



Antenna Analysis and Design

TECHNOLOGY OVERVIEW

Antenna Outputs: Near Field

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Core Technology

- ▶ *True-3D Full-Wave Broadband Electromagnetic Solvers with Maxwell accuracy*
- ▶ *Linear Scaling* solvers even on single cores
- ▶ *True Parallelization* for load-balanced, large-scale multicore solution
 - Additional distributed simulation mode for hybrid multicore-cluster architectures
- ▶ Products are currently helping customers in a variety of application areas
 - wireless, memory, microprocessors, mixed-signal and high-speed serdes
- ▶ Multiple patents on core technology

Core Technology

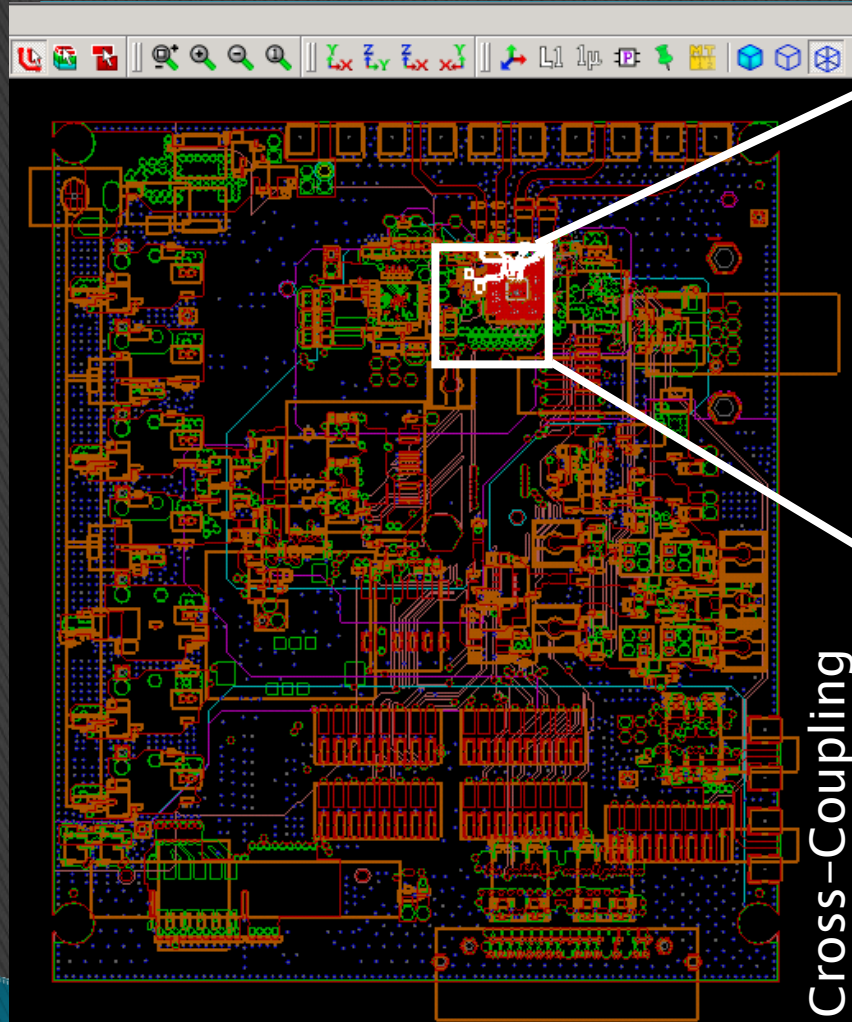
- *Fast Multilevel Boundary Element Solvers*
- *Circuit-Electromagnetic Cosimulation*
- *Accelerated Meshing Algorithms*
- *DC to High-Frequency in Single Solver*
- *Loss Models for Surface and Volume Current Flow*

PhysWAVE OVERVIEW

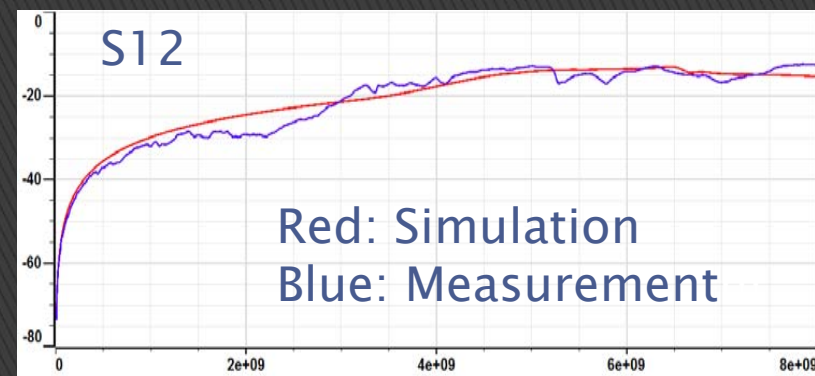
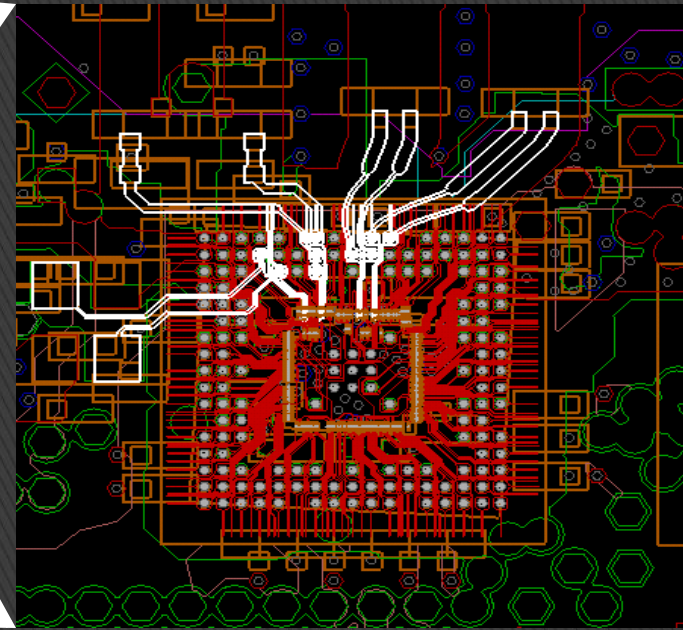
PhysWAVE: Product Overview

