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BL3: A Next Generation Beam Neutron Lifetime Experiment[1]

F. E. WIETFELDT, Tulane University, N. FOMIN, G. L. GREENE, University of Tennessee, Knoxville, W. M. SNOW, C.-Y. LIU, Indiana University, C. B. CRAWFORD, W. KORSCH, B. PLASTER, University of Kentucky, G. L. JONES, B. COLLETT, Hamilton College, M. S. DEWEY, National Institute of Standards and Technology — BL3 (Beam Lifetime 3) is a proposed next generation neutron lifetime experiment using the beam method. It continues a program, spanning more than three decades, of experiments at the ILL (France) and the NIST Center for Neutron Research that achieved the most precise beam method neutron lifetime measurements to date. A collimated cold neutron beam passes through a quasi-Penning trap where recoil protons from neutron decay are trapped. Periodically the trap is opened and these protons follow a bend in the magnetic field to a silicon detector. The same neutron beam passes through a thin-foil neutron counter that measures the neutron density. The ratio of neutron and proton count rates, along with efficiency factors, gives the neutron lifetime. The main goal of BL3 is to thoroughly investigate and test systematic effects in the beam method in an effort to address the current 4σ discrepancy between the beam and bottle methods. It will employ a much larger, higher flux neutron beam, a large area position-sensitive proton detector, and an improved magnet design, with a proton trapping rate 100 times higher than past experiments.

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