ePIC pfRICH Aerogel QA Progress Report

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Aerogel Factory Tiles

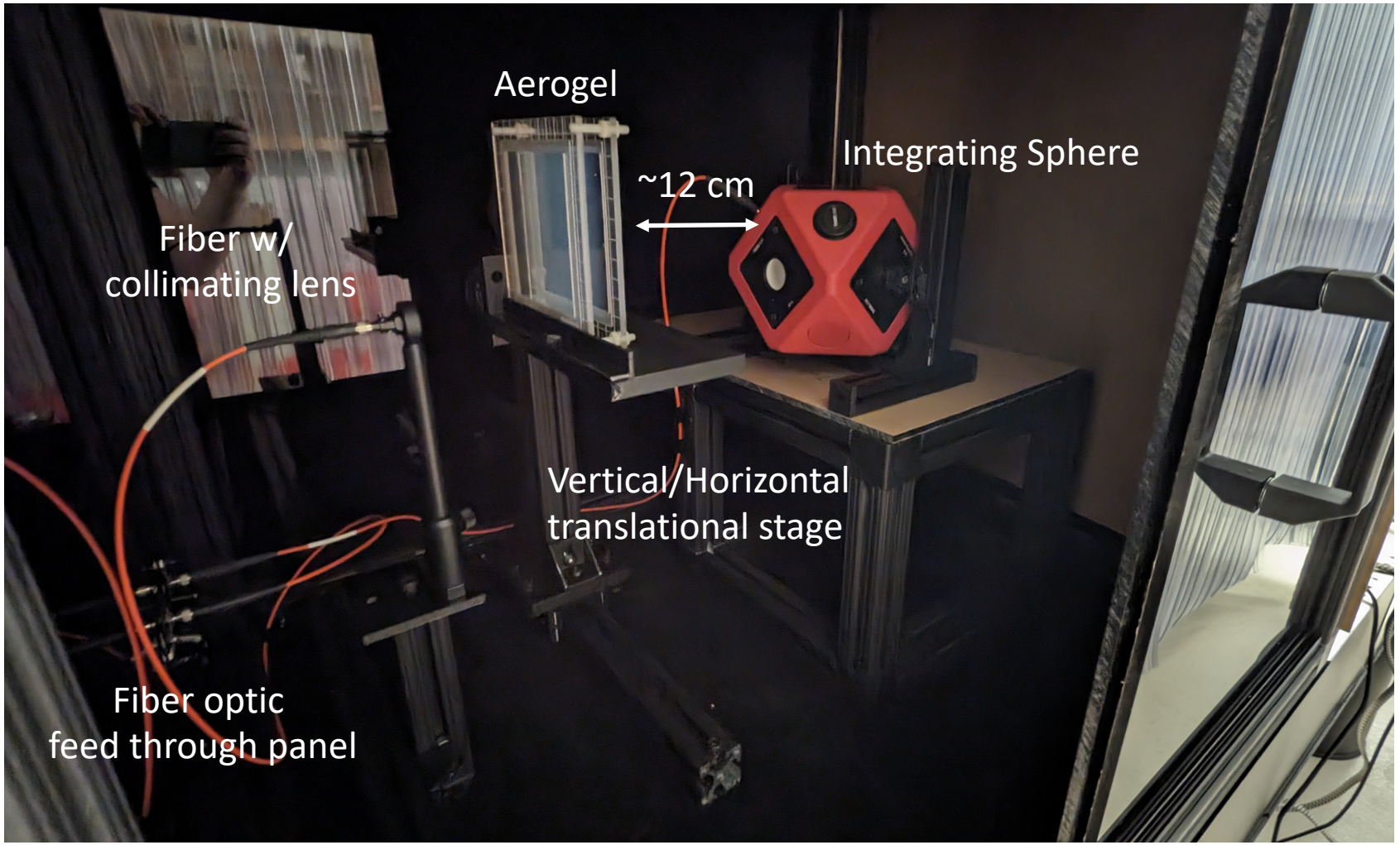
- Current aerogel tiles from Aerogel Factory

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

Tile	TU Measured
TSA88-1	Yes
TSA120-1	Yes
TSA120-2	Yes
TSA114-3	Yes

Transmittance Setup

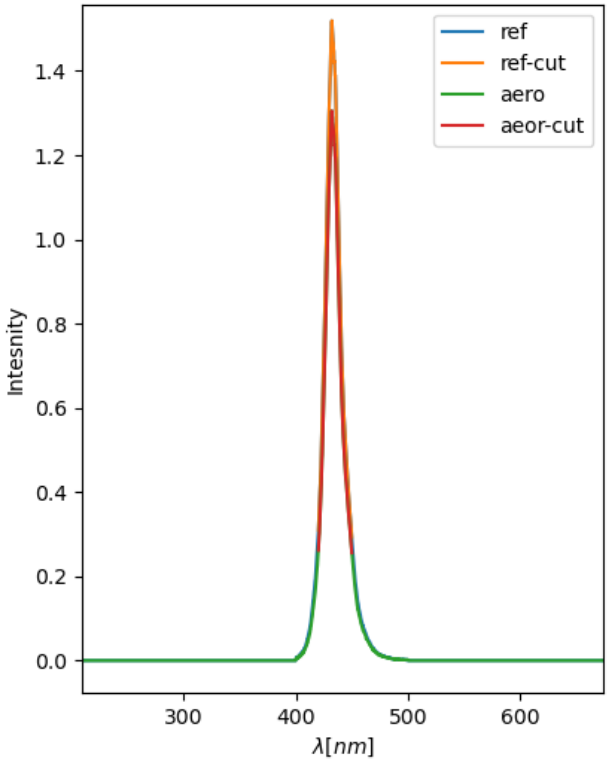
- Beam spot at Aerogel:
  - 3mm
- Beam spot at integrating sphere:
  - 10mm
- Distance from aerogel to integrating sphere
  - 12 cm