- ▶ Physware's flagship true-3D, true-parallel, linear scaling, broadband, full-wave electromagnetic solver
- ▶ SiP Design for Integrity™ Enabling Solver
 - SI, PI, and EMI Features
- ▶ Integrated GUI for functionality and ease of use
 - Automated ports and boundary conditions (no “bounding box”!)
 - SiP and package-board import
 - Advanced editing and what-if scenario support
 - SI, PI, EMI solutions and features
 - Multiple output choices: S, field plots, TDR waveforms
 - SPICE model and S-parameter import and export
- ▶ Fastest and Largest-Scale Accurate EMI Simulator

Package-Board Applications

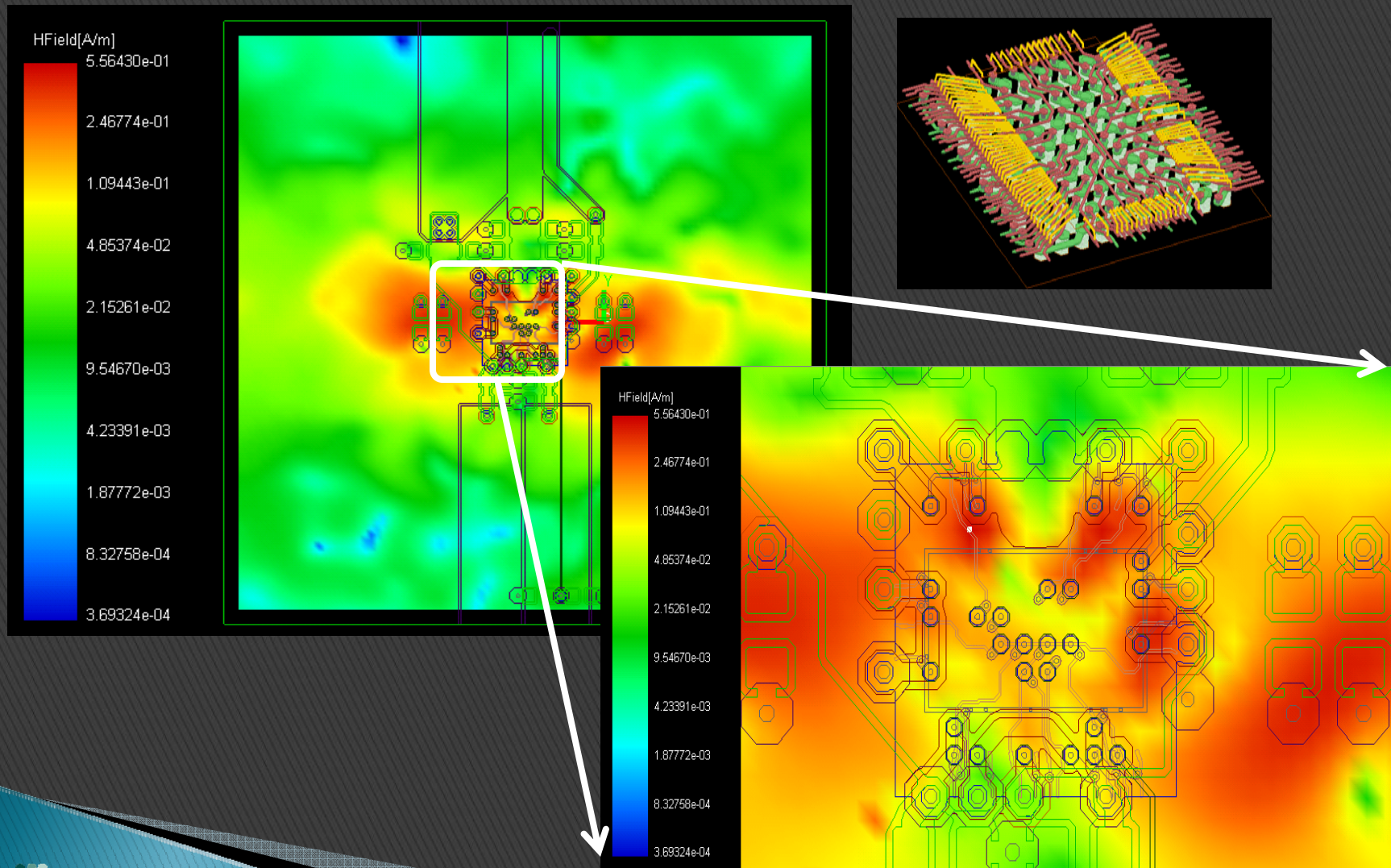


Cross-Coupling



Texas Instruments: Merged Board Package

EMI Applications



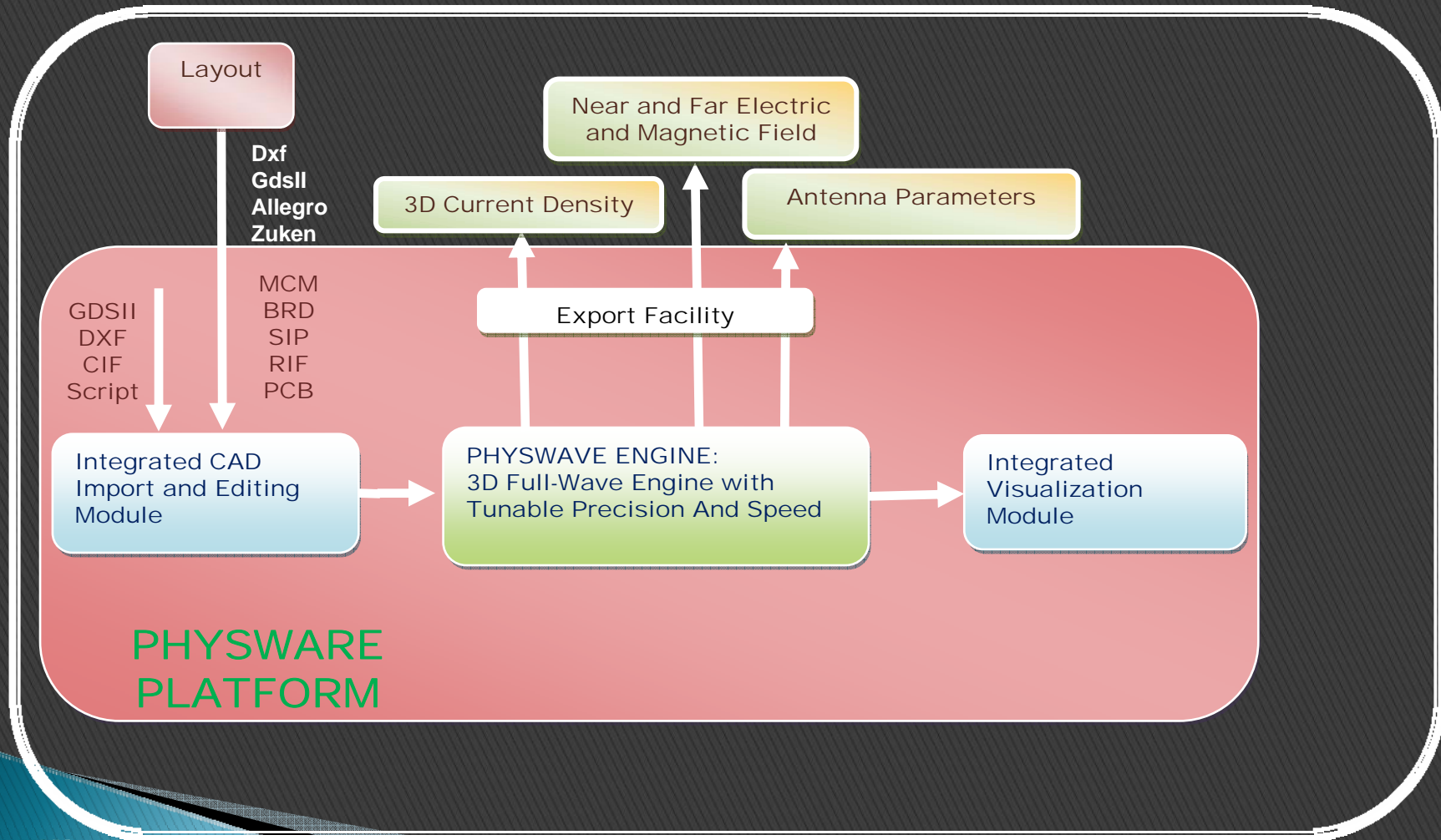
Magnetic Field Radiation

ANTENNA ASSIST

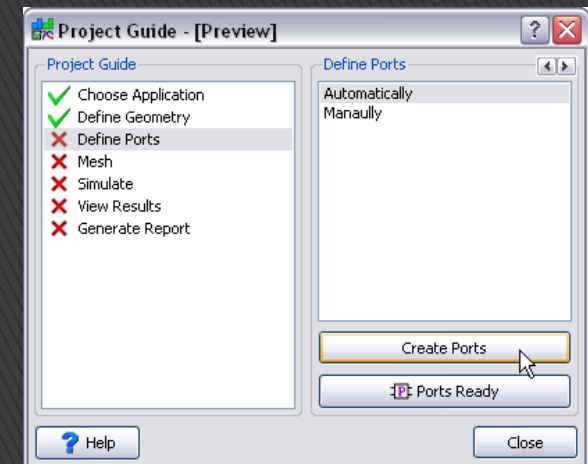
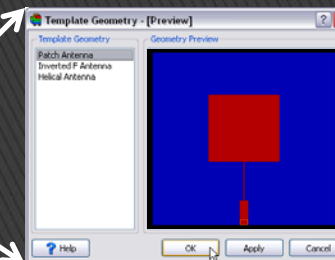
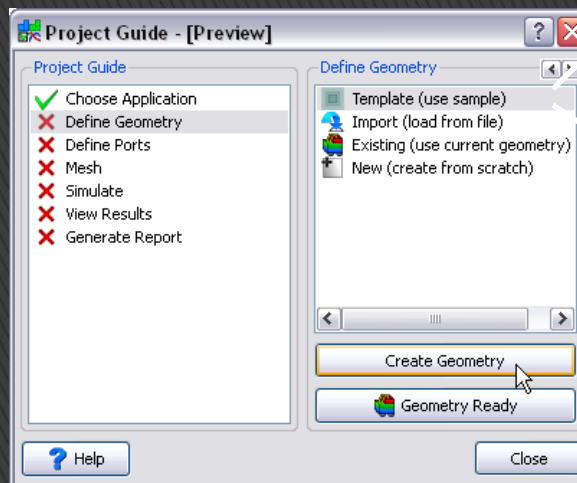
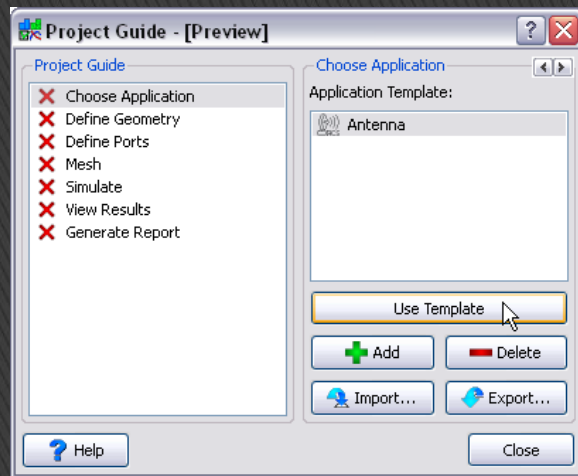
Antenna Application Assist

