The ESSnuSB/ESSnuSB+ detector design

Co-funded by the European Union

ESS neutrino Super Beam plus

Author's information

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More on ESSnuSB

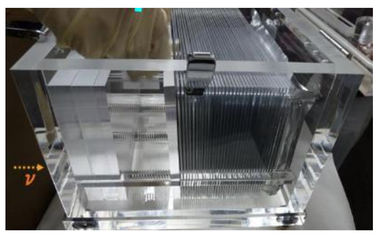
#18 – Physics opportunities at the ESSnuSB/ESSnuSB+ setup
#29 – ESSnuSB+ Target Station
#40 – Decoherence at ESSnuSB
#82 – New Physics at ESSnuSB/ESSnuSB+
#370 – Overview of ESSnuSB+

Staging of the ESSnuSB/ESSnuSB+ project

- Stage 1: Cross-section measurement using the low energy monitored beam (LEMMOND detector)
- Stage 2: Cross-section measurement using the LEnuSTORM (LEMMOND and END detectors)
- Stage 3: CP violation measurement

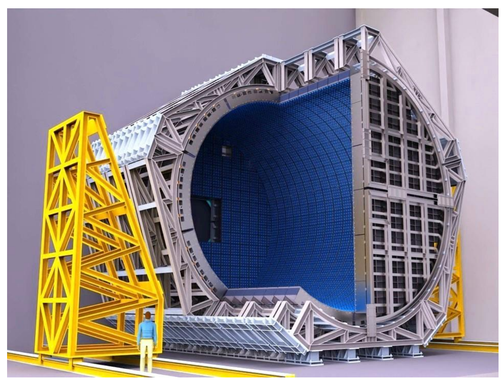
Stages 2 and 3

ESSnuSB near detectors (END)



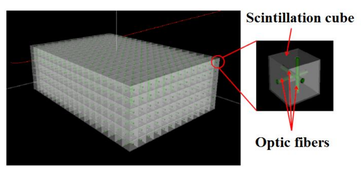
Emulsion detector (vIKING)

- water target, 1 t fiducial mass
- precise interaction topology measurement



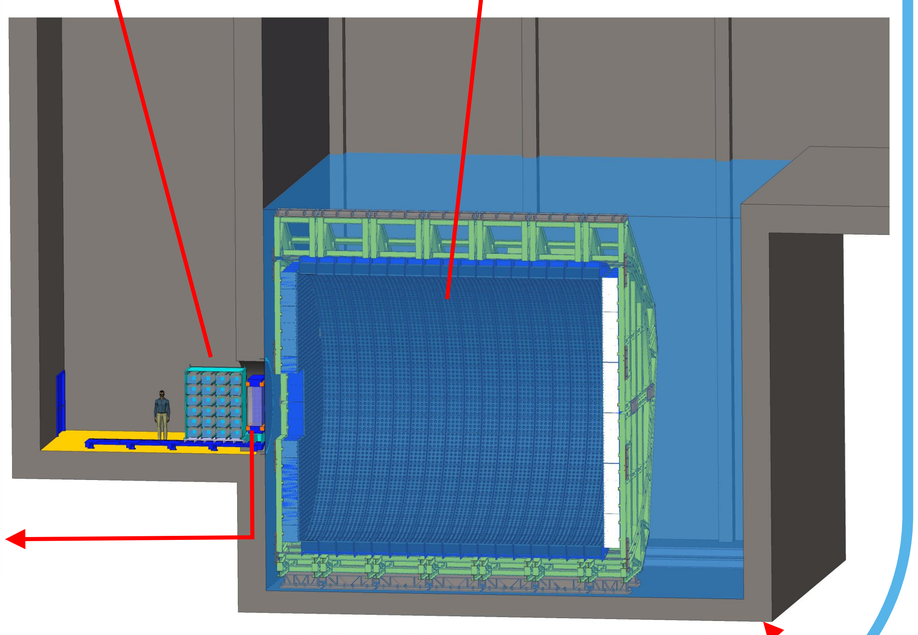
Near water Cherenkov detector

- 475 t fiducial mass
- high statistics xsec measurement
- beam monitoring



SFGD-like detector

- plastic scintillator
- 1 t fiducial mass
- 1x1x1 cm^3 cubes with semi-independent readout
- calorimetry possible

