

# COMSOL® Analysis-Led Design of Prototype Coil Program for Bi-2212 Coils

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## Abstract

The National High Magnetic Field Laboratory (NHMFL) strives to push magnet technology to ever higher field strengths. Supported by a unified effort of material research as well as coil research, Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8+δ</sub> (Bi 2212) technology shows promise as a high temperature superconductor (HTS) practical for use in these ultra-high field (+30 T) magnets. Throughout this research and development, accurate numerical analysis has proven to be a pivotal tool, in so far as utility and importance.

The finite element modeling (FEM) has been focused on the complex stress/strain behavior of energized superconducting prototype coils wound with Bi 2212. Both the AC/DC and the Structural Mechanics modules are used. Good agreement between each prototype coil and its corresponding COMSOL model further contributes to the confidence in the models relevance and accuracy. Given this reliability, the far more cost effective numerical environment permits investigation of new magnet construction methods, materials, and techniques. The outcome being analysis-led design of subsequent prototype coils. In this presentation, models are deconstructed with emphasis on real world meaning and implications.