- ▶ Antenna Assist: Motivation
 - To guide the user through project setup and solution
 - Easy ramp up for user with zero training
 - User only exposed to antenna specific functionalities of PhysWAVE
- ▶ Simulation Core of PhysWAVE
 - 3D Full-wave Maxwell Accurate Solution
 - Broadband loss model
 - True multithreading for multicore processors
 - Parametric support

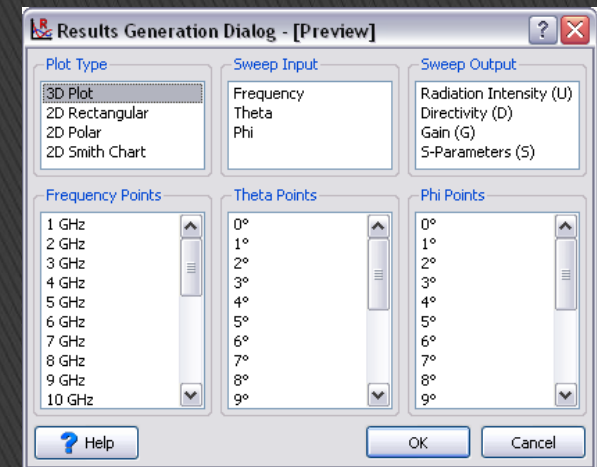
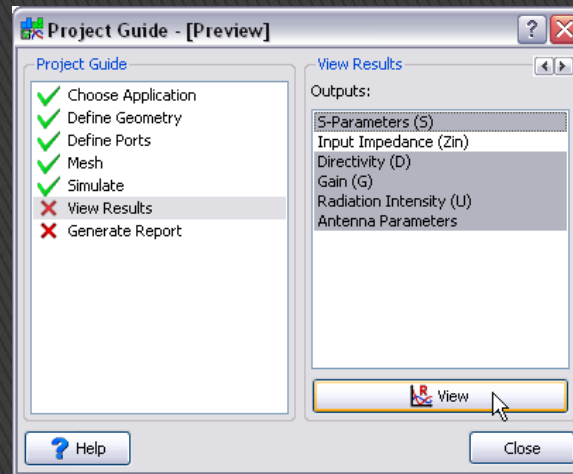
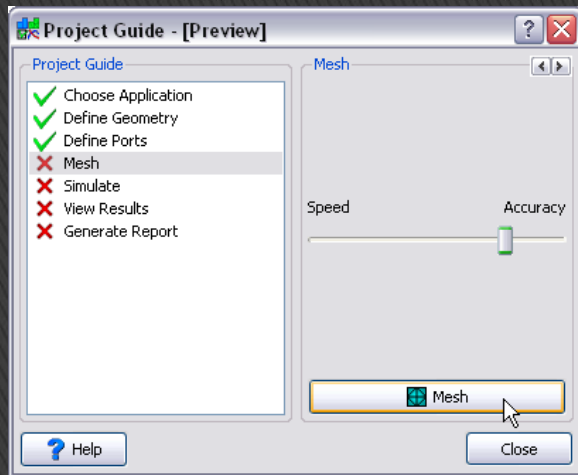
Analysis Flow



