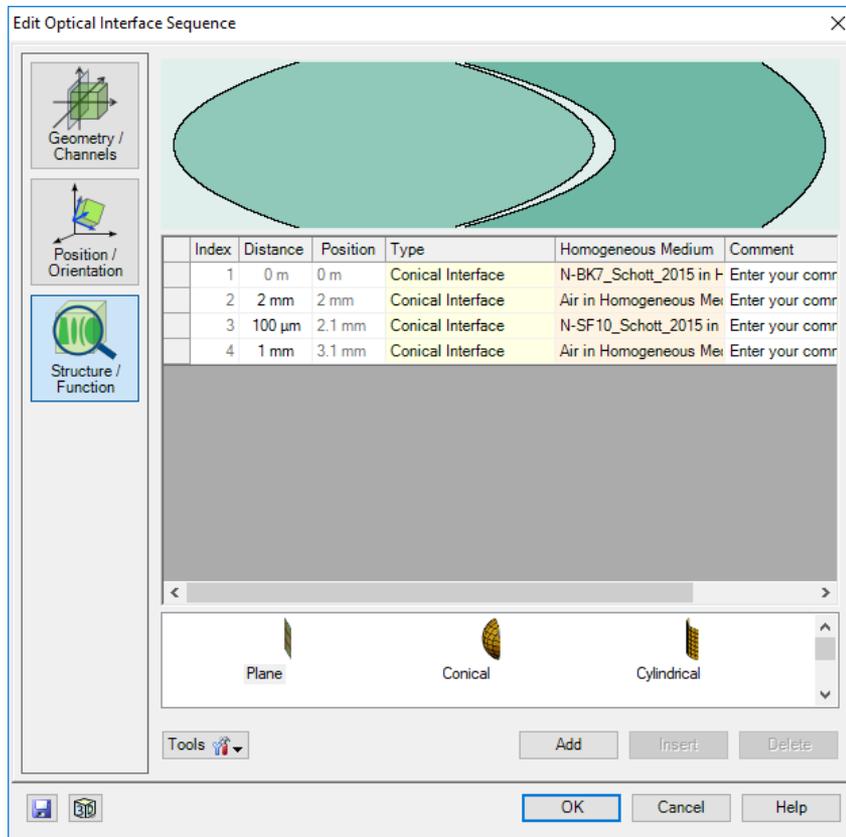


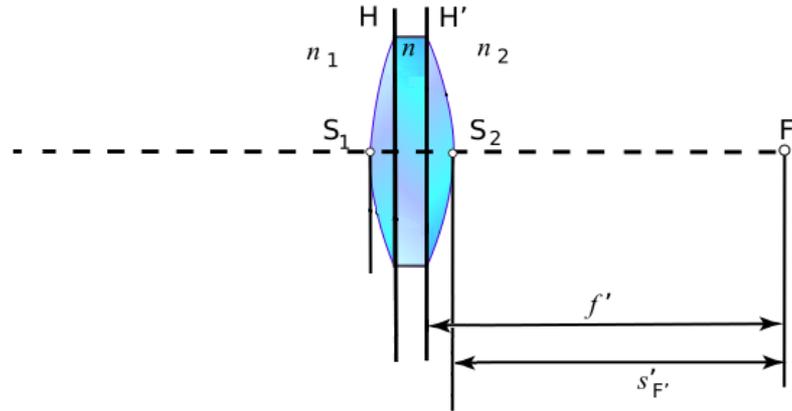
Usage of Focal Length Analyzer

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

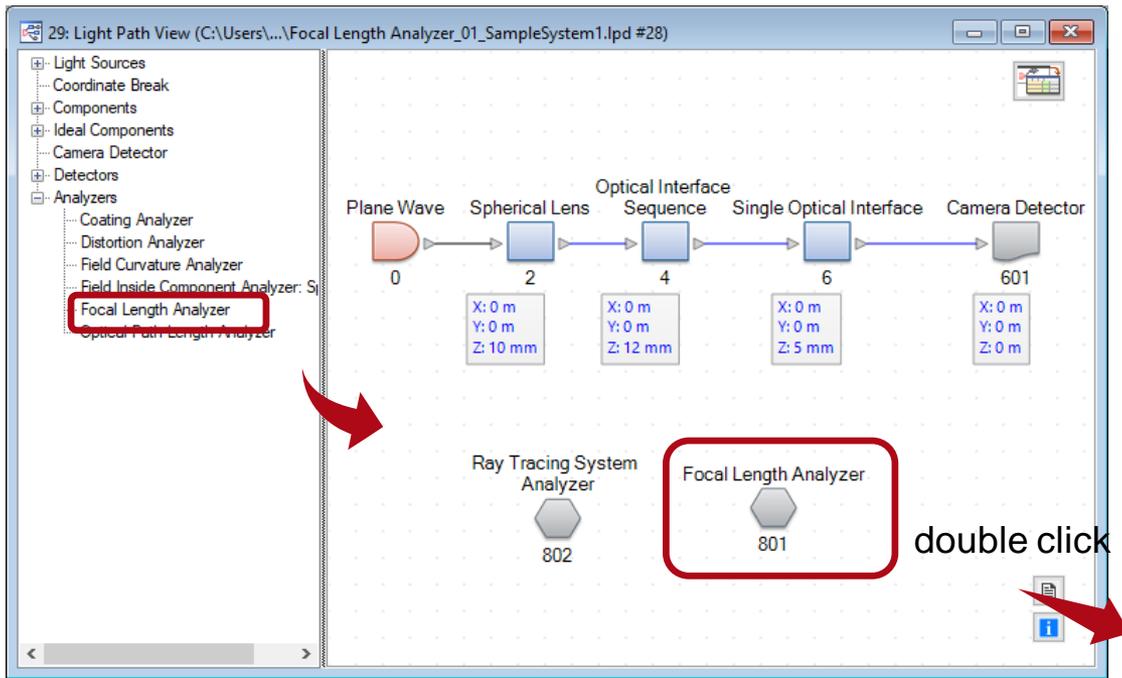


[1]

- **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



