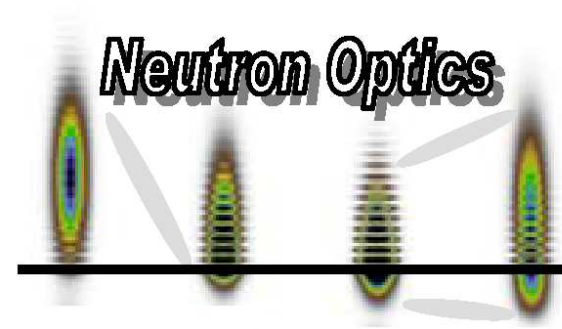
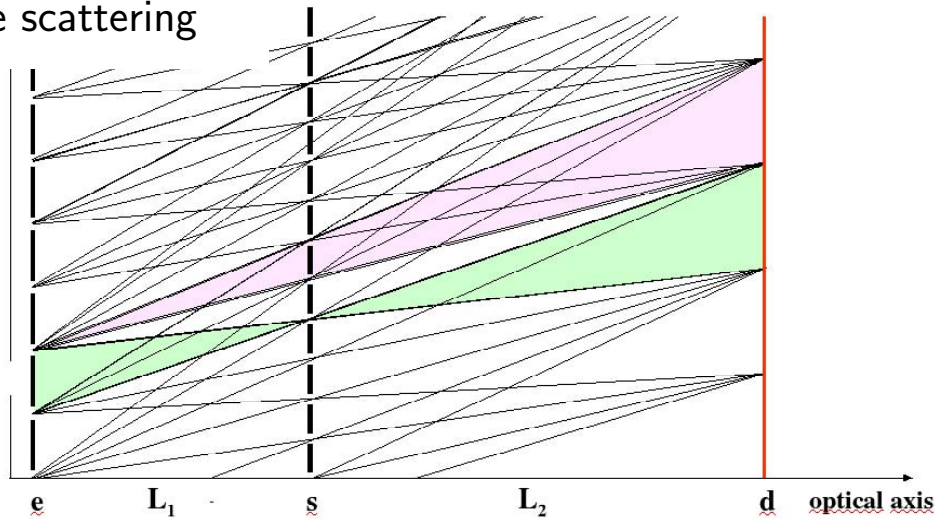


TUM	Germany	P. Böni
CEA-LLB	France	F. Ott
HMI	Germany	T. Krist
PSI	Switzerland	J. Stahn
BNC-RISP	Hungary	J. Füzi
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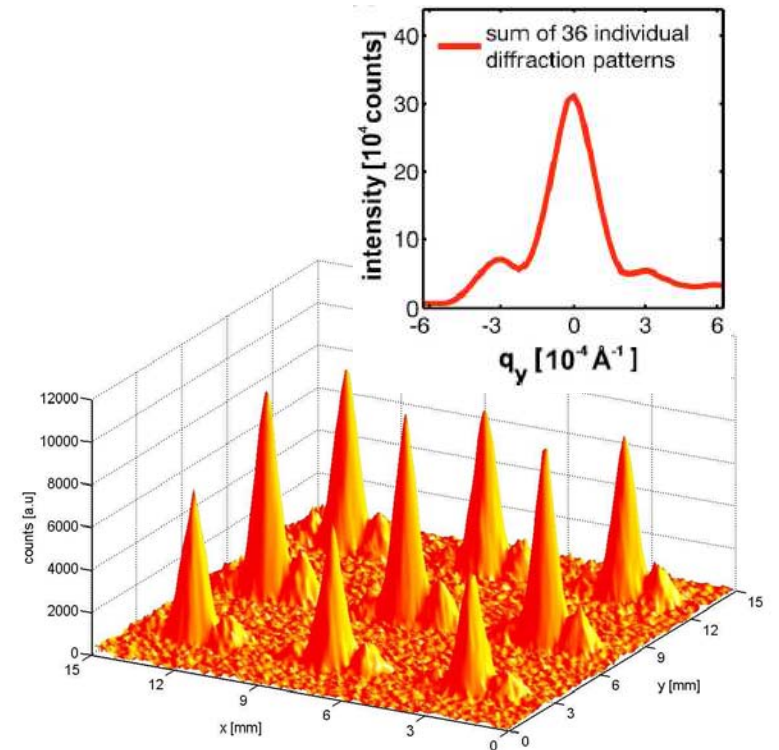
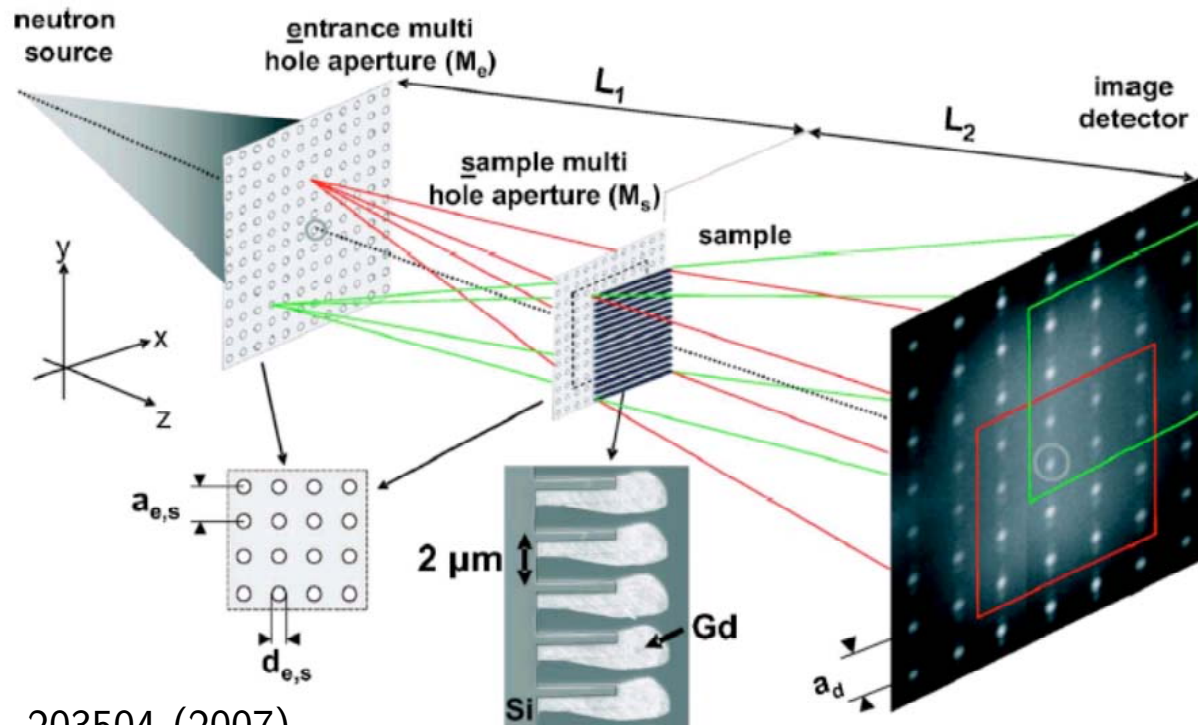


