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Reducing Cost & Schedule Risk Through Advanced EM Simulation: A Phased Array Radome Case Study

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Nullspace, Inc.

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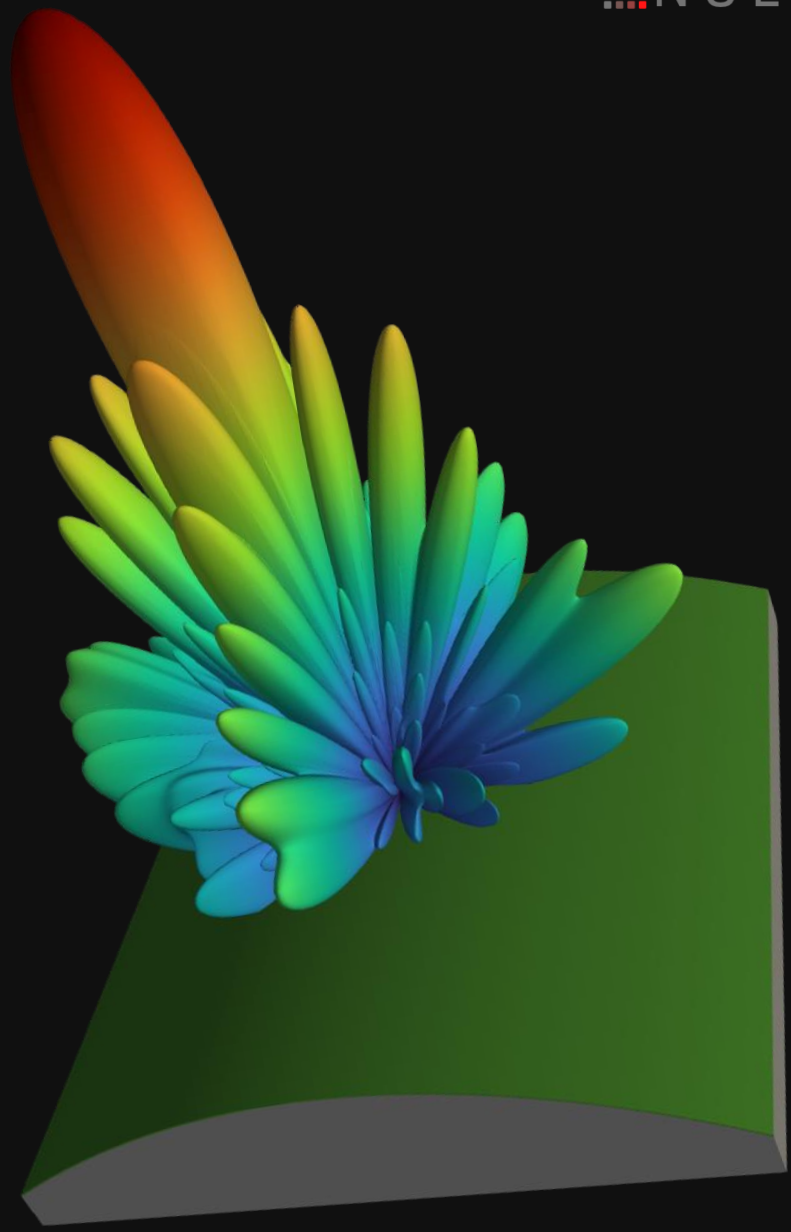
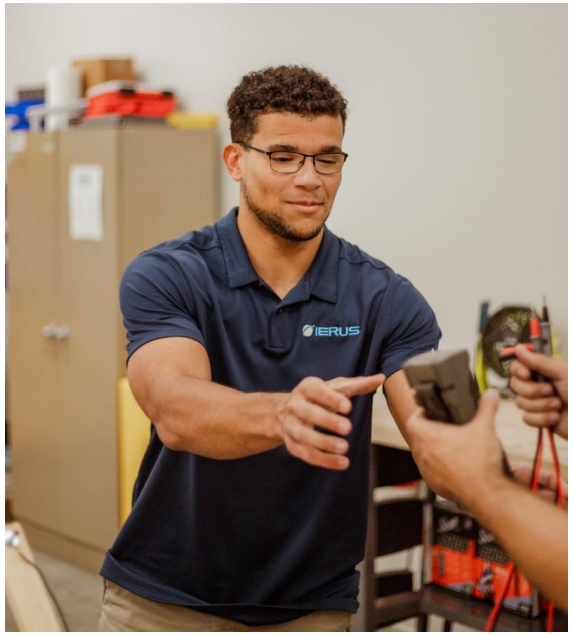
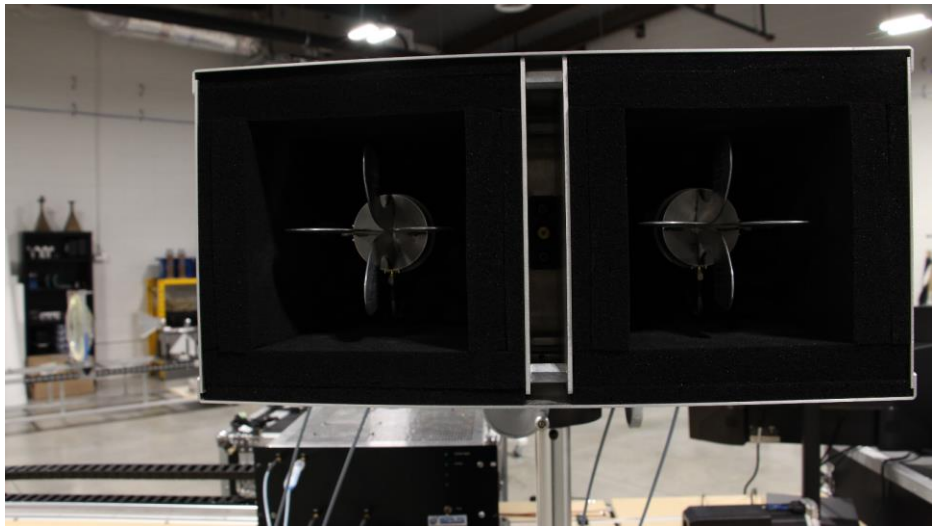


