

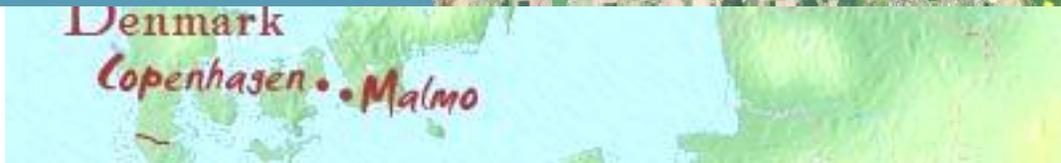


EUROPEAN
SPALLATION
SOURCE

The European Spallation Source

**ESS - a 5MW linac-based long-pulse
spallation neutron source to be built in Sweden**





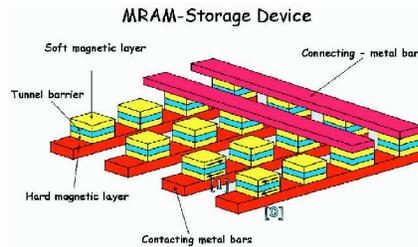
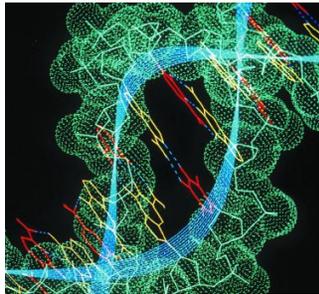


ESS – multi-science with neutrons

Materials science
Energy Technology

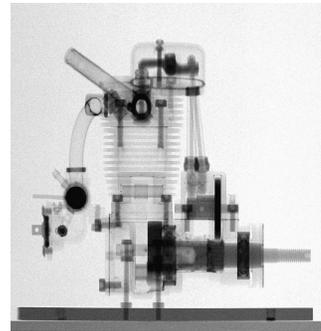
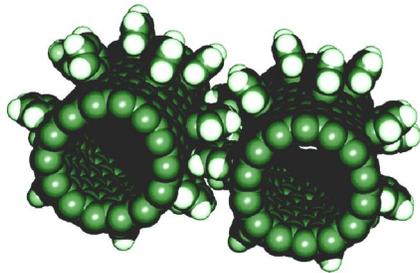
Bio-technology
Hardware for IT

Nano science
Engineering science



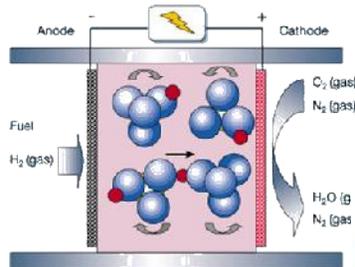
- Neutrons can provide unique and information on almost all materials.

- Information on both structure and dynamics simultaneously. "Where are the atoms and what are they doing?"



- 5000 users in Europe today
Access based on peer review.

- Science with neutrons is limited by the intensity of today's sources



NB. Neutrons and synchrotron light are very complementary methods, often used together. ESS will be sited next to MAX IV, a fourth generation light source



Intensity opens new possibilities

Complexity/
Count-rate

ESS intensity allows studies of

- complex materials
- weak signals
- important details
- time dependent phenomena



Details/Resolution



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Preconstruction phase

Site decision May 2009 - Brussels

1st ESS Steering Committee October 2009 - Copenhagen

strong support from 13 countries to:

- to engage in the ESS Design Update
- to prepare organisation aimed for construction

Now 16 member states and others on the way...





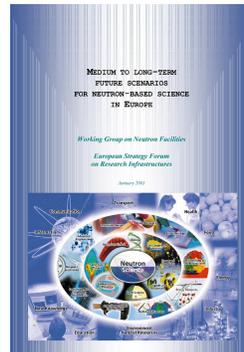
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Time lines



first design
2002-2003

ESFRI Report
2003



site
decision
2009

ESS Pre-construction phase

2010-2012

ESS Construction phase

2013-2018

Completion phase

2018-2025

Operations phase

2026-2066

My retirement

~2037

Decommissioning phase !!!

