ICHEP 2022 BOLOGNA
ICHEP 2022 XLI International Conference on High Energy Physics Bologna (Italy)
6 13 07 2022

Contribution ID: **733** Type: **Parallel Talk**

Measuring neutrino oscillations precisely: Reducing Systematics in Water Cherenkov Detectors With the Water Cherenkov Test Experiment

Saturday, 9 July 2022 09:45 (15 minutes)

Water Cherenkov neutrino experiments have played a crucial role in neutrino discoveries over the years and provide a well-established and affordable way to instrument large target masses. The largest uncertainty in the most recent T2K oscillation results are from the Super-Kamiokande detector systematic errors in the oscillated event samples. As neutrino experiments move from discovery to precision measurements, a comprehensive understanding of water Cherenkov detectors becomes increasingly important. To help address these uncertainties in experiments such as T2K and Hyper-Kamiokande, a test bed for current and new technologies will be constructed at CERN.

The test bed; the Water Cherenkov Test Experiment (WCTE); a small-scale water Cherenkov detector which will be in the T9 experimental area at CERN. WCTE will be used to study the water Cherenkov detector response to hadron, electron, and muon beams, and will use new photosensor technologies. The detector will be instrumented with multi-PMT (mPMT) modules consisting of 19, 3-inch PMTs each, and will test a newly developed calibration deployment system. Calibration techniques with known particle fluxes will be used to demonstrate a 1% level calibration for GeV scale neutrino interactions. Other measurements will include those of Cherenkov light production, pion scattering and secondary neutron production, to provide direct inputs to the T2K, Super-Kamiokande and Hyper-Kamiokande experiments. This talk will discuss the current oscillation results from T2K and the predictions for Hyper-Kamiokande, alongside describing the WCTE detector design, the newly developed mPMT and calibration hardware and the all-important physics program.

In-person participation

Yes

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Session Classification: Neutrino Physics

Track Classification: Neutrino Physics