

## *C-Spec: The cold chopper spectrometer of the ESS*

Phase 1: Team

Lead Scientist: P.P. Deen

Lead Engineer: Joseph Guyon le Bouffy



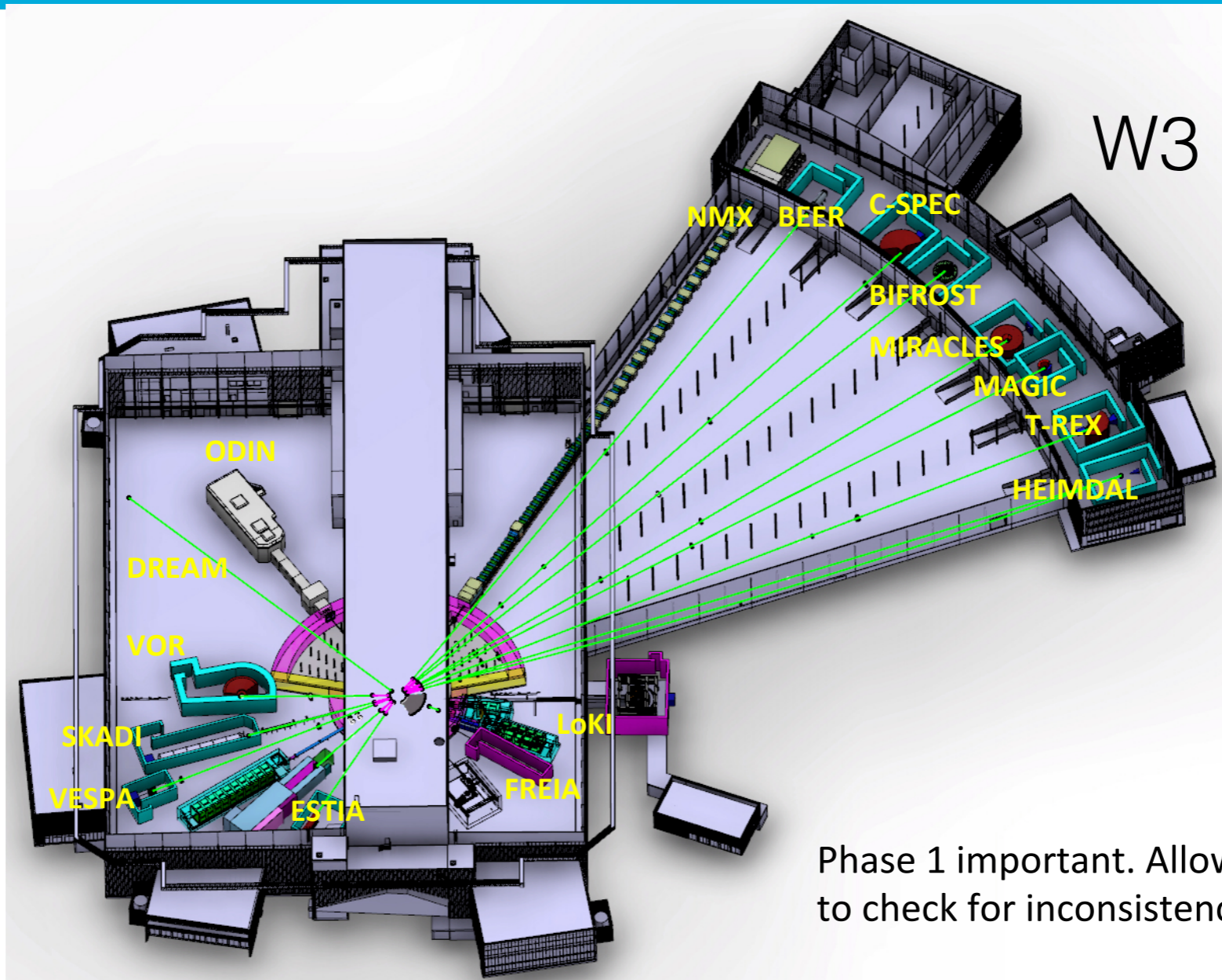
Phase 1: Support & proposal authors

TUM: W. Lohstroh, J. Neuhaus, W. Petry

LLB: S. Longeville, C. Alba-Simionesco



# Instrument layout 3D CAD - baseline



Phase 1 important. Allows us to check for inconsistencies.

Guide Requirements:

**Focus on cold moderator (2 - 20 Å).**

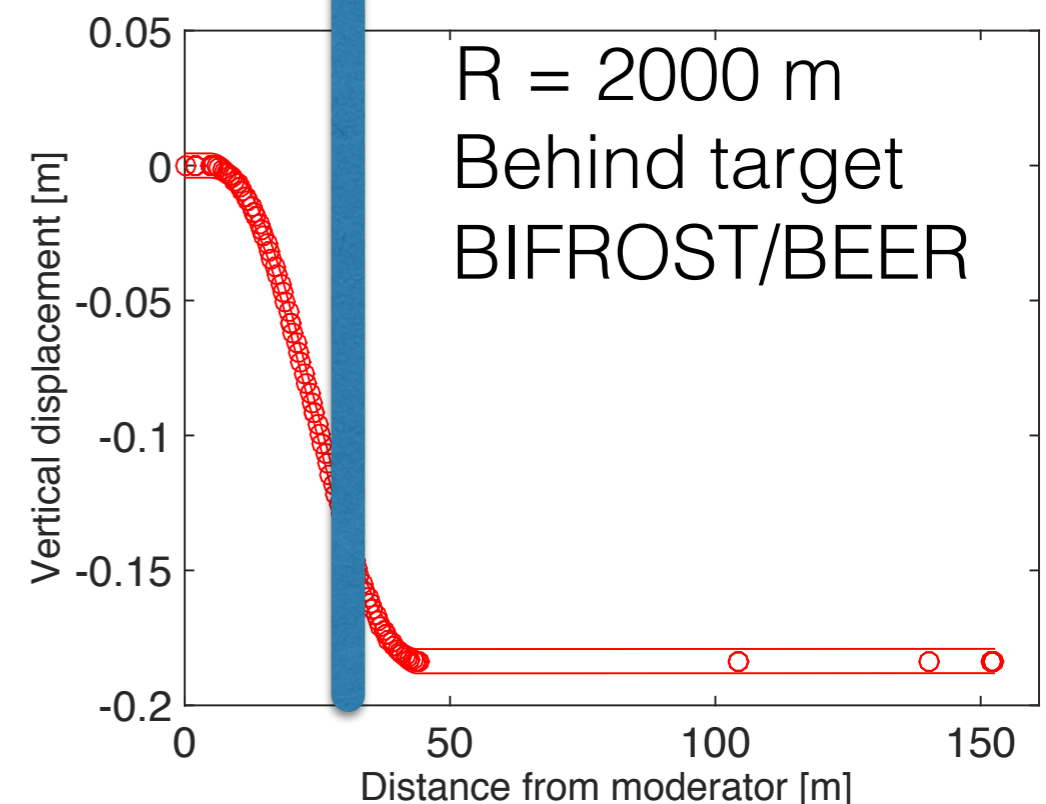
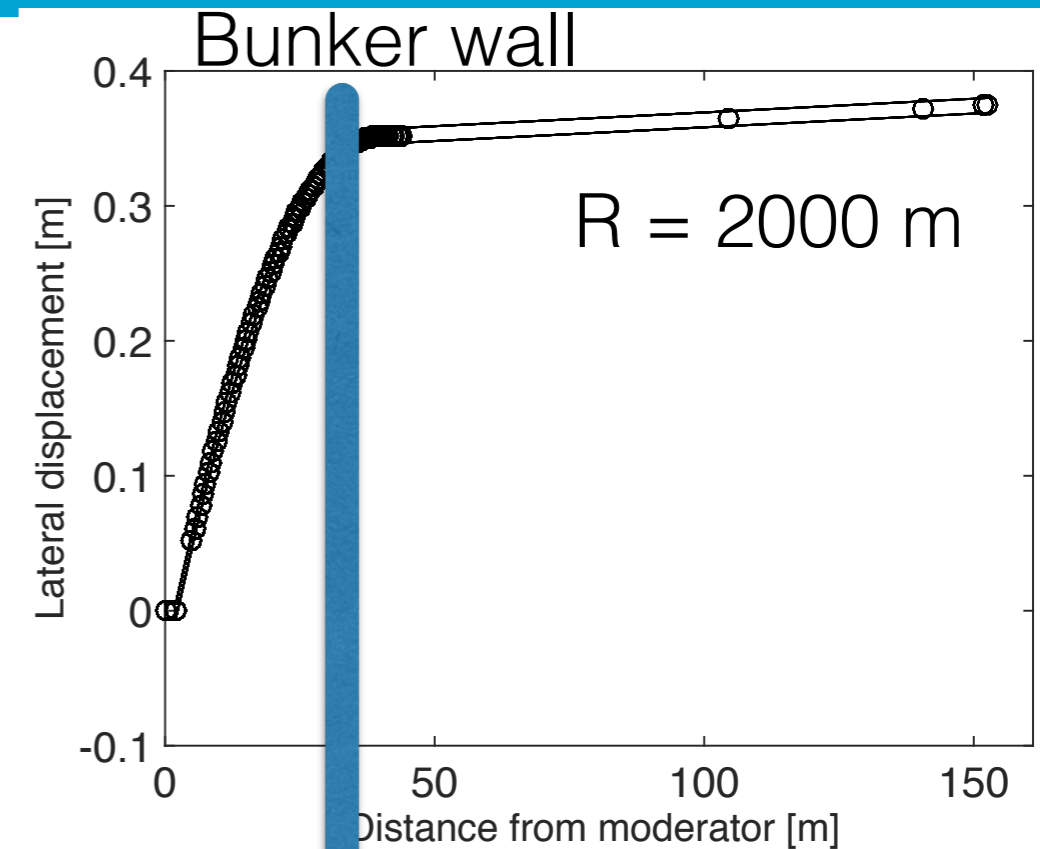
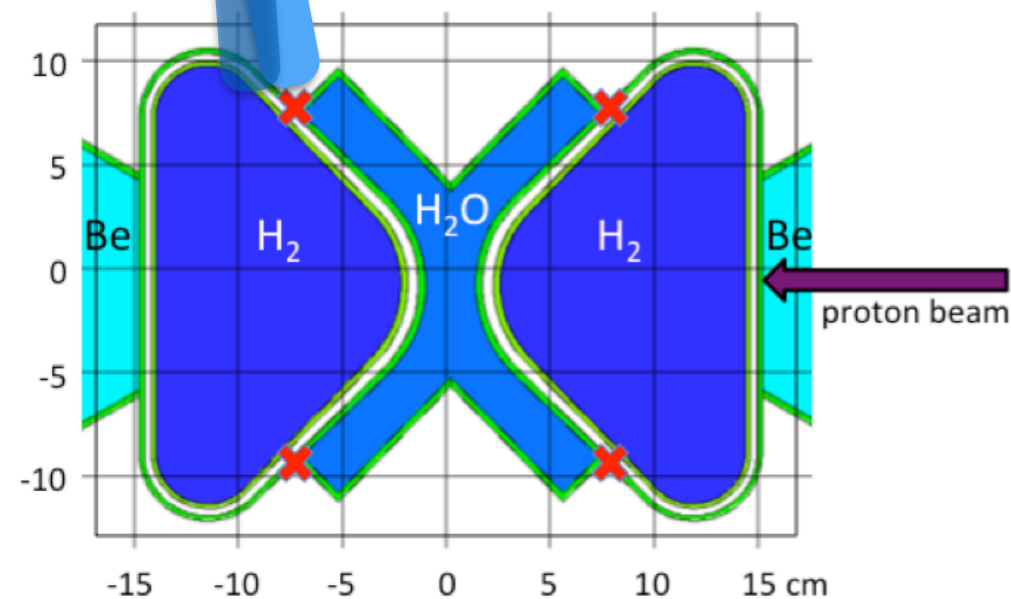
**Optimise for signal to noise.**

