Luneburg Lens: Electromagnetic Design Options

What do we need to consider to do a design / evaluation:

- Material requirements
- Lens structure
- Constructional aspects
- Feed Systems
- Hierarchy
- Modelling and Design

Material Characteristics

- Low loss materials / loss profile
- Usable dielectric constant range
- Homogeneity
- Compatibility
  - varying density foams
  - loaded foams (artificial dielectrics etc.)

Lens Structure

- Layered Hemisphere
  - gradation and uniformity
  - airgaps and misalignments
  - deformations
  - obstructions
- Ground Plane
  - size and structure
  - discontinuities and imperfections

Constructional Aspects

- Effect of supporting structure
- Effect of feeds and feed network
- Effect of cabling and mechanical control
- Effect of multiple lenses in a station

  – scattering and blockage effects
  – beam / sidelobe structure
  – realistic coverage envelope

Feed Systems

Wide band line feeds

Line feed arrays (phased / BFN ?)

- band segments - wideband array design?
- polarisation
- imaging

Multibeaming - multiple line feeds

Spot beams (calibration, interference rejection etc.)

Hierarchy

- Number of lenses per station
- Number of independent beams / feeds
  - blockage limitation
- System design
  - optics
  - antenna array and elements
  - electronics
  - sampling
  - fibre-optic data links

Modelling and Design

Size of problem space for lens modelling

- resolution to 2 GHz for cell size (eg. FDTD)
- 0.5 cm resolution = 4×10^9 storage

Feed array and antenna element design

Ground plane and structural simulation

- approximation techniques