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Modeling and Optimization of a Discrete Cos Theta Coil for a New Neutron Electric Dipole Moment Search MICHAEL BETANCOURT, W.K. Kellogg Radiation Laboratory, California Institute of Technology, EDM COLLABORATION — The goal of the new neutron electric dipole moment experiment is to improve the limit on the current measurements of the neutron EDM by two orders of magnitude, resulting in the discovery of a finite EDM or the reduction of the limit on its value to the order of 10^{-28} e-cm. Ultra cold neutrons, produced via downscattering of 8.9 Å cold neutrons from superfluid ^{4}He, will be bottled in static electric and magnetic fields where they will process at a frequency $\omega = (\mu_n B + d_n E)/J\hbar$. Neutron capture by surrounding ^{3}He atoms produces scintillation light from which the neutron EDM can be extracted. Nonuniformities in the fields, however, induce a geometric phase in the neutrons that induces a false EDM signal. In order to minimize these errors, the uniformity of the fields, especially the magnetic field, must be optimized. To this end an analytical model of the discrete $\cos\theta$ coil that will generate the magnetic field for this experiment was developed and its validity tested with experimental measurements made on a prototype coil. Finally the model was used to optimize the final geometry of the $\cos\theta$ coil.

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