Antenna Application Assist



Antenna Application Assist

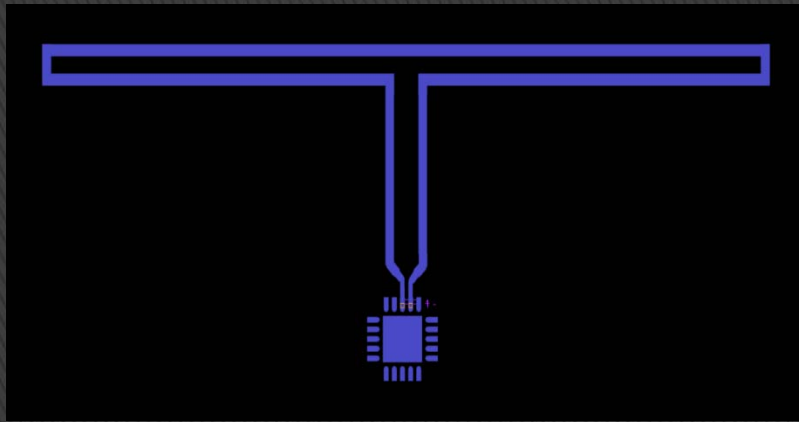


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ANTENNA ANALYSIS

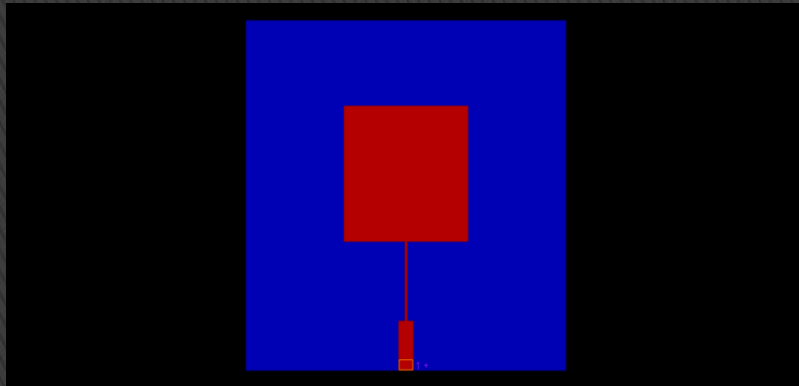
Common Antenna Templates



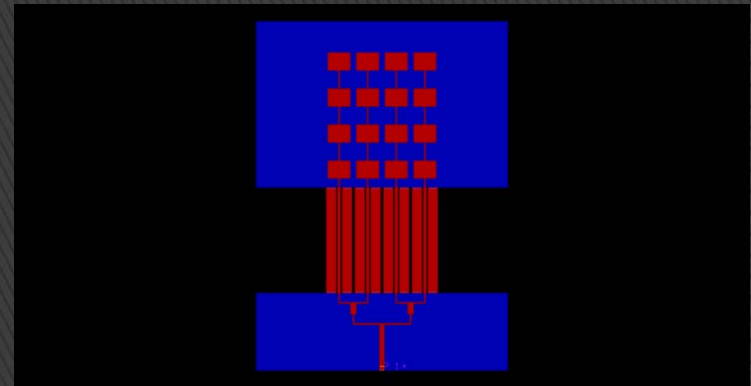
Loop Antenna



Inverted-F Antenna

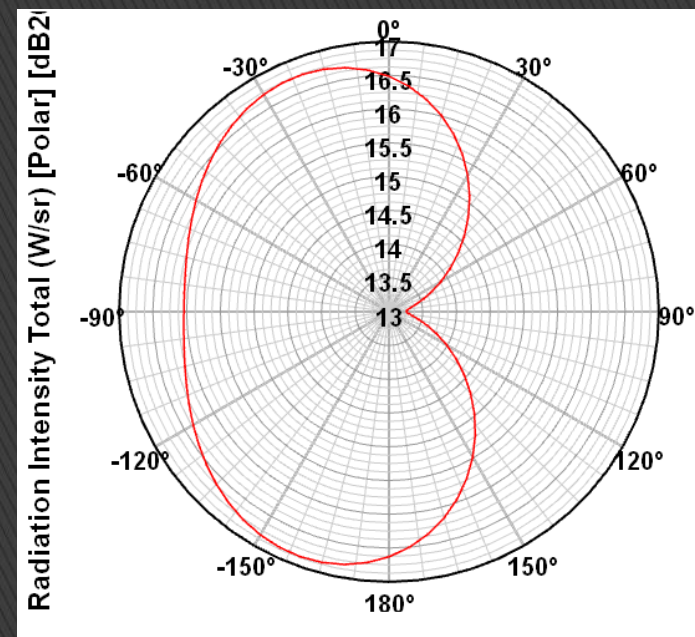
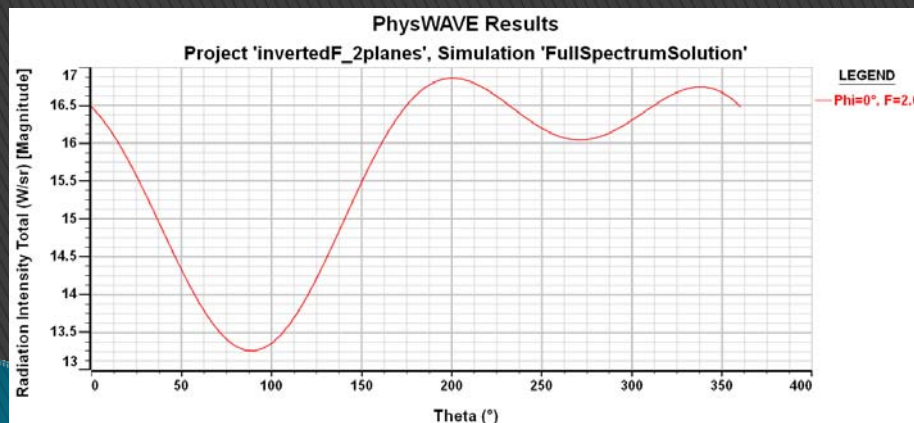
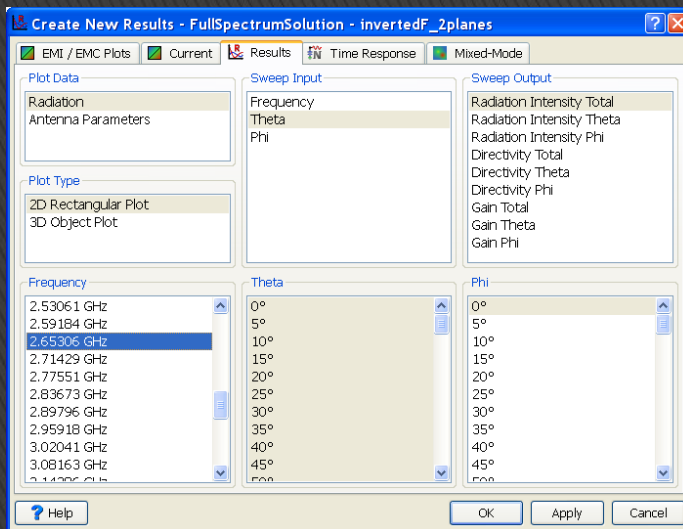


