

Towards a Neutrino Beam Experiment in EU

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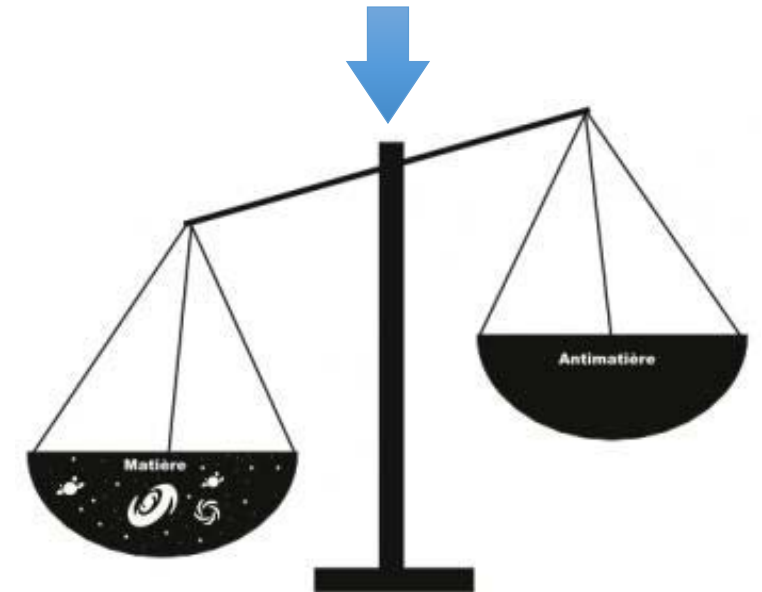
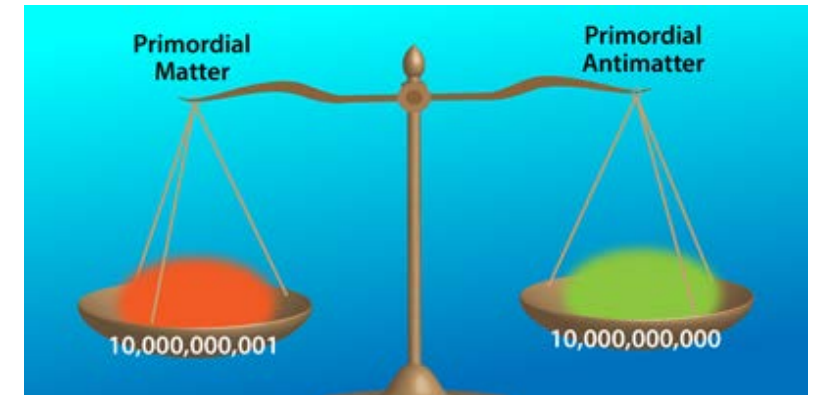


Why this Infrastructure?

- After the Big bang Equal amount of Matter and Antimatter created.
- The observed universe is dominated by matter only!
- For this to happen, fundamental physics principles and symmetries must be broken in the early universe.

This is not fully understood!

- At the international level, in contrast to 20 years ago, neutrino long baseline projects exist only in the USA and Japan.
- Crucial Information appeared in 2012 that gave an advantage to an EU-based infrastructure.

