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Development of an Ultra-Low Threshold Liquid Argon Detector for Future Dark Matter and Neutrino Experiments

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In the field of direct detection of light dark matter (DM) with masses below 10 GeV/c², the DarkSide-50 experiment, based on a dual-phase argon time projection chamber (DAr-TPC), has demonstrated competitive performance. Building on DarkSide-50, the DarkSide-LowMass experiment will focus on achieving low-threshold measurements and is projected to extend the search for light DM down to the neutrino fog region, spanning masses from sub-GeV/c² to around 10 GeV/c². To accurately identify the corresponding low-energy responses, both high detector performance and precise calibration of the argon ionization yield for nuclear recoil (NR) events are essential. To meet the demands of such low-threshold experiments with argon detectors, we are preparing an experiment using a small DAr-TPC to investigate various factors affecting the detector's performance at low thresholds. Additionally, we aim to calibrate the liquid argon ionization response for nuclear recoils in the sub-keVnr energy region with a pulsed neutron beam. This report will introduce the experimental design, the current status of the setup construction, and the preliminary performance testing results of the system.

Collaboration you are representing

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