

ePIC pfRICH Aerogel QA Progress Report

Matt Posik
Temple University

- Integration of 340nm LED
- Fit to data assessment
- First look at $n=1.02$ tiles

- Integration of 340nm LED

- Fit to data assessment

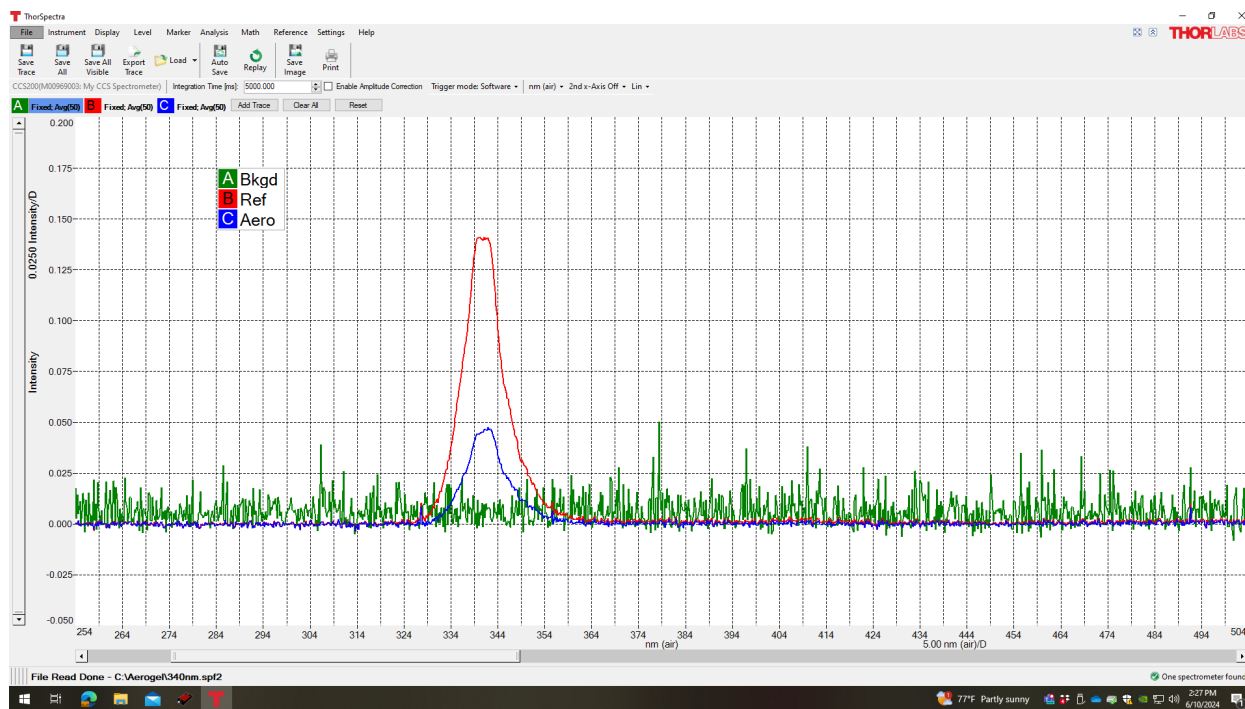
- First look at $n=1.02$ tiles

- ❑ Aerogel tiles from Aerogel Factory used in assessment

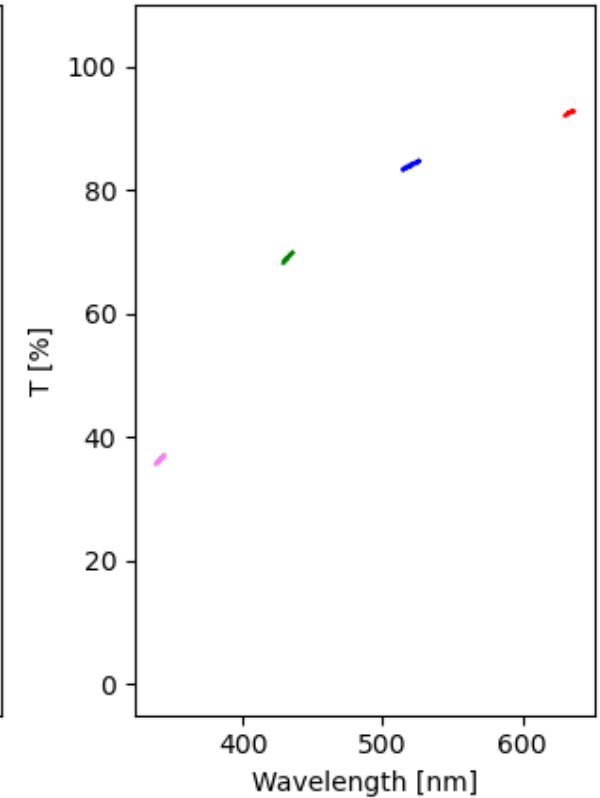
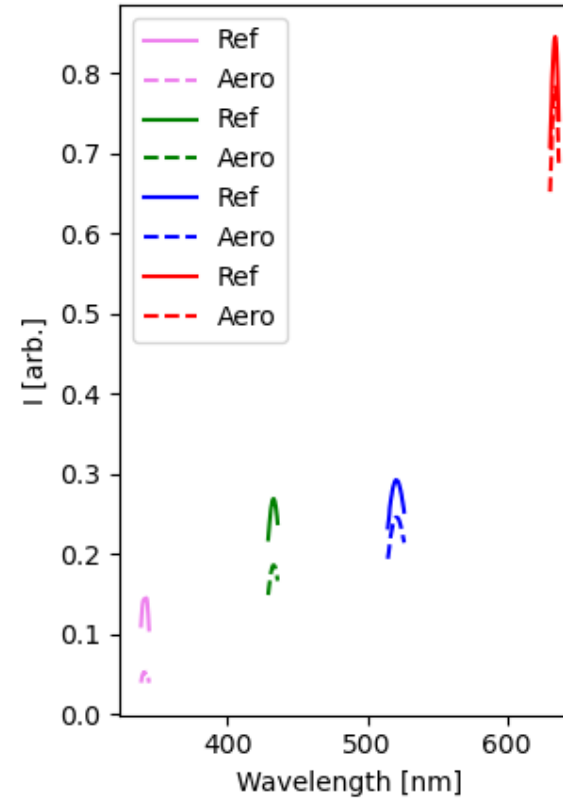
Type	TSA1.04	TSA1.04	TSA1.04
Serial number	TSA114-3	TSA120-1	TSA120-2
Refractive index (at 405 nm)	1.0377	1.0404	1.0401
Transmission length (at 400 nm) [mm]	51.2	48.9	49.3
Transmittance (at 400 nm) [%]	61.2	60.6	60.5
Lateral tile size (nominal) [mm]	109.9	109.4	110.4
Thickness (nominal) [mm]	25.1	24.5	24.8
Weight [g]	42.79	42.21	43.12
Density [g/cm ³]	0.141	0.144	0.143
Appearance	Slight damages	Good	Good
File name of transmittance data [.txt]	tsa114-3_2023.12	tsa120-1	tsa120-2

Including 340nm LED

☐ Added 340 nm LED into TU setup

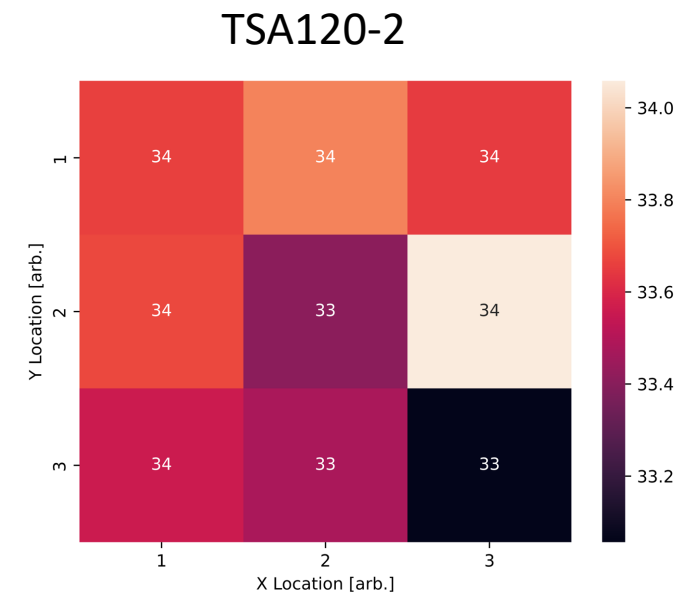
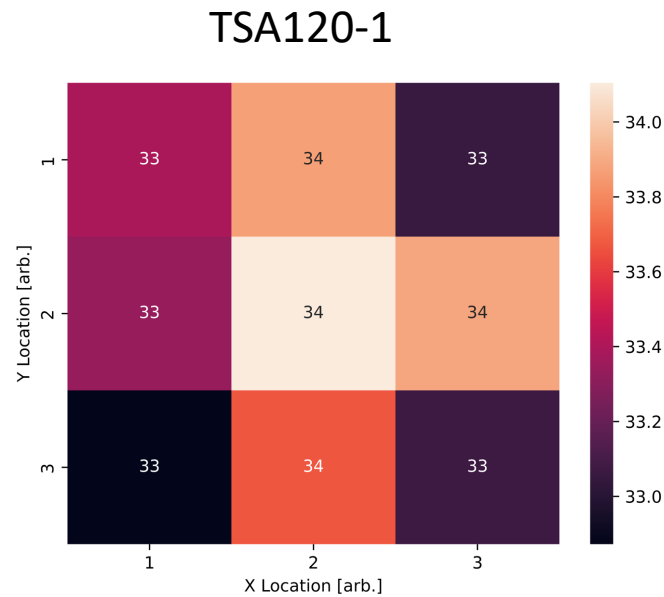
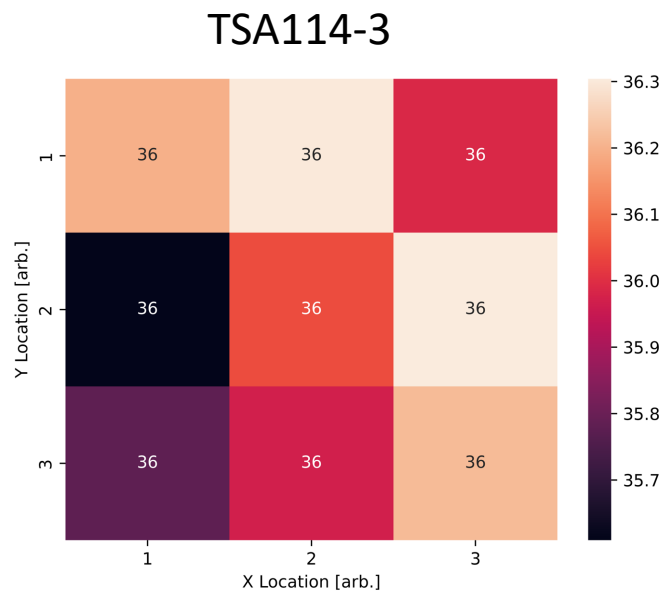


run 1

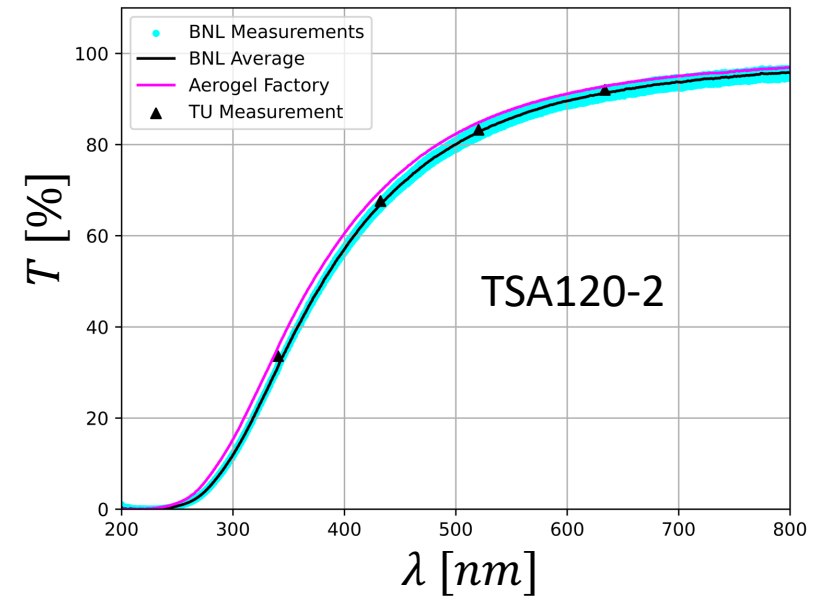
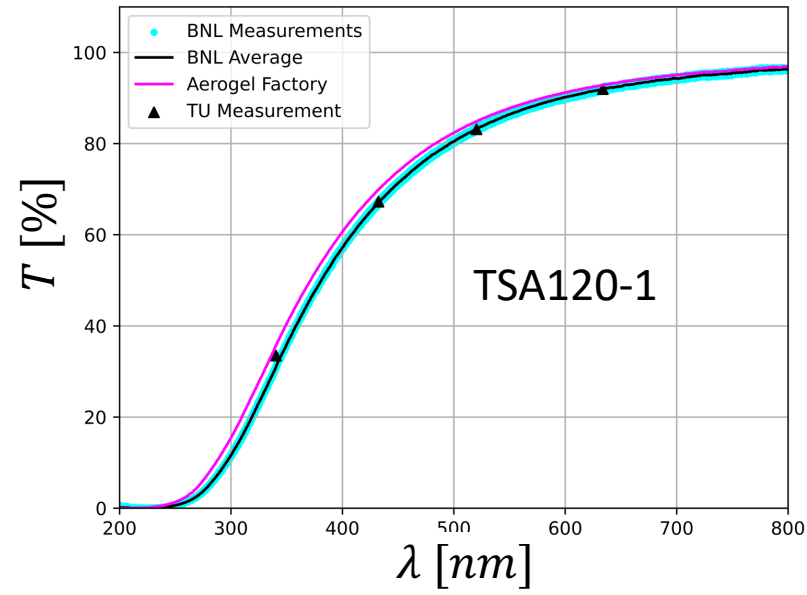
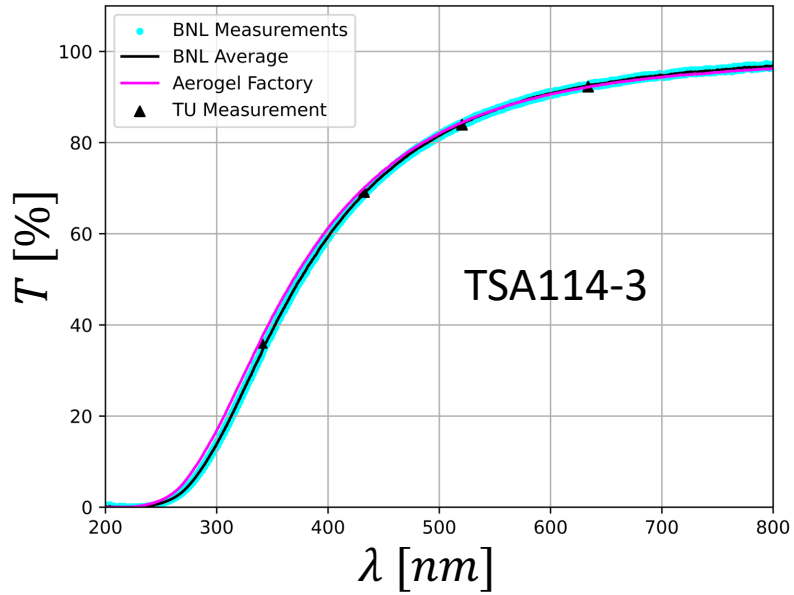


