

6 partners:

Participant short name	LLB CEA	HZB	JCNS	ILL	TUM	STFC

4 tasks:

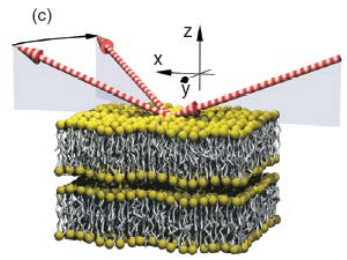
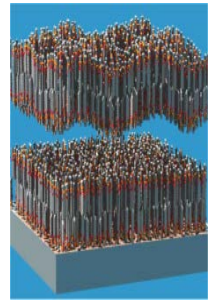
- Platform for model biological membranes Task 1
- Kinetic & Dynamics experiments Task 2
- Humidity chamber with sample changer Task 3
- Cryogen free cryostat with sample changer Task 4

Optimization of model bilayer systems including natural membrane lipids

Basic requirements of model Bbilayer for feffectivity:
large and uniform membrane

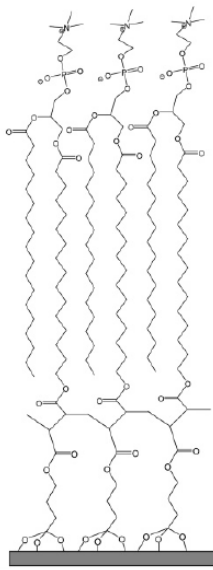
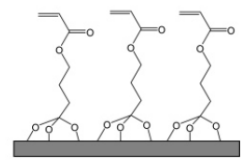
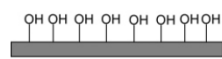
Solution - ‘Floating’ Bilayers..

Works – But.. only for the simplest lipids
Need to hold lower ‘support’ more firmly.



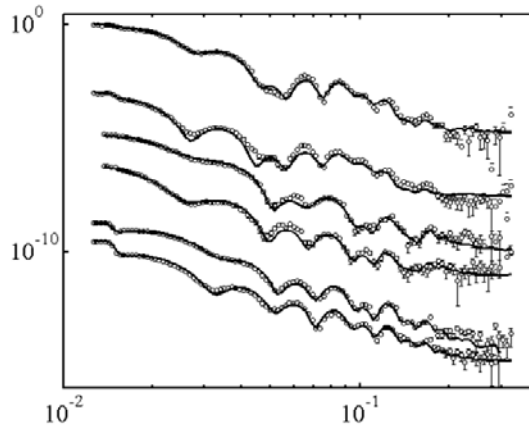
Solution – Grafted phospholipid on Self Assembled Monolayers

Fabrication of membrane of more complex mixtures

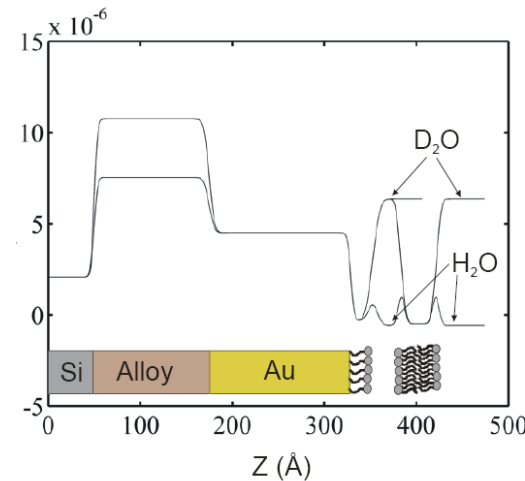


Latest developments – Gold/Thiolipids

STFC



100% coverage



Hughes et al.

Developed novel LB technology for accurate positioning of substrates.

MD and MC simulations of membrane profiles (STFC)

Fully deuterated natural lipid membranes

Yeast cells grown in a deuterated medium (D-lab)

Lipids extracted with Folch method

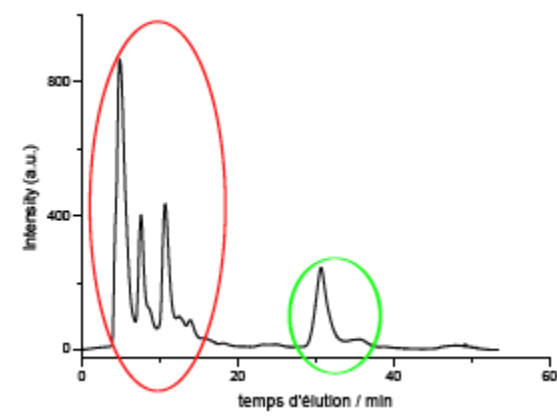
Phospholipids separated by 2D TLC

Lipids separation (HPLC):

