

## ArCS: A Magnetized Liquid Argon Time Projection Chamber for Neutrino Physics and Beyond

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Liquid Argon Time Projection Chambers (LArTPCs) have revolutionized neutrino physics with their exceptional imaging and calorimetric capabilities. However, the lack of a magnetic field limits their ability to distinguish particle charge and measure momentum through curvature. ArCS (Argon detector with Charge Separation) presents an experimental program to demonstrate the operation of a magnetized LArTPC, a critical step toward enhancing the physics reach of future detectors. Using the existing LArIAT detector placed inside the Jolly Green Giant magnet at Fermilab's Test Beam Facility, we aim to: (i) establish charge sign discrimination for electrons and positrons, (ii) reconstruct particle momenta via curvature, and (iii) determine the minimal magnetic field required for these measurements. A successful demonstration will open pathways for large-scale magnetized LArTPCs, enabling precise neutrino-antineutrino separation, improved electron-photon discrimination, and expanded sensitivity to Beyond Standard Model physics.

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