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Measurement of Magnetic Field Uniformity For a Neutron Electric Dipole Moment Detector with New Lead Endcaps[1] ANITA KULKARNI, BRADLEY FILIPPONE, SIMON SLUTSKY, CHRISTOPHER SWANK, ROBERT CARR, CHARLES OSTHELDER, ARITRA BISWAS, DANIEL MOLINA, California Institute of Technology — Over the last several decades, physicists have been measuring the neutron electric dipole moment (nEDM) with greater and greater sensitivity. The latest experiment we are developing will have 100 times more sensitivity than the previous leading experiment. A nonzero nEDM could, among other consequences, explain the presence of more matter than antimatter in the universe. To measure the nEDM with high accuracy, it is necessary to have a very uniform magnetic field inside the detector since non-uniformities can create false signals via the geometric phase effect. One way to improve field uniformity is to add superconducting lead endcaps to the detector, which constrain the fields at their surfaces to be parallel to them. Here, we test how the endcaps improve field uniformity by measuring the magnetic field at various points in a 1/3-scale experimental volume, inferring what the field must be at all other points, and calculating gradients in the field. This knowledge could help guide further steps needed to improve field uniformity and characterize limitations to the sensitivity of nEDM measurements for the full-scale experiment.

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