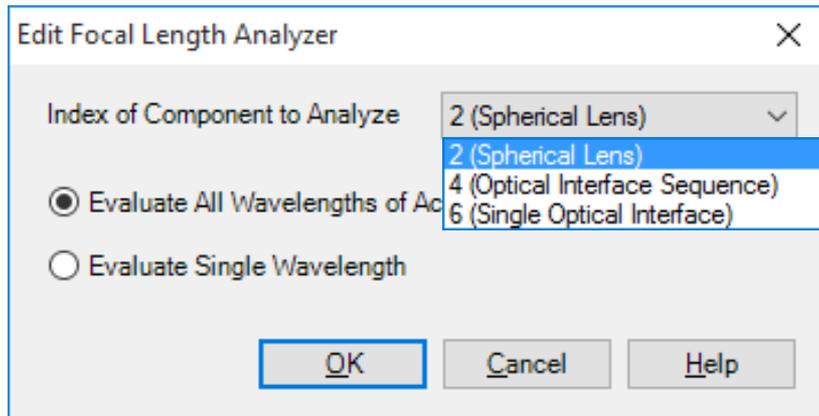
double click

The 'Edit Focal Length Analyzer' dialog box contains the following settings:

- Index of Component to Analyze: 2 (Spherical Lens)
- Evaluate All Wavelengths of Active Light Source
- Evaluate Single Wavelength

