Status of the PANDA Barrel DIRC optics lab

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panda

Outline

1. Setup

2. Measuring procedure

    I. Bulk transmission

    II. Internal Reflection

3. Results (bars & plates)

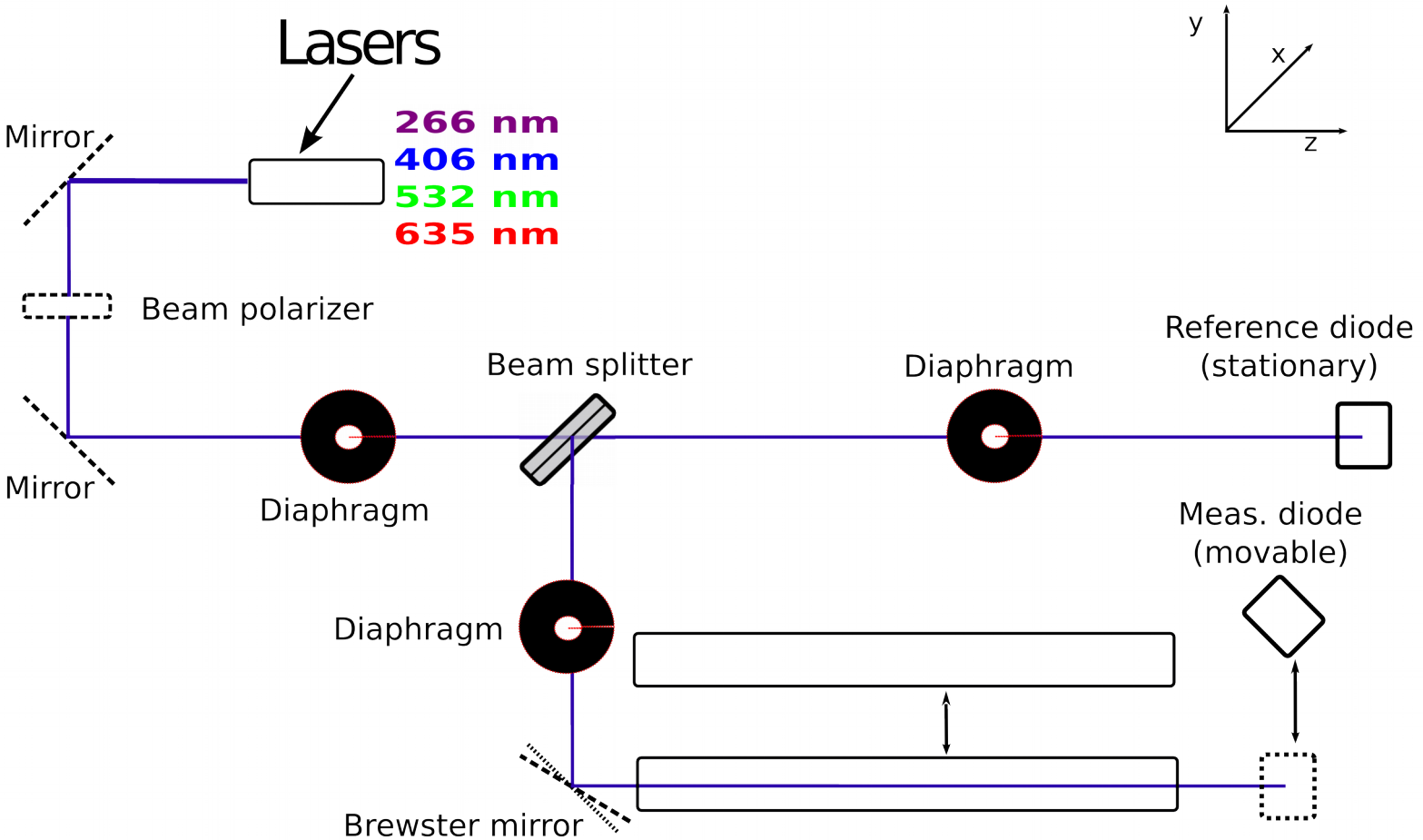
4. Conclusion & Outlook

Current setup in the Barrel DIRC optics lab

Bulk transmission case

→ Measures the transparency of the material

→ Determine the attenuation length $\Lambda(\lambda)$



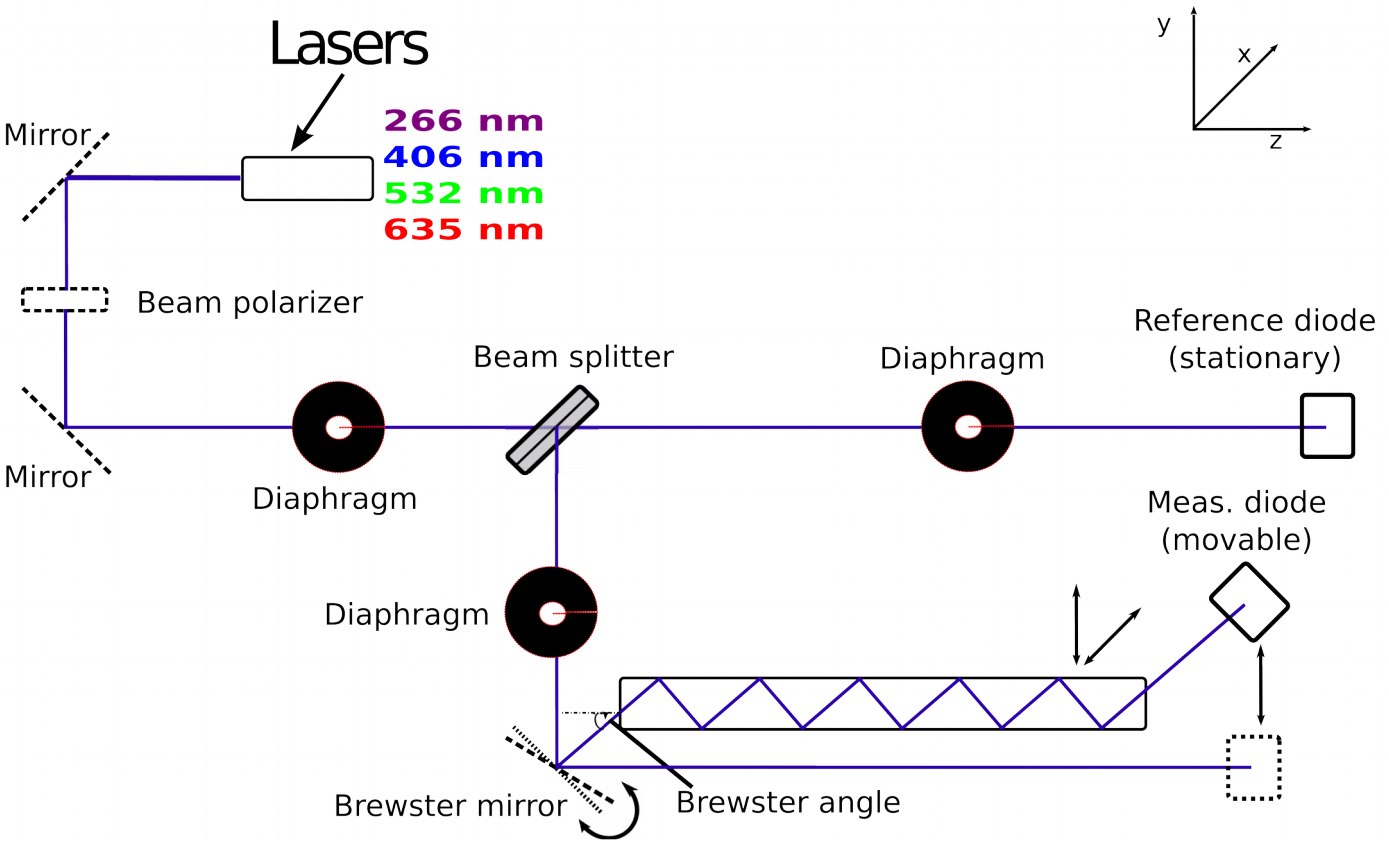
$$T = \frac{\frac{I_{val_{bar}}}{I_{ref_{bar}}}}{\frac{I_{val_{air}}}{I_{ref_{air}}}}$$

