Experiences with the Selene guide prototype

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Selene guide

point-to-point focusing

with

2 subsequent elliptical reflectors

for

horizontal and vertical direction
light-field-diaphragm
c control of footprint

uncorrected, inverted image

aperture
defines divergence

image/sample
concept

coma aberration

chromatic aberration (gravity)
→ limits length \times wavelength to \approx 400 \text{ m Å}

transmission
→ 4 reflections at relatively high \( q_z \)
\Rightarrow \text{reduced transmission}

coating \( m \approx 8 \frac{\Delta\theta/\text{deg}}{\lambda_{\text{min}}/\text{Å}} \)
comparison to normal elliptic guide

$I(y)$

$I(\theta)$

0, 1, and $\geq 2$ reflections

prototype

on Amor @PSI

slit = virtual source
polariser
1st segment
spin flipper
2nd segment
sample stage
flight tube
detector

optical bench, 8 m long
on Amor @PSI

- total length $= 4 \text{ m}$
- divergence $\approx 1.8^\circ \times 1.8^\circ$
- max spot size $\approx 2 \times 2 \text{ mm}^2$
- wavelength $\geq 4 \text{ \AA}$
high-intensity specular reflectometry

angle-dispersive reflectometry

energy-dispersive reflectometry

angle- and energy-dispersive reflectometry
high-intensity specular reflectometry

data acquisition and reduction

raw data

illumination corrected

normalised

$A = 60 \text{ mm}^2$

$t = 180 \text{ s}$
guide quality

- negligible waviness (due to glue)
- deviation of guide shape from the ellipse at the junctions (due to polishing)
  ⇒ dark lines in $I(y, z)$ and widening of focal spot

$I(y, z)$ reflected by a SM

guide alignment

- using optical light & pin-hole
- criteria: small focal spot
  homogeneous $I(y, z)$ map on detector
  ⇒ very accurate but time-consuming due to limited access
reliability

- guide on support beam is very robust
- position of guide relative to source depends on $T$!
- thermal expansion of tilting-stage
- inclination (and its encoding) are not precise enough
- position of sample is the main problem
  - alignment of sample (and reference) at the focal spot
  - shift in $z$ and $\omega$ due to environment, $T$ and $H$
a TOF reflectometer for the ESS

- horizontal scattering plane
- sample size $< 10 \times 50 \text{ mm}^2$
- divergence $1.5^\circ \times 1.5^\circ$
- $\lambda \in [4, 10] \text{ Å}$
- principle operation modes: classical, optimised, high-intensity
- lay-out
guide lay-out

side view

monolith
common shielding
instrument shielding

top view

cave

0 2 6 15 23 36 43 x/m
replacement of beam guide

old guide:
- 4.5 m $5 \times 12 \text{ cm}^2$ straight together with SANS
- 24.5 m $5 \times 5 \text{ cm}^2$ curved & split vertically
- 5 m $5 \times 5 \text{ cm}^2$ straight

new guide:  
  *Selene*-type focusing on moderator
further applications

higher $\theta$-coverage (option for *Estia*)

Werner Schweika’s thermal & cold guide

polariser / analyser (realised on *Amor*)

astigmatic beam
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