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A Low Energy Muon Storage Ring for Neutrino Cross-Section Measurements

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The ESS Neutrino SuperBeam project (ESSnuSB) is a proposed neutrino long-baseline experiment at ESS, Lund, Swedem, which aims at measuring the leptonic CP-violating phase, δ_{CP}. By using the high-intensity ESS linear accelerator to produce the world's brightest pulsed neutrino source, the measurement will reach a uniquely high precision. In order to further enhance the precision, the Low Energy nuSTORM (Neutrinos from STored Muons) facility is under design, focusing on the detailed measurement of neutrino-nucleus cross-section within the neutrino energy range relevant to ESSnuSB.

The nuSTORM concept, introduced in 1980, uses neutrinos from muons stored in a racetrack-shaped ring. The precisely controlled stored muon intensities, in the nuSTORM ring makes it possible to measure absolute cross-section with high precistion, explore the potential existence of sterile neutrinos and test technologies critical to the progress towards a Muon Collider or Neutrino Factory.

LEnuSTORM utilizes much of the infrastructure of ESSnuSB long-baseline experiment. It will receive compressed proton beam pulses from the ESSnuSB accumulator, requiring only one of the four sub-pulses per main pulse, and a single target with a horn. The compressed proton pulse will generate a short pulse of charged pions emerging from the horn. These pions will be transferred to and injected into the muon storage ring, where they will decay and produce the muon beam.

Previous nuSTORM designs are designed for higher beam energies in the GeV range whereas the LEnuSTORM, which relies on the ESS, aims at performing cross-section measurements in the low-energy region 0.2-0.6 GeV where cross-section data is currently missing.

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