Total internal reflection measurement

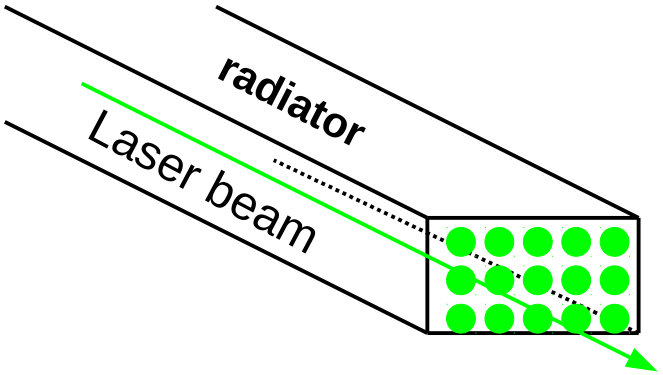
→ Quality assurance for prototype radiators

→ Determine reflection coefficient from measured intensities

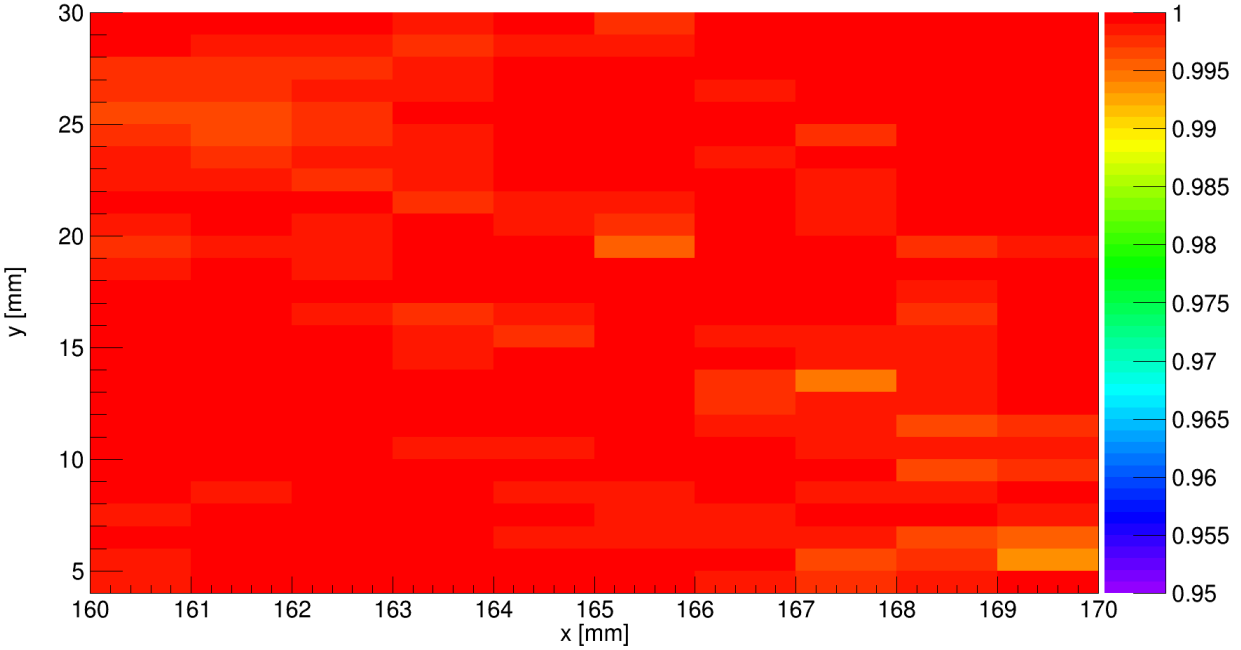
→ Obtain surface roughness from reflection coefficient via scalar scattering theory



Example for bulk transmission for Zygo Corp. bar (#1)



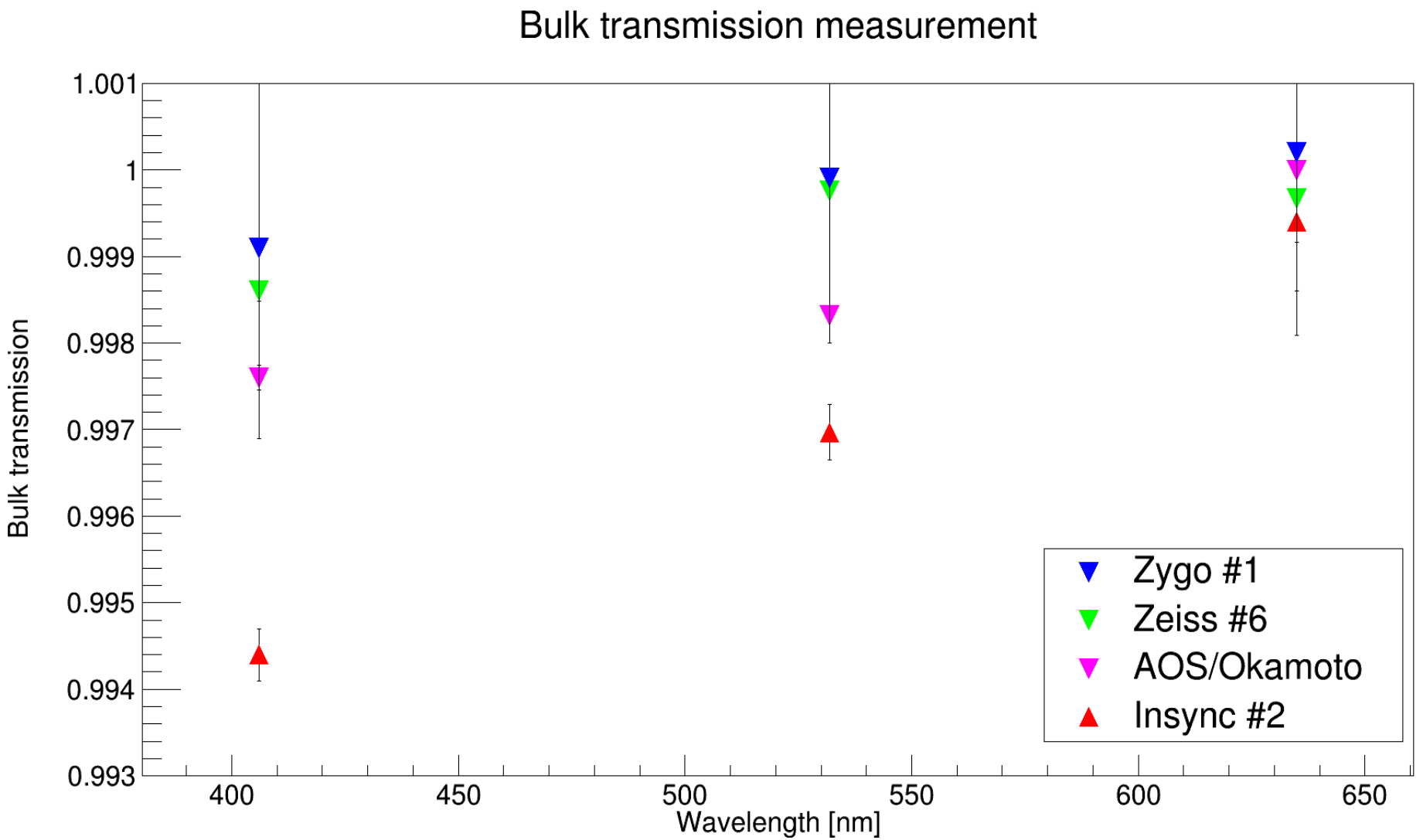
$$T = \frac{\frac{I_{val_{bar}}}{I_{ref_{bar}}}}{\frac{I_{val_{air}}}{I_{ref_{air}}}}$$



