



# **FREIA**

## **Fast Reflectometer for Extended Interfacial Analysis**

### **McStas simulation status**

**August 2012 update**

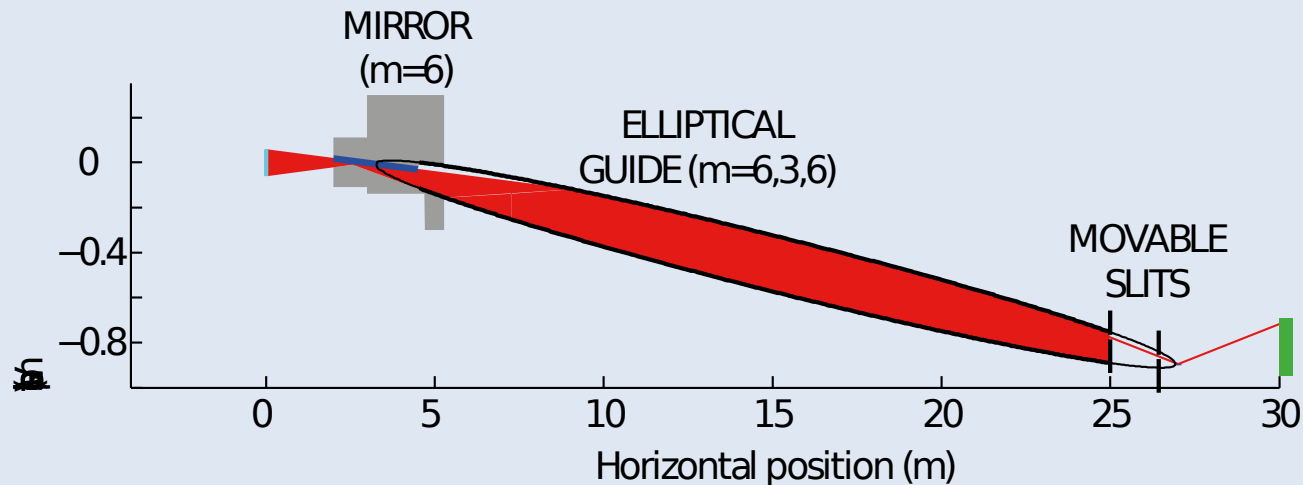
**Anette Vickery**

ESS Design Update Programme-Denmark  
Niels Bohr Institute, Copenhagen

# FREIA

## Fast Reflectometer for Extended Interfacial Analysis

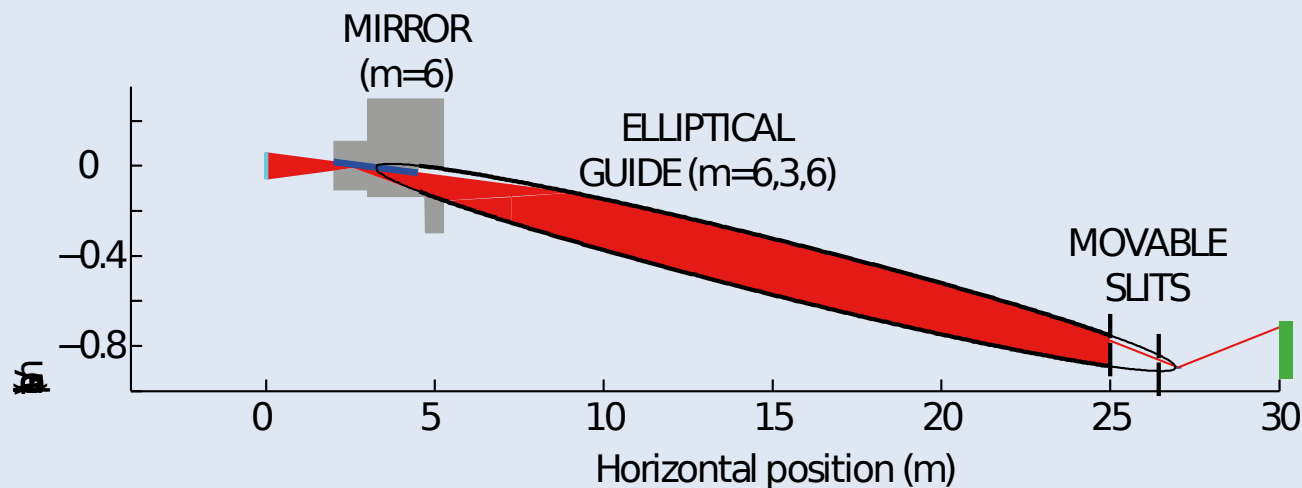
- Horizontal sample (40 x 40 mm<sup>2</sup> or smaller)
  - The reflectivity is determined as function of wave-vector transfer  $Q=4\pi\sin(\theta)/\lambda$
  - Short instrument (~30m) – wide bandwidth (~8Å)
  - Wide range of grazing angles (0.20°- 4.11°)
- $\lambda = [2\text{Å}-10\text{Å}]$ ,  $\theta=[0.20^\circ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

