Transmission of cookies Update

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Update

- Transmittance data from Belle II, [1407.3258v1], Eljen is superimposed with our measurements so that one can conclude
  - We measured transmittance <400 nm, which is significantly lower than in other results
  - Epotek cuts at ~300 nm, so 300-400 nm is an important region

- Cost of RTV material vs. sheets

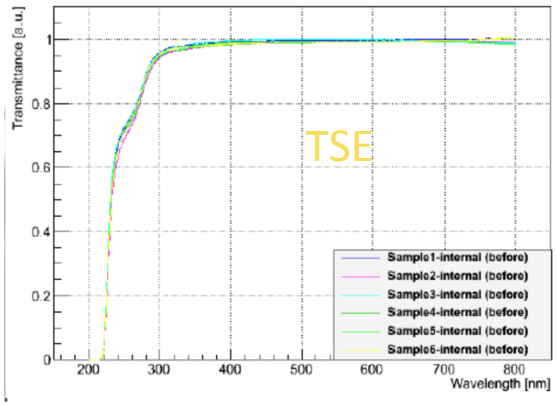
- Light port – buy feedthrough ?

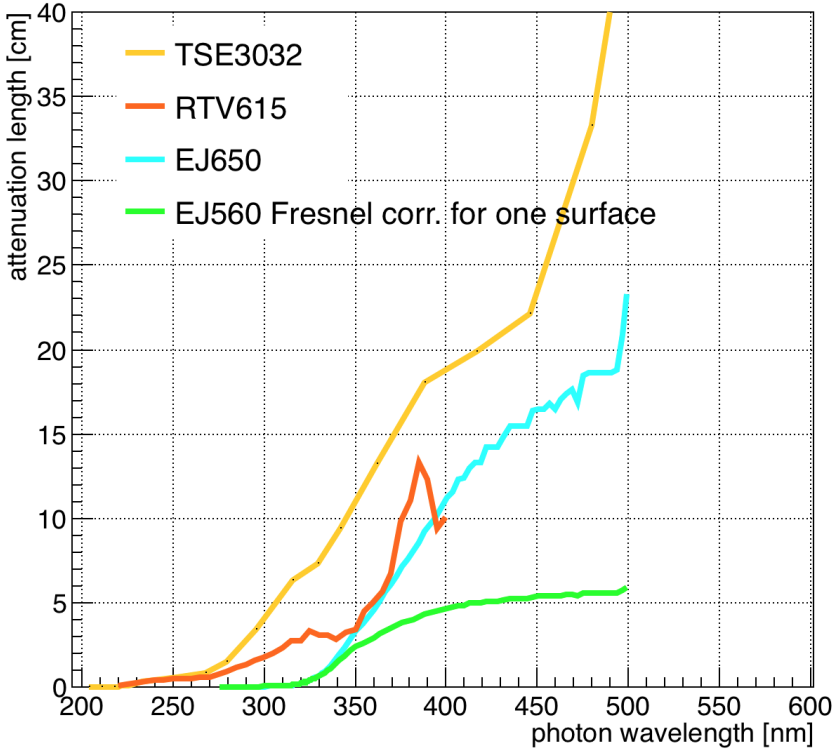
TSE vs. RTV

Geant4 uses attenuation length to characterize materials:

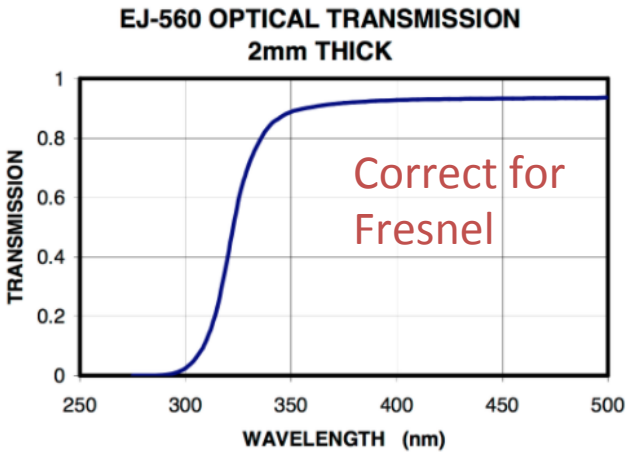
T = exp(-x/L), L = - x / ln(T)

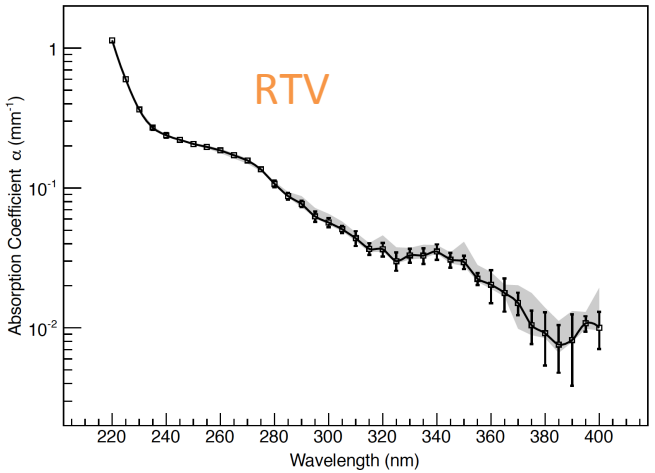
x – thickness of the sample, T - transmittance



