Proposal for medium performance symbiotic diffractometers

Rasmus Toft-Petersen, BIFROST

Motivation: Capacity

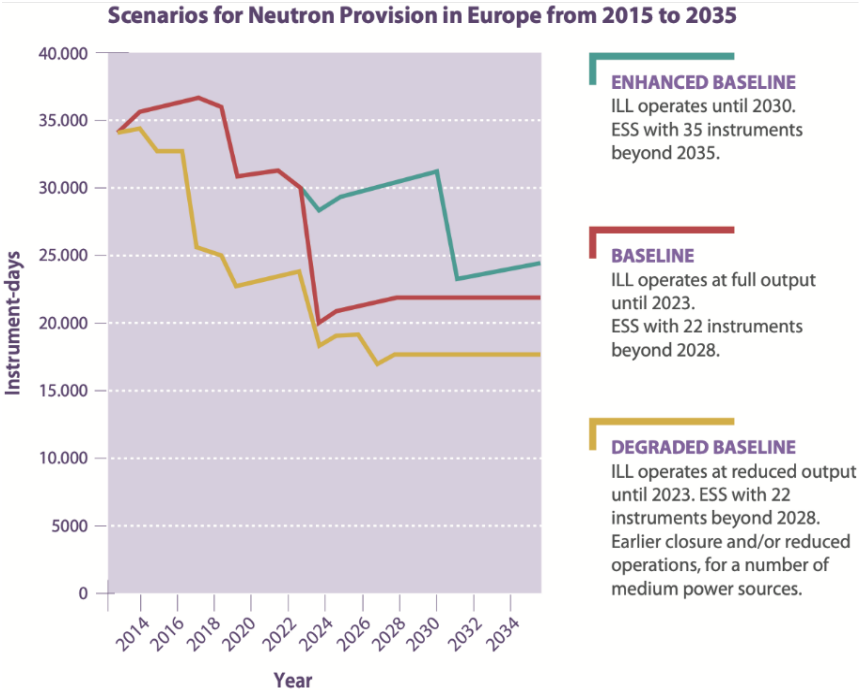


Figure 1: Instrument days available in Europe in the coming years. From [1].

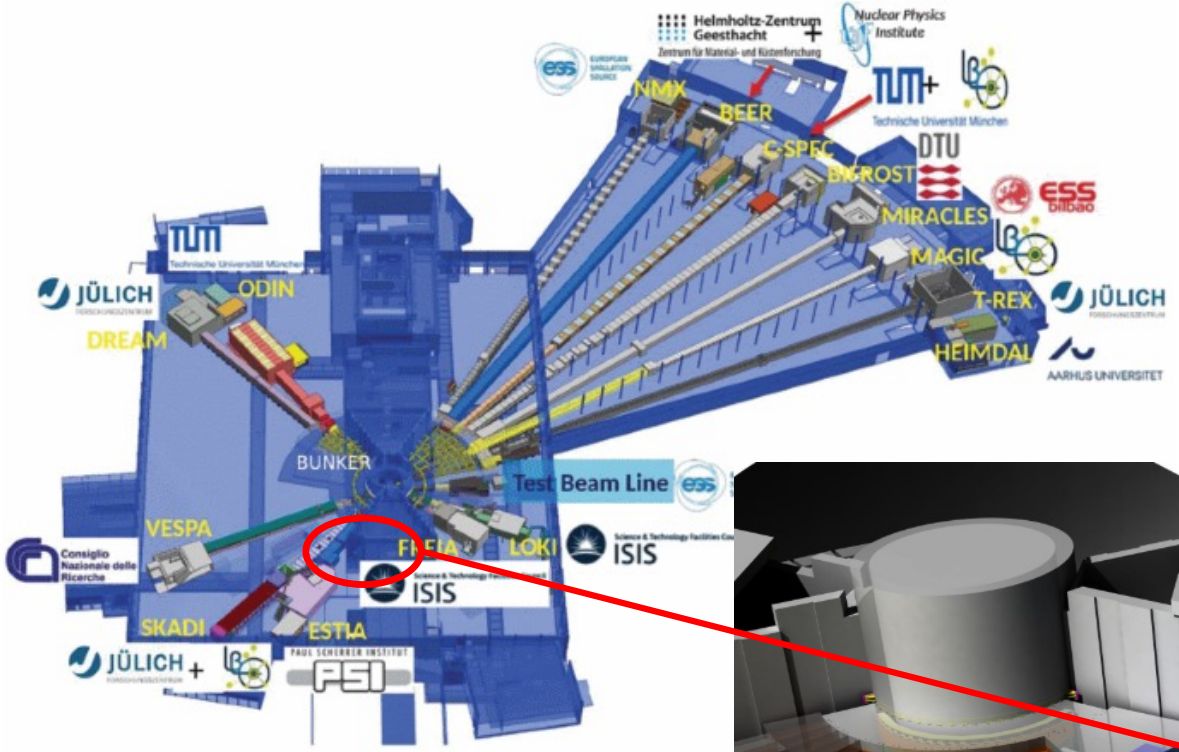
Local discussions:

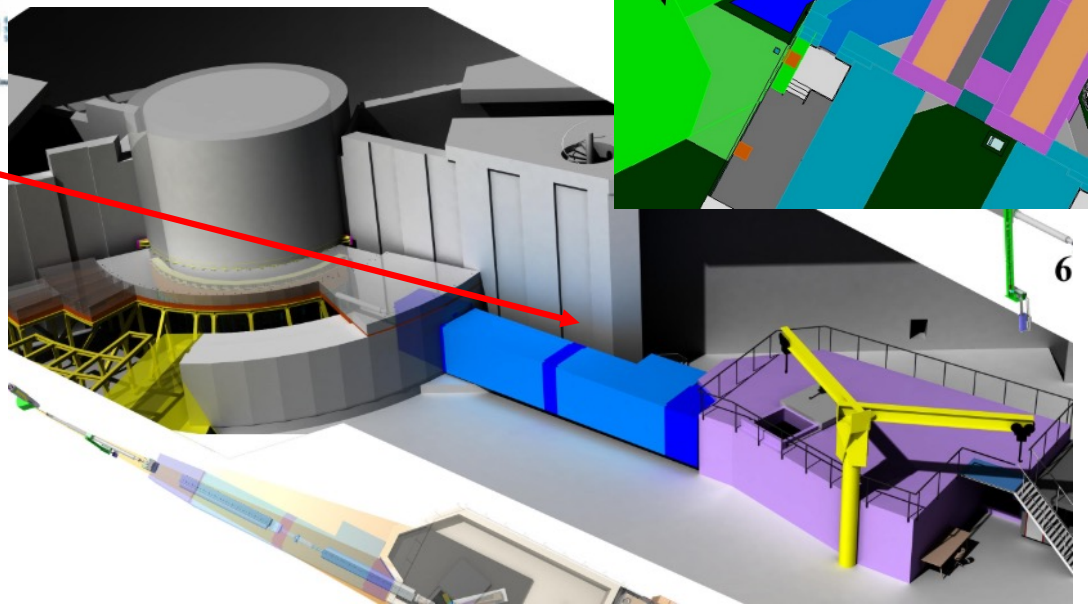
- The Danish neutron community have long discussed a Danish or Scandinavian CANS
- It seems infeasible, due to the cost relative to the size of our communities. All neutron money goes to ESS, and it is hard not to understand the reluctance of funding bodies.
- We have ESS right next door. The worlds brightest neutron source. The difference between CANS brilliance and ESS brilliance is so large, that if you could find a way of using neutrons otherwise wasted, even a fraction of them, you would have something decent.

Personal opinion on using ESS for capacity

- ESS is built for world class science. If there is room for a world class instrument, it should be built. Capacity would be more the he role of CANS and medium flux sources.
- ESS has 42 beam ports. There is no way we can fit 42 large instruments, but we could find ways of building a couple of small ones, if they are cheap

