

Sub-100 ps Coincidence Time Resolution for ToF-PET detectors using FastIC

Monday, 30 May 2022 18:20 (20 minutes)

Recent developments in Silicon Photomultiplier (SiPM) sensors and fast readout electronics are enabling new achievements in Coincidence-Time Resolution (CTR) for Positron-Emission Tomography (PET) detectors. The new 8-channel FastIC ASIC developed in CMOS 65-nm technology provides an accurate time-stamping of the detected particles and a linear energy measurement while having a power consumption of 12-mW/Ch. The ASIC have the capability of summing different readout channels in clusters of 4 channels before measuring time and energy. Evaluation of the ASIC showed CTR values of 94 ± 2 and 76 ± 2 ps FWHM for HPK SiPM S13360-3050PE and new technology FBK HD-NUV Low Field (3.2×3.12 mm² pixel, 40 μ m cell) coupled to a pair of LSO:Ce:Ca 0.2% measuring $2 \times 2 \times 3$ mm³. Furthermore, new FBK HD-NUV Low Field SiPM coupled to LYSO:Ce:Ca 0.2% measuring $3.13 \times 3.13 \times 20$ mm³ yielded a CTR value of 126 ± 2 ps FWHM. Additionally, first measurements of the chip confirmed its ability to detect prompt light emitters e.g., using Cherenkov radiators like TICl and PbF₂.

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Session Classification: New technologies for PET/MR and TB-PET

Track Classification: New technologies for PET/MR and TB-PET