Spectral Throughput Characterization of PTFE Diffuser Thickness

SMA905 Cosine Corrector - controlled stacked-diffuser study

CASE STUDY AT A GLANCE

Five total PTFE thicknesses (0.1-0.5 mm) were constructed from 0.1 mm diffuser layers and measured under fixed optical geometry. Increasing total PTFE thickness produced a strong, wavelength-dependent reduction in relative system throughput. The study provides a practical basis for selecting diffuser thickness according to signal level and spectral region of interest.

Objective

The purpose of this experiment was to quantify how the total thickness of the interchangeable PTFE diffuser affects the relative spectral throughput of the Thunder Optics SMA905 Cosine Corrector. The controlled series used the same 0.1 mm source material to build five total thicknesses: 0.1, 0.2, 0.3, 0.4 and 0.5 mm.

Experimental conditions

- Thunder Optics O Spectrometer
- Spectrometer slit: 50 µm
- SMA905 optical fiber: 200 µm core
- Halogen light source
- Integration time: 10 ms
- 100 averaged acquisitions
- Individual ambient measurement/correction for each thickness
- Optical geometry kept fixed during the series

1. Relative spectral throughput

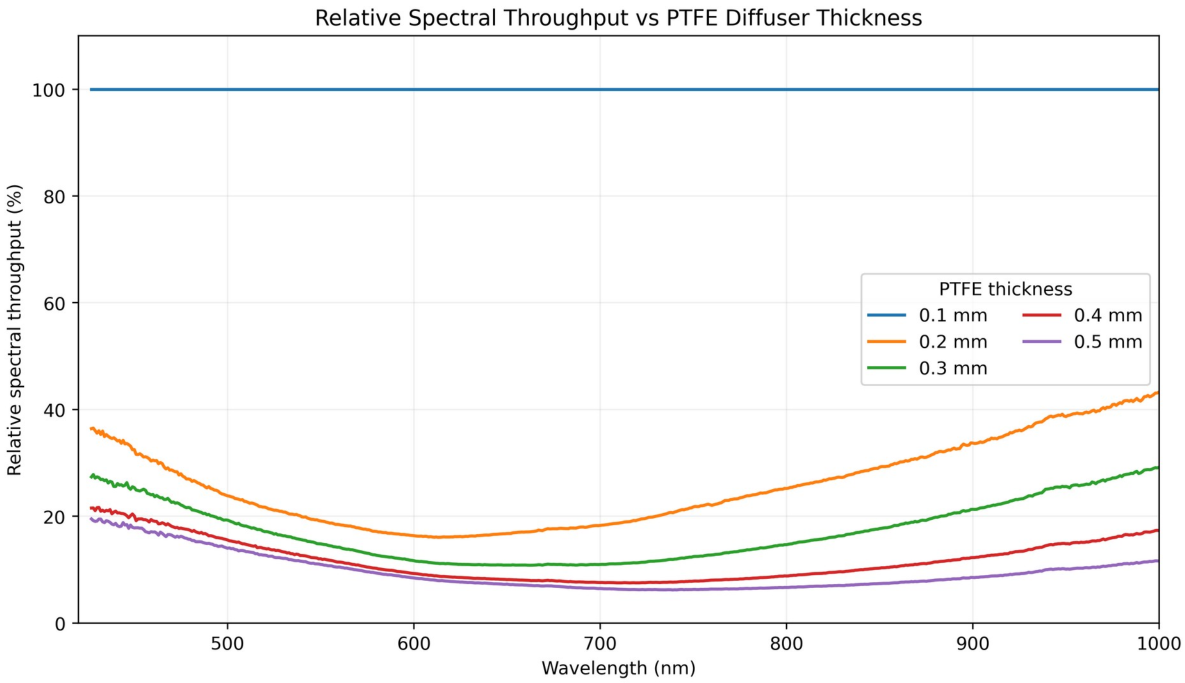

Figure 1. Relative system throughput for total PTFE thicknesses from 0.1 to 0.5 mm. The 0.1 mm configuration is the 100% spectral reference.

The measured response decreases systematically as additional PTFE layers are introduced. The separation between curves is not constant with wavelength, demonstrating that the effect of diffuser thickness is spectrally dependent rather than a wavelength-independent attenuation factor.

