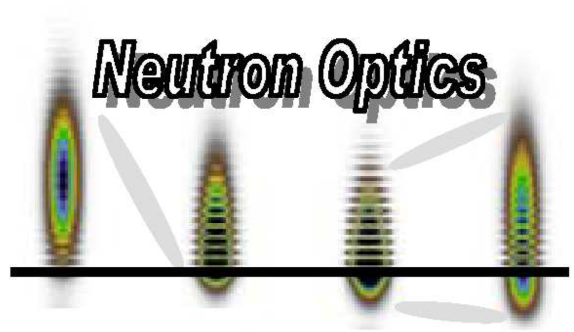


TUM	Germany	P. Böni
CEA-LLB	France	F. Ott
HMI	Germany	T. Krist
PSI	Switzerland	**J. Stahn**
BNC-RISP	Hungary	J. Füzi
INFM	Italy	F. Sacchetti

T1 **honeycomb lenses**, **multi beam**, **beam conditioning for SANS**, **solid state devices**
TUM, **LLB**, PSI, HMI, BNC, INFM

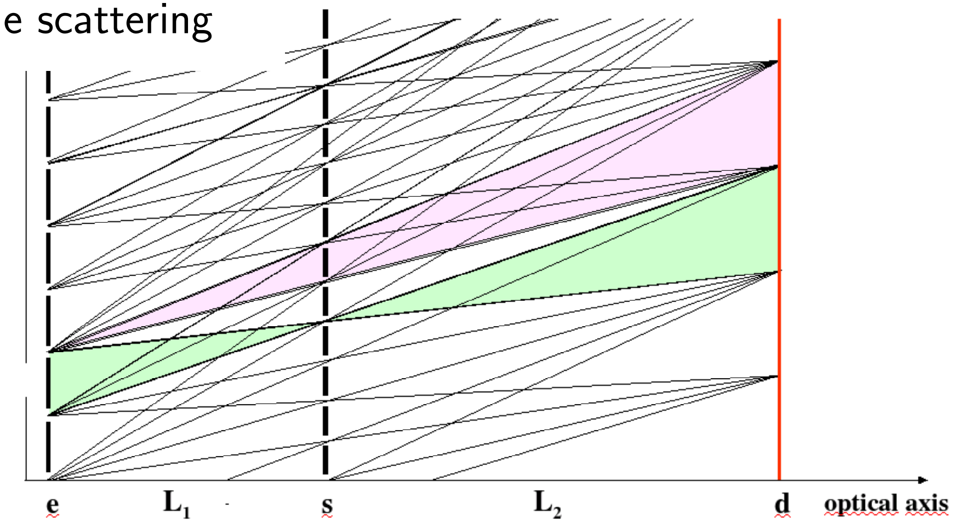
T2 **focusing devices** (not solid state), more homogenous phase space, optimum transport
TUM, PSI

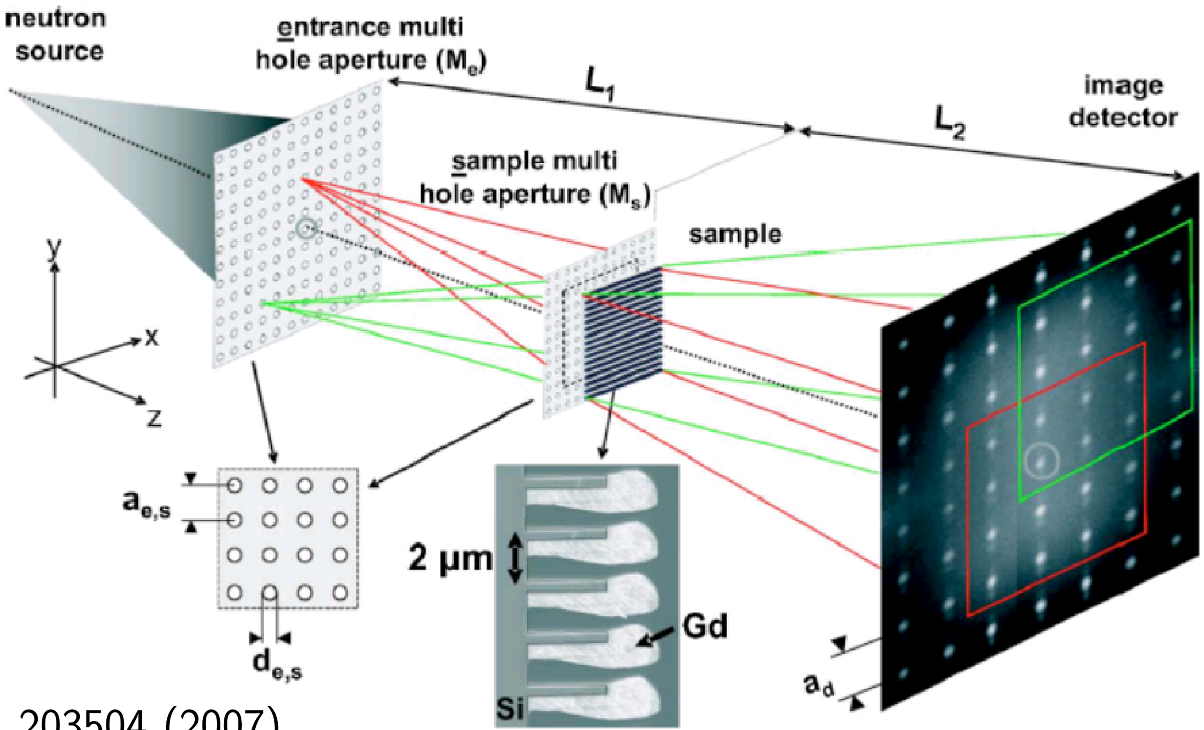
T3 diffuse scattering, **new sputtering techniques**, reduce roughness, stress
TUM, **PSI**, HMI, BNC

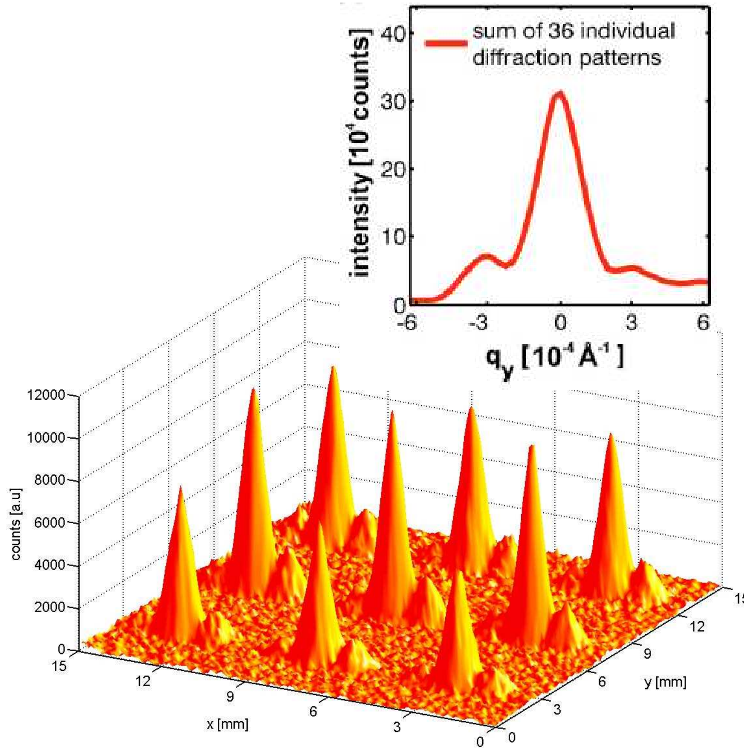
T4 phase space transformation, UCN, **thermal neutrons by moving monochromators**
PSI

