Aerogel Transmittance (Analysis and Graphs)

PerkinElmer Lambda 750

UV/Vis/Nir Spectrometer

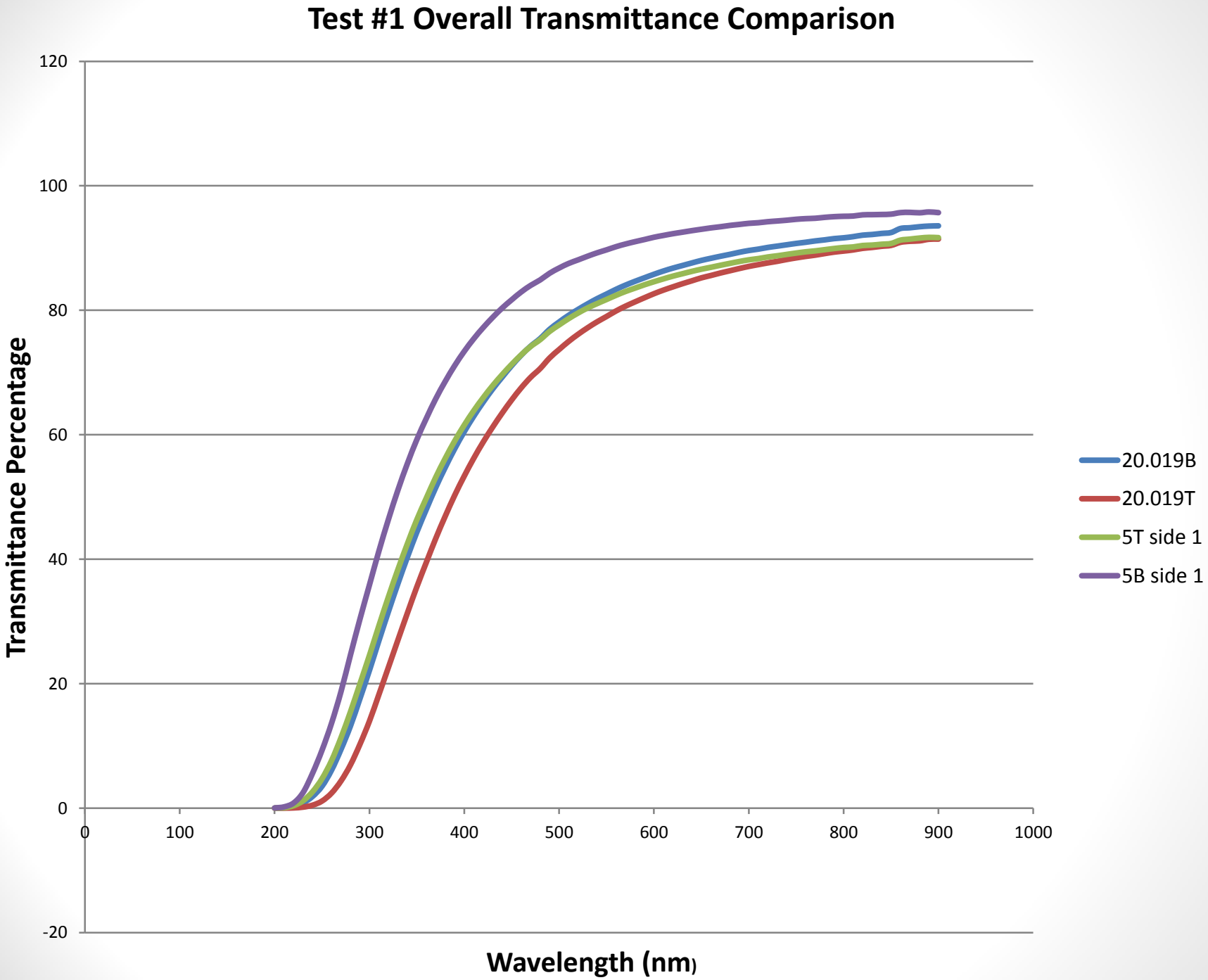
Table of Contents

Transmittance

- Transmittance: how much light of a certain wavelength can travel through an object
- Uniform transmittance is important for uniform Cerenkov radiation readings during testing.
- For our test the wavelengths ranged from 900 to 200 nm, covering the spectrum between UV and infrared light.

