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Performance of monolithic BGO-based detector implementing a Neural-Network event decoding algorithm for TB-PET applications

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Total body positron emission tomography (TB-PET) is currently changing the way the medical imaging community approaches PET scanner and data acquisition system designs, shifting the focus to reducing costs while still achieving good 3-D spatial resolution, time resolution and sensitivity.
Monolithic BGO-based detectors allow to significantly cut costs compared to the 3x more expensive standard pixellated LYSO, but it has seldom been used in recent PET scanners because of its slower response and lower light yield, leading to worse time and energy resolution, respectively.
We will present results that disprove this theory, showing that a 25 mm x 25 mm x 12 mm monolithic BGO crystal read by a 4x4 matrix of Hamamatsu S14160 6 mm MPPCs can achieve sub-mm spatial resolution, sub-300 ps CTR and an energy resolution around 15%.
These results are obtained using a novel algorithm for event characterization based neural networks. The algorithm is light and has a real-time implementation in a low-cost FPGA that allows it to process 1 Mcps.
These characteristics make monolithic BGO the optimal scintillator choice for TB-PET, allowing to keep costs down without compromising on performance.

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