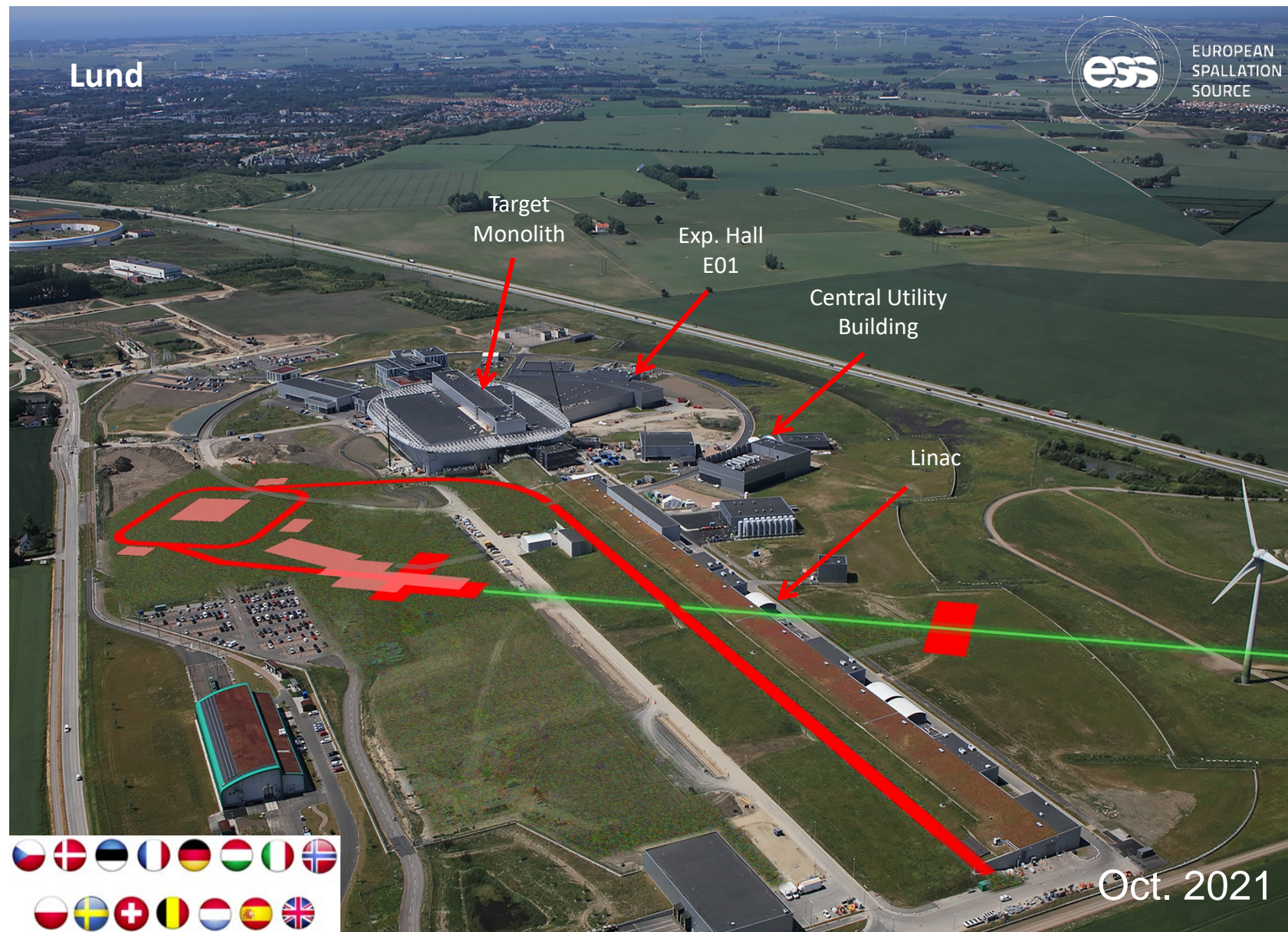


The European Spallation Source (ESS) layout

- The ESS facility is under construction in Lund, Sweden
- The most powerful proton linear accelerator ever built, with beam kinetic energy of 2 GeV and power of 5 MW
- The world's most powerful neutron source (ca. $40 \times 10^{15} \text{ n} \cdot \text{cm}^{-2} \cdot \text{s}^{-1}$)



