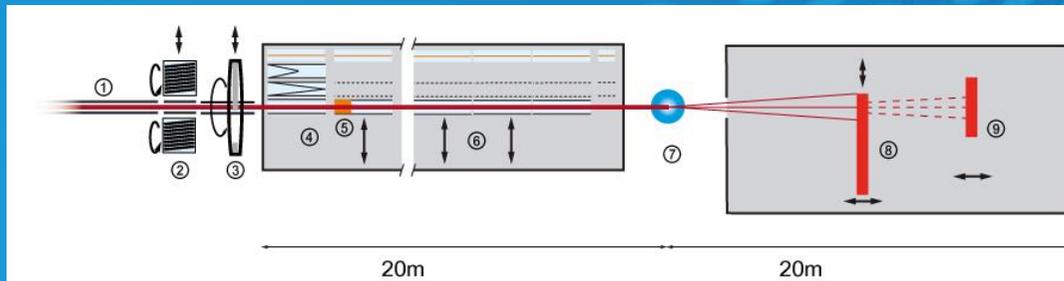


Experience of exploitation of instrument SANS1 at MLZ: advantages and disadvantages

Sven-Arne Siegfried

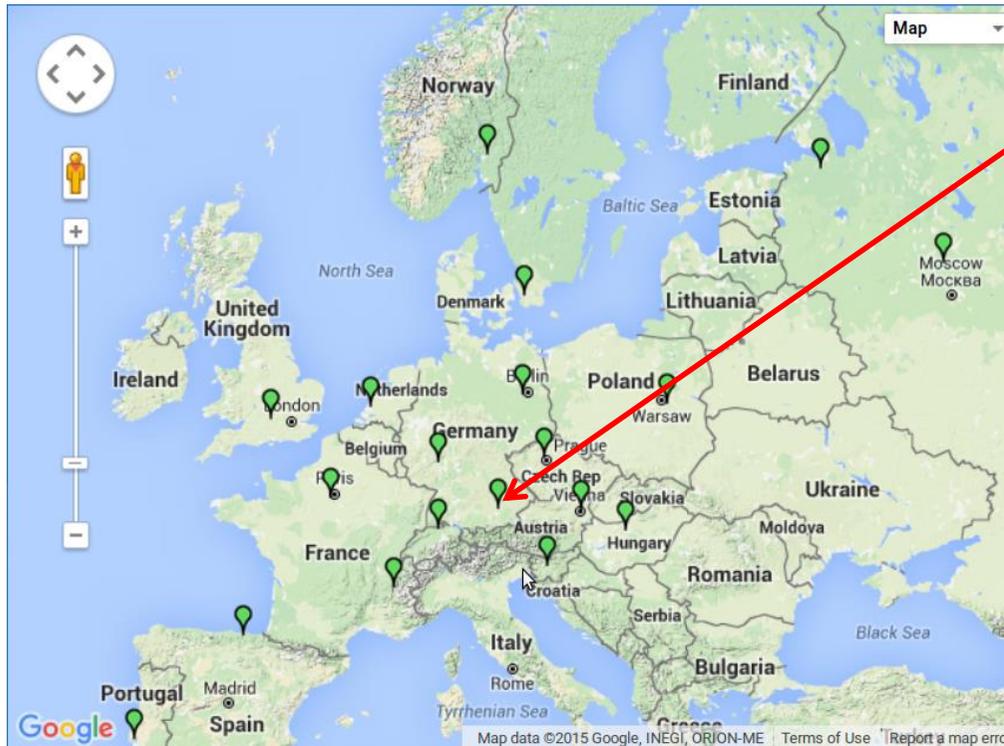


- ① Neutron guide NL4a
- ② Velocity selector 1+2
- ③ TISANE Chopper
- ④ Changeable polarisers
- ⑤ Spin flipper
- ⑥ 4 collimation sections 19 m
(neutron guide, collimation slits)

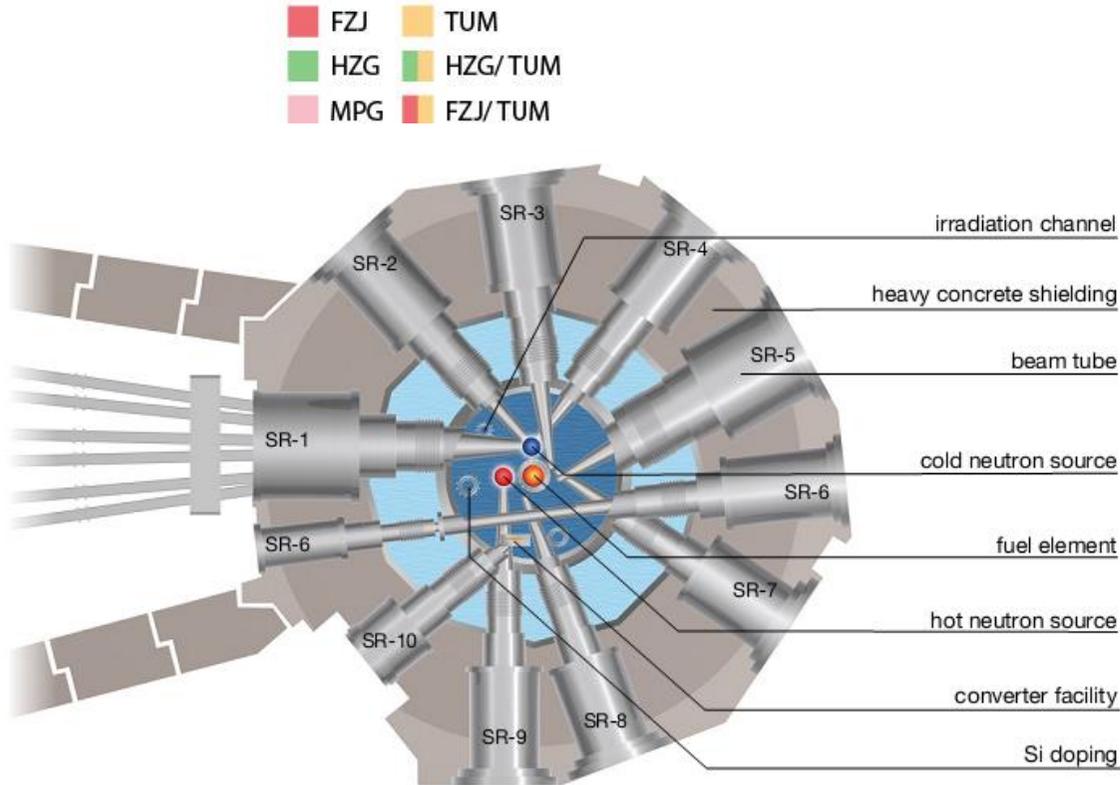
- ⑦ Sample position
- ⑧ Position sensitive area detector, 1 x 1 m²
- ⑨ High resolution position-sensitive
area detector, 0.5 x 0.5 m²
(installation 2016)



