



FREIA

Fast Reflectometer for Extended Interfacial Analysis

McStas simulation status

August 2012 update

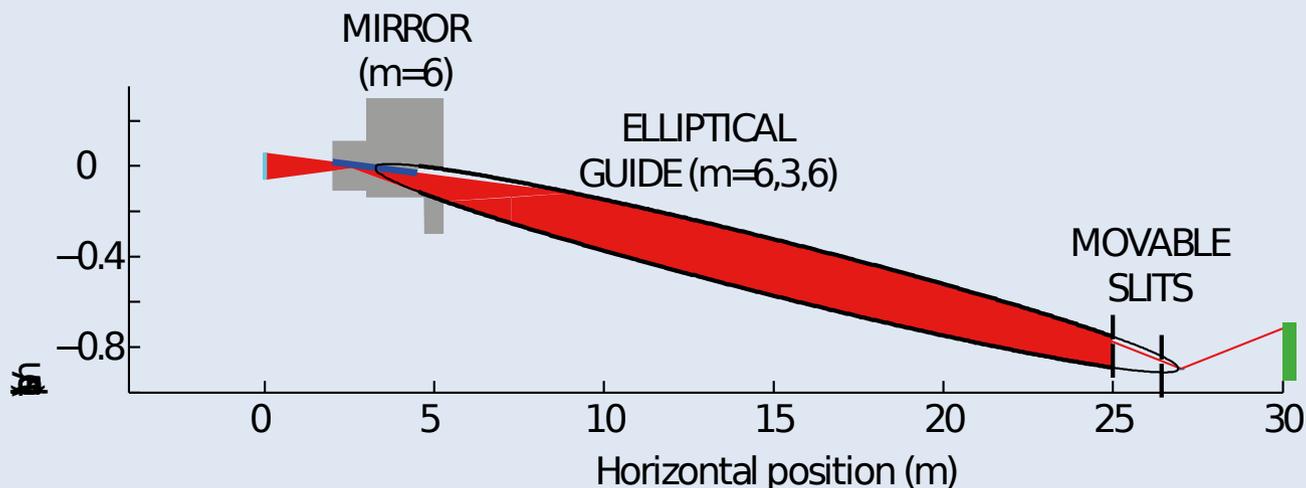
Anette Vickery

ESS Design Update Programme-Denmark
Niels Bohr Institute, Copenhagen

FREIA

Fast Reflectometer for Extended Interfacial Analysis

- Horizontal sample (40 x 40 mm² or smaller)
 - The reflectivity is determined as function of wave-vector transfer $Q=4\pi\sin(\theta)/\lambda$
 - Short instrument (~30m) – wide bandwidth (~8Å)
 - Wide range of grazing angles (0.20°- 4.11°)
- $\lambda = [2\text{Å}-10\text{Å}]$, $\theta=[0.20^\circ - 4.11^\circ] \rightarrow$ Accessible Q -range= $[0.0063\text{Å}^{-1} - 0.45\text{Å}^{-1}]$

