

ESS

*A Next Generation
Neutron Source for Europe*



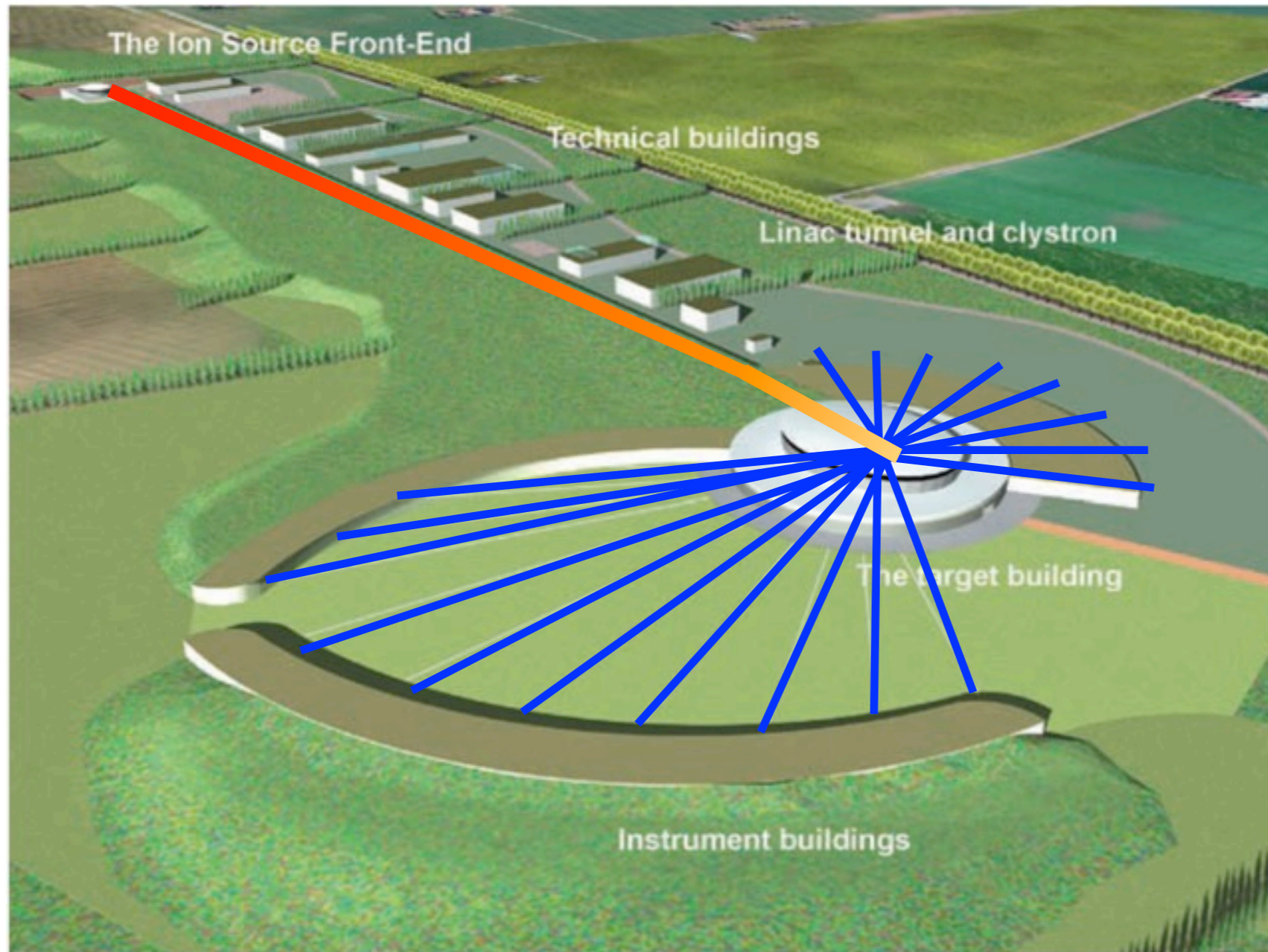
the European Spallation Source

a European Source of Science



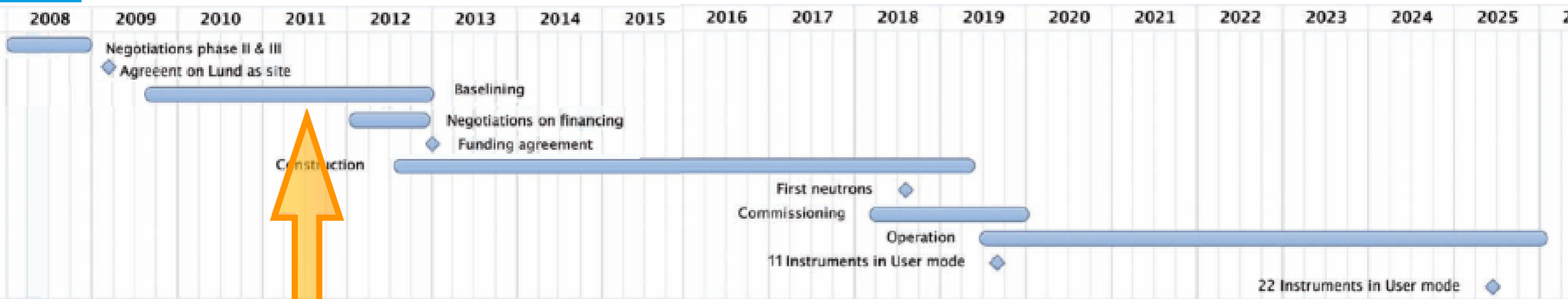
22 instruments

High reliability, Low losses





When ???