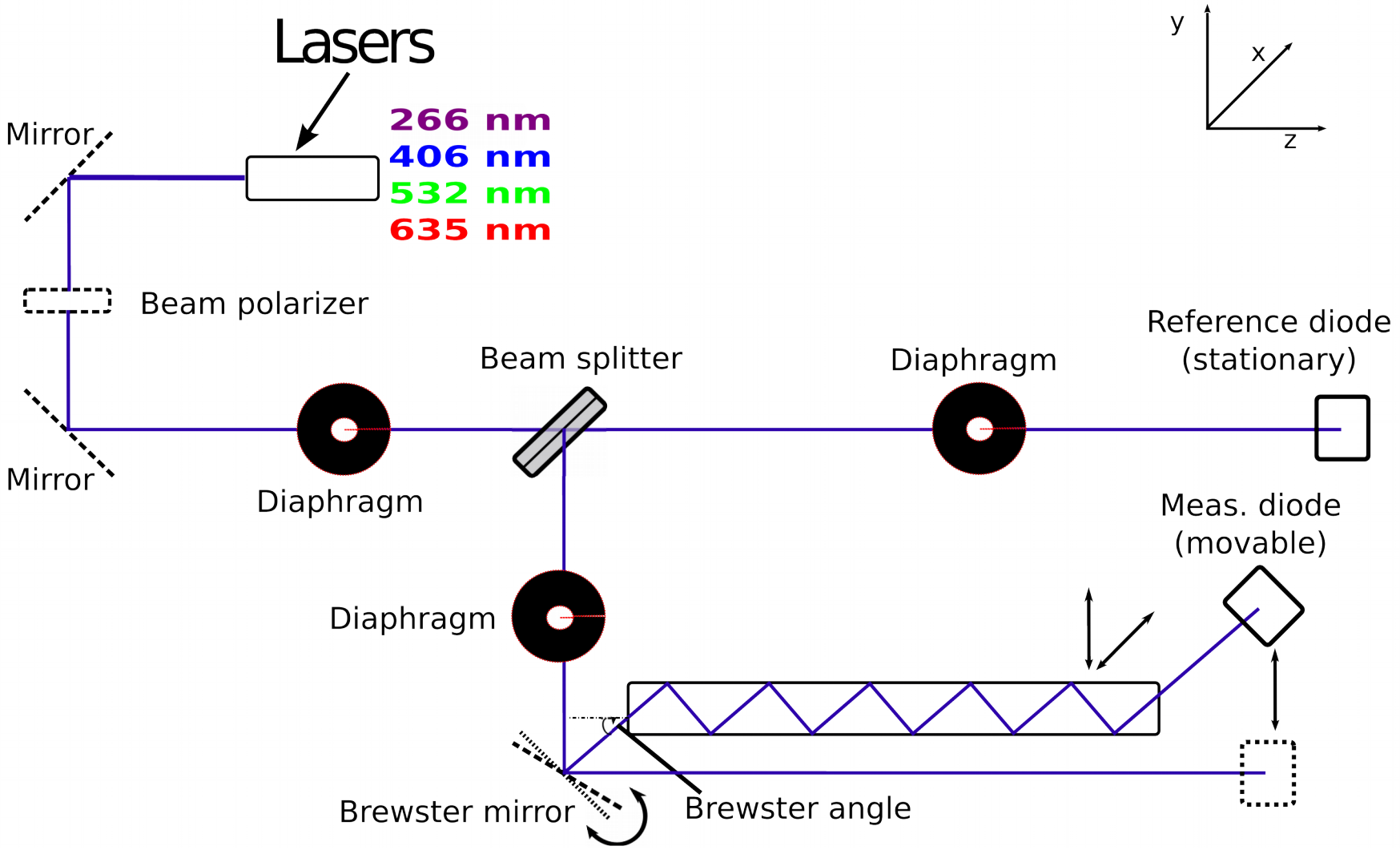
$$T = R^N \exp\left(\frac{L}{\Lambda}\right)\cdot(1-F)$$

→ 532 nm laser: $\Lambda = 1845.55\,m \pm 418\,m$

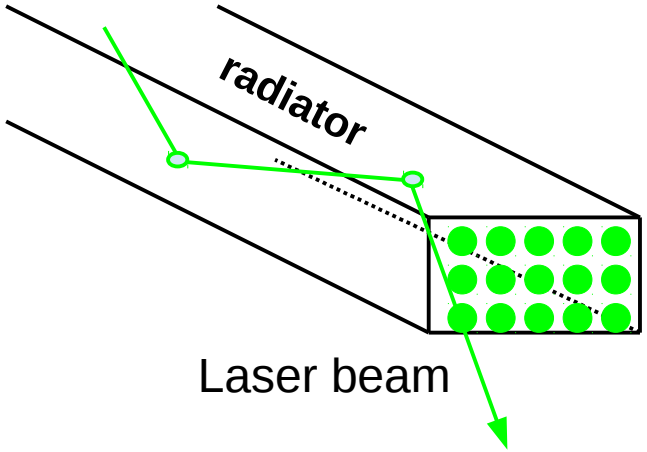
Measured Transmissions



Internal reflection measurement:

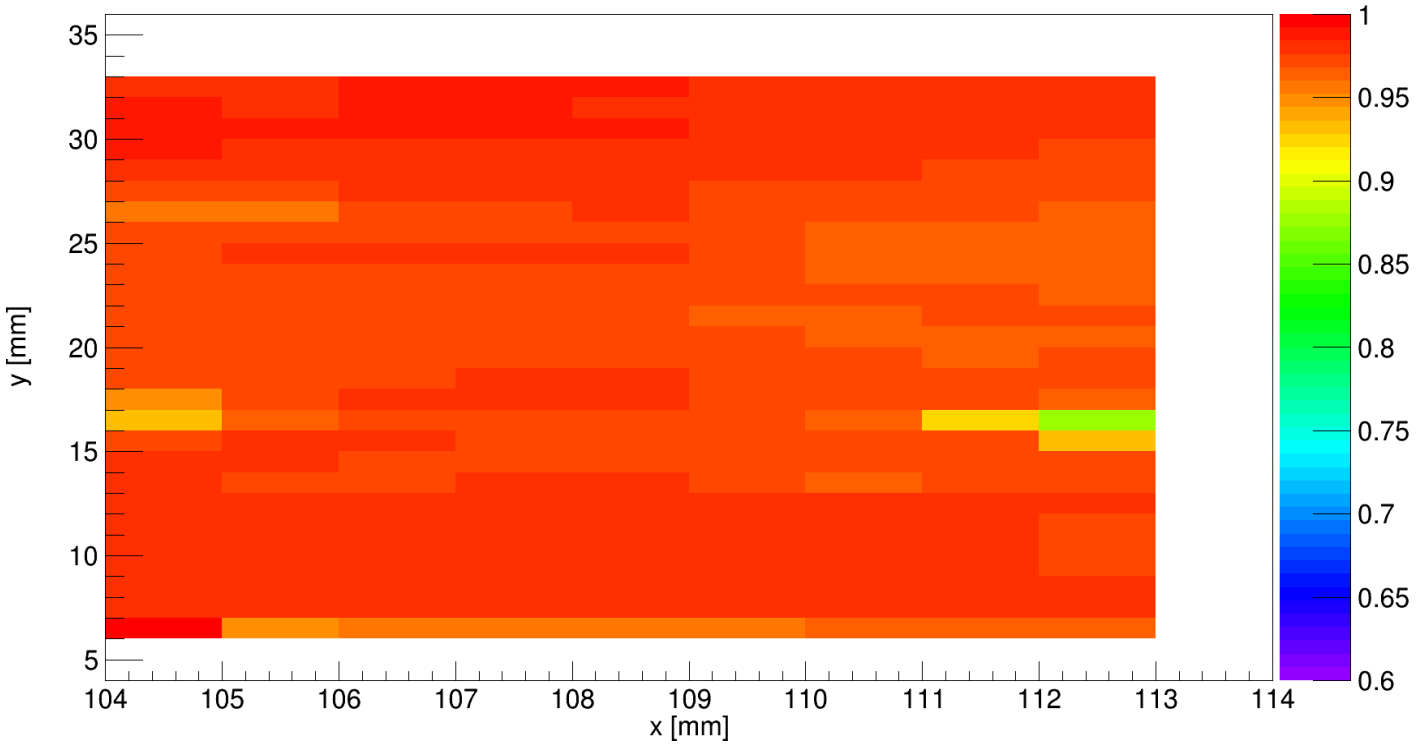


Internal reflection measurement



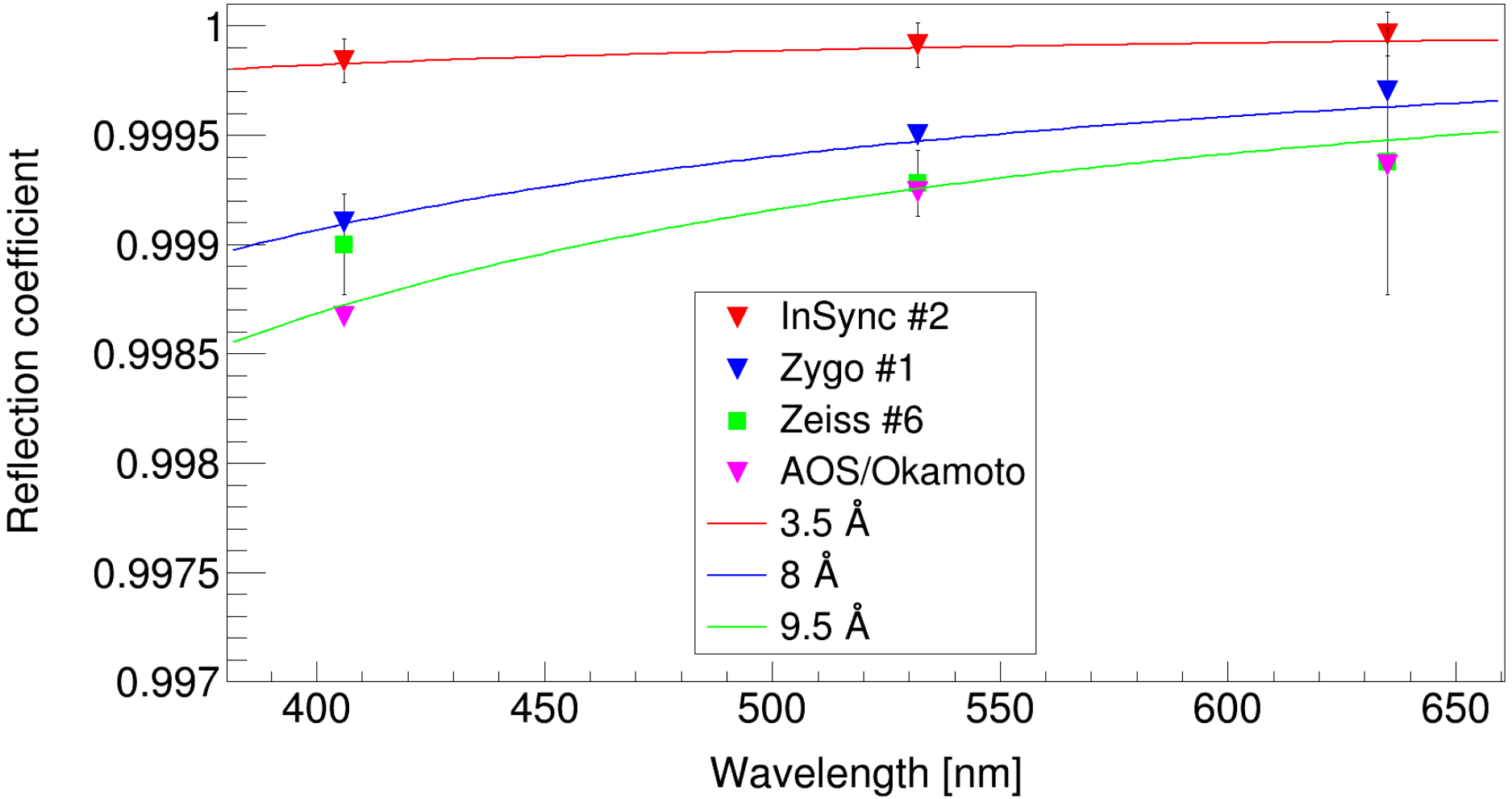
$$R = 1 - \left(\frac{4\pi \cdot \cos(\theta) \cdot n \cdot H}{\lambda} \right)^2$$

