

Report from Workgroup 2 at Danish CANS Workshop November 2016

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Workgroup topic: Training and education, and Instrument development

Possible applications of a CANS at Risø

From a training and educational perspective, a CANS at Risø should be as similar to ESS as possible. A Danish CANS can play a very important role in capacity building of new neutron users in Denmark that can make use of ESS. But this is only true, if the ways in which neutron scattering experiments are carried out and subsequently analyzed are realistically similar at the CANS and ESS.

Also from the instrument development perspective, a close similarity between the mode of operation at the CANS and ESS is desirable. However, the detailed requirements may be somewhat less stringent as in the case of training and education, at least for some types of instruments. Here, the main criterion may be simply to test the instrument or components of an instrument in any neutron flux regardless of the special characteristics.

If a close similarity between the CANS and ESS can be achieved, a number of desirable applications can be obtained:

- “Hands on” operation. Due to the lower radiation level at a CANS than at ESS, researchers and students (including under-grads) can obtain very valuable insight of how neutron scattering experiments work and easily change a set-up to study the following effects.
- Moderator test facility. Whereas the target and moderator area are totally inaccessible for several years at ESS once the facility is started, a CANS offers the possibility to perform moderator development and feasibility studies relevant to ESS.
- Easy beamline access. The procedure to get beamline access to carry out experiments will be considerably easier at a CANS than at ESS.
- Year-round flexibility. Not only will it be easier to access a beamline at a CANS, the access will not be bound to a tight time window. This opens the possibility to make flexible types of experiments that are not bound to result in a publication.

Requirements to a CANS facility

- Time of Flight (ToF) is essential for educational purposes for most neutron scattering experiments at ESS, since ToF requires special tools and analysis methods, that are not used in continuous flux experiments, and that need to be trained.
- A sufficient flux to allow for making meaningful experiments in less than one day.
- As low activation levels as possible for hands on operation.
- Possibility to re-configure instruments.
- Data acquisition system should be identical to ESS and instrument types should mimic ESS instruments.
- Dedicated (permanent) scientific staff to train students.
- Possibility to vary some parameters in sample environment (temperature, pressure, external forces, etc.)
- A friendly and stimulating campus life.

- Maybe also guest rooms/houses nearby.

Demand for a CANS from Danish and European users

- Sample testing prior to experiment at ESS (pre-experiment testing)
- Instrument component testing
- Easy access to data for algorithm development
- Moderator test facility (wish from ESS Target Division)

Possible sources for financing

Initial investment

- Private funds

Running costs

- Research projects (incl. European grants)
- Universities for educational activities
- Danish and Swedish industries?
- Isotope production?

Competition: Other facilities and alternative methods

- ESS is not a competitor – on the contrary!
- X-ray facilities are true competitors/alternatives, although they cannot replace neutron facilities
- From a student's perspective, anything lab-based (scattering or not) is an alternative to a CANS facility – even with close connections to ESS

SWOT analysis

The Strengths and Weaknesses below refer to the situation in the neutron scattering community in Denmark with no CANS, while the Opportunities and Threats describe a situation with a Danish CANS.

Strengths

- Good competences in neutron scattering measurements and instrumentation
- Close collaboration with ESS
- Good political support in Denmark from both science councils and public institutions
- Good position in the Nordic Countries with special funding from NordForsk under the Nordic Council

Weaknesses

- No Super User status – meaning no direct access to a neutron beam line.
- Access to neutron beams in general is getting worse in Europe due to the shut-down of research reactors.
- Difficult for students to make “true” neutron experiments – most of the training is “virtual” through computer simulations.
- The career possibilities for students in neutron scattering are very abstract.

Opportunities

- Creation of an exciting learning and training environment for neutron users in Denmark.
- Strong support to Danish capacity building for ESS.
- Possibility for “hands on” experiments and testing of new instrument concepts.
- Closer collaboration with ESS, e.g. on moderator development.
- Stimulating meeting place for scientists with international competences.
- Creation of links to industry to demonstrate the usefulness of neutron scattering.
- Good introduction to science for High School students and teachers (as in “Nanoteket” at DTU Physics).
- More “life” on DTU Risø Campus.

Threats

- The funding of a Danish CANS may take money away from other neutron scattering projects.
- The running costs – including salary costs for the necessary staff - are underfinanced.
- The neutron flux is too low to be useful for education and training.
- Insufficient support from Heads of relevant university departments to allow staff members to spend time on the project.
- The CANS may be perceived as a local DTU project, rather than a national project.

Recommendations for the future process

Funding

- Gain support from major universities
- Approach Danish Industry
- Work out synergies between isotopes and neutron scattering

Carry out a feasibility study (Conceptual Design Report). This may require some *pre-seed* financing.

Make a development plan describing which instruments should be installed first, etc.