SBM-JRA Meeting

High Pressure Cells for NSE/SANS

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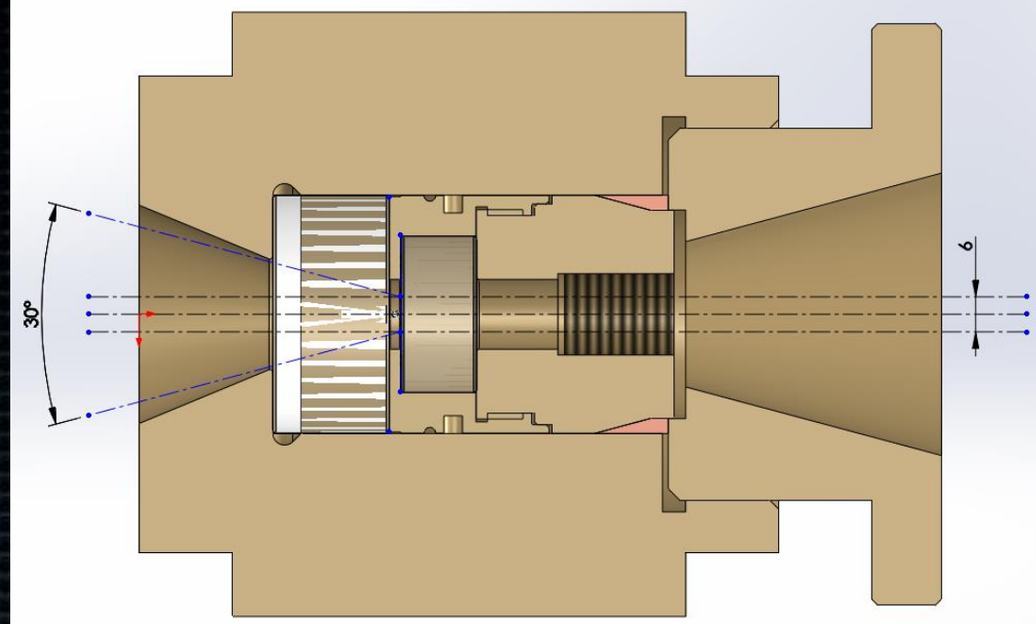
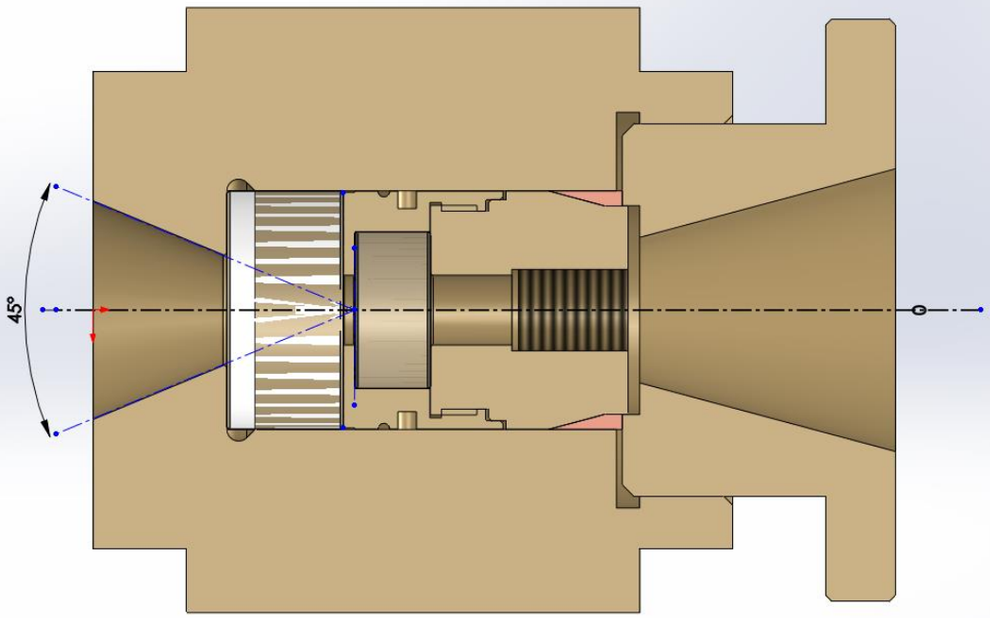
HP Cells for NSE/SANS

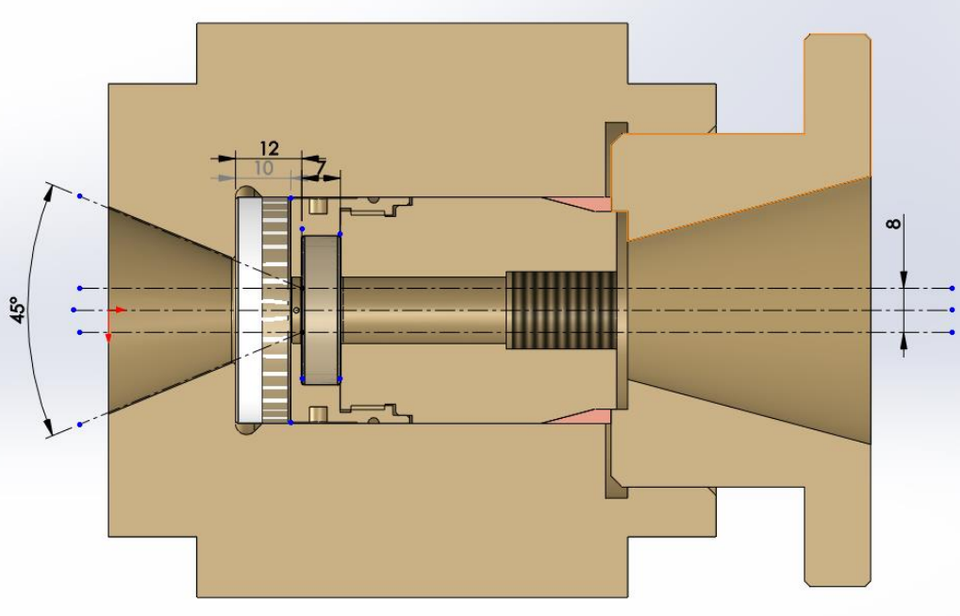
- Pressure range: 0 to 5 kbar
- Temperature range: 0 to 100 °C
- 35° - 60° access to the scattered beam
- Bio-compatible
- Non-magnetic for NSE

