Рефлектометр поляризованных нейтронов Super ADAM в ILL: о некоторых из последних экспериментов

(или будущее сегодня)

Алексей Воробьев, Университет Уппсала, Швеция

ФПН-2016, 16 декабря, Гатчина

Официальный статус в ИЛЛ

NEUTRONS FOR SCIENCE

Contract on the operation of the CRG-B Instrument Super ADAM

Between

THE INSTITUT MAX VON LAUE – PAUL LANGEVIN
71, avenue des Martyrs, 38000 Grenoble, FRANCE
Represented in this instance by Prof. William G. Stirling, Director and Mr. Manuel Rodriguez Castellano, Head of Administration,

Hereinafter referred to as "ILL"

On the one hand,

And

THE UPPSALA UNIVERSITY
Department of Physics and Astronomy, Box 516, SE-751 20 Uppsala, SWEDEN
Represented in this instance by Prof. Eva Åkesson, Vice-chancellor and Prof. Björgvin Hjörvarsson, head of the Materials Physics.

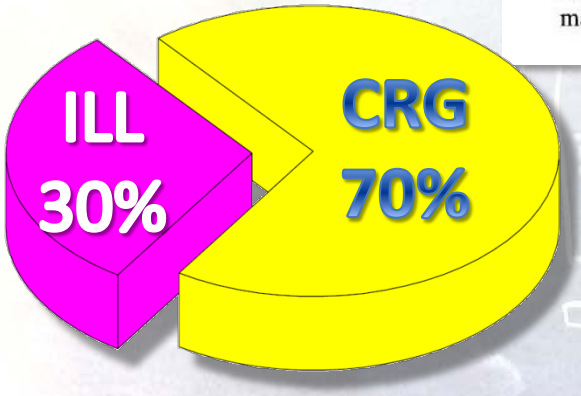
Hereinafter referred to as "Uppsala University"

On the other hand,

Vetenskapsrådet

ARTICLE 7
Allocation of scheduled beam time for ILL use

As a CRG-Type B instrument, 30% of the scheduled beam time for scientific use, shall be made available for ILL use, as set out in Article 11 of the "General Conditions".

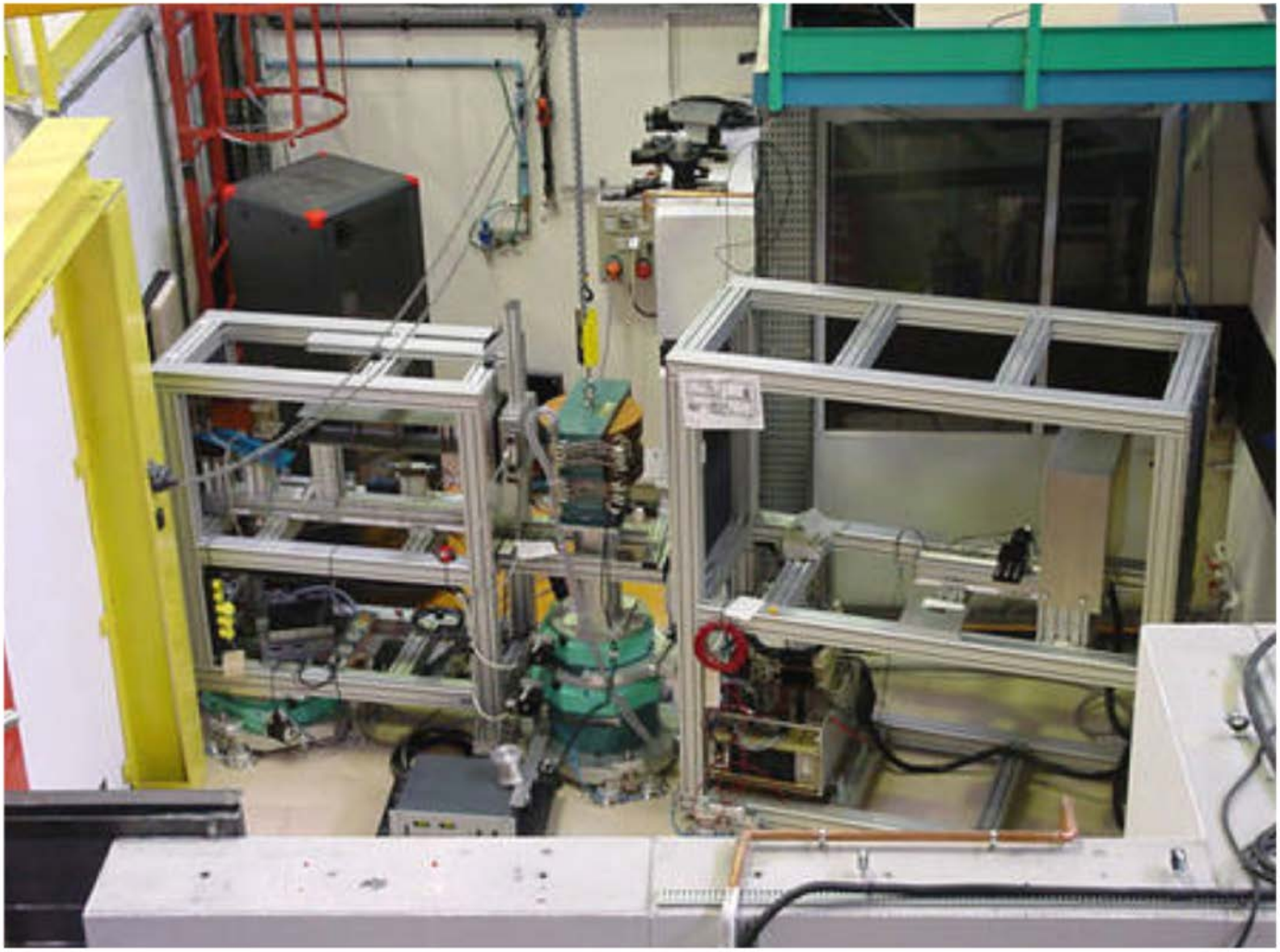


ARTICLE 11
Duration of the contract

This contract is concluded for a period starting on July 1st 2016 and expiring June 30th 2019.

The engagement of Uppsala University in operating the Instrument is dependent on support from the Swedish research council. Therefore, in case such support would cease, Uppsala University may terminate this contract upon one year prior written notice. Such notice shall be communicated at latest in December for the contract to terminate in December the year after.

High resolution polarized neutron reflectometer Super ADAM. Version < 2013



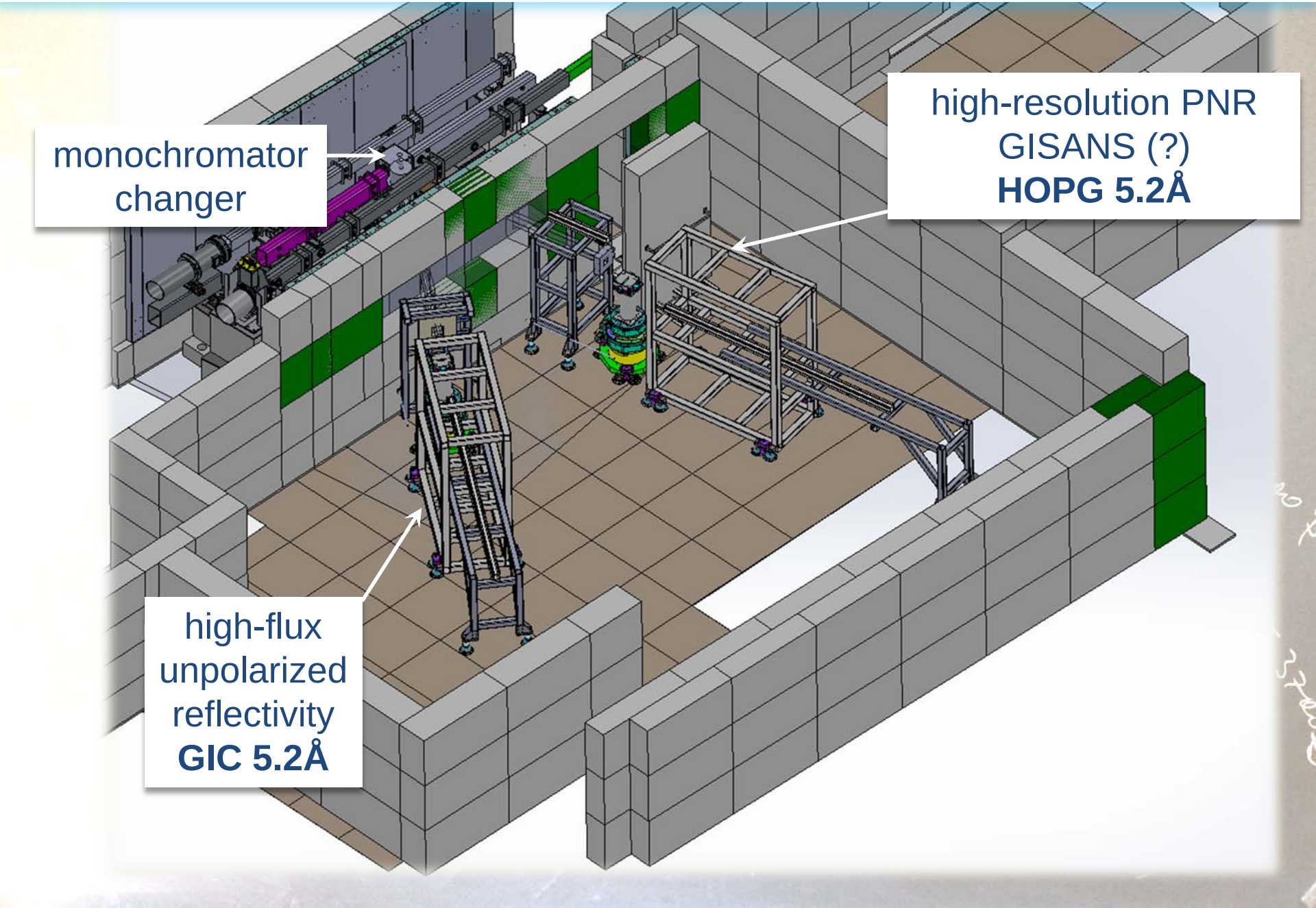
August 2013 – September 2014: Relocation of Super ADAM