□ $\langle \lambda \rangle = 340.5 \text{ nm}$

- Good uniformity measured across 9 spots on each of the 3 tiles

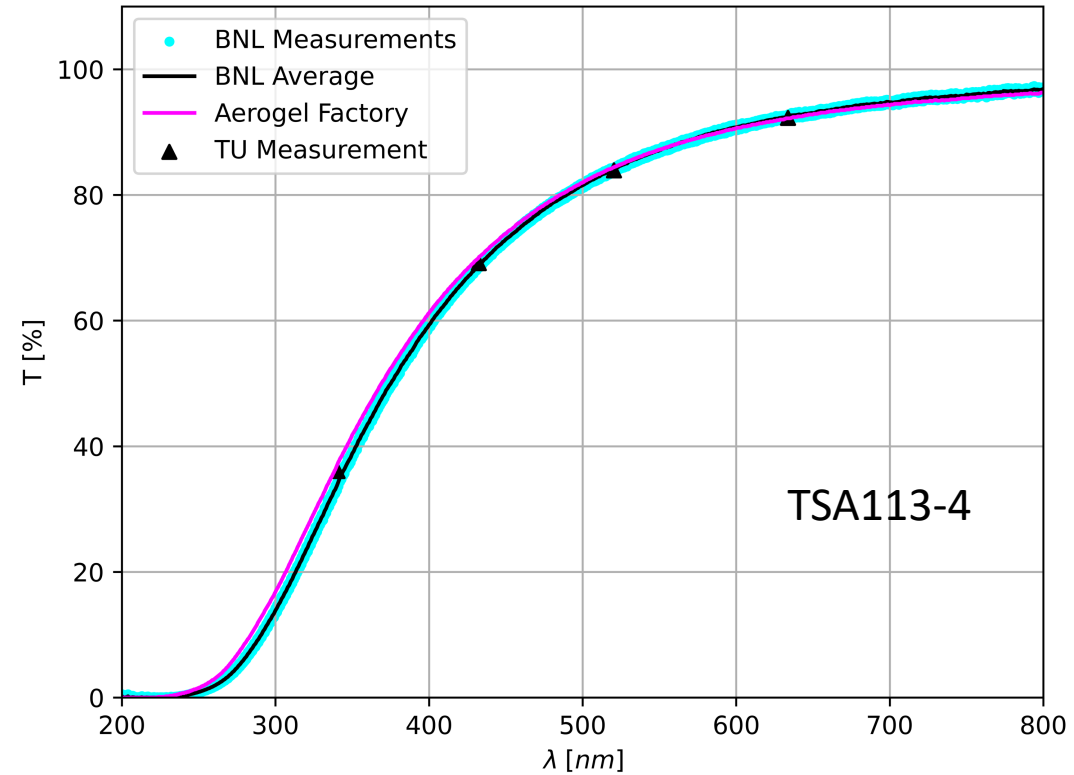


☐ Good agreement between Aerogel Factory, BNL, and TU



□ TSA113-4

- Good agreement between Aerogel Factory, BNL, and TU
- New TU measurements show repeatability of TU setup with those taken a couple months ago



λ [nm]	TU T[%]	TU T[%] (2)	BNL T[%]	Aerogel Factory [%]
340.5	--	36.05	33.95	37.2
432.4	69.35	69.14	68.79	70.1
520.5	84.12	83.91	84.08	84.4
633.7	92.69	92.26	92.44	92.2

Integration of 340nm LED

Fit to data assessment

First look at $n=1.02$ tiles

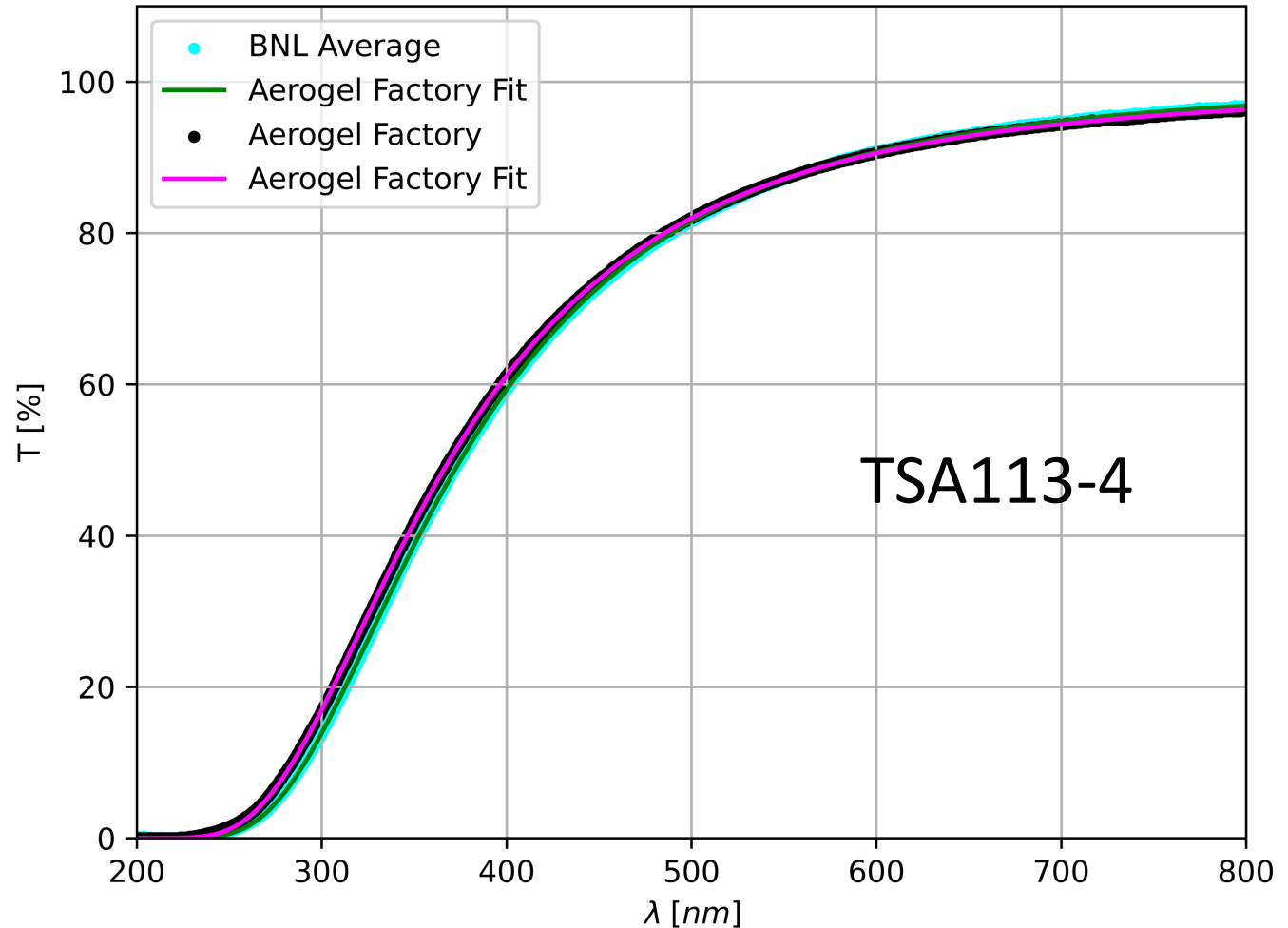
□ Hunt Extended Formula

$$T(\lambda) = e^{-\frac{t}{\Lambda_{transm}}} = e^{-t\left(\frac{1}{\Lambda_{abs}} + \frac{1}{\Lambda_{scat}}\right)} = A \cdot e^{-\frac{Bt}{\lambda^8}} \cdot e^{-\frac{Ct}{\lambda^4}}$$

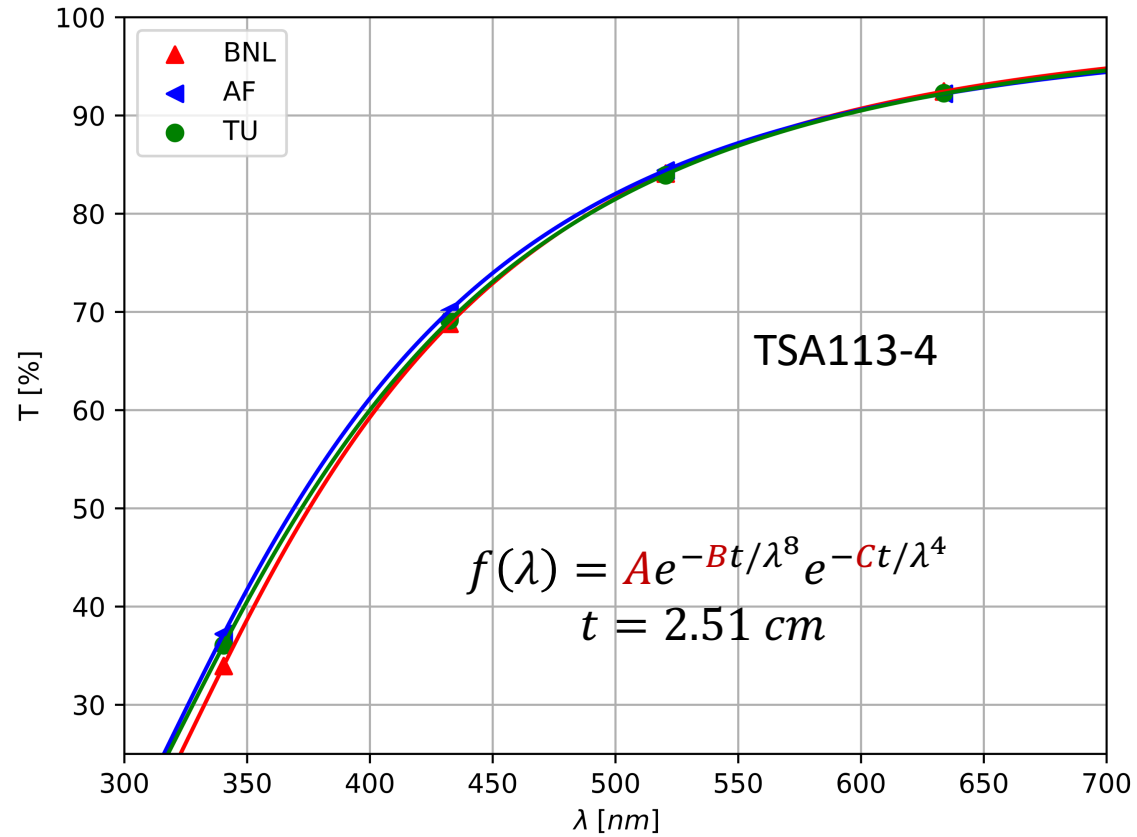
$$\Lambda_{transm} = -\frac{t}{\ln(T)}$$

