

Thor: a megabar-class accelerator for quasi-isentropic compression experiments (ICE)

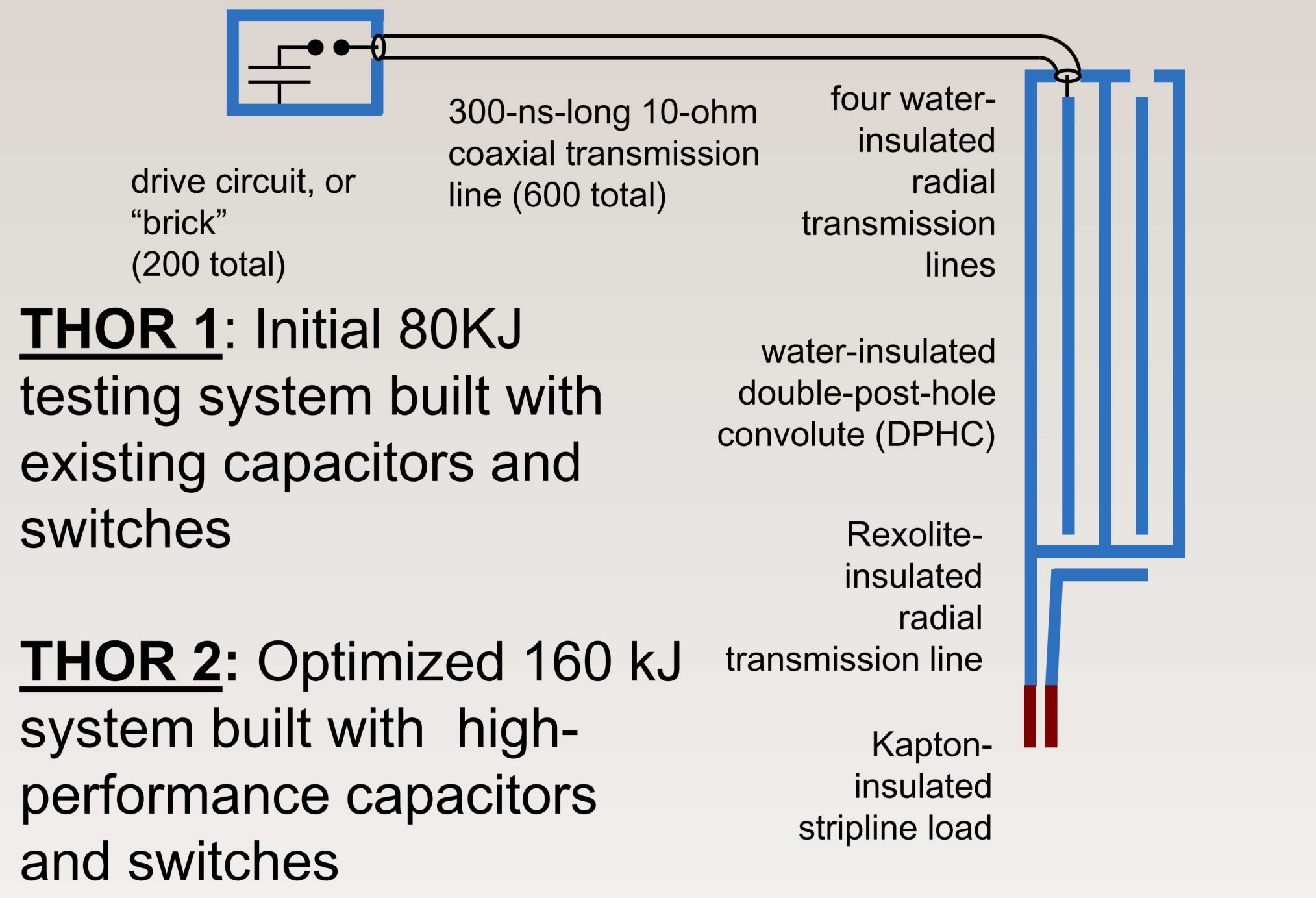


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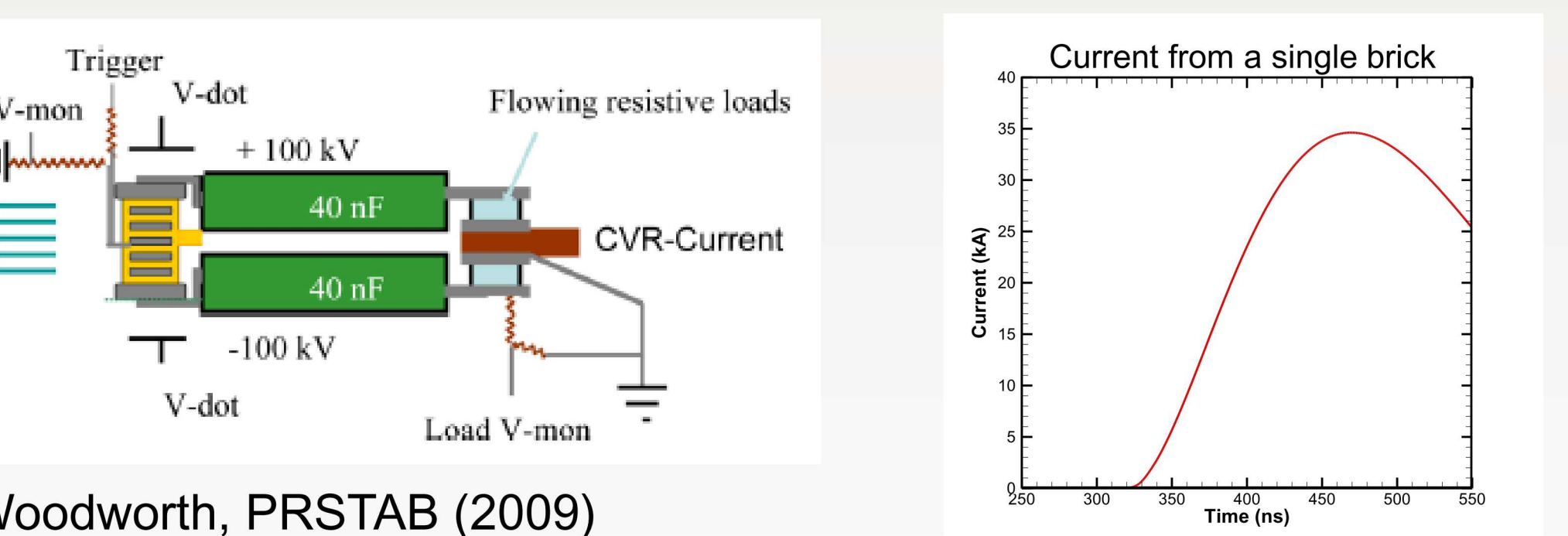
Requirements

- Thor Specifications
 - Peak current: 8 MA
 - Current rise time: 200-500 ns
 - Pulse shaping through 200 independent, de-coupled switches
 - Megabar peak magnetic pressure
 - Enables a variety of experiments:
 - ◆ Soft Materials: Cerium, Lithium
 - ◆ Flat Top Pulse: Strength
 - ◆ Shock-Ramp: Iron