multi beam small angle scattering

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





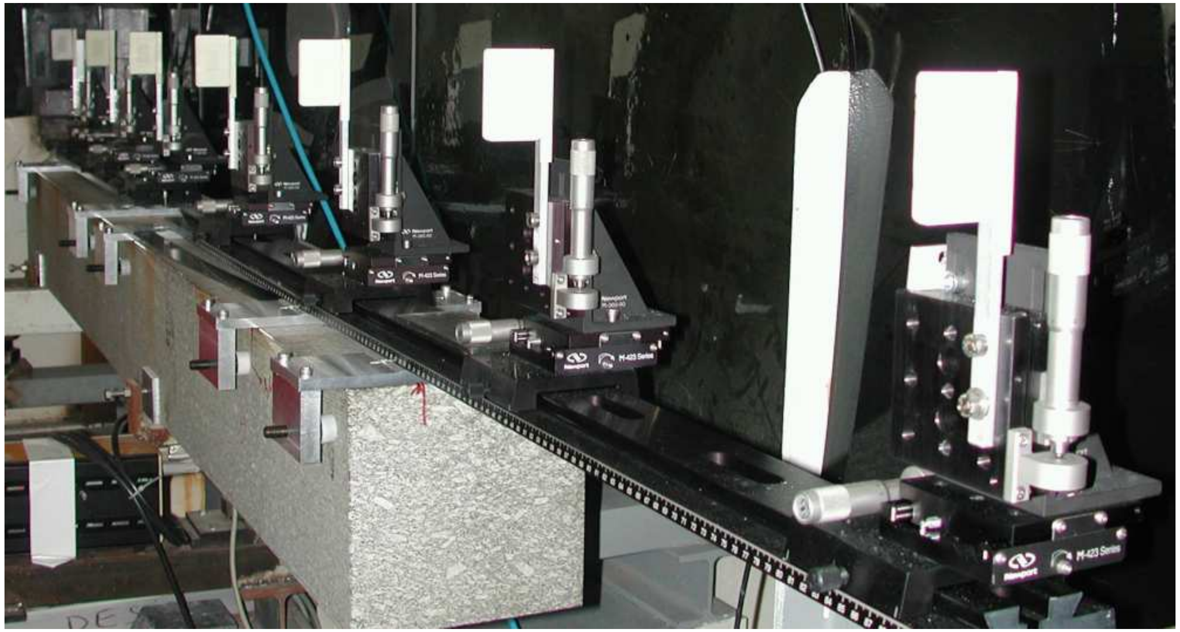


APL 91, 203504 (2007)

