



NRC-CMRC

*Herzberg Institute
of Astrophysics*

*Dominion
Radio
Astrophysical
Observatory*



NRC-HIA/DRAO SKA Activities

Gary Hovey
22 March 2010

Key Areas (WP 2.2, 2.5, 2.6)

- Composite Antenna Reflectors (WP 2.2.1)
- Wide-band Feeds (WP 2.2.2)
- Phased Array Feeds (WP 2.2.3)
 - Vivaldi Feeds and LNAs
 - Receiver systems
 - Beamformers
- Digital Signal Processing (WP 2.5)
 - Leading Correlators (WP 2.5.1)
 - PAF and Station Beamformers
- Calibration and Imaging (WP 2.6.3)
 - PAFs and Single Pixel Feeds

CART Project: Composite Reflectors

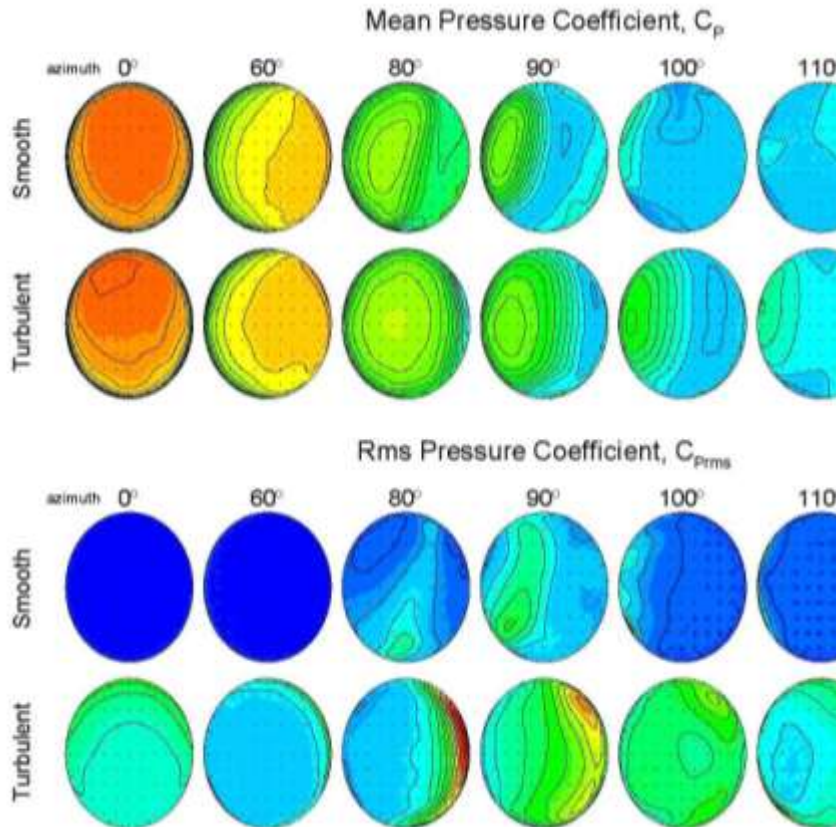
Several Studies Completed

- Feasibility and costs of CART dishes: SKA Memo 116
- Review of creep and expected impact on CART dishes
- Weathering and environmental issues study of CART dishes at SKA sites.
- Wind tunnel testing of symmetric and offset (model) antennas
- Structural optimization investigations

On going

- 15-m concept designs for DVA-1
- Materials investigations and performance test program
- Structural optimization