ILL H5 project: reconstruction of the guide system at ILL22

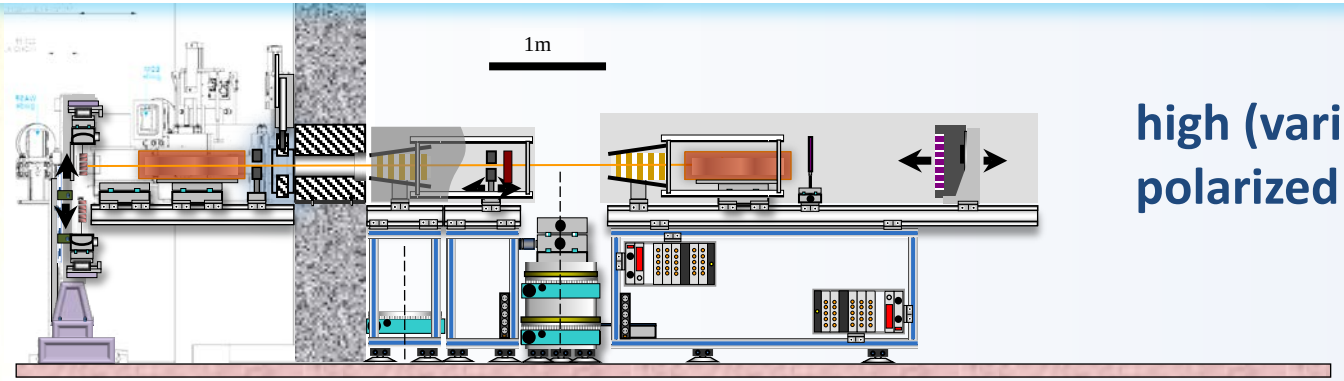
2 September 2013

Иногда они возвращаются ….