experiments realised on MIRA at FRM II

small angle scattering with a focused bundle of collimated beams

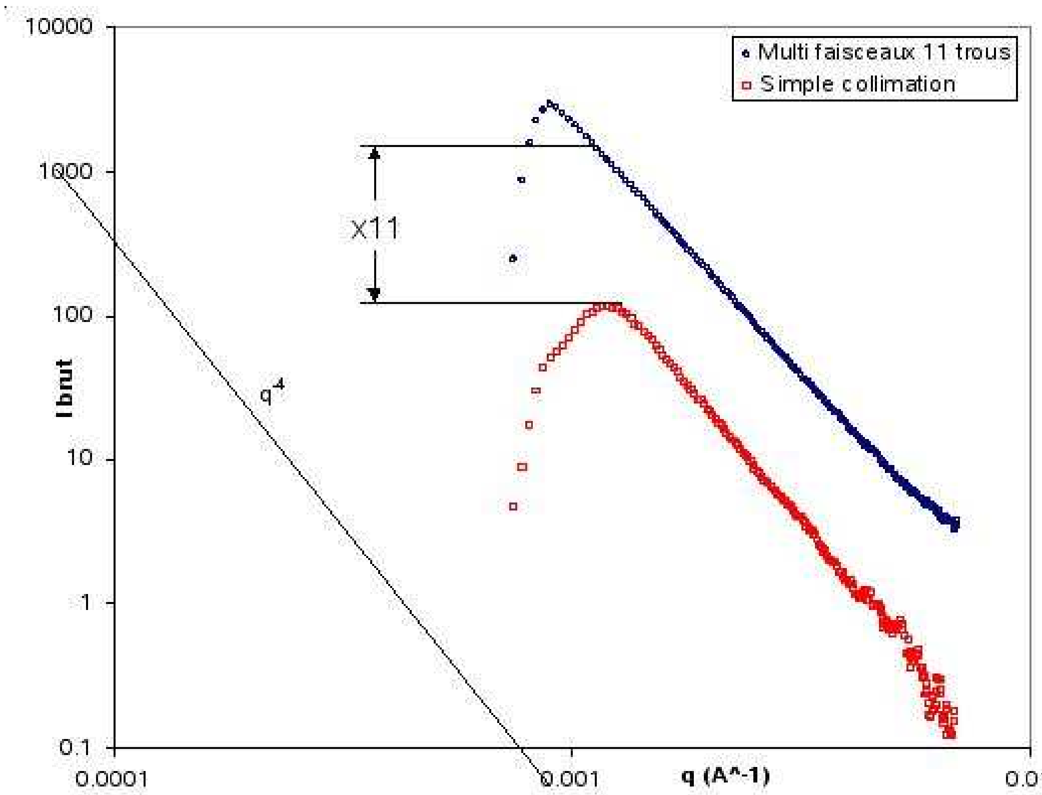
F. Ott, LLB



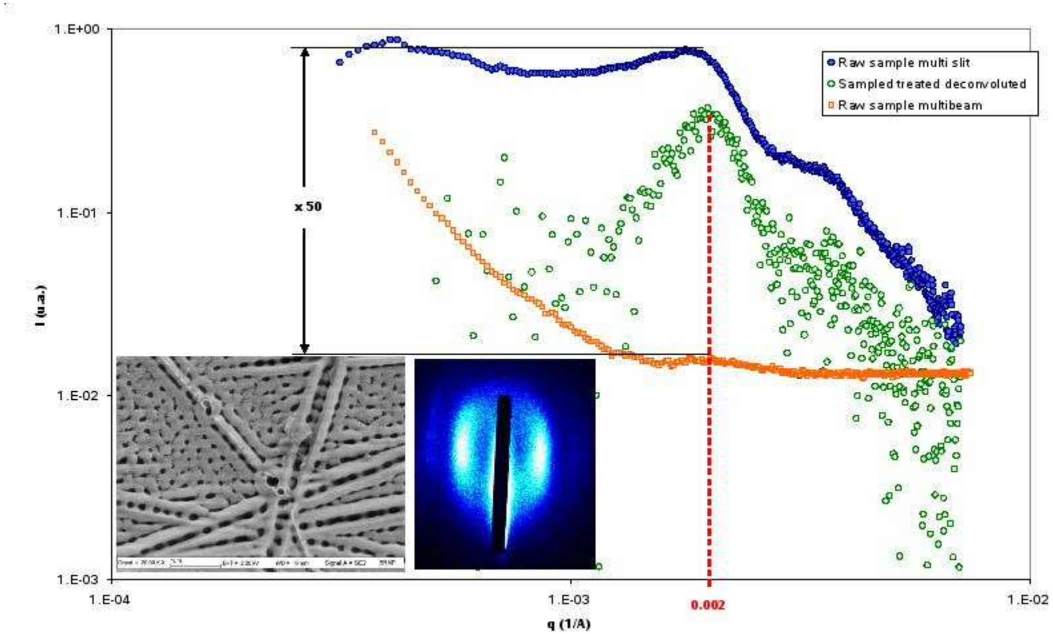
set-up on TPA:	collimation length	2.85 m
	entrance pinhole	1.31 mm
	exit pinhole	0.91 mm
	masks	13
	min. between 2 pinholes	0.4 mm
	pinholes / masks	400

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

4 sets of masks / position (3 detector lengthes + 1 multislit)
for $q_{\rm min} = 2.10^{-4}$ Å^{-1} at 14 Å, sample–detector distance of 6 m



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



sample: porous alumina

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

Multislit with gain $\approx$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

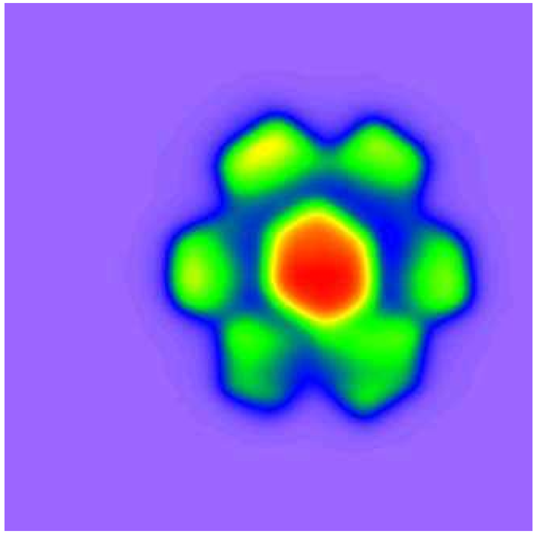
F. Saccetti, INFM

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

view against a light source

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

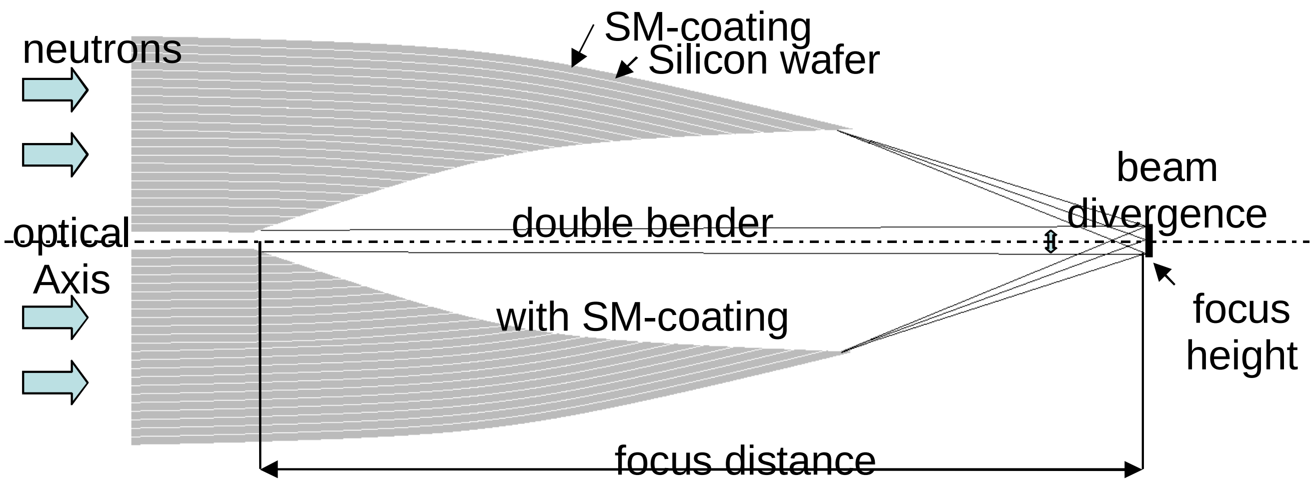


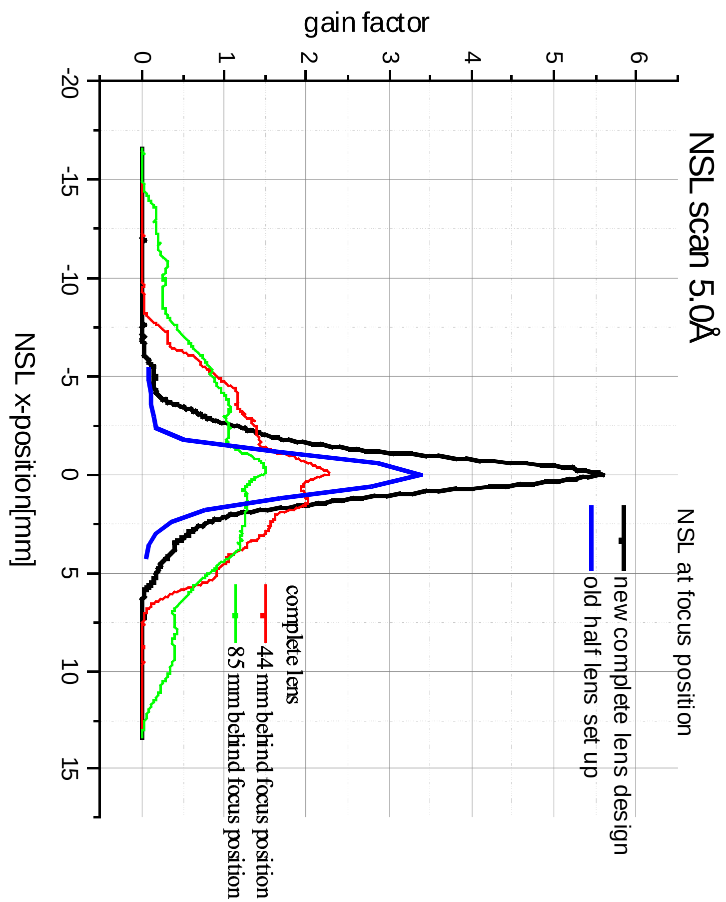
a 2 m long device with 0.4° divergence is installed at BRISP at ILL

