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Innovative technology for SiPM-like detectors

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Invented in Russia at the end of last century SiPMs have been significantly improved during following years. From the very beginning a SiPM demonstrated an ability to detect visible light photons from a single one to thousands and more but now this is a detector with really high photon detection efficiency which is even higher than 60%. Main figures of merit for the SiPM-like detectors - SSPM, APD-G, MPPC, SPM- are photon detection efficiency (PDE), interpixel crosstalk (XT) and dark rate. It should be noted that for significant number of applications it is not enough to have just a high PDE. It is quite important to have at the same time XT as low as possible. Crosstalk suppression is a hot technological problem for SiPM detectors now. SiPM's dark rate was considerably improved during last years of detector developments. Several years ago the average value for dark rate was at the level of 1MHz/mm² and now advanced producers show values below 100 kHz/mm². It looks like such trend will continue further. SiPMs started as matrixes of a p-n-junctions connected together on a common substrate and now such detectors have a name "analog" SiPM. It means that during last years a digital SiPM family have appeared where each photosensitive p-n-junction equipped by active electronic components. Such dSiPMs have an ability to access an each micropixel and in case of bad noise behavior to mask them out. In comparison to analog SiPM this kind of detectors is less sensitive to external conditions (voltage, temperature), do not require external electronics but PDE is lower and readout is slower. However, the position sensitivity of such detector is an attractive feature of a dSiPM and timing properties for large area detectors look better than for traditional analog SiPM approach.

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