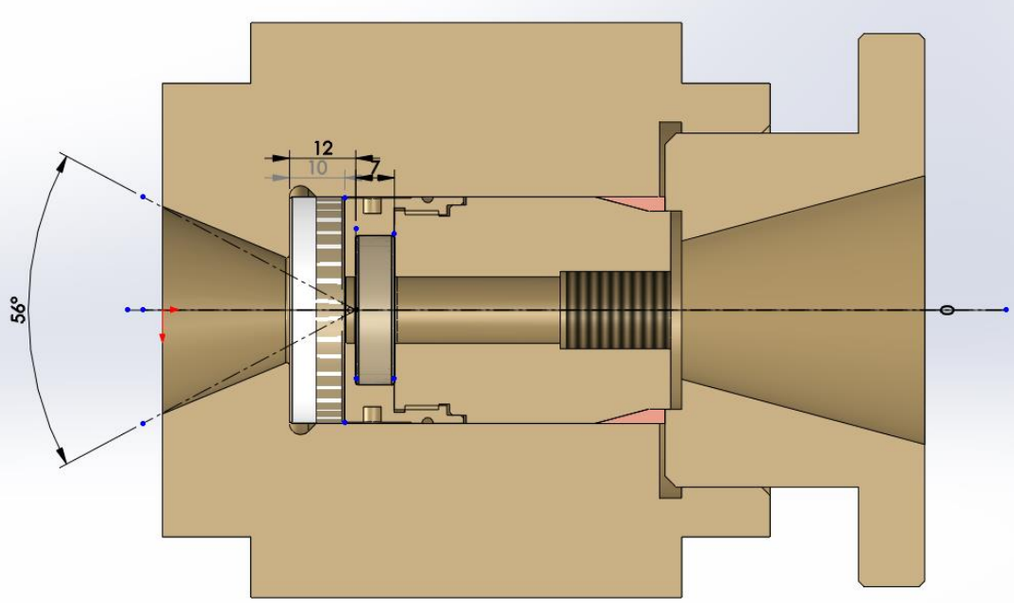
5 kbar

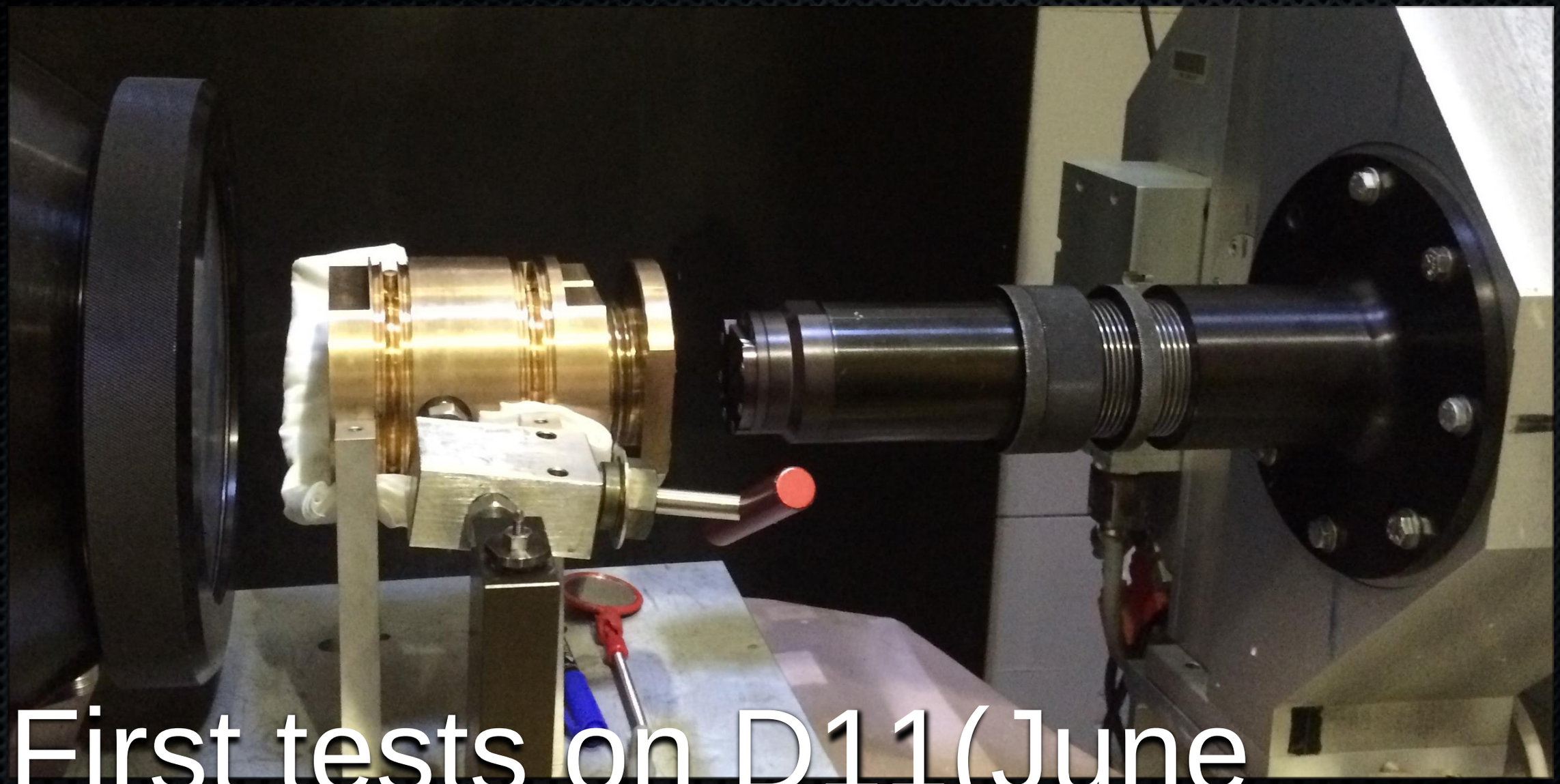




2 kbar

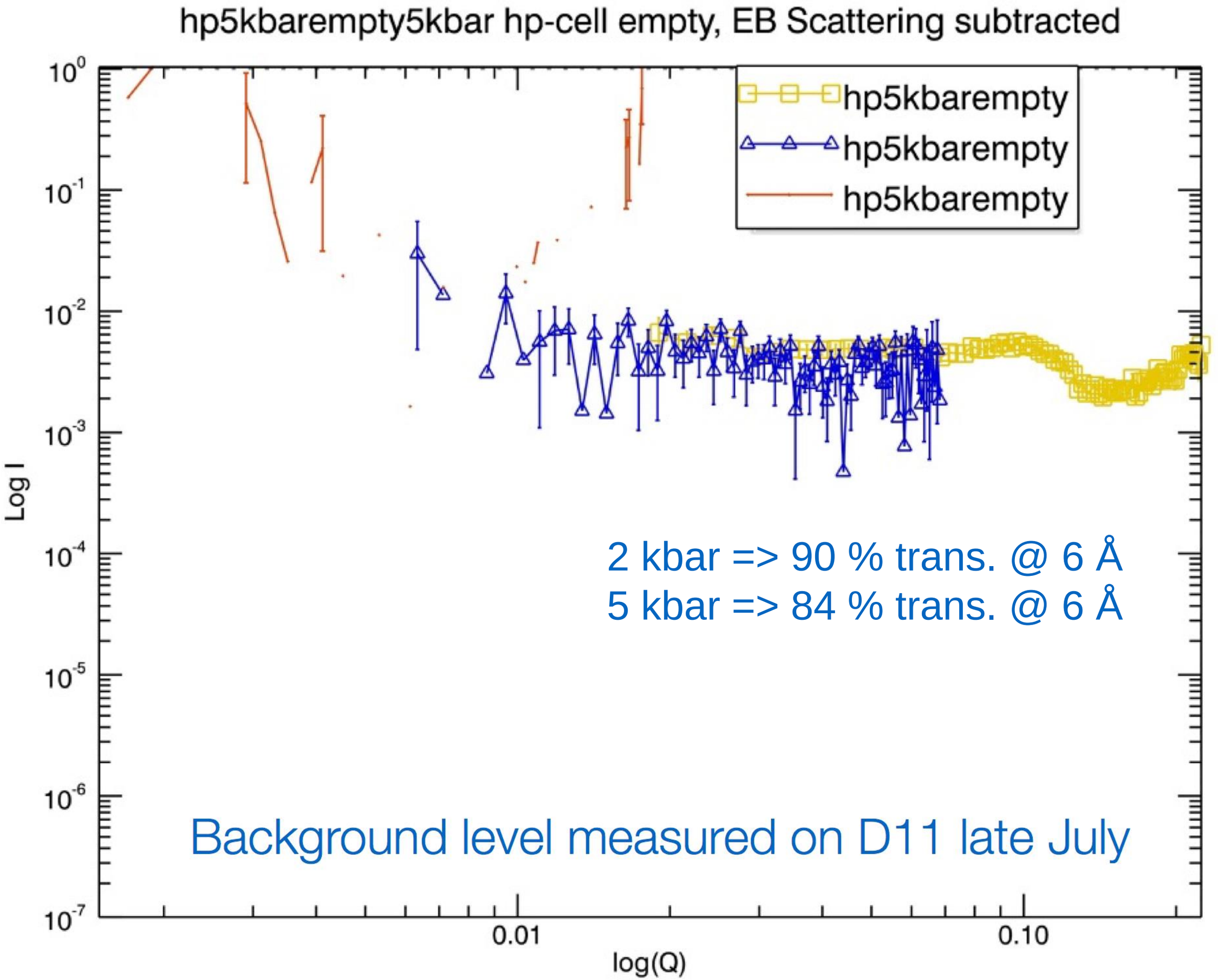