$$H_{Zc1_{532nm}} = 8\,A \pm 0.2\,A$$



Internal reflection measurement

→ Results for InSync, Zygo, Zeiss and AOS/Okamoto



→ **No 266 nm laser at this point**

Plate measurements

In stock: 2 plates from InSync → already used in Prototype at CERN

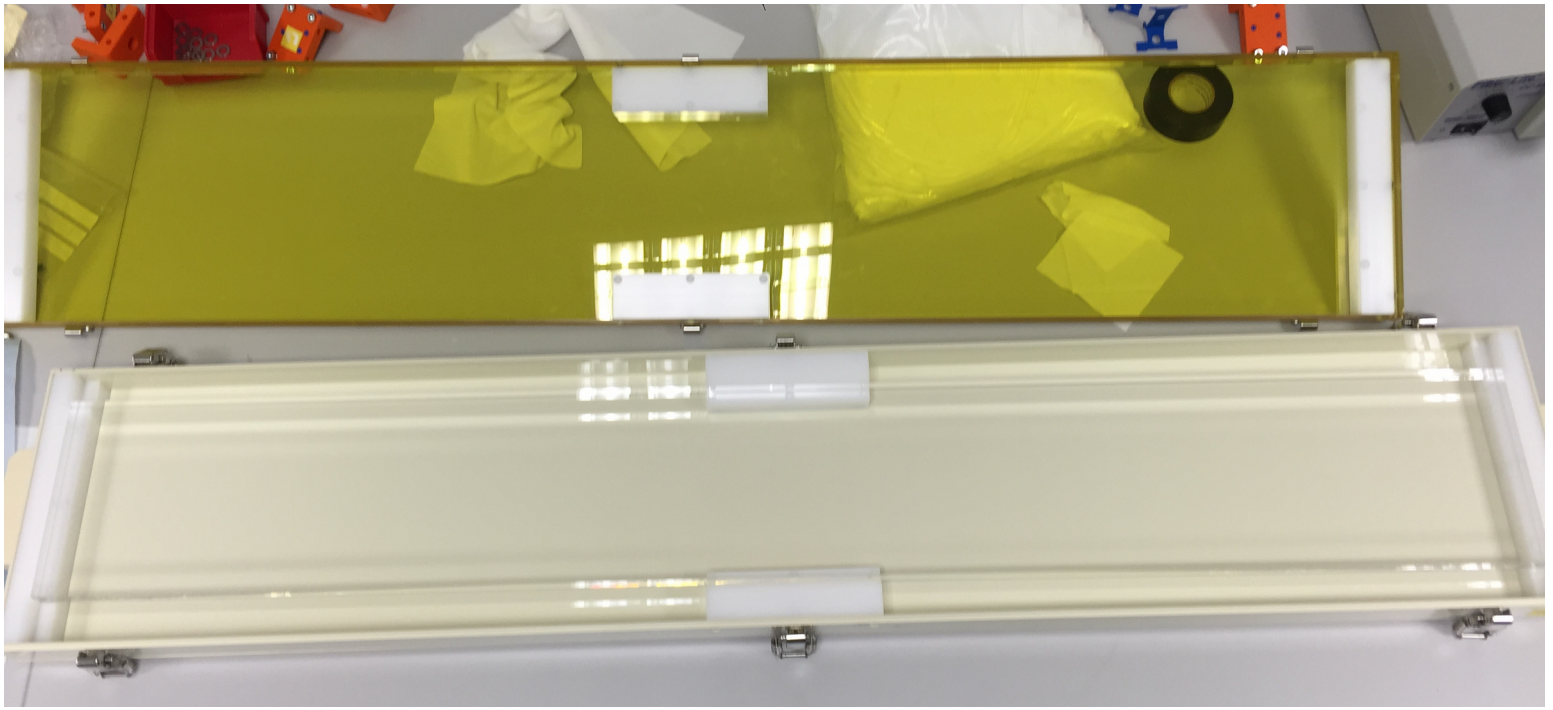


Plate from Nikon arrived in June this year …

17.0 mm (T) x 160.0 mm (W) x 1200.0 mm (L)

Setup changes for measuring plate(s)

Complete realignment of setup

→ Change in beam height

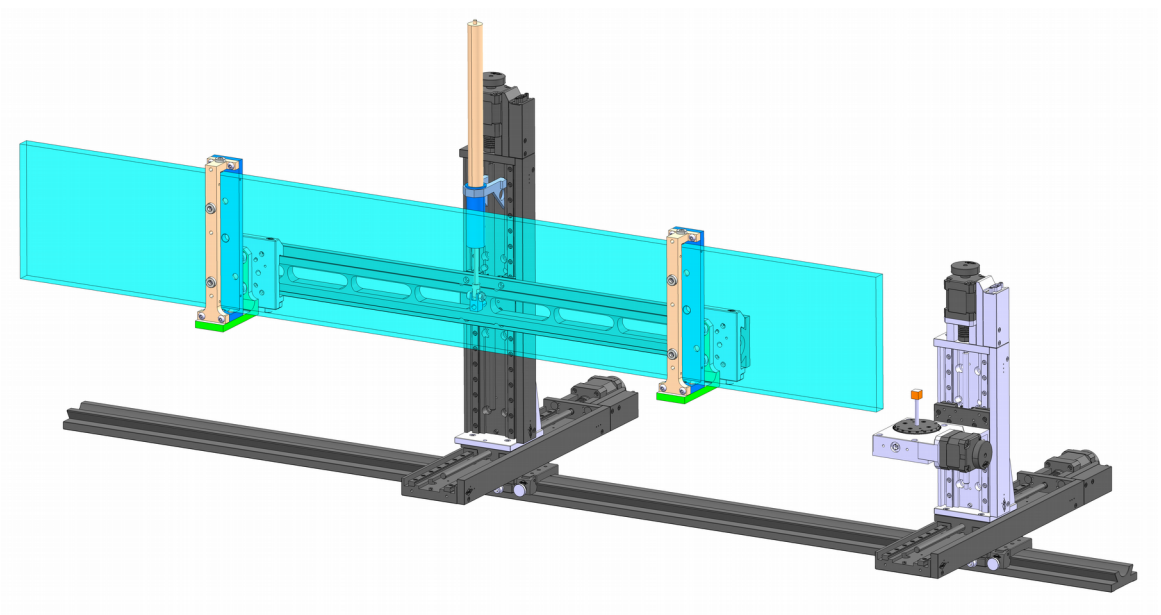
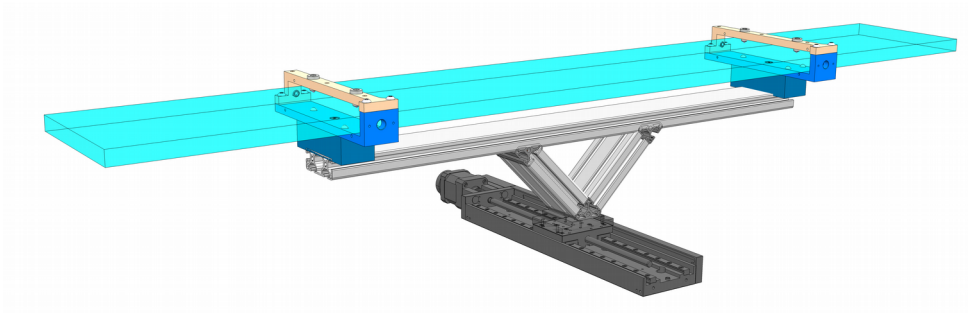


