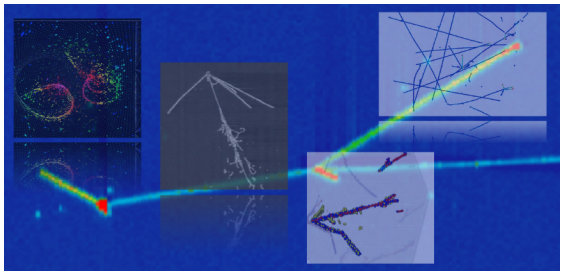

Contribution ID: **25** Type: **Individual Talk**

Differentiable simulation of the DUNE near detector liquid argon time projection chamber

Wednesday, 23 August 2023 11:35 (35 minutes)

The fidelity of detector simulation is crucial for precision experiments, such as the Deep Underground Neutrino Experiment (DUNE) which uses liquid argon time projection chambers (LArTPCs). We can improve the detector simulation by performing dedicated calibration measurements against controlled real data and then applying them to the simulation. Using conventional calibration approaches, typically we are only able to tackle individual detector processes per measurement. However, as in LArTPCs, all the detector effects are entangled in the measured detector output. We present a differentiable simulator for a LArTPC based on a DUNE near detector prototype. It enables gradient-based optimization of the detector simulation by simultaneously fitting multiple relevant modeling parameters. The use of the differentiable simulator allows in-situ calibration which provides natural consistency between the calibration measurements and simulation application. This work also paves a way to solve "inverse detector simulation" challenge which aims to map the detector output to detector physics quantities of interest.

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