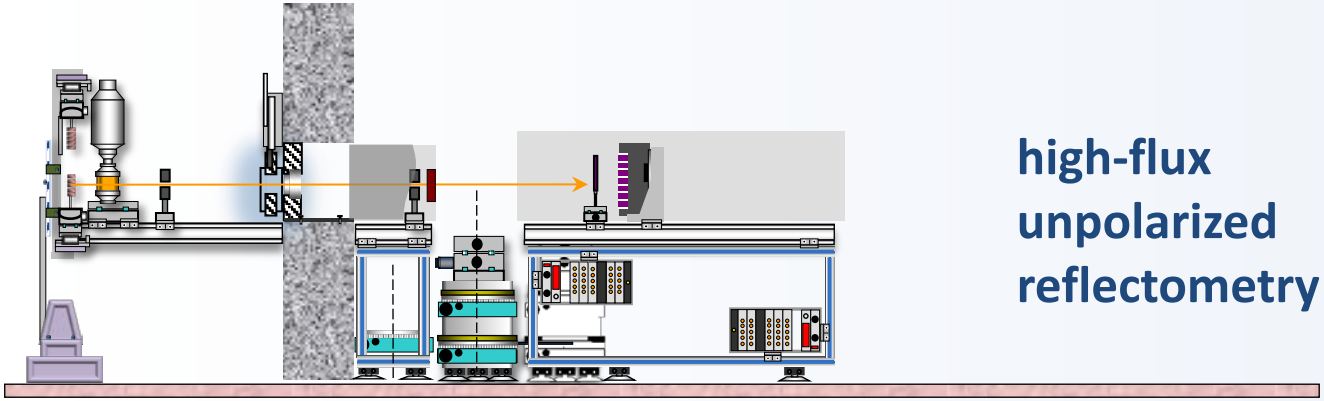
New concept of the instrument



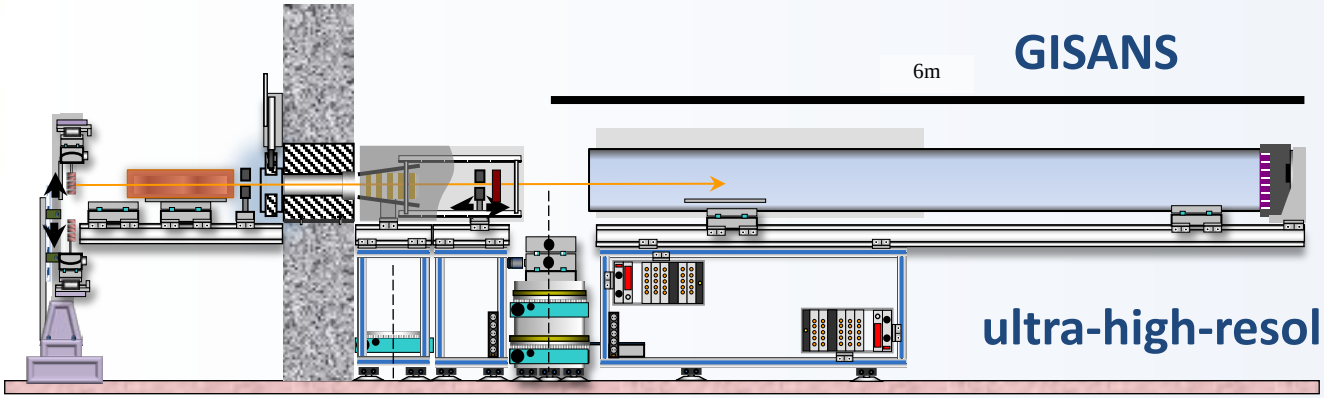
Modular design and modes of operation



high (variable) -resolution polarized reflectometry



high-flux unpolarized reflectometry

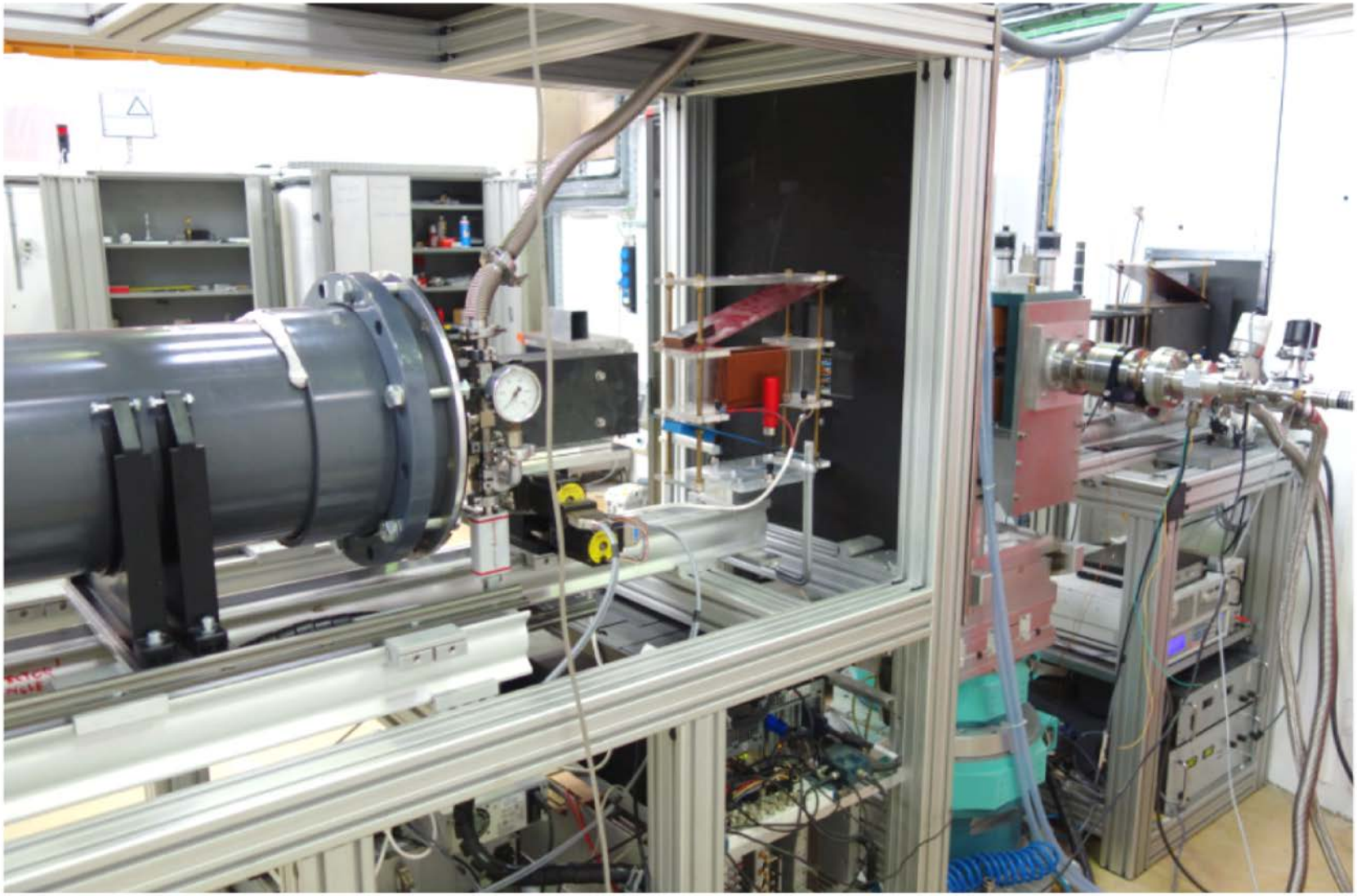


GISANS

ultra-high-resolution PNR

Modular design and modes of operation

Modular design and modes of operation



Modular design and modes of operation

Modular design and modes of operation

Casemate

The performance of Super ADAM at the end of 2016

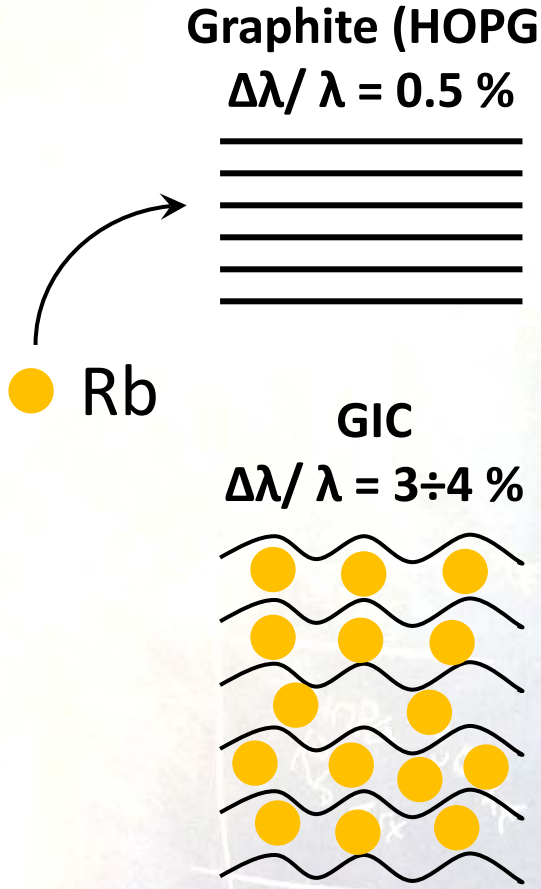
Characteristic	High resolution (HOPG monochromator)	High flux (GIC Monochromator)
Wavelength (Å)	5.18	5.2
$\Delta\lambda / \lambda$ (%)	0.5	? 3
$\Delta\alpha_i$ (mrad)	0.3*	**
Flux (n/s/cm^2)	6x10^5	? 1.5x10^6
Polarized flux (n/s/cm^2)	3x10^5	not applied
Typical polarisation (%)	99.7	not applied