17 countries participate to the pre-construction phase





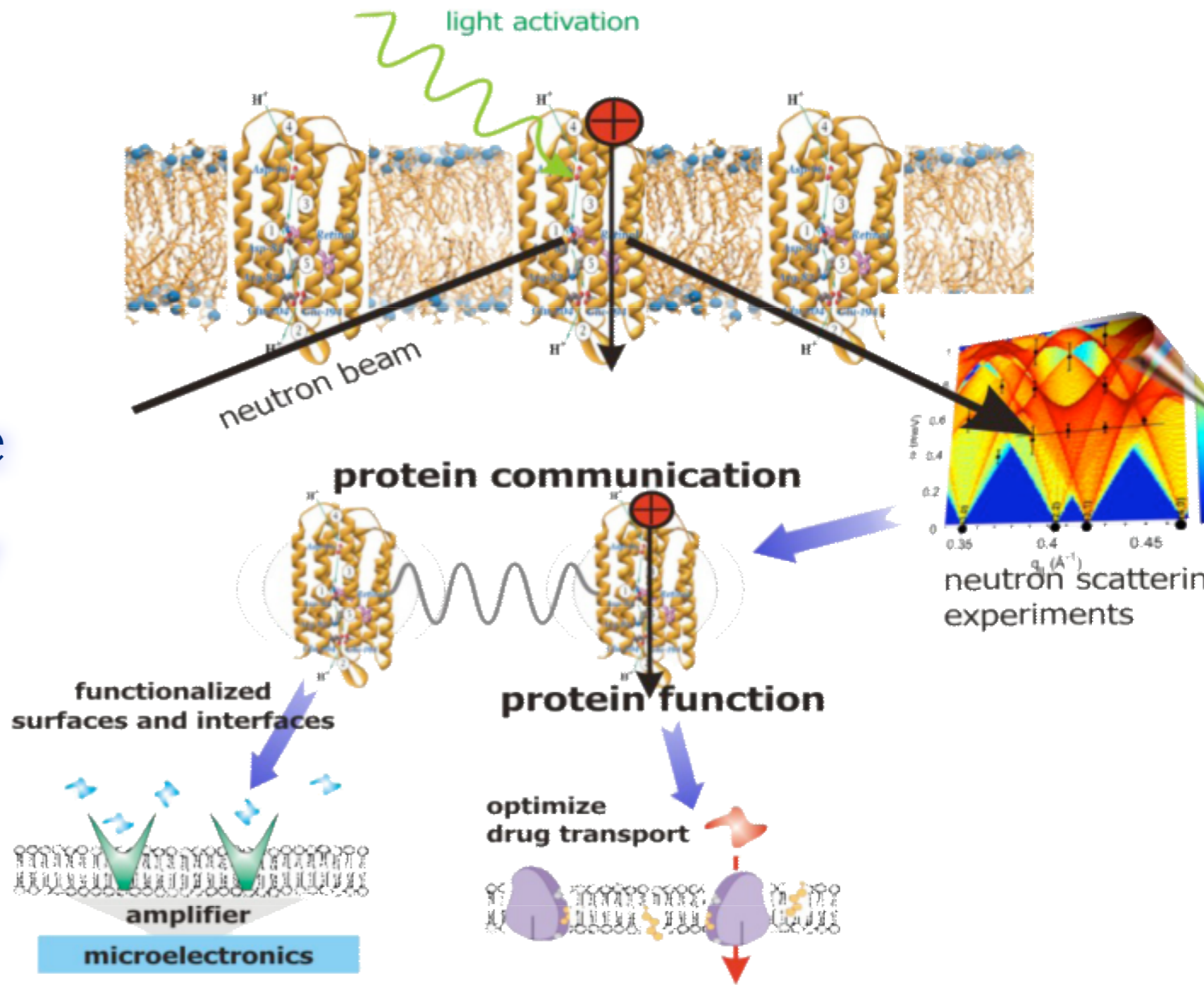
Signatures of MoU

February 3rd, Paris



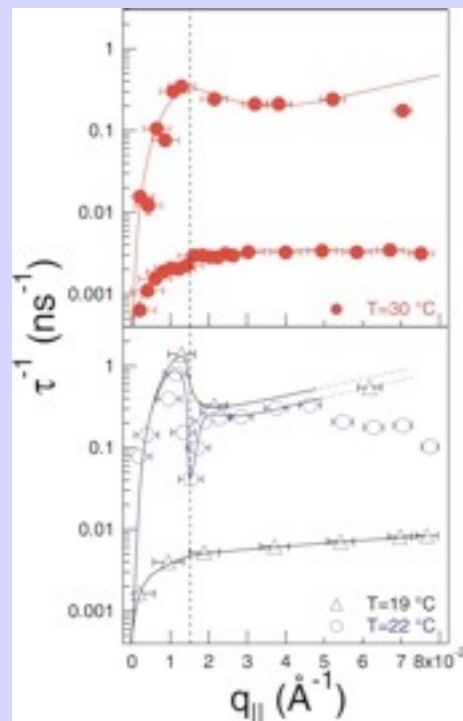
Why ???

an extremely
powerful microscope
enabling a new view
to nature

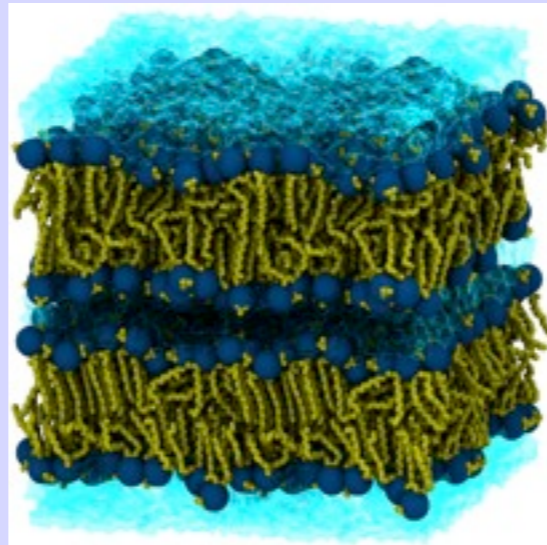


Why ???

