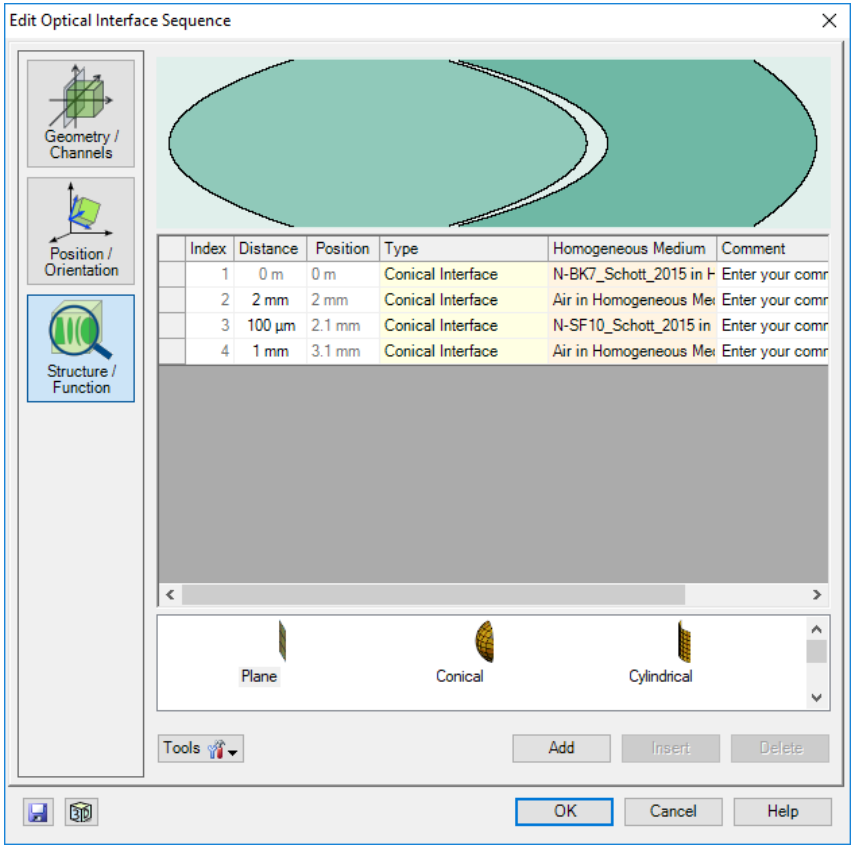
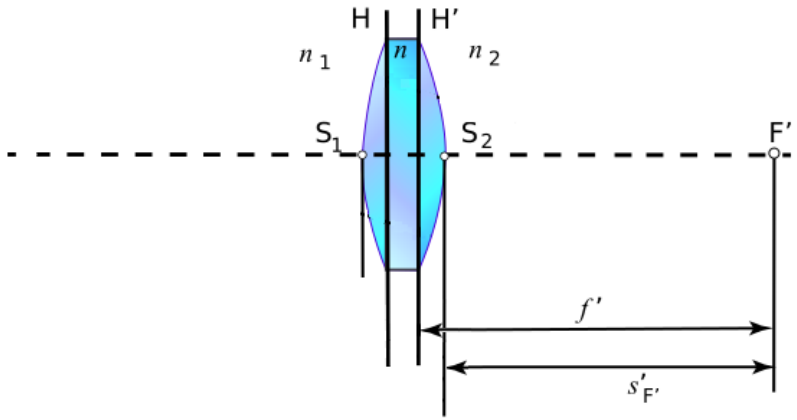
Usage of Focal Length Analyzer

Abstract



The focal length is an important parameter to evaluate an imaging system. But for real thick lenses, or systems consisting of several lenses and mirrors, the effective focal length is not easy to calculate. By using the Focal Length Analyzer, the effective and back focal length of an Optical Interface Sequence (OIS), a Single Optical Interface or a Spherical Lens can be obtained. The Focal Length Analyzer can also be applied in a Parametric Optimization. The corresponding result can be configured as a merit function for optimization.

