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The 3DST Spectrometer as part of the DUNE Near Detector

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The main purpose of the Deep Underground Neutrino Experiment (DUNE) is to observe the CP-violation in neutrinos, proton decay and supernova neutrinos with a liquid-argon far detector of unprecedented size.

In the near detector complex, a spectrometer system called 3DST-S centered by a 3D projection scintillator tracker (3DST) is proposed and being studied. The 3DST-S system is located downstream of a liquid-argon TPC and a high pressure gaseous-argon TPC in a magnetic field. The 3DST-S system consists of 3DST, surrounded by a normal pressure gas TPC, a ECAL and a dipole magnet. The 3DST-S provides comprehensive measurements on a fully active scintillator target allowing constraints on the A-dependence of neutrino interaction models and beam monitoring. In addition, with the capability of neutron detection and energy measurements, full reconstruction of neutrino interaction event would be possible, which in turn provides new ways to analyze the events. For example, the interactions on H can be isolated from the interactions on CH, and these can be utilized to disentangle the degeneracy of the neutrino flux and cross section model.

The 3DST detector consists of a large 3D array of 1 cm x 1 cm x 1cm scintillator cubes. This tracker has a full solid angle coverage ability for charged particles, as well as precise energy and angular measurements, with which, the neutrino-electron scattering channel can be fully utilized in order to do the flux constraint. Besides, 3DST gives an unique opportunity to connect carbon target cross section measurements in DUNE to those in other experiments, such as T2K, NOvA and Minerva. In this talk, the simulation studies and test beam performances of the 3DST-S system will be presented.

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