Experiments

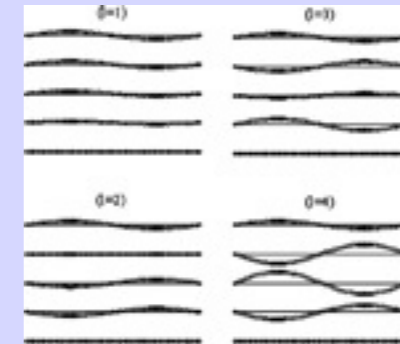


Simulations

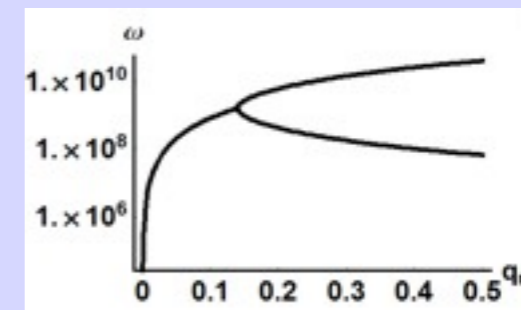


System S2: 48,880 atoms
(256 lipids + 6224 waters)

Analytical Theory



$$\tau^{-1}(q_{\parallel}) = \frac{\kappa/d}{\eta_3} q_{\parallel}^2 \frac{q_{\parallel}^4 + (\pi/(\Lambda D))^2}{q_{\parallel}^4 + \frac{1}{\mu\eta_3} (\pi D)^2}$$



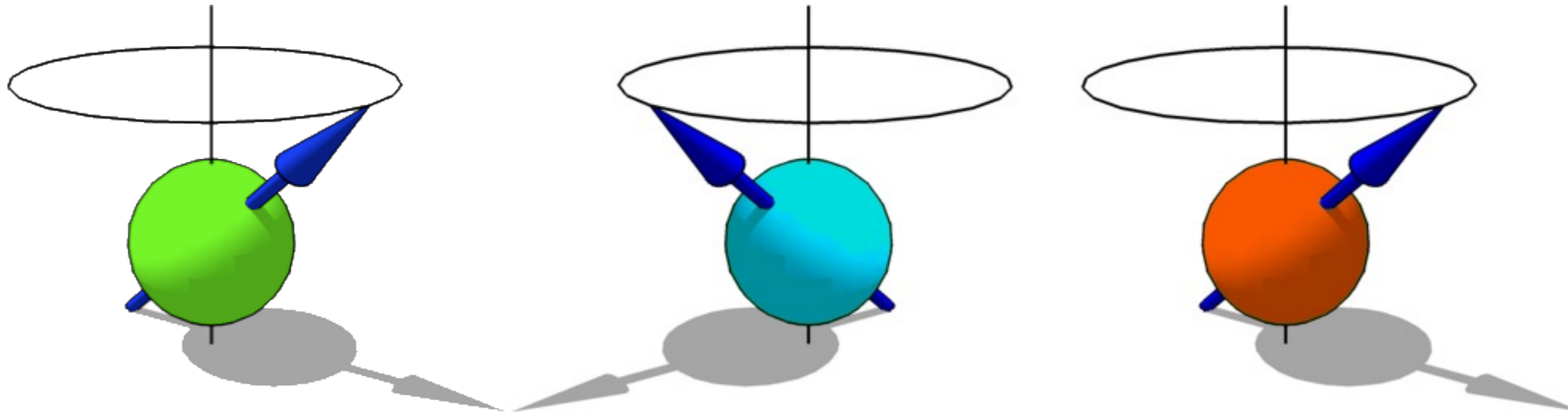
bio- physical and chemical processes



What do we need ??
more neutrons ??

“better” neutrons ??

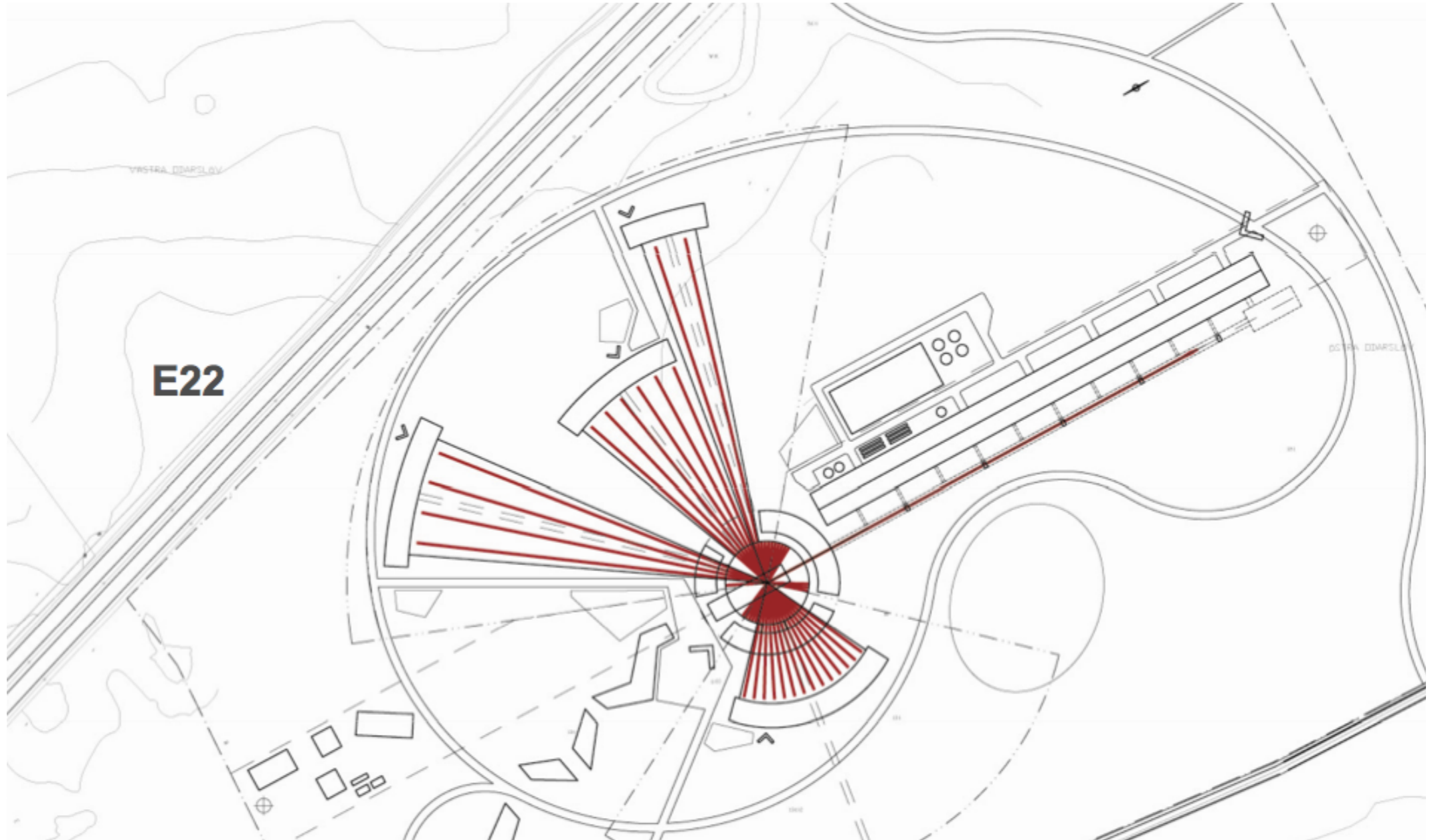
improved neutron economy - optimized instrument design



