Aerogel Transmittance (Analysis and Graphs)

PerkinElmer Lambda 750

UV/Vis/Nir Spectrometer

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Transmittance

- Transmittance: how much light of a certain wavelength can travel through an object
- For our test the wavelengths ranged from 900 to 200 nm, covering the spectrum between UV and infrared light.

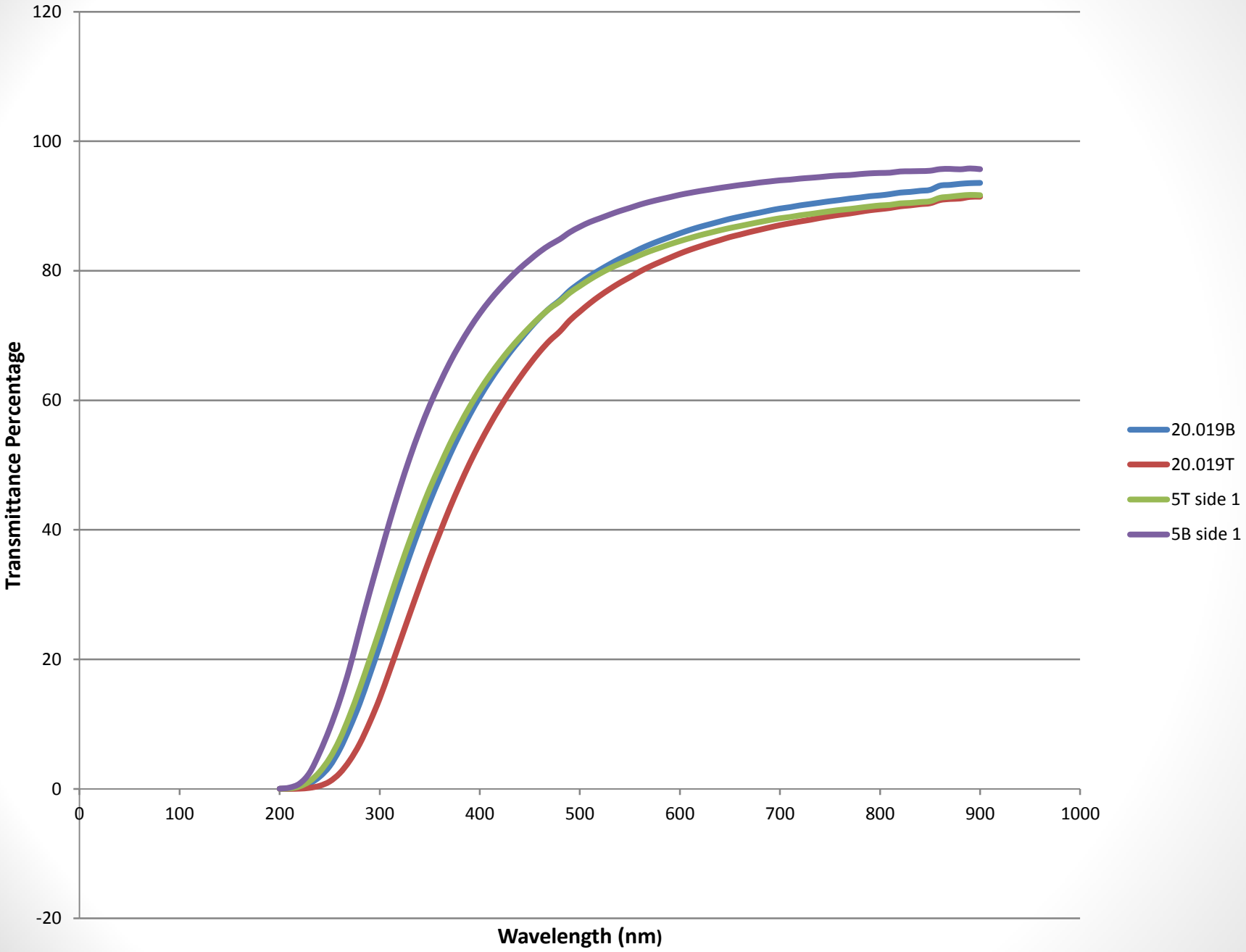
Pre-Testing Assumptions

- SP-30 tiles are more dense than SP-20 tiles, therefore they will have a lower transmittance.
- Within the SP-30's and SP-20's the one with the higher refractive index will have a lower transmittance.

