

Engineering Design of a Special Purpose Functional Magnetic Resonance Scanner Magnet

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Abstract - A 2 T open MRI scanner for fMRI investigations of subjects maintaining a natural stance and free access to the environment is presented. The self-shielded multi-coil magnet is composed from solenoids optimized in positions and cross-sectional shape. It provides a room temperature gap of 800 mm at the subject shoulders, tapering down to 600 mm at its narrowest point. The system consists of symmetrical magnetic poles, five NbTi superconducting coils each, maintained at 4.2 K in a liquid helium cryostat with a re-condenser. Windings, coil formers, mechanical structure, cryostat, vacuum chamber, thermal shield, mechanical supports, and cryogenics have been modeled in detail using Catia CAD software, accounting for the interactions among components and the constraints posed by winding and assembly methods. The cable characteristics have been chosen based on simulations of thermodynamic stability in operating conditions; self-protection against quench has been provided by inductance subdivision with bypass diodes

Keywords - Field homogeneity, magnetic resonance imaging, magnets, MRI

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