

Design, optimization and simulation of the hadron beam-line for the ENUBET tagged neutrino beam

The ENUBET group at **INFN**-Padova¹ has an immediate opening for a postdoctoral research associate to work on the **ENUBET** project (Enhanced **NeU**trino **BE**ams from kaon **T**agging, ERC-Consolidator Grant, G.A. 681647, 2016-2021²). The duration of the appointment is three years. The contract may be renewed up to the end of the Project (2021). The start of term is May 2017.

- Contract type and duration: 3 years full-time, fixed term. Senior post-doc. INFN researcher (Art. 36, III level).
- Salary: 45.000 € gross/year + pension and social security benefits + subsistence allowance for stay outside Padova (mostly at CERN)
- Job location: Padova (Italy) and CERN (Switzerland)
- **Tasks**: the activity will be performed within the ENUBET Working Package 1 (beam-line design).

ENUBET aims at demonstrating the feasibility of a 1% systematic error on the ν_e cross section by monitoring positrons emitted at large angles by K_{e3} decays in an instrumented decay tunnel.

The conceptual design of a suitable beam of charged kaons and pions plays a key role for the success of the Project. Secondaries from protontarget interactions have to be focused and selected in momentum and charge through a short focusing and transfer line to minimize kaon decays. The transfer line must be matched to the acceptance of the instrumented decay tunnel so that undecayed hadrons impinge on the beam dump without crossing the instrumented walls. The detectors located in the tunnel monitor the production of large angle particles

¹INFN Padova, http://www.pd.infn.it/indexEN.html

²http://cordis.europa.eu/project/rcn/200776_it.html

and, in particular, of positrons from the three body decay of charged kaons.

The candidate will have a leading role in Working Group 1 and, in particular, in

- designing an optimal transfer line of few tens of meters in order to reduce kaon decay losses before the instrumented decay tunnel. The values of the Reference Design (i.e. the average selected momentum and its spread) will be re-optimized with the goal of preserving a low emittance and sufficiently high efficiency for positrons.

The candidate will also contribute to the general activities of WP1 that include

- the design of the **focusing system** either based on a pulsed beam (O(ms)) with magnetic horn focusing or on a static focusing system allowing for long proton extractions (O(1 s)).
- investigating proton extraction schemes compatible with the maximum rates sustainable at the decay tunnel and with the operation modes of the CERN SPS. This activity also includes machine tests at CERN-SPS.

The work of the candidate is cast into a team composed of two senior staff physicists with experience in accelerator neutrino physics (focusing system), a full-time physicists at the PhD level (extraction schemes) and researchers/students from the Universities of Bologna, Insubria, Milano-Bicocca and Padova. The work will be performed in collaboration with CERN ATS, which provides consulting and supervision for the above-mentioned activities. The candidate is requested to spend a significant fraction of time (about 50%) at CERN, where most of the WP1 activities will be performed.

• Requirements:

- PhD in Physics and 3 years research experience (at postgraduate level) in experimental neutrino physics with accelerator-based beams.
- Familiarity with simulations softwares and the process of optimization of multi-parametric systems.

- Basic knowledge of accelerator physics especially for neutrino applications.
- Ingenuity and pro-activity towards potentially interesting new schemes.
- Self-responsible, timely work in accordance with mutually defined objectives, while also integrating into a team.
- Communicative and collaborative personality within the team.
- Application: please provide a motivation letter next to a CV in English, your list of publications and references in one single pdf-file by sending it to the ENUBET Principal Investigator, A. Longhin (andrea.longhin@pd.infn.it).
- Selection process: candidates are expected to attend an interview either in person at the Padova Physics Department or using a remote connection. The selection of the candidates will be based on the evaluation of the documents sent with the application and on the interview. The interview will focus on the candidate's own research, curriculum and publications.
- Useful bibliography
 - A novel technique for the measurement of the electron neutrino cross section, A. Longhin, L. Ludovici, F. Terranova E.P.J. C, April 2015, 75:155, arXiv://1412.5987.
 - A compact light readout system for longitudinally segmented shashlik calorimeters, A. Berra et al. Nucl. Instrum. Meth. A830 (2016), 345-354.
 - Expression of Interest: Enabling precise measurements of flux in accelerator neutrino beams: the ENUBET project. CERN-SPSC-2016-036; SPSC-EOI-014-2016.
- This position is advertised on:
 - the ENUBET web page (http://enubet.pd.infn.it/pos.html)
 - Euraxess jobs (http://ec.europa.eu/euraxess/index.cfm/jobs/index)