Plate faces will be scanned over the full range



→ Sides will be scanned with smaller amount of data points

Plate measurements

Bulk transmission

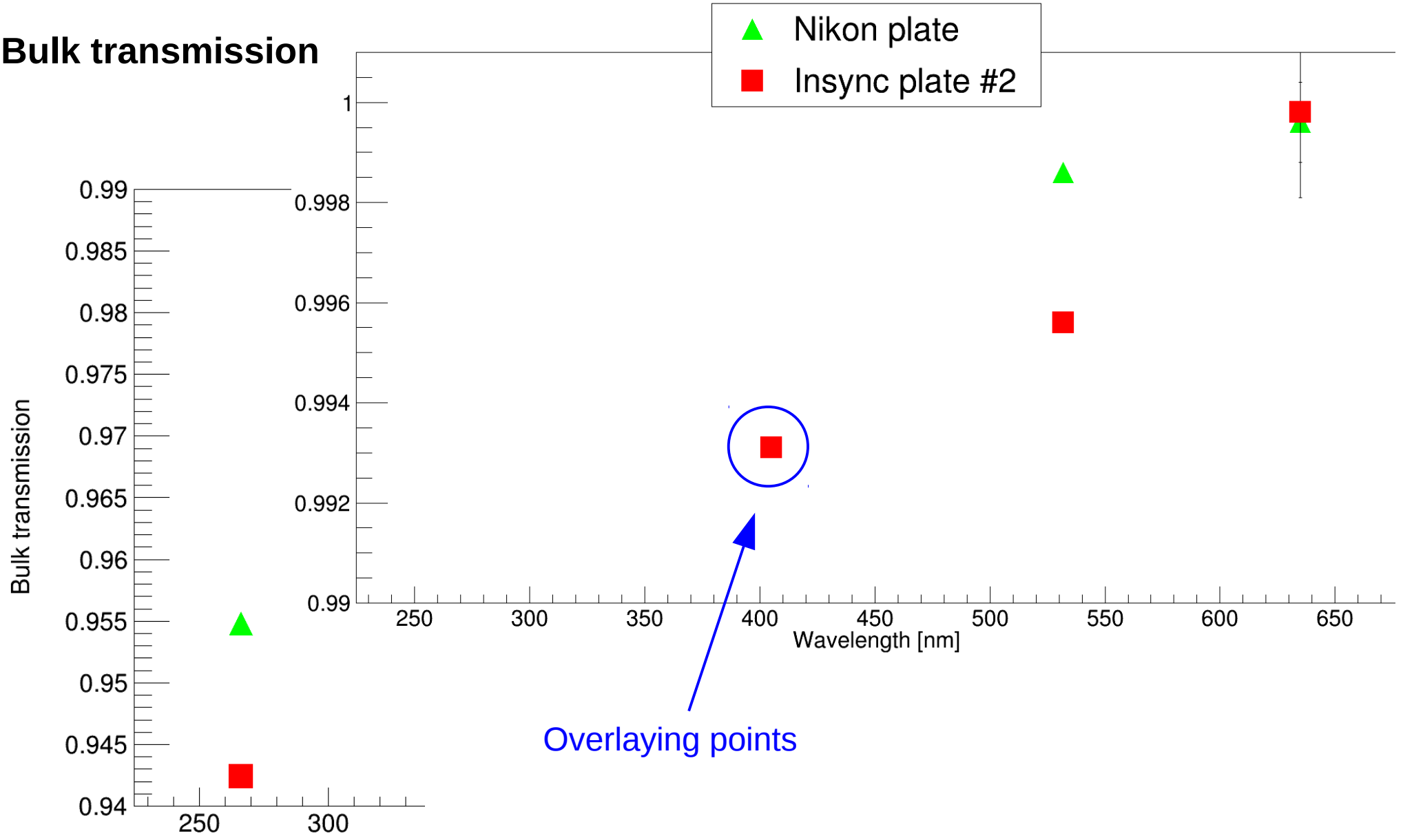
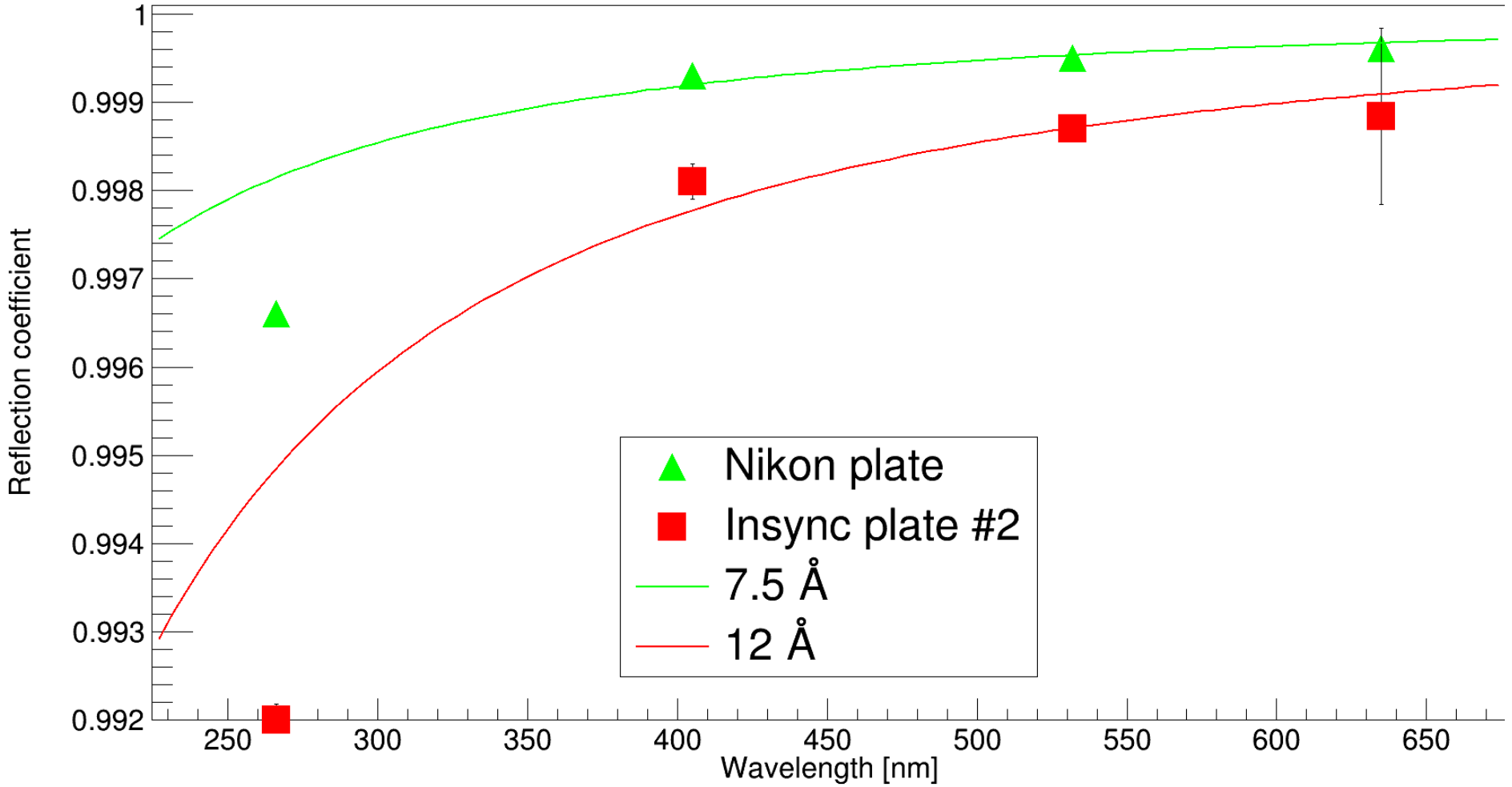


Plate measurements

Reflection coefficients



Conclusion & Outlook

→ Various bars/plates have been measured

→ Some show good optical properties
→ Surface roughness of < 10 Å (faces),
e.g. Nikon plate, Insync bar no. 2 etc …

