

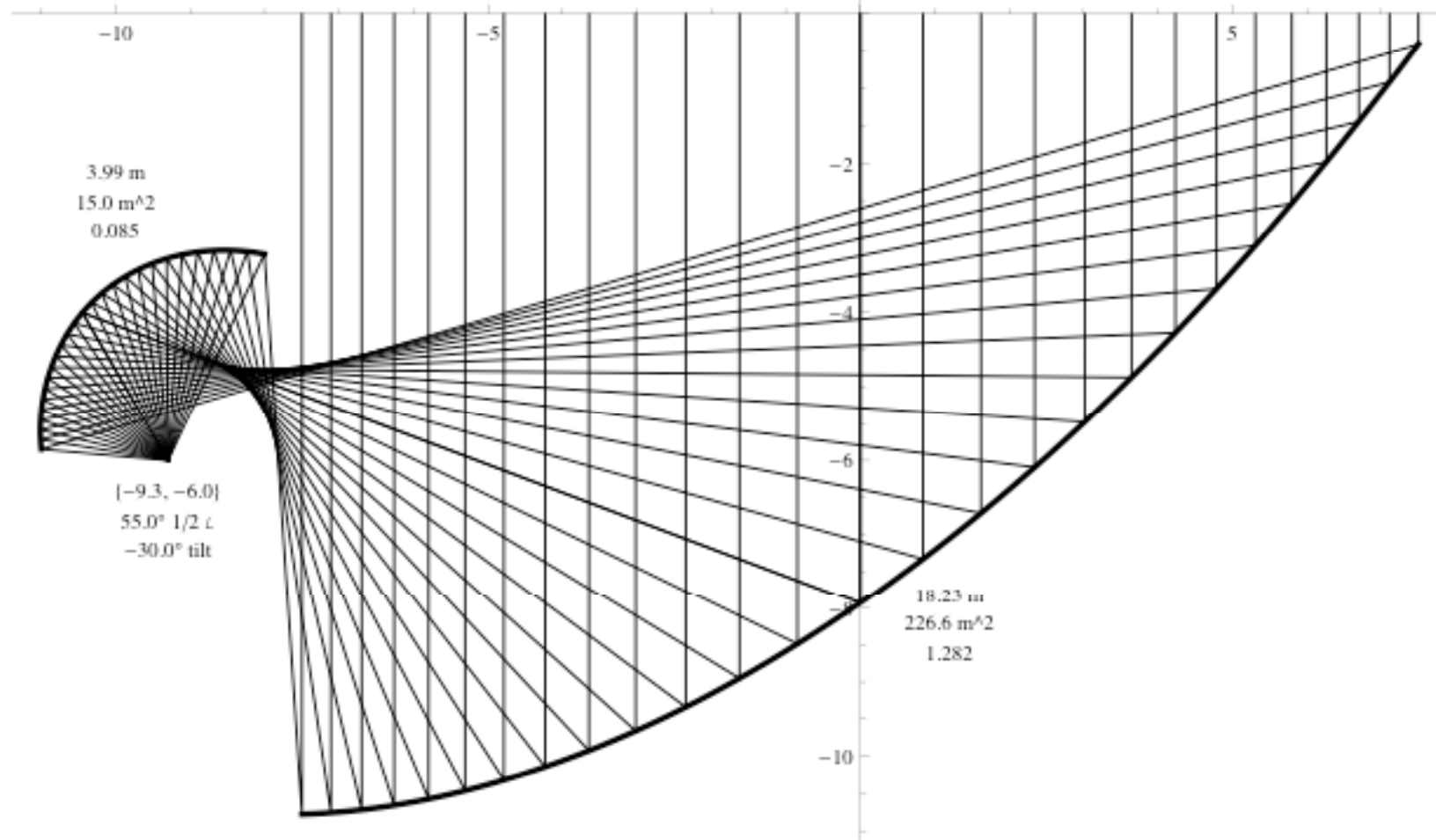


How Offset, Shaped Reflectors Meet SKA Requirements

Offset, Shaped Gregorian Optics



Reflector system cross section in the symmetry plane



Offset Reflector Antennas



- Optics Goals for SKA Reflector Antennas
 - High aperture efficiency
 - Low Noise Temperature
 - RFI Immunity
 - Low frequency performance (.3 GHz.)
 - Accommodation of Wide Band Feeds
 - Accommodation of a PAF
 - Ability to mount multiple feeds
 - Cost Effective in the System Wide Sense

Offset Reflector Antennas



- High Aperture Efficiency
 - Clear optical path, no blockage
 - Deep edge taper on secondary
 - Shaped optics gives desired aperture illumination (first sidelobe control)

Offset Reflector Antennas



- Low Noise Temperature
 - Clear optical path, no blockage
 - Deep edge taper on secondary
 - Shaped optics gives desired aperture illumination, deep edge taper on primary
 - Net result is very low spillover outside of the main beam area
- Same Features Produce RFI Immunity

Offset Reflector Antennas



- Low Frequency Performance
 - Electrically large secondary
 - No blockage in an offset configuration

Offset Reflector Antennas



- Accommodation Of Wide Band Feeds
 - Wide Bandwidth => Electrically Small
 - Electrically Small => Wide Angle Patterns
 - Gregorian Optics: up to 65 degrees half opening angle
 - Offset Gregorian Optics can accommodate wide band feeds
- Corrugated Horns Can Be Designed For Most Of This Angular Range

Offset Reflector Antennas



- Accommodation Of A Phased Array Feed
 - Opening angle of both secondary and primary matches array element patterns
 - Swing arm mechanism allows for primary illumination
 - Feed positioner allows for secondary illumination
 - Shaping blurs the primary focus, increasing the number of illuminated elements

Offset Reflector Antennas



- Multiple Feeds At Secondary Focus
 - Volume available for a feed interchange mechanism at secondary focus
 - No ray blockage from the mechanism
 - Support structure is integrated with the support for the secondary.

Offset Reflector Antennas



- Cost Effectiveness
 - Higher $A_{\text{eff}} / T_{\text{sys}}$ performance => fewer antennas
 - The number of antennas drives many aspects of system cost
 - Higher antenna cost may well reduce system cost

Offset Reflector Antennas



- Offset, Gregorian Antenna Costs
 - Large quantities supports investing in specialized tooling for each part
 - Large quantities negates the cost advantages of symmetric structures
 - Multiple cost studies indicate an offset premium of 5% to 10%.

Offset Reflector Antennas



Thank You