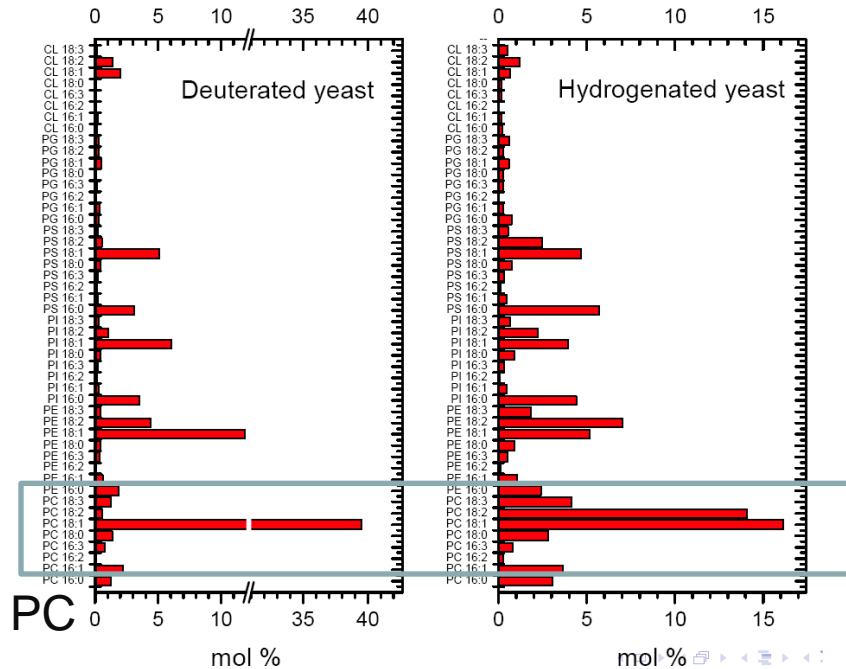
Apolar lipids (chloroform-acetic acid)

Polar lipids (methanol)

