

Science & Technology Facilities Council

UK-ESS interactions and opportunities: Current status of neutron beamlines

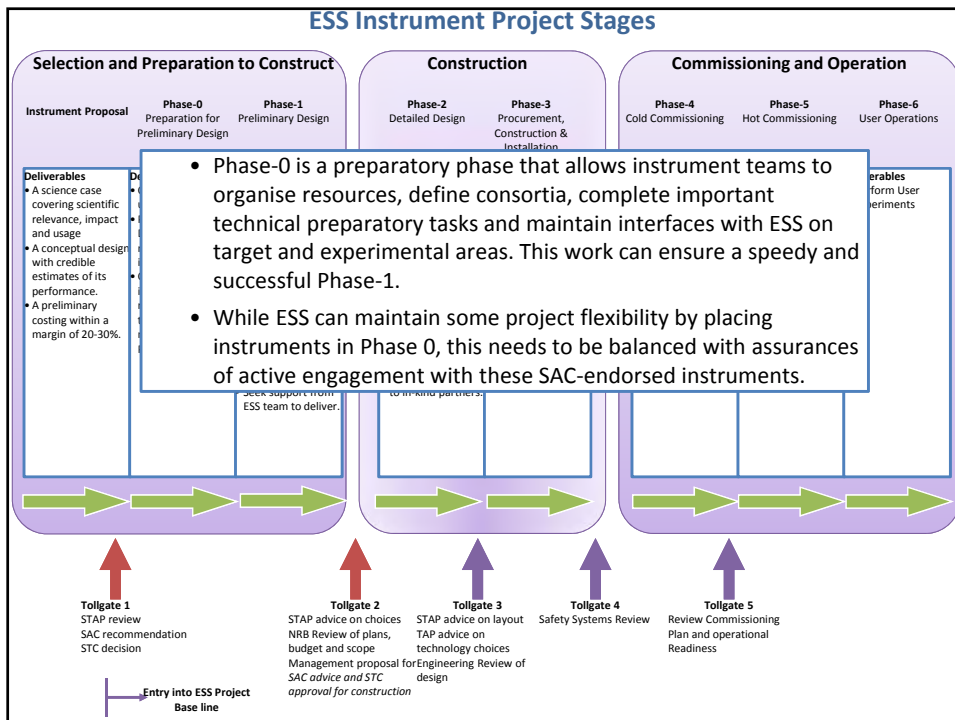
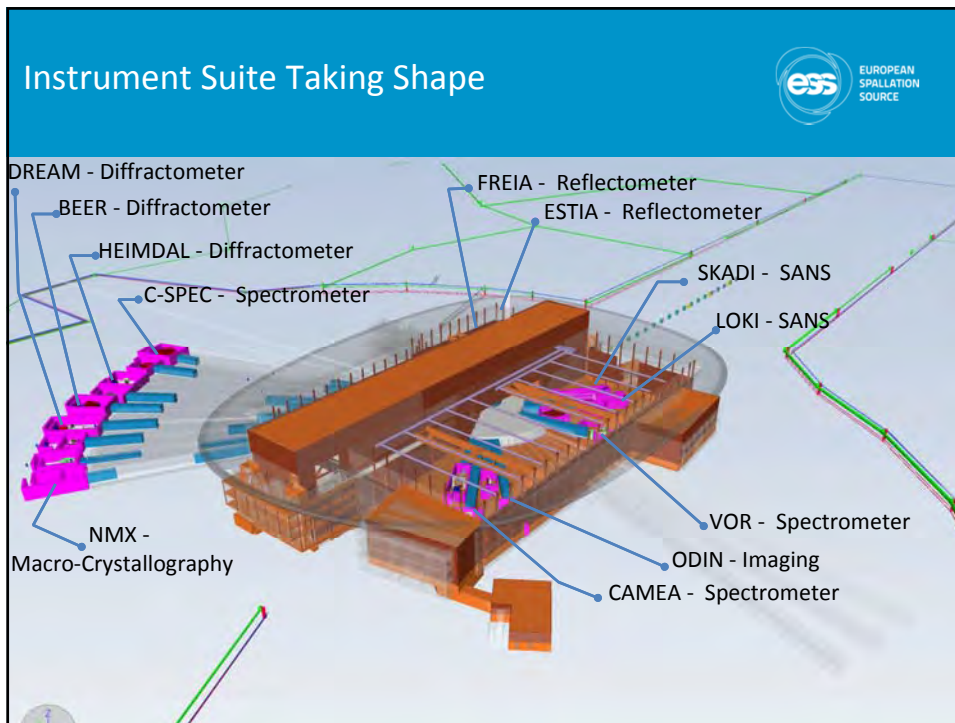
Sean Langridge
ISIS, Rutherford Appleton Laboratory