About Nullspace, Inc.

Spun out of IERUS Technologies, an established Huntsville-based defense contractor





Nullspace software validated with real-world applications and products for 10+ years

Our Products

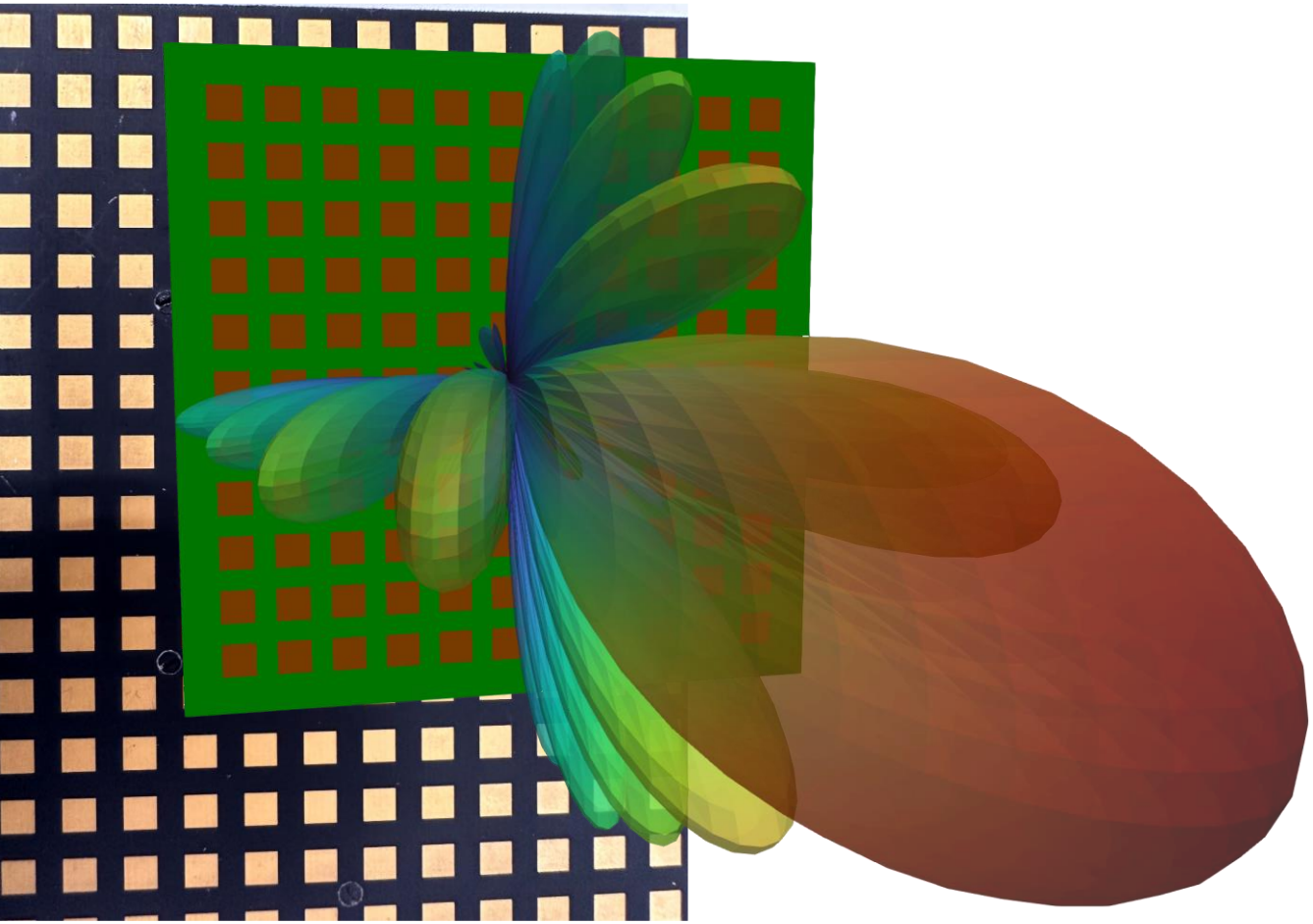
Nullspace Prep

- CAD and meshing pre-processor
- User-friendly GUI
- Import/Export many formats
- Powerful Python API

Nullspace EM

- Fast, accurate, 3D electromagnetic simulation software
- Designed for speed and accuracy of large optimization problems
- Robust, validated solver technology

Solving Large Problems … Accurately



- **Electrically large simulations** with many excitations – Phased arrays, scattering, co-site, etc.
- Available solutions are expensive and inaccurate for large problems
- With **Nullspace EM**, run much larger simulations **accurately and efficiently**