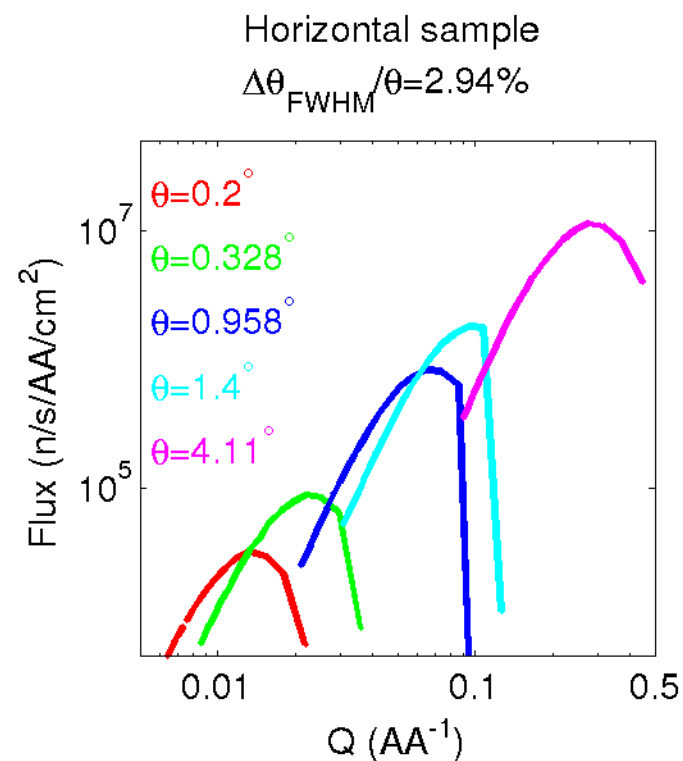
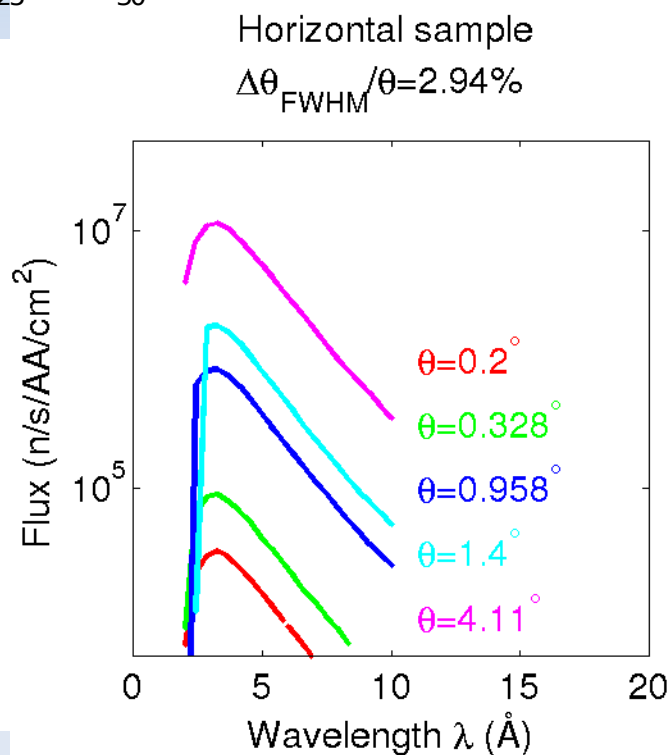
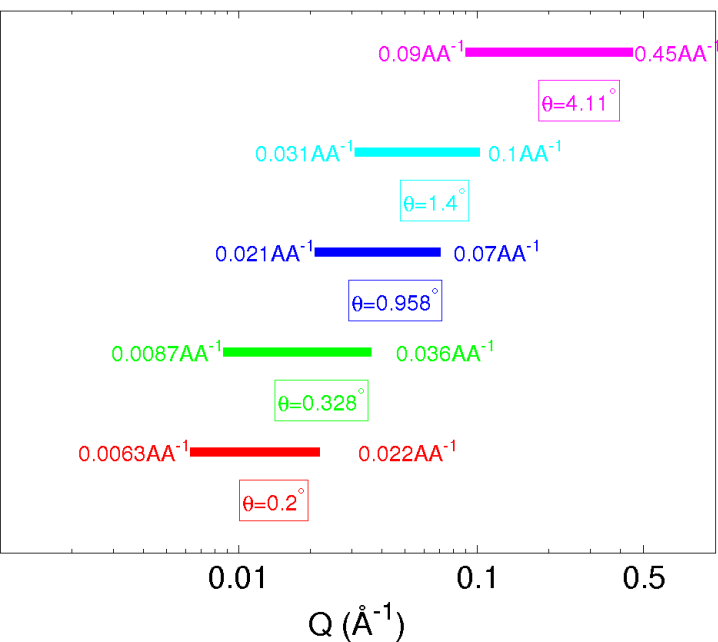
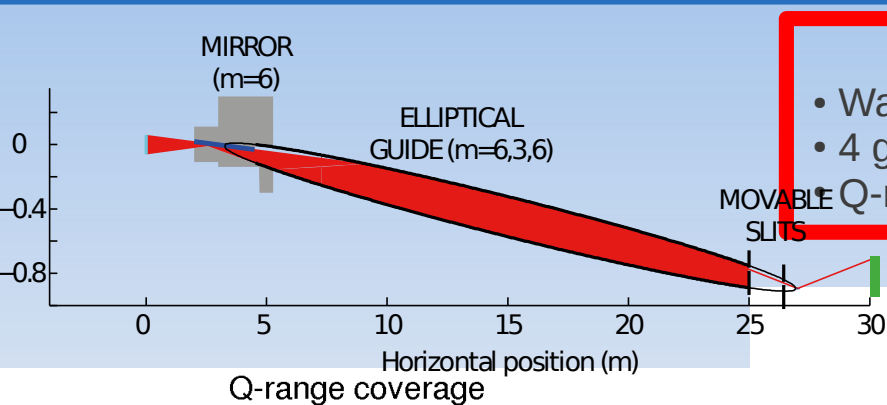


