elliptic neutron guides

from the idea to the implementation

TECHNISCHE UNIVERSITÄT MÜNCHEN

Peter Böni
Sebastian Mühlbauer
Martin Stadlbauer

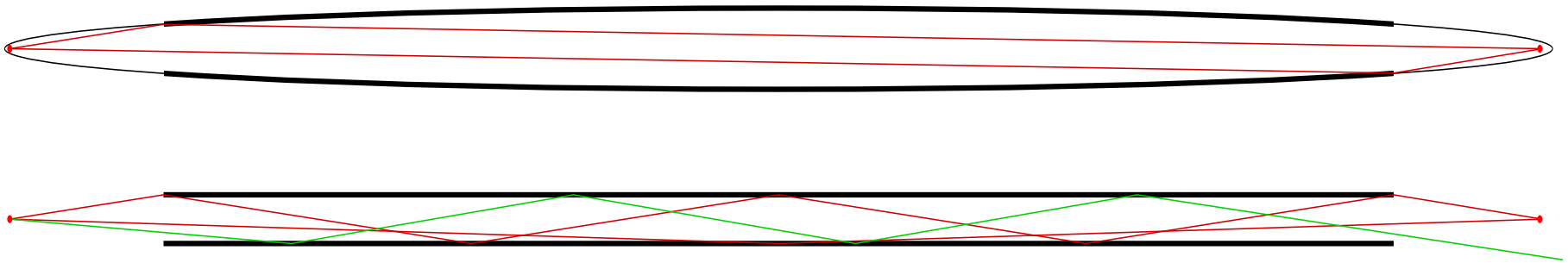
Paul Scherrer Institut

Jochen Stahn
Murat Ay
Uwe Filges
Christian Schanzer

SwissNeutronics

Idea: all walls of the guide (rectangular cross section) are elliptically tapered

the (point-like) source is in one focal point of the ellipse
the other is at the sample / the monochromator / the detector ...



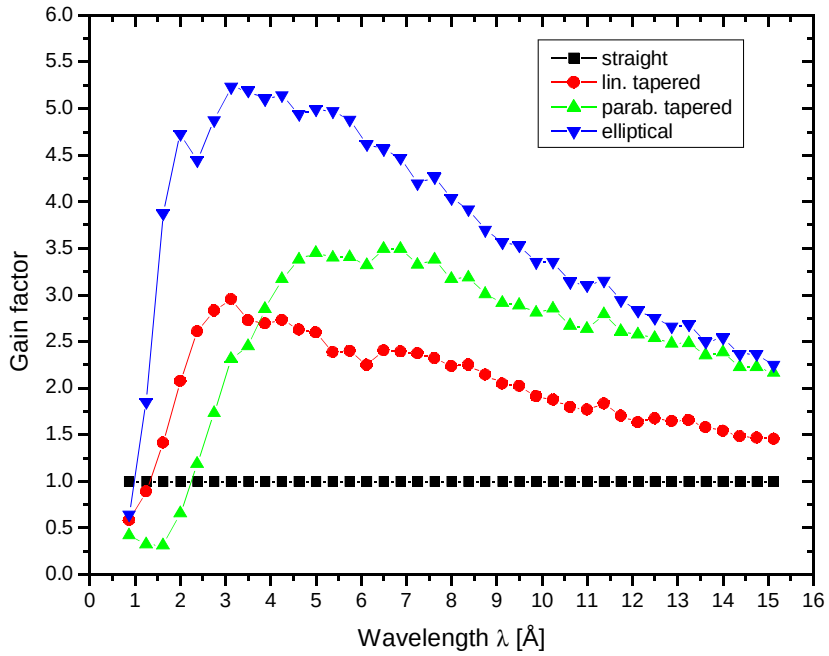
only 1 reflection horizontally and vertically for a point source

high-m coatings are necessary close to the focal points, only

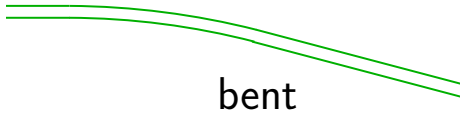
e.g. comparison of guide-types by
Monte Carlo simulations (MCstas):