solid state lens

T. Krist, HMI

focusing in 1 direction

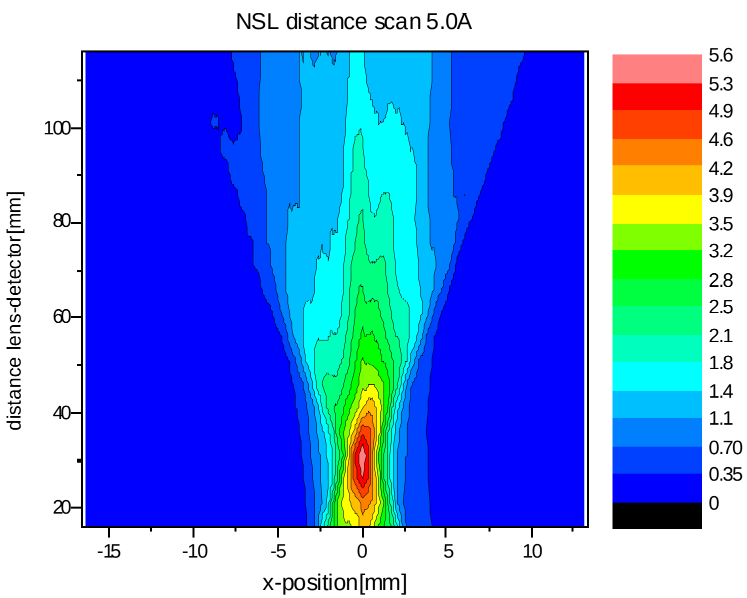




$2 \times 95 \times 150\,\mu$m bended Silicon Wafer

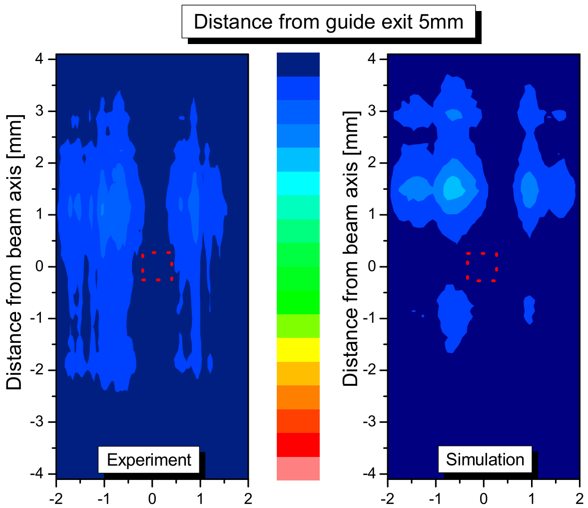
– $m = 2$ supermirror coating

– focus distance: 171 mm

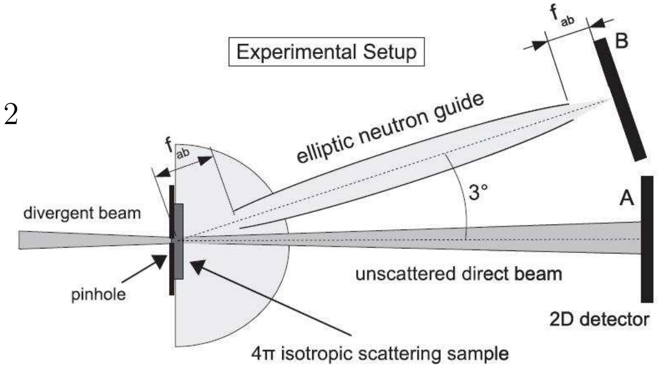


accepted beam:	30 mm high
focal point:	2.4 mm high
	30 mm behind lens
gain:	5.6

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

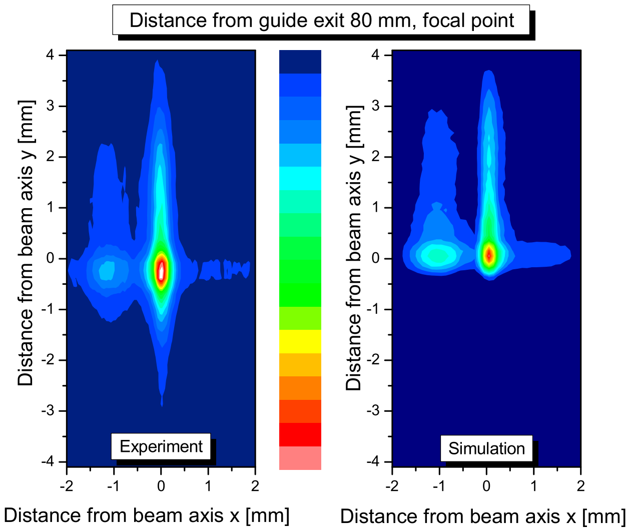


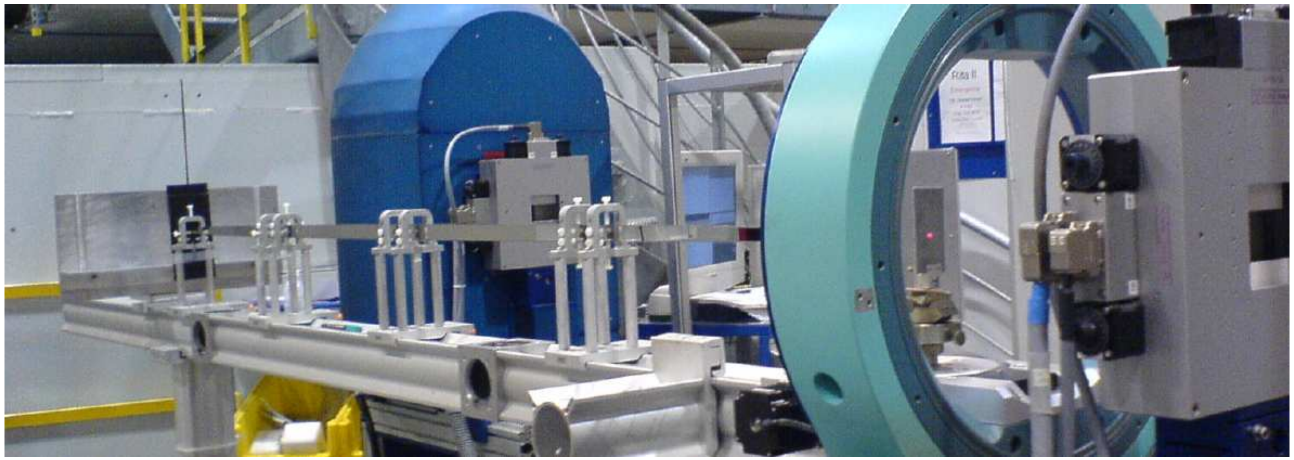
bi-elliptic guide scaled 1:10
2 m long
entrance: $4 \times 8\,\mathrm{mm}^2$
maximum dimensions: $8 \times 16\,\mathrm{mm}^2$



