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A Novel Spectroscope with Machine Learning at the Edge for Real-Time Position Sensitivity in Thick LaBr3 Crystal

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We present a 144-channel detection module for gamma spectroscopy that couples a SiPM detectors array to a thick LaBr3 scintillation crystal. The module features custom front-end electronics, state-of-the-art energy resolution (2.9% at 662keV), 80kHz monolithic acquisition rate and embedded, real-time imaging capabilities. The relatively large number of independent channels allows to achieve a large energy range (up to 20MeV) and spatial resolution in photon-interaction position reconstruction (aiming at relativistic Doppler effect correction in accelerator-based nuclear physics experiments), without sacrificing state-of-the-art energy resolution, thanks to the 84dB dynamic range GAMMA ASIC. The experimental results, obtained in real-time, edge computing of coordinates and energy per scintillation event on the FPGA device with sub-µs processing time, suggest an innovative approach in instrumentation development for nuclear science.

Minioral

Yes

IEEE Member

Yes

Are you a student?

Yes

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