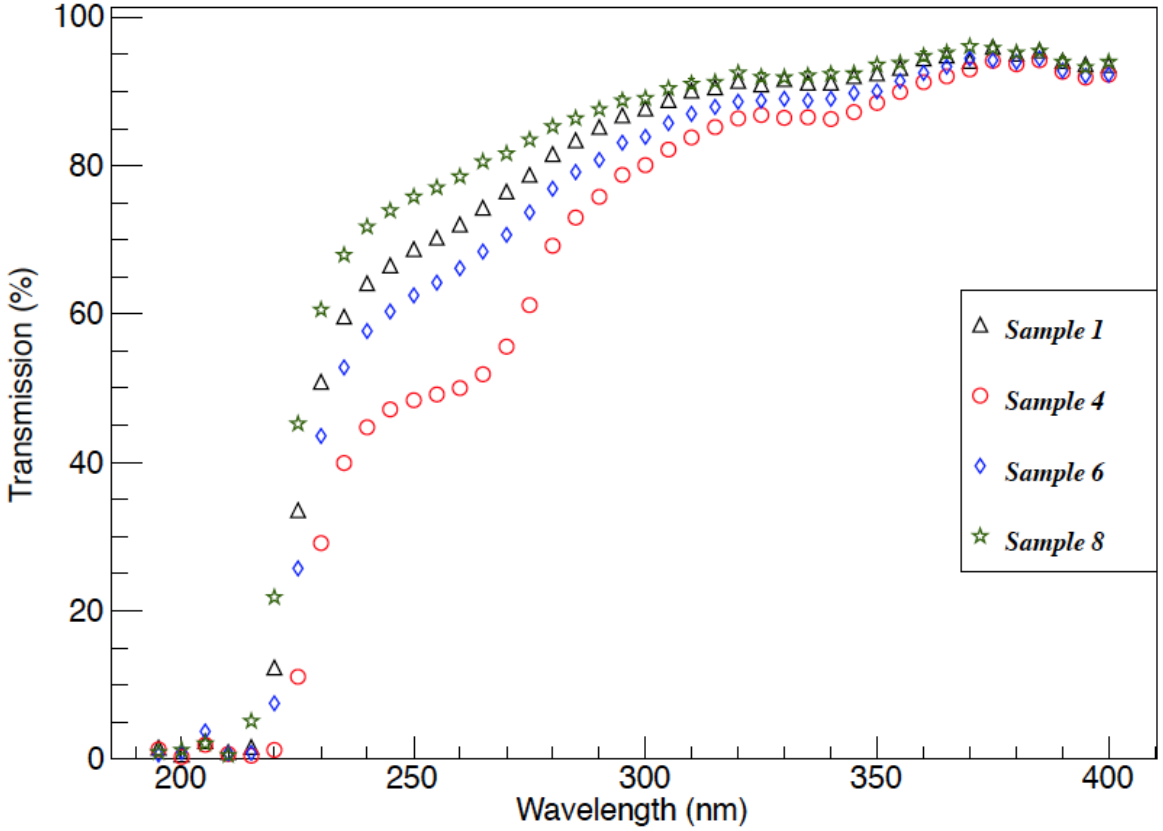


<350 nm – range of difference btw TSE and RTV





Transmittance for RTV615, 100:10, 20C

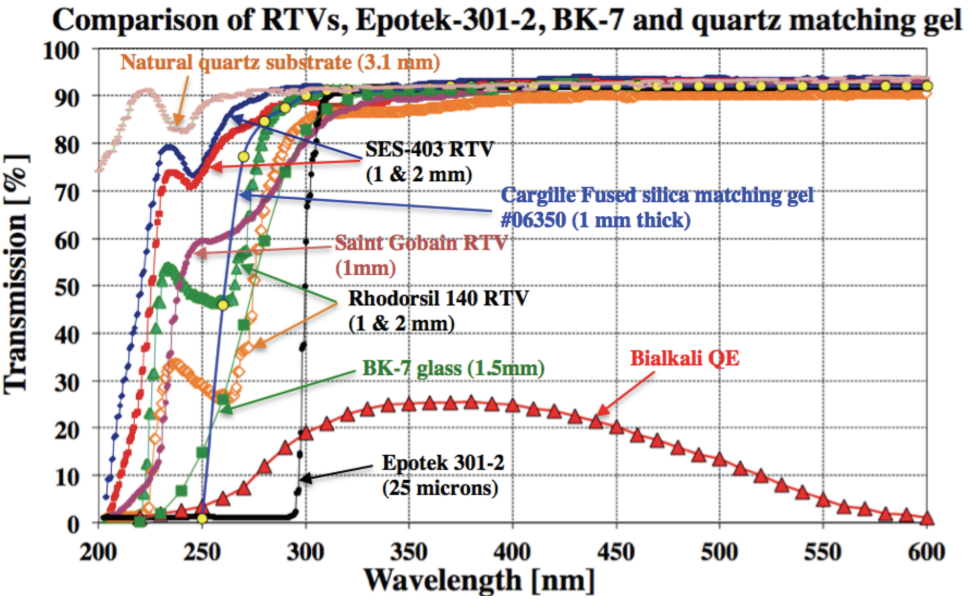


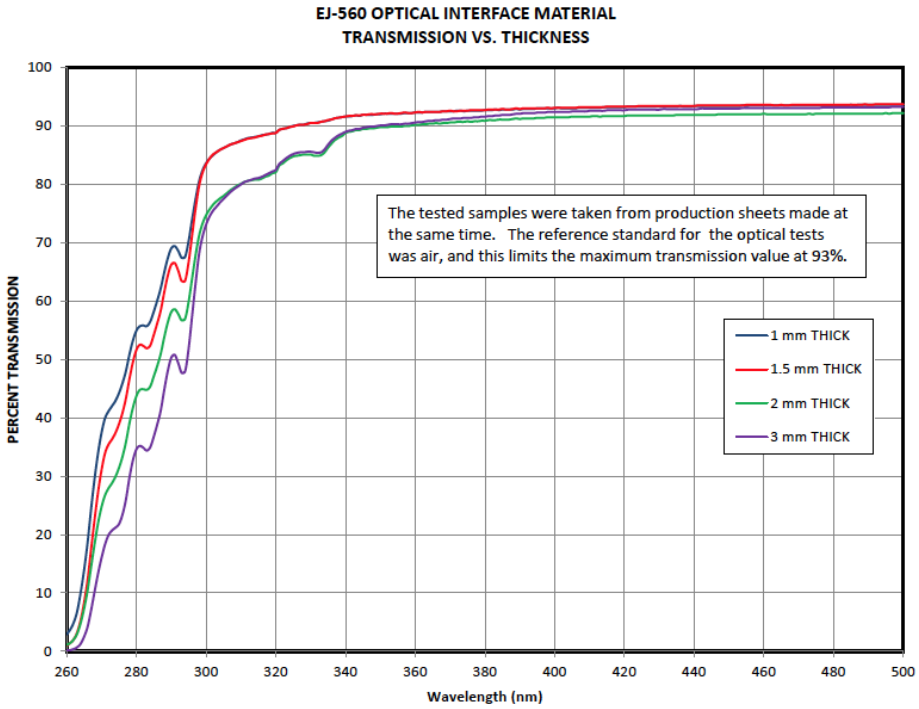
[1407.3258v1]

Sample 1: 1.9 mm, 25 C
Sample 4: 3.3 mm, 25 C
Sample 6: 2.3 mm, 25 C
Sample 8: 1.4 mm, 25 C