**Divergence +/- 1° at 3 Å.**

Width ~ 10 cm at P chopper.

Width ~ 14 mm at M chopper  $\Delta E/E = 1 - 4\%$

Focus to (a)  $4 \times 2 \text{ cm}^2$ , (b) several  $\text{mm}^2$



## Guide Requirements:

**Focus on cold moderator (2 - 20 Å).**

**Optimise for signal to noise.**

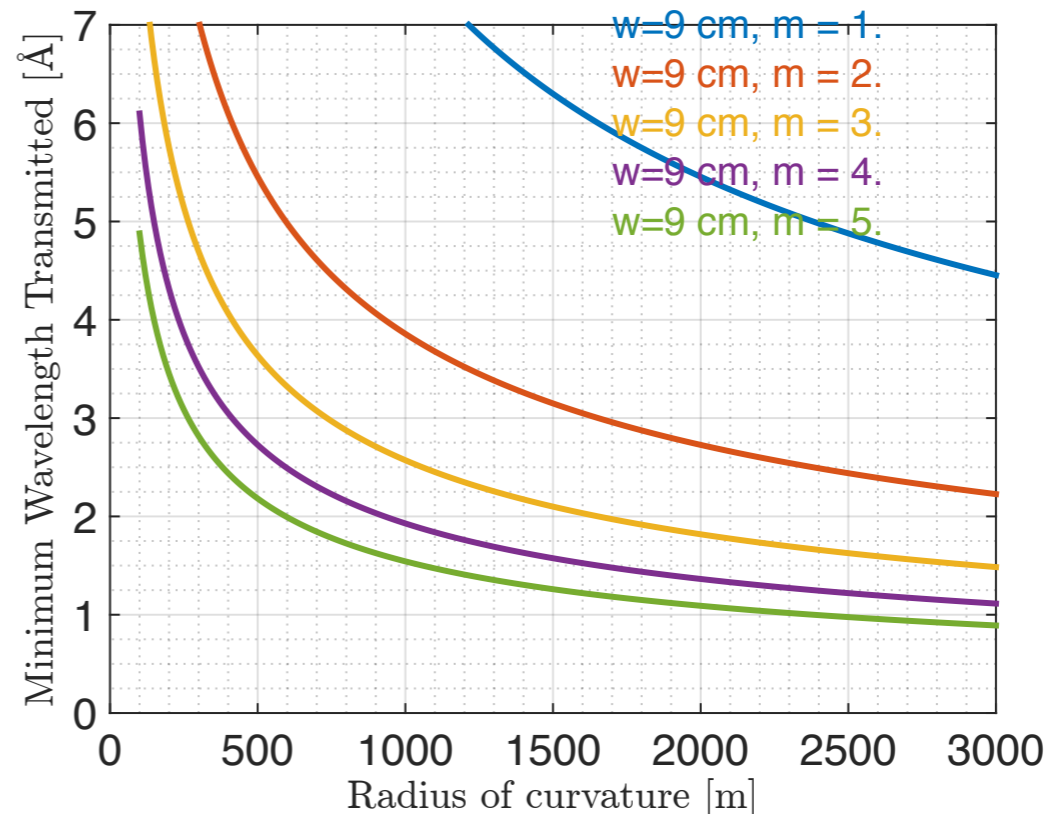
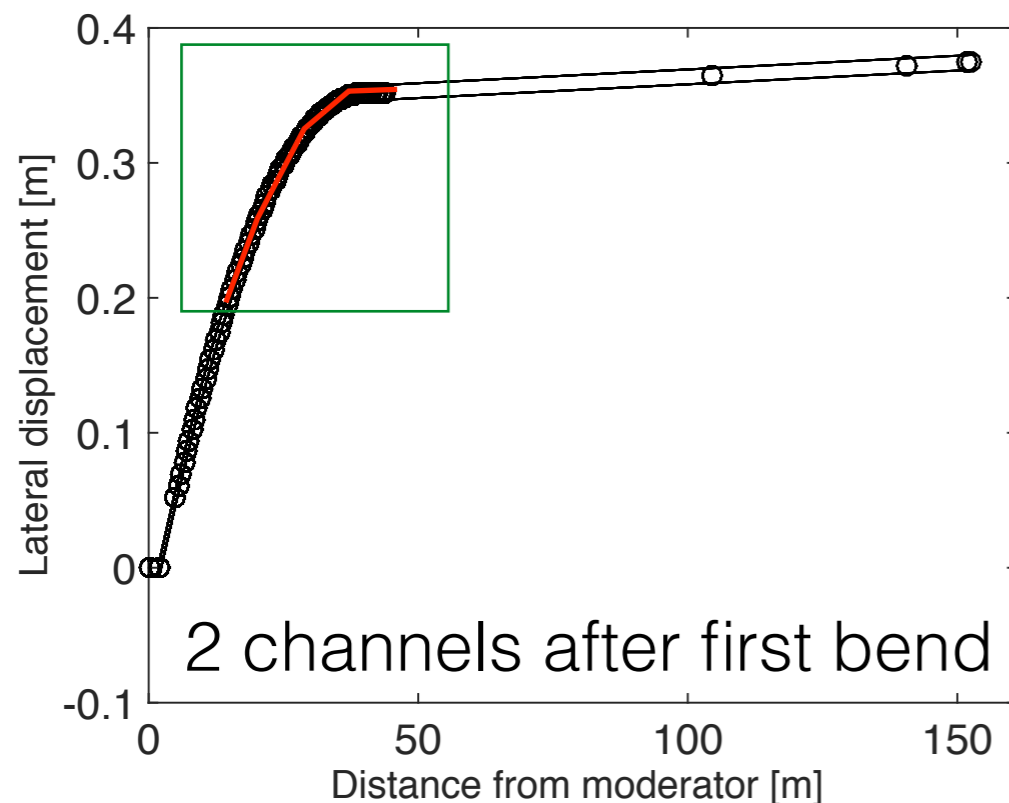
**Divergence +/- 1° at 3 Å: 9 x 11 cm guide entrance**