Heinz Maier-Leibnitz Zentrum (MLZ)

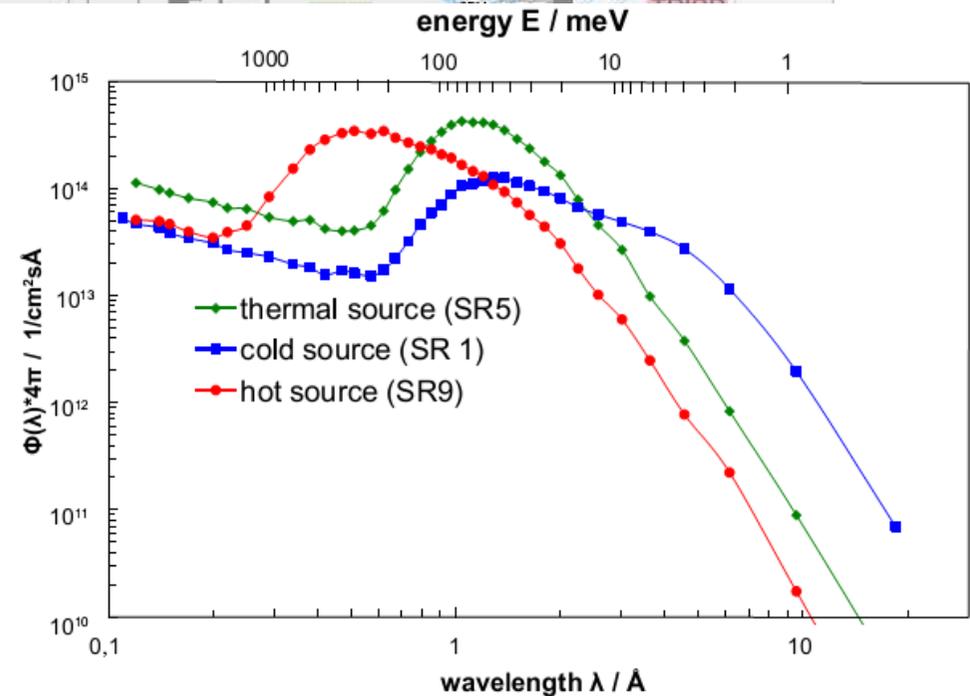
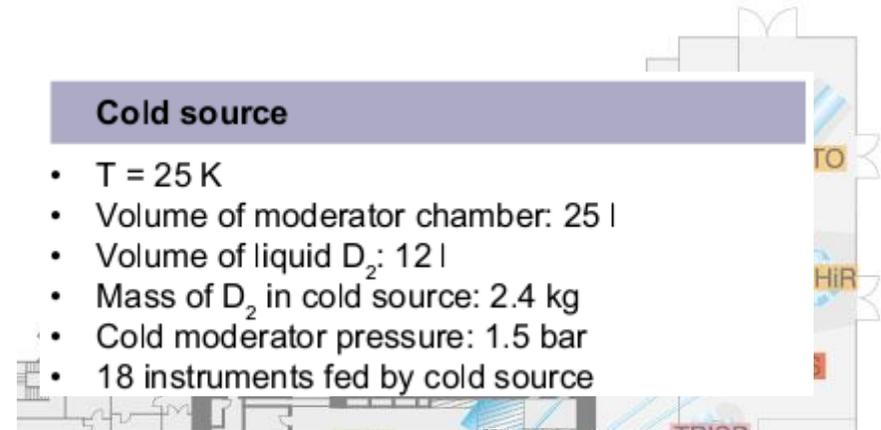


Research-neutrons source Heinz Maier-Leibnitz (FRM II)



Cold source

- $T = 25\text{ K}$
- Volume of moderator chamber: 25 l
- Volume of liquid D_2 : 12 l
- Mass of D_2 in cold source: 2.4 kg
- Cold moderator pressure: 1.5 bar
- 18 instruments fed by cold source

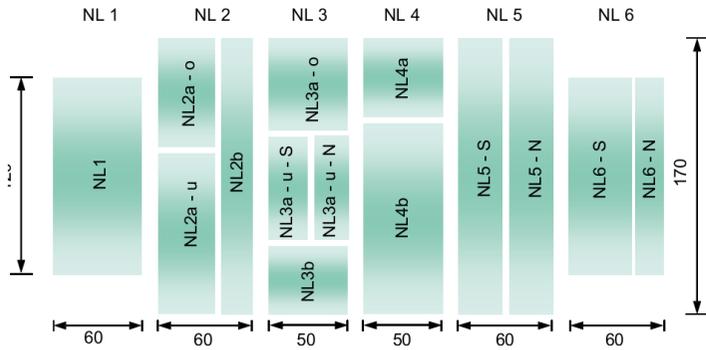
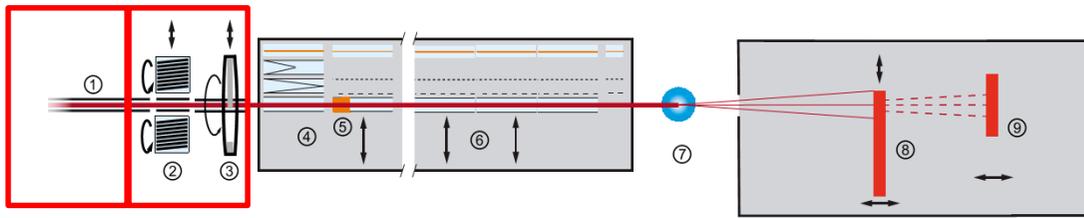