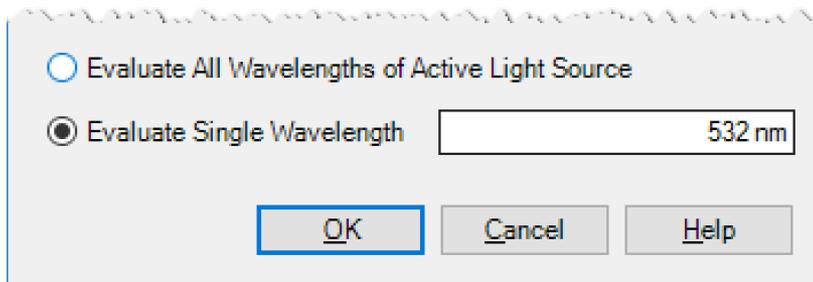
Buttons: OK, Cancel, Help

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

Start Element				Target Element		Linkage	
Index	Type	Channel	Medium	Index	Type	Propagation Method	On/Off
0	Plane Wave	-	Air in Homogeneous Medi...	2	Spherical Lens	Automatic Propagation Operator	On
2	Spherical Lens	T	Air in Homogeneous Medi...	4	Optical Interface Sequence	Automatic Propagation Operator	On
4	Optical Interface Sequence	T	Air in Homogeneous Medi...	6	Single Optical Interface	Automatic Propagation Operator	On
6	Single Optical Interface	T	N-BK7_Schott_2015 in Ho...				

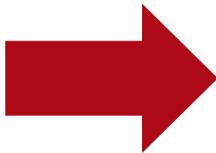
The results are shown in the tab *Detector Results*.

Date/Time	Detector	Sub - Detector	Result
05/18/2017 21:06:09	Focal Length Analyzer #801	Back Focal Length of Component #2 for a Wavelength of	44.049 mm
		Effective Focal Length of Component #2 for a Wavelength of 532 nm	48.468 mm

Parametric Optimization of An Achromatic Doublet

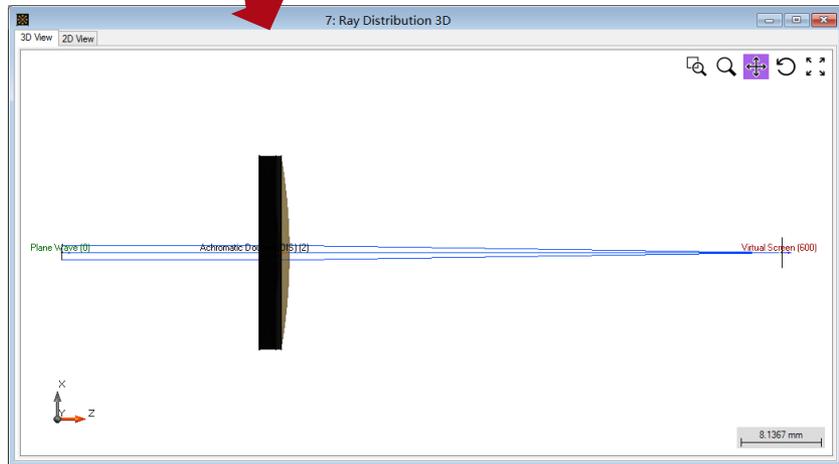
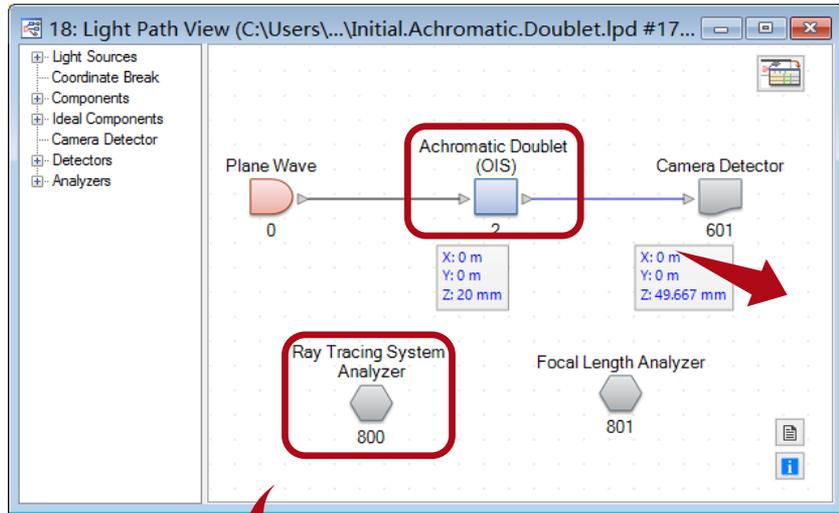
Optimization Task Description

