Fabrication, Assembly, and First Measurements of a New Facility to Characterize Optical Elements for Observing the Cosmic Microwave Background

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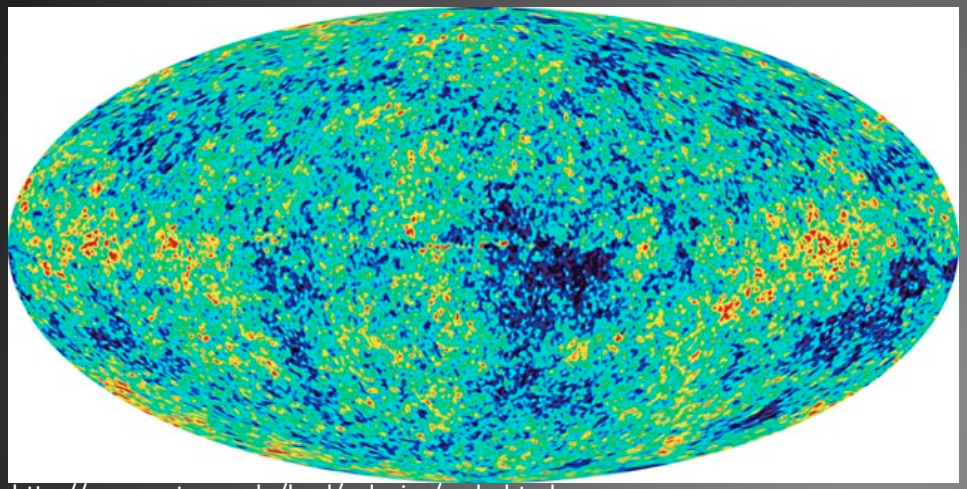
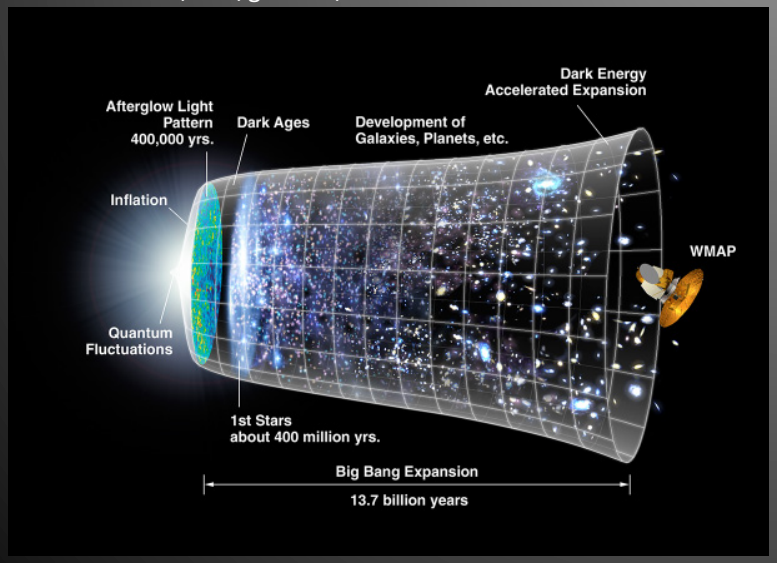
The Cosmic Microwave Background