# FREIA

## Fast Reflectometer for Extended Interfacial Analysis

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

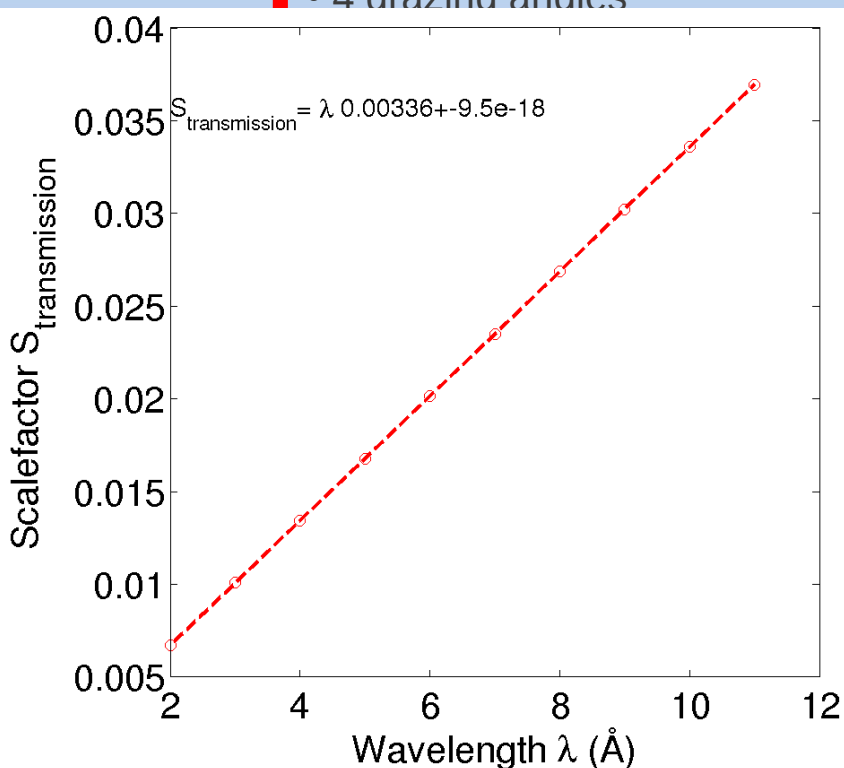




# Q-range and time averaged flux Comparison to existing instrument FIGARO

## FREIA

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



## FIGARO

- Wavelengths 2 Å --- 30 Å
- 2 grazing angles
- Q-range 0.0045 Å<sup>-1</sup> --- 0.42 Å<sup>-1</sup>

- The FIGARO flux is simulated with the ILL-source, choppers disabled and scaled by the chopper transmission( $\lambda$ ).
- 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