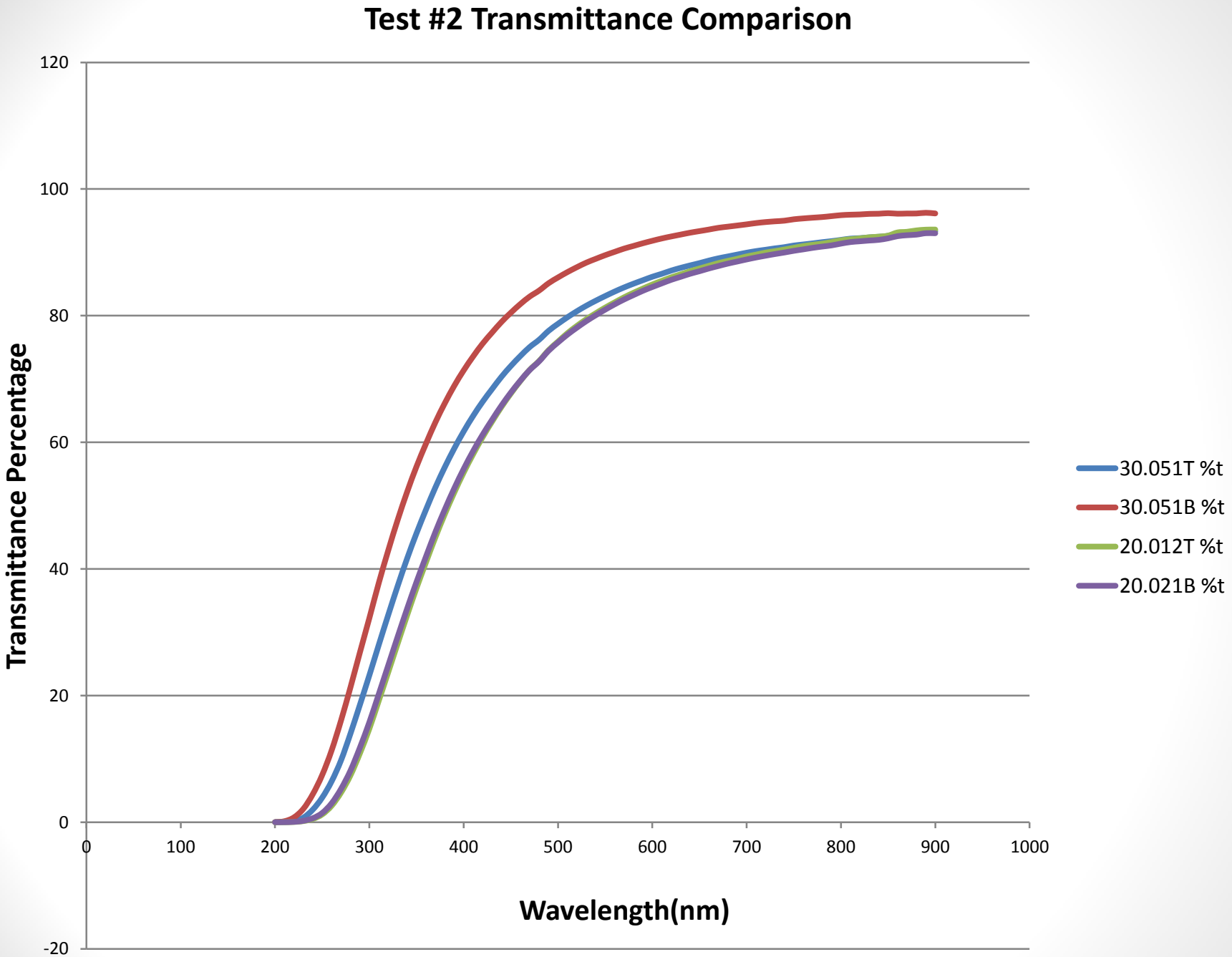
Test #1 (SP-30 5 and 20.019)

- The SP-30 tiles had a higher transmittance than the SP-20 tiles due the cloudy nature of the SP-20 tiles
- Tile of the same refractive index had very similar transmittance


