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Machine learning approach for the directional reconstruction of atmospheric neutrinos in JUNO

The Jiangmen Underground Neutrino Observatory (JUNO) is a next-generation large (20 kton) liquid-scintillator neutrino detector, which is designed to determine the neutrino mass ordering from its precise reactor neutrino spectrum measurement. Moreover, high-energy (GeV-level) atmospheric neutrino measurements could also improve its sensitivity to mass ordering via matter effects on oscillations, which depend on the directional (zenith angle) resolution of the incident neutrino. However, large unsegmented liquid scintillator detectors like JUNO are traditionally limited in their capabilities of measuring event directionality.
This poster presents a machine learning approach for the directional reconstruction of atmospheric neutrinos in JUNO. In this method, several features relevant to event directionality are extracted from PMT waveforms and used as inputs to the machine learning models. Three independent models are used to perform reconstruction, each with its own unique approach for handling the same input features. The results are make use of simulated data based on the GENIE generator, and an independent sample simulated with an alternative generator is also used to check the robustness of this approach.

Primary author: LIU, Jiaxi

Co-authors: DUYANG, Hongyue (Shandong University); Dr LI, Teng (Shandong University, CN); LUO, Wuming (Institute of High Energy Physics, Chinese Academy of Science); LIU, Zhen (Institute of High Energy Physics (IHEP)); YANG, Zekun (Shandong University)

Presenter: LIU, Jiaxi