# CREATE-RF Development
## Product Description

## Product: SENTRI

### SENTRI – Scalable Engineering Tools for RF Integration

**What it is:**

- Computer Aided Engineering Software for DoD Electromagnetic Applications
- Designed for High Accuracy – Full Wave (non-optical) Numerical Methods
  - Finite Elements
  - Boundary Integral
  - Harmonic Expansions
- Designed for Extensibility, Maintainability, and Flexibility
  - Not All Electromagnetic Applications are the same
  - Need for Specific and Tailored Methods for Unique Applications
- Designed to Run on Wide Range of Computers
  - from Engineering Workstations to High Performance Computers


Distribution A: Approved for public release; distribution is unlimited

# CREATE-RF Requirement Summary

- **Antennas on Air, Sea, Ground, And Space Platforms**
- **Communication, Navigation, Surveillance, Target Recognition, Electronic Attack, Countermeasure, Etc.**





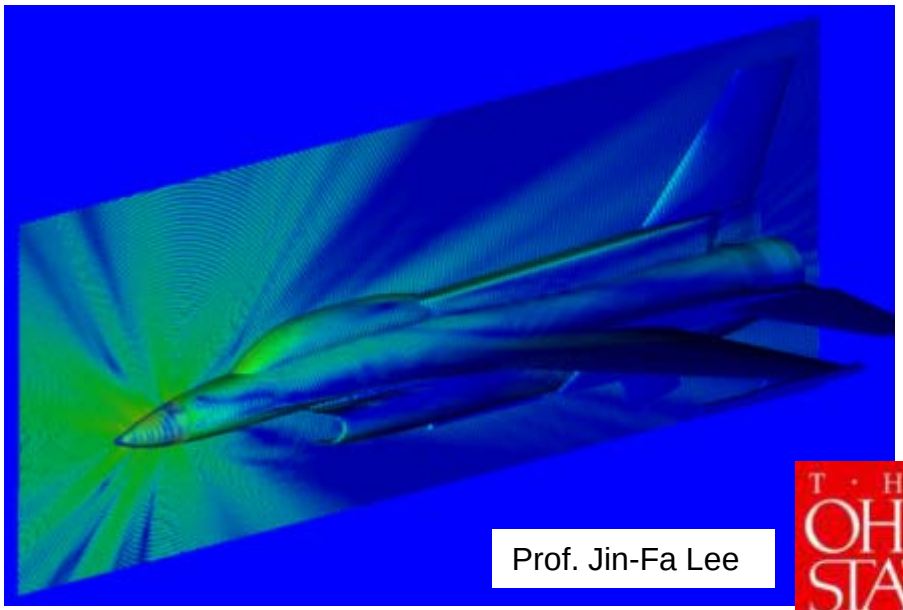

**Computational Electromagnetics Applies to Almost All DoD Systems**

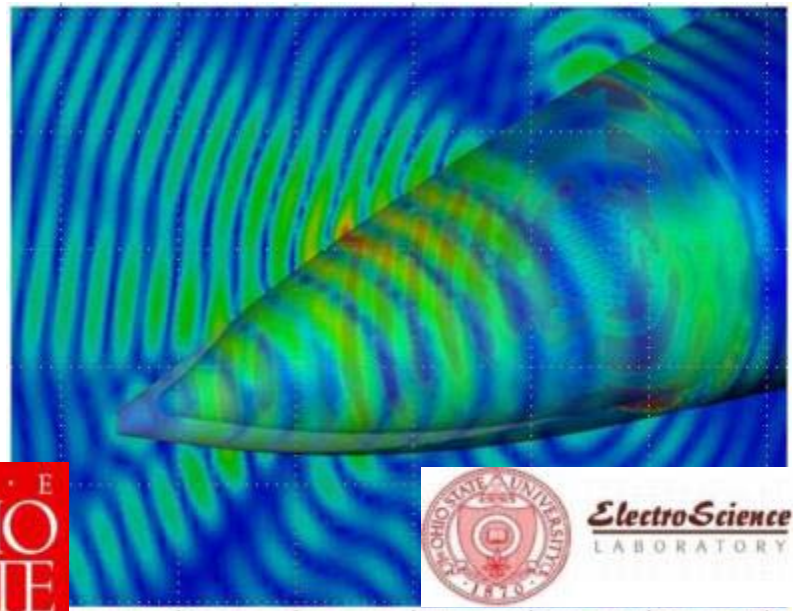


Distribution A: Approved for public release; distribution is unlimited

## Challenge of Computational Electromagnetics

- Complex Geometries, Complex Material Application, Multi-Scale Geometries
- Computationally Expensive for Accurate Full-Wave Analysis
- Electromagnetic Phenomena (Singularities, Resonances, Wide-Band)



