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Hardware and electronic setup for aging study on P-Terphenyl thin films

Prolonged exposure of p-terphenyl (PTP) to environmental factors such as light, temperature, and humidity can induce aging processes that degrade their optical performance, potentially compromising the long-term stability and reliability of detector systems. A systematic investigation of these degradation mechanisms is therefore essential for qualifying WLS coatings in experiments, such as liquid argon time projection chambers (LAr-TPCs), that require stable operation over extended periods.

This work presents the development of a dedicated experimental setup to investigate the aging of PTP thin films under controlled environmental conditions. The system combines modular, custom-designed 3D-printed hardware with electronic instrumentation based on an Arduino microcontroller to precisely regulate and continuously monitor illumination, temperature, and relative humidity during long-term exposure tests. Environmental parameters are recorded in real time and wirelessly transmitted via Bluetooth to a database, ensuring traceability, reproducibility, and fully automated operation throughout the experiments.

The setup accommodates eight PTP thin-film samples (2.5×2.5 cm), arranged in pairs and exposed to red, yellow, green, and ultraviolet LEDs to investigate wavelength-dependent aging effects. At regular intervals, the samples are characterized by measuring their mass and relative wavelength-shifting conversion efficiency using a spectrophotometer available at the Leptons Laboratory (Universidade Estadual de Campinas, Brazil). The resulting long-term dataset will enable correlations between environmental exposure conditions and optical degradation, providing valuable information for improving the durability and performance of WLS coatings in photodetection systems.

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