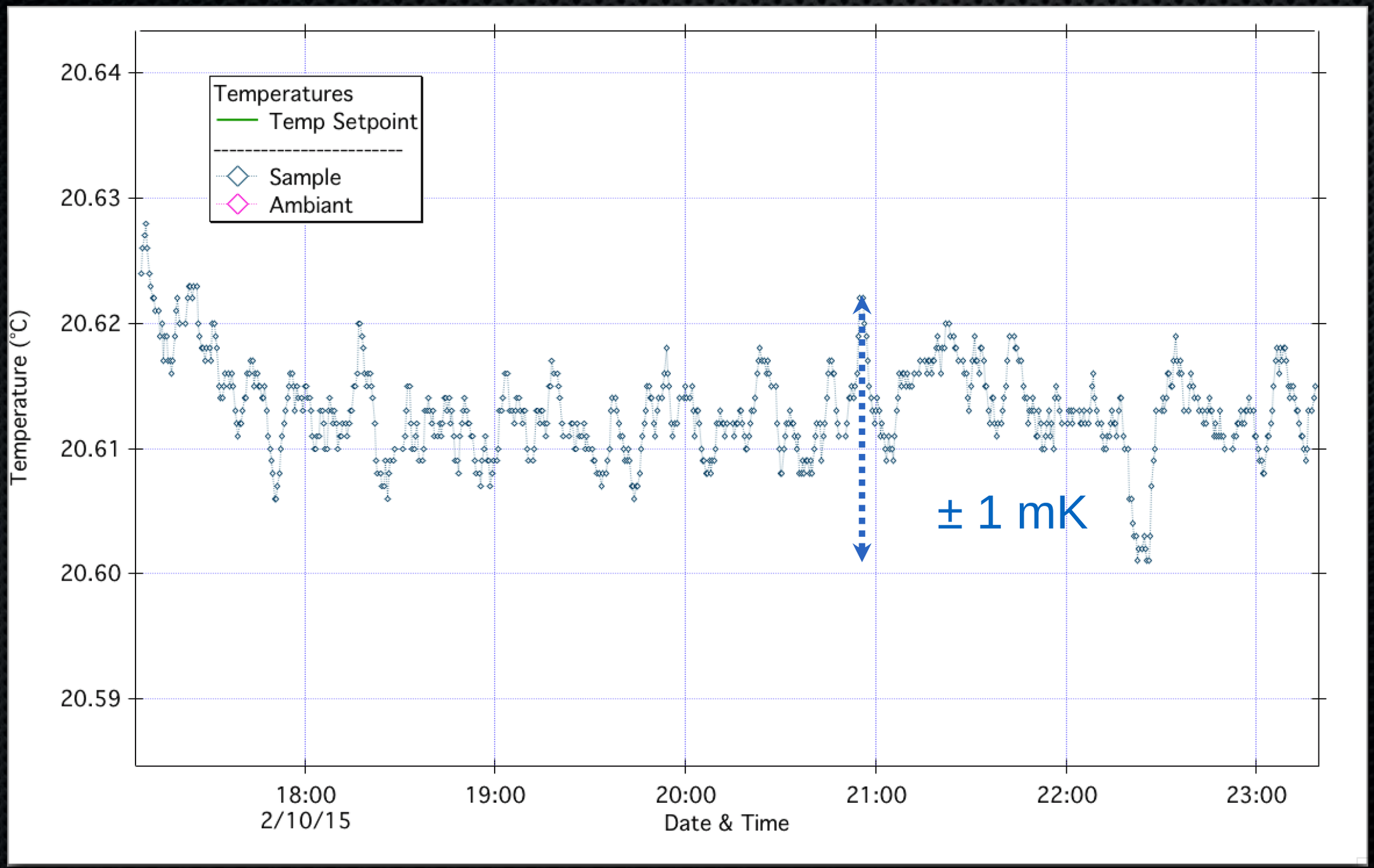


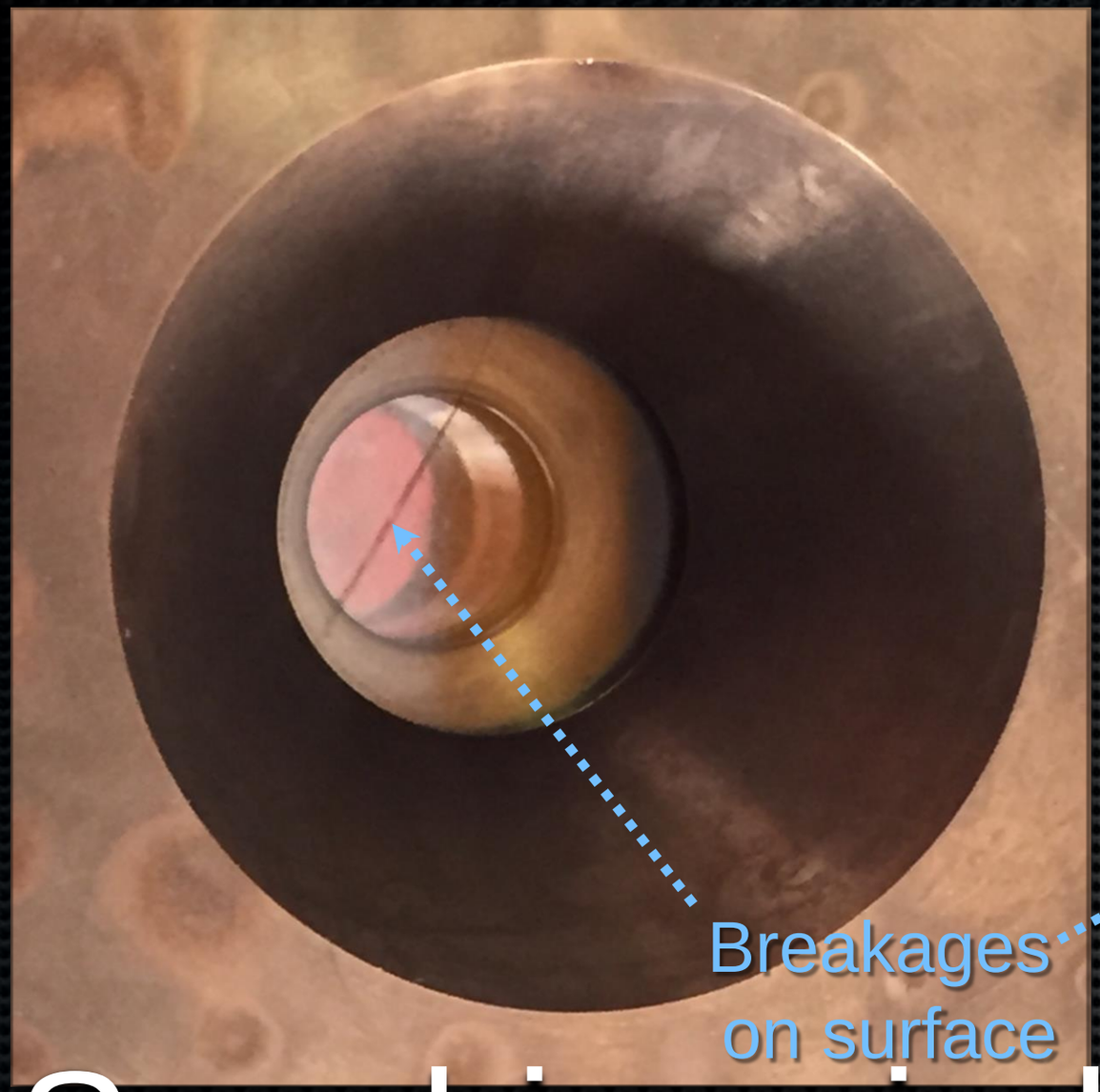
First tests on D11(June 2015)

Thanks to LLB team
(Annie, Sophie, Alexandre, Burkhard)