- source
 - plane wave: wavelength 473nm, 532nm and 635nm
- 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



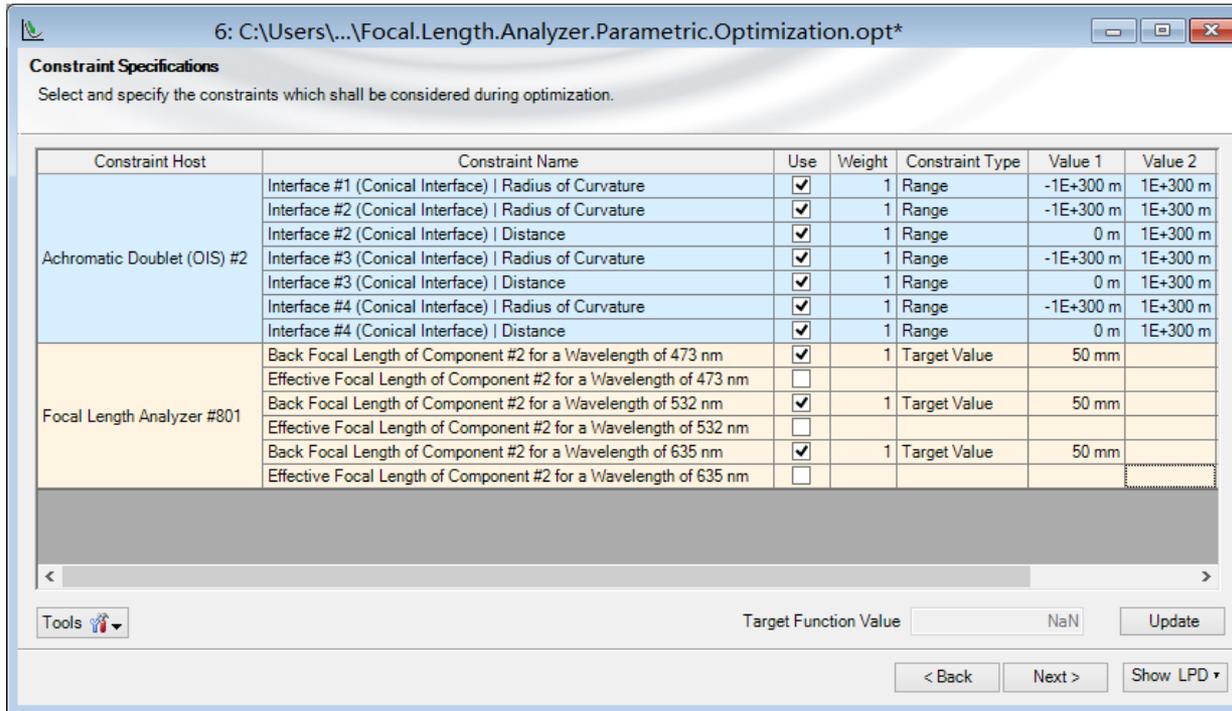
Edit Optical Interface Sequence

Index	Distance	Position	Type	Homogeneous Medium	Comment
1	0 m	0 m	Conical Interface	N-BK7_Schott_2015 in F	Enter your comr
2	2 mm	2 mm	Conical Interface	Air in Homogeneous Me	Enter your comr
3	100 μm	2.1 mm	Conical Interface	N-SF10_Schott_2015 in	Enter your comr
4	1 mm	3.1 mm	Conical Interface	Air in Homogeneous Me	Enter your comr

