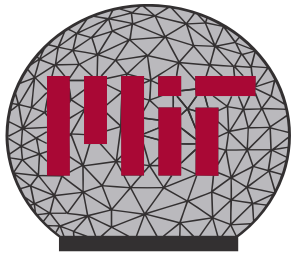


Looking Inwards:

Holographic Imaging of Parabolic Antenna Apertures

Rachel Nancollas

Advisors: Chris Beaudoin

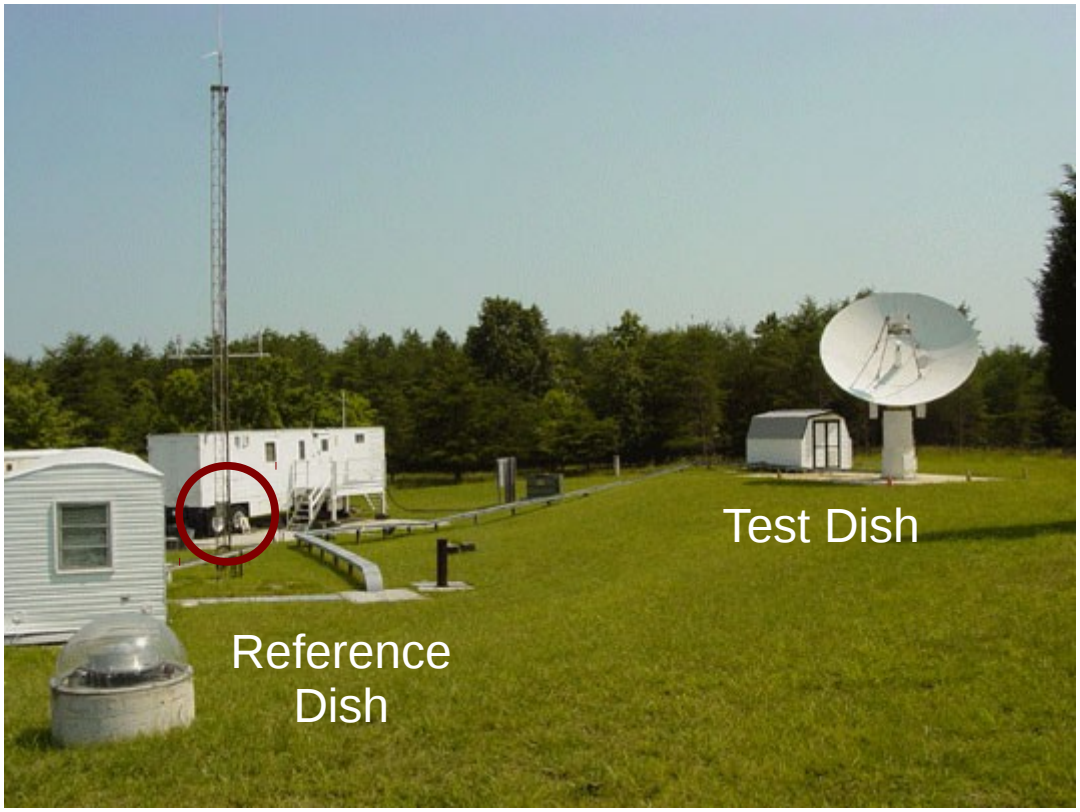
& Arthur Niell

The Story Unfolds...

