Optical characterization of aerogel tiles for prototype

L. Barion, M. Contalbrigo, L.L. Pappalardo
INFN-Ferrara

Basic formalism

Transmittance

Hunt formula

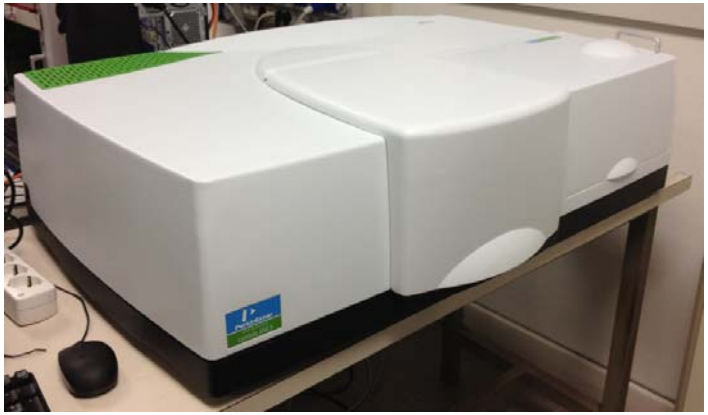
$$\mathrm{T} = e^{-\frac{t}{\Lambda_{tot}}} = e^{-t\left(\frac{1}{\Lambda_A}+\frac{1}{\Lambda_S}\right)} = e^{-\frac{t}{\Lambda_A}} \cdot e^{-\frac{t}{\Lambda_S}} = A \cdot e^{-\frac{Ct}{\lambda^4}}$$

$$\mathrm{A} = TF = e^{-\frac{t}{\Lambda_A}} \quad \Longrightarrow \quad \Lambda_A = \frac{-t}{lnA}$$ **Absorption length**

