Contribution ID: **260** Type: **Oral**

First attempt of reconstruction for multi-point events based on Markov chain Monte Carlo method in liquid scintillator detectors

Tuesday 26 August 2025 17:20 (20 minutes)

Liquid scintillator detectors have assumed significant importance in neutrino physics owing to their cost-effectiveness and high precision. Multi\text{-}point reconstruction algorithm can address pileup in the liquid scintillator detectors through simultaneous optimization of temporal and spatial resolution, achieving sub-nanosecond precision in photon arrival time discrimination coupled with sub-centimeter spatial reconstruction accuracy.We develop the Bayesian Probe for Point\text{-}like Events (BAPPE), based on Markov chain Monte Carlo method (MCMC). This method achieves more accurate reconstruction results by jointly considering the energy, position, and timing of the vertex. BAPPE naturally extends to BAPPEn through the generation or annihilation of vertices by the reversible jump MCMC (RJMCMC). BAPPEn can improve particle identification accuracy while substantially refining spatial reconstruction resolution and energy resolution across diverse interaction topologies. Our method has achieved preliminary results in event reconstruction for the Jinping Neutrino Experiment (JNE).

Collaboration you are representing

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Session Classification: Underground Laboratories

Track Classification: Underground Laboratories – Technology