Single Patch

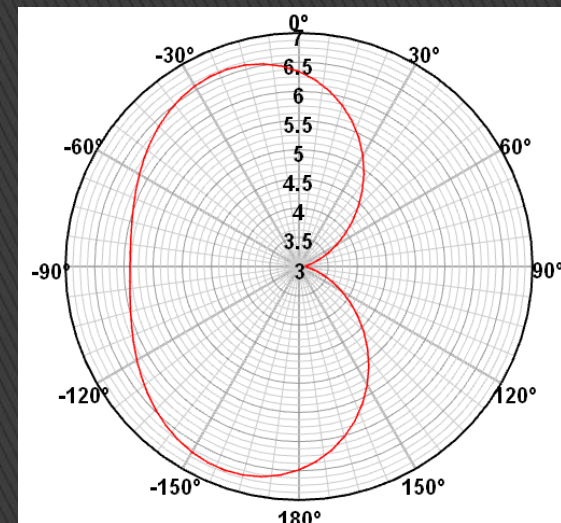
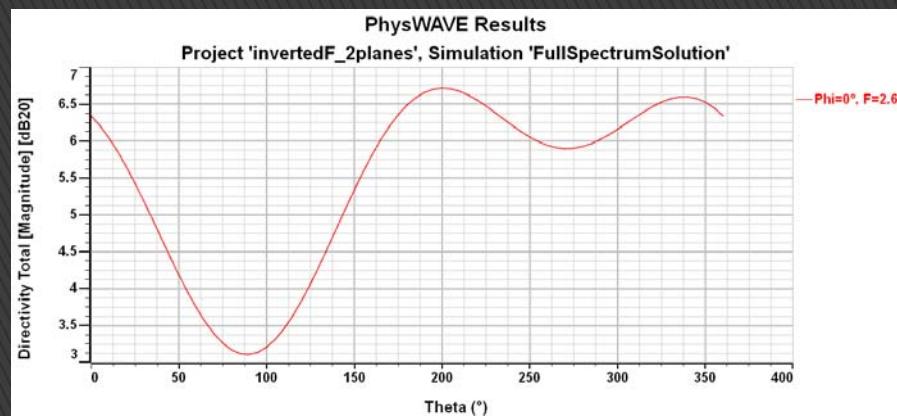
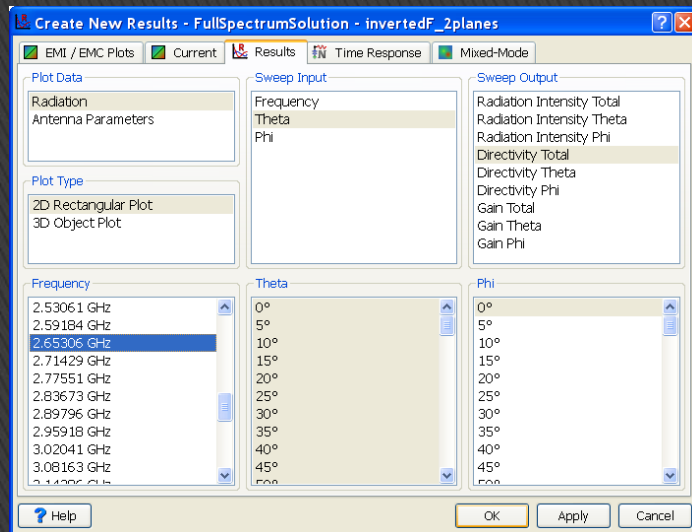


Patch Array

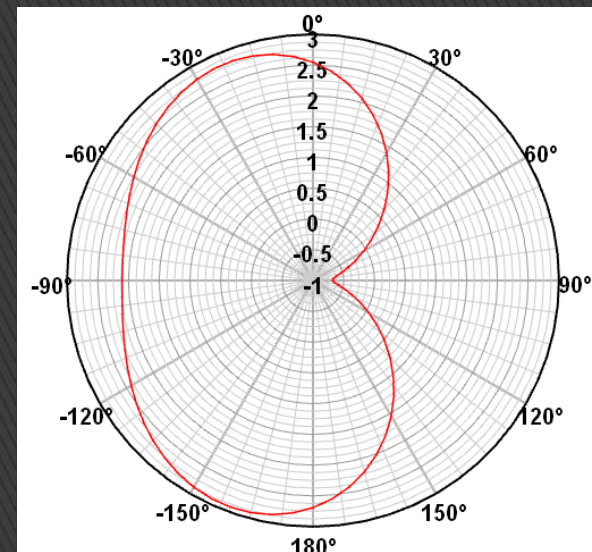
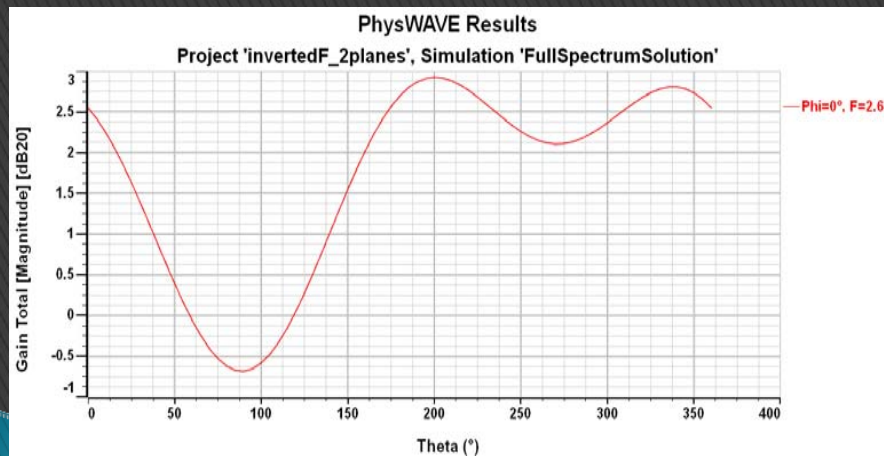
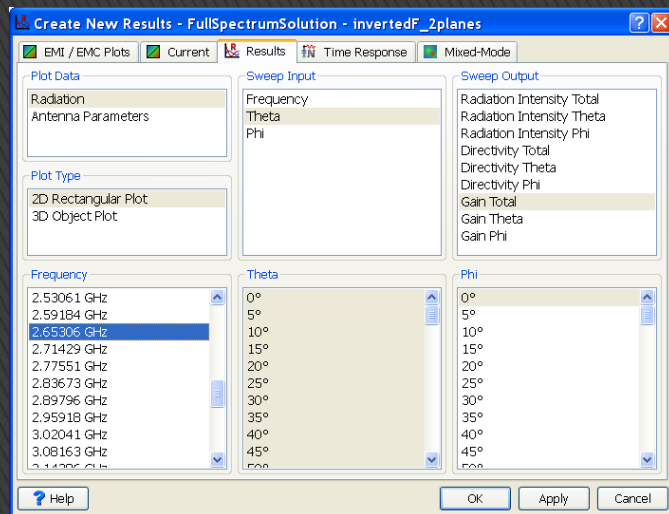
Antenna Outputs: Radiation Intensity