- T1 **honeycomb lenses, multi beam, beam conditioning for SANS, solid state devices**
TUM, **LLB**, PSI, HMI, BNC, INFM
- T2 **focusing devices** (not solid state), more homogenous phase space, optimum transport
TUM, PSI
- T3 diffuse scattering, **new sputtering techniques**, reduce roughness, stress
TUM, **PSI**, HMI, BNC
- T4 phase space transformation, UCN, **thermal neutrons by moving monochromators**
PSI

multi beam small angle scattering



P. Böni, TUM
 S. Mühlbauer, TUM
 M. Ay, PSI
 R. Gähler, ILL
 et al.

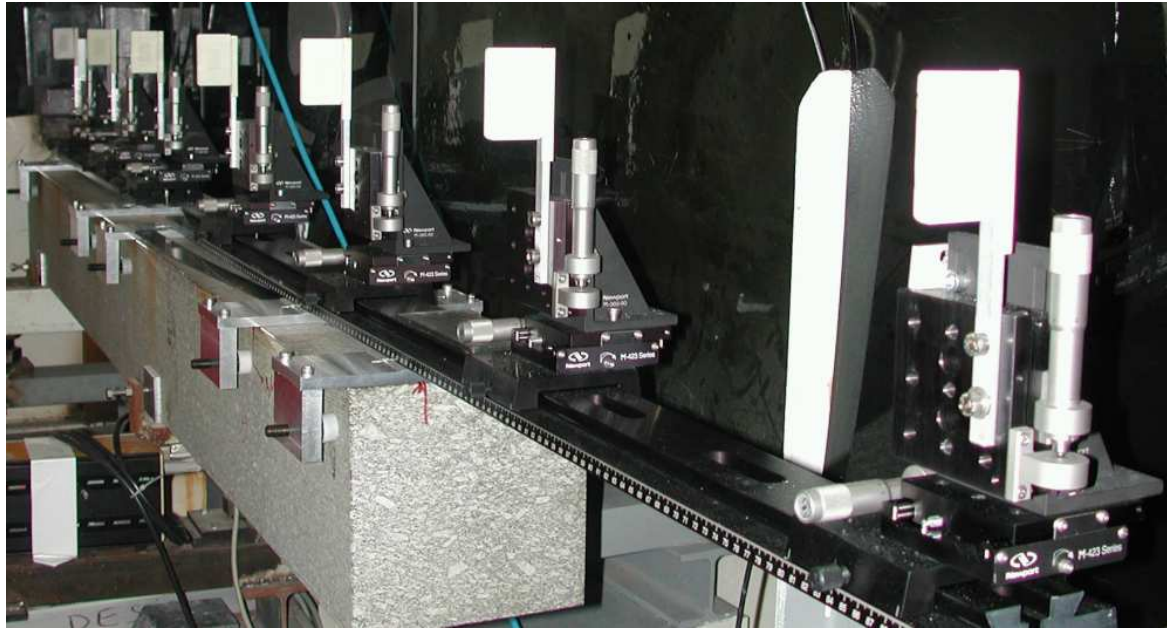


APL 91, 203504 (2007)

experiments realised on MIRA at FRM II

small angle scattering with a focused bundle of collimated beams

F. Ott, LLB

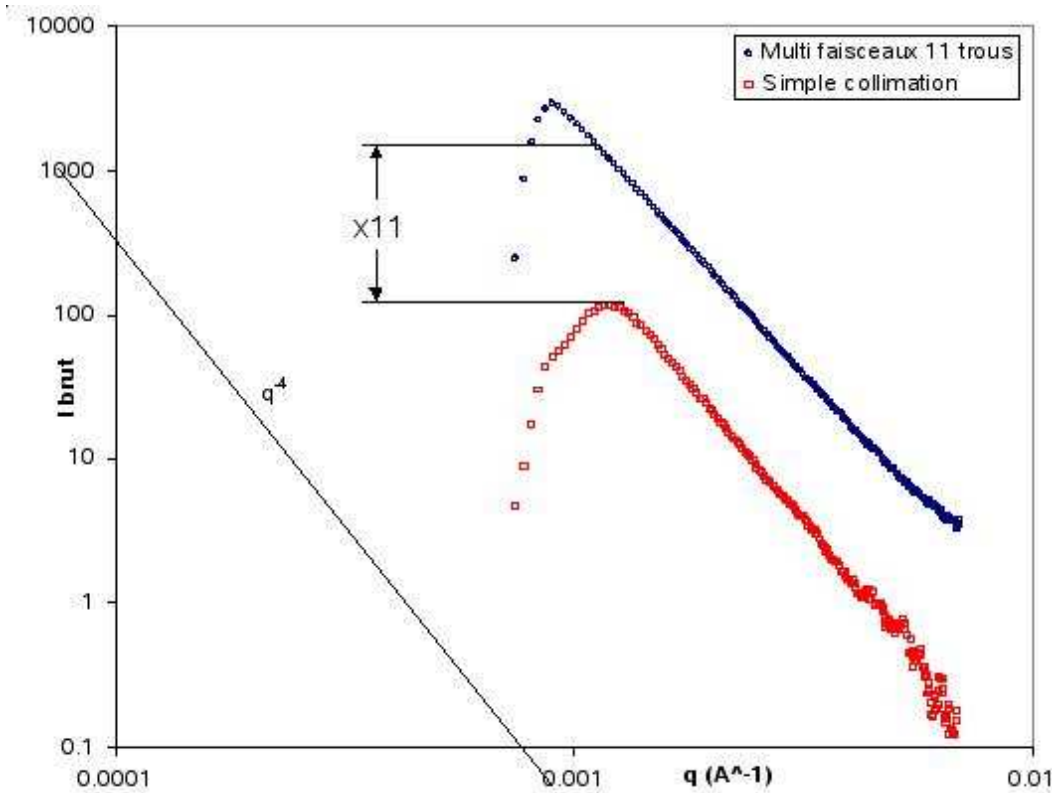


set-up on TPA:	collimation length	2.85 m
	entrance pinhole	1.31 mm
	exit pinhole	0.91 mm
	masks	13
	min. between 2 pinholes	0.4 mm
	pinholes / masks	400



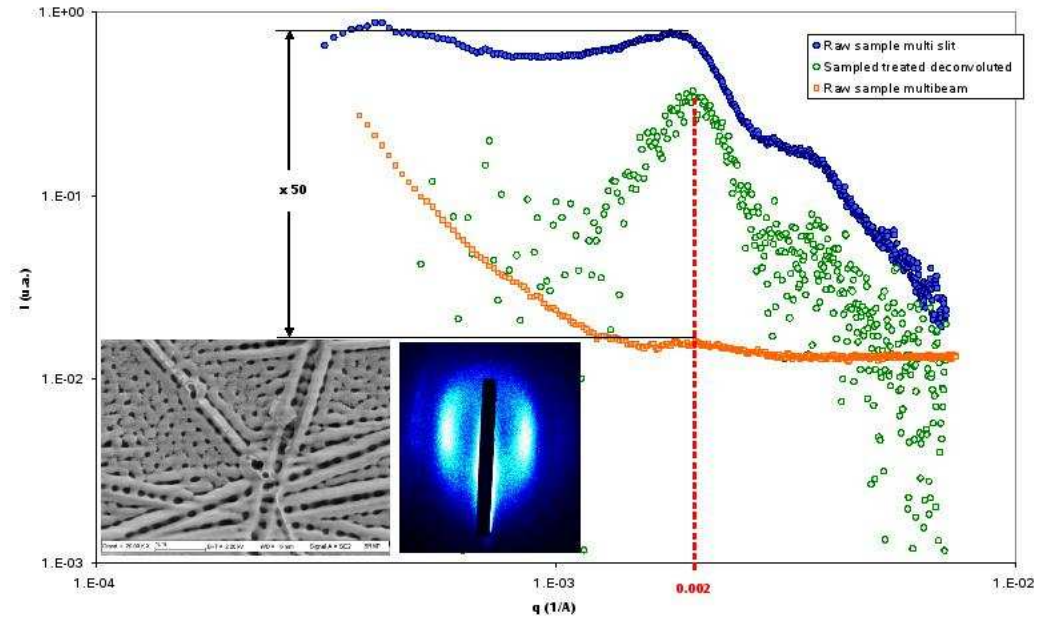
masks:
 ^6Li powder in epoxy, mechanically machined,
 aligned with laser
 gravity correction taken into account