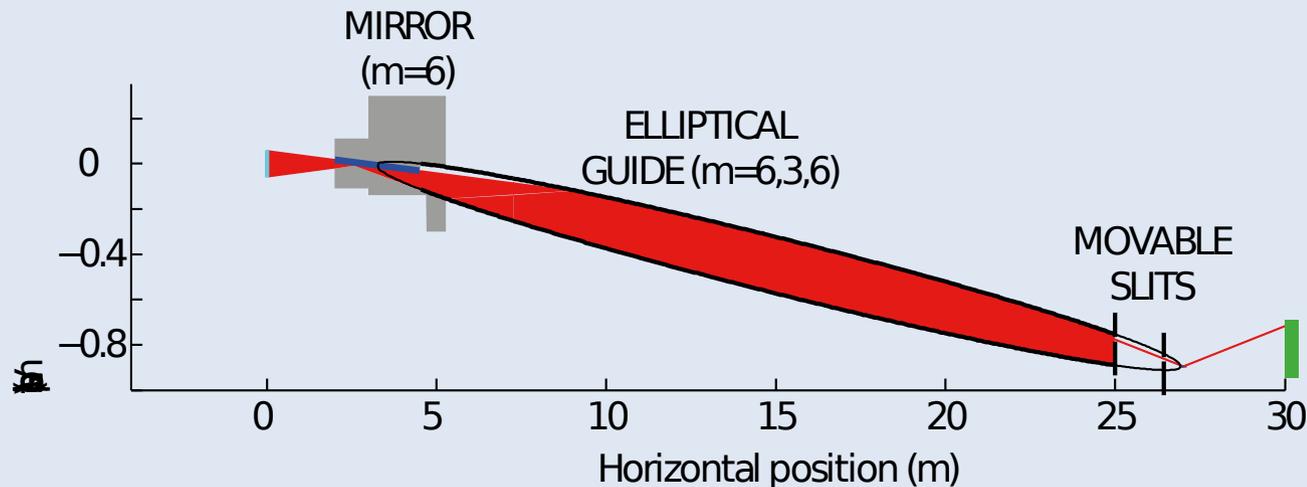


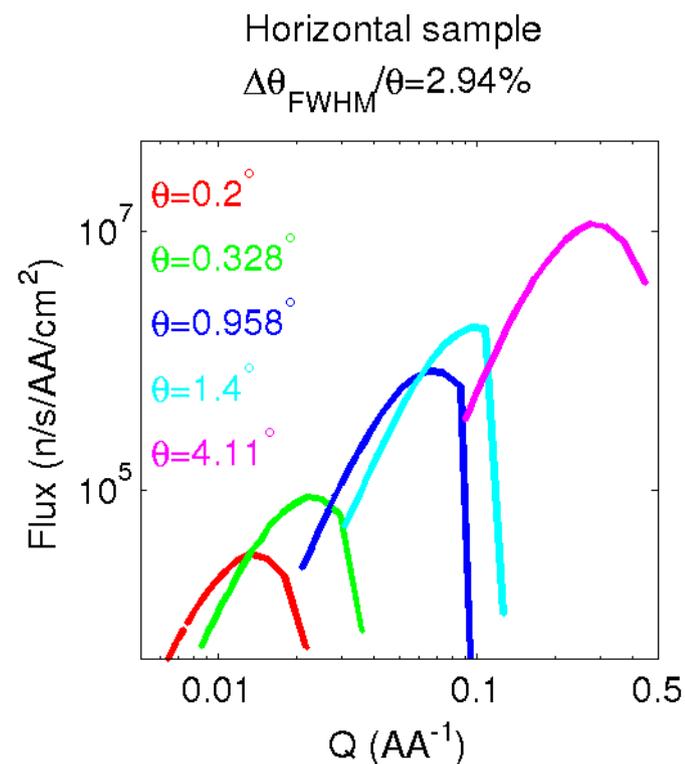
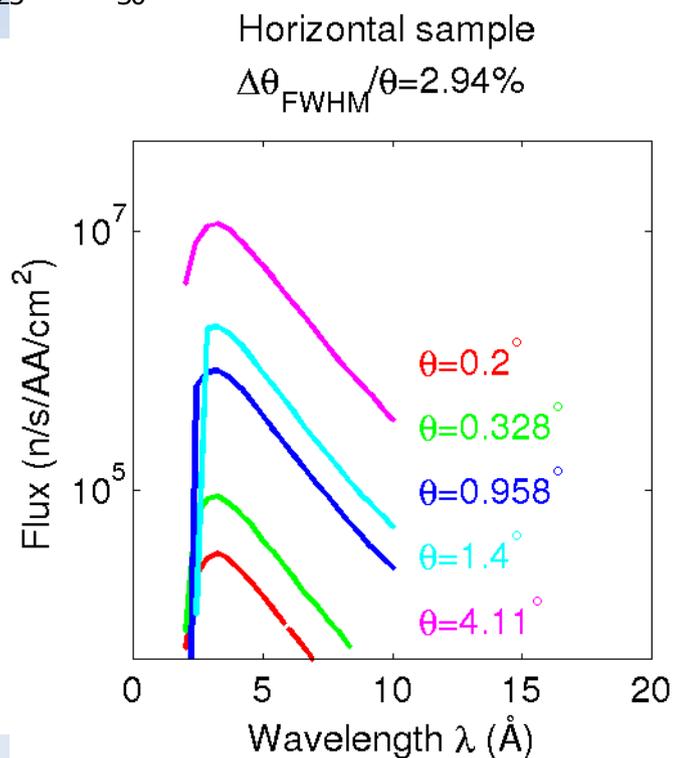
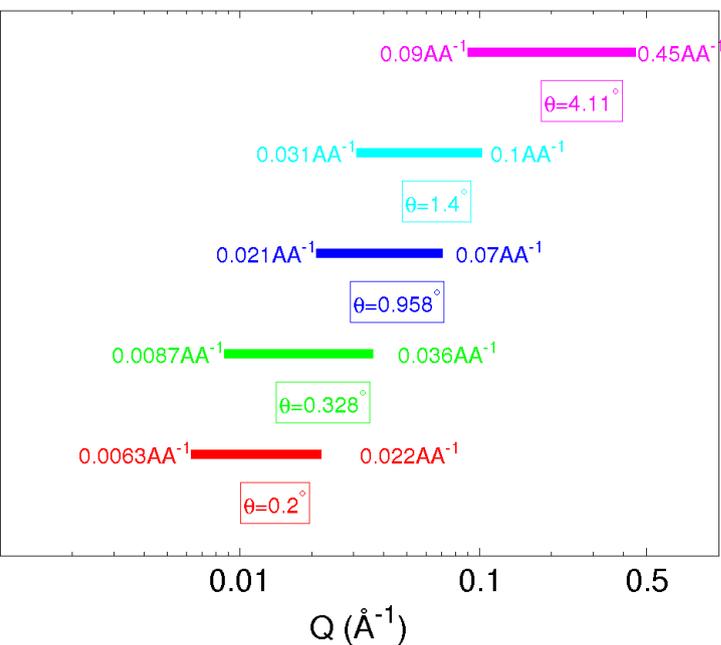
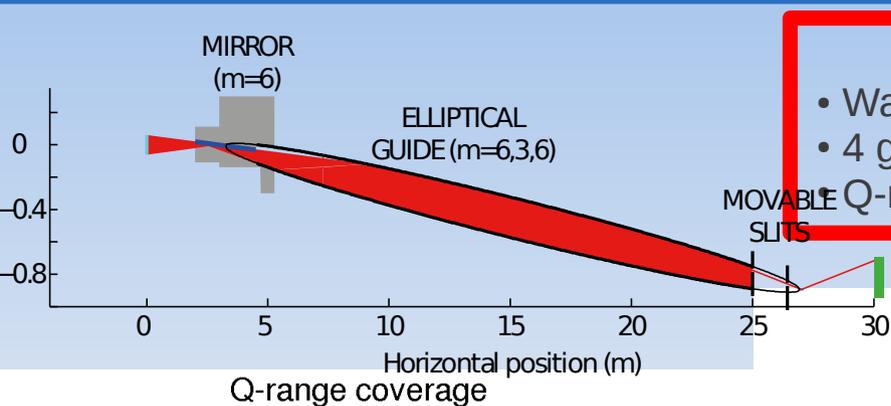


Fast Reflectometer for Extended Interfacial Analysis



- 2.5m mirror, $m=6$
- Mirror inclination 1.14°
- 20.5m elliptical guide, $m=6,3,6$
- Guide inclination 2.14°
- Max guide height 25cm
- guide entry 12cm x 11cm
- guide exit 14cm x 14cm
- Sample 0.9m below moderator

