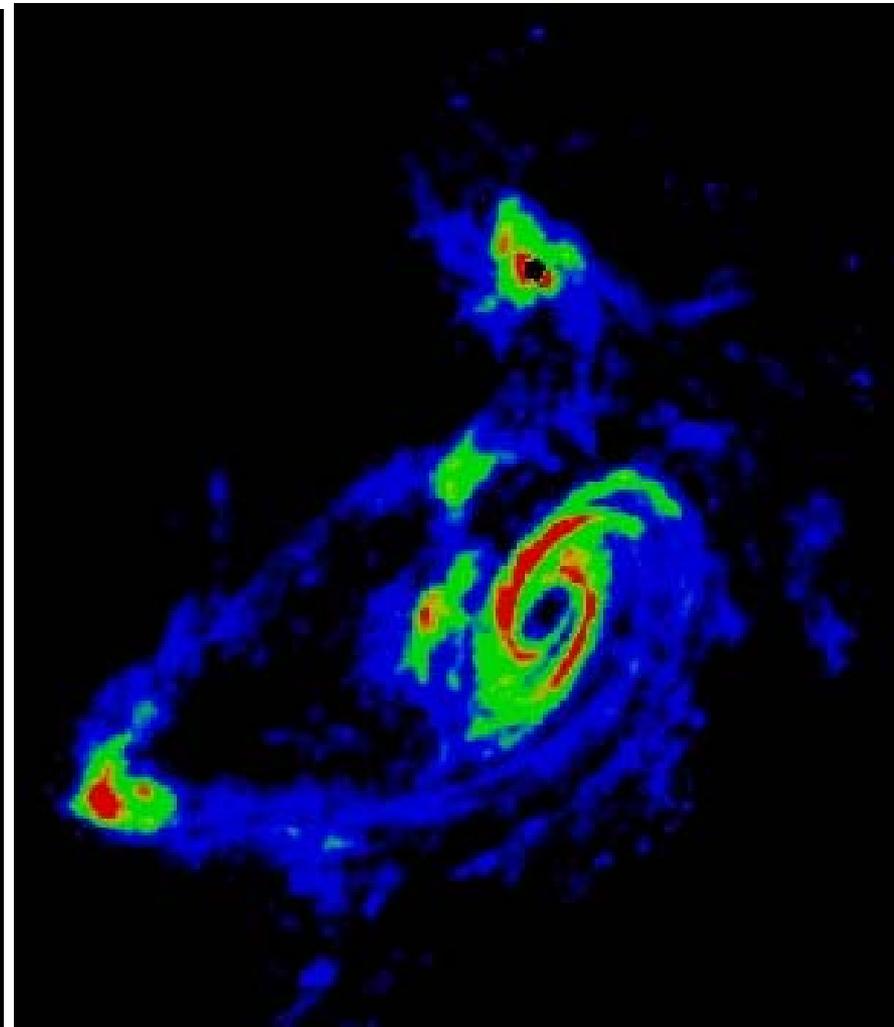
**No spectrum? (no ELT!)
Photo Z workflow**

Radio-X-ray -



- Radio:X-ray rest-frame luminosity
- Low-z 'well-known' correlation
- Vanishes at high z /high luminosity!
- Embedded AGN(s) + starburst: merger

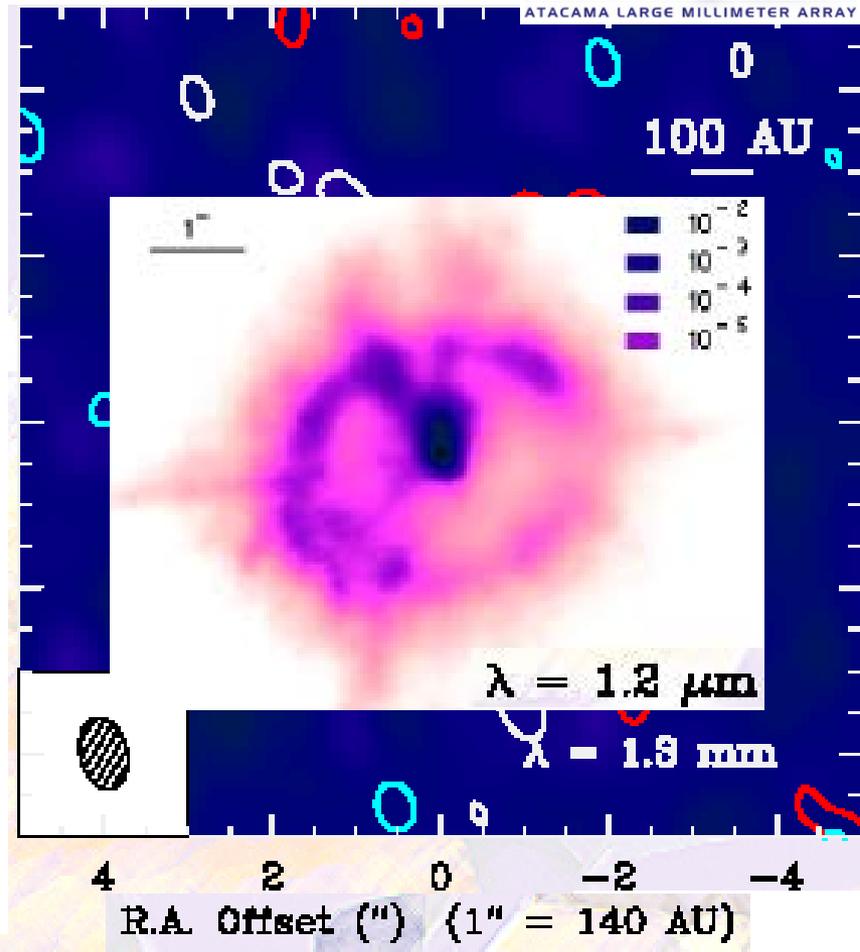
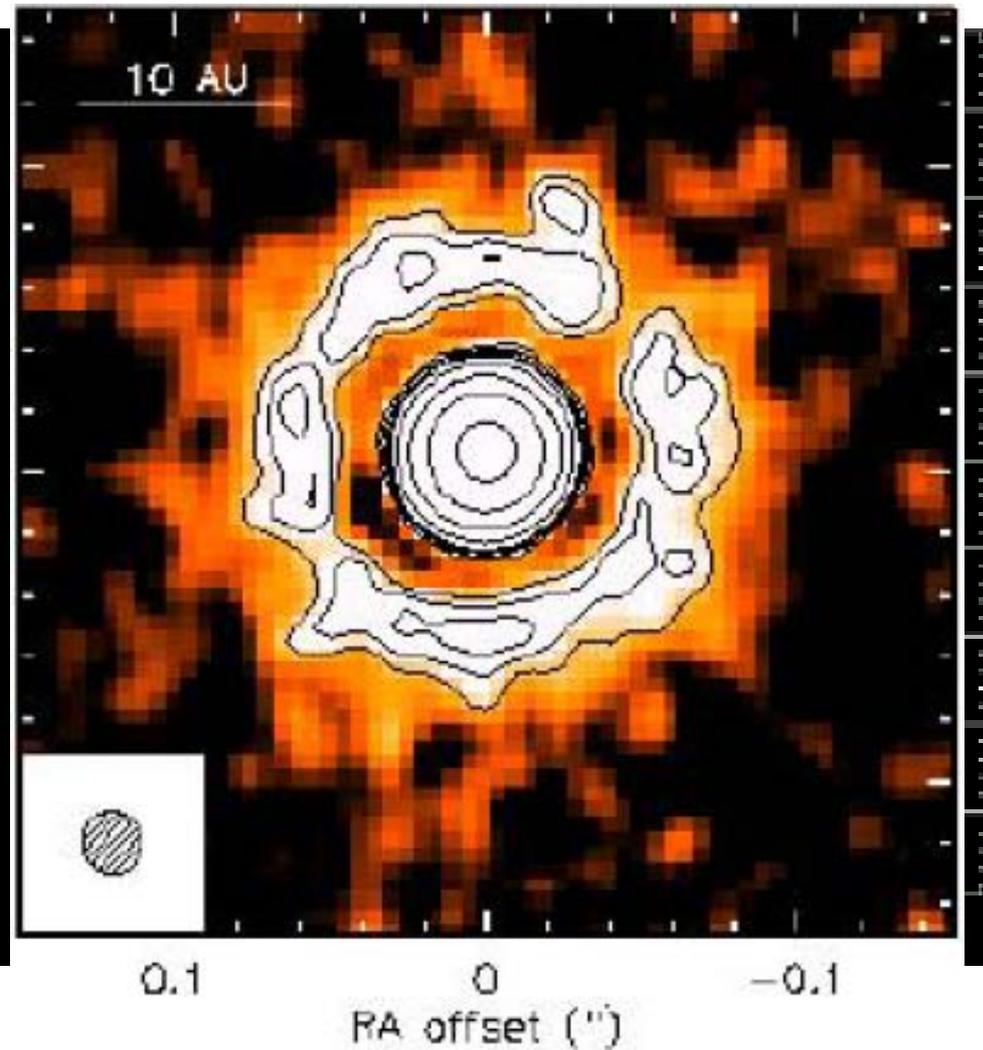
HI + optical from galaxy building...