$$\Lambda_{scat} = \frac{\lambda^4}{C}$$

$$\Lambda_{abs} = \frac{t\lambda^8}{Bt - \lambda^8 \ln(A)}$$

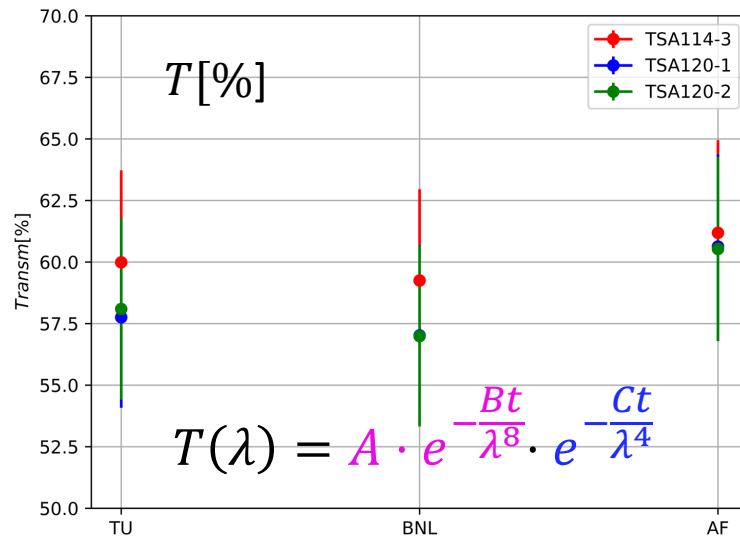
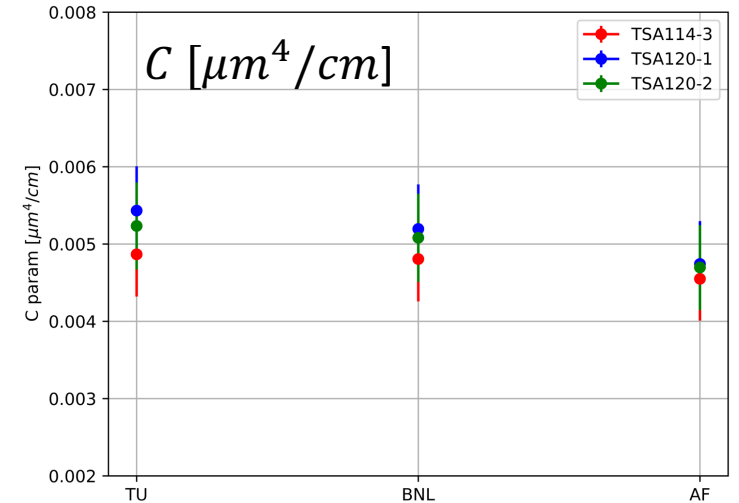
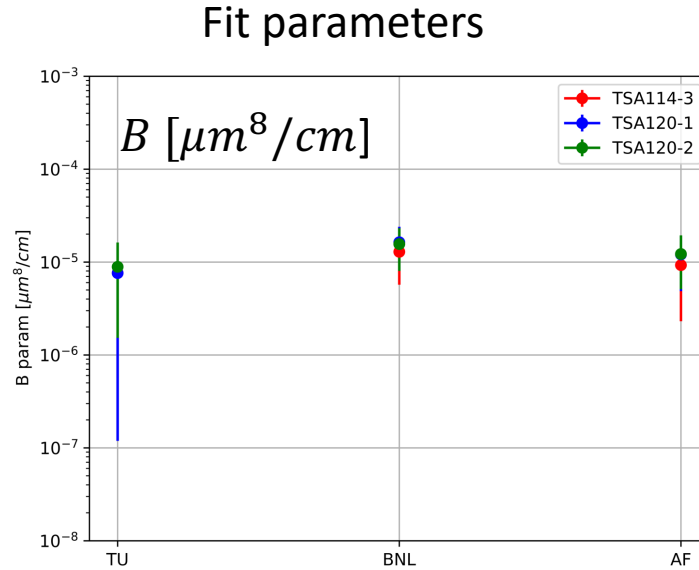
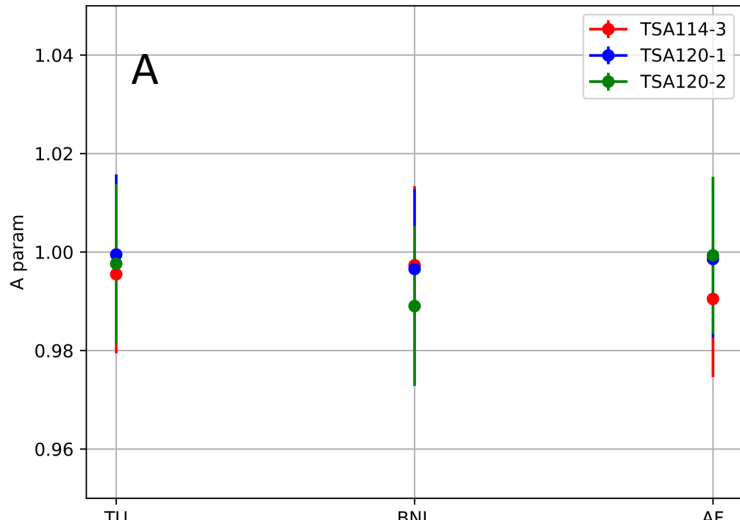


- ☐ Good agreement between full and partial data fits (BNL,AF)

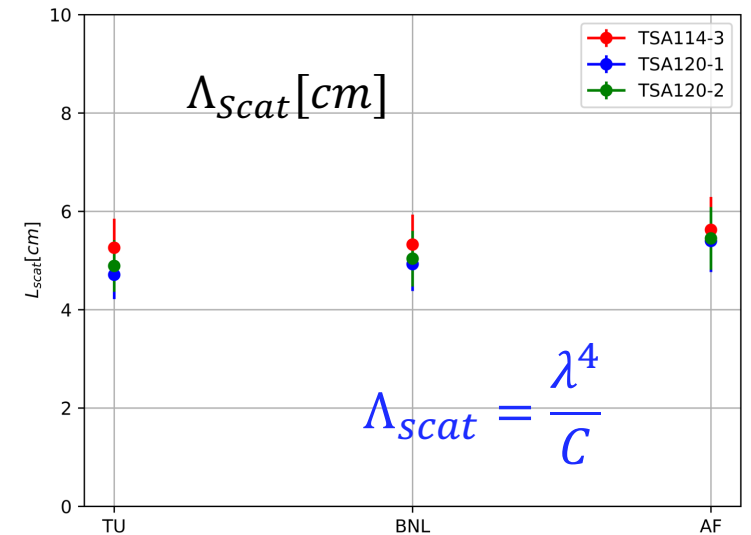
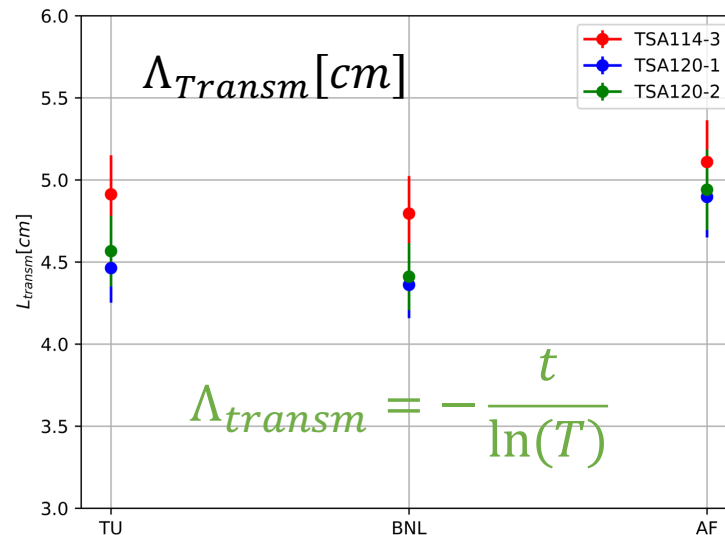


Note: $Bt \sim 10^{-5}$

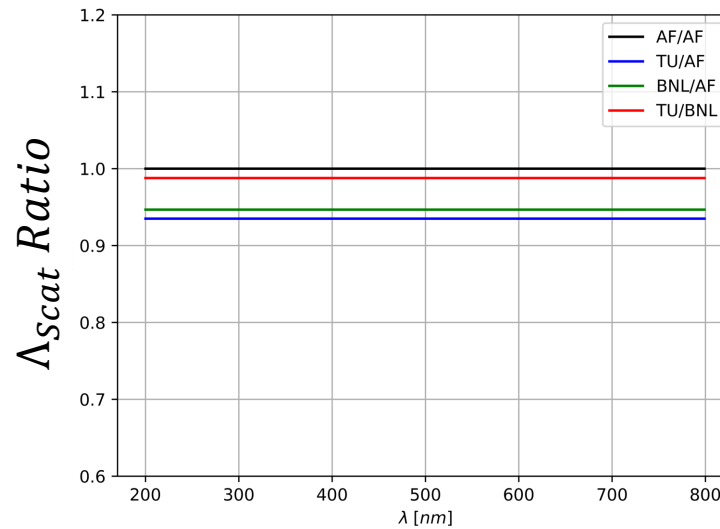
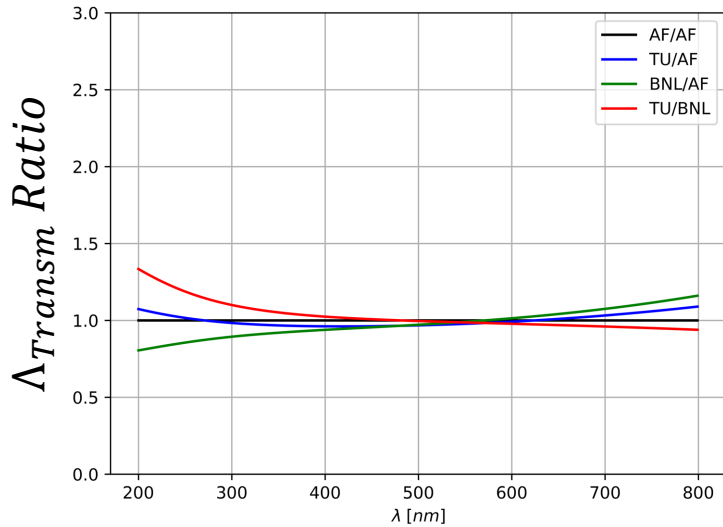
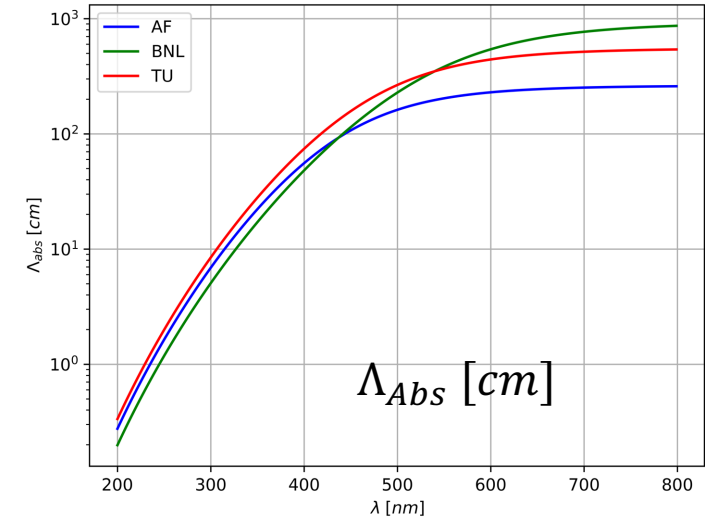
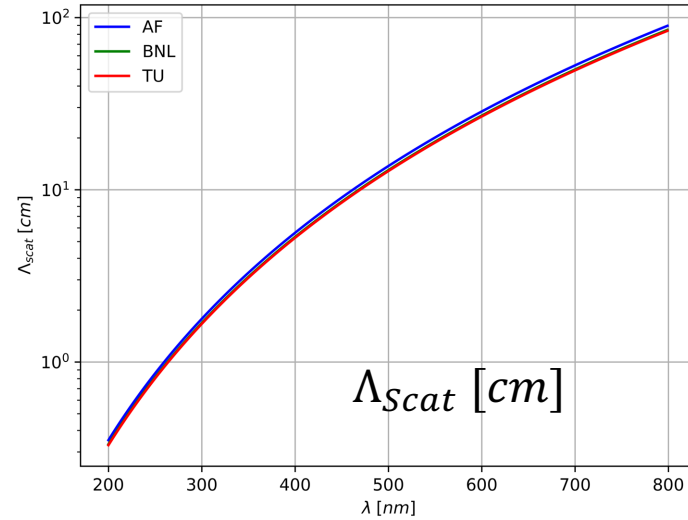
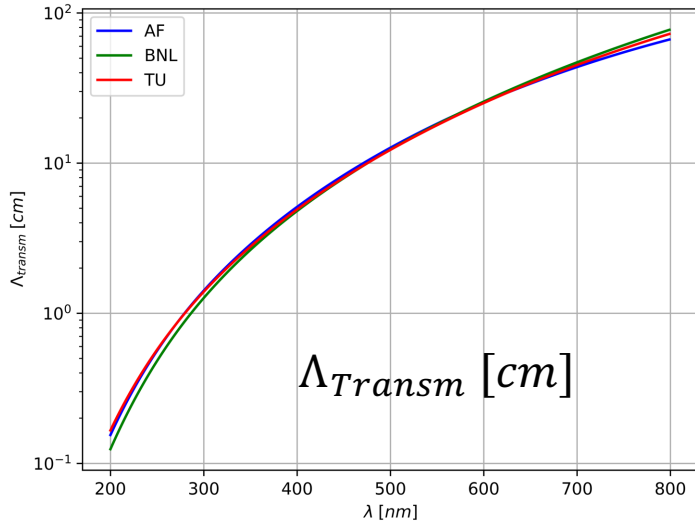
	Fit [Full/Partial]	A	Bt [μm^8]	Ct [μm^4]
BNL	Full	99.767 ± 0.090	0.000	0.012
BLN	Partial	99.731 ± 1.607	0.000	0.012 ± 0.001
AF	Full	99.047 ± 0.062	0.000	0.011
AF	Partial	99.050 ± 1.590	0.000	0.011 ± 0.001
TU	--	99.548 ± 1.606	0.000	0.012 ± 0.001



Extracted quantities @ 400nm



□ TSA114-3 (thickness = 2.51 cm)



Evaluated at $\lambda = 400 \text{ nm}$

	T[%]	$\Delta_{Transm} [cm]$	$\Delta_{Scat} [cm]$
AF Spec	61.2	5.12	--
AF	61.19	5.1092	5.6256
BNL	59.25	4.7954	5.3256
TU	59.99+/- 3.73	4.9123 +/- 0.238	5.2603 +/- 0.033

- Integration of 340nm LED
- Fit to data assessment
- First look at $n=1.02$ tiles

- ❑ Received 5 tiles with n = 1.02
 - First tile (1a) measured at Temple (Transmittance and index of refraction)

