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Vertex reconstruction in JUNO-TAO using Deep Learning

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The primary goal of JUNO is to resolve the neutrino mass hierarchy using precision spectral measurements of reactor antineutrino oscillations. To achieve this goal a precise knowledge of the unoscillated reactor spectrum is required in order to constrain its fine structure. To account for this, Taishan Antineutrino Observatory (TAO), a ton-level, high energy resolution liquid scintillator detector with a baseline of about 30 m, is set up as a reference detector to JUNO. The 20% increase in the coverage of photosensors, the replacement of Photomultiplier Tubes (PMTs) with Silicon Photomultiplier (SiPM) tiles, the smaller dimension and the operating temperature at -50℃, would enable TAO to achieve a yield of 4,500 p.e./MeV. Consequently TAO will achieve an energy resolution better than 2%/E(MeV).

The ability to accurately reconstruct reactor antineutrino events in TAO is of great importance for providing a model-independent reference spectrum for JUNO. Previous studies have proven that Deep Learning yields competitive reconstruction results. This work aims to demonstrate the general applicability of Graph Neural Network (GNN) for the vertex reconstruction. Owing to the spherical nature of the detector, GNN architecture is preferred since it eliminates the need of co-ordinate transformation. The dataset for model training and validation is generated by the Monte Carlo method with the official TAO offline software. The network is trained on the aggregated features that are obtained from the information collected by SiPMs. Preliminary results of reconstruction are presented in this poster.

In-person participation

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