

WSRT Users' Meeting 2008

Views and Perspectives
on the future course of the WSRT

An Introduction

Integrated LOFAR+WSRT Observatory

- Integrated Radio Observatory
 - Aims at maximal efficiency
- Separate Astronomy Group in ASTRON
- Radio Observatory has new structure
 - Science Support Group (vital link to astronomers)
 - “Under Construction”
 - 5-8 junior, 2 senior positions
 - Technical Operations (integrated processes)
 - 3 operators, 7 software, 5 hardware, 1 head
 - Systems Engineers (anchor expertise, enhancements)
 - 4 system engineers/scientists

Integrated LOFAR+WSRT Observatory

- Move all operations to Dwingeloo base now
 - Building extension planned for next couple of years
 - Control Room for WSRT & LOFAR:
 - operational in Dwingeloo since October 2007
 - Science Support:
 - Support Scientists housed in “astronomy wing”
 - Science Support Centre with office facilities for visiting astronomers improved in May 2008
 - Software engineers:
 - ASTRON “software pavilion” by July 2008
 - Hardware engineers:
 - In Dwingeloo labs by August 2008

Integrated LOFAR+WSRT Observatory

- New Radio PC starts operating this autumn
 - Members selected on expertise
 - Independent assessment of all projects
 - Must cover a wide range of fields
 - International composition
 - Dedicated partner for the Radio Observatory
 - Technical expertise
 - Optimisation of schedule
 - Some Observatory resources shared by LOFAR and WSRT
 - Transparent and inviting user contacts

Integrated LOFAR+WSRT Observatory

- Streamlining WSRT operations:
 - WSRT on-site activities in planned campaigns
 - Fixed maintenance days/week
 - Cryogenic MFFE maintenance stays on-site
 - No major extension work during next couple of years
 - Increased automation & improved remote access
 - More monitoring points
 - More computer-control of equipment
 - Extended self-diagnosis, alarms, recovery after failures
 - Simplified VLBI operations
 - TADUmax + standardised scripted setup of TMS
 - Automatic phasing of Tied Array ?
 - VLBI data recording in Dwingeloo ?

Integrated LOFAR+WSRT Observatory

- Project specifications/schedules mostly prepared at start of semester:
 - Online observation preparation by the PI
 - Specifications in proposal
 - Online help
 - Standard templates (including sub-arrays, mosaics etc.)
 - Support scientists advice
 - Basic schedule fixed for long periods
 - Target-of-opportunity overrides possible
 - Built to accommodate interrupts
 - Expanded Service Proposal scheme:
 - Propose any time, “lightly” refereed
 - Only to fill schedule ad hoc, may request total 24 hours
 - Never guaranteed to get on

Integrated LOFAR+WSRT Observatory

- Data retrievable online for PI immediately after observing:
 - Without data quality verification
 - Pipelined diagnostic plots and manual report (general status) available online
 - Can also accumulate datasets and then request DVD

Current WSRT Facilities

- Receivers:
 - MFFEs: 8 frequency bands 250- 8700 MHz
 - LFFEs: no longer maintained after 2008 (LOFAR)
 - 6 GHz (single receiver, so far used only for VLBI)
- 160 MHz IF system (IVC)
- DZB correlator:
 - 500000 channels, highly flexibly configurable but standard modes to cover most use cases
 - Recirculation operational up to factor 4

Current WSRT Facilities

- TADUmax Tied Array adding/redistribution
 - In final commissioning
- PuMa-II pulsar backend
 - PuMa-I to be decommissioned
- VLBI field system and data acquisition
 - Soon switching to Mark 5B disk recording
 - eVLBI

Galileo signal monitoring facility

- ESA project, through Alenia
- Collaboration with S&T, TUD, TNO
- Special filters added in an MFFE
- Dedicated digitiser
- Satellite tracking mode
- Contracted 150 h Single-dish + 25 h Array

Possible Paths for the WSRT

- LOFAR:
 - Fantastic new facility for 240 MHz and below
 - Important SKA pathfinder
 - Demonstrator of phased array concepts
 - Data processing challenges
 - Multi-user support challenges
- Phase1 SKA:
 - Needs path-finding in lots of ways
 - Is many years from operation
- “The work must go on” in cm radio astronomy
 - LOFAR projects will need lots of follow-up observing
 - Existing experience must be built upon
- What role could the WSRT play for the national and international community in the next decade ?