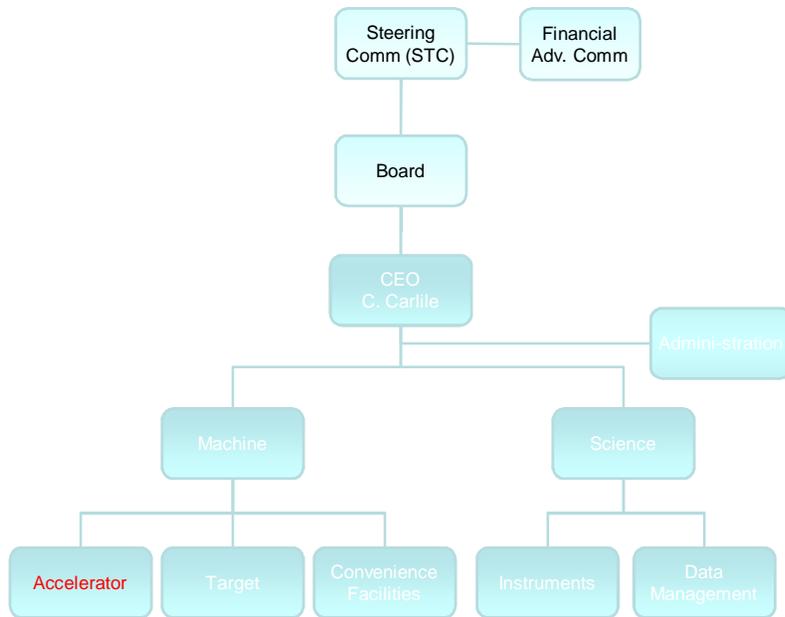
2067-2071



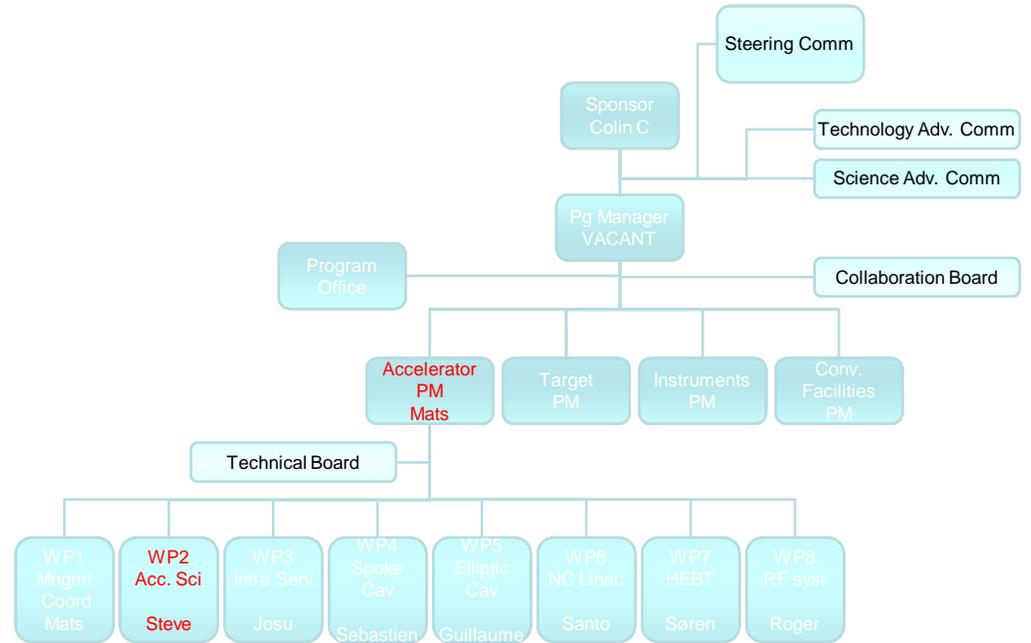


ESS Organization

ESS Line Organization (Local)



ESS Program (Collaboration)



Local organization is currently being built up (in Lund).



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ESS accelerator high-level technical objectives:

5 MW long pulse source

≤ 2 ms pulses

≤ 20 Hz

Protons (H^+)

Low losses

High reliability, $>95\%$



NB. No accumulator ring

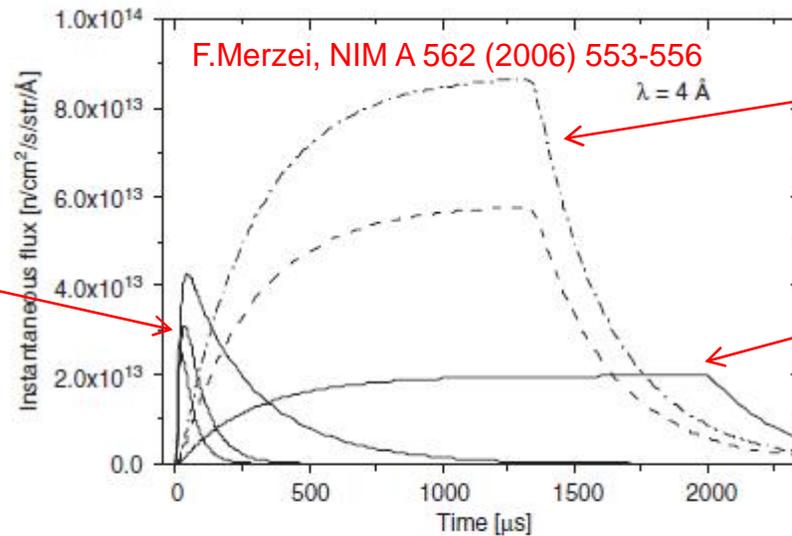


Why long pulse?

