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[Invited] Development of precise shimming technique with materials having low saturation magnetization

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MuSEUM experiment is in progress at J-PARC to measure the muonium hyperfine structure with a sensitivity as low as a few ppb. Muon $g-2$ /EDM experiment is also planned in J-PARC to measure muon's anomalous magnetic moment and electric dipole moment with an accuracy below 0.1 ppm. Both experiments require high homogeneous magnetic field below 0.2 ppm pp(peak-to-peak). Commercial MRI magnets successfully realize a homogeneity of several ppm in 40 cm DSV(Diameter Spherical Volume) by magnetic field shimming using iron pieces. An iron has a high saturation magnetization so that it is useful for magnetic field shimming from several hundreds ppm to several ppm. On the other hand, it is too high to perform fine shimming operation below 1 ppm. We have been developed a new shimming technique with materials having low saturation magnetization, that is, Nickel, magnetic fluid and magnetic putty. The latter two materials are commercially available. Those saturation magnetizations were measured at 1.7 T to use them for magnetic shimming, and about 19 and 22 % of iron for magnetic fluid and putty, respectively. The magnetic shimming test was performed using MRI magnet for MuSEUM experiment at 1.2 T with Ni thin plates and magnetic putty, and the homogeneities can be reached to 0.16 and 0.17 ppm pp, respectively.

This presentation reports the details of magnetic saturation measurement and shimming test with Ni, magnetic fluid and putty.

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