

The Water Cherenkov Test Experiment: Investigating Particle Detection in Small-Scale Water Cherenkov Detectors

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The Intermediate Water Cherenkov Detector (IWCD) will serve as a near detector for the Hyper-Kamiokande (Hyper-K) experiment. The IWCD will be used to measure and study neutrino interactions approximately 1 km downstream of the production point, where the oscillation effect is negligible. The multi-PMT (mPMT) photosensor has been developed for use in the IWCD detector due to its better timing and spatial resolution compared to the Super-K or Hyper-K 50-cm diameter PMTs. This will facilitate precise event reconstruction in the small-scale detector like the IWCD. To validate the performance of the mPMTs and event reconstruction using mPMTs in a small water Cherenkov detector, we are currently in the process of constructing a ~40-ton scale Water Cherenkov Test Experiment (WCTE) as a prototype for IWCD, with plans for operation in late 2024. The WCTE will operate in the CERN East Area T9 beam line with low momentum charged particle fluxes. The WCTE has a tank with a height and diameter of ~4 m, with the capacity to house 100 mPMT modules during operation. These mPMT modules are constructed using nineteen 3-inch PMTs arranged in a semicircle inside a water-tight vessel. The WCTE will also focus on refining the calibration system to achieve accurate particle reconstruction, a critical factor in optimizing the IWCD's performance. Additionally, the WCTE will conduct in-depth investigations into key physics processes, such as charge leptons and pion scattering, electron/gamma separation, and neutron tagging. We are currently developing an accurate mPMT simulation within the GEANT4 framework to understand the measurements taken by mPMTs. The goal of this presentation is to provide detailed information on the WCTE detector design, including a novel assembly procedure developed for building the mPMT modules, a concise overview of their mechanical and electronic components, and the calibration hardware. We will also report on the simulation as well as the crucial physics program.

Poster prize

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Collaboration (if any)

WCTE Collaboration

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Classifica Sessioni: Poster session and reception 1

Classificazione della track: New technologies for neutrino physics