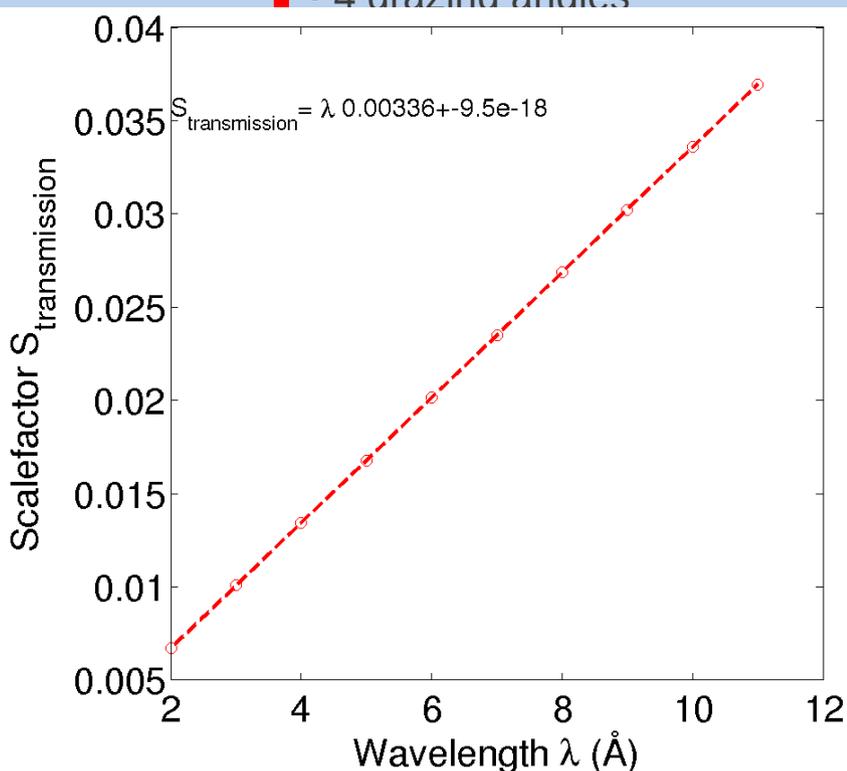




Q-range and time averaged flux Comparison to existing instrument FIGARO

FREIA

- Wavelengths 2 Å --- 10 Å
- 4 grazing angles



FIGARO

- Wavelengths 2 Å --- 30 Å
- 2 grazing angles
- Q-range 0.0045 Å⁻¹ --- 0.42 Å⁻¹

- The FIGARO flux is simulated with the ILL-source, choppers disabled and scaled by the chopper transmission(λ).
- The FIGARO flux VS Q (without any scaling) simulated with the ESS source is very similar to what we get with the FREIA.

