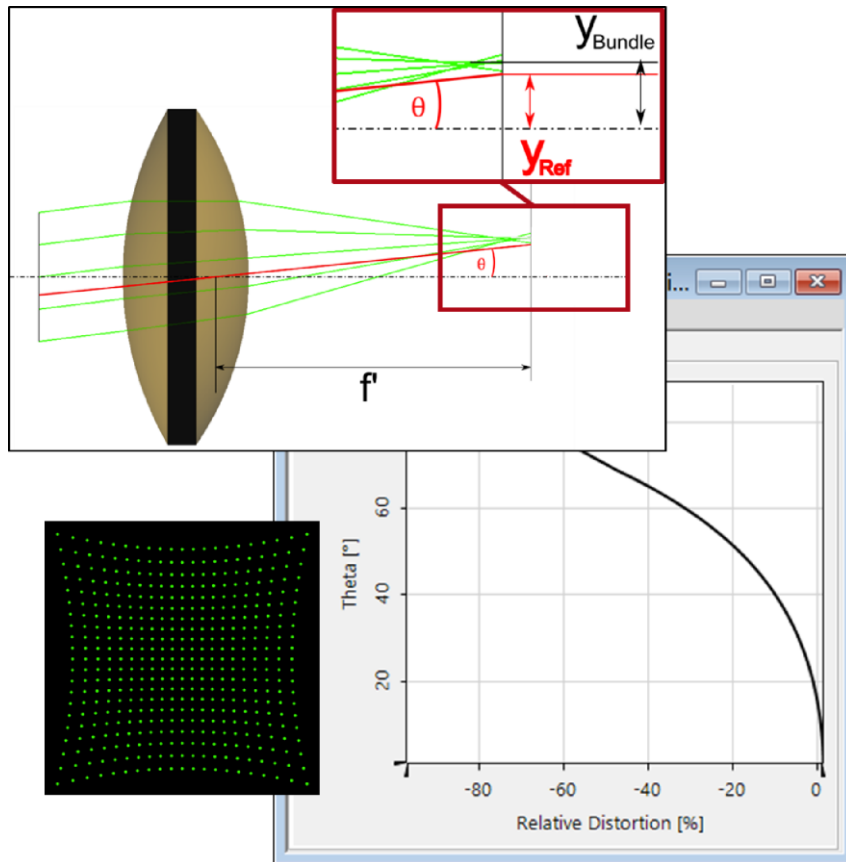


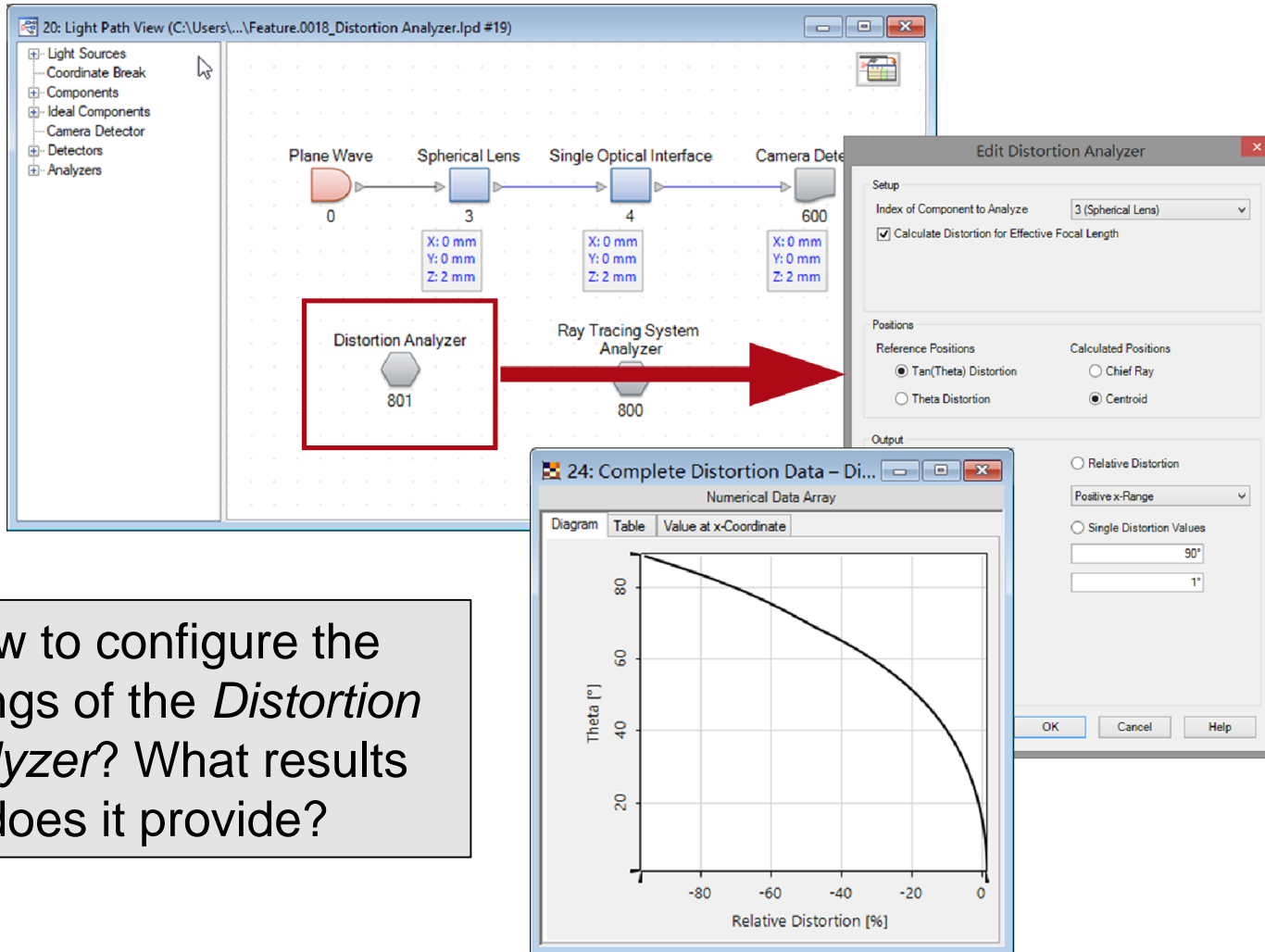
Usage of Distortion Analyzer

Abstract



Distortion is a vital aberration to consider in lens design. VirtualLab Fusion provides a specific analyzer for the distortion of an optical system that yields the standard representation of distortion versus angle. Here