measured on

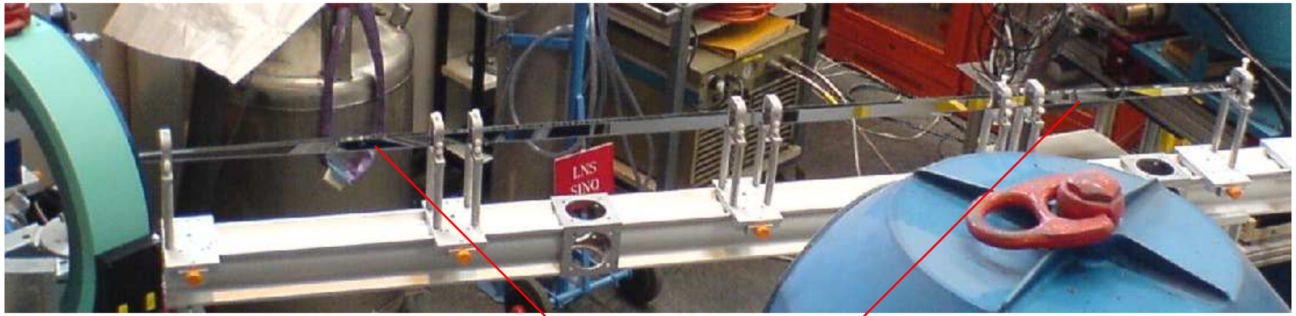
- Morpheus at SINQ
- MIRA at FRM II



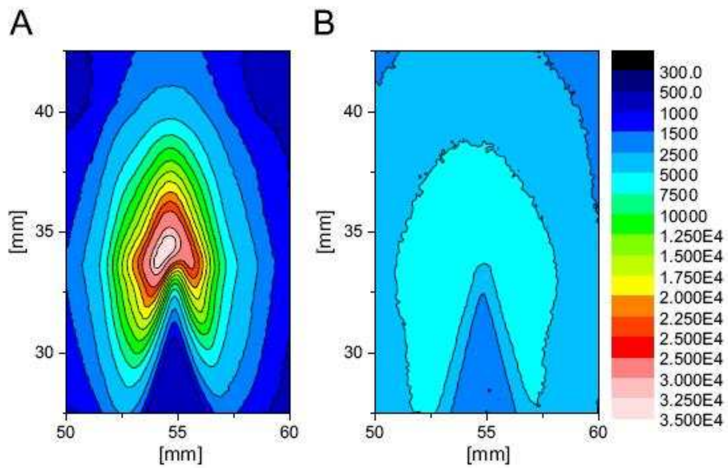


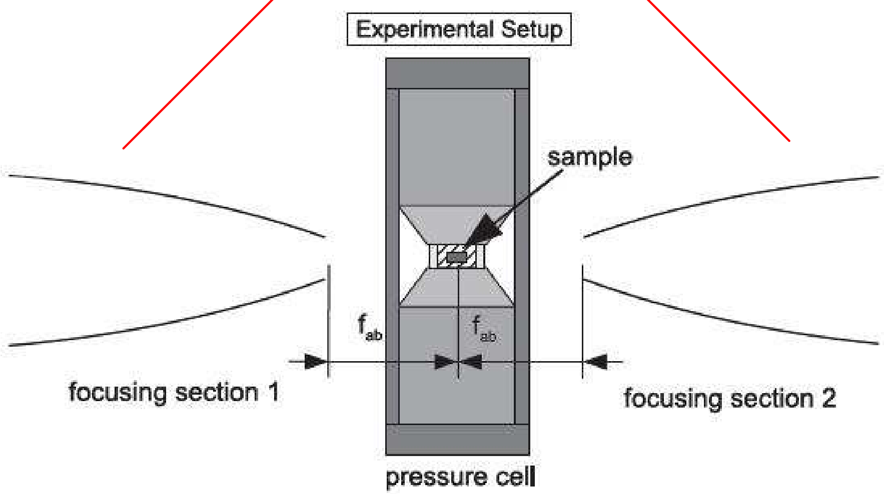
idea:

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:



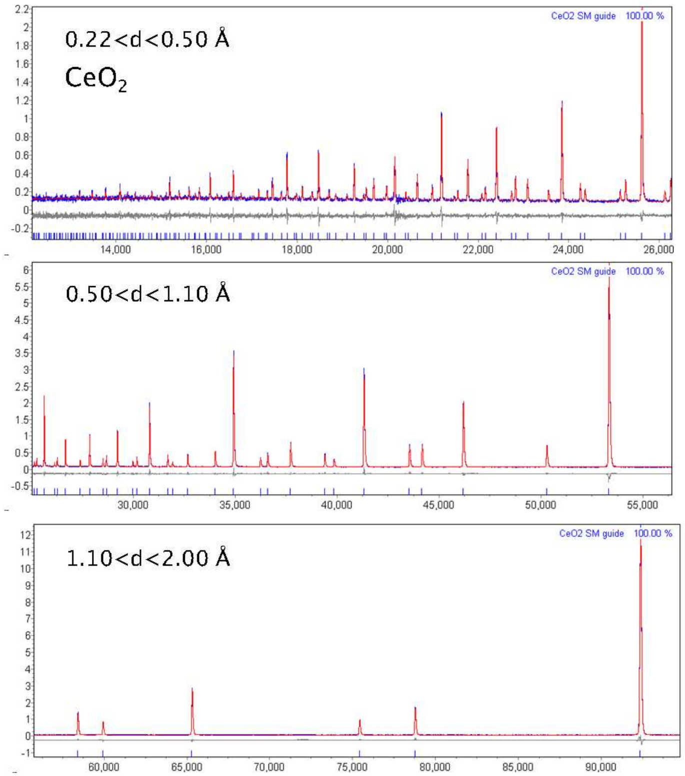


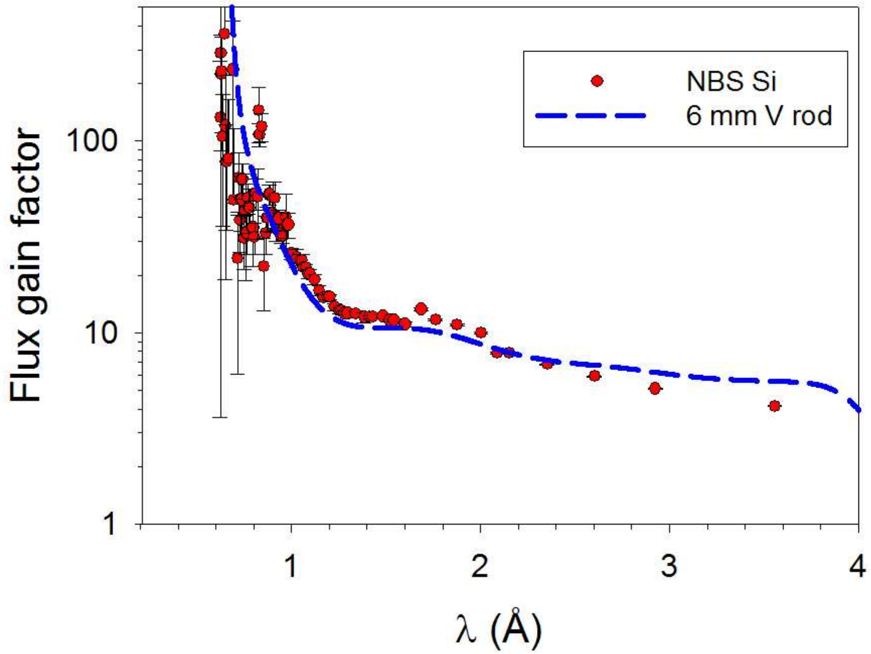
N.I.M. A **586**, 77-80 (2008)

