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The ESSnuSB Experiment - Conceptual Design and Physics Potential

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The ESSnuSB experiment is a proposed long-baseline neutrino beam experiment that will measure the CP violation in the lepton sector. The CP violation will be determined by measuring the neutrino beam at the second probability maximum for muon neutrino oscillation into electron neutrinos, where the systematic uncertainty in the measurement is significantly reduced compared to the first oscillation maximum. The required high intensity neutrino beam will be produced with the high-intensity proton accelerator at the European Spallation Source (ESS) in Lund, Sweden. Within the ESSnuSB proposal the ESS proton accelerator will be upgraded to accommodate a doubling of the intensity, and an accumulator ring will be added to shorten the pulse-length by three orders of magnitude. The proton beam pulses will be distributed over four granular titanium targets to produce secondary particles, primarily pions, that are collimated and charge-selected using focusing horns. The pions will decay-in-flight to muons and neutrinos, where the selected sign of the pions determines if neutrinos or anti-neutrinos are produced. The neutrino beam will then be measured in the un-oscillated state with a near-detector complex on the ESS premises, using three different detector technologies. After this it will propagate 360 km to the water-Cherenkov far-detector in Zinkgruvan, north of Vättern lake, where the oscillated beam will be measured.

The ESSnuSB Conceptual Design Report is in the final stages of preparation, and will be presented here along with the evaluated physics potential for discovery of leptonic CP violation and, in particular, precision measurements of the CP violating phase.

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