



Cryogen-free cryostat with sample changer for fast automatic data collection

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■ Motivation

Dead times related to sample environment changes and setup are going to be the limiting factor in sample throughput due to

- increased efficiency of neutron sources and of instruments
- comparatively short measuring periods investigating Soft and Bio Materials

Many experiments are carried out at low temperatures

→ need of low temperature equipment suitable for rapid and automated sample and temperature change

■ Basic conditions

- Cryogen-free, temperature 3 K or lower and up well above room temperature.
- Modular setup to allow the mounting of a tail optimised for SANS, Reflectometry, and other neutron instruments from different facilities.
- Tail windows designed in order to apply in-situ light/UV or other external radiation.

Two different approach:

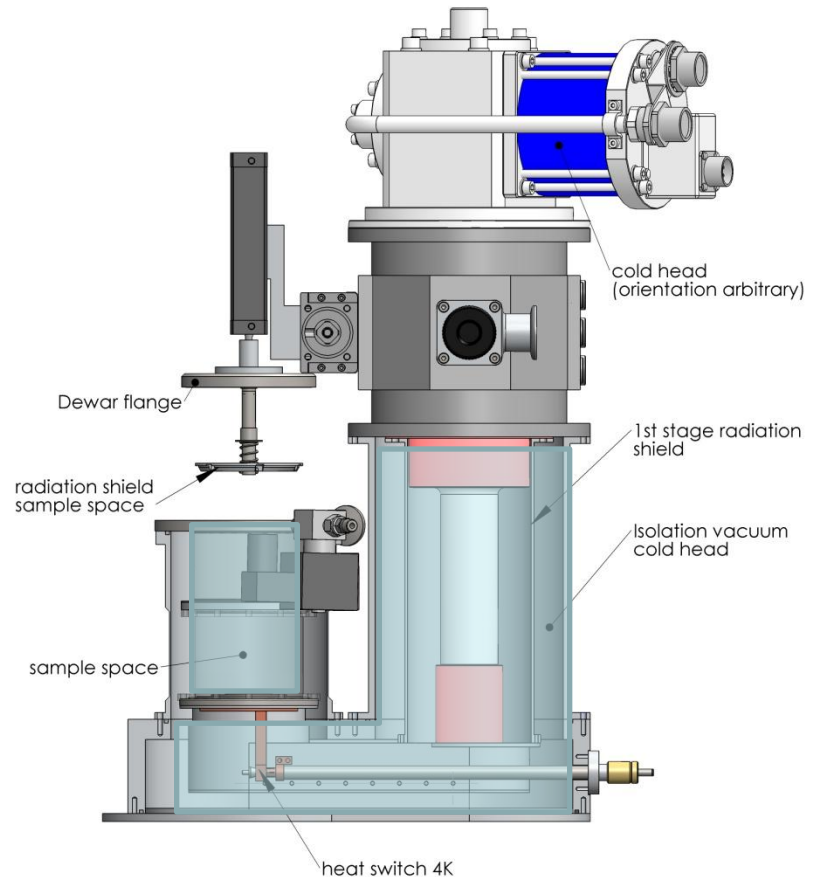
- Samples (and changer mechanics) are pre-cooled to intermediate temperature level e.g. 1st stage cold head temperature level. Place requirement for mechanics and lock (ILL)
- Compact cryostat design with minimized cold mass allowing fast cool down. Samples and robot at RT (FRM II)

■ Compact cryostat: objectives

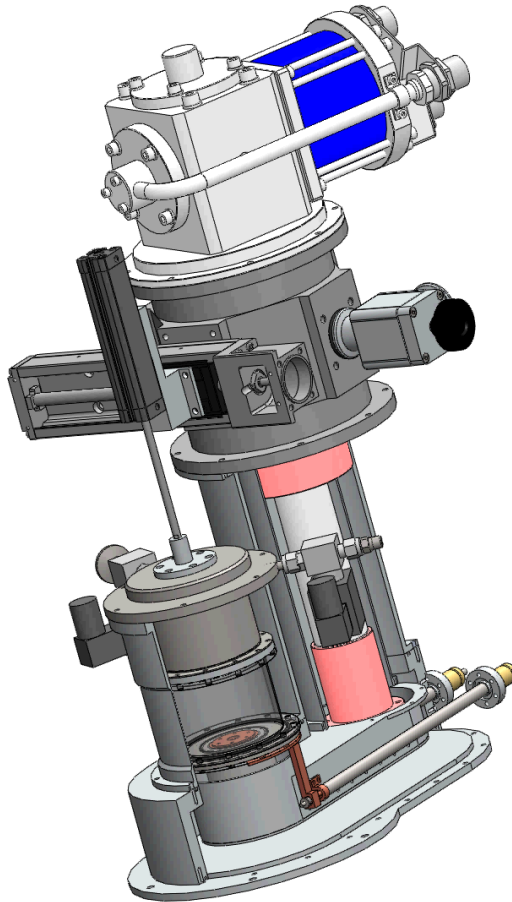
- Compact cryostat design (limited space at instrument)
- Fast remote controlled sample change
- Broad temperature range
- Sample storage and robot at RT
- Modular setup
- Top and bottom loader possible (arbitrary)