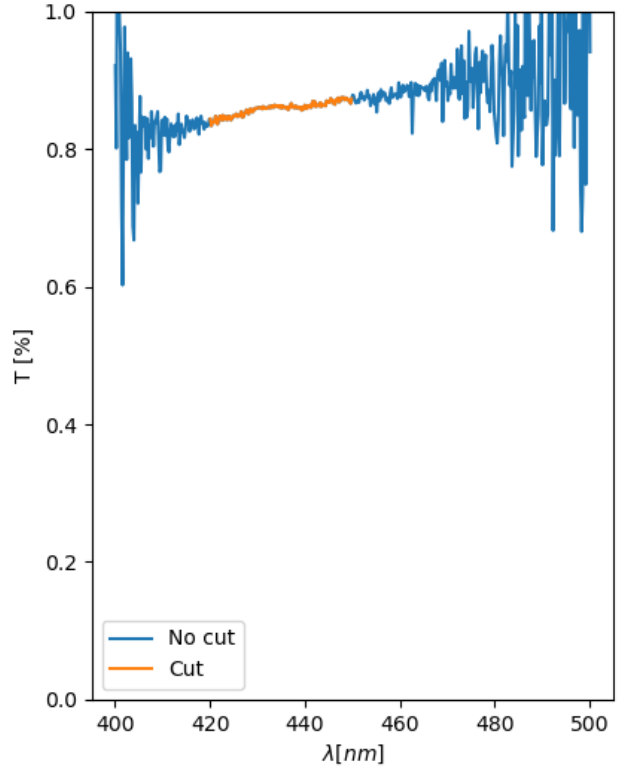


Transmittance Measurement Procedure

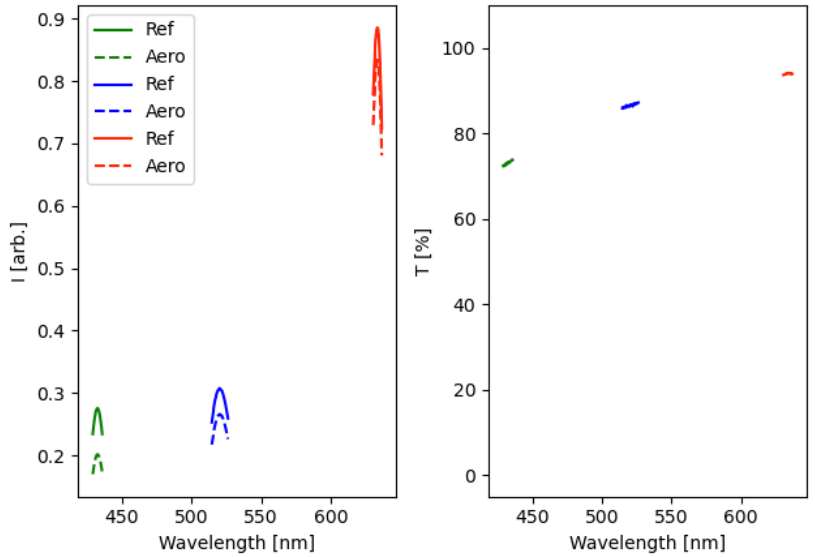
- Currently using 3 fixed wavelength LEDs are used to measure the transmittance $(430nm, 530nm, 625nm)$
- LED Measurement point
  - Cut window to remove tails where intensity is too low
  - Window sensitivity less than ~0.2%

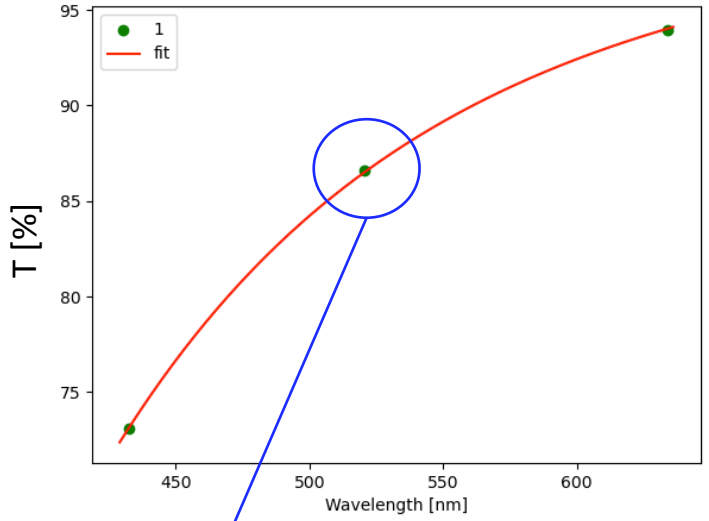
Example





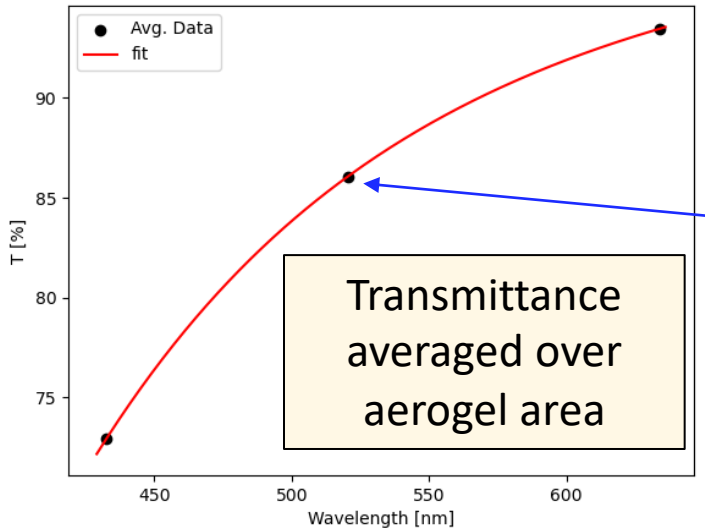
Transmittance Measurement Systematic Study