http://www.astr.ua.edu/keel/galaxies/cmbr.html

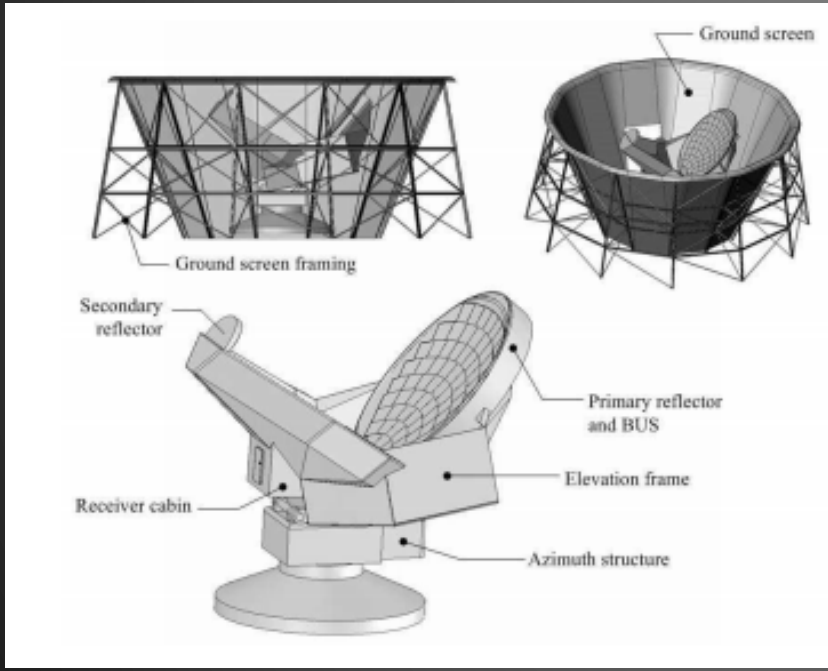


http://www.nasa.gov/vision/universe/starsgalaxies/wmap_pol.html

- Radiation left from Big Bang
- Roughly 2.7K in all directions
- Small temperature fluctuations

Goals of ACTPol

(Atacama Cosmology Telescope)

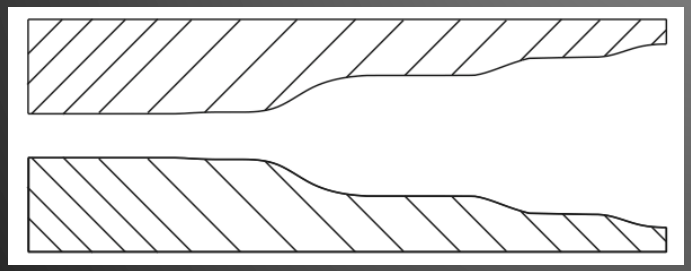


http://arxiv.org/pdf/astro-ph/0701020.pdf

- Orientation of polarization
- Multiple frequency pixels
- Learn more about expansion of the universe, neutrino masses, and the nature of dark matter and dark energy