■ Compact cryostat: (sample tube) concept study

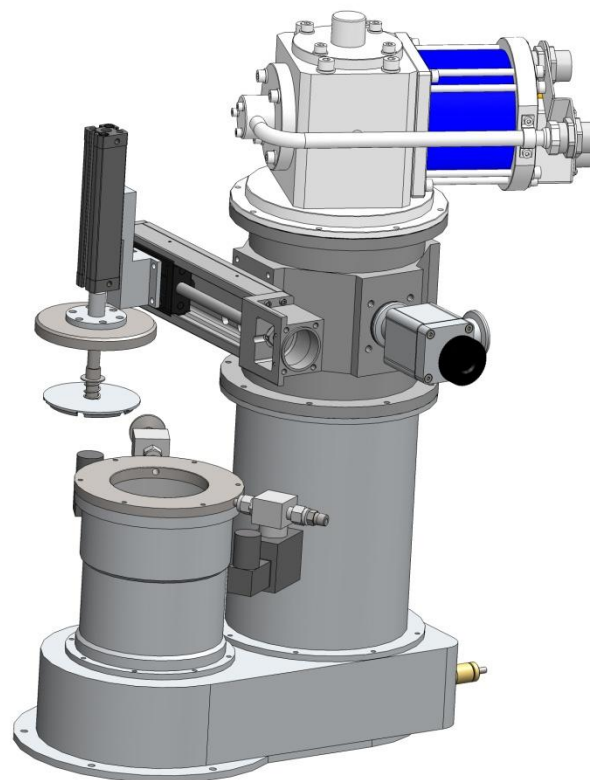
- Separate sample space and cold head isolation vacuum
- Minimized cold mass
- Remote controlled reload
- Standardised sample holder
- Pin connection for thermal link and thermometry
- Sample in exchange gas via sample container



Compact cryostat: reload mechanics

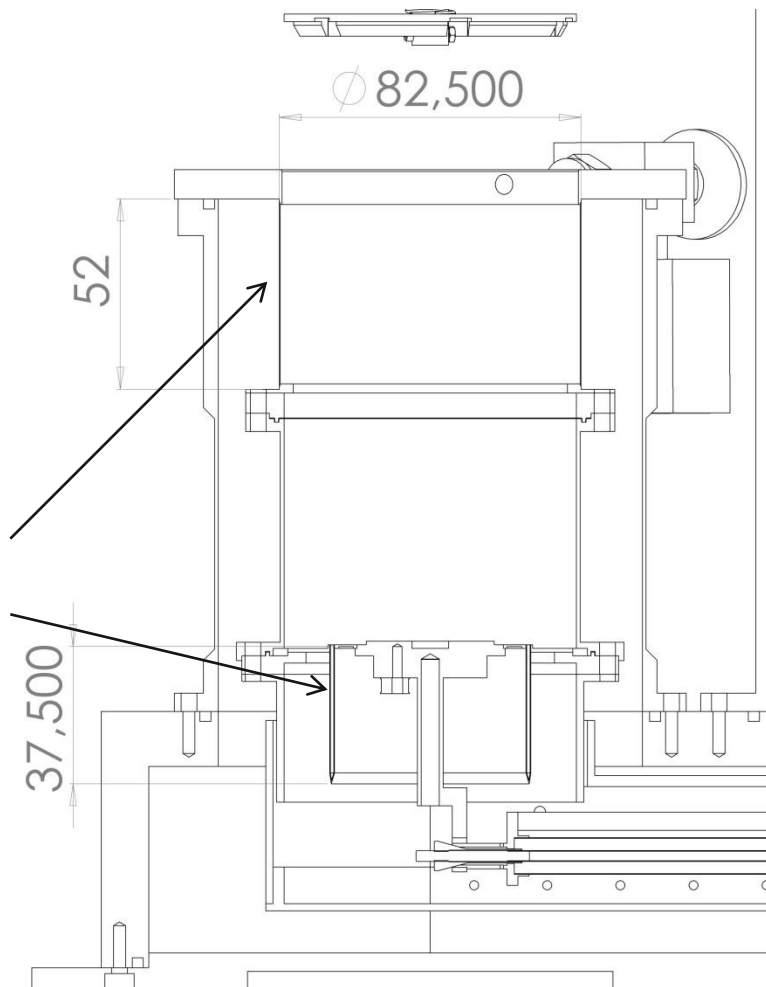
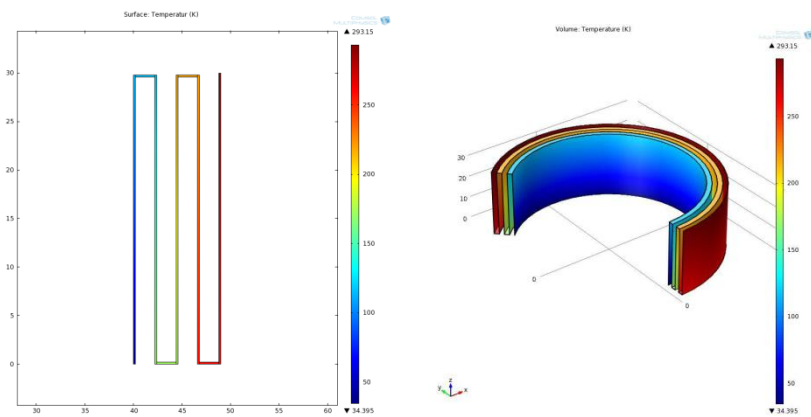