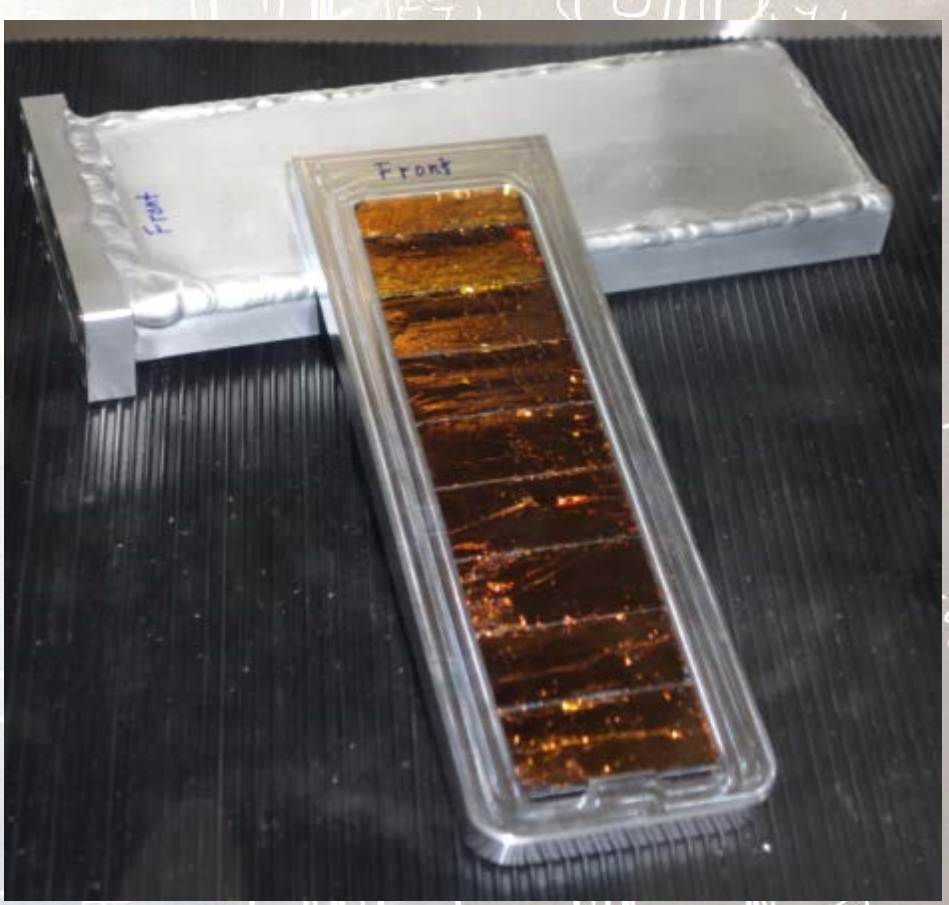
** variable value*

***the GIC monochromator option is currently under optimization and characterization*

Будущее … завтра

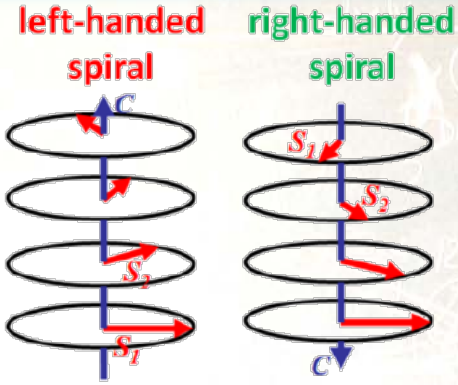
GIC = graphite intercalated compound

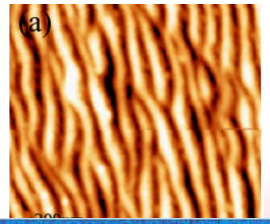


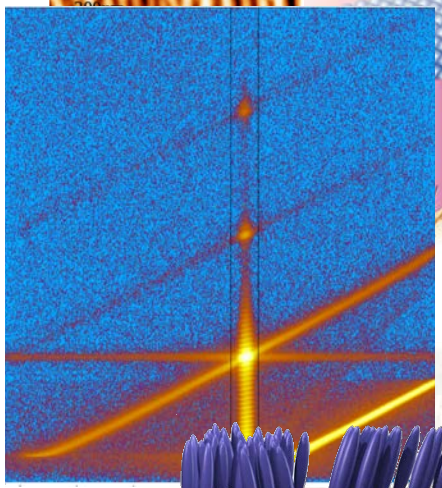


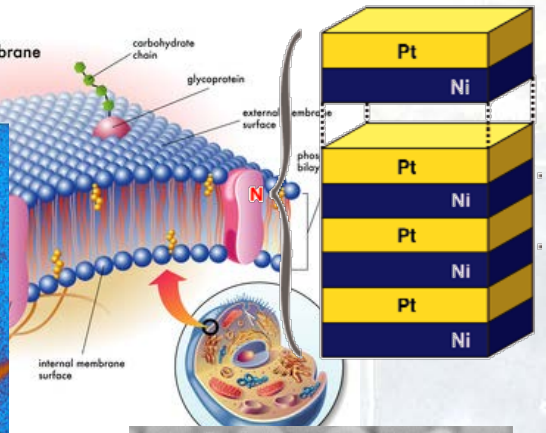
Будущее … завтра

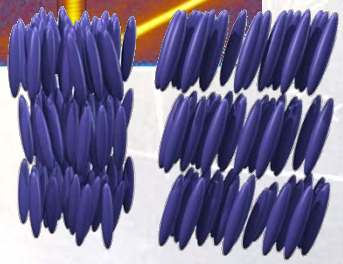
Scientific interests

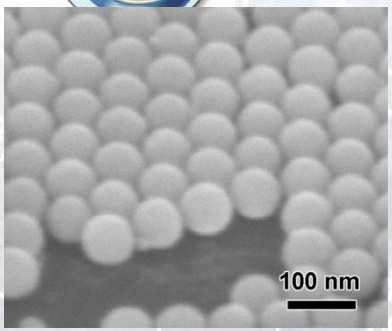












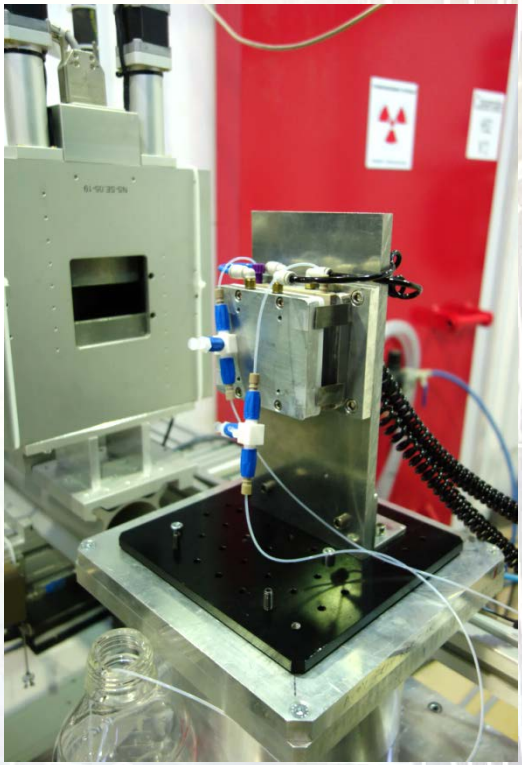
Solid Films and Superlattices:
- Layer magnetizations and hysteresis
- Exchange coupling
- Antiferromagnetic exchange coupling
- Exchange bias effects
- Isotopic superlattices
- Hydrogen profiles in metal superlattices
- Superconductivity

Soft Films and Multilayers:
- Langmuir-Blodgett films
- Liquids under shear
- Nanoparticles ordering at interfaces
- Polyelectrolytes
- Ion Implantation

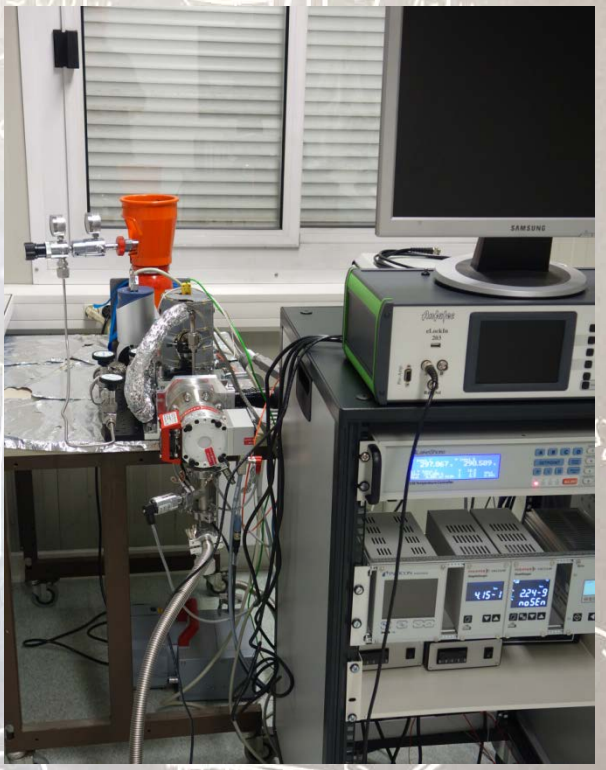
In-situ studies:
- Phase transitions
- Surface adsorption
- Intercalation
- Chemical reactions

Sample environment

1T electromagnet
(optionally 7T on D17)
2-400K cryostat



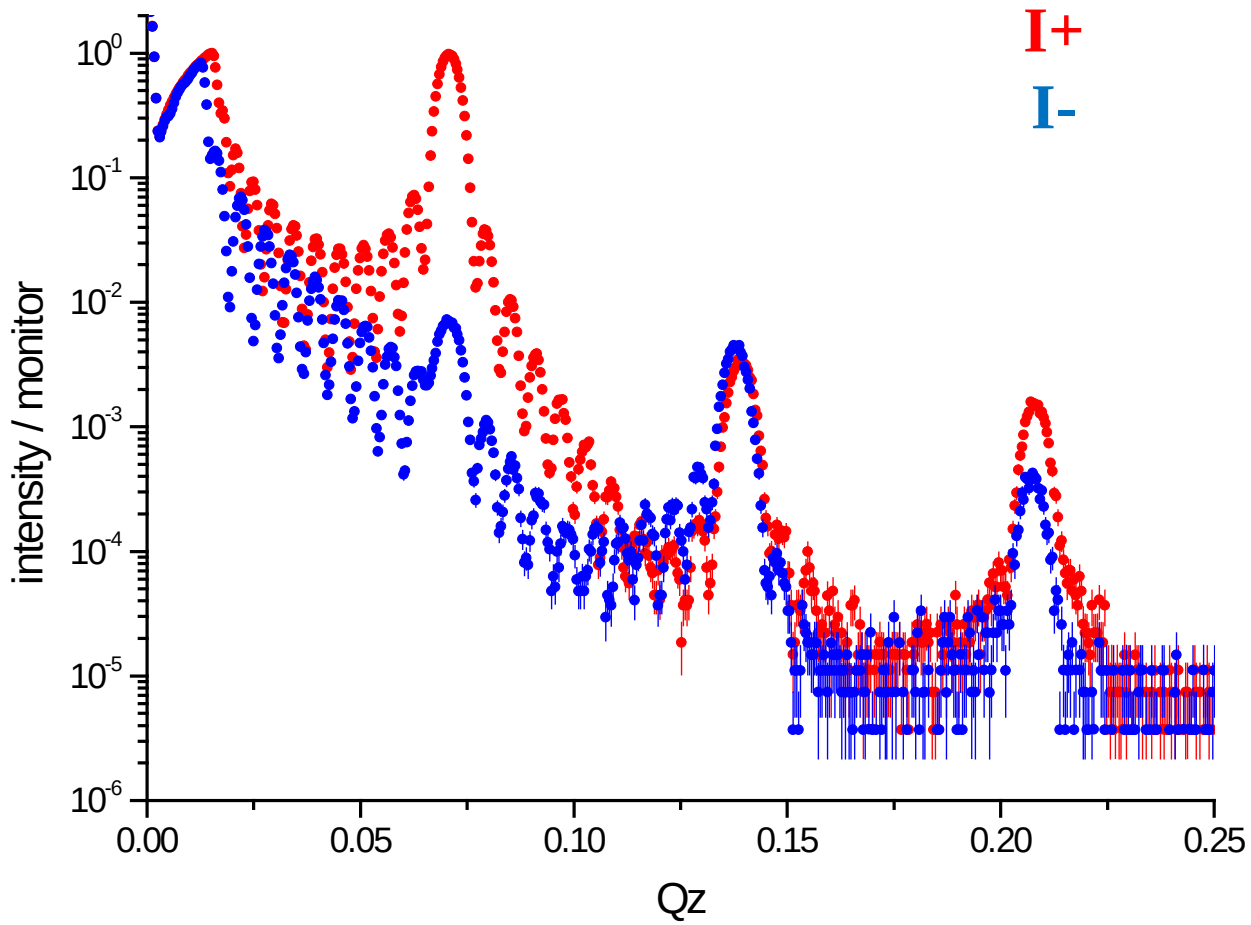
Sample cells for solid-liquid interfaces



In-situ gas loading chamber

Typical polarized experiments

Magnetic thin film and super-lattices for understanding of magnetism in confinement and neutron optics



Typical polarized experiments

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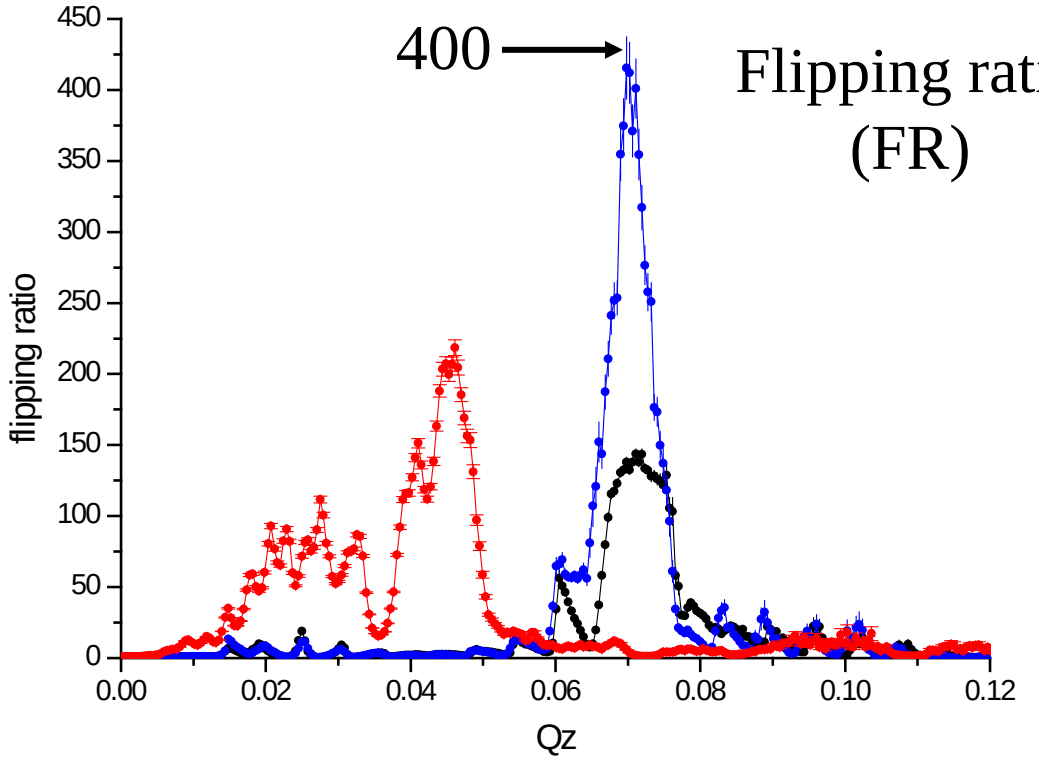