Why Accuracy Matters

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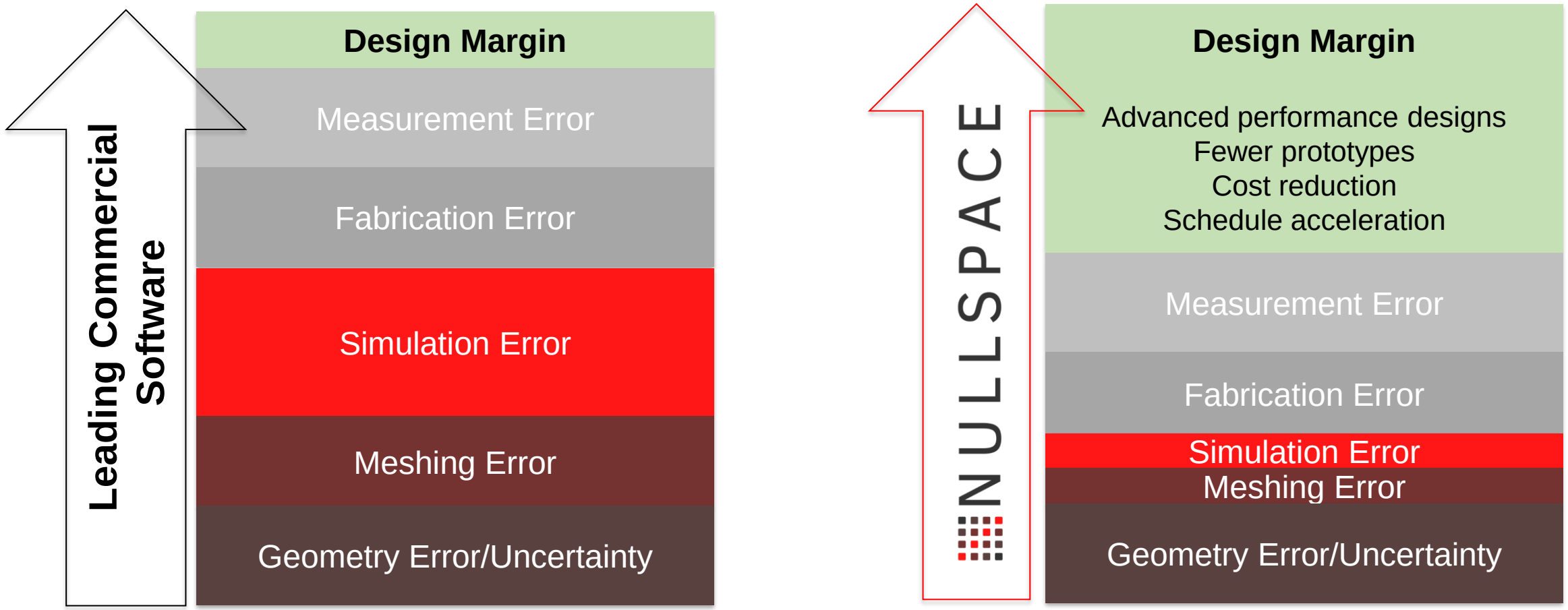
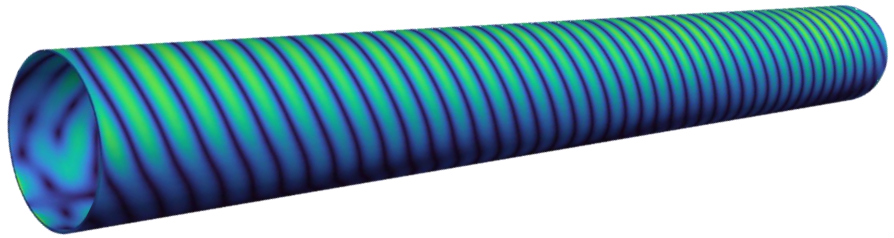
Error build-up for a typical design process – 2-5X Error Reduction