you can expect to find a definition of distortion and a step-by-step description of how to set the Distortion Analyzer in VirtualLab Fusion, illustrated with the example of a spherical lens.

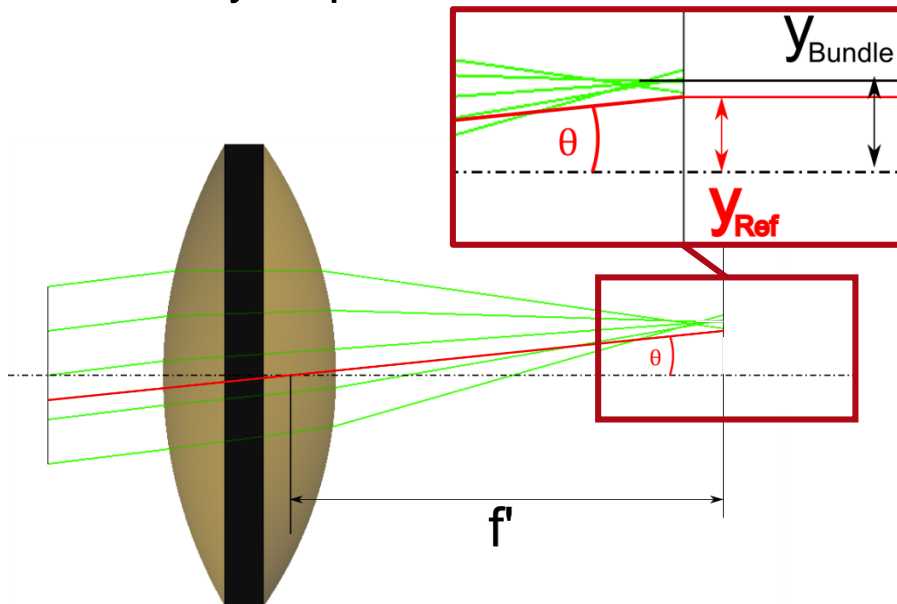
Modeling Task



How to configure the settings of the *Distortion Analyzer*? What results does it provide?