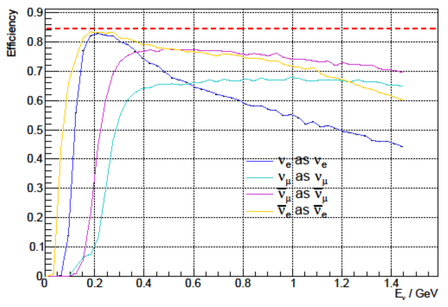


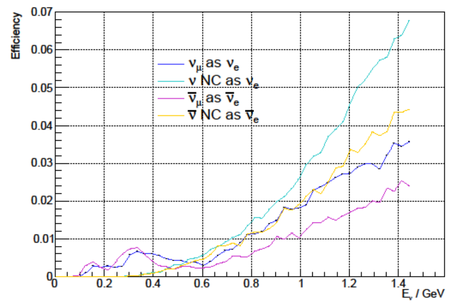
ESSnuSB near detector hall

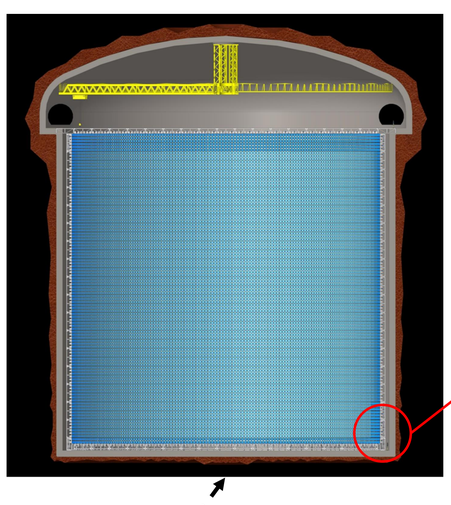
ESSnuSB far detectors

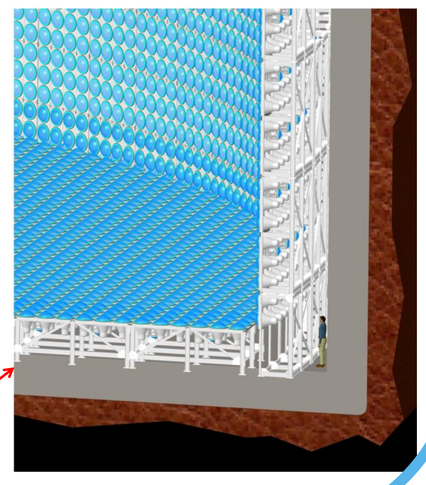
Stage 3

- 2 x 270 kt fiducial volume (~2x HyperK)
- Readout: 2 x 38k 20" PMTs
- 30% optical coverage
- High efficiency at the 2nd oscillation maximum
- Gadolinium doping foreseen

