



Contribution ID: 100

Type: **Poster**

Integrated Electro-Photonic Graph Neural Networks (GNNs) for Charged Particle Tracking

Wednesday 8 October 2025 20:00 (20 minutes)

In this talk, we will present our on-going work on the co-design of integrated electro-photonic Graph Neural Networks (GNNs) for real-time charged particle tracking, as part of the El-Pho project within the MEERCAT microelectronics science research center (MSRC). GNNs are a natural fit for particle track reconstruction due to their ability to efficiently process the sparse and irregular data produced by tracking detectors. Our approach emphasizes a hardware-software co-design methodology, including novel techniques for optimal partitioning of hardware between electronic and photonic components, to exploit the low-latency, high-bandwidth and energy-efficiency of integrated photonics. We evaluate our GNN architectures using publicly available physics-based tracking datasets and benchmarks, laying the groundwork for next-generation intelligent detector systems for high-energy physics experiments.

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Session Classification: Poster

Track Classification: RDC 4 Readout & ASICs