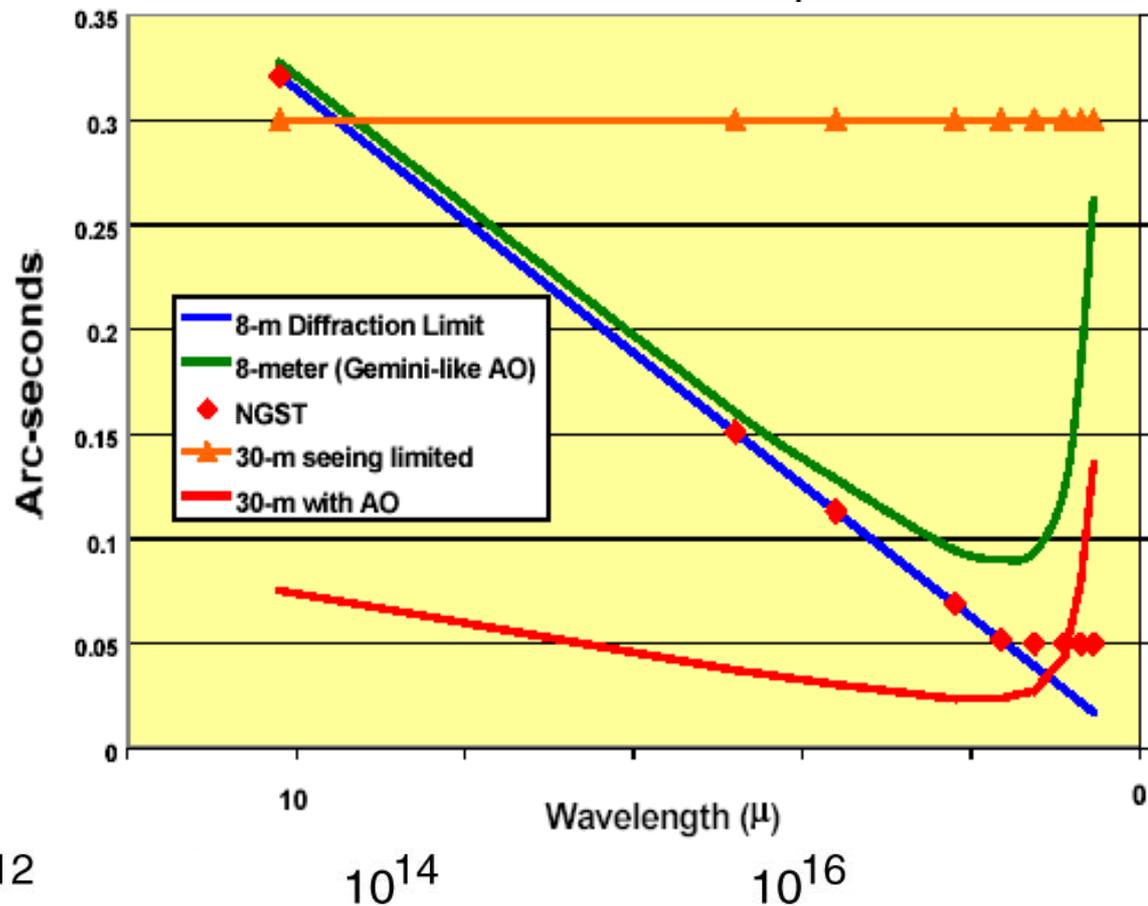
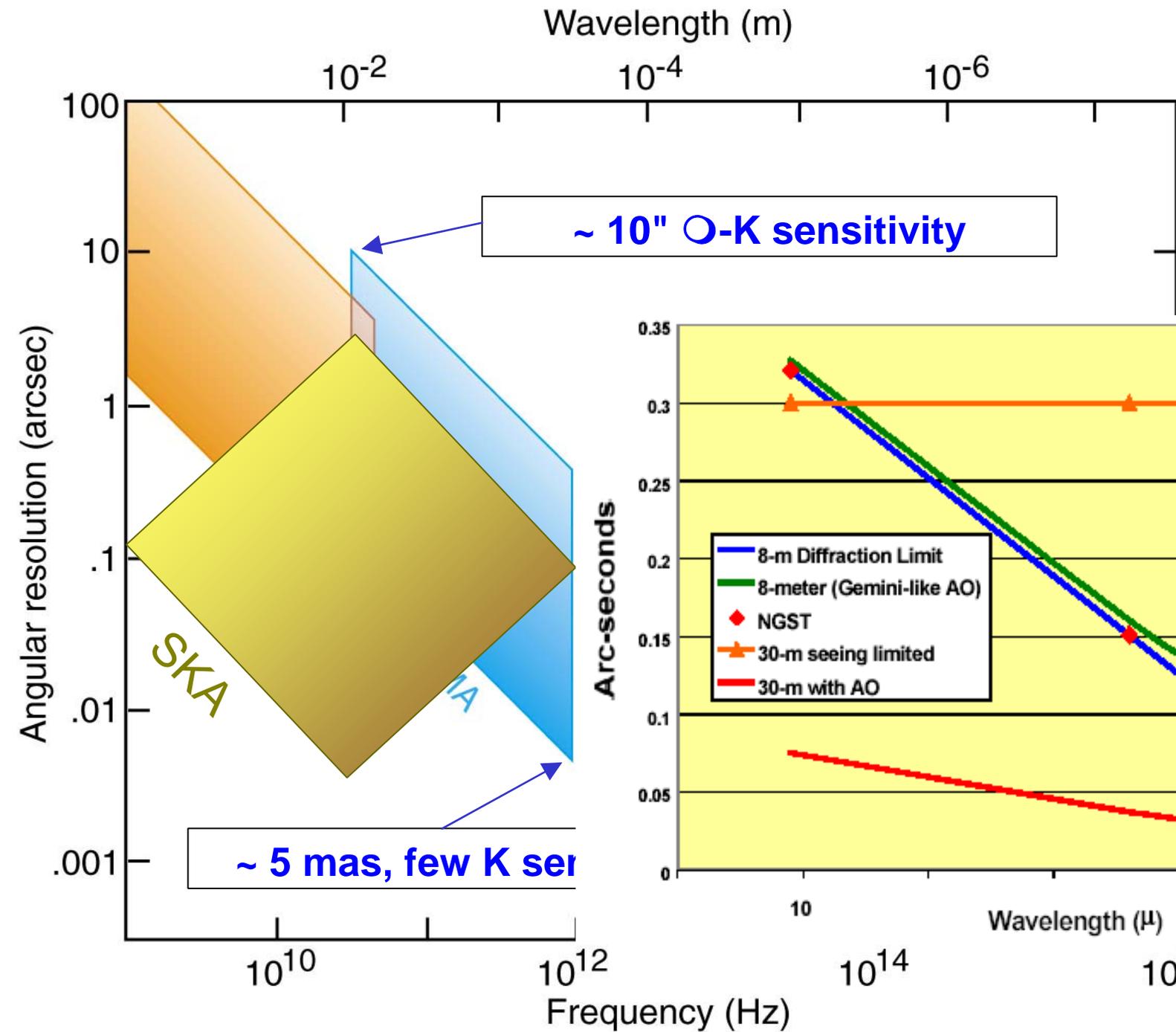
• Ly a & HI absorption v.

