

Empowering the next generation of neutrino experiments through measurements at the Water Cherenkov Test Experiment

Tuesday, 18 June 2024 17:30 (2 hours)

The current and next generation of long-baseline neutrino experiments are bringing about the era of precision neutrino oscillation measurements. New detectors, technologies and analysis techniques are being developed to meet the challenges posed by these precision measurements. Water Cherenkov neutrino experiments have played a crucial role in neutrino discoveries over the years, providing a well-established and affordable way to instrument large target masses, and the future water-based detectors of Hyper-Kamiokande, ESSnuSB and THEIA are expected to observe unprecedented rates of neutrino interactions. A corresponding suppression of backgrounds and systematic uncertainties to the 1% level is required to achieve the goals of these experiments.

The Water Cherenkov Test Experiment (WCTE) is a 50-ton water Cherenkov detector that is scheduled to take data in 2024. The WCTE detector will receive tagged 200 MeV to 1 GeV electrons, muons, charged pions and protons from the CERN East Area T9 beam, as well as observing secondary neutrons and operating in a dedicated tagged photon setup. WCTE will be used to study the water Cherenkov detector response using new photosensor technologies, instrumented with multi-PMT modules each containing 19 3-inch PMTs. This provides a unique opportunity for new technologies and techniques to be demonstrated with known particle fluxes, towards reaching 1% level systematic uncertainties for GeV scale neutrino interactions. Advances in calibration, event reconstruction and analysis will be used in measurements including Cherenkov light production, lepton and pion scattering and secondary neutron production, which will also provide direct inputs to existing and future water Cherenkov experiments.

This poster will provide an overview of the physics goals of WCTE, the novel analyses that will be used and demonstrated by each of these measurements, and how they will facilitate the goals of next generation neutrino experiments.

Poster prize

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Water Cherenkov Test Experiment (WCTE)

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Session Classification: Poster session and reception 1

Track Classification: New technologies for neutrino physics