- Objectives
- Data Collection
- Data Processing
- Imaging Results
- Future Work

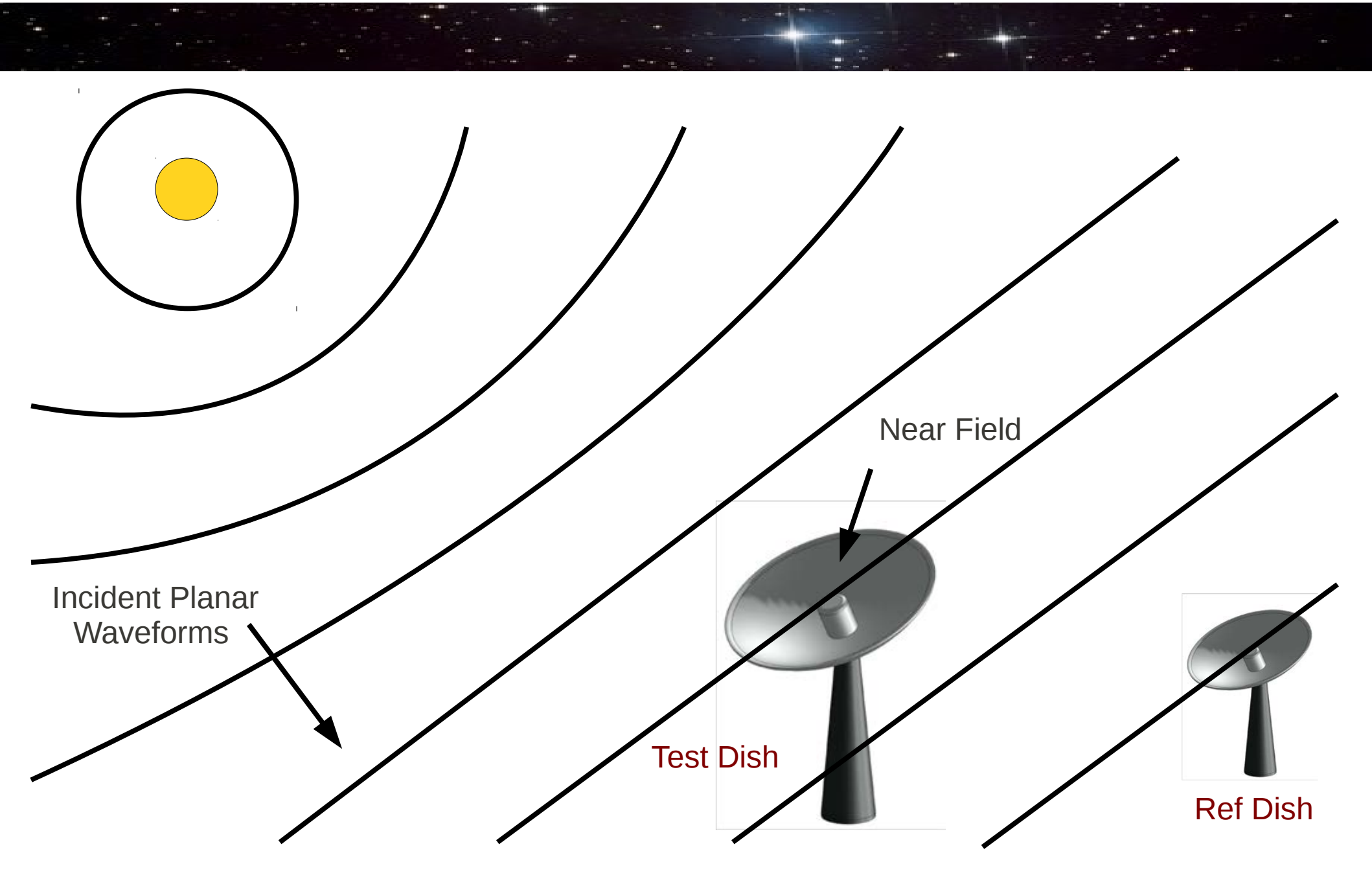
Imaging Objectives

- Develop software for creating holographic images of antenna apertures
- Analyze MV3 (5 meter dish at GGAO)
- Use software on the new 12 meter dish at GGAO
- Allows us to diagnose problems