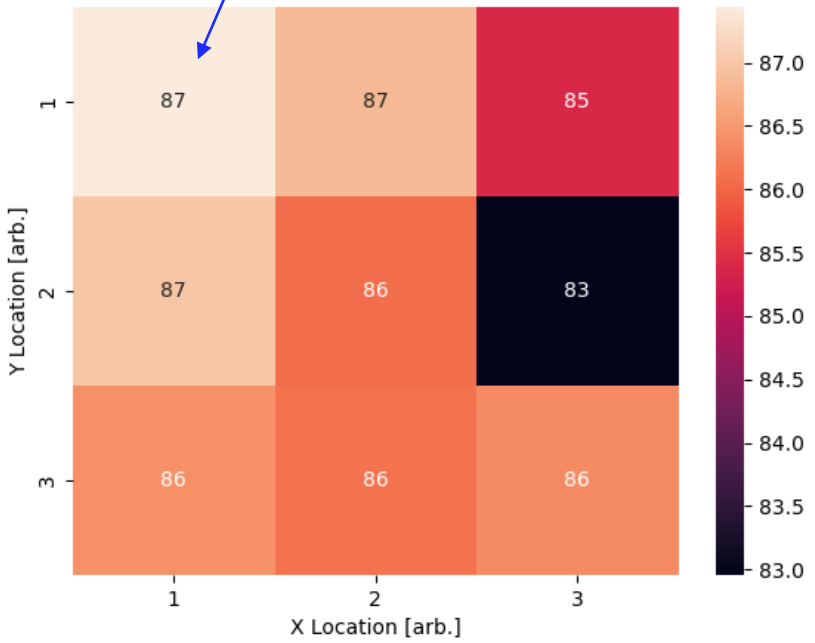


Transmittance for single aerogel location

$< \lambda > = 520\ nm$



Transmittance averaged over aerogel area

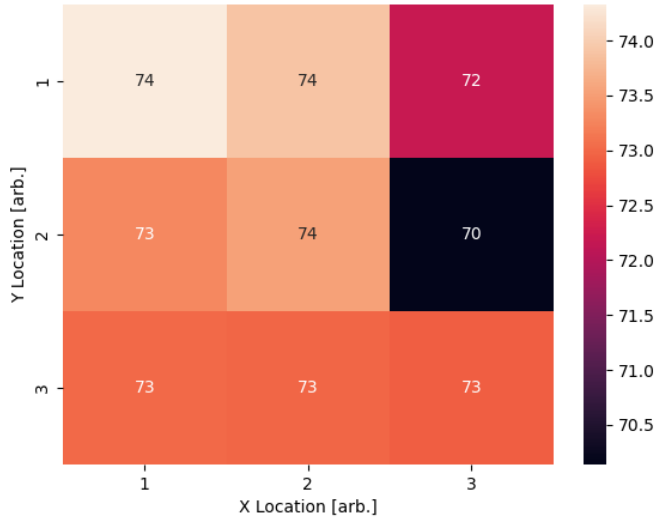


Each LED wavelength has its own aerogel area map

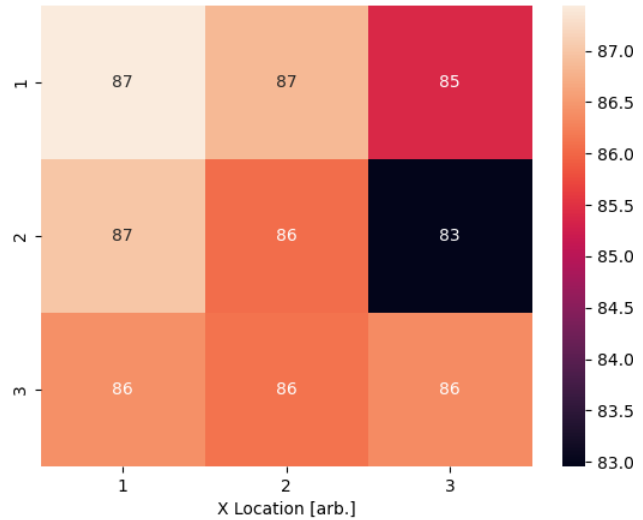
TU Transmittance Results

- TSA88-1

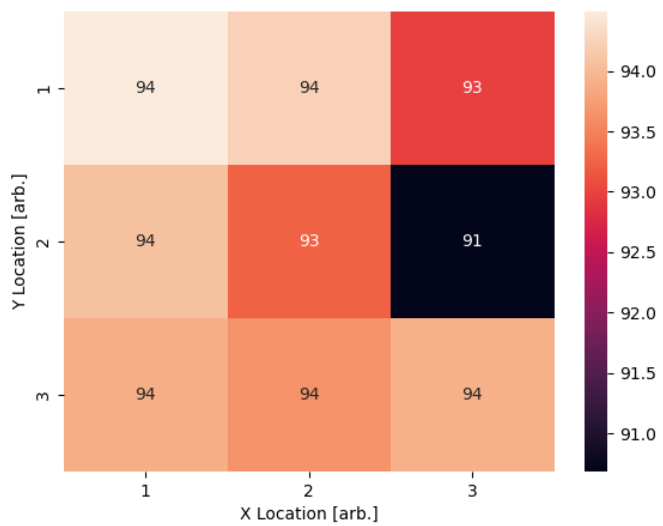
$< \lambda > = 432\ nm$



$< \lambda > = 520\ nm$

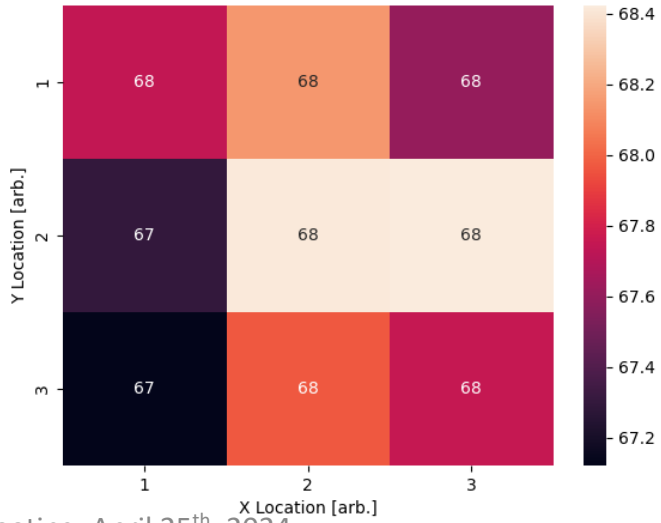


