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Quality Assurance for Potential Supernova Neutrino Detections with DUNE at SURF

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When completed, the far detector of the Deep Underground Neutrino Experiment (DUNE), which will be located nearly a mile underground at the Sanford Underground Research Facility (SURF) in Lead, SD, will be the world's largest and most advanced liquid argon time projection chamber-based neutrino detector. DUNE's goal is to answer open questions on neutrino properties and to explore potential topics beyond it, such as detecting supernova neutrinos. These neutrinos can be produced and released as a near-light speed isotropic burst during a supernova event. Information encoded in such neutrino bursts can improve our understanding of the supernova process, including how neutron stars and black holes are formed during these events, as well as illuminate new characteristics of neutrino flavor oscillations and mass ordering. Moreover, the far detector will serve as an early warning supernova detection system, as neutrino bursts can arrive several hours before the photon component. For DUNE to be able to detect supernova burst neutrinos, it is crucial that the radiological backgrounds (from the detector components, surrounding cavern and the argon itself) are small enough and that we understand the response of the detector for such faint low energy signals by developing appropriate calibration methods. We will present ongoing radiological assay work and on the development of a unique 9 MeV gamma-ray calibration source gauging the detector response near DUNE's threshold for supernova neutrino detection.

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