Thor Concept

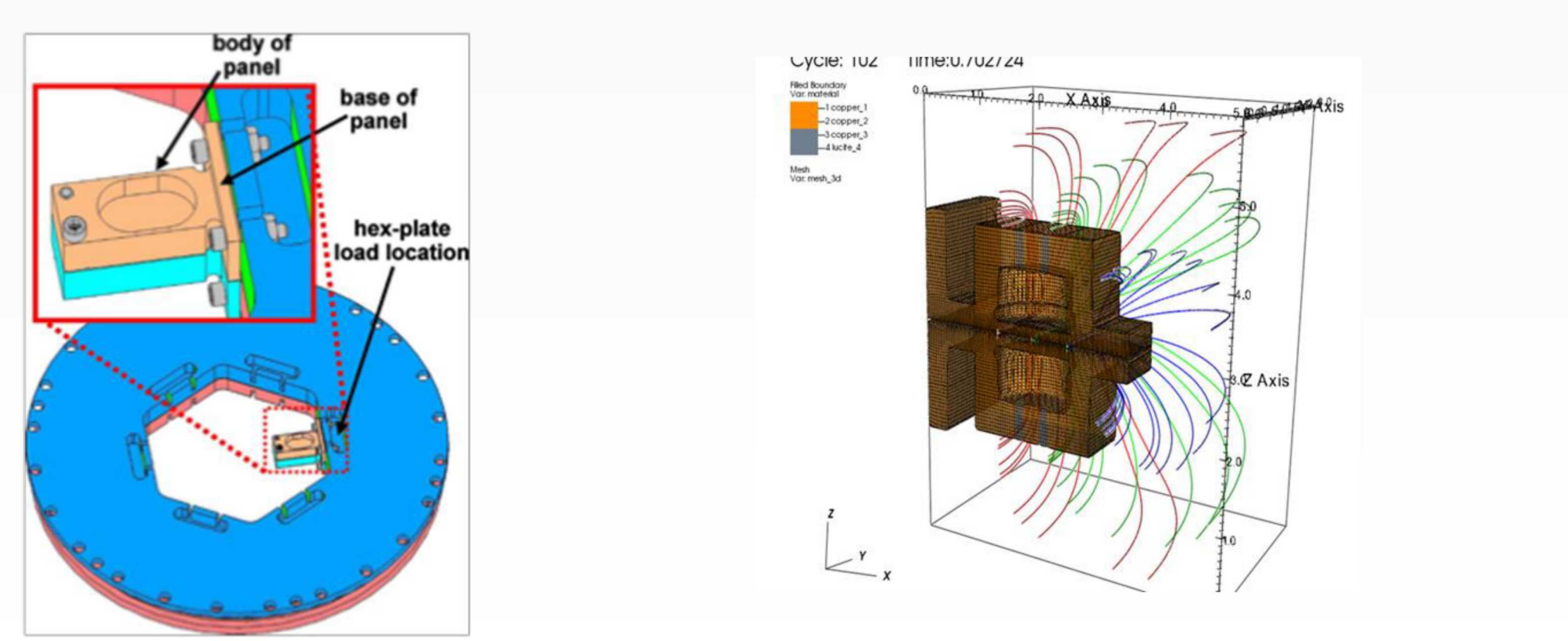


The LTD brick provides 100-ns pulse