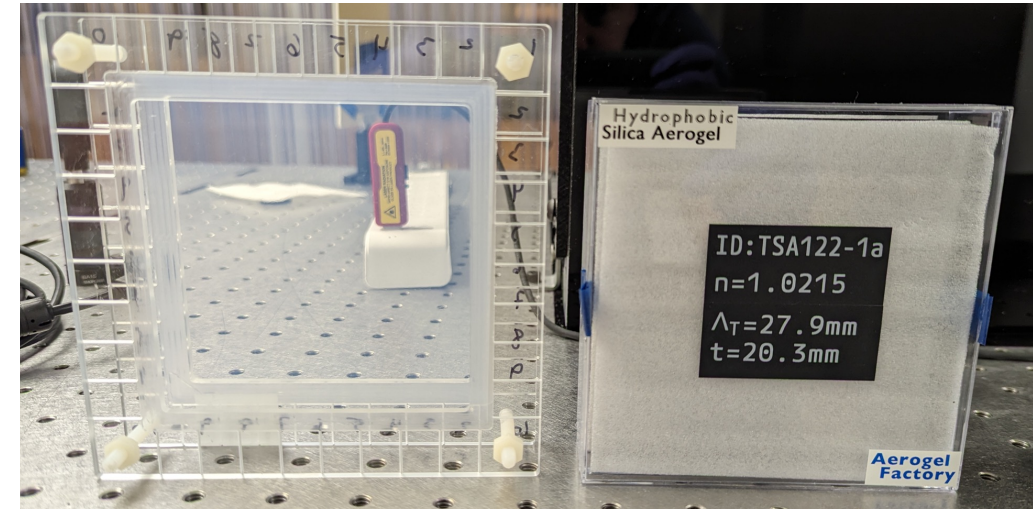
Aerogel Specifications

Dated March 15, 2024

To: JLab

Manufactured and measured by M. Tabata

Type	n=1.02	n=1.02	n=1.02	n=1.02	n=1.02
Serial number	TSA122-1a	TSA122-2a	TSA122-2b	TSA153-2	TSA153-3
Refractive index (at 405 nm)	1.0215	1.0215	1.0215	1.0215	1.0223
Transmission length (at 400 nm) [mm]	27.9	33.3	34.1	28.0	30.0
Transmittance (at 400 nm) [%]	48.4	54.7	55.7	49.0	51.5
Lateral tile size (nominal) [mm]	107.1	107.2	107.1	107.5	106.8
Thickness (nominal) [mm]	20.3	20.1	19.9	20.0	19.9
Weight [g]	18.59	18.62	18.37	18.36	18.56
Density [g/cm ³]	0.080	0.081	0.080	0.079	0.082
Appearance	Good	Good	Good	Good	Good
File name of transmittance data [.txt]	tsa122-1a	tsa122-2a	tsa122-2b	tsa153-2	tsa153-3



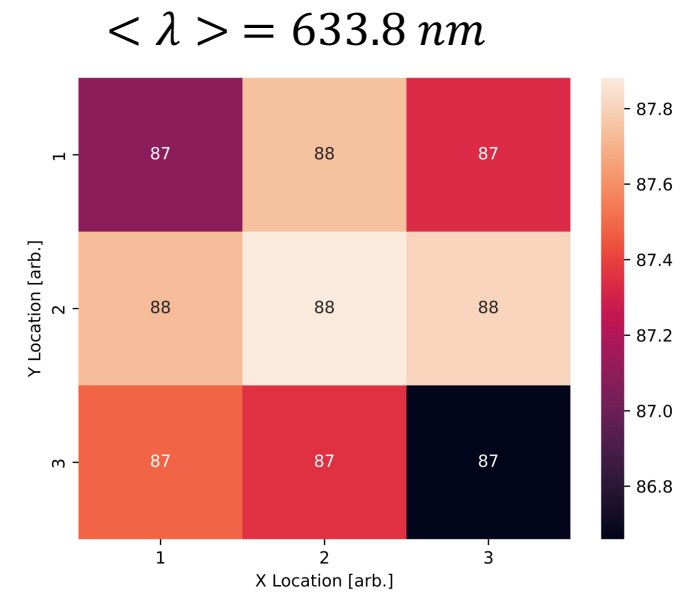
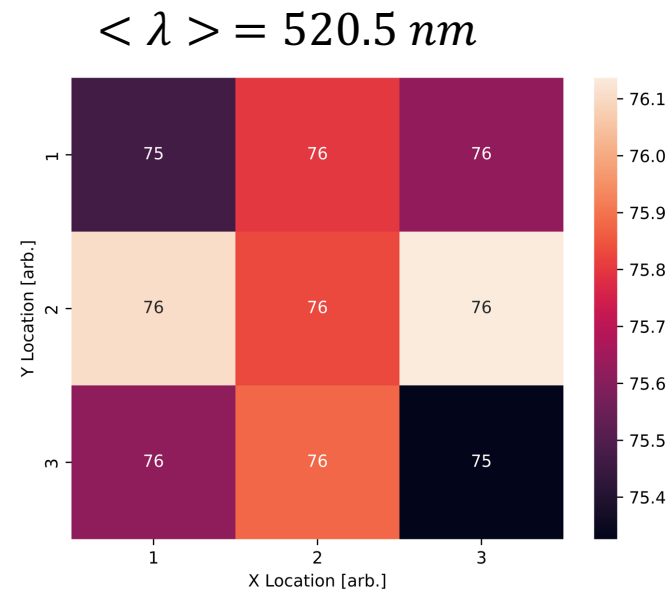
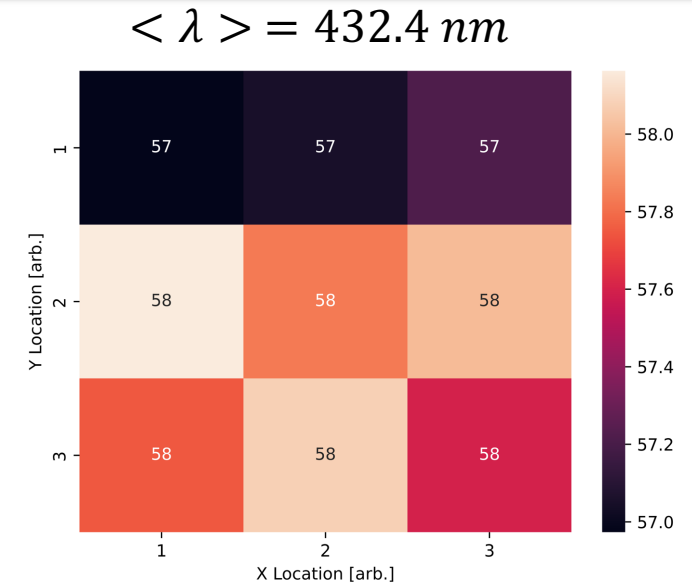
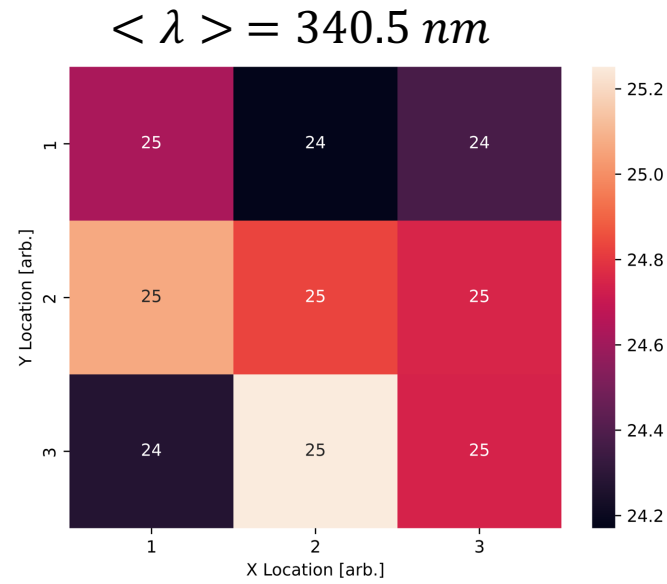
TSA122-1a index of refraction results. TU average of four corner measurements.

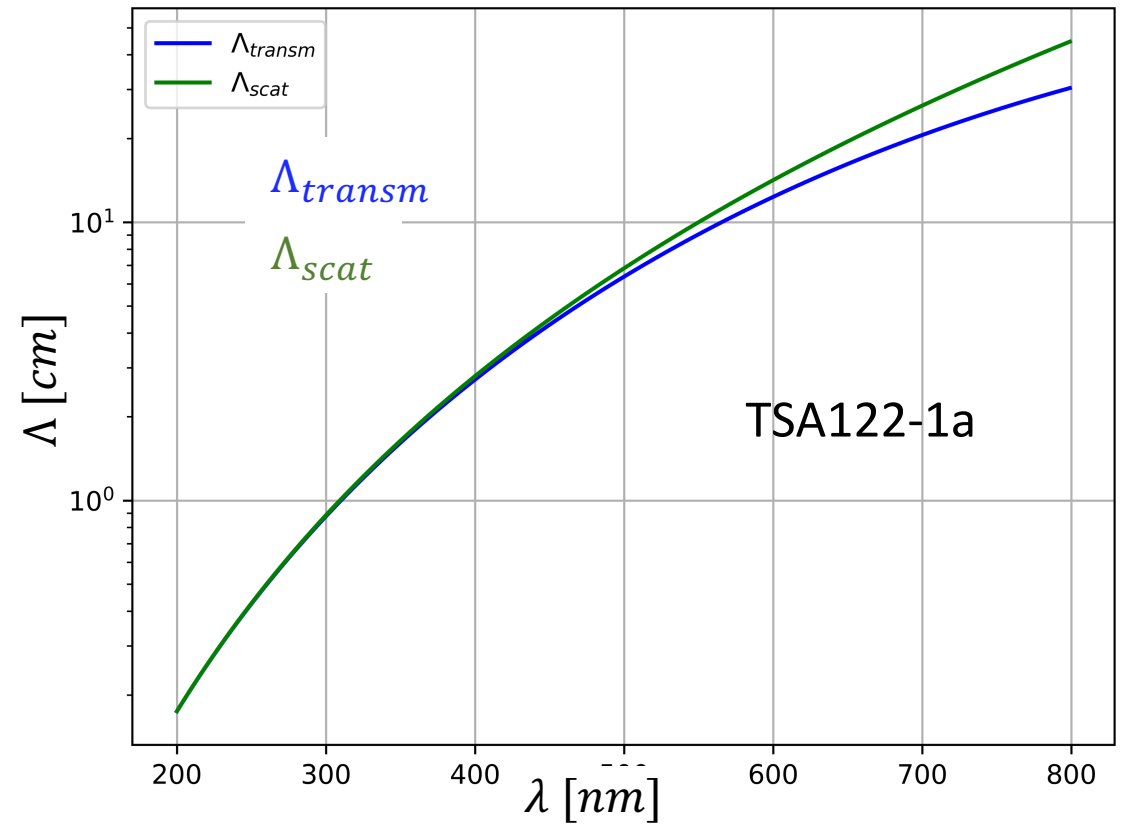
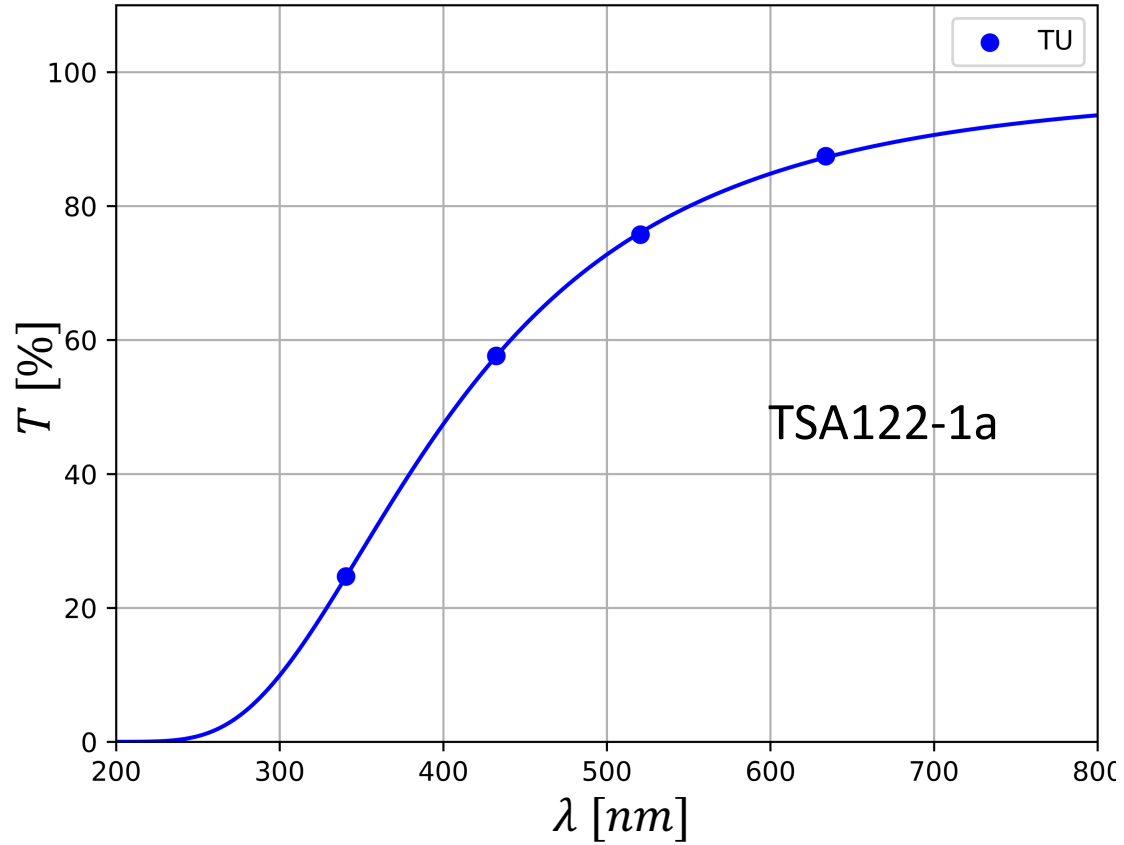
Source	LED λ [nm]	n
Aerogel Factory	405	1.0215
Temple	403	1.0216 +/- 0.0026