Test #1 Overall Transmittance Comparison
Transmittance Percentage
120
100
80
60
40
20
0
-20
0
100
200
300
400
500
600
700
800
900
1000
Wavelength (nm)
20.019B
20.019T
5T side 1
5B side 1

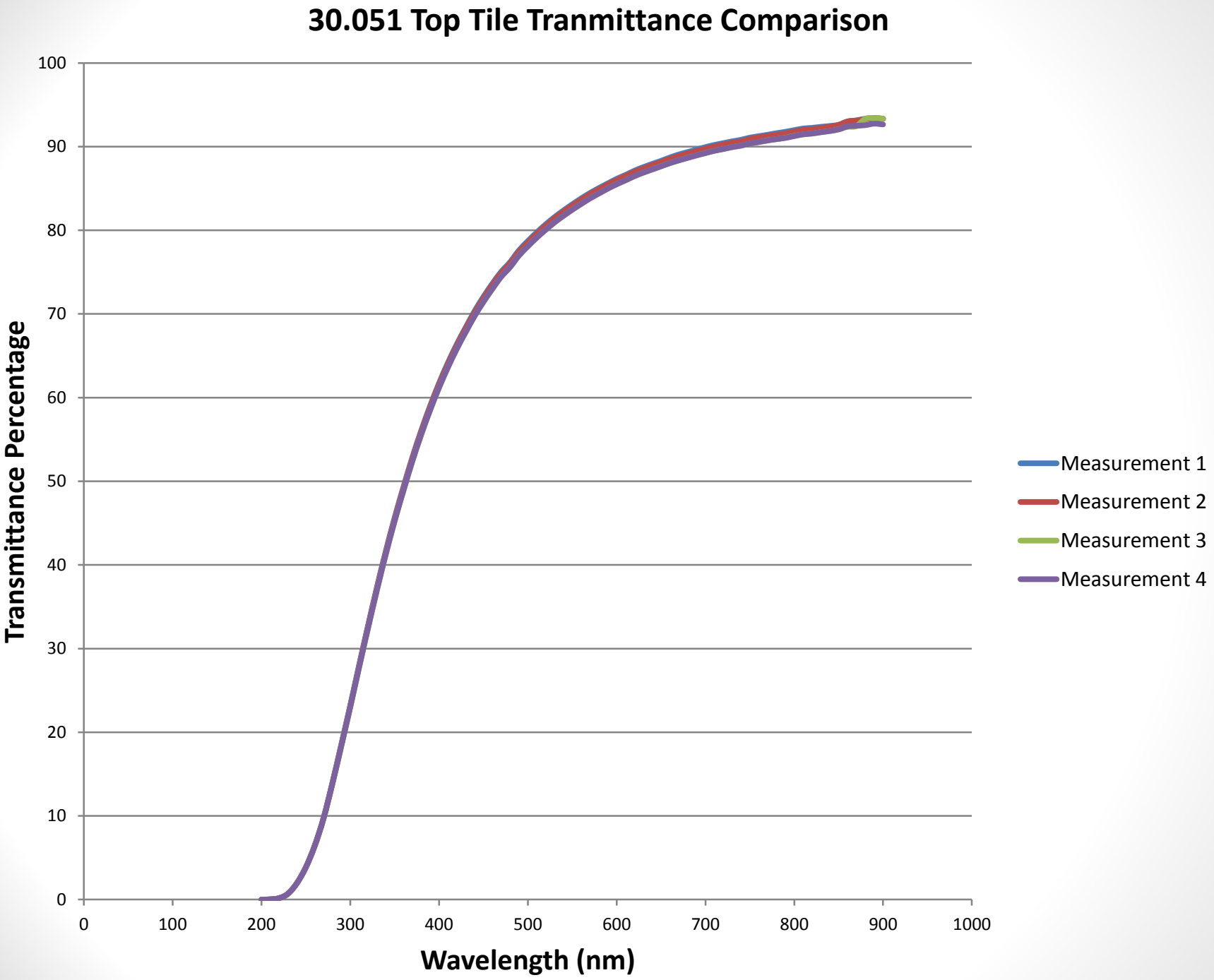
Test #2 (20.021 and 30.051)

- Next we tested four more tiles to confirm our previous test
- The data from the second test matched the data from the first


