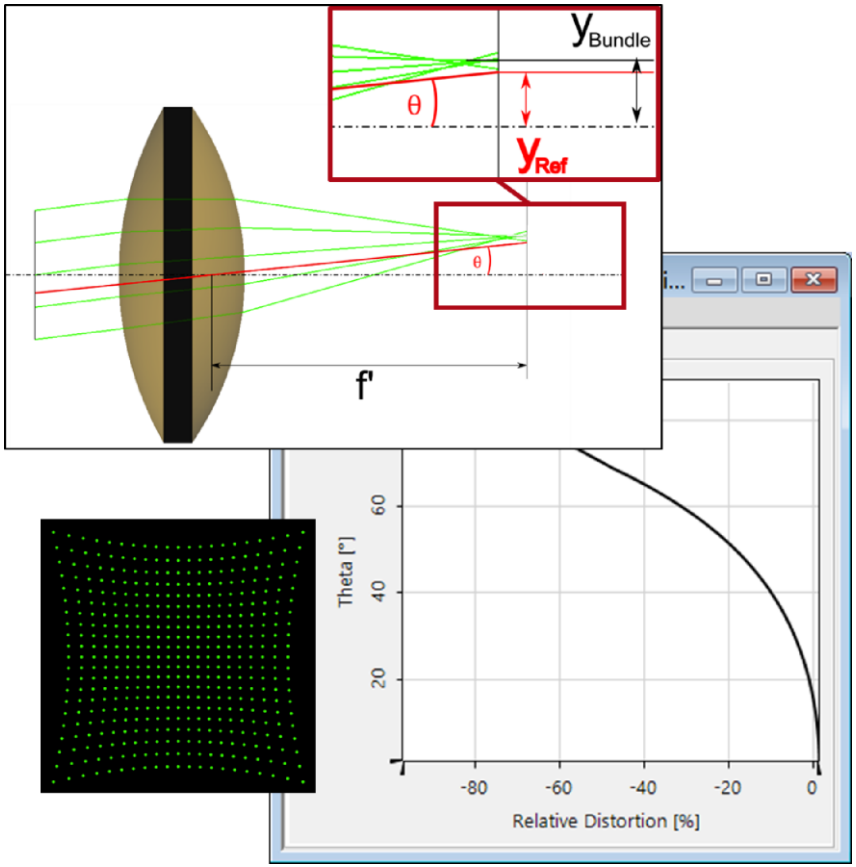
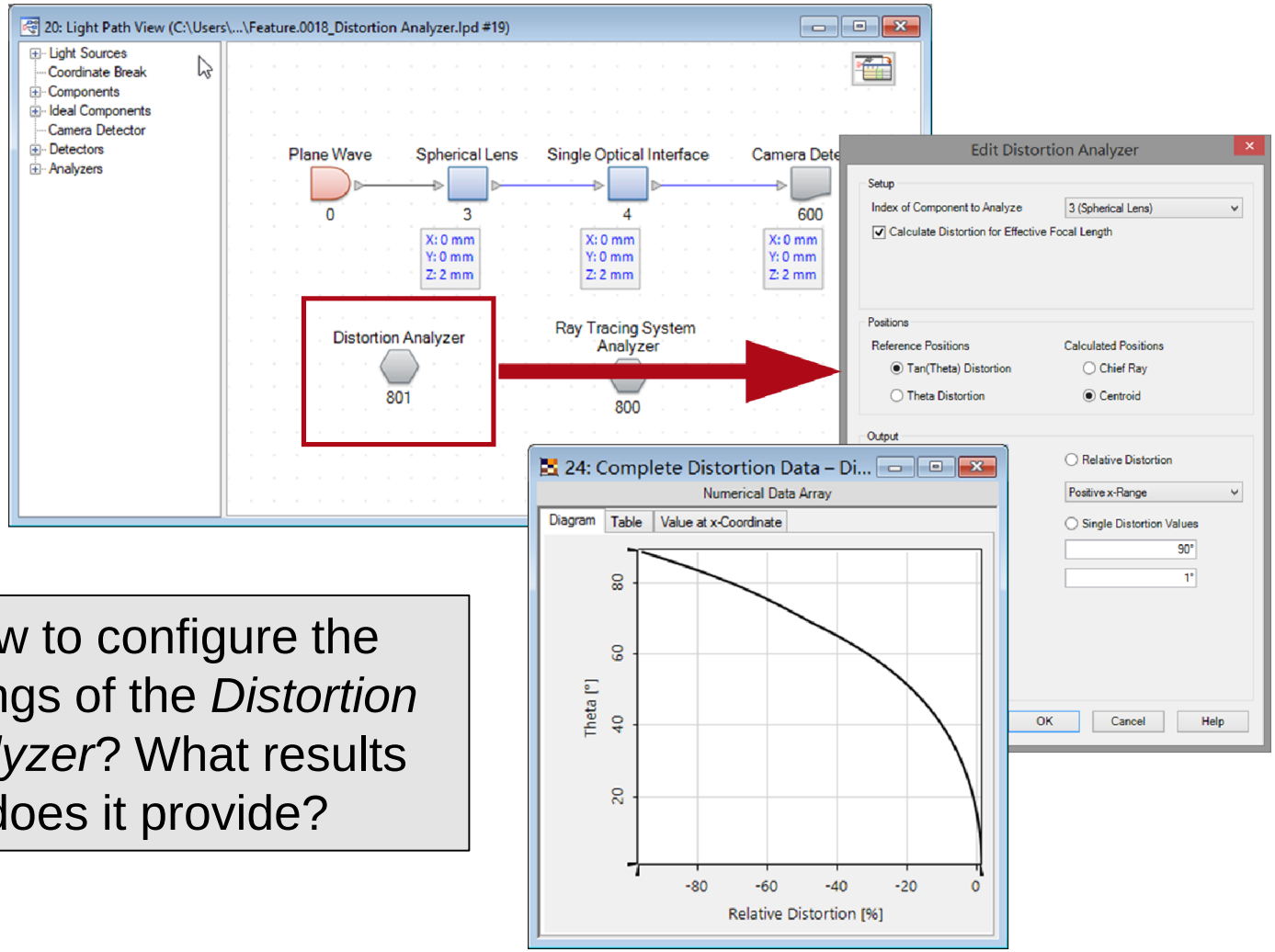
Usage of Distortion Analyzer