TU Measurement Results: Area Scan



□ TSA122-1a



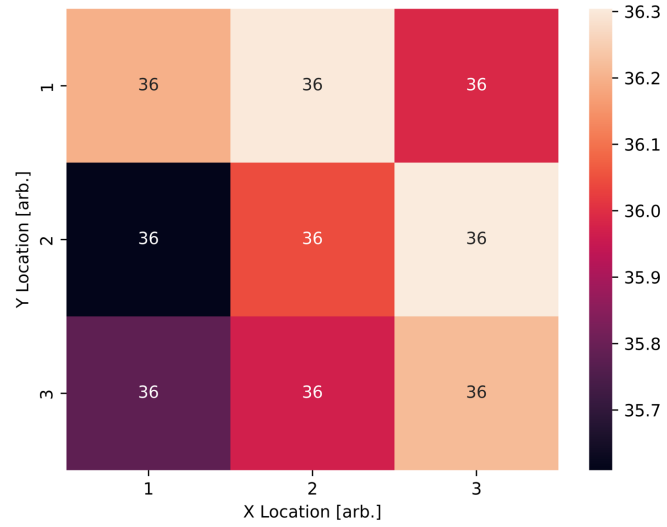


TSA122-1a	A	C [$\mu m^4/cm$]	$T(\lambda = 400nm)$ [%]	$\Delta_{transm}(\lambda = 400nm)$ [cm]
Aerogel Factory	--	--	48.8	2.79
Temple	0.9789 ± 0.1730	0.0091 ± 0.0008	47.44 ± 3.45	2.72 ± 0.13

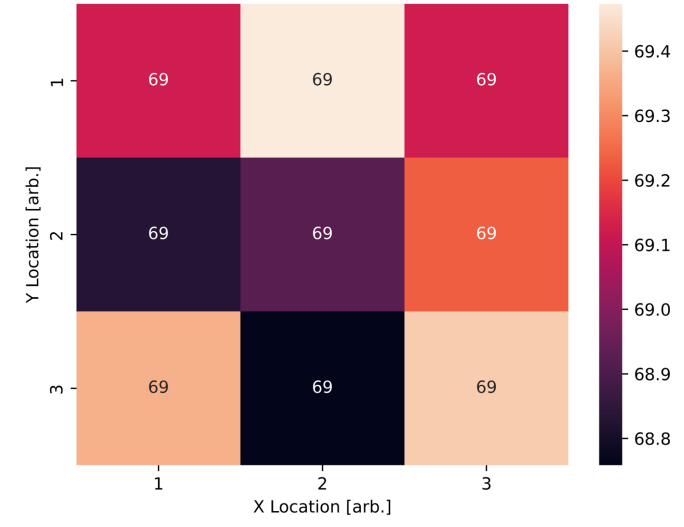
- ❑ 340nm LED now included in measurements
- ❑ Fits and QA extractions seem reasonable
- ❑ First of five $n=1.02$ tiles have been measured
 - Continue measurements next week

□ TSA114-3

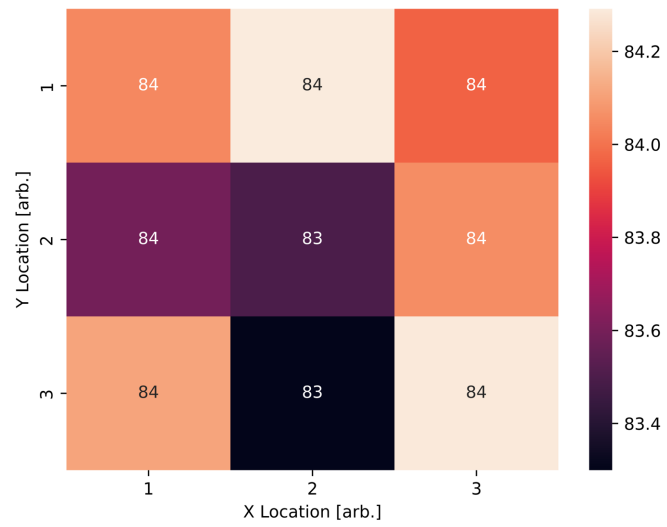
$\langle \lambda \rangle = 340.5 \text{ nm}$



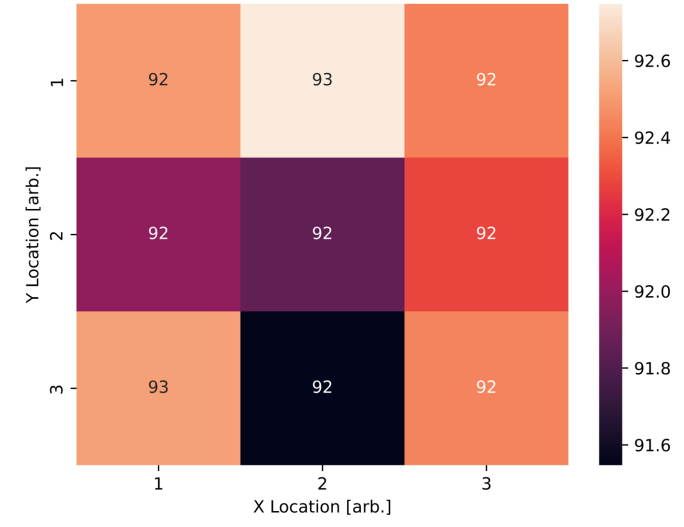
$\langle \lambda \rangle = 432.4 \text{ nm}$



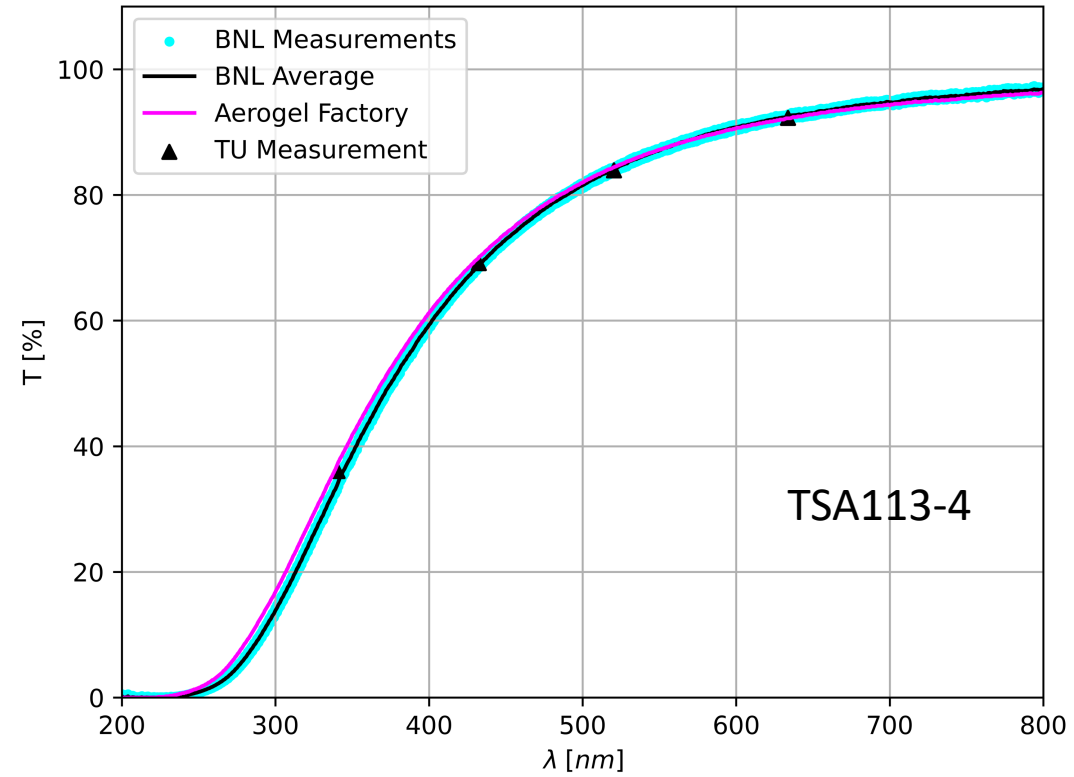
$\langle \lambda \rangle = 520.5 \text{ nm}$



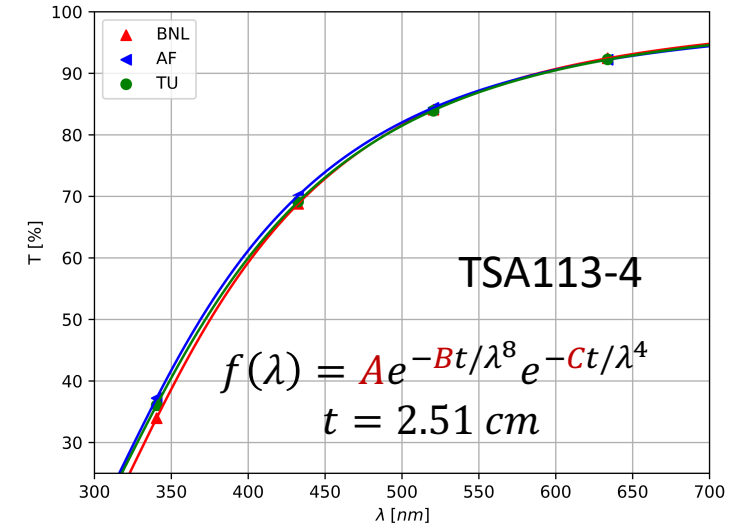
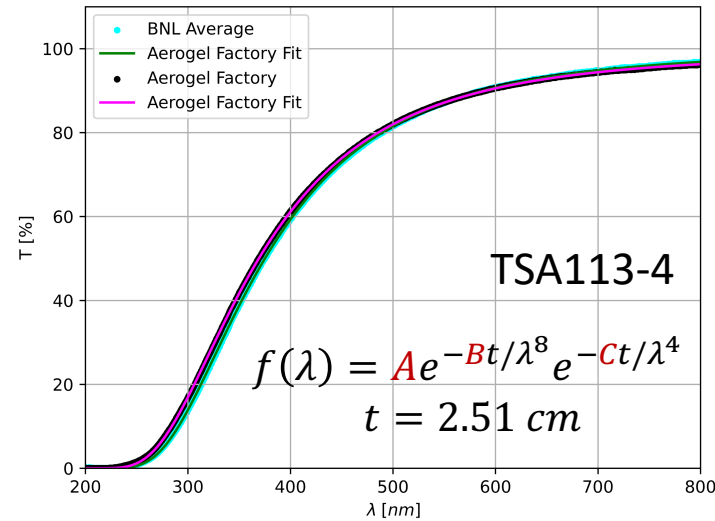
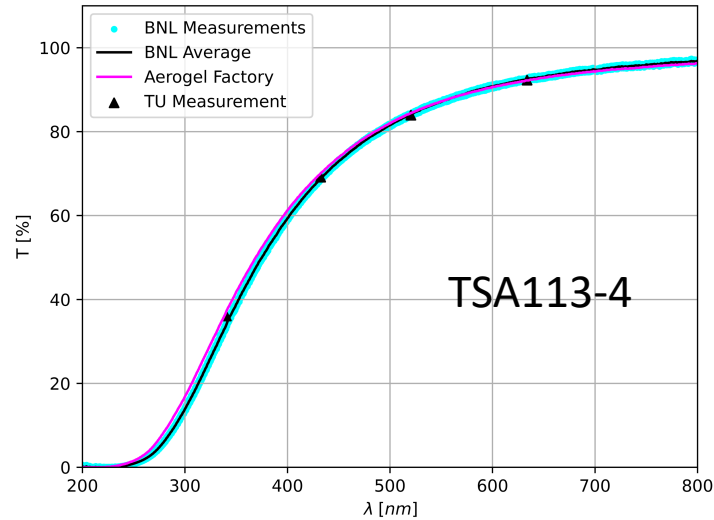
$\langle \lambda \rangle = 633.8 \text{ nm}$



□ TSA113-4



λ [nm]	TU T [%]	TU T [%] (2)	BNL T [%]	Aerogel Factory [%]
340.5	--	36.05	33.95	37.2
432.4	69.35	69.14	68.79	70.1
520.5	84.12	83.91	84.08	84.4
633.7	92.69	92.26	92.44	92.2

