A SiPM-based Depolarization Monitor for UCNτ+

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Silicon photomultipliers, also known as SiPMs, are sensitive photon detectors that are useful in resolving single photons in very dark environments, comparable to photomultiplier tubes. As such, they have potential application in the UCNτ+ experiment being conducted at Los Alamos National Laboratory. In this experiment, ultracold neutrons are confined to a volume using magnetic gradients to ultimately measure the mean free neutron lifetime. As the neutrons evolve in this system, they occasionally depolarize, causing the neutrons to be drawn towards the magnets. These depolarization events create error when calculating the mean free neutron lifetime. To solve this, a scintillating material, thinly coated with Boron-10, is placed over the magnets to capture these depolarized neutrons, resulting in the emission of photons. The goal in using SiPMs is to detect the emitted photons and estimate limits on the rate at which depolarization occurs. However, as nothing can be placed in the volume of trapped neutrons, optical elements must be used to extend the effective distance of the SiPM to about a meter. The results of our research and development of the detector will be presented.