Reactor main parameters

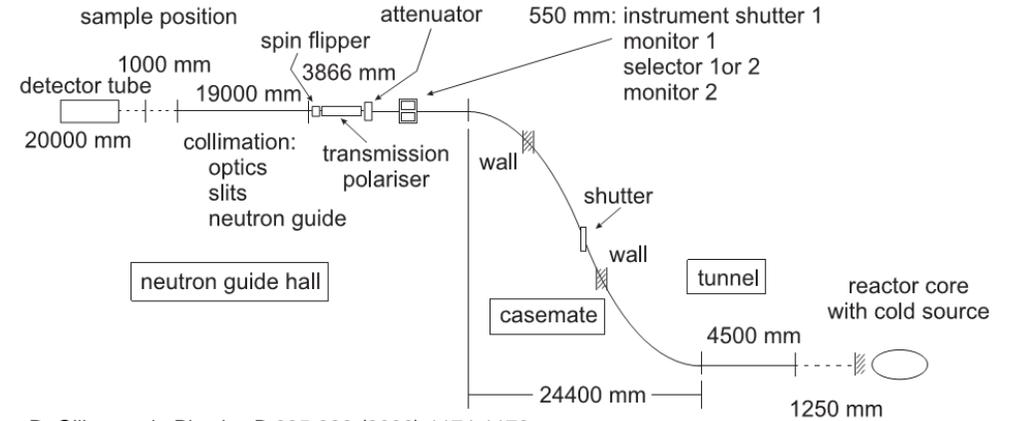
- Thermal power: 20 MW
- Max. undisturbed thermal neutron flux density: $8 \cdot 10^{14} \text{ n/cm}^2 \text{ s}^{-1}$
- 10 horizontal; 2 tilted beam tubes
- D_2O moderator
- H_2O cooling water

Instruments

- 26 instruments
- 6 instruments



Guide	NL4a
Length (m)	34
Section (mm²)	50 × 50
Coating up to	m = 2.0
Curvature (m)	480
Instrument(s)	SANS-1

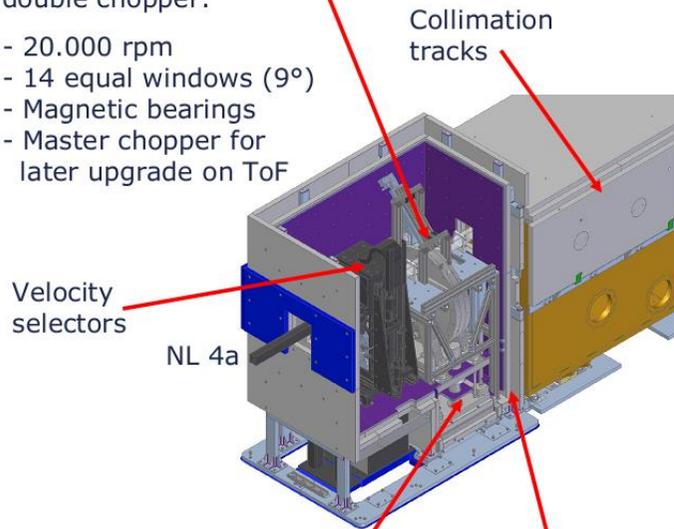


R. Gilles et al., Physica B 385-386 (2006) 1174-1176.

vertical S-shaped guide → cut off at $\bullet_c = 3 \text{ \AA}$

Astrium counter rotating double chopper:

- 20.000 rpm
- 14 equal windows (9°)
- Magnetic bearings
- Master chopper for later upgrade on ToF



