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Construction and optimization of local 3rd order passive shim system for human brain imaging at 4T MRI MOHAN JAYATILAKE, JUDD STORRS, JEFF OSTERHAGE, JING-HUEI LEE — The optimal MRI quality relies on a homogeneous magnetic field. However, local susceptibility variations within human brain can lead to field inhomogeneity that causes artifacts such as image distortion and signal drop-out, which become worse with increasing magnetic field strength. Many evidences showed that high order shims are required for optimal MRI at field greater than 3T. However, due to limited space, many MRI systems provide only up to second order active shims. In this work, we introduce a 3rd order local passive shimming along with the active 1st and 2nd order shimming to improve field homogeneity within the human brain for a group of subjects. A 3D gradient-echo pulse sequence was used to obtain B_0 field maps of four subjects' brains at 4T. The field maps for each subject were then decomposed into third-order spherical harmonic coefficients and averaged. The optimized positions, the required susceptibility and dimensions of shim elements for placement of shim elements on a cylindrical shim tube that fits over the RF coil were evaluated on a cylindrical surface to generate the desired magnetic field that can optimize the field variation over the entire human brain.When combined with first- and second-order active shimming, the passive shim tube significantly improved B_0 homogeneity within the brain.

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