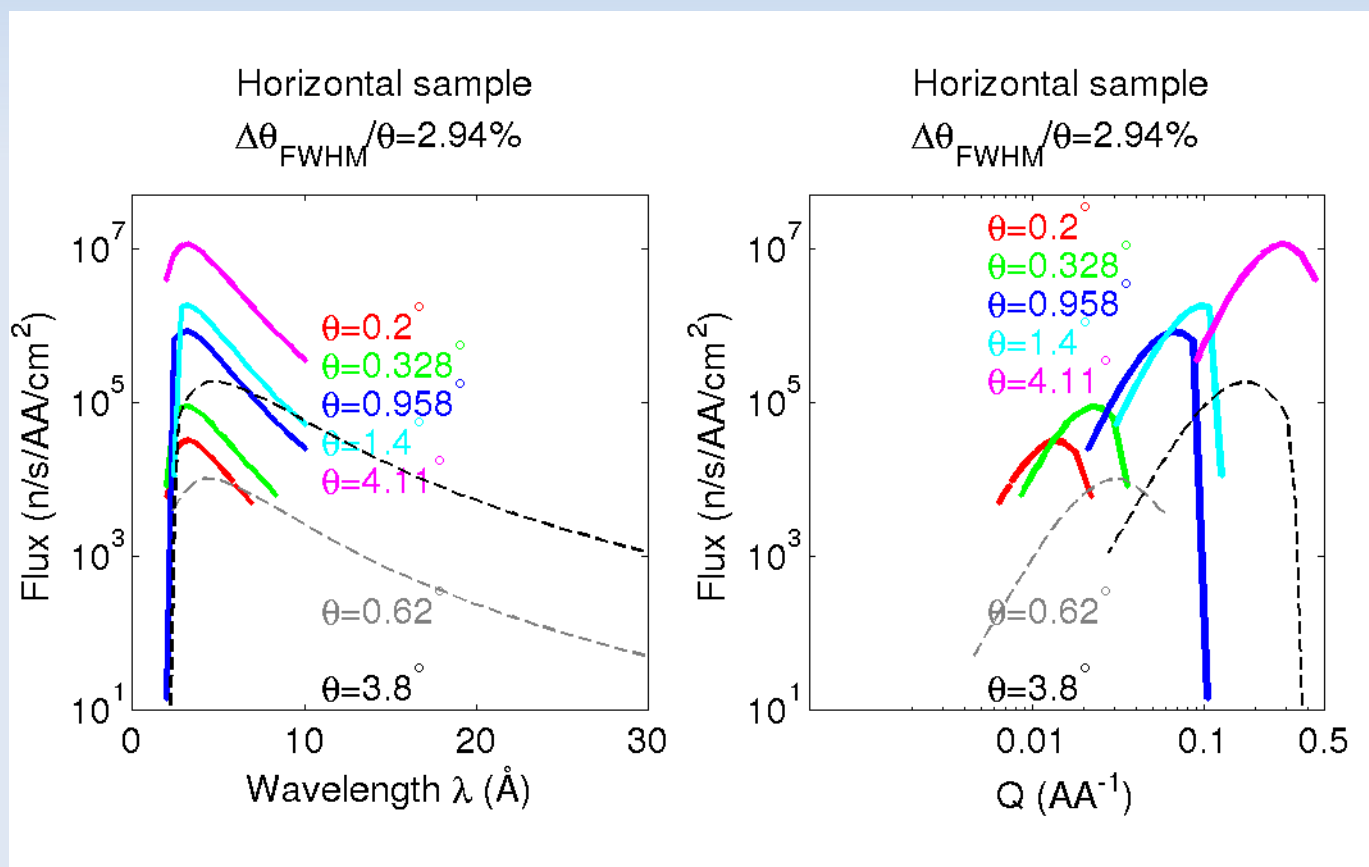


## FREIA

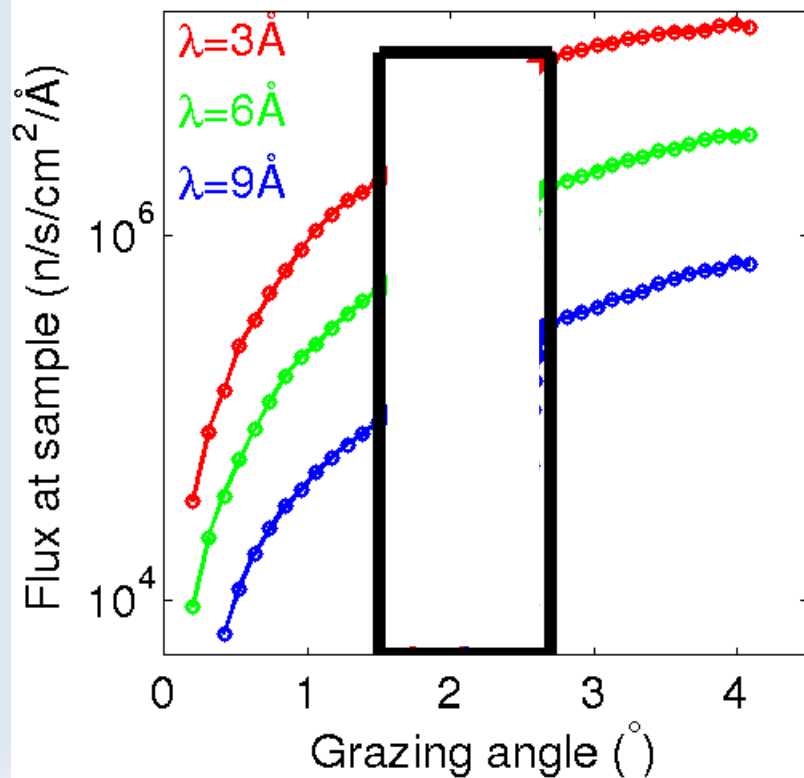
- Wavelengths 2 Å --- 10 Å
- 4 – 5 grazing angles
- Q-range 0.0063 Å<sup>-1</sup> --- 0.45 Å<sup>-1</sup>

## FIGARO

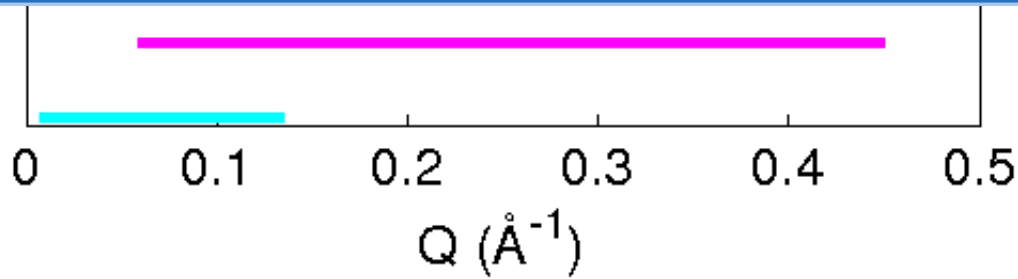
- Wavelengths 2 Å --- 30 Å
- 2 grazing angles
- Q-range 0.0045 Å<sup>-1</sup> --- 0.42 Å<sup>-1</sup>



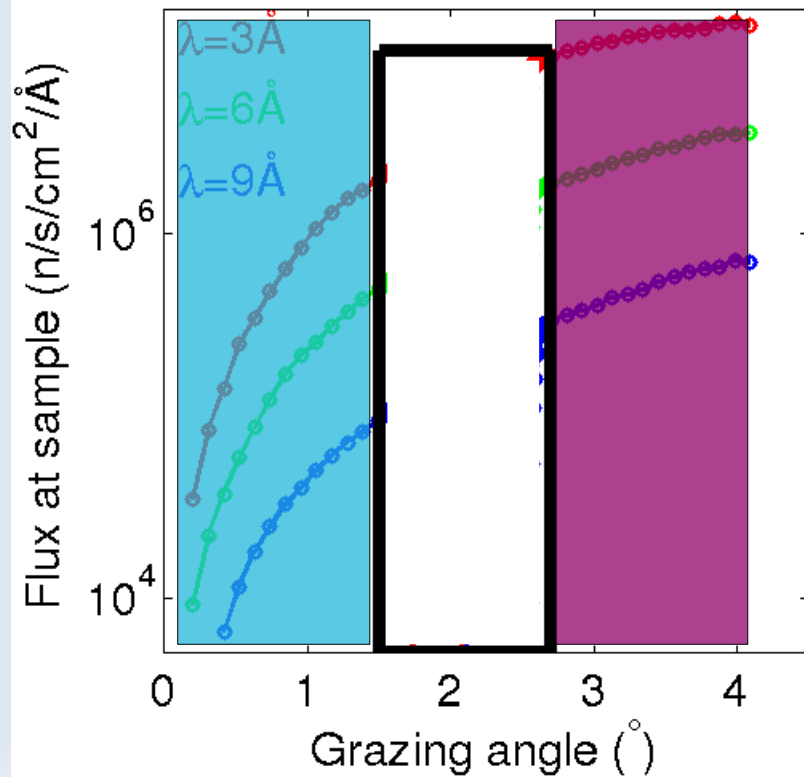
Horizontal sample  
 $\Delta\theta_{\text{FWHM}}/\theta = 2.94\%$



