



Contribution ID: 48

Type: **Oral contribution**

Carving a Neutrino Factory: A Multi-Disciplinary Conceptual Design Methodology for ESSnuSB

Friday, September 4, 2026 5:00 PM (25 minutes)

The ESSnuSB project aims at searching the matter anti-matter asymmetry at 5σ significance level, in more than 70% of the lepton Dirac δCP violating phase range, and measuring the phase value with precision. Its first phase, the ESSnuSB, investigated the upgrade of the European Spallation Source to deliver the intense neutrino beam toward a far detector hosted within the Zinkgruvan mine, Sweden. Its extension phase, ESSnuSBplus, is aiming at neutrino-nucleus cross-section measurements at the low neutrino energies. ESSnuSB experiment will benefit from the very high intensity of the European Spallation Source 5 MW linac in Lund (Sweden) allowing the installation of the far neutrino detector at the second oscillation maximum.

However, several technological challenges must be studied before the design of the ESSnuSB experiment. In particular, the design of the accumulator ring and the Target-Station producing the neutrino super-beam from the proton linac beam is one of the highest priorities at this phase of the project. Moreover, the facility combines civil engineering works at an operating accelerator complex, subject to coupled radiological, geotechnical and operational constraints. This contribution presents the multi-disciplinary design methodology developed for ESSnuSB, in particular, the linac-to-accumulator transfer line, the accumulator ring, the ring-to-target transfer line and the staged target-station deployment, all integrated within the operating ESS site.

We will report on the ongoing design and civil engineering efforts for the ESSnuSB project that lies within the ESS site.

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Session Classification: JOINT WG1+WG3 — Beams for Precision Oscillation Physics

Track Classification: WG3: Accelerator Physics