2. Thickness dependence at representative wavelengths

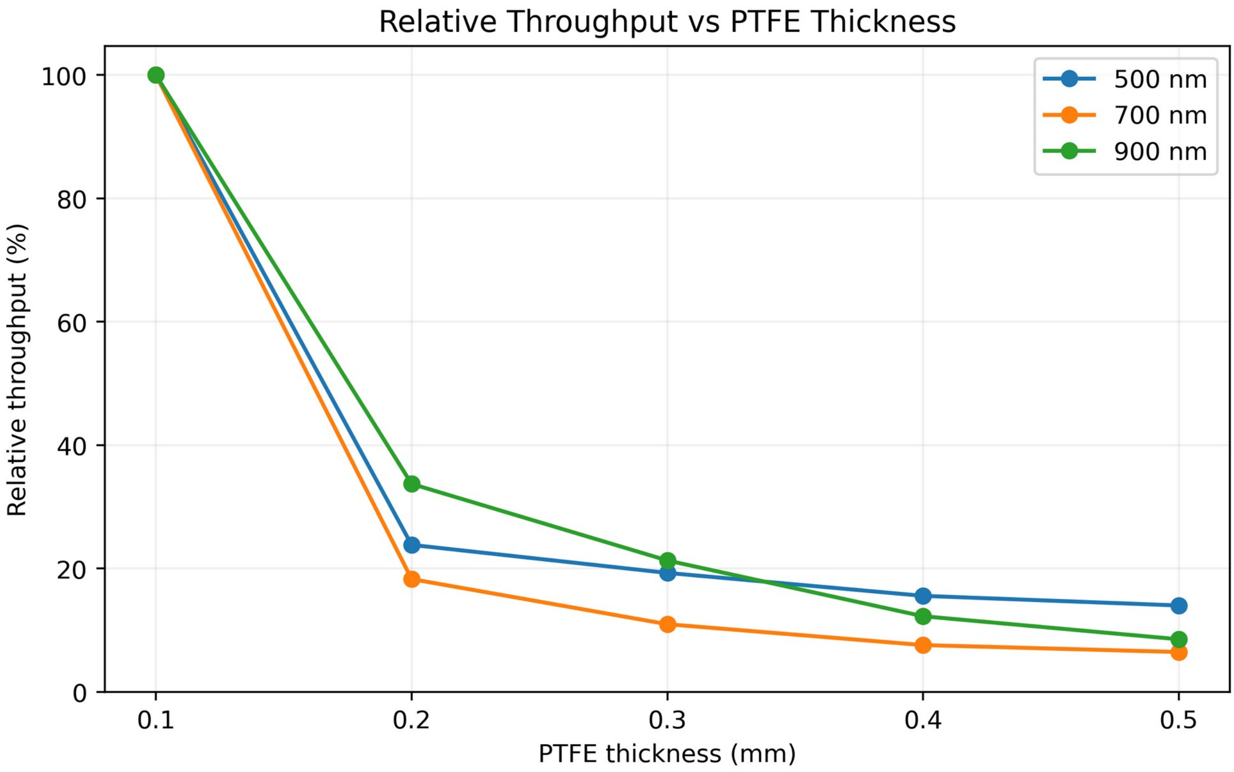

Figure 2. Relative throughput versus total PTFE thickness at 500, 700 and 900 nm.

Total PTFE thickness	500 nm	700 nm	900 nm
0.1 mm	100.0	100.0	100.0
0.2 mm	23.8	18.3	33.7
0.3 mm	19.3	11.0	21.3
0.4 mm	15.6	7.6	12.3
0.5 mm	14.0	6.5	8.5

Key observations

• The largest throughput reduction occurs when moving from the 0.1 mm reference to 0.2 mm.

• Further increases from 0.2 to 0.5 mm progressively reduce the collected signal.

• The magnitude of the attenuation depends on wavelength. For example, the 0.2 mm configuration retains 23.8% of the 0.1 mm reference at 500 nm, 18.3% at 700 nm and 33.7% at 900 nm.

• At 0.5 mm, the corresponding relative throughputs are 14.0%, 6.5% and 8.5%.

PRACTICAL IMPLICATION

PTFE thickness can be used as a practical optical design parameter to adjust the signal reaching the spectrometer. Because the attenuation is wavelength-dependent, the diffuser should be selected with both detector signal level and spectral region of interest in mind.

3. Scope and interpretation

These measurements characterize the relative throughput of the complete experimental optical system under the stated conditions. They should not be interpreted as absolute PTFE transmission values. The 0.1 mm configuration is used as the spectral reference (100%), and each thickness was corrected using its corresponding ambient measurement.

Conclusion

The controlled stacked-diffuser experiment demonstrates a reproducible, monotonic reduction in relative system throughput as total PTFE thickness increases from 0.1 to 0.5 mm. The attenuation is wavelength-dependent, making interchangeable diffuser thickness a useful means of adapting the SMA905 Cosine Corrector to different signal levels and spectral measurement conditions.

Visuals to add before publication

• One high-resolution photograph of the complete experimental setup (halogen source, Cosine Corrector, fiber and O Spectrometer).

• Optional close-up showing the stacked 0.1 mm PTFE discs installed in the Cosine Corrector.

• Optional clean product image of the opened corrector with a PTFE disc, if a more product-oriented first page is desired.