# Q-range and time averaged flux

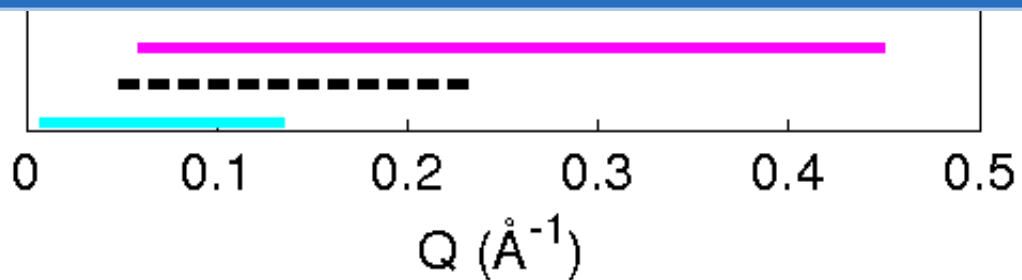


Horizontal sample  
 $\Delta\theta_{\text{FWHM}}/\theta = 2.94\%$

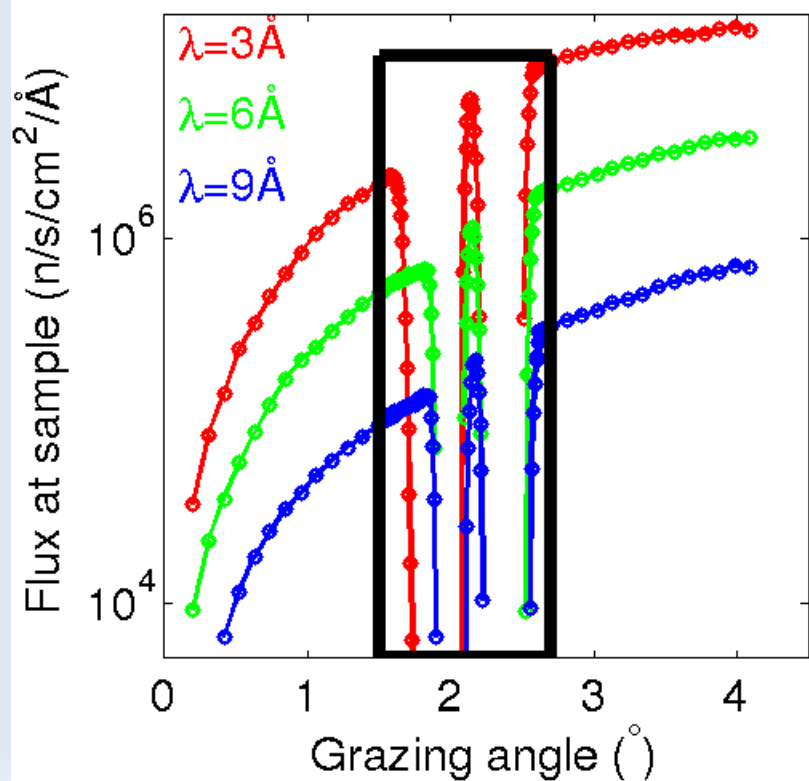




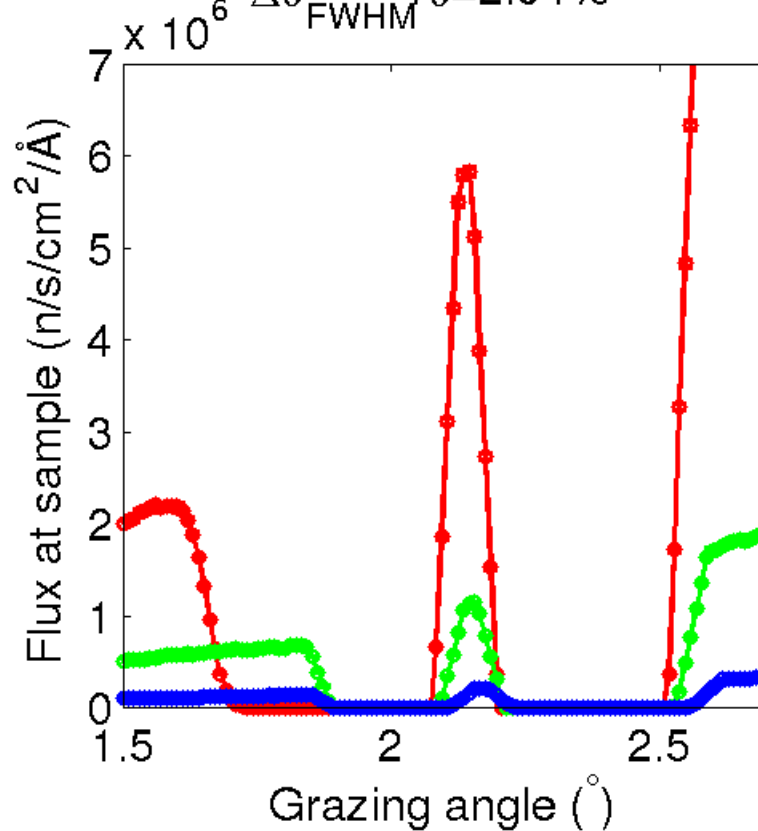