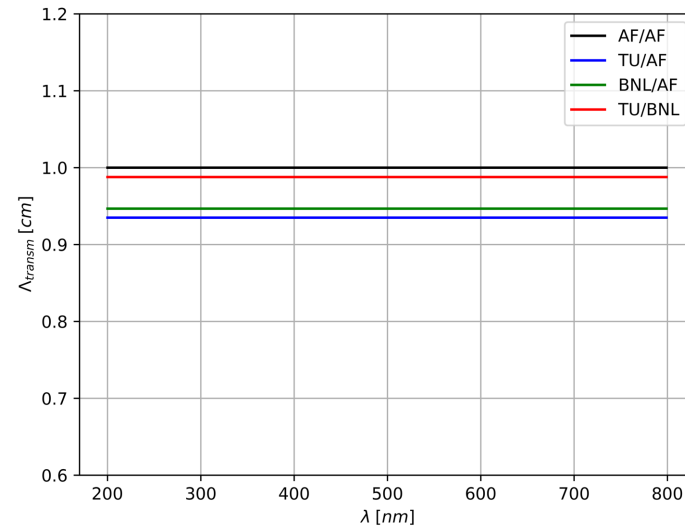
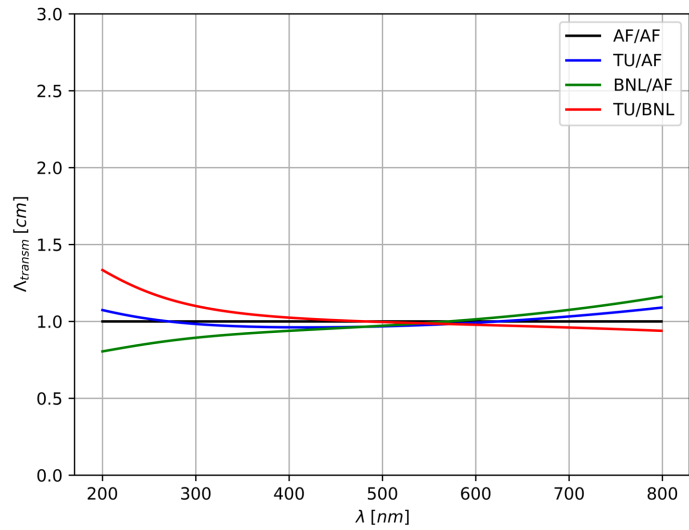
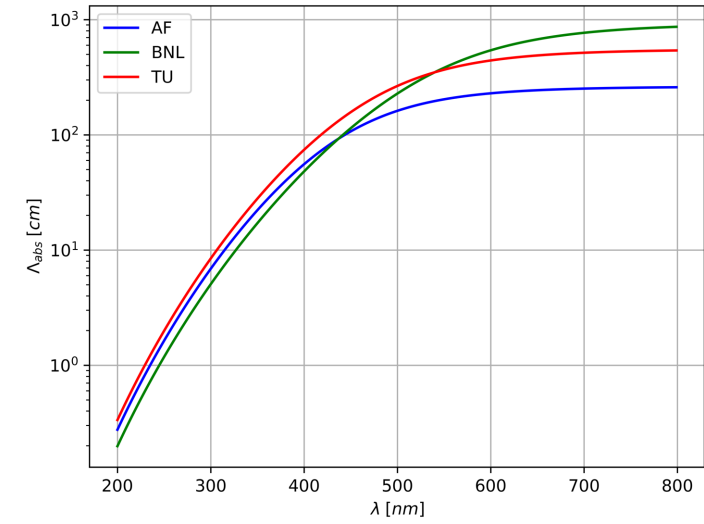
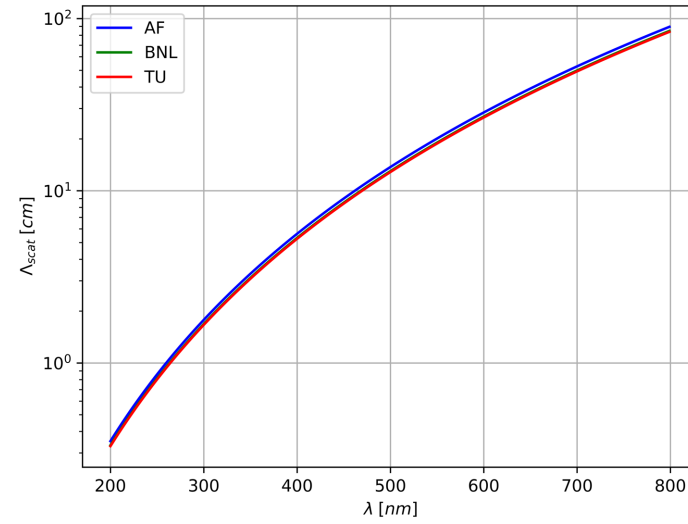
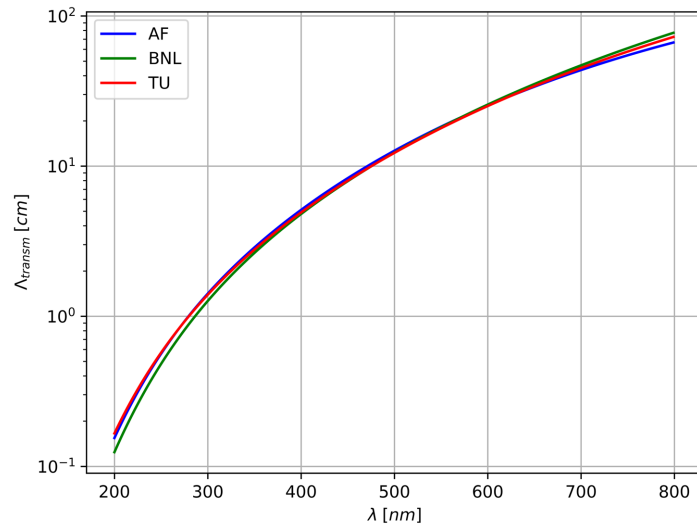


❑ Aerogel Factory measurements generally larger than BNL

	Fit [Full/Partial]	A	Bt [μm^8]	Ct [μm^4]
BNL	Full	99.767 ± 0.090	0.000	0.012
BLN	Partial	99.731 ± 1.607	0.000	0.012 ± 0.001
AF	Full	99.047 ± 0.062	0.000	0.011
AF	Partial	99.050 ± 1.590	0.000	0.011 ± 0.001
TU	--	99.549 ± 1.604	0.000	0.012 ± 0.001

Note: $Bt \sim 10^{-5}$

□ TSA113-4



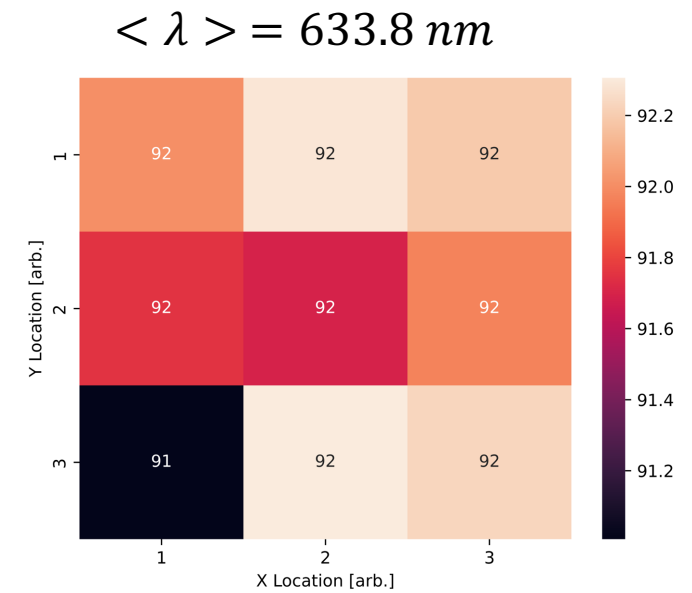
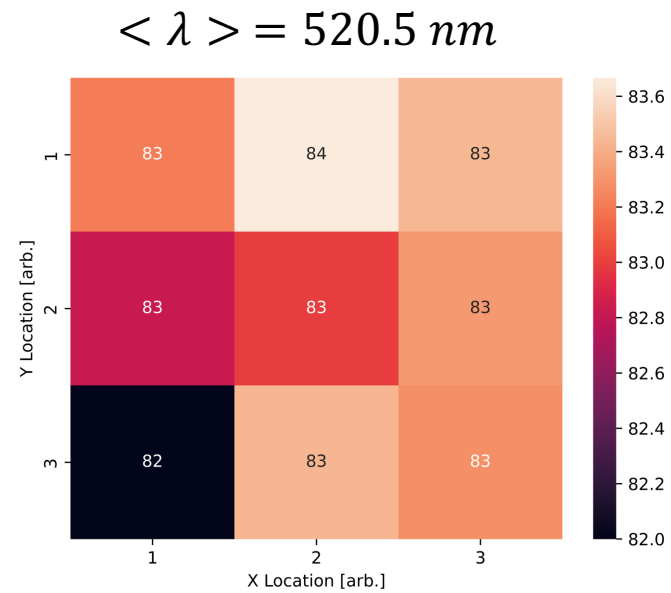
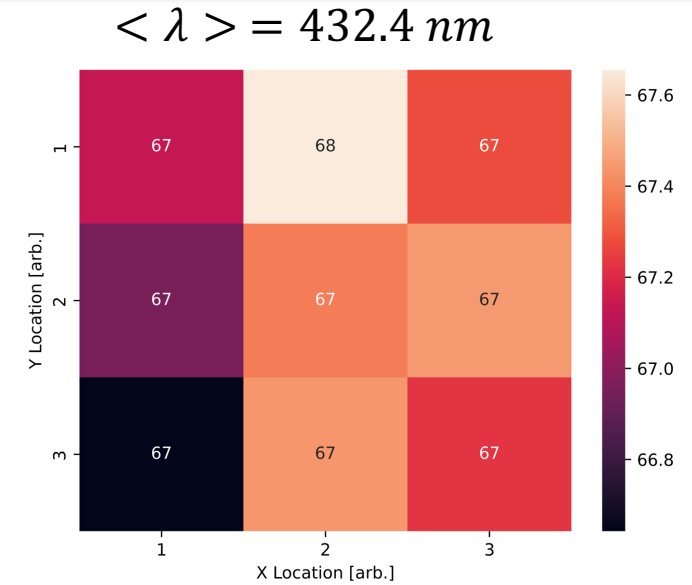
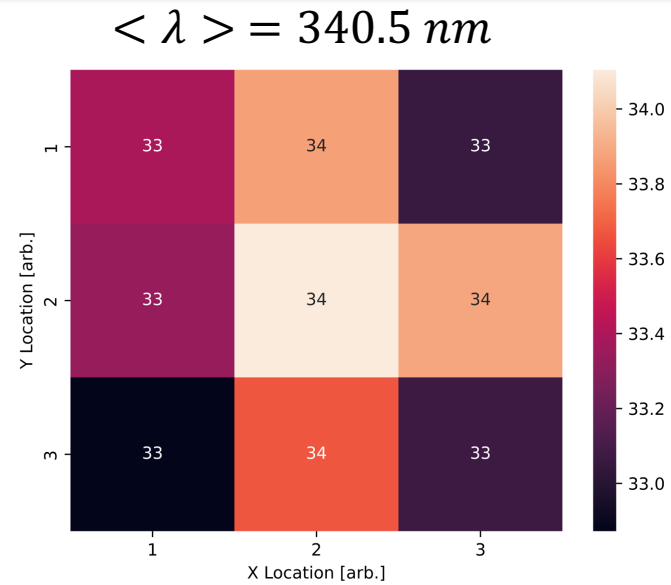
TSA114-3

	t [cm]	A	B $\left[\frac{\mu\text{m}^8}{\text{cm}}\right]$	C $\left[\frac{\mu\text{m}^4}{\text{cm}}\right]$	T [%]	Λ_{Transm} [cm]	Λ_{Scat} [cm]
AF Spec	2.51	--	--	--	61.2	5.12	--
AF	2.51	0.9905	0.0000	0.0046	61.19	5.1092	5.6256
BNL	2.51	0.9973	0.0000	0.0048	59.25	4.7954	5.3256
TU	2.51	0.9955	0.0000	0.0049	59.99	4.9123	5.2603

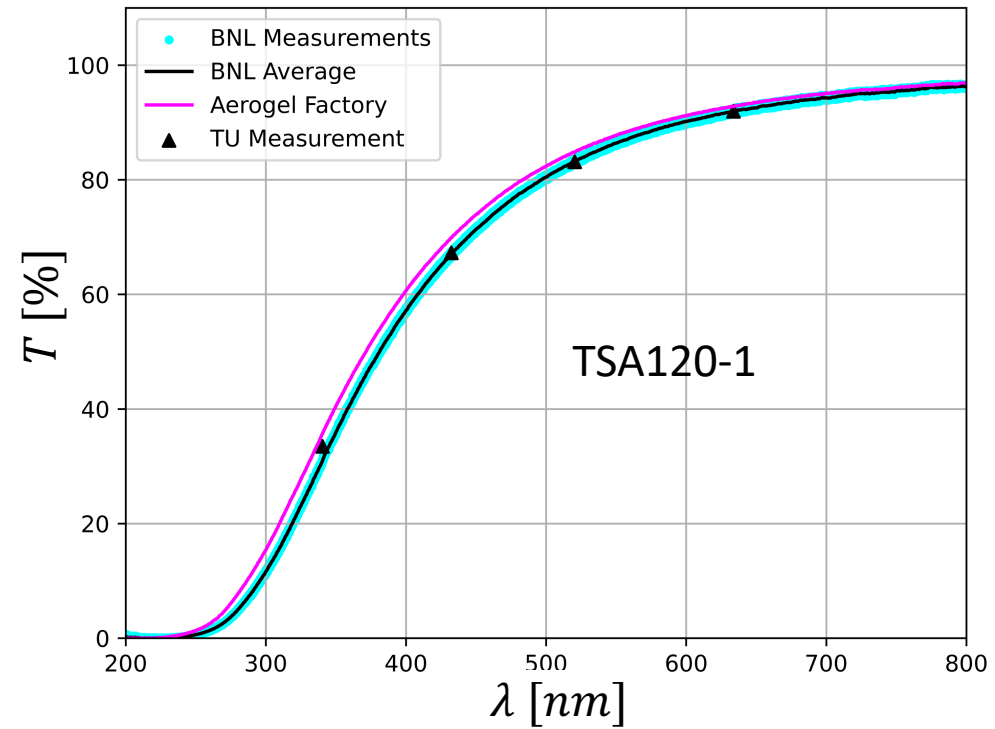
TU Measurement Results: Area Scan



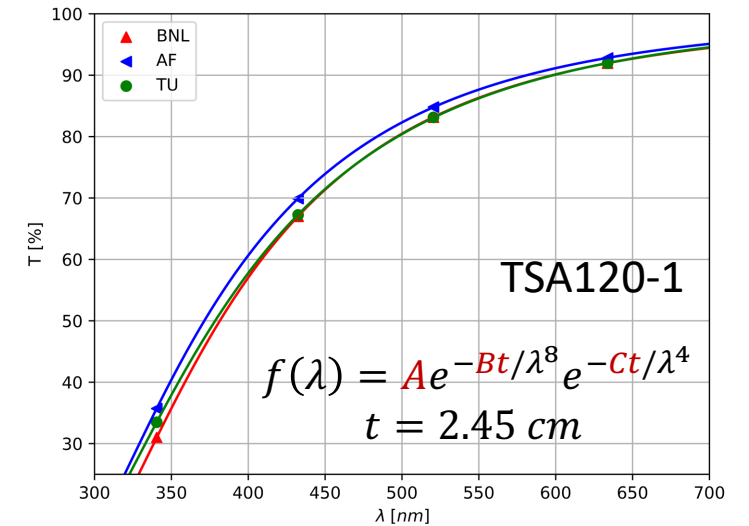
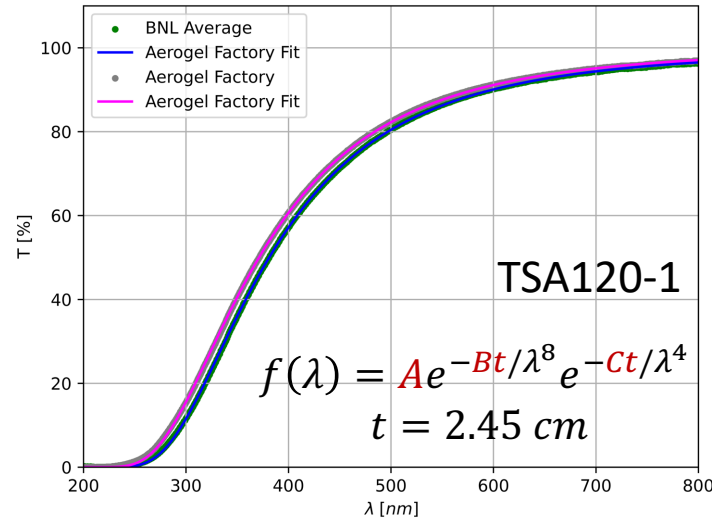
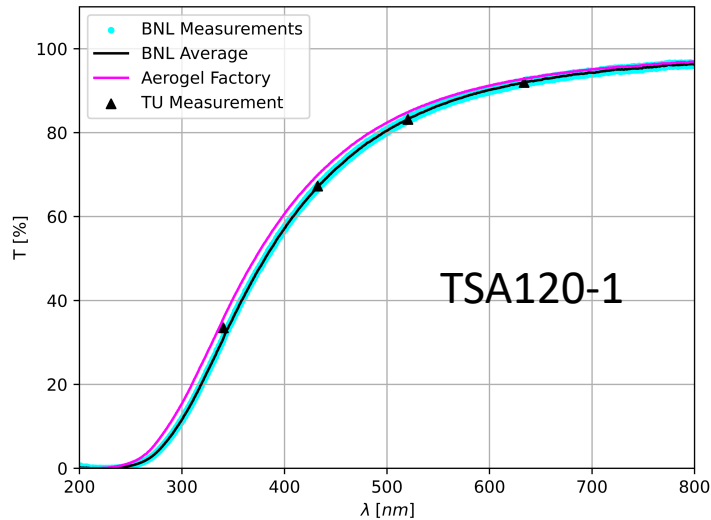
□ TSA120-1