Thick Lens Diagram and Definition

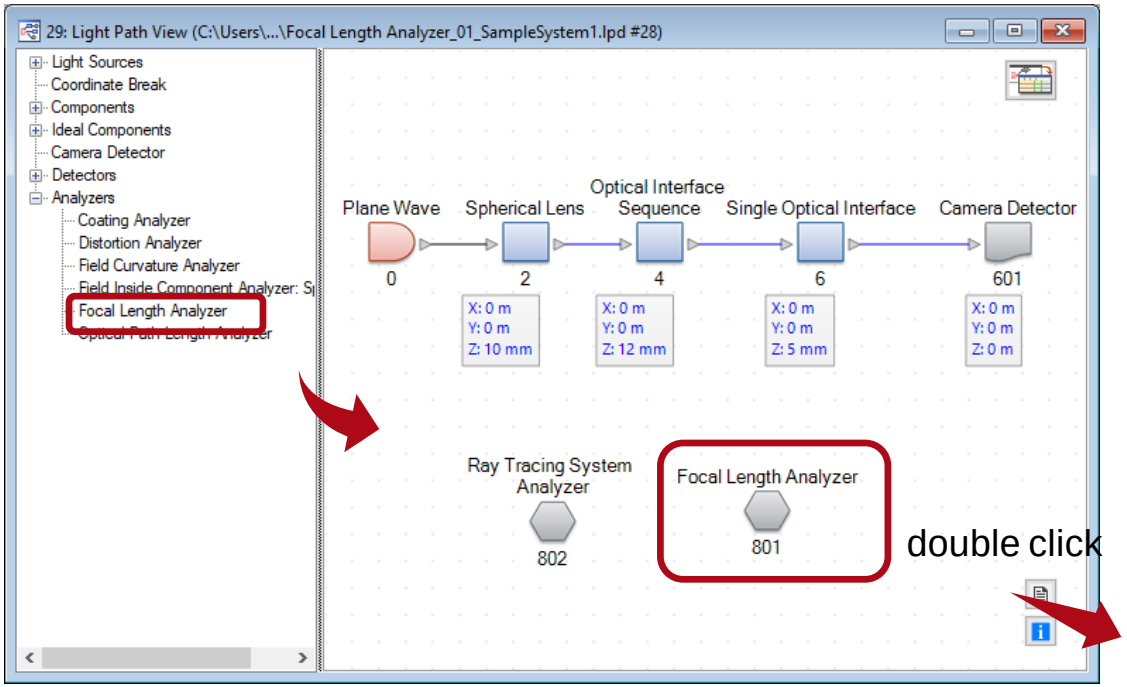


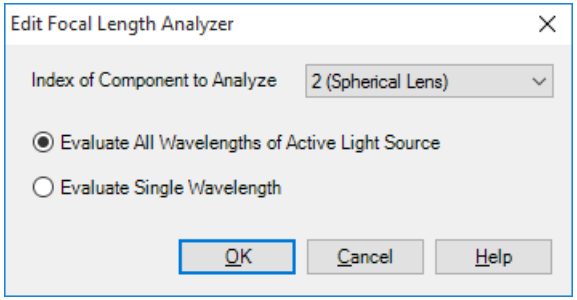
[1]

- **effective focal length (f′):** distance from the rear principal plane (H′) to the rear focal point (F′)
- **back focal length ($s'_{F'}$):** distance from the vertex of the last optical surface of the system (S_2) to the rear focal point (F′)