# Q-range and time averaged flux



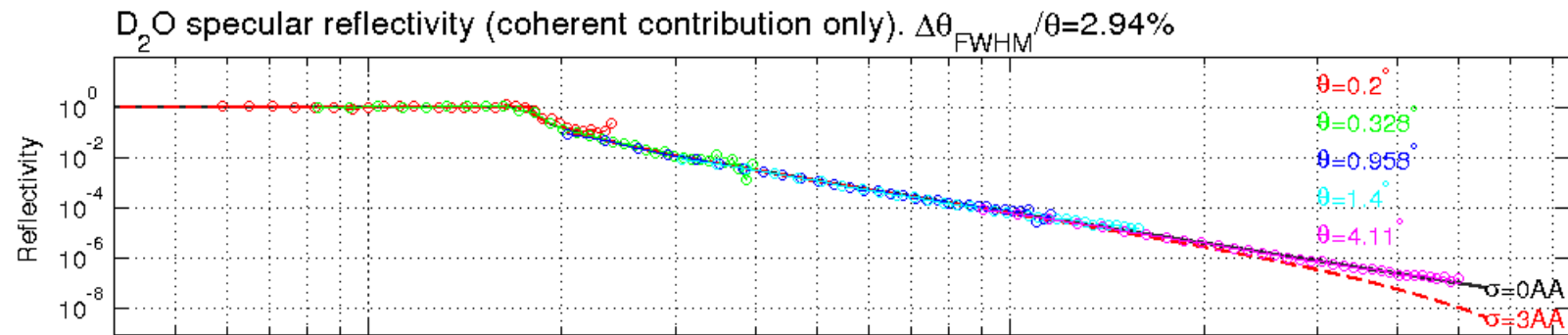
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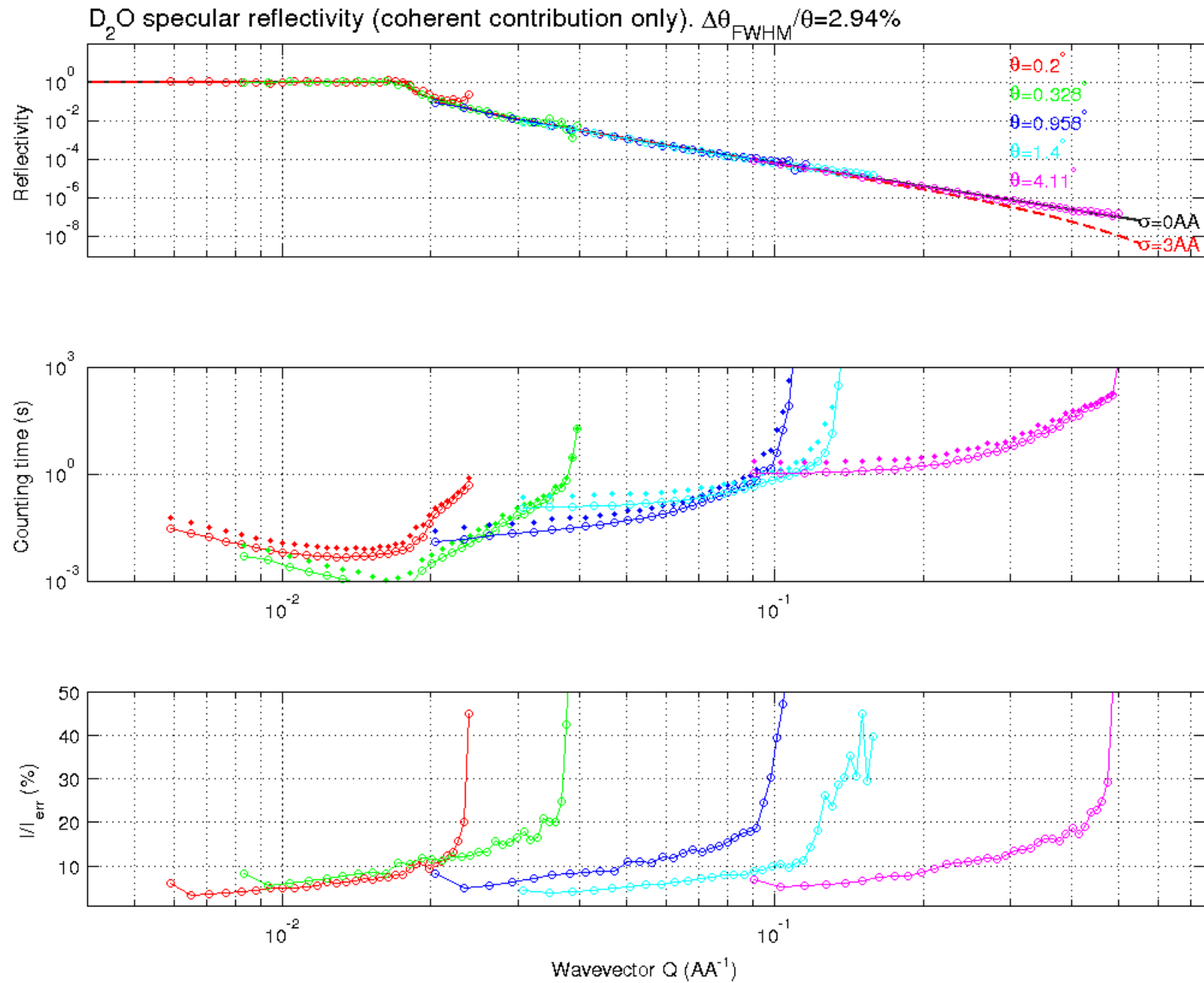
Horizontal sample  
 $\Delta\theta_{\text{FWHM}}/\theta=2.94\%$



