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A monitored neutrino beam for high precision cross section measurements: the ENUBET experiment at CERN

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Monitored neutrino beams represent a powerful and cost effective tool to suppress cross section related systematics for the full exploitation of data collected in long baseline oscillation projects like DUNE and Hyper-Kamiokande. In the last years the NP06/ENUBET project has demonstrated that the systematic uncertainties on the neutrino flux can be suppressed to 1% in an accelerator based facility where charged leptons produced in kaon and pion decays are monitored in an instrumented decay tunnel. In this talk, we will present the final results of this successful R&D programme. The collaboration is now working to provide the full implementation of such a facility at CERN in order to perform high precision cross section measurements at the GeV scale exploiting the ProtoDUNEs as neutrino detectors. This contribution will present the final design of the ENUBET beamline that allows to collect $\sim 10^4$ ν_e and $\sim 6\times 10^5$ ν_μ charged current interactions on a 500 ton LAr detector in about 2 years of data taking. The experimental setup for high purity identification of charged leptons in the tunnel instrumentation will be described together with the framework for the assessment of the final systematics budget on the neutrino fluxes, that employs an extended likelihood fit of a model where the hadro-production, beamline geometry and detector-related uncertainties are parametrized by nuisance parameters. We will also present the results of a test beam exposure at CERN-PS of the Demonstrator: a fully instrumented 1.65 m long section of the ENUBET instrumented decay tunnel. Finally the physics potential of the ENUBET beam with ProtoDUNE-SP and plans for its implementation in the CERN North Area will be discussed.

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