Optical Quality of the PANDA Barrel DIRC Prototype Radiator Plates
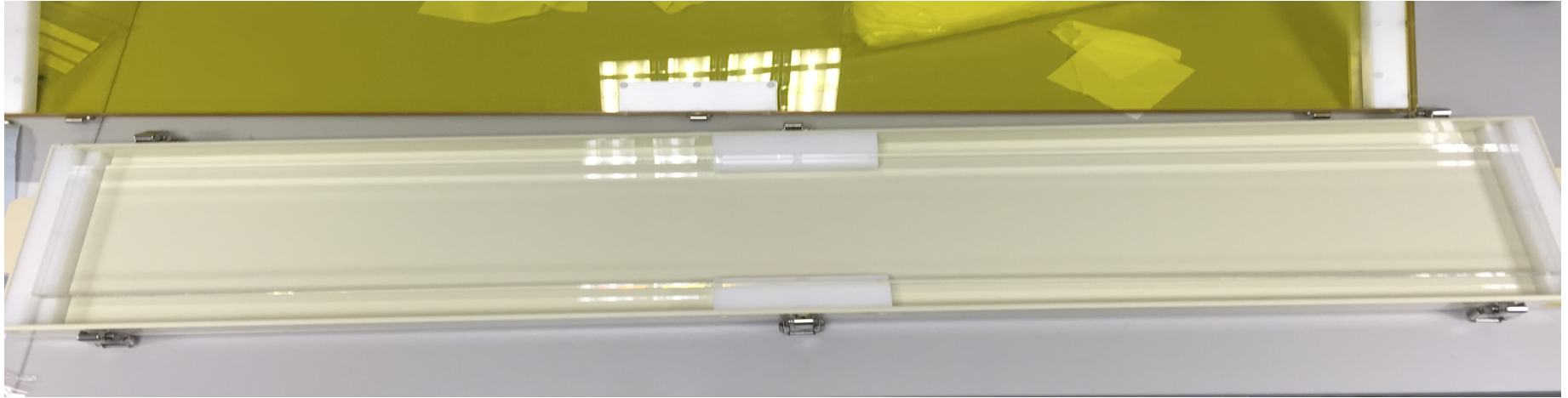
Marvin Krebs*

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* m.krebs@gsi.de

1 plate from Nikon Corp. (loan ended end of May)
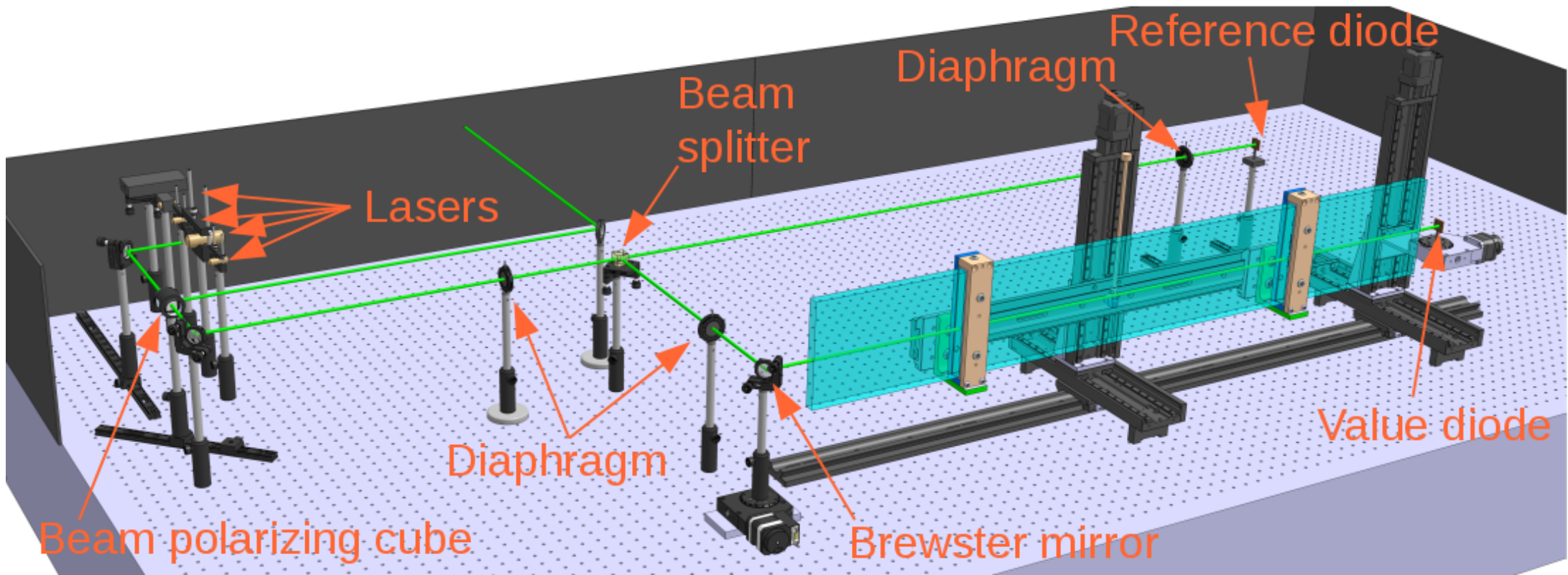
1200.0 x 160.0 x 17.0 mm (L x W x T)

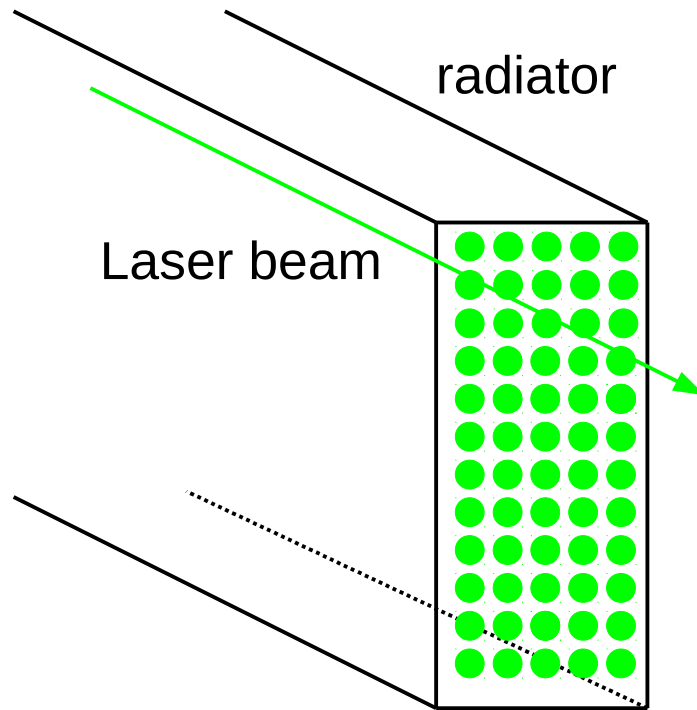2 plates from InSync Corp. 1225.0 x 175.0 x 17.0 mm (L x W x T)