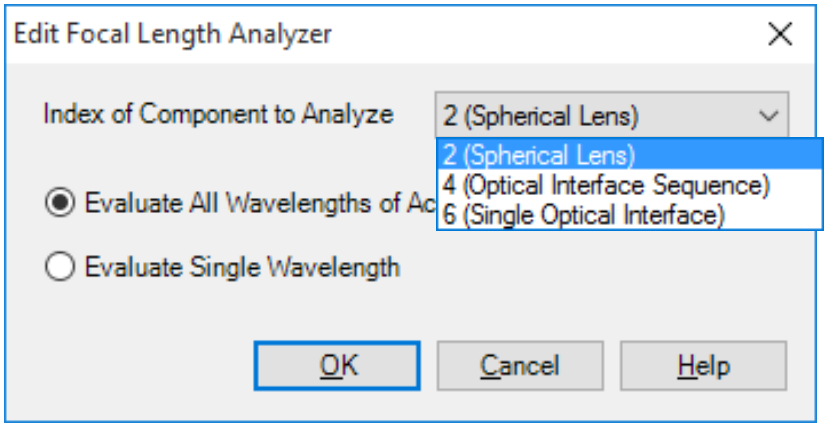
[1] Wikipedia, https://en.wikipedia.org/wiki/Focal_length

