EUROPEAN AI FOR FUNDAMENTAL PHYSICS CONFERENCE EuCAIFCon 2025

Contribution ID: **141**

Type: **Poster + Flashtalk**

Neuromorphic Readout for Hadron Calorimeters

In this work we simulate hadrons impinging on a homogeneous lead-tungstate (PbWO4) calorimeter to investigate how the resulting light yield and its temporal structure, as detected by an array of light-sensitive sensors, can be processed by a neuromorphic computing system. Our model encodes temporal photon distributions in the form of spike trains and employs a fully connected spiking neural network to regress the total deposited energy, as well as the position and spatial distribution of the light emissions within the sensitive material. The model is able to estimate the aforementioned observables in both single task and multi-tasks scenarios, obtaining consistent results in both settings. The extracted primitives offer valuable topological information about the shower development in the material, achieved without requiring a segmentation of the active medium. A potential nanophotonic implementation using III-V semiconductor nanowires is discussed.

AI keywords

simulation-based inference; neuromorphic computing; real time processing; spiking neural network

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Track Classification: Inference & Uncertainty