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Light-only Liquid Xenon Detector Hardware Overview

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Neutrinoless double beta decay (0□□□) detection would shed light on whether neutrinos are Majorana or Dirac particles, however these measurements necessitate a high energy resolution. Xe-136 double beta decay into Ba-136 is a prime candidate for 0□□□ detection, understanding the scintillation light this decay produces enhances 0□□□ detection capabilities. Silicon photomultipliers (SiPMs) and photomultiplier tubes (PMTs) are two types of photosensors, with SiPMs a candidate for scintillation light detection in various liquid xenon detectors. PMT components are more radioactive than SiPM components, making them less optimal for decay signal observation. SiPMs are composed of many single photon avalanche diodes with higher single photon resolution. Background signals from dark count and noise from optical cross-talk between SiPMs need to be quantified to characterize SiPM behavior, compared to better understood PMTs.

The Light-only Liquid Xenon (LoLX) detector is a vacuum-insulated cryostat where SiPMs and PMTs can be tested and characterized in liquid xenon. The photosensors are currently set up in a cubic inward facing configuration inside the LoLX inner detector, with one PMT and eighty SiPMs, half of which are Hamamatsu Photonics' and half Fondazione Brune Kessler's. LoLX is composed of many interdependent detector and hardware components, presented on this poster, including an LXe purification system, gas handling infrastructure, a cryostat and cryogenic system, data acquisition electronics, and a cubic photosensor array.

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