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New Approaches of first selection for Neutron Tagging in Hyper-Kamiokande

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Hyper-Kamiokande (HK) is a next-generation neutrino experiment with a large-scale water-Cherenkov far detector approved in Japan. Its physics program addresses some of the most challenging questions in fundamental physics like the precise measurement of the neutrino oscillation parameters (solar, atmospheric, accelerator), search for leptonic CP violation, the investigation of astrophysical neutrino sources; supernovae and Diffused Supernova Bursts (DSNB), and the search for proton and exotic nucleon decays.

Since over a decade, HK's predecessor, Super-Kamiokande, has proven the importance of neutron-tagging in a large variety of measurements, improving the limits of DSNB and proton-decay searches, and enhancing the sensitivity to the atmospheric oscillation parameters.

The neutrons produced in the interaction of an HK event thermalize and are eventually captured by hydrogen, emitting a 2.2 MeV photon. This signal is too weak for HK's trigger threshold; therefore, the delayed neutron signal is searched by scanning all the hit PMTs of the prompt signal.
The newly developed method feeds this information into the neural network, providing as output which of the hit PMTs are more likely to receive the neutron capture signal. This not only improves the candidate selection efficiency and purity, but also provides valuable information about hit PMTs, identifying the most relevant ones for the subsequent fitting process.

In this presentation the details, features and performance of this method in the context of the Hyper-Kamiokande experiment will be shown.

Working group

WG1

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