Measured for interface air-silicone-air,
to compare with our results this curve was corrected for Fresnel reflection using factor 0.98 = T(air-FS-air) / T(air-silicone-air)

Transmittance for RTV and Eljen-560





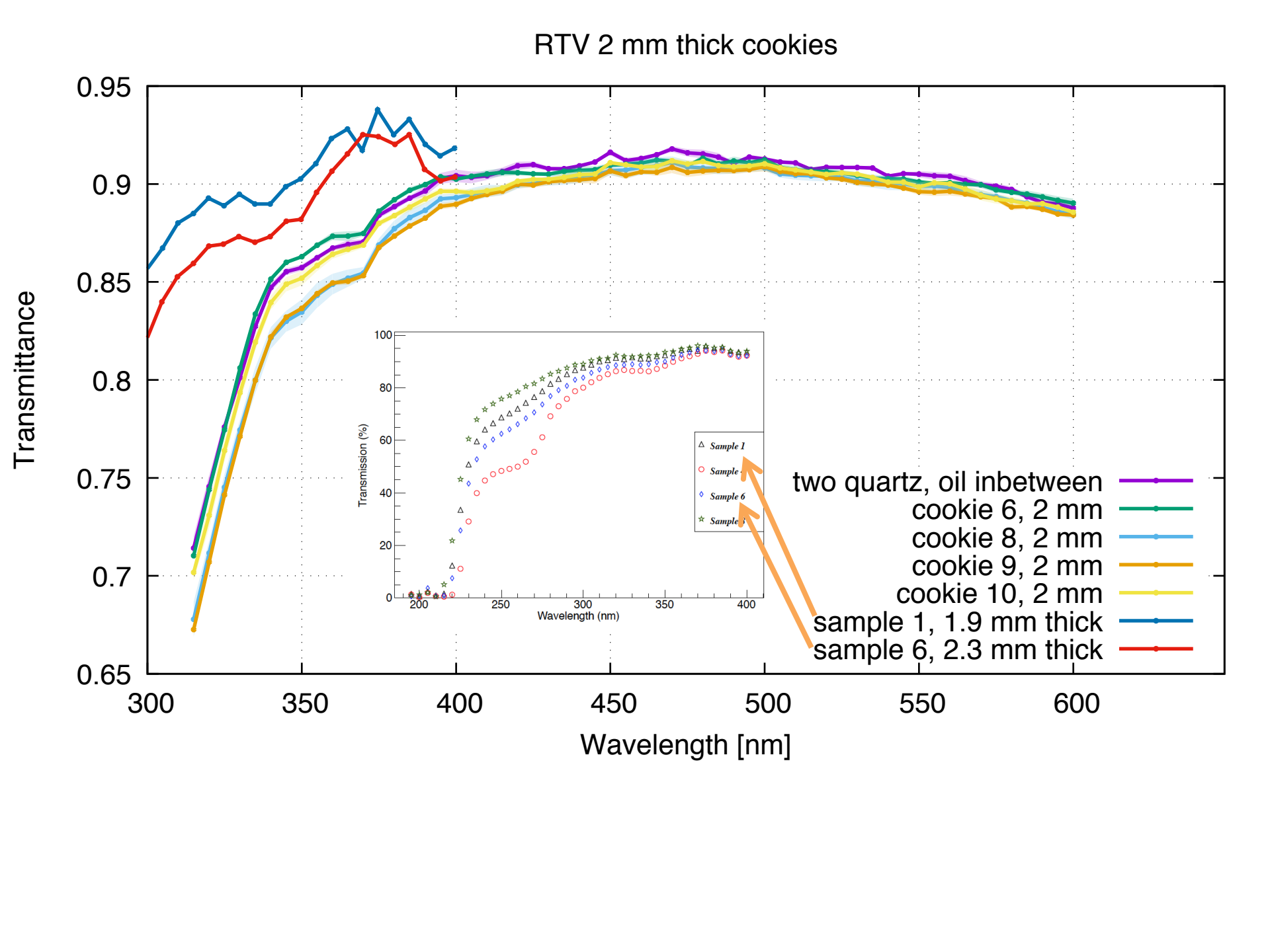
From J.Vavra "Optical properties of RICH detectors"

