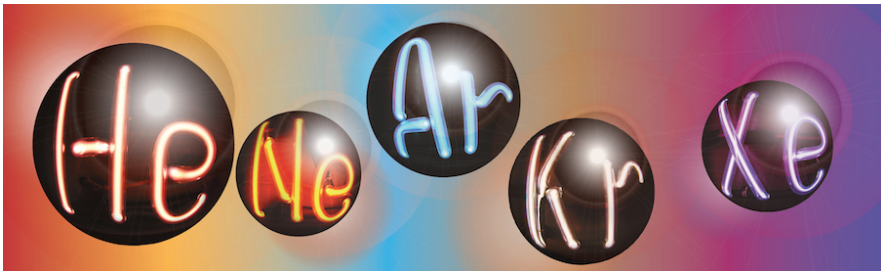


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# The Liquid Argon Atmospheric Veto for LEGEND 1000

*Tuesday, 21 October 2025 11:40 (20 minutes)*

LEGEND-1000 is the next-generation, ton-scale experiment searching for neutrinoless double beta decay of germanium (Ge) using p-type, high-purity germanium (Ge) detectors. It is a scaled-up project of LEGEND-200. The experiment will use 1,000 kilograms of germanium detectors enriched to over 90% $^{76}$Ge.
The experiment has been approved and supported by the relevant agencies and will be installed at LNGS (3,800 m.w.e.).
Simulations suggest that the residual muon flux at LNGS generates neutrons in the detector. Upon absorption, these neutrons produce long-lived isotopes in both the liquid argon and germanium detectors. If their decay is not properly identified, it will contribute significantly to the maximum background budget of $10^{-5}$ counts/(keV kg y)-1 required for LEGEND-1000 to fully span the inverted order region of mββ.
Since the liquid argon cuts developed for prompt background mitigation are suboptimal for sibling neutron tagging, a neutron moderator and a new liquid argon veto volume, external to the germanium detector array, will be deployed. This will allow for delayed coincidence cuts between the water Cerenkov muon veto, the inner liquid argon veto, and the germanium detectors.
In this talk, I will present the design concept and status of the detector instrumentation. This instrumentation aims to maximize the efficiency of the delayed coincidence cuts by identifying neutron captures in hydrogen and argon via de-excitation gamma rays. We will also discuss light yield and photon detection efficiency requirements and possible instrumentation configurations that can efficiently detect neutron captures by hydrogen and $^{40}$Ar. Additionally, we will discuss technologies to achieve low activity requirements and performance based on current knowledge and experimental data.
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