guide: 40 m, source/guide and guide sample: 1.8 m

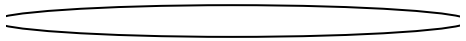
simmulated gain factors for the
3-axes-spectrometer TASP at SINQ



straight guide



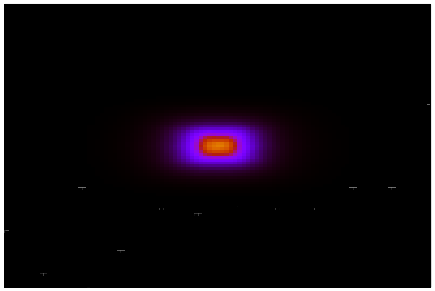
bent
straight guide

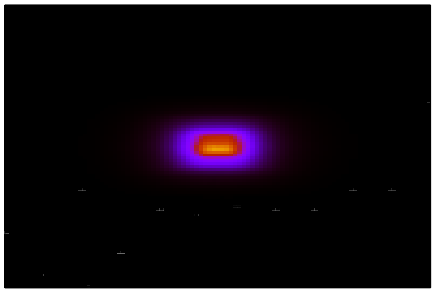


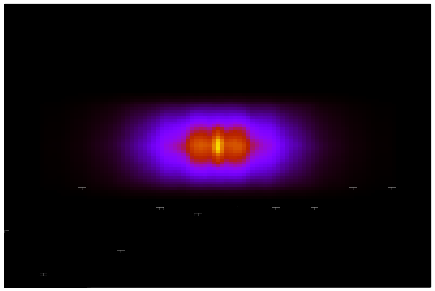
elliptic guide

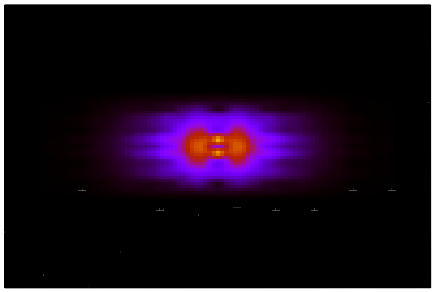
elliptic guide
with absorber

divergence after guide



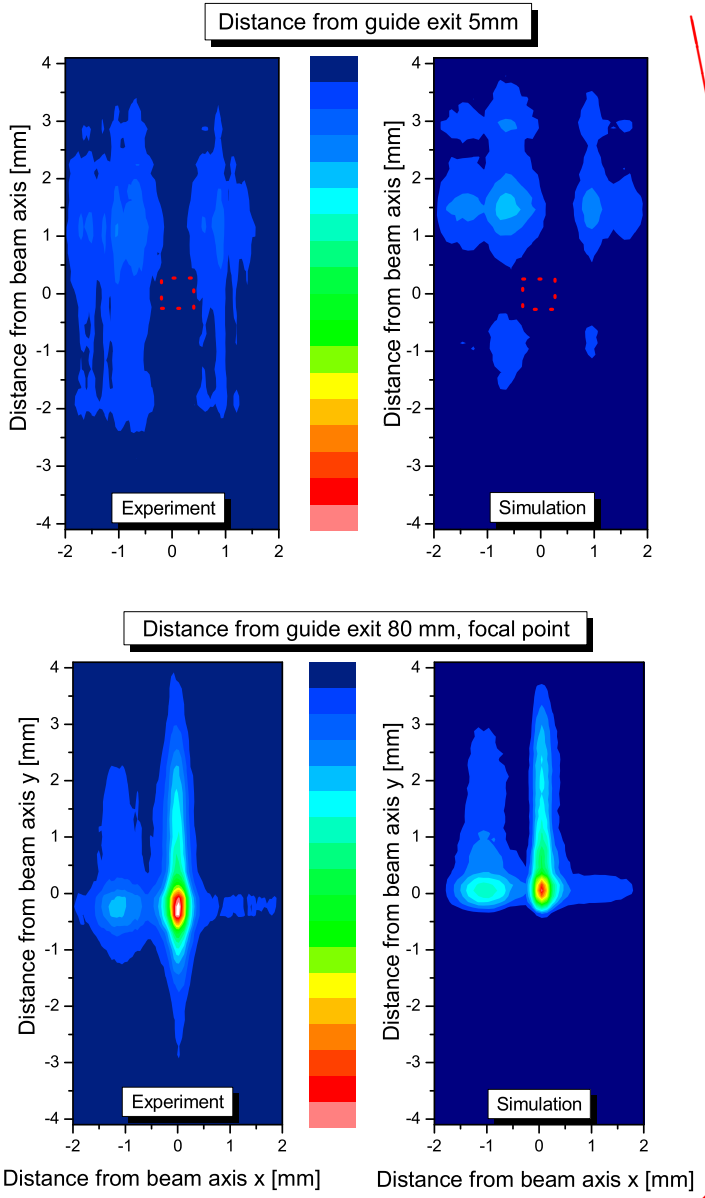






N.I.M. A **529**, 63-68 (2004)