Why Speed Matters

Actual time comparison for a challenging, large-scale EM simulation



Leading Commercial Software

Design Schedule Margin

Post-Processing – 9 Minutes

Simulation – 15 **HOURS**

Configuration – 3 Minutes

CAD & Meshing – 1 Minute

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Design Schedule Margin

Sophisticated optimizations
Uncertainty analysis
Reduced time to market

Post-Processing – 3 Minutes

Simulation – 30 **MINUTES**

Configuration – 2 Minutes

CAD & Meshing – 6 Minutes

Comparison performed on identical hardware

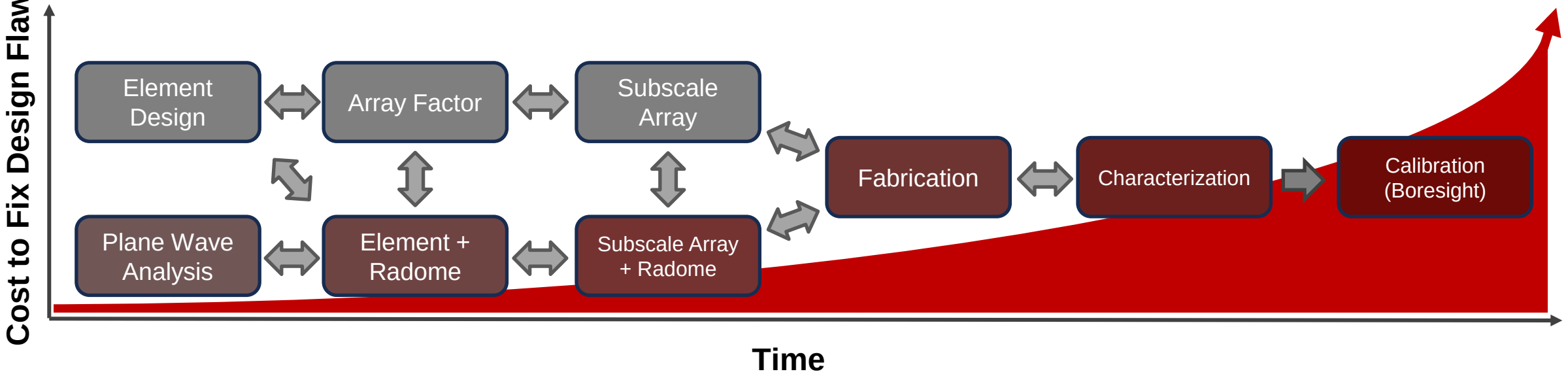
Radome Impacts on Antenna Performance

- Radomes offer environmental protection for antennas and arrays
  - Wind, precipitation, lightning, static discharge, etc.
- Tug-of-war between protection and performance
- Impact to performance must be considered but ...
  - No/Limited ability to perform detailed analysis before fabrication
  - Limitations on antenna calibration

https://bit.ly/2FSsnii
https://bit.ly/3NEbGrO
https://bit.ly/3HGC0xE

The Radome Design Dilemma

- Disaggregated design tools introduce cost and schedule risk
- No/Limited ability to assess antenna+radome performance in simulation
- Delayed identification of design issues -> Higher cost to fix
- Limited calibration impacts performance