THE OHIO STATE UNIVERSITY

ElectroScience LABORATORY



Distribution A: Approved for public release; distribution is unlimited

# Development Approach

## Product Roadmap

## SENTRI at version 2.0

### Antenna Modeling

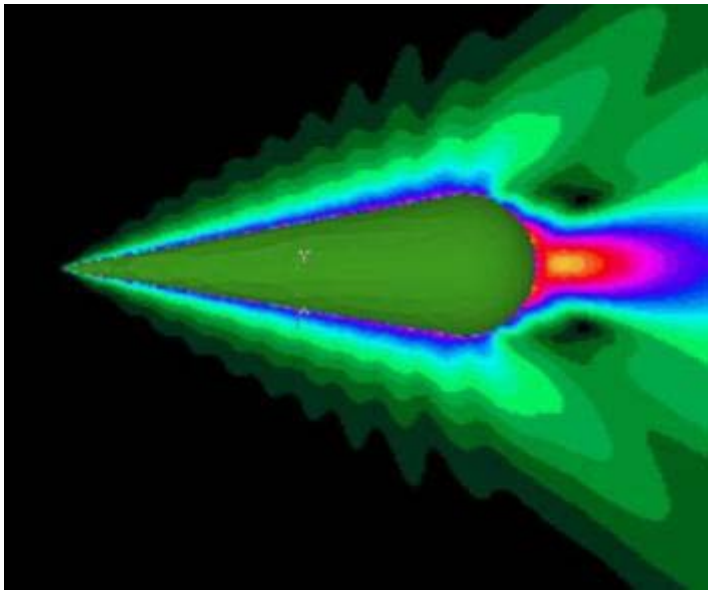
- Patch, Notch, Horn, Spirals (Applications: Radar, Communication, GPS)
- Phased Array Antennas
- Cavity Backed Antenna (Approximate In-Situ Analysis)

### Periodic Structures

- Frequency Selective Surfaces
- Circuit Analog Absorbers
- Metamaterials
- Infrared Filters / Absorbers