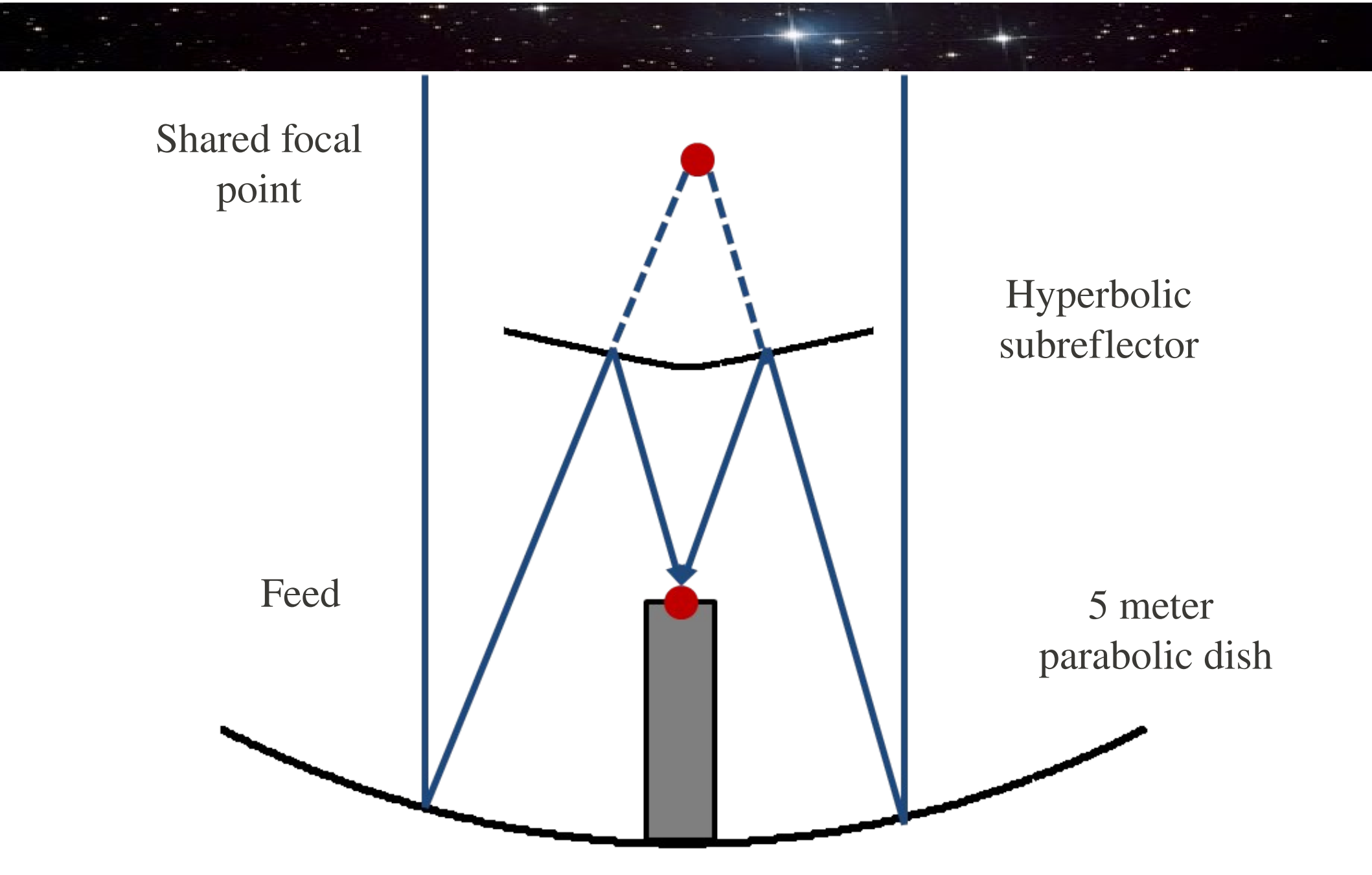


http://cddis.gsfc.nasa.gov/ggao/photos/images/vlbi_ggaovlbi_jpg.jpg

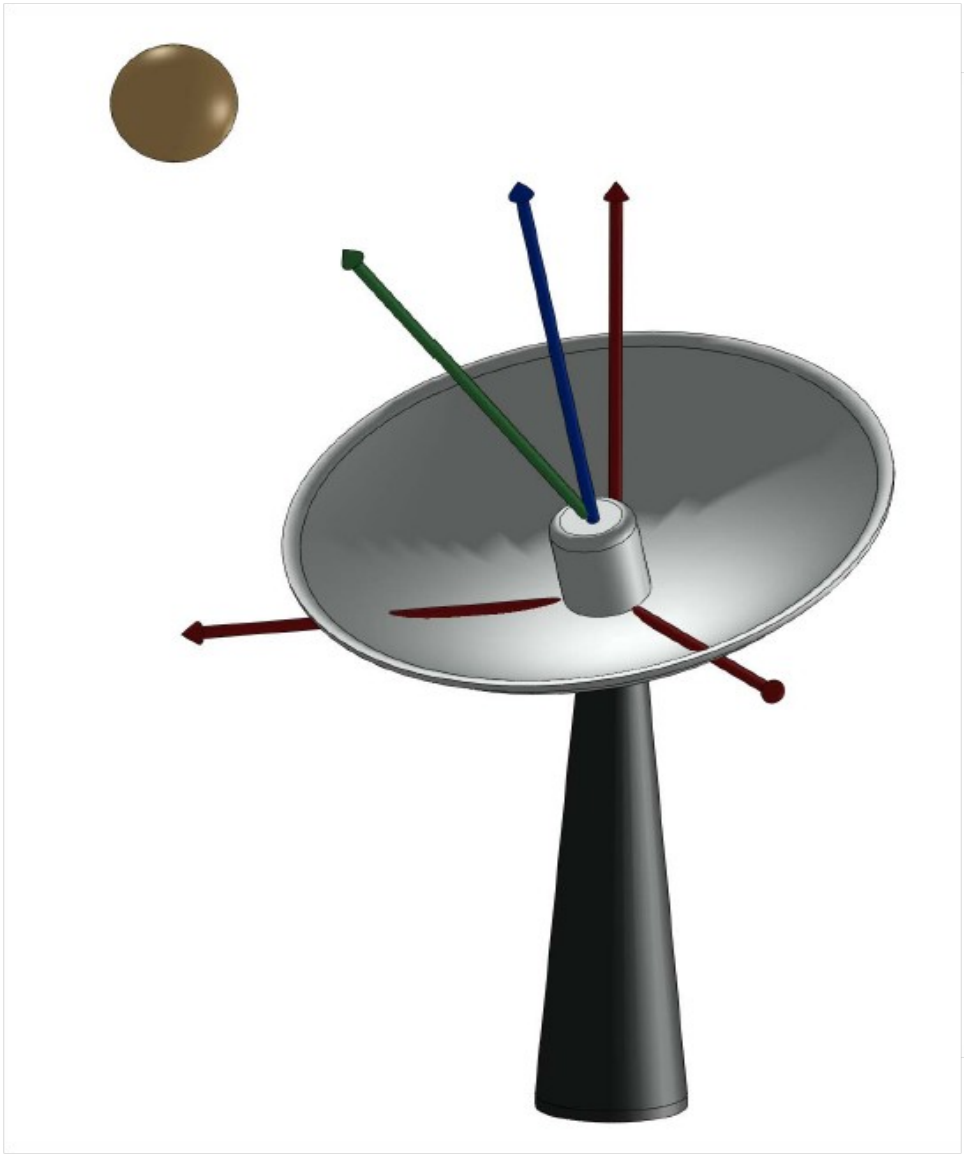