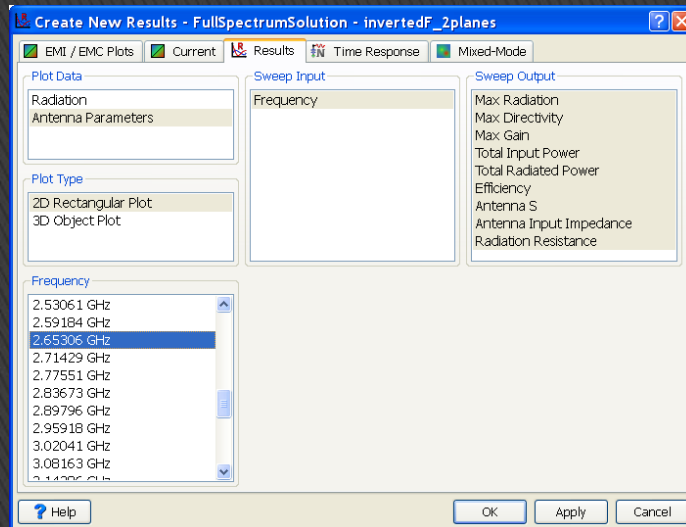
Antenna Outputs: Directivity



Antenna Outputs: Gain



Antenna Outputs: Parameters



Efficiency vs. Frequency [Real]

	Frequency (Hz)	Efficiency
1	2.65306e+009	0.646205

Max Directivity vs. Frequency [Real]

	Frequency (Hz)	Max Directivity
1	2.65306e+009	2.18268

Max Gain vs. Frequency [Real]

	Frequency (Hz)	Max Gain
1	2.65306e+009	1.41046

Max Radiation vs. Frequency (W/sr)

	Frequency (Hz)	Max Radiation
1	2.65306e+009	7.01874

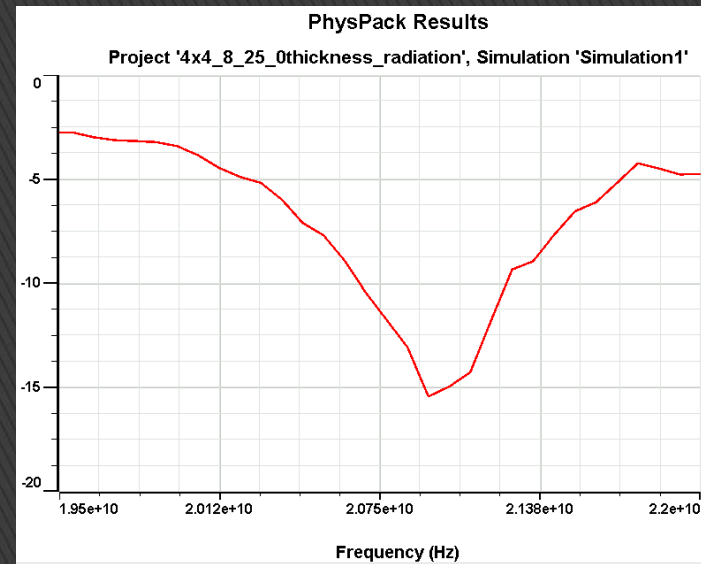
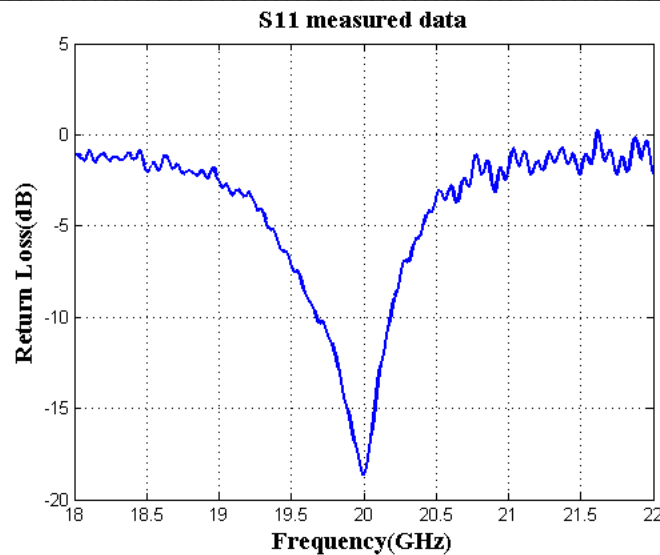
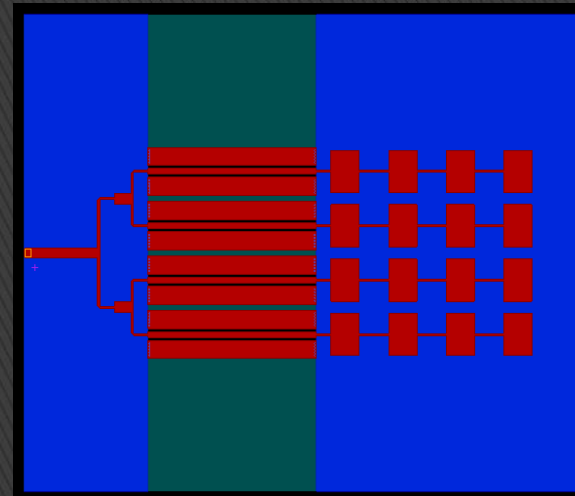
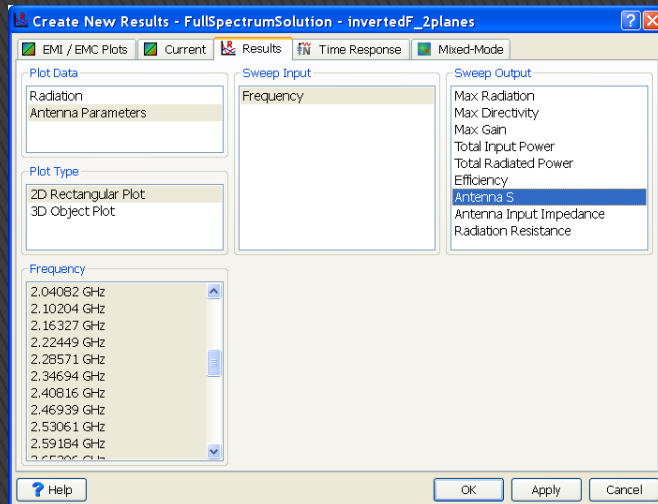
Radiation Resistance vs. Frequency (Ohms)

