

## AND ITS SYNERGY WITH A HIGH INTENSITY FRONTIER INITIATIVE HIFI

- The EU supported ESSnuSB Design Study project proposes to add to the European Spallation Source a Super Beam neutrino facility based on a 5 MW beam from the ESS linac and mainly devoted to the precision measurement of a leptonic CP violation.
- The uniquely high neutrino beam intensity allows for operation exclusively at the **second neutrino oscillation maximum** aiming to cover after 10/20 years data-taking 60%/72% of  $\delta_{CP}$  values with the reasonable assumption of 5%/10% systematic errors on signal/background. After 10 years of data taking a resolution in  $\delta_{CP}$  of  $13^\circ/6^\circ$  at  $\delta_{CP} = -90^\circ/0^\circ$  respectively will be obtained.
- Concurrently with the neutrinos a copious number of **muons** ( $>10^{21}/\text{year}$ ) will be produced, which can be used to realize an extensive High Intensity Frontier Physics program for **nuSTORM** for neutrino cross-section measurements and sterile neutrino searches **and vFactory** for precision PMNS parameter measurements
- The ESSnuSB **Accumulator ring** (radius=68 m) will be used to accumulate the 2.86 ms long linac pulse and extract the accumulated protons in one single turn, resulting in a  $1.3 \mu\text{s}$  long pulse. The same ring can be used as the compressor ring in the first stage of a **vFactory** at ESS and also for a **Muon Collider Higgs Factory**.
- Furthermore,  $1.3 \mu\text{s}$  pulses will allow for  **$\pi$  and K Decay at Rest (DAR)** experiments and **Coherent Neutrino Scattering** experiments with very low background.
- Employing slow extraction the Accumulator ring can also be used to generate compressed spallation-neutron pulses of  $50 \mu\text{s}$  length of significant interest for **Spallation Neutron Science**.



ESS linac and site May 2020



ESSnuSB layout at ESS