$< \lambda > = 634\ nm$

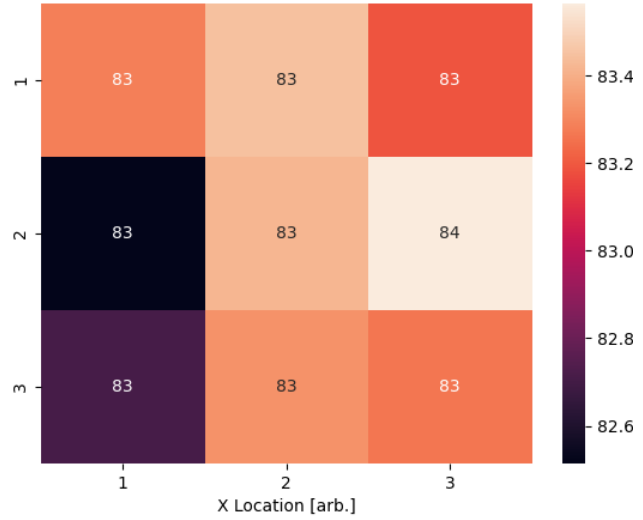


- TSA120-1

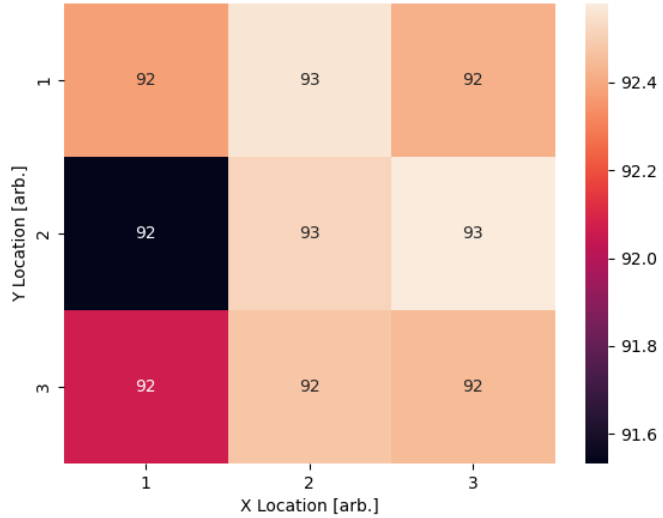
$< \lambda > = 432\ nm$



$< \lambda > = 520\ nm$



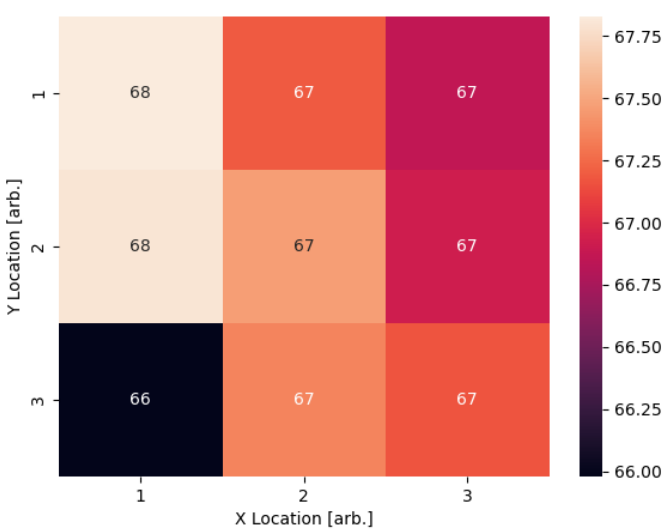
$< \lambda > = 634\ nm$



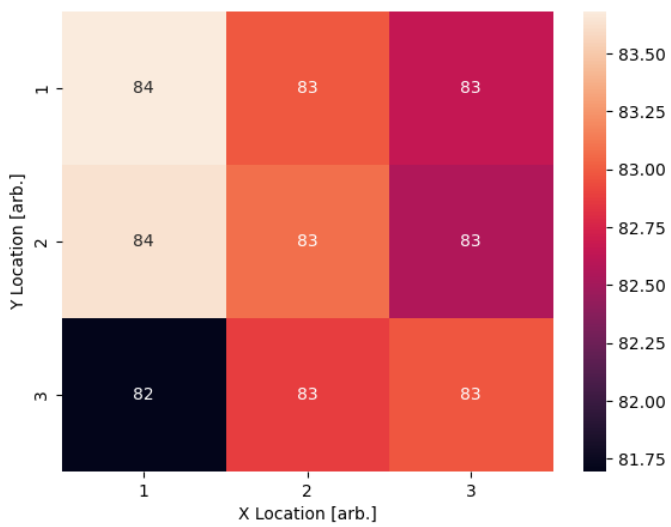
TU Transmittance Results

- TSA120-2

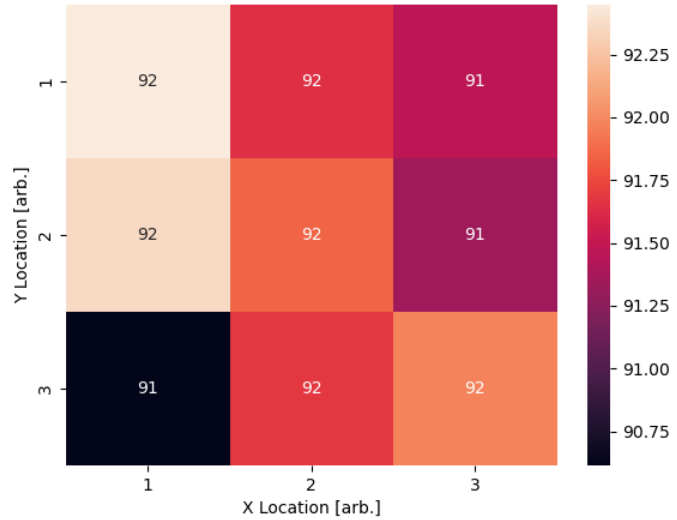
$< \lambda > = 432\ nm$



$< \lambda > = 520\ nm$

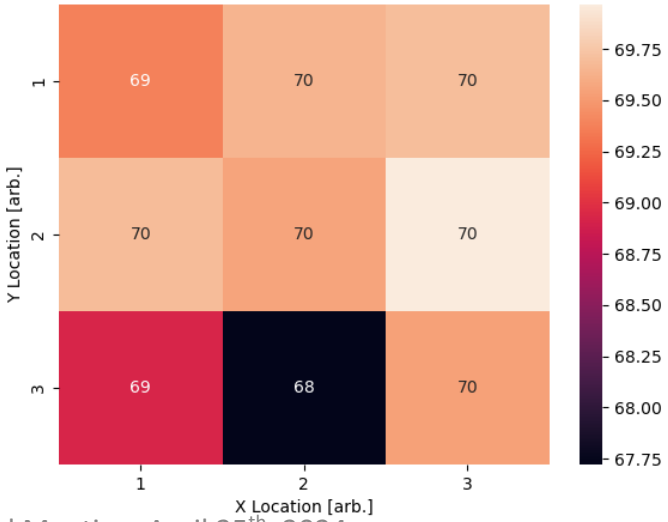