Q-range and time averaged flux Comparison to existing instrument FIGARO

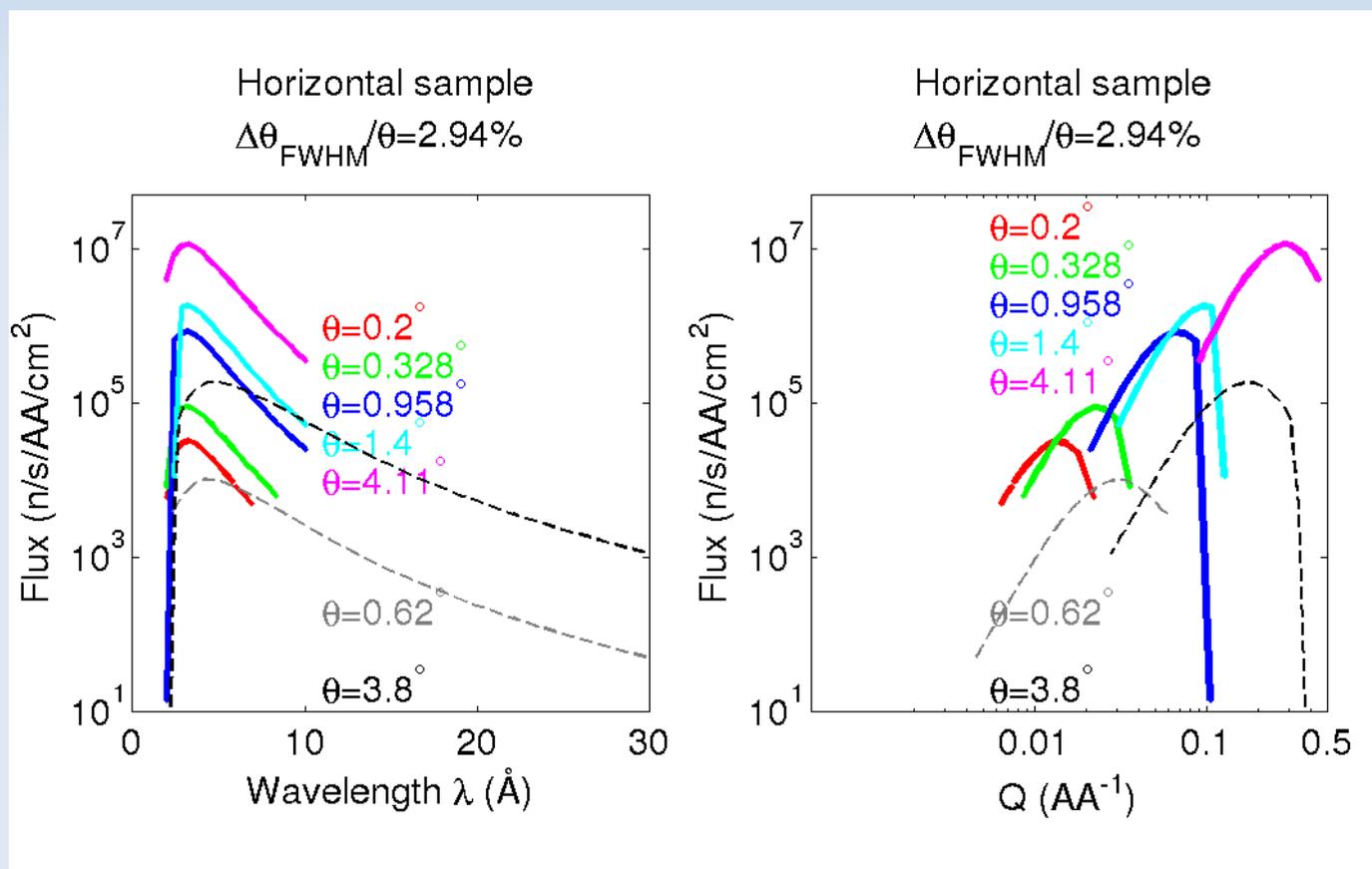


FREIA

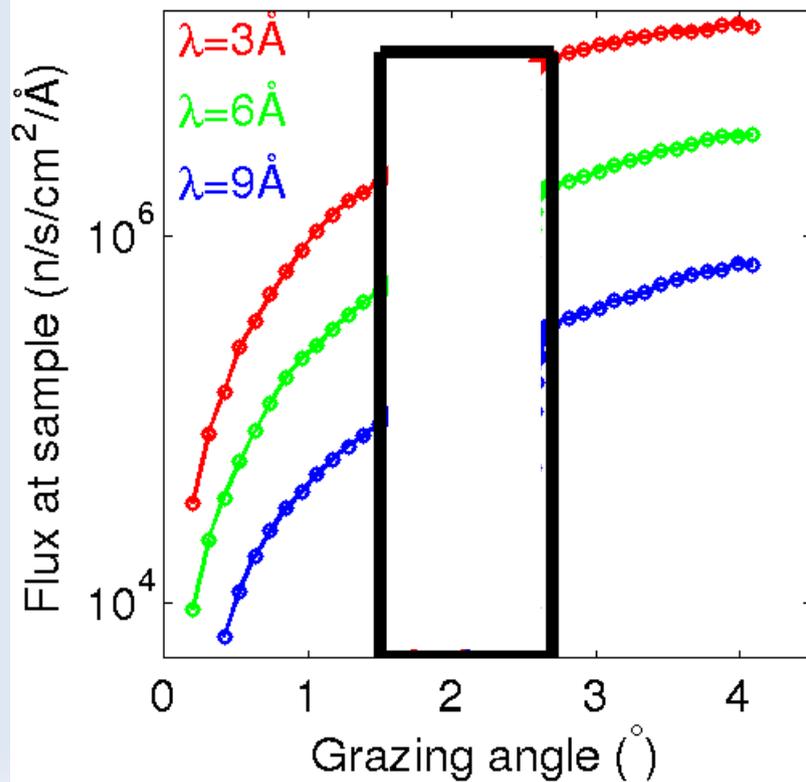
- Wavelengths 2 Å --- 10 Å
- 4 – 5 grazing angles
- Q-range 0.0063 Å⁻¹ --- 0.45 Å⁻¹

FIGARO

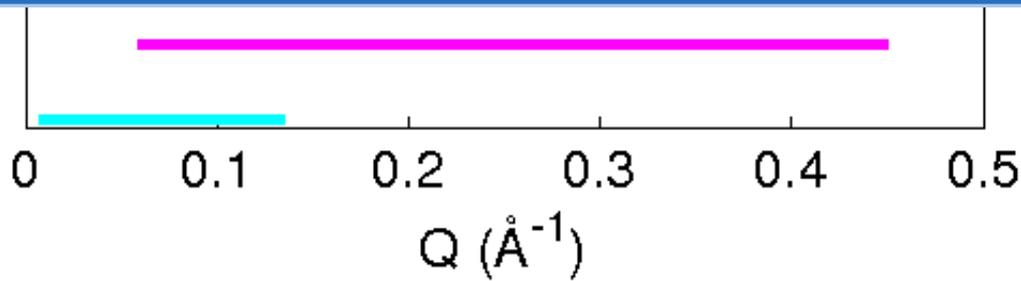
- Wavelengths 2 Å --- 30 Å
- 2 grazing angles
- Q-range 0.0045 Å⁻¹ --- 0.42 Å⁻¹



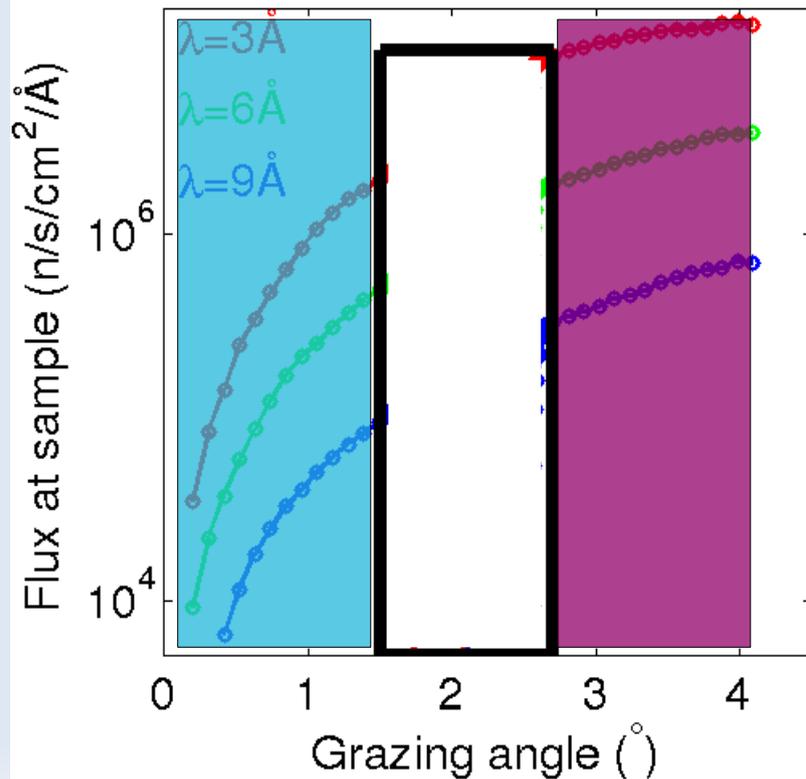
Horizontal sample
 $\Delta\theta_{\text{FWHM}}/\theta = 2.94\%$