■ Compact cryostat



■ Feasibility: Heat management

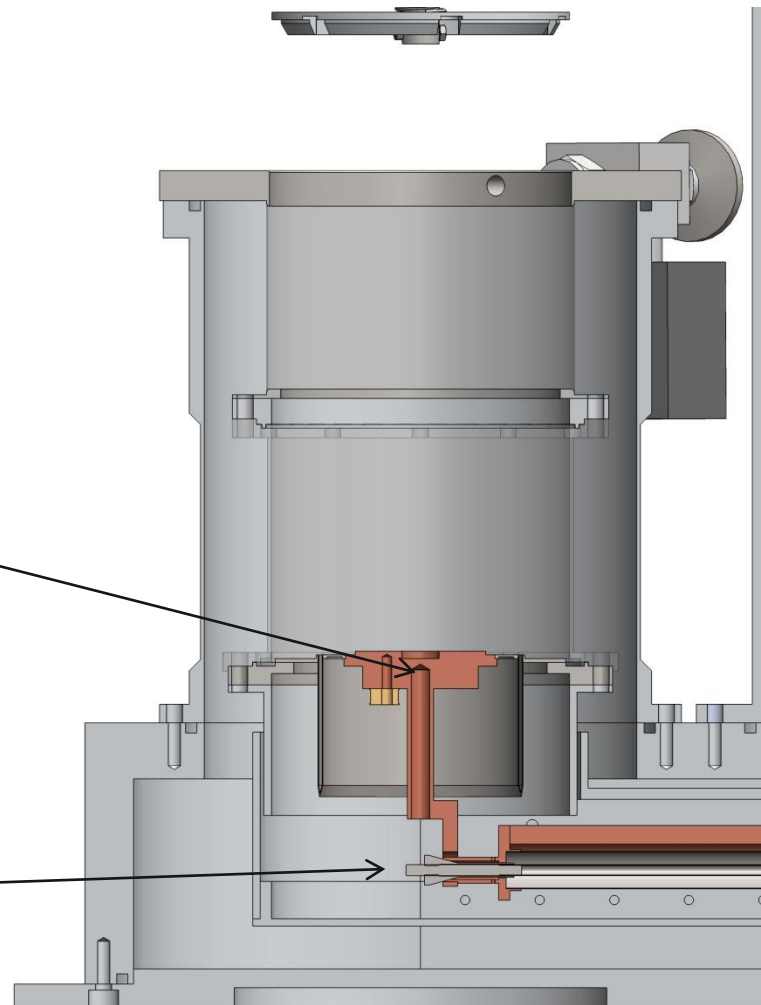
● (Nested) thermal links