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.

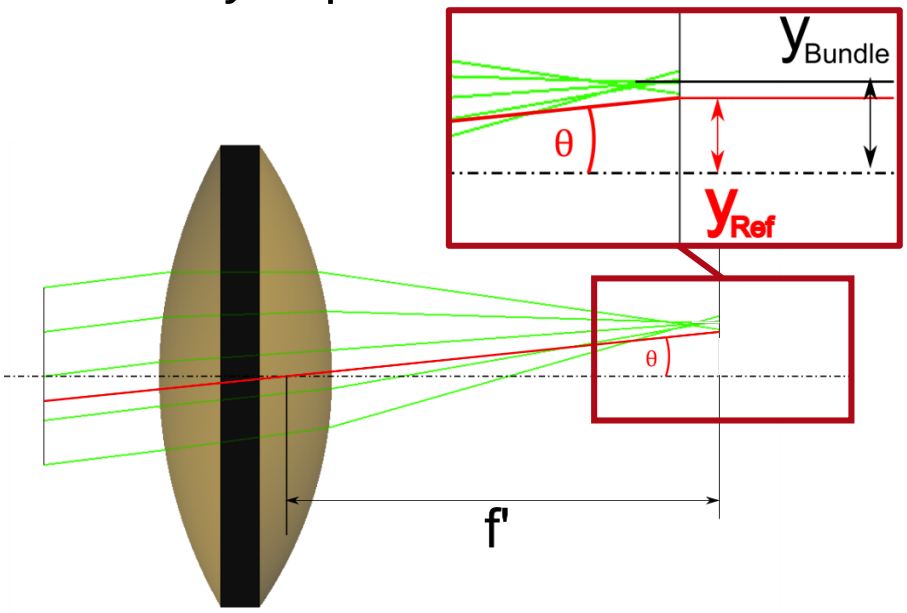
Modeling Task



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

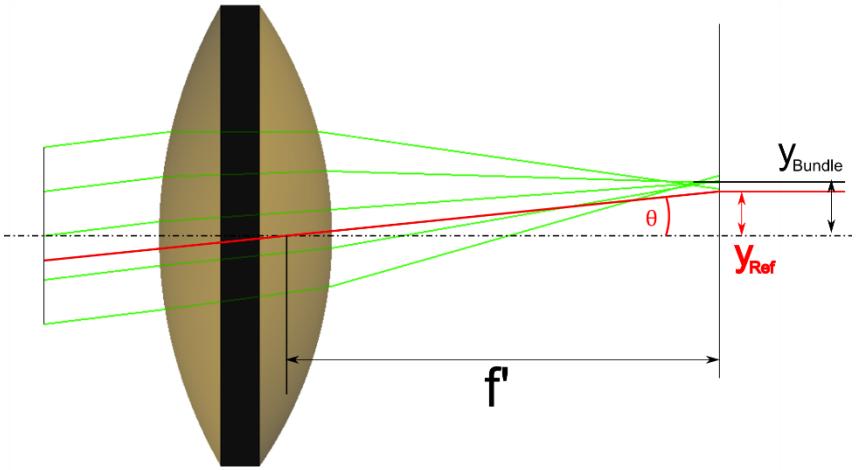
Definition of Distortion

