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## **Measuring Free Electron Lifetimes in the ProtoDUNE-SP Single Phase Detector**

The ProtoDUNE-SP Liquid Argon Time Projection Chamber (TPC) serves as the prototype for the DUNE Far Detector Single-Phase modules and measures the properties of final-state particles for neutrino experiments using liquid argon. ProtoDUNE-SP's liquid argon allows for precision energy reconstruction, but impurities in the liquid argon can capture ionized electrons. This electron attenuation can be expressed as exponential decay of free charge as a function of drift time, characterized by the "free electron lifetime." To measure this lifetime in ProtoDUNE-SP, cosmic tracks reconstructed by both the Cosmic Ray Tagger (external panels of scintillator strips) and TPC were collected and the  $dQ/dx$  of each hit from the track measured as a function of drift time. This method measured an electron lifetime above the 10 ms goal for the DUNE single-phase modules and charge loss between the cathode and anode typically less than 10%.

### **Mini-abstract**

Measuring the electron lifetime in ProtoDUNE Single-Phase using externally tagged tracks

### **Experiment/Collaboration**

ProtoDUNE-SP

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