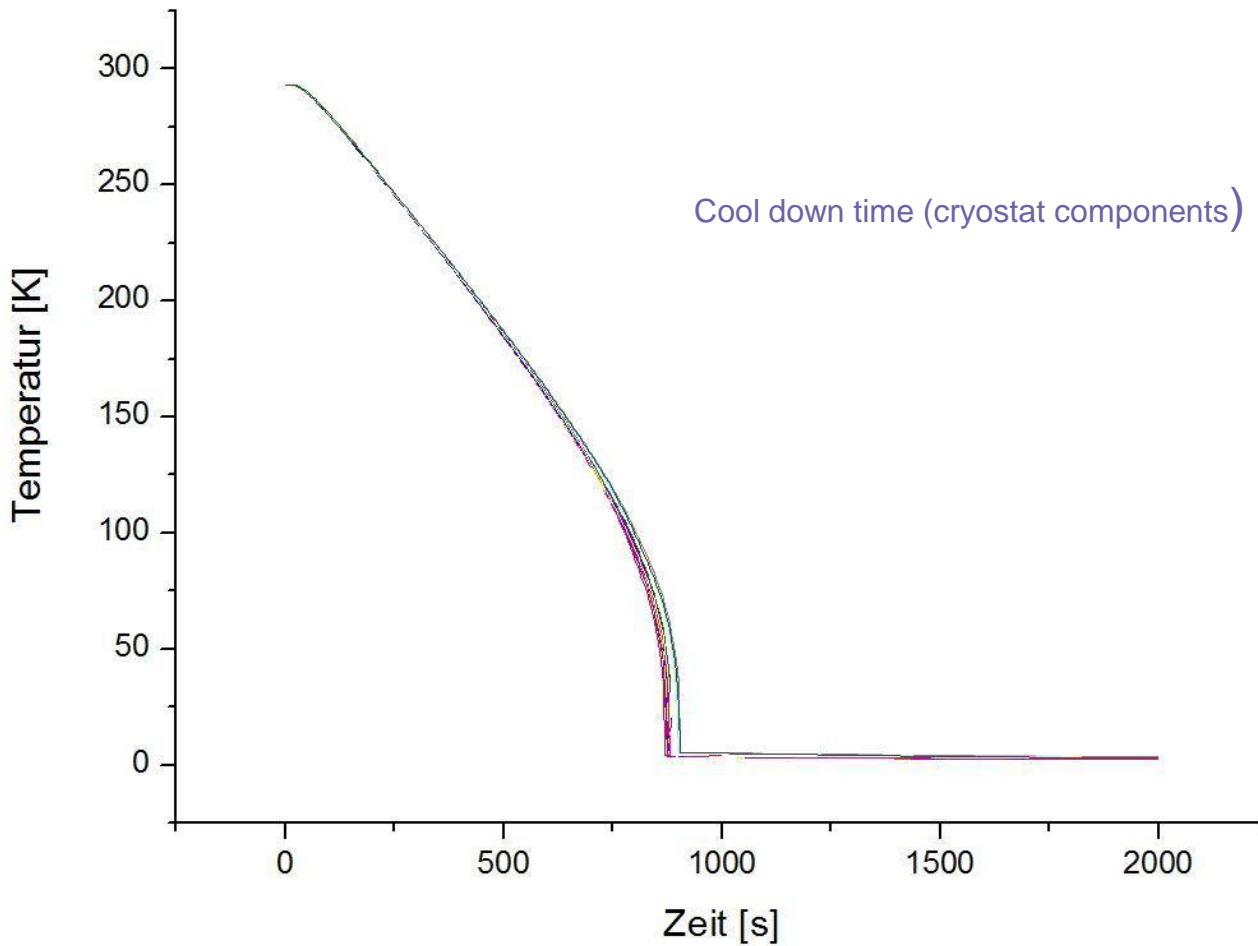
■ Feasibility: Heat management

- Minimised cold mass
→ Cool down time

