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A new-concept calorimeter for future neutrino beams based on Kaon tagging

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Neutrino cross section measurements are an essential requirement for the next generation of neutrino oscillation experiments and they are presently limited by uncertainties on neutrino fluxes. In [1] we propose to instrument a neutrino decay tunnel to detect large angle positrons and tag the three-body semileptonic $K^+ \to e^+\pi^0\nu_e$ decays. In such a facility the absolute electron neutrino flux could be determined with unprecedented precision (O(1\%)).

An e^+/π separation capability of about 2\% as well as a high e^+ efficiency is required for a diffuse particle source over a length of several tens of meters. Additional constraints, due to the harsh beam environment, involve radiation hardness and fast response.

For this purpose we propose a specialised shashlik calorimeter (copper-scintillator) with a compact readout based on small-area Silicon PhotoMultipliers coupled to WLS fibers. The setup would allow an effective longitudinal segmentation for electron/hadron separation, reducing the dead zones introduced by fiber bundling. Detailed Monte Carlo simulations are in progress. The construction of a small prototype and exposures to pion and electron beams are foreseen.

[1] A. Longhin, L. Ludovici and F. Terranova,
“A novel technique for the measurement of the electron neutrino cross section”,
arXiv:1412.5987 [hep-ex], submitted to European Physical Journal C.

Collaboration

A. Longhin, L. Ludovici, F. Terranova

Primary authors: LONGHIN, Andrea (LNF); TERRANOVA, Francesco (MIB); LUDOVICI, Lucio (ROMA1)

Presenter: LONGHIN, Andrea (LNF)

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