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Quench Analysis of the 9.4-T Whole-Body MRI Superconducting Magnet

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The 9.4-T whole-body MRI superconducting magnet system with a warm bore of 800mm in diameter has been designed and fabricated in the Institute of Electrical Engineering, Chinese Academy of Sciences (IEE, CAS) for bioscience research applications. A passive quench protection system with the coil subdivisions and the heater network to accelerate quench propagation has been employed to avoid the damage of the magnet. Recently, the magnet system was tested successively and the magnet underwent two premature quenches at the operating current of 172.6 and 174.7 A respectively. In this paper, the test quench results have been analyzed. The quench behaviors including time-dependent current decay, voltages and hot-spot temperatures during aforementioned quenches are calculated in full by means of two quench numerical simulation codes based separately on anisotropic continuum model and finite difference model. The simulation results of the two numerical methods have been analyzed and compared to the test quench results and the performance of the two numerical methods has been discussed.

Key Words—MRI, superconducting magnets, quench protection, numerical simulation.

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