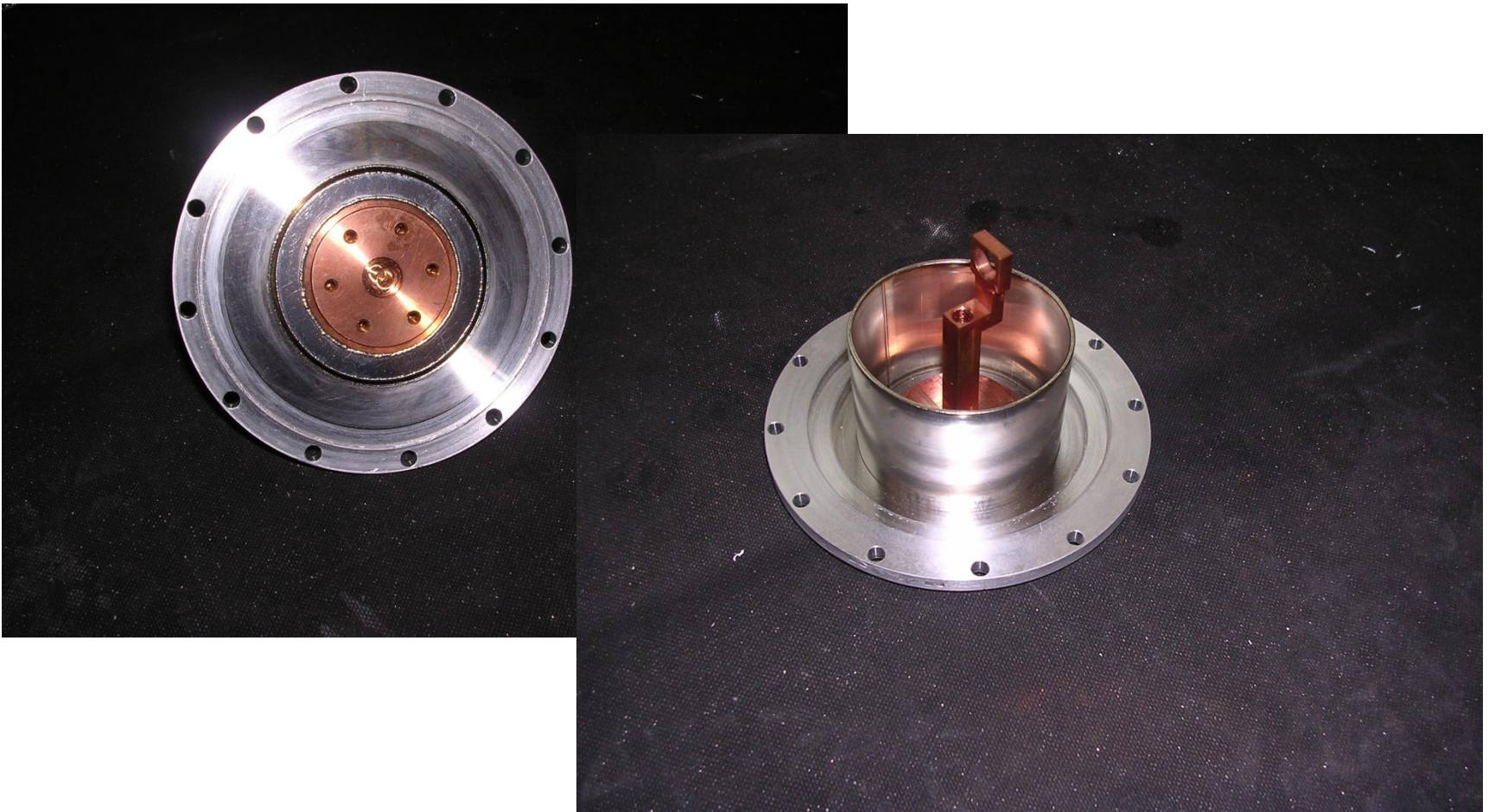
- Heat switch



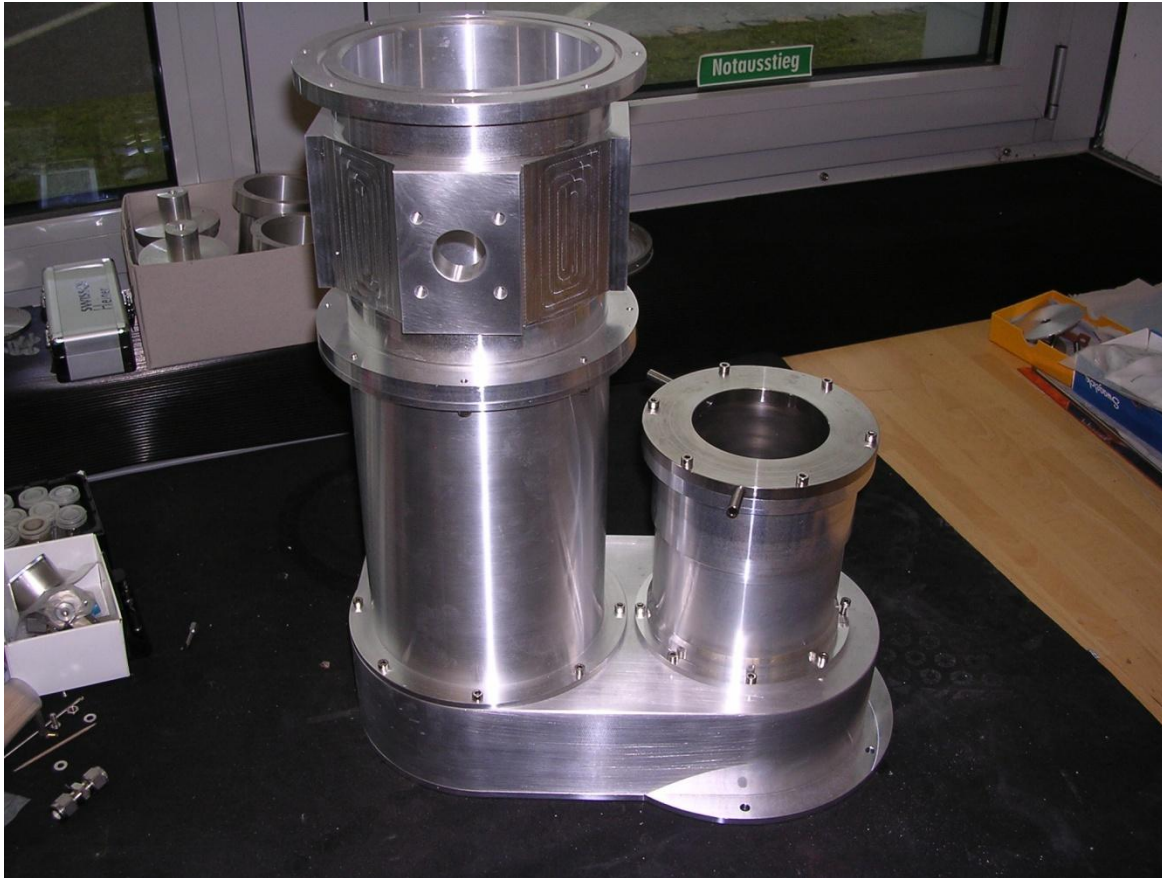
■ Feasibility: Heat management



