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Development of magnetic field mapping system for MuSEUM experiment with high precision using CW-NMR probes

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MuSEUM experiment to measure the muonium hyperfine structure at 1.7 T, is planned at J-PARC. The objective is to measure hyperfine transitions in the ground state hyperfine structure interval of Muonium precisely. The essential parameter is the magnetic field homogeneity, which is required to be less than 0.2 ppm pp(peak-to-peak) within a spheroid region with an equatorial radius of 100 mm and a polar radius of 150 mm. A measurement system of magnetic field distribution using CW(Continuous Wave)-NMR probes with a resolution of less than 10 ppb are being developed to do the shimming operation of magnetic field and verify the magnetic field homogeneity. The 24 CW-NMR probes are aligned on a circumference of semi-ellipse to shorten measurement time in the present design. The probes are placed at a short distance each other, therefore, the effect of cross talk between probes has to be reduced. And also, the structural materials and electric circuit had better to be zero-susceptibility materials, otherwise the resolution would be reduced because of field distortion by those materials.

This presentation reports the development status of the measurement system.

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