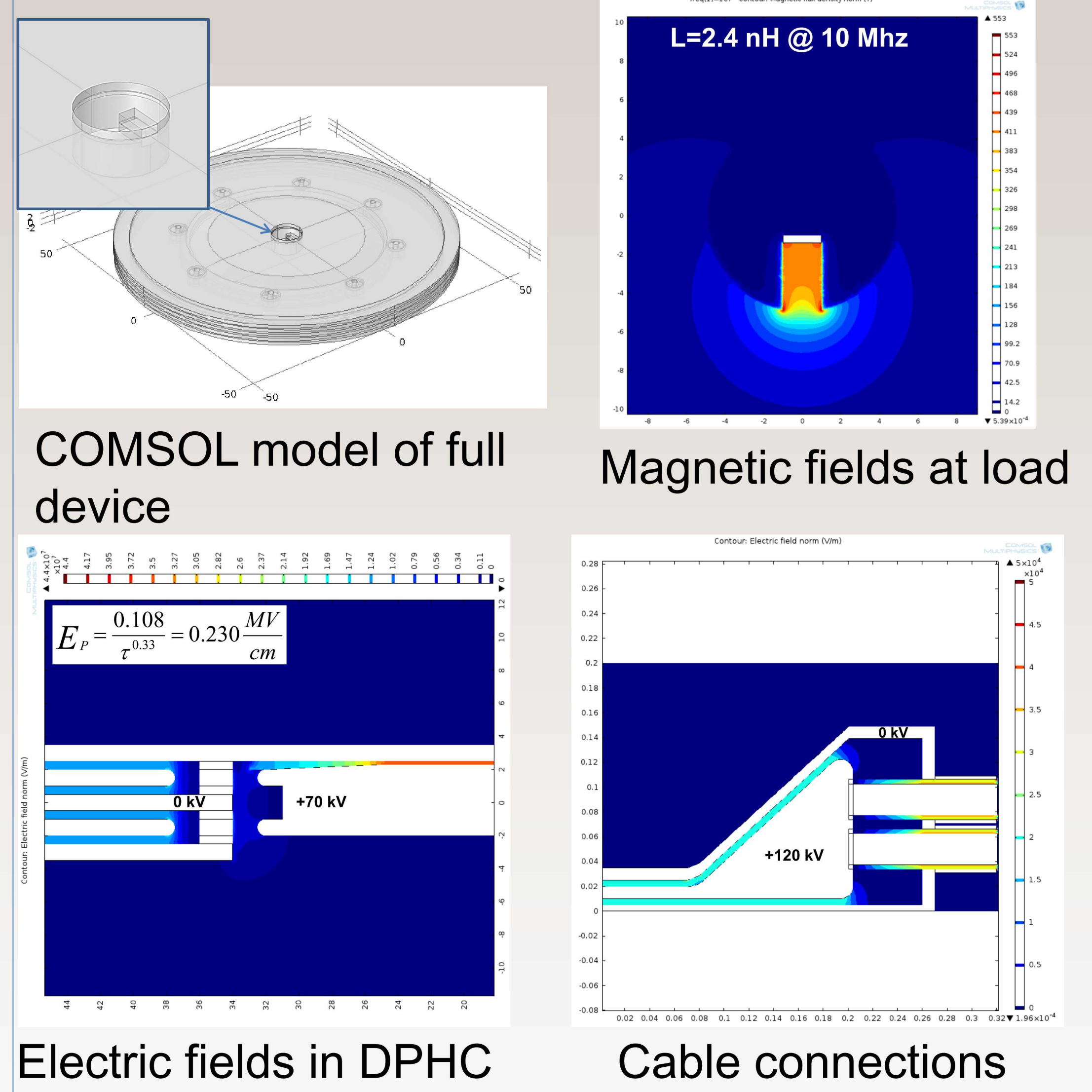
J.R. Woodworth, PRSTAB (2009)

