

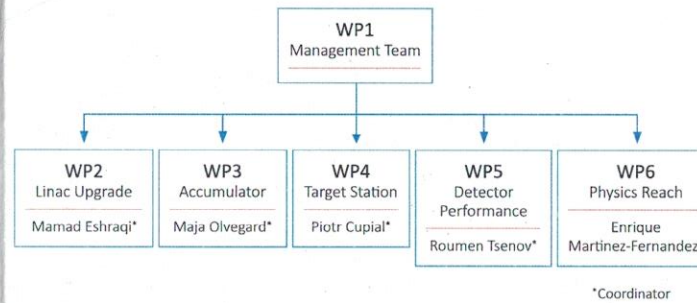
The world's most intense Neutrino beam project

An Eleven Nation Partnership
dedicated to understanding
— The moments after the Big Bang —
— Why do we exist at all? —

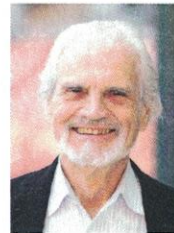
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Credit: European Southern Observatory

Project team and organisation



Key members



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cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY



Partner Countries

Bulgaria	Greece	Spain	Turkey
Croatia	Italy	Sweden	UK
France	Poland	Switzerland	

Partners

Centre National de la Recherche Scientifique
Uppsala University
Kungliga Tekniska Högskolan
European Spallation Source ERIC, ESS
University of Cukurova
Universidad Autonoma de Madrid
Demokritos National Centre for Scientific Research
Istituto Nazionale di Fisica Nucleare
Ruder Boskovi Institute
Sofiiski Universitet Sveti Kliment Ohridski
Lund University
Akademia Gorniczo-Hutnicza Krakow
European Organization for Nuclear Research CERN
University of Geneva
University of Durham

What are neutrinos?

- The lightest fundamental particle
- Elusive and difficult to detect
- Plentiful – they are everywhere
- Travel as fast as light (almost!)
- Three different flavours
- The flavours oscillate!

Big Bang
The Sun
The Earth
Supernovae

Neutrino Discoveries and Nobel Prizes

- Pauli 1930/1945 [prediction of the neutrino]
- Cowan & Reines 1956/1995 [discovery of the neutrino]
- Davis and Koshiba 1987/2002 [solar & cosmic neutrinos]
- Kajita & McDonald 1998/2001/2015 [neutrino oscillations]

What is Matter and Antimatter?

- There were equal quantities after the Big Bang
- But there is 'no' antimatter now. Why?
- Symmetry was broken. How?
- Otherwise we would not exist

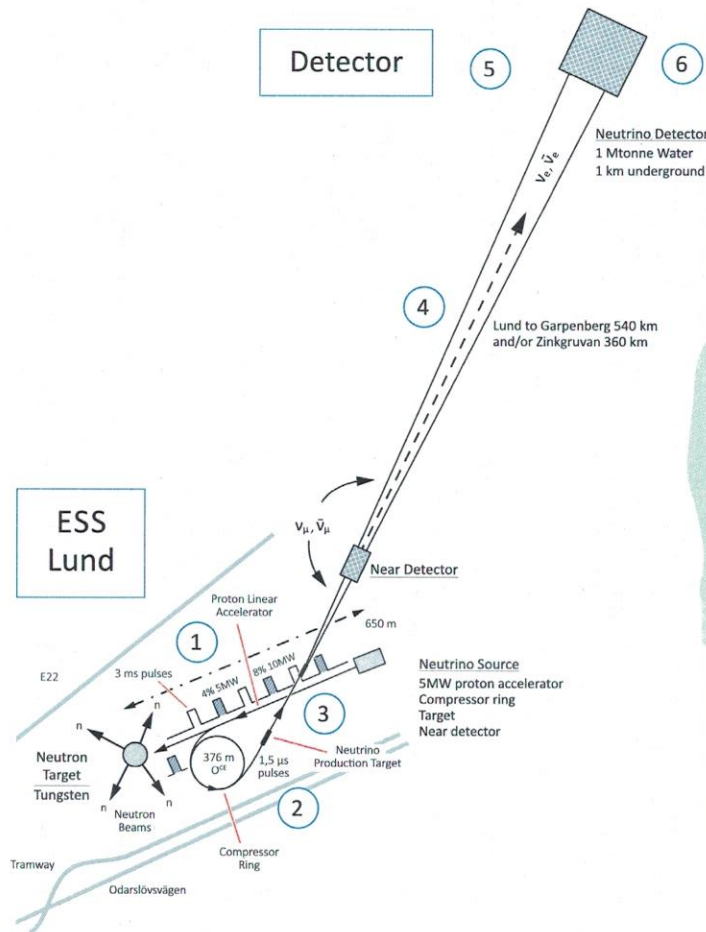
So why was symmetry broken?