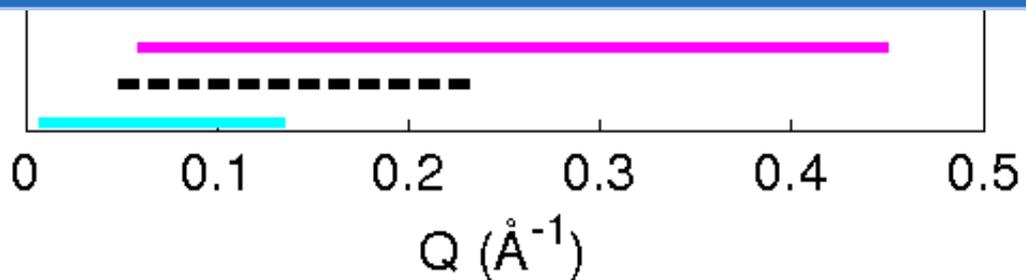
Q-range and time averaged flux



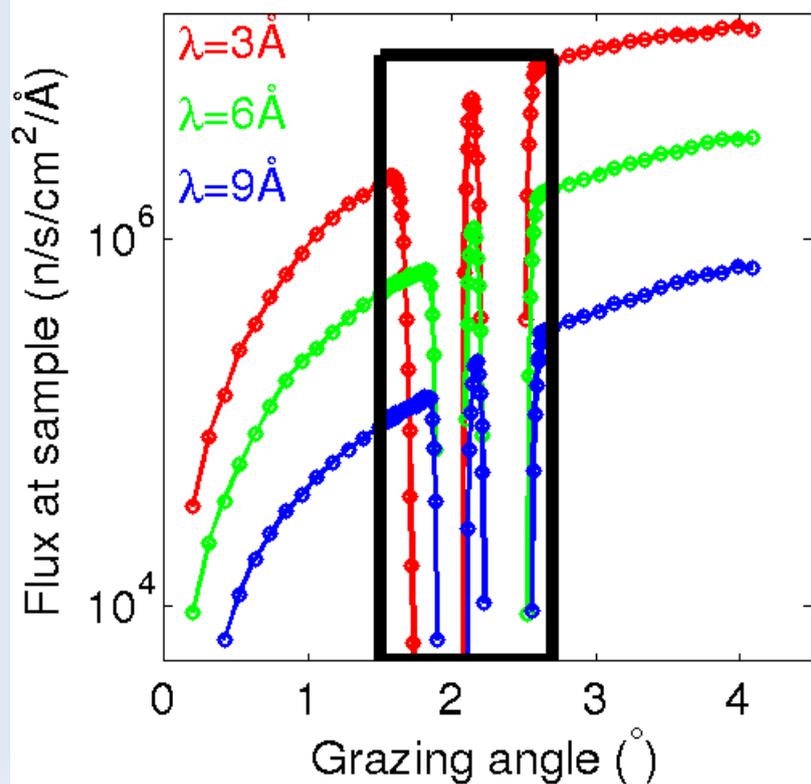
Horizontal sample
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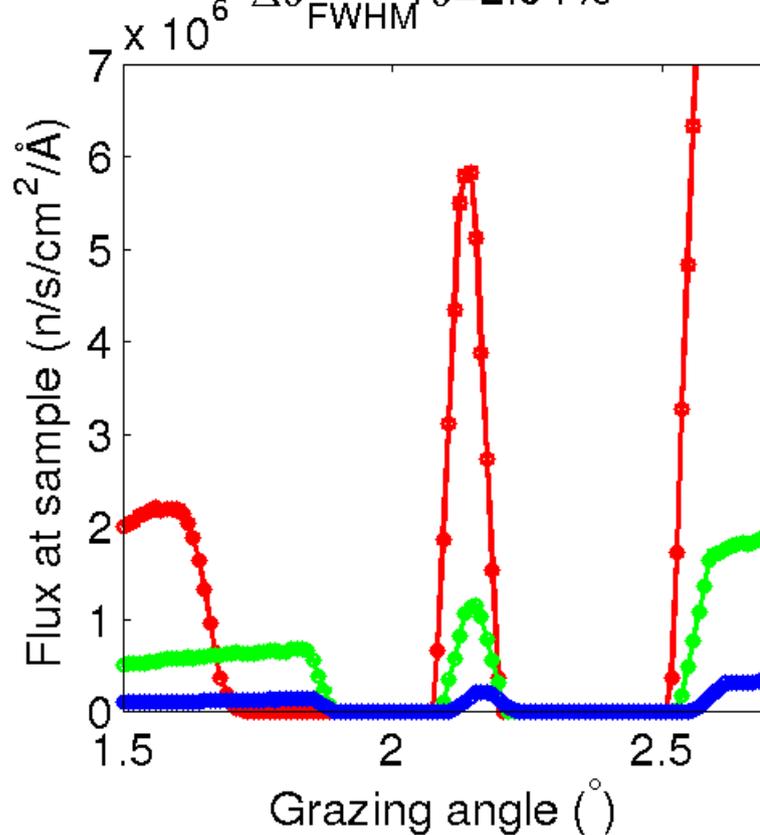
Q-range and time averaged flux