Data Collection: Antenna Orientation

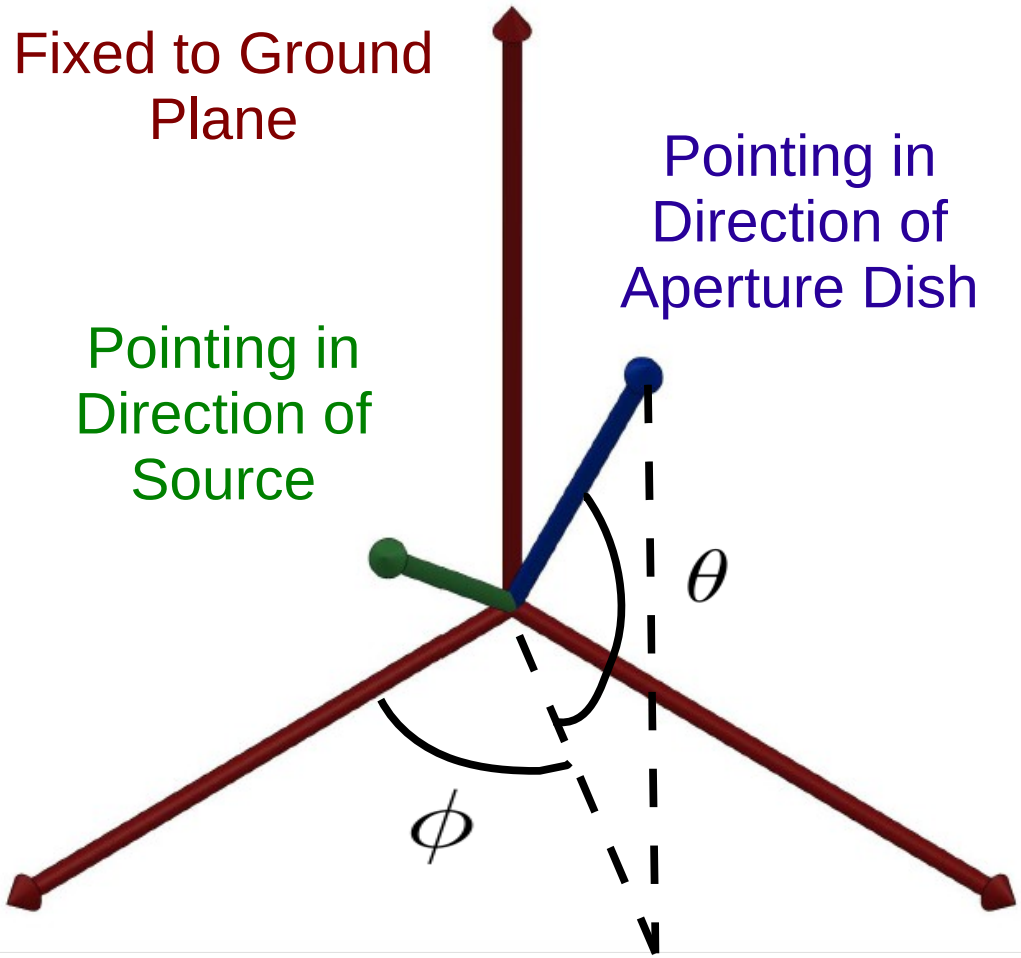


Data Collection: Optics

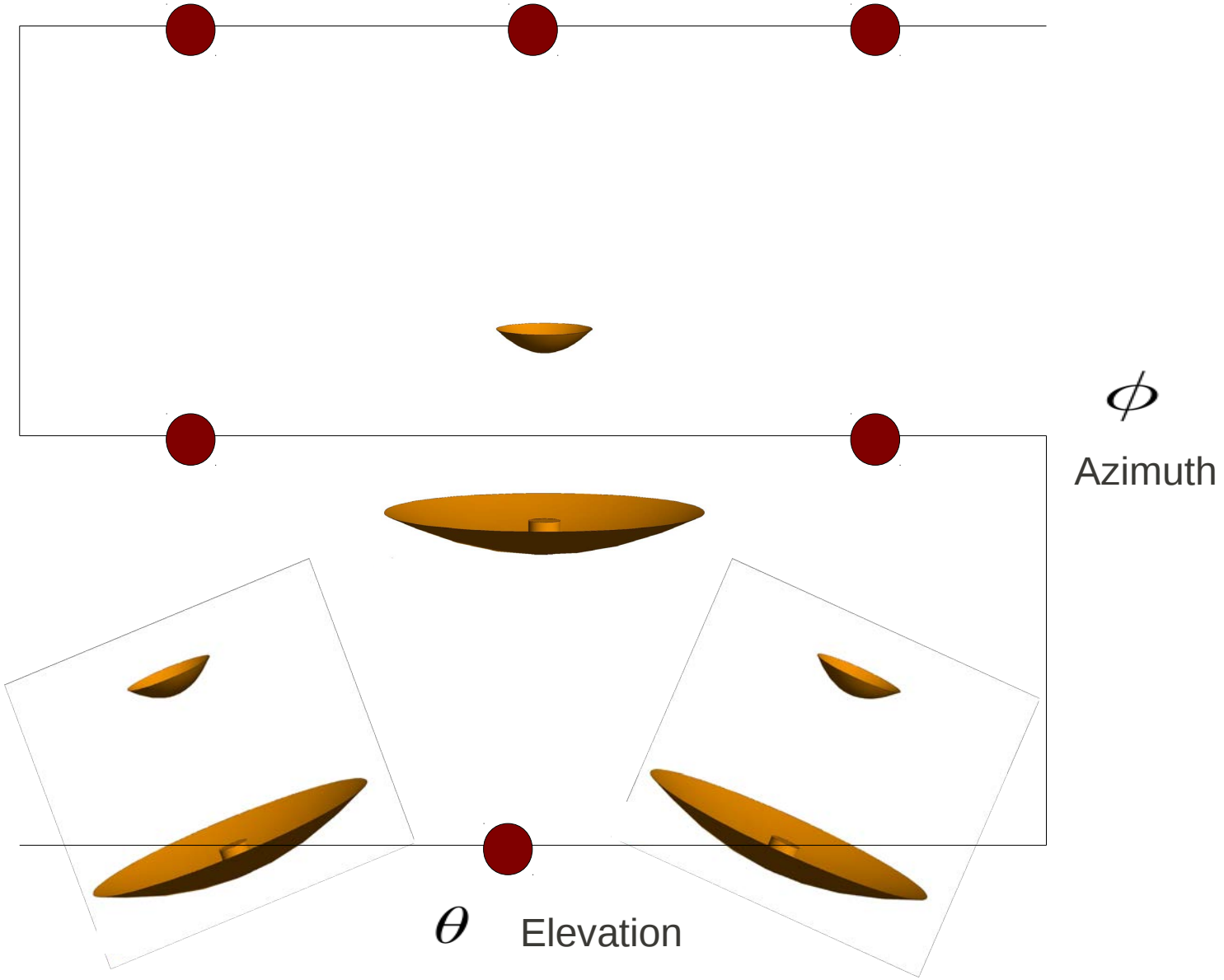


