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Conceptual Design of a Quench Protection System for a MARS Magnet

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MARS (Mixed Axial and Radial field System) is a new superconducting magnet underdevelopment with a novel coil layout for more efficiently generating high strength minimum-B fields for the next generation of Electron Cyclotron Resonance (ECR) ion source. It consists of a hexagonal closed-loop-coil and a set of auxiliary solenoids. A new quench protection system is needed for a MARS magnet to be built with NbTi conductor cooled through thermal conduction. Using the Vector Fields'3-D QUENCH program, different scenarios were computed to investigate the key parameters in the cases with and without energy-extraction during quenches. The analyses have resulted in the design of a quench protection system for a MARS NbTi magnet with good safety margins at maximum quench voltage of ~ 400 V and hot-spot temperature of ~ 80 K.

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