Contribution ID: **15** Type: **not specified**

Vision / Language Calorimeter: deep-learning-based anti-neutron reconstruction in an electromagnetic calorimeter

Friday, 22 August 2025 11:20 (20 minutes)

Long-lived neutral hadrons, including (anti-)neutron and K_L^0 meson, are important probes for physics in the tau-charm energy region. However, most tau-charm facilities do not include dedicated hadronic calorimeters, and their neutral hadron detection must rely on the electromagnetic calorimeter (EMC). Because the EMC's small volume and dense material only partially contain hadronic showers, conventional reconstruction methods face significant limitations. In the talk, we introduce Vision Calorimeter (ViC) and Language Calorimeter (LaC), two deep-learning frameworks inspired by modern architectures from computer vision and natural language processing fields. By leveraging an end-to-end, data-driven approach, ViC & LaC perform unified reconstruction of anti-neutrons, simultaneously identifying particle type, estimating the incident position on the EMC, and inferring the momentum magnitude.

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Session Classification: Session