Time-of-Flight (ToF) measurements using a solid methane (CH_4) moderator

A. Schwab, 2nd JCNS-2 PhD days 2022

Jülich Centre for Neutron Science

ZEA-1 | ENGINEERING AND TECHNOLOGY
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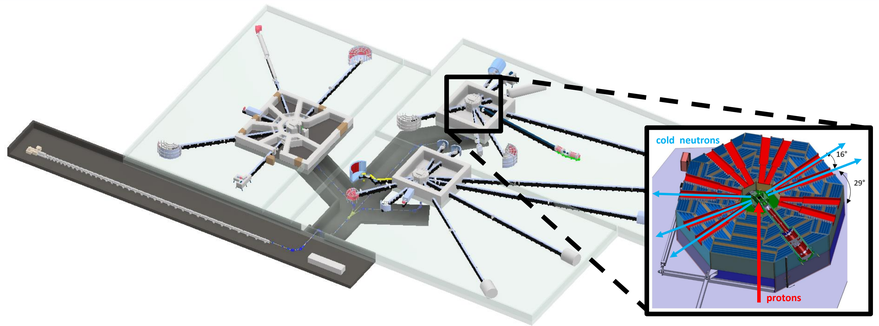
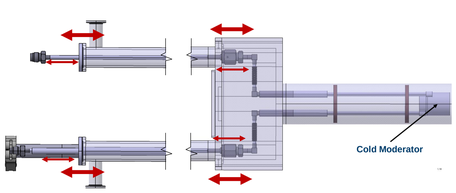
Motivation

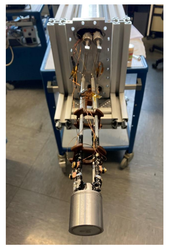
High Brilliance Neutron Source (HBS):

- Compact Accelerator-driven Neutron Source (CANS)
- Production of free neutrons by (p,n)-reactions ($E \backsim$ MeV)
- Nano-scale measurements require long-wavelength neutrons ($\lambda > 10$ Å)
- Optimization of moderators (geometry/temperature) to achieve high cold neutron brilliance

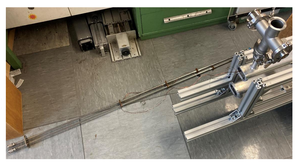


Cryostat assembly and operation

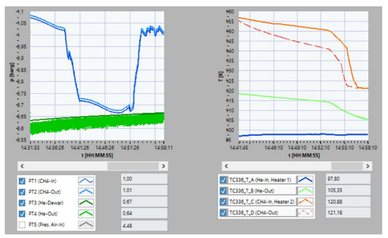




→ Metal-sealed connectors induce large deformations and stresses

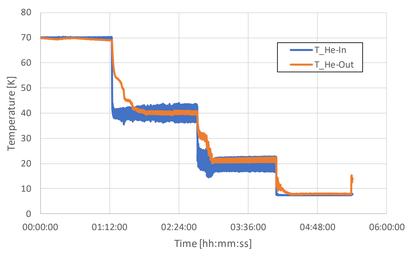


→ Transfer line (dis)assembly not possible without sensor and heater cabling



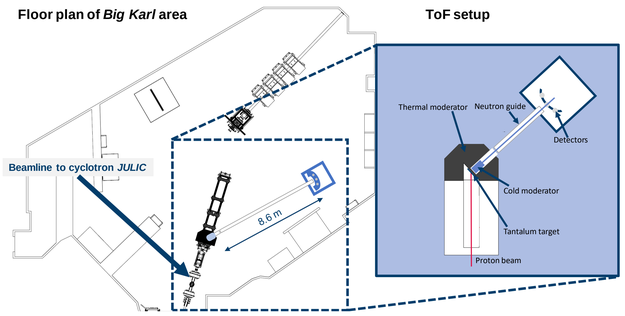
→ LHe cooling prone to oscillating behaviour

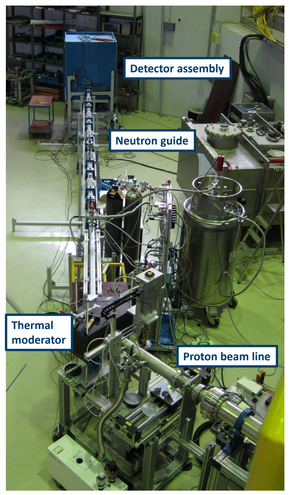
→ Impact of freezing rate on neutron spectrum not known

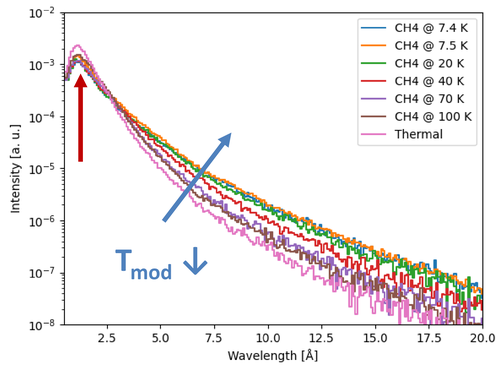


→ Temperature measurement at center of moderator vessel

Time-of-Flight measurements







- Normalization to detector at therm. Moderator
  → good agreement for similar T_{Mod}
- ^{3}He detector efficiency
- Neutron transmission (VITESS)

→ proton current different for each one of the two measurement days, but changes are not proportional to neutron count

→ increase of cold neutrons, but only small changes and no observable formation or shift of cold peak with decreasing temperature