4 sets of masks / position (3 detector lengths + 1 multislit)
 for $q_{\min} = 2 \cdot 10^{-4} \text{ \AA}^{-1}$ at 14 \AA , sample-detector distance of 6 m



sample: 1 μm latex spheres, $\Delta\lambda/\lambda = 30\%$

Multibeam work with gain \propto number of pinholes
Simulation tools proof to be useful for the design



sample: porous alumina

Multislit with gain ≈ 50 compared to multibeam
(but need for advanced data treatment)

implementation of multibeam/multislit technique for TPA:

- number of useful pinholes decreases faster than flux increases when distance increases
- flux optimum not for longest collimation length (as known for simple collimation)
- allows components insertion inside the collimator (e.g. monochromator for smaller overall spectrometer length)

honeycomp collimator

array of confocal tubes, coated with an absorber

- final device:
- 700 mm long
- focal point 2 m behind device
- hole diameter 6 mm (exit)
- material Al:Mg (2%)
- coating: ^{10}Be

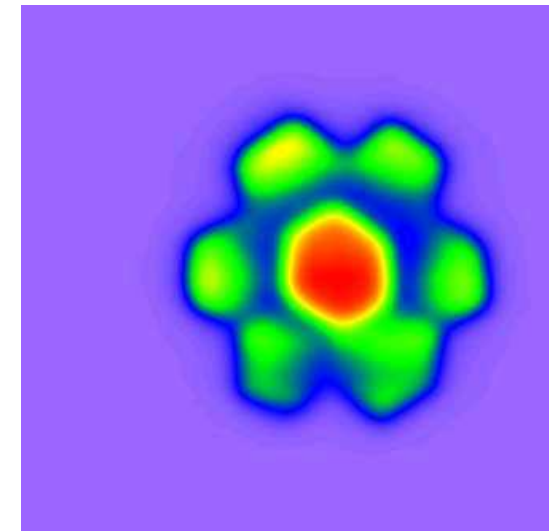
assembled honeycomp collimator



F. Saccetti, INFM

image of a $20 \times 20 \text{ mm}^2$ neutron beam at the exit

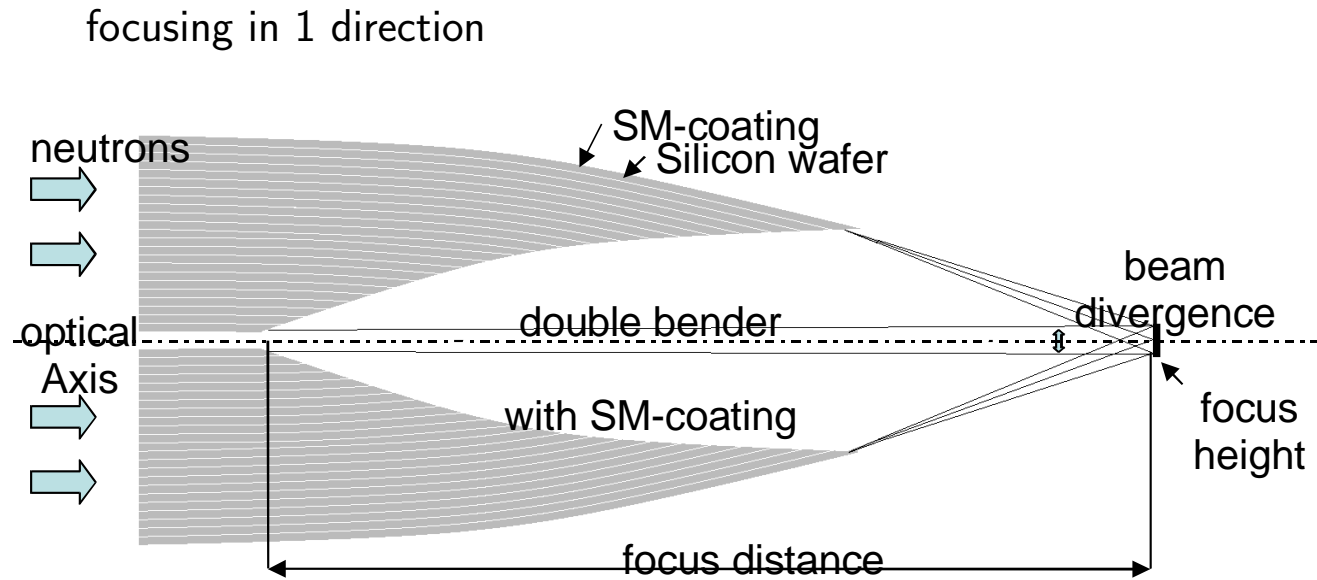
view against a light source



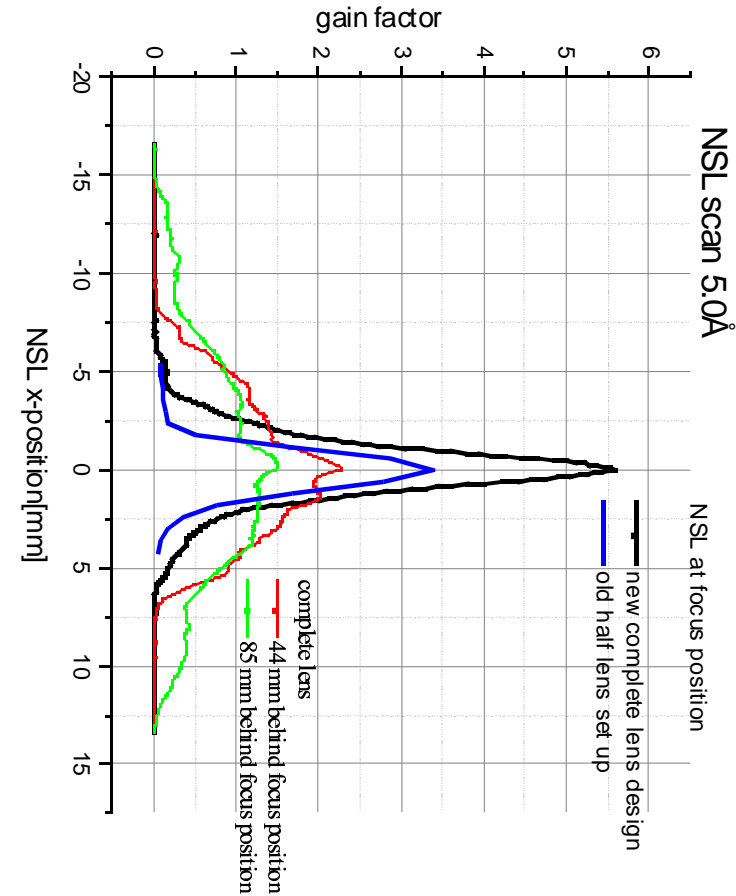
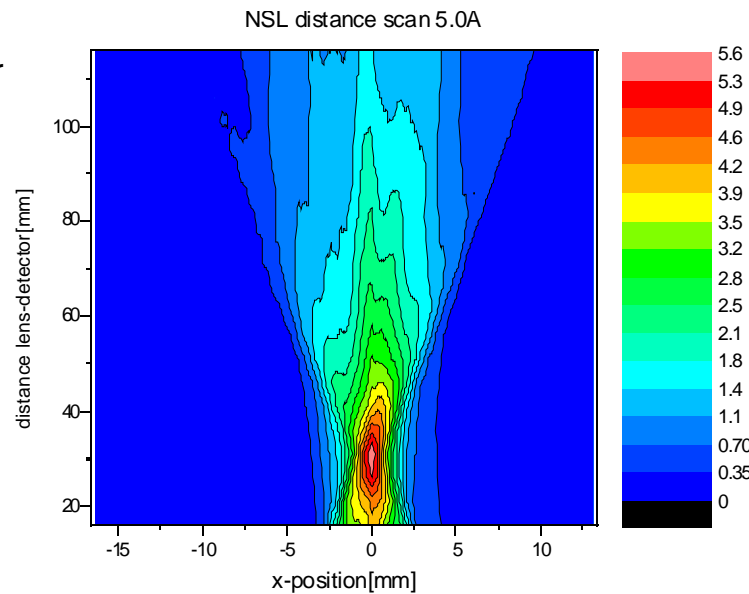
a 2 m long device with 0.4° divergence is installed at BRISP at ILL

