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Faint magnetic field shield using the Meissner effect

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Magnetic fields play an important role in many physics studies, and many measurement items in physics experiments require control of micro magnetic fields. Although superconducting accelerating cavities can generate high electric fields at low power, the material niobium is a type-II superconductor, and trapping the ambient magnetic flux during the superconducting transition increases the operational losses. For this reason, micro magnetic shielding is important, and strengthening micro magnetic shielding is essential when aiming for further power saving. Therefore, we have begun to study the shielding effect of micro magnetic fields based on the Meissner effect of superconductors, which are perfectly antimagnetic. We have selected AMR (Anisotropic-Magneto-Resistive) type 3-axis sensors, drive five 3-axis sensors under cryogenic temperature, and bring their signals to the room temperature side with nine cables, including the power supply, by multiplexing. The signals were calibrated with the output of the FluxGate under cryogenic conditions. Preliminary results show that the amount of flux rejection is generally monotonically increasing with temperature gradient.

Footnotes

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