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Beam Injection and Storage Study for the muEDM Experiment at PSI

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Permanent electric dipole moments (EDMs) of elementary particles violate CP symmetry. Compared with the current muon EDM limit($|d_\mu| < 1.8 \times 10^{-19} e \cdot cm$) obtained from the BNL Muon g-2 Collaboration, the contribution to the muon EDM from the standard model is negligible ($|d_\mu| \sim 1.4 \times 10^{-38} e \cdot cm$), making the EDMs of elementary particles very sensitive probes for searching Beyond Standard Model (BSM) Physics for additional CP violation sources. The latter is one of the three criteria proposed by Sakharov for creating matter-antimatter asymmetry in the universe. The muon EDM experiment at PSI using frozen-spin technique expect to reach a sensitivity of $3 \times 10^{-21} e \cdot cm$ in phase I. The study of muon beam injection and storage is one of the critical parts of the experiment. Muons are injected into the solenoid through a superconducting channel and an entrance detector. When muons pass through the entrance detector, a signal is produced to trigger a pulsed magnetic field, which will deflect the trajectory of muons into a stable orbit in the central solenoid region. A Geant4 simulation incorporating all electric and magnetic fields in the solenoid will be developed to simulate the beam injection and storage from the exit of the superconducting channel to the central region of the solenoid. Four different magnetic fields will be used in the simulation: a PSC solenoid field, correction coil fields, a weakly-focusing coil field and a pulsed magnetic field. Finally, the storage efficiency will be studied. In this poster, we will present the status of the beam injection and storage simulation.

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