UK-ESS
Dec 2014


Science & Technology Facilities Council
ISIS

ESS
EUROPEAN SPALLATION SOURCE

European Spallation Source



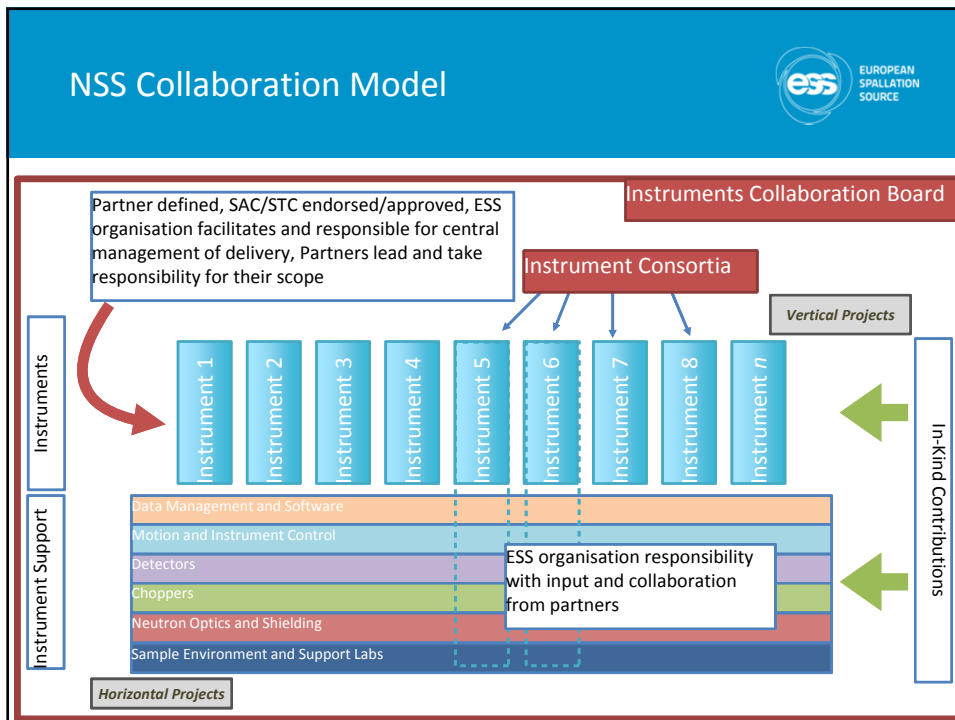
Current Alignment of Instruments and Resources - High level view



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| Instrument | Type | Lead Lab | Supporting Labs |
|------------|--|----------------------------|----------------------------|
| ODIN | Imaging | ESS->TUM | PSI,ESS |
| LOKI | High Intensity SANS | ESS | ESS-Bilbao (in discussion) |
| BEER | Engineering Diffractometer | HZG(DE) and Rez(CZ) | |
| C-SPEC | Cold Chopper Spectrometer | TUM(DE) | LLB(FR) |
| VOR | High Intensity Bi-spectral Spectrometer | Discussions with ISIS (UK) | ESS |
| DREAMS | Variable Resolution Materials Diffractometer | Juelich (DE) | others in discussion |
| FREIA | Fast kinetics horizontal Reflectometer | Discussions with ISIS (UK) | ESS |
| NMX | Macromolecular - Diffractometer | ESS | IBS-France (developing) |
| ESTIA | Horizontal High Intensity Reflectometer | PSI(CH) | |
| SKADI | High Resolutions SANS | Juelich (DE) | LLB(FR) |
| CAMEA | Extreme Environments Spectrometer | DK-Universities | PSI (CH) |
| HEIMDAL | Wide Q-Range Materials Diffractometer | DK-Universities | PSI (CH) |

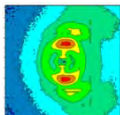
In Phase-1 Design



4 Instrument Proposals in 2012-13 Round



SANS

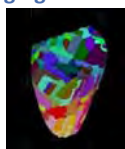

LOKI
 Compact SANS

Broadband SANS
 Bio-SANS

Macromolecular Diffraction

**NMX****Macromolecular Crystallography**

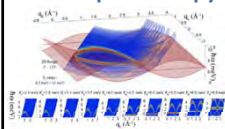
Imaging & Radiography

**ODIN****Multi-Purpose Imaging**

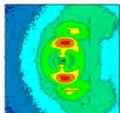
16 Instrument Proposals in 2013-14 Round