$< \lambda > = 634\ nm$

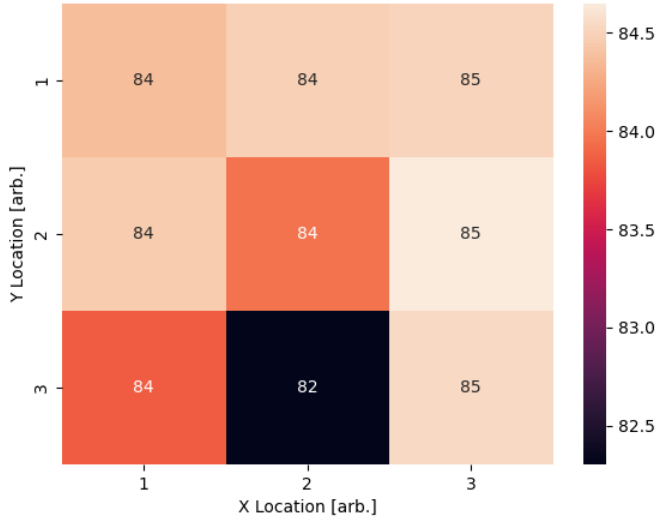


- TSA114-3

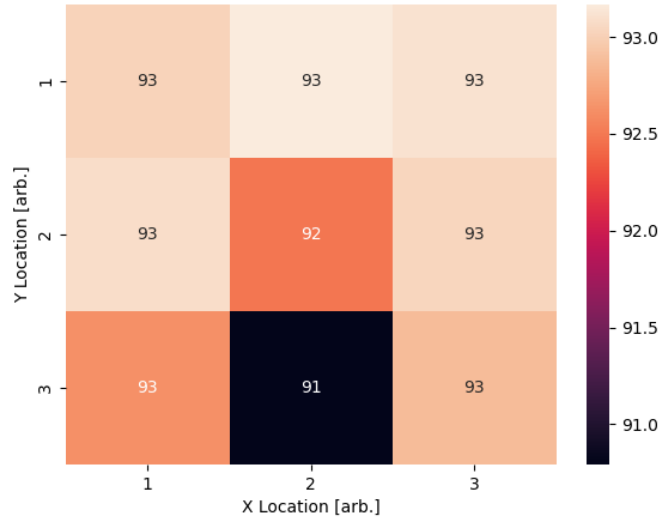
$< \lambda > = 432\ nm$



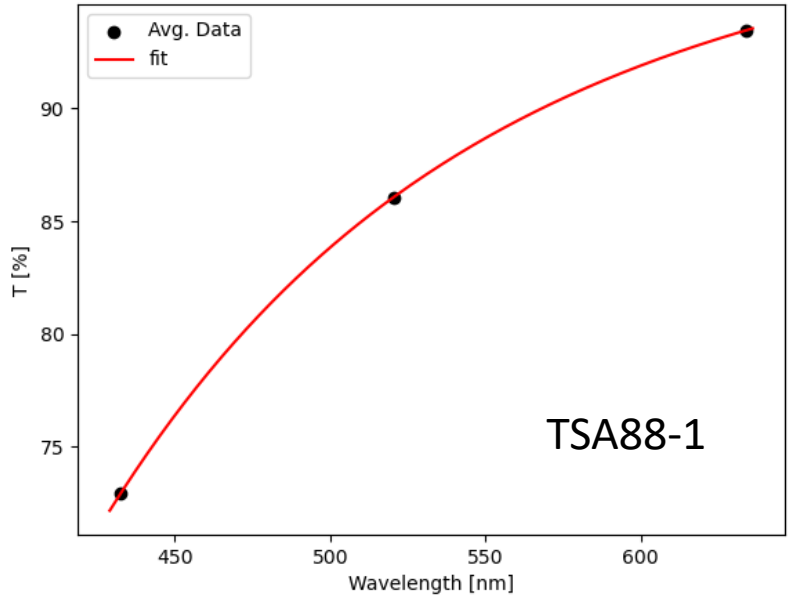
$< \lambda > = 520\ nm$

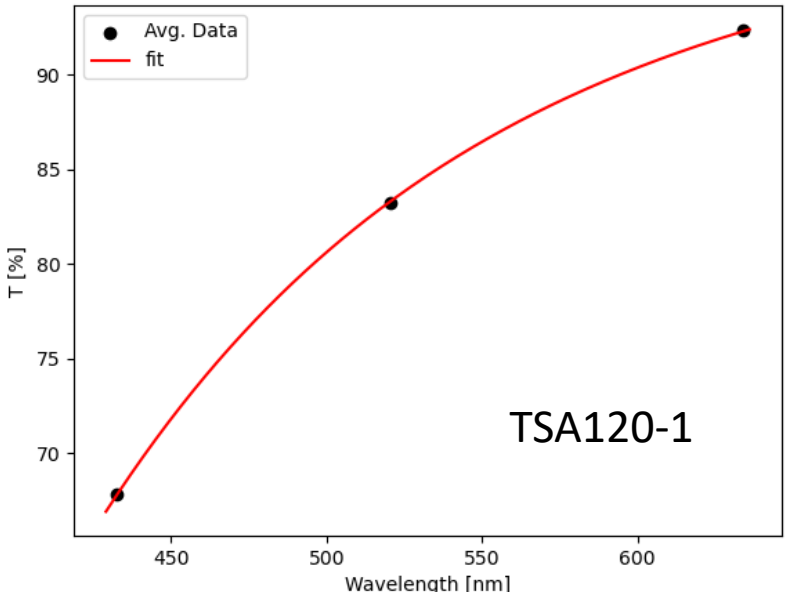


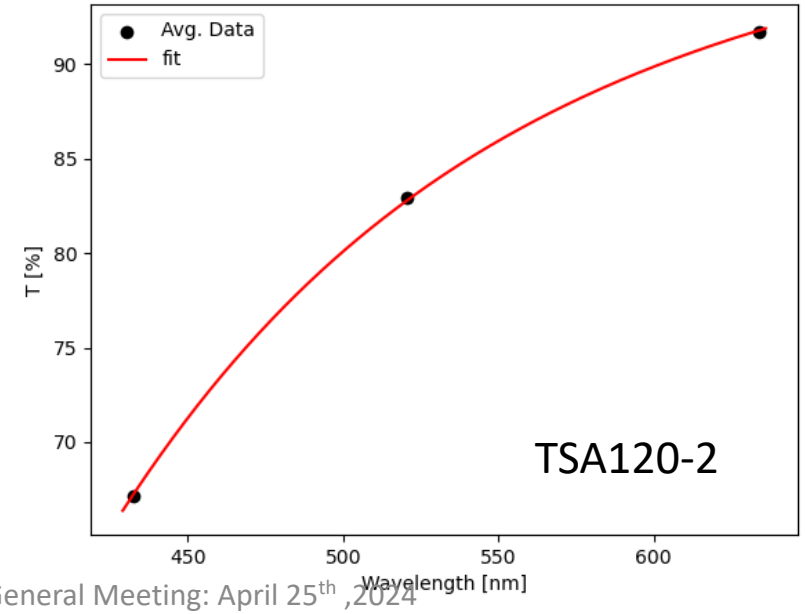
$< \lambda > = 634\ nm$

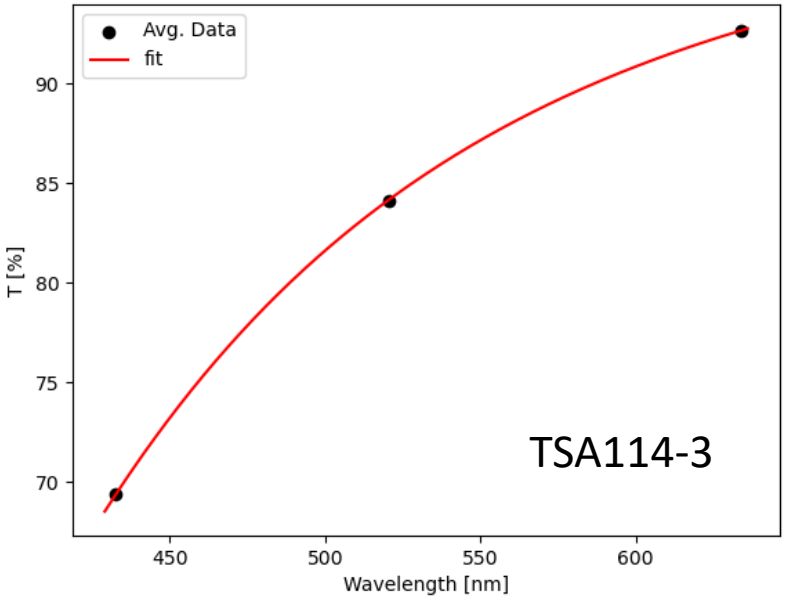


TU Transmittance Results

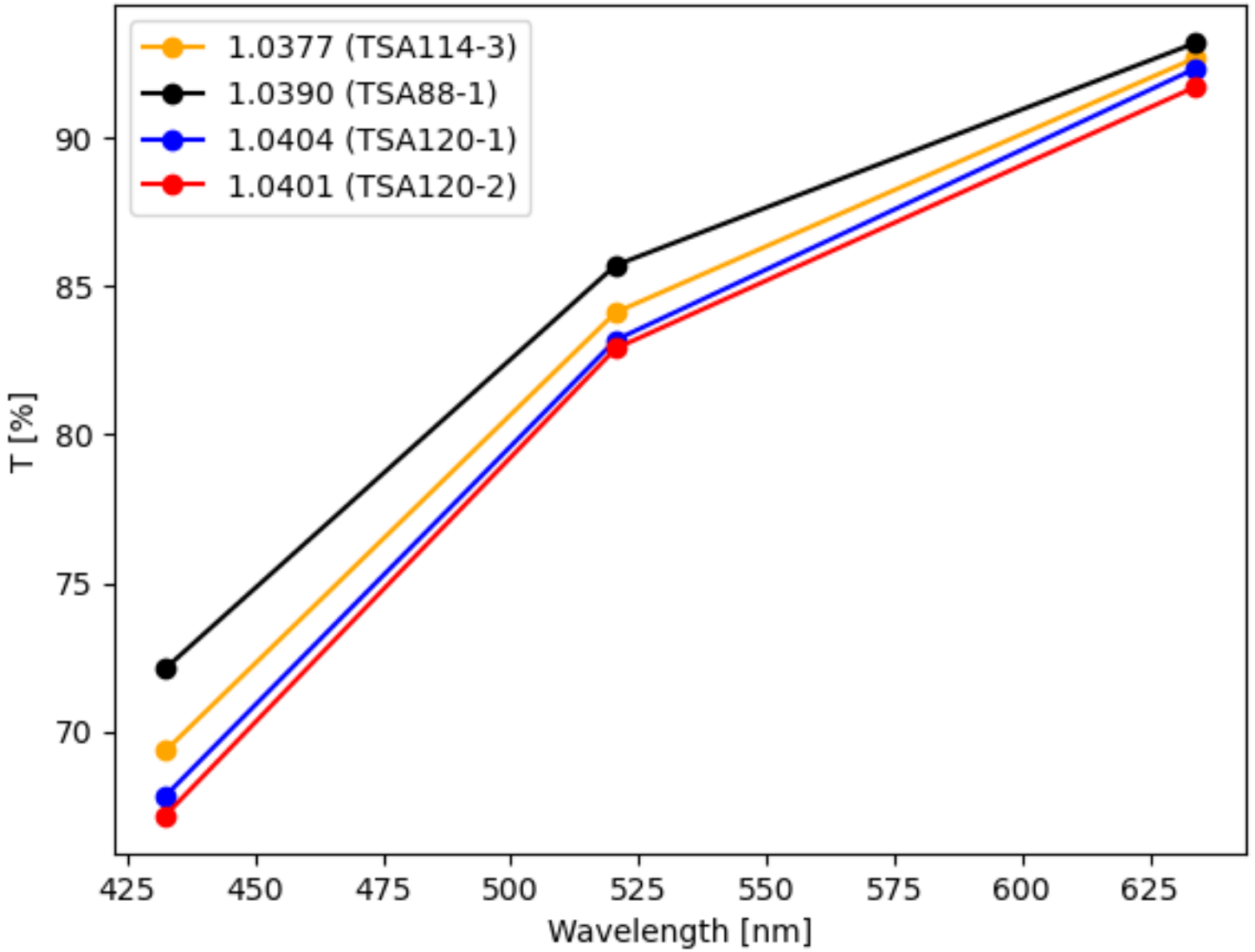






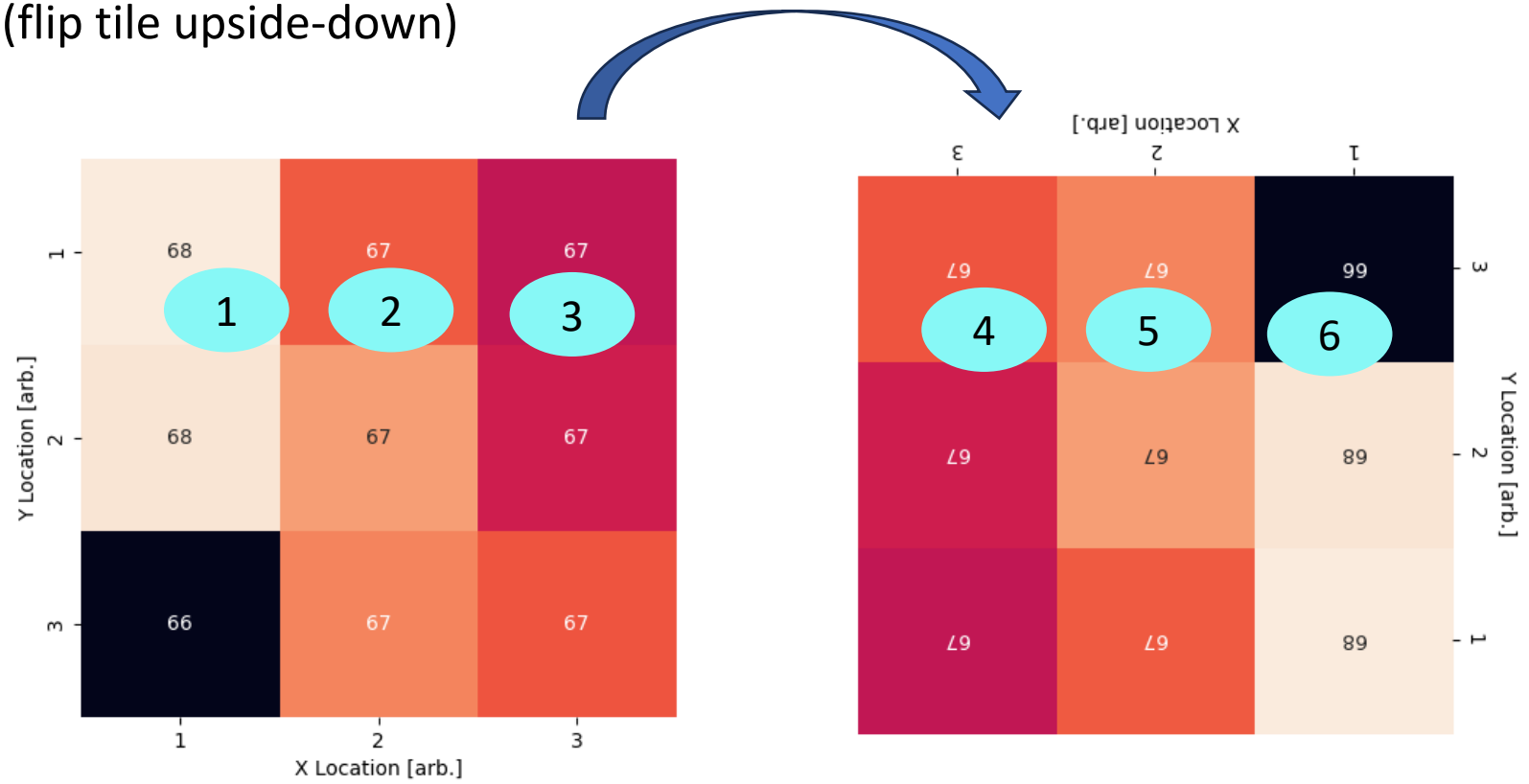