CART: Wind Tunnel Studies

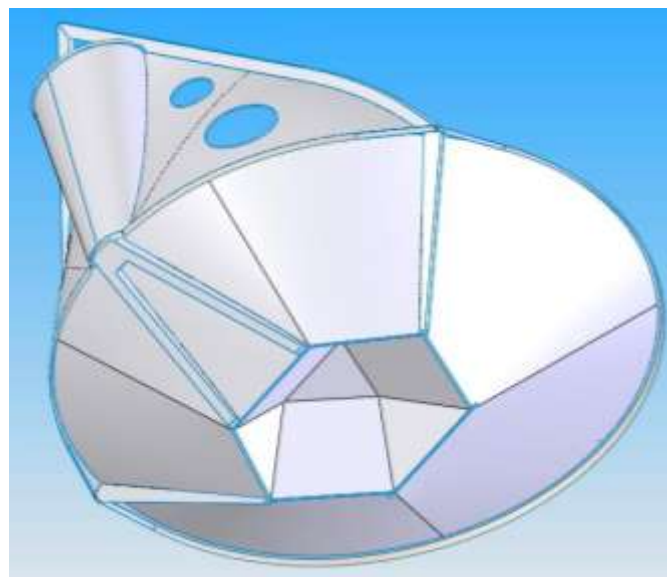
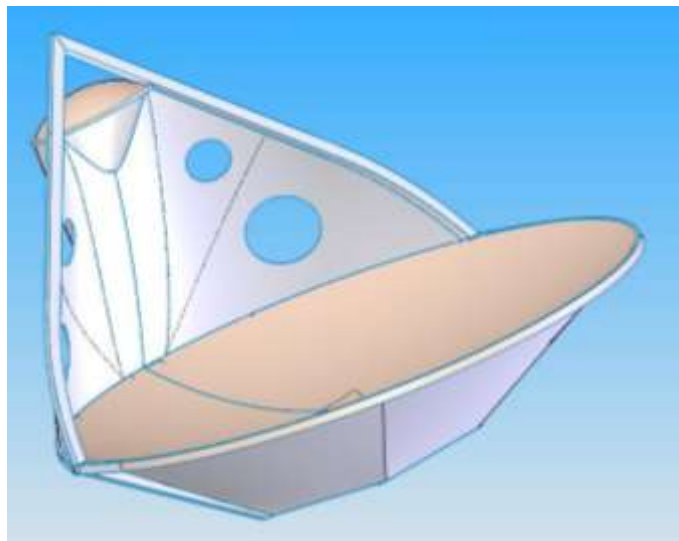


Wind tunnel report completed by IAR/NRC in 2009. Work includes smooth and turbulent flow on offset feed antenna. Data includes mean and rms pressures on front and rear surfaces as well as forces and moments at elevation axis.

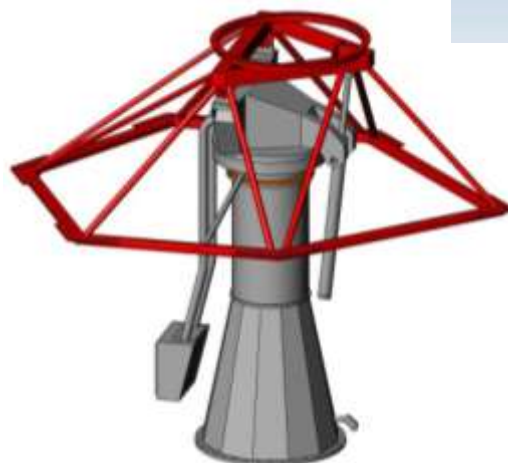
Summary: Pressure fields on dish are similar to center feed design. Loads on mount are also similar but moments are different when secondary mirror is included.

NRC-HIA: Concept Reflector

15-m NRC-HIA Reflector (Gordon Lacy)