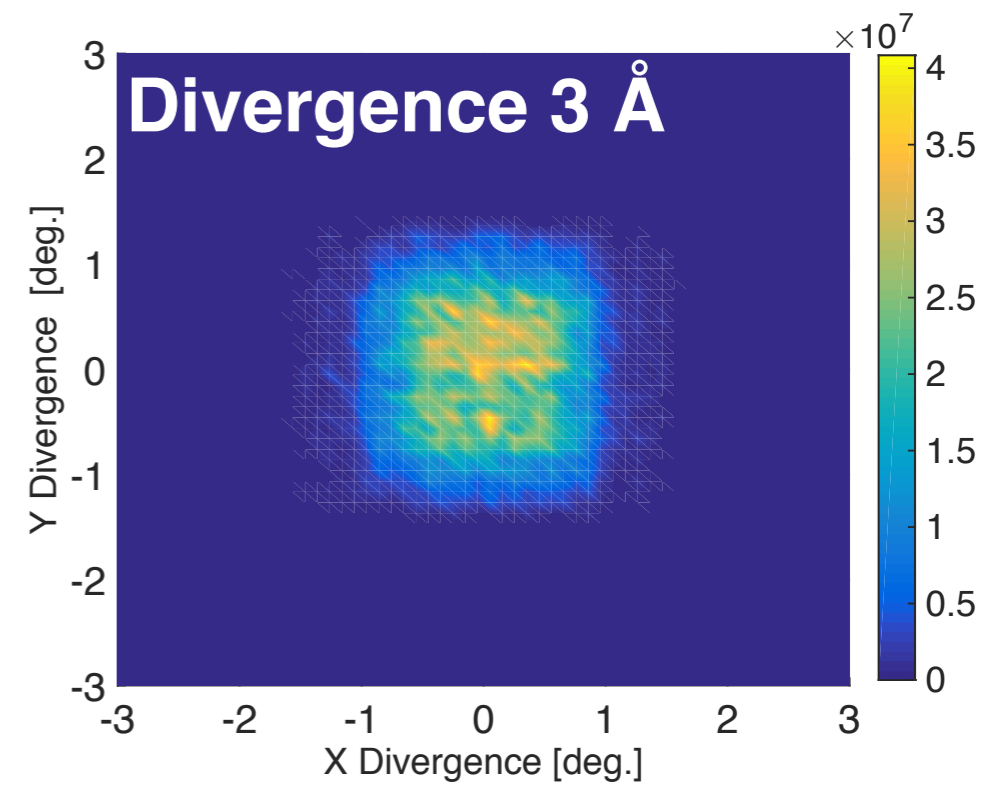
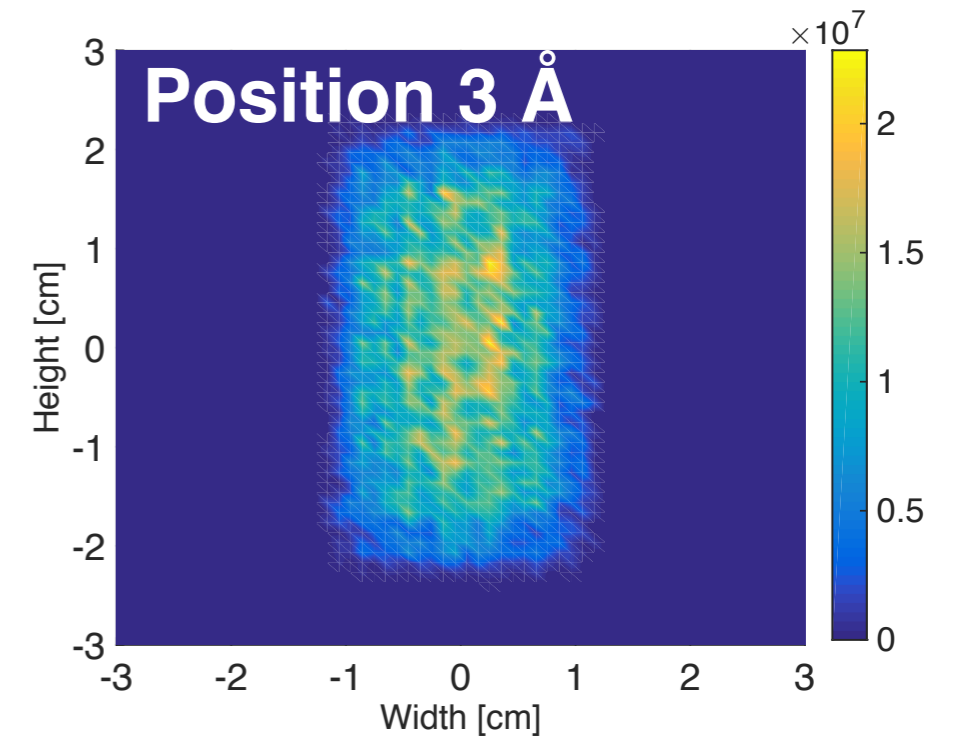
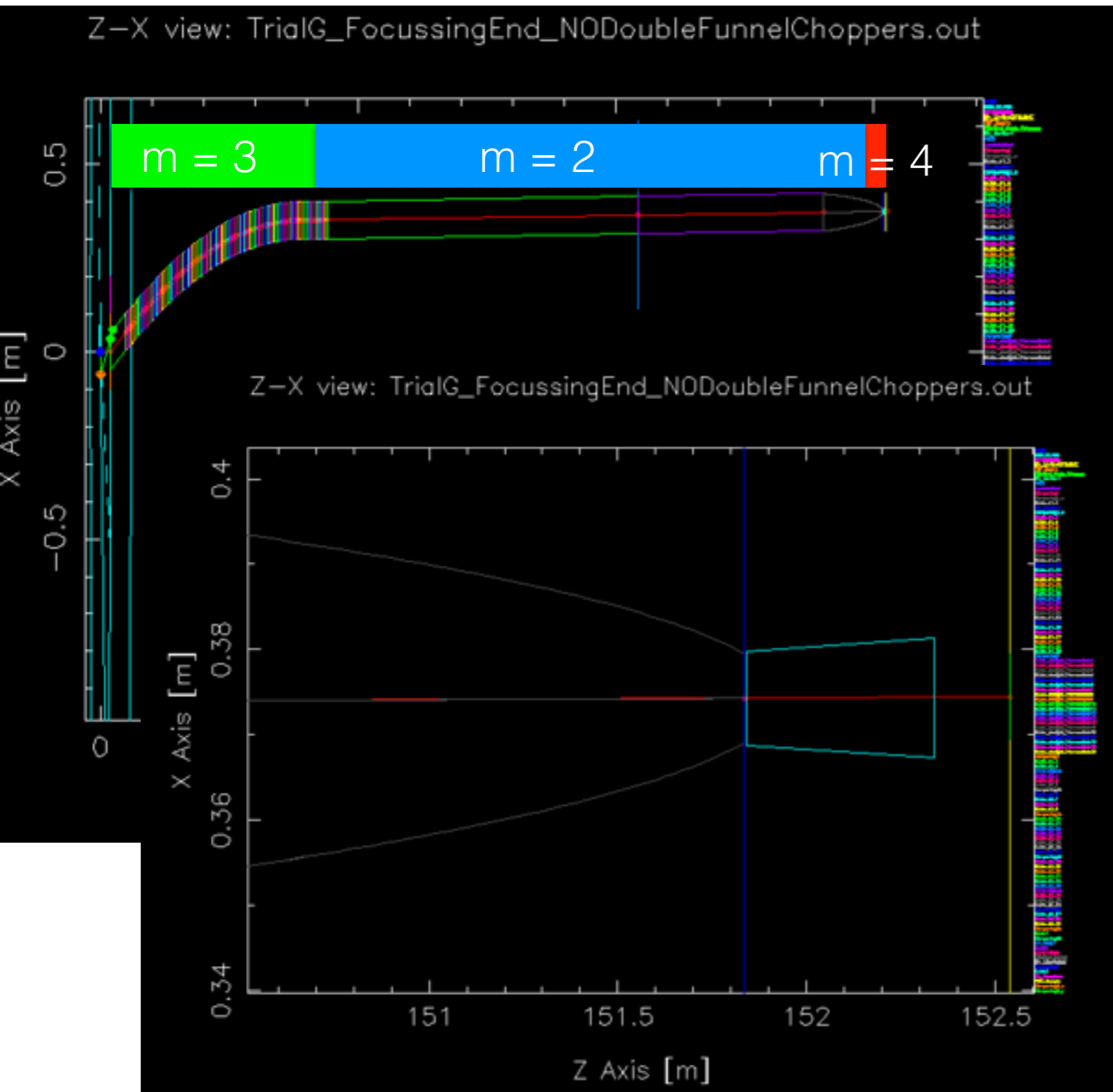
Width ~ 10 cm at P chopper.