Test #1 (SP-30 5 and 20.019)

- A comparison of all four tiles showed that the SP-30 tiles had a higher transmittance, opposite to the result that we were expecting. We found that this is because the SP-20 tiles are considerably more cloudy than the SP-30 tiles.
- The SP-30 tiles that we tested had one tile (5T) that was considerably cloudier than the other one, but had a lower refractive index. Its cloudiness outweighed its smaller density and it therefore had a lower transmittance than the denser tile.

Test #1 Overall Transmittance Comparison



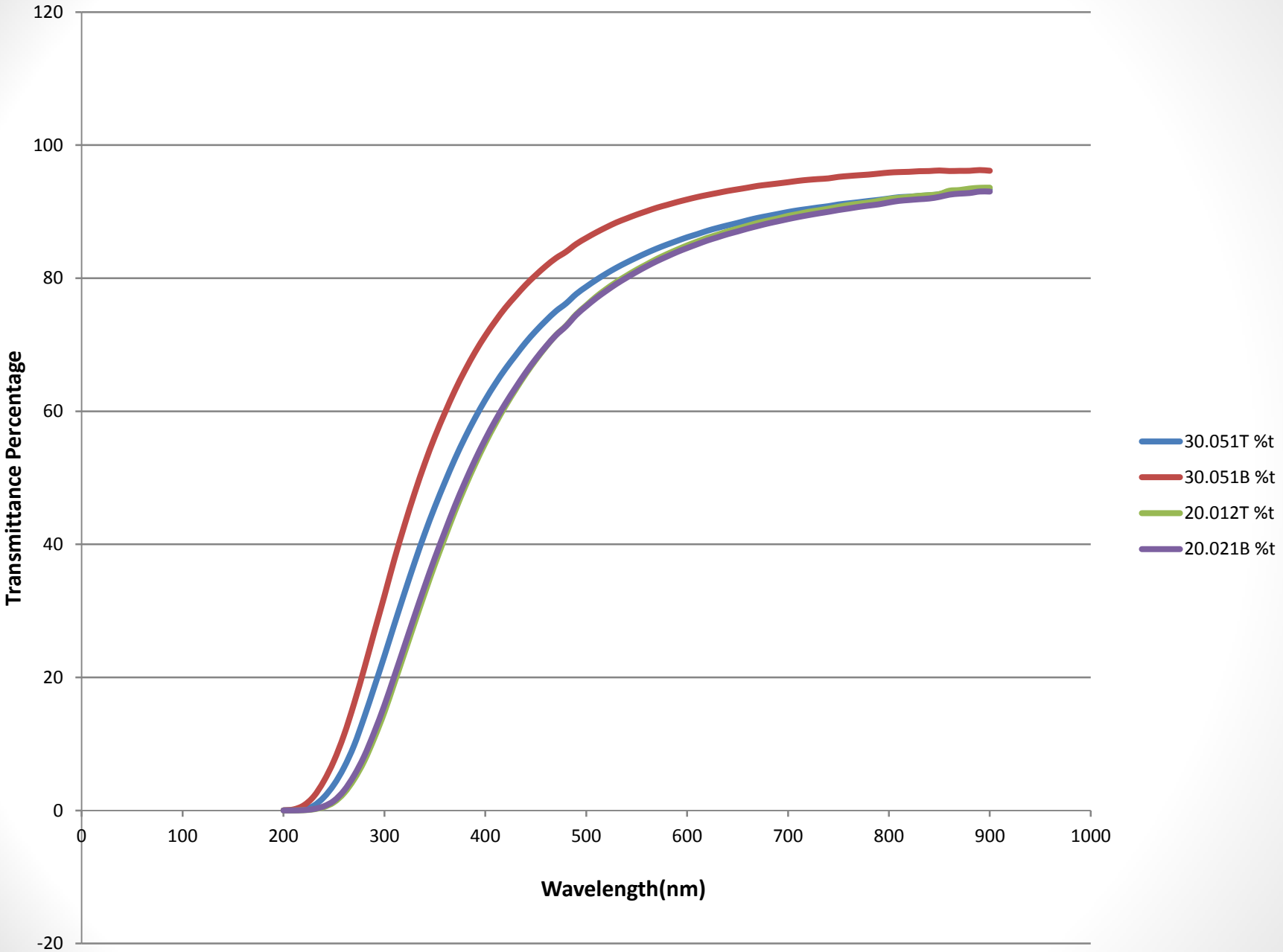
Test #2 (20.021 and 30.051)

- Next we tested four more tiles to see if our assumptions about cloudiness being a larger factor in transmittance than density was true.
- We also ran the top tile of 30.051 through the photospectrometer four times in the same position to find the machine's uncertainty.

