

Access to Radio and Interferometry Data

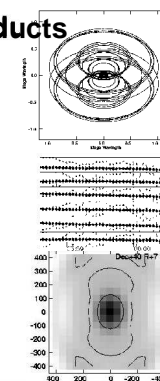
S.T. Garrington, P.A. Harrison, A.M.S. Richards, A.M. Stirling, N. Winstanley (JBO); M.D. Allen, B. Vollmer (GDS); P. Lamb, R. Power (CSIRO); T. Venturi (EVN) et al. and all who replied to the radiovo@ivoa.net and RadioNet mailings

- Advances in radio astronomy
 - Wide band-width
 - Multiple products
 - High data rates
 - Current access prototypes
- Radio Data Providers questionnaire
 - VO awareness
 - Data supply requirements
 - Pointers to specialised tools
- RadioNet



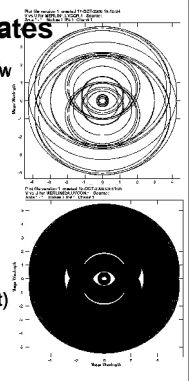
Interferometry Data Products

- Calibrated complex visibilities
 - Model fitting
 - 'Light' curves
 - Edit *before* imaging
 - Combine data from other arrays
- Image (Fourier Transform, CLEAN)
 - selected regions*
 - Field of view determined by
 - Individual antenna radii
 - Channel width
 - Integration time
 - Quality - baseline coverage
 - Beam size - weighting
 - Sensitivity or resolution
- Data cubes, spectra, polarization



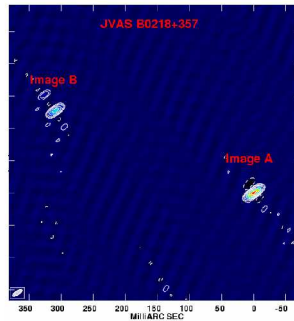
Interferometry Data Rates

- MERLIN sensitivity limit: 16 MHz b/w
- e-MERLIN 2 GHz b/w ($v > 4$ GHz)
 - Optical fibres (dedicated)
 - B/W fills aperture plane
- 10 - 30 x sensitivity
- FOV 15 arcmin at 18cm
 - 18x18k pixel potential images
- Data rate 1-100 Gb/s ($\times 10^3$ present)
- Similar upgrades of other arrays
 - e.g. eVLA



Real-time VLBI correlation

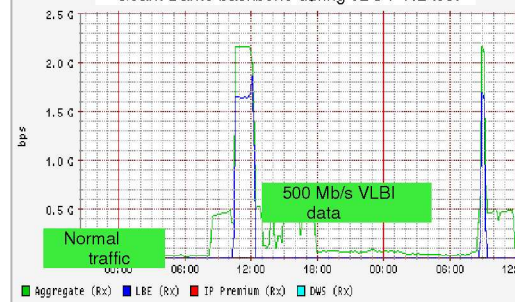
- Transatlantic real-time fringes
 - 25 March 2004
 - Onsala (Sweden), Westford (USA)
 - Haystack correlator
- EVN real-time imaging
 - 28 April 2004
 - Onsala, JBO(UK), Westerbork (NL)
 - No buffering
 - 32 Mb/s
 - JIVE correlator (NL)



i-Grid & ER2002 demo transfers

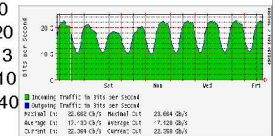
Sustained 500 Mb/s VLBI data transfer

Geant Dante backbone during JBO > NL test

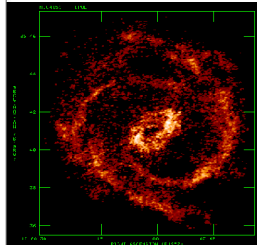


Data bandwidth requirements

- E-MERLIN, NMA 30-120 Gb/s/site 200-5000 km
- EVN/Global/Geo-VLB ~ 1 Gb/s/site 2000-8000 km
- Total IP traffic
 - US: 300 Gb/s
 - UK: 20 Gb/s
 - Geant: 3 Gb/s
 - widest pipes 10 Gb/s
 - lit capacity NY-DC 140 Gb/s
- E-MERLIN @ 30 Gb/s/tel
- VLBA @ 120 Gb/s/tel
- 20-50% IP traffic in 2007, assuming continued growth