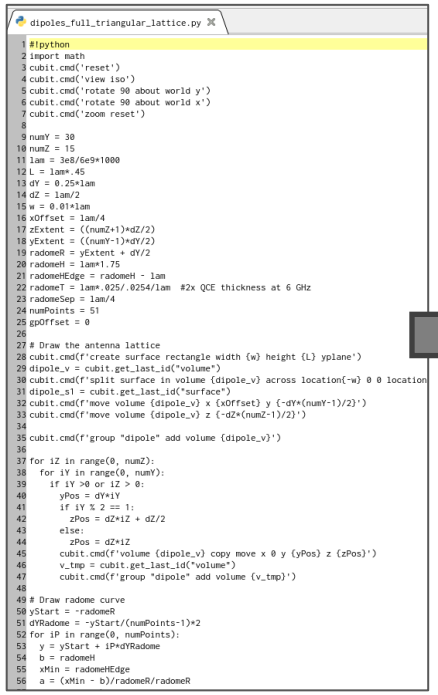


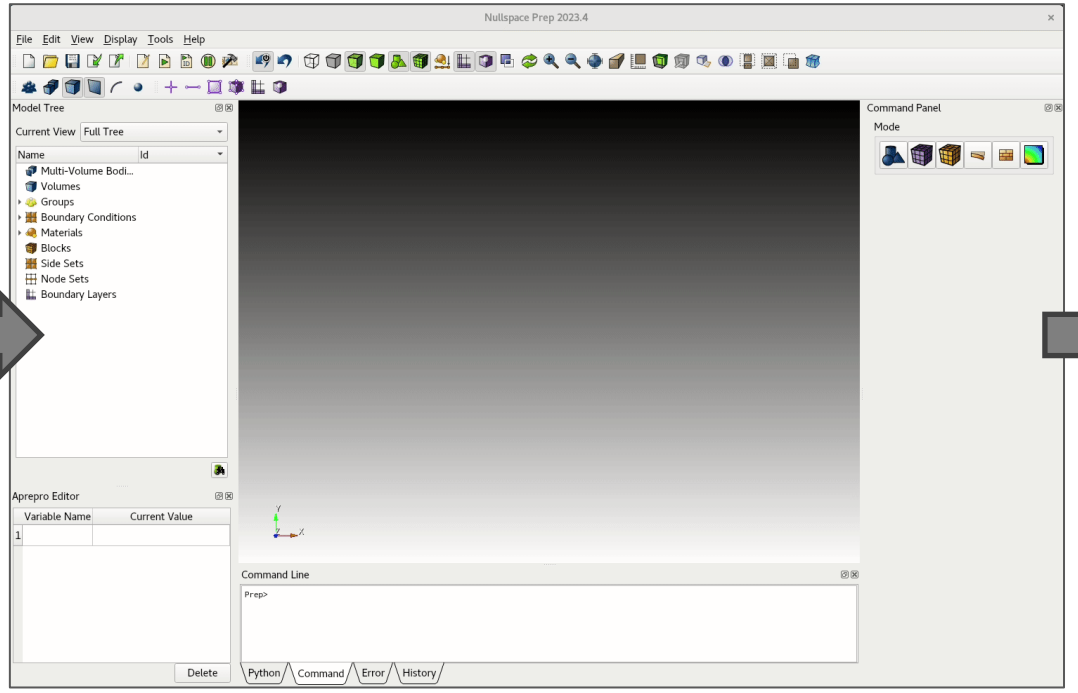
Phased Array Example

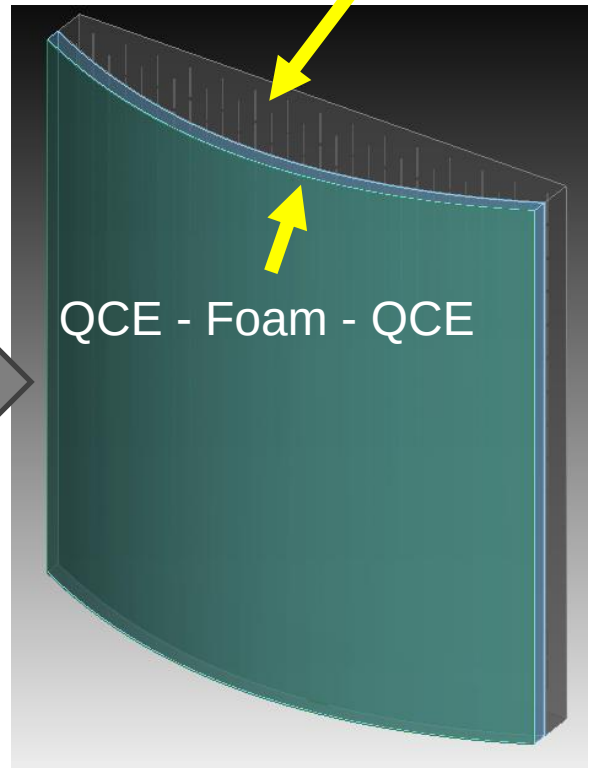
Nullspace Prep Python API

Parameterized model creation