Test #2 Conclusions

- We found that the SP-30's had a higher transmittance than the SP-20's and the cloudier SP-30 tile (30.015T) had the lower transmittance of the two SP-30 tiles. This supported our previous data from Test #1.

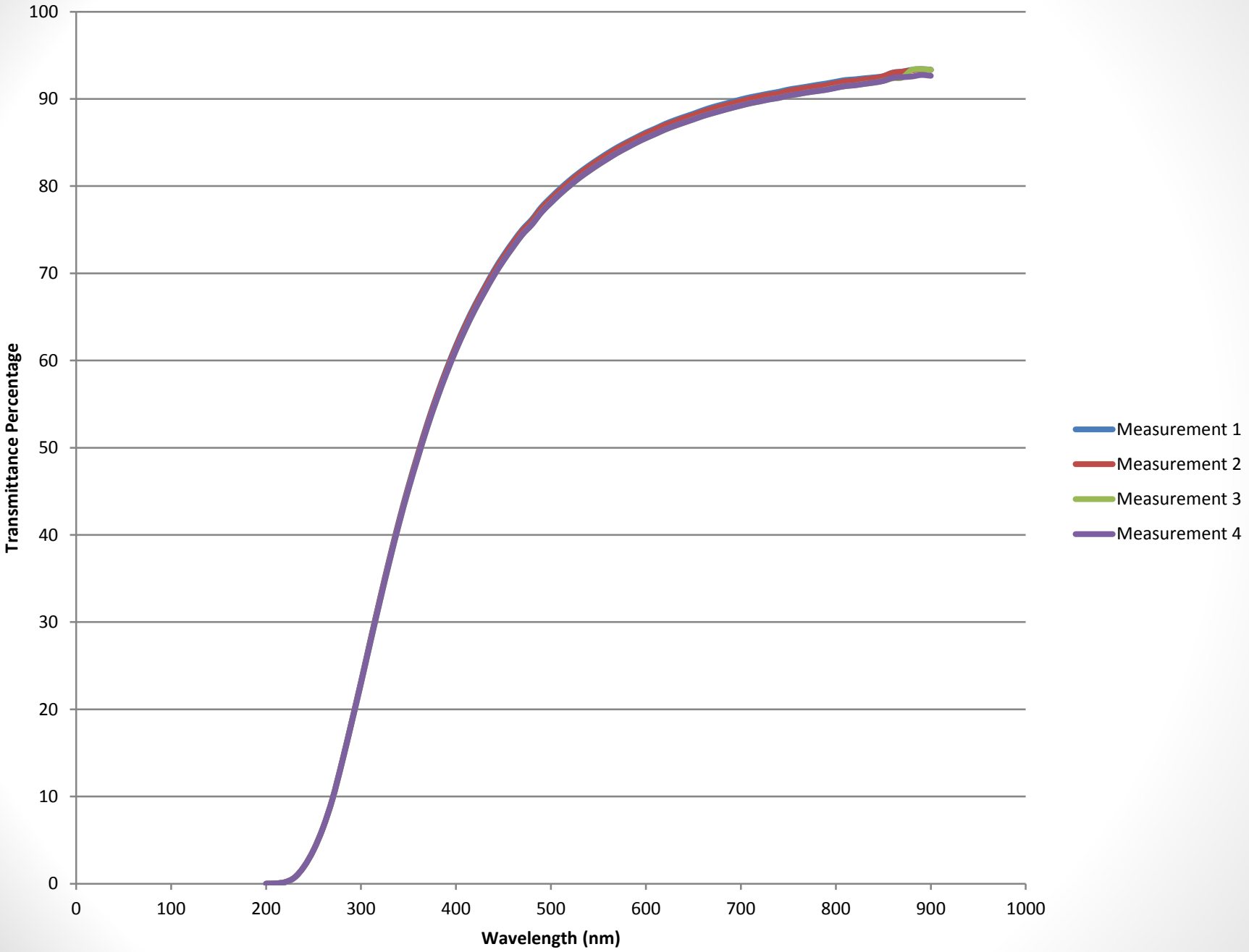
Test #2 Transmittance Comparison