TSA120-1



λ [nm]	TU T[%]	TU T[%] (2)	BNL T[%]	Aerogel Factory [%]
340.5	--	33.47	30.95	35.7
432.4	67.83	67.24	67.01	69.9
520.5	83.19	83.13	83.17	84.8
633.7	92.33	91.94	91.95	92.8

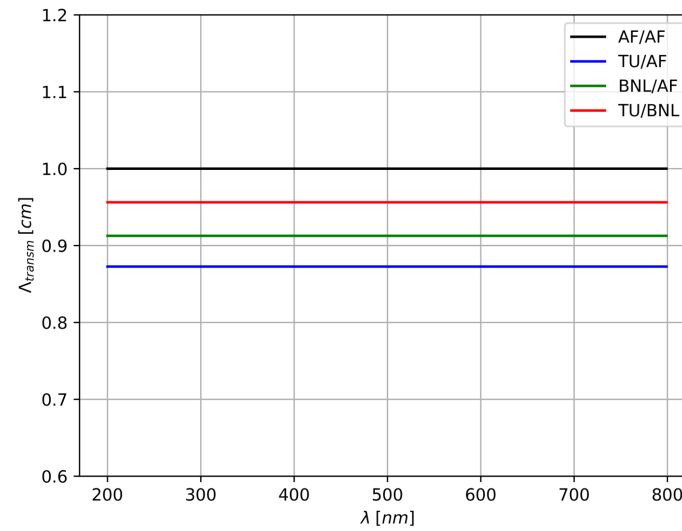
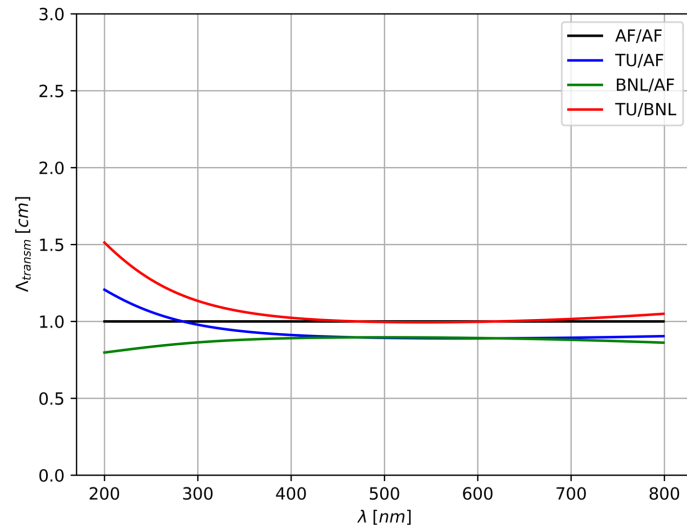
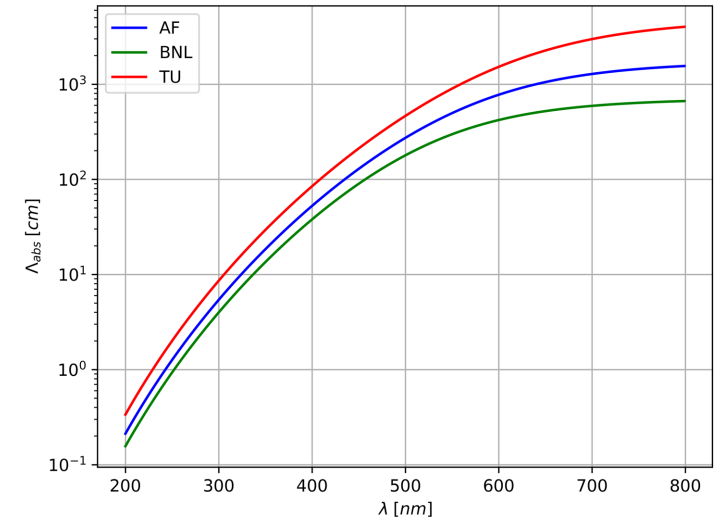
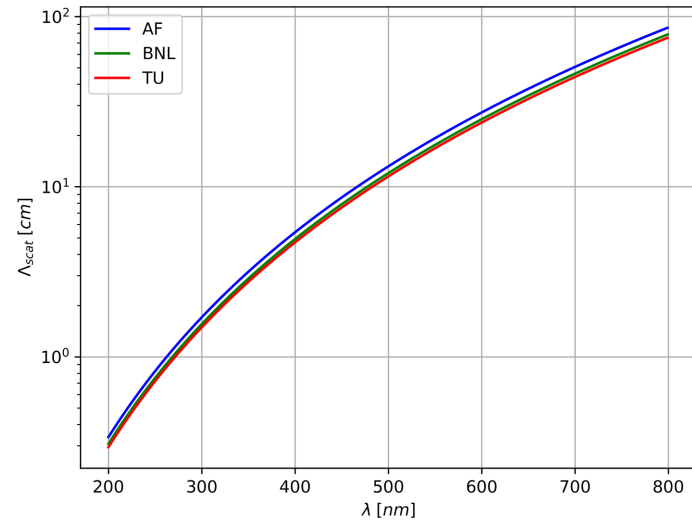
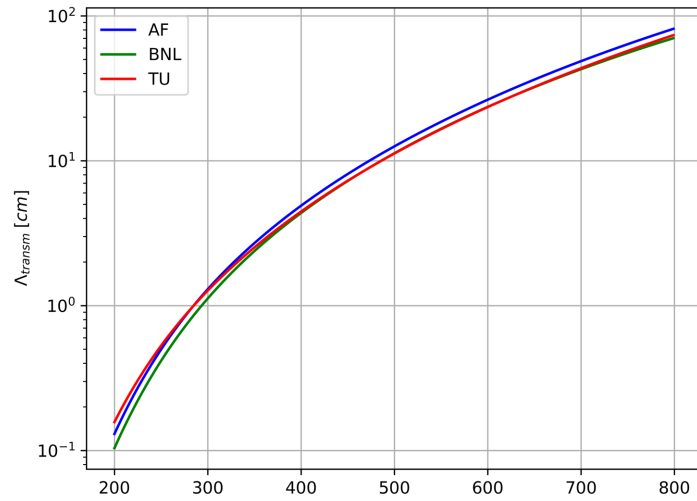


❑ Aerogel Factory measurements generally larger than BNL

	Fit [Full/Partial]	A	Bt [μm^8]	Ct [μm^4]
BNL	Full	99.577 ± 0.093	0.000	0.013
BLN	Partial	99.657 ± 1.625	0.000	0.013 ± 0.001
AF	Full	99.918 ± 0.063	0.000	0.012
AF	Partial	99.860 ± 1.597	0.000	0.012 ± 0.001
TU	--	99.950 ± 1.626	0.000	0.013 ± 0.001

Note: $Bt \sim 10^{-5}$

□ TSA120-1



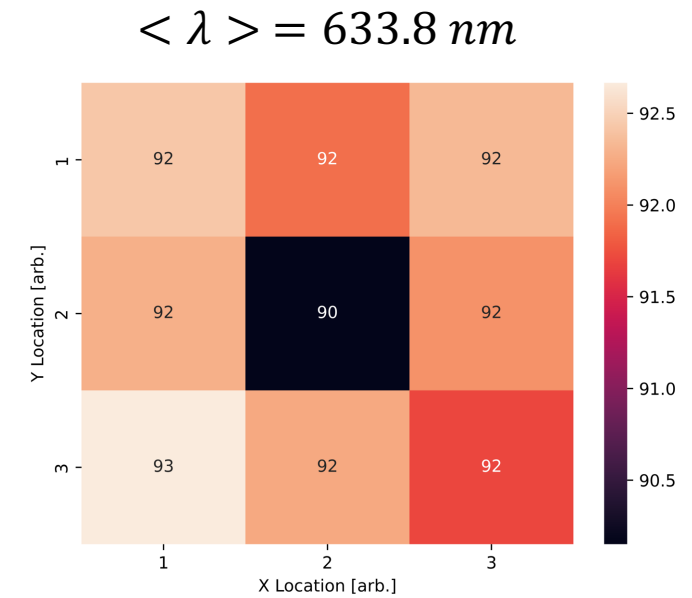
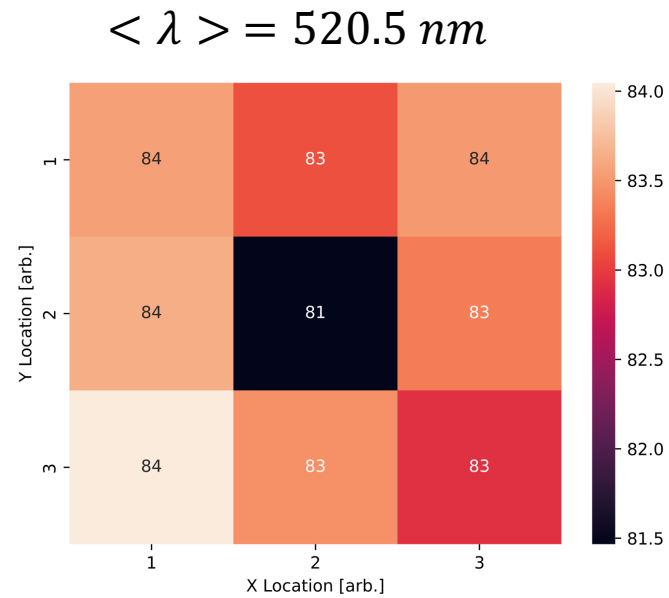
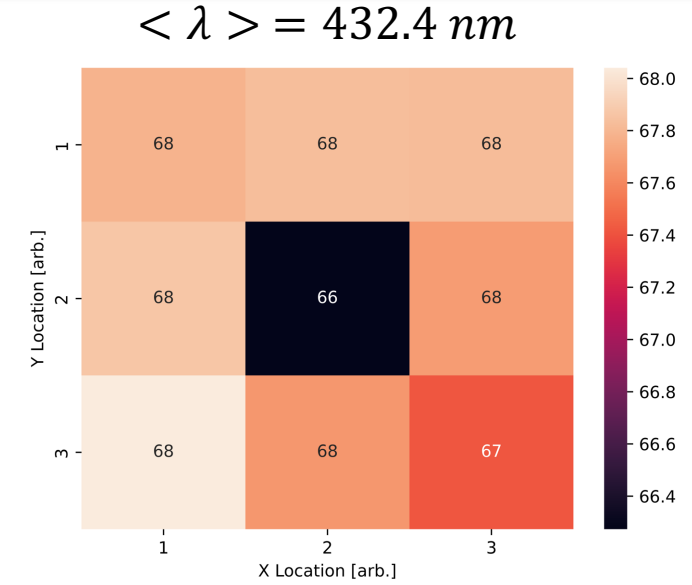
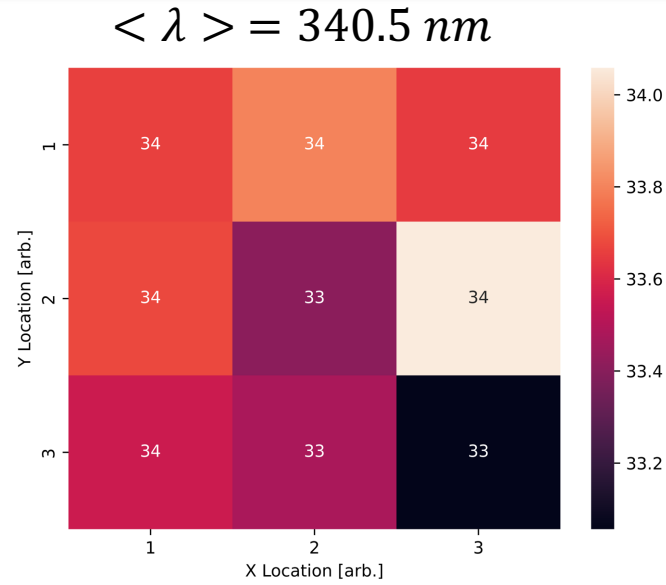
☐ TSA120-1

	t [cm]	A	B $\left[\frac{\mu m^8}{cm}\right]$	C $\left[\frac{\mu m^4}{cm}\right]$	T [%]	Λ_{Transm} [cm]	Λ_{Scat} [cm]
AF Spec	2.45	--	--	--	60.6	4.89	--
AF	2.45	0.9986	0.0000	0.0047	60.63	4.8965	5.3987
BNL	2.45	0.9966	0.0000	0.0052	57.02	4.3611	4.9271
TU	2.45	0.9995	0.0000	0.0054	57.76	4.4632	4.7115