Setup of the shielding: 05/2014

Commissioning: 10/2015



Huber-Table

Lifts the TISANE-Chopper into the beam position

New common shielding for both selectors and chopper

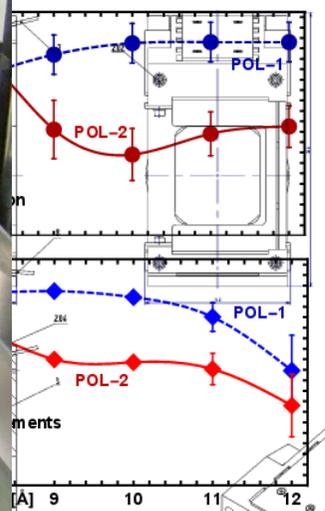
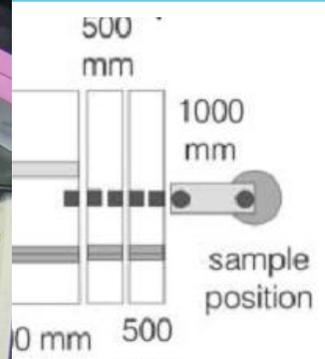
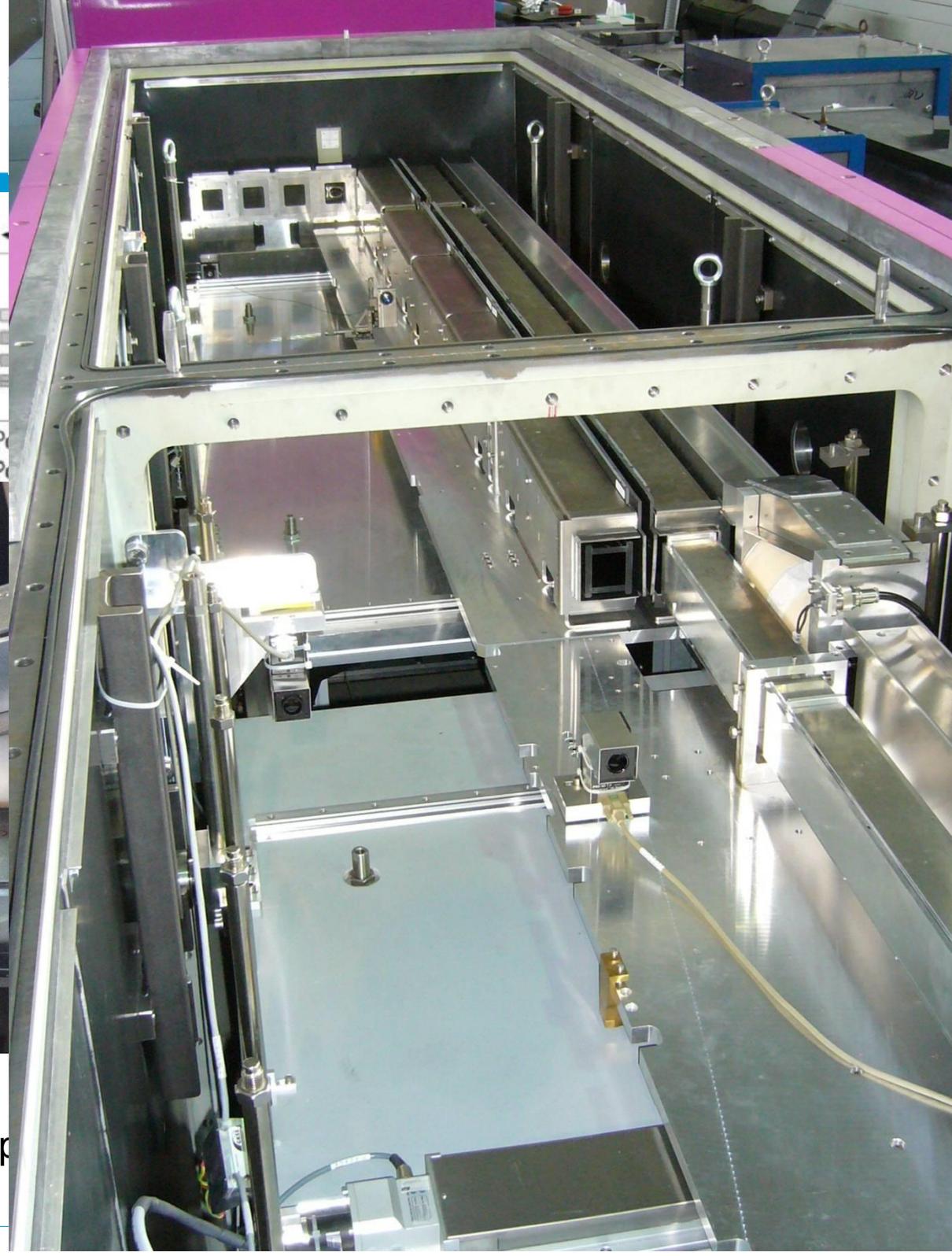
Comparison of flux and resolution for different selectors.

Selector type	Specifications of ASTRIUM	Monte Carlo simulation with <i>McStas</i>						
	Analytical resolution $\Delta\lambda/\lambda$ (%)†	Accessible wavelength range (Å)	No. of lamellae	Screwing angle (°)	Relative flux (%) and resolution $\Delta\lambda/\lambda$ (%)‡			
Standard	10.3	≥ 4.5	72	48.3	100	11.1	100	10.6
High intensity	18.4	≥ 4.5	45	42.9	186	19.2	189	18.6
High resolution No. 1	7.9	≥ 4.5	120	39.0	70	9.3	68	7.6
High resolution No. 2	6.2	≥ 5.6	144	42.9	52	7.5	50	6.1
High resolution No. 3	5.6	≥ 6.4	144	48.3	43	6.6	42	5.6

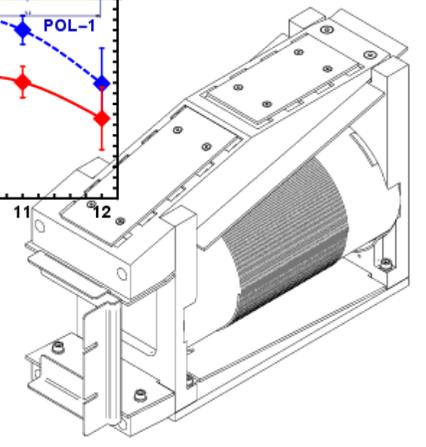
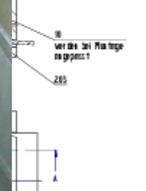
R. Gilles et al., J. Appl. Cryst. (2007). 40, s428–s432



