Contribution ID: **200** Type: **not specified**

Neutrinos from Stored Muons (nuSTORM)

The Neutrinos from Stored Muons, nuSTORM, facility has been designed to deliver a definitive neutrino-nucleus scattering programme using beams of ν_e and ν_μ from the decay of muons confined within a storage ring. The facility is unique, it will be capable of storing $\mu^\pm$ beams with a central momentum of between 1\,GeV/c and 6\,GeV/c and a momentum spread of 16\%. This specification will allow neutrino-scattering measurements to be made over the kinematic range of interest to the DUNE and Hyper-K collaborations. At nuSTORM, the flavour composition of the beam and the neutrino-energy spectrum are both precisely known. The storage-ring instrumentation will allow the neutrino flux to be determined to a precision of 1\% or better. By exploiting sophisticated neutrino-detector techniques such as those being developed for the near detectors of DUNE and Hyper-K, the nuSTORM facility will:
* Serve the future long- and short-baseline neutrino-oscillation programmes by providing definitive measurements of $\nu_e A$ and $\nu_\mu A$ scattering cross-sections with percent-level precision;
* Provide a probe that is 100\% polarised and sensitive to isospin to allow incisive studies of nuclear dynamics and collective effects in nuclei;
* Deliver the capability to extend the search for light sterile neutrinos beyond the sensitivities that will be provided by the FNAL Short Baseline Neutrino (SBN) programme; and
* Through the delivery of a unique neutrino-physics programme, create an essential test facility for the development of muon accelerators to serve as the basis of a multi-TeV lepton-antilepton collider.
To maximise its impact, nuSTORM should be implemented such that data-taking coincides with the accumulation of substantial data samples by the the DUNE and Hyper-K collaborations. This will allow measurements at nuSTORM to be used to resolve the correlation between flux and cross-section uncertainties that naturally arise in the analysis of near-detector data and so allow oscillation probabilities to be determined with percent-level precision.

With its existing proton-beam infrastructure, CERN is uniquely well-placed to implement nuSTORM. The feasibility of implementing nuSTORM at CERN has been studied by a CERN Physics Beyond Colliders study group. The muon storage ring has been optimised for the neutrino-scattering programme to store muon beams with momenta in the range 1\,GeV/c to 6\,GeV/c. The implementation of nuSTORM exploits the existing fast-extraction from the SPS that delivers beam to the LHC and to HiRadMat. A summary of the proposed implementation of nuSTORM at CERN is presented below. An indicative cost estimate and a preliminary discussion of a possible time-line for the implementation of nuSTORM are presented in the PBC study report.

Authors: PASARI, DHRUV (Durham University); TURNER, JESSICA; FRANKLIN, Jack; LONG, Kenneth Richard (Imperial College (GB)); ALVAREZ-RUSO, Luis; Mx VOGIATZI, Maria (Imperial); KYBERD, Paul (Brunel University (GB)); JURJ, Paul-Bogdan; Prof. HOBSON, Peter; KAMATH, Rohan (Imperial College London); Mr CHANG, Wongjong (Warwick); Dr LU, Xianguo (University of Warwick); RICCIARDI, stefania (CCLRC RAL)