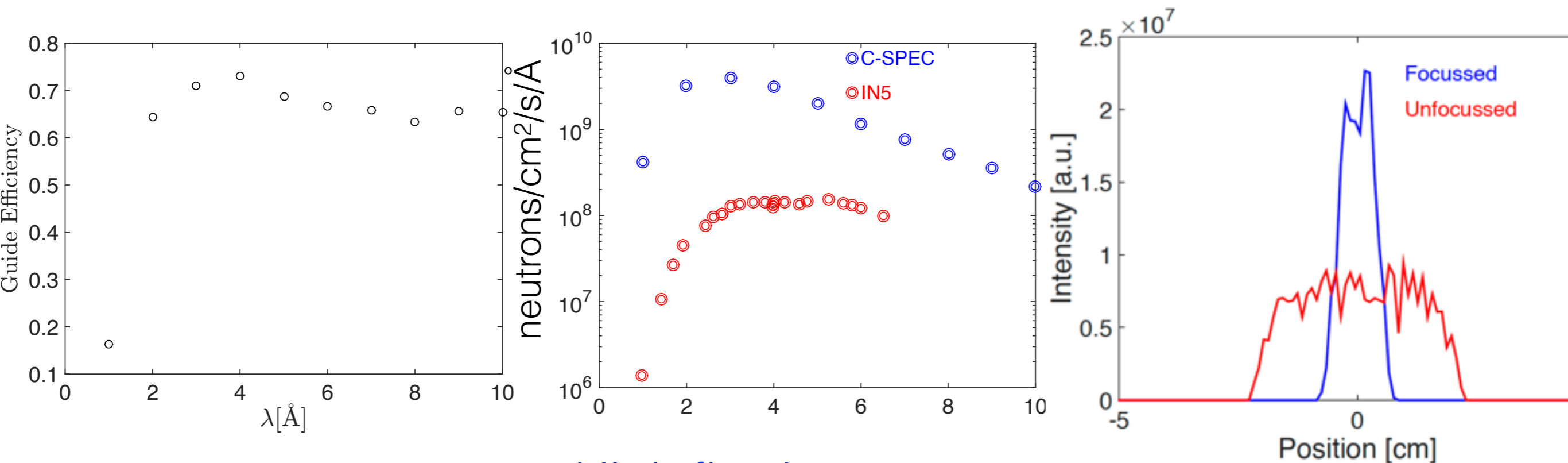
Width ~ 14 mm at M chopper.  $\Delta E/E = 1 - 4\%$

Focus to (a) 4 x 2 cm<sup>2</sup>, (b) several mm<sup>2</sup>

$$\lambda_c = \frac{575}{m} \sqrt{\frac{2w}{R}}$$



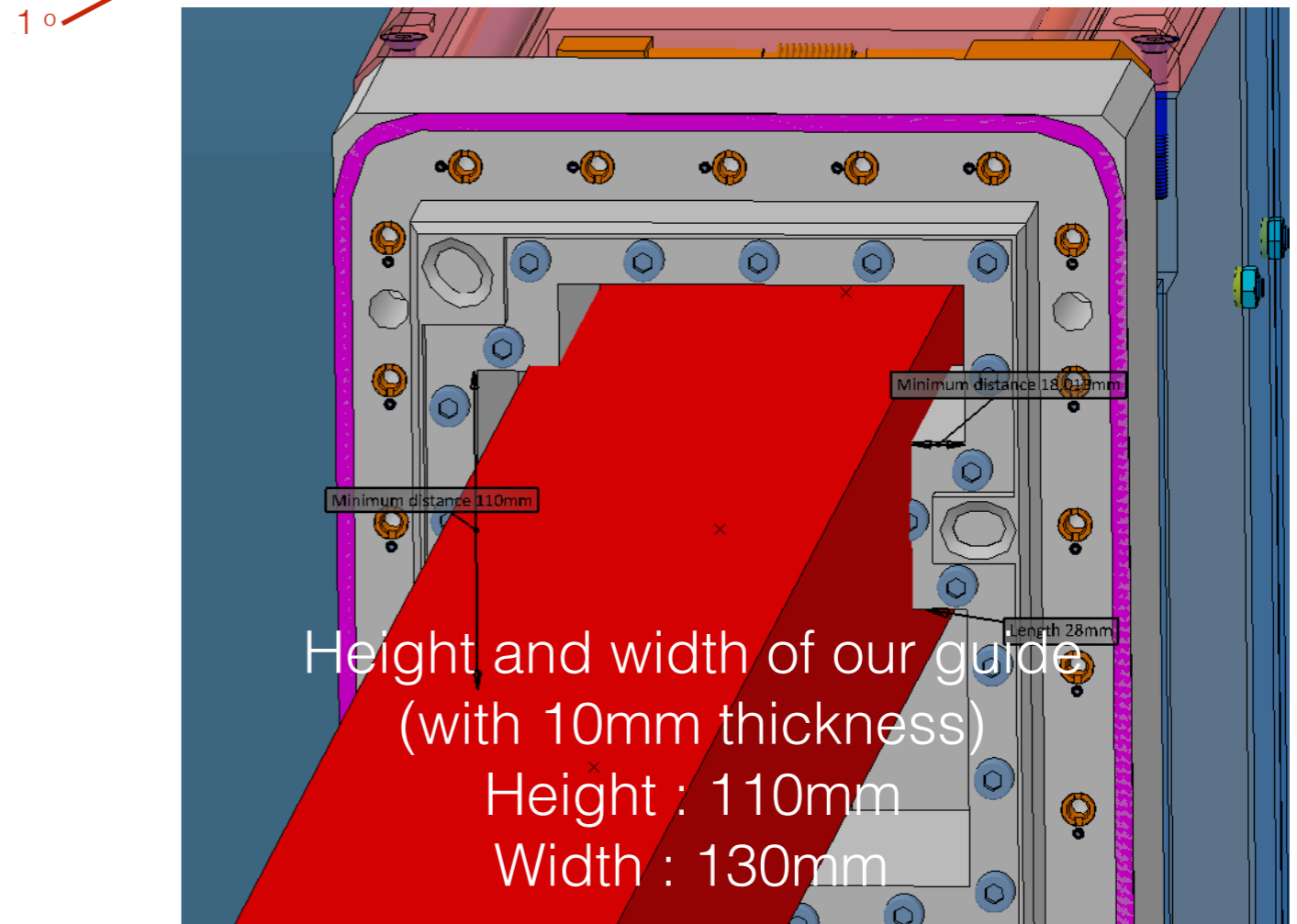
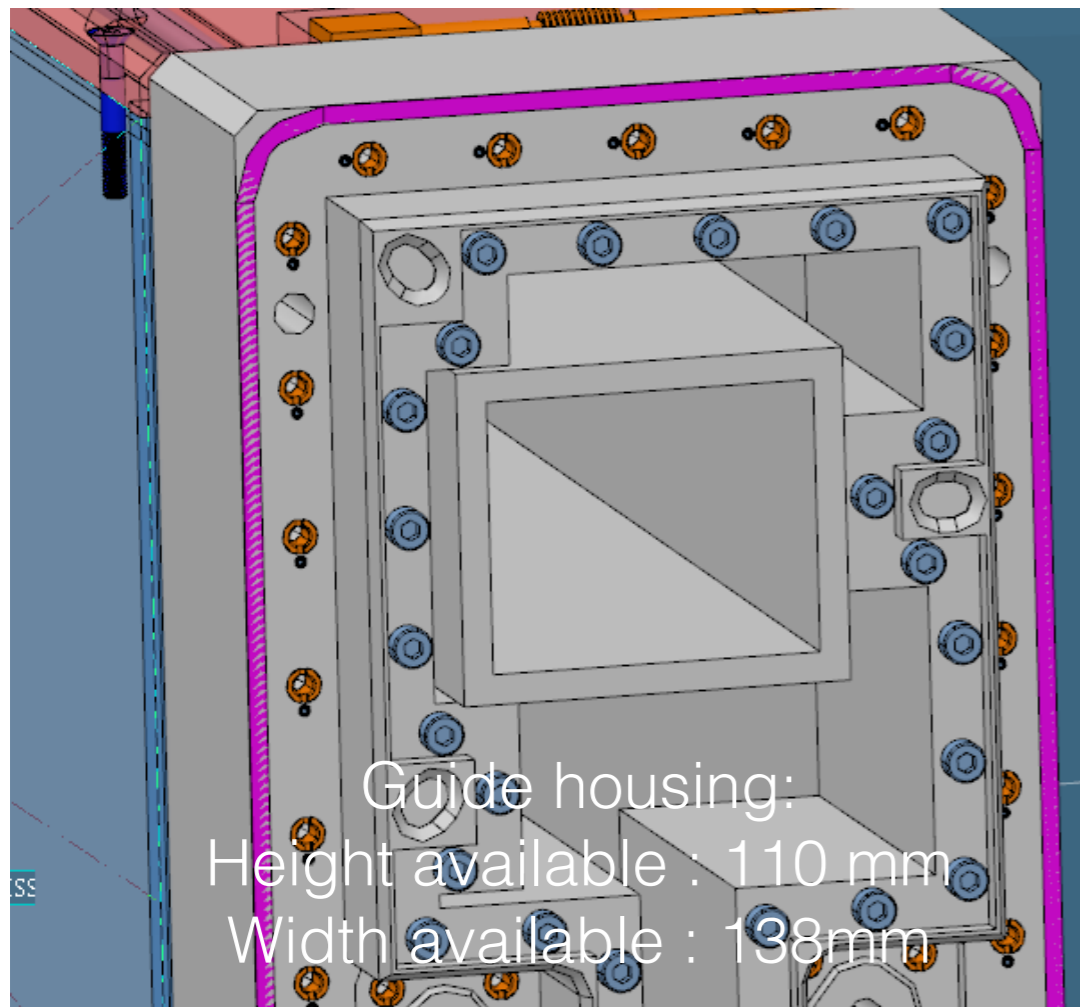
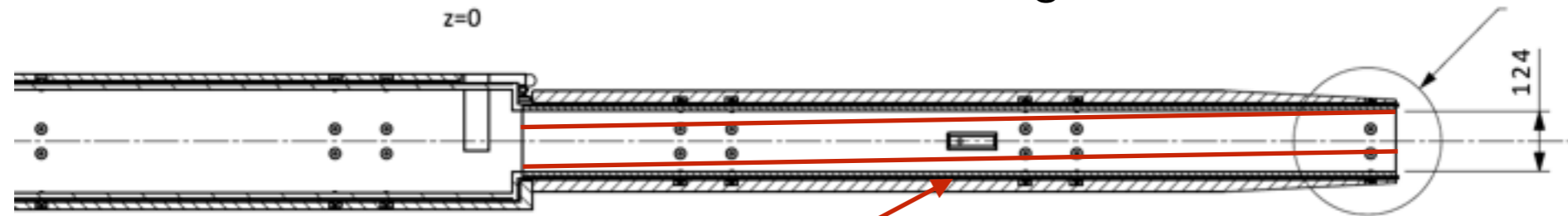