Flipp



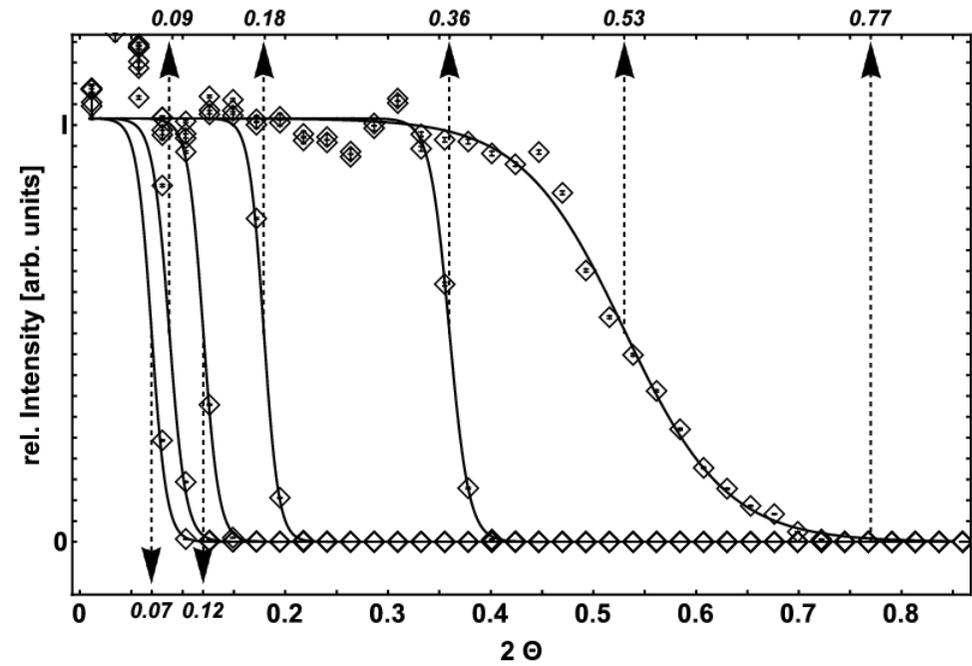
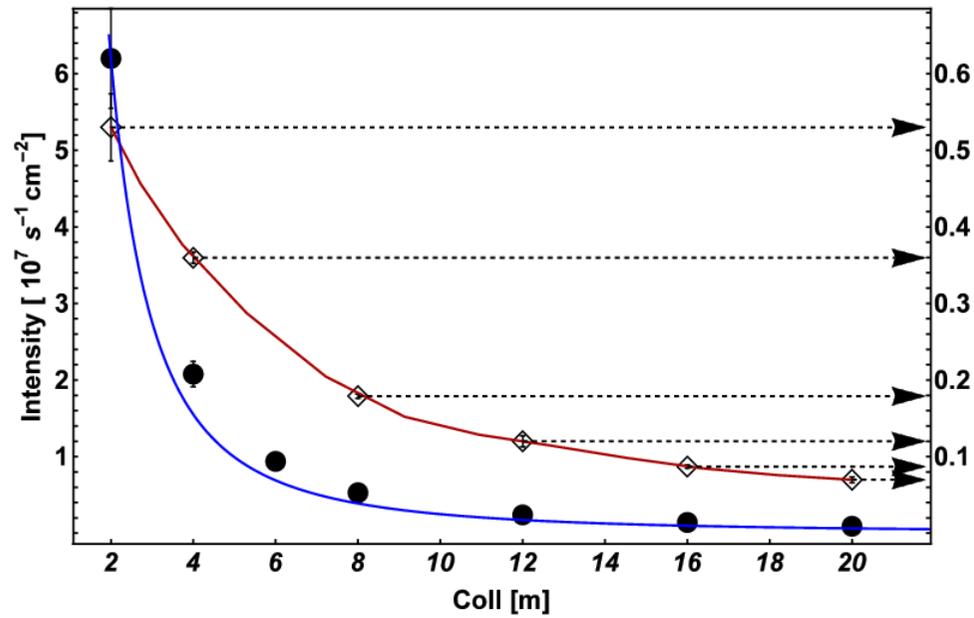
polished.



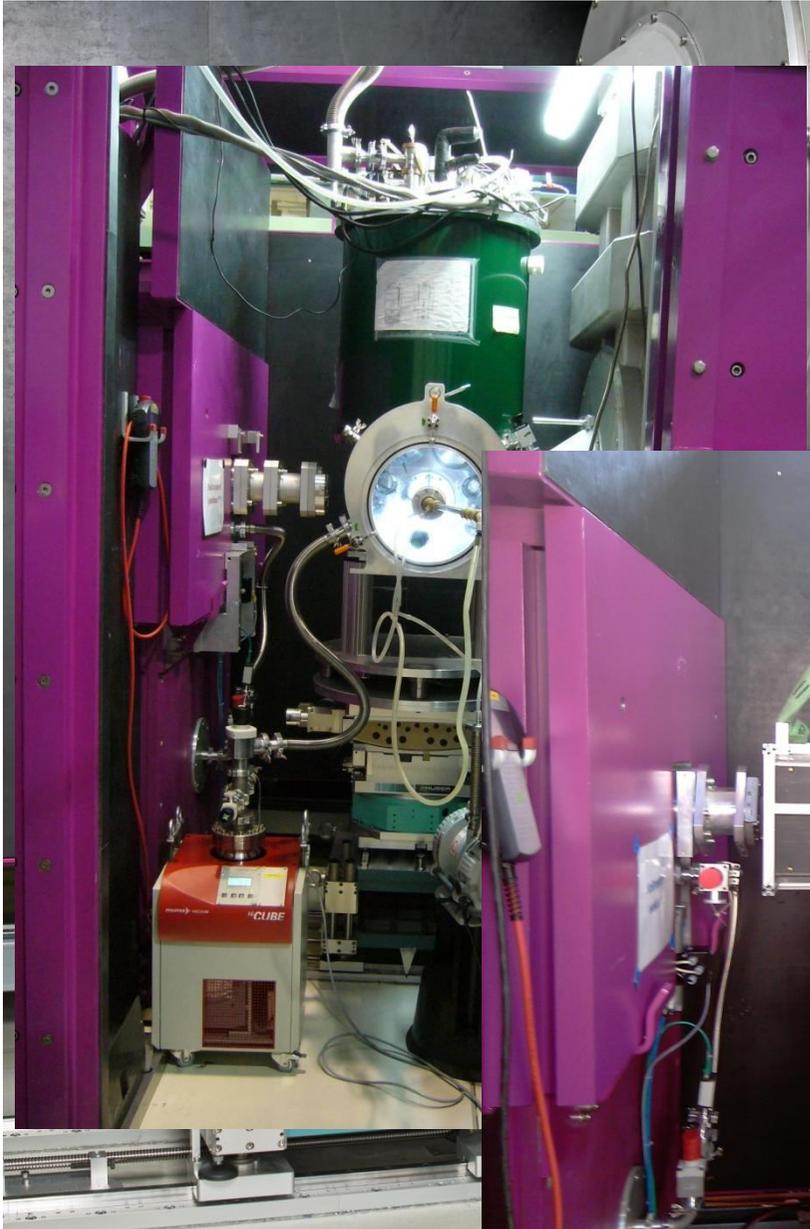
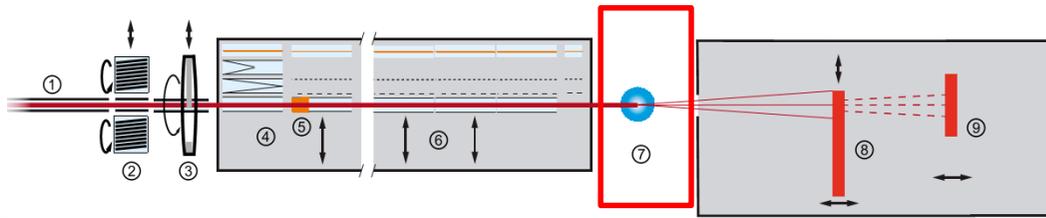
COPY