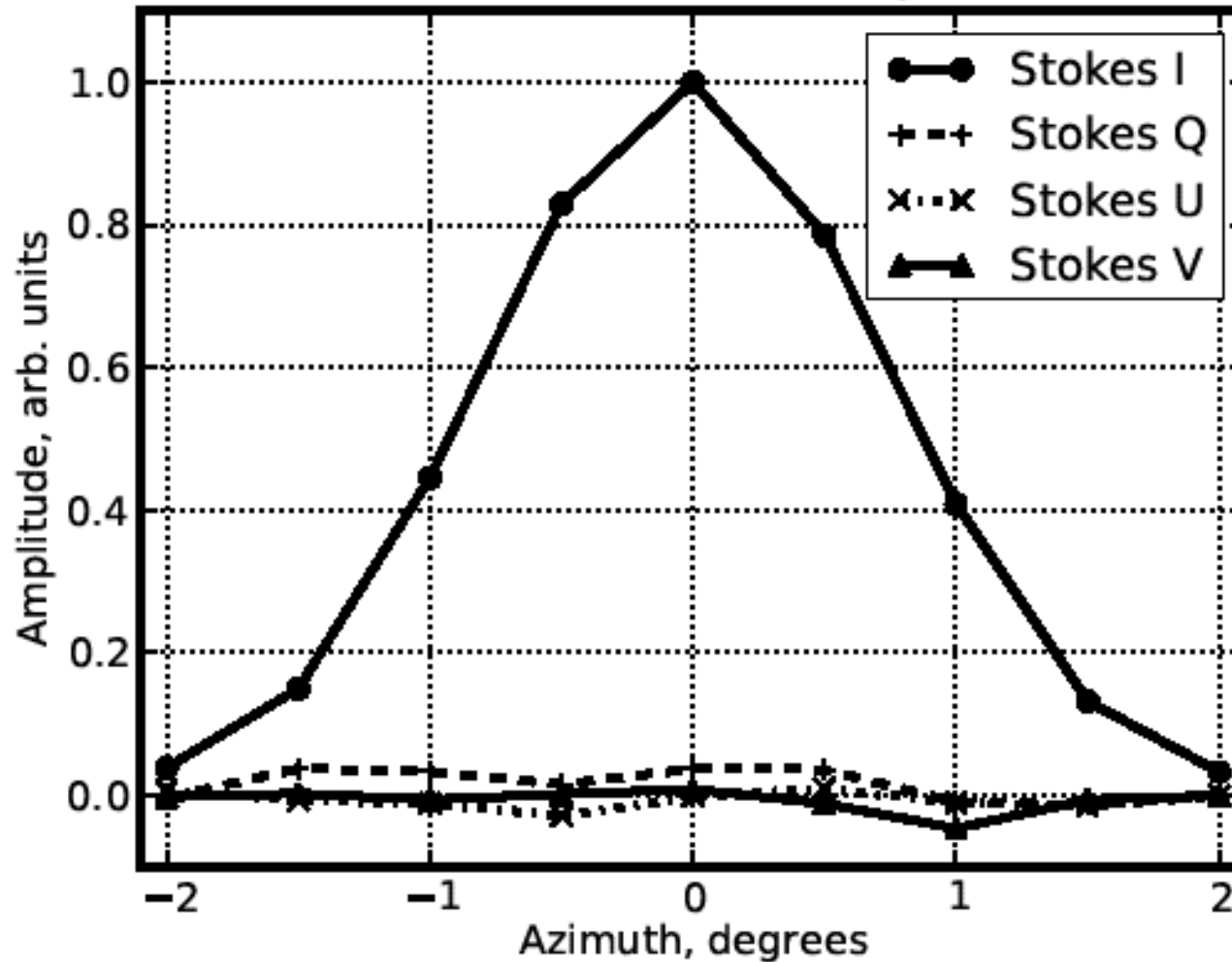


12-m TDP Mount
(Matt Fleming)



- PHAD: Phased Array Feed Demonstrator complete
 - Demonstrator: Limited sensitivity and instantaneous bandwidth
 - Coupling, stability, calibration, beamforming, polarization: OK
- AFAD: Advanced Focal Array Demonstrator started
 - SKA capable demonstrator
 - Low loss feeds, low noise amplifiers (< 20k)
 - Broadband (.5 - 1.5 GHz), direct-conversion
 - FPGA beamformer

PHAD: Polarization Response



TDP WBSPF Optics and PAFs

- Investigating suitability of PAFs with TDP shaped optics design
 - Use GRASP step beams +/- 3 degrees in plane of symmetry and cross-plane
- Off-boresight focal spots *significantly* distorted
- PAF could recover 95% for +/- 2 deg FoV at the cost of 21% more elements

- Investigation of PAF at secondary focus next step

- EVLA Correlator nearly complete SKA work ramping up.
- SKA correlator investigations just starting.
- New FPGA board development well underway
 - Using to study architecture and technology limits
 - Multiple uses:
 - AFAD beamformer.
 - 3D beamforming studies.
 - Correlator studies.

