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Monte Carlo Modeling the UCNτ Magneto-Gravitational Trap
A.T. HOLLEY FOR THE UCNTAU COLLABORATION, Tennessee Technological University — The current uncertainty in our knowledge of the free neutron lifetime is dominated by the nearly 4σ discrepancy between complementary "beam" and "bottle" measurement techniques. An incomplete assessment of systematic effects is the most likely explanation for this difference and must be addressed in order to realize the potential of both approaches. The UCNτ collaboration has constructed a large-volume magneto-gravitational trap that eliminates the material interactions which complicated the interpretation of previous bottle experiments. This is accomplished using permanent NdFeB magnets in a bowl-shaped Halbach array to confine polarized UCN from the sides and below and the earth's gravitational field to trap them from above. New *in situ* detectors that count surviving UCN provide a means of empirically assessing residual systematic effects. The interpretation of that data, and its implication for experimental configurations with enhanced precision, can be bolstered by Monte Carlo models of the current experiment which provide the capability for stable tracking of trapped UCN and detailed modeling of their polarization. Work to develop such models and their comparison with data acquired during our first extensive set of systematics studies will be discussed.

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