Project	...
Task	...
Lead	...
...	...

intensity & divergence

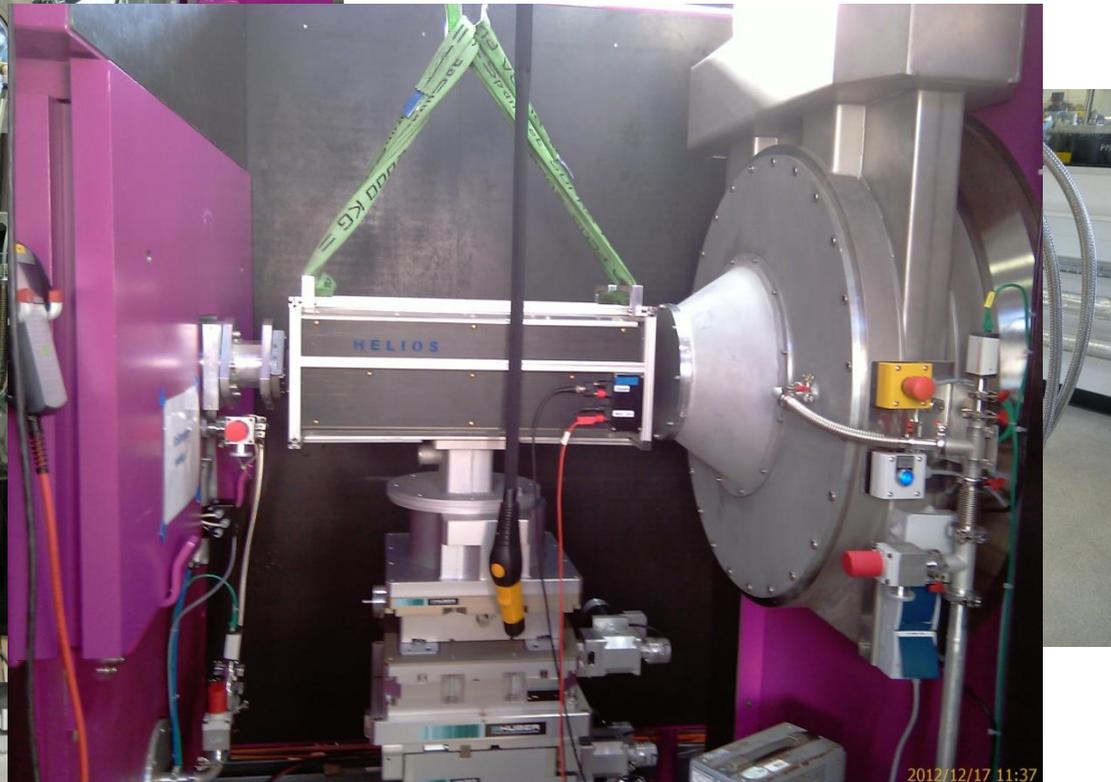


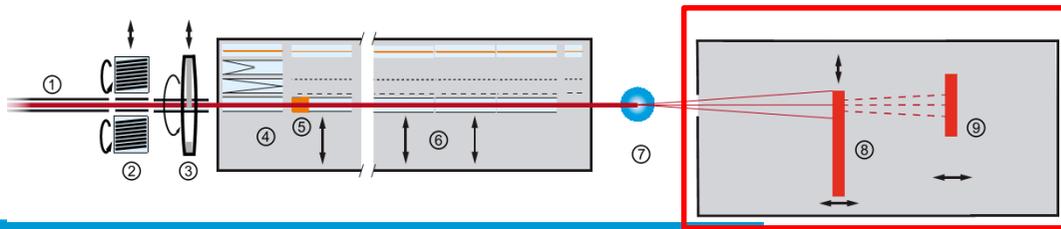
➤ 6 Å, maximum at 5.5 Å + 10 %



FRM II standard sample environment:

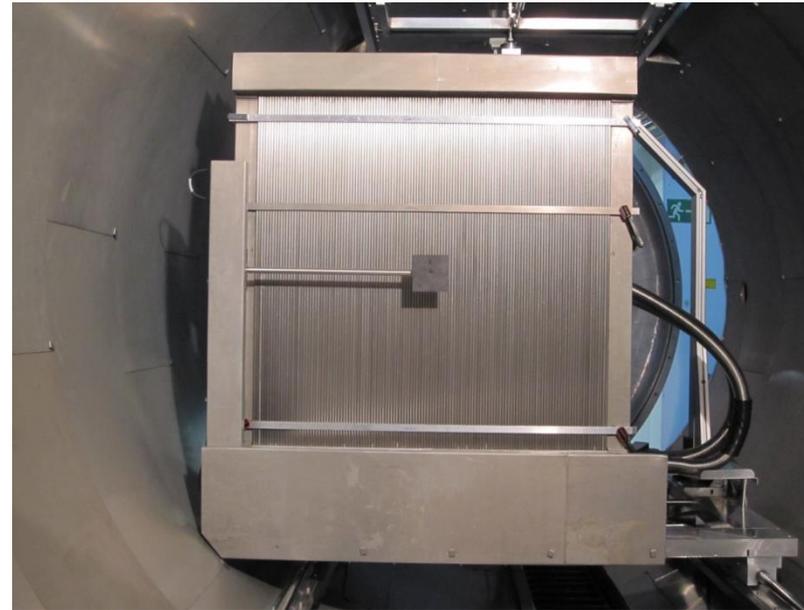
- Sample changer
- Low temperatures: cryo 3 K – 300 K (50 mK – 700 K)
- High temperatures: 2200 K
- High pressure: up to 7 Gpa
- Magnetic fields: up to 17 T
- Magic box