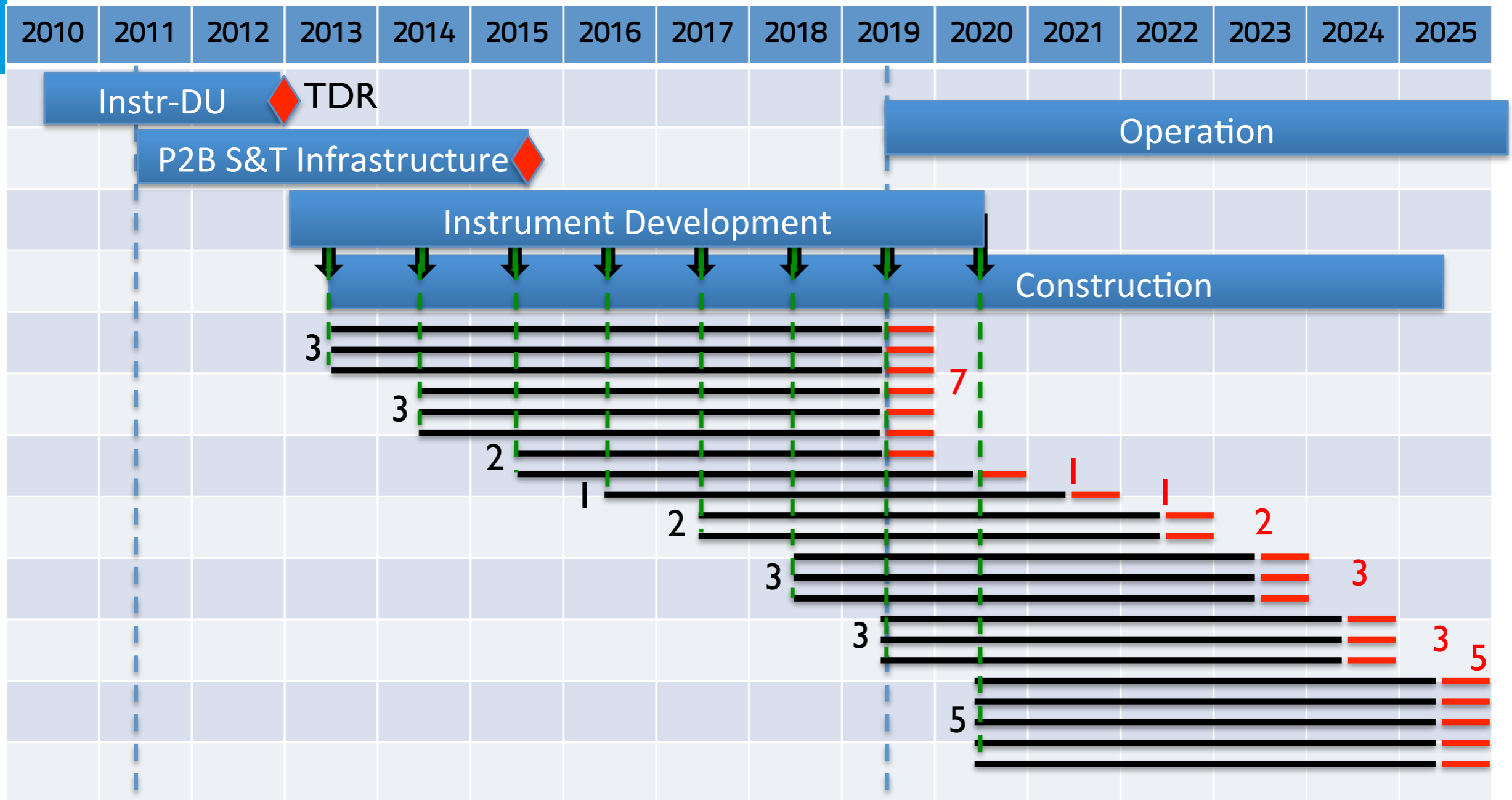
we need neutrons for science

What do we need ??

