Dishes+PAFs for the SKA-mid

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Current state of PAF research

Four groups have constructed demonstrators which have been tested on reflector antennas

- BYU/NRAO: 19-element dipole array
- ASTRON: DIGESTIF Vivaldi array (112 elements, 56 active)
  - now second generation with 144 elements/60 active
  - also have realtime BF
- CSIRO: Chequerboard array
- NRC: PHAD Vivaldi array (180 elements, 84 active, 2 pols)

Significant results from demonstrators

- Coupling efficiencies now understood
- Noise better understood
- Beamformer calibration shown to work with variety of optimization goals
- Polarimetric measurements have been made
- Wide-field imaging demonstrated
- Interferometry performed
- Demonstrated capabilities not possible with traditional feeds
- EM simulation tool suited for PAFs has been developed

Next steps

- ASTRON: APERTIF on WSRT (all-metal elements, 300 MHz BW) (2012)
- BYU/NRAO: 38-ele dual-pol array w/ integrated LNA
  - Arecibo spring 2010, Green Bank late summer 2010
  - cryostat under development at NRAO
  - continue beamformer algorithm development
  - measure long-term stability
- NRC: wide-band/low-loss/low-noise array w/ real-time BF (2012)
- CSIRO: chequerboard for ASKAP (2013)

Key issues to be addressed for PAFs to be 'SKA-ready'

- Field de-rotation (electronic)
  - stable main beam
  - circularly-symmetric main beam
  - stable sidelobes
  - high efficiency and low noise
- Complete the development of polarimetric calibration methods
- Demonstrate optimal element/beamformer design to minimize coupled noise

Key issues (II)

- Develop real-time gain/phase calibration system
- Very-low-noise LNAs need to be demonstrated on-sky
- Compatibility with shaped off-axis Gregorian reflector
- Need to work closely with imaging people to ensure spec's are compatible with high dynamic-range imaging
- On-sky use by astronomers

Concluding remarks

- No "show stoppers" found
- Significant progress has been made
- But more work to be done
  - demonstrator $\Rightarrow$ prototype
- TRL 5 – 6
  - Risk likelihood 4 – 3