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Smartpixels: Developing ASICs for high-energy particle detectors with on-chip neural networks in 28 nm CMOS

Thursday 9 October 2025 11:40 (20 minutes)

Fine-granularity trackers have the potential to enhance high-priority physics in challenging environments of future high-energy experiments. This requires intelligent ways to overcome the strict bandwidth and power constraints of the detector. As part of the Smartpixels project, we have been developing and testing radiation-hard ASICs fabricated using a 28 nm CMOS process with on-chip neural networks, which can enable data-reduction using single-layer hit information. In particular, we have implemented a filtering neural network informed by prior simulation and algorithm development, capable of classifying the transverse momentum of incident particles based on the charge clusters they deposit in the sensors. Preliminary results of the ASIC characterization and the on-chip neural network performance will be presented. Ongoing studies will seed further algorithm and hardware development efforts, improving performance and validating this approach for future experiments.

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