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ENUBET: a monitored neutrino beam for the precision era of neutrino physics

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The ENUBET experiment, included in the CERN Neutrino Platform effort as NP06/ENUBET, is developing a new neutrino beam based on conventional techniques in which the flux and the flavor composition are known with unprecedented precision ($\mathcal{O}(1\%)$). Such a goal is accomplished monitoring the associated charged leptons produced in the decay region of the ENUBET facility. Positrons and muons from kaon decays are measured by a segmented calorimeter instrumenting the walls of the decay tunnel, while muon stations after the hadron dump can be used to monitor the neutrino component from pion decays. Furthermore, the narrow momentum width (<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, that could enhance the discovery potential of the next-generation of long baseline experiments. It is also a powerful tool for testing the sterile neutrino hypothesis and to investigate possible non-standard interactions.

In this contribution the design of the beamline and of the monitoring instrumentation will be shown. A new improved design of the proton target and of the meson transfer line ensures a larger neutrino flux while preserving a purity in the lepton monitoring similar to the one previously achieved. A demonstrator of the instrumented decay tunnel is currently being built and will be exposed to particle beams at CERN in 2022 to prove the effectiveness of the approach. Progress on the full simulation of the ENUBET facility and of the lepton reconstruction, towards the full assessment of neutrino flux systematics, will be also reported, together with the physics potential of the ENUBET beam.

Reference to paper (DOI or arXiv)

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