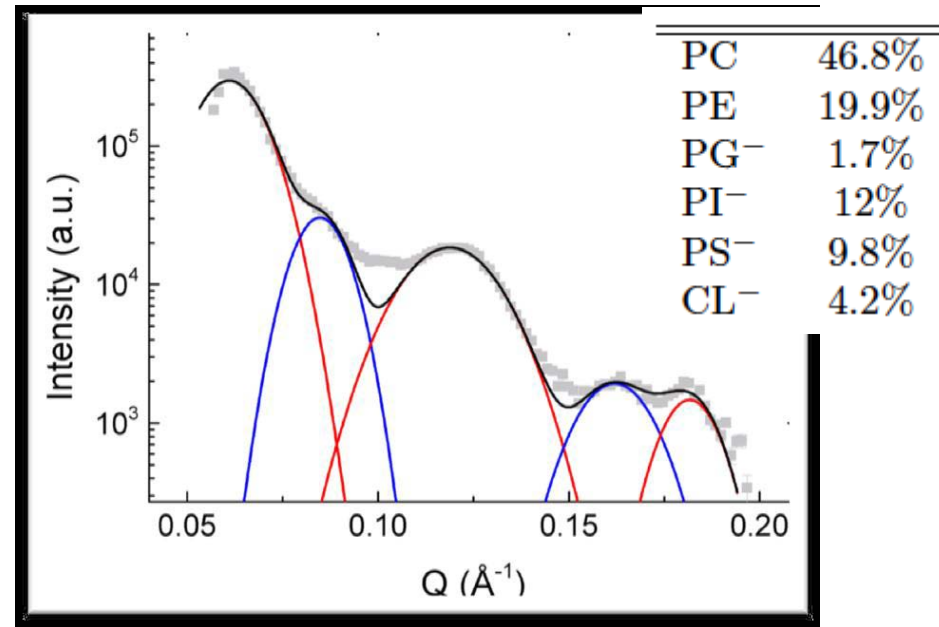
Separation of sterols from apolar



A platform for model biological membranes Task 1



Neutron Diffraction from P. Pastoris

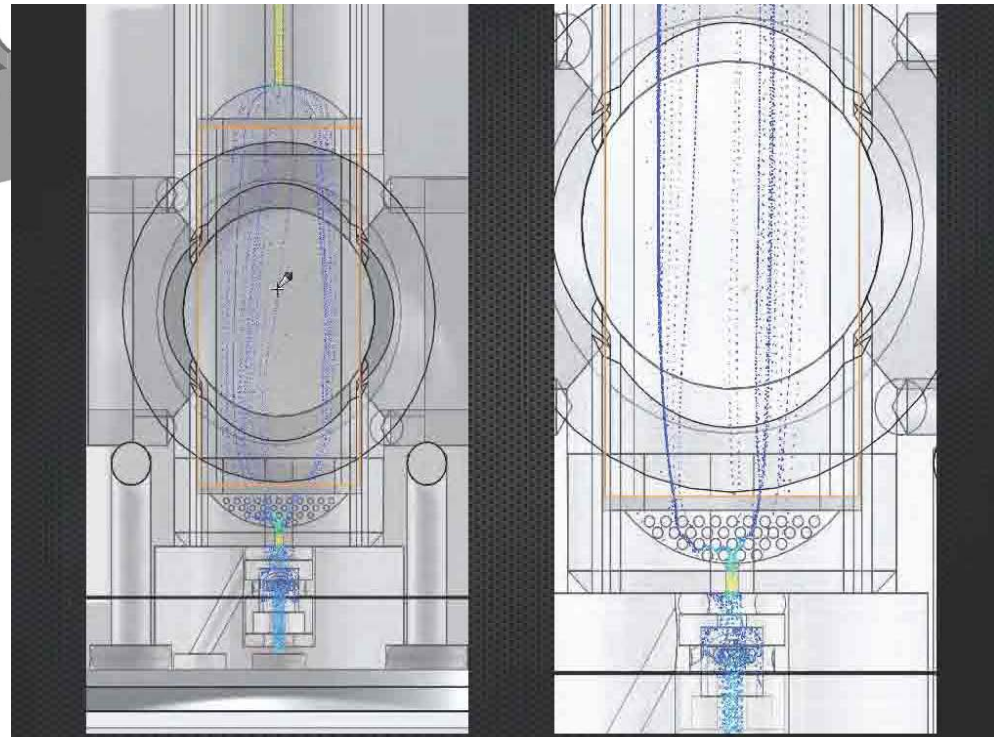
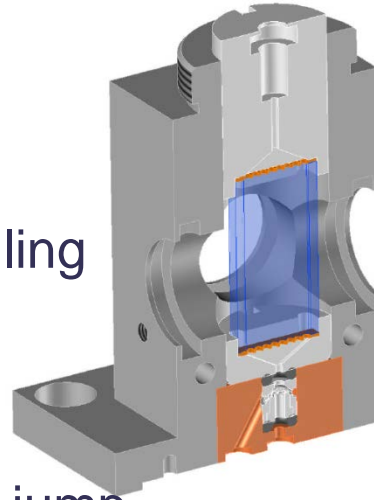


Gerelli et al.

D lipids synthesis depends on the T° of growing media
Vary the T° (RT or 30°C)

New observation heads for Stop Flow ILL

- Improve the cell filling (homogeneity, duration)
- New furnace for T-jump.

