Measuring the Neutron Lifetime with Ultracold Neutrons

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The UCNτ experiment is designed to measure the average lifetime of a free neutron (τ_n) by trapping ultracold neutrons (UCN) in a magneto-gravitational trap and allowing them to β-decay, with the ultimate goal of minimizing the uncertainty to approximately 0.01% (0.1 s). Understanding the systematics of the experiment at the level necessary to reach this high precision may help to better understand the disparity between measurements from cold neutron beam and UCN bottle experiments (τ_n~888 s and τ_n~878 s, respectively). To assist in evaluating systemics that might conceivably contribute at this level, a neutron spin-tracking Monte Carlo simulation, which models a UCN population's behavior throughout a run, is currently under development. The simulation will utilize an empirical map of the magnetic field in the trap by interpolating the field between measured points in order to model the depolarization mechanism with high fidelity. As a preliminary step, the simulated data must be compared to data from a real run cycle. I will explain some basics of the simulation and analysis of real data.