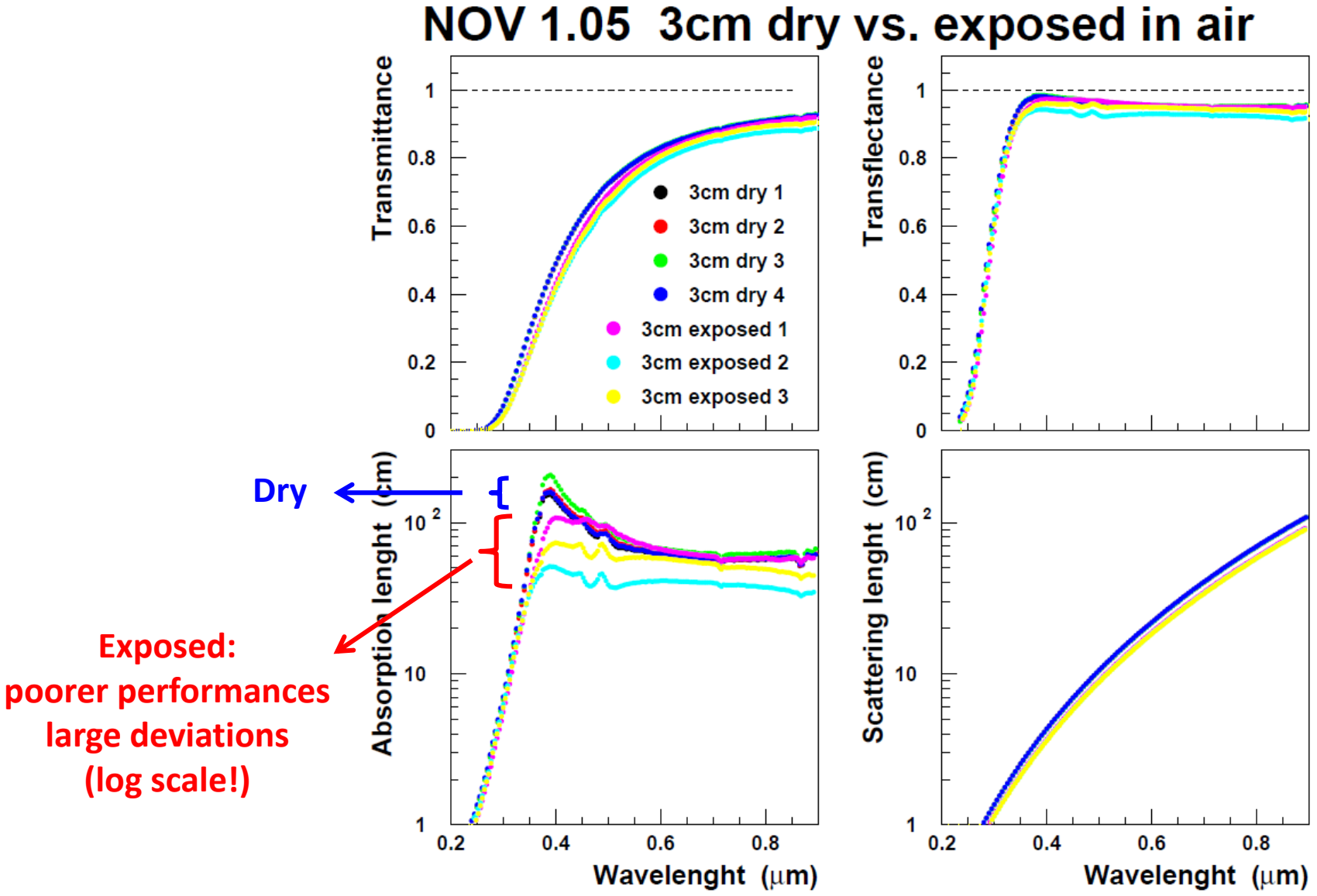
Transflectance

$$\Lambda_S = \frac{\lambda^4}{Ct}t$$ **Scattering length**

Procedure: measure $T(\lambda)$ → fit with Hunt formula → extract Λ_A and Λ_S

