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Trigger and data-acquisition software developments for the Pacific Ocean Neutrino Experiment

The Pacific Ocean Neutrino Experiment (P-ONE) is set to deploy its first detection string in the Cascadia Basin off the coast of British Columbia, Canada. As a next-generation Cherenkov neutrino telescope, P-ONE will be sensitive to ultra-high-energy neutrinos (10³–10⁸ GeV) from astrophysical sources. To effectively capture these rare physics signatures, the experiment's trigger system must operate in a high-background environment dominated by K40 decay and bioluminescence.

This talk presents the design and integration of the P-ONE trigger system, which spans multiple levels of data acquisition (DAQ). The trigger must seamlessly interface with both the high-level Maximum Integrated Data Acquisition System (MIDAS) and the low-level fastDAQ system to select and preliminarily cluster events.

The trigger system operates in a hierarchical fashion: first, an initial firmware (L0) trigger identifies candidate events, which are then refined by a physics trigger that requests additional waveform data from neighboring modules. Onshore, these waveform packets and timing information are assembled into full events for storage and analysis. This talk will detail the trigger chain, with a focus on bioluminescence mitigation and physics-driven event selection, as well as its integration with the DAQ and Run Control systems.

Collaboration(s)

P-ONE collaboration

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