- High flux instrument.
- Cold neutron energies = 0.2 - 20 meV.
- High/ medium energy resolution for  $\Delta E/E = 1 - 3 \%$ .
- $0.5 < Q < 6 \text{ \AA}^{-1}$ .
- Excellent signal to noise.
- In-situ measurements: Stable time of flight instrument with stable source of neutrons!
- Experiment to paper: fast data analysis closely linked with theory.

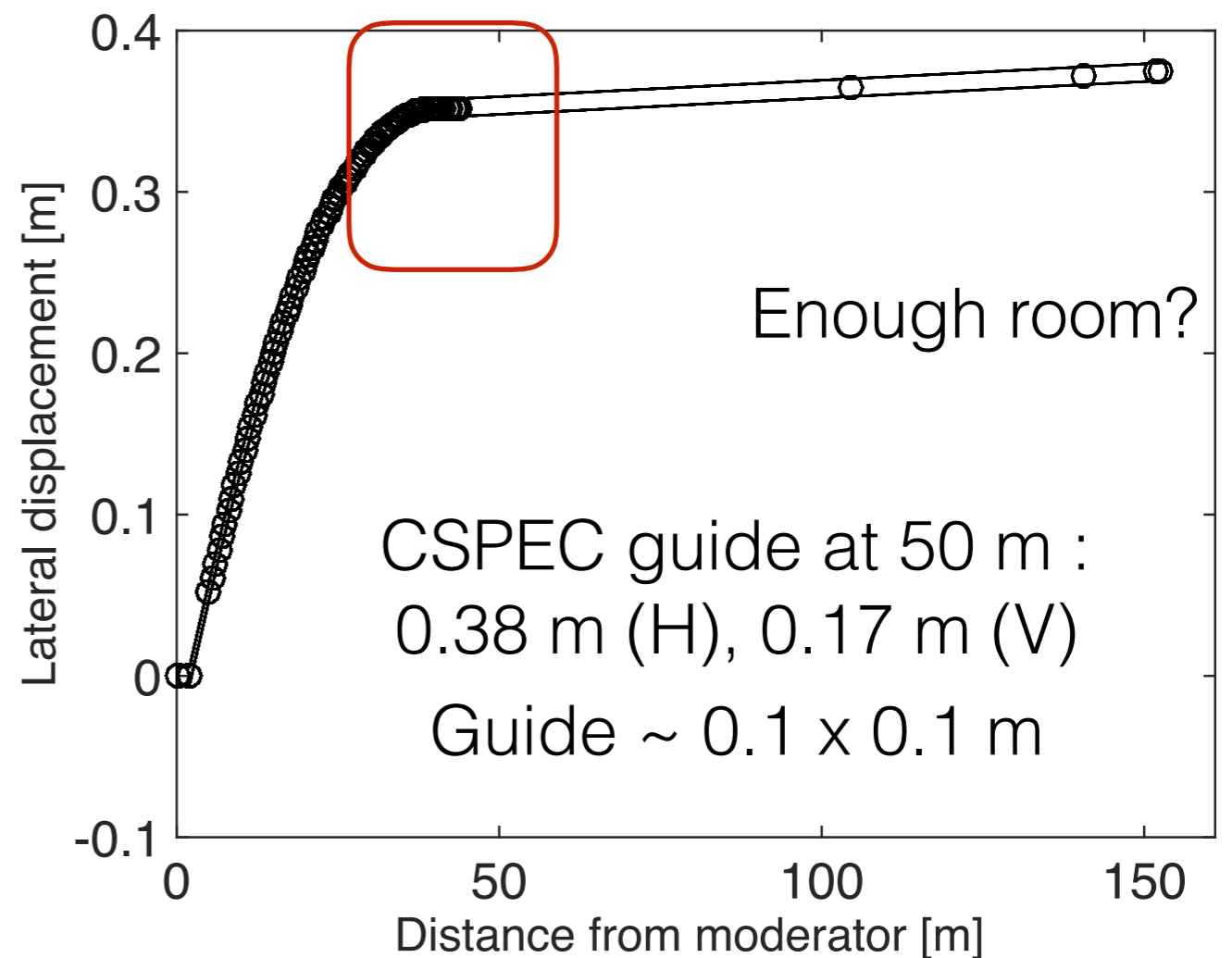
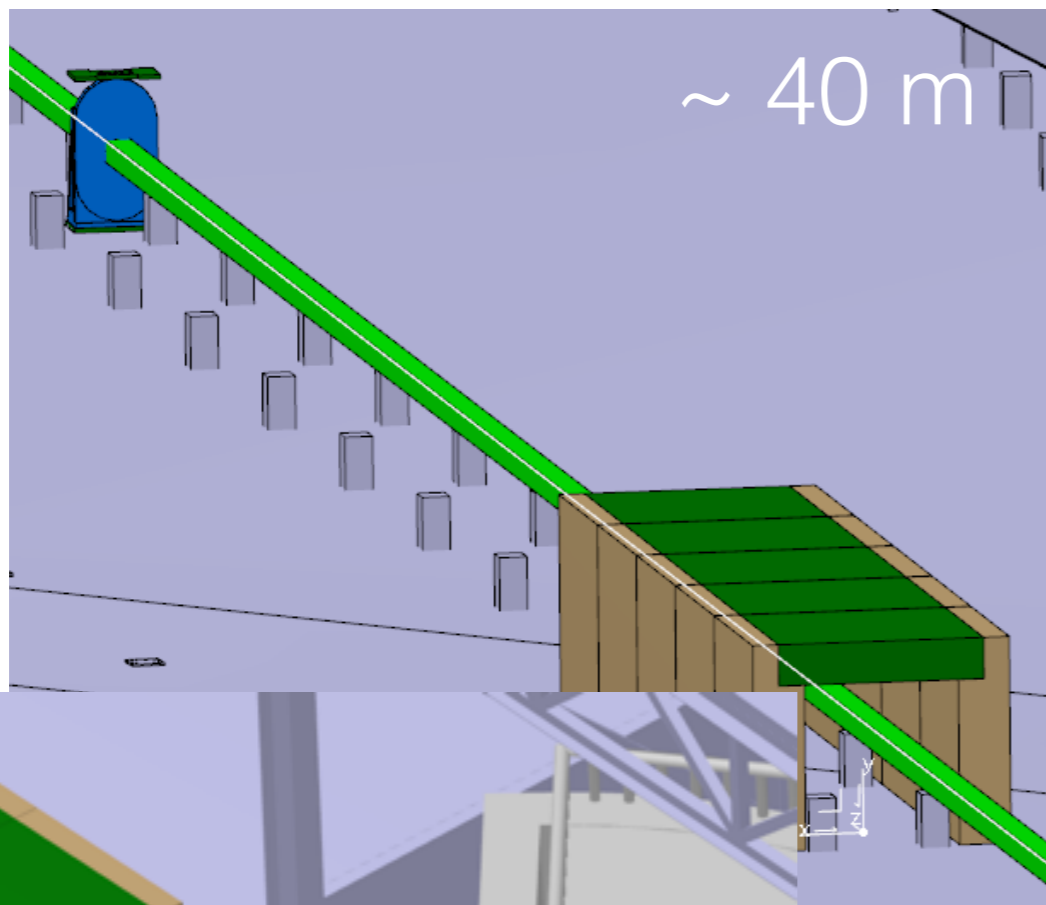
ESS-0044607