Data Collection: Coordinate Systems

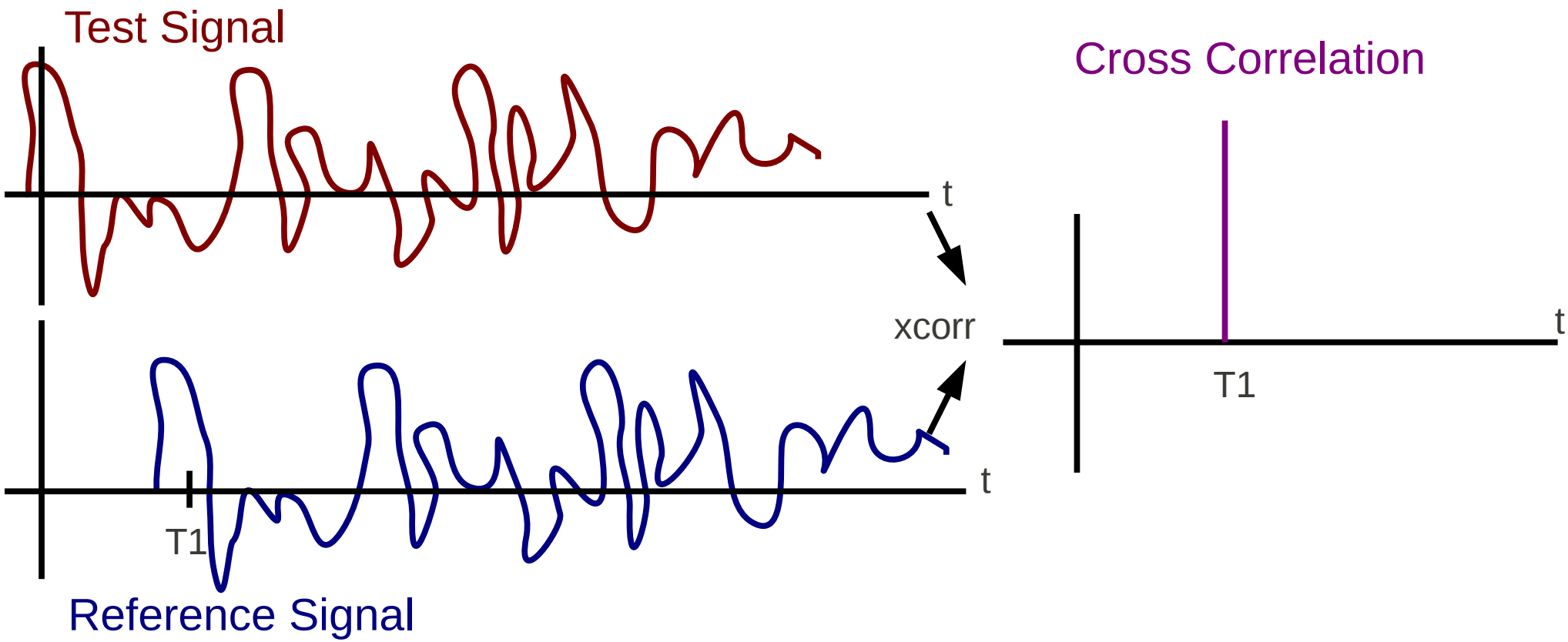




Data Collection: Raster Scan

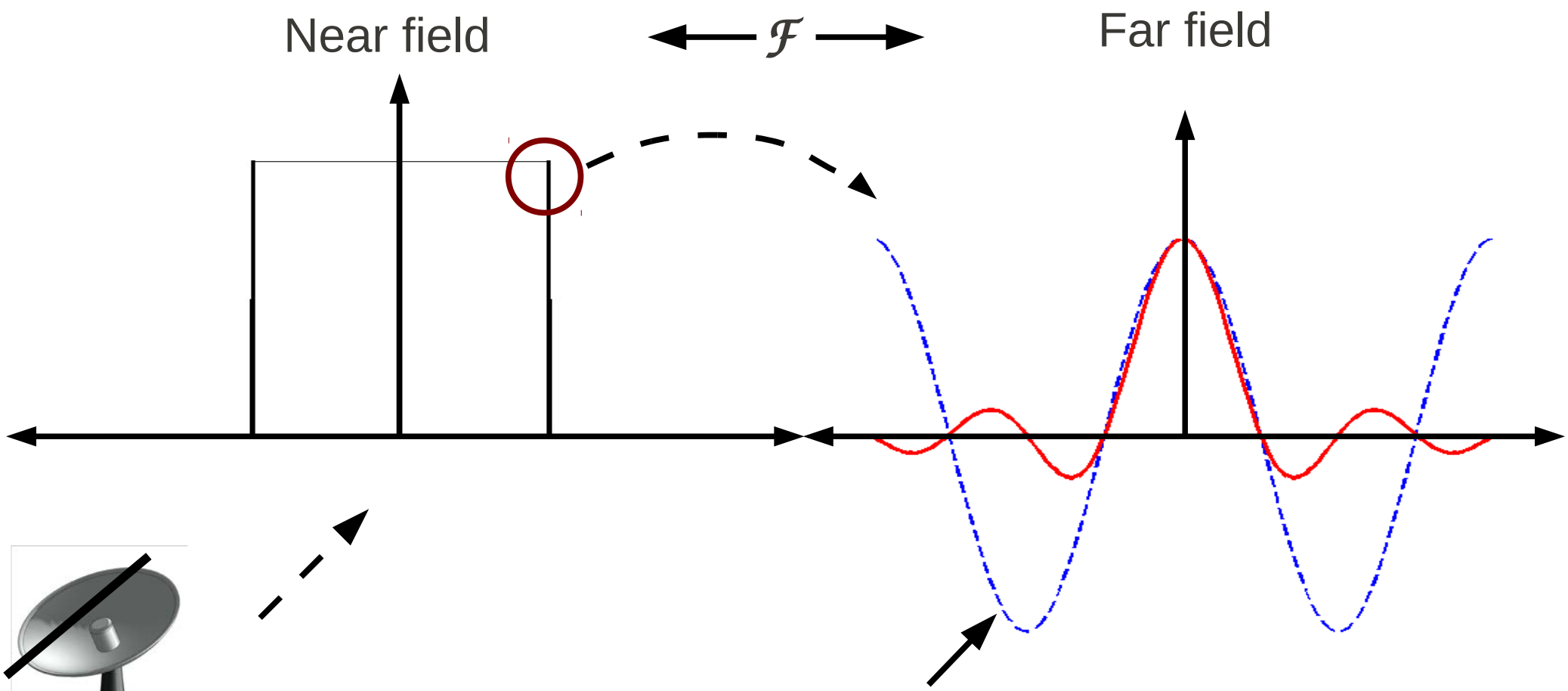