solid state lens

T. Krist, HMI

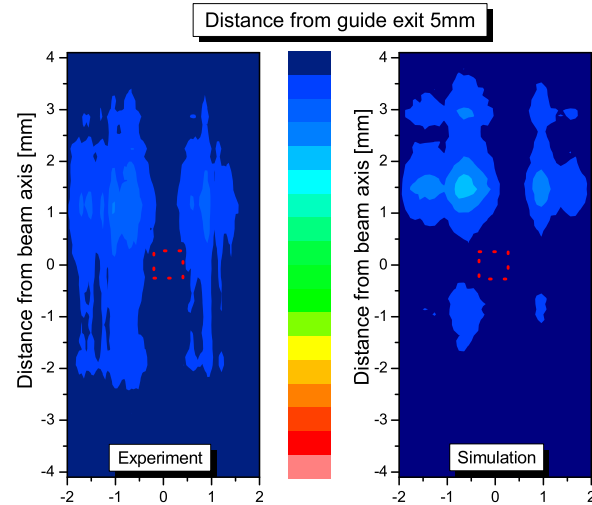


2 × 95 × 150 μm bended Silicon Wafer
 – m = 2 supermirror coating
 – focus distance: 171 mm

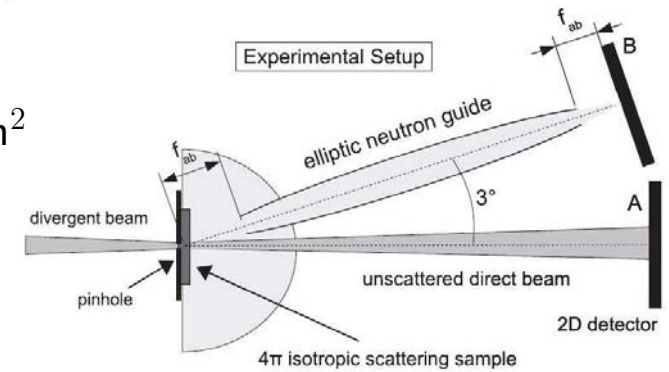


accepted beam: 30 mm high
 focal point: 2.4 mm high
 30 mm behind lens
 gain: 5.6

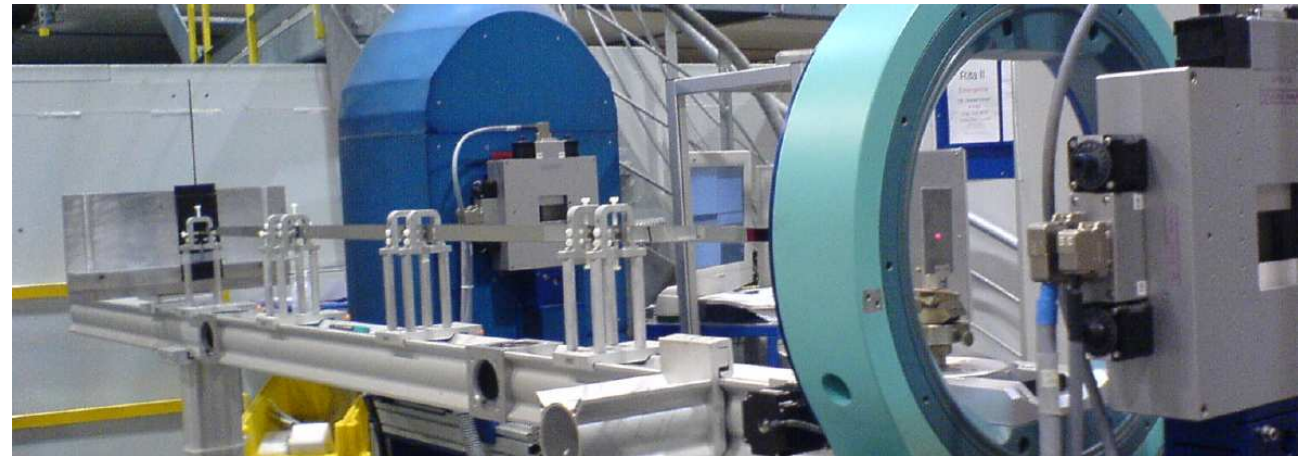
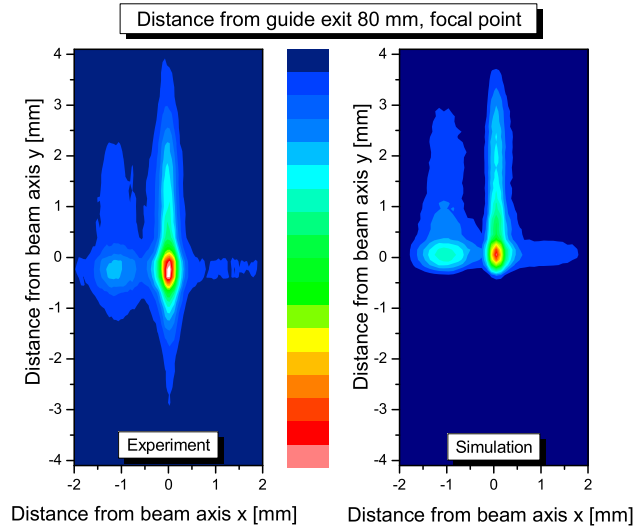
P. Böni, S. Mühlbauer, M. Stadlbauer, TUM
 J. Stahn, U. Filges, M. Ay, PSI



bi-elliptic guide scaled 1:10
 2 m long
 entrance: $4 \times 8 \text{ mm}^2$
 maximum dimensions: $8 \times 16 \text{ mm}^2$