# D2O reflectivity

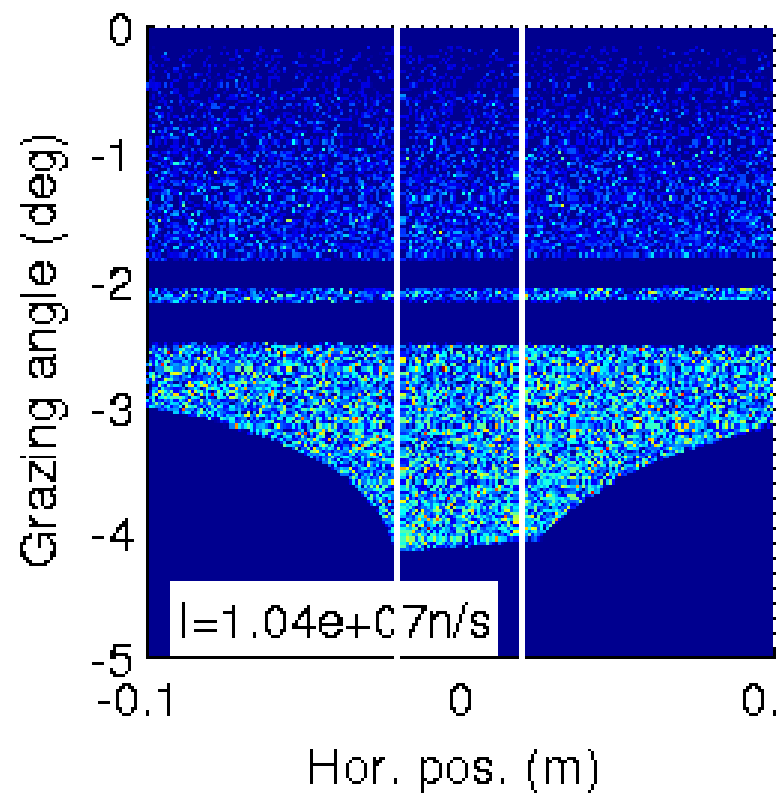


# D2O reflectivity



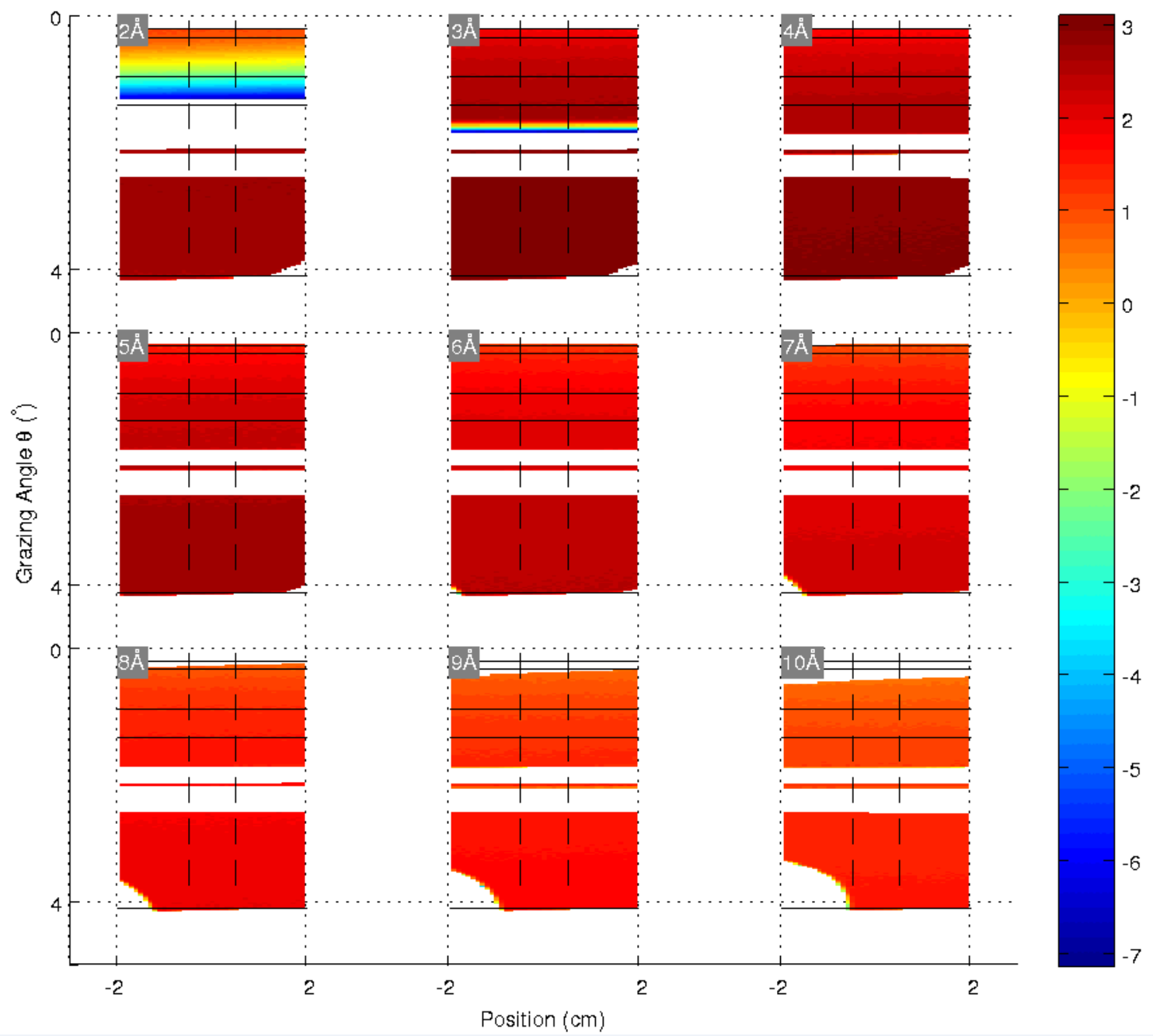
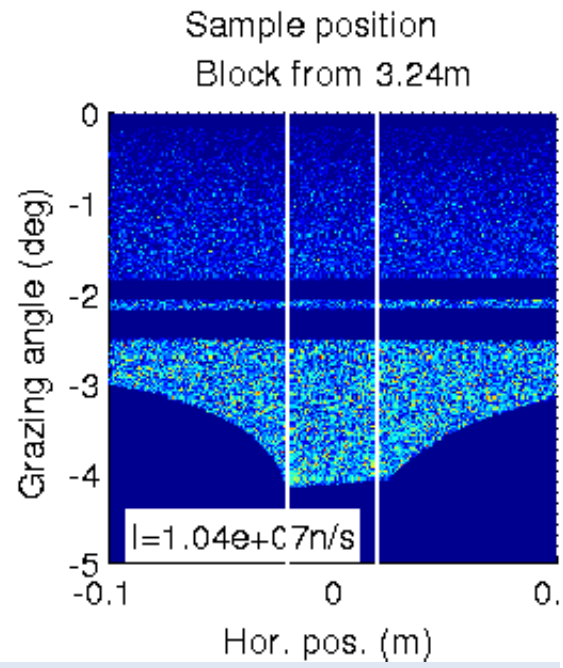
# Sample size

Sample position  
Block from 3.24m





# Sample size





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

## Line Of Sight:

- The combination of shielding and the mirror seems like a good solution for the blocking of Line-Of-Sight.
- 
- 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

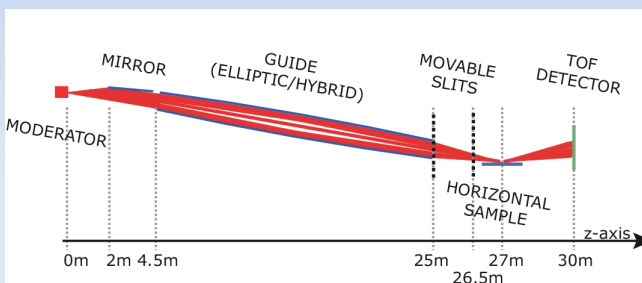
# FREIA

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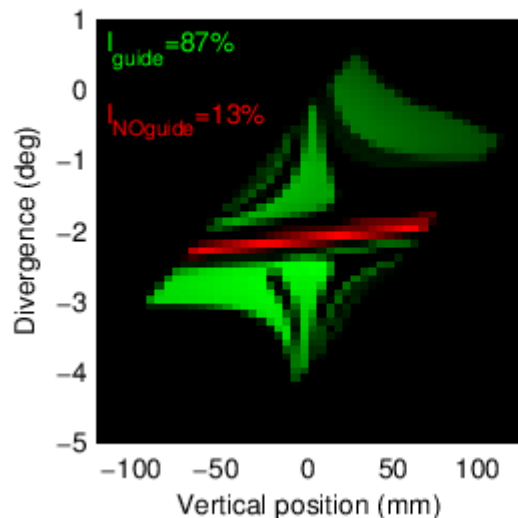