Data Processing: Cross Correlation

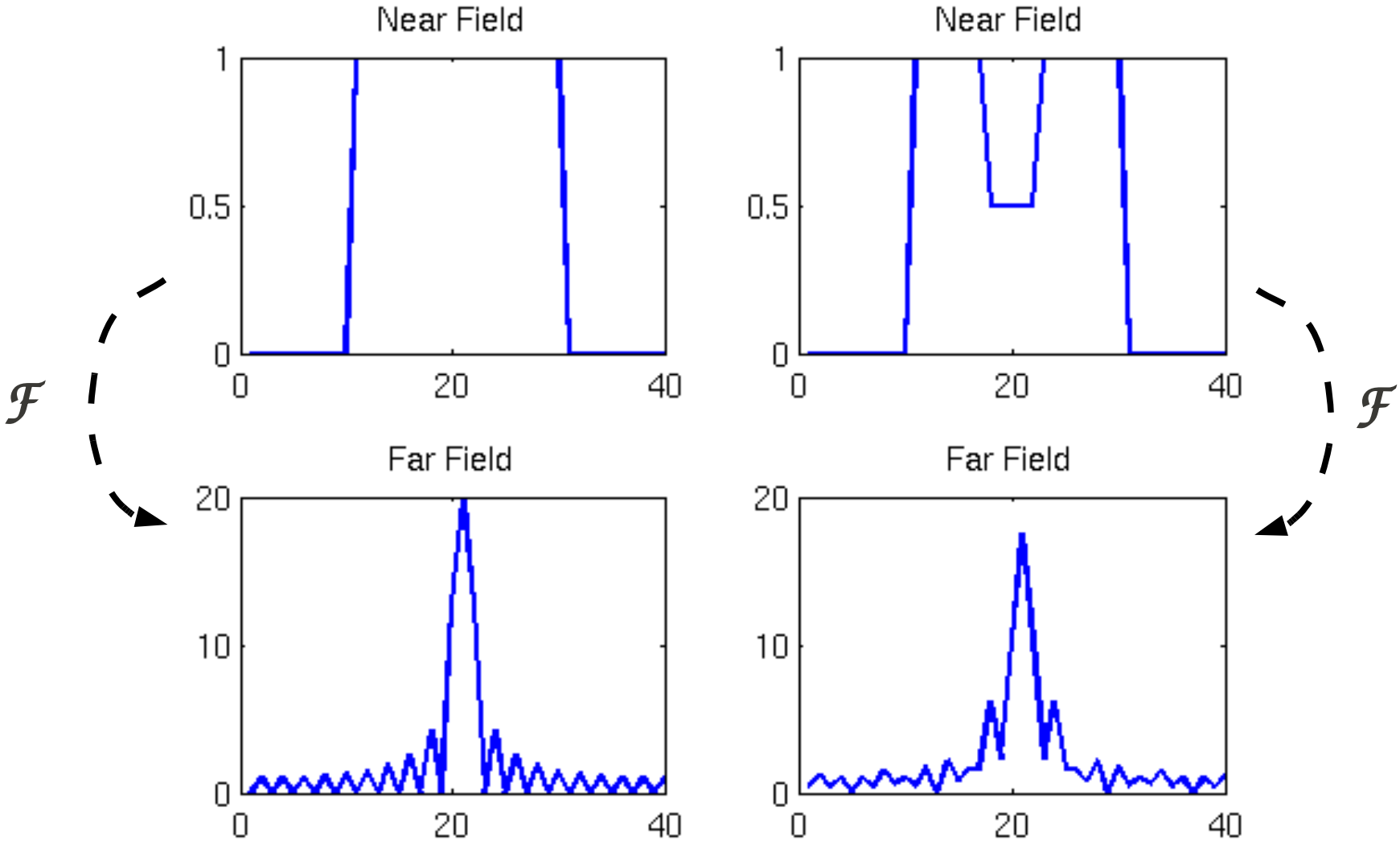


- Phase of one antenna is meaningless
- Need a second antenna to provide a reference point

