

NUV-sensitive SiPMs developed at FBK and Applications

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Near Ultraviolet, High Density (NUV-HD) SiPM technology, developed at FBK (Trento, Italy), is based on a p-on-n junction and features peak photon-detection efficiency (PDE) in excess of 60% at 410 nm. Dark Count Rate (DCR) is in the order of 100 kHz/mm², correlated noise is 10% at 55% PDE and microcell pitch ranges between 15 μ m and 40 μ m. Sensitivity remains high down to 320 nm, with a PDE of 48% (including package). Single Photon Timing Resolution (SPTR) of NUV-HD SiPMs was below 30 ps FWHM, when measured on single SPAD with covered edges, and increased to 75 and 180 ps FWHM for SiPMs with active areas of 1x1 mm² and 3x3 mm², respectively, because of the electronic noise. NUV-HD SiPMs provide state-of-the art 85 ps FWHM coincidence resolving time (CRT) in PET applications, reading out the light of a Ca co-doped LYSO crystal.

Recent interest in the SiPM readout of liquid scintillators (mainly LAr and LXe) triggered the development of a cryogenic variant of the NUV-HD technology (NUV-HD-Cryo), which is optimized for operation at cryogenic temperatures and features a DCR of a few mHz/mm² at 77 K. At this temperature, few-photon counting capability was demonstrated, with S/N larger than 14, using a 24 cm² SiPM array coupled to a single analog readout channel. Ongoing optimizations include the development of devices with extended deep-UV sensitivity: preliminary results show a PDE of 20 % at 178 nm.

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