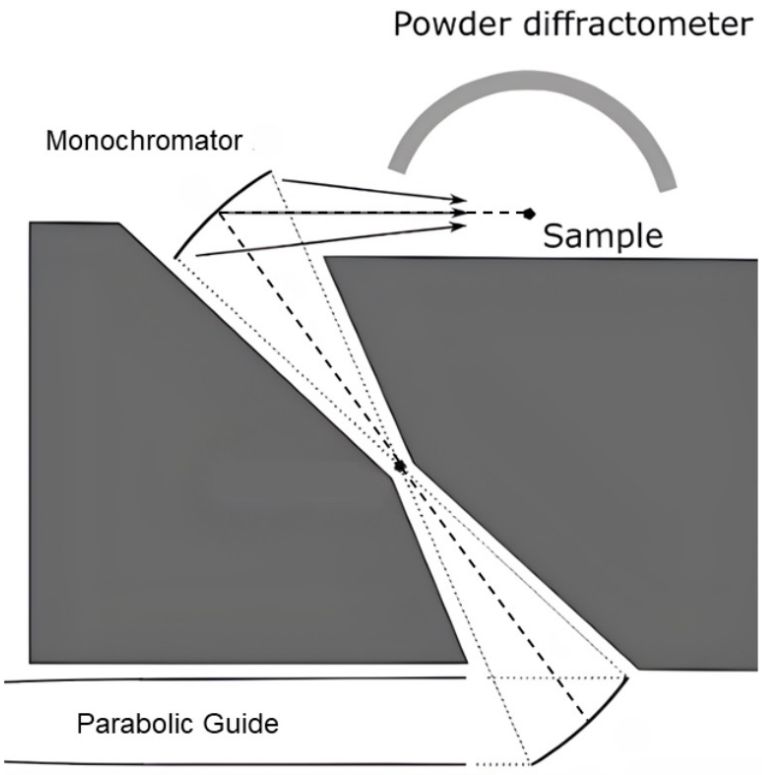
ESS outline and hidden gems

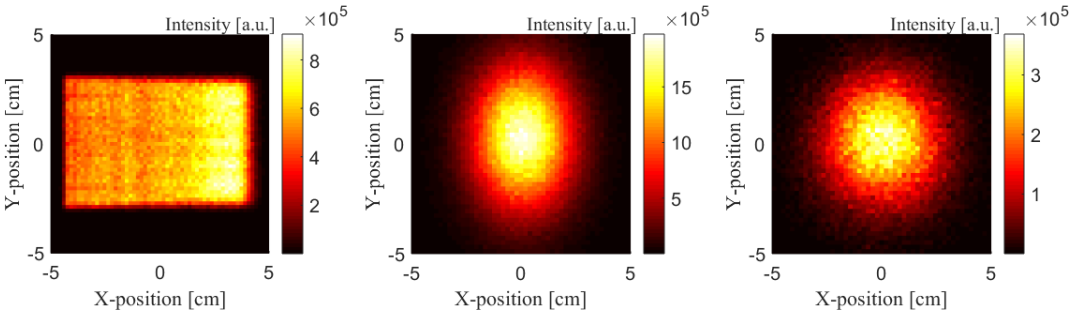


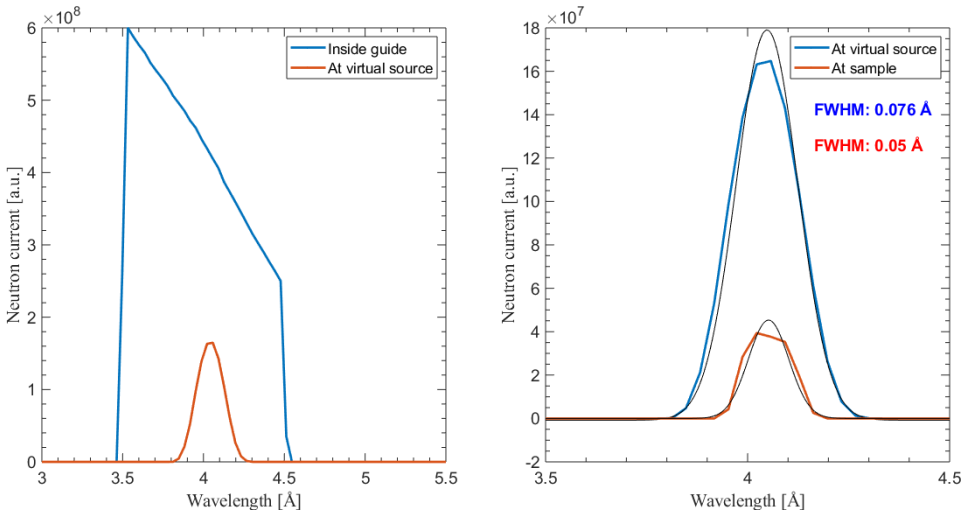


- Some beam ports are squeezed between two other beamlines
- Other beam ports have no space for shielding or access on the floor

Proposal: Use virtual sources and double bounce monochromators to shift the beam 2 meters vertically







