ESS and the UK share

Justin Greenhalgh
Senior programme manager, UK-ESS
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• What is the European Spallation Source?
  – And why do neutrons matter?

• The UK’s role
  – Brief history
  – UK contribution
  – UK In-kind contributions
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• Many research reactors in Europe are aging and will be closed before 2020.

• The spallation technology will replace reactor-based sources.

• There is a urgent need for a new high-flux cold neutron source in Europe.
Neutrons?

- **Charge neutral**: deeply penetrating... except for some isotopes. Non-invasive.

- **Nuclear interaction**: cross-section depending on isotope (not $Z$), sensitive to light elements.

- **Spin $S = 1/2$**: probes magnetism

- **Unstable** $n \to p + e + \nu_e$ with life time $\tau \sim 900s$, $l = l_0 \, e^{-t/\tau}$

- **Mass**: $n \sim p$; thermal energies result in non-relativistic velocities. $E=293 \, K=25 \, \text{meV}$, $v=2196 \, \text{m/s}$, $\lambda = 1.8 \, \text{Å}$. 
Try this with x-rays!

- Rose
- Lead box
Neutrons are special

Charge neutral
Deeply penetrating

Magnetic moment (spin)
Probe of magnetism

Nuclear scattering
Sensitive to light elements and isotopes

Li motion in fuel cells

Solve the high-temperature Superconductivity puzzle

Active sites in proteins

Improve electric cars

Efficient high-speed trains

Better drugs
Neutrons see the Light Element

Images from the NIAG group, PSI, Switzerland.
Journey to deliver the world’s leading facility for research using neutrons

- 2009: Decision to Site ESS in Lund
- 2003: European Design of ESS Completed
- 2014: Construction Starts on Green Field Site
- 2012: ESS Design Update Phase Complete
- 2019: Machine Ready for 1st Beam on Target
- 2023: ESS Starts User Program
- 2025: ESS Construction Phase Complete
Financing includes cash and deliverables

Host Countries Sweden and Denmark

- Construction 47.5%
- Operations 15%

Cash Investment ~ 97%

Non Host Member Countries

- Construction 52.5%
- Operations 85%

In-kind Deliverables ~ 70%
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UK-ESS outline

- Ministerial announcement Feb 2014
- £165M fixed flat-cash contribution (equivalent to 10% of €1.843Bn at 2013 prices)
- UK allocation over 5 years (though the work will last longer)
- Agreement is that up to 70% (£115M) may be provided in kind, the rest in cash.
- Chancellor signed Business Case Dec 2015
- UK formally applied to join the ESS ERIC in August 2016
- Allocation of final cash funding profile from BEIS
- Agreement reached on what the 70% will be used for
The Prime Minister

20 February 2014

Dear Fredrik,

You raised UK involvement in the European Spallation Source (ESS) project, to be hosted by Sweden, when we met early last year in Riga. I am keen for the UK to participate in this important project. Good progress has been made by our representatives in the negotiations on our participation.

I am delighted that an agreement in principle has been reached between our countries on the UK’s participation in the construction and operation of ESS. That includes Swedish participation in the operation of the UK’s complementary facility, ISIS, which is very welcome. These discussions are being taken forward by my Universities and Science Minister, David Willetts, and your Ministry of Education and Research State Secretary, Peter Honeth, who are meeting in the margins of the Competitiveness Council on Friday 21 February.

We plan to make a public announcement about our backing for the ESS as part of my Science Week here, which starts on Monday 10 March.

Yours,

David

His Excellency Mr Fredrik Reinfeldt
UK In-kind list

• Large contributions:
  – RF Distribution system (waveguides, supports)
  – Beam transport modules (Vacuum systems)
  – High-beta cavities (Niobium fabrication; cryogenic systems)
  – Instruments (motion control; detectors; mechanical assemblies)
  – Remote handling hot cells (remote cranes, etc)

• Minor contributions
  – Supply of STFC expertise in computing, electronics, labs layout
Upcoming procurements - 1

- RF distribution system ([Rob.Edgecock@stfc.ac.uk](mailto:Rob.Edgecock@stfc.ac.uk))
- Waveguides, coax, bends – about now
- Support structures – Jan & Feb 2017
- Circulators, loads – active now (?)
- Arc detectors – soon
- High power RF switches – Dec 2016
Upcoming procurements - 2

- Beam transport modules (Paul.Aden@stfc.ac.uk)
- Machined parts (50k+) – active now
- Aluminium girder (50k+) – active now
- Many other smaller tenders for machined parts etc
Upcoming procurements - 3

- RF cavities ([Mike.Ellis@stfc.ac.uk](mailto:Mike.Ellis@stfc.ac.uk))
  - Niobium material (£Millions; tender in Dec ‘16)
  - SRF cavity fabrication (£Millions; tender early ‘17)
  - Cleanroom (£100,000s; Q1/2017)
  - Cavity High Pressure Rinse (£100,000s; Dec ’16)
  - Control & safety systems (£10,000s; Q1/17)
  - Vacuum systems (currently underway)
  - Mechanical support structures (£10,000s; Dec ‘16)
Upcoming procurements - 4

• Instruments ([kevin.jones@stfc.ac.uk](mailto:kevin.jones@stfc.ac.uk))
  – See Kevin’s talk coming up.

• Hot cells ([simon.pattison@ukaea.uk](mailto:simon.pattison@ukaea.uk))
  – Confinement and Shielding
  – Size Reduction
  – Handling
  – Electrical Distribution
  – Control Systems
  – Safety Systems
  – See talk later and tour at Culham this afternoon
Upcoming procurements - 5

• Procurements from ESS
  – Using any of the cash we or others have given them
  – See talk coming up from Julie Bellingham, UK ILO

• Procurements by other partners
  – Somebody has to make all the rest of ESS
  – Keep an eye out for tenders from other partners
  – UK ILO may be able to help.
Questions