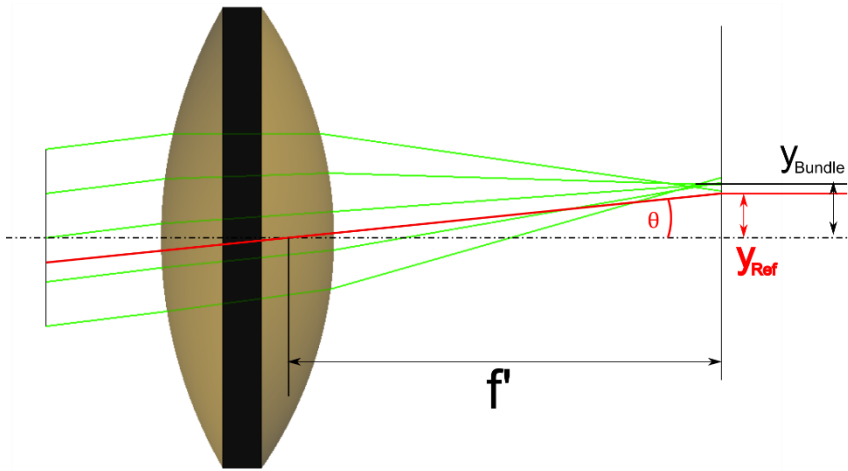
Definition of Distortion

- Distortion corresponds to spherical aberration of the chief ray. It is defined as the deviation of the lateral position of the ray bundle to a reference position at the focal plane.
- Using the effective focal length (f') of the scanning lens, one can calculate the position of reference ray at the focal plane, which mainly depends on the incidence angle.



- f' : effective focal length
- θ : incidence angle
- y_{Bundle} : lateral position of ray bundle
- y_{Ref} : lateral position of reference ray