TU Transmittance Results



BNL Transmittance

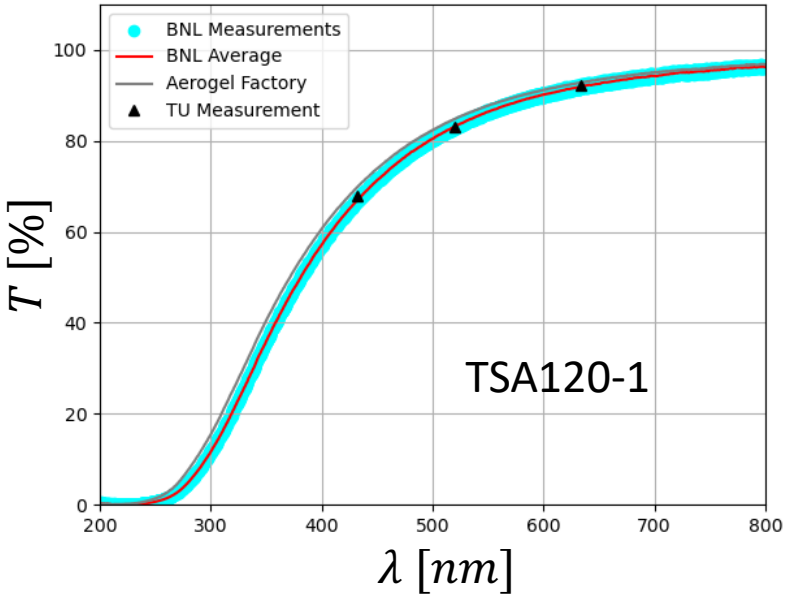
- Not able to scan entire tile at BNL –> compartment too small
- 6 measurement spots per tile
  - 3 near top
  - 3 near bottom (flip tile upside-down)

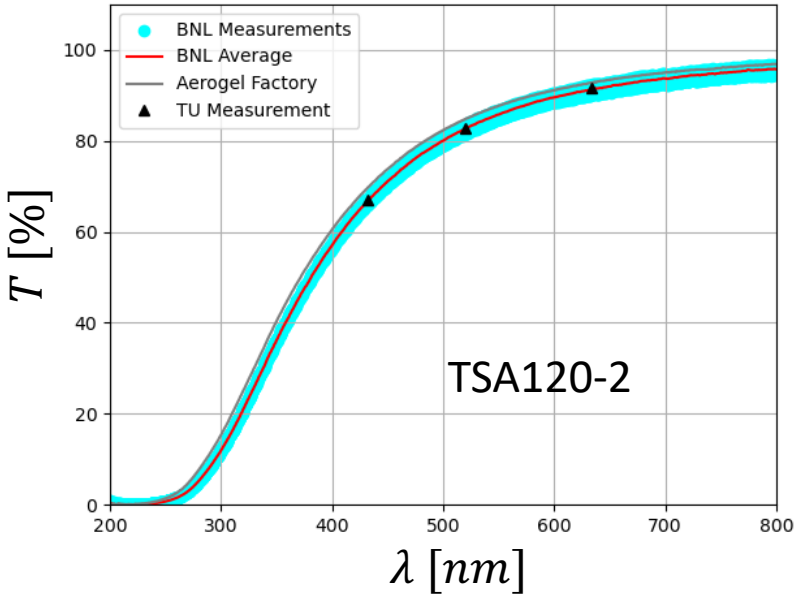


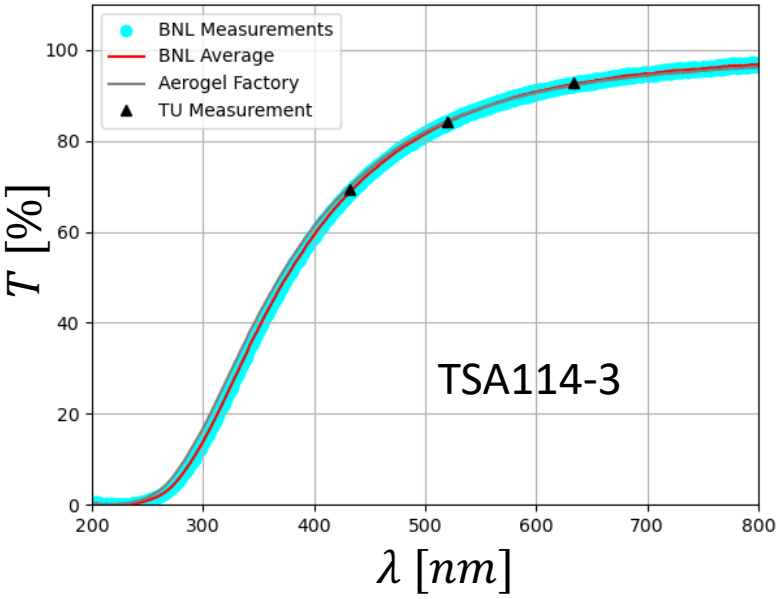
Example: TU tile scan

Transmittance Comparisons

- Good agreement seen between TU and BNL Transmittance values for all three tiles