Test #2 Transmittance Comparison
Transmittance Percentage
120
100
80
60
40
20
0
-20
0
100
200
300
400
500
600
700
800
900
1000
Wavelength(nm)
30.051T %t
30.051B %t
20.012T %t
20.021B %t

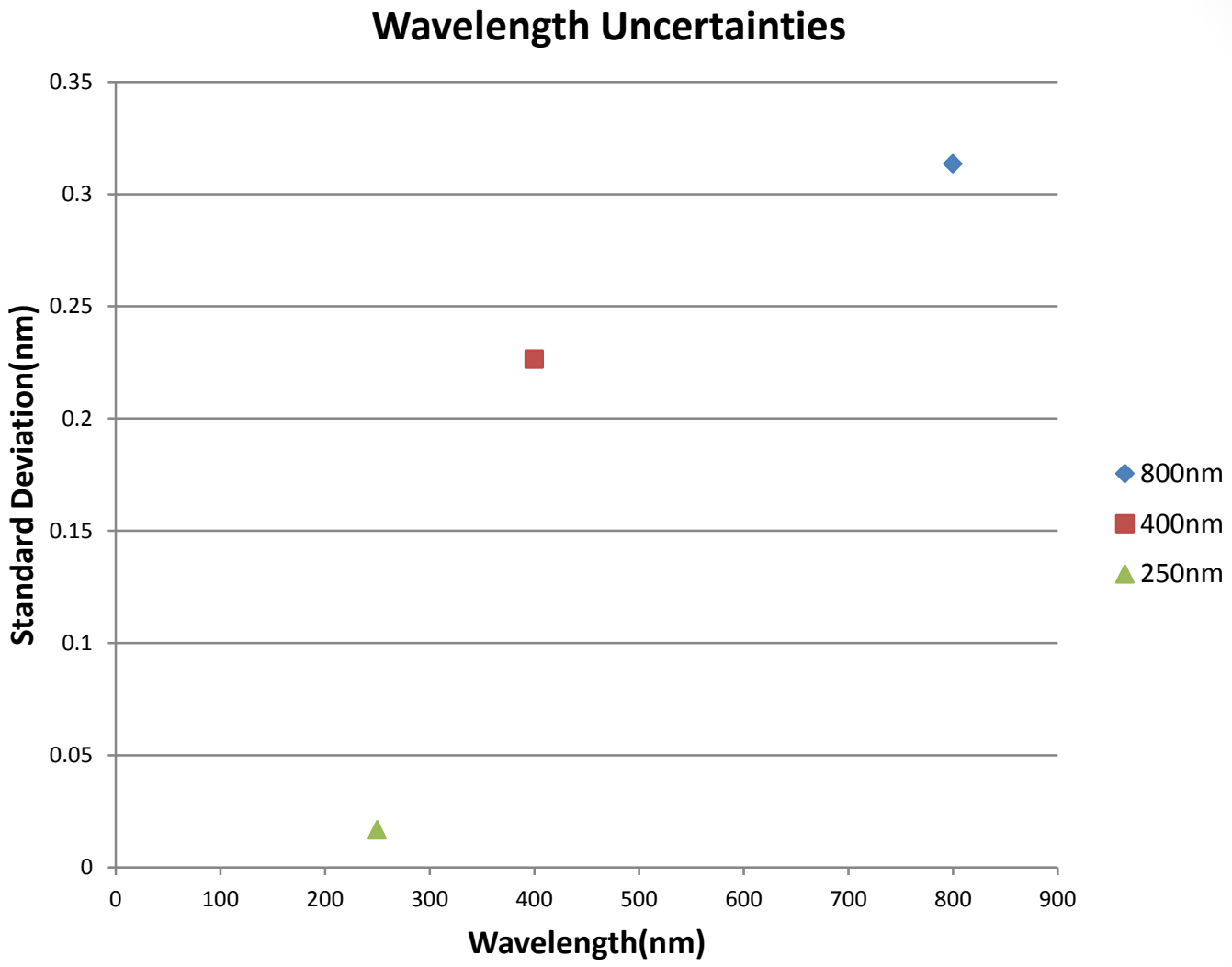
Average Uncertainty

- 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 .24 nm
- The four runs can be seen on the following graph.