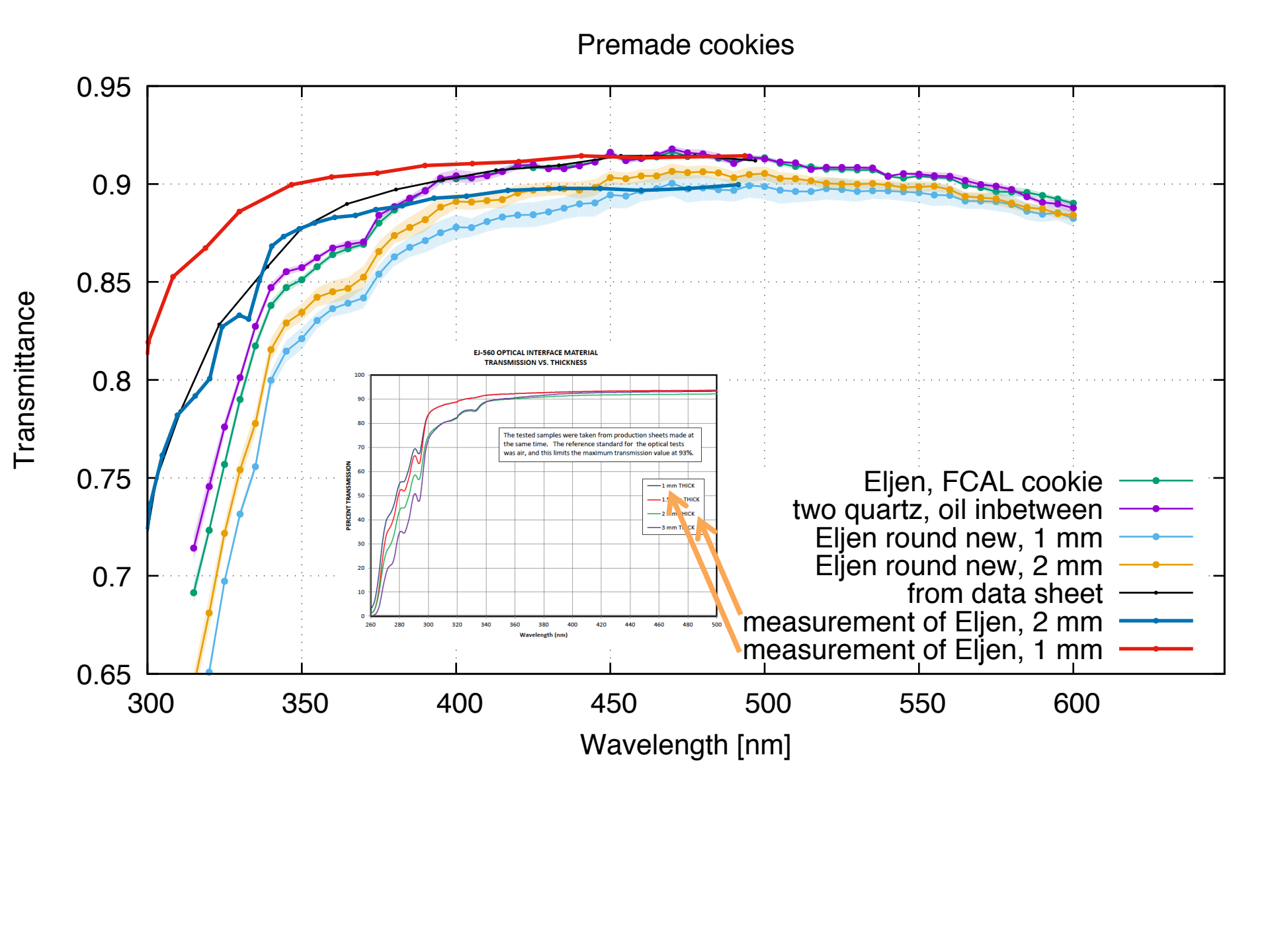
Absolute measurement:
(air-FS-material-FS-air)

Epotek cuts at ~290 nm

Manufacturer has variations in transmission within the same batch

Relative measurement: (air-silicone-air)/air → Fresnel limit is 94%


RTV 2 mm thick cookies
Transmittance
Wavelength [nm]
0.95
0.9
0.85
0.8
0.75
0.7
0.65
300
350
400
450
500
550
600
two quartz, oil inbetween
cookie 6, 2 mm
cookie 8, 2 mm
cookie 9, 2 mm
cookie 10, 2 mm
sample 1, 1.9 mm thick
sample 6, 2.3 mm thick
Transmission (%)
Wavelength (nm)
100
80
60
40
20
0
200
250
300
350
400
Sample 1
Sample 6

