Maintaining ProtoDUNE Dual Phase’s Uniform Electric Field with Divider Board

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The ProtoDUNE project of the dual-phase Liquid Argon (LAr) Time Projection Chapter (TPC) is a prototype experiment for the Deep Underground Neutrino Experiment (DUNE) at Fermilab. The protoDUNE field cage (FC) consists of 98 extruded aluminum profiles, supported by fiber reinforced plastic I-beams. A neutrino will interact with LAr, and the resulting secondary particles ionize LAr, whose electrons are detected in the gaseous argon. A strong, uniform electric field of 500V/cm generated by the FC will cause the electron to drift upwards, requiring a voltage potential of -300kV at the cathode at the bottom. To connect profiles electrically and to protect the power supply, four 2GΩ resistors, reducing the current flowing, and two groups of four varistors in series, protecting the resistors from potential electrical surges, will be placed in parallel between each profile placed on a divider board. Testing will ensure the quality of the parts using liquid nitrogen. The resistors used will have only 1.5% difference from the mean of its resistance compared to other resistors, causing about a 40% rejection rate. Varistors will be tested to show if a high resistance at 1.5kV is present, showing about a 15% rejection rate.

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2Prototype Deep Underground Neutrino Experiment Dual-Phase with UTA