...to the epoch of reionisation
• HI absorption v. Ly a absorption stopped?

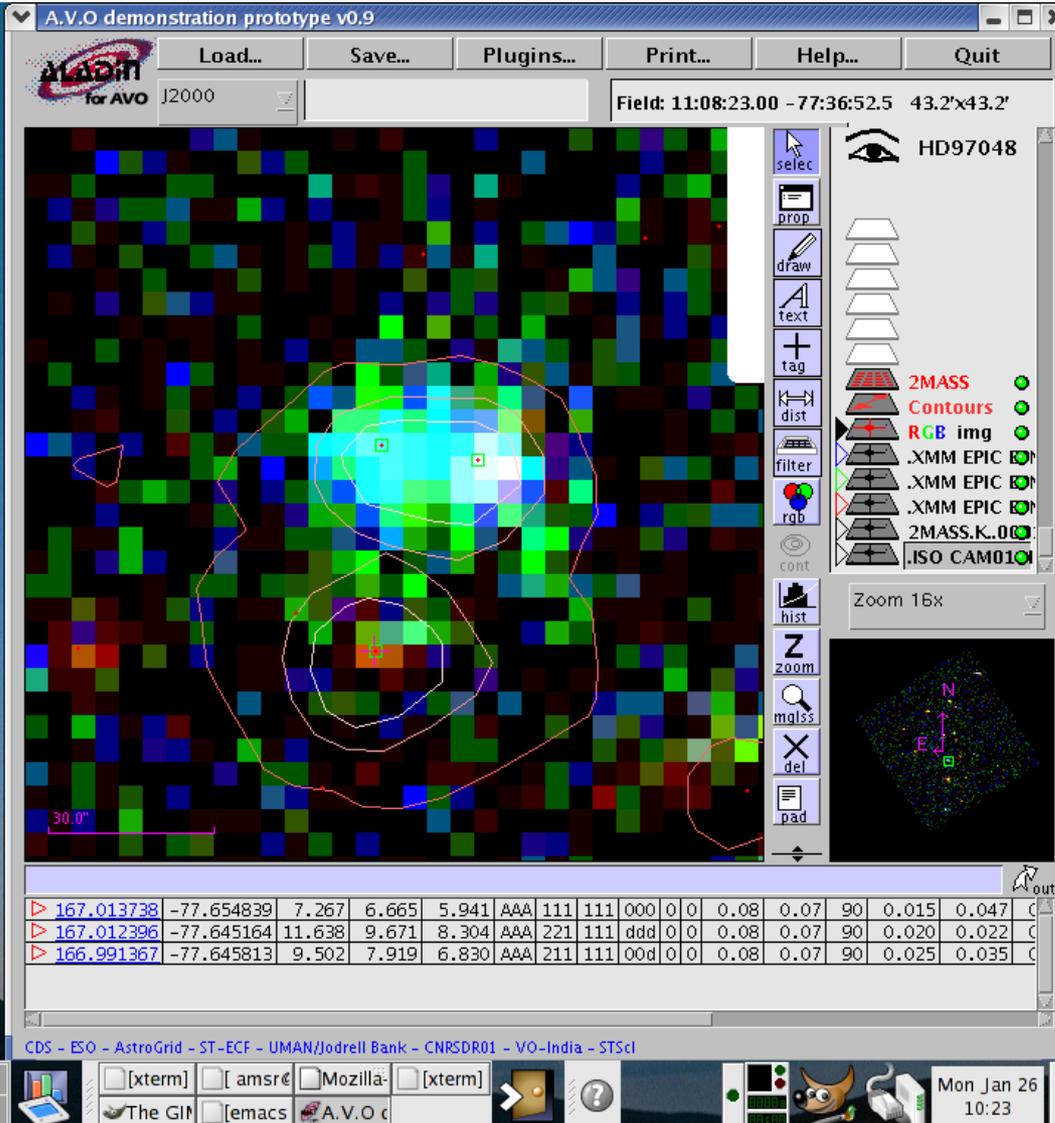
Planet formation



- ELT + ALMA $\gg 10x$ resolution
- Resolve terrestrial planet

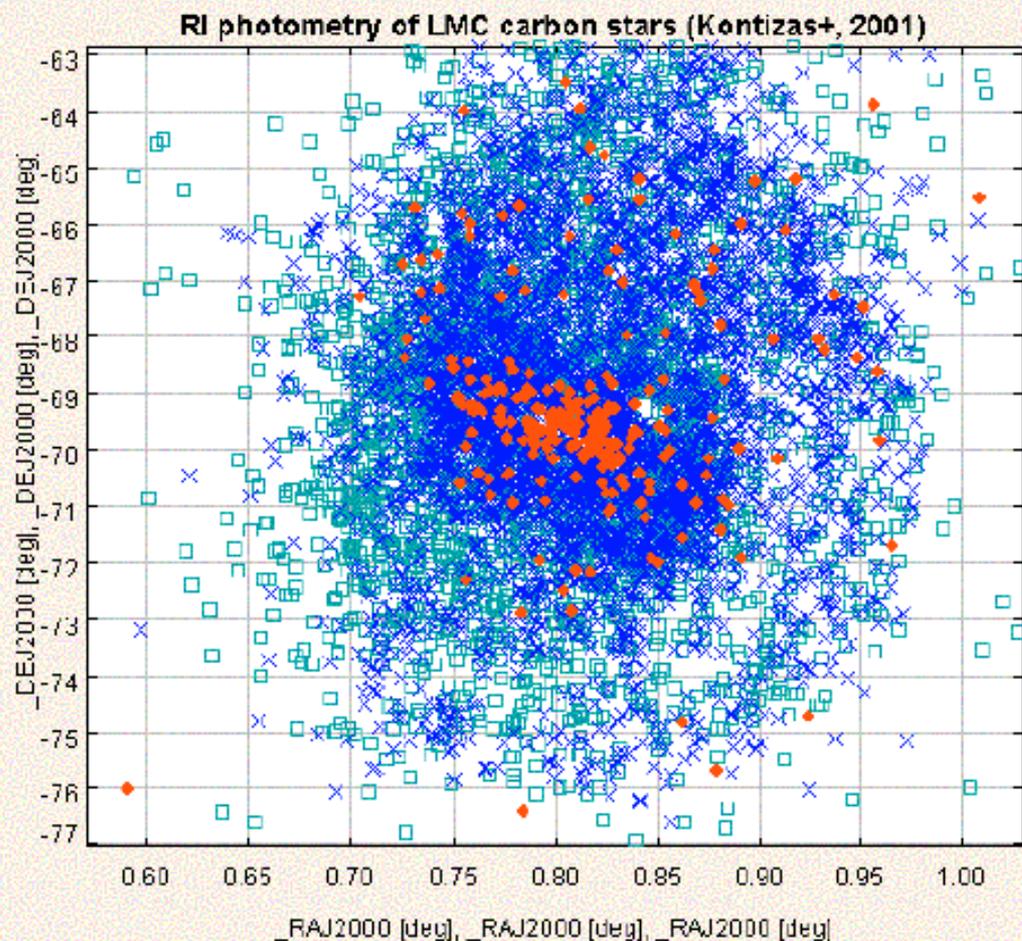


Stellar populations: Breaking the age-mass degeneracy



- IR-selected Cha 1 sources
- Direct discovery of XMM archive
- 3 bands in false colour
- Low mass: X-rays
- younger: more

Stellar populations



$R < 14$ [DEJ2000 : _RAJ2000] ◆
 $14 < R < 15$ [DEJ2000 : _RAJ2000] ×
 $R > 15$ [DEJ2000 : _RAJ2000] □

