ESS Collaborations: From Defining to Delivering

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www.europeanspallationsource.se
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Introduction

2003
European design of ESS completed

2009
Decision to site ESS in Lund

2012
ESS design update phase complete

2014
Construction starts on green field site

2019
Start of initial operations phase

2023
Start user program

2025
Construction phase complete

60%
Accelerator start-up

- When Lund was selected at the site of ESS in 2009, the so-called Design Update Phase started.

- ESS was the proverbial green-field site, and building up a complete organization in Lund to do design and construct the accelerator ”in-house” was not an option.

- Instead, the emerging Accelerator Division under Mats Lindroos started by looking for collaborators in Europe that had the necessary competence, resources and willingness to become involved in the ESS project.

- Forming the collaboration went in parallel with the start of the accelerator design.
Linear Accelerator

Particle species: p
Energy: 2.0 GeV
Current: 62.5 mA
Average power: 5 MW
Peak power: 125 MW
Pulse length: 2.86 ms
Repetition rate: 14 Hz
Operating time: 5200 h/year
Reliability (all facility): 95%
Partner Institutions

In-kind (main contributions)

- ATOMKI (RF-LPS)
- CEA (RFQ, SRF, Diagn)
- CNRS (SRF, Cryogenics)
- Cockcroft Inst (Diagn)
- Daresbury Lab (SRF, Vacuum)
- Elettra (RF, Magnets, PS, Diagn)
- ESS-Bilbao (MEBT, RF)
- Huddersfield Univ (RF distrib)
- IFJ PAN (Installations, test stand)
- INFN Catania (Source, LEBT)
- INFN Legnaro (DTL)
- INFN Milan (SRF)
- Lodz UT (LLRF)
- NCBJ (LLRF, gamma blockers)
- Tallinn UT (RF)
- Univ Bergen (Seconded staff)
- Univ Oslo (Diagn)
- Warsaw UT (LLRF)
- Wroclaw UT (Cryogenics)

Collaboration agreements

- Aarhus Univ (Beam delivery, diag)
- DESY (Diagn)
- Lund Univ (LLRF, RF)
- Uppsala Univ (Test stand)
- University West (Diagn)

IK signed
IK endorsed
Collaboration agreement signed
Completed

Big Science Sweden, Lund, 26 November 2019
Accelerator Components
~50 Technical Annexes
Protons are accelerated by strong electric fields in resonant cavities. The cavities are made from superconducting niobium, cooled to 2 K in order to reduce dissipation from currents induced in the cavity walls.

The cavities are enclosed in cryomodules that are vacuum vessels and provide the thermal shielding.

The cavities are delivered in-kind from STFC (UK) and INFN (Italy), that are in turn subcontracting services to DESY (Germany), and IPNO (France) has provided design support.

Development started 2009, and ESS will get 30 cryomodules from CEA at a total value of more than 100 M euro.
Status of Deliveries to the Accelerator

- Ion-source & Low Energy beam transport commissioned and Medium Energy beam transport & Radio Frequency Quadrupole (RFQ) installation are under way (INFN-LNS, ESS, CEA)
- ESS cryoplants operating and delivering liquid Helium to clients (ESS)
- Drift Tube Linac tank (DTL) assembly started on ESS site (INFN)
- 5 ESS-designed modulators and 27 klystrons delivered to ESS (ESS-Bilbao, ESS)
- 22 out of 30 valve boxes with interconnections for elliptical linac installed (Wroclaw University)
- Installation of RF distribution well under way (Huddersfield Univ., IFJ-PAN)
Procurements in Near and Long Term

- 5 high-beta modulators (ESS design)
- Spare parts for beam diagnostics, vacuum, cryogenics, RF sources, modulators and power supplies
- Installation material such as cables, cable trays etc
- Services such as specialised welding
- Consumables such as oil for modulator transformers and industrial gases

- General spare parts, consumables and services
- Superconducting RF Maintenance and Repair Facility
- ESS Neutrino Super Beam
- Participation in external projects (e.g. DONES)
- ...

Thank you