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Wed-Af-Po3.22-07 [85]: Development of fine shimming technique with magnetorheological fluid

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Two physics experiments using Muon are proceeded in J-PARC, named MuSEUM and g-2/EDM experiments. Objectives of these experiments are to measure hyperfine transitions in the ground state hyperfine structure interval of Muonium and to measure the anomalous magnetic moment of the positive muon, respectively. High homogeneity of magnetic field is essential to achieve the physics goals of both experiments. In general, iron pieces are used to shim a magnetic field to achieve required homogeneity, with the level of a few ppm. However, a fine-tuning shimming using iron pieces needs a lot of time effort due to a large magnetization. The further small iron pieces are required for the fine tuning, but it is difficult to assure sufficient manufacturing accuracy.

We are developing a new shimming technique using magnetorheological fluid. That has smaller magnetization than iron and the volume can be easily controlled because of a nature of liquid, so that it seems to control magnetic field precisely. Magnetizations of some commercial fluids are measured and capability of magnetic field shimming using fluids are studied.

In addition, a multi-channel NMR probe with high resolution of less than 10 ppb are being developed. The magnetic field generated by superconducting magnet would shift since temperature and pressure change etc., which cause change of magnet size. Therefore, we have to measure the magnetic field as quickly as possible. Besides, we also need to suppress an amount of the materials of the field measurement probe because the magnetizations of the probe own would degrade resolution. In order to fulfill these requirements, a multi-channel NMR probe with simultaneous reading is being developed. The probes compose of not only non-magnetized but also suppressed to less quantity.

This presentation reports the status of the development with the system of generating the homogeneous magnetic field.

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