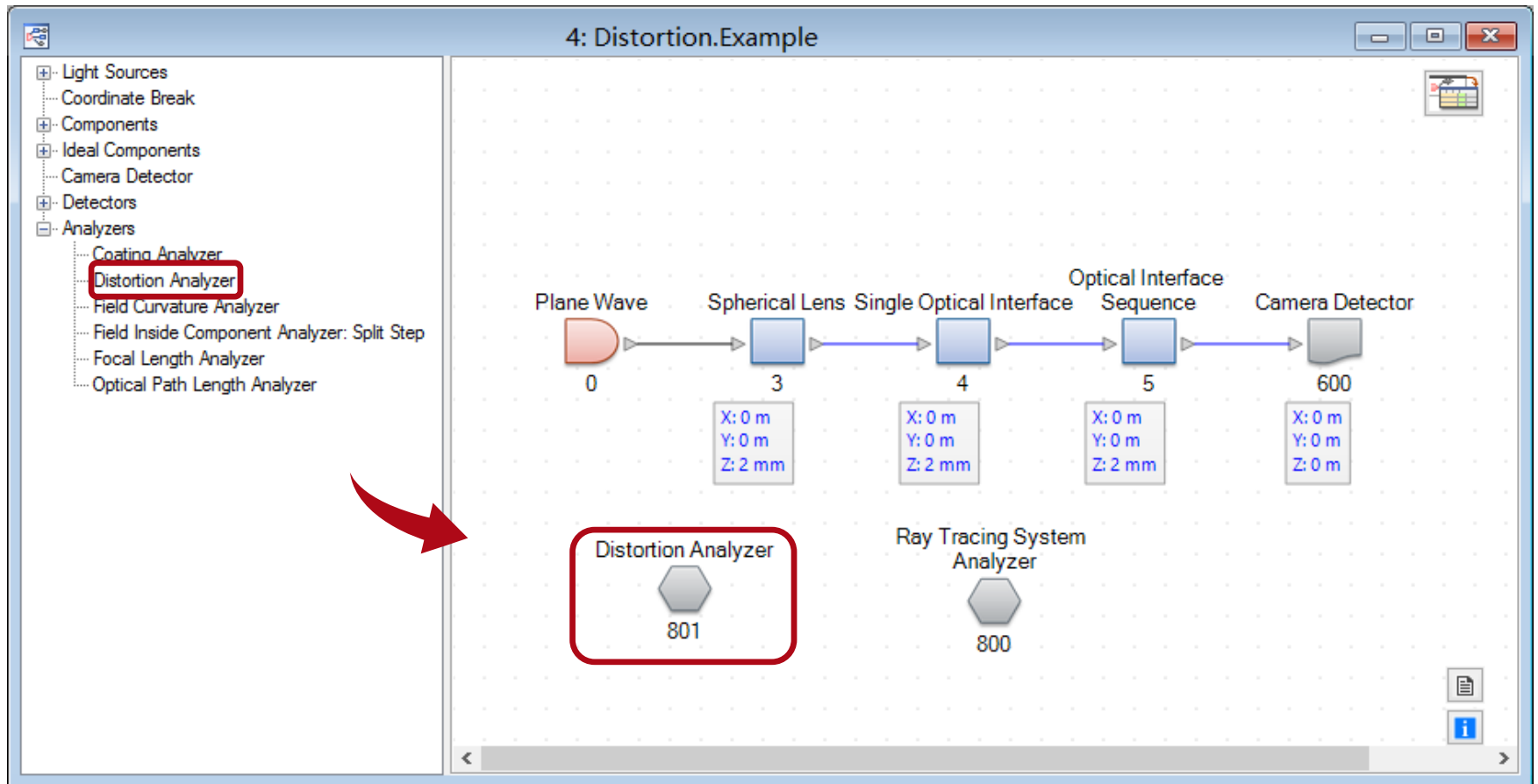
Definition of Distortion



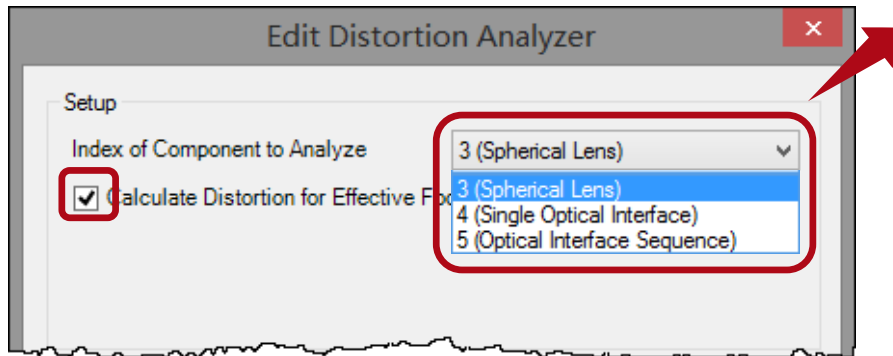
$$\text{Distortion} = \frac{y_{\text{Bundle}} - y_{\text{Ref}}}{y_{\text{Ref}}}$$

- F-Tan(Theta) distortion: $y_{\text{Ref}} = f' \cdot \tan(\theta)$
- F-Theta distortion: $y_{\text{Ref}} = f' \cdot \theta$
- Ray bundle position (y_{Bundle}):
 - Chief ray: connects the outer point of the field of view and the center of the pupil
 - Centroid: physical relevant is the energy centroid