### Microwave Circuits

- Power Splitting
- Material Measurement
- Filters
- Circulators





Distribution A: Approved for public release; distribution is unlimited

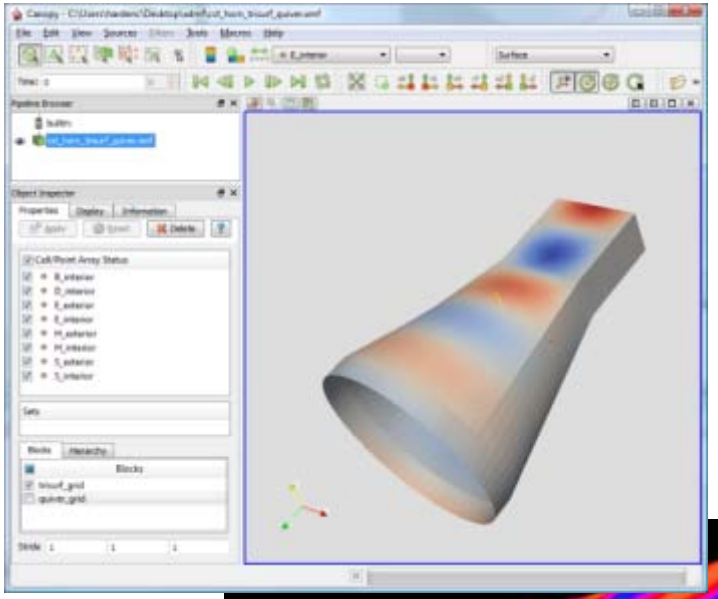
# Development Approach

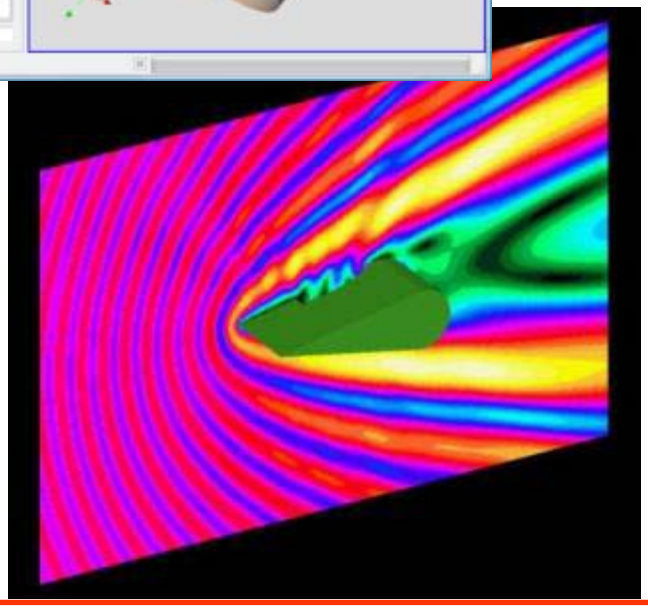
## Product Roadmap

## Future Releases of SENTRI

### Full End-to-End Analysis System

- Graphical User Interface
- Material Database
- Visualization of Solutions
- Analysis Traceability
- Optimization





### Programmable System

- Software Release as a Application Programming Interface for Further Tailoring by End User

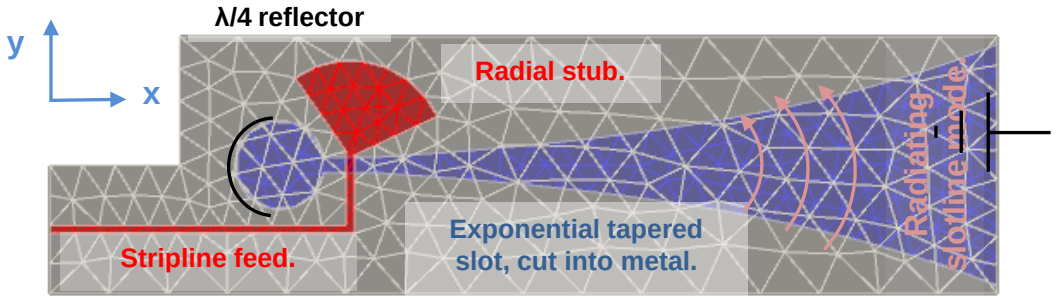


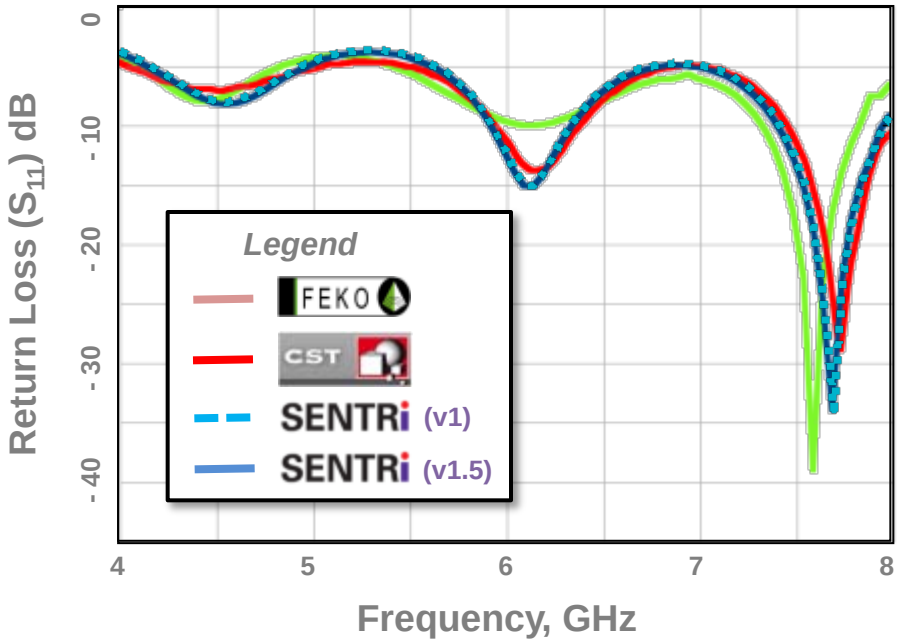
Distribution A: Approved for public release; distribution is unlimited