- 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

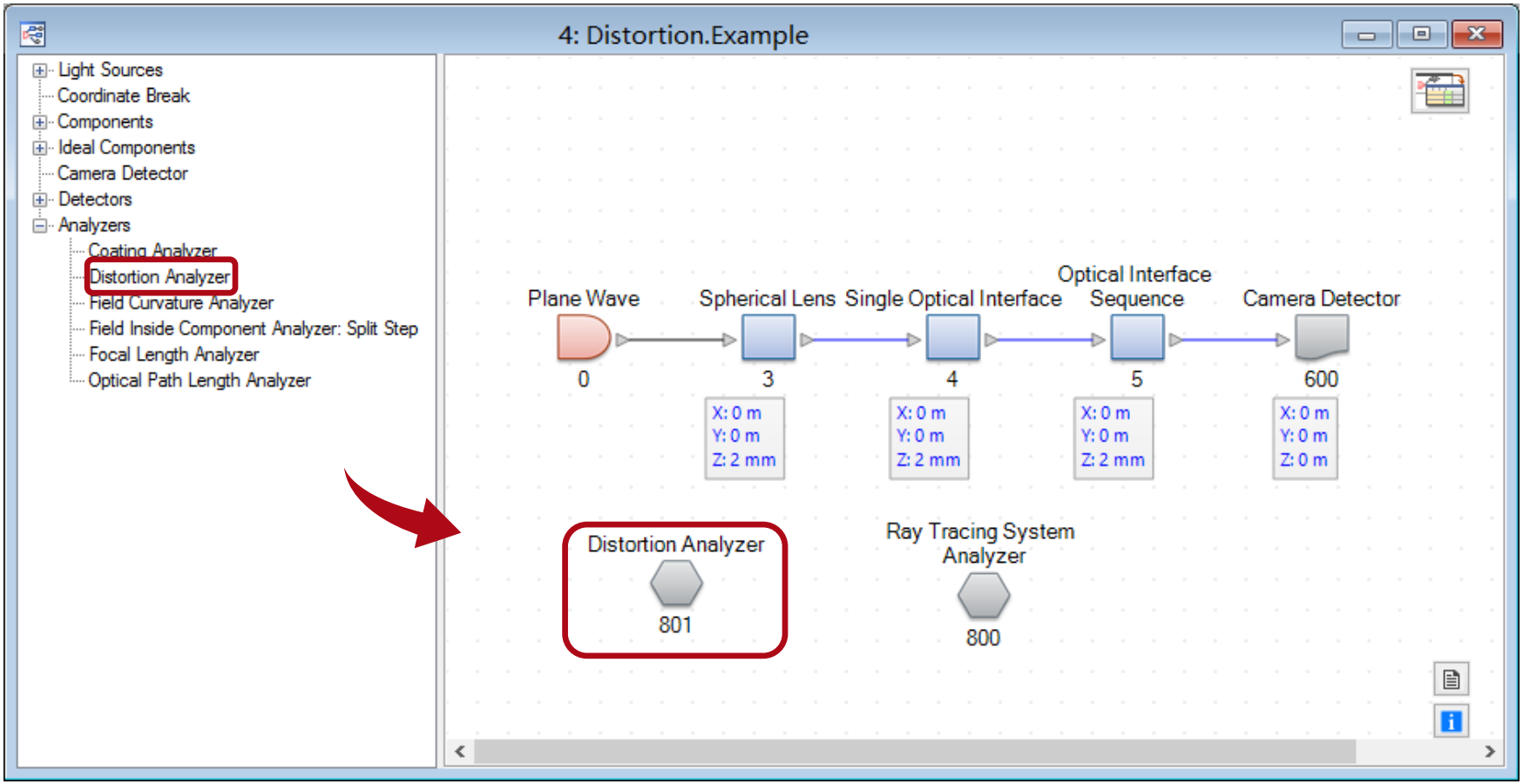
Definition of Distortion



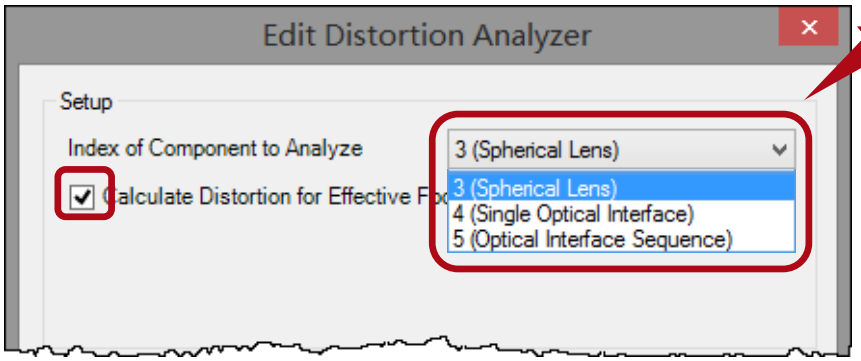
$$\text{Distortion} = \frac{y_{\text{Bundle}} - y_{\text{Ref}}}{y_{\text{Ref}}}$$