elliptic neutron guides — test device — measurements



bi-elliptic guide scaled 1:10

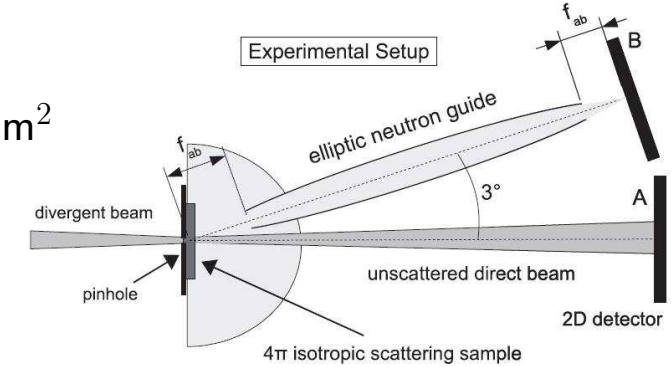
2 m long

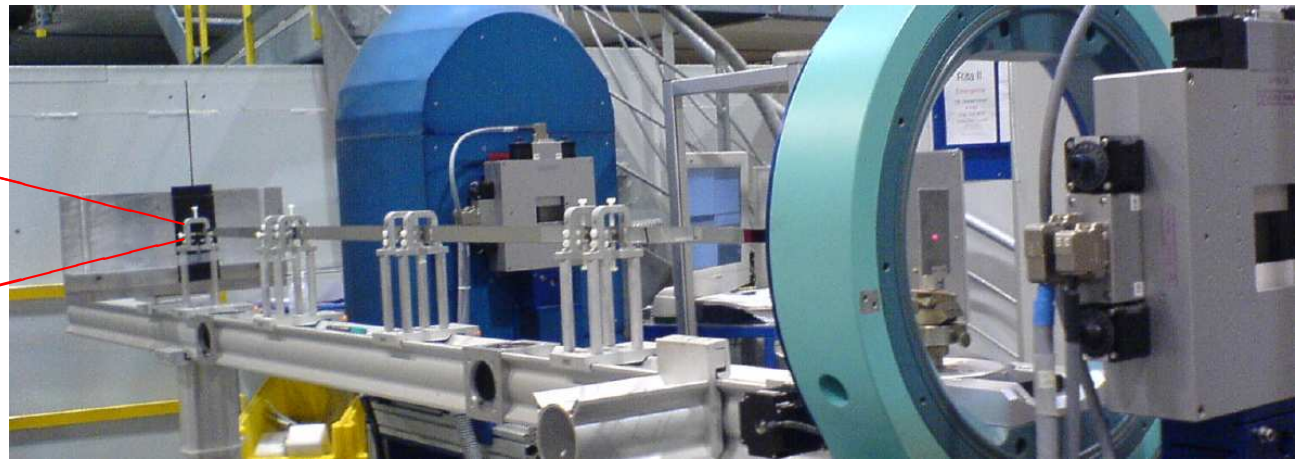
entrance: $4 \times 8\,\mathrm{mm}^2$