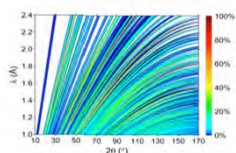
Spectroscopy


VOR
T-REX
C-SPEC
Tempus Fugit
CAMEA
ESSENSE
Wide Bandwidth Spectrometer
Bi-Spectral Spectrometer
Cold Chopper Spectrometer
Time-Focusing Spectrometer
Indirect Geometry Spectrometer
Spin Echo Spectrometer

SANS


SKADI
Sleipnir
High Intensity SANS
SANS Biology & Materials Science

Diffraction


BEER
HOD
HEIMDAL
DREAM
Engineering Diffractometer
Monochromatic Diffractometer
Thermal Powder Diffractometer
Bi-Spectral Powder Diffractometer



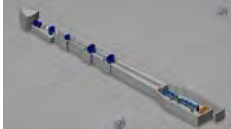
Reflectometry

FREIA
THOR
Veritas
ESTIA
Reflectometer for liquid interfaces
Horizontal Reflectometer
Polarised Reflectometer
Focusing Reflectometer

| EUROPEAN SPALLATION SOURCE | | | | | | | | | | |
|----------------------------|------------|---------------|---|--------------------|-------------------------------------|---------|------------------------------|--------------------------------|------------------------|--------------------------------|
| | SANS | Reflectometry | Macromolecular & Single Crystal Diffraction | Powder Diffraction | Materials & Engineering Diffraction | Imaging | Direct Geometry Spectroscopy | Indirect Geometry Spectroscopy | Spin Echo Spectroscopy | Fundamental & Particle Physics |
| Accepted | LOKI ✓ | | NMX ✓ | | | ODIN ✓ | | | | |
| 2013-14 | Sleipnir ✓ | THOR | | DREAM ✓ | BEER ✓ | | C-SPEC ✓ | CAMEA ✓ | ESSENSE | |
| | SKADI ✓ | VERITAS | | HEIMDAL ✓ | | | VOR ✓ | | | |
| | | ESTIA ✓ | | HOD | | | T-REX | | | |
| | | FREIA ✓ | | | | | Tempus Fugit | | | |

Progress on Instruments

- LOKI, NMX and ODIN are progressing well through Phase-1 and as a collaboration and project we are learning and adjusting our processes.
- Progress and Major Issues:
 - **LOKI:** Shielding and detector choices are current hot issues for the project and emphasis is placed in their resolution. In-kind resources are been discussed with ESS-Bilbao and Italy-CNR on GEM detectors.
 - **NMX:** Great boost in performance by flat moderator. Issues with shielding and detector choice. Clarification of in-kind contribution from IBS-Grenoble is needed in the near term.
 - **ODIN:** Leadership is been transferred to TUM. Impact of flat moderator is been worked on and likely instrument will need to be placed on the lower moderator. Shielding definition is needed and more work on pulse shaping chopper.

Current Progress on New Instrument Projects




- General Principles
 - We ask each instrument team for a proposal on how to work together through phase-1 of the project.
 - We agree on deliverables and a fixed in-kind price for the work.
 - Sign contracts, MoU etc and start work.
- ESTIA: Advanced discussions with PSI and we are reaching agreement on personnel and division of work between organisations.
- BEER: Advanced discussion with HZG & NPI and working towards reaching agreement on personnel and division of work between organisations.
- SKADI: Initial discussions were held. More effort is needed to launch instrument project.
- DREAM: Initial discussions were held. More effort is needed to launch instrument project.
- C-SPEC: Positive discussions with TUM & LLB and awaiting to see detailed proposal.

Horizontal Activities









- Shielding
- Optics
- Detectors
- Modular Instrument Control


Neutron Optics and Shielding Progress




- Heavily engaged in specific instrument optics and shielding calculations
- Standards documents for shielding and optics in place and evolving – iterative design between optics and shielding is key
- Path to enhanced shielding solutions at ESS:
 - Background surveys at existing facilities, such as PSI and SNS
 - Simulating and benchmarking instrument/facility models
 - Development of new shielding concepts
 - Measurements with direct neutron and photon beams
- Close collaboration with instrument teams, detector group, target group, and partners

Shielding Materials development and testing




Copper-based materials to augment traditional shielding solutions



CNCS @ SNS installs copper shielding

At ESS: Install new shielding concepts at strategic locations




Courtesy of Georg Ehlers, CNCS instrument scientist, SNS




ESS-NOSG, ESS-DG, Swiss Neutronics, Uppsala University collaboration


Copper metal substrates

Collaboration on advanced concretes




LU concretes tested at PSI




Beam line at IFE for testing materials and detectors

Detectors




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IN5 Demonstrator: Upscaling Production