The SKA vision: imaging high-Z galaxies in HI with <1" resolution

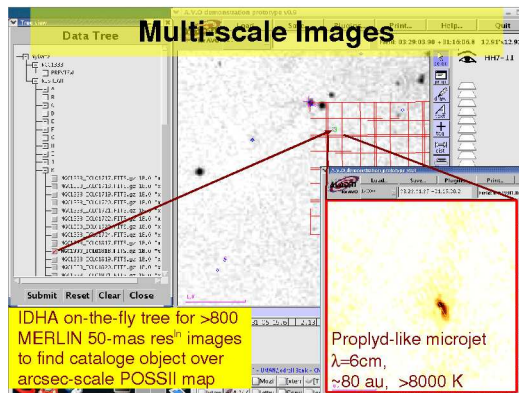
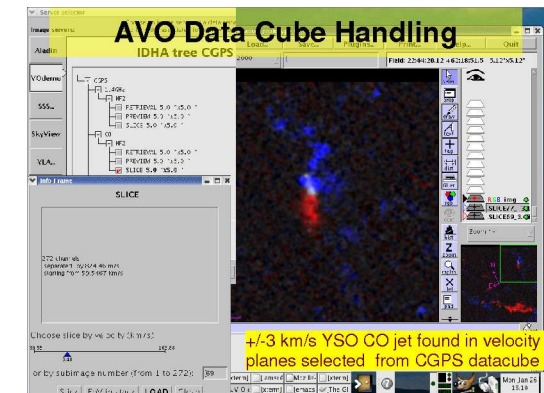
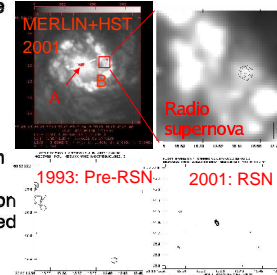


VLA image NGC 4151

- 100x VLA sensitivity
- Testing gravity (PSR, BH)
- Dark ages e.g. high z CO
- Cosmic magnetism
- Cradle of life
- Evolution of galaxies & large-scale structure
- Date-rate-limited
- SKADS low-v test array
- Initially can't correlate all element pairs

On-demand processing

- MERLIN uv data on-line
 - http, cgi, AIPS
 - On-the-fly imaging
 - just fill in position, resolution, size
- NGC7469 supernova
 - Colina et al. 2001
- 1993 obs. HI absorption against core **A**
 - Off-centre RSN position
 - B** imaged from archived visibilities
- There it was gone!
- Also see ATCA prototype
- on-demand imaging using web services

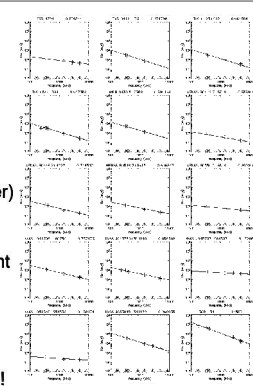


IVOA Radio Data Provider Quest'aire

- Replies from $\lambda < 0.001$ - $\lambda > 1$ m, fixed-link and VLBI
 - ATNF, BIMA, IRAM, JIVE, MERLIN, NRAO, JCMT, (ALMA, CARMA)
- Developing data models, VO involvement
 - AVO, AstroGrid, NVO (incl. cone search), Aus-VO
- Archive ID by experiment, pointing position, date
 - Registry needs to know FoV
- Most interferometry data on ICRF, WCS
- Various data retrieval paths:
 - Visibility FITS on request by FTP
 - Plots and cal data
 - Some web access to FITS images
 - Metadata

Catalogues

- Obs. catalogues on-line
 - Some published via VO
- Published surveys
 - WENSS, SUMSS, NVSS
 - SIMBAD radio ID
 - Spectral indices (Vollmer)
- Extend publication of catalogues and archives
 - CADC GPS - development
 - HIP/JASS
 - AG/AusVO prototype
 - + MIGALE discussion
 - SCUBA survey - request
 - VLBI calibrators - sort out!



Requirements

- Consistent metadata, integrated data handling
 - Clean images ready for analysis/multi- λ comparison
 - High spatial, spectral resolution, datacubes
 - Full history and quality characterisation
 - Calibrated uv data e.g. combine from different arrays
 - Fast (parallelised) user-driven processing
 - Options depending on user experience
 - Standard software or VO interface to local package
- Specialised VO-linked data centres
 - VO to understand Jy/beam, polarization, μ as precision
- One path for all users
 - Authorisation filter if access is restricted
- Liaise with related projects
 - Pulsar VO (linked to gravitational wave grid proposal)
 - Planck VO working group

RadioNet

- Collaboration between European facilities (Synergy)
- Science workshop and training group
- European Radio Astronomy engineering forum
- Software and users forum
 - ALBUS joint research activity
 - Parallelization
 - Software package evaluation
 - Wide-band/wide-field imaging
 - Archives and VOs
- ALMA forum
- Astronomy across Europe
 - Opticon, ILIAS
 - JENAM
- Radio frequency management