Bulk Transmission
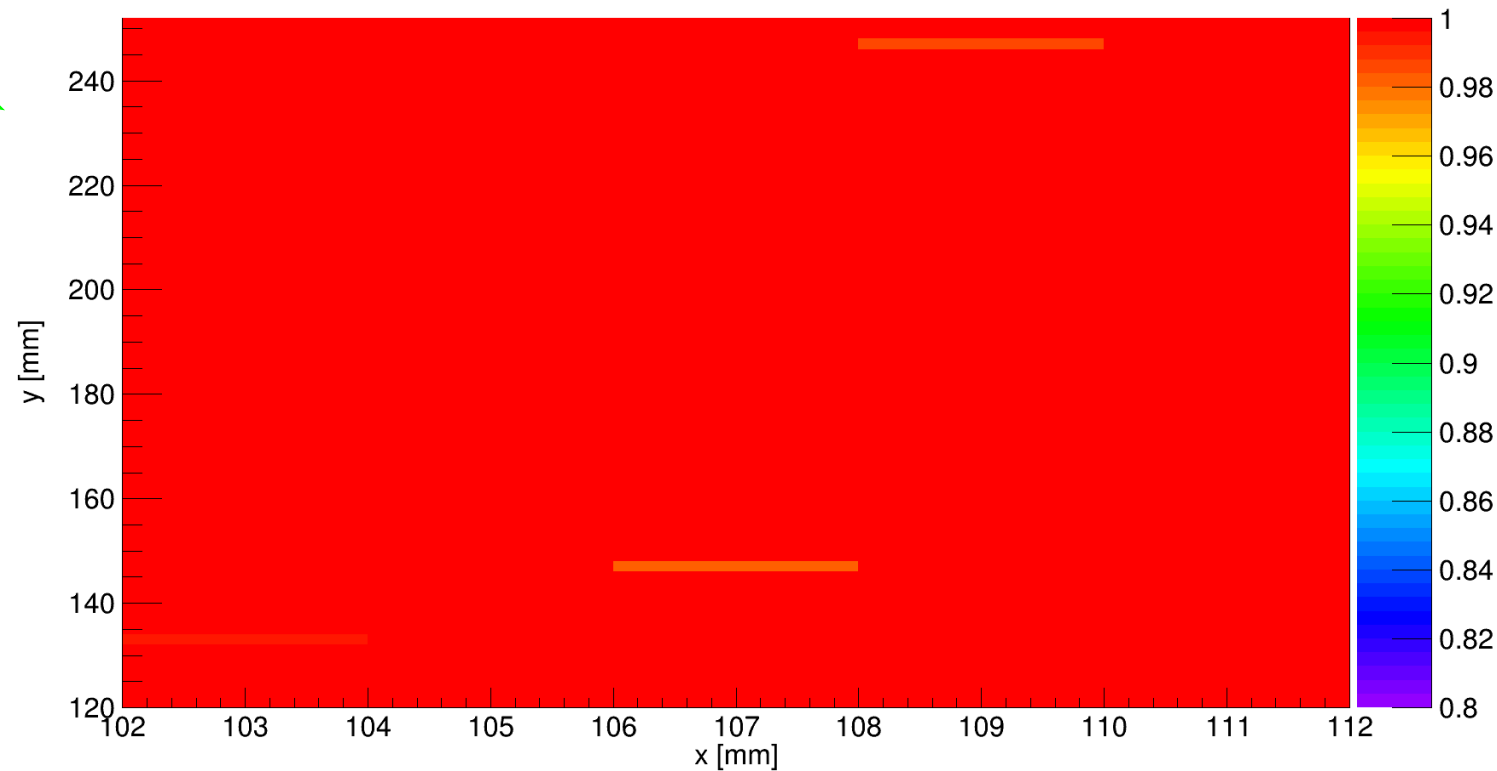
→ Determination of attenuation length Λ

Bulk Transmission

→ Bulk transmission measurement for each wavelength

radiator

Laser beam

Result: Color matrix; Intensities are already Fresnel corrected
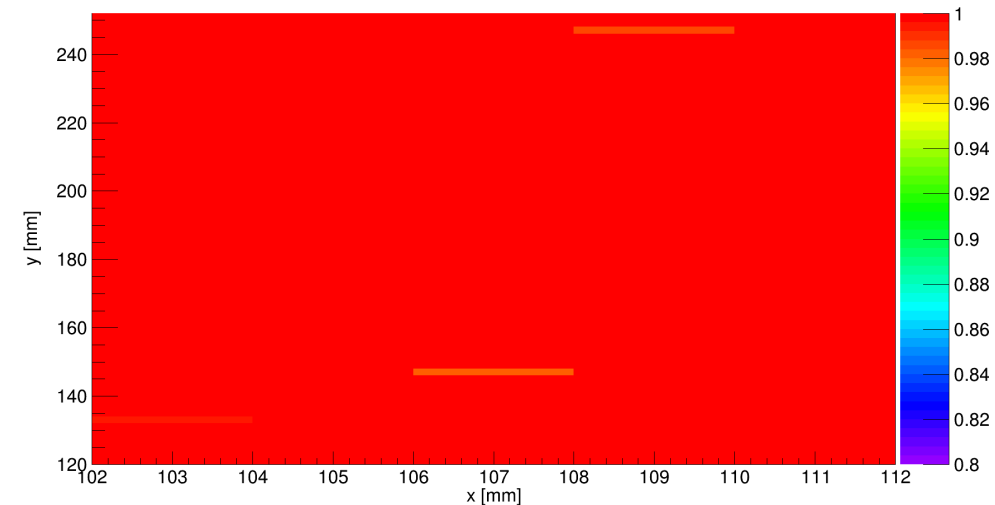
→ Matrix scan of radiator

$$T = R^N \exp\left(\frac{L}{\Lambda}\right) \cdot (1-F)$$
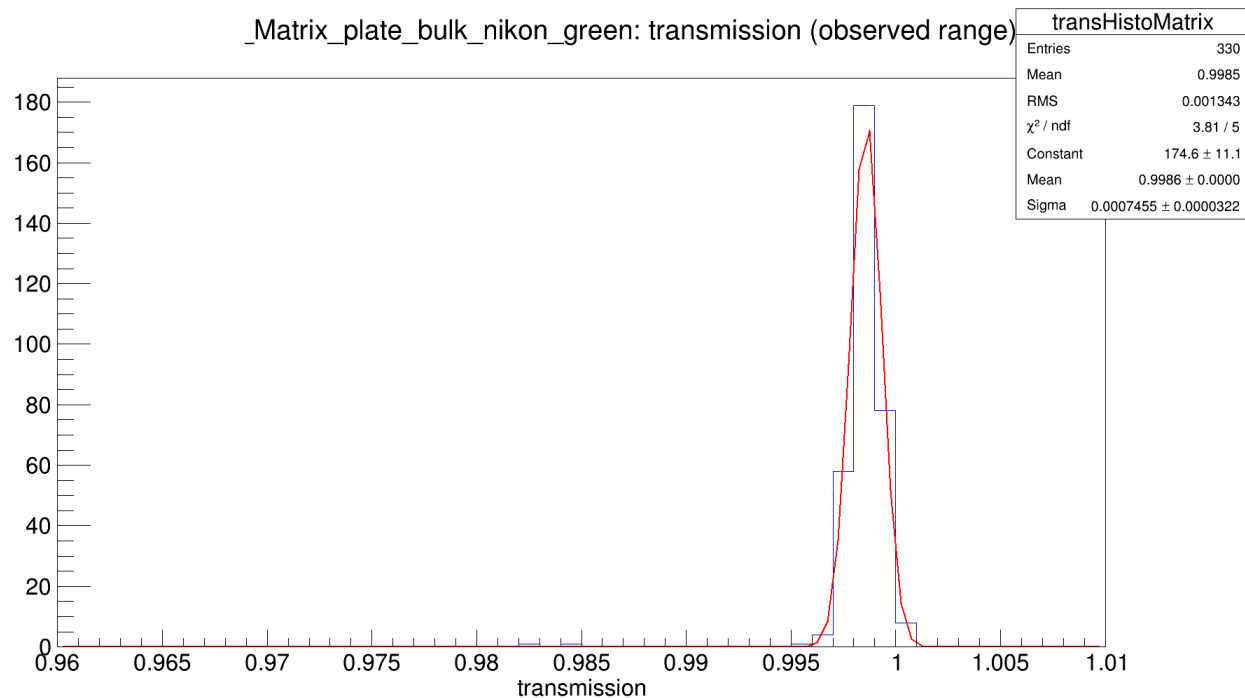
Nikon plate

Bulk Transmission

→ Bulk transmission measurement for each wavelength

→ Measured intensities on the z-axis

_Matrix_plate_bulk_nikon_green: transmission (observed range)

transHistoMatrix	
Entries	330
Mean	0.9985
RMS	0.001343
χ² / ndf	3.81 / 5
Constant	174.6 ± 11.1
Mean	0.9986 ± 0.0000
Sigma	0.0007455 ± 0.0000322