maximum dimensions: $12 \times 24\,\mathrm{mm}^2$

measured on

- Morpheus at SINQ
- MIRA at FRM II

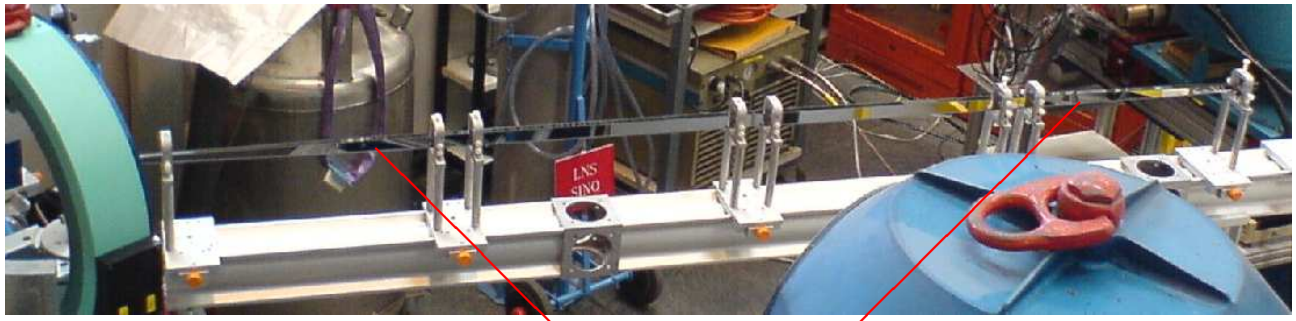


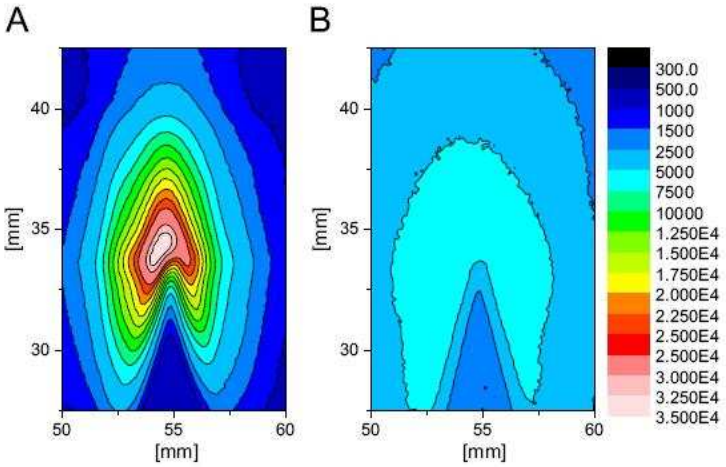


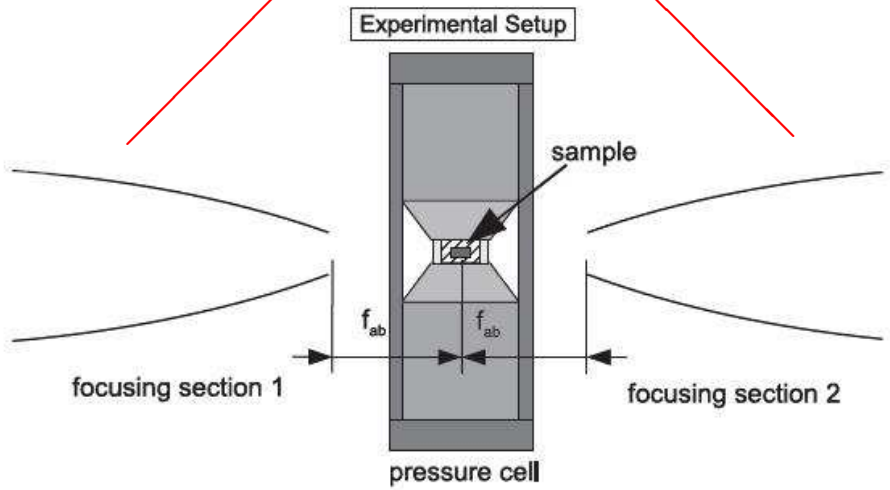
idea:

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 it into the detector

tested on PANDA at FRM II
result:







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

modern grinding machines

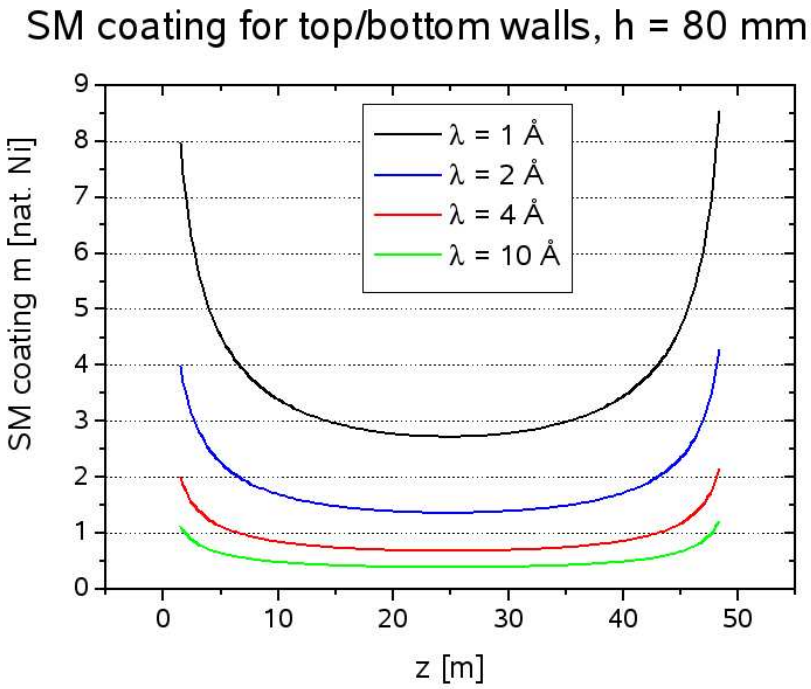
$\Rightarrow$ non-linear shapes

dimensions:

typically twice of straight guide

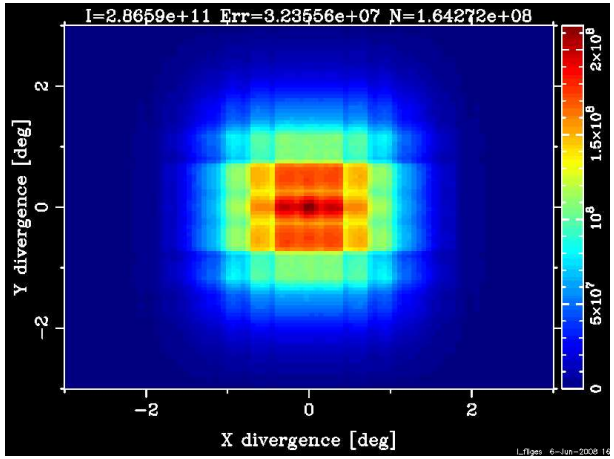
value for money:

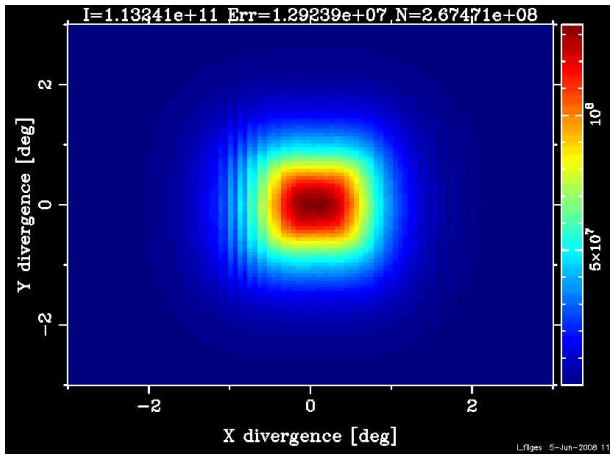
more glass, cheaper coatings



direct line of sight might be a problem

divergence shows cross-pattern:

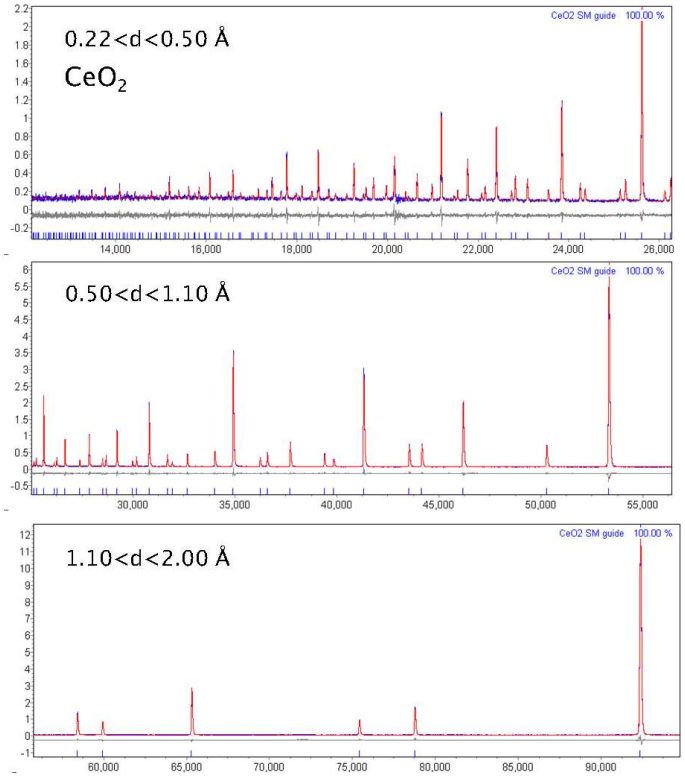


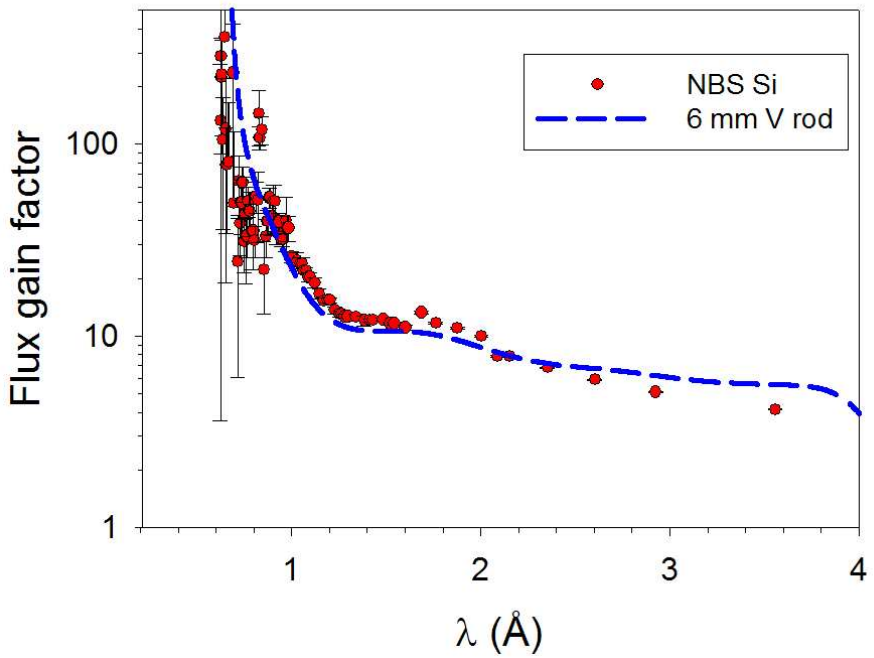


first bi-elliptical neutron guide
for HRPD at ISIS

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

from the idea

via simulations

and test devices

to a working guide