Average Uncertainty

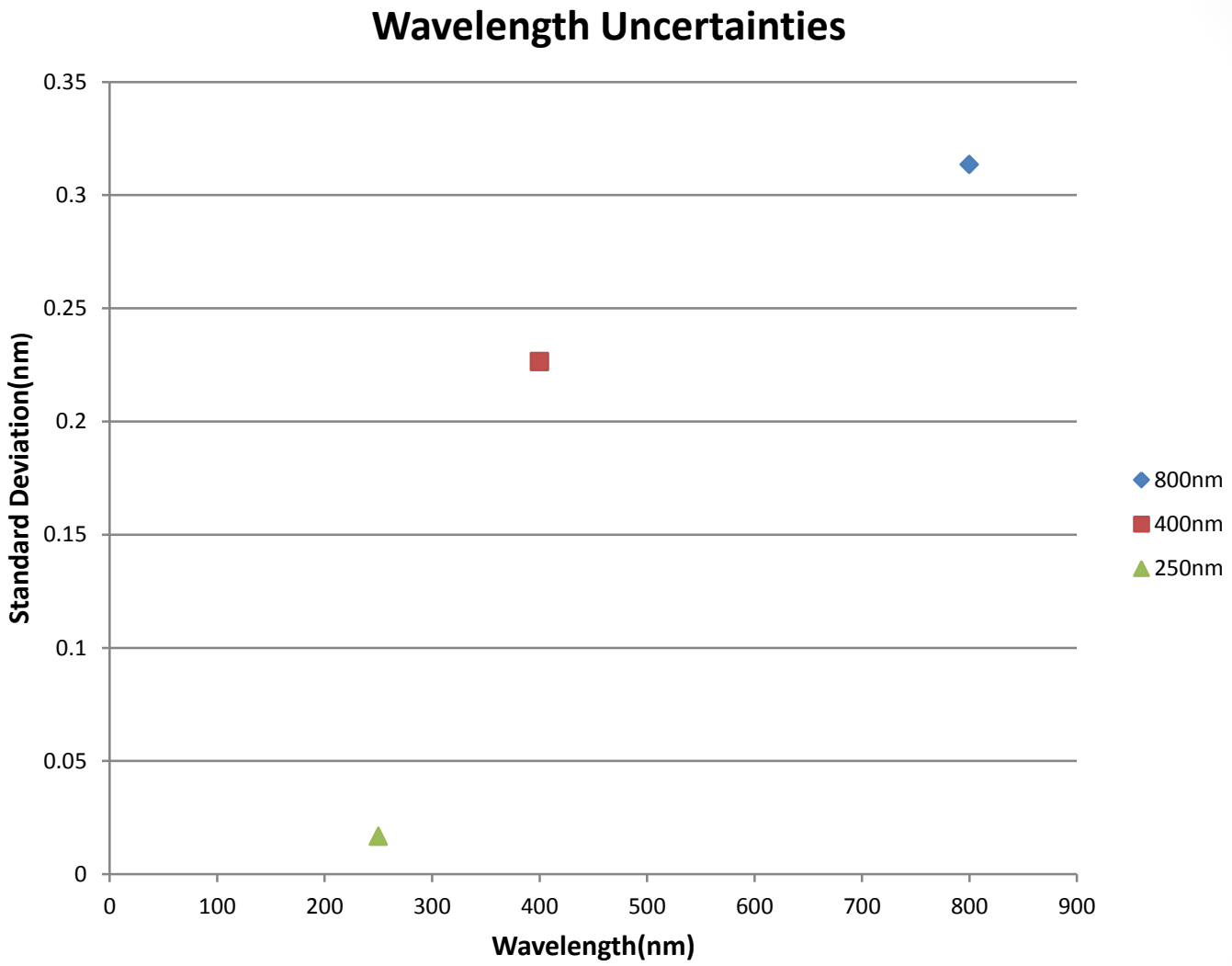
- In order to test the uncertainty of the spectrometer we ran the top tile of 30.051 through 4 times without moving the tile.
- The average deviation was .23 nm
- The four runs can be seen on the following graph.

