Explore ESS

A European big-science research facility in Scandinavia

ESS (European Spallation Source ERIC) is a research facility under construction in Lund, with its data management and software centre in Copenhagen. When completed, ESS will be the world's most powerful accelerator-based source of neutrons. Once generated, the neutrons are used to study the properties and behaviour of materials that would otherwise be impossible to see –right down to the level of atoms. Every year, thousands of researchers from academia and industry will use the ESS facility to learn more about materials; unlocking discoveries and driving innovative solutions to address some of humanity's biggest challenges in energy, health and the environment.

Funded by 13 European countries, the ESS facility is built with contributions from more than 40 research institutes. ESS attracts people from diverse fields and cultures who share the excitement of building a state-of-the-art facility to enable great science and innovation for a sustainable world.

How does it work?

1 Protons are generated in the ion source

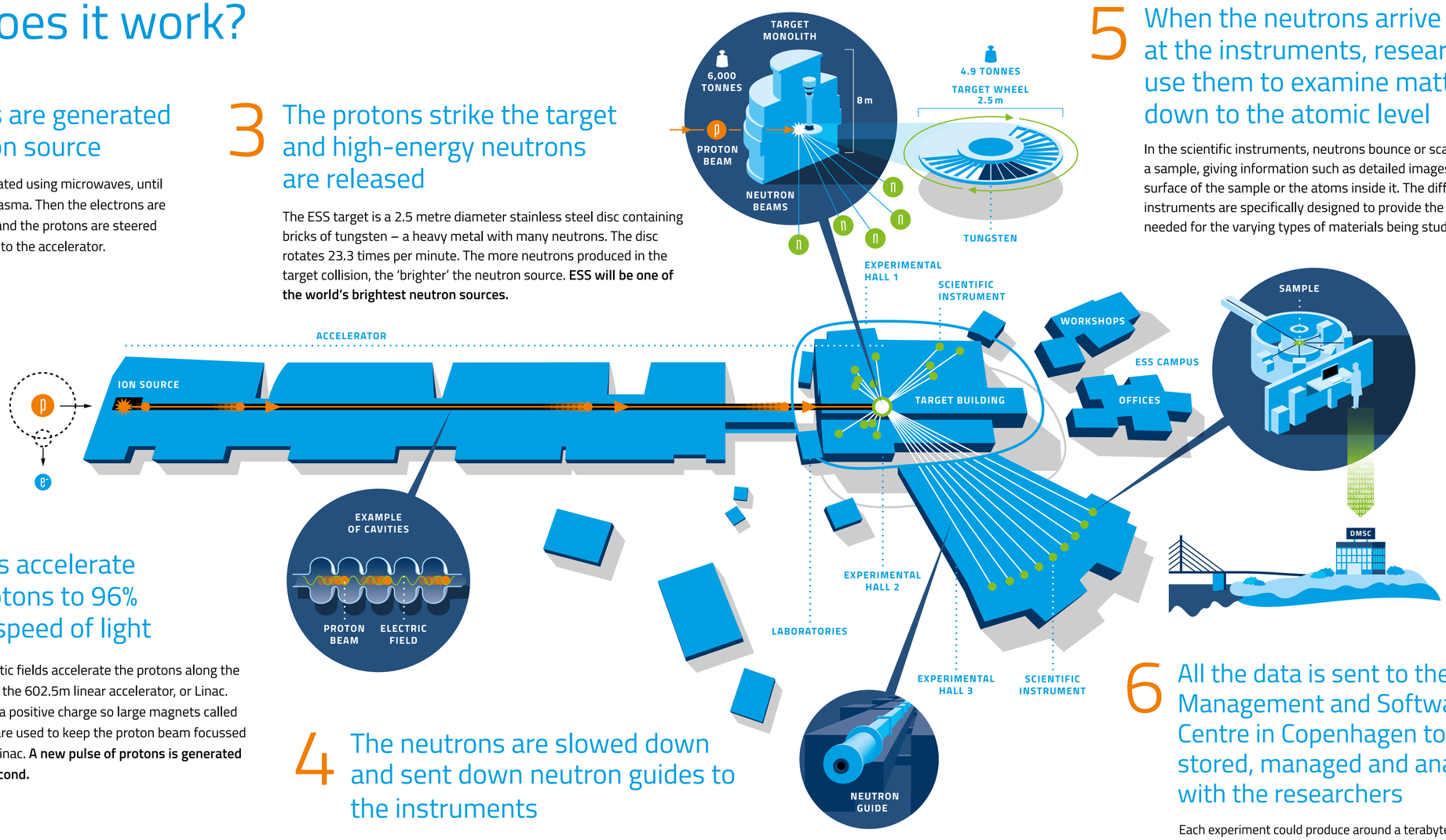
Hydrogen is heated using microwaves, until it becomes a plasma. Then the electrons are stripped away and the protons are steered and focussed into the accelerator.

2 Cavities accelerate the protons to 96% of the speed of light

Electromagnetic fields accelerate the protons along the protons along the 602.5m linear accelerator, or Linac. Protons have a positive charge so large magnets called quadrupoles are used to keep the proton beam focussed all along the Linac. **A new pulse of protons is generated 14 times a second.**

3 The protons strike the target and high-energy neutrons are released

The ESS target is a 2.5 metre diameter stainless steel disc containing bricks of tungsten – a heavy metal with many neutrons. The disc rotates 23.3 times per minute. The more neutrons produced in the target collision, the 'brighter' the neutron source. **ESS will be one of the world's brightest neutron sources.**



4 The neutrons are slowed down and sent down neutron guides to the instruments

The guides are extremely stable, with highly reflective walls, so that as many neutrons as possible reach all the way to the end. **Some of these neutron guides are up to 160 m in length!**

5 When the neutrons arrive at the instruments, researchers use them to examine matter down to the atomic level

In the scientific instruments, neutrons bounce or scatter off a sample, giving information such as detailed images of the surface of the sample or the atoms inside it. The different instruments are specifically designed to provide the data needed for the varying types of materials being studied.

6 All the data is sent to the Data Management and Software Centre in Copenhagen to be stored, managed and analysed with the researchers

Each experiment could produce around a terabyte of data – **that is around 500 hours of movies!** Software and scientific computing experts help the researchers understand, visualise and interpret their results.

SCAN ME