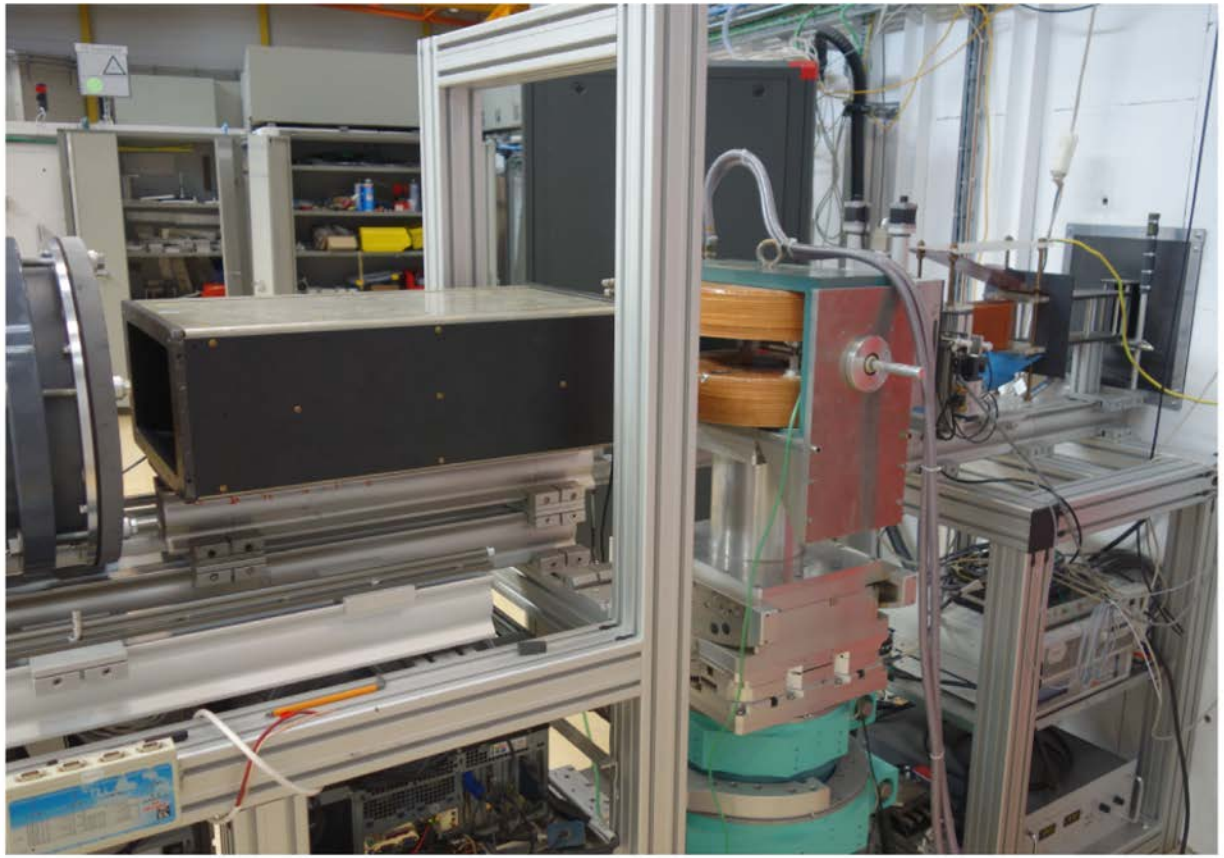
$P_p * P_a = (FR-1)/(FR+1) = \mathbf{1 - 2/FR}$

at FR >> 1

FR=20	$P_p * P_a = 90\%$
FR=200	$P_p * P_a = 99\%$
FR=2000	$P_p * P_a = 99.9\%$

Remarkable experiments

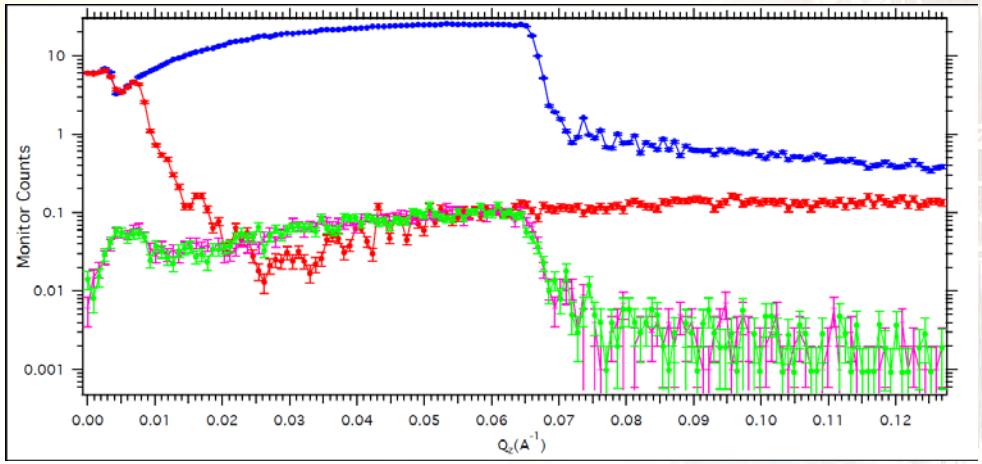
He^3 neutron spin filter

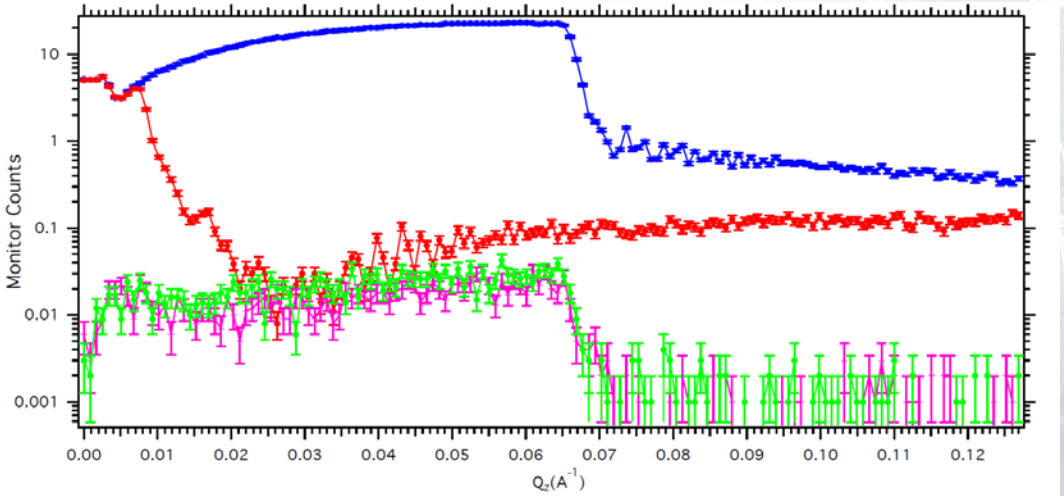


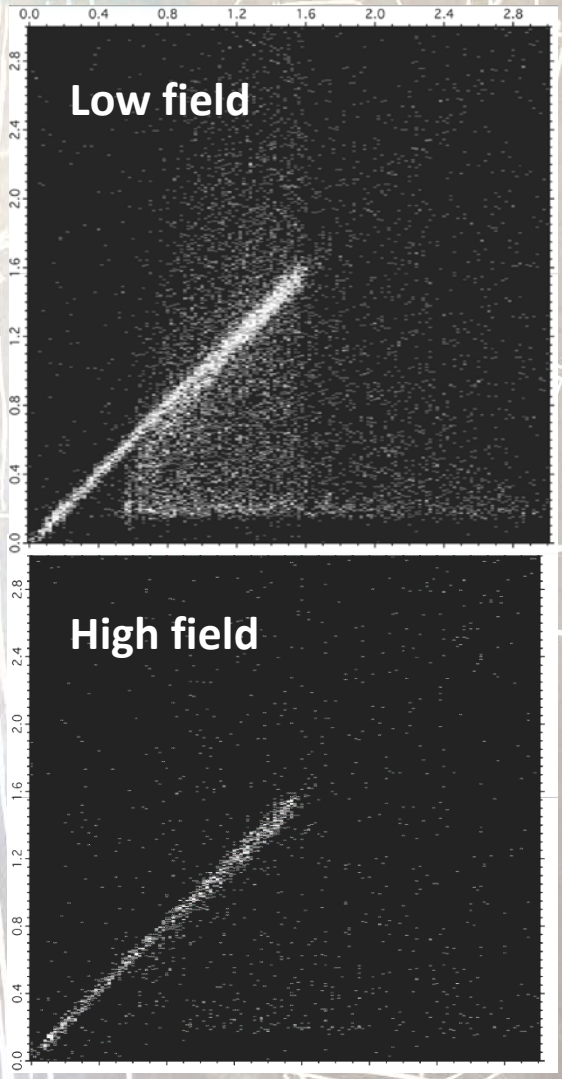
measurements with FR 1000 (P_p=99.8%) and polarization analysis of wide-angle (~5°) off-specular scattering are proved to be feasible