→ These measured intensities are plotted into a histogram
→ The mean bulk transmission T is obtained

Bulk Transmission
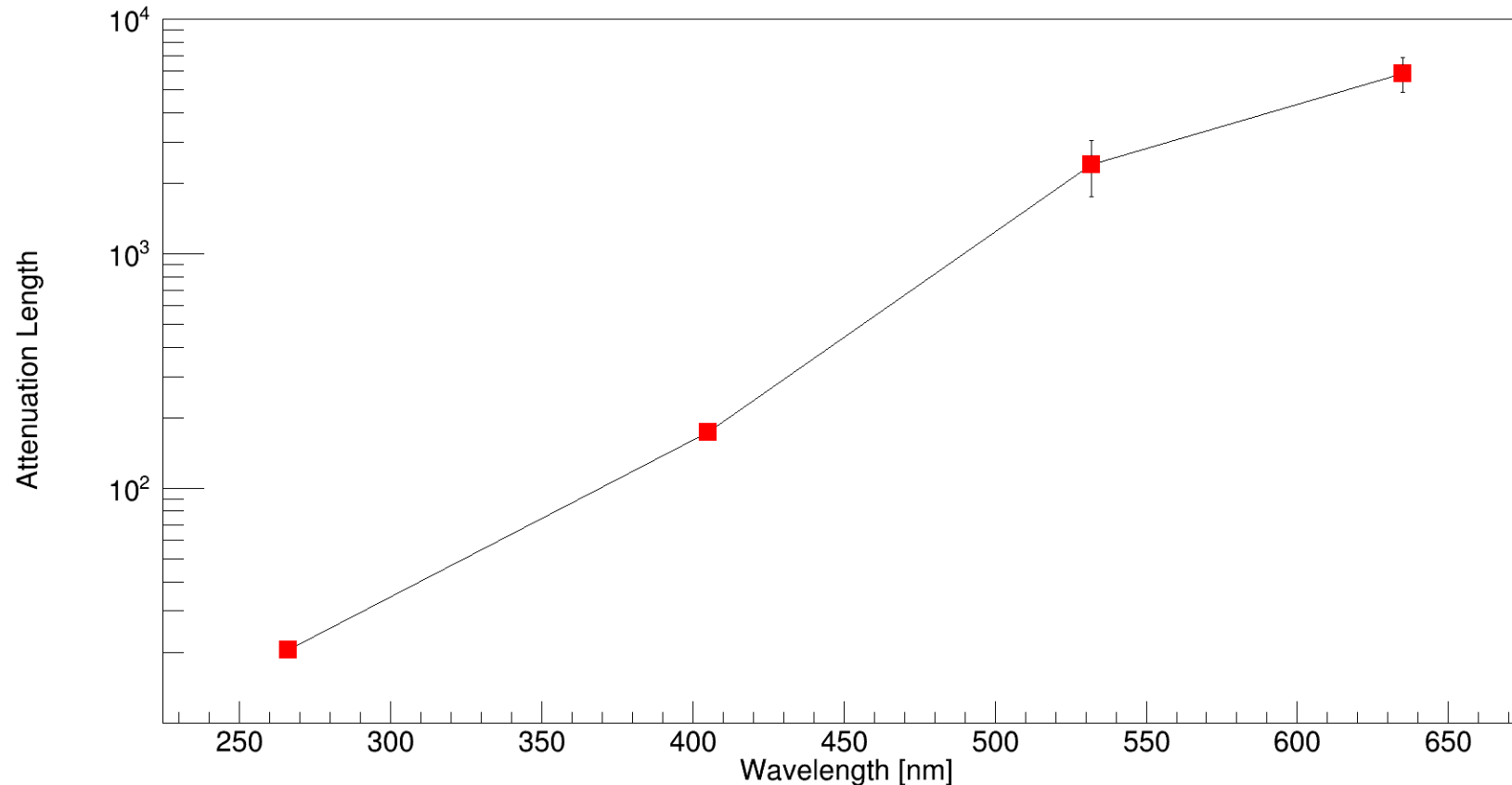
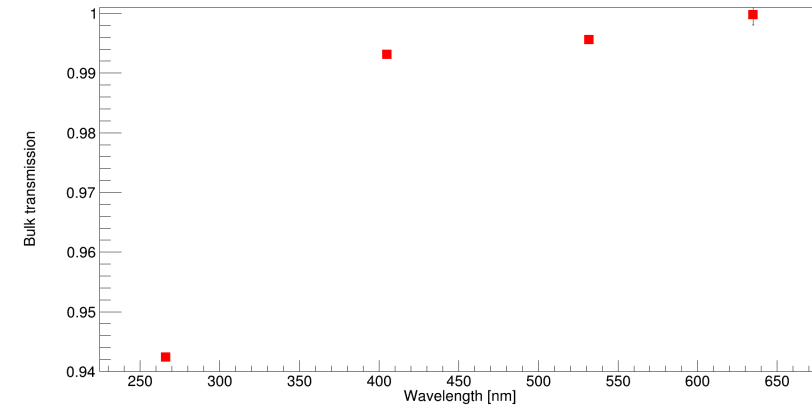→   Bulk transmission measurement for each wavelength
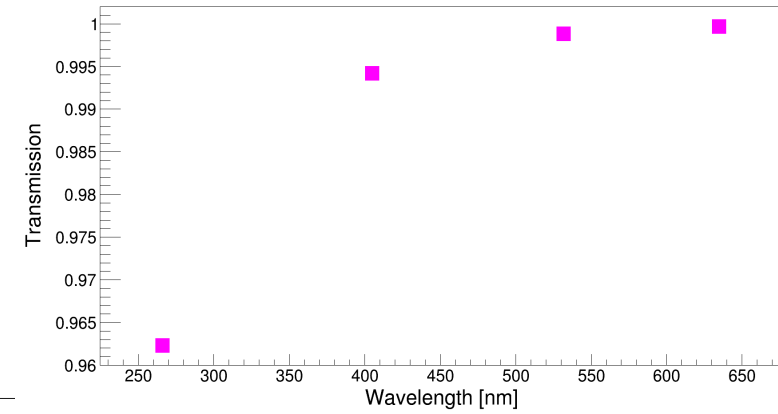