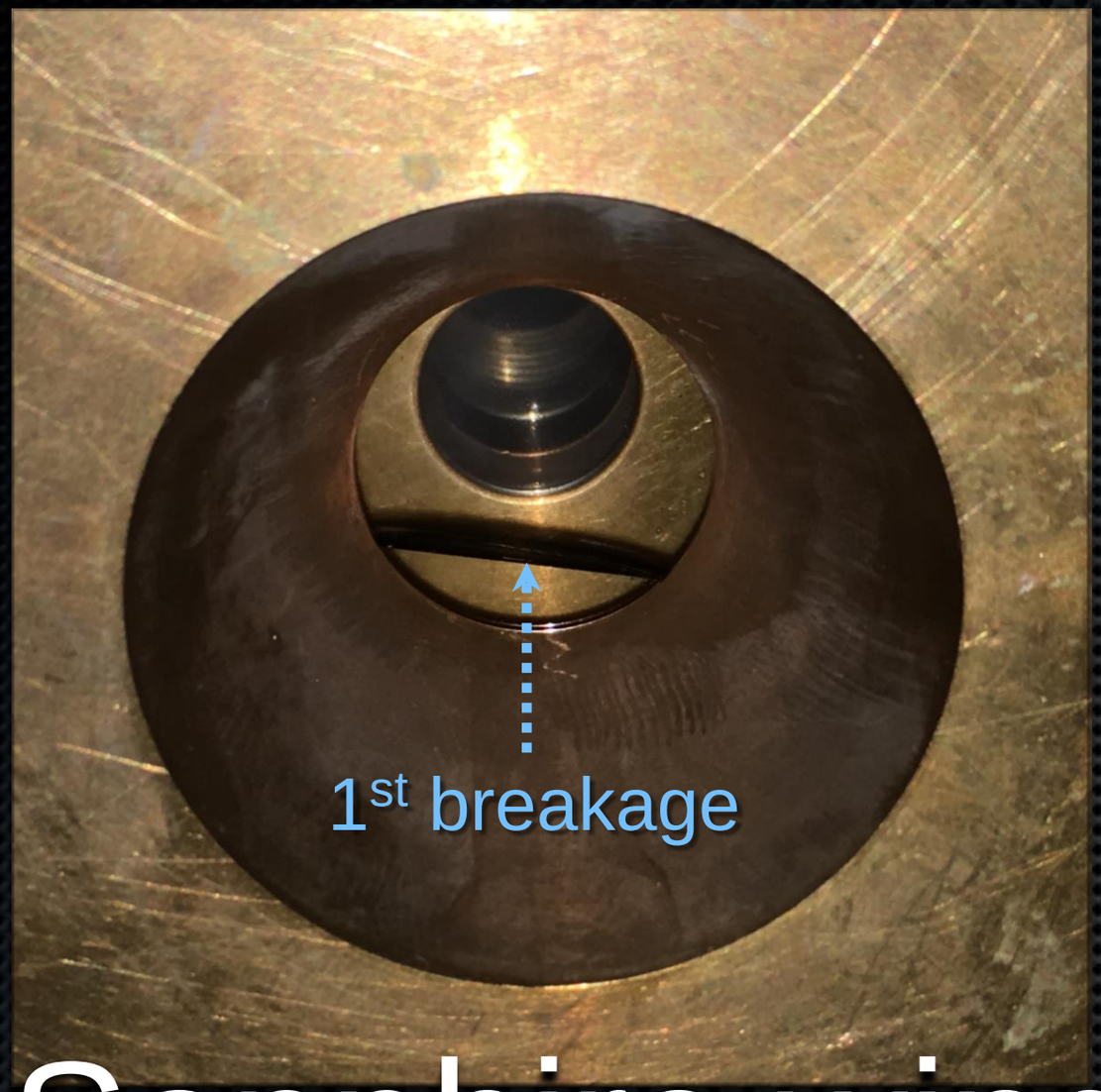
Temperature stability

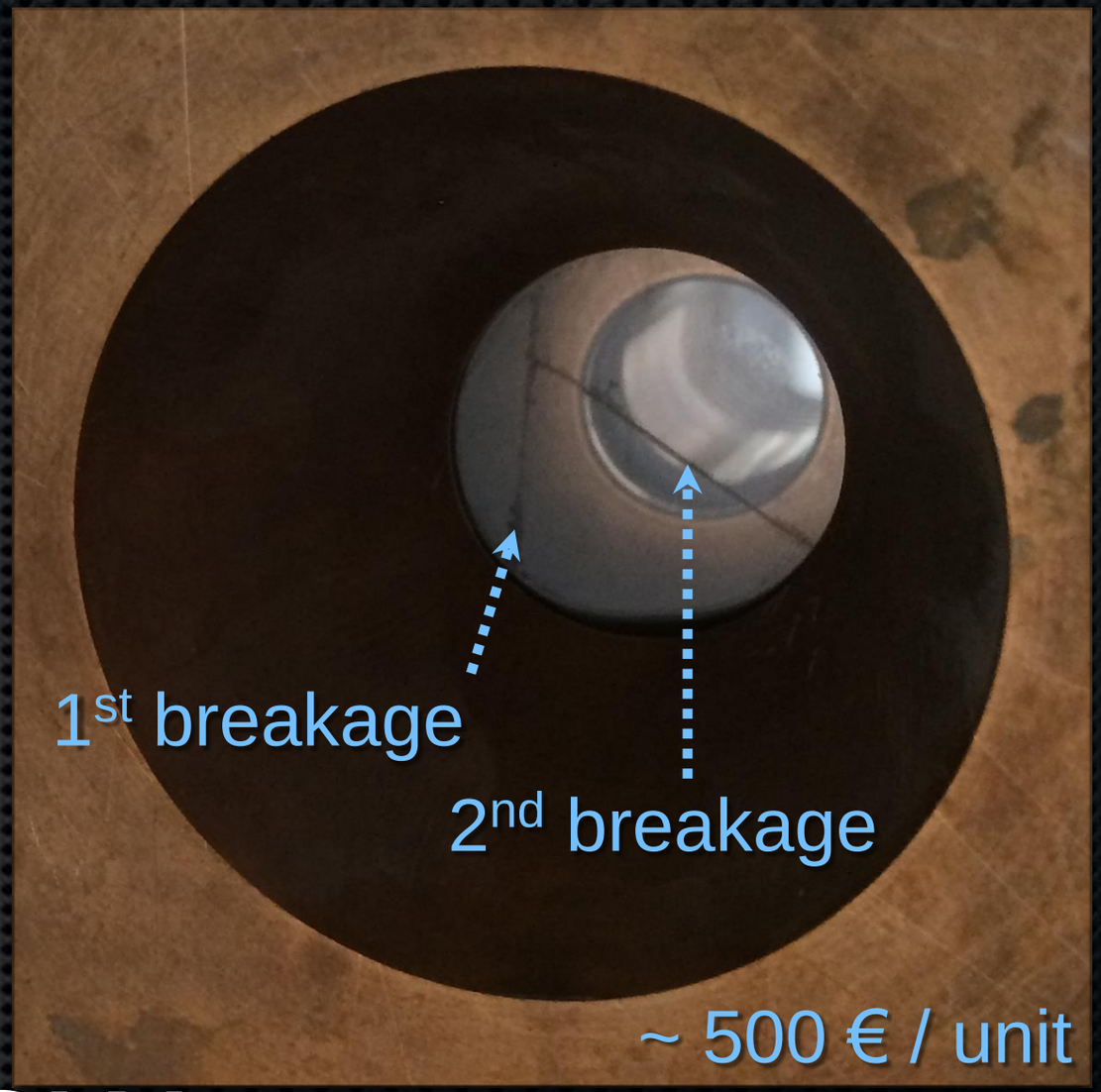




Sapphire window breakages

5 kbar still applied after breakages but…

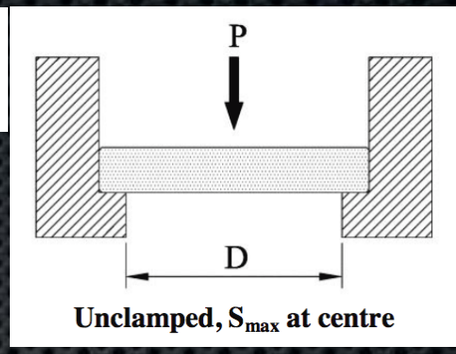




Sapphire window breakages

4.5 kbar still applied after 2nd breakage but…

Sapphire thickness?