# Engineering realities: Beam extraction discussions with Bengt Jönsson



## Further engineering realities

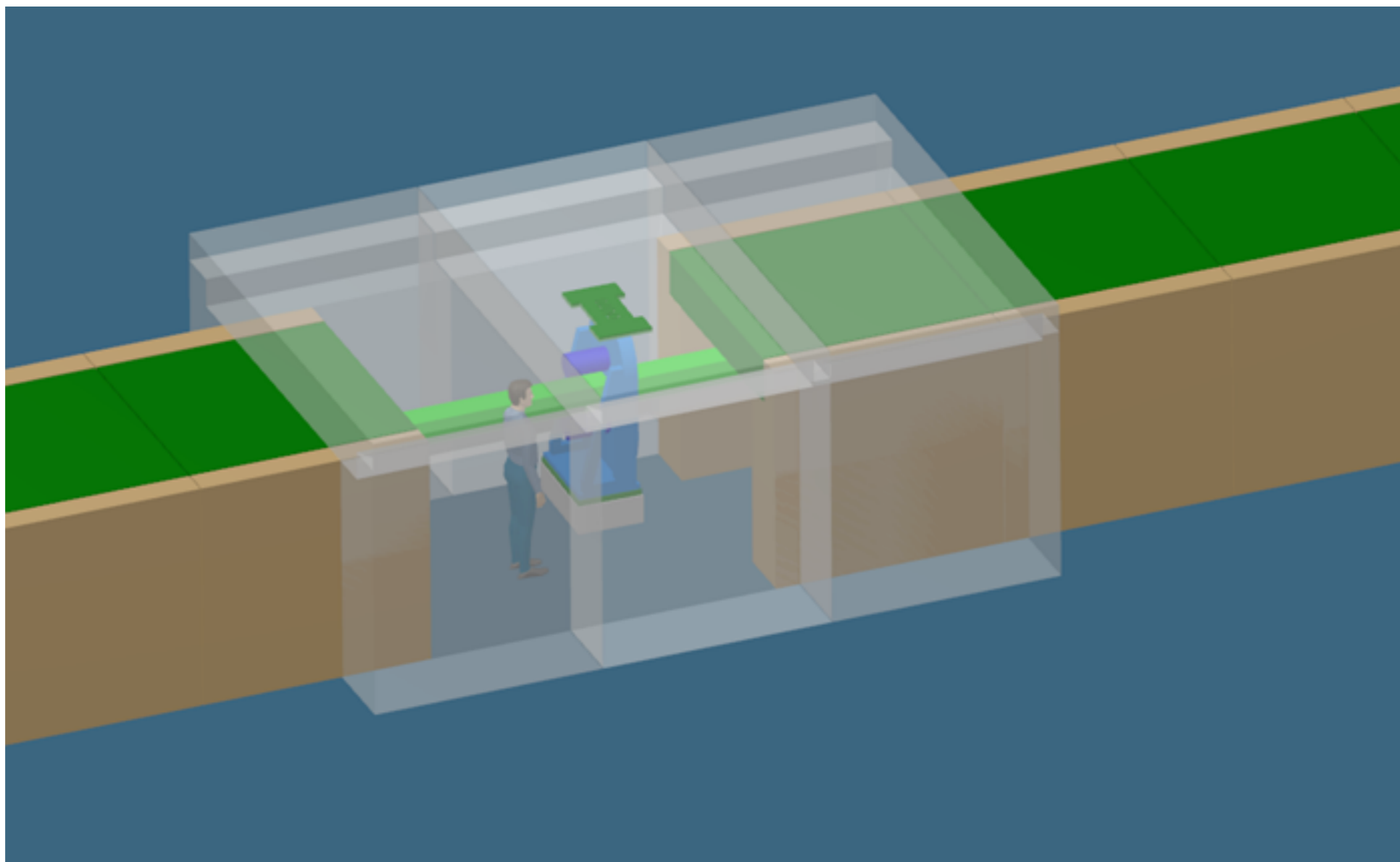
According to ESS Instrument Buildings K-models ESS-0029974



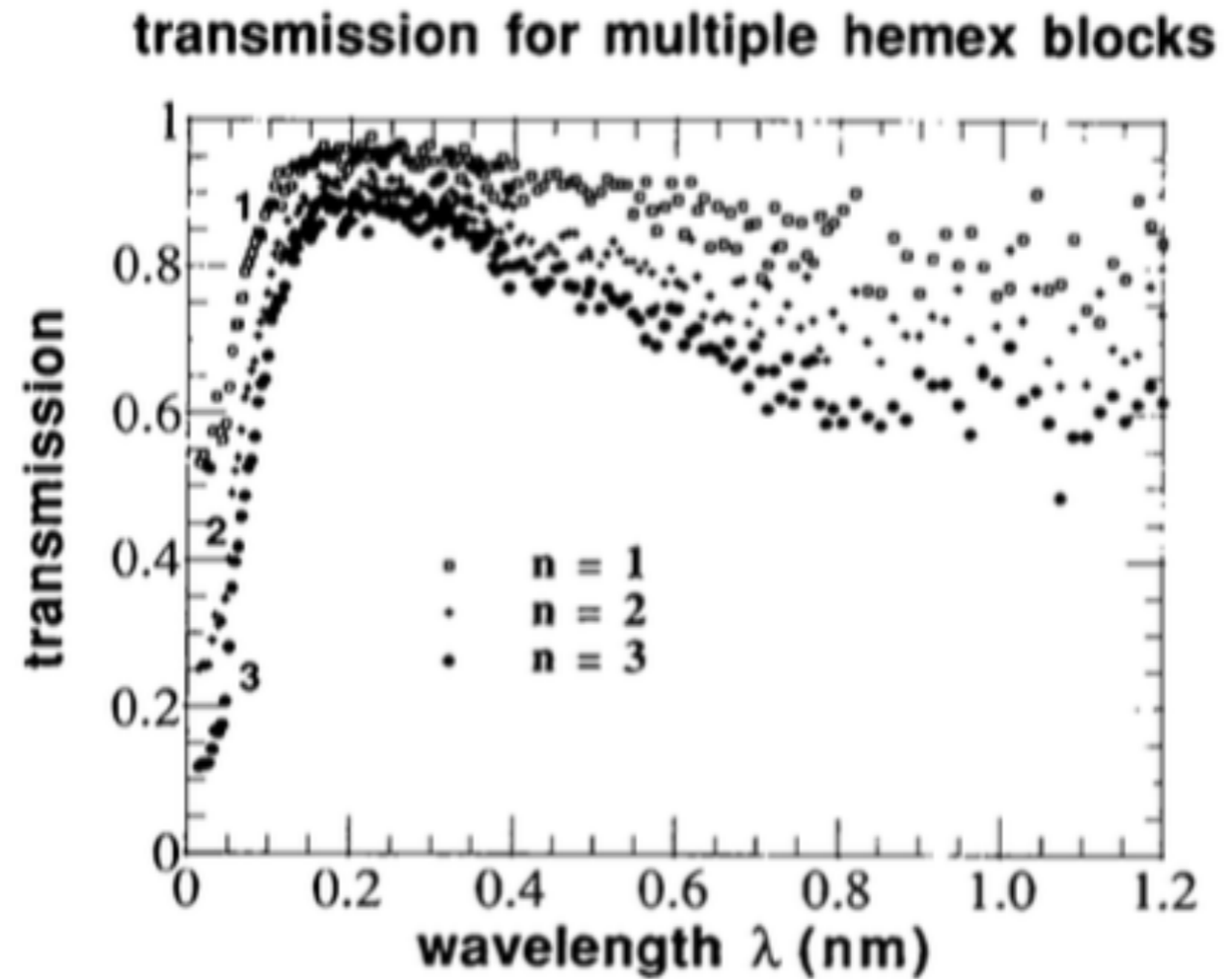
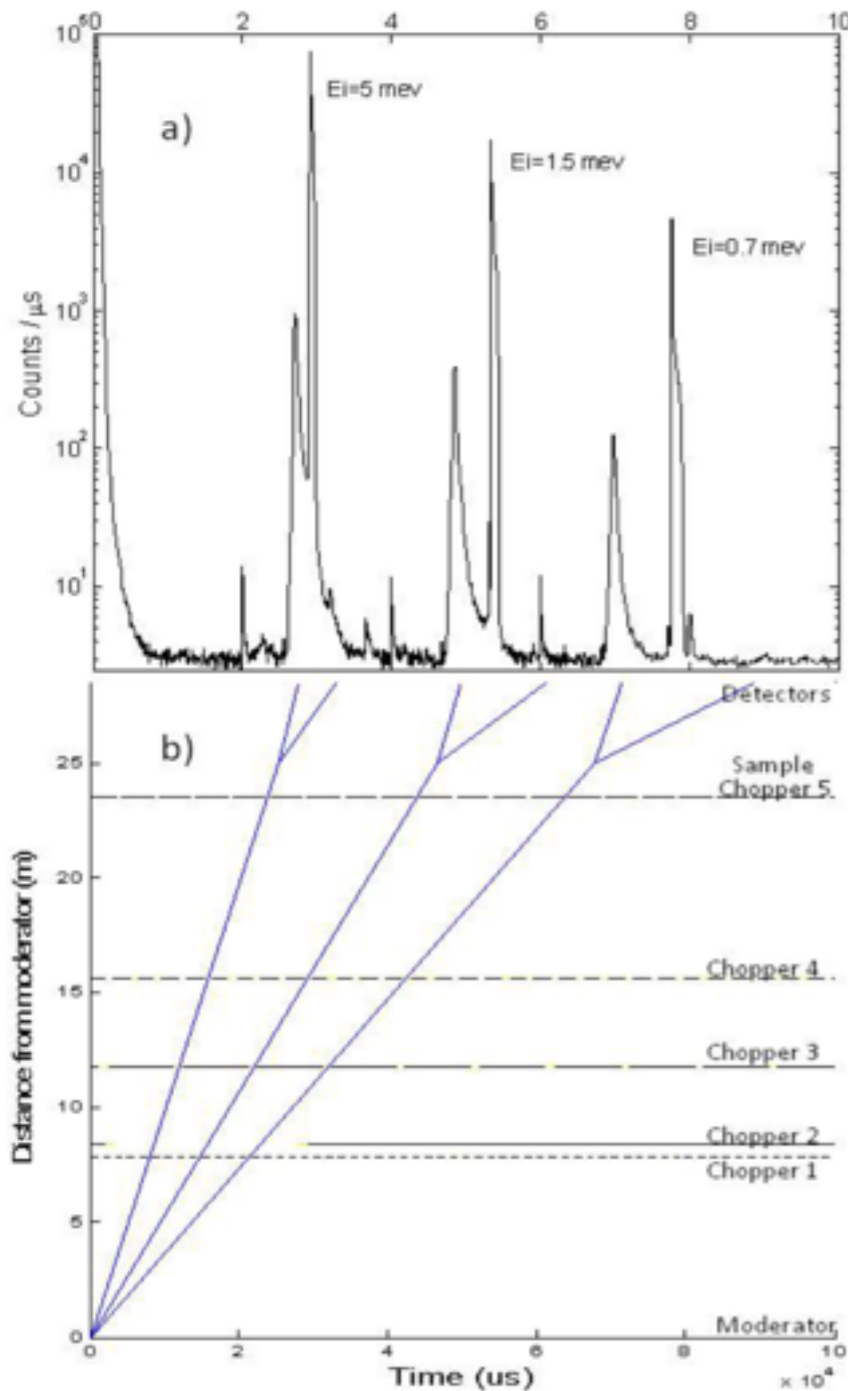


