Charge particle identification

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Classification of particle type from a reaction

- Our detector, a time projection chamber, can detect the energy lost per unit length ($dE/dX$) and momentum vector ($\vec{P}$) of reaction fragments.

- At a constant momentum, different types of particle lost different amount of energy and we can classify they can be easily classified by plotting $dE/dX$ vs $|\vec{P}|$ as shown.

Figure courtesy G. Jhang
Why AI

• Currently we draw graphical cuts from the aforementioned 2D plots, but we know the shape of those line changes depending on emission angle.

• Hope is instead of making selection in 2D feature space (dE/dX and |\vec{P}|), we increase the dimensionality to 4D (dE/dX, px, py, pz) and hope for better results.

• Machine learning algorithm should excel at higher dimensional classification.
Current result and challenges

• Confusion matrix shows that fully connected neural network did do better than graphical cut on simulated data.

• Challenges:
  • Simulated data will not be identical to experimental data
  • Difficult to incorporate the python library into FairROOT framework

Figure courtesy T. Ladouceur