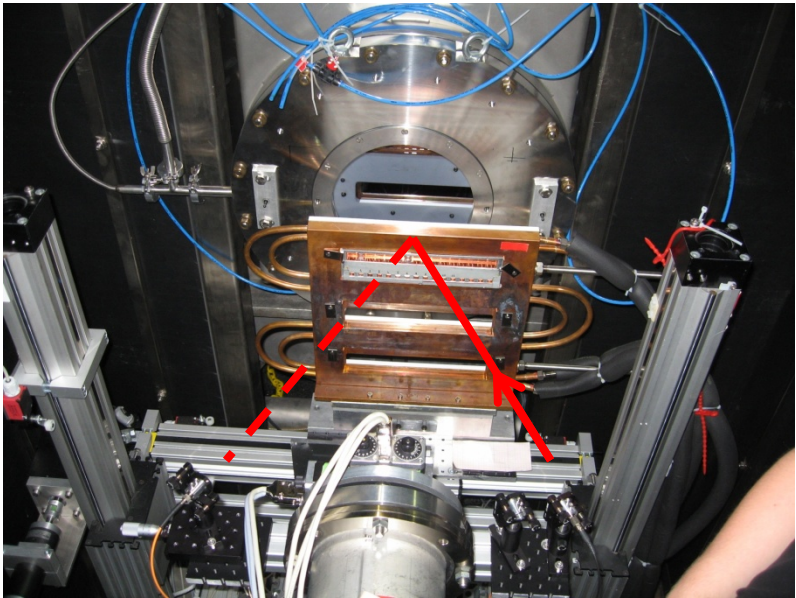
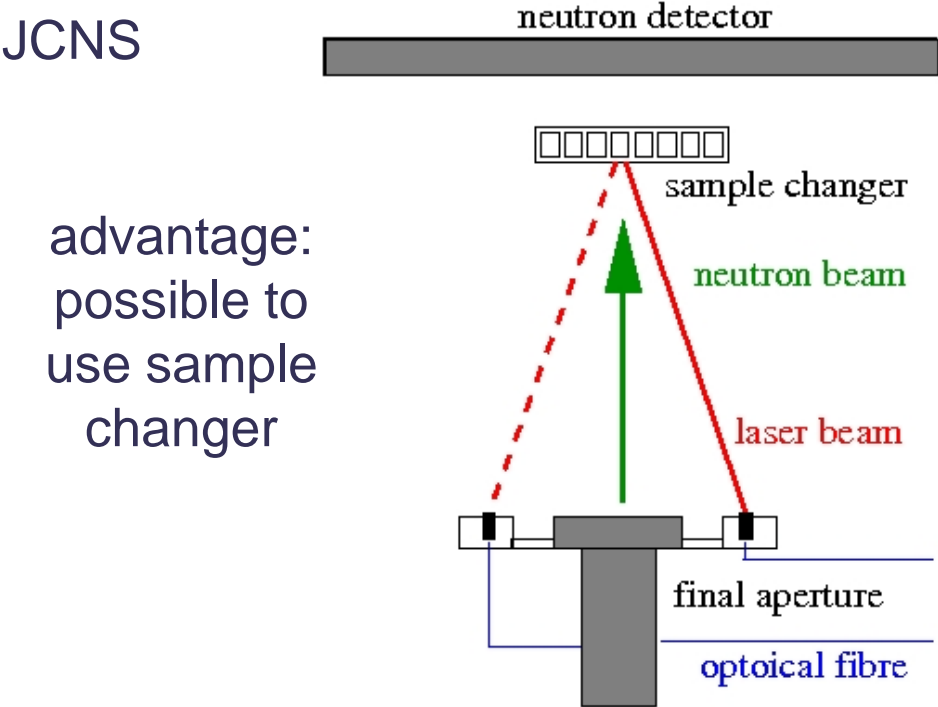


Started to study the cell filling by changing the solution injection device (bottom of the SF head)

A combined static LS DLS and SANS

Implement DLS ... with the flow-through cell of the stopped flow ...

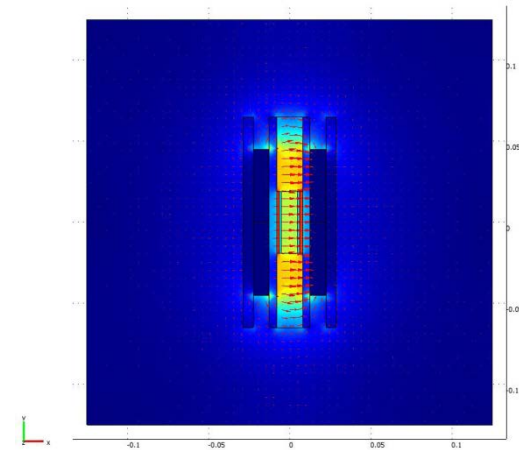
LS in fiber configuration permanently fixed on the SANS collimator exit



DLS Tests

Electric field cell with electrodes outside the sample

LLB



Comsol simulation

Build a prototype

Effective electric field measurement (probe inside the sample)

Vary the permeativity of samples (solvents) and materials around the sample cell

Next step : Comparison tests measurements/ Simulations ComSol,
New design with thermalization