Tools: Add, Insert, Delete

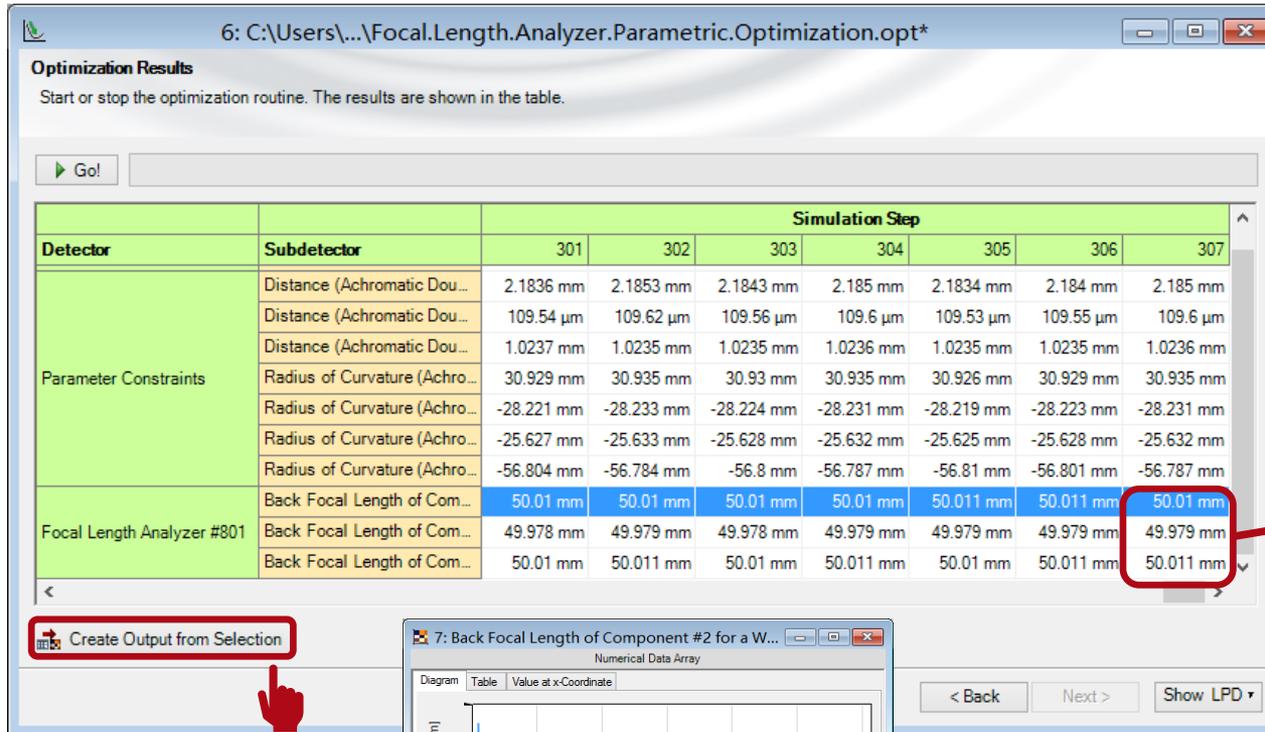
Buttons: OK, Cancel, Help

Set Optimization Target



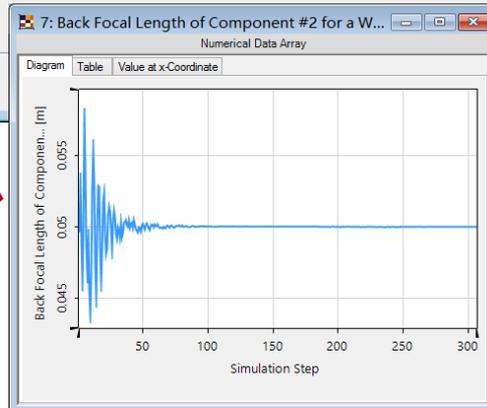
- Focal Length Analyzer
 - Back Focal Length is set to **50 mm**: for all chosen wavelengths