EVLA Correlator On-site

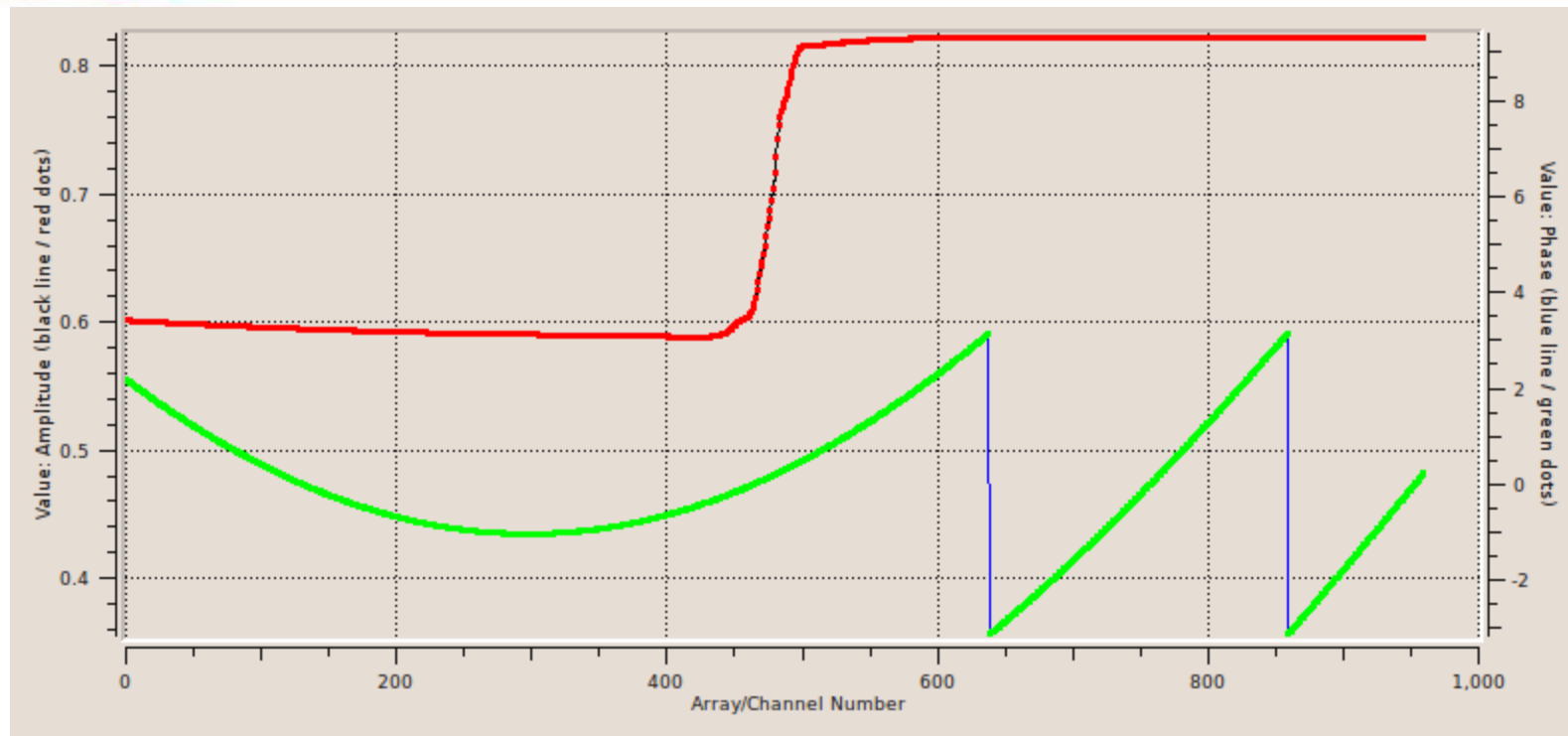


SKA 2010
Manchester, UK

NRC-HIA/DRAO SKA Activities

- Three SKA memos on polarization properties of simulated focal plane arrays completed.
- SKA memo describing pointing error simulations for a 3-axis (ASKAP-style) antenna underway.
- Also testing MeqTrees parallel processing
- Currently, investigating proposed optics for DVA-1 with Lindgren Feed
 - Need good antenna beam uniformity and symmetry have be very good for dynamic range $> 10^6 : 1$ without huge imaging computing burden.

Recent Simulation Result



Simulated visibility seen by an array of antennas (using a possible optics configuration) situated at the ASKAP site. A point source is offset 24 arcmin in direction cosine M from a field centre situated at -28 deg declination. The field was tracked from -4 to + 4 hours in hour angle.

Beam shape needs to be considered with Az El mounts in maximizing Aeff!