30.051 Top Tile Tranmittance Comparison
Transmittance Percentage
100
90
80
70
60
50
40
30
20
10
0
0
100
200
300
400
500
600
700
800
900
1000
Wavelength (nm)
Measurement 1
Measurement 2
Measurement 3
Measurement 4

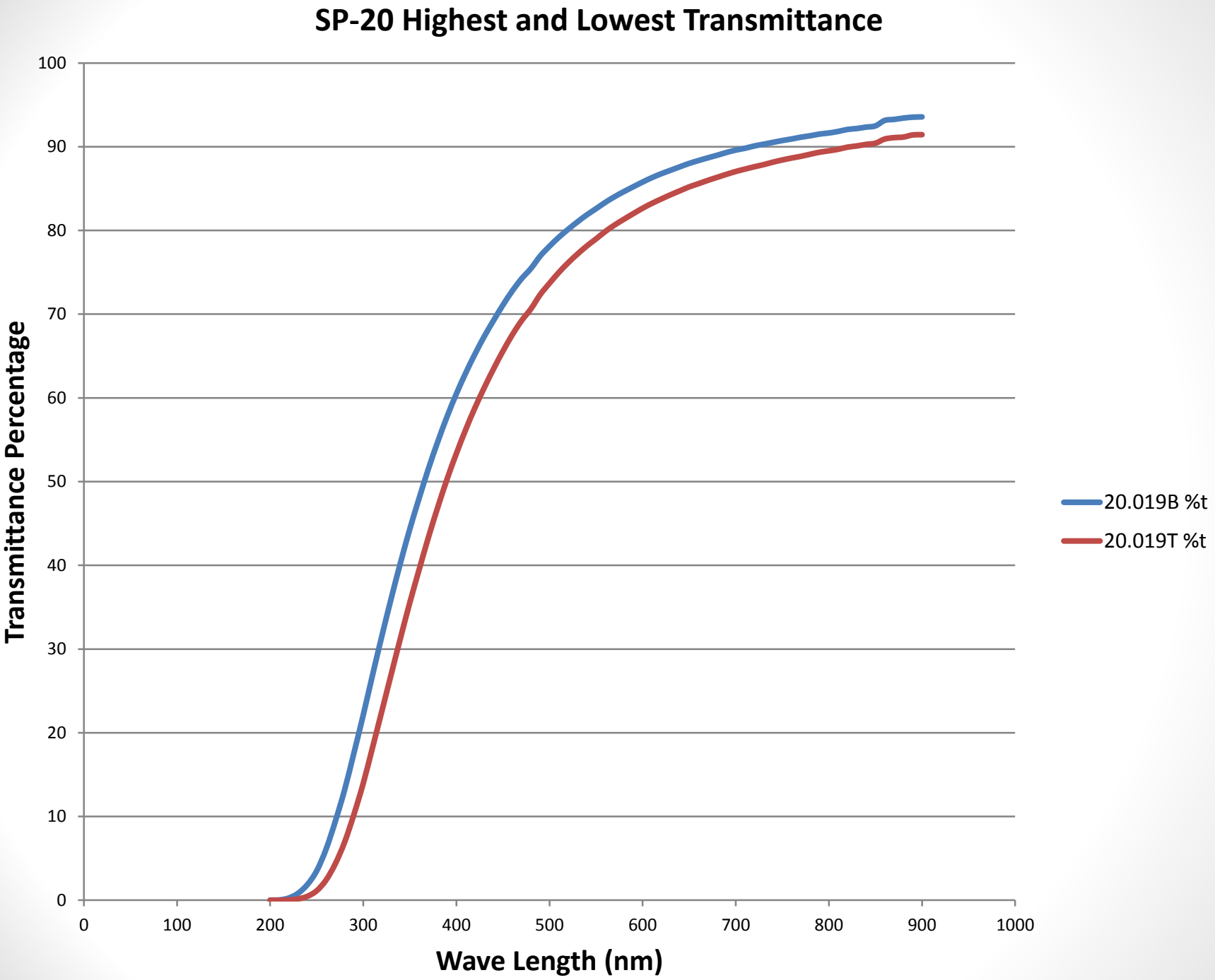
Wavelength Uncertainty

- 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
Transmittance Percentage
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
900
1000
Wavelength (nm)
30.051B %t
5T %t