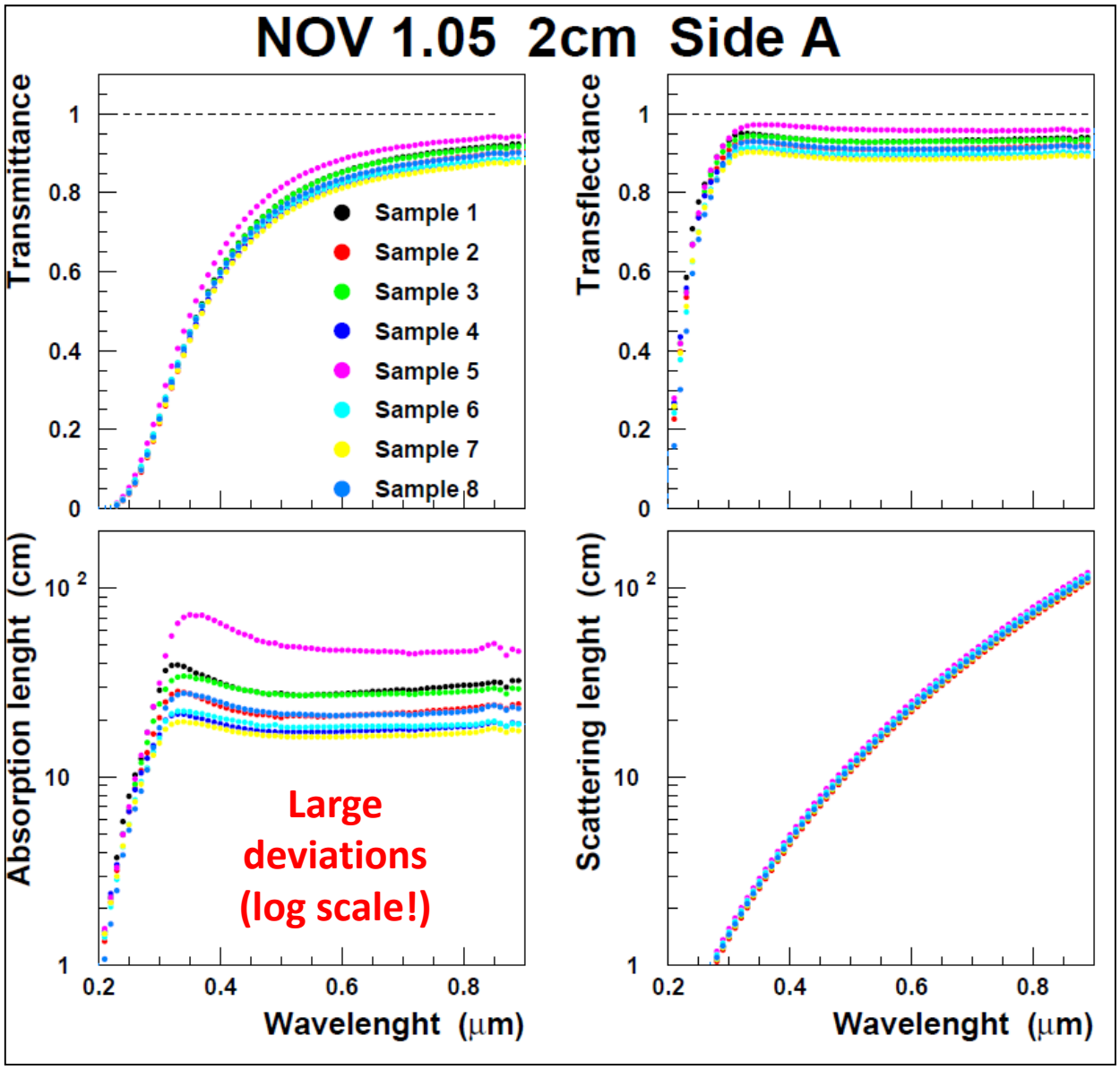


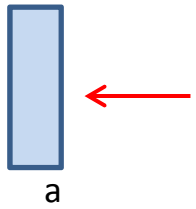
Comparing "old" (3cm) tiles before and after 3 month of exposure to air



Status of new Russian 2cm tiles

Comparing new tiles (2cm)