16/02/2023



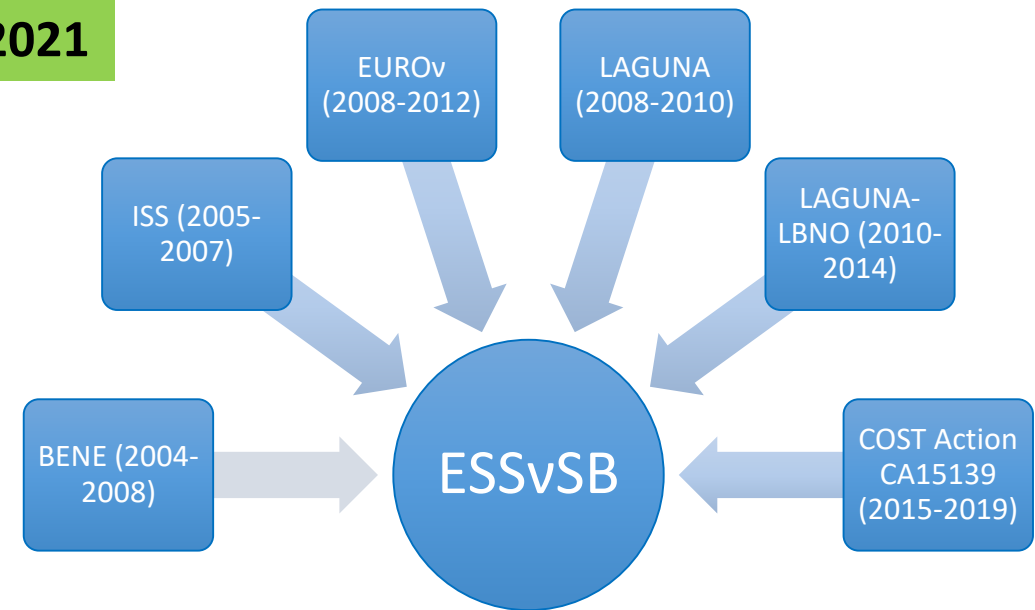
T. Tolba, 11th European Networking Event 2024, Düsseldorf



A H2020 EU Design Study (Call INFRADEV-01-2017)

- **Title of Proposal:** *Discovery and measurement of leptonic CP violation using an intensive neutrino Super Beam generated with the exceptionally powerful ESS linear accelerator*
- **Duration:** 4 years
- **Total cost:** 4.7 M€
- **Requested budget:** 3 M€
- **15 participating institutes from 11 European countries including CERN and ESS**
- **6 Work Packages**
- **Approved end of August 2017**

Funding period 2018 - 2021





A H2020 EU Design Study (Call INFRADEV-01-2017)

intensive neutrino
accelerator

(0)
 LAGUNA-LBNO (2010-2014)
 COST Action CA15139 (2015-2019)

Research and Innovation actions

Innovation actions

And the EU decision arrived on...
26/07/2022

Design Study

HORIZON-INFRA-2022-DEV-01



3 M€



Funding period 2023 - 2026

Study of the use of the ESS facility to accurately measure the neutrino cross-sections for ESSvSB leptonic CP violation measurements and to perform sterile neutrino searches and astroparticle physics.

Acronym of Proposal: ESSvSB+



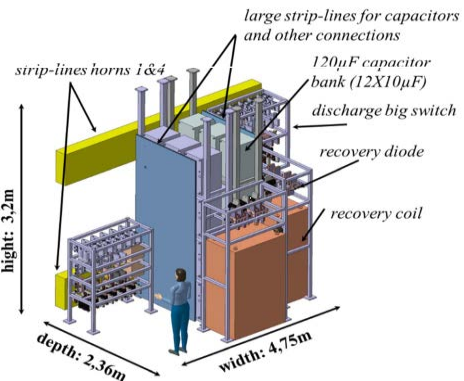
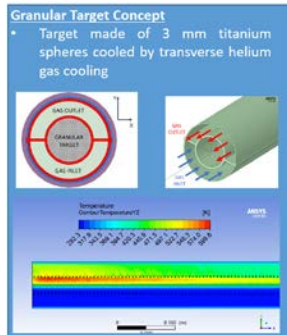
Co-funded by the European Union