Focal Length Analyzer



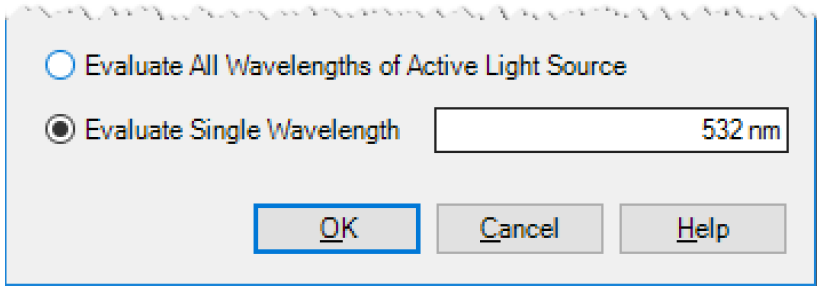


Configuration of Focal Length Analyzer



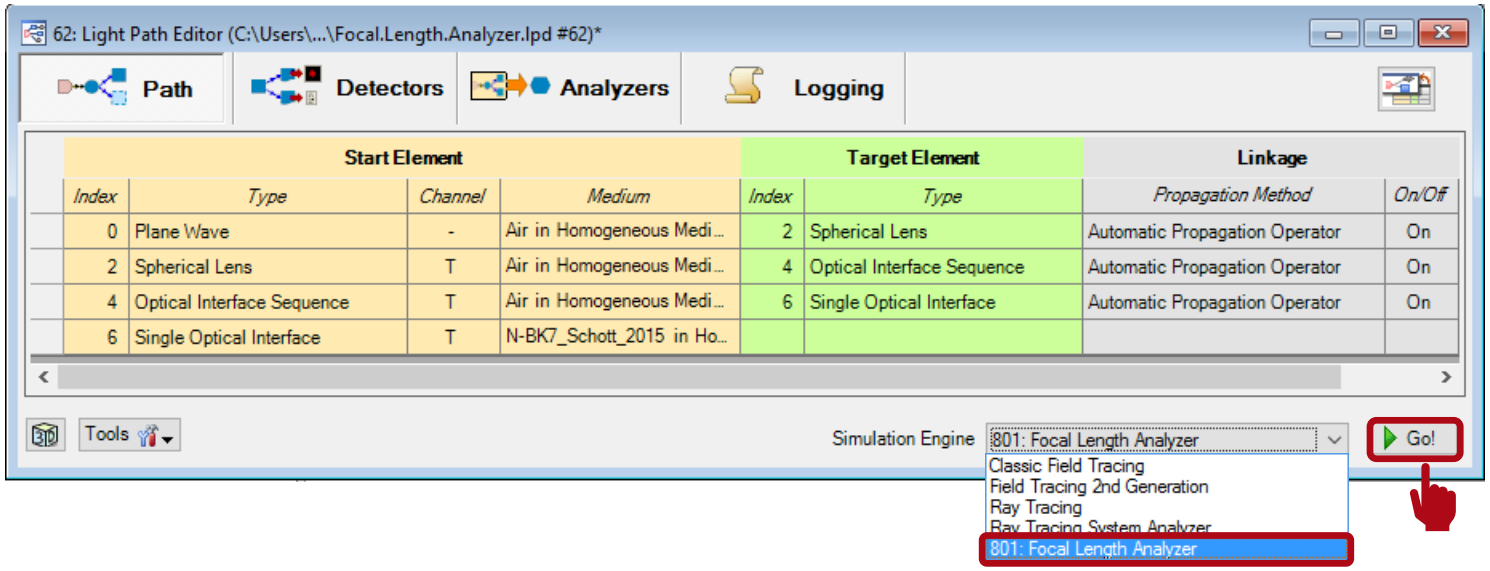
- select the component to be analyzed

and

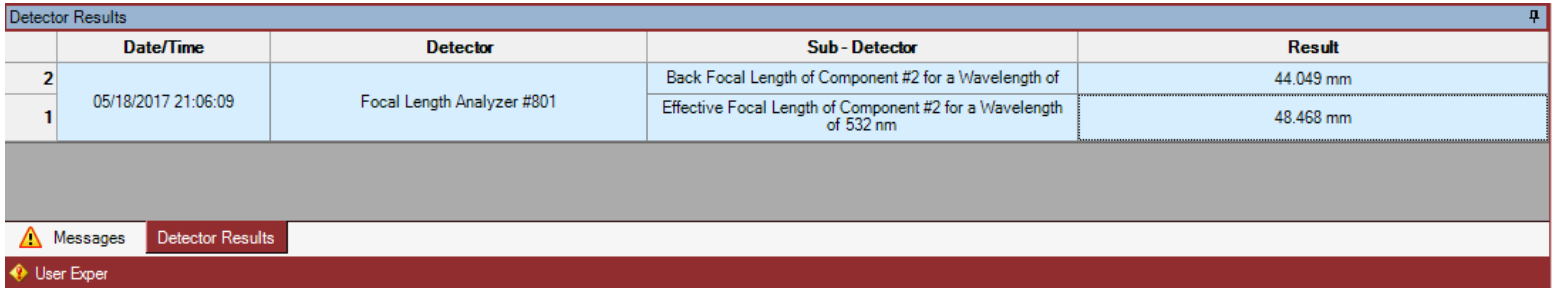


- choose whether to evaluate all wavelengths or a given single wavelength

Running the Analyzer and Result Display



The results are shown in the tab *Detector Results*.



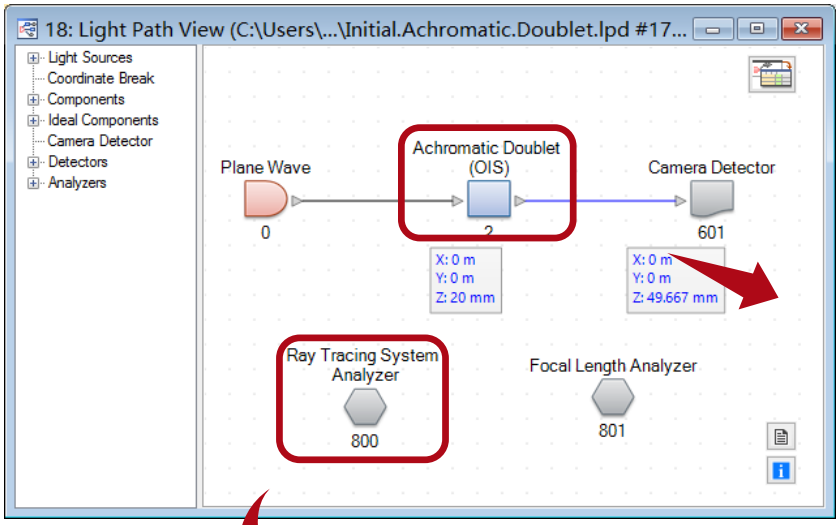
Parametric Optimization of An Achromatic Doublet