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)





Photos Courtesy ISIS - Science and Technology Facilities Council, UK

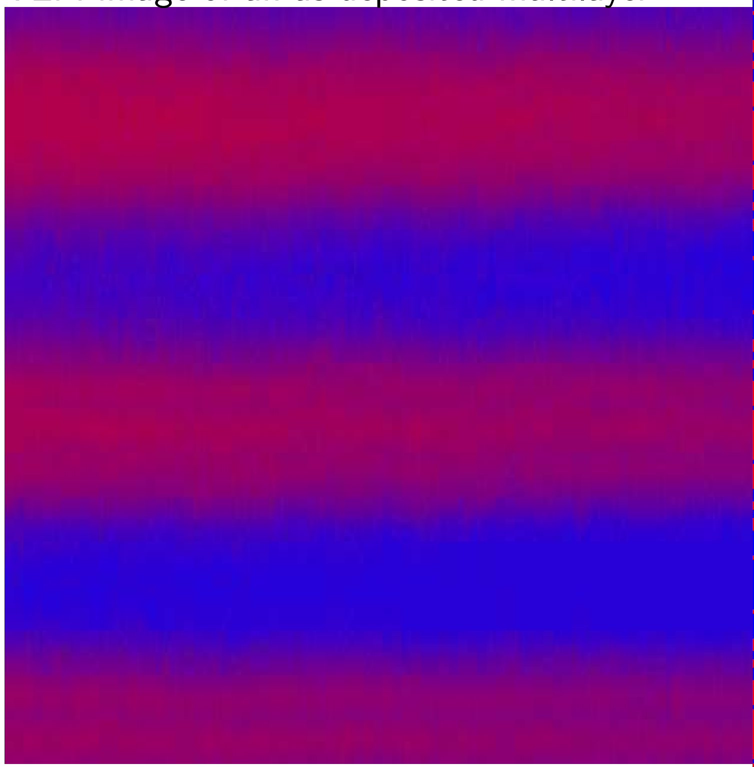
complex multilayers

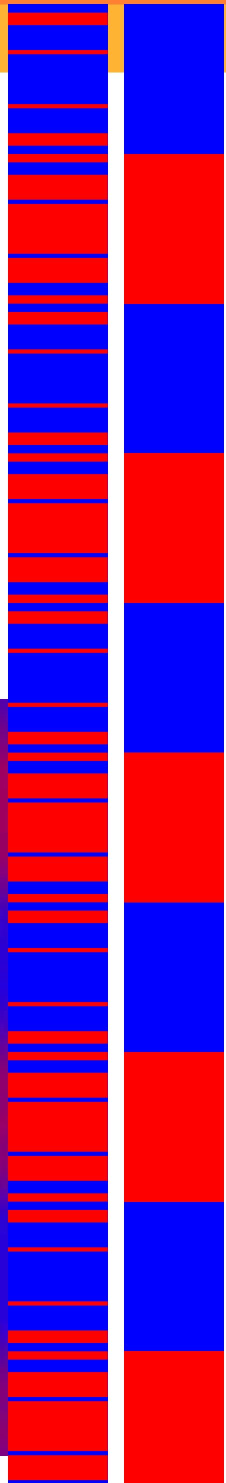
blured interfaces

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

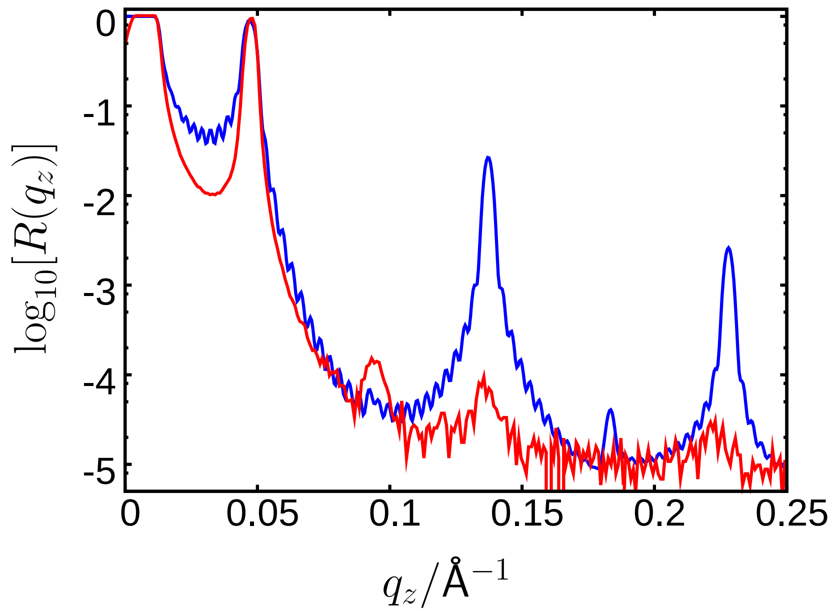
attempt to create a sinusoidal density profile by
- deposition of thin films
- subsequent annealing to get interdiffustion

TEM image of an as-deposited multilayer





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



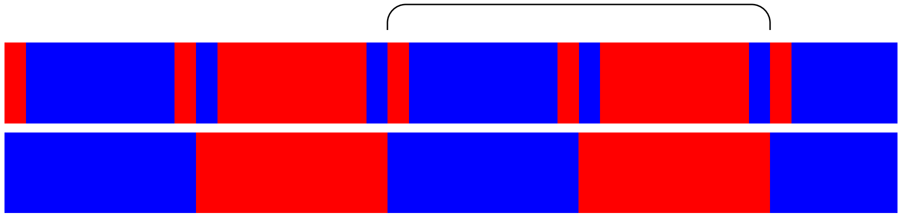
reflectivity of the annealed multilayer compared to the calculated multi-bilayer