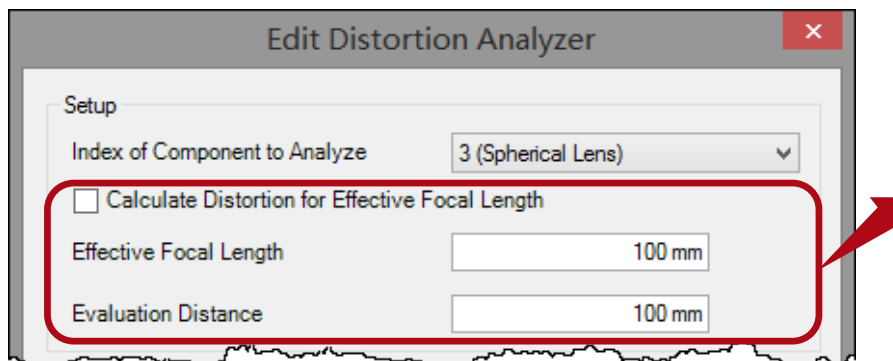
Distortion Analyzer in VLF



Setting of the Analyzer

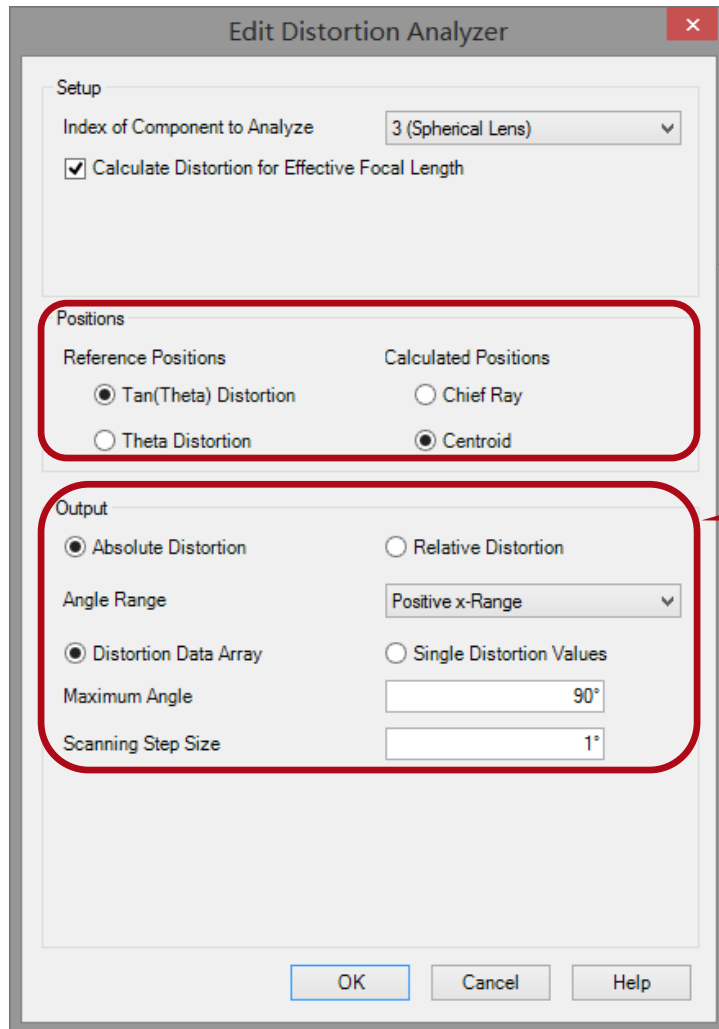


or



- Select a lens component to be analyzed. The analysis is independent of the system.
- Check the option to set the detector plane at effective focal length
- Determine the *Evaluation Distance* by the user's requirement.

Setting of the Analyzer



- Positions (distortion type)
 - Reference position
 - Calculated ray bundle position
- Output (Result display)
 - *Absolute Distortion* ([m]) or *Relative Distortion* ([%])
 - *Angle Range*: 4 scan options (x, y, -x, -y)
 - *Distortion Data Array* or *Single Distortion Values*

Distortion of Spherical Lens

22: Light Path View (C:\Users\...\Distortion.Example.Ipd #21)

Plane Wave 0 Spherical Lens 3 Single Optical Interface 4 Optical Interface Sequence 5 Camera Detector 600

