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Observation of Radon Mitigation in MicroBooNE by a Liquid Argon Filtration System

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The MicroBooNE liquid argon time projection chamber has proven to be an excellent detector to study physics at the MeV-scale. It employs a large-scale liquid argon filtration system, using copper-based filters, to remove electronegative impurities from liquid argon to achieve and maintain a high level of purity. One prevalent background in this energy range is the decay of radon and its decay products. To study the system's efficacy in removing this radioactivity, a 500 kBq 222Rn source is placed in the cryogenic system upstream of the filter and MeV-scale reconstruction is leveraged to search for activity in the MicroBooNE TPC. The filtration system was able to remove more than 99.999% of the radon injected into the system. This is the first time that radon mitigation has been observed with a copper-based filter on a large scale and such filters may offer a viable radon mitigation option to support low-energy physics analysis in future large liquid argon time projection chambers, such as the Deep Underground Neutrino Experiment (DUNE).

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