X 1.19E2
Y 72.5
Y axis Log
_DEJ2000
X axis Log
_RAJ2000
Filter R > 15
 Overlay
Print
Histogram
Help
Navigation icons

Multi-SED plugin tool

VOSPEC Spectra Extraction Tool 

Fix axes Target Ra Dec Size

Choose Units

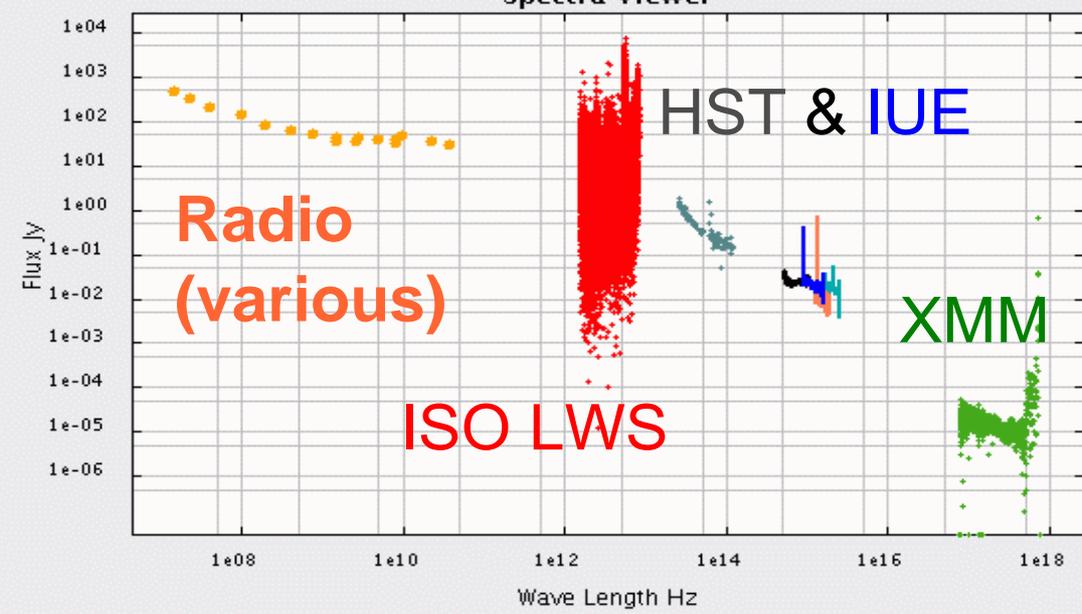
Wave Unit Log Scale

Flux Unit

Graphic Mode

- Points
- Lines
- Lines
- Points
- Dots
- Points
- Lines
- Points

Spectra Viewer



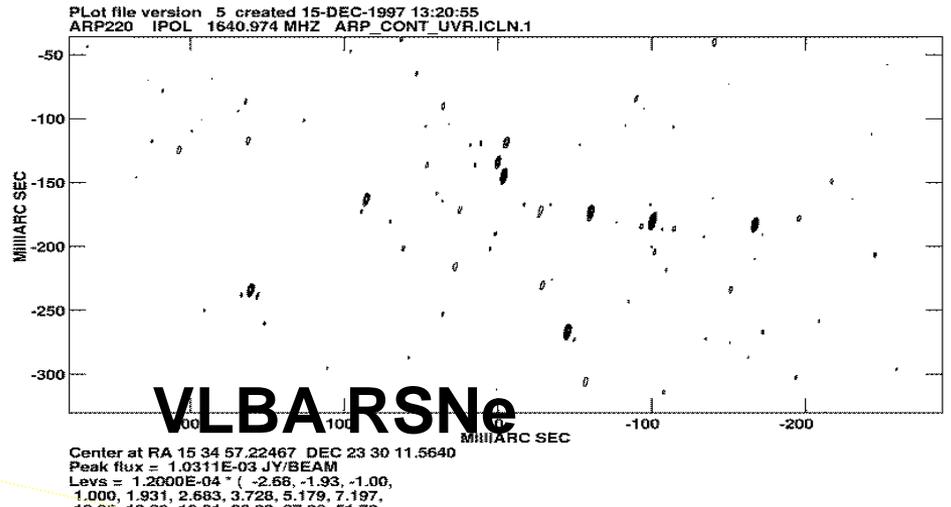
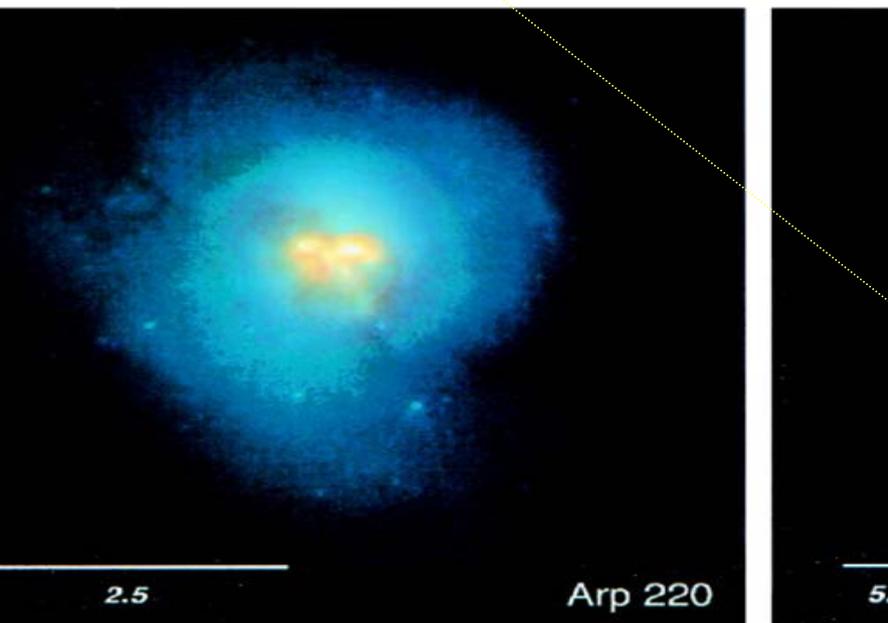
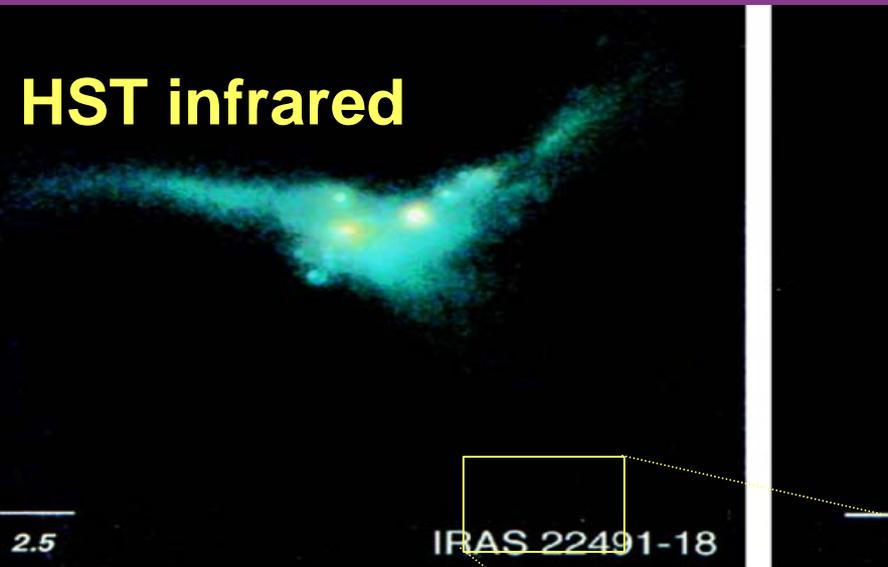
Flux_Jy

