Clustering hits of Time Projection Chamber by machine learning and artificial neural networks at sPHENIX

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Abstract

The Time Projection Chamber (TPC) at sPHENIX coverages pseudorapidity $|\eta| < 1.1$. TPC is the major tracking detector and plays a key role in jet and heavy-flavor measurements. Charged particles passing through the TPC ionize electrons, and their positions are calculated using electron-drift time. These ionized electrons produce hits that form clusters for track reconstruction. The traditional method of grouping connected hits into clusters, known as connected component analysis (CCA), becomes less effective in high-multiplicity events, such as Au+Au collisions with pileup, due to effects like δ-electrons. A neural network (NN) clustering, which uses an NN to predict the cluster position based on the distribution of hits, is supposed to improve the clustering performance. We simulate high-multiplicity events and sPHENIX detector responses and train the NN to predict the associated truth cluster position based on the distribution of the reconstructed hits. I will show the implementation of NN clustering at sPHENIX and our plan to enhance its performance by improving truth-information association and fine-tuning the parameters of the NN.