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Performance Characteristics of the Next Generation Solid-State Photomultipliers ERIK BJORN JOHNSON, CHRISTOPHER STAPELS, XIAO JIE CHEN, CHAD WHITNEY, Radiation Monitoring Devices, MARK HAMMIG, University of Michigan, JOE CAMPBELL, University of Virginia, JAMES CHRISTIAN, Radiation Monitoring Devices — A typical method for detection of radiation consists of using a scintillation material with a photomultiplier tube (PMT), which continues to provide excellent performance in comparison to the solid-state photomultiplier (SSPM). The SSPM has a number of features that makes it a viable alternative, as in being insensitive to magnetic fields, robust, compact, and requiring low voltages for operation, but the major limiting factor associated with a direct replacement for the PMT with SSPMs is the dark current. We will demonstrate a potential, low-cost solution for an upgrade to the PRIMEX experiment at Jefferson Laboratories. We will discuss the characteristics of SSPMs fabricated with commercial and non-commercial CMOS processes. Where the commercial process is reliable but limited in design features, the non-commercial process, which allows for greater control of the design, may have challenges with process control without a dedicated foundry. Fabricated designs show an increase in the ratio of detected photons to dark counts by a factor of 10, and the work will discuss the performance characteristics of the next-generation of solid-state photomultiplier in the context of nuclear and high-energy physics experiments.

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