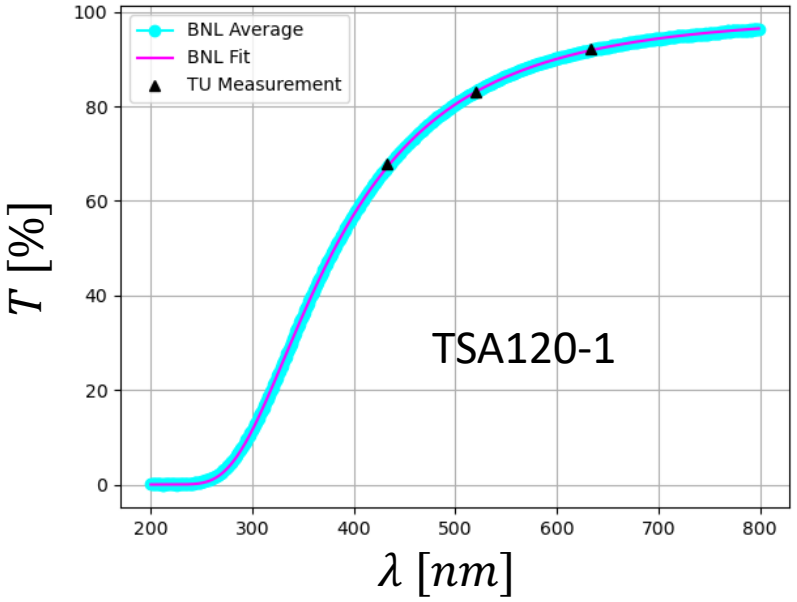


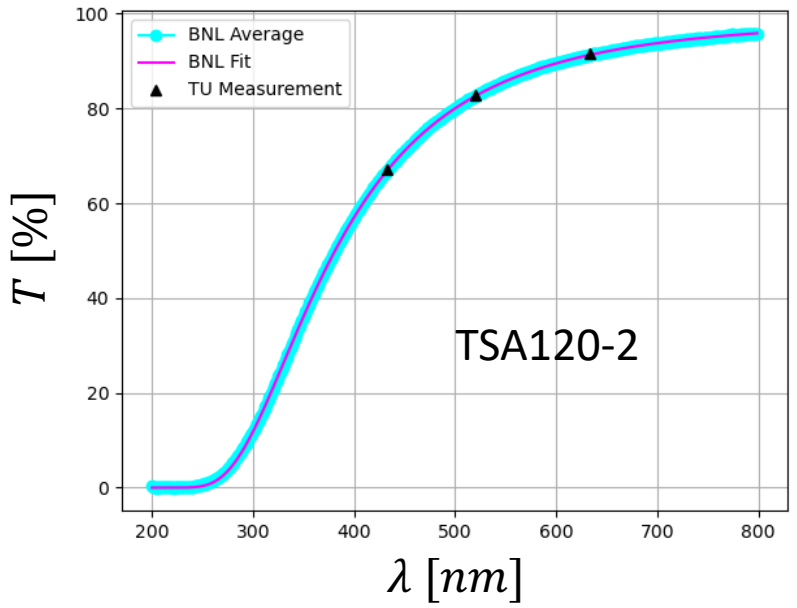


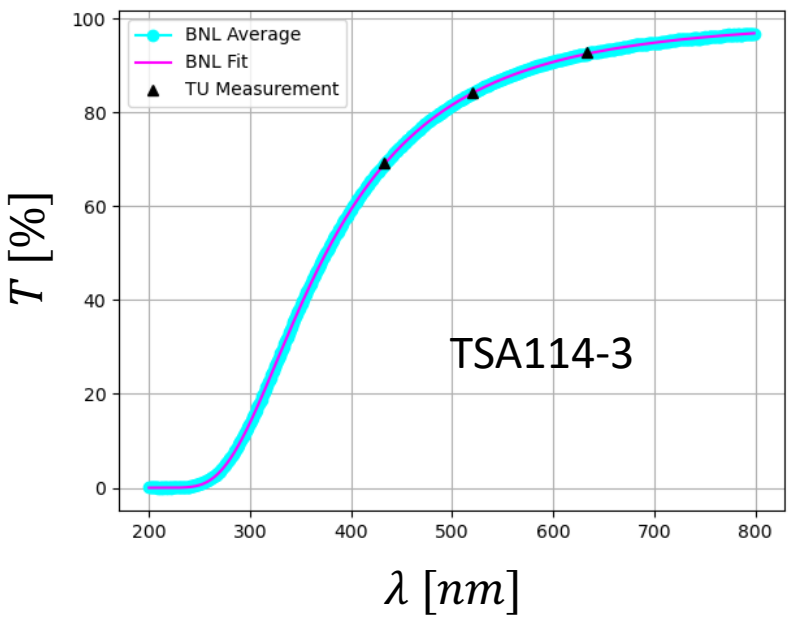


Transmittance Comparisons: Average

- Good agreement seen between TU and BNL Transmittance values for all three tiles







TU Transmittance Comparisons: BNL

TSA120-1

$\lambda\ [nm]$	TU T[%]	BNL T[%]	(TU-BNL)/BNL [%]
432.4	67.83	67.01	1.22
520.5	83.19	83.17	0.02
633.7	92.33	91.95	0.41

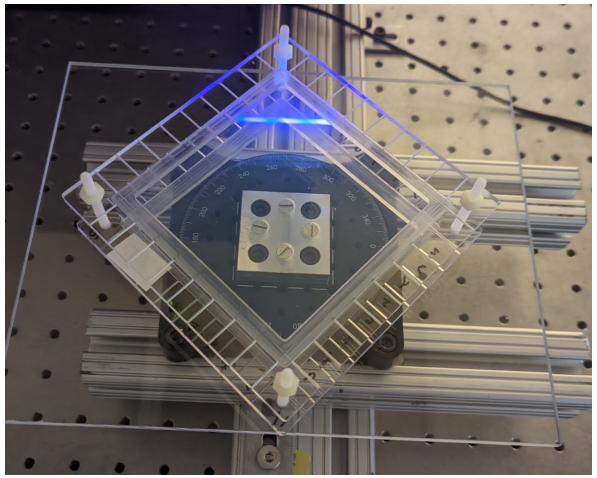
TSA120-2

$\lambda\ [nm]$	TU T[%]	BNL T[%]	(TU-BNL)/BNL [%]
432.4	67.17	66.84	0.49
520.5	82.91	82.68	0.28
633.7	91.71	91.35	0.39

TSA114-3

$\lambda\ [nm]$	TU T[%]	BNL T[%]	(TU-BNL)/BNL [%]
432.4	69.35	68.79	0.81
520.5	84.12	84.08	0.05
633.7	92.69	92.44	0.27