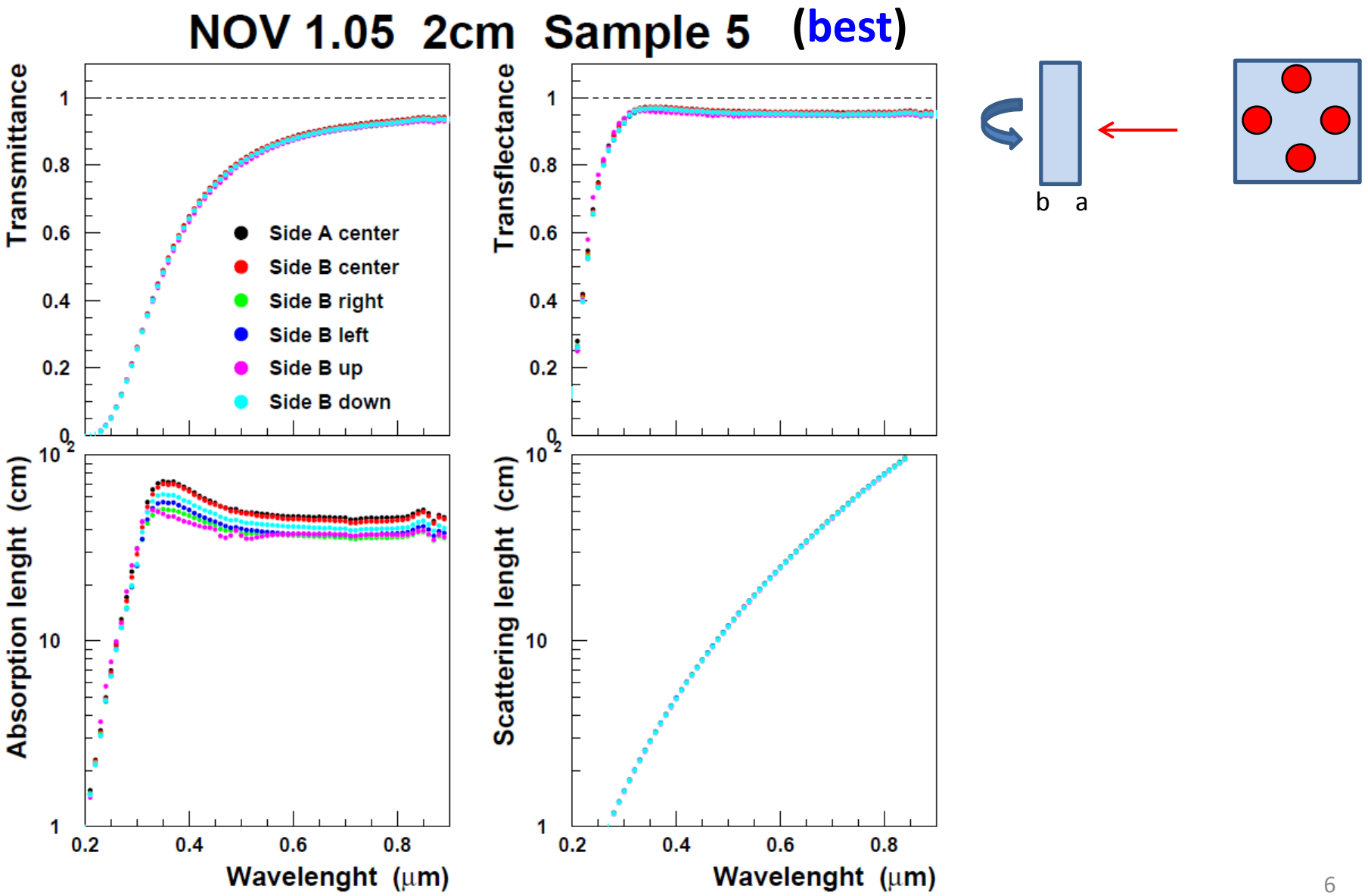




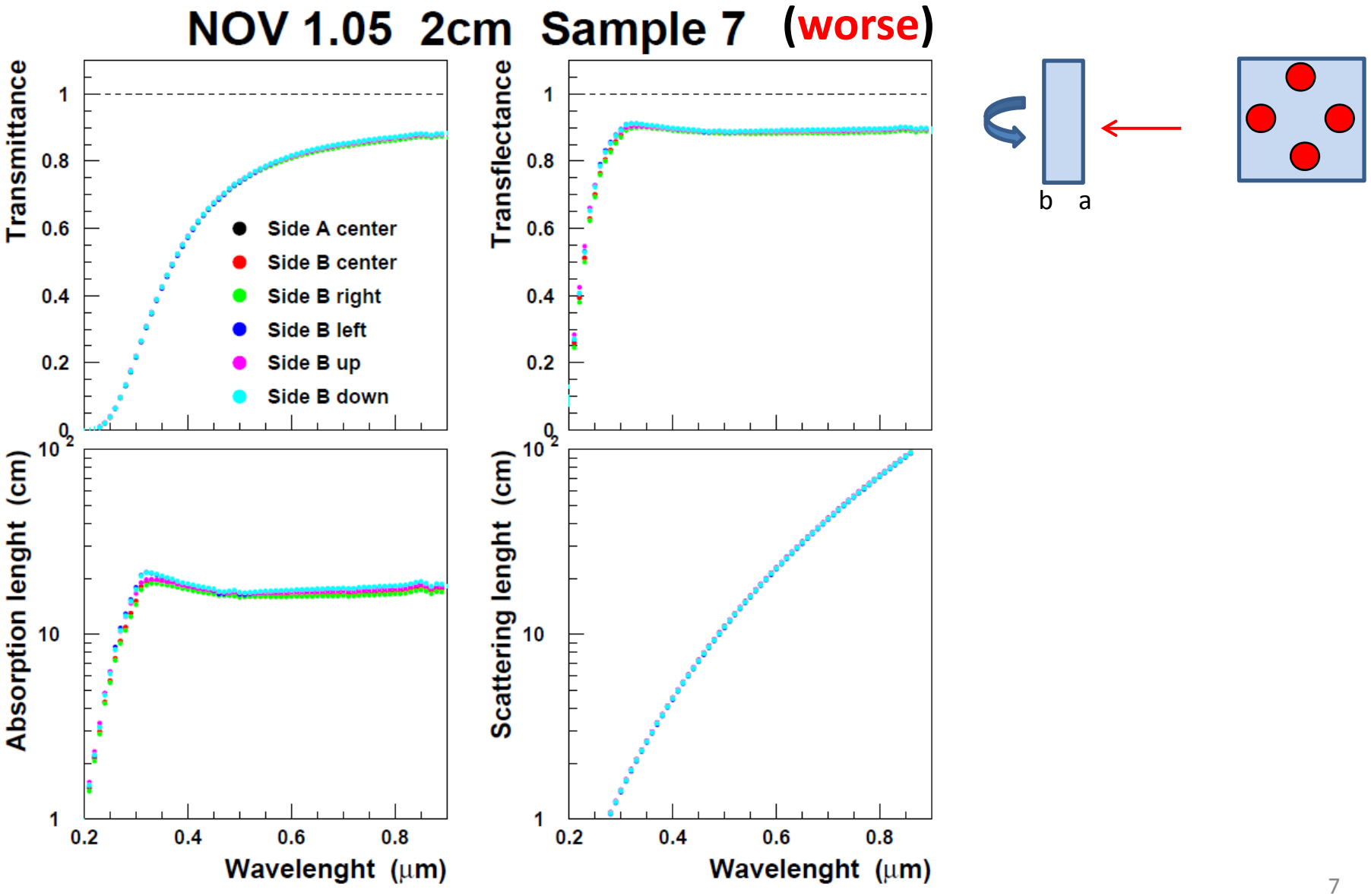
$$\Lambda_A = \frac{-t}{\ln(TF)}$$

TF	Λ_A (cm)
