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ANNIE in 10 Minutes

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The Accelerator Neutrino Neutron Interaction Experiment (ANNIE) is a new water-Cherenkov neutrino detector at Fermilab. It aims to measure the neutron yield of neutrino-nucleus interactions. As future experiments seek to make more precise measurements of neutrino oscillations, improving estimation of the initial neutrino energy will be key. Located in the Booster Neutrino Beamline, the 30 ton detector will be the first to use large area picosecond photodetectors to allow detailed timing-based event reconstruction of the initial and secondary particle interactions. It will also extend traditional water-Cherenkov charged-particle detection by using gadolinium-enhanced water to capture and detect the otherwise invisible neutrons produced in complex neutrino-nucleus interactions. The number and energy of these final-state neutrons help constrain the type of interaction and the atomic kinematics of the target nucleus, which are major sources of uncertainty in event reconstruction and simulation. The measurement of neutrino-induced neutron production also has implications for the next generation of proton decay experiments and for the detection of the diffuse supernova neutrino background.

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