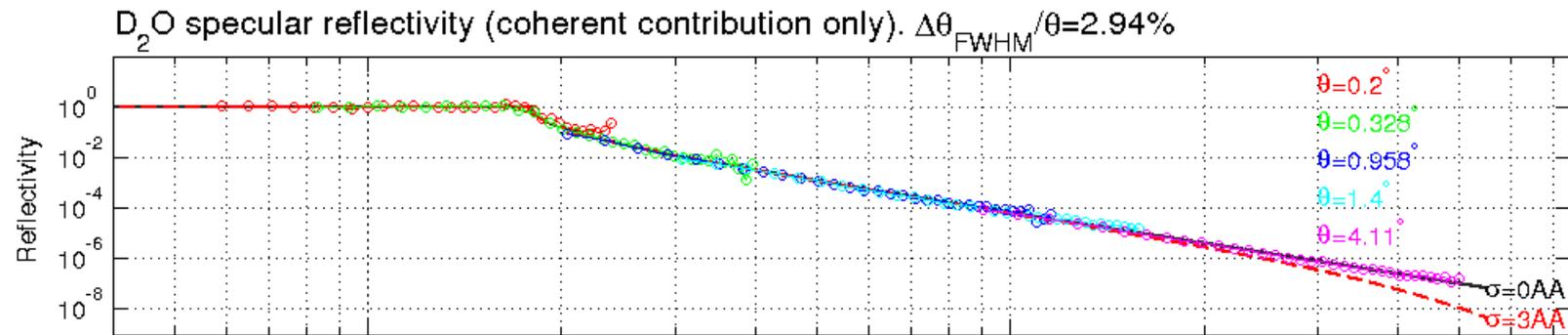
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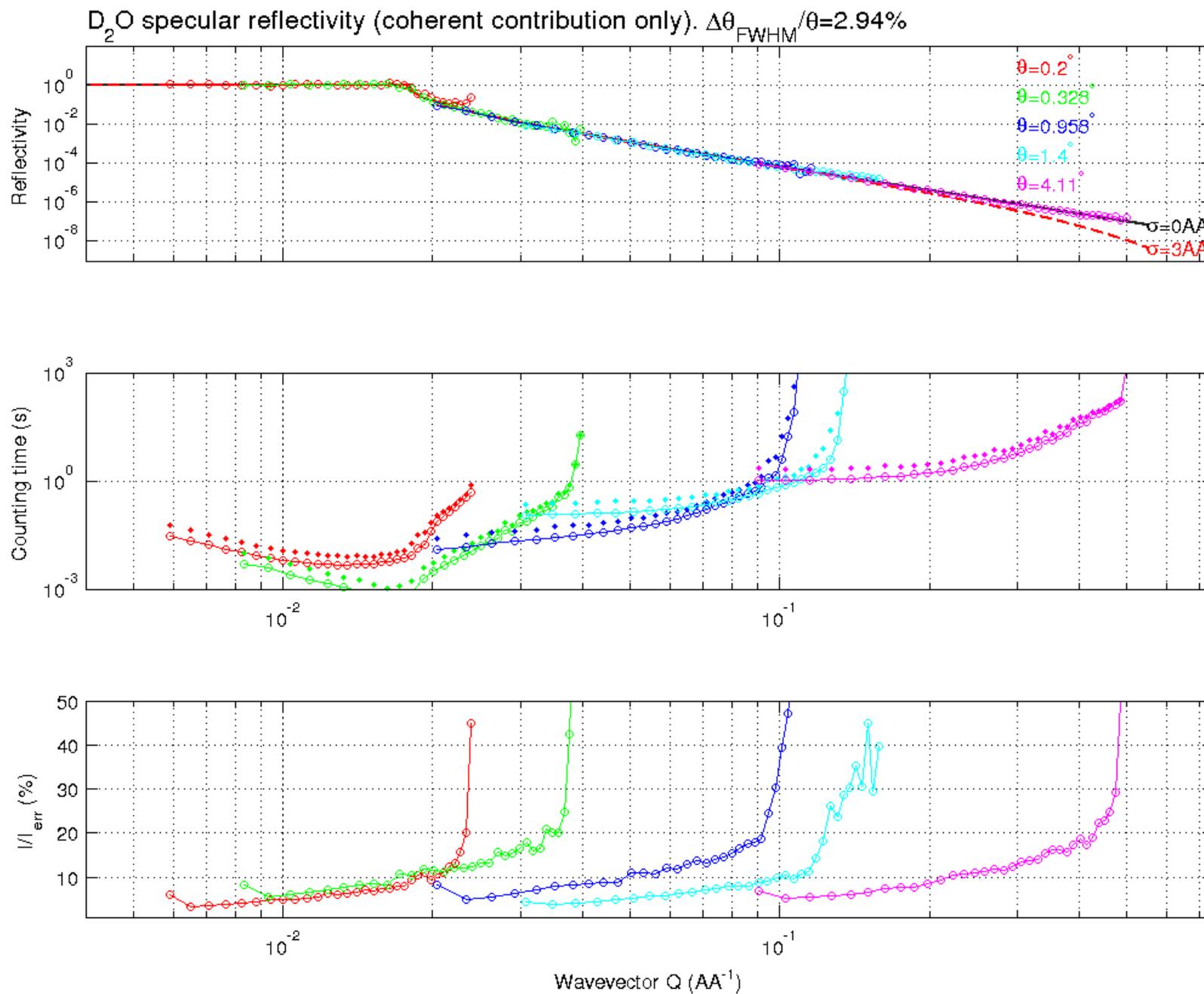
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D2O reflectivity