Most users want cold neutrons!

(traditionally used reactors, many of which are closing down in the next decade)

ESS'03 short pulse
(~80GW pulse power)



'Optimized' long pulse
(~450MW pulse power)

ESS'03 long pulse
(~150MW pulse power)

Fig. 1. Estimated cold neutron pulse shapes for the various moderator and pulse length options for ESS (continuous lines) and for an optimized long pulse source (dashed line). The dot-dashed line is explained in the text.

NB. Time structure can be produced with mechanical choppers.



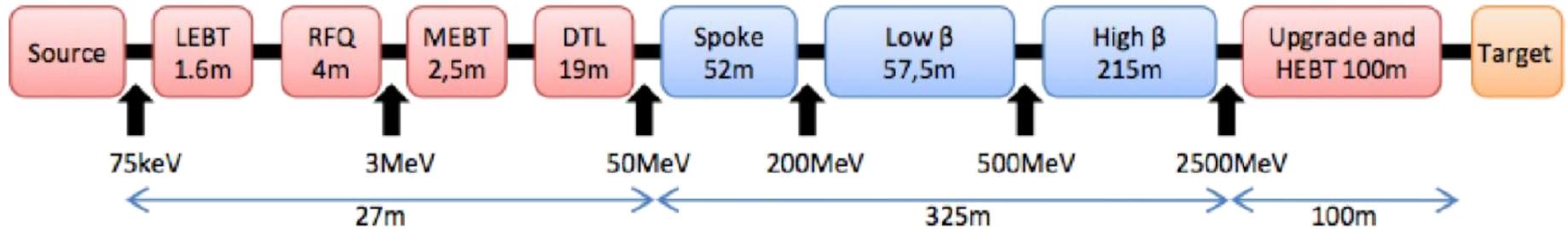
ESS Linac Spec

Parameter	ESS	ESS'03
Average beam power	5 MW	
Pulse length	1.5-2 ms	<2 ms
Rep rate	20 Hz	16.7 Hz
Energy	2.2-2.5 GeV	1 GeV
Average beam current	2-2.3 mA	
Peak beam current	50-75 mA	150 mA
Linac length	~420 m	
RF Frequency	352/704 MHz	

Ranges indicate differences between Bilbao and Scandinavia proposals, which are now being combined. Some original ESS design values shown to indicate the need for a detailed design update.



LINAC Layout



	Length (m)	Input Energy (MeV)	Frequency (MHz)	Geometric β	# of Sections	Temp (K)
RFQ	4	75×10^{-3}	352.2	--	1	≈ 300
DTL	19	3	352.2	--	3	≈ 300
Spoke	52	50	352.2	0.45	14 (3c)	≈ 2
Low Beta	57.5	200	704.4	0.63	10 (4c)	≈ 2
High Beta	215	500	704.4	0.75	19 (8c)	≈ 2
HEBT	100	2500	--	--	--	--

M. Eshraqi and A. Ponton, ESS



Collaboration Possibilities

- ESS and Project X are similar in many ways and have similar beam instrumentation needs
 - Beam intensity, loss and position
 - Beam profile/size and halo
 - Difference in RF frequency not a big issue.
- Interceptive/destructive diagnostics may be used for initial commissioning, non-intercepting diagnostics required for operation.
 - Profile/Halo measurement particular challenge for protons (vs H-)
- Preliminary instrumentation specification ready at the end of this year (along with initial linac baseline)
 - In the same time frame, assessing which institutions are interested in collaborating (and in what areas).
- Final spec, R&D, design choices and some initial design/costing to be completed during “design update” phase (2012-2013).
 - Key issue yet to be resolved is cryogenic segmentation of linac (warm vs cold instrumentation)
 - If cold, detailed instrument design may need to be fast-tracked



Summary

- ESS is happening!
- Although ESS is a European project, there is no a priori restriction on US involvement
 - By pooling our resources, both sides win (“grow the pie”)!
- If you’re interested and/or have ideas on specific areas of collaboration (either as part of the Project X effort or direct lab-to-lab collaboration), I’d like to talk to you in the coffee break.



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What can you get for 1.5 B€ today ?

You could buy four A380 airbuses...



or, 28% of the Fehmarn Bridge



or, you could pay the bonuses of US bankers for...

24 days