- 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

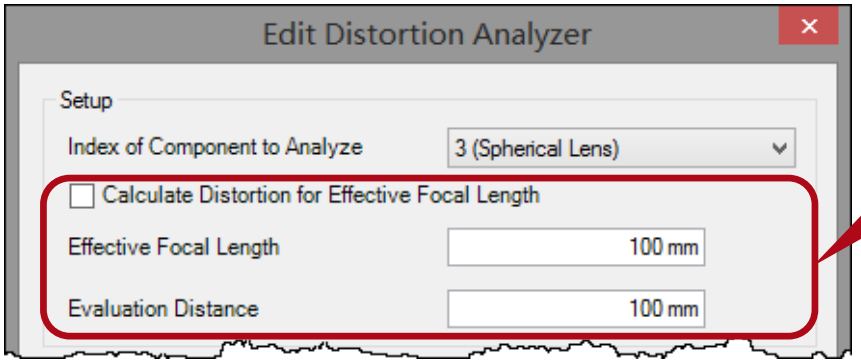
Distortion Analyzer in VLF



Setting of the Analyzer

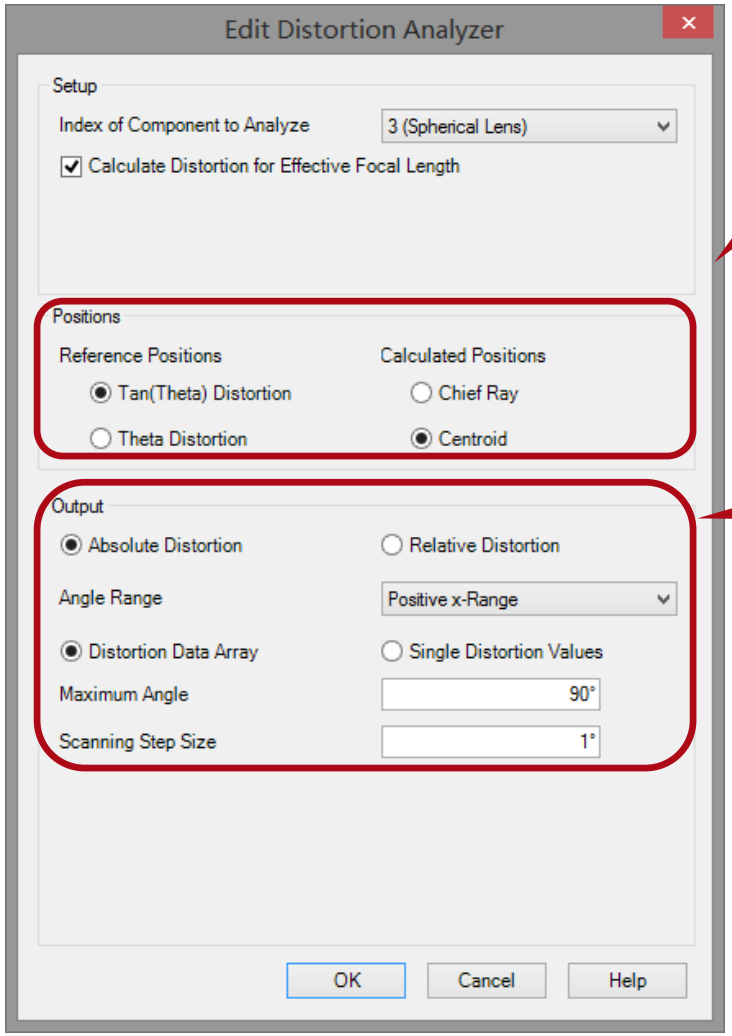


or



