Reconstruction of neutrino interactions in SAND with an innovative liquid Argon imaging detector

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Abstract: The Deep Underground Neutrino Experiment will be a next-generation neutrino oscillation long-baseline accelerator experiment with the aim of determining the still unknown neutrino oscillation parameters, observing proton decay and detecting supernova neutrinos exploiting Liquid Argon Time Projection Chambers (LArTPC) of unprecedented size. However, despite their successfully application in neutrino and DM experiments, the performances of LArTPCs are limitated in high intensity environments, such as in near-site detectors on neutrino beams, due to the long drift time needed to collect the ionisation charge. The design of SAND at the DUNE Near Detector complex includes a 1-ton LAr target -GRAIN (Granular Argon for Interaction of Neutrinos)- designed to overcome such limitation by imaging the scintillation light produced in neutrino interactions. By capturing "pictures" of the LAr (or LXe), GRAIN will allow to reconstruct the event topologies and energy deposition. Using this information, and that provided by the SAND electromagnetic calorimeter (ECAL) and target tracker system (STT), SAND will allow on-axis beam monitoring, the control of systematics uncertainties for the oscillation analysis, precision measurements of neutrino cross-sections, and BSM searches. In this talk, the current design of GRAIN and the development of its image and calorimetric reconstruction algorithms will be presented. Preliminary results on energy reconstruction of simulated neutrino interaction in SAND, combining GRAIN information with the STT and ECAL reconstructions are also presented.