Flux reasonable

Nicolai Lindaa Amin
Masters student

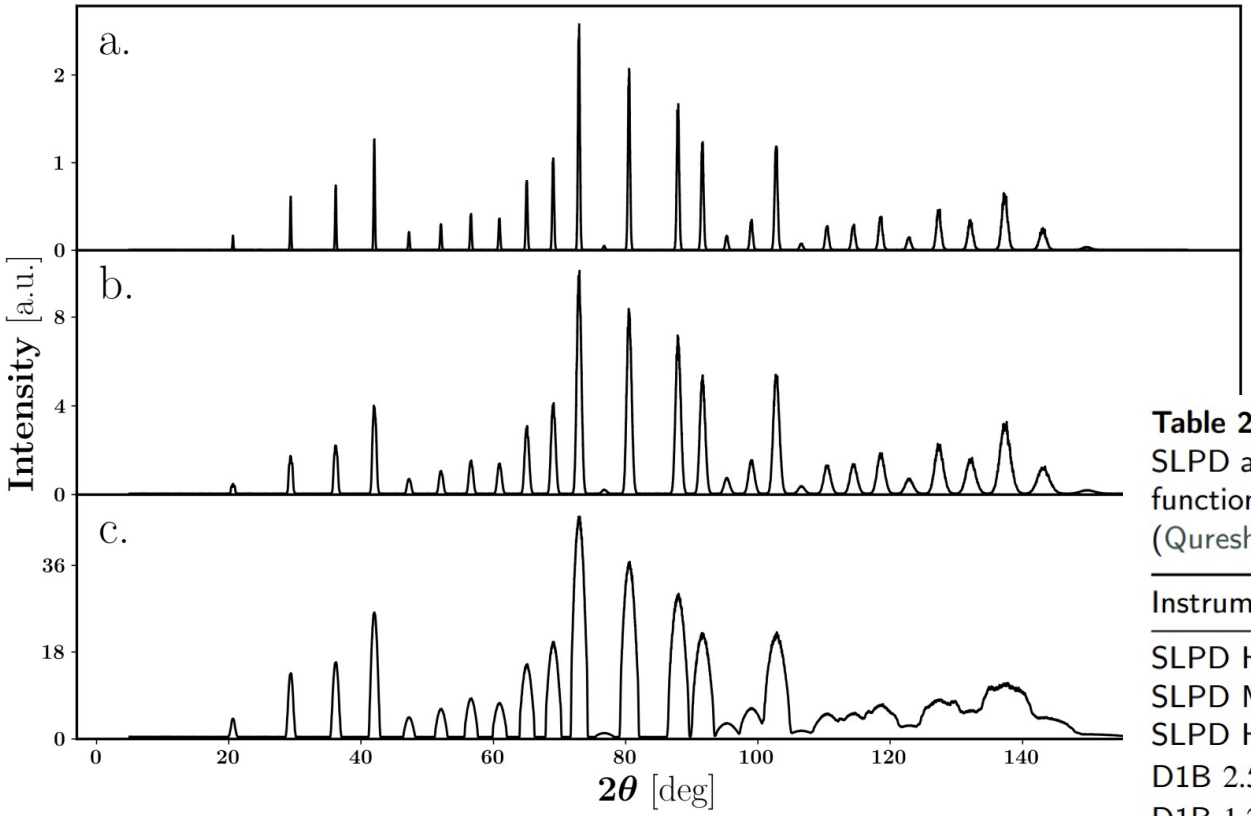


Figure 4: Diffraction spectra of a NAC sample for the three different models of SLPD, a. High Resolution, b. Med c. High Flux

- Flux a factor of 4 below D1B, essentially explained by the virtual source trick. But that is by no means a bad beam intensity, and can be used for science

Table 2
SLPD and D1B Flux at Sample position (S.P.) and Resolution function comparision. Values for D1B found on website (ILL), (Qureshi, 2019)

Instrument	Flux at S.P.	U	V	W
SLPD High Res	$2.75 \cdot 10^7$	3.028	0.127	0.24
SLPD Mid Flux	$2.25 \cdot 10^6$	0.417	0.135	0.22
SLPD High Flux	$4.48 \cdot 10^5$	0.144	0.0013	0.025
D1B 2.52 Å	$7.9 \cdot 10^6$	1.508	-0.283	0.091
D1B 1.28 Å	$4 \cdot 10^5$	0.984	-0.505	0.129