Remarkable experiments

He^3 neutron spin filter



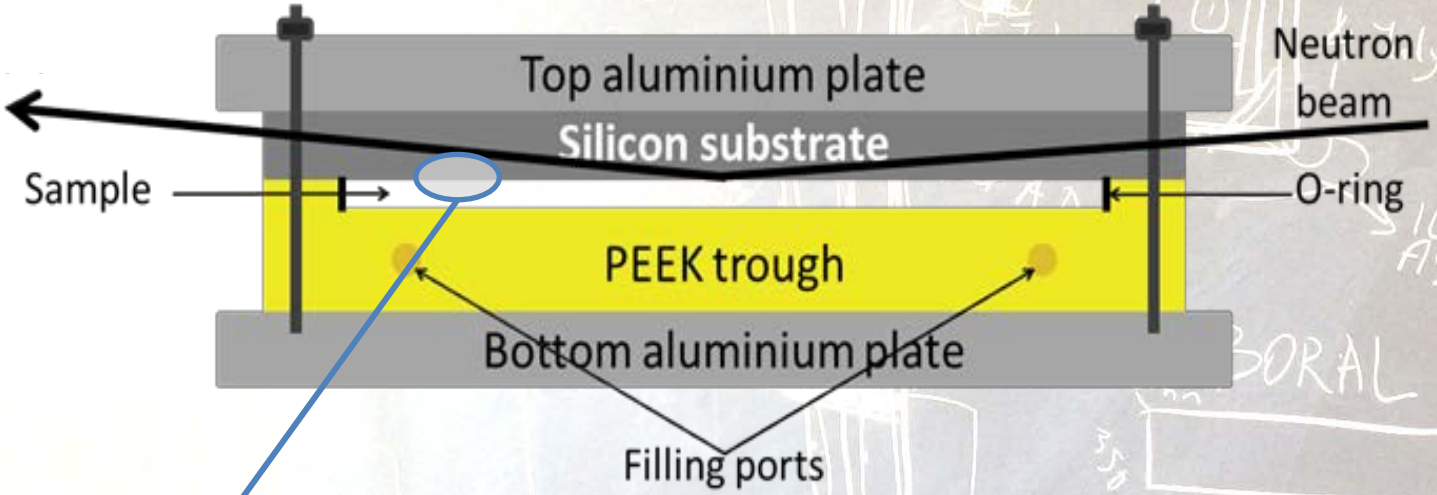


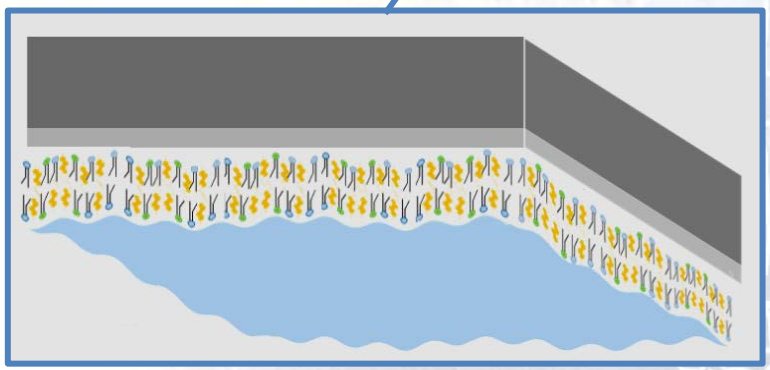


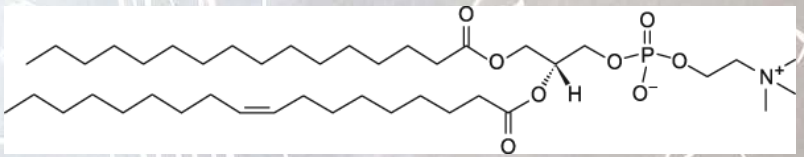
In the nearest plans: 3d polarization analysis with Cryopad etc. err($P_{x,y,z}$) < 0.3%

Remarkable experiments

Structure of non-magnetic solid-liquid interfaces using magnetic reference layers

