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Status of the Hyper-K Experiment, and Mexican contributions so far

Wednesday 10 July 2024 16:30 (30 minutes)

"The Hyper-Kamiokande (HK) experiment, a next-generation water-Cherenkov neutrino detector near Toyama, Japan, aims to significantly advance our understanding of neutrino physics. The specific physics goals include studying neutrino oscillations to refine their parameters, observing asymmetries between neutrino and antineutrino oscillations to investigate CP violation, probing Grand Unified Theories(GUTs) through the search for nucleon decay, investigating potential signals of dark matter through indirect detection methods, studying neutrinos produced by the Sun to understand solar processes, and observing neutrinos from astrophysical sources such as supernovas. With approximately eight times the fiducial volume of its predecessor, Super-Kamiokande (SK), HK is designed to house around 20,000 20-inch photomultiplier tubes (PMTs) and about 800 additional multi-PMTs (mPMTs) to improve event directionality and calibration accuracy, each mPMT with 19 3-inch PMTs in the inner detector region, along with up to 3,600 3-inch PMTs in the outer detector region, providing extensive photo-coverage for signal detection.

This talk focuses on the development and evaluation of deep learning models to classify neutrino type or detect background from Cherenkov light cone images within the HK framework. Specifically, it compares the performance of four state-of-the-art deep learning architectures—VGG19, ResNet50, PointNet, and Vision Transformer—using data simulated by the WCSim software for the Intermediate Water Cherenkov Detector (IWCD). This work contributes to the broader Hyper-K effort by proposing robust machine learning solutions for particle identification, aiming to enhance event reconstruction accuracy and reliability. Additionally, this talk also focuses on mPMT mechanical developments and testing to ensure the robustness of the sensor technology used in the experiment, which is crucial for maintaining detector reliability and precision to reach the experimental physics goals."

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