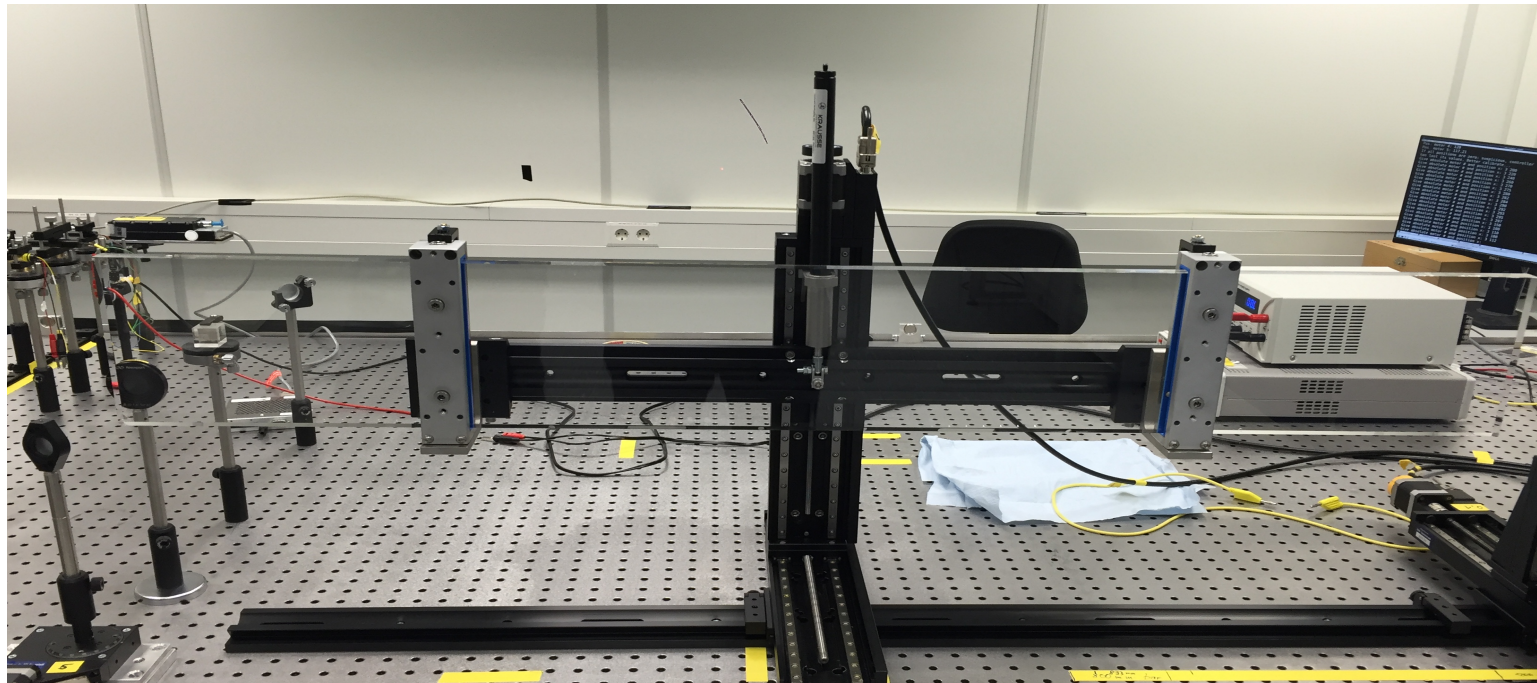Nikon plate - Attenuation lengths
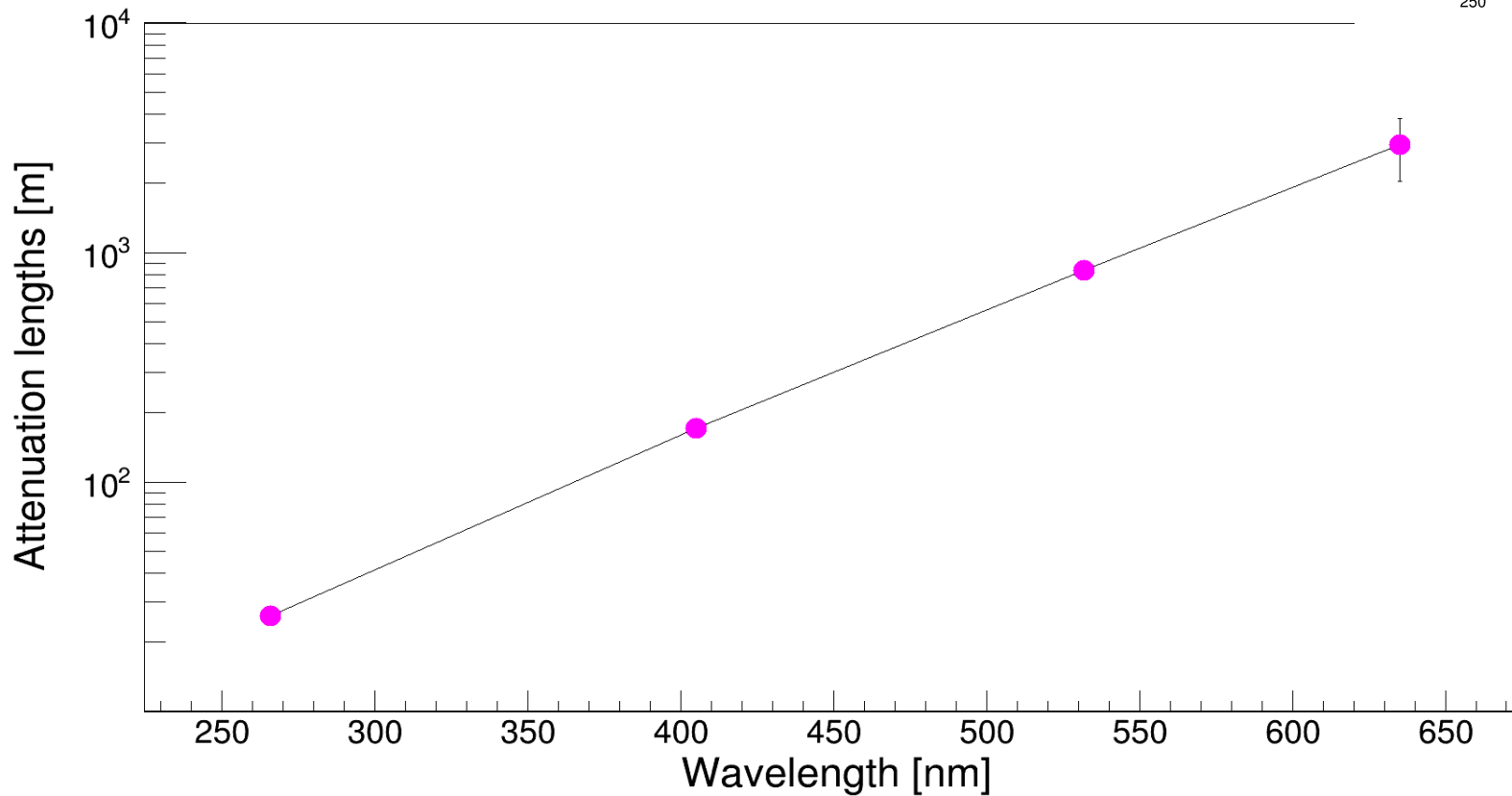
→ Attenuation length Λ
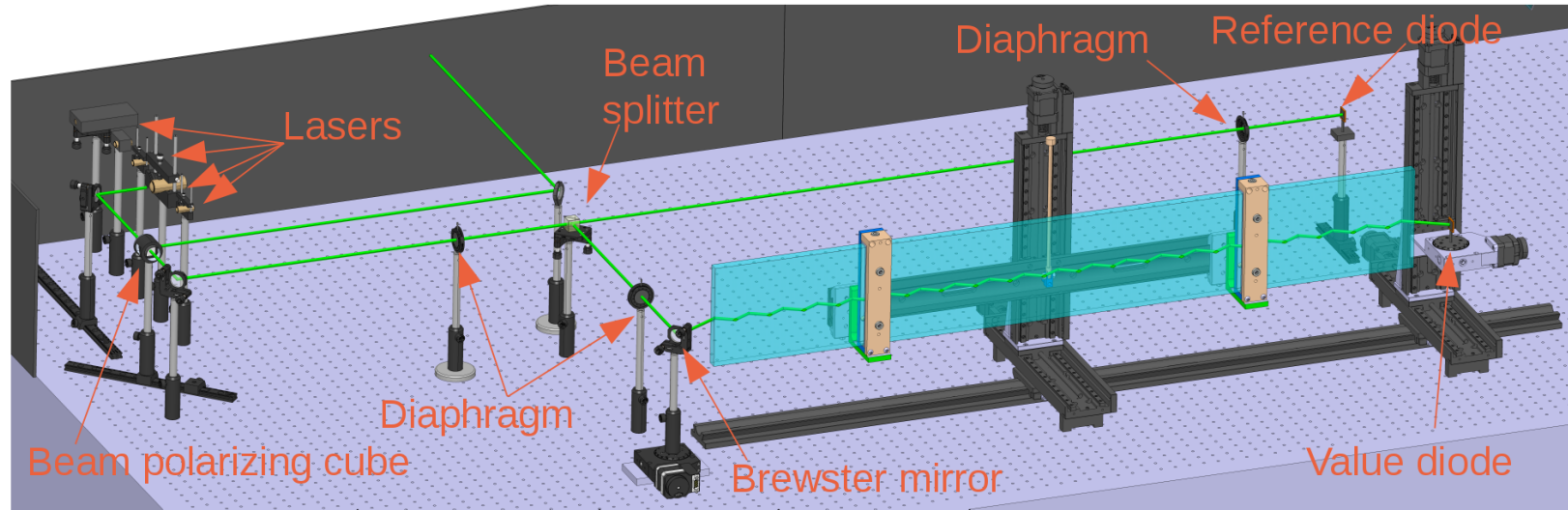
Bulk Transmission
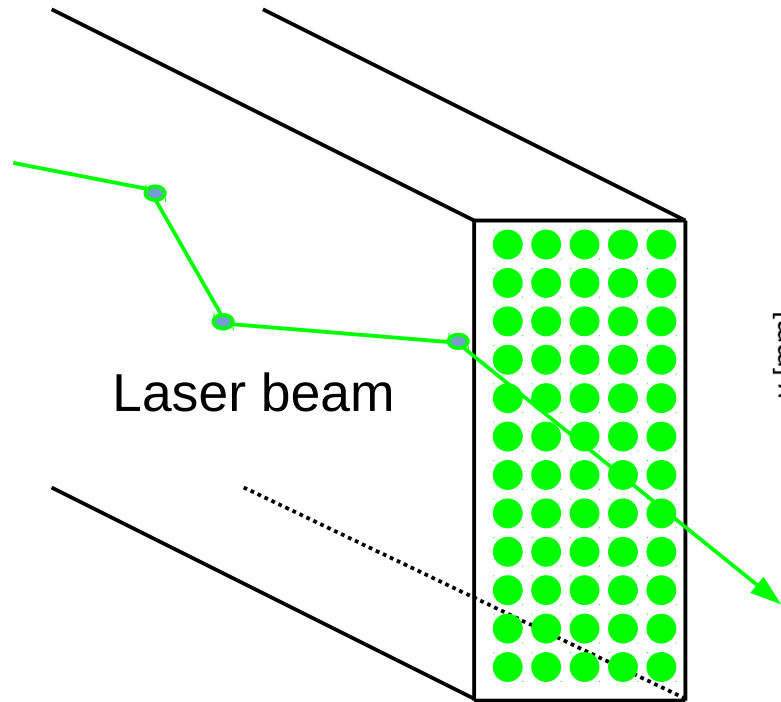
→   Bulk transmission measurement for each wavelength

