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New photon detector device based on a matrix of PPDs with FPGA-based digital readout

Light detection through photosensitive devices represents one of the key issues for a large variety of experiments.

In the recent years, Pixelated Photon Detectors (PPDs) based on limited Geiger-mode avalanche have been extensively studied in view of their future applications.

However, their use is strongly limited by their small sensitive surfaces and by the fact that any increment in the surface turns out into an increase of the dark count rate.

In the present work we describe the dark count rate reduction obtained by using a FPGA-based logical circuit for fast pre-processing of pulses from a 3×3 matrix of PPDs. The prototype we developed supports two PPDs: we show that a rate reduction from 2.8 Mcps (Mega counts per second) down to 0.13 Mcps at the lowest threshold (0.5 photon-equivalent) and from 0.8 kcps down to 0.005 cps for the highest threshold (3.5 photon-equivalent) is obtainable. We also introduce a possible application based on the use of a 3×3 matrix of PPDs at very low temperatures (approx. -190 C) in dark matter search experiments.

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