SKA: UK involvement

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MERLIN

PPARC

EUROPEAN VLBI NETWORK

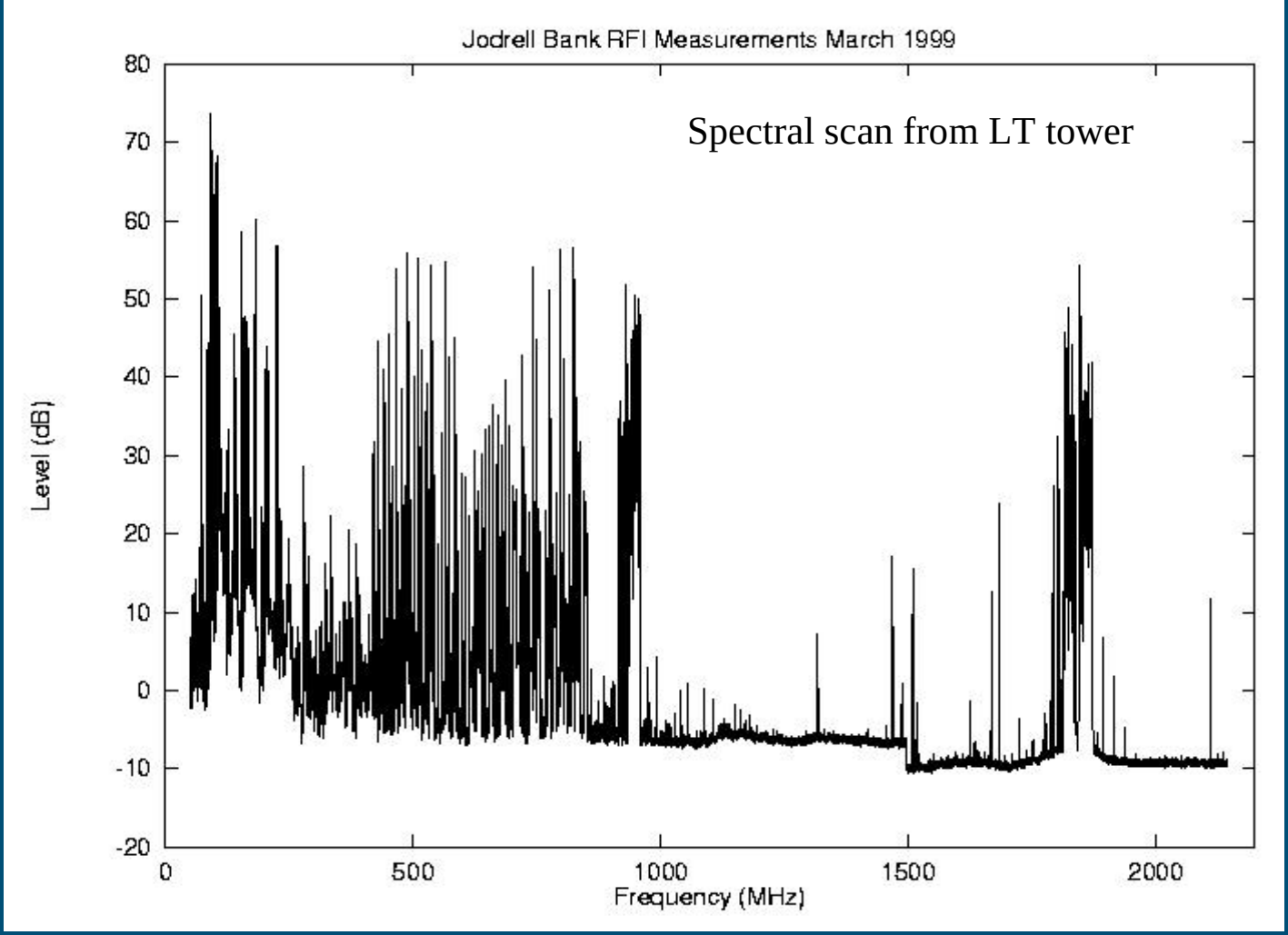

S K A
220 Lovell Telescopes
$11 billion

JBO areas of expertise

- RF technology: build cryogenically-cooled receivers up to 44 GHz: LT, MERLIN, VSA, Planck, OCRA, Multibeams
- Digital systems: correlators, microwave links, e-MERLIN, pulsar systems
- Software: real-time control of massive systems, post-processing, image processing, large system design
- Data transmission: microwave links, fibre optic development for e-MERLIN and ALMA
- Mechanical systems: design of carousels for E-systems and MkII telescope, L-band lens system for 25-m telescopes

