

## Validation of a highly integrated PET readout system scalable to several 10'000 channels

SiPMs allow a dramatic improvement of PET performance because SiPMs are intrinsically faster than PMTs and because SiPMs can easily be subdivided in a large number of small independent photodetector pixels. The good timing performance of SiPMs will result in better effective sensitivity. The small and independent photodetector pixels allow using one-to-one coupling between a SiPM pixels and a LYSO crystals. This will result in significant improvement of the spatial resolution compared to PMT base systems, where some form of crystal encoding must be used to identify the LYSO crystal where the interaction occurred.

A whole body PET scanner will typically have 30'000 LYSO crystals measuring 4x4x20mm. To take advantage of SiPMs in PET applications, it is mandatory to have highly integrated electronics readout. We have developed the 64 channel TOFPET1 ASIC for this purpose. It has 64 independent readout channels without multiplexing. The output is only digital, 80 bits per event. The rest of the electronics only has to transfer the data to the computer. The coincidence sorting is done in firmware. The readout electronics will scale to many tens of thousands of channels.

The electronics will be described, and we will present the performance of the readout in a test PET scanner setup with 2'048 channels.

We will report on rate performance, energy resolution, spatial resolution and time resolution of the system. Images with phantoms will also be presented

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**Track Classification:** Medical Applications