- Horizontal sample
- The reflectivity is determined as function of wave-vector transfer  $Q=4\pi\sin(\theta)/\lambda$
- Short instrument ( $\sim 30\text{m}$ ) – wide bandwidth ( $\sim 8\text{\AA}$ )
- Wide range of grazing angles ( $0.26^\circ$ - $4.11^\circ$ )
- $\lambda = [2\text{\AA}-10\text{\AA}]$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

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Sample position  
Vertical monitor



August 15, 2012

McStas simulation status: FREIA  
A. Vickery

# FREIA

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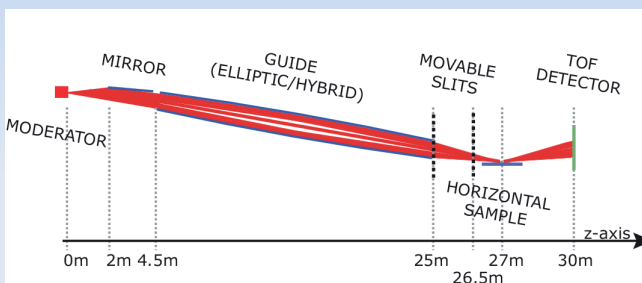
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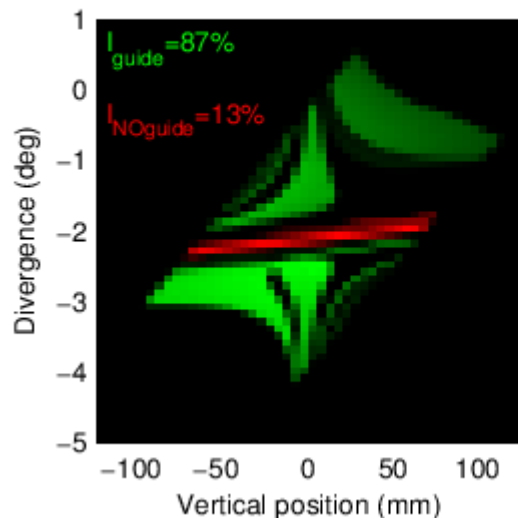
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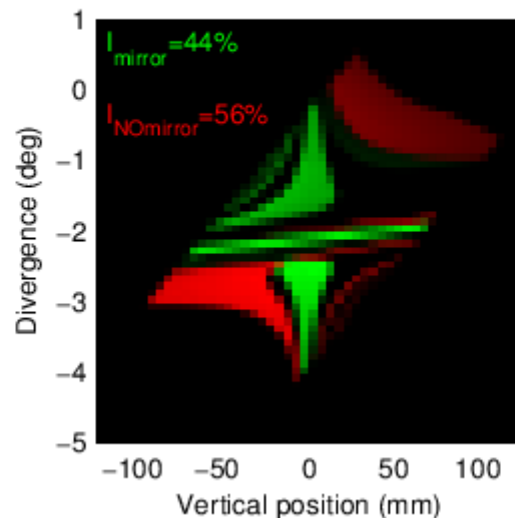
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Sample position  
Vertical monitor



Sample position  
Vertical monitor

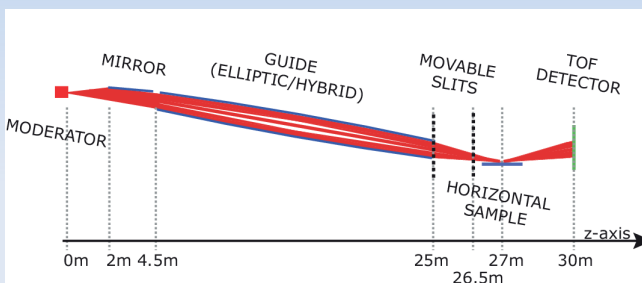




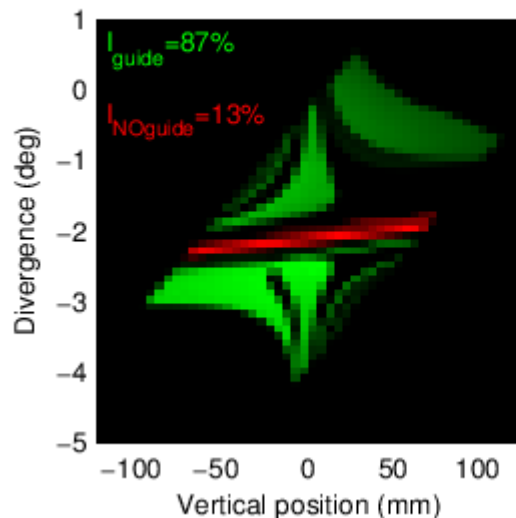
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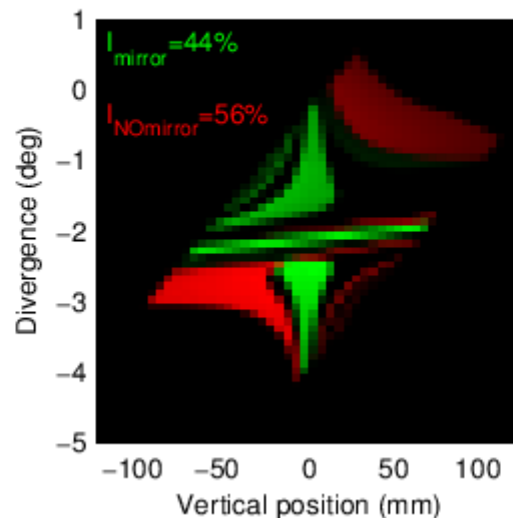
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Sample position  
Vertical monitor



Sample position  
Vertical monitor



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