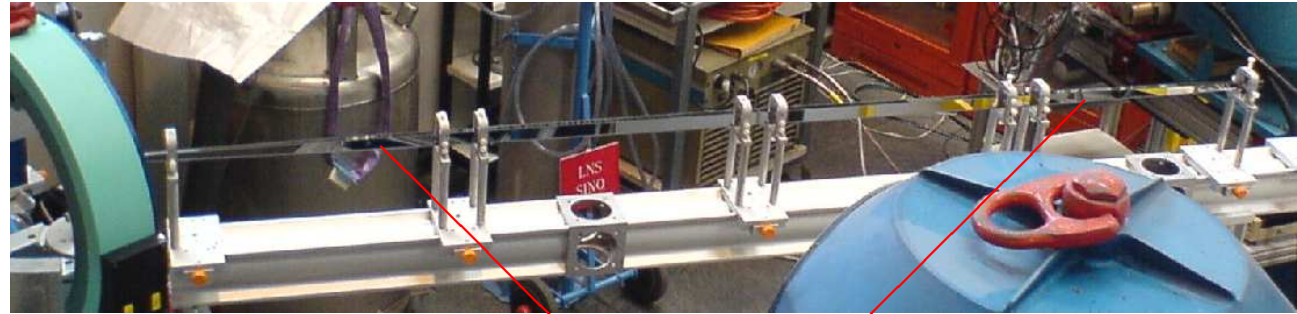


measured on
 Morpheus at SINQ
 MIRA at FRM II

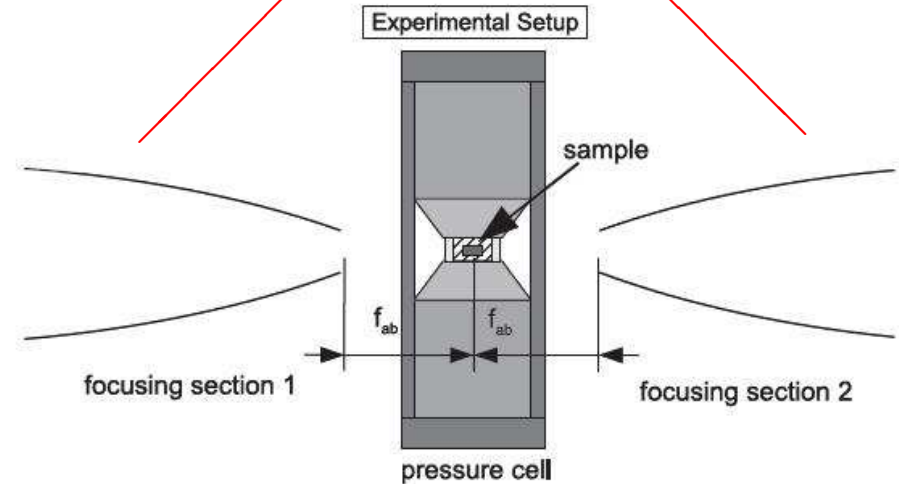
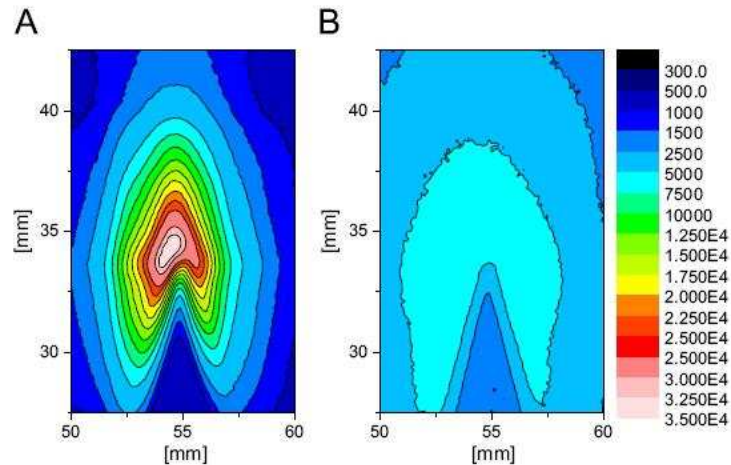


idea:

- use the end-sections of the test device to
 - focus the beam to a tiny sample in a pressure cell
 - defocus the scattered beam to get a better resolution on the detector



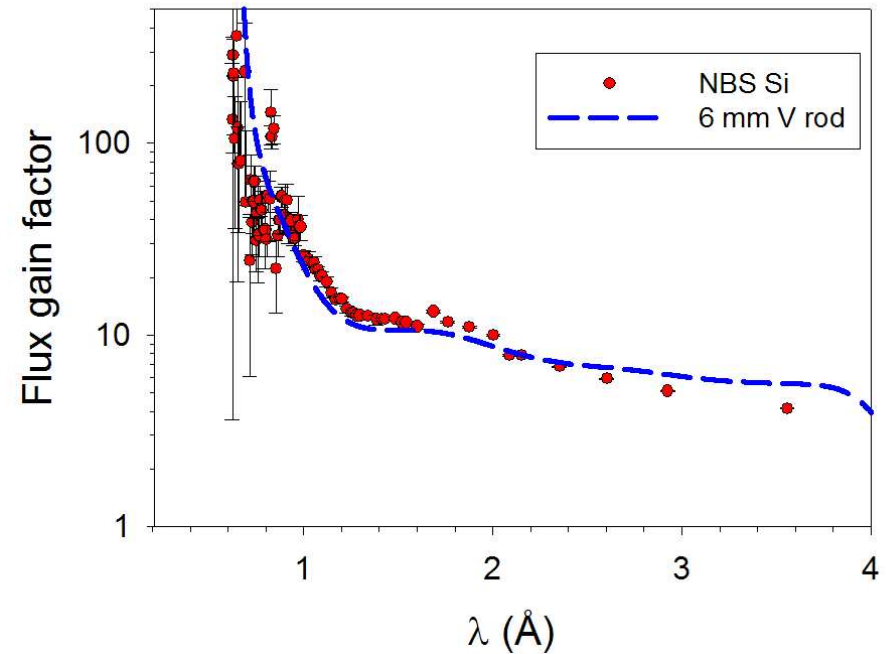
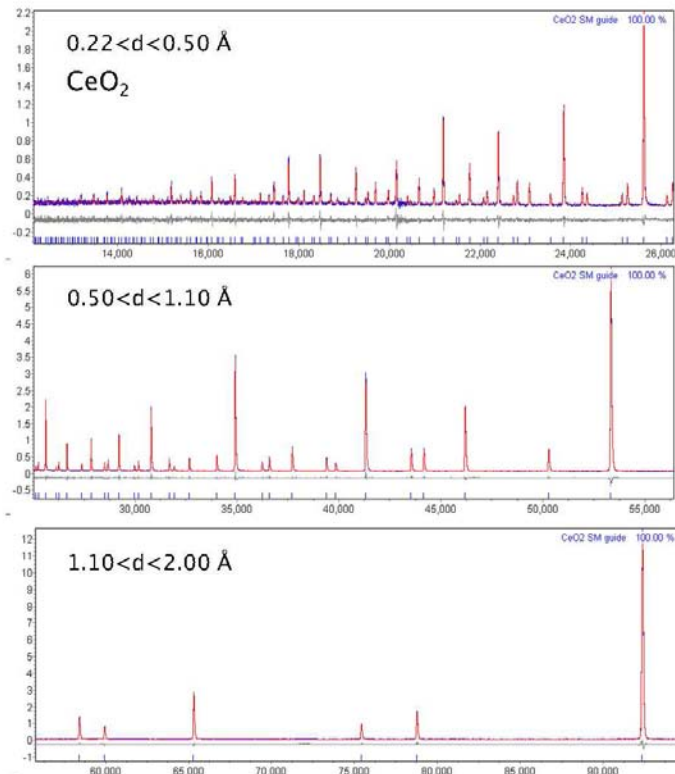
tested on PANDA at FRM II
 result:



first bi-elliptical neutron guide
for HRPD at ISIS

length = 100 m
operational since 11. 2007

measured gain: 10 to 100
(depending on λ , relative to old guide)

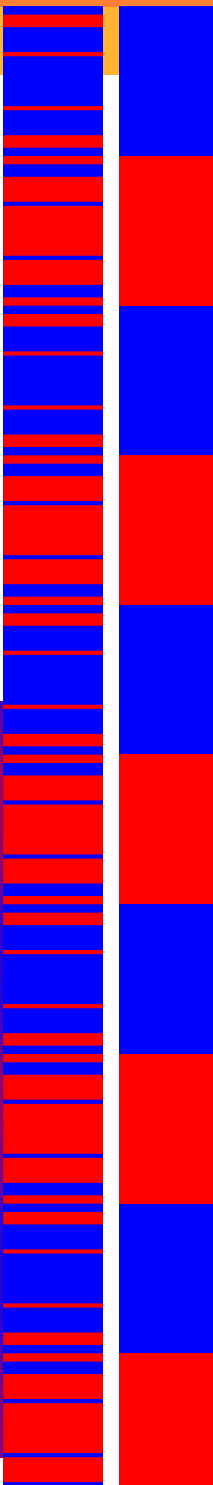
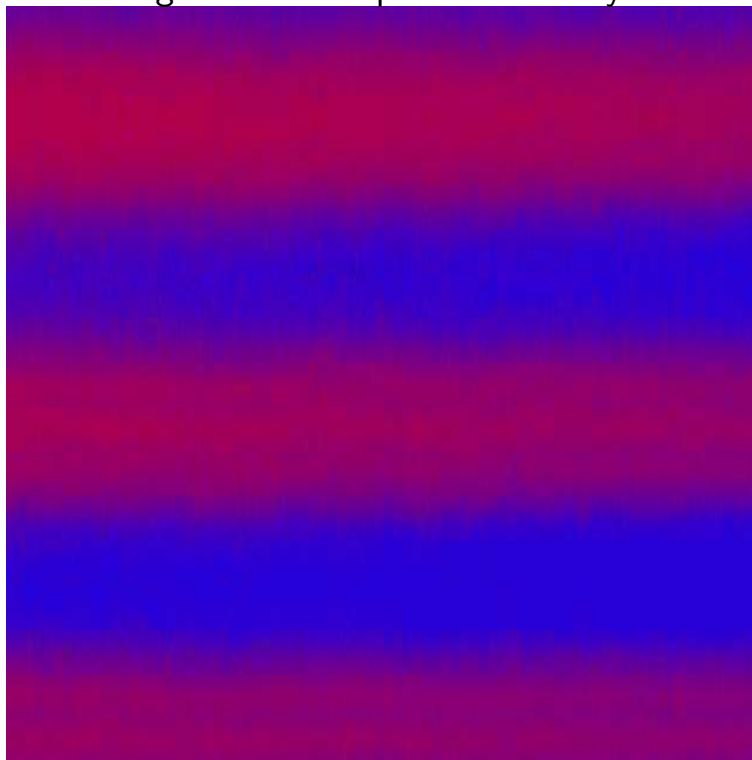


