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Magnetic Mapping of the UCNτ Apparatus[1] ROWAN LUMB, Tennessee Technological University, UCNTAU COLLABORATION — The lifetime of free neutron decay has been determined by two different experimental techniques that differ in reported values by about 8 s, while individual experiments report an error of about 1 s. The UCNτ collaboration has an immediate goal to measure the lifetime of the neutron to within 0.1%, i.e. about 1 s, using an apparatus that addresses systematic effects in previous experiments by confining the neutrons with a magnetic field. The UCNτ apparatus is a magneto-gravitational trap capable of holding polarized low-energy ($\sim$100 neV) "ultracold" neutrons (UCN) in a magnetic "bowl" with the help of gravity. The trap is composed of a discrete Halbach permanent magnet array as well as a number of normally conducting field coils that wrap around the array itself. The array produces an exponentially decaying magnetic field capable of trapping the UCN, while the coils create a holding field that inhibits depolarization. However, there is concern over whether mechanical defects might cause cancellation between the two field sources. If cancellation does occur within the trap, magnetic field zeros or uncontrolled field gradients could result, which could increase the depolarization rate. In response, we are performing a surface mapping of the array using a three-axis Hall probe, as well as a volume mapping of the holding field to search for any cancellations or inconsistencies that would create a systematic error in the experiment. We will also report on a stereo tracking system designed to allow precise measurement of the probe's position in real-time within the array.

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