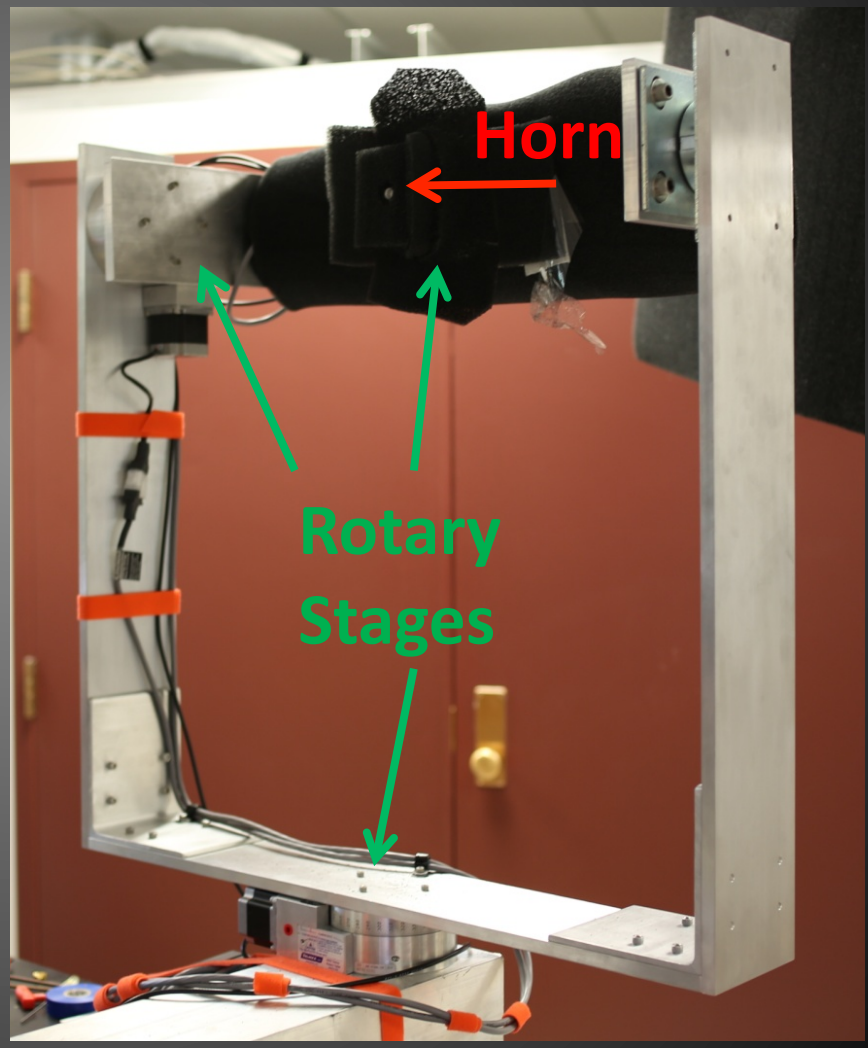
Beam Mapping

- Diffraction Pattern
- Polarization Coupling
- Interpretation of data from the telescope