Technologies impeded in the Infrastructure

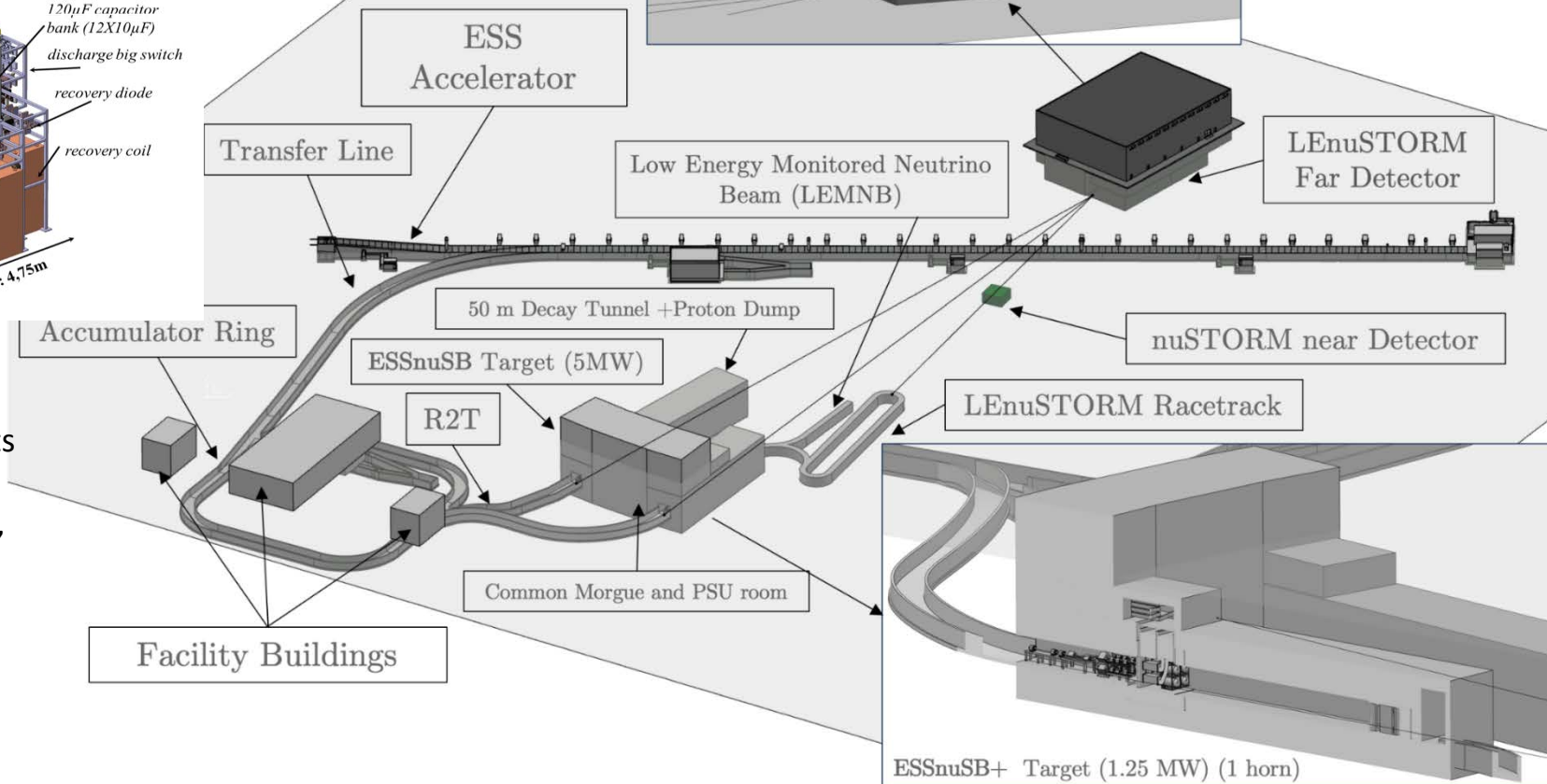
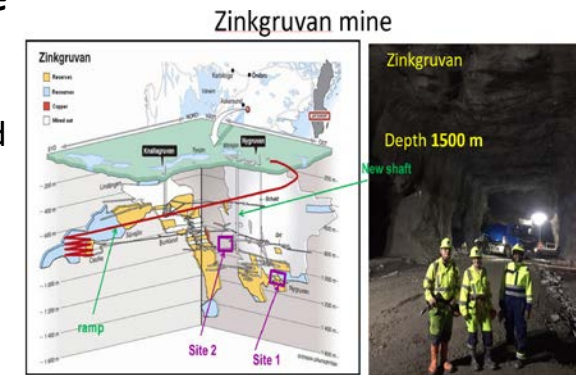
Material Science

Target materials, cooling system and technology to withstand Mega Watt power beams.