	Frequency (Hz)	Radiation Resistance
1	2.65306e+009	80.818

Total Input Power vs. Frequency (W)

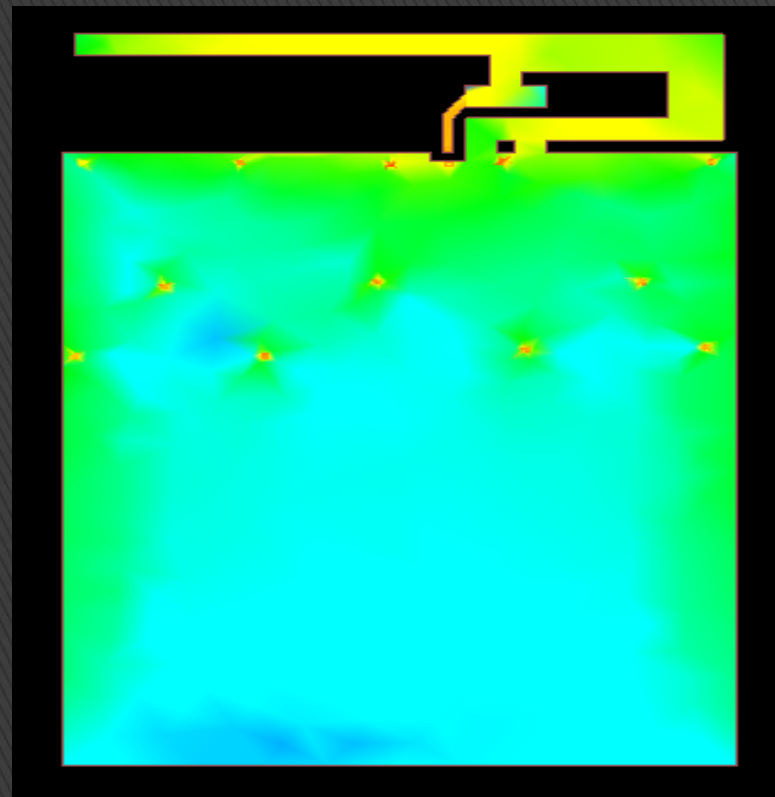
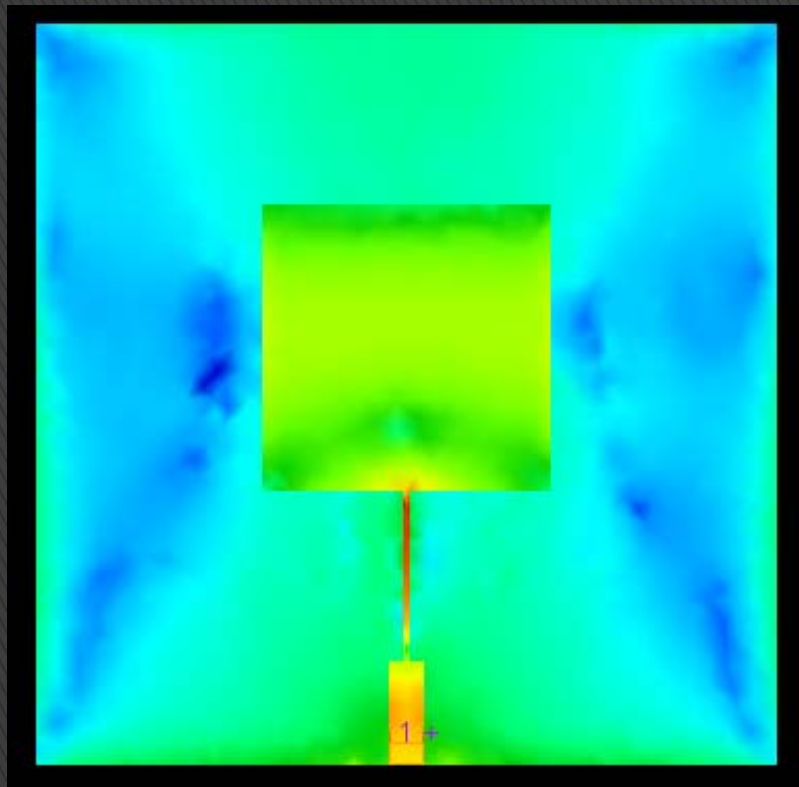
	Frequency (Hz)	Total Input Power
1	2.65306e+009	62.5328

Antenna Outputs: S-parameter



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Antenna Outputs: Current Density



Antenna Outputs: Near Field

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Summary

- ▶ 3D Maxwell-Accurate Solutions
- ▶ Unprecedented Capacity and Speed
- ▶ True-Multicore Solution
- ▶ Accurately Model Loss At All Frequencies
- ▶ Capable of Handling Embedded Linear Passive
- ▶ Antenna with Package Board Simulation
- ▶ Antenna Assist for ease of use
- ▶ Multiple products at entry level or advanced
- ▶ Check www.physware.com for more information