$$Thickness = \emptyset u \sqrt{\frac{SF \cdot Ku}{4}} \sqrt{\frac{P}{AEL}}$$

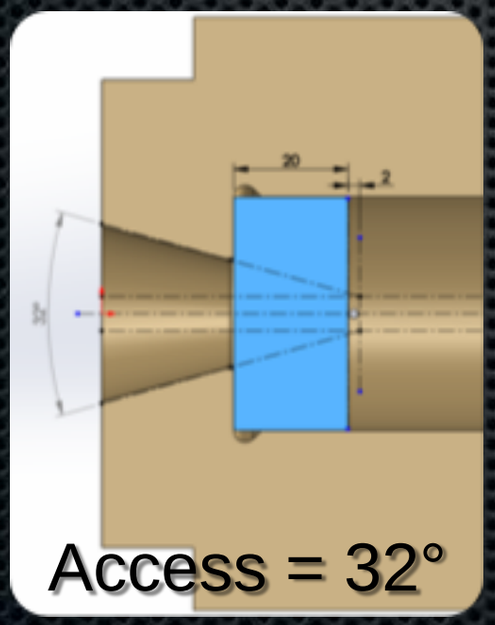
1.125

600 MPa

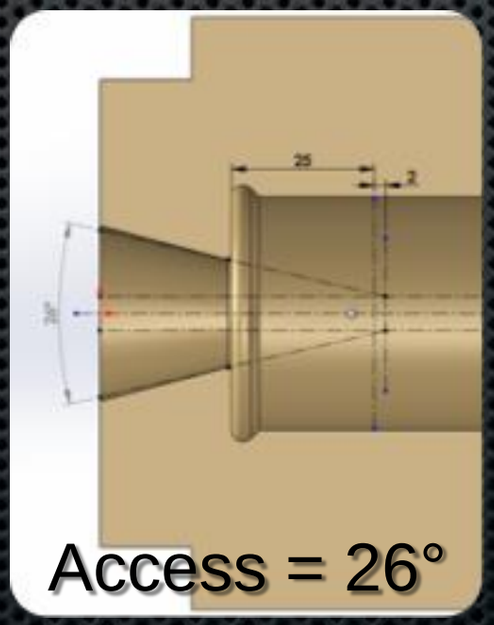
Ø 20 mm

276 MPa

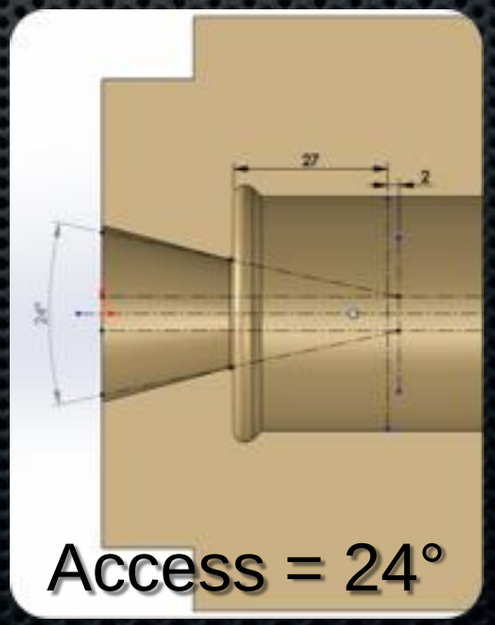
SF = 1.6 / Th. = 20



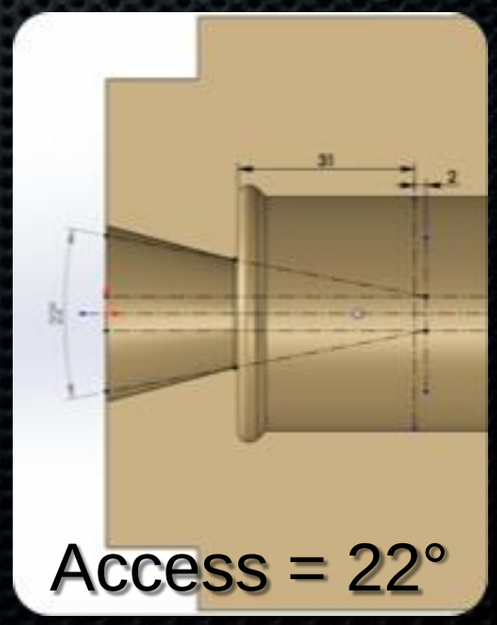
SF = 2.6 / Th. = 25



SF = 3 / Th. = 27



SF = 4 / Th. = 31



Sapphire thickness?

1st prototype
Thickness = 20 mm
Safety factor = 4

Max. pressure
2.5 kbar

Max. pressure
3.5 kbar

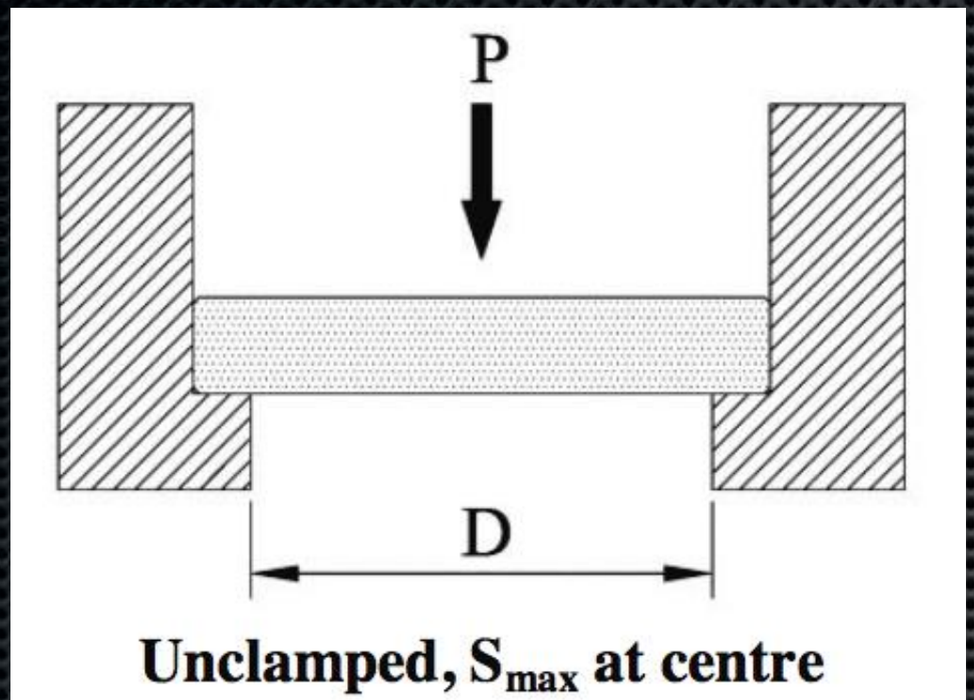
Safety factor = 3

Thickness = 25 mm
Scattered angle = 26°

Safety Factor = 3
Max. pres. = 5 kbar

Acceptable?

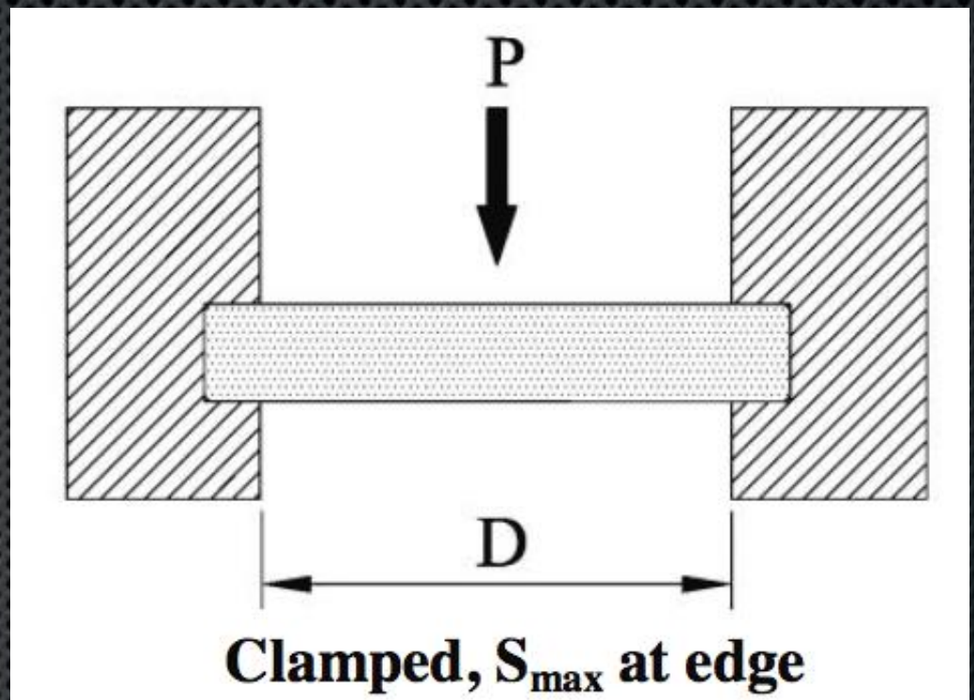
Unclamped or clamped?



Unclamped, S_{max} at centre

$$Thickness = 0.92 \times \emptyset u \sqrt{\frac{P}{AEL}}$$

Thickness = 25 mm
Scattered angle = 26°

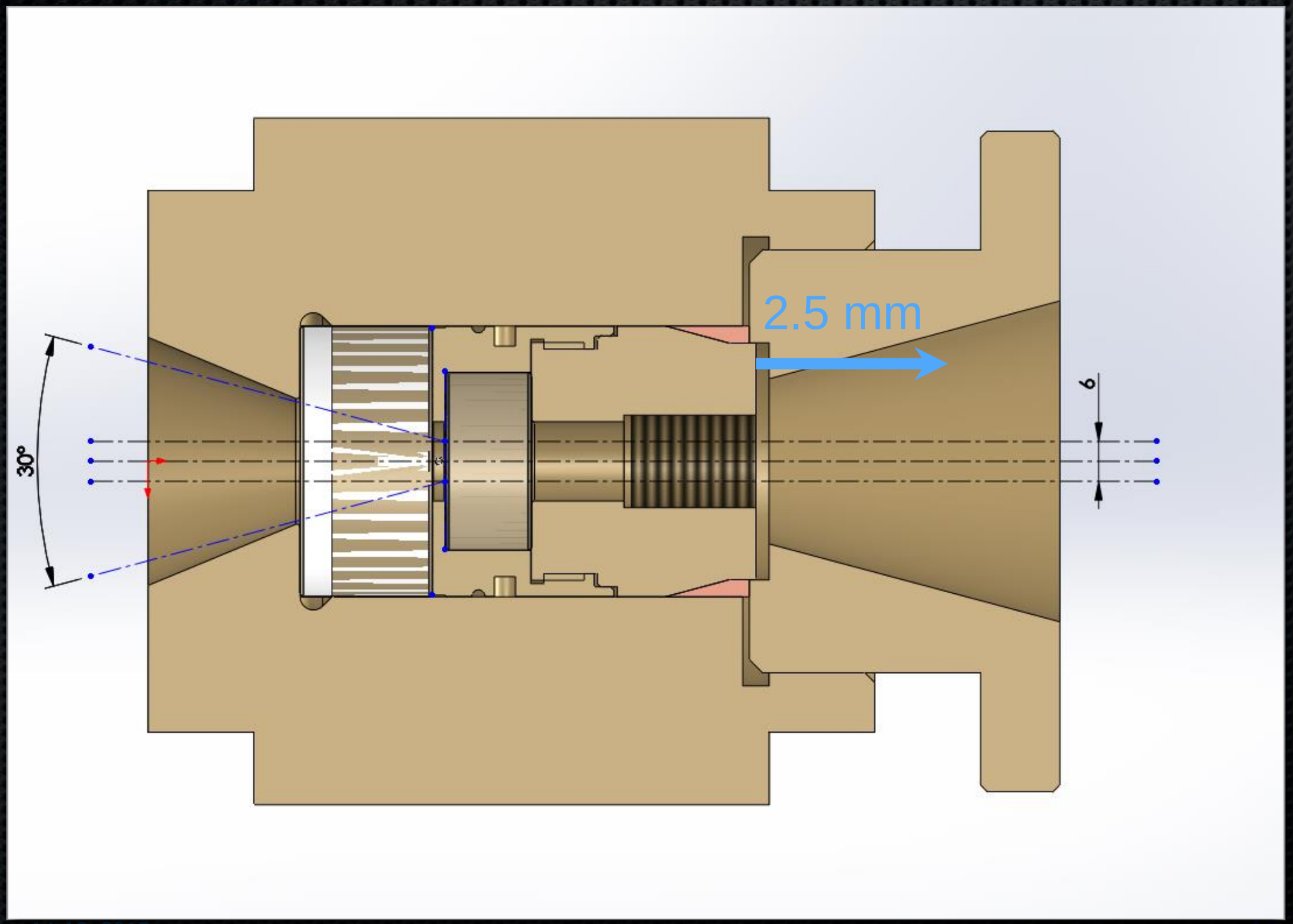


Clamped, S_{max} at edge

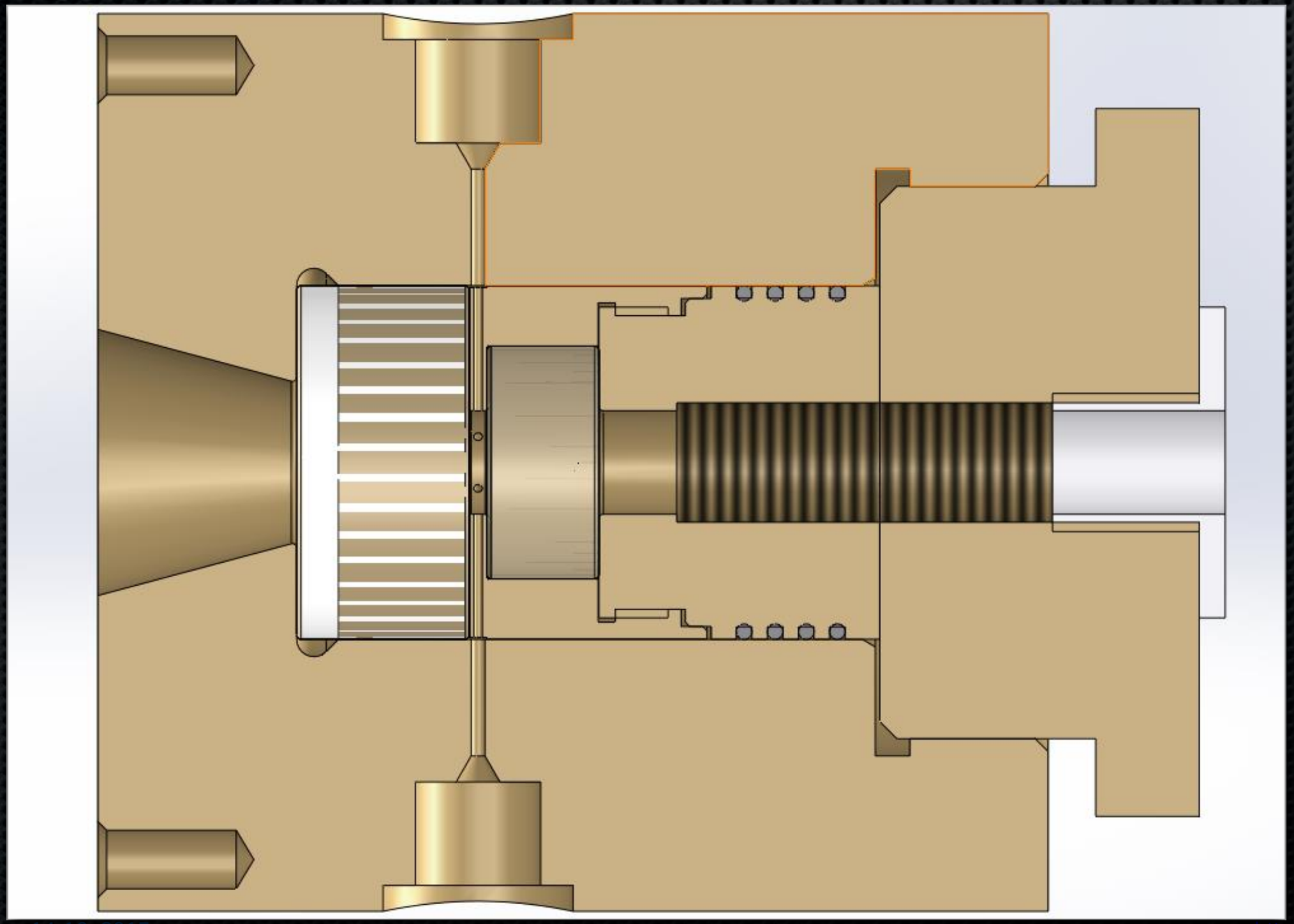
$$Thickness = 0.75 \times \emptyset u \sqrt{\frac{P}{AEL}}$$

Thickness = 20.5 mm
Scattered angle = 31°

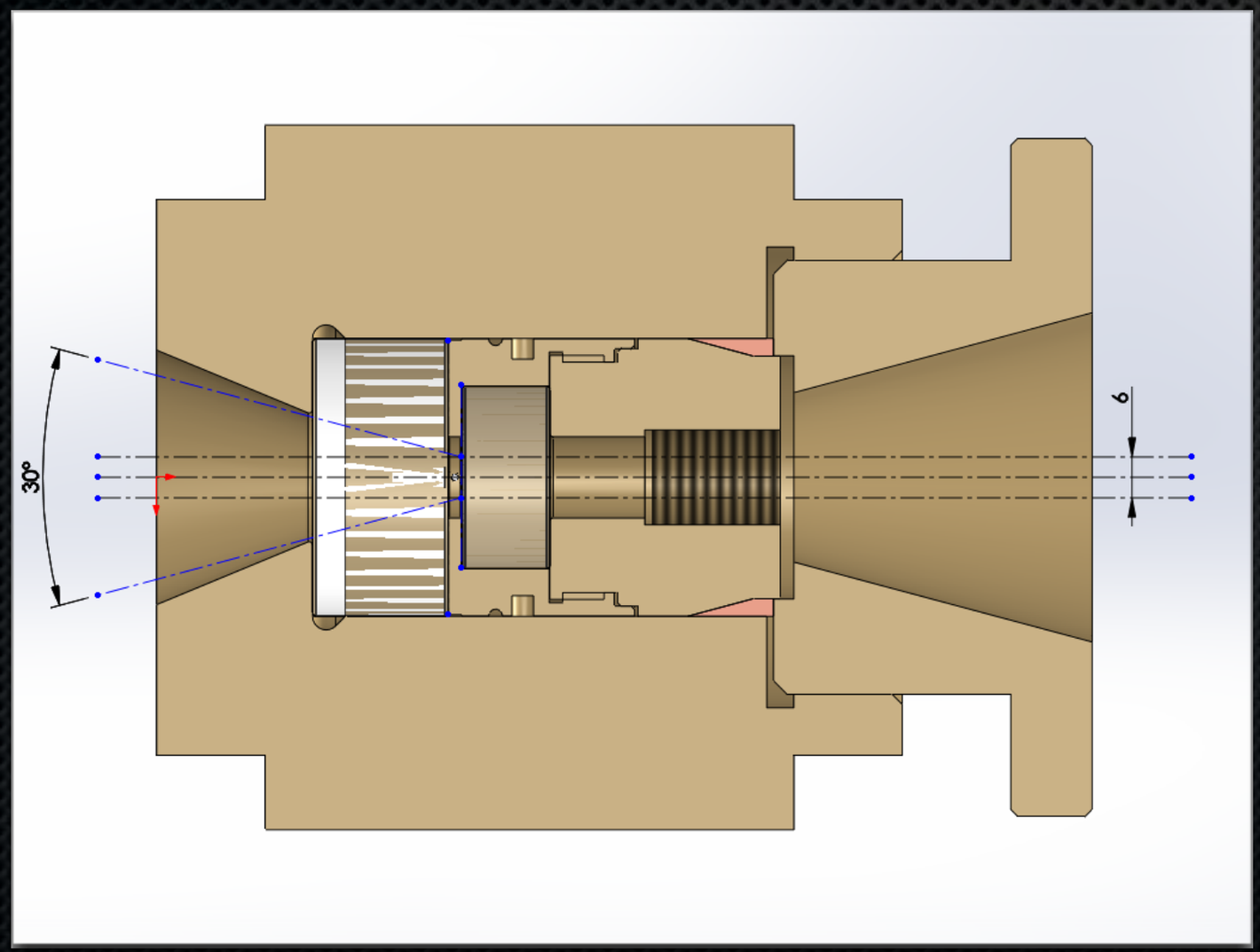
Window displacement



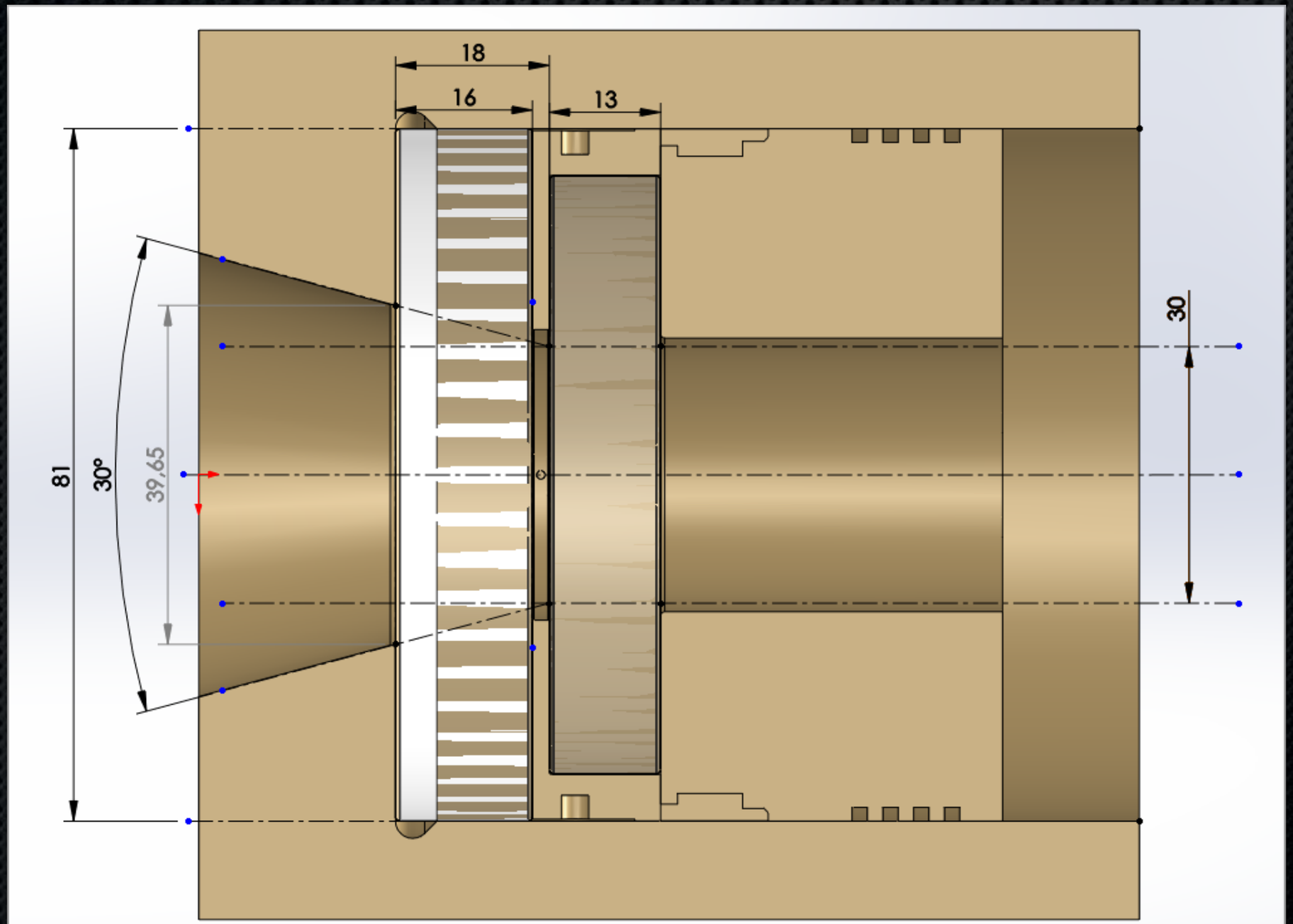
Window displacement



62 tons!!! Strong enough to open it?



500 bar / Ø30 bore for NSE



Conclusion & perspectives

- First experiments carried out successfully!!!
- Pressure up to 3.5 kbar reliable (5 kbar feasible)
- Temperature controlled & stable
- Very high transmission (+84 % @ 6 Å)
- Incident window displacement => to be fixed
- 500 bar with Ø 30 mm bore for NSE/SANS

Very special thanks to the LLB team
(Annie, Burkhard, Sophie & Alexandre)

Thanks to ILL team too
(Claude, James, Ralf, Peter, Eddy & David)

Questions ?