30.051 Top Tile Tranmittance Comparison



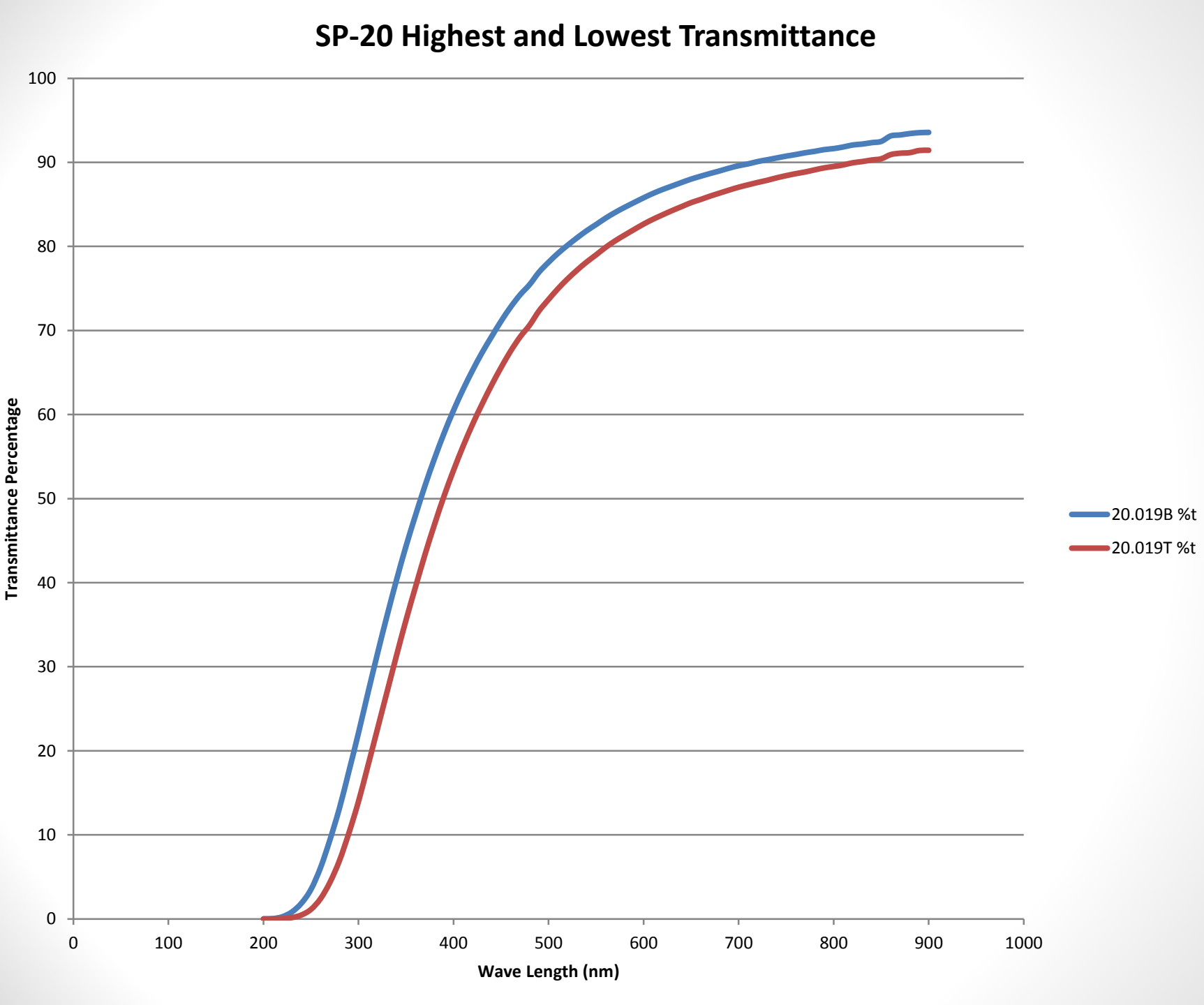
Wavelength Uncertainty

- At three specific wavelengths we calculated the uncertainty.
- We found that the amount of uncertainty follows a similar curve to the transmittance itself. The uncertainty is largest at higher wavelengths and decreases as the wavelengths decrease.
- The graph of uncertainty as a function of wavelength can be seen on the next graph.


Wavelength Uncertainties
Standard Deviation(nm)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
100
200
300
400
500
600
700
800
900
Wavelength(nm)
800nm
400nm
250nm

SP-20 Comparison

- Between the highest(20.019B) and lowest transmittance (20.019T) tiles the average deviation was 1.9 nm.


SP-20 Highest and Lowest Transmittance
Transmittance Percentage
100
90
80
70
60
50
40
30
20
10
0
0
100
200
300
400
500
600
700
800
900
1000
Wave Length (nm)
20.019B %t
20.019T %t

SP-30 Comparison

- Between the tiles with the highest an lowest transmittance (30.051B and 5T respectively) the average deviation was 3.4 nm.

SP-30 Highest and Lowest Transmittance