Today, one of the most tantalizing mysteries in physics revolves around the matter-antimatter asymmetry in our universe : why does nature favor matter, while little antimatter survived the fiery aftermath of the Big Bang ? Worldwide, neutrino-oscillation experiments as SBN, T2K, and the future DUNE and HK are investigating the mechanisms behind this matter dominance. Also in Europe, the ESSnuSB+ collaboration is preparing for a contribution to this quest. Leveraging the unique opportunities offered by the intense neutrino beams that can be produced at the European Spallation Source, the collaboration proposes to measure this asymmetry at the second neutrino oscillation maximum with discovery precision.

The accuracy of these programs however strongly depends on the ability to simulate the interaction between neutrinos and the nuclei that serve as target material. The aim of this project is to develop accurate descriptions in the specific energy range below the quasi-elastic peak i.e. with neutrino energies of at most a couple of hundreds of MeVs.

Currently used simulation tools are optimized for significantly higher energies, rendering them unsuitable for e.g. the ESSnuSB beam, which primarily operates with neutrino energies ranging from 200 to 300 MeV, as well as for the lower energy part of all other spectra. We aim at a performant extension of the Wroclaw neutrino simulation tool NuWro, grounded in microscopic theoretical models developed in Ghent, to fill this caveat.