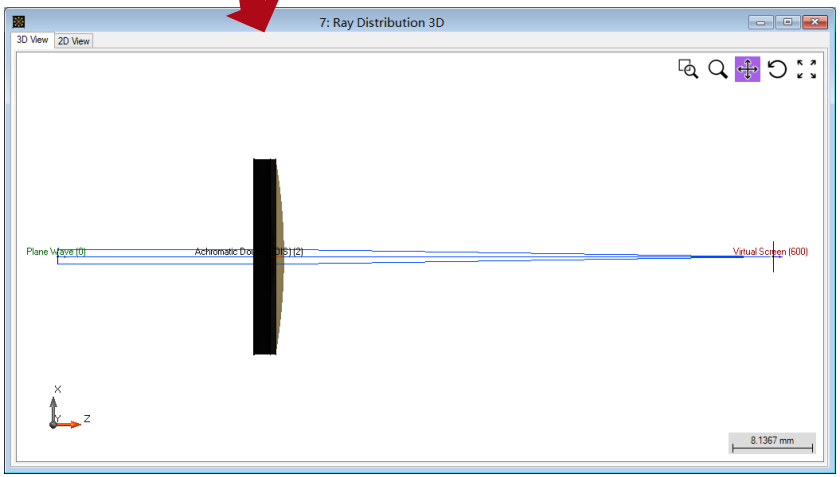
Optimization Task Description

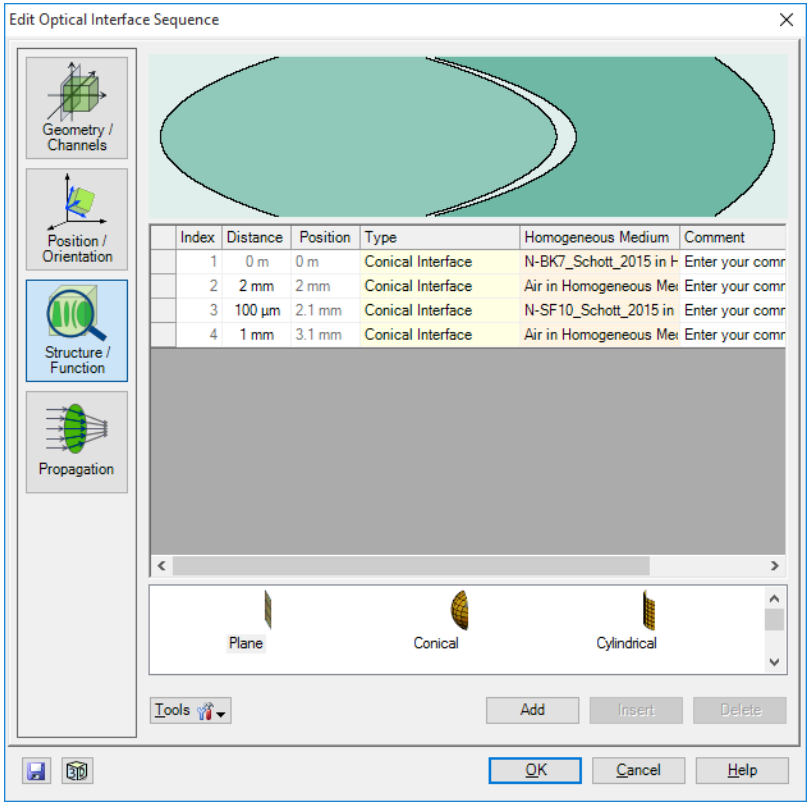
- source
  - plane wave: wavelength 473 nm, 532 nm and 635 nm
- component
  - Optical Interface Sequence (achromatic doublet): four conical interfaces
- detectors and analyzers
  - Camera Detector
  - Ray Tracing Analyzer
  - Focal Length Analyzer

Optimize system parameters to achieve same back focal length of 50 mm for all three wavelength

