Contribution ID: **40** Type: **Talk**

The design of the ENUBET beamline

Friday, August 5, 2022 3:20 PM (30 minutes)

The ENUBET project aims at reducing to 1% the flux related systematics on a narrow band neutrino beam through the monitoring of the associated charged leptons in an instrumented decay tunnel. A key element of the project is the design of a meson transfer line with conventional magnets that maximizes the yield of K^+ and π^+, while minimizing the total length to reduce meson decays in the not instrumented region. In order to limit particle rates on the tunnel instrumentation, a high level of beam collimation is needed, thus allowing undecayed mesons to reach the end of the tunnel. At the same time a fine tuning of the shielding and the collimators is required to minimize any beam induced background in the decay region. The magnetic lattice is optimized with TRANSPORT: the focusing of mesons from the target is performed with a static (quadrupole-based) system that, coupled with a slow proton extraction scheme, allows for a significant pile-up reduction at the tunnel instrumentation while retaining a particle yield large enough for a high precision neutrino cross section measurement on a 3 year time scale. Charge and momentum selection in a 8.5 GeV$\pm$10% momenum bite is performed by a double dipole system. Shielding elements are optimized with a full simulation of the facility in Geant4. In particular a powerful genetic algorithm is used to scan automatically the parameter space of the collimators in order to find a configuration that minimizes the halo background in the decay tunnel while preserving a large meson yield.
This contribution will report the results of the optimization studies and the final design of the ENUBET beamline, together with doses estimation through a FLUKA simulation. 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, is discussed in addition.

Attendance type

In-person presentation

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Session Classification: WG3: Accelerator Physics

Track Classification: WG3: Accelerator Physics