Optimization Result



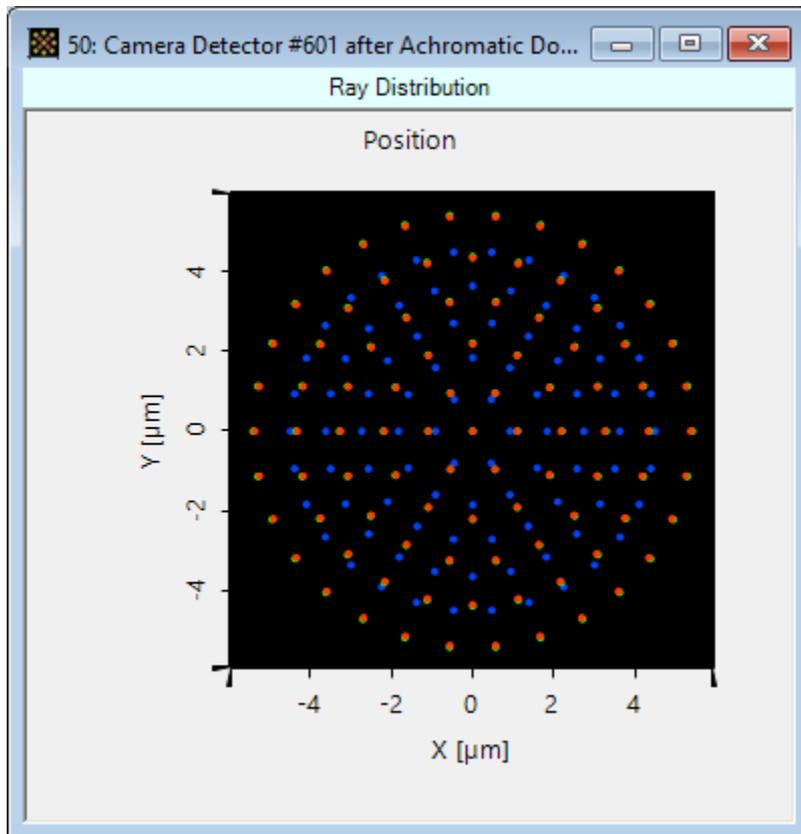
focal length after optimization

50.01 mm
49.979 mm
50.011 mm

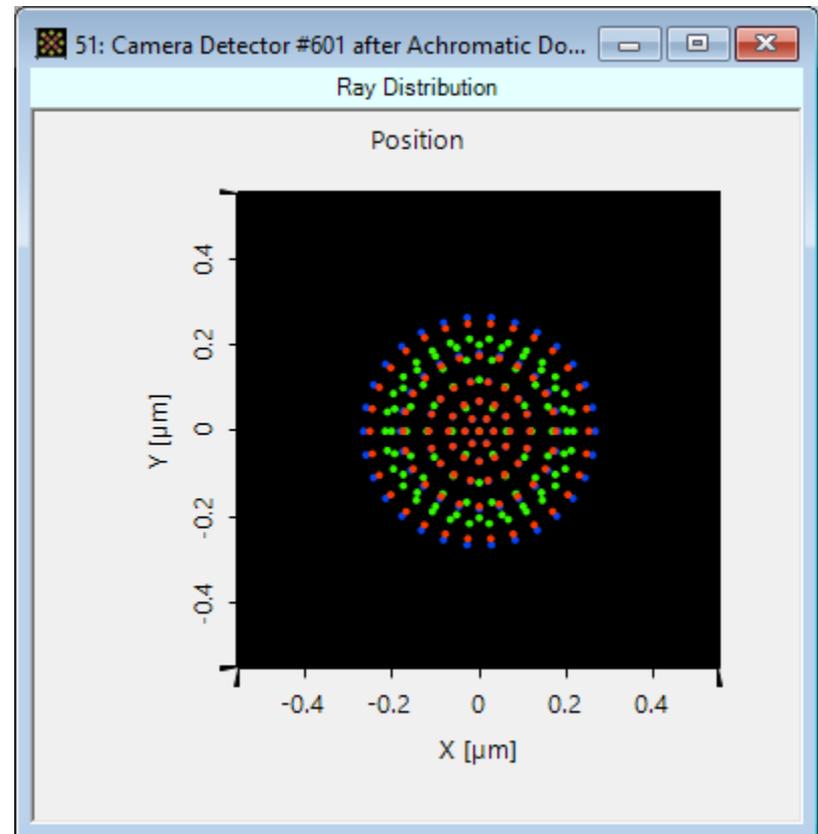


Comparison of Results

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