TU Index of Refraction Comparison

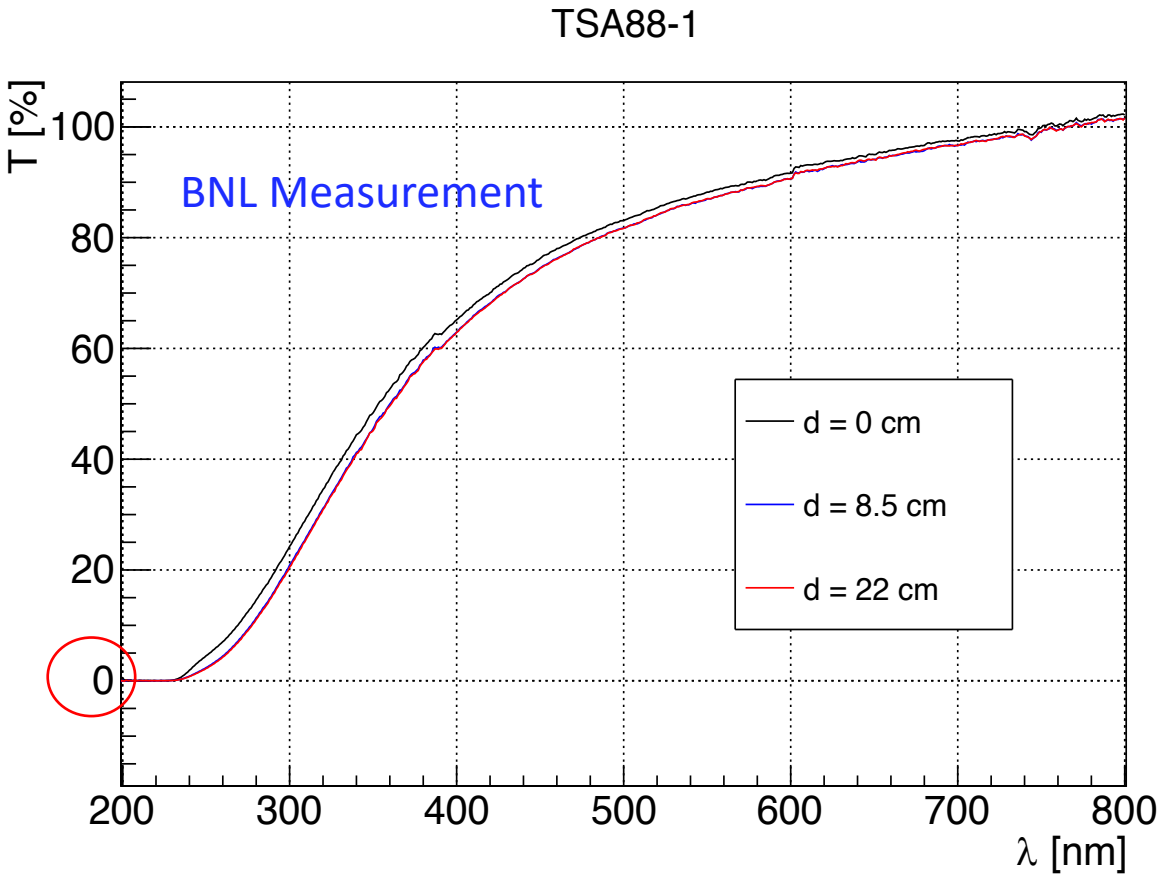


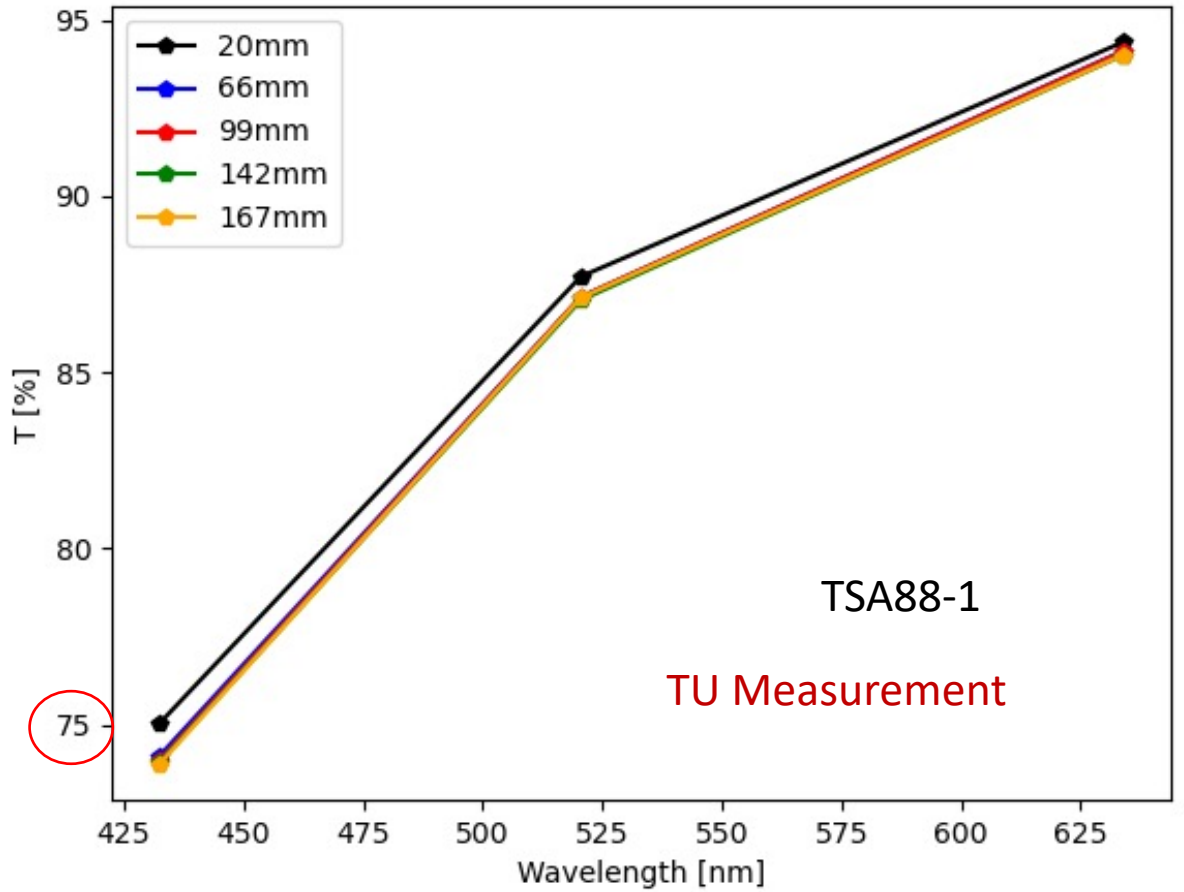
Comparison of TU (average of four corners) and Aerogel Factory index of refraction measurements

Tile	TU $(\lambda = 403\ nm)$	AF $(\lambda = 405\ nm)$	(TU-AF)/AF [%]
TSA88-1	1.0398 +/- 0.0007	1.0390	0.077
TSA120-1	1.0413 +/- 0.0011	1.0404	0.087
TSA120-2	1.0401 +/- 0.0025	1.0401	0.000
TSA114-3	1.0383 +/- 0.0026	1.0377	0.062

Transmittance vs. Distance

- Distance is the distance form light exiting the aerogel to the input port of the integrating sphere





Summary

- Transmittance Setup
  - TU measurements of aerogel tiles consistent with those measured at BNL
    - Measurements validated!
  - Add additional LED (340 nm) to increase number of measurement points to 4
    - Investigate fit to TU measurements to determine QA parameters
- Investigate new method of assessing index of refraction
  - Aerogel tiles will be cut with water jet → non-optical quality edges
- Reassess frames used for aerogel handling
  - Noticed some damage around tile edges due to frames