Cold moderator developments for the *High Brilliance Neutron Source*

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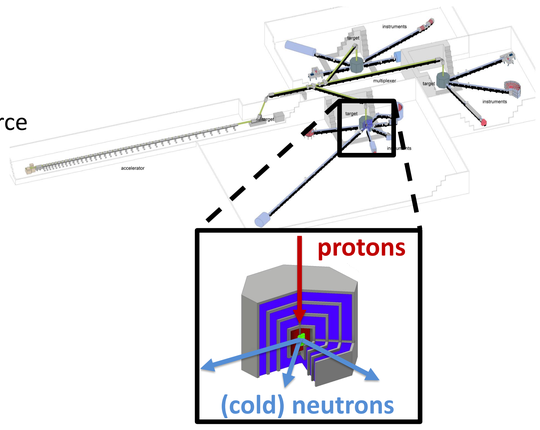
Motivation

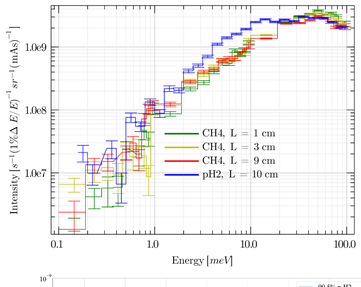
High Brilliance Neutron Source (HBS):
- Compact Accelerator-driven Neutron Source (CANS)
- Production of free neutrons by (p,n)-reactions ($E \backsim$ MeV)
- Nano-scale measurements require long-wavelength neutrons (λ > 10 Å)
- Optimization of moderators (geometry/temperature) to achieve high cold neutron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

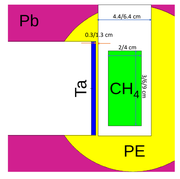


Cold moderator materials

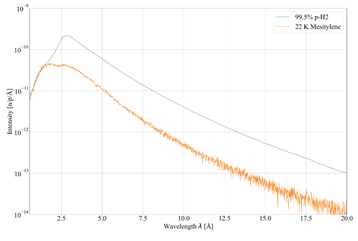
- Liquid parahydrogen (l-pH_2)
- Solid methane in phase II (s-CH_4)
- Solid mesitylene (s-C_9H_{12})

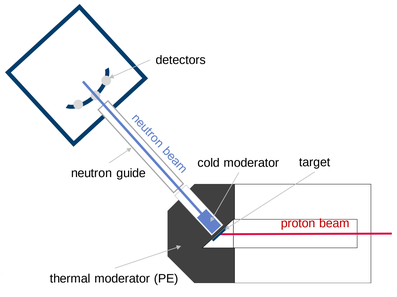
MCNP simulations





Experiments

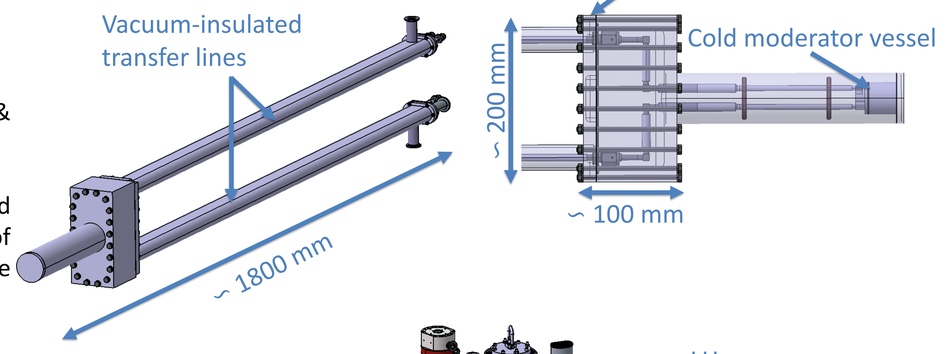




Cryostat designs

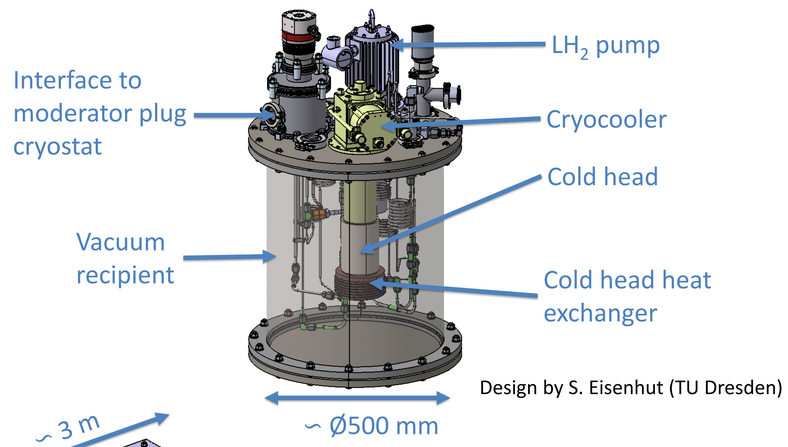
Moderator plug cryostat(s)

- Part of moderator plug (+ shielding & neutron guide)
- Interchangeable moderator vessel
- Version with two vacuum-insulated transfer lines allows operation of solid cryogenic moderators using LHe and a gas management system



p-H_2 main cryostat

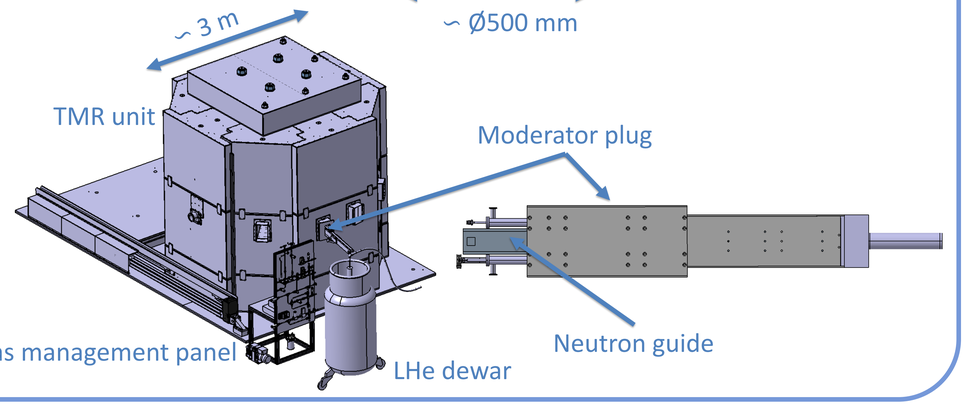
- GM cryocooler (40 W @ 20 K)
- Closed-cycle flow system (continuous operation $\backsim$ 2 weeks)
- Catalyst bed for conversion of ortho- to parahydrogen (almost 100% p-H_2)
- Positioning by adjustable flange connections and scissors lift



Design by S. Eisenhut (TU Dresden)

Target-Moderator-Reflector prototype

- Systems are currently being manufactured in workshops of JCNS and ZEA-1
- Planned commissioning in summer 2022 (design by ZEA-1)
- Proton beam characteristics:
  $E_{p,max}$ = 45 MeV
  $I_{p,max}$ = 10 µA
- Operation of solid and liquid cryogenic moderators



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