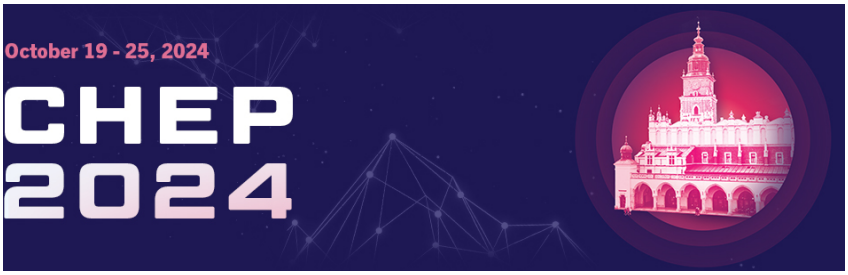


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# Cluster counting reconstruction with classical supervised learning and transfer learning

*Tuesday 22 October 2024 14:06 (18 minutes)*

Particle identification (PID) is crucial in particle physics experiments. A promising breakthrough in PID involves cluster counting, which quantifies primary ionizations along a particle's trajectory in a drift chamber (DC), rather than relying on traditional dE/dx measurements. However, a significant challenge in cluster counting lies in developing an efficient reconstruction algorithm to recover cluster signals from DC cell waveforms.

In PID, machine learning algorithms have emerged as the state-of-the-art. For simulated samples, an updated supervised model based on LSTM and DGCNN achieves a remarkable 10% improvement in separating K from $\pi$ compared to traditional methods. For test beam data samples collected at CERN, due to label scarcity and data/MC discrepancy, a semi-supervised domain adaptation model, which exploits Optimal Transport to transfer information between simulation and real data domains, is developed. The model is validated using pseudo data and further applied to real data. The performance is superior to the traditional methods and maintains consistent across varying track lengths.

There are two related papers that have been submitted to journals: 2402.16270 and 2402.16493. The previous one about the transfer learning has been accepted by the Computer Physics Communications (https://doi.org/10.1016/j.cpc.2024.109208).

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