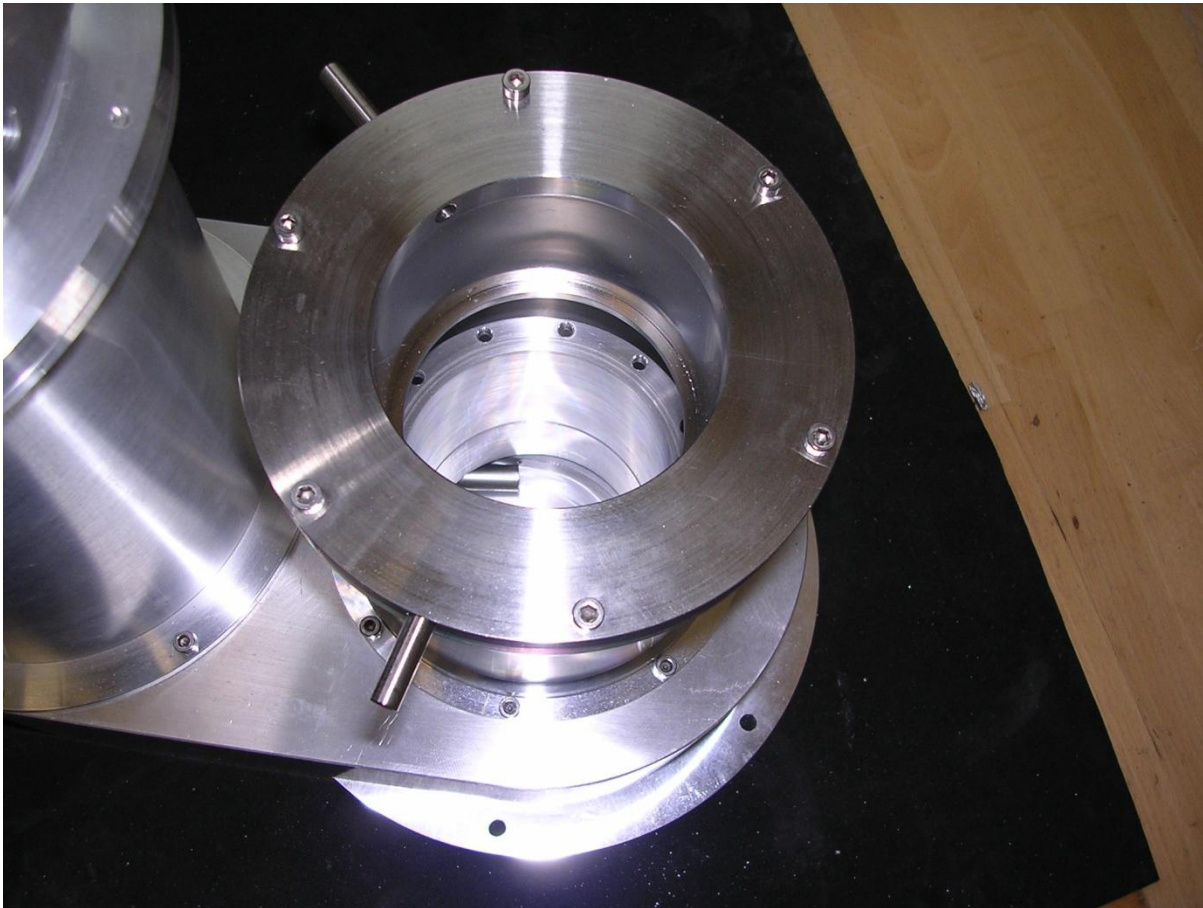
- Present status: 3K plate Al-SS sandwich material, nested link



