

3Dimensionally integrated Digital SiPM

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Analog silicon photo-multipliers (SiPMs) are now a mature technology in particle physics being widely used for the detection of scintillation and Cerenkov light. Digital SiPMs remain an emerging technology driven in part by the goal of achieving 10ps coincidence timing resolution for Positron Emission Tomography, which translates roughly to requiring photo-detectors with 10ps single photon timing resolution (SPTR). Our group is developing a photo-detector solution based on 3 dimensional integration capable of achieving 10ps SPTR with high efficiency, while remaining cost effective. Our 3-Dimensionally integrated digital SiPM (3DdSiPM) solution is expected to be ideally suited for many particle physics experiments requiring timing resolution better than 100ps. Our solution is also fully digital (photon coming in, bits coming out) hence eliminating the need for front end electronics. The power dissipation of 3DdSiPMs is expected to be significantly lower than analog SiPM front end electronics for the same performance, which is a very attractive feature for the detection of scintillation light in liquid Xenon and liquid Argon, where liquid boil-off is a serious concern. Our group is pursuing in particular a solution for the nEXO experiment requiring the detection of 175nm light over 5 m². We will describe the technology in details showing prototype performances and discussing applications in particle and astro-particle physics.

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