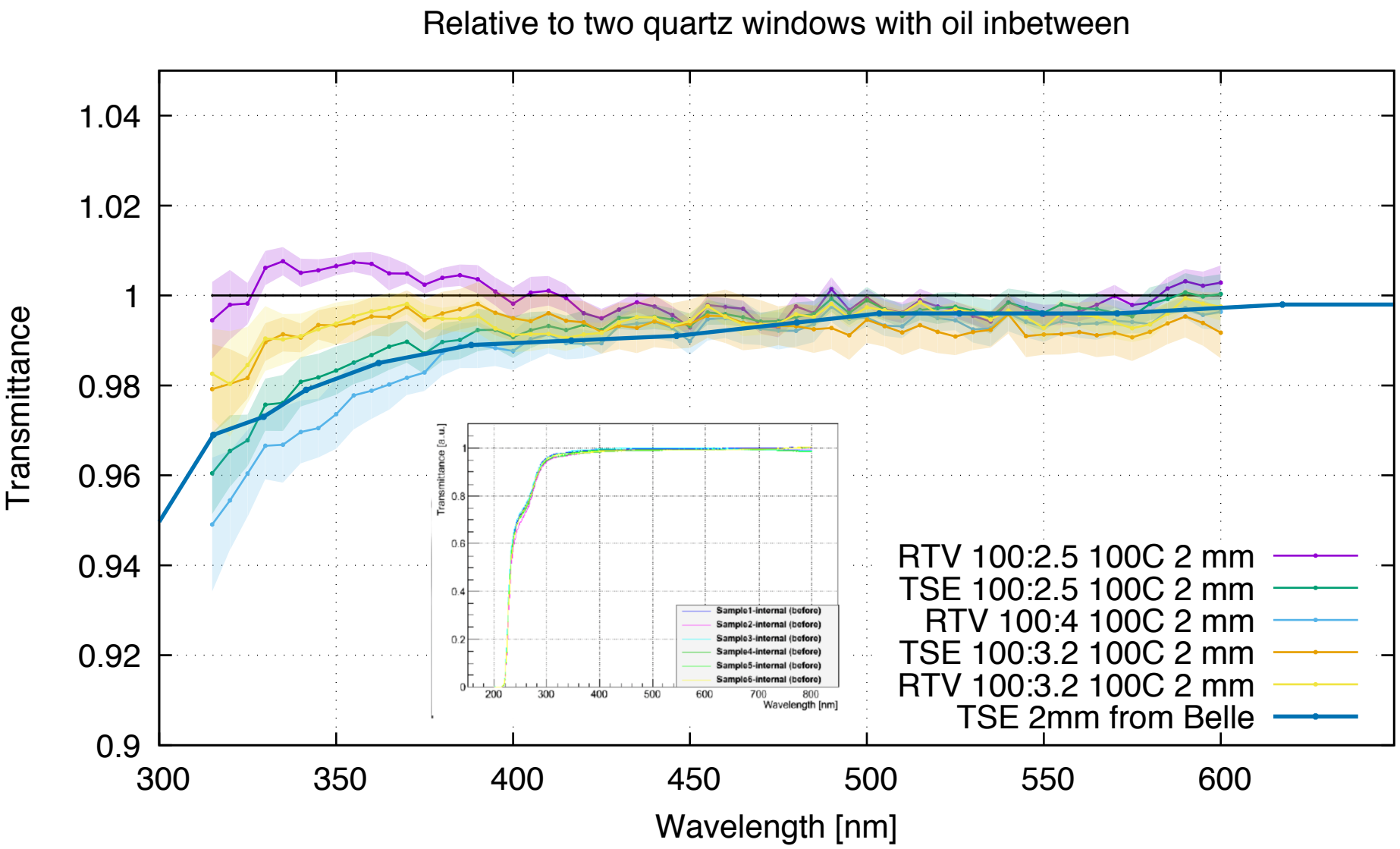

Premade cookies
Transmittance
Wavelength [nm]
0.95
0.9
0.85
0.8
0.75
0.7
0.65
300
350
400
450
500
550
600
Eljen, FCAL cookie
two quartz, oil inbetween
Eljen round new, 1 mm
Eljen round new, 2 mm
from data sheet
measurement of Eljen, 2 mm
measurement of Eljen, 1 mm
EJ-560 OPTICAL INTERFACE MATERIAL
TRANSMISSION VS. THICKNESS
The tested samples were taken from production sheets made at the same time. The reference standard for the optical tests was air, and this limits the maximum transmission value at 93%.
PERCENT TRANSMISSION
Wavelength (nm)
1 mm THICK

