Contribution ID: **72** Type: **Oral**

Classification of muon- and electron neutrino events for the ESSnuSB Near Detector using Graph Neural Networks

Friday 25 August 2023 14:40 (20 minutes)

Accurate and fast event reconstruction is central for the design and performance of the ESSnuSB detectors. While precise, the currently proposed likelihood-based method for event reconstruction is computationally expensive. In recent years, machine learning methods have been implemented for reconstruction in several high energy physics experiments, including neutrino experiments, enabling fast reconstruction without reducing performance and in some cases even improving it.
In this work, we investigate the use of Graph Neural Networks (GNNs) for classification of muon and electron events and muon- and electron neutrino charged current events in the Near Detector of the proposed ESSnuSB experiment. We demonstrate that the accuracy of the GNN method is comparable to that of the likelihood method, and that the GNN can even learn the signatures of, and accurately identify, complex events that are currently discarded, while providing a factor 104 increase in reconstruction speed. Furthermore, we study the performance of the GNN by investigating the relation between event signatures and reconstruction performance.
Using the GNN based method will enable fast event reconstruction when making changes to the detector design, and will thus allow for easier investigation of different detector designs. Eventually, the GNN could also be used for regression tasks, such as energy reconstruction. In this talk, we will present the method and results of training and running a GNN on simulated events for the ESSnuSB detectors, and compare the performance and reconstruction speed to the likelihood-based method.

Authors: IVERSEN, Kaare Endrup (Lund University (SE)); CHRISTIANSEN, Peter (Lund University (SE))

Presenter: IVERSEN, Kaare Endrup (Lund University (SE))

Session Classification: parallel (room#101)

Track Classification: WG6: Detector Physics