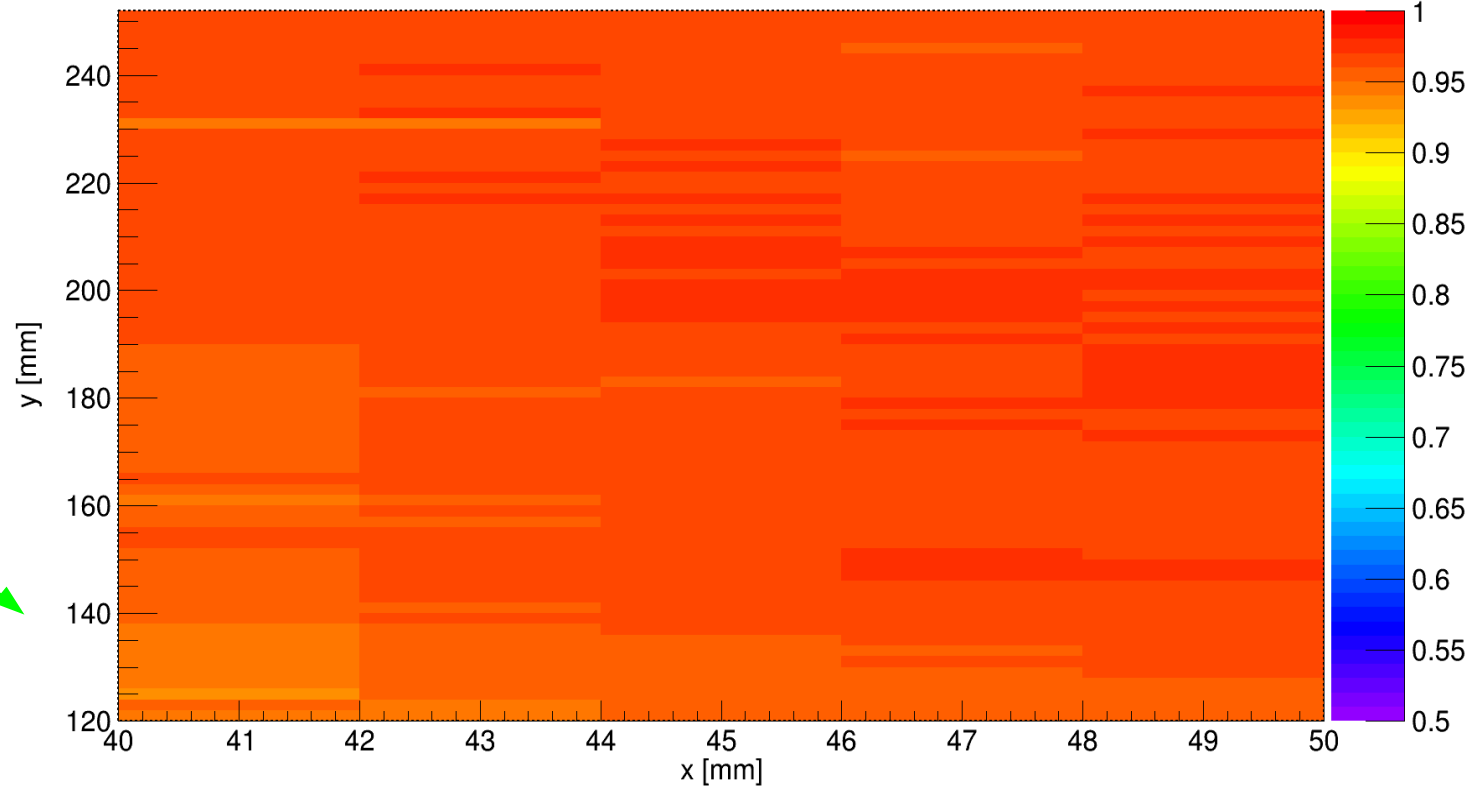→ Attenuation length Λ

Internal Reflection

→ For large sides (faces)

Internal Reflection
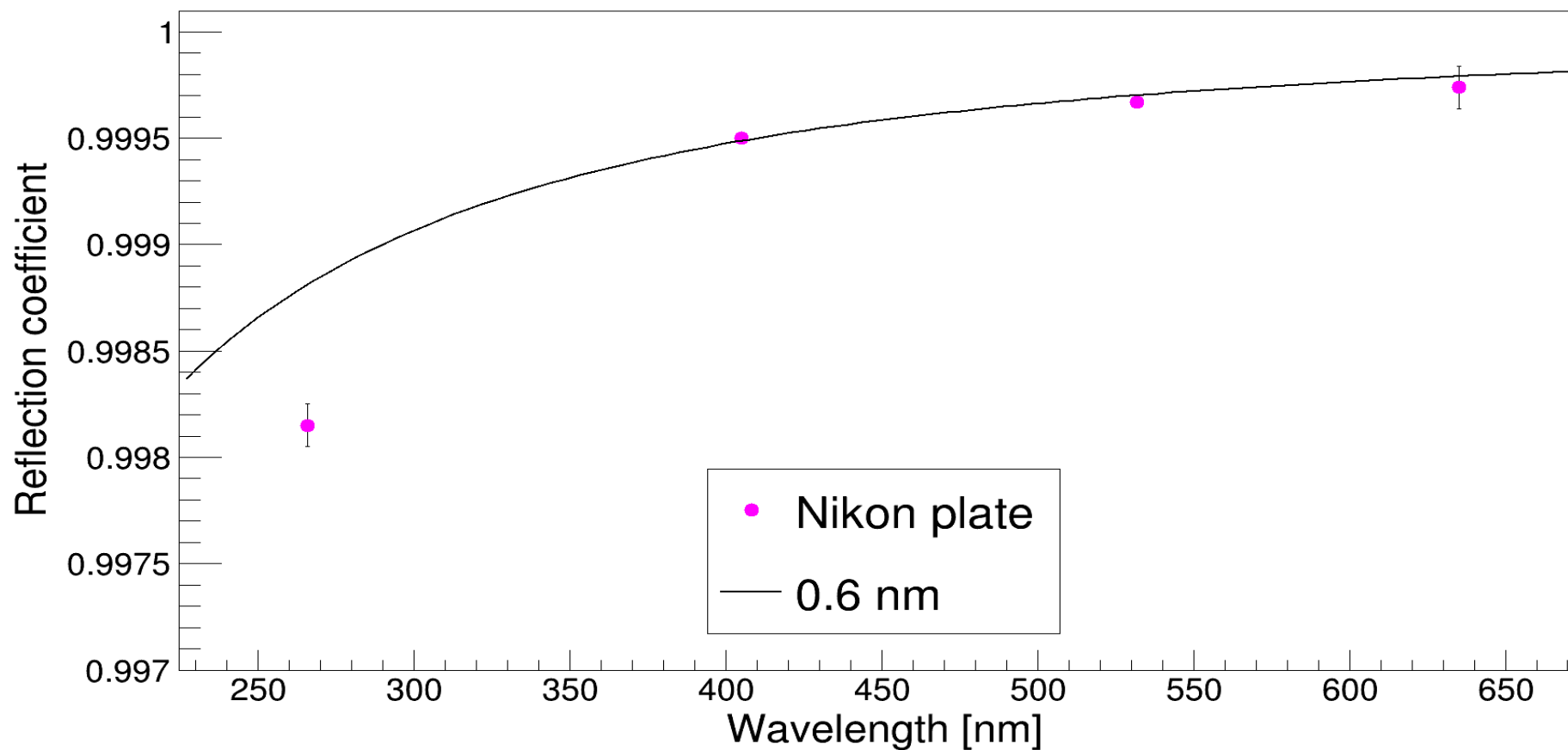
Blue laser:

Laser beam

→ 50 reflections inside the radiator

Reflection Coefficient

$$R = 1 - \left(\frac{4\pi \cdot \cos(\theta) \cdot n \cdot H}{\lambda} \right)^2$$
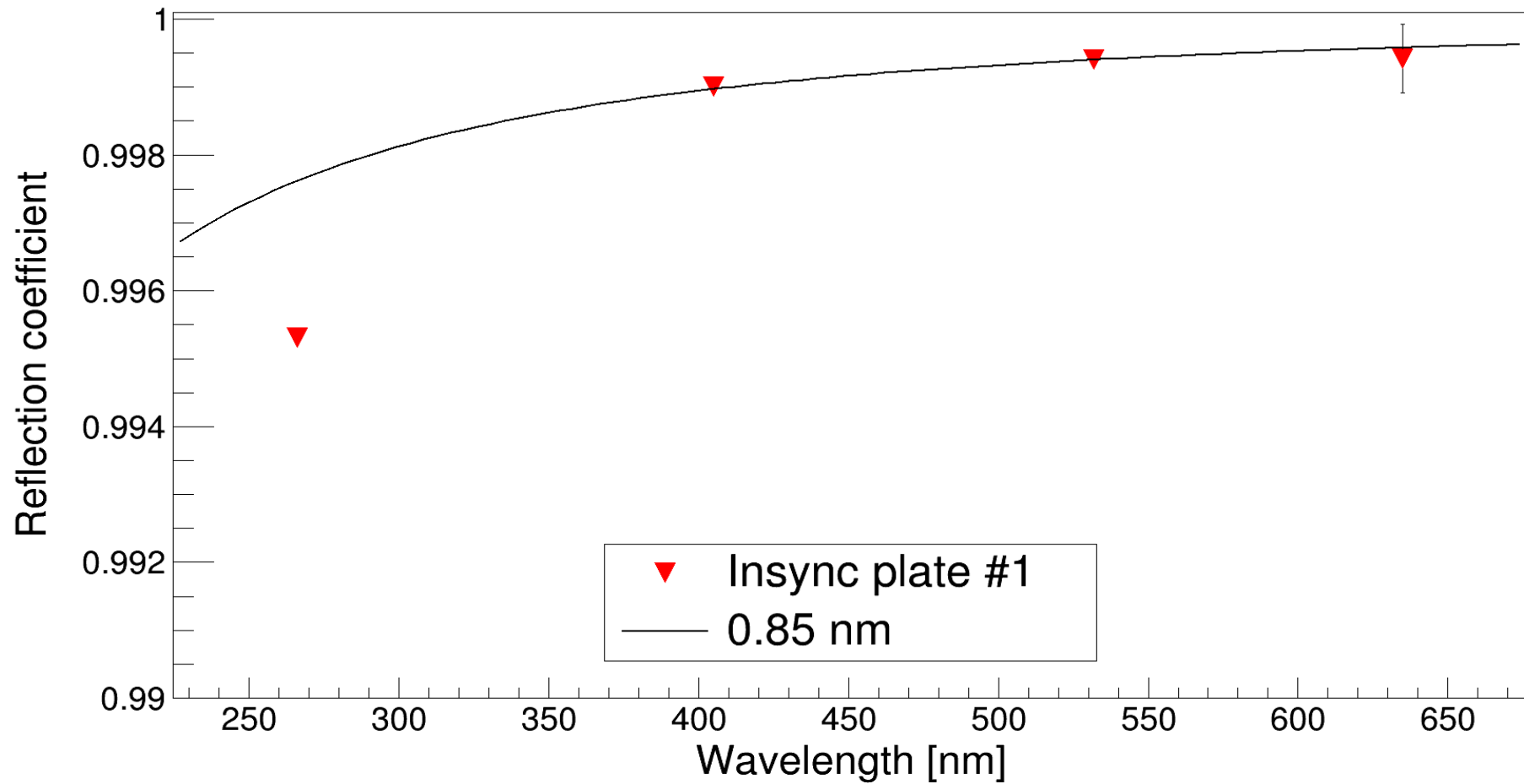
→ Large sides (faces)

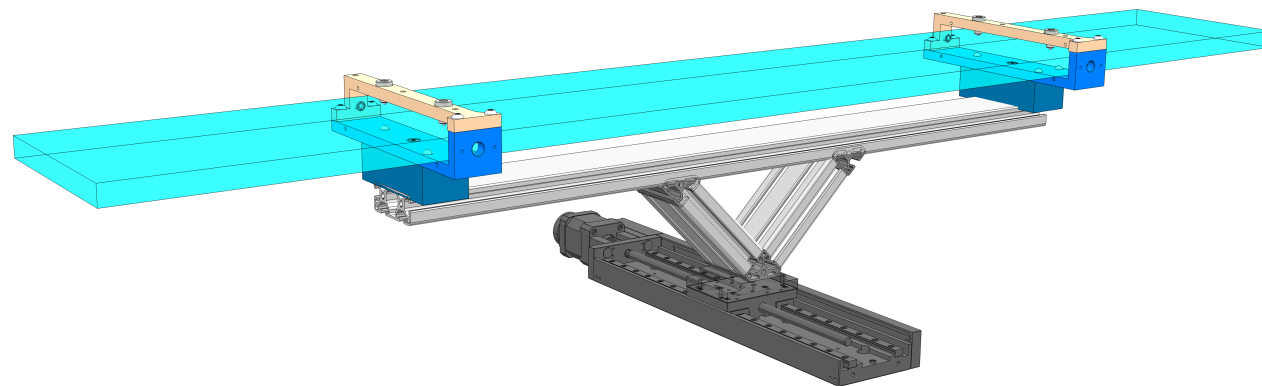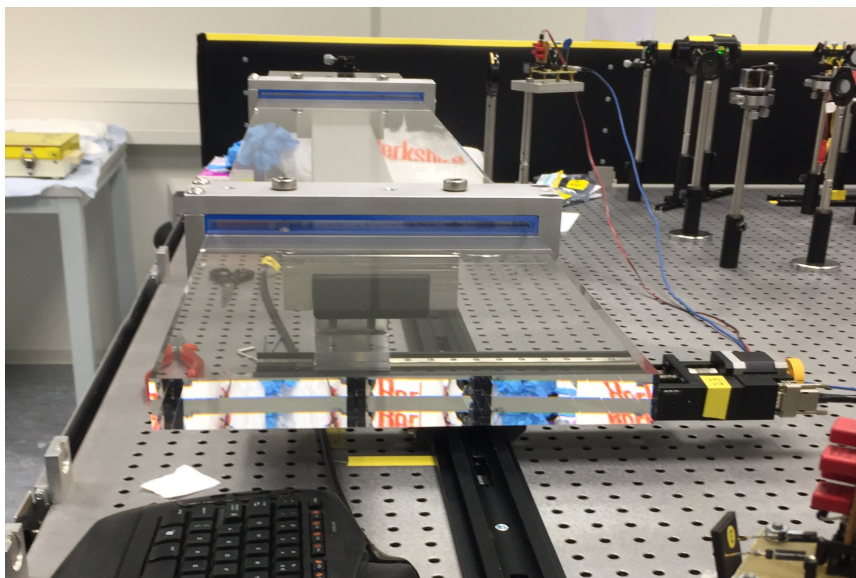Nikon plate - Reflection coefficients for faces

