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Position-sensitive "movie" *in situ* neutron detector for the UCNτ experiment HANNAH WEAVER, Los Alamos National Laboratory, FOR THE UCNTAU COLLABORATION — Precision measurements of neutron β-decay parameters provide tests of fundamental theories in elementary particle physics and cosmology such as the Standard Model and Big Bang nucleosynthesis. In particular, the UCNτ experiment aims to measure the mean lifetime of ultracold neutrons confined in an asymmetric magneto-gravitational trap using an *in situ* neutron detector. This detector consists of a 20 nm film of ^{10}B on top of a ZnS:Ag scintillating screen. The screen is readout using two photomultipliers which view an array of wavelength shifting fibers optically coupled to the scintillator. When the detector is lowered into the loaded trap, light is emitted due to the charged particles recoiling into the ZnS:Ag when neutrons absorb on the ^{10}B. Phase space evolution in the stored neutron population can lead to apparent shifts in the measured neutron lifetime with the detector height. In order to quantify this systematic uncertainty, we are implementing a supplemental 64-channel position-sensitive PMT module with high quantum efficiency and fast time response to image the entire detector *in situ* during measurements. We have characterized a prototype using a ZnS screen and an α-particle source along with a prototype lens system and will report the results and future plans.

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