Plots of relative transmission

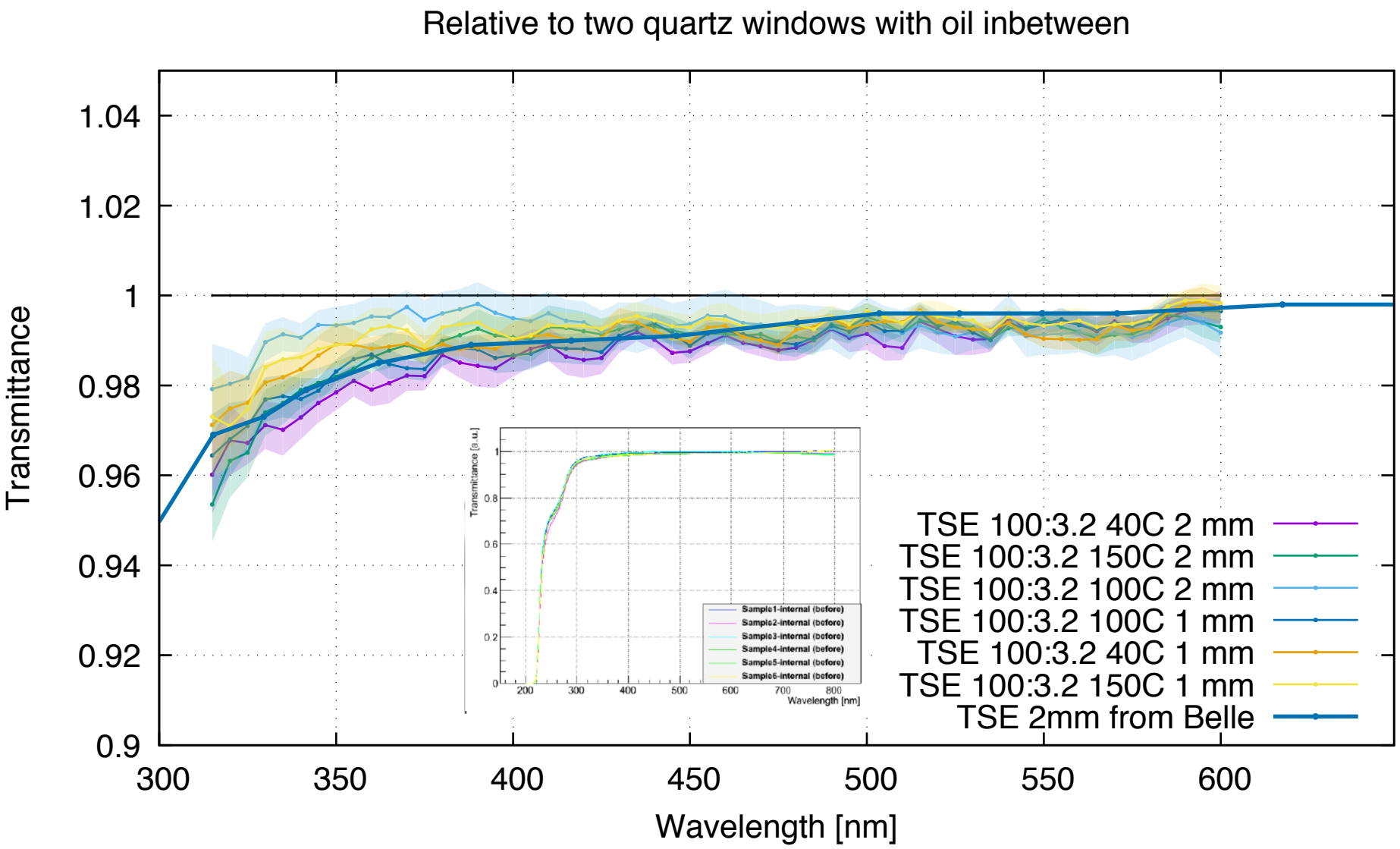
relative to

- two windows with greasing oil inbetween

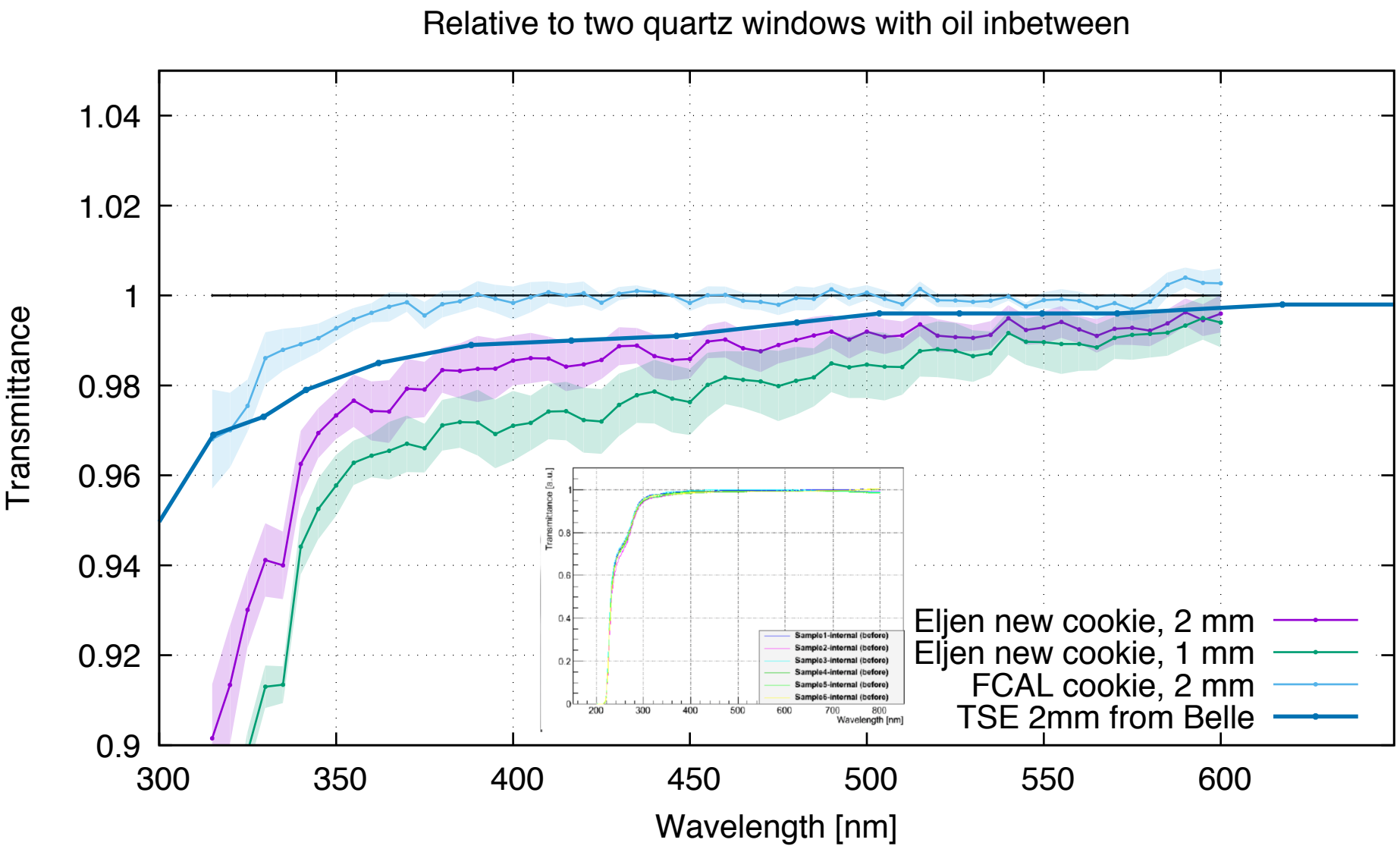
Shaded area shows averaging between 3 points