X: 0 m
Y: 0 m
Z: 2 mm

X: 0 m
Y: 0 m
Z: 2 mm

X: 0 m
Y: 0 m
Z: 2 mm

X: 0 m
Y: 0 m
Z: 0 m

Distortion Analyzer 801 Ray Tracing System Analyzer 800

3: Distortion.Example*

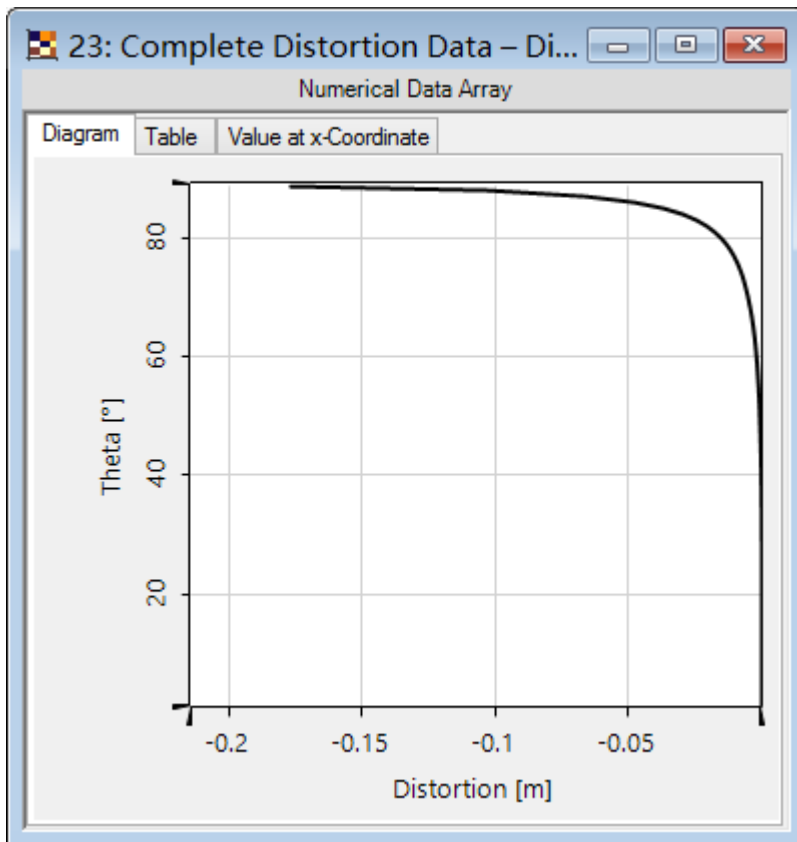
Path Detectors Analyzers Logging

Start Element				Target Element		Linkage	
Index	Type	Channel	Medium	Index	Type	Propagation Method	On/Off
0	Plane Wave	-	Air in Homogeneous Medi...	3	Spherical Lens	Automatic Propagation Operator	On
3	Spherical Lens	T	Air in Homogeneous Medi...	4	Single Optical Interface	Automatic Propagation Operator	On
4	Single Optical Interface	T	N-BK7_Schott_2015 in Ho...	5	Optical Interface Sequence	Automatic Propagation Operator	On
5	Optical Interface Sequence	T	N-BK7_Schott_2015 in Ho...				

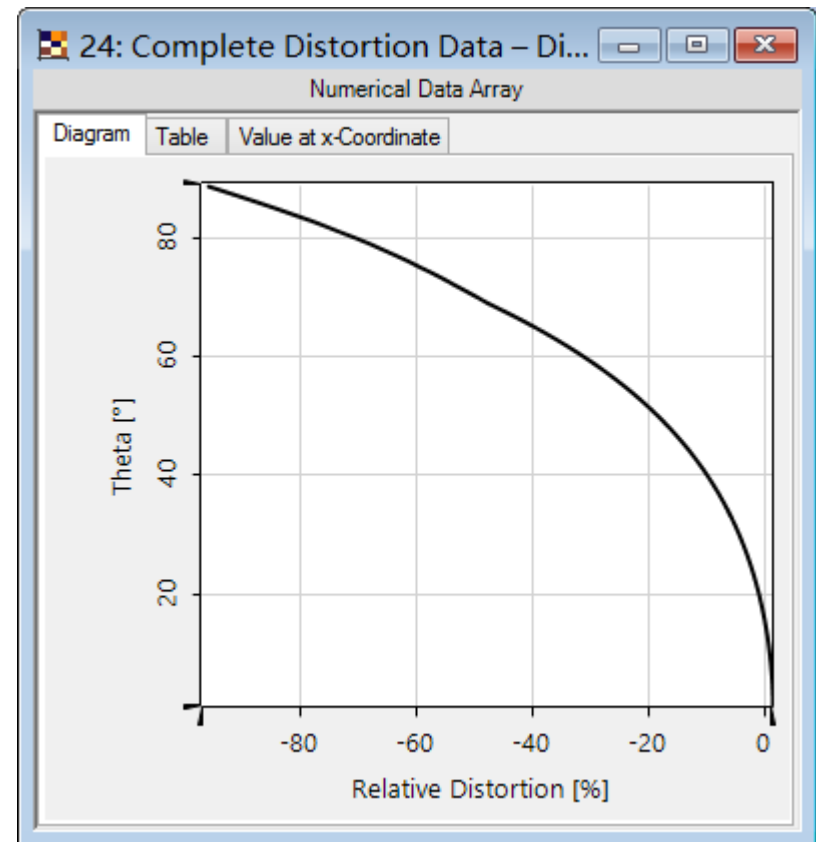
Simulation Engine 801: Distortion Analyzer Go!

Distortion of Spherical Lens

Absolute Distortion Result



Relative Distortion Result



Document Information

title	Usage of Distortion Analyzer
version	2.0
VL version used for simulations	7.0.3.4
category	Feature Use Case