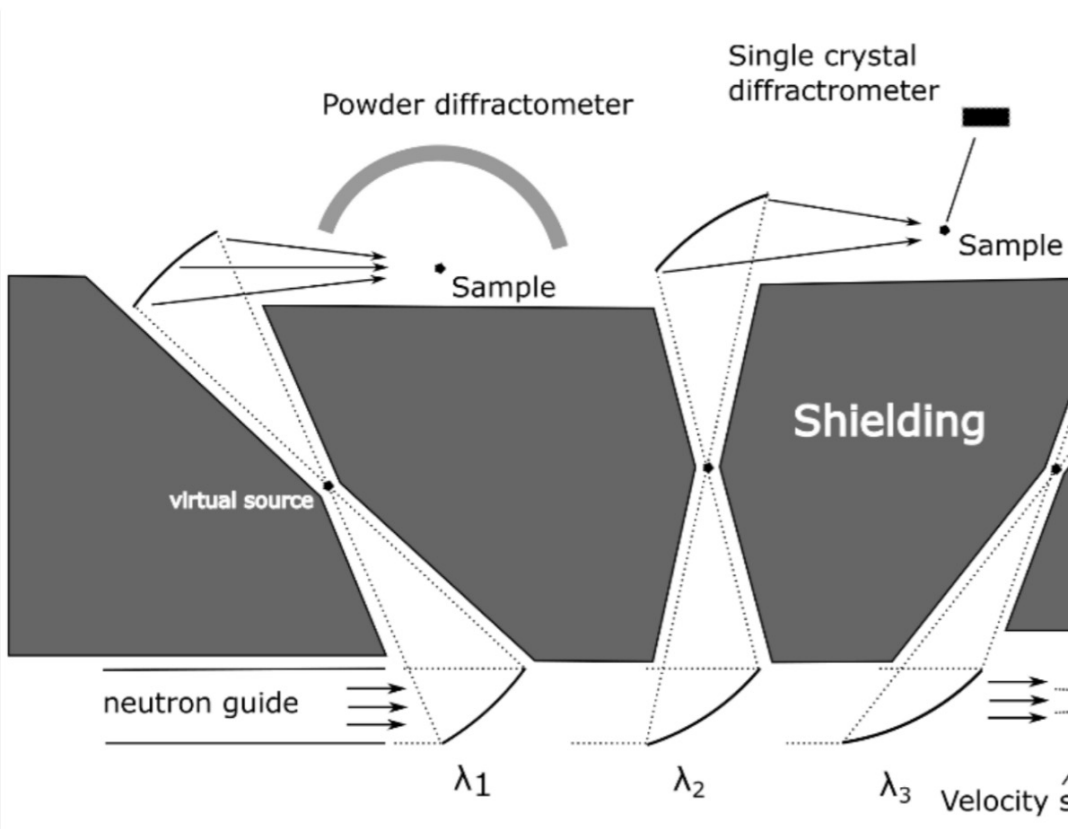
ESS plan: using the accelerator commissioning time

Postives:

- If space allows, more than one diffractometer can be built on the same guide, with some losses
- No moving parts (to some extent) very cheap instruments
- CCRs and pressure cells can be used

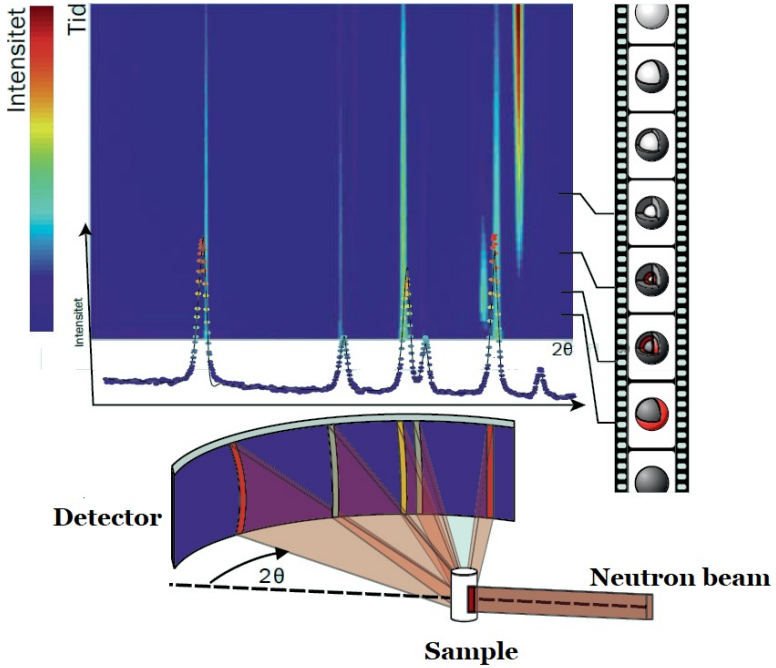
Negatives:

- A lot of optimization. Need to explore HOPG/Si combinations (reduce flux further)
- Manpower needed regardless. Needs money to operate
- No magnets



ESS plan: PSC chopper and fission monitor

- PSC sets the ‘real’ T0 for the instrument and the wavelength band
- Pulse timing and shaping needs experimental confirmation to make sure we understand the time delays between reference pulse, proton pulse and ‘PSC phase’
- ***Use case***
  - Training
  - Test measurements for DREAM/NMX/MAGIC (crystal quality, Bragg peak intensity etc)
  - Bringing in students (Danish training at PSI has been extremely valuable to catch them while they are young – ESS could provide that service to the community
  - *Some experiments don’t need high flux.*



An in-situ powder diffraction experiment, where the Bragg peaks evolve in time, as the nature of the sample changes.

Thank you for your attention