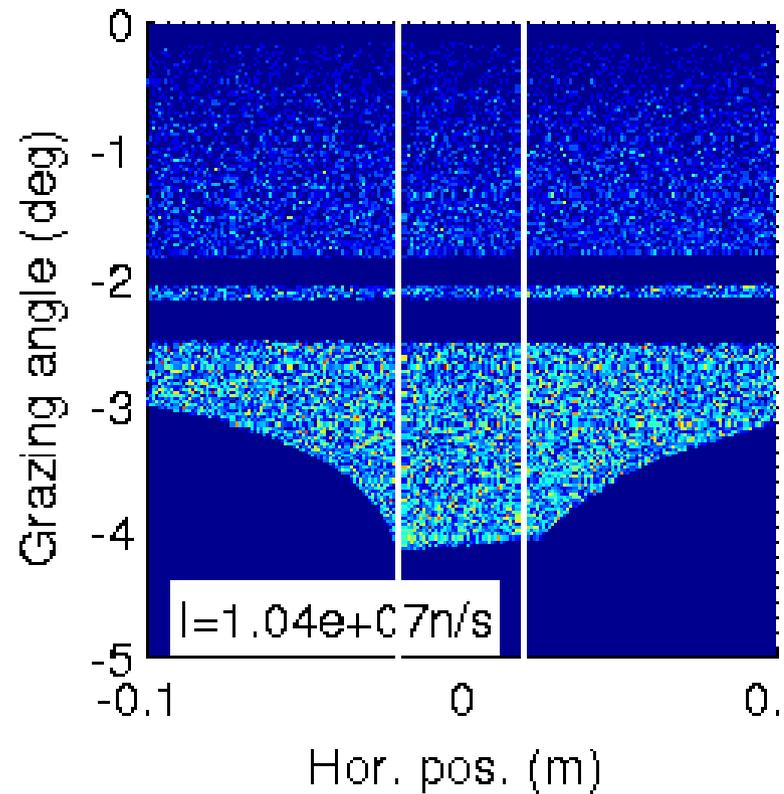


D2O reflectivity



Sample size

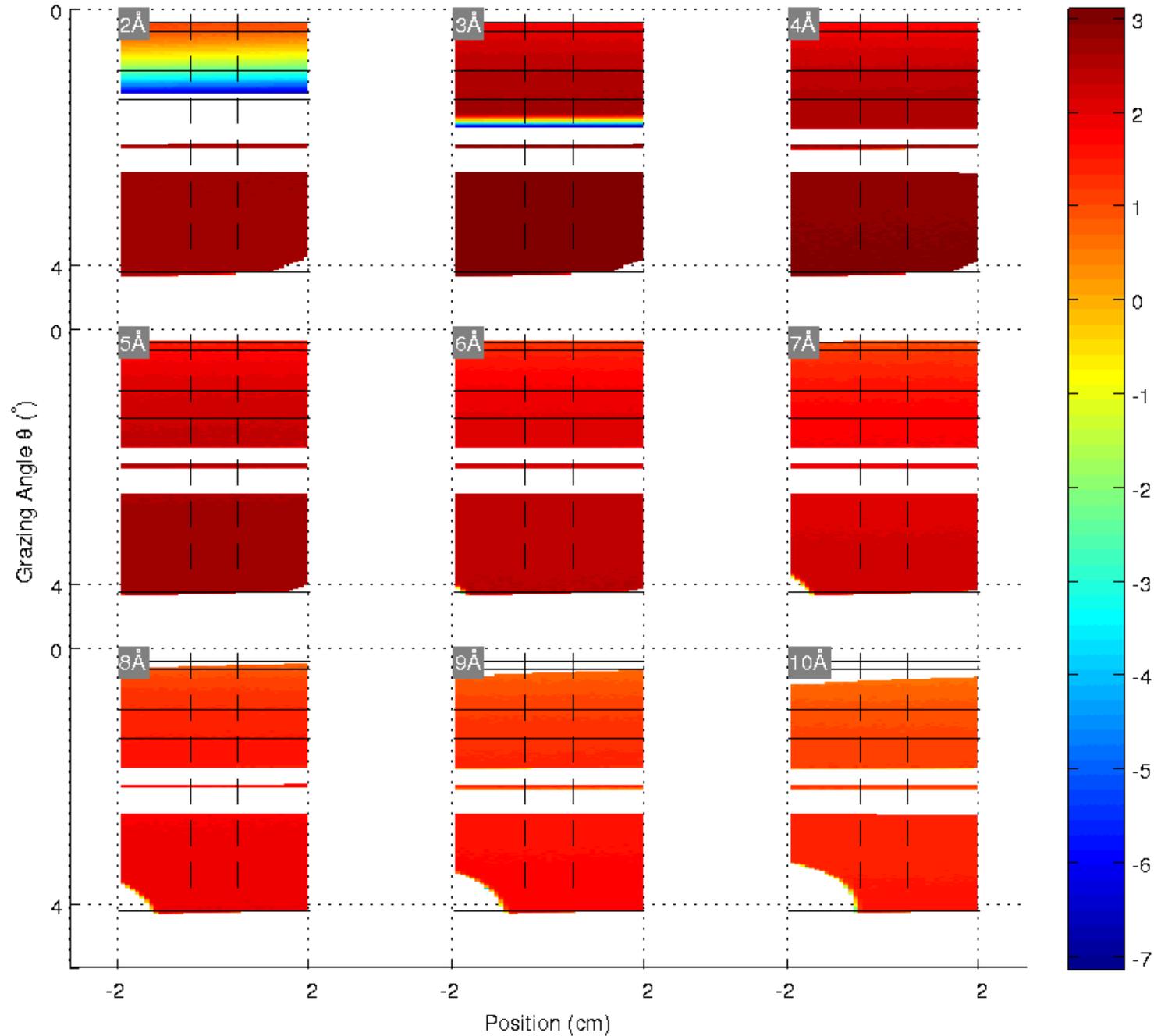
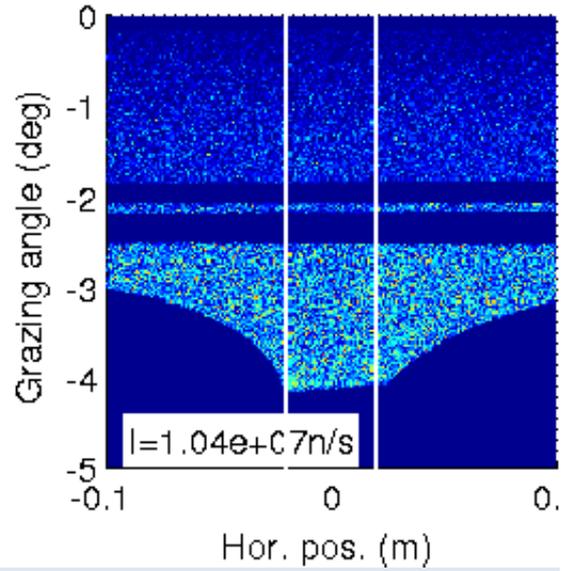
Sample position
Block from 3.24m





Sample size

Sample position
Block from 3.24m



- FREIA is a concept with a huge potential
- It offers a large flexibility in Q-range coverage
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Line Of Sight:

- The combination of shielding and the mirror seems like a good solution for the blocking of Line-Of-Sight.
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- It may be necessary to get even further out of Line-Of-Sight twice

This could be done by

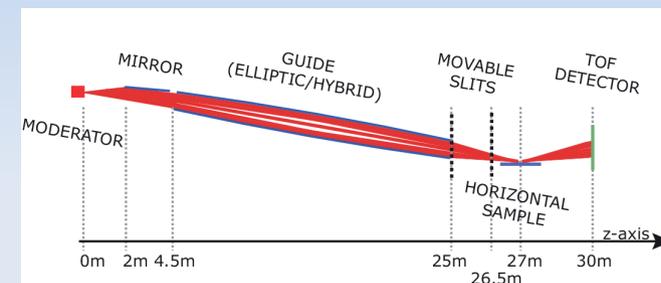
- Adding a curvature in the horizontal plane
- Adding a second mirror reflecting to the side
- No mirror, curving the guide in the horizontal plane
- Mirror reflecting to the side

FREIA

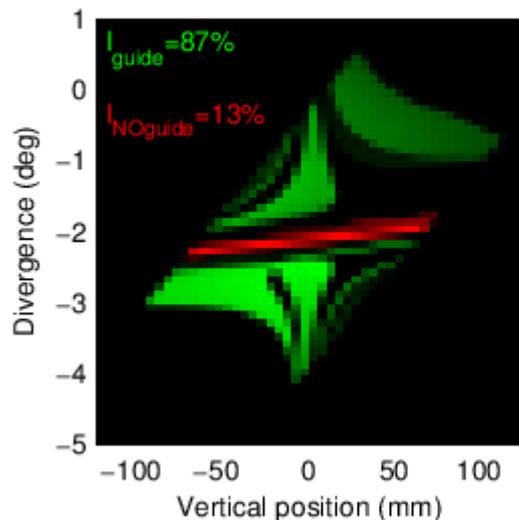
Fast Reflectometer for Extended Interfacial Analysis