Linköpings universitet
INSTITUTE OF TECHNOLOGY

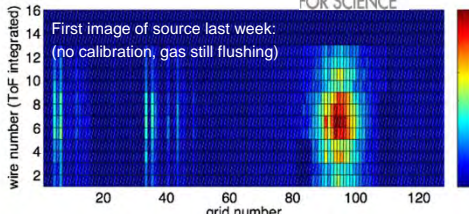


Lund


- Coatings complete in June
- 104m²
- ca. 25k items
- <6 weeks coating time

- New B10 facility running
- Capacity for >1000 m² of ¹⁰B₄C per year (ESS needs ~6000 m²)
- Price: coatings will be <20% detector cost, target was <25%



First image of source last week:
(no calibration, gas still flushing)

Modular Instrument Control Concept



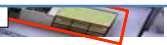
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- Defines a clear frame to fit in (what's provided by ESS and what's not and where to fit)
- Provides modules with well defined boundaries and standardised interfaces (EPICS/timing)
- Facilitates performance and acceptance tests of modules off-site

Beam Extraction + Bunker Area

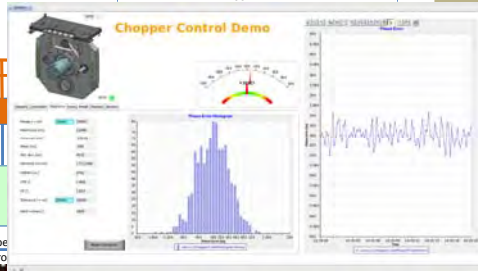
Beam Transport & Conditioning Area

Sample Area




← 160m →

ESS



Chopper Control

in-kind




Instrument Control, Data Acquisition, GUI (DMSC)

EPICS (ICS)


Timing (ICS)

CB




Vacuum Control

CB




Detector Movement

CB

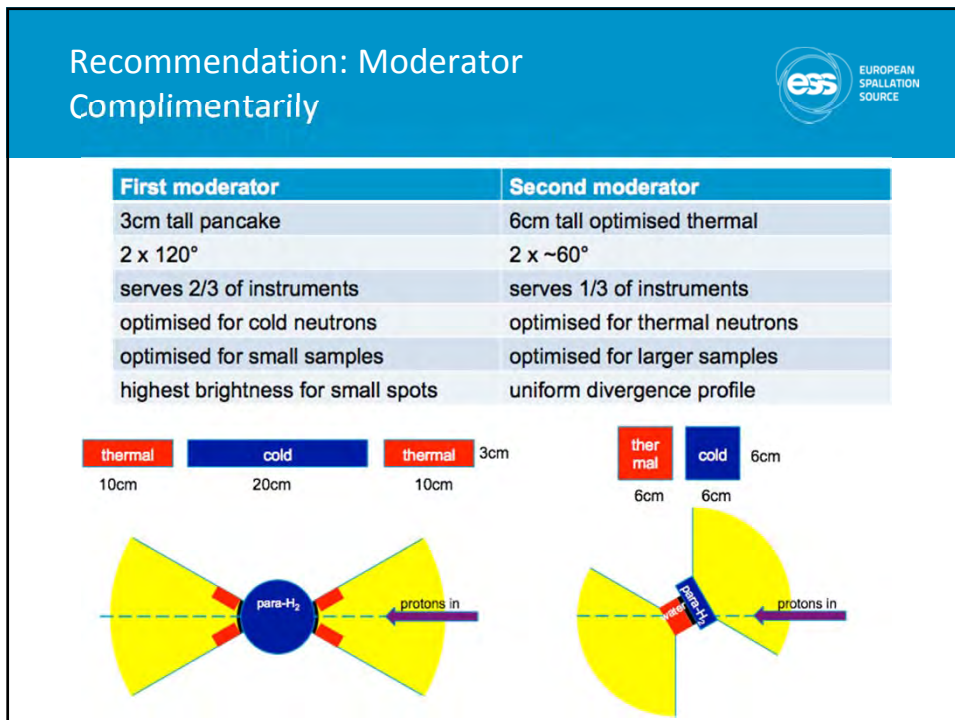
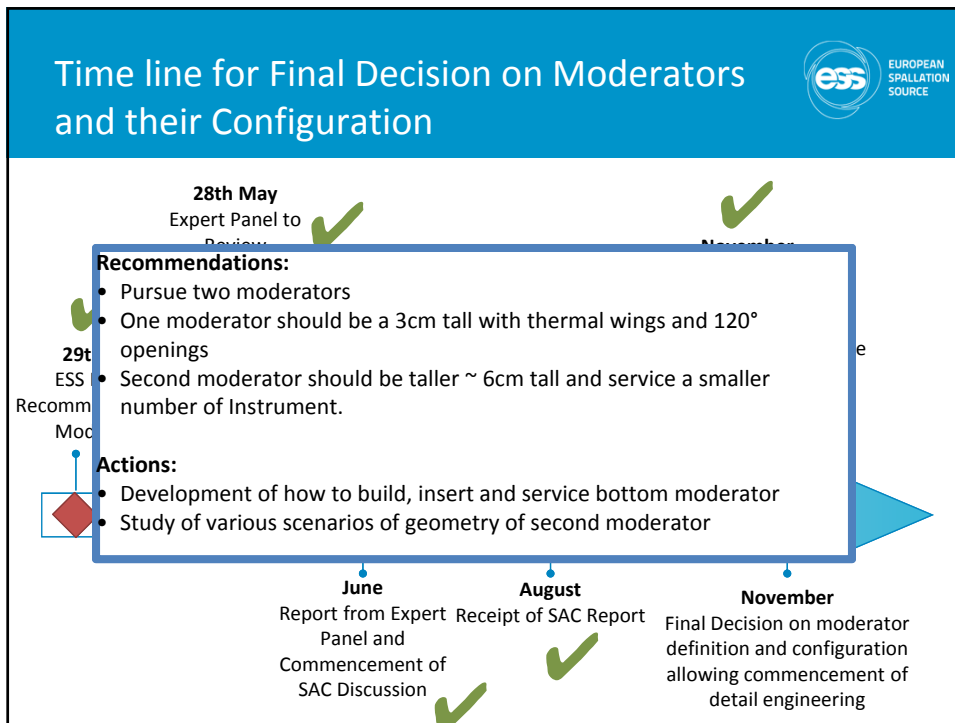