Application of expertise to SKA

- Interference mitigation: astronomical survival in a hostile RFI environment



Digital Signal Processing

- Bryan Anderson: talk on ‘Aspects of Digital Signal Processing’
- Investigations of:
  - Linearity and dynamic range
  - FIR filtering
  - Image-reject down-conversion
  - Interference cancellation

Robust receivers

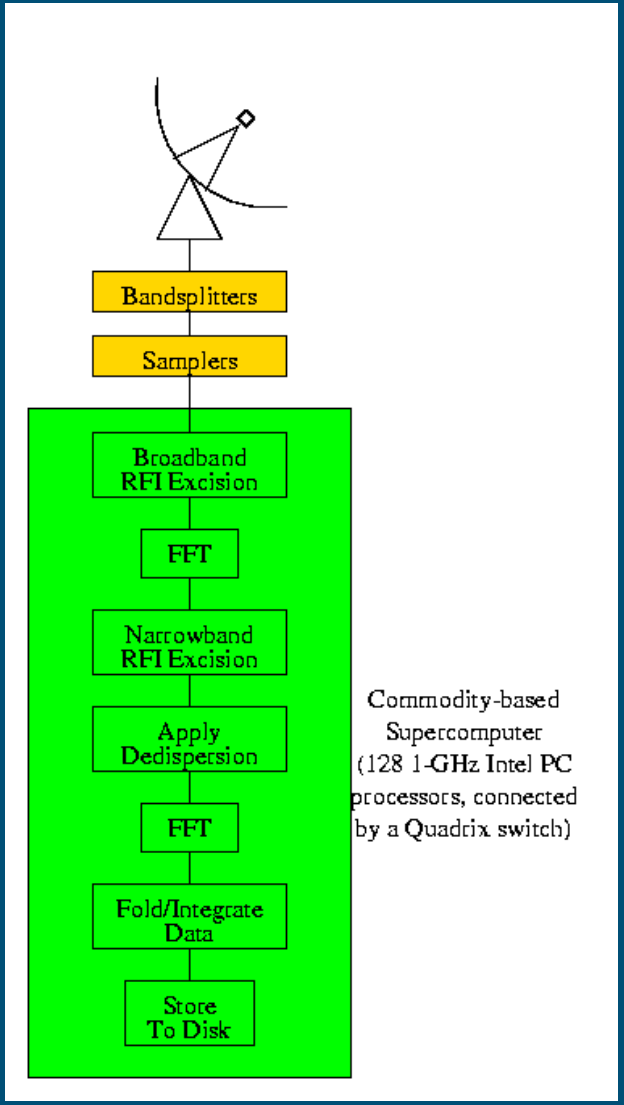
- Thriving in the UK’s RFI environment
- Increased monitoring of the RFI
- Establishing a collaboration with Birmingham to investigate the use of super-conducting filters

Digital Receiver- I

- Rationale: Requirement for coherent dedispersion of pulsar signals
- Present strategies:
  - Record on tape and process off-line
  - Problems: limited bandwidth
    limited number of bits/dynamic range
    use of many expensive tapes
  - Micro-processor/DSP-based on-line sytems
- New strategy:
  - Developing real-time PC-based system with general applicability
  - Build in interference mitigation abilities from start

Digital Receiver - II

- Specification:
  - 100 MHz bandwidth
  - 2 polarizations
  - 8-bit sampling
- Uses:
  - Precision pulsar timing/polarimetry
  - Filterbank simulation for pulsar search data
  - Spectral line studies with full polzn
  - Powerful interference mitigation in freq. and time



Status

- 4-processor narrow-band unit in prep.
- Applied for funding for 128 1-GHz Intel PC processors with Quadrix switch

SKA and fibres

- Optical fibres will probably play a crucial role in connecting the SKA elements, especially those physically separated from any central condensation.
- Involvement in ALMA and, of more relevance, the development of fibre systems for the several hundred km baselines of e-MERLIN will establish JBO as a centre of excellence for the technology of astronomical fibre systems
- The recent establishment of a fibre-optic lab at JBO reinforces this role.

MERLIN as an SKA prototype

- MERLIN has 10^4 m^2 collecting area BUT has similar freq. range and angular resolution to some SKA ideas.
- When connected by fibres will be even closer in concept

MERLIN → *e*-MERLIN

- Replace microwave links by fibre optic cables. Data rates of 40 Gbit/sec
- Build new broad-band correlator (combines signals)
- Install new digital electronics systems at telescopes to handle broad-band data
- Implement frequency flexibility, switch between receiver bands on timescales < 1 minute
- Build new receiver bands
  - New areas of science
- Replace old Defford telescope
- Develop 327 MHz system, collaborate with Oxford. Maybe add new, cheap telescopes along the fibre links. 20-30 MHz bandwidths use single colours on fibres, can handle many such systems.

Problem: cost of telescope + sites!