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- The reflectivity is determined as function of wave-vector transfer $Q=4\pi\sin(\theta)/\lambda$
- Short instrument ($\sim 30\text{m}$) – wide bandwidth ($\sim 8\text{\AA}$)
- Wide range of grazing angles (0.26° - 4.11°)
- $\lambda = [2\text{\AA}-10\text{\AA}]$, $\theta=[0.26^\circ - 4.11^\circ] \rightarrow$ Accessible Q -range= $[0.0076\text{\AA}^{-1} - 0.45\text{\AA}^{-1}]$

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- guide exit 14cm x 14cm
- Sample 0.9m below moderator



Sample position
Vertical monitor



August 15, 2012

McStas simulation status: FREIA
A. Vickery

FREIA

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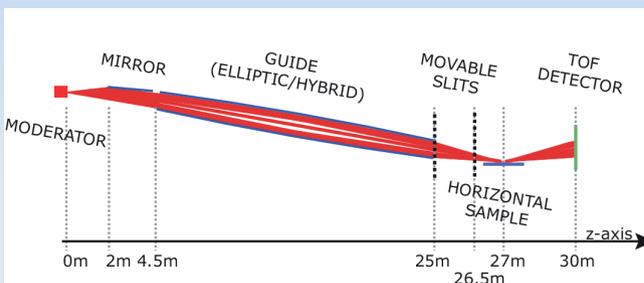
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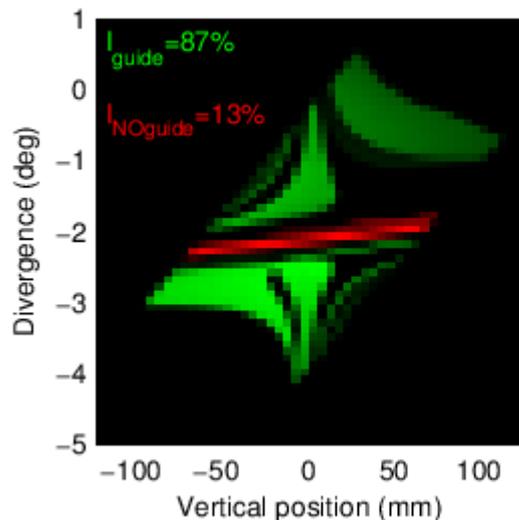
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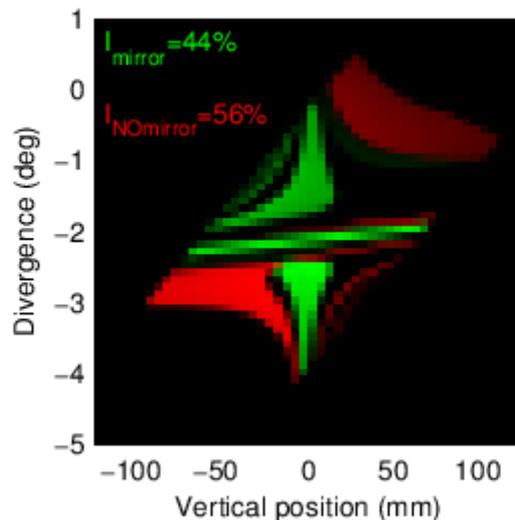
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Sample position
Vertical monitor



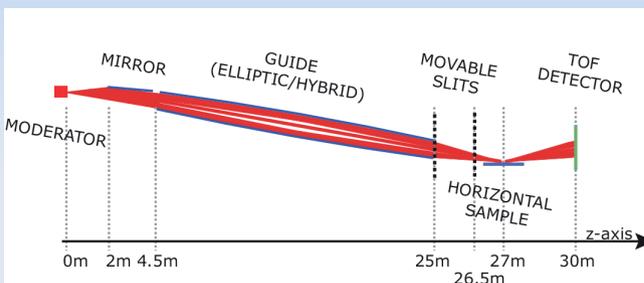
Sample position
Vertical monitor



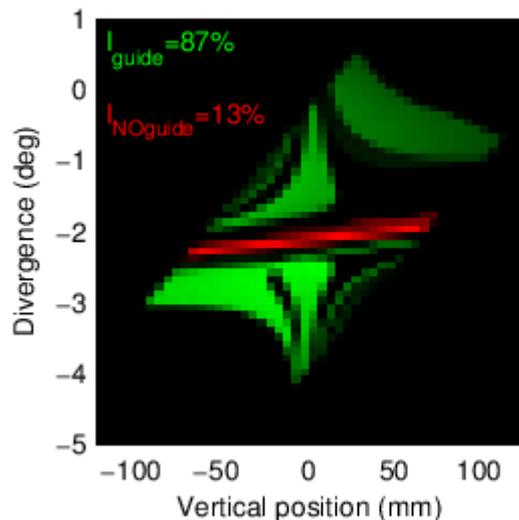
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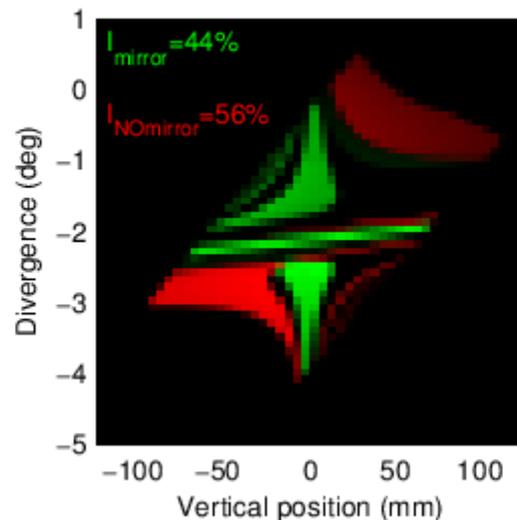
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Sample position
Vertical monitor



Sample position
Vertical monitor



Sample position $40 \times 40 \text{mm}^2$
Horizontal monitor