0.900	10
0.950	20
0.980	50
0.990	100
0.995	200
0.998	500
0.999	1000

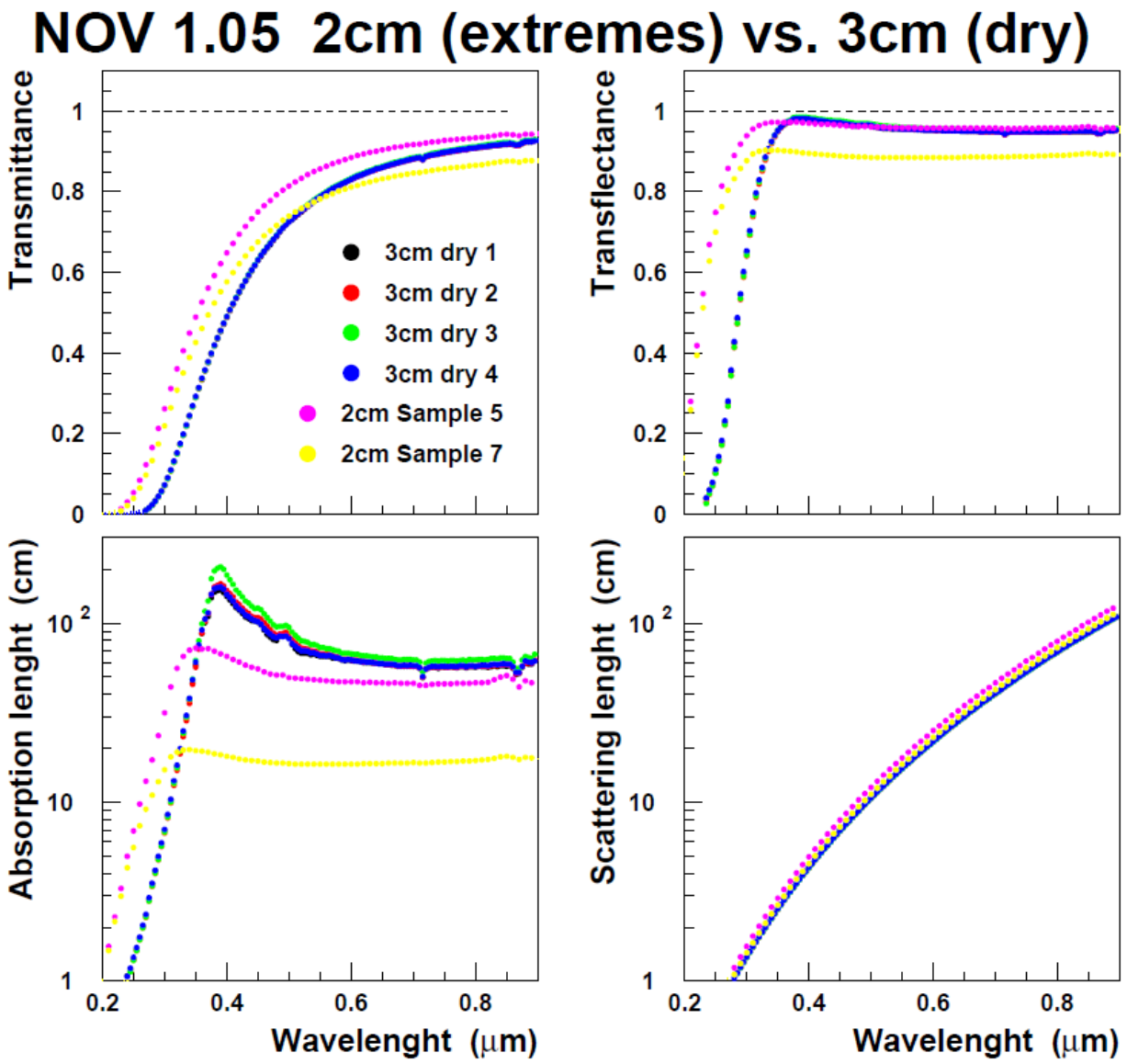
Comparing new tiles (2cm)



