Evaluating the Performance of the ProtoDUNE–SP Detector using Michel Electrons

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University College
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A thesis submitted for the degree of Doctor of Philosophy

Hilary 2020

Abstract

This thesis presents the results of the study of electromagnetic (EM) interactions in the ProtoDUNE–SP liquid argon time projection chamber (LArTPC) detector. The LArTPC detector technology provides high spatial resolution on the final states of neutrino interactions, allowing interaction modes to be distinguished based on the event topology. In order to perform high precision measurements of ν_e in LArTPC detectors, electrons must be identified and their energy accurately reconstructed. In this work EM activity is studied in the 10–50 MeV range using Michel electrons as a source with a well defined energy spectrum. The sensitivity, bias and energy scale are studied and the implications for neutrino physics in the Deep Underground Neutrino Experiment (DUNE) are discussed.

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List of Abbreviations

EM . . . . . Electromagnetic.

LArTPC . . . Liquid Argon Time Projection Chamber.

DUNE . . . . . Deep Underground Neutrino Experiment.

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