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# A Deep Learning based algorithm for PID study with cluster counting

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Ionization of matters by charged particles are the main mechanism for particle identification in gaseous detectors. Traditionally, the ionization is measured by the total energy loss (dE/dx). The concept of cluster counting, which measures the number of clusters per track length (dN/dx), was proposed in the 1970s. The dN/dx measurement can avoid many sources of fluctuations from the dE/dx measurement, which in the end can potentially have a resolution two times better than the dE/dx.

The dN/dx measurement requires highly efficient reconstruction algorithm. One need to determine the number of peaks associated with the primary electrons in the induced current waveform in a single detection unit. The main challenge of the algorithm is to handle the highly pileup situations of the single peaks and to discriminate the primary peaks from the secondary electrons and noises. A machine learning based algorithm is developed for the cluster counting problem. The algorithm consists of a peak finding algorithm, which aims to find all peaks in the waveform, based on the Recurrent Neural Network (RNN). And a clustering algorithm, which is to determine the number of primary peaks, based on the Convolutional Neural Network (CNN).

In the talk, the basic idea of cluster counting and the reconstruction algorithm based on machine learning will be presented.

## Experiment context, if any

The study is applied for the drift chamber design in Circular Electron Positron Collider (CEPC).

## References

## Significance

The peak finding is essential for the cluster counting technique. The new developed algorithm based on machine learning overcomes the traditional algorithm such as derivatives for the peak finding.

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