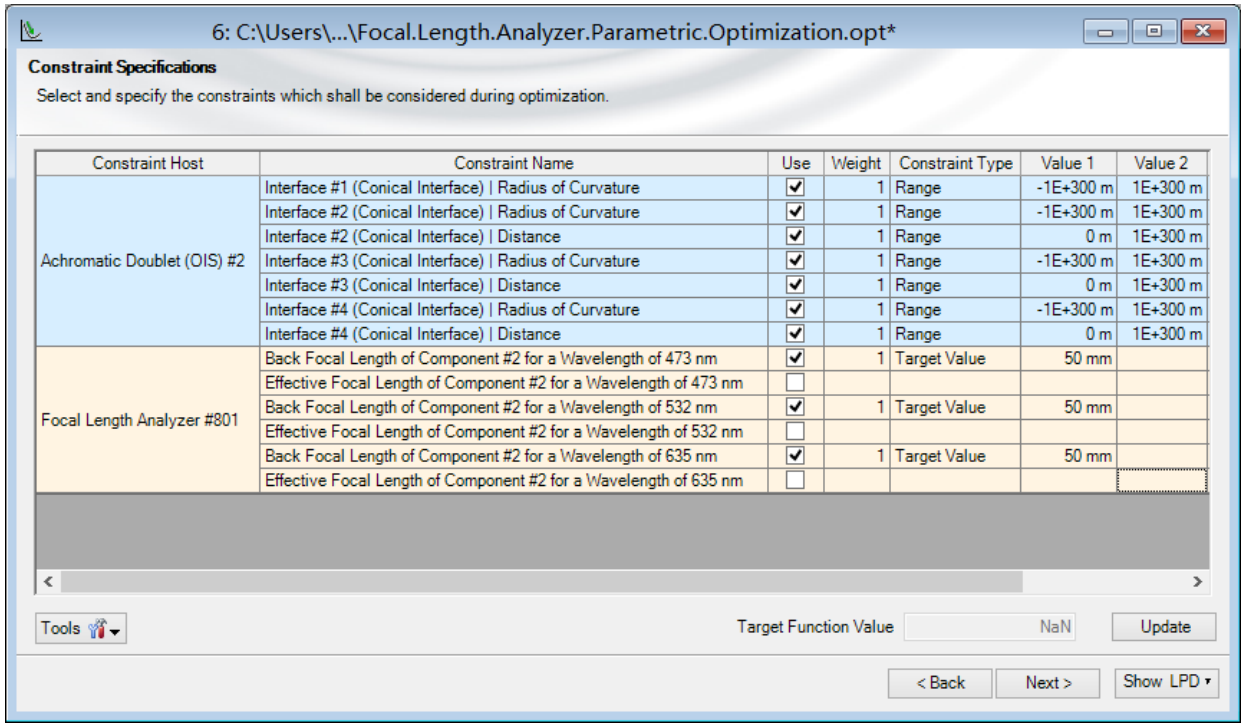
System Configuration







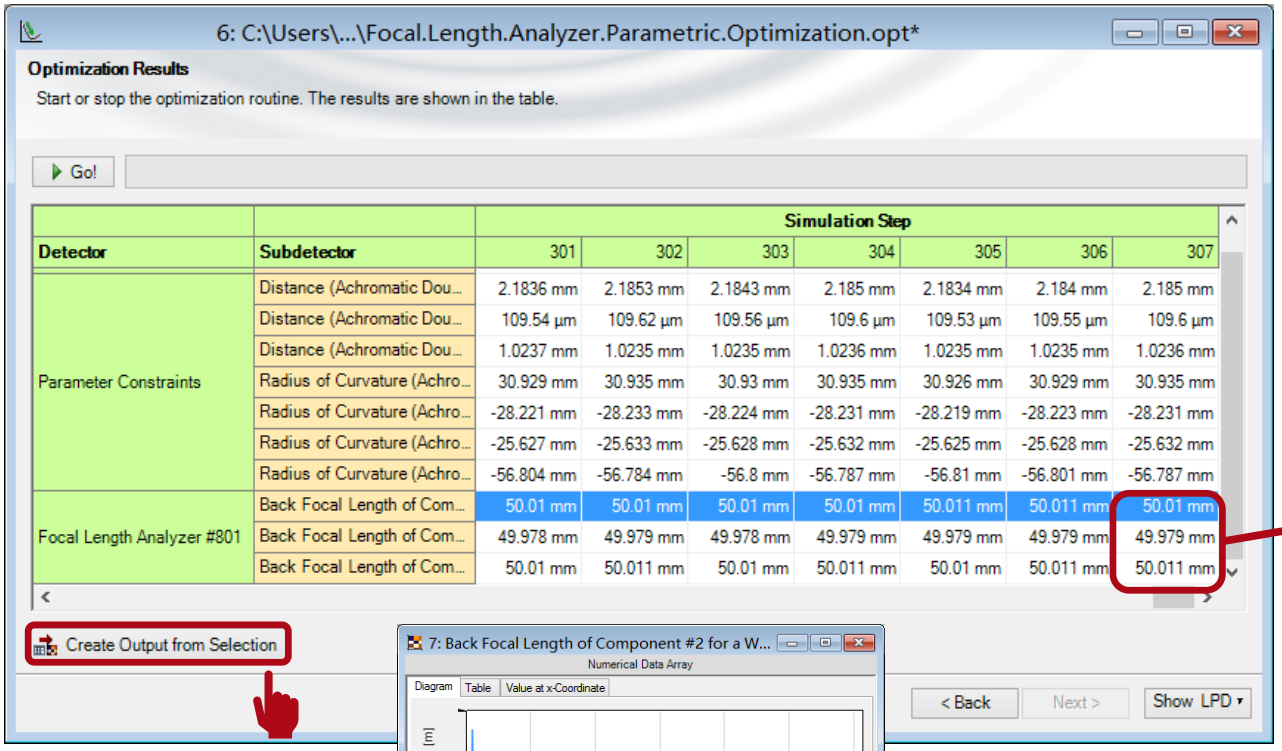
Set Optimization Target



Constraint Host	Constraint Name	Use	Weight	Constraint Type	Value 1	Value 2
Achromatic Doublet (OIS) #2	Interface #1 (Conical Interface) | Radius of Curvature	☑	1	Range	-1E+300 m	1E+300 m
	Interface #2 (Conical Interface) | Radius of Curvature	☑	1	Range	-1E+300 m	1E+300 m
	Interface #2 (Conical Interface) | Distance	☑	1	Range	0 m	1E+300 m
	Interface #3 (Conical Interface) | Radius of Curvature	☑	1	Range	-1E+300 m	1E+300 m
	Interface #3 (Conical Interface) | Distance	☑	1	Range	0 m	1E+300 m
	Interface #4 (Conical Interface) | Radius of Curvature	☑	1	Range	-1E+300 m	1E+300 m
	Interface #4 (Conical Interface) | Distance	☑	1	Range	0 m	1E+300 m
Focal Length Analyzer #801	Back Focal Length of Component #2 for a Wavelength of 473 nm	☑	1	Target Value	50 mm	
	Effective Focal Length of Component #2 for a Wavelength of 473 nm	☐				
	Back Focal Length of Component #2 for a Wavelength of 532 nm	☑	1	Target Value	50 mm	
	Effective Focal Length of Component #2 for a Wavelength of 532 nm	☐				
	Back Focal Length of Component #2 for a Wavelength of 635 nm	☑	1	Target Value	50 mm	
	Effective Focal Length of Component #2 for a Wavelength of 635 nm	☐				