go beyond the straw-man instrument suite



Instrument development timeline



Day One Instruments

2013 2014 2015 2016 2017 2018 2019

Engineering design

Tendering

Ordering

Manufacturing

Delivery / testing

Assembly

Commissioning

CID

1st neutrons

Instrument decision

User operations

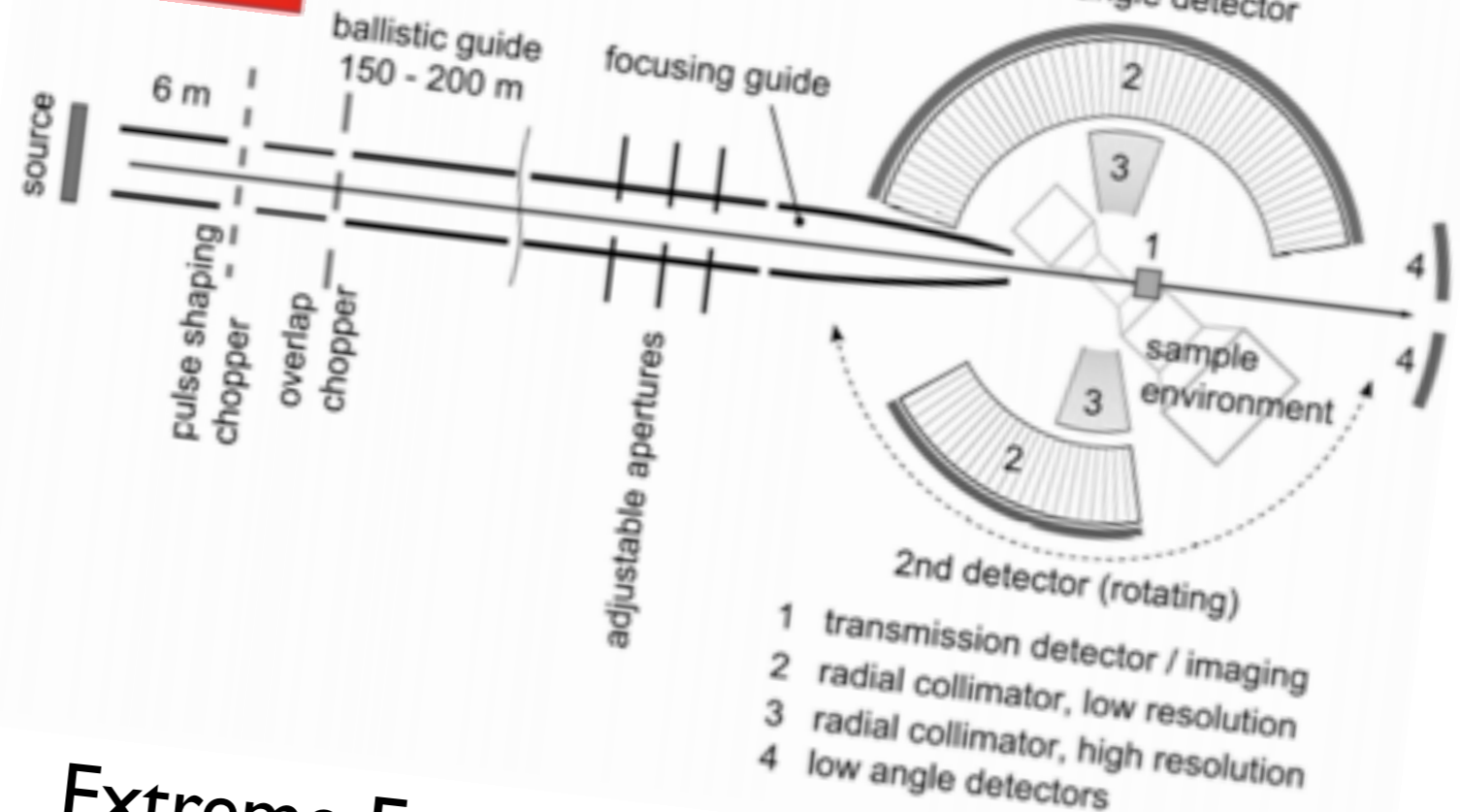
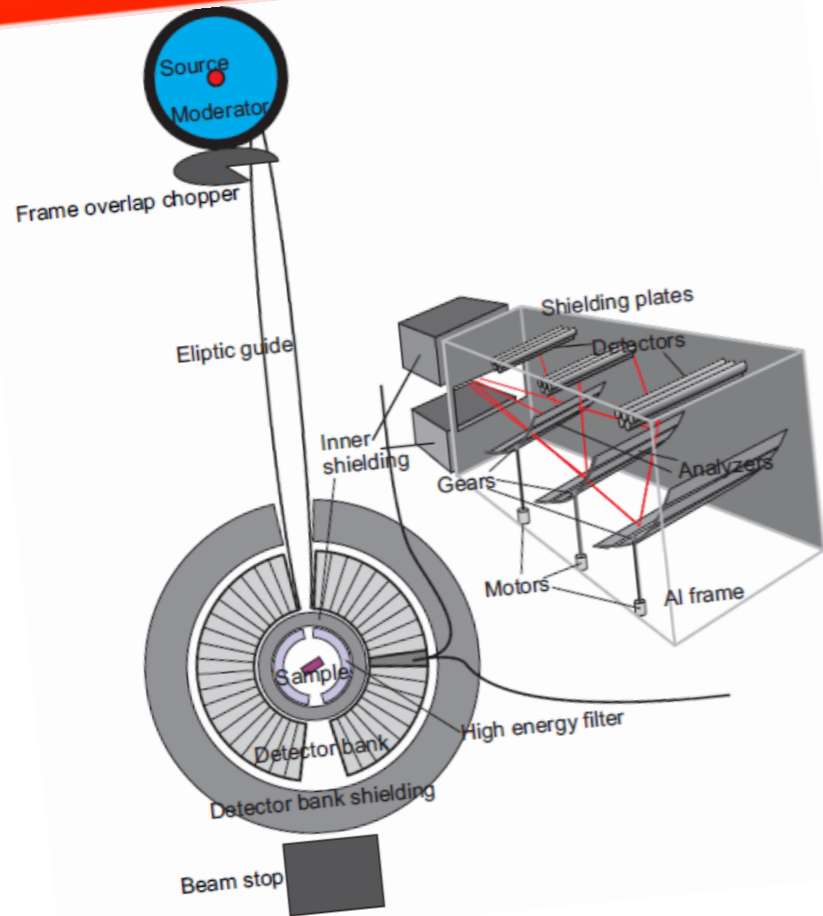
How to build instruments at ESS ?