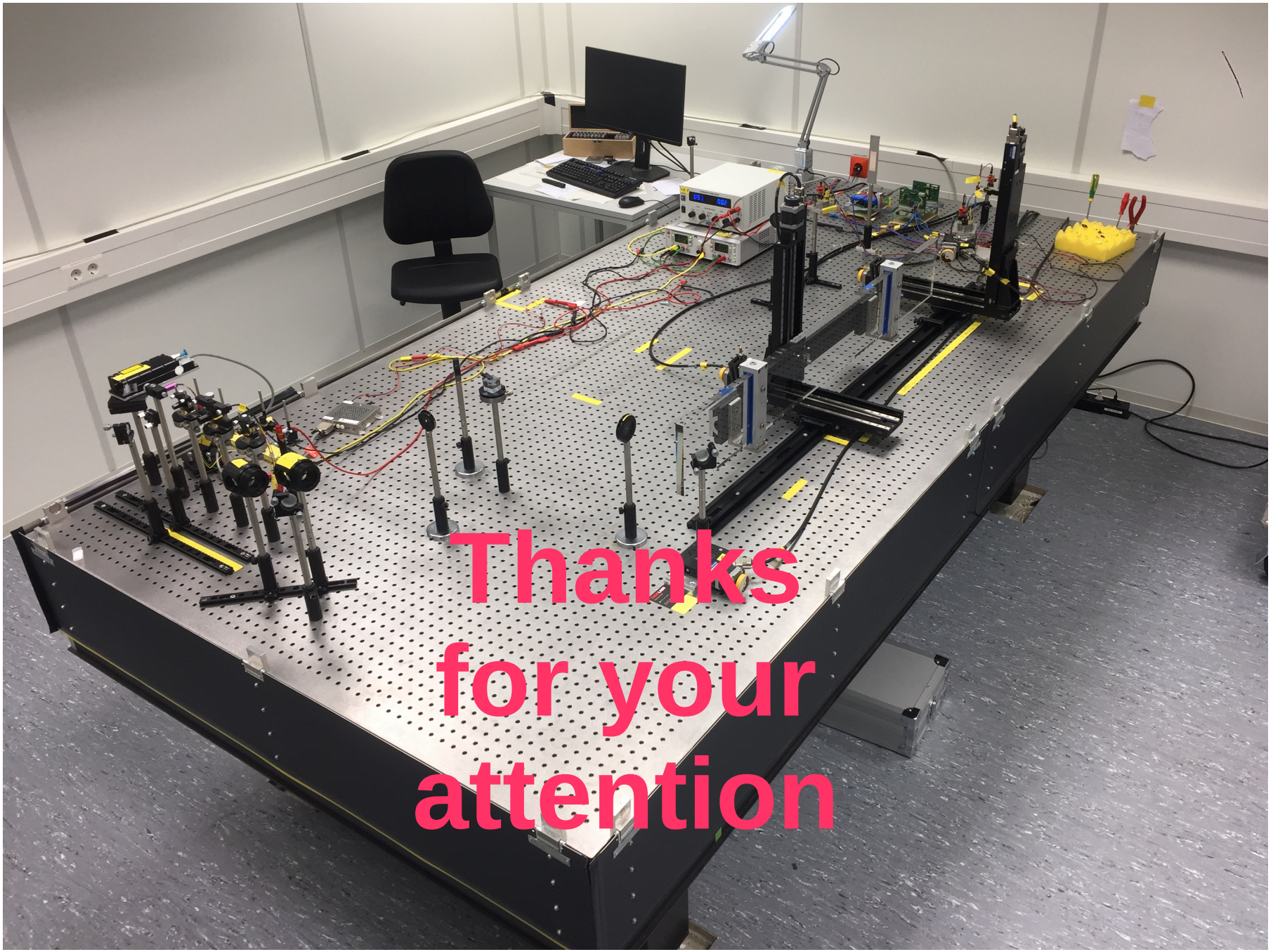
→ Insync plate #2 shows worse results (used at CERN 2016)

Next steps:

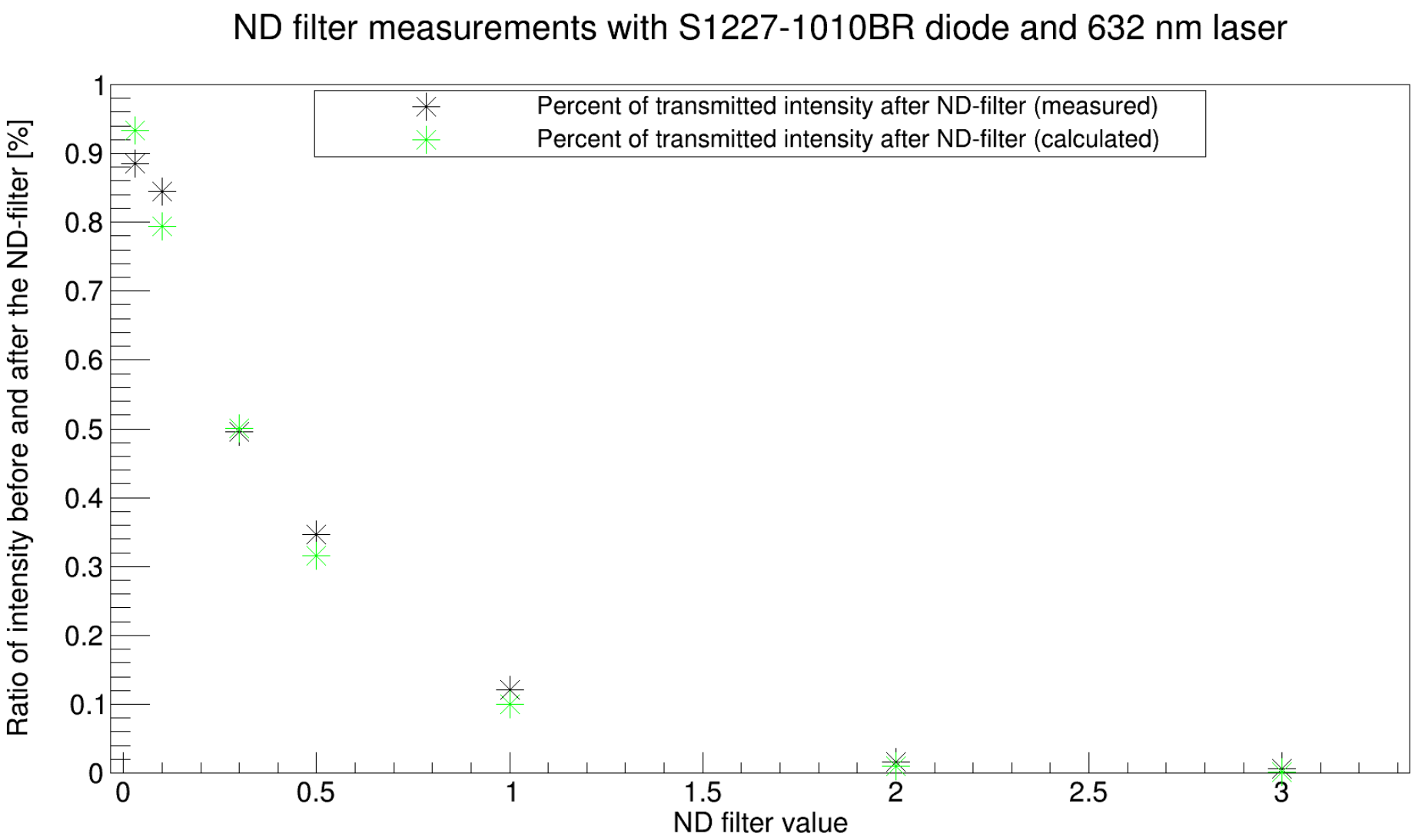
→ Measure remaining radiator bars & insync no. 1 plate(T,R)