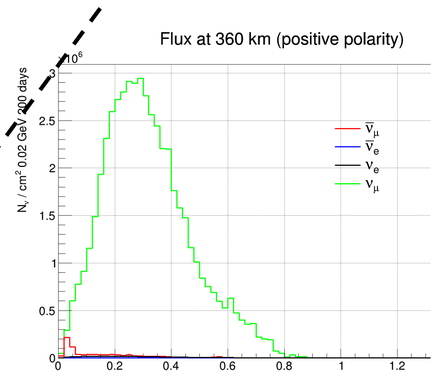


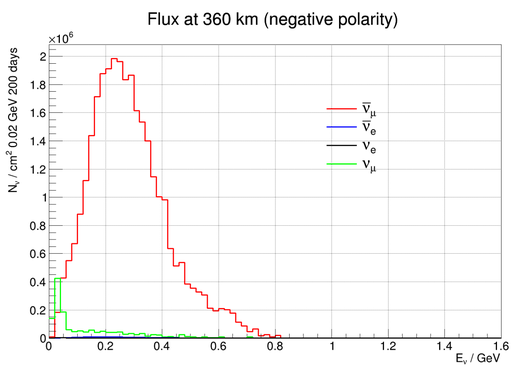






360 km

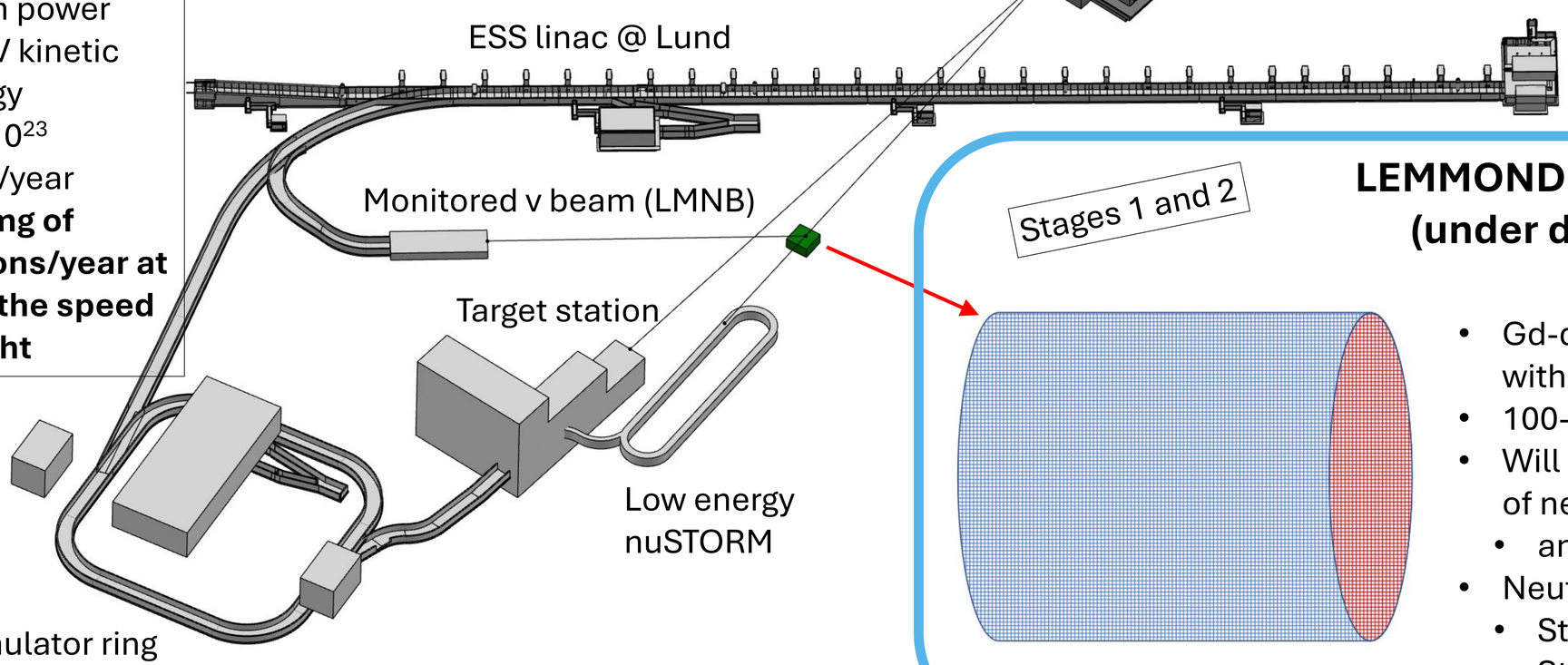




Neutrino flux

ESS proton linac:

- 5 MW average beam power
- 2 GeV kinetic energy
- $2.7x10^{23}$ p.o.t./year
- **450 mg of protons/year at 95% the speed of light**



Stages 1 and 2

LEMMOND detector (under design)

- Gd-doped water Cherenkov detector with mixed (PMT + picosec) readout
- 100-500 t water mass
- Will be used for precision measurement of neutrino interaction cross-sections
  - and additional physics
- Neutrino sources:
  - Stage 1: monitored beam
  - Stage 2: LEnuSTORM