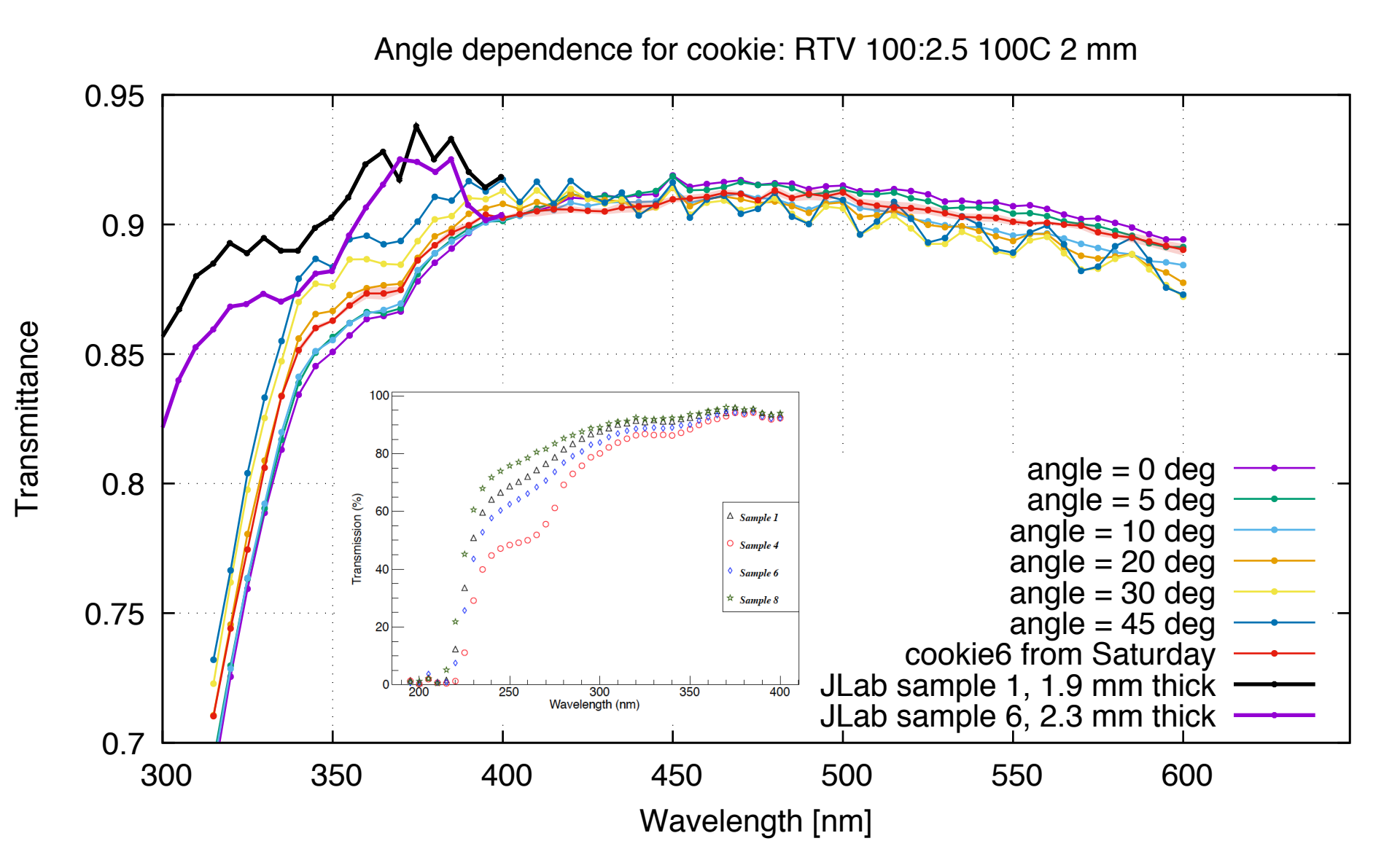
Comparison of different mixing ratios using 2 mm thick cookies



Comparison of different curing temperatures



Old FCAL cookies are very good.
Recently purchased Eljen cookies are worse, and slightly worse than ours.


Angle dependence for cookie: RTV 100:2.5 100C 2 mm
Transmittance
Wavelength [nm]
0.95
0.9
0.85
0.8
0.75
0.7
300
350
400
450
500
550
600
angle = 0 deg
angle = 5 deg
angle = 10 deg
angle = 20 deg
angle = 30 deg
angle = 45 deg
cookie6 from Saturday
JLab sample 1, 1.9 mm thick
JLab sample 6, 2.3 mm thick
Transmission (%)
Wavelength (nm)
Sample 1
Sample 4
Sample 6
Sample 8