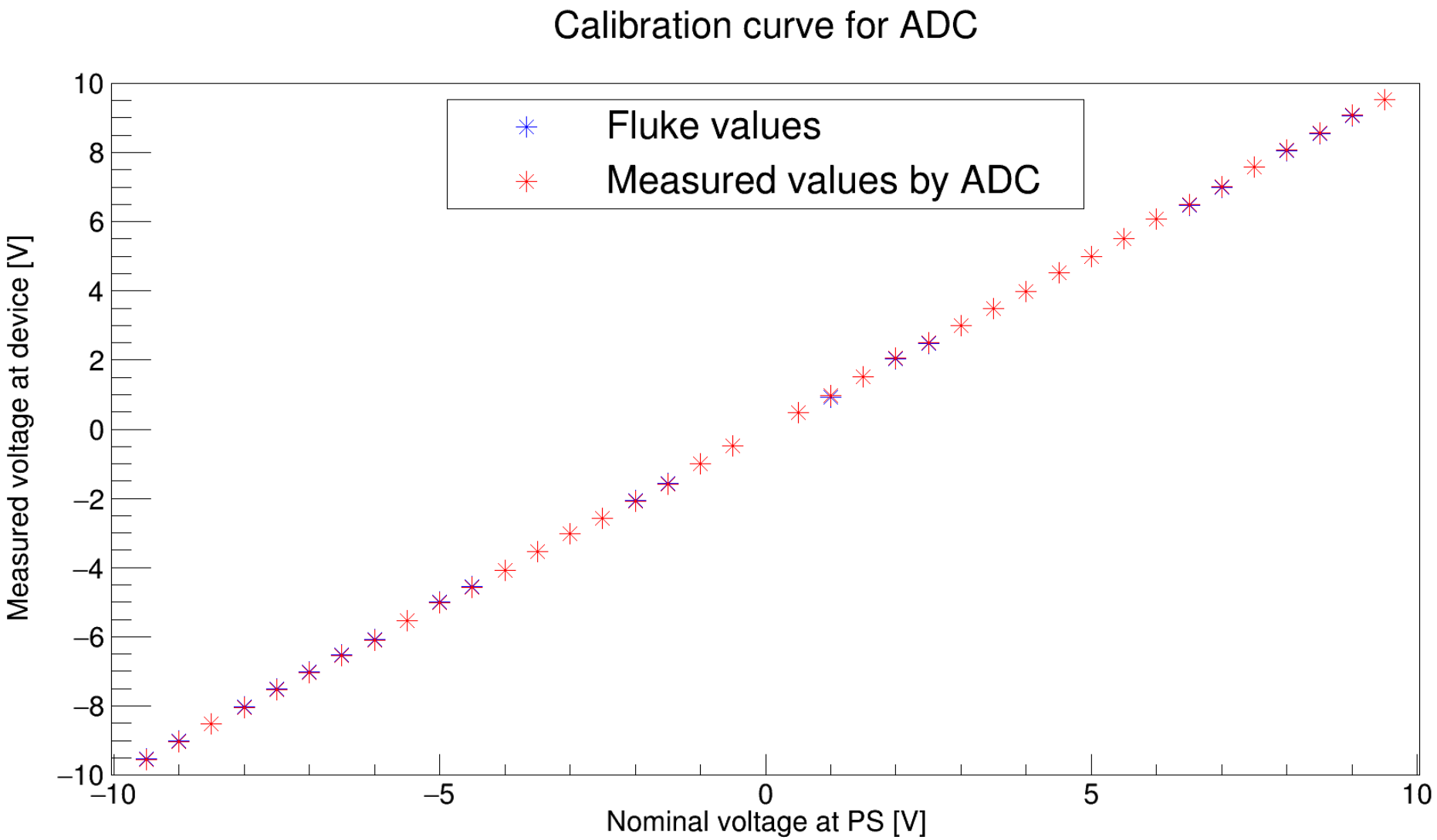
→ Measure small sides of all radiators

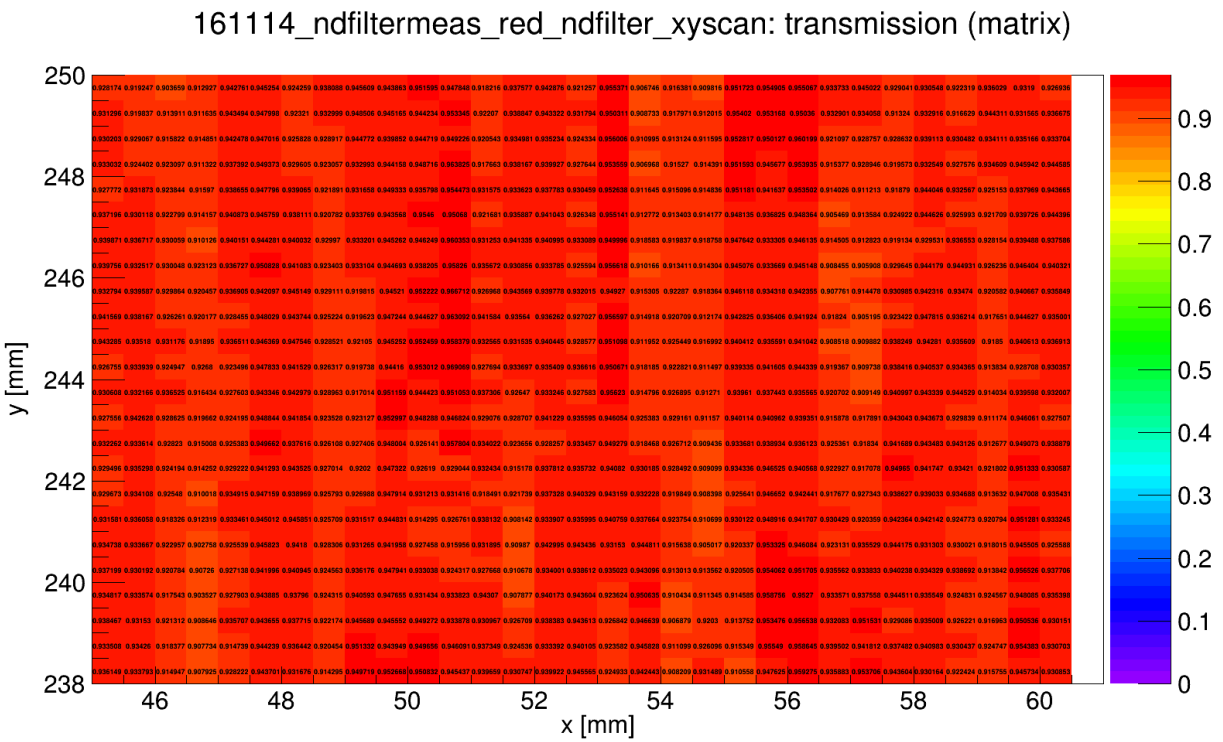
→ Determine the final systematic error of the setup


Thanks
for your
attention

Back up slides




Calibration curve for ADC
Fluke values
Measured values by ADC
Measured voltage at device [V]
Nominal voltage at PS [V]
10
8
6
4
2
0
−2
−4
−6
−8
−10
−10
−5
0
5
10



Nominal transmission after OD 0.03 : 0.93325 for 635 nm