- **Instruments will be build in as a distributed project between ESS and partner labs**
 - ESS will specify parameters and building codes
 - Partners will design and build to specifications
 - ESS will keep control of safety i.e. shielding, shutters etc
 - Any equipment that needs maintenance or operation by ESS will also be specified by the project.
- **Commenced hiring process for employing instruments engineers**

Instrument Concepts are coming !

K. Lefmann, KU, H. M. Ronnow, EPFL, C. Niedermayer, PSI



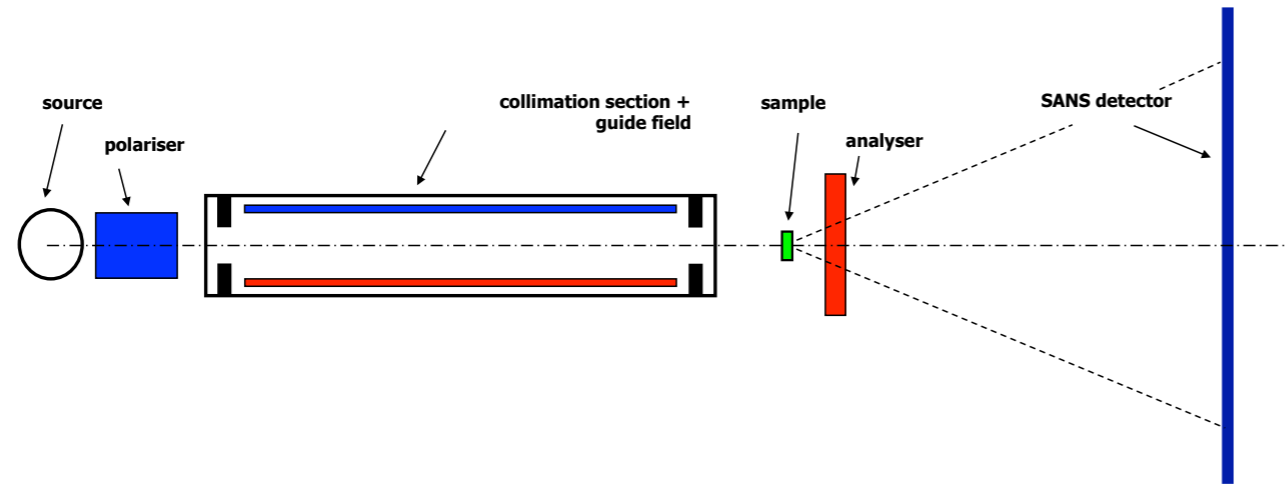
Extreme Environment Diffractometer

Jan Šaroun, Pavel Strunz, Přemysl Beran, Jan Pilch, Petr Šitner

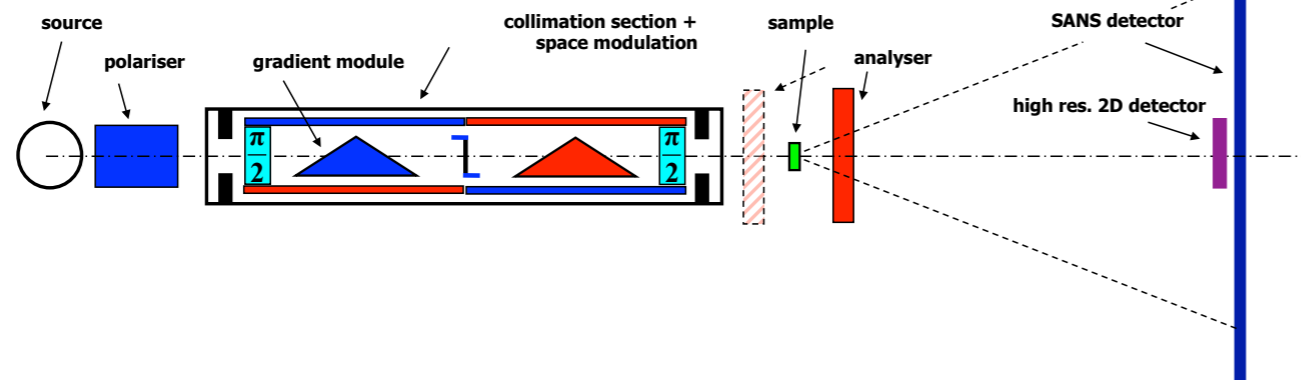
CAMEA: inverse time-of-flight with an advanced multi-analyzer back-end

WPs resources 2011-12 in man/years:
Instruments: 54
Neutron Technologies: 23.3

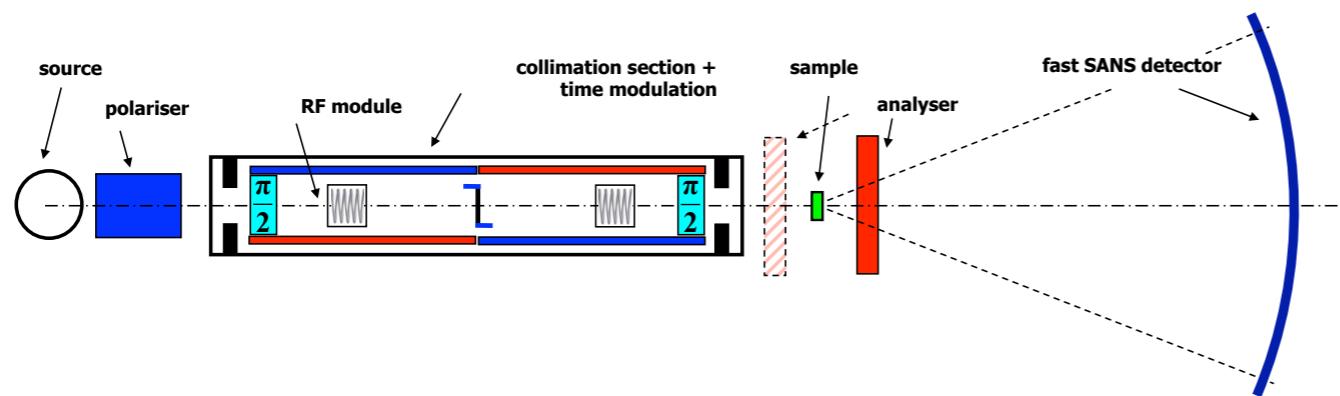
Instrument Concepts are coming !



