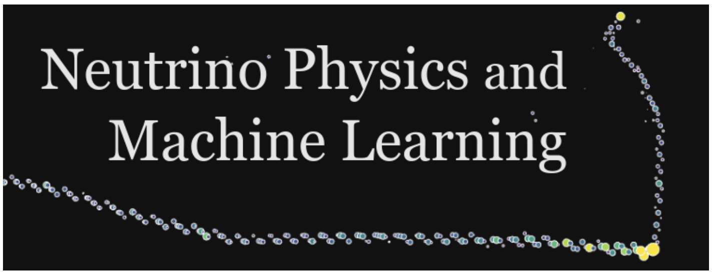

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Enabling A Deep Neural Networks based 3D LArTPC Data Reconstruction Chain for ICARUS

Friday, 10 July 2020 15:10 (25 minutes)

Liquid Argon Time Projection Chamber (LArTPC) offers high resolution (~3mm/pixel) 2D or 3D imaging of charged particles' trajectories. Deep neural networks (DNN) have been successfully applied to the data reconstruction of LArTPC. At SLAC we are building an end-to-end 3D LArTPC data reconstruction chain of algorithms, specifically designed for sparse LArTPC data. However LArTPCs come in two flavors: wire and pixel LArTPCs, that record multiple 2D projection images and 3D images respectively. In order to enable the 3D reconstruction chain for 2D imaging wire LArTPCs, 3D points must first be reconstructed. Existing 3D point reconstruction algorithms produce a large number of fake 3D hits formed by incorrect combinations of hits in 2D projection images, and the resulting 3D images of particle trajectories are difficult to analyze. In this talk, we present an efficient 3D deep convolutional neural network that disambiguates such fake 3D points from underlying true particle trajectories using the detector simulation of ICARUS, a large-scale (760-ton) LArTPC far detector for the Short Baseline Neutrino Program at Fermilab. Our method enables the application of a 3D reconstruction chain to any wire LArTPC detectors for a variety of tasks. We highlight here a pixel-level particle type classification followed by the reconstruction of a Michel electron, a commissioning analysis target for the calibration of the low energy electromagnetic showers.

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