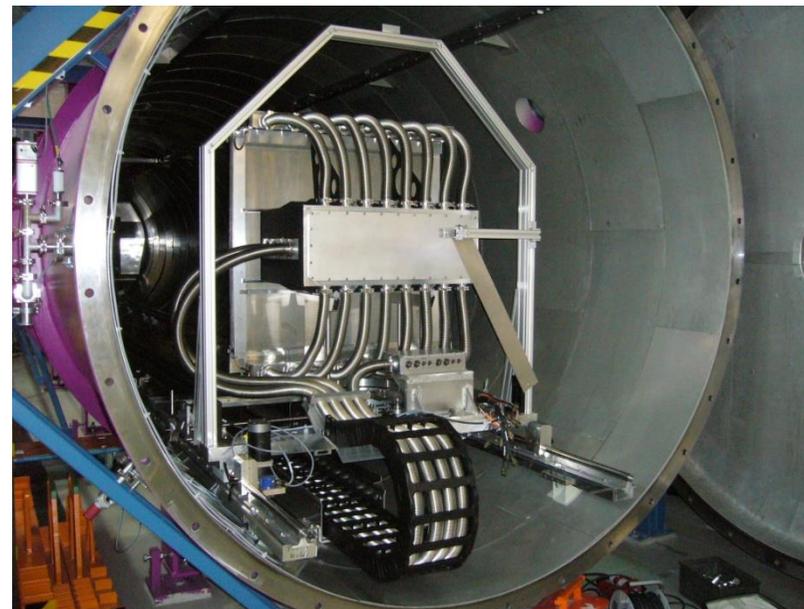
Primary:

- 128 He³ position sensitive tubes
- Active area 1000 x 1020 mm²
- 8 mm resolution
- 0.5 m lateral movement
- Counting capacity 1 MHz



Secondary:

- High resolution 3 mm
- Active area 500 x 500 mm²
- Installed 2016



Instrument control & software

NICOS - andreas at sans1ctrl1301@sans1ctrl.sans1.frm2

Application Script control Output Windows Tools Help

Connect Exit Setup Editor Watches Scans History Logbook Log files Errors

Experiment i...

- Proposal ...
- Title ...
- Users ...
- Local Contact ...
- Setups ...
- Samples ...
- Environments
- Detectors ...
- Scans ...
- Remark ...

Remark('Field Drop')

maw(B,0.025)

Remark('Field Wiggle')

```
for i in range(0,20):
    maw(B,field+0.003)
    maw(B,field-0.003)
    print(str(i))
```

for i in (0.003,-0.003,0.002,-0.002,0.001,-0.001,0):
 maw(B,i+field)

Remark('FG Scan FD 0.100 T to 0.025T + FW')

cscan(stl_omg,0.14, 0.15,1,time)

Status: Scan stl_omg :: Point 2/3 :: Counting

```
[10:49:52] B : at 0.022 T
[10:49:52] 17 : moving to 0.028 T
[10:50:10] B : at 0.028 T
[10:50:10] B : moving to 0.022 T
[10:50:28] B : at 0.022 T
[10:50:28] 18 : moving to 0.028 T
[10:50:46] B : at 0.028 T
[10:50:47] B : moving to 0.022 T
[10:51:07] B : at 0.022 T
[10:51:07] 19 : moving to 0.028 T
[10:51:26] B : at 0.028 T
[10:51:26] B : moving to 0.022 T
[10:51:44] B : at 0.022 T
[10:51:44] B : moving to 0.027 T
[10:51:47] WARNING: B_ccmsans : TACO write failed, retrying up to 8 times
[10:52:13] B : at 0.027 T
[10:52:13] B : moving to 0.023 T
[10:52:29] B : at 0.023 T
[10:52:29] B : moving to 0.026 T
[10:52:32] WARNING: B_ccmsans : TACO write failed, retrying up to 8 times
[10:52:51] B : at 0.026 T
[10:52:51] B : moving to 0.024 T
[10:53:06] B : at 0.024 T
[10:53:06] B : moving to 0.025 T
[10:53:09] WARNING: B_ccmsans : TACO write failed, retrying up to 8 times
[10:53:22] B : at 0.025 T
[10:53:39] =====
[10:53:39] Starting scan: cscan(stl_omg, 0.14, 0.15, 1, 1000)
[10:53:39] filename: 20150917101416_1416
[10:53:39] number: 1416
[10:53:39] filepath: /data/nicos/2015/.../data/...5.dat
[10:53:39] Started at: 2015-09-17 10:53:22
[10:53:39] =====
[10:53:39] # stl_omg T Ts B det1_timer det1_mon1 det1_mon2 det1.sum det1.BerSANS
[10:53:39] deg K K T s cts cts cts file
[10:53:39] -----
[11:10:22] 1/3 -0.01 0.453 0.453 0.025 1000.003 1607820 1668218 1960078 D0303541.001
```

TANGO

hardware

instrument control software

- developed at FRM-II
- not hardware/instrument limited

TACO (originally ESRF)

- building distributed control systems
- classes C++, C, Python, Labview

TANGO (started ESRF)

