Contribution ID: **23** Type: **Talk**

Status and Perspectives of CMOS SPAD-based single photon detectors

Tuesday, September 16, 2025 5:05 PM (30 minutes)

CMOS-based individual SPAD detectors and arrays have seen a host of applications being explored and industrialised in the past years, relying on their single-photon detection capability, combined with excellent photon-timing precision and noiseless read-out (in the digital flavour). Manufactured in standard CMOS technologies, their sensitivity spans the entire spectrum, from NUV to NIR.
We will start by looking at some of the recent commercial developments, technology trends and general manufacturing options, with emphasis on manufacturing bottlenecks and opportunities. This will be followed by a review of representative CMOS SPAD arrays and digital SiPM (dSiPM) designs, as well as hybrid architectures, for high-energy physics and the nuclear science community in the large sense (e.g. including Positron Emission Tomography). Digital SiPMs are one of the array flavours, where the intrinsically digital nature of the SPAD response is preserved and exploited as close as possible to the SPAD itself, without necessarily reaching the granularity of true imagers.
We will also highlight how the target applications drive high level architectural choices and the ultimate system performance, be it for synchronous, high data rate scenarios such as RICH detectors (spadRICH project), or event-driven, low data rate experiments such as neutrino tracking.

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Session Classification: Photon sensor techniques for Cherenkov imaging counters

Track Classification: Photon sensor techniques for Cherenkov imaging counters