ESSvSB will provide the answer!



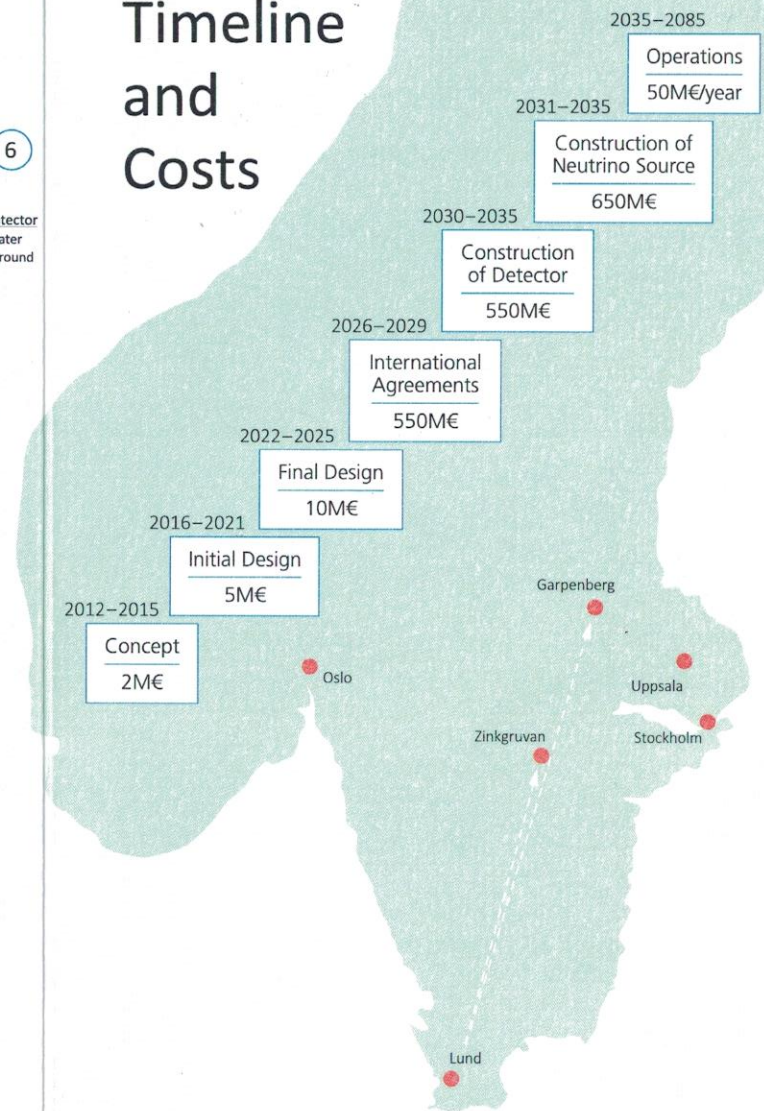
European Spallation Source

ESSvSB – The Basics



- 1 Proton beam in Lund 5+5 MW
- 2 Protons ⇒ Pions
- 3 Pions ⇒ Neutrinos
- 4 Neutrinos ⇒ Garpenberg 540 km and/or Zinkgruvan 360 km
- 5 Neutrinos detected in million tonne detector
- 6 Data distributed to the rest of the world

Timeline and Costs



Advantages of ESSvSB

- Highest production intensity [5MW driver]
- Largest detector [1 million tonnes]
- Greatest sensitivity [2nd oscillation maximum]