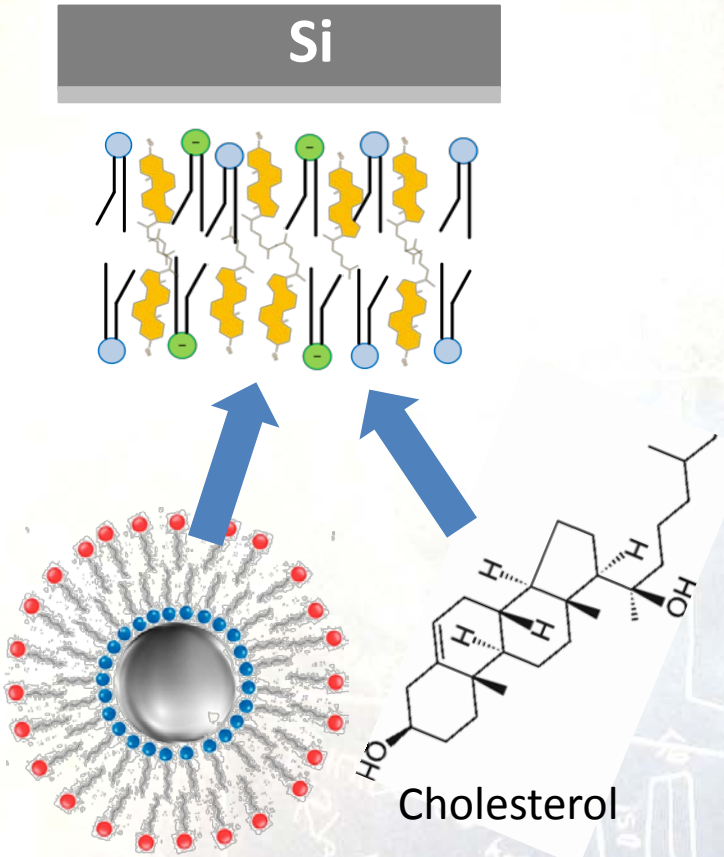


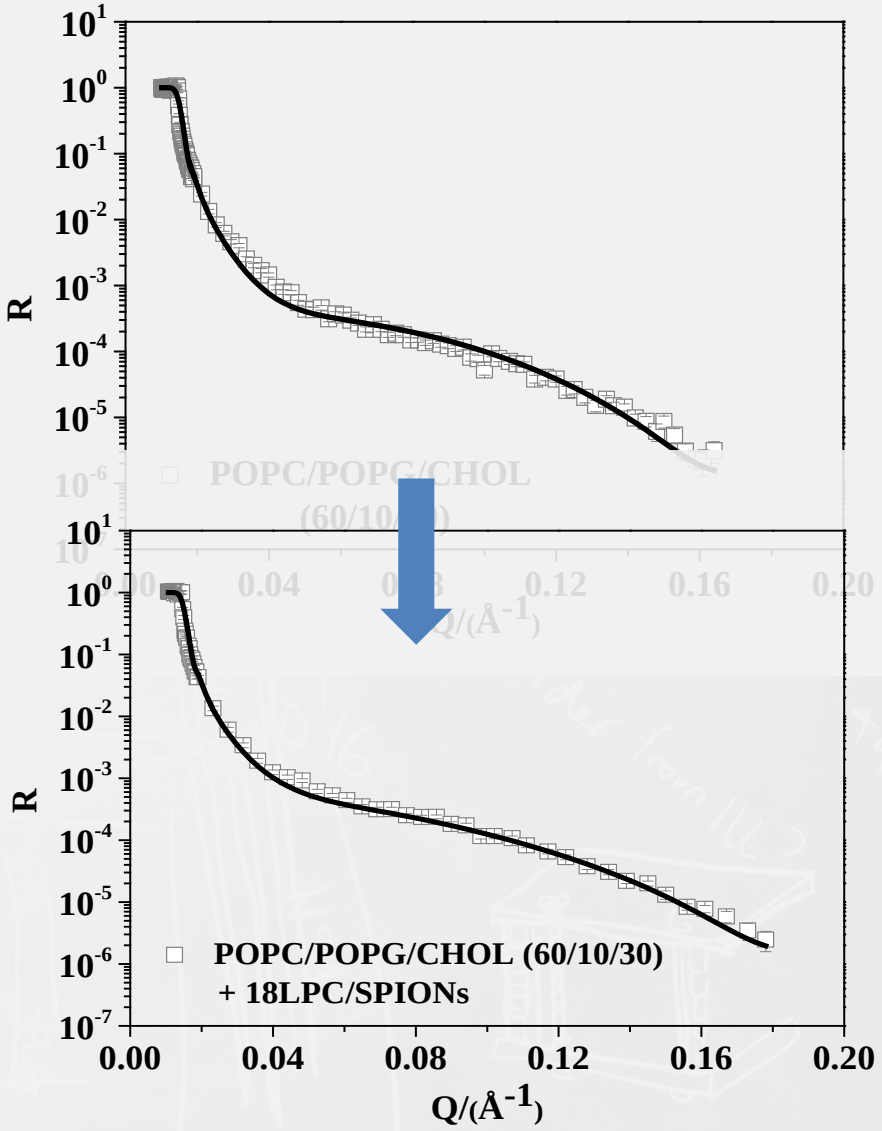




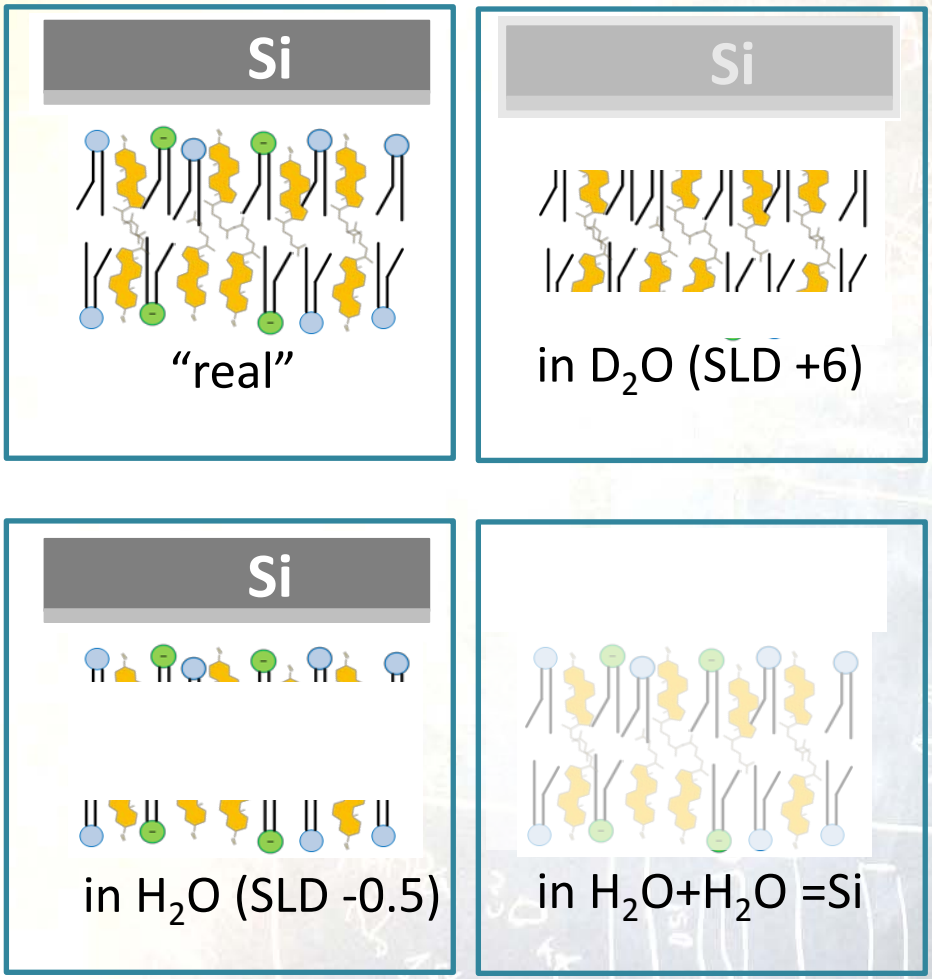
1-palmitoyl-2-oleoyl-*sn*-glycero-3-phosphocholine
as well as
other lipids, surfactants, ionic liquids,
nanoparticles
etc.

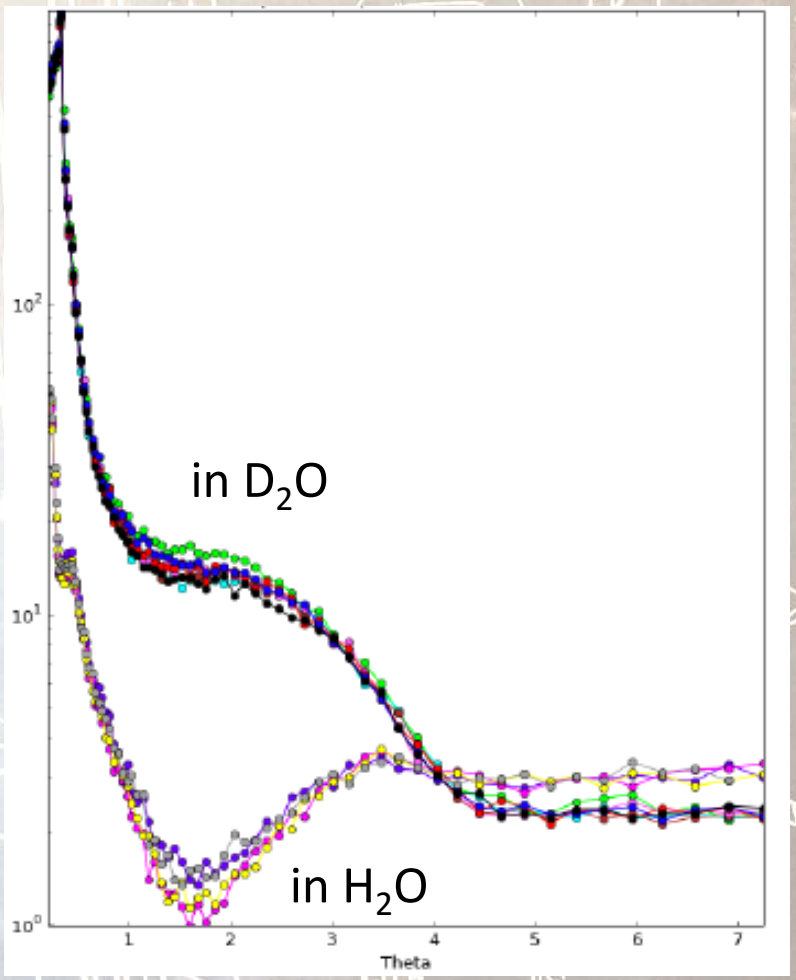
Structure of non-magnetic solid-liquid interfaces using magnetic reference layers





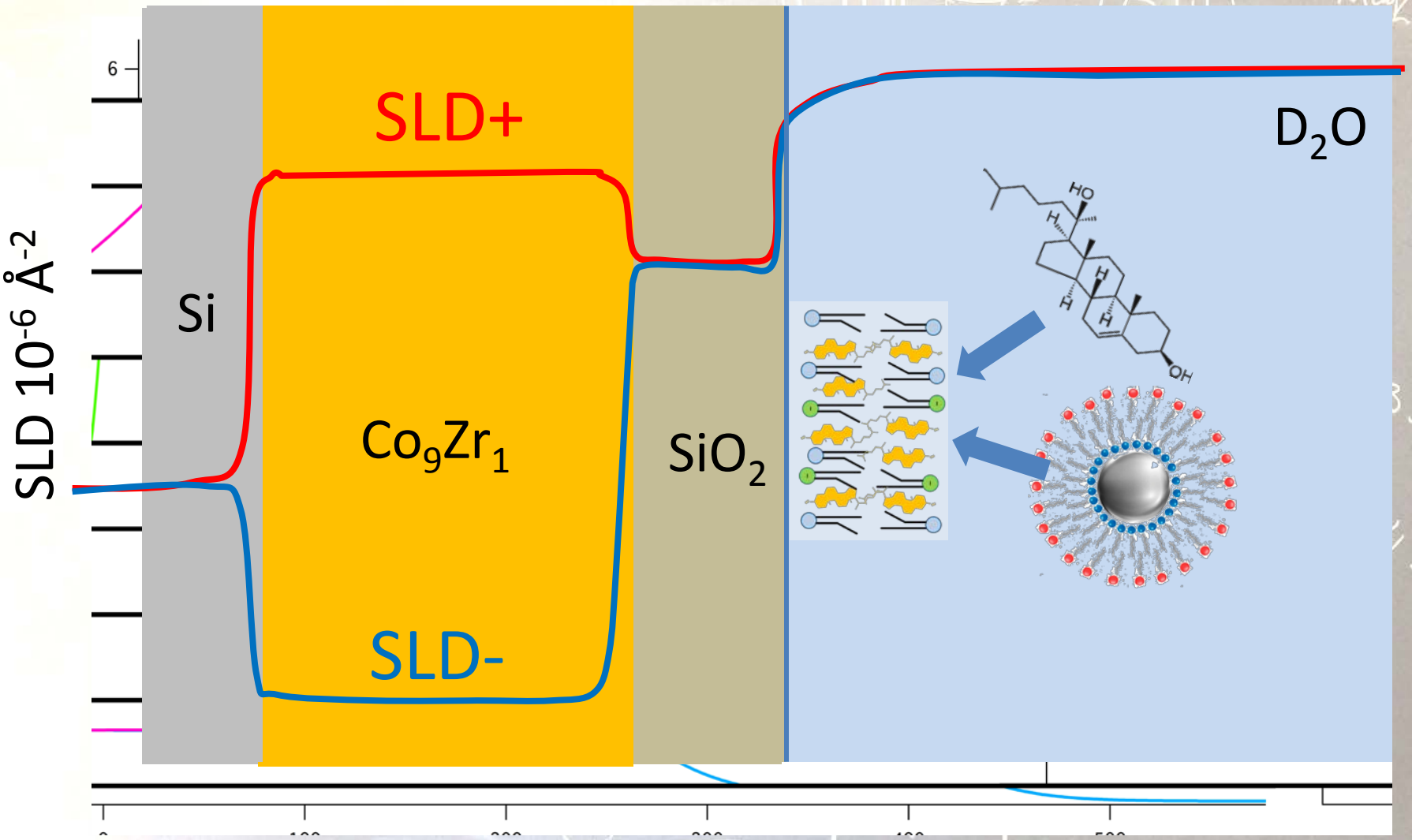
Structure of non-magnetic solid-liquid interfaces using magnetic reference layers