Veloce-type stripline load

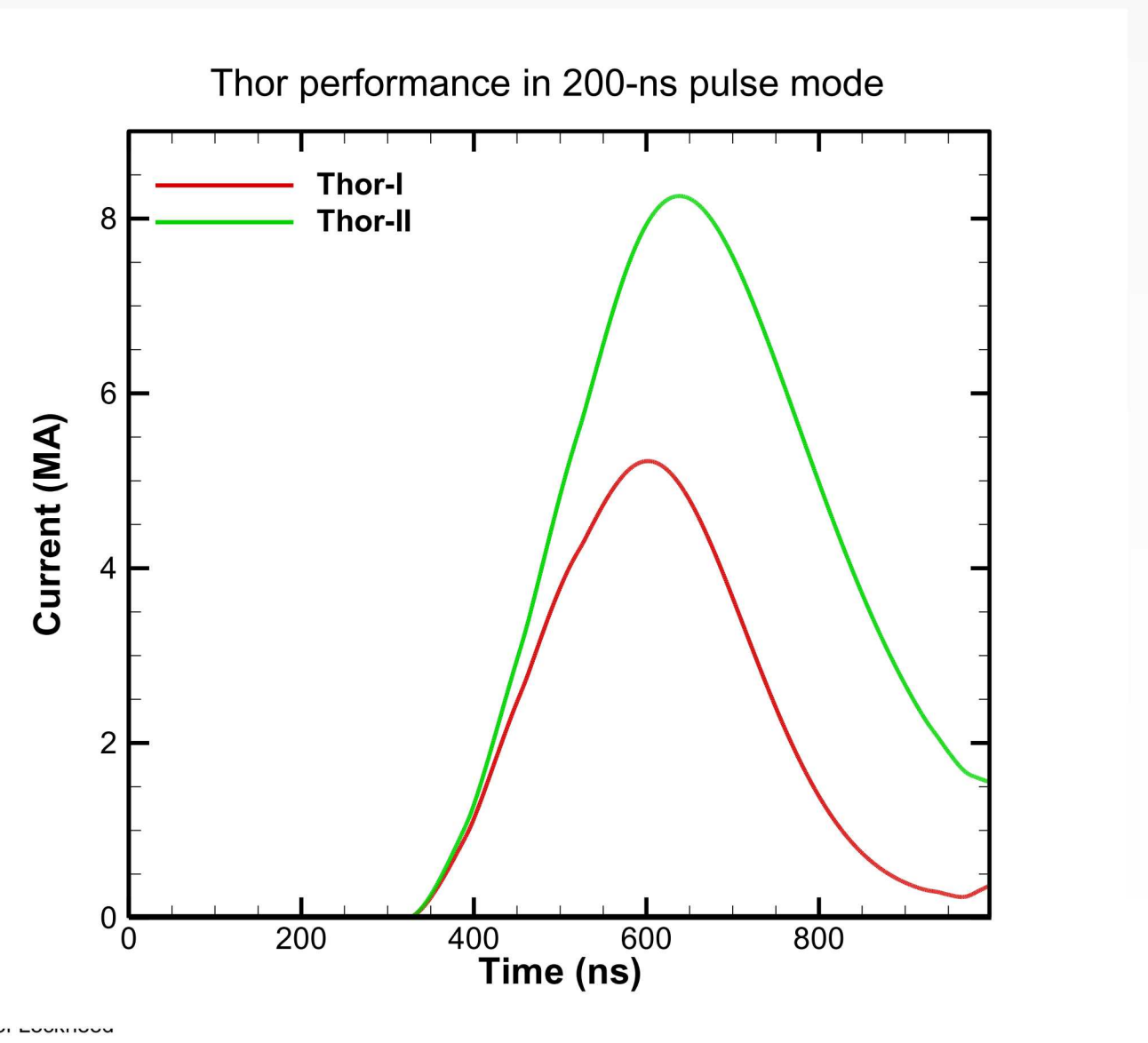


Modeling Approach

- Screamer-Trac-II-COMSOL are used iteratively to determine design
 - COMSOL – FEM code for E&M fields, calculate inductance and impedance
 - Screamer – Circuit code to calculate element voltages, current, power
 - Trac-II – 2D MHD code to calculate pressure drive on ICE load, dynamic inductance. Transition to ALEGRA.
- Power flow section