Wave Length Hz

Server	Title	Ra	Dec	Format	Select	Status
<input checked="" type="checkbox"/>	Infrared Sp... ISO LWS01 ...	187.2778...	2.05237	spectrum/f...	<input checked="" type="checkbox"/>	complete
<input type="checkbox"/>	INES IUE SKY	187.2696	2.0358	spectrum/f...	<input type="checkbox"/>	ready
<input type="checkbox"/>	INES IUE SKY	187.2696	2.0358	spectrum/f...	<input type="checkbox"/>	ready
<input type="checkbox"/>	INES IUE SKY	187.2696	2.0355	spectrum/f...	<input type="checkbox"/>	ready
<input type="checkbox"/>	INES IUE SKY	187.2696	2.0355	spectrum/f...	<input type="checkbox"/>	ready

- Archives use VO-standard metadata
- Query gives dynamic data discovery
- Dimension equation to convert flux units
- Aperture corrections

Supernova hunting



- ELT will image some SNe/ SNR with VLBI resolution
- SKA will detect more Type 1
- VOs will reveal precursors
 - reconcile distance scales
 - investigate cosmic evolutionary changes

Data selection: Virtual data

- Non-expert access to any
- Real archive with flexible products
 - Cut-outs of Gpixel images
 - HST associations
 - Optional ISO spectral flags
 - Interferometry sensitivity *or* resolution
- Archive calibrated visibilities
 - IVOA-standard metadata
- Web services/Java/AIPS++
 - User gets full history
- Challenges
 - Connection speeds

The screenshot shows a web browser window titled "Australia Telescope Online Archive - Mozilla". The page content includes a navigation bar with "Resources", "Contact", "Search", and "Internal". The main heading is "Australia Telescope Online Archive". Below this, there are several search criteria sections:

- Project Codes (required)**: A text input field.
- Observation Date**: A section containing "From" and "To" date pickers. Each picker has dropdowns for Day, Month, Year, Hour, and Minute.
- Observer's Last Name**: A text input field.
- Source Name**: A text input field containing "3C273".
- Source Position (J2000)**: A section with "Right Ascension" and "Declination" sub-sections. Each has input fields for hours, minutes, and seconds.
- Search Window (arc-minutes)**: A text input field containing "1".
- Band Name**: A dropdown menu with options: 3mm, 1cm (selected), 3cm, 6cm, 13cm, and 20cm.

Data delivery: First spectral-line real-time VLBI (JIVE correlator)