## Chopper Cascade Solution

Technically feasible  
Easy access to all choppers  
Helps with shielding - large caves.



Ensure optimal signal to noise without  
a T0 chopper (1 0000000000000000 euros ...)

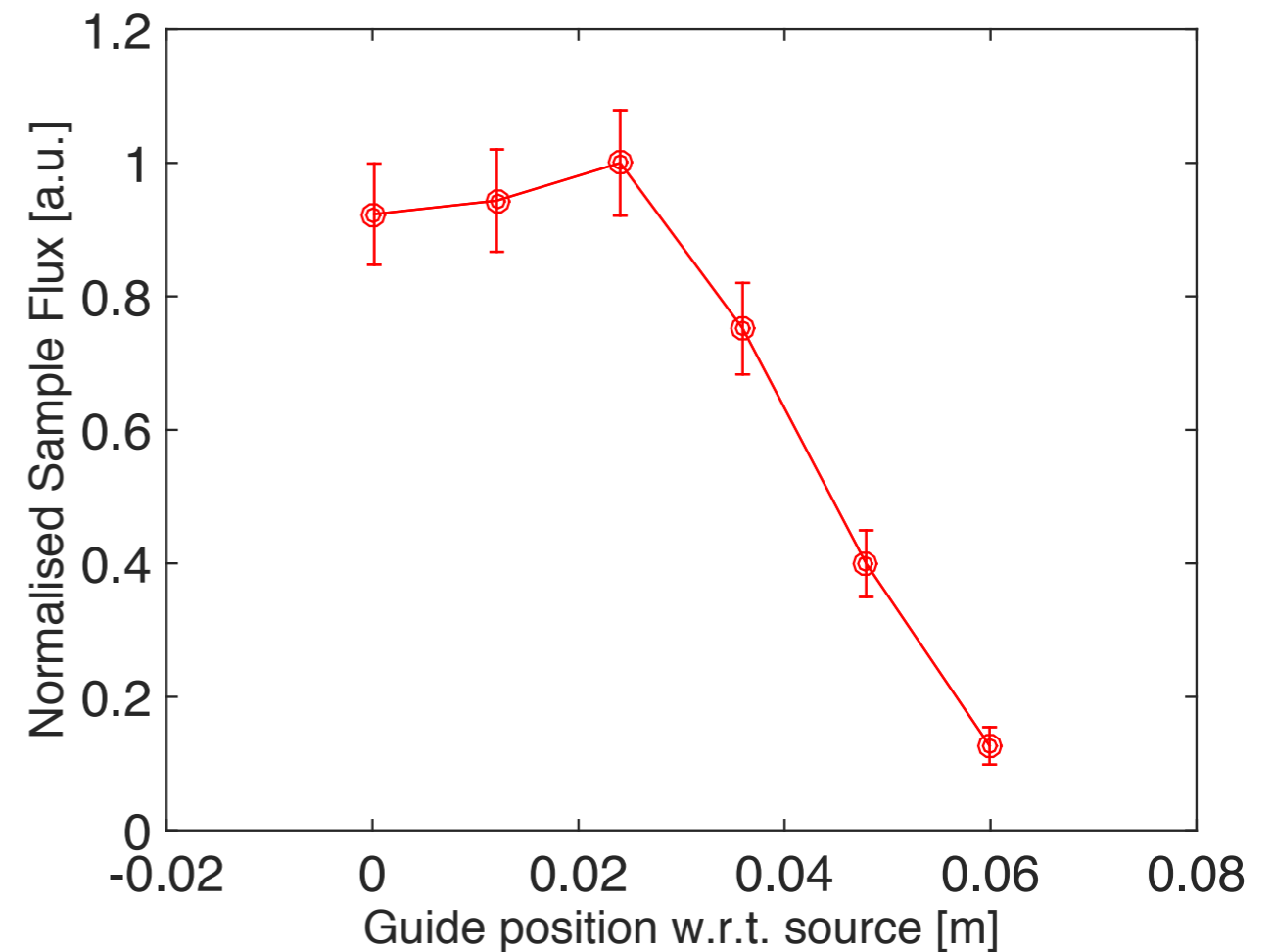
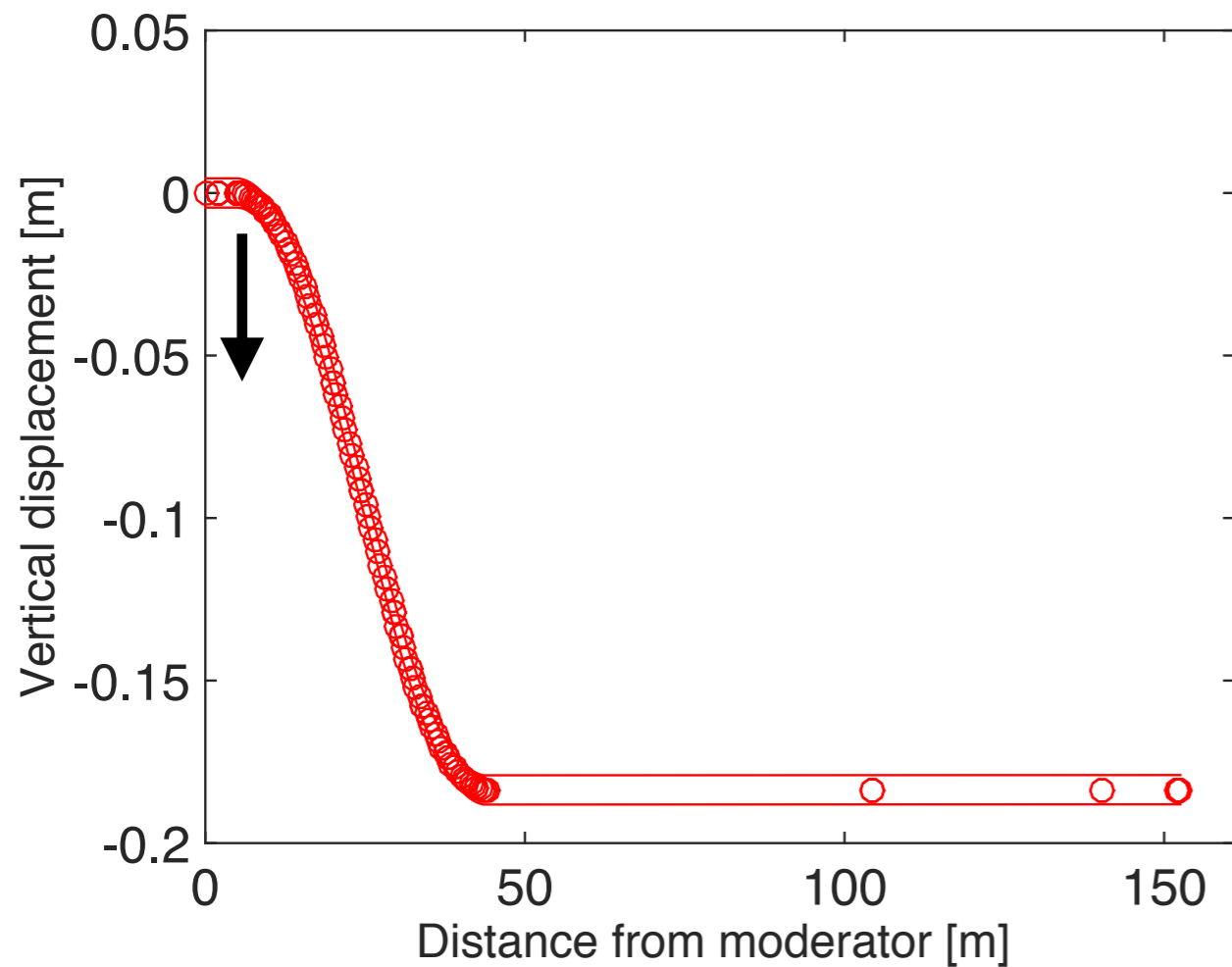


Transmission probability as a function of wavelength for different numbers  $n$  of  $\text{Al}_2\text{O}_3$  hemex crystal of thickness 27 mm at ambient temperatures.