Possible Paths for the WSRT

- WSRT and other radio telescopes:
 - E-VLA, ATA, GBT, European single dishes: often going mainly for high sensitivity at high(er) frequency
 - E-MERLIN: going for high sensitivity at higher resolution
 - GMRT: restrictions in bandwidth / field-of-view
 - ASKAP, MEERKAT: in Southern hemisphere, different combinations of frequency, field-of-view, resolution
- Current WSRT use:
 - Built 40 years ago as 21cm array; still the largest application
 - Strong also in wideband “low” frequencies (300-1200 MHz)
 - Important VLBI station, also at 5 GHz
 - Regularly used for multi-frequency monitoring up to 8 GHz

Possible Paths for the WSRT

- Technical indications:
 - Maintaining telescopes is tractable for 10+ years
 - Maintaining cryogenics, electronics of 14 MFFE's is tractable for some (5+ ?) years, but major revision may be required at some point.
 - Maintaining the LFFE's is not tractable (mechanical wear)
 - Maintaining full IVC+DZB backend is tractable for some years (5+ ?), but electronics may wear out at some point.
 - Broadening the bandwidth beyond 160 MHz in 2 pol is not feasible with the existing coaxial cabling.
 - Increasing performance at frequencies above 5 GHz is mechanically ill-advised on the current telescopes.
 - Installing heavier frontends is ill-advised on the telescopes.
 - Any major new instrumental development will take 2-4 years.

Possible Paths for the WSRT

- Short term: focus on science returns
 - Steady WSRT operations
 - Increased daytime availability
 - Operationally best to have large blocks in the same (standard) observing mode
 - Scheduling complexities:
 - Full synthesis runs and no HA flexibility
 - Frequent night time requests (solar interference, RFI)
 - Large excess of requests at RA=10-14 and RA=17-19
 - When schedule is full, interrupts keep rippling through
 - Different solutions:
 - Set aside time for large “fundamental science” surveys, and accept resultant schedule inefficiencies; use “filler” projects.
 - Stimulate projects with relaxed scheduling requirements (daytime, lots of short (<4 hr) observations spread in LST)

Possible Paths for the WSRT

- Longer term possible paths (in parallel?):
 - Maintain or somewhat expand current suite of facilities
 - Allow large programmes to do great science for which other telescopes have insufficient time available
 - Keep improving pulsar backends
 - Apertif: “21cm” focal plane arrays for the WSRT
 - Concentrate on wide-field surveys
 - Build wide-bandwidth receivers at 1-2 GHz, or 2-4 GHz, or 4-8 GHz
 - for VLBI
 - possibly to join in E-MERLIN
 - 1, a few, 14 ??

Possible Paths for the WSRT

- Build new wideband low-frequency receivers for the array (somewhere in the range 300-1200 MHz)
 - With modern RFI mitigation (high dynamic range needed in analogue and digital domains)
 - For LOFAR follow-up and pulsar studies
- WSRT telescope supplements/replacements:
 - New dish(es), aperture arrays, ...

- YOUR IDEA HERE...

Possible Paths for the WSRT

- This Users Meeting is a place to float ideas, have discussion, be creative, stimulating (and, yes, also to gripe !). We are not looking to arrive at any conclusions right now.
- But we should also try to look at realistic estimates of the potential of any path to attract or generate:
 - “Scientist” time and effort: **YOU**
 - Funding
 - Results on the right timescales (given LOFAR, path to SKA, other telescopes in the world)