Data Processing: 1-D Fourier Transform

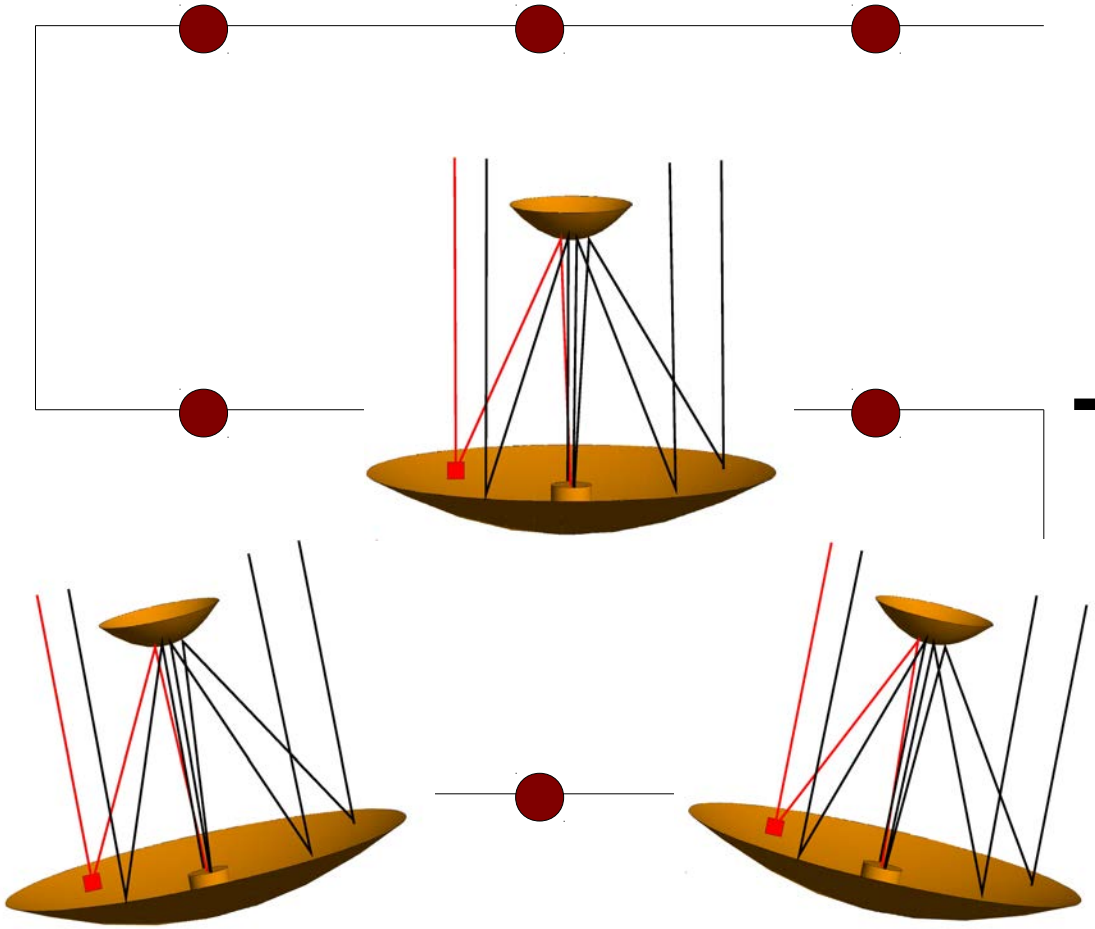


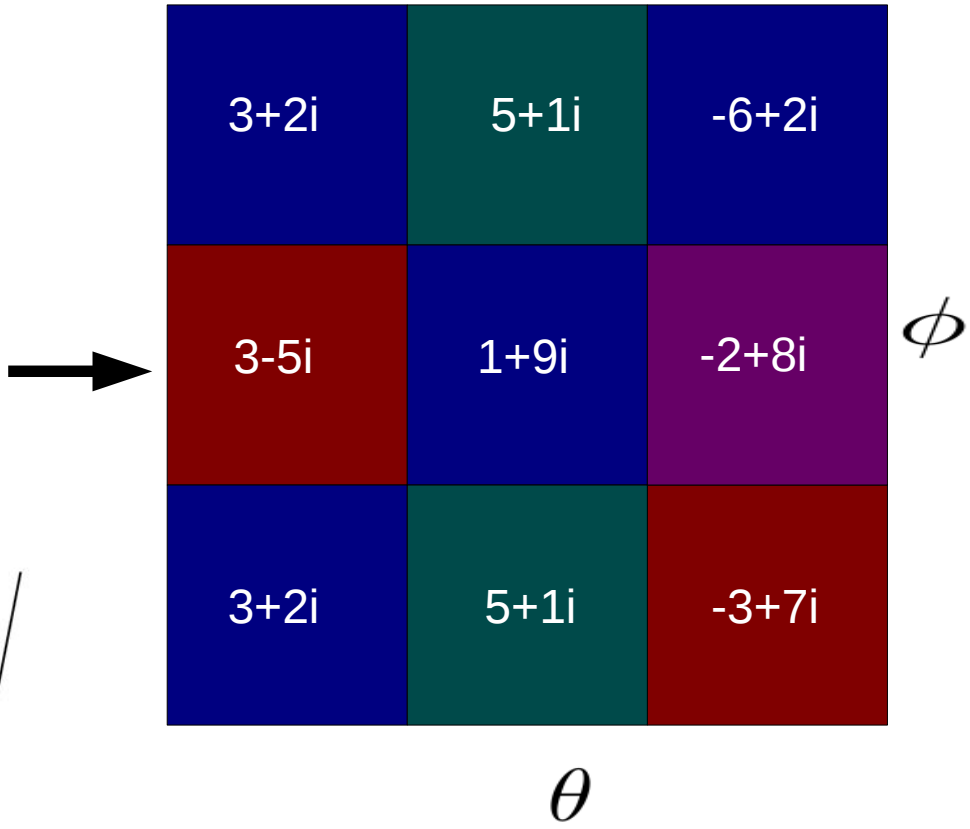
Results: Antenna Sensitivity



Data Processing: 2-D Fourier Transform

Far Field





Data Processing: 2-D Fourier Transform

Far Field

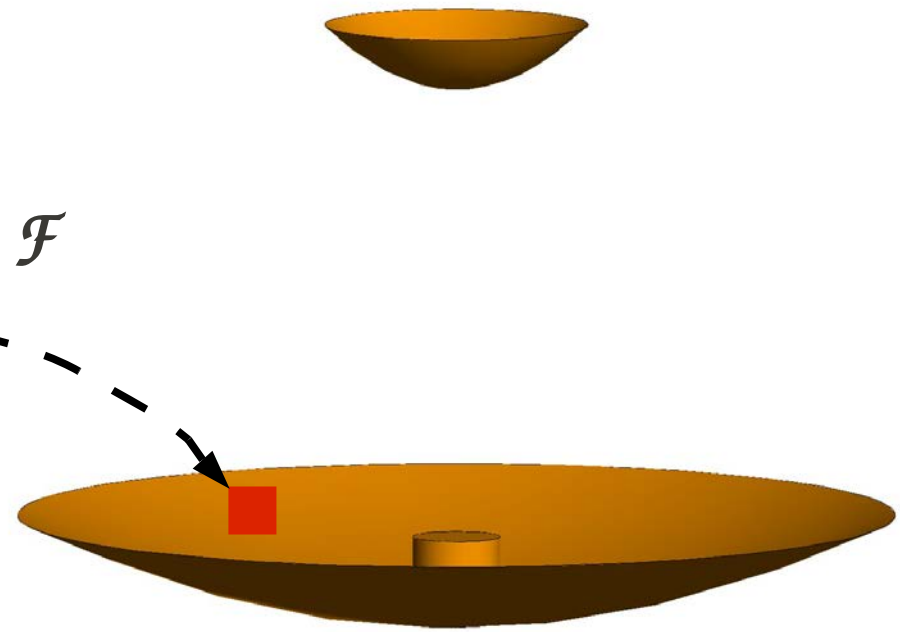
3+2i	5+1i	-6+2i
3-5i	1+9i	-2+8i
3+2i	5+1i	-3+7i

ϕ

θ

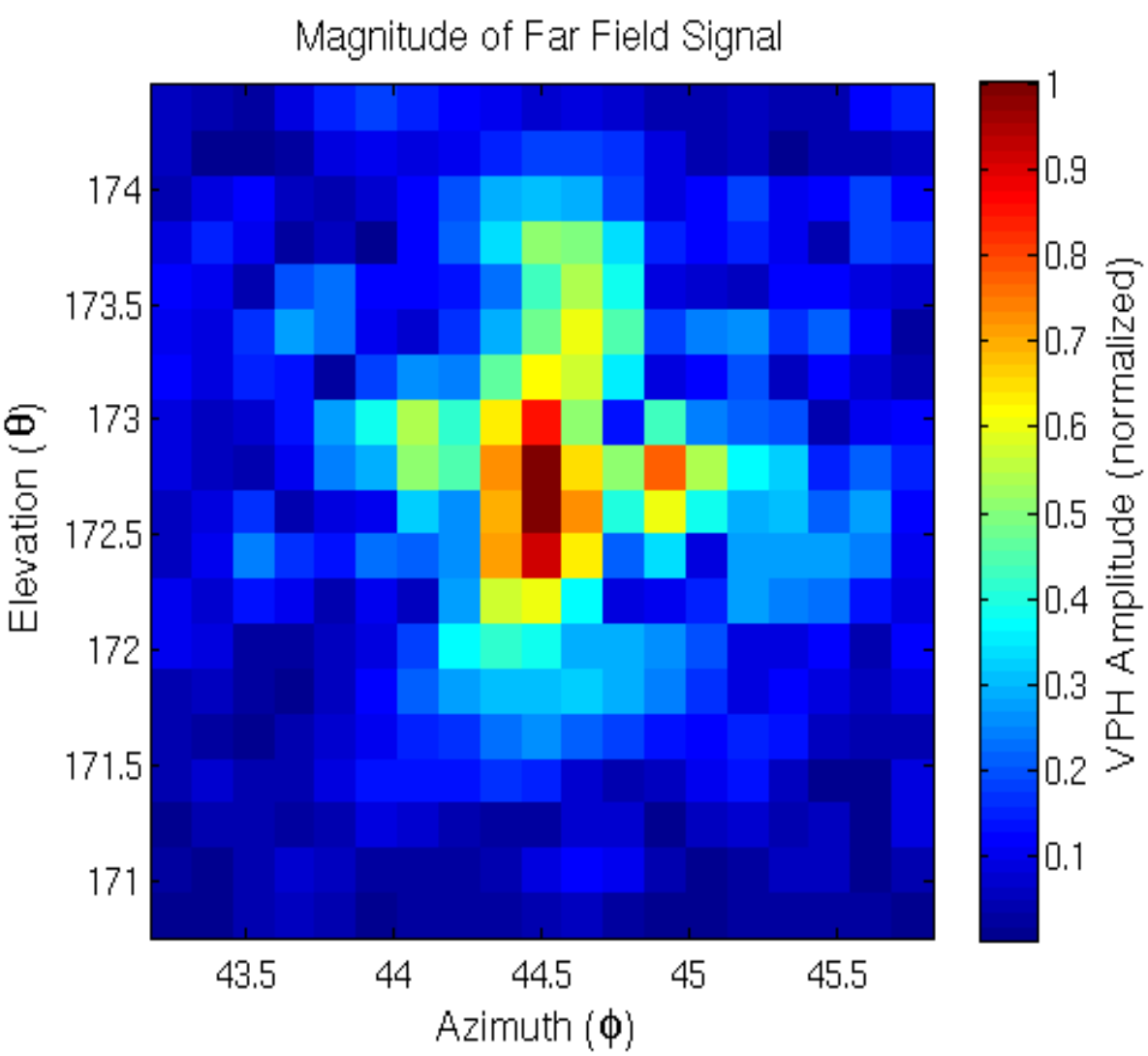
$\mathcal{F}$

Near Field



- Aperture is the superposition of the differential far field elements
- Use 2D-FT to reconstruct the near field

