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Design and Implementation of Ferromagnetic Shims for a 3-T 100 mm All-REBCO No-Insulation Magnet

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This paper presents design and implementation of ferromagnetic shims for a conduction-cooled 3-T 100 mm winding diameter no-insulation (NI) all-REBCO magnet. The initial magnetic field profile was measured by an in-house 3-D field mapper with an NMR magnetometer, from which harmonic coefficients up to 3 order are derived. A ferromagnetic shim design code was developed, which includes an optimization process to minimize target harmonic field errors with a given volume of ferromagnetic shims. For experiment, two designed sets of ferromagnetic shim matrices, which consist of 0.025-25 mm thick iron pieces, were attached on two concentric cylindrical tubes of 54 mm and 60 mm in diameter, respectively, and then installed in a 64 mm room temperature bore of the 3 T magnet. Through recursive mapping and shimming steps, the magnet field uniformity was gradually improved from ~ 500 ppm to ~ 100 ppm. The results imply the first shimming test of all-REBCO no-insulation magnet, which will be a basis for our upcoming high-resolution all-REBCO NMR magnet currently being developed.

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