Cookie 6

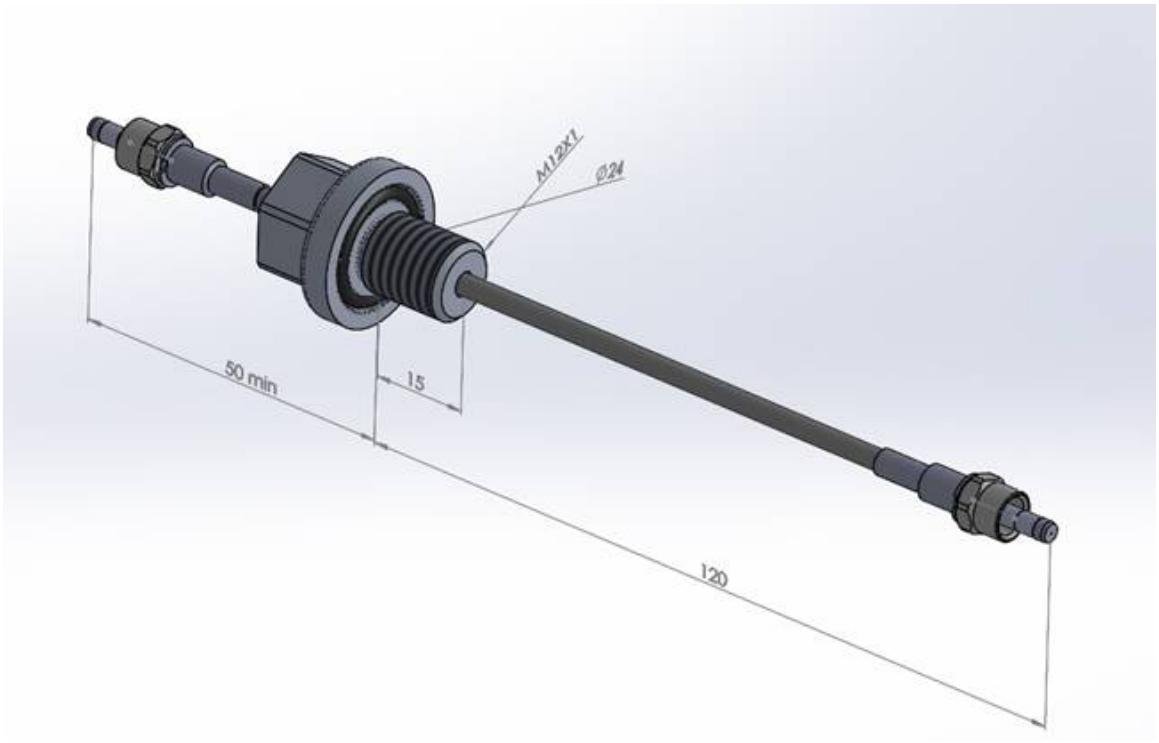
Cost of RTV

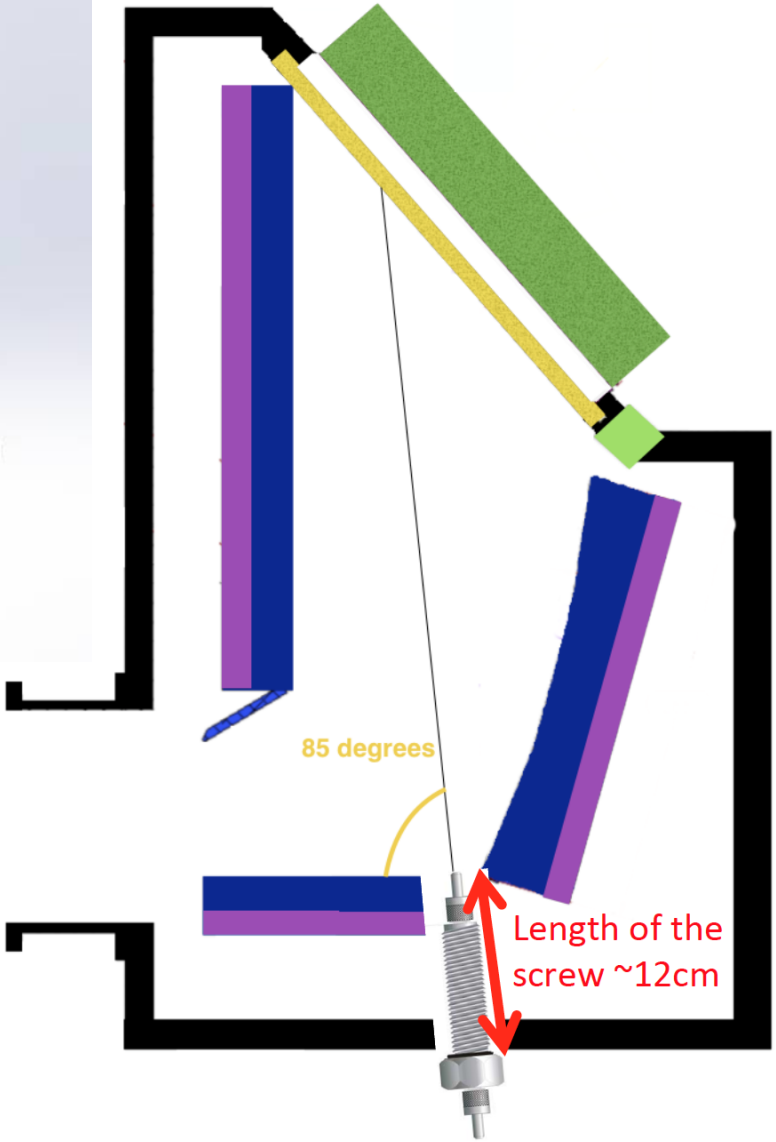
Comparison of buying pre-made cookies to buying RTV material:

material needed to equip DIRC [cc]	RTV615 material	Eljen optical interface sheets
18 x 2 x 2 = 72 cookies (5.2 cm x 15.8 cm) with thickness 0.2 cm	minimal order 12 lb = 5443g, density 1.03 g/cc	size of one sheet: 330mm x 530mm x 2 mm, which makes 20 cookies
~1200	~5300 for $1626	4 sheets x $350 = $1740
extra volume we get for a minimal order	340% (4100 cc)	18% (210 cc = 0.6 sheet)

It is significantly cheaper to buy molding set of RTV615: for about the same money ($1700) we can get either Eljen sheets with extra 4100 cc (340%) of material or RTV615 (assuming we mold ourselves) with excess of 0.6 sheet (18%).

Laser feedthrough





Price for 1 piece = 1 587 EUR

We have 3 ports in each box.

Price for 8 pieces = 12 696 EUR

Plans

- Measure transparency for new cookies:
  - Order RTV material and an EJ-560 sheet
  - New molds?
- Order feedthrough?
- Simulation in GlueX software using Geant4