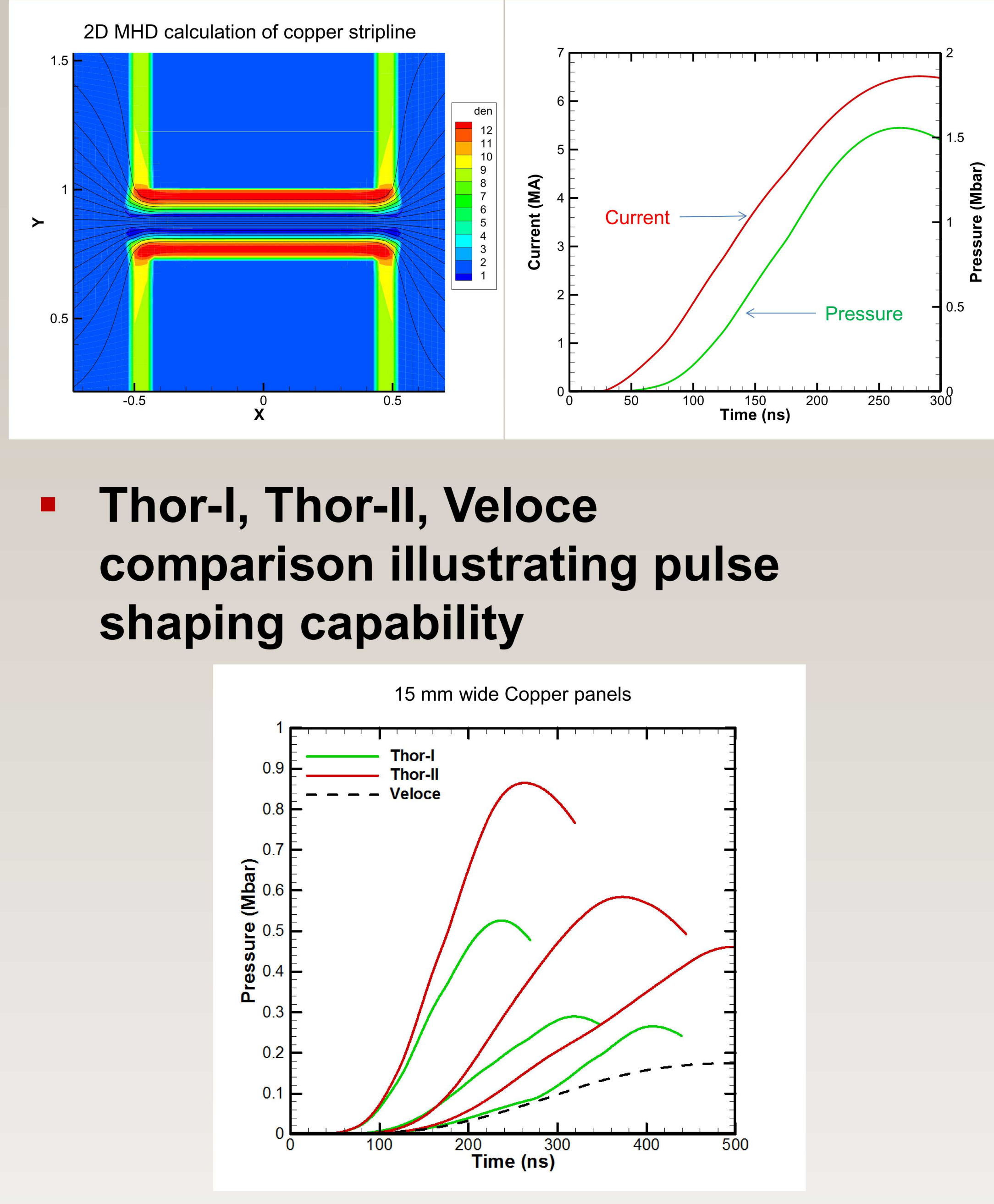


Screamer circuit calculations

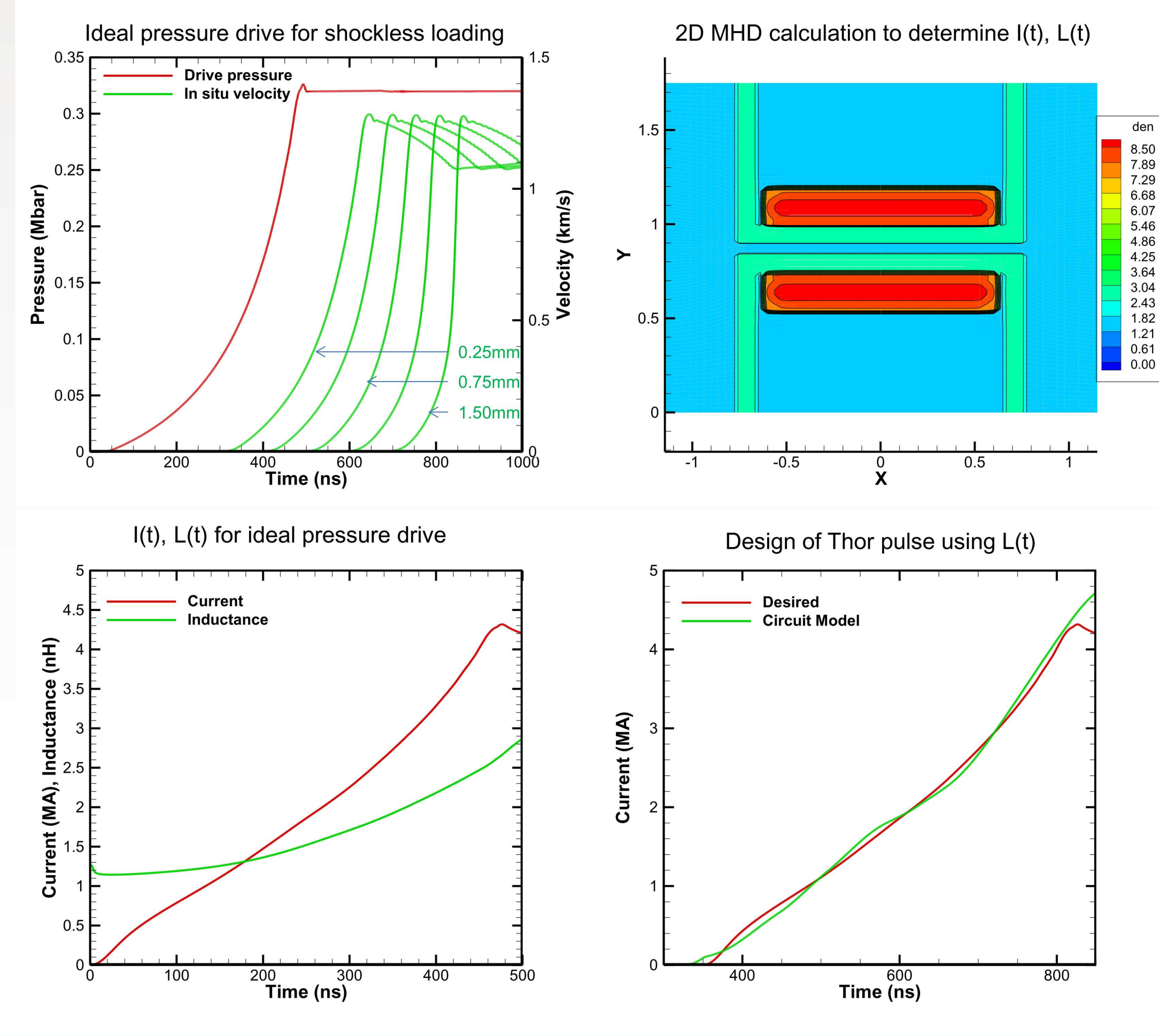


Performance

- 1.5 Megabar peak pressure
- Thor-I, Thor-II, Veloce comparison illustrating pulse shaping capability



Point design for cerium



Progress and Schedule

- Brick testing and Cable Development
 - $C=20 \text{ nF}$, $L=185 \text{ nH}$, $R=0.37\Omega$
 - $Z = 1.1\sqrt{\frac{L}{C}} + 0.8R = 3.3\Omega$
- Single Brick testing layout
- Thor "Brick Box"
- 10 Ω cable designed with Dielectric Sciences
- Thor facility
 - Section of Brick Wall
 - Thor in 961 High Bay
 - Overhead view
 - Cable Run
 - Power Flow and Load
- Cost and operation of Thor-II
 - \$4M cost in materials
 - One person required to operate
 - One hour turnaround between shots
- 3 year schedule
 - FY14: Design of Thor, testing of single brick system
 - FY15: Fabrication and testing of 20-Brick Thor, Thor-I power flow section
 - FY16: Completion of Thor-I accelerator, preparations for Thor-II