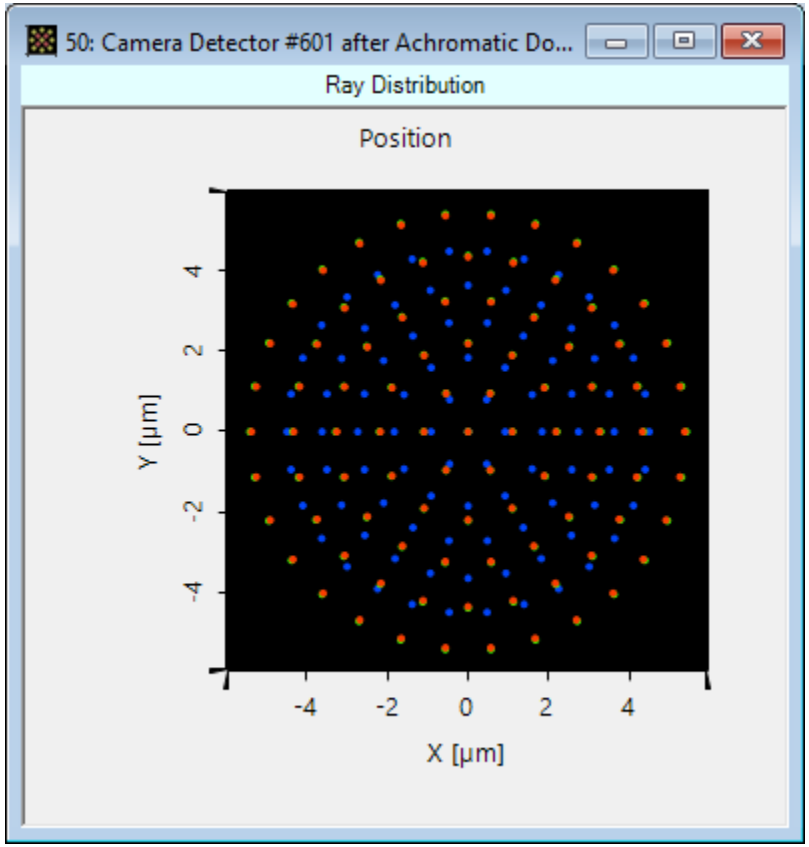
- Focal Length Analyzer
  - Back Focal Length is set to **50 mm**: for all chosen wavelengths

Optimization Result

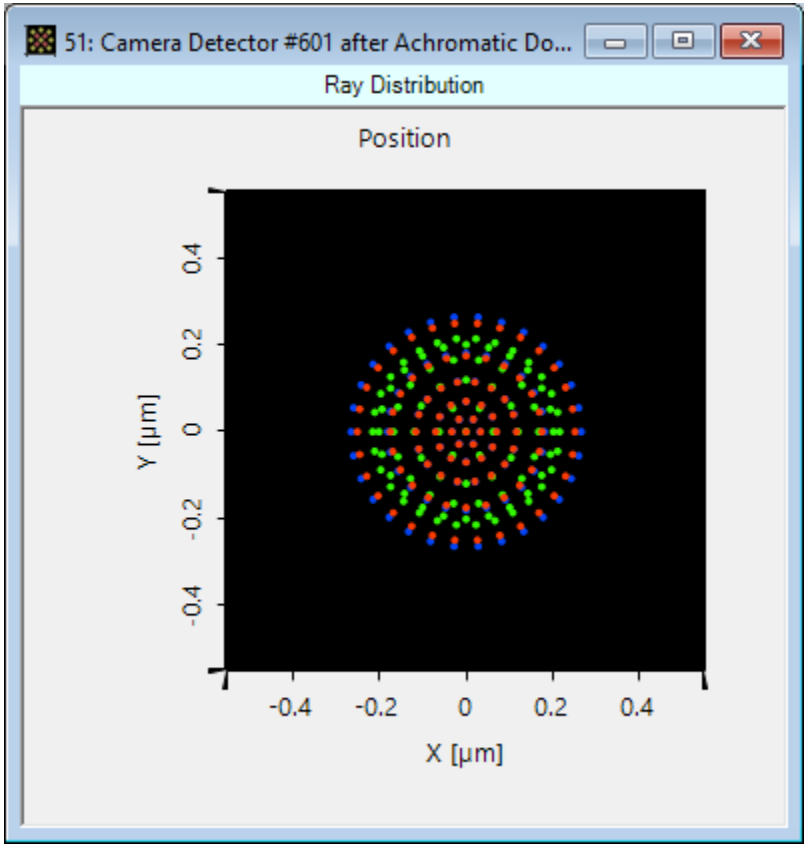


Comparison of Results

Dot Diagram (initial setup)



Dot Diagram (optimized)



Document Information

title	Usage of Focal Length Analyzer
version	1.0
VL version used for simulations	7.0.3.4
category	Feature Use Case