ENUBET (Enhanced NeUtrino BEams from kaon Tagging)

A new-concept \( \nu_e \) source based on tagging of \( e^+ \) from \( K^+ \rightarrow e^+ \pi^- \nu_e \) decays

The goal of the project is to demonstrate the feasibility of real time monitoring of the positrons produced at high angle in the decay tunnel of conventional neutrino beam to obtain a x 10 reduction in the systematics on the neutrino flux → Highly beneficial for the leptonic CP violation international program at long baselines (\( \nu_\mu \rightarrow \nu_e \)).

ENUBET is an ERC Consolidator Grant-2015 project (n° 681647, P.I. A. Longhin) with a 2 MEUR funding started on 1/6/2016 w. a 5 years duration.

A traditional beam

- Passive decay region
- \( \nu_e \) flux relies on ab-initio simulations of the full chain
- large uncertainties from model dependency

The tagged beam

- Fully instrumented decay region
- \( \nu_e \) flux prediction = \( e^+ \) counting
- Hadron beam-line: collects, focuses, transports \( K^+ \) to the \( e^+ \) tagger
- \( e^+ \) tagger: real-time, “inclusive” monitoring of produced \( e^+ \)

The positron tagger

The decay tunnel: a harsh environment

- particle rates: > 200 kHz/cm²
- backgrounds: pions from \( K^+ \) decays

Need to veto 98-99% of them

- extended source of \( \sim 50 \) m
- grazing incidence
- significant spread in the initial direction

Key point:
- longitudinal sampling
- perfect homogeneity
- integrated light-readout

Conventional beam-pipe replaced by active instrumentation

ENUBET final results:

1) \( e^+ \) tagger validated with particle beams data
2) a detailed design for the hadron beam-line

By-products and cross-fertilization:

- calorimetry → new low-cost, ultra-compact detectors
- accelerator physics solutions → novel proton extraction schemes for fixed-target and beam-dump experiments

The complete picture to move to a full scale experiment

Tagger detector R&D:

SCENTT

Shashlik Calorimeters for Electron Neutrino Tagging and Tracing

INFN-CSN5 activity (P.I. F. Terranova) [2]

Prototype of the Ultra-Compact shashlik calorimeter CERN East Area, T9 beamline (29/06/2016)

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References, additional info

http://enubet.pd.infn.it


A compact light readout system for longitudinally segmented shashlik calorimeters