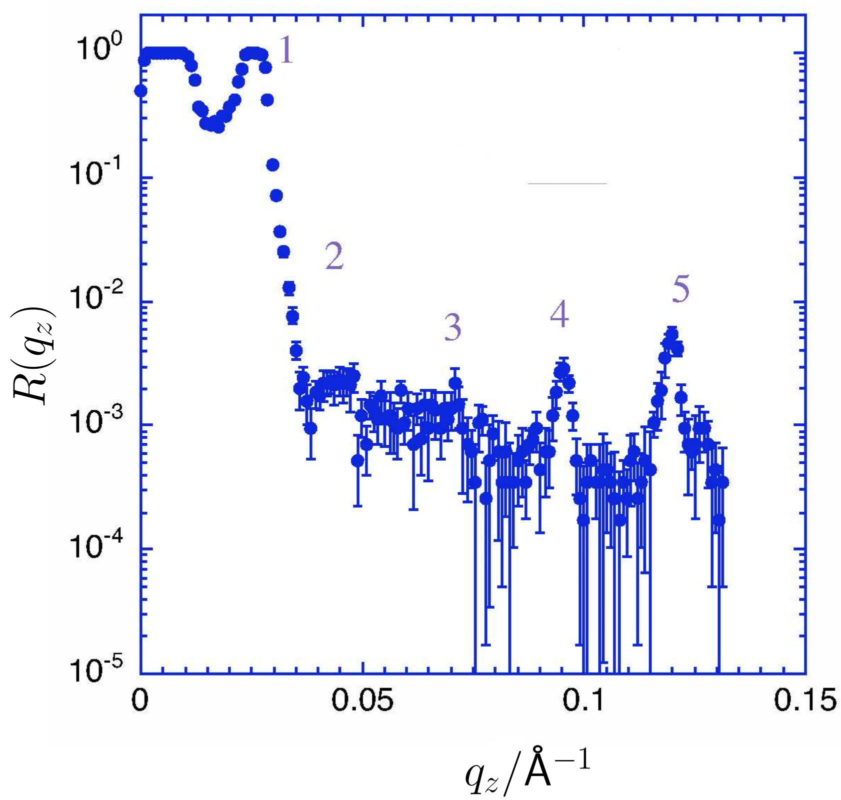
problem:
annealing leads to grain-formation and thus to rough interfaces

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 rations 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

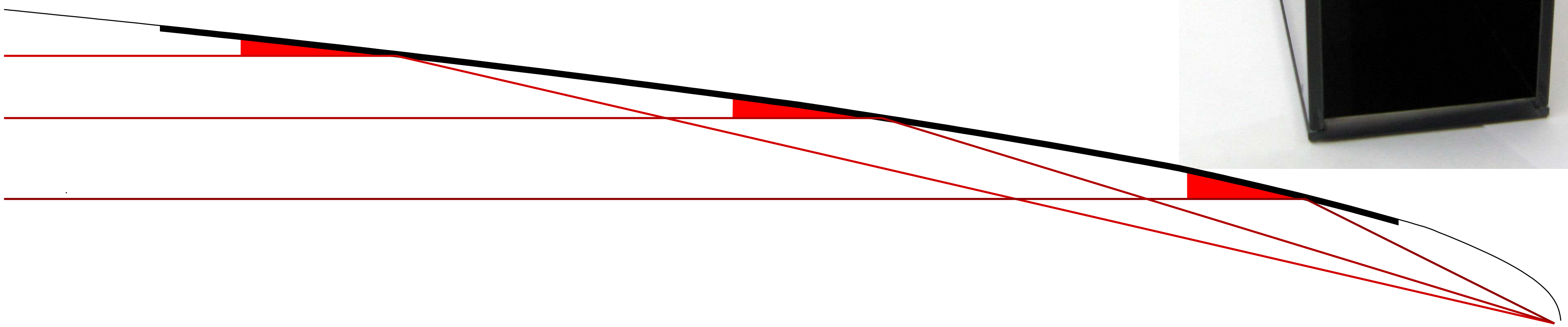
if the *necessary* q range varies spacially

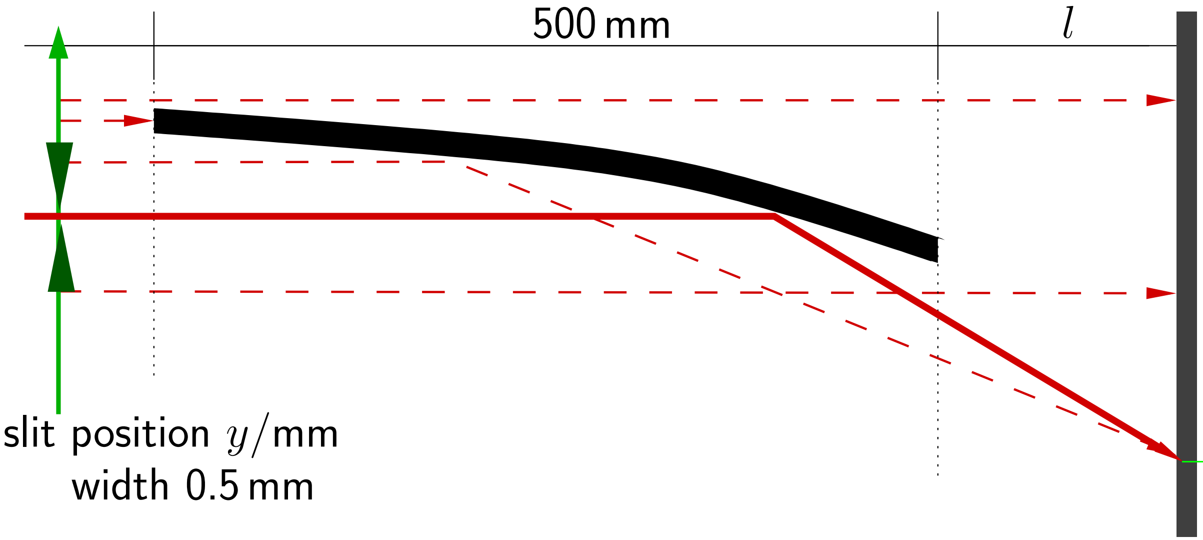
one can skip the needless layers (better: periods).