Pressure cell for Neutron Spin Echo

Sample area: ca. $3 \times 3 \text{ cm}^2$

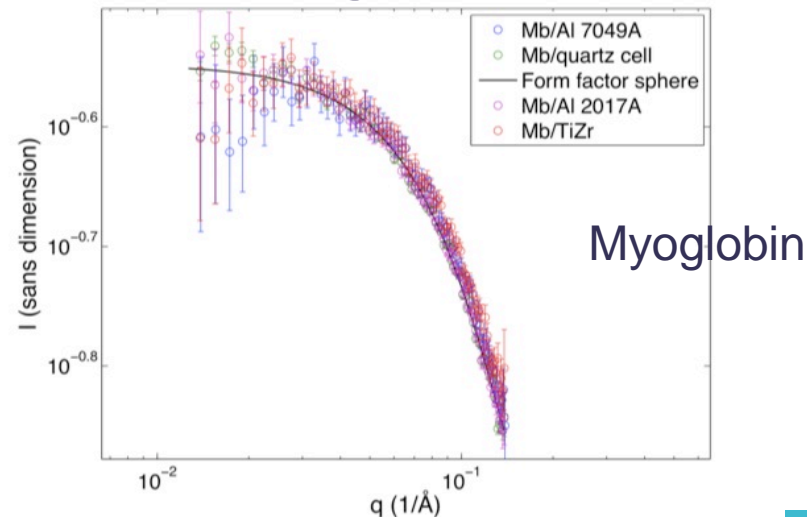
Thickness: ca. 2mm

Pressure: 10 kbar (if possible)

Sapphire or alloys windows? Which geometry?

Tests in SANS with sapphire : cell broken (ILL) , leaks (JCNS)

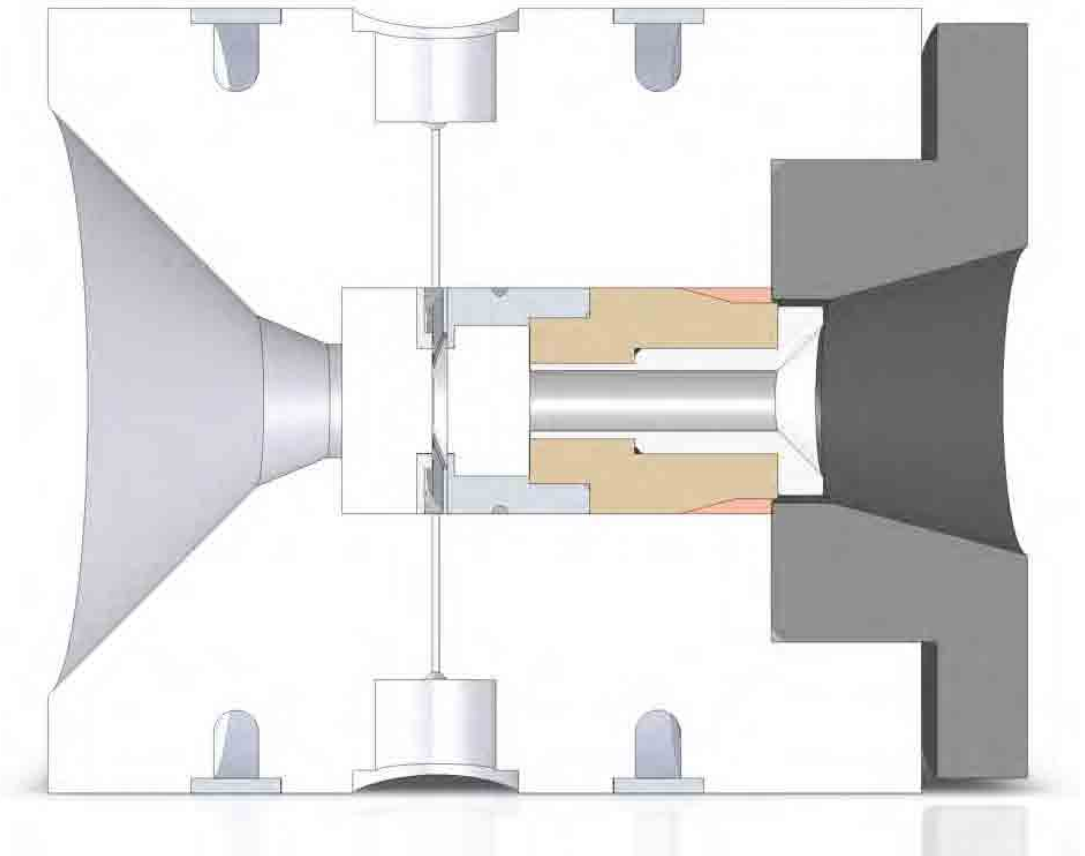
Tests of windows at LLB in SANS, Q Range of NSE