**polarized neutrons
are important**

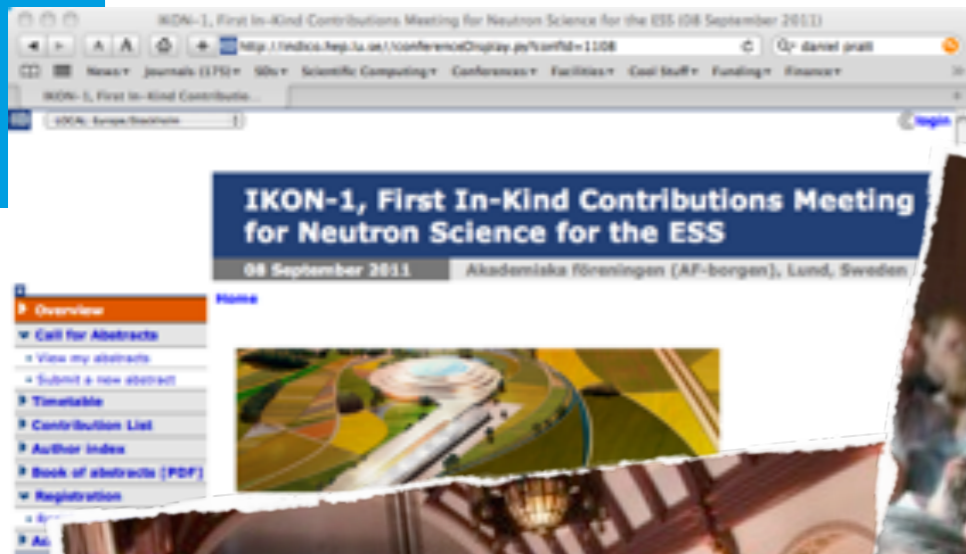


**Dutch-French
work-packages in
preparation**



IKON-I

September 8th, 2011, Lund, Sweden



IKON meetings will be held every 6 months !

IKON - I participants

SE: 13



EE: 1



NO: 2



DE: 39



UK: 2



IT: 8



DK: 19



SP: 1



103 registered
~115 present

FR: 5



CH: 7



CA: 1



CZ: 3



PL: 2



NL: 3



US: 1



Choosing Instruments for ESS

1.

Work-Packages
work on
Instruments
Concepts

2.

Presentation of
Instruments
Concepts
in Berlin



3.

Workshops
to discuss and
sort Instrument
Concepts

Diffraction
TOF/SX Spectrometry
Reflectometry
High-Resolution
Imaging and Engineering
SANS

4.

Instruments
Concepts
Review by
ESS-SAC

5.

ESS Steering
Committee
Approves

Now

April

May-September

November

February

2012

2013

Prague Science and Scientists at ESS

Over 170
participants
from Europe
and USA and
Japan !



TUDelft

Instrumentation Workshops

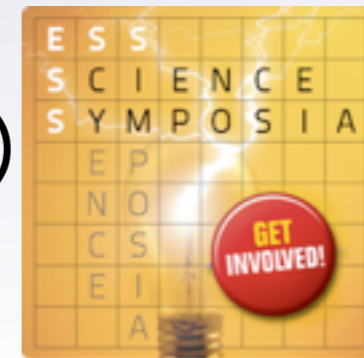


Instruments

GET
INVOLVED



S&S meetings
(Prague, Berlin)



ESS
Science
Symposia
Science

Science Workshops

Main Proposer

Heloisa Bordallo
Copenhagen University

Title

NBIS ESS Science, NMR meets Neutron
Scattering

Location

NBI
Copenhagen

Tom Fennell-ILL

Topological Materials

ILL

A. Boothroyd, Oxford

Spin dynamics of correlated electron
systems

Oxford, UK

Egelhaaf, S
Duesseldorf University

Non-equilibrium SANS on Soft Materials

Lund

Eriksson, S
Chalmers University

In-situ Chemistry

Chalmers University

Wim Bouwman
TU Delft

Neutrons & Food

TU Delft

F. Mulder
TU Delft

Advanced materials for energy storage

Amsterdam

Sferrazza, M
ULB Brussels

Next generation instrumentation for the
investigation of three-dimensional
structures in thin films

