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Systematic effects in the search for the muon EDM using the frozen-spin method

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At the Paul Scherrer Institute we are developing a high precision instrument to measure the electric dipole moment (EDM) of the muon. The salient feature of the experiment is the use of the frozen-spin method to suppress the anomalous precession of the muon spin, allowing for a sensitivity that cannot be achieved with conventional g-2 muon storage rings. With this technique, the expected statistical sensitivity for the EDM after one year of data taking is $6 \times 10^{-23}\ e \cdot \mathrm{cm}$ with the $p = 125$ MeV/c muon beam available at PSI.

Reaching this goal necessitates a comprehensive analysis on spurious effects that mimic the EDM signal. This work discusses a quantitative approach to study systematic effects for the frozen-spin method when searching for the muon EDM. Equations for the motion of the muon spin in the electromagnetic fields of the experimental system are analytically derived and validated by simulation. The kinematics of decay positrons in the context of the experiment will also be shown.

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