A new pressure cell for SANS up to 7kbar

Begin the design phase

ILL, LLB, JCNS

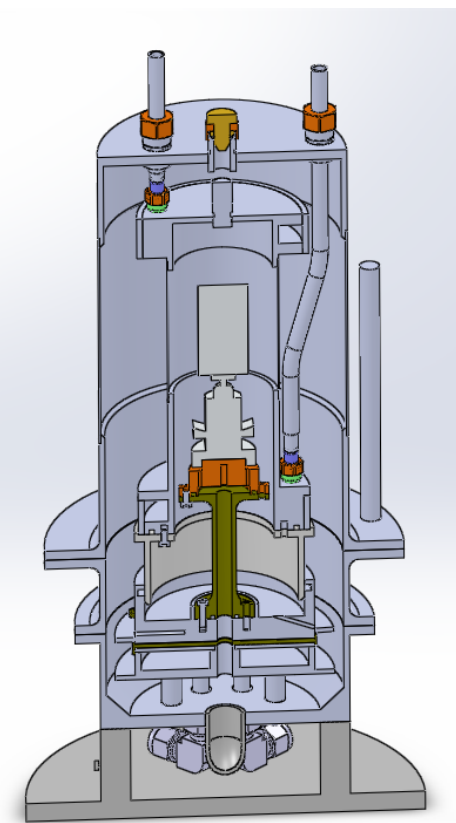


HZB, LL

End of design phase

- Double walled (evacuated) Al
- Total size=400xØ110 (270 mm from base to sample)
- Inner cell=220xØ50 (170 mm above cold chamber region) , small volume for fast equilibration
- Wide angular scanning range possible ($\sim 300^\circ$), neutron windows with 15° opening
- 3 water chiller channels for precise temp.
- 2 resistive heating foils possible (below gonio and below reservoir)
- Sample cell thermally isolated (plastic post, steel supports),