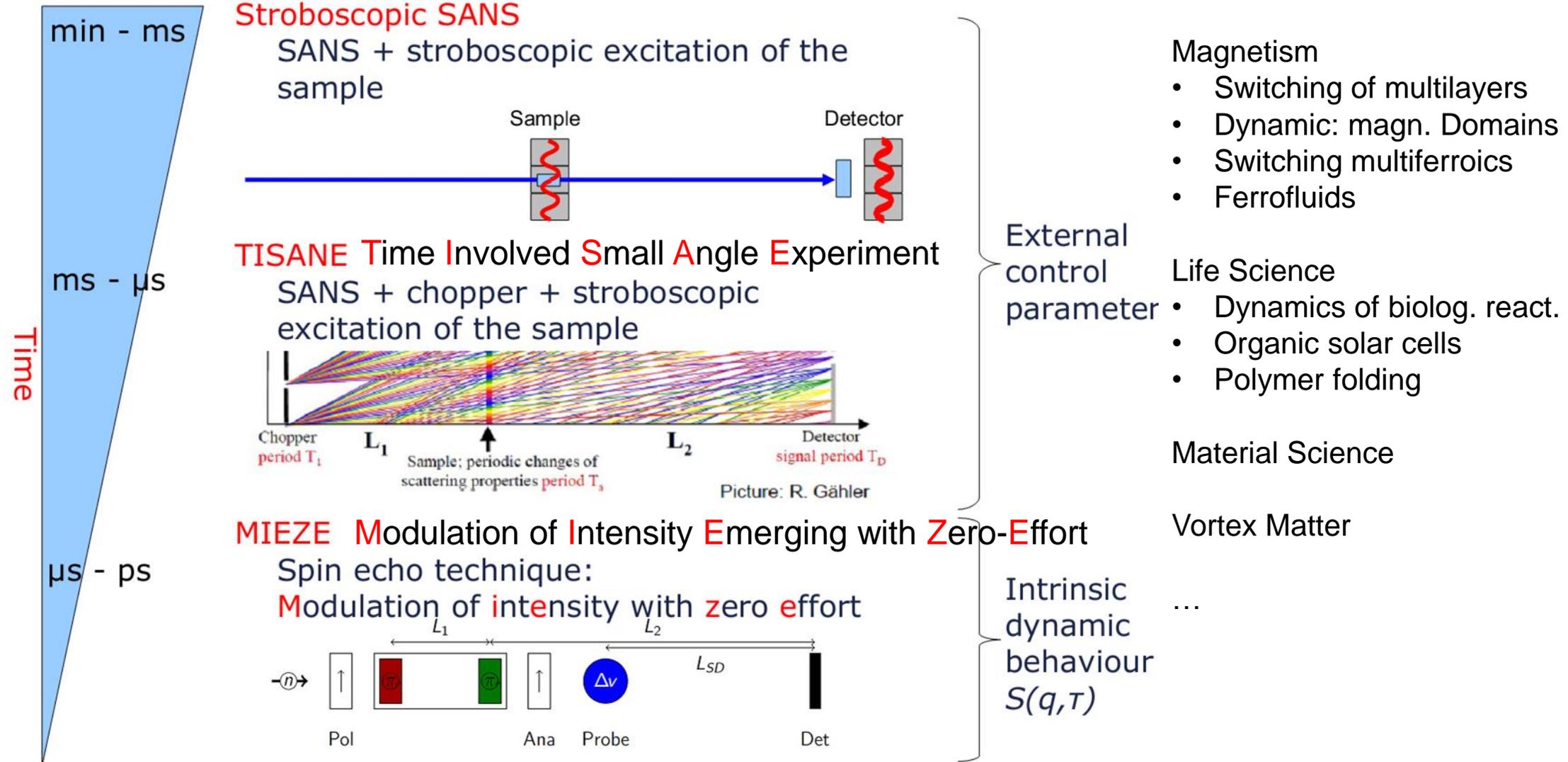
- Replacing TACO
- classes C++, Java, Python

Filter:

Name	Value	Status
T_ccr19.D	3.468 K	idle
T_ccr19	3.468 K	temperature not reached
T_ccr19.tube	3.468 K	preselection reached
collimation		
att	open	
bg1	20mm	
bg2	12mm	
col	20.000	idle
ng_pol	ng	
sa1	10mm	
cryo4		
cryo4_p1	0.0218 bar	idle
cryo4_p2	0.0218 bar	idle
cryo4_p3	0.0078 bar	idle
cryo4_p4	1.345 bar	idle
cryo4_p5	0.0078 bar	idle
cryo4_p6	0.00116 bar	idle
T_cryo4	0.454 K	temperature not reached
T_cryo4.A	0.454 K	idle
T_cryo4.B	2.616 K	alarm
det1		
det1_ev	861362 cts	counting
det1_mon1	0.50 cts	counting
det1_mon2	730159 cts	counting
det1_sum	1391 cts	counting
bs1_x	492.00 mm	idle
bs1_y	100.00 mm	idle
det1_hv	ON	idle
det1_hv_offtime	0:00:05	hv_supply=idle
det1_omg	0.0 deg	tripped
det1_x	4.0 mm	tripped
det1_z	20000.1	tripped
guidehall		
Crane	50.193 m	idle
Sixfold	open	idle
manual		
sa2	12 mm	
outerworld		
meteo	25.5 C	
sample_table_1		
stl_chi	-0.00 deg	idle
stl_omg	0.14 deg	idle
stl_phi	0.00 deg	idle
stl_x	-160.00 mm	idle
stl_y	8.50 mm	idle
stl_z	-6.00 mm	idle
selector_tower		
selector_ng	SEL1	blocked
selector_tilt	-0.0 deg	blocked
system		
email		
Exp		
Instrument		
Sample		
Space	105.054 GiB	1.05.06 GiB free
wut		
p_diff_wut	0.15 bar	
p_in_wut	4.12 bar	
p_out_wut	3.94 bar	

<https://forge.frm2.tum.de/wiki/>

Outlook: TISANE, MIEZE, TOF



summary

advantages:

- one of the best SANS machines worldwide
- high flux, low background
- flexible: broad application range
- good team 😊

disadvantages (minor):

- space: sample position, ...
- accessibility: collimation, ...
- missing remote shutter
- slit system: size, position, shape

things to keep in mind:

- keep it easy, no 'swiss army knife'
- absolute encoder
- shielding
- plan the software/ instrument control early
- vacuum test chamber
- detector: high counting rate
- no dry cryos/ magnets – He return
- no shielded magnets

Acknowledgments

A. Heineman
S. Busch
A. Beldowski
O. Frank
A. Schreyer
...



S. Mühlbauer
A. Wilhelm
S. Semecky
R. Gilles
...



Thank you for your attention