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Measuring the Neutron Lifetime Using Magnetically Trapped Ultracold Neutrons H.P. MUMM, K.J. COAKLEY, A.K. THOMPSON, G. YANG, National Institute of Standards and Technology, R. GOLUB, P.R. HUFFMAN, C.M. O'SHAUGHNESSY, K.W. SCHELHAMMER, P. SEO, North Carolina State University, J.M. DOYLE, Harvard University, L. YANG, Stanford University, S.K. LAMOREAUX, Yale University — The neutron beta-decay lifetime is important in both theoretical predictions of the primordial abundance of ^{4}He and providing a strong unitarity test of the CKM mixing matrix. We have previously demonstrated trapping of Ultracold Neutrons (UCN) in a magnetic trap, and, though statistically limited, measured a lifetime consistent with the world average. A major upgrade of the apparatus is nearing completion at NIST. In our unique approach, a 8.9 Angstrom neutron beam is incident on a superfluid ^{4}He target within the minimum field region of an Ioffe- type magnetic trap. Some neutrons are downscattered by single phonon emission in the superfluid helium to near rest and trapped; at sufficiently low temperatures, the low phonon density in the helium suppresses upscatter. The electron accompanying neutron decay produces scintillation in the superfluid helium and can be detected in real time. Statistical limitations of the previous apparatus as well as systematics related to neutron material bottling will be reduced by significant increases in field strength and trap volume. Tests of a new magnetic trap, cryostat, and details of the upgrade will be presented.

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