Final inner can

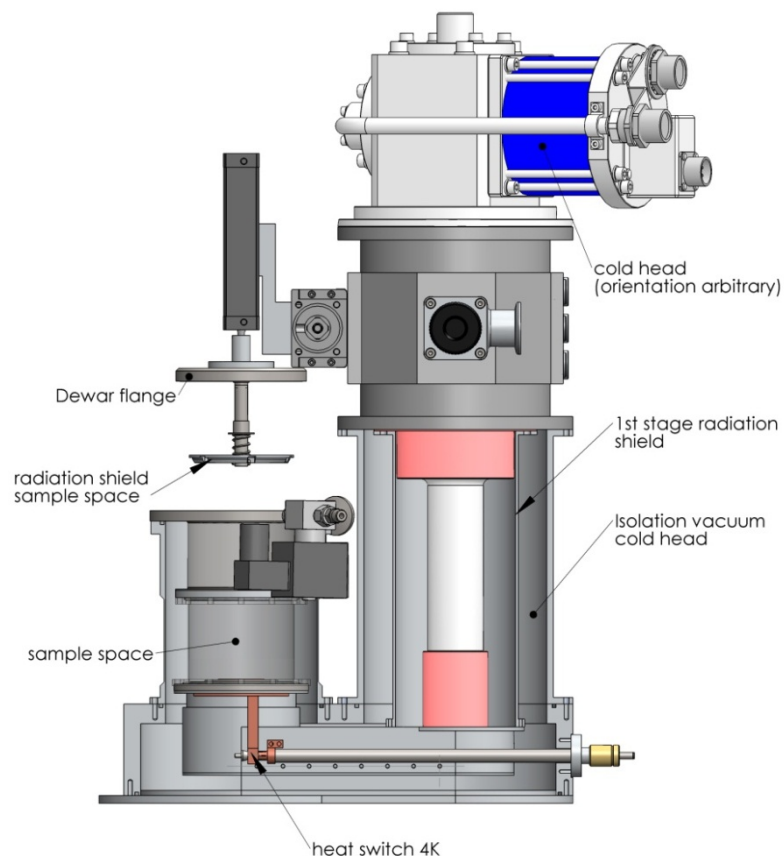


Next step: manufacture, assembly -> 06- 2014 1st tests end 2014

■ Compact cryostat

FRMII

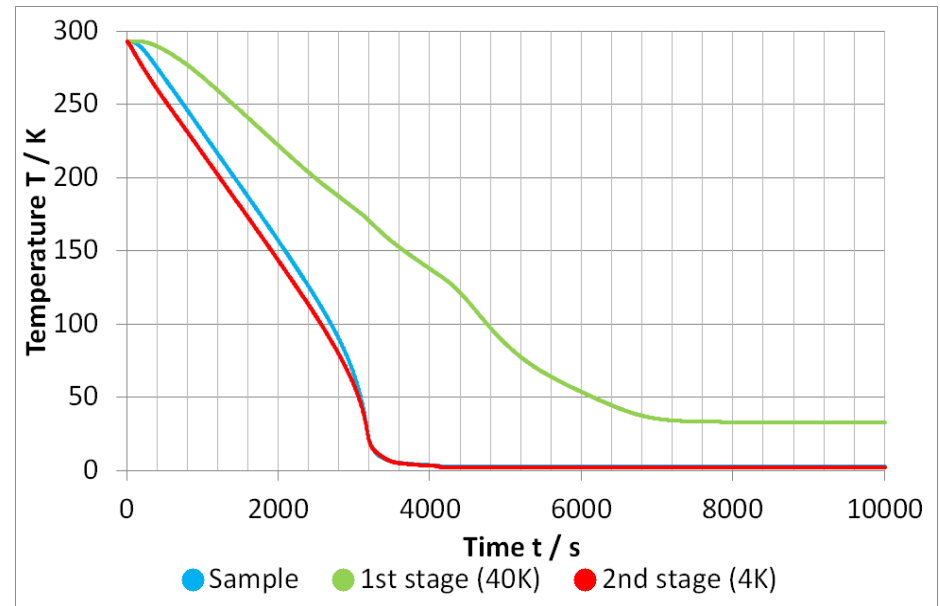
- Separate sample space and cold head isolation vacuum
- Minimized cold mass
- Sample in exchange gas via sample container



Cryogen-free cryostat with sample changer Task 4

1st tests: Cooling

Sample holder thermally decoupled



1:25 h: 2nd stage at $\sim 2,4$ K

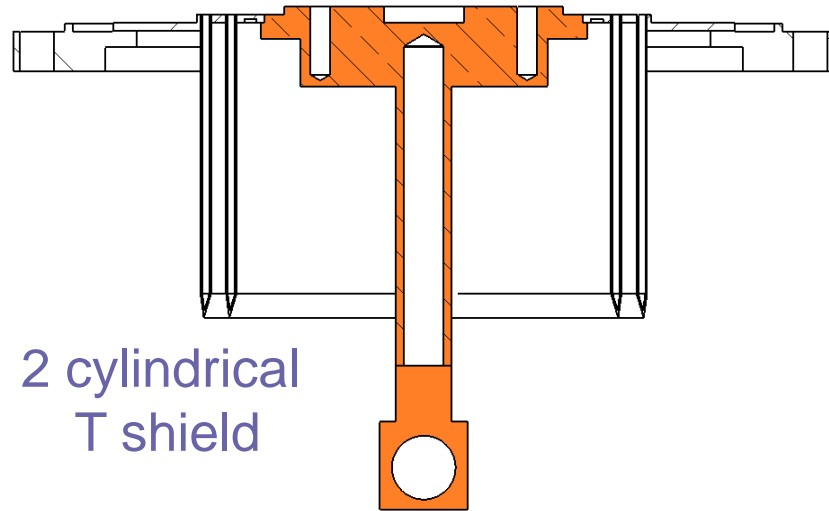
2:40 h: Sample at $\sim 2,8$ K

(1:30 h: Sample at $\sim 2,9$ K)

$\Delta T \approx 0,4$ K

Heat management change

New sample holder



2 cylindrical
T shield

Length = 75mm–150mm

Next...

New tests

- Thermal connection of sample
 - ◆ Pin connection
 - ◆ Standardised sample cans (orbital laser welding)
- Automation of the sample exchange
 - ◆ Control of the heat switches
 - ◆ Robot arm

Next meeting in 2014

At ILL in May 2014

*At the 8th International Workshop on Sample Environment
Oxfordshire, 12th– 16th October 2014
Hosted by ISIS STFC*

Possible change of MM distribution

For the pressure cell subtask ILL, JCNS and CEA (LLB)
Decision mid 2014