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The Water Cherenkov Test Experiment: Detector and Physics Lessons Towards Hyper-Kamiokande

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The Water Cherenkov Test Experiment (WCTE) is a 40-ton water Cherenkov detector operated in the T9 beamline of the East Area at CERN from October 2024 to June 2025. It is instrumented with 97 multi-PMT modules, each consisting of 19 3" PMTs. Charged particles in the beam are characterized by a series of trigger scintillators and aerogel Cherenkov threshold detectors on an event-by-event basis before entering WCTE, thus enabling detailed studies of how particles with known momentum, direction, and type are reconstructed in a water Cherenkov detector. In addition, a tagged photon beam is produced using a permanent magnet and hodoscope setup. As a technology prototype of the Intermediate Water Cherenkov Detector (IWCD) of the Hyper-Kamiokande (Hyper-K) experiment, WCTE has provided valuable experience in detector construction, commissioning, operation, and calibration. Physics data collected during the 2025 run in both pure water and gadolinium-loaded configurations will also offer useful physics input to current and future water Cherenkov experiments, such as improved understanding of neutrino multi-nucleon interaction, pion secondary interactions, and ^9Li background in the diffuse supernova neutrino background search. In this talk, I will present the detector systems of WCTE and discuss the expected impact on the physics goals of Hyper-K.

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