Netscape

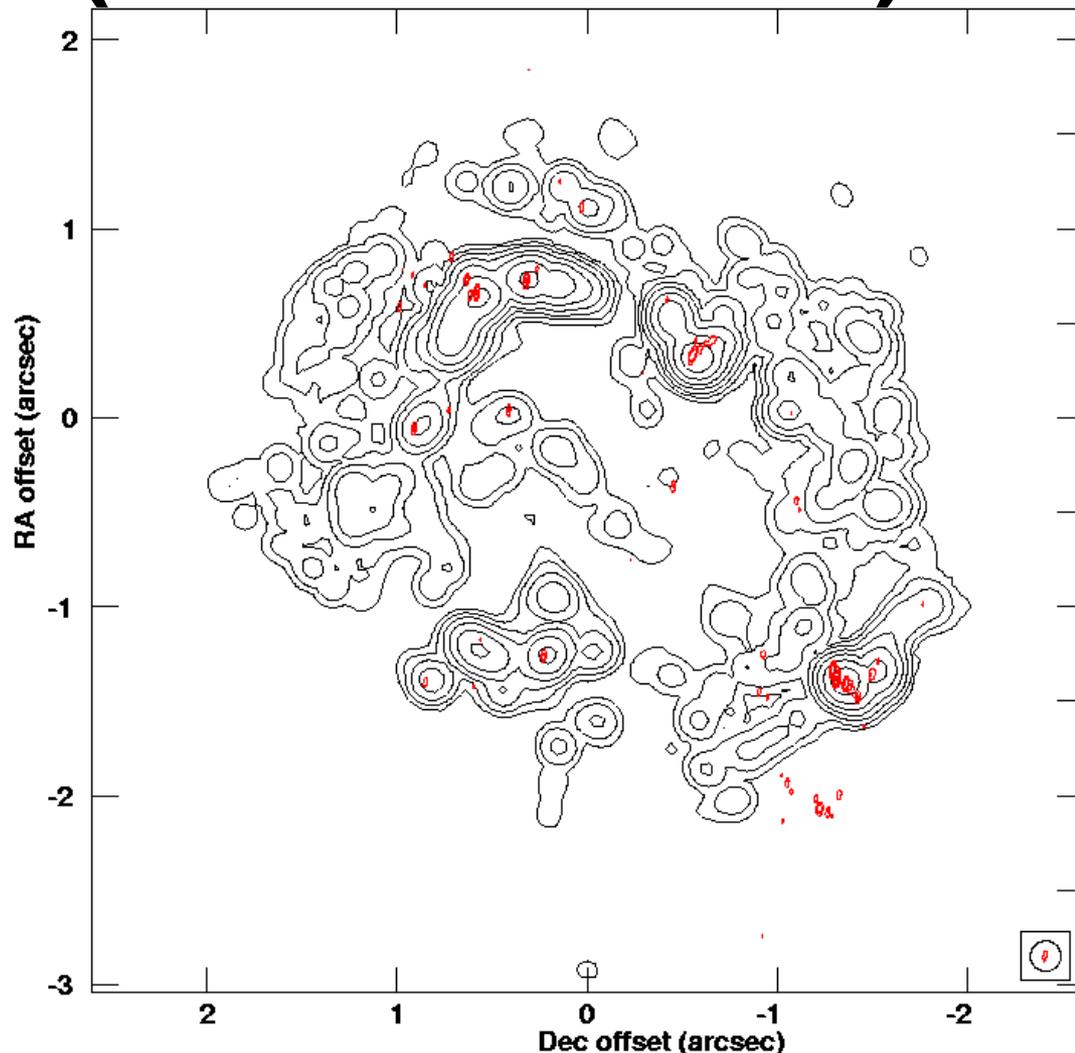
File Edit View Go Communicator Help

Standard Plots of EVN Correlator at JIVE

Exp. Name	RAH2
P.I. Name	Richards
Description	evlbi tests - OH 1612 MHz masers around IRC+10420
Wavelength	18cm
Stations	Wb Tr On Ctn
Plot description	Description

	cross corr. amp/phase	auto corr. amp/phase	amp
RAH2	rah2-cross-1.1.png	rah2-auto-1.1.png	rah2-amp-1.1.png
	rah2-cross-2.1.png	rah2-auto-2.1.png	rah2-amp-2.1.png