D. Mildner et al. J. Appl Cryst 26,438

## Uncertainty on Guide/Source displacement

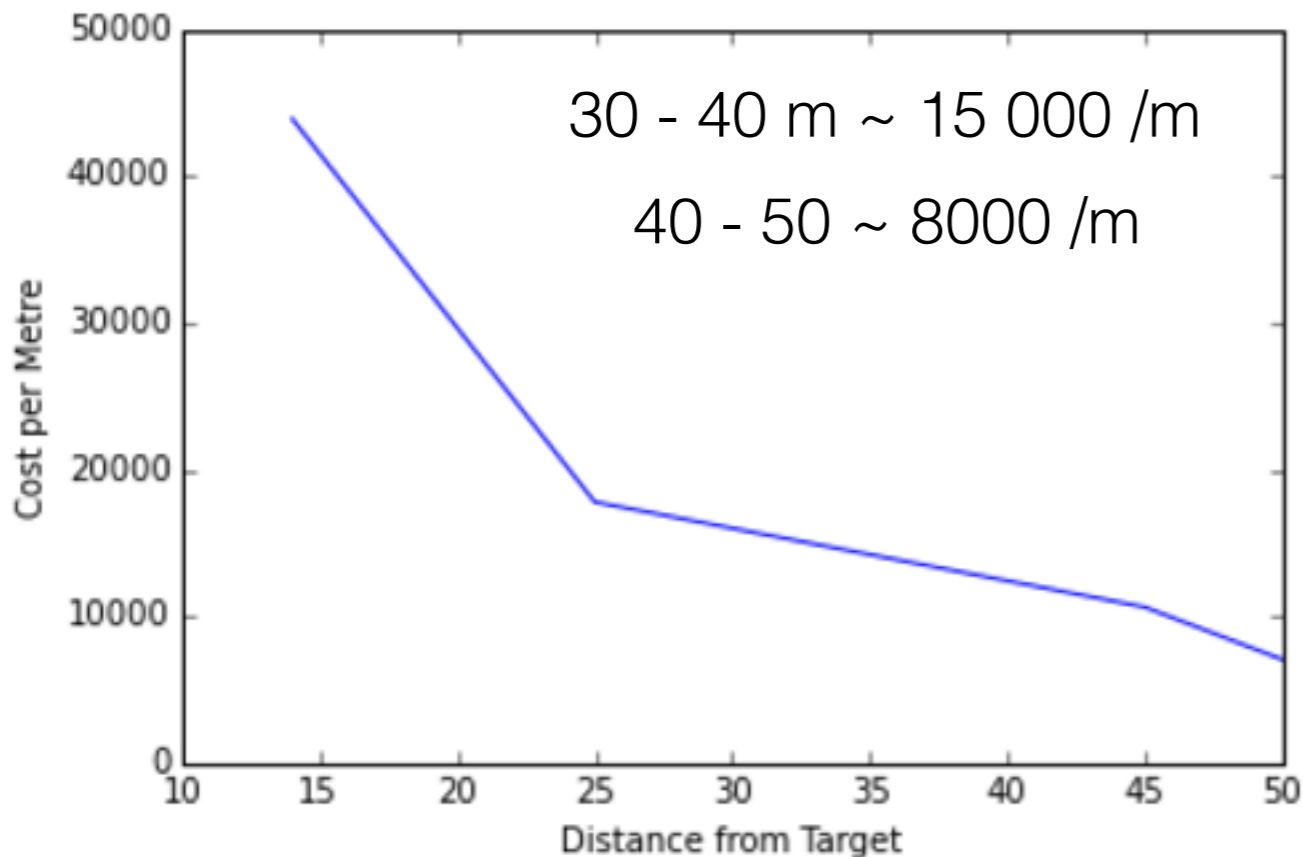
C-SPEC guide: width x height = 0.09 x 0.11 cm



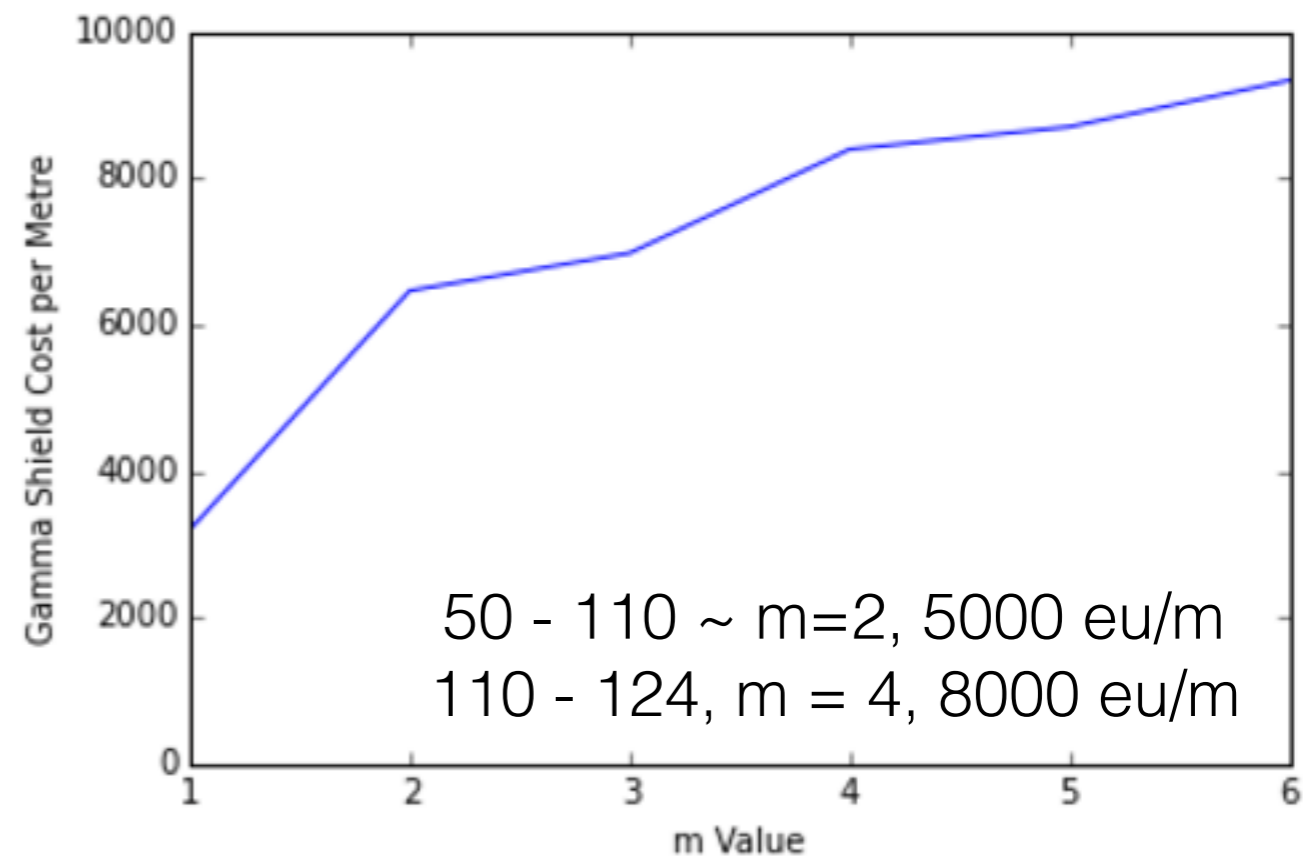
For CSPEC movement up to 3 cm will have little impact

## Straight beam line costs - so cost could be reduced.

Shielding (Steel & concrete) due to direct beam - up to 50 m



Gamma shielding - for distances beyond 50 m



$15000 \cdot 10 + 8000 \cdot 10 + 5000 \cdot 60 + 8000 \cdot 12 = 626,000 \text{ eu}$   
 Still need to consider beamstop & shielding around the detector.