30x15 Dipole Triangular Lattice

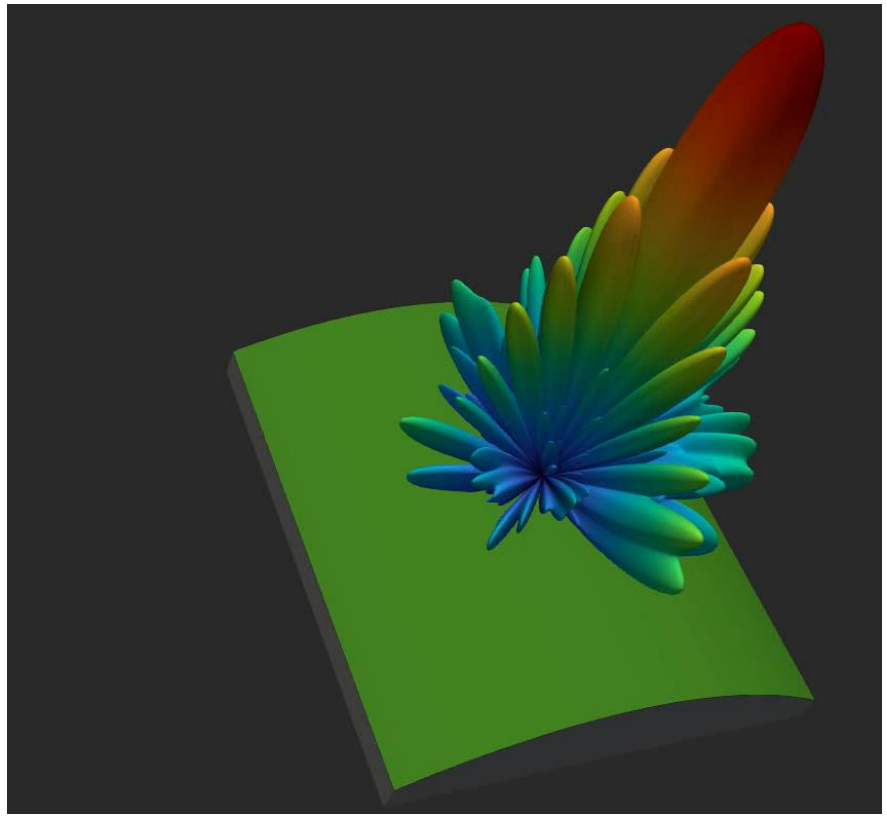


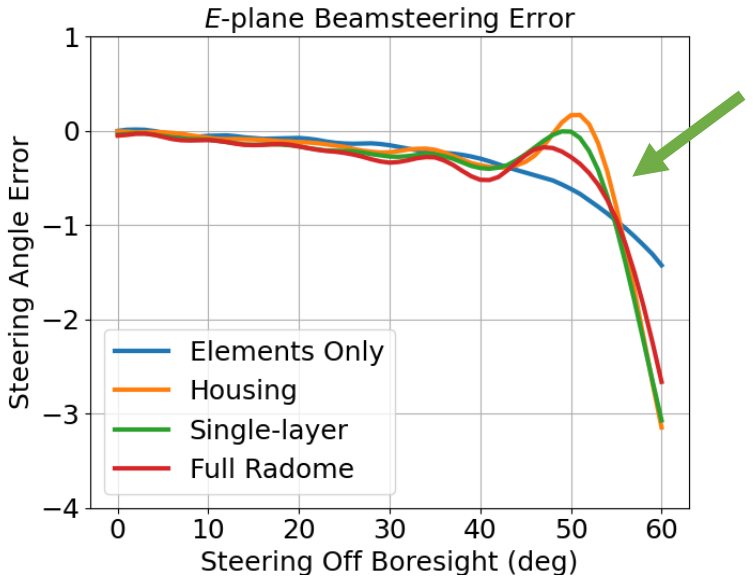




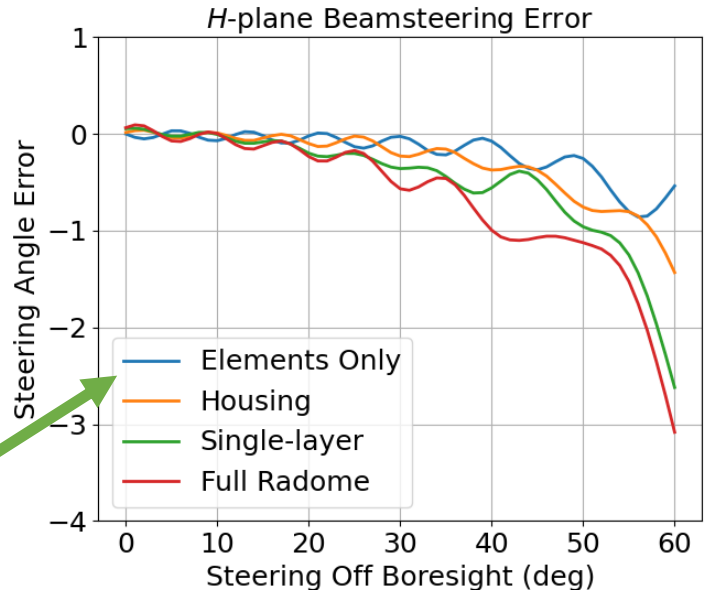
Beamsteering Error

- *Before* fabrication, opportunity for …
  - Weights optimization
  - Uncertainty analysis
  - Simulation-based calibration





Degradation at steep angles



Parametrically identify contributors

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