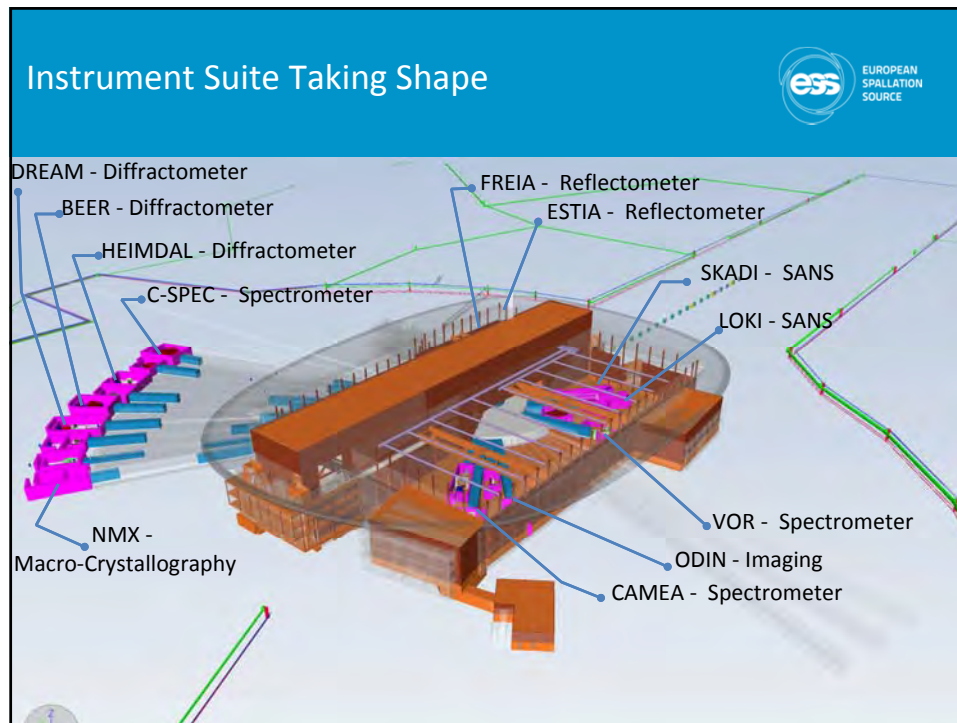
Sample Environment

CB+



Detector Readout





Summary

- 12/16 beamlines endorsed by the SAC
- 4 to be considered 2015
- 22 Public Instrument

- Vertical and Horizontal opportunities in the collaboration model

Acknowledgements

■ Dmitry Agyriou
■ Director for Science



■ Ken Andersen
■ Head of Instruments and Neutron Beams
Division



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Dec 2014

