Contribution ID: **612** Type: **Poster**

Deep Learning Event Reconstruction Techniques for the CLOUD LiquidO Based Experiment

Friday, 21 June 2024 17:30 (2 hours)

Building upon the LiquidO detection paradigm, the CLOUD detector represents a significant evolution in neutrino detection, offering rich capabilities in capturing both spatial and temporal information of low-energy particle interactions. With a 5-10 ton opaque scintillator inner detector volume, CLOUD is the byproduct of the EIC/UKRI funded AntiMatter-OTech project, whose main objective is to make a high-statistics, above-ground measurement of antineutrinos at the Chooz reactor ultra near detector site. Possible physics measurements of CLOUD include the weak mixing angle, solar neutrinos using Indium loading, and geoneutrinos.

This poster focuses on exploiting CLOUD data through development of event reconstruction techniques required for precise measurement and classification of MeV-scale neutrino interactions. Leveraging the intrinsically segmented design of the CLOUD detector, we aim to capitalize on both timing and spatial signals to reconstruct neutrino interaction kinematics quickly and accurately. We outline innovative approaches to event reconstruction, emphasizing Likelihood-free inference density estimation techniques for reconstructing neutrino interaction kinematics. Furthermore, advanced event classification techniques incorporating symmetry-exploiting neural networks (e.g., CNNs and GNNs), will play a pivotal role in background rejection, enhancing the precision of our measurements.

Poster prize

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Session Classification: Poster session and reception 2

Track Classification: New technologies for neutrino physics