complex multilayers

J. Stahn, M. Schneider, PSI
P. Böni, TUM

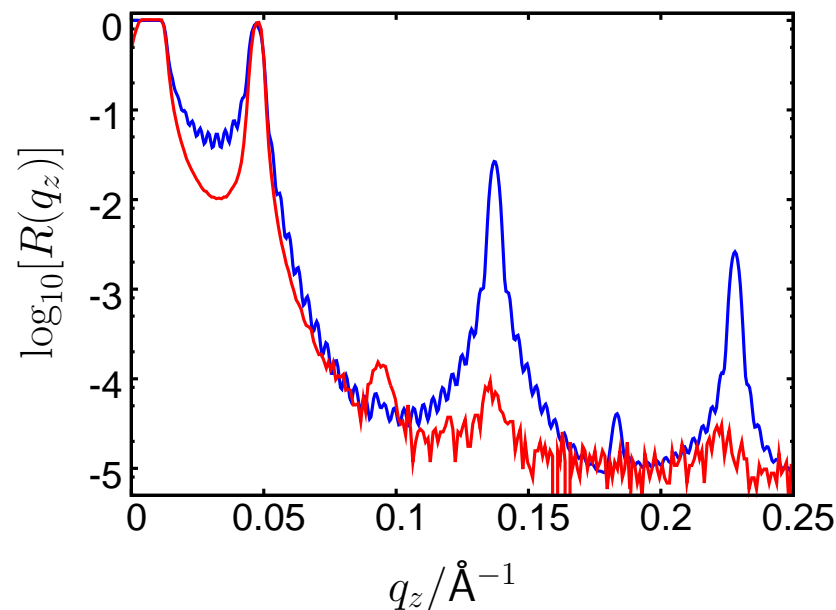
- attempt to create a sinusoidal density profile by
- deposition of thin films
 - subsequent annealing to get interdiffusion

TEM image of an as-deposited multilayer



blured interfaces

- accept a non-sharp profile step but with low roughness
- intermediate layers
 - controlled interdiffusion

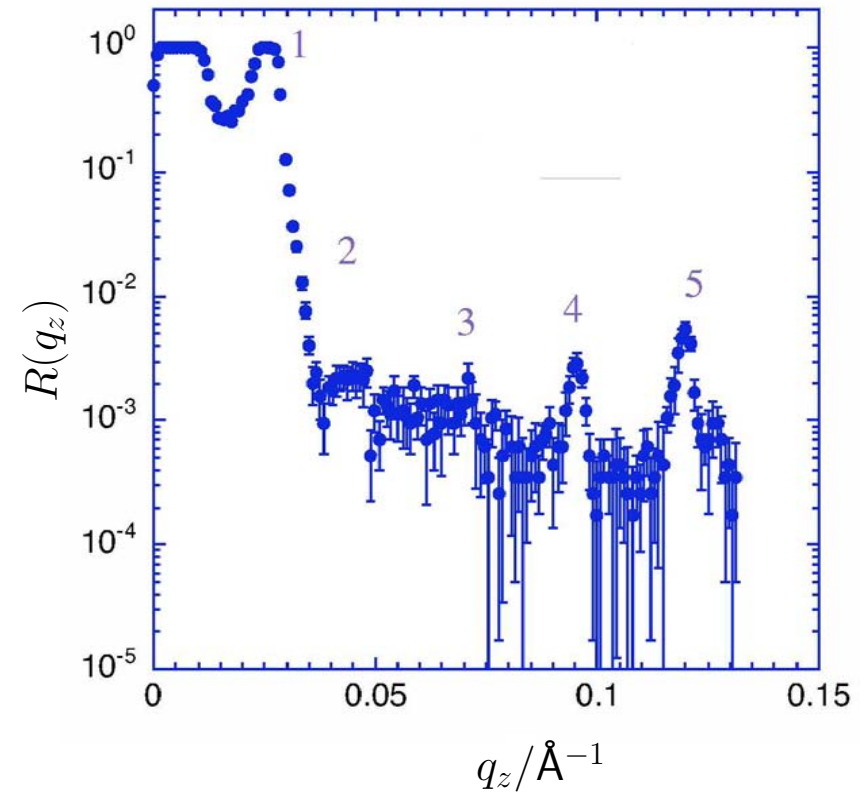
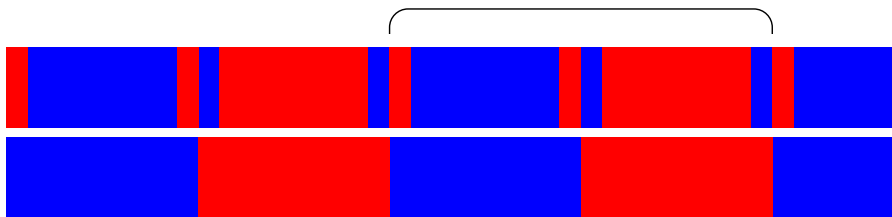


reflectivity of the annealed multilayer compared to the calculated multi-bilayer

- problem:
annealing leads to grain-formation
and thus to rough interfaces
- but:
the as-depositded film shows no higher order reflections!

aim:
 starting from the quasi-sinusoidal profile
 reduce number of layers and still suppress higher orders

example:
 suppression of orders 2, 3 and 4 is possible with 6 layers per period
 with (approximate) thickness ratios 1:7:1:1:7:1



reflectivity of a Ni-Ti-multilayer, period: 27 nm,
 6 sublayers/period, 10 repetitions

a long-wavelength filter of this type is used on the neutron reflectometer Narziss, SINQ

discrete layers allow for the application of the principle for polarising monochromators

conventional supermirror coatings cover a *large* angular / q range

but reflectivity decays with q

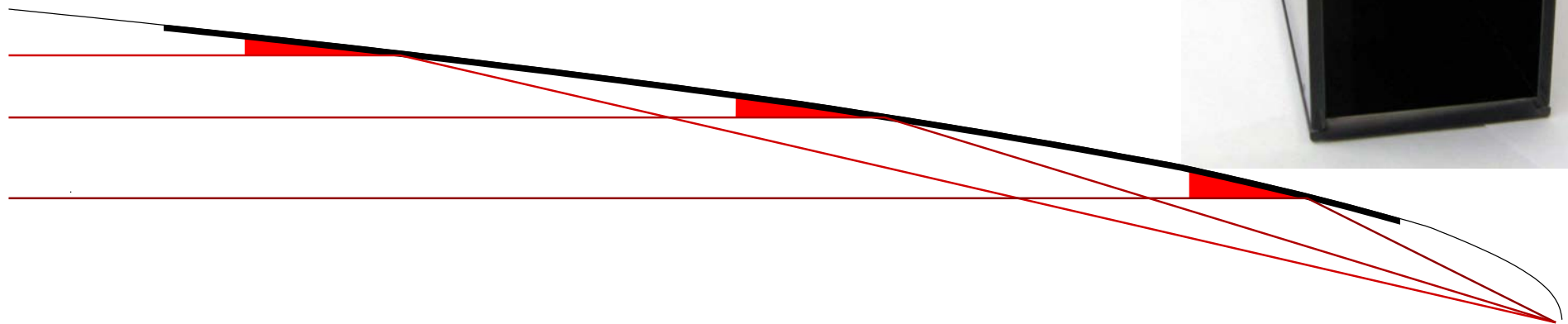
if the *necessary* q range varies spacially