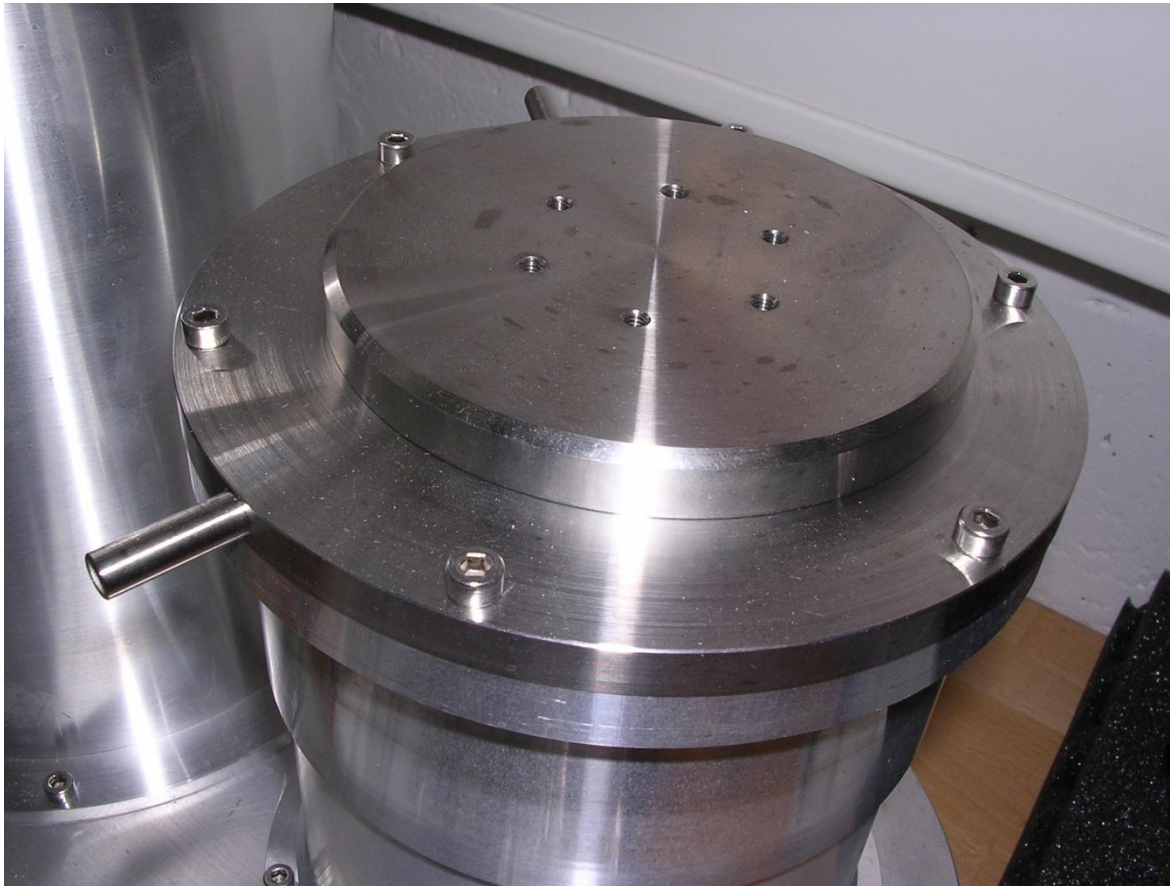
■ Dewar



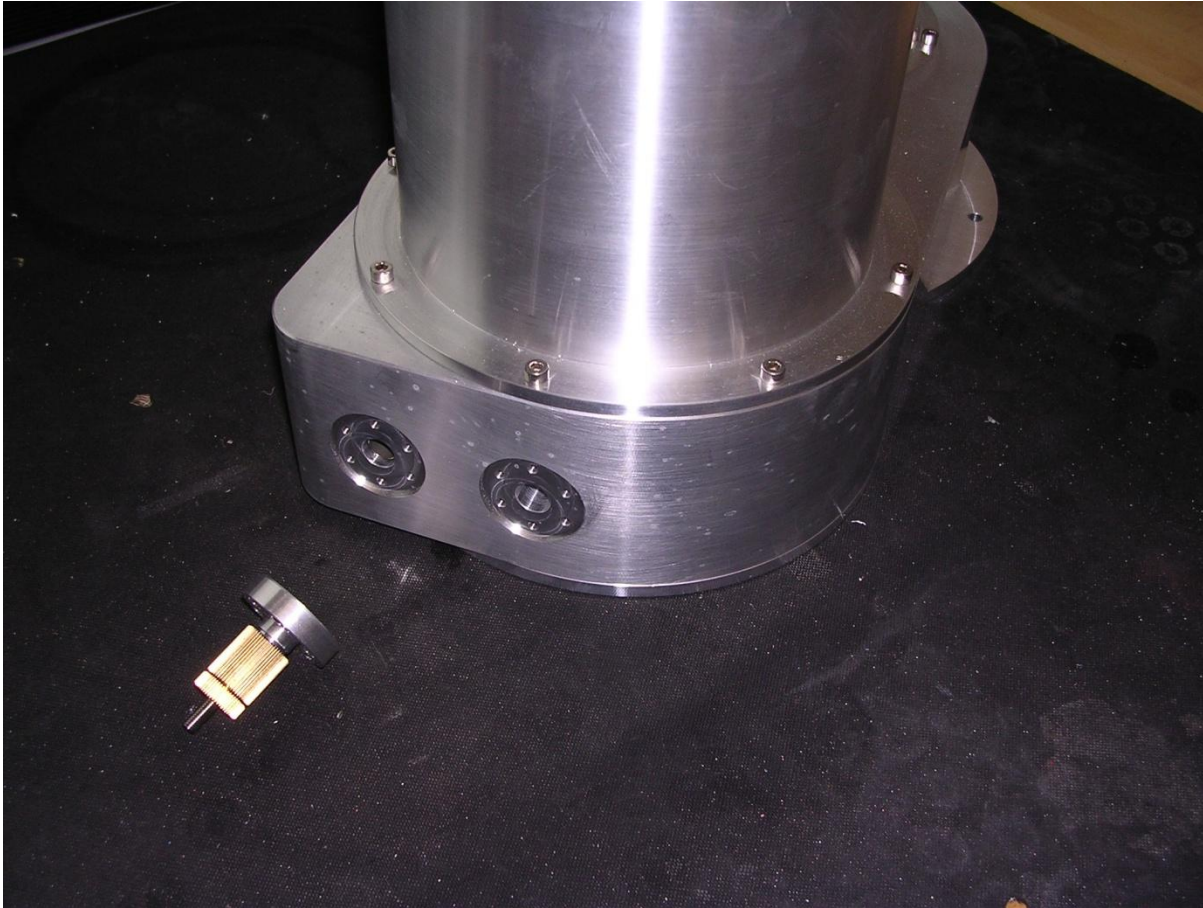
■ Dewar, radiation shield



■ **Top cover, in/outlet**



■ Heat switch



■ Compact cryostat: problems to be solved

- Efficiency of heat switch
 - Cool down time
 - Temperature
- Thermal connection of sample
 - Pin connection
 - Standardised sample cans (orbital laser welding)

Thank you!