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The ENUBET monitored neutrino beam

The study of neutrino properties in the precision era of oscillation physics requires a superior knowledge of the flux, flavor, and energy of neutrino beams. The NP06/ENUBET experiment is designing a facility in which large angle leptons produced in kaon decays are monitored in a segmented calorimeter instrumenting the decay tunnel walls. The pion component of the neutrino flux can be monitored through muon stations after the hadron dump. Such complete beam diagnostics will bring the systematics on the neutrino flavor and flux to the percent level. Furthermore, the narrow momentum width (8.5 GeV/c +-10%) of the beam provides a precise measurement ($\mathcal{O}$(10%)) of the neutrino energy on an event by event basis, thanks to its correlation with the radial position of the interaction at the neutrino detector. ENUBET is therefore an ideal facility for a high precision neutrino cross-section measurement at the GeV scale and the study of non-standard neutrino models.

This contribution presents a new improved design of the proton target as well as the meson transfer line. These improvements ensure a larger neutrino flux while preserving a purity in the lepton monitoring similar to the one previously achieved. We report the final design of the ENUBET demonstrator for the instrumented decay tunnel, which has been determined based on the results obtained during the 2016-2018 test-beam campaign. This model will be exposed to particle beams in 2022 to prove the scalability and performance of the detector technology. We also discuss studies on the design of an alternative secondary beamline with a broad momentum range (4, 6, 8.5 GeV/c), that could enhance the physics reach of the facility.

Finally, we outline the progress on the full simulation of the ENUBET facility and the lepton reconstruction, towards the full assessment of neutrino flux systematics.

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