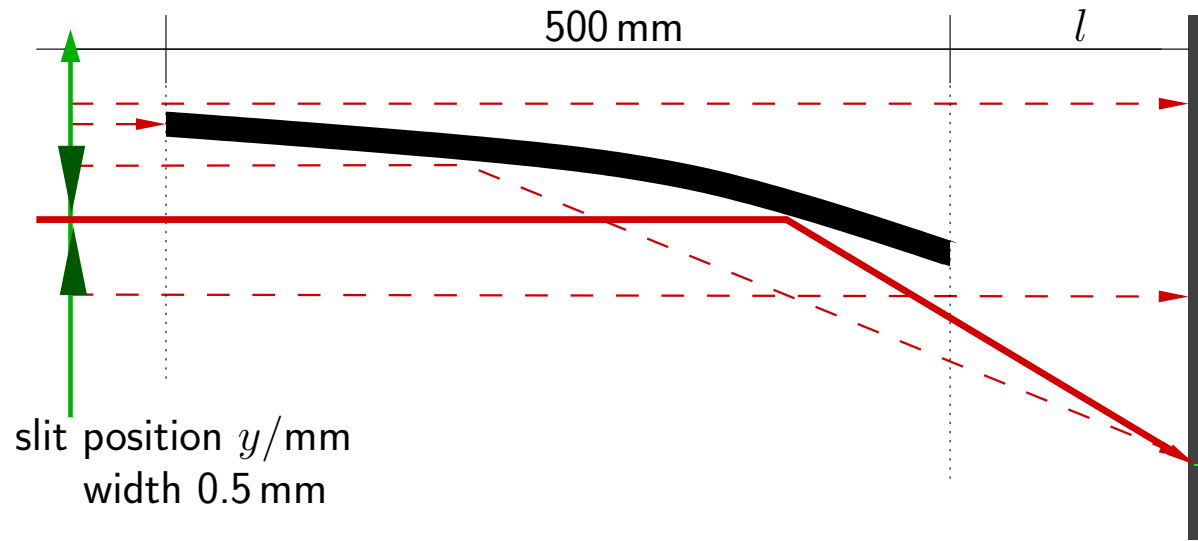
one can skip the needless layers (better: periods).

⇒ higher reflectivity of the coating

example:

focusing element (parabula-branch) for a wavelength band $\lambda = 4.7 \text{ \AA} \pm 10\%$





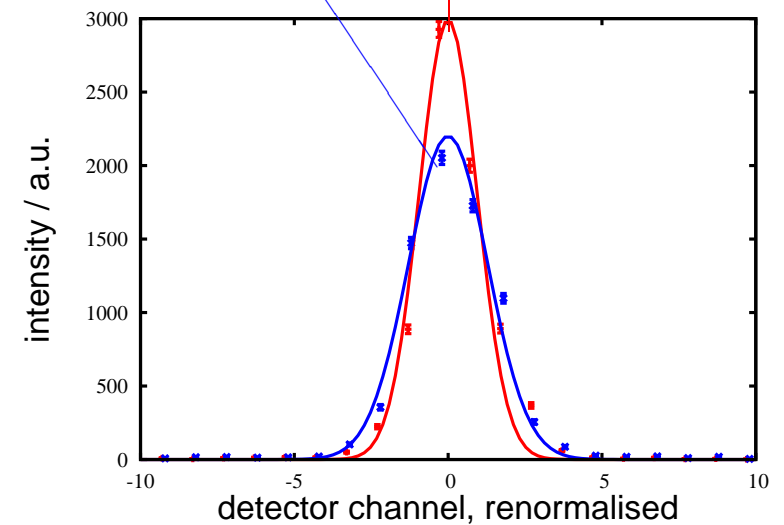
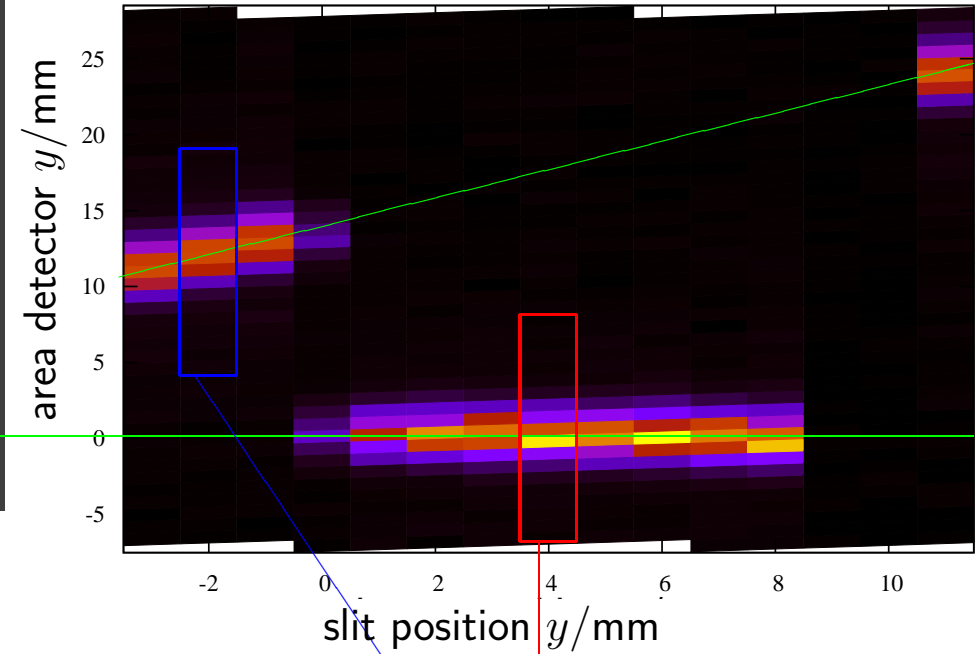
instrument: Morpheus at SINQ, PSI

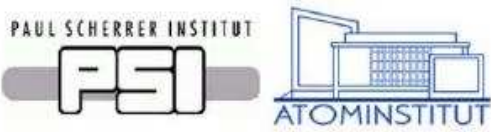
$\lambda = 4.5 \dots 5 \text{ \AA}$

various tilt angles

various distances l (optimum 250 mm)