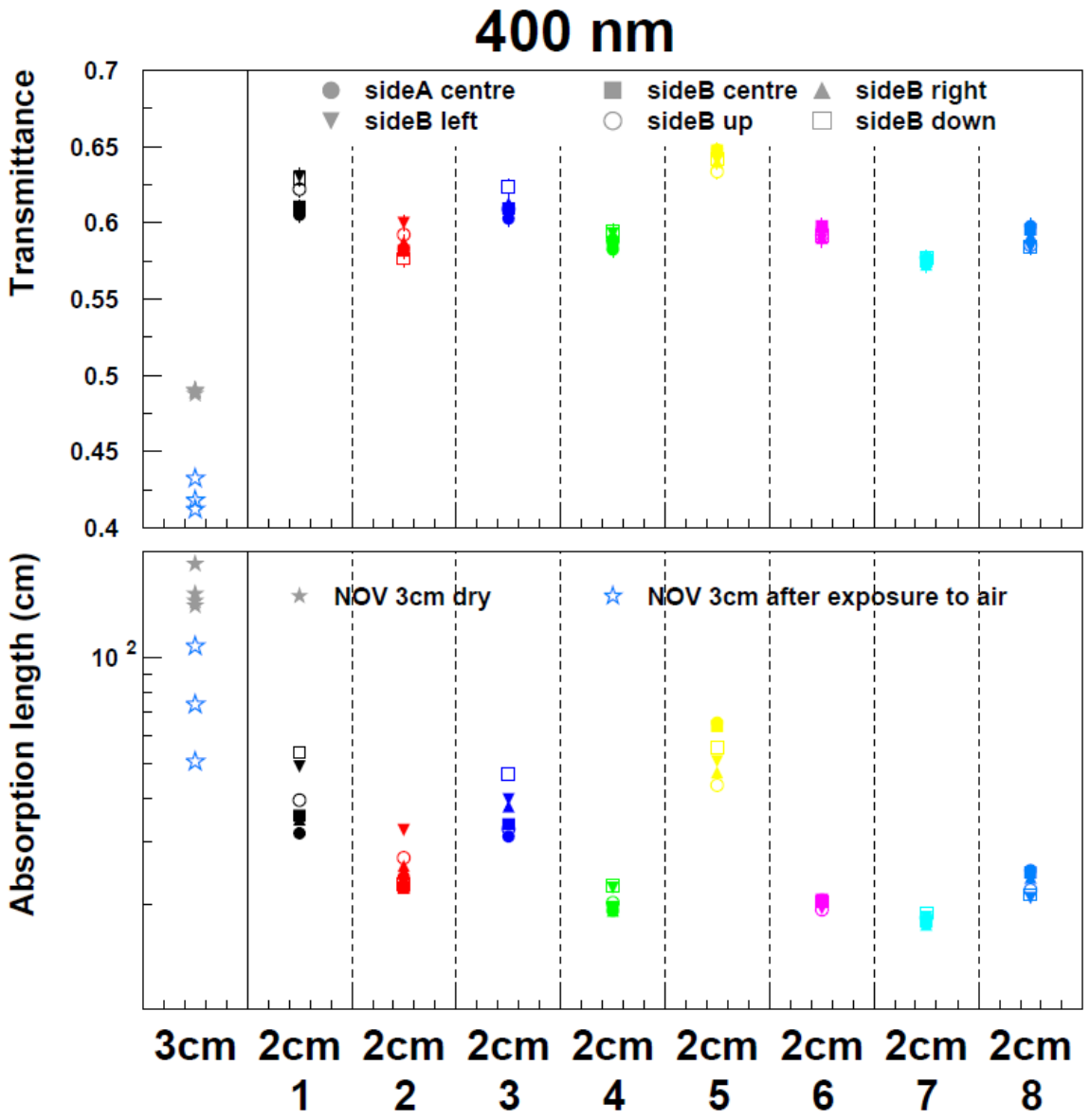
Comparing new tiles (2cm)



Comparing new (2cm) with old (3cm) tiles



Comparing new (2cm) with old (3cm) tiles



Conclusions

- Exposure to air (humidity) has an impact on the absorption length
- New 2cm Russian tiles (for use in prototype) were tested in Ferrara
- Basically all of them show clusters of bubbles on one face
- Some of them have defects (at edges or on the surfaces) or cracks
- The absorption length varies a lot among different tiles and, for each tile, among different positions
- The overall performances at 400nm in terms of absorption length are poorer than the “old” 3cm tiles (even after exposure to air).