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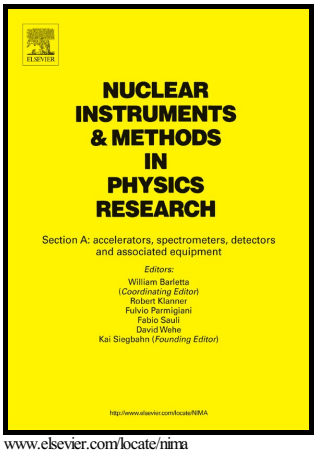

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Ultrafast Detection in Particle Physics and Positron Emission Tomography Using SiPMs

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Abstract

Silicon photomultiplier (SiPM) photodetectors perform well in many particle and medical physics applications, especially where good efficiency, insensitivity to magnetic field and precise timing are required. In Cherenkov time-of-flight positron emission tomography the requirements for photodetector performance are especially high. On average only a couple of photons are available for detection and the best possible timing resolution is needed. Using SiPMs as photodetectors enables good detection efficiency, but the large sensitive area devices needed have somewhat limited time resolution for single photons. We have observed an additional degradation of the timing at very low light intensities due to delayed events in distribution of signals resulting from multiple fired micro cells. In this work we present the timing properties of AdvanSiD ASD-NUV3S-P-40 SiPM at single photon level picosecond laser illumination and a simple modification of the time-walk correction algorithm, that resulted in reduced degradation of timing resolution due to the delayed events.

Key words: Silicon photomultipliers, PET, Time-of-flight, Cherenkov radiation

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