Fondation Universitaire, ULB

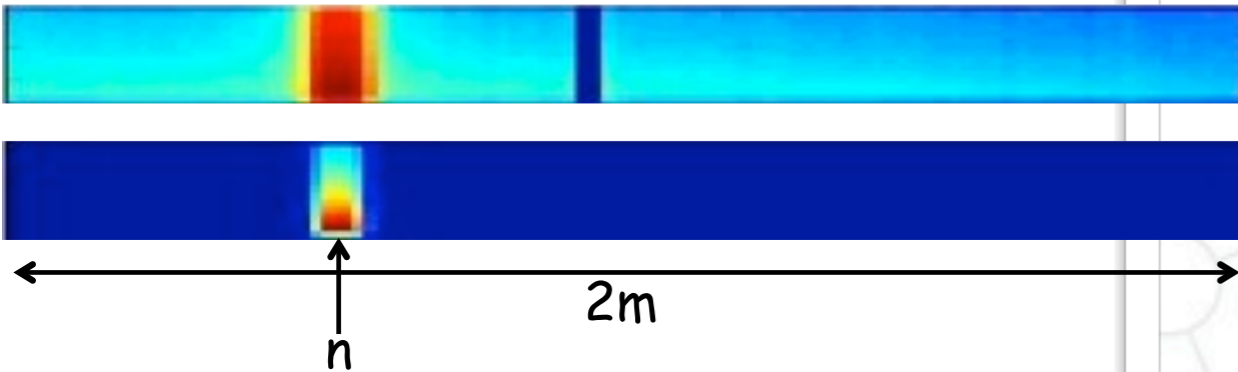
Zhang, S Y
ISIS, STFC

Materials Engineering at a long
pulse source

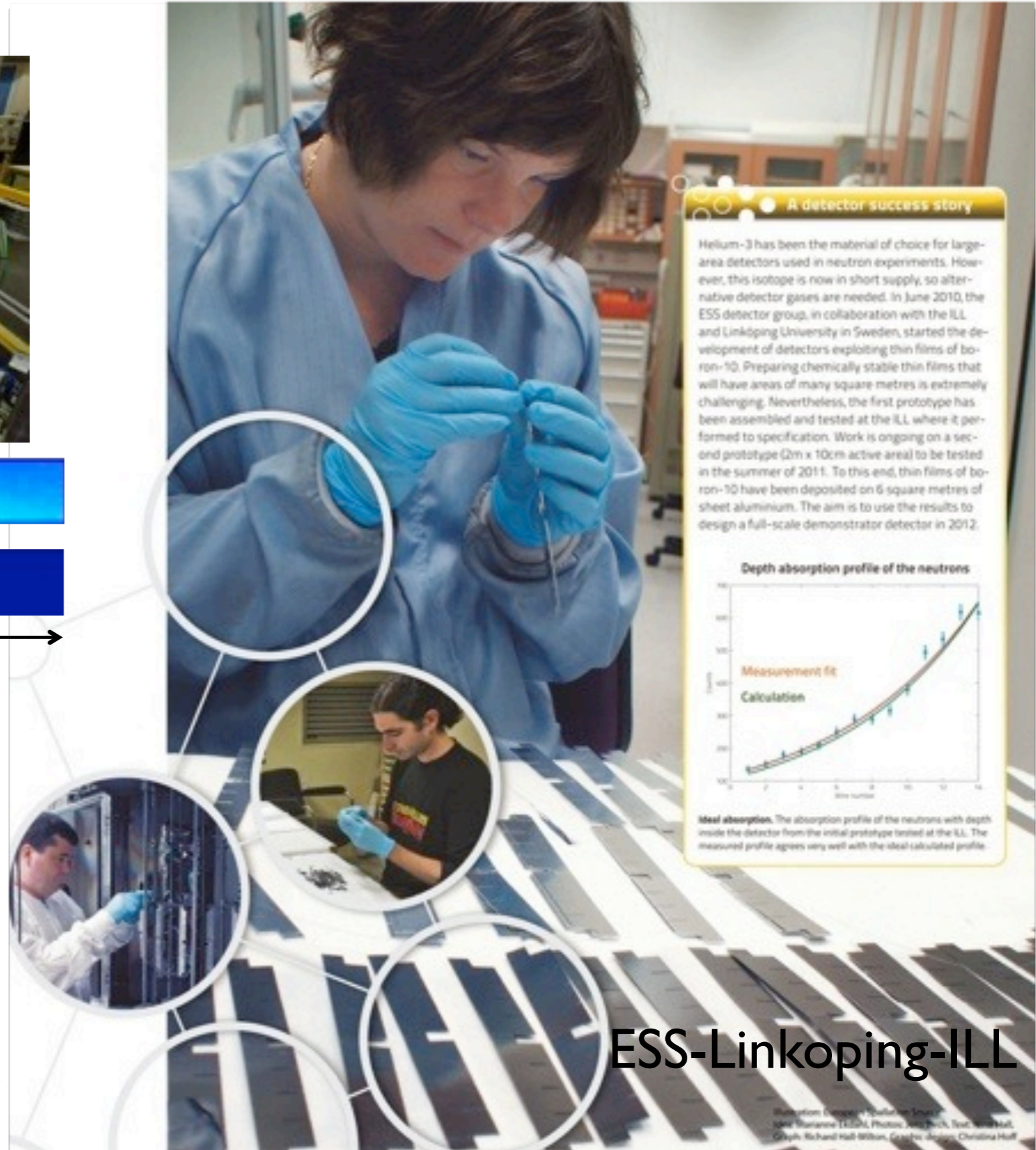
Abingdon, UK



Progress on ^{10}B Detectors



- 96 grids, 2 cm wide - 2D detector
 - 96 x 4 pixels
 - 192 x 8 cm² (0.16 m² active area)
 - 2x2 cm resolution
 - 60 anode wires
- Enriched $^{10}\text{B}_4\text{C}$ -coatings done at Linköping University
- Individual (standard ILL) readout electronics for grids & wires
- Standard off-the-shelf electronics
- Assembly took 3 weeks at ILL



A detector success story

Helium-3 has been the material of choice for large-area detectors used in neutron experiments. However, this isotope is now in short supply, so alternative detector gases are needed. In June 2010, the ESS detector group, in collaboration with the ILL and Linköping University in Sweden, started the development of detectors exploiting thin films of boron-10. Preparing chemically stable thin films that will have areas of many square metres is extremely challenging. Nevertheless, the first prototype has been assembled and tested at the ILL where it performed to specification. Work is ongoing on a second prototype (2m x 10cm active area) to be tested in the summer of 2011. To this end, thin films of boron-10 have been deposited on 6 square metres of sheet aluminium. The aim is to use the results to design a full-scale demonstrator detector in 2012.

Depth absorption profile of the neutrons

Neutron absorption. The absorption profile of the neutrons with depth inside the detector from the initial prototype tested at the ILL. The measured profile agrees very well with the ideal calculated profile.

ESS-Linköping-ILL

Future Directions

definition of the Target Conceptual Design is very important for instruments

- Allows progress to be made on moderators, target monolith, beam ports and beam extraction.
- Activities on all of these areas has started and interfaces between Instruments and target have been defined and activated.

Optimization of Key ESS parameters

- effect of small changes to the Repetition Rate, pulse width and position of the 1st pulse shaping chopper on;
- Performance of various instruments
- Length and of instruments
- Distribution of instruments across the ESS site
- Interacting regularly with the SAC over various possibilities

20 Hz/2 ms 14 Hz/2.8 ms