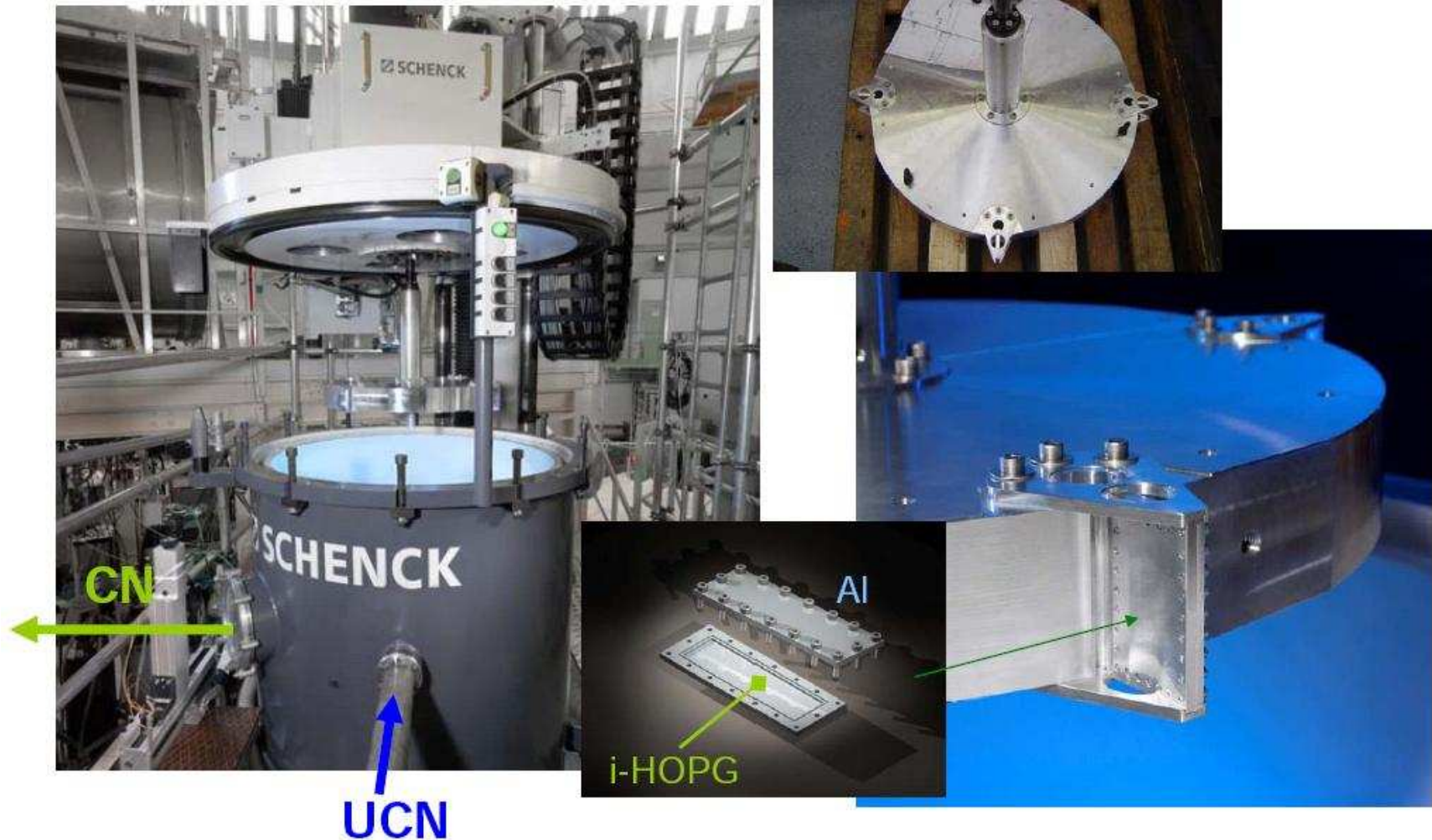
a 8 mm wide beam is focused to $< 0.8 \text{ mm}$
with a yeald of almost 100%

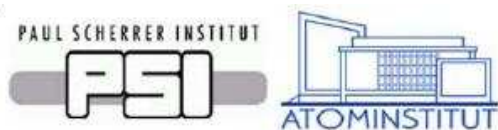




Phase Space Transformer: UCN \Rightarrow CN

- AIMS:**
- Proof of principle experiment
 - Validate MC simulations





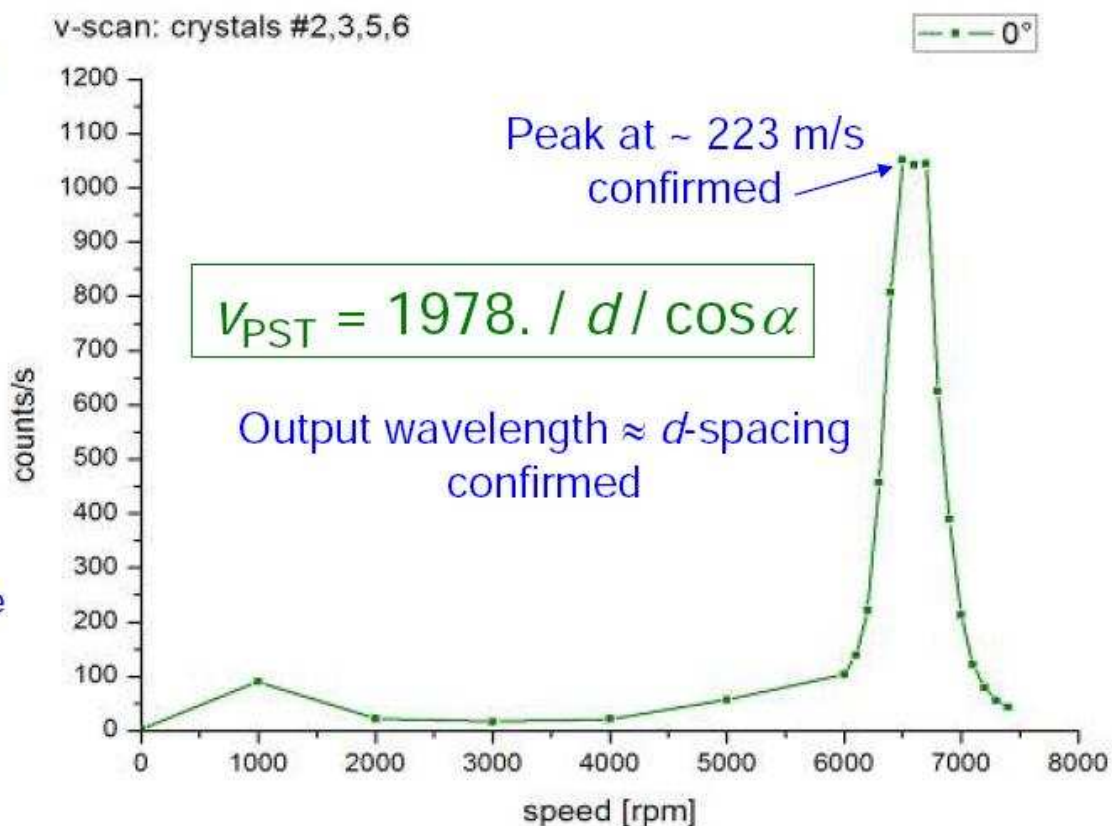
Phase Space Transformer: UCN \Rightarrow CN

■ Device for the acceleration of ultra cold neutrons (UCN) into monochromatic cold neutrons by taking advantage of the *high phase space density of UCN* at next-generation sources.

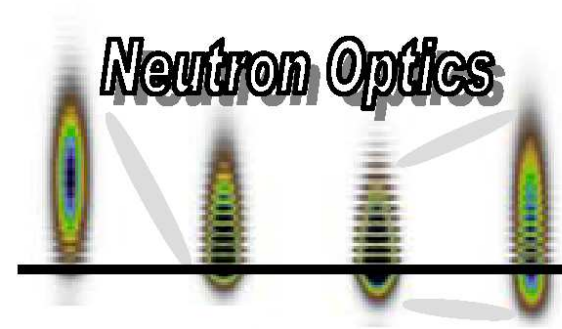
■ **Principle:** up-scattering of UCN on one or several rotating crystals using the Doppler-effect to match the Bragg condition.

■ Final experiments 2008 at the ILL PF2-UCN source were successfully carried out proving that the principle of PST works as predicted in detailed MC simulations.

■ PhD Thesis of S. Mayer ATI



TUM	Germany	P. Böni
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HMI	Germany	T. Krist
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