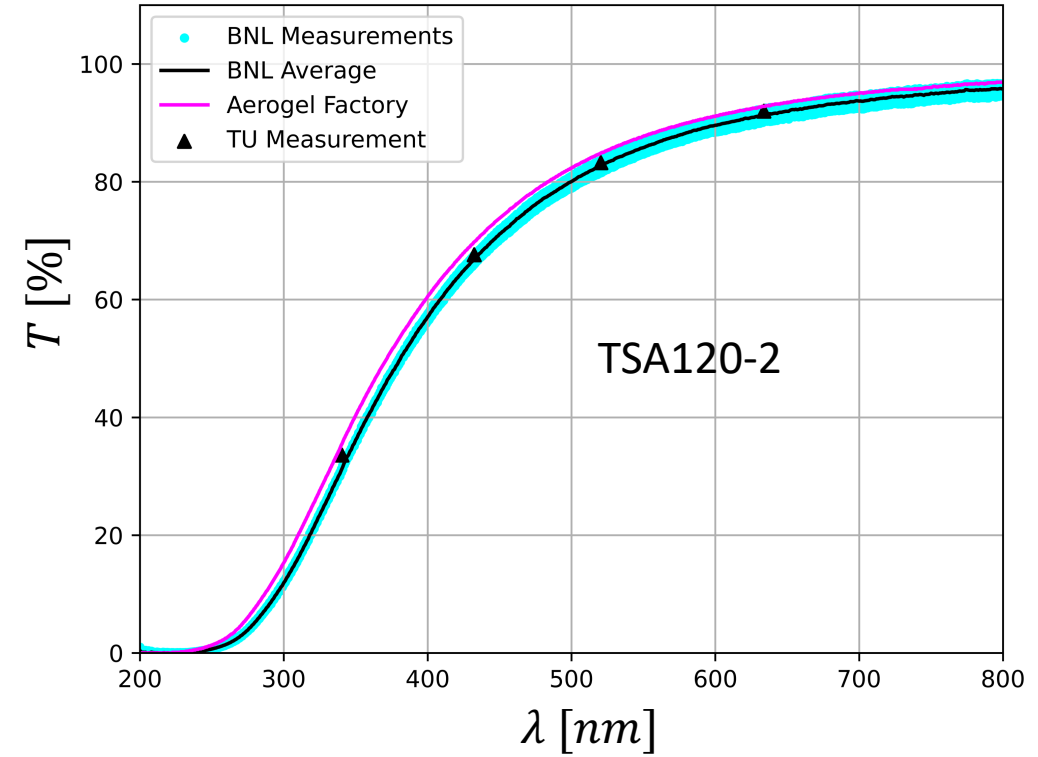
TU Measurement Results: Area Scan



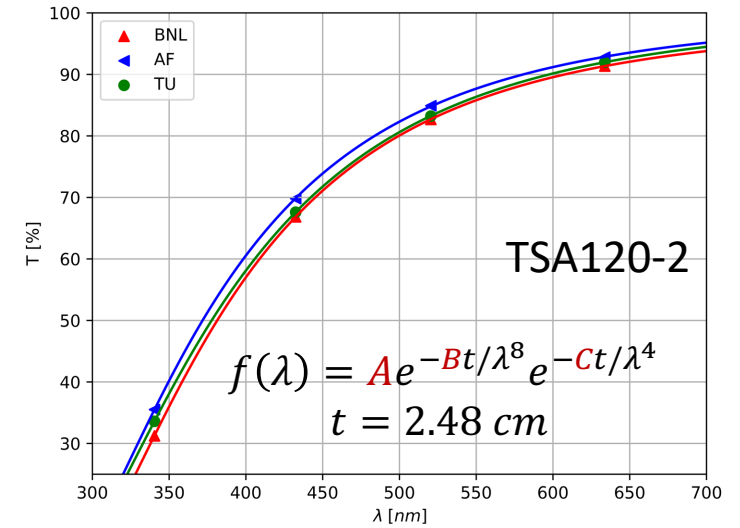
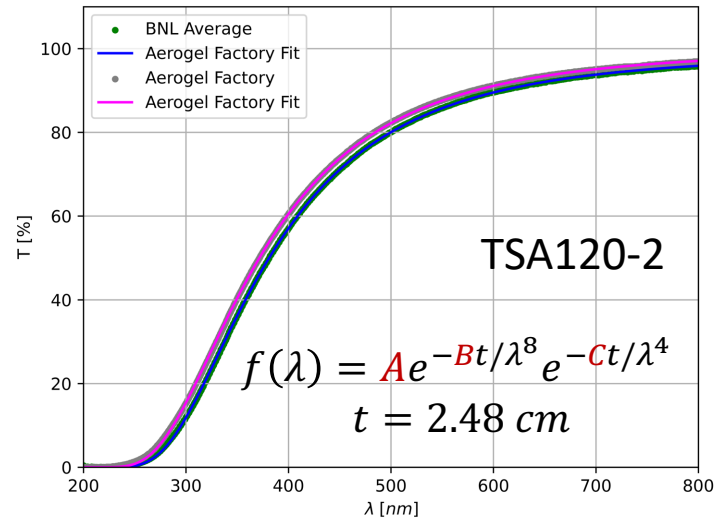
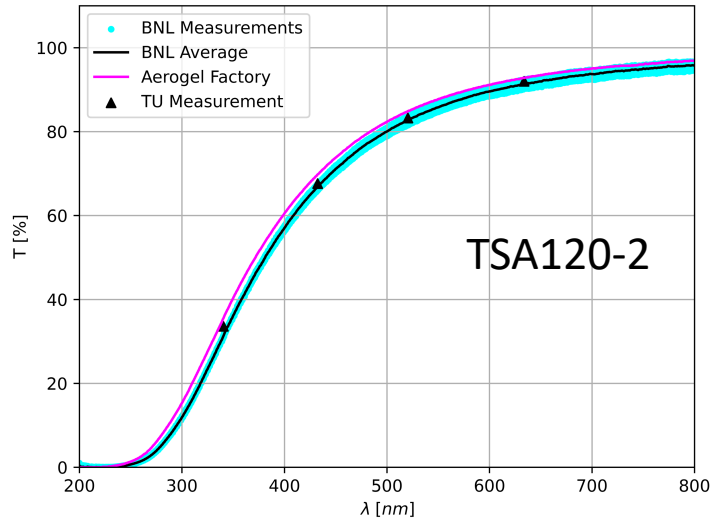
□ TSA120-2



☐ TSA120-2



λ [nm]	TU T[%]	TU T[%] (2)	BNL T[%]	Aerogel Factory [%]
340.5	--	33.59	31.24	35.5
432.4	67.17	67.60	66.84	69.8
520.5	82.91	83.23	82.68	84.9
633.7	91.71	91.98	91.35	92.8

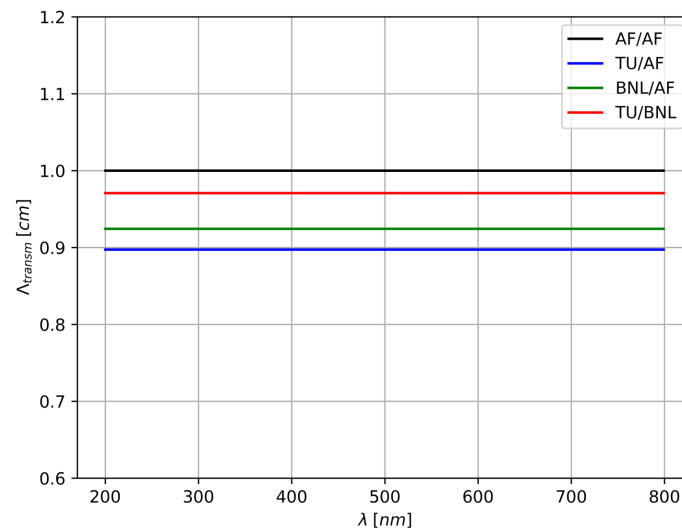
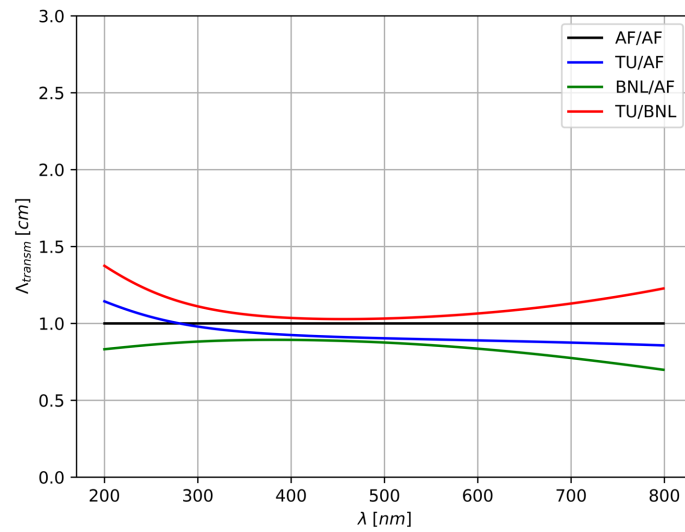
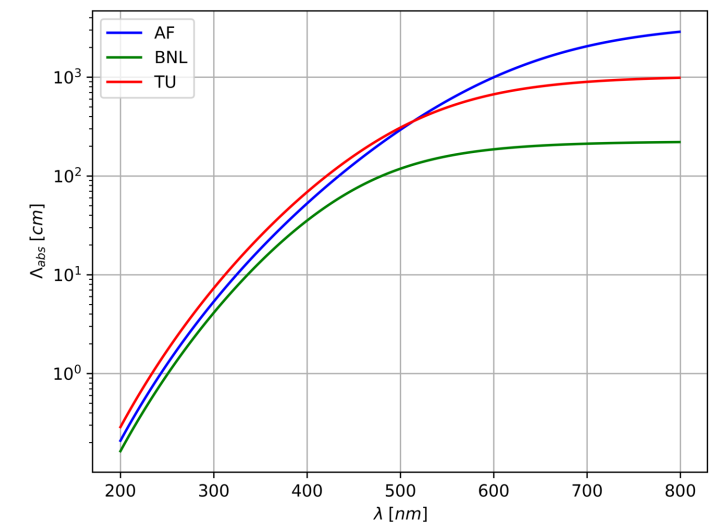
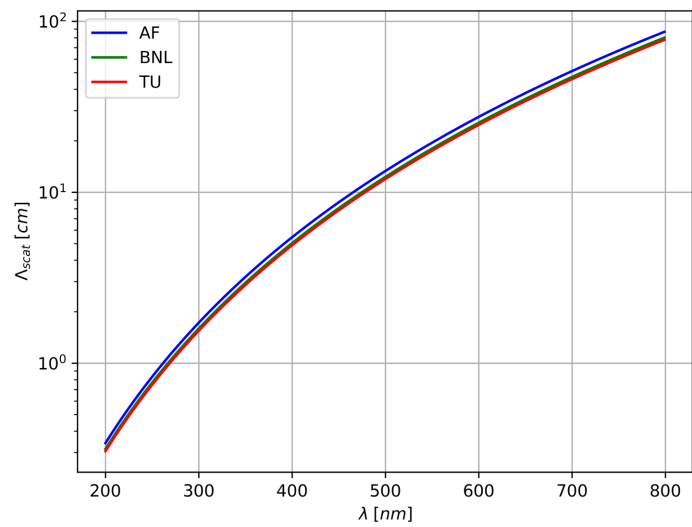
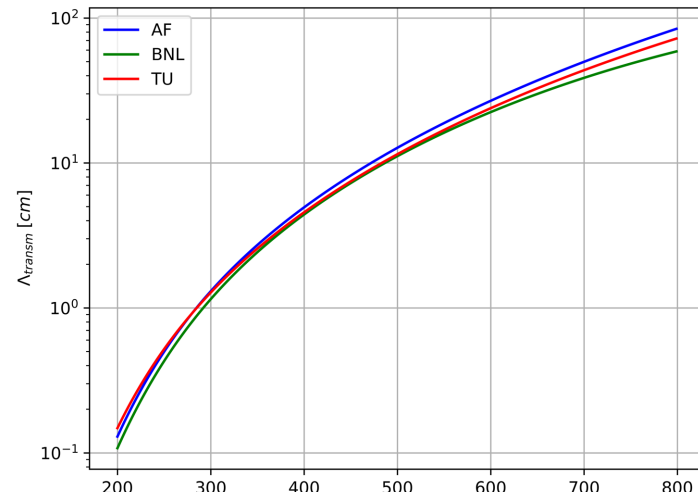


❑ Aerogel Factory measurements generally larger than BNL

	Fit [Full/Partial]	A	Bt [μm^8]	Ct [μm^4]
BNL	Full	98.926 ± 0.092	0.000	0.013
BLN	Partial	98.905 ± 1.622	0.000	0.013 ± 0.001
AF	Full	99.916 ± 0.063	0.000	0.012
AF	Partial	99.932 ± 1.598	0.000	0.012 ± 0.001
TU	--	99.762 ± 1.628	0.000	0.012 ± 0.001

Note: $Bt \sim 10^{-5}$

□ TSA120-2



☐ TSA120-2

	t [cm]	A	B $\left[\frac{\mu m^8}{cm}\right]$	C $\left[\frac{\mu m^4}{cm}\right]$	T [%]	Λ_{Transm} [cm]	Λ_{Scat} [cm]
AF Spec	2.48	--	--	--	60.5	4.93	--
AF	2.48	0.9993	0.0000	0.0047	60.53	4.9403	5.4507
BNL	2.48	0.9890	0.0000	0.0051	56.99	4.4107	5.0389
TU	2.48	0.9976	0.0000	0.0052	58.09	4.5664	4.8913