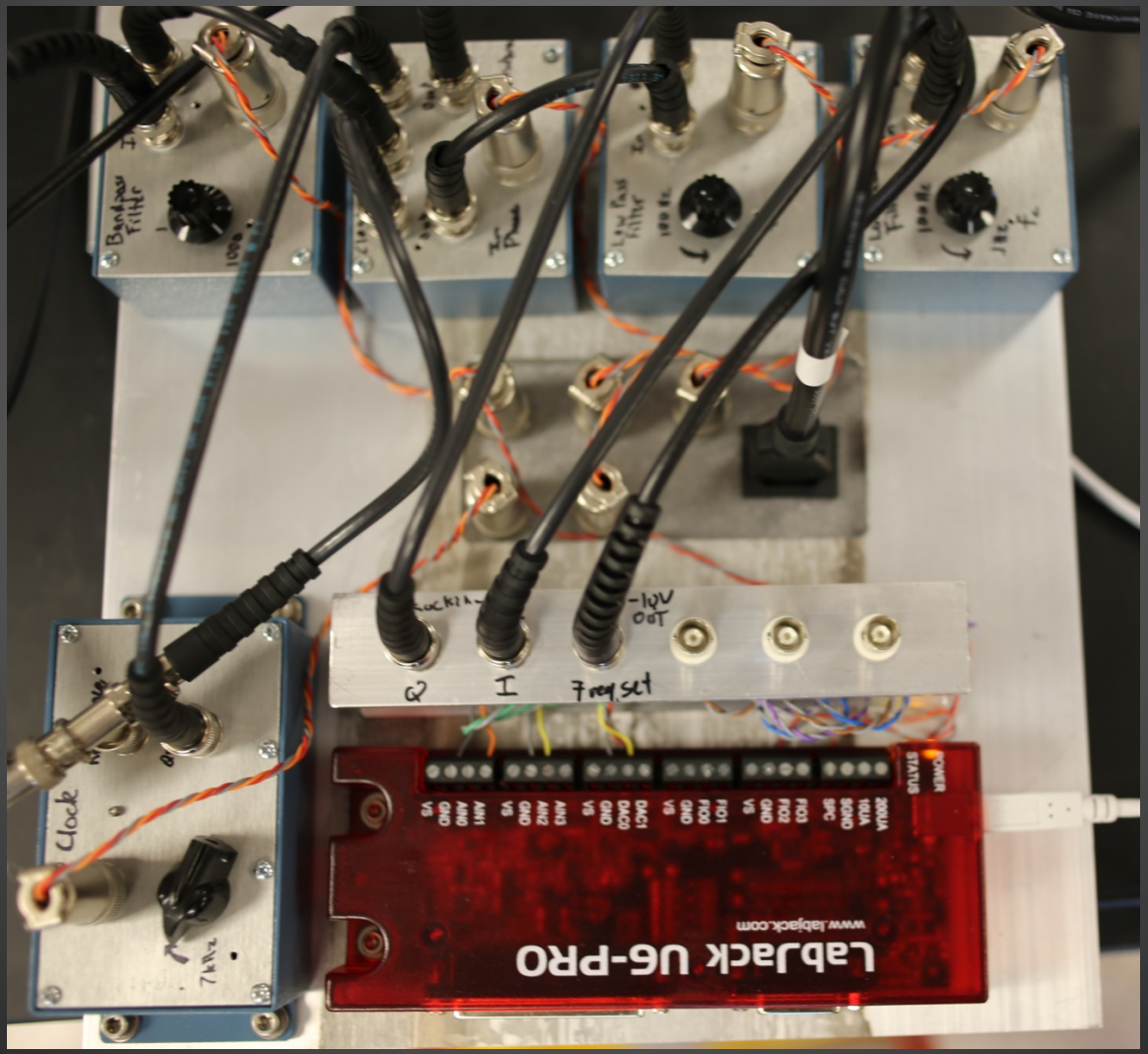


Horn Mount

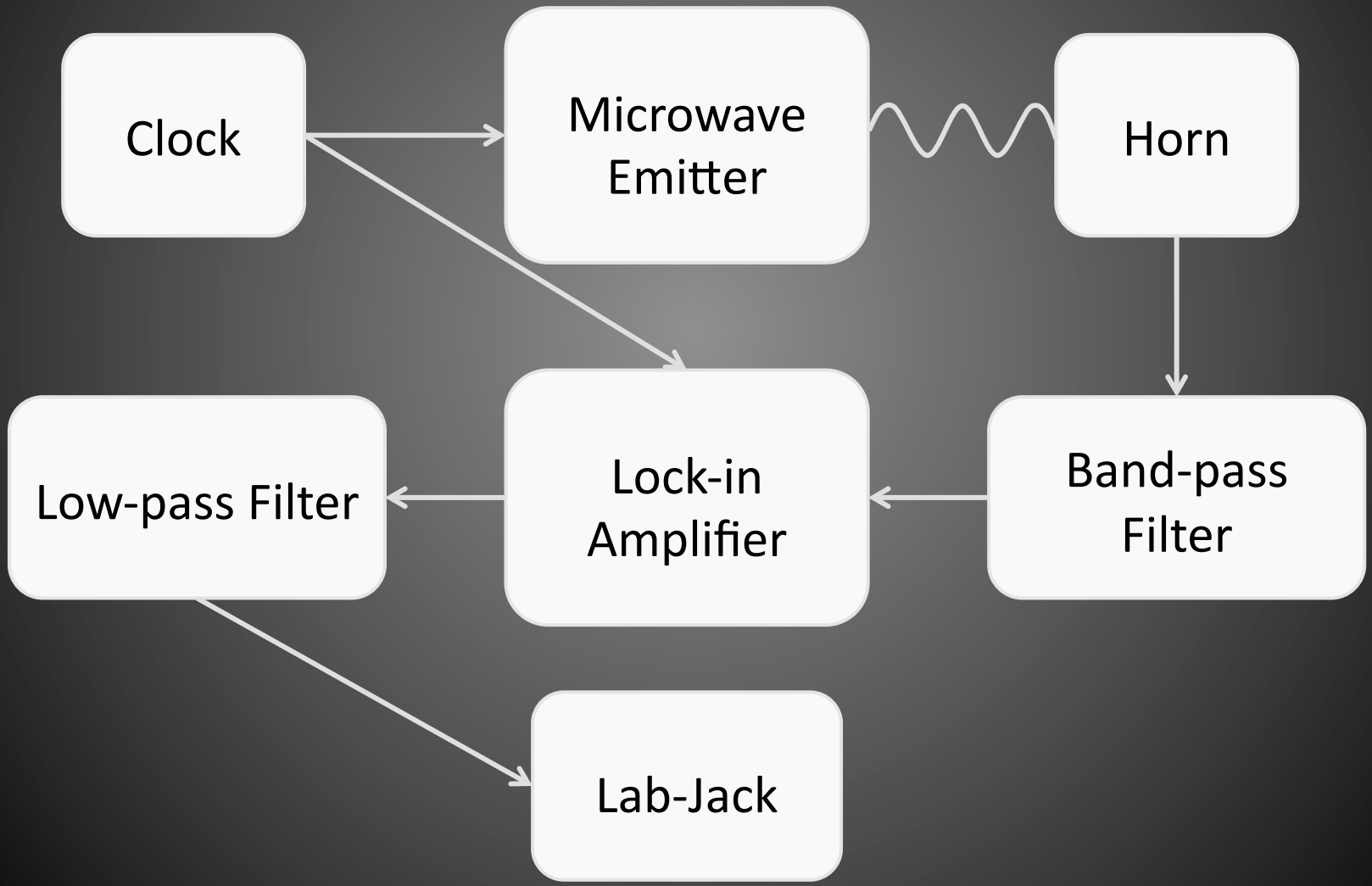
- Large design
- Microwave absorbing foam
- Three axes of rotation
- Front of horn located on axes of rotation