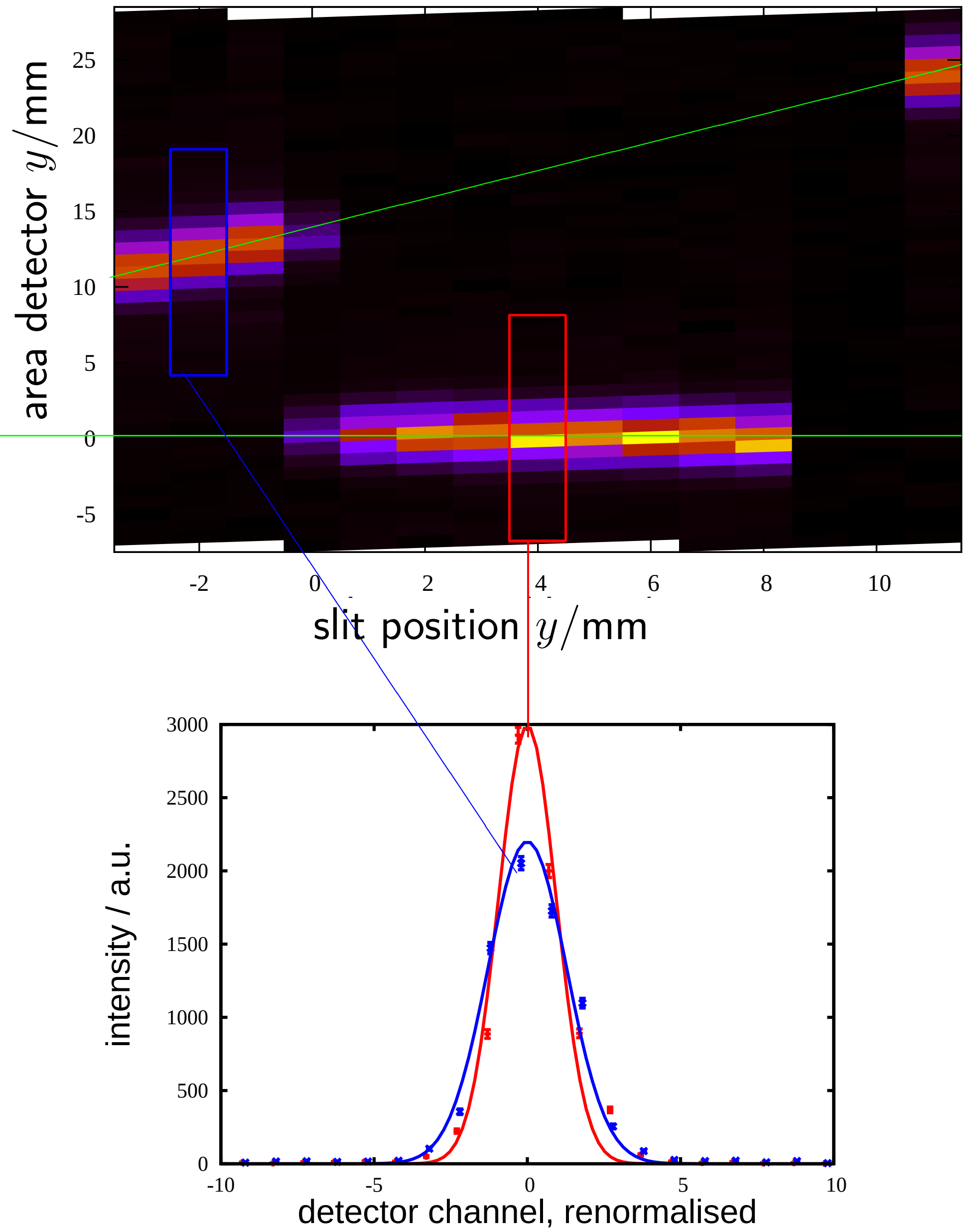
$\Rightarrow$ higher reflectivity of the coating

example:

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







instrument: Morpheus at SINQ, PSI

$\lambda = 4.5 \ldots 5$ Å

various tilt angles

various distances l (optimum 250 mm)

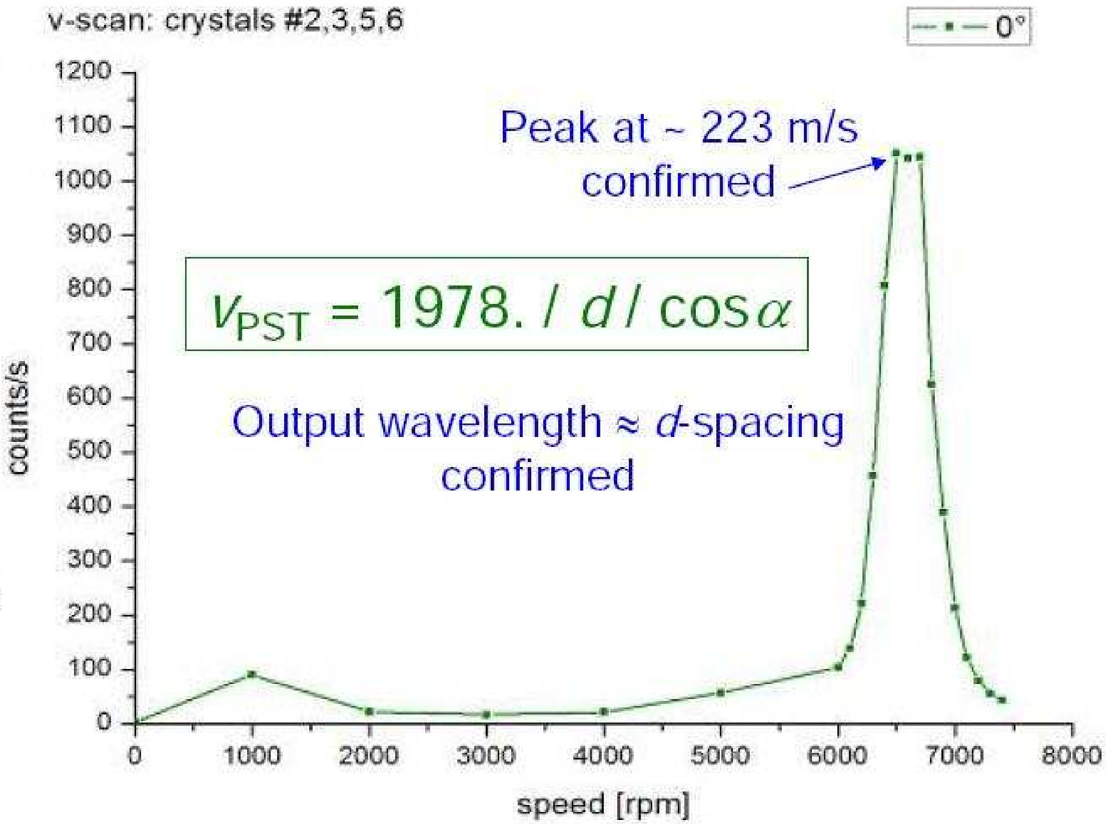
a 8 mm wide beam is focused to $<$0.8 mm
with a yeald of almost 100%

Phase Space Transformer: UCN $\Rightarrow$ CN

AIMS:
- Proof of principle experiment
- Validate MC simulations

Phase Space Transformer: UCN ⇒ 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



partner & tasks

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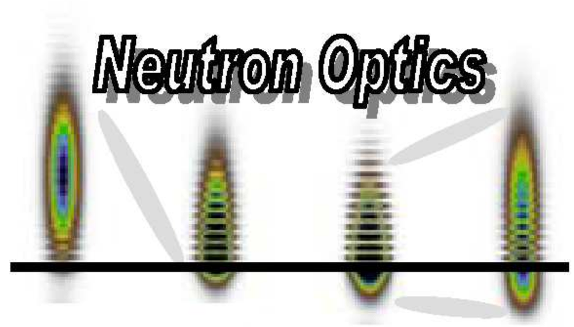

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T2 **focusing devices** (not solid state), more homogenous phase space, optimum transport
TUM, PSI

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TUM, **PSI**, HMI, BNC

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PSI