Geological Science

Mining, Large cavern Excavation, Diamond drilling, Underground safety and handling systems



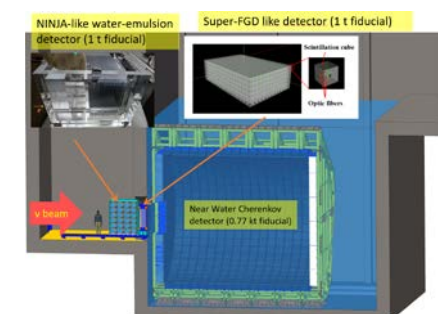
Ground Plane

High voltage technologies

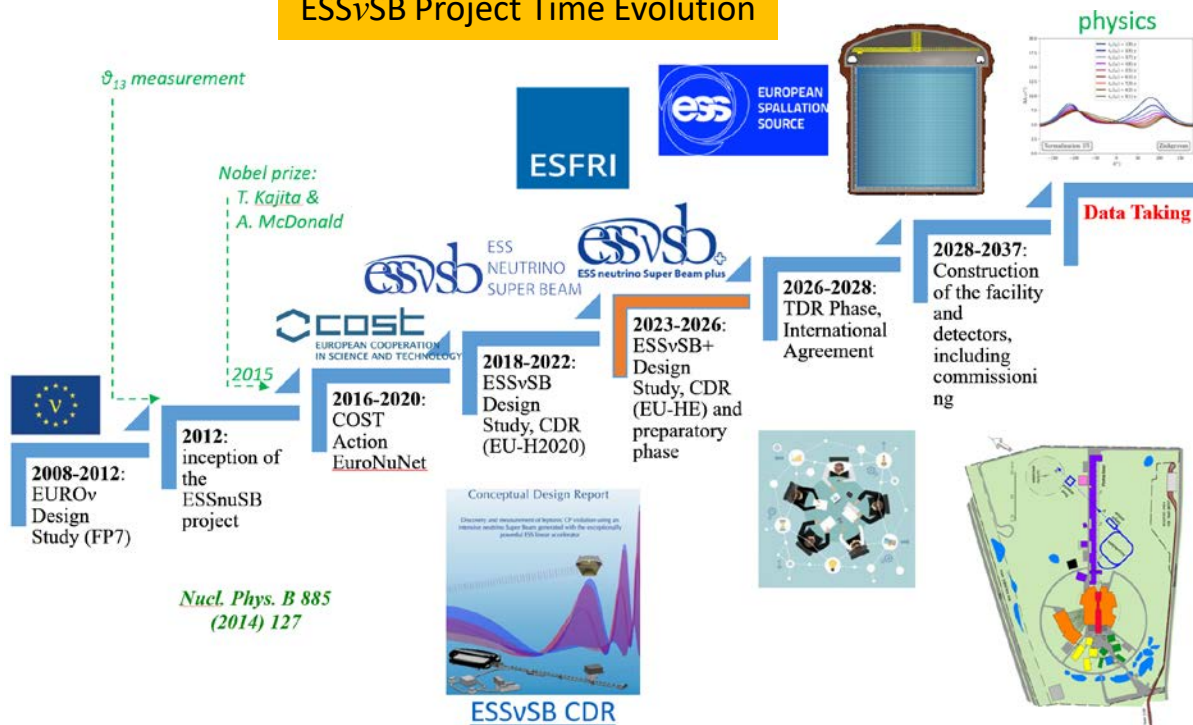
Deliver kA currents in few Hz rates, electric insulators, strip lines, etc.

Detection technologies & Analysis tools

Photo-sensors (e.g., PMTs), read-out electronics, control electronics, Machine learning, AI, etc.

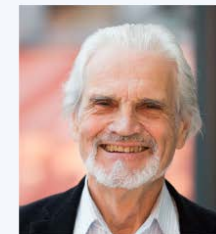


ESSνSB Project Time Evolution



You are welcome to contact us and explore further the opportunities within our infrastructure!

Key members



Tord Ekelöf
Science Leader



Marcos Dracos
Project Leader



Aysel Kayis Topaksu
Governing Board Chair



Tamer Tolba
Dissemination and Exploitation Board Chair

ESSnuSB Design Study Project



<https://www.youtube.com/watch?v=PwzNzLQh-Dw>

ESSnuSB looking for the answer.



<https://www.youtube.com/watch?v=qAnvft0nAlg>

How to contact us

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