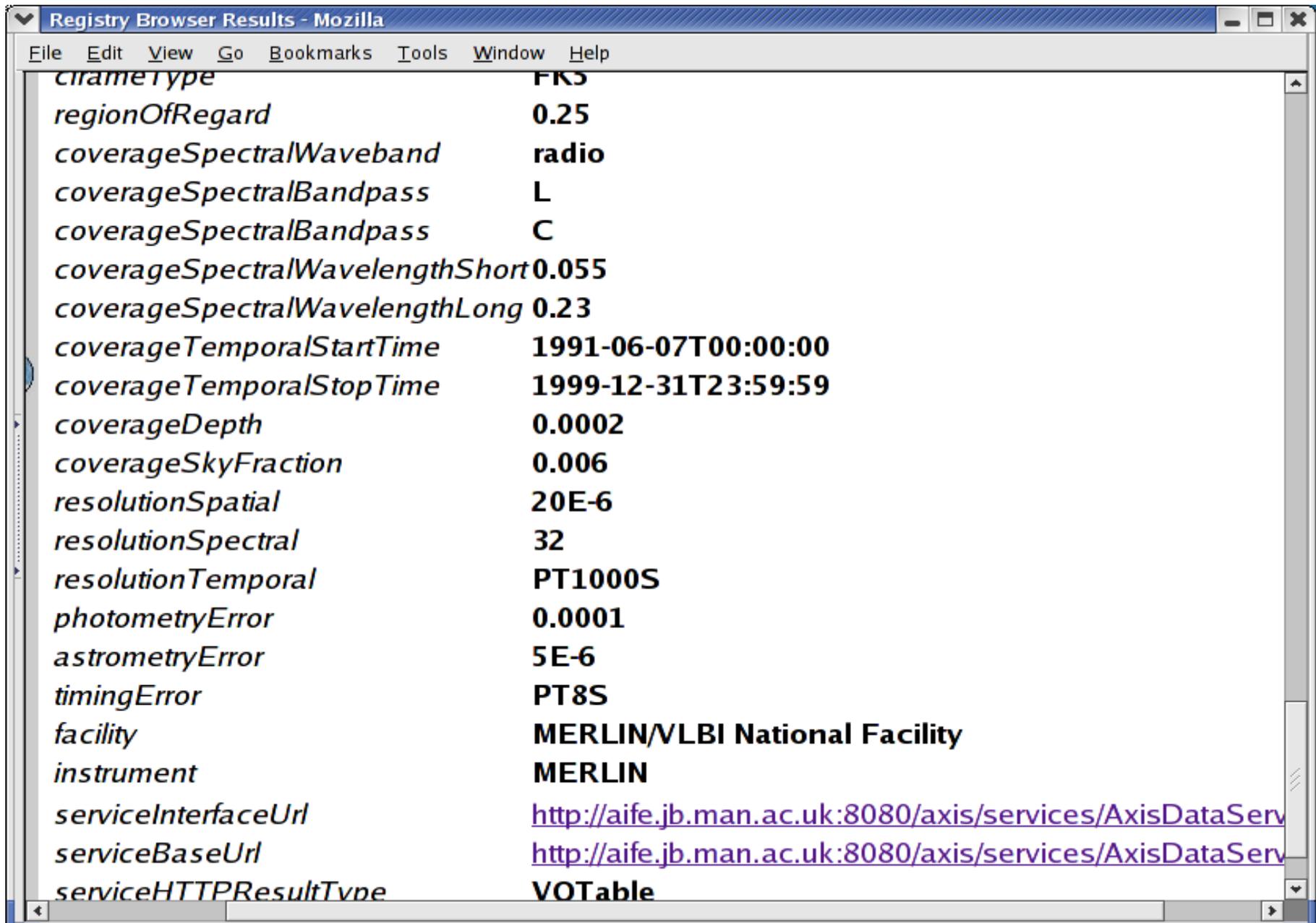
Document: Done



MERLIN 2002: Peak 5.89 Jy/bm, contours (-1,1,2,4...)x0.05 Jy/bm

eEVN 2004 Peak 4.60 Jy/bm, contours (-1,1,2,4...)x0.5 Jy/bm

Metadata standards & schema

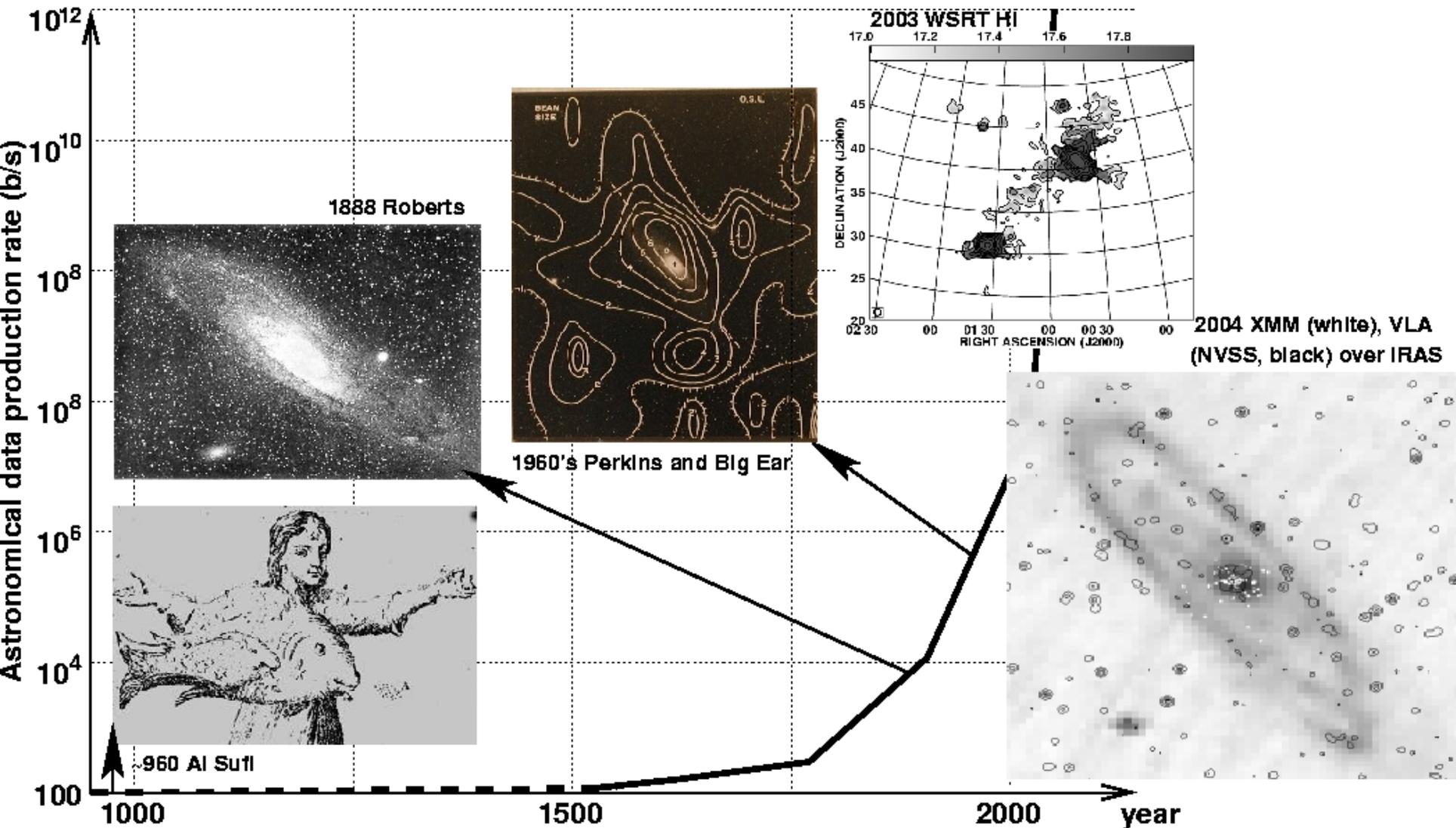


Registry Browser Results - Mozilla

File Edit View Go Bookmarks Tools Window Help

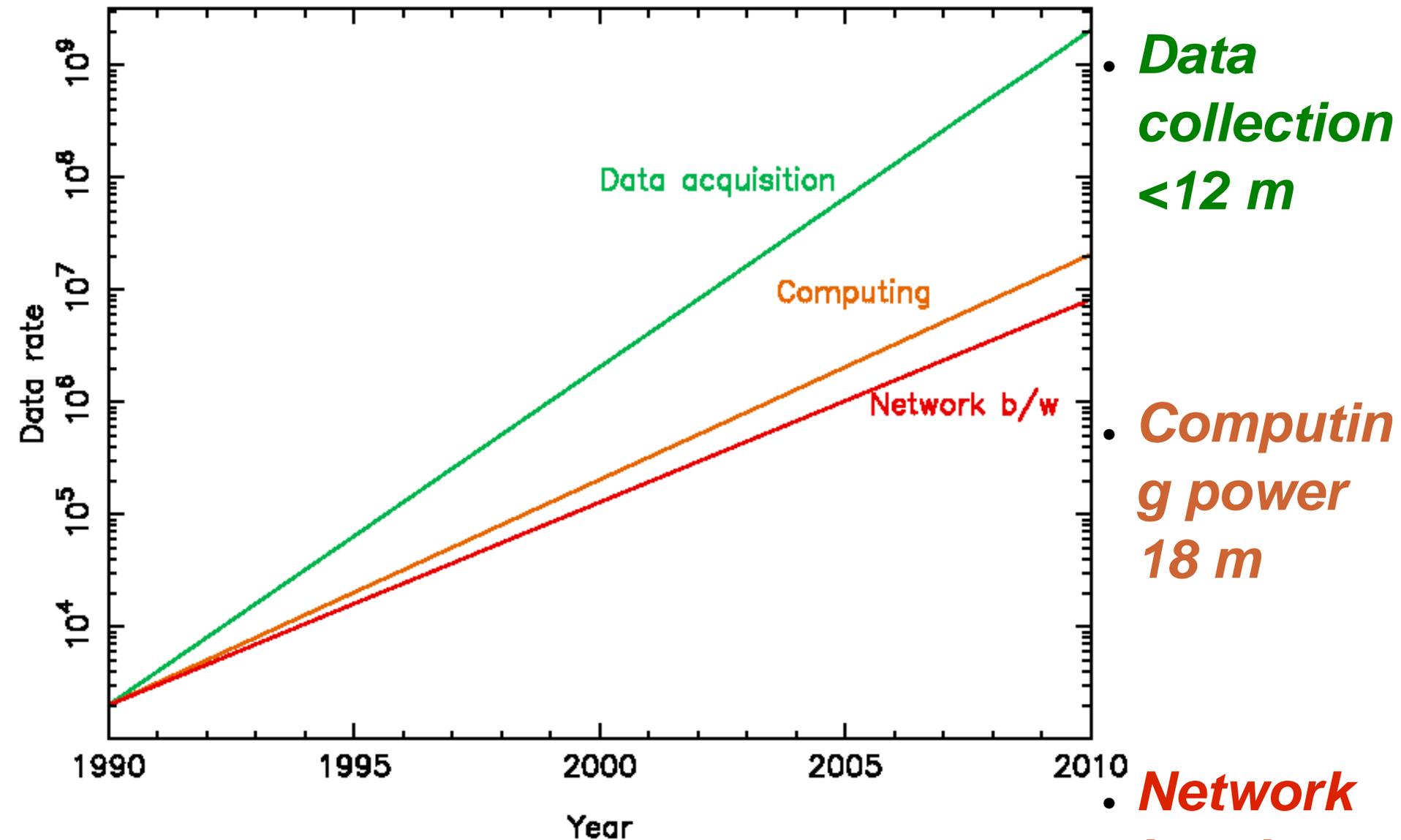
<i>coverageType</i>	FKS
<i>regionOfRegard</i>	0.25
<i>coverageSpectralWaveband</i>	radio
<i>coverageSpectralBandpass</i>	L
<i>coverageSpectralBandpass</i>	C
<i>coverageSpectralWavelengthShort</i>	0.055
<i>coverageSpectralWavelengthLong</i>	0.23
<i>coverageTemporalStartTime</i>	1991-06-07T00:00:00
<i>coverageTemporalStopTime</i>	1999-12-31T23:59:59
<i>coverageDepth</i>	0.0002
<i>coverageSkyFraction</i>	0.006
<i>resolutionSpatial</i>	20E-6
<i>resolutionSpectral</i>	32
<i>resolutionTemporal</i>	PT1000S
<i>photometryError</i>	0.0001
<i>astrometryError</i>	5E-6
<i>timingError</i>	PT8S
<i>facility</i>	MERLIN/VLBI National Facility
<i>instrument</i>	MERLIN
<i>serviceInterfaceUrl</i>	http://aife.jb.man.ac.uk:8080/axis/services/AxisDataServ
<i>serviceBaseUrl</i>	http://aife.jb.man.ac.uk:8080/axis/services/AxisDataServ
<i>serviceHTTPResultType</i>	VOTable