Results: Far Field



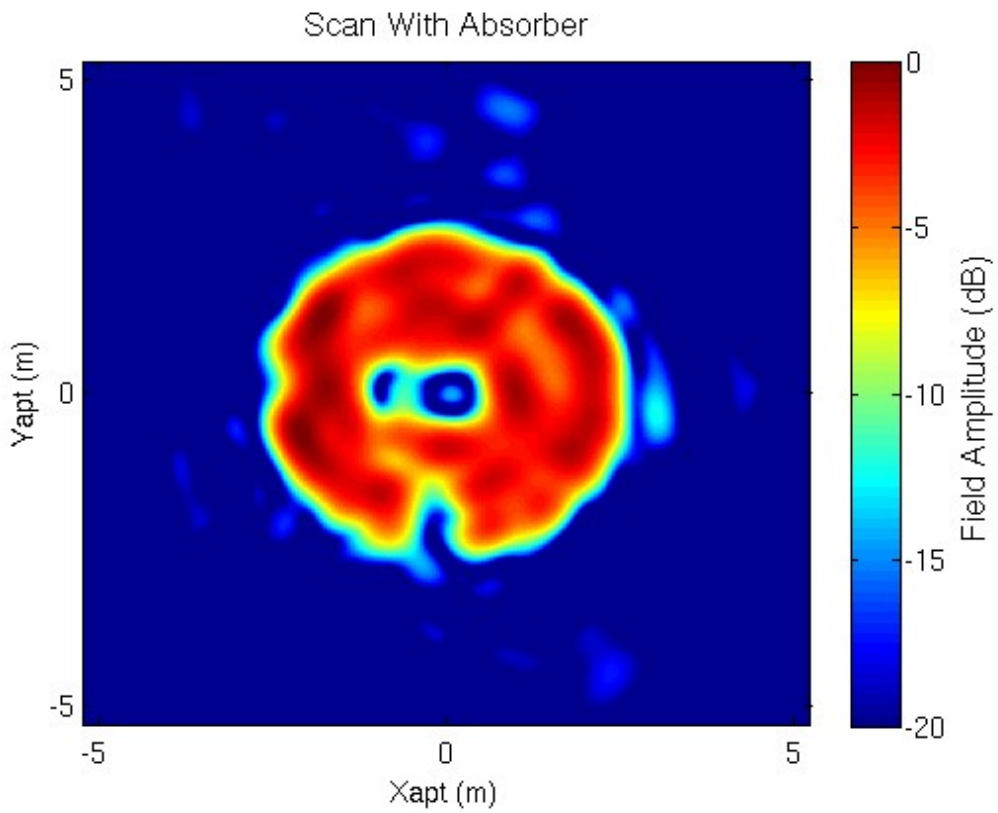
- Azimuth range = 3.51 deg
- Azimuth resolution = .195 deg

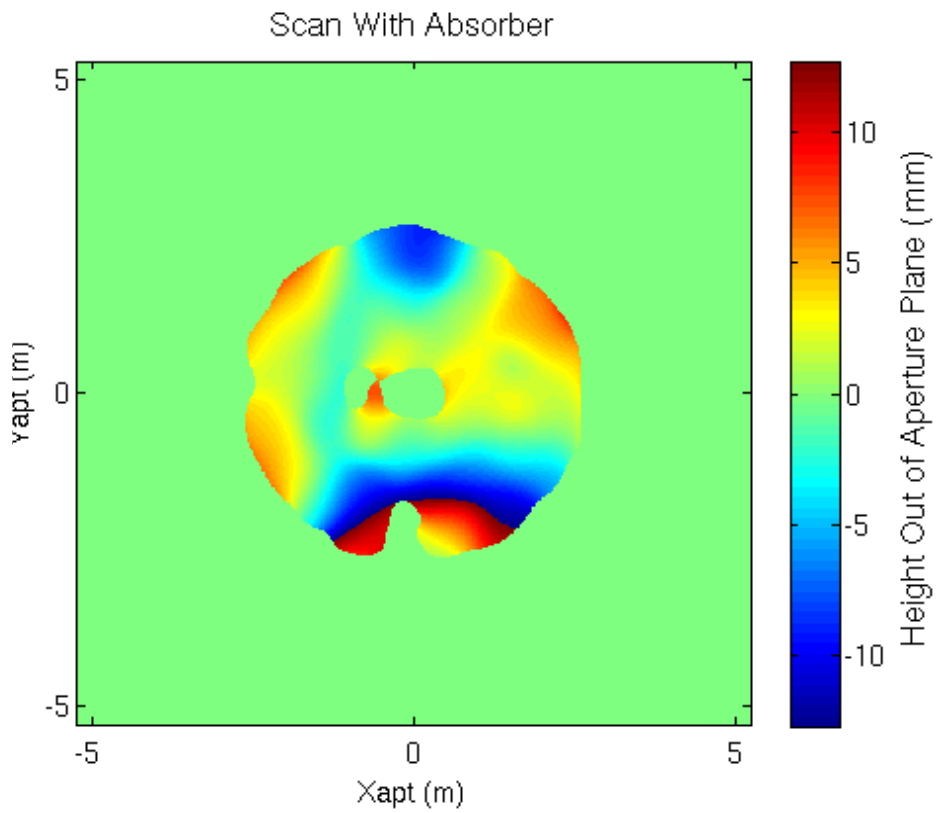
- Elevation range = 2.5 deg
- Elevation resolution = .139 deg

- X range = 10.47 m
- X resolution = .583 m

- Y range = 10.56 m
- Y resolution = .580 m

Results: Near Field





Future Work

- Use holographic imaging software to image the NEW 12 meter dish at GGAO
- Design a new subreflector for MV3

Thanks to...

- Chris Beaudoin
- Arthur Niell
- Rich Crowley
- Jason SooHoo
- Jay Redmond
- Haystack
- NSF
- GGAO