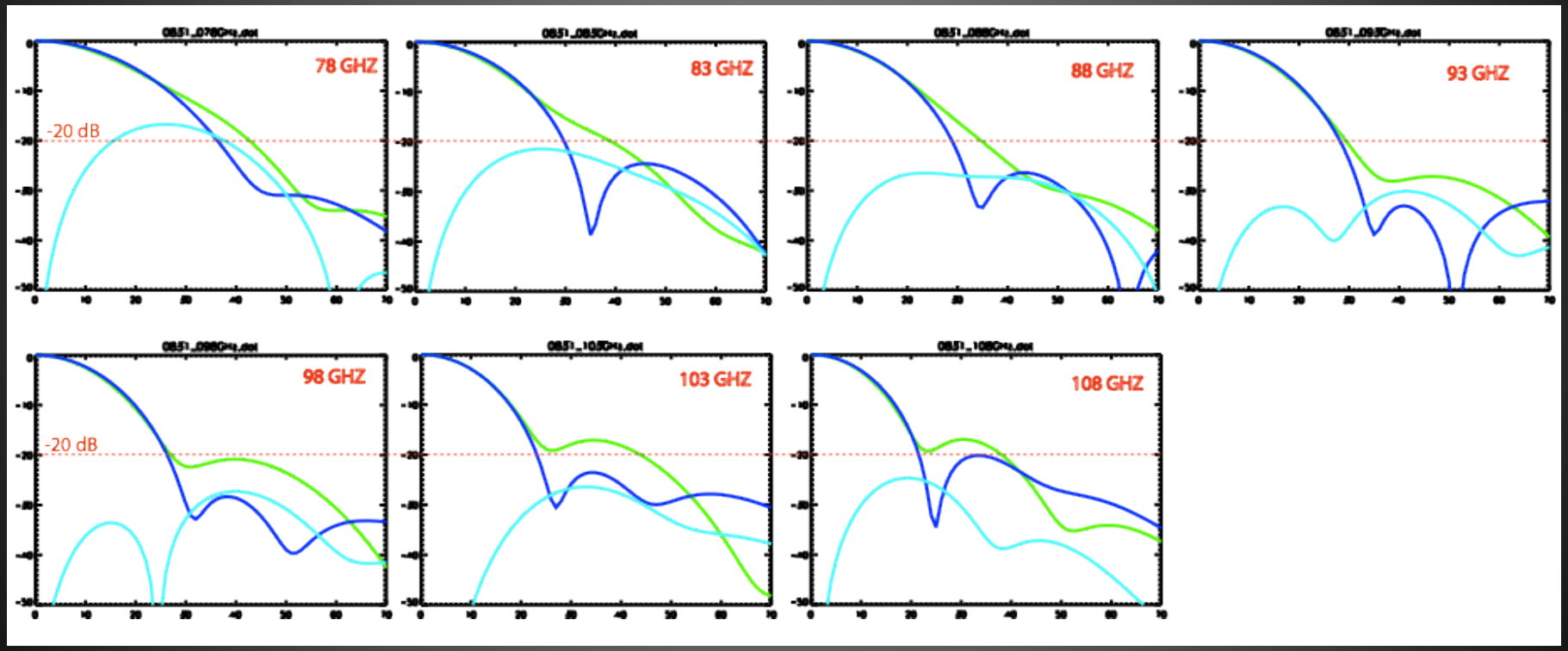
Circuit Plate



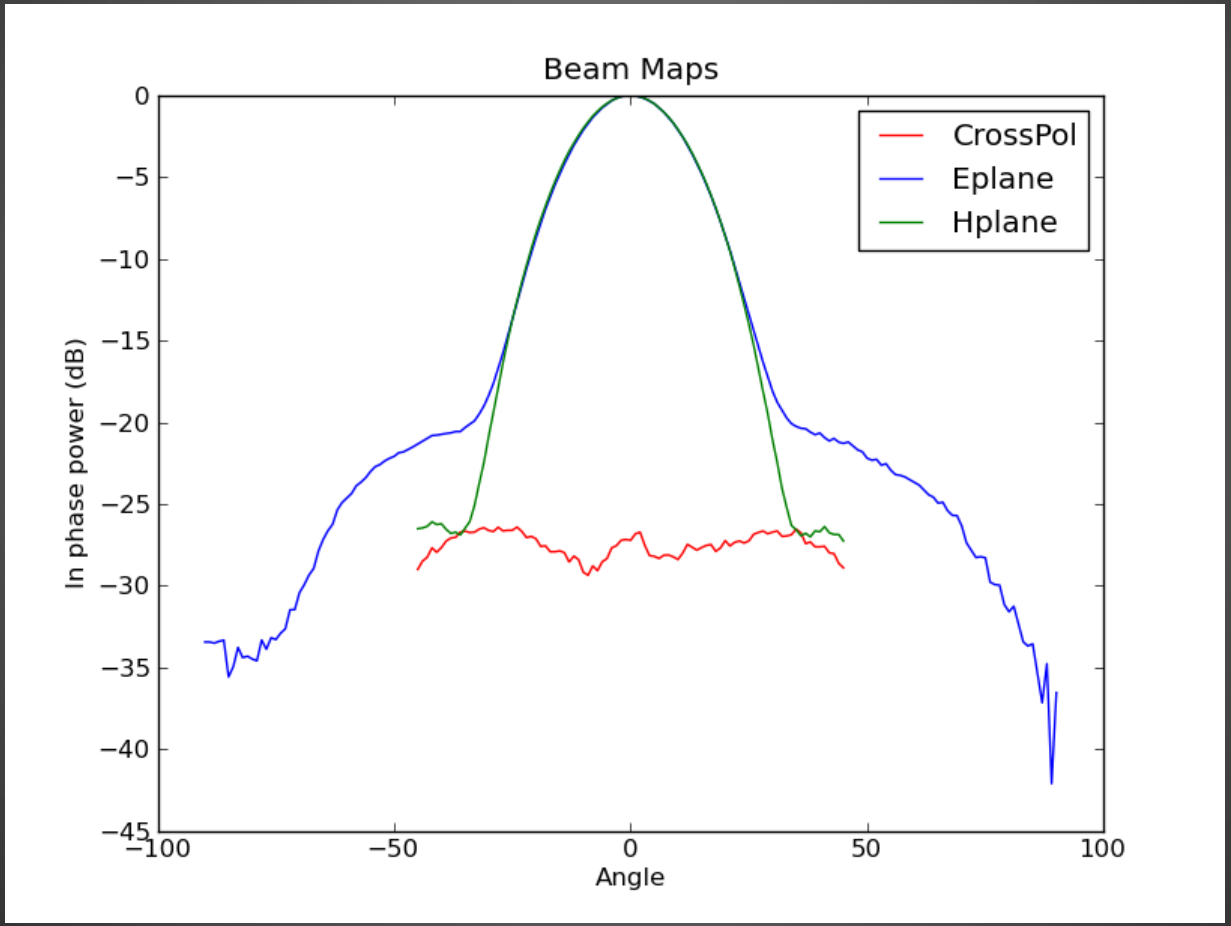
Circuit Setup



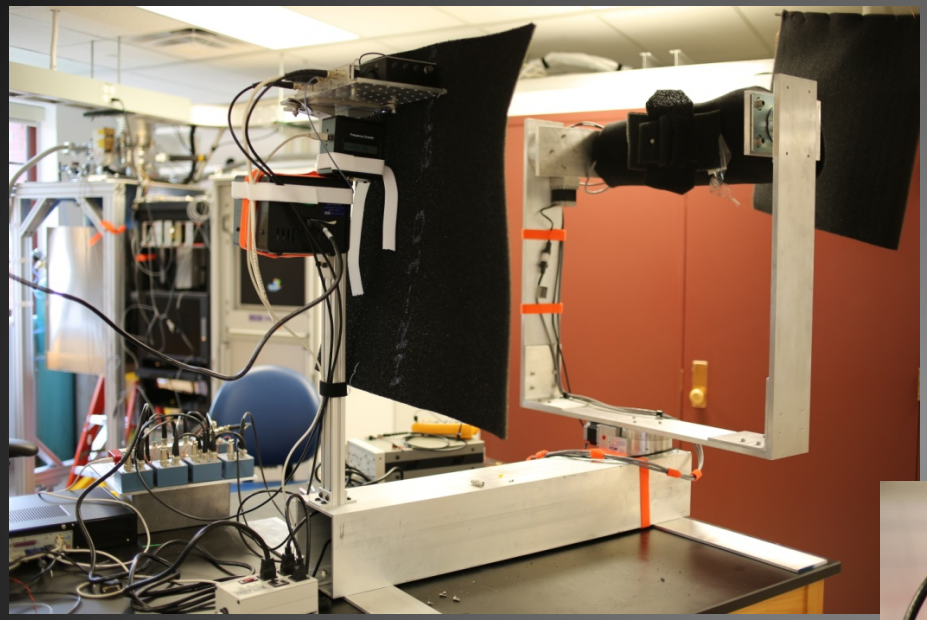
Modeled Data



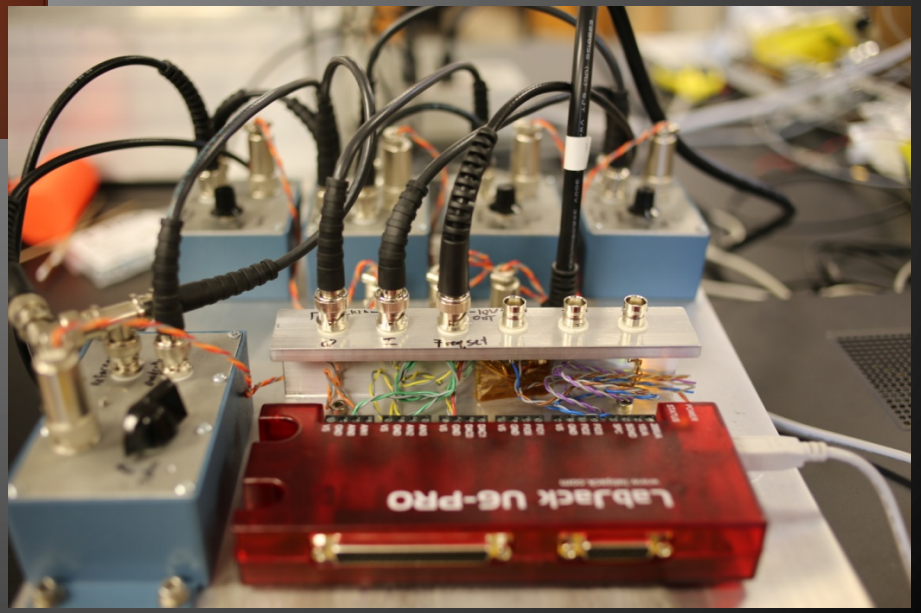
Results


Beam Maps
CrossPol
Eplane
Hplane
In phase power (dB)
Angle
0
−5
−10
−15
−20
−25
−30
−35
−40
−45
−100
−50
0
50
100

Future Work



- Can be kept in the lab and used to test new horns



- Continue to reduce reflections and improve computer coding

Acknowledgements

- Dr. Jeff McMahon
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- University of Michigan Physics
- NSF

Questions?