131 through the ages



Hand-drawn Photo-plate Radio+optical HI X-ray+radio+IR

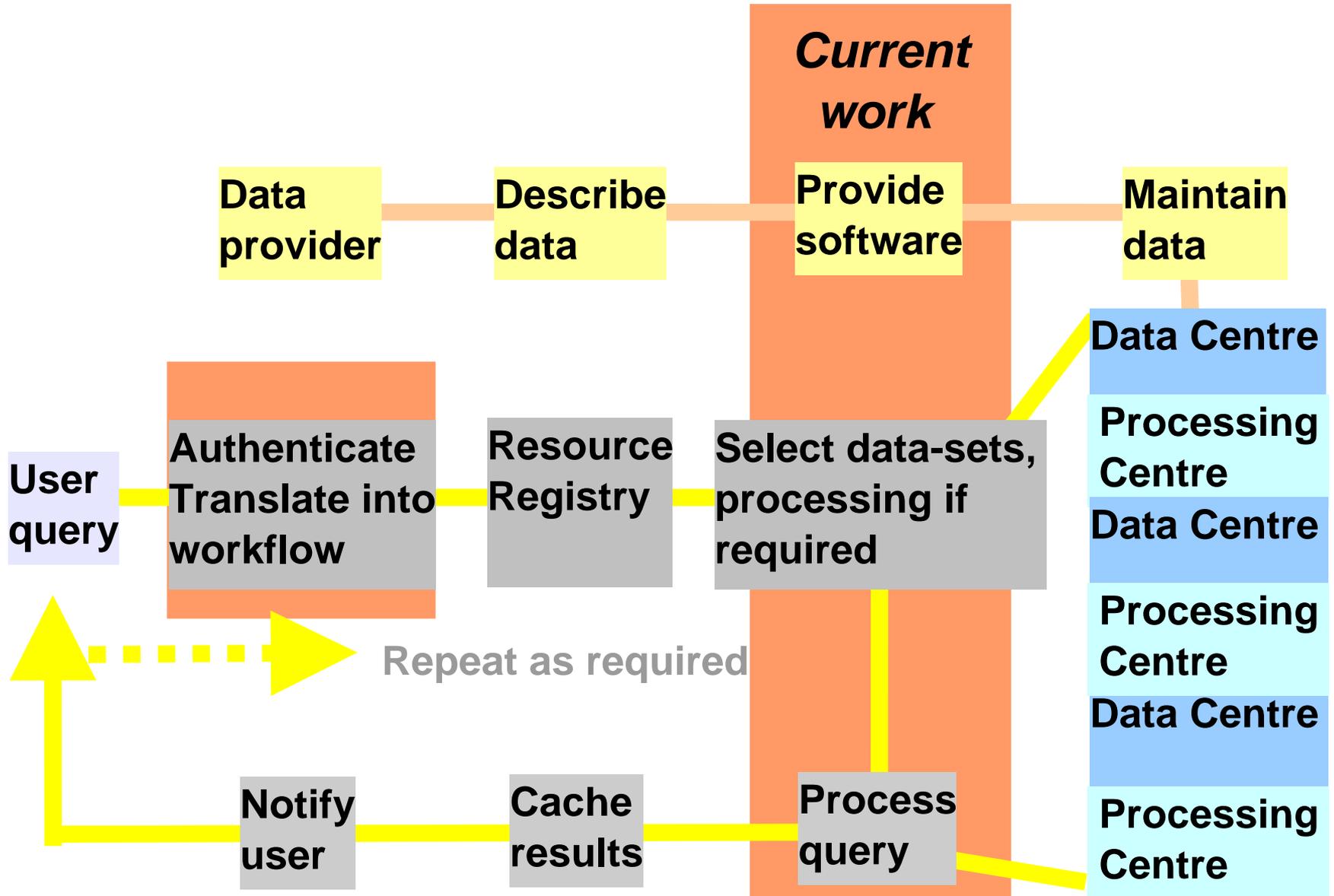
Growth rates $\blacklozenge_{1/2}$



Virtual solutions

- *Move the results, not the data, not the people!*
- *Specialised data centres with high-speed links*
- *Universally-understood specifications (metadata)*
 - *Multi-scale, multi-●, multi-epoch*
 - *Full data description and history*
 - *Expert and lazy modes*
 - *Tools, model fitting, model tweaking*
- *Security/authentication*
 - *One user, one profile*
 - *MySpace virtual storage facility*
- *Identify*
 - *User needs (science drivers)*
 - *Priority data sources*

VO access - simplified overview





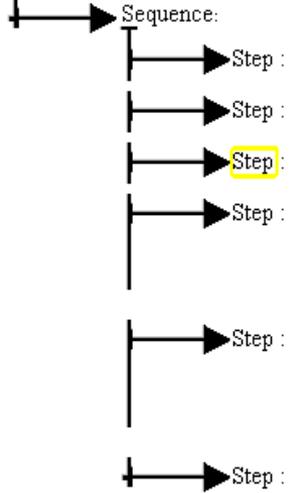
AstroGrid Login Community Workflow MySpace DataCenter Registry

Workflow Administration

File Edit

Name: ivorn: agsl:

Description: ivorn: agsl:



Parameters for step: **sexttractor - z**; tool: **org.astrogrid.itn05/SExtractor.**

Input:			
Name:	Type:	Value:	
DetectionImage	FileReference	/home/applications/data/GOODS/h_sz_	<input type="button" value="Browse..."/> <input type="button" value="submit"/>
PhotoImage	FileReference	/home/applications/data/GOODS/h_sz_	<input type="button" value="Browse..."/> <input type="button" value="submit"/>
config_file	FileReference	/home/applications/demo/h_goods_sz_	<input type="button" value="Browse..."/> <input type="button" value="submit"/>
PARAMETERS_NAME	FileReference	/home/applications/demo/std.param	<input type="button" value="Browse..."/> <input type="button" value="submit"/>
Output:			
Name:	Type:	Value:	
CATALOG_NAME	MySpace_FileReference	ivo://org.astrogrid.itn05/myspace#frog/s	<input type="button" value="Browse..."/> <input type="button" value="submit"/>

Step

Name:

Join: any true false

Description:

Tool

Name:

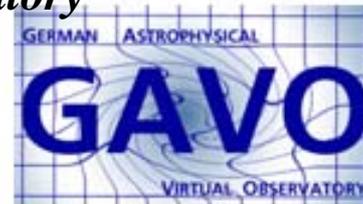
Description:



International Virtual Observatory Alliance



To facilitate the international coordination and collaboration necessary for the development and deployment of the tools, systems and organizational structures necessary to enable the international utilization of astronomical archives as an integrated and interoperating virtual observatory



What do you need from VOs?

- ***Examples showed:***
 - ***Multi-● data comparison, unit conversion***
 - ***Off-the-shelf Cone Search, Simple Image Access***
 - ***Multi-scale image matching (astrometry to be included)***
 - ***Spectral analysis & SEDs (aperture matching needed)***
 - ***Workflow building***
 - ***Incorporation of common model & analysis packages***
- ***Ideas from last few days***
 - ***Handling massive catalogues***
 - ***Handling high-resolution data (lessons from VLBI!)***
 - ***Encourage integration of Pulsar, Planck, Theory***