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Event Reconstruction Techniques for ANNIE Phase II

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The Accelerator Neutrino Neutron Interaction Experiment (ANNIE), deployed on the Booster Neutrino Beam (BNB) at Fermilab, is planning to use a 26-ton Gd-doped water Cherenkov detector to study the multiplicity of final state neutrons from neutrino-nucleus interactions in water, which provides a unique opportunity to study this physics in an energy range relevant to both atmospheric and long baseline neutrino experiments. The experiment has two main goals: (1) perform the first measurement of the abundance of neutrons from neutrino interactions in water, as a function of momentum transfer, in order to constrain neutrino-nucleus interaction models, and (2) demonstrate the power of new fast-timing, position-sensitive detectors by making the first deployment of the Large Area Picosecond PhotoDetectors (LAPPDs) in a physics experiment. The Phase I of ANNIE has successfully measured the neutron background inherent to the BNB. The Phase II of ANNIE will realize the physics measurements by using the arrival time and position of the Cherenkov photons in both PMTs and LAPPDs. The interaction vertices and the charged lepton tracks are reconstructed by using a maximum likelihood fit. The energies of the charged lepton and the neutrino are reconstructed by using Machine and Deep Leaning algorithms. This presentation will give an overview of the ANNIE Phase II simulation and present the recent development of event reconstruction techniques.

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