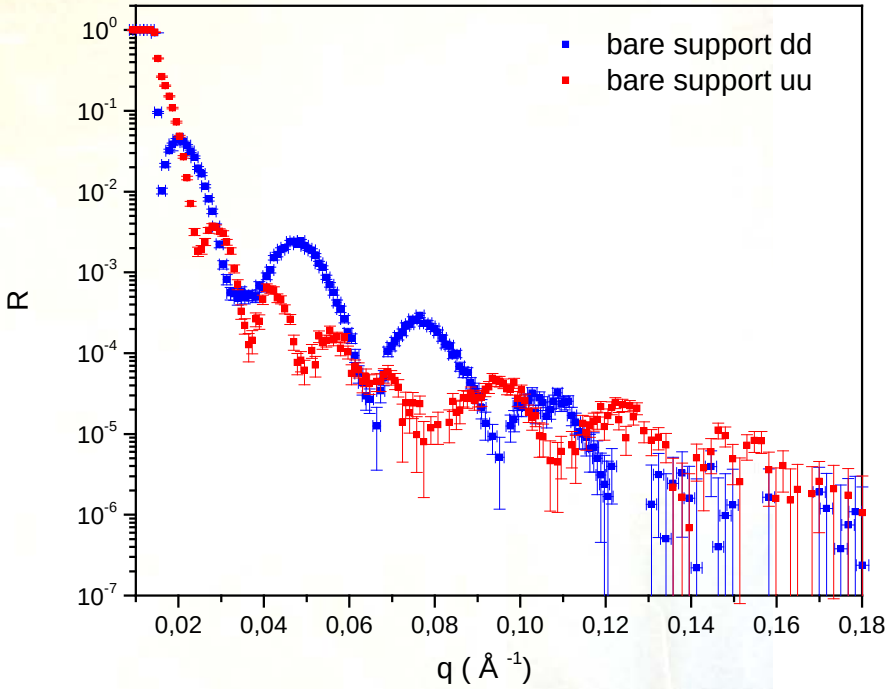


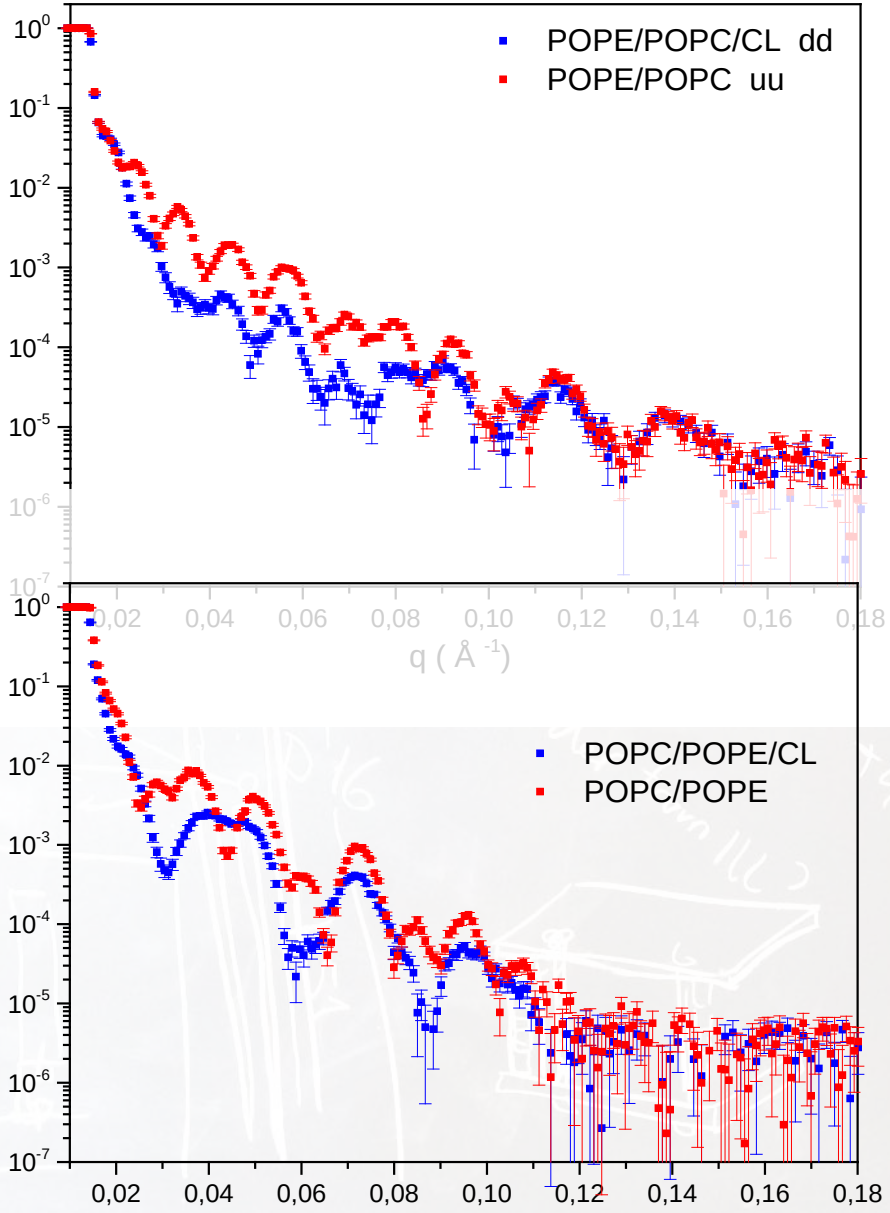
issues:
not complete refilling, washing out of the sample etc.

Structure of non-magnetic solid-liquid interfaces using magnetic reference layers



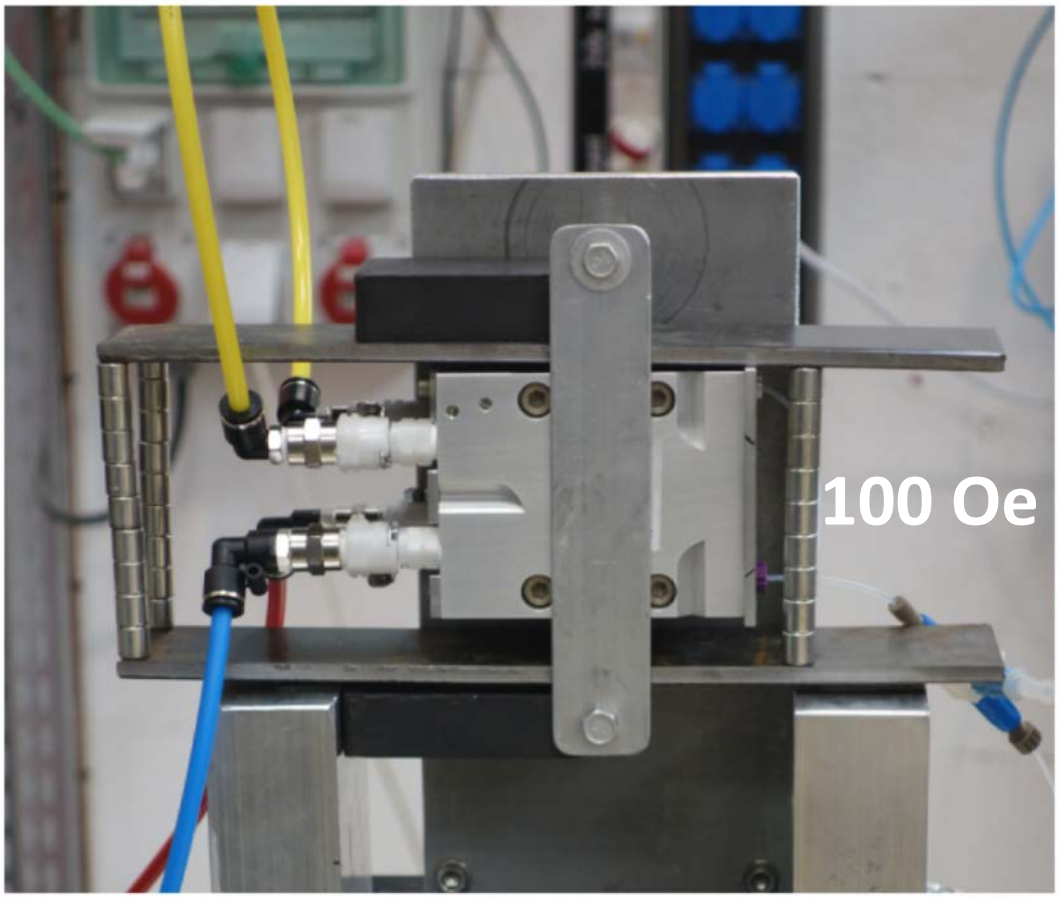
Structure of non-magnetic solid-liquid interfaces using magnetic reference layers





Remarkable experiments

Structure of solid-liquid interfaces using magnetic reference layers



Many thanks to all people involved in to the Super ADAM project!

Super ADAM team in Uppsala:
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