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R&D Developments for PoWER Proof of Concept Tests

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A prototype setup is being developed at the Leptons Laboratory, Universidade Estadual de Campinas (UNICAMP), for preliminary validation of the PoWER (Polymer Wavelength shifter and Enhanced Reflection) concept. PoWER is a novel detector design aimed at improving spatial discrimination of scintillation photons in liquid argon (LAr) detectors. The concept relies on wavelength-shifting PEN foils to convert 127 nm LAr scintillation light into visible photons (~ 420 nm), and on acrylic barriers to suppress VUV photon conversion in undesired regions. Conventional (C-SiPM) and VUV-sensitive (V-SiPM) silicon photomultipliers are coupled to read out the converted and native scintillation light, respectively.

The current proof-of-concept features a $10 \times 10 \times 10$ cm³ cubic detector. The inner structure is made of acrylic and contains the PEN foils. A highly reflective foil is applied to the inner walls of the Teflon structure to minimize photon losses and enhance light collection. The arrays combine regular Hamamatsu C-SiPMs and C-SiPMs coated with a thin PTP layer to simulate VUV SiPMs. The detector is inserted into a larger cryostat using a motorized trolley system and filled with ultra-pure gaseous argon, which is subsequently liquefied in situ. Alpha and gamma particles will be used to excite scintillation in the argon.

Instrumentation includes resistive level sensors integrated into the Teflon vessel to monitor the LAr height at three distinct levels. SiPM signals are digitized using a CAEN digitizer, with power and bias supplied by an APSAIA unit. A pulsed 400 nm LED is employed for periodic gain calibration of the photosensors. This contribution presents the instrumentation layout, mechanical design, and electronic configuration of the setup. Preliminary results are presented.

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