Reflection Coefficient
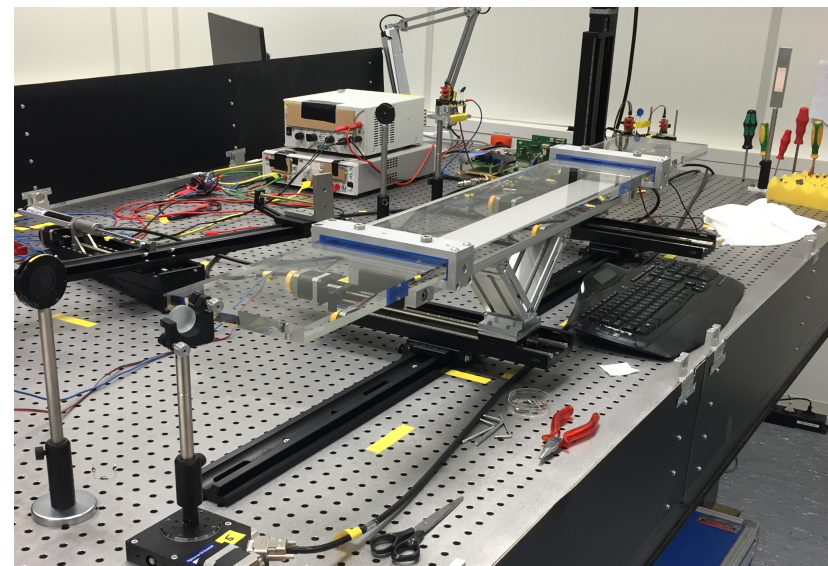
→ Large sides (faces)

Reflection Coefficient

→ For narrow sides

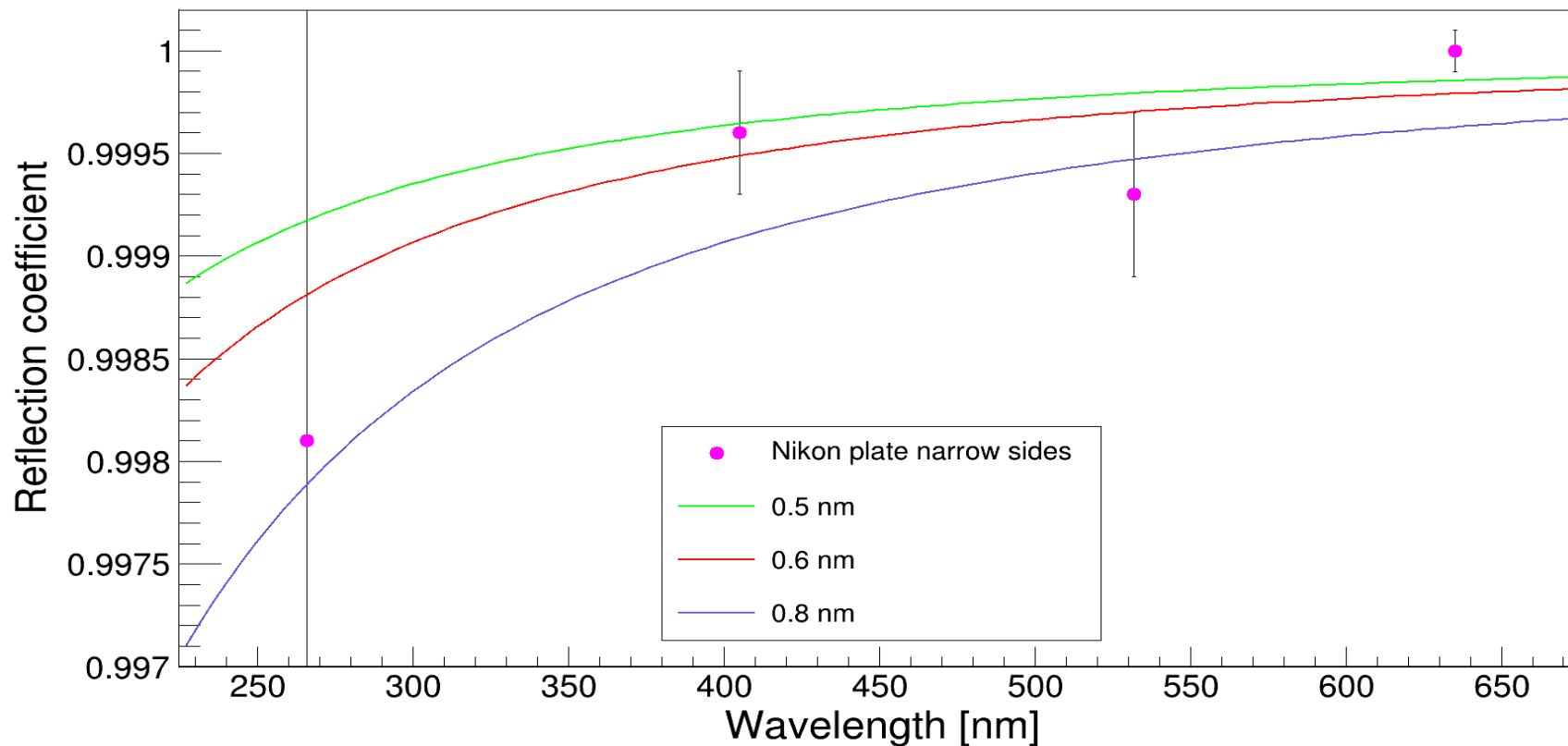→ Horizontal orientation of the radiator is needed

→ Only 5 reflections happen inside the radiator
→ No movability in y-direction
→ Sides are scanned with smaller granularity

Reflection Coefficient

→ Narrow sides

Nikon plate - Reflection coefficients for narrow sides

→ Only 5 reflections for the horizontal plate orientation
→ Larger systematic error
→ Values show an lower limit for reflection coefficients

→ **Measured T & R for faces and narrow sides**
→ **Determined Λ and H (surface roughness) for all wavelengths**

Summary of measured values:

	266 nm	405 nm	532 nm	635 nm
Λ_{Nikon}	26 ± 1 m	172 ± 6 m	833 ± 6 m	2941 ± 900 m
$\Lambda_{\text{InSync1\&2}}$	20 ± 1 m	174 ± 2 m	2400 ± 650 m	5880 ± 1000 m
H_narrow$_{\text{Nikon}}$	0.74 ± 0.7 nm	0.5 ± 0.27 nm	0.9 ± 0.35 nm	0.05 ± 0.35 nm
H_faces$_{\text{Nikon}}$	0.73 ± 0.05 nm	0.6 ± 0.02 nm	0.63 ± 0.03 nm	0.68 ± 0.15 nm
H_faces$_{\text{InSync 1}}$	1.1 ± 0.03 nm	0.84 ± 0.05 nm	0.86 ± 0.05 nm	1 ± 0.2 nm

Thanks for your attention
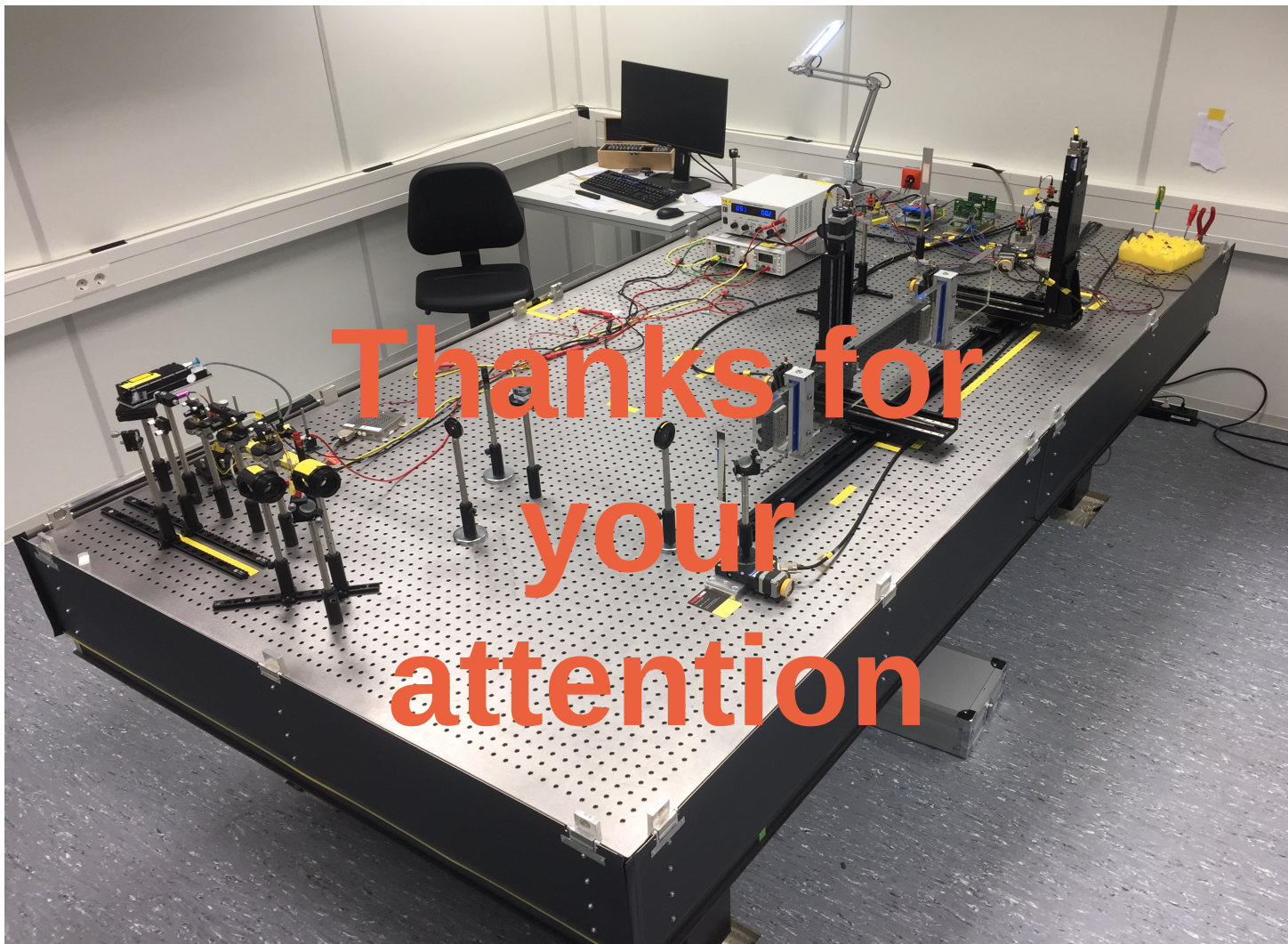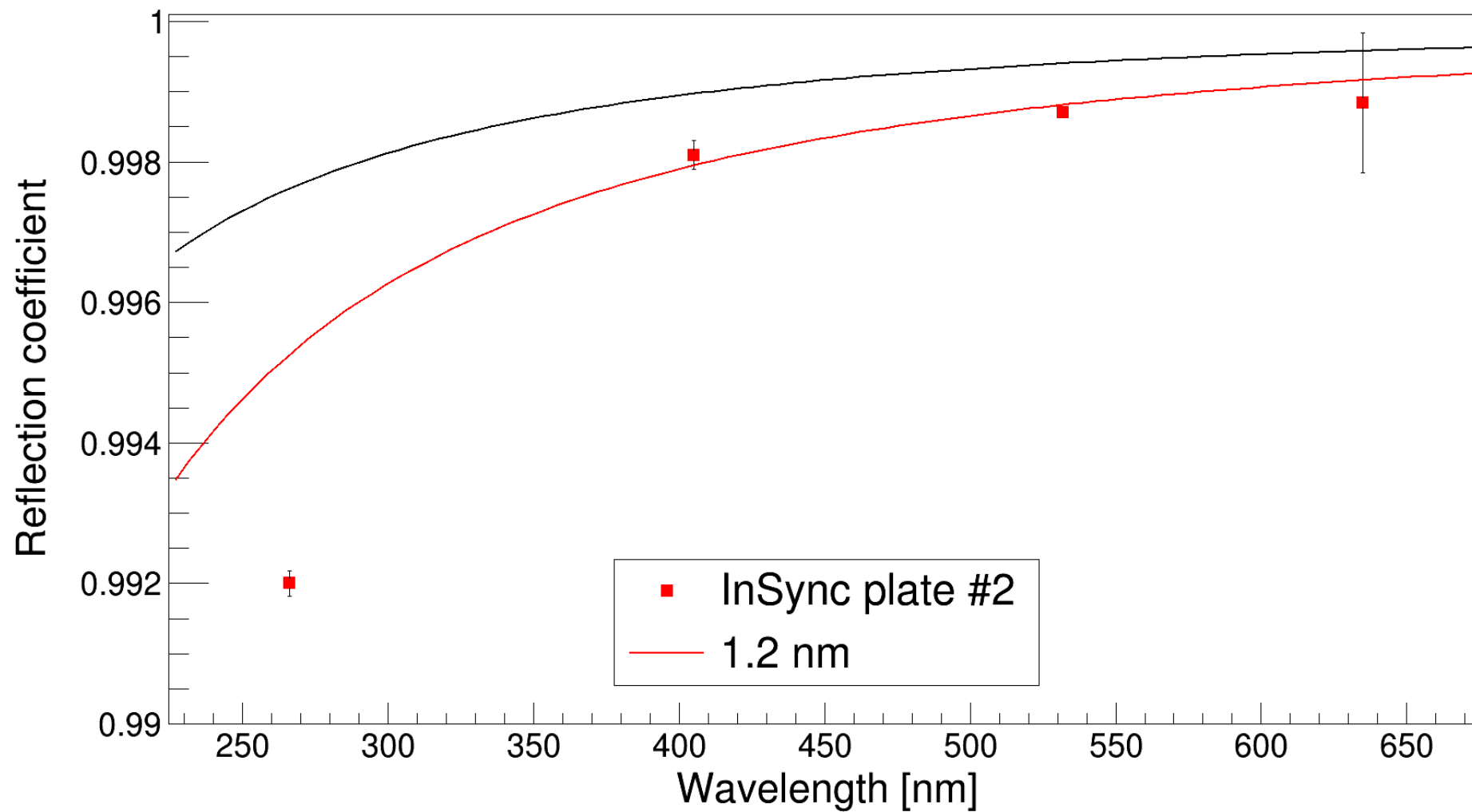
| H_faces_Insync2 | 1.5 ± 0.05 | 1.15 ± 0.1 | 1.26 ± 0.05 | 1.4 ± 0.90 |