



Schematic drawing of the proposed strip Multi-Pixel Photon Counters (MPPC).

(Image: Doroud et al. 2017. See reference [here](#).)

## AREA OF EXPERTISE

- Electronics
- Particle Tracking
- Radiation Monitoring

## IP STATUS

- Co-owned with INFN
- USA: patented (US201314889309)
- Europe: filed (EP20130725063)

## TECHNOLOGY READINESS LEVEL

- Prototype

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## Silicon Photo-Multipliers with Strip Geometry for Enhanced Timing Resolution

Silicon photomultipliers (SiPM) are solid-state single photon counting detectors that consist in an array of single-photon avalanche diodes (SPAD). In analog SiPM (aSiPM) designs, all SPADs are connected in parallel, with the analog output signal being fed into the subsequent electronics. A differential readout of each aSiPM's anode and cathode reduces noise and cross-talk and, therefore, improves the timing performance.

The strip SiPM consists in strips of SPADs and allows arrangements of several thin strips next to each other on a single detector. In contrast to commonly available aSiPM arrays, where through-silicon vias (TSVs) need to be used for an optimal implementation of differential readout, the anode and cathode of SPAD strips can easily be read out at each end. The average of both readings provides the exact timing of the hit, while the time difference provides the position of the firing SPAD on the strip.

## APPLICATIONS

- Medical Imaging (Time of Flight Positron Emission Tomography TOF-PET)
- Mass Spectrometry

## ADVANTAGES

- SPADs are arranged as strips
- Differential readout at both ends of the strip

## LIMITATIONS

- Need to design matching read-out electronics

## PUBLICATIONS

- Doroud, K., Williams, M. C. S., & Yamamoto, K. (2017). The Strip Silicon Photo-Multiplier: An innovation for enhanced time and position measurement. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 853, 1–8. <https://doi.org/10.1016/j.nima.2017.02.016>
- Doroud, K., Liu, Z., & Williams, M. C. S. (2019). A new geometry of scintillating crystals with strip SiPMs: a PET detector with precise position and time determination. *Journal of Instrumentation*, 14(01), P01016. <http://dx.doi.org/10.1088/1748-0221/14/01/P01016>