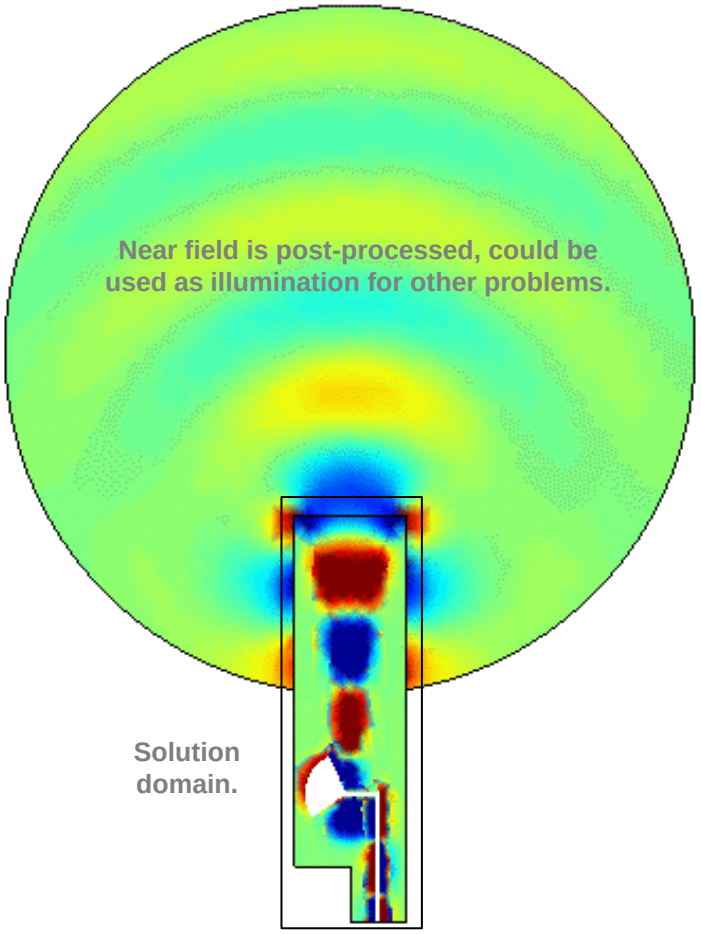
# Application Examples

## Printed Circuit Antennas

## SENTRI vs. Commercial Codes




**Successfully Benchmarked w/ Independent Software Vendor Tools**

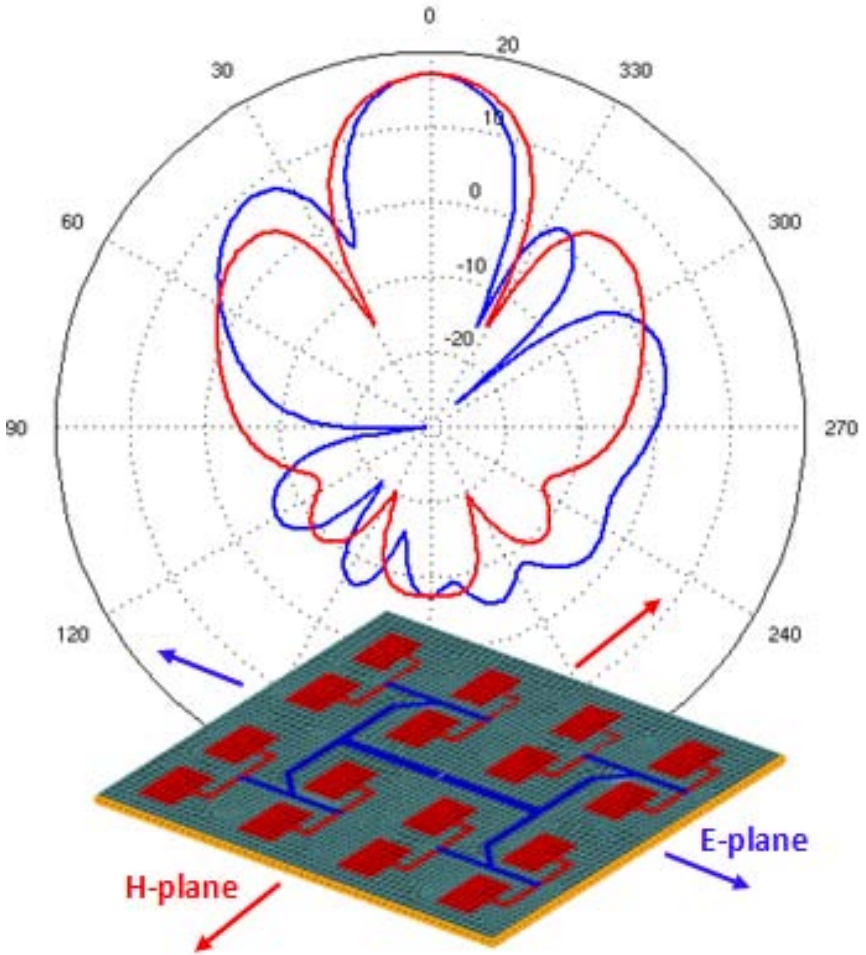


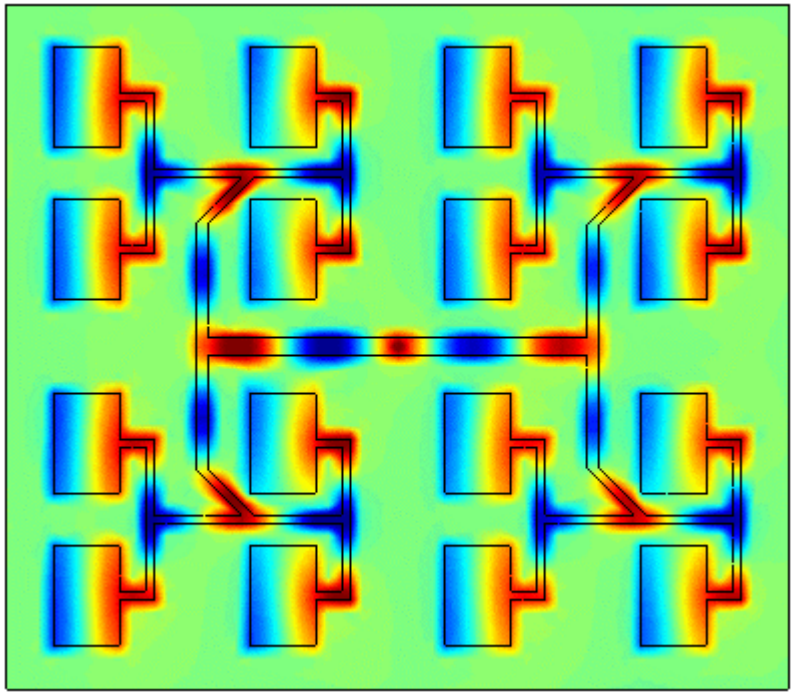
Distribution A: Approved for public release; distribution is unlimited

# Application Examples

## Antenna Patch Array

**A large printed array is an antenna-type problem that also benefits.**



**Gain (left) & field structure (right).**

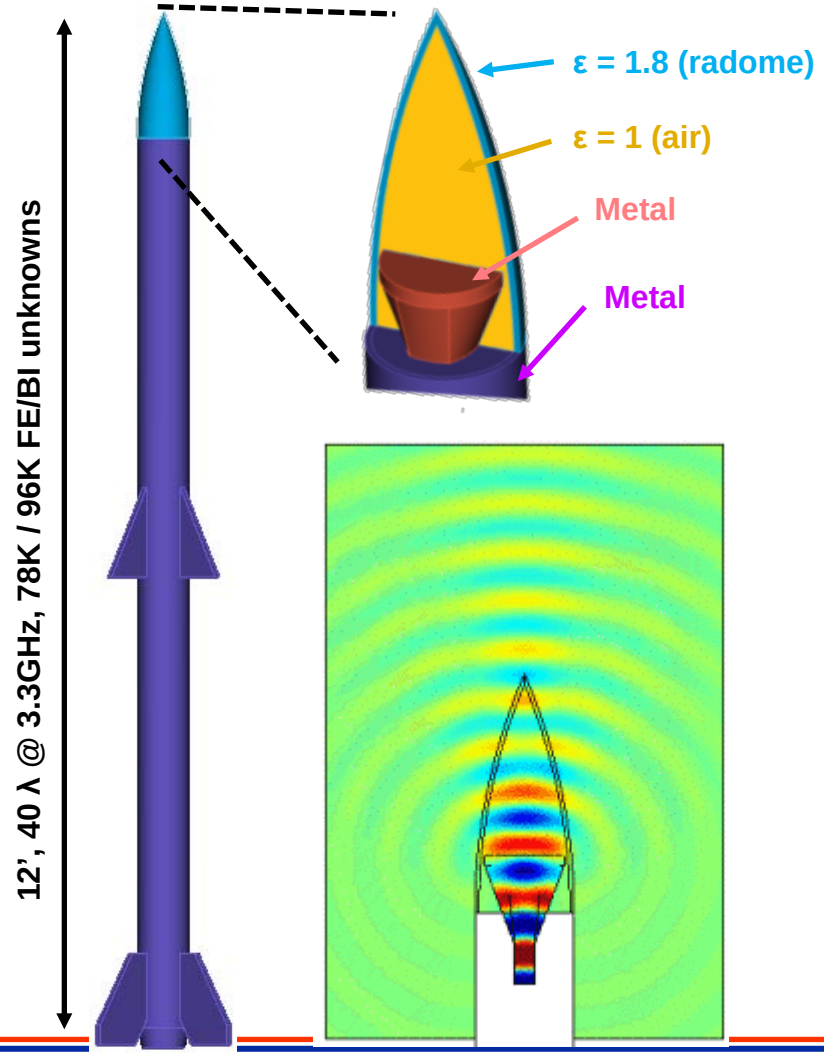


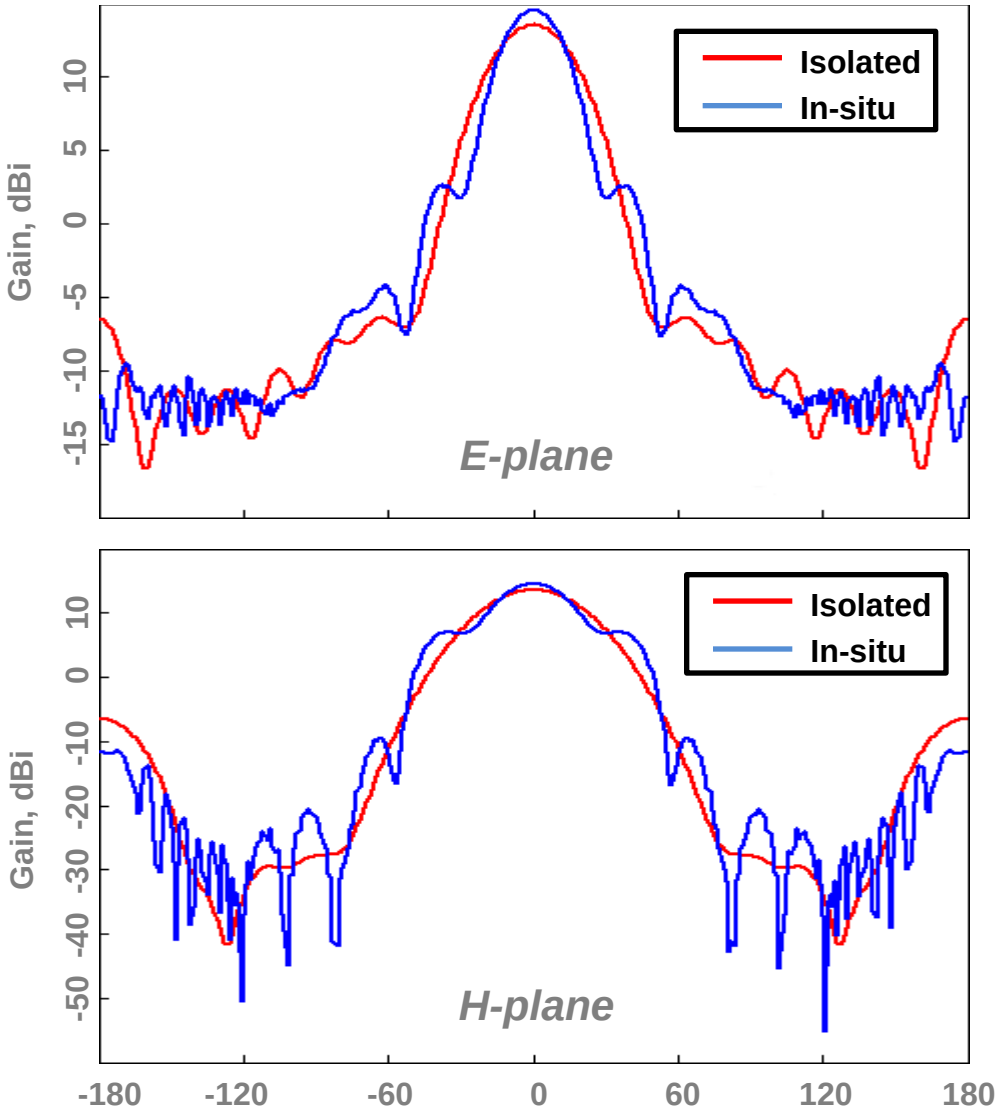
Distribution A: Approved for public release; distribution is unlimited

# Application Examples

## In-Situ Antenna Analysis

### Lofted horn on notional missile.





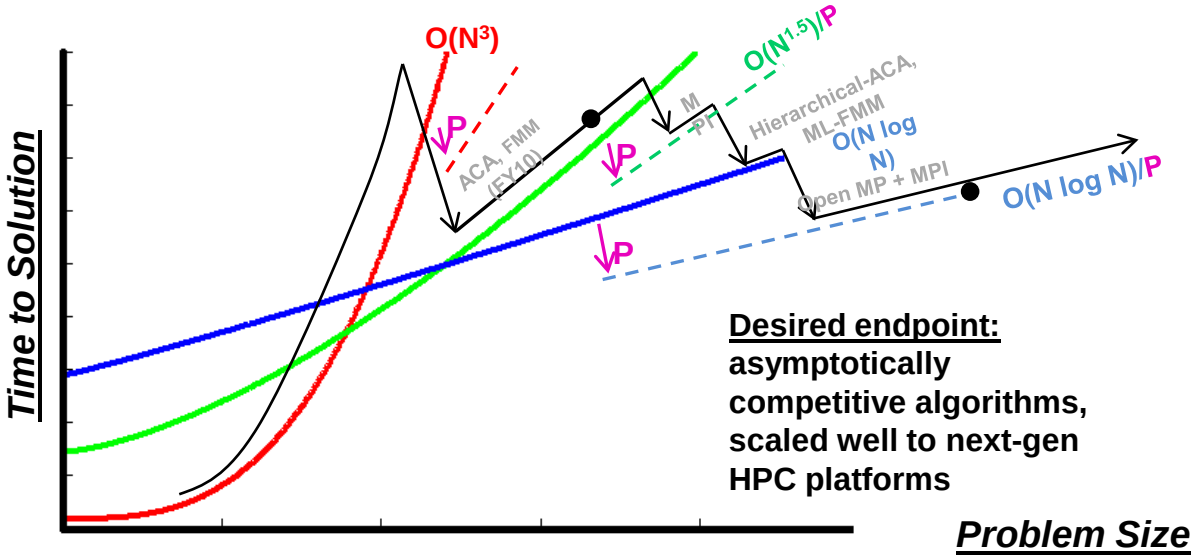

Distribution A: Approved for public release; distribution is unlimited

# Analysis Scalability

## Running Large, High Fidelity Models

**Big Computers Not the Total Solution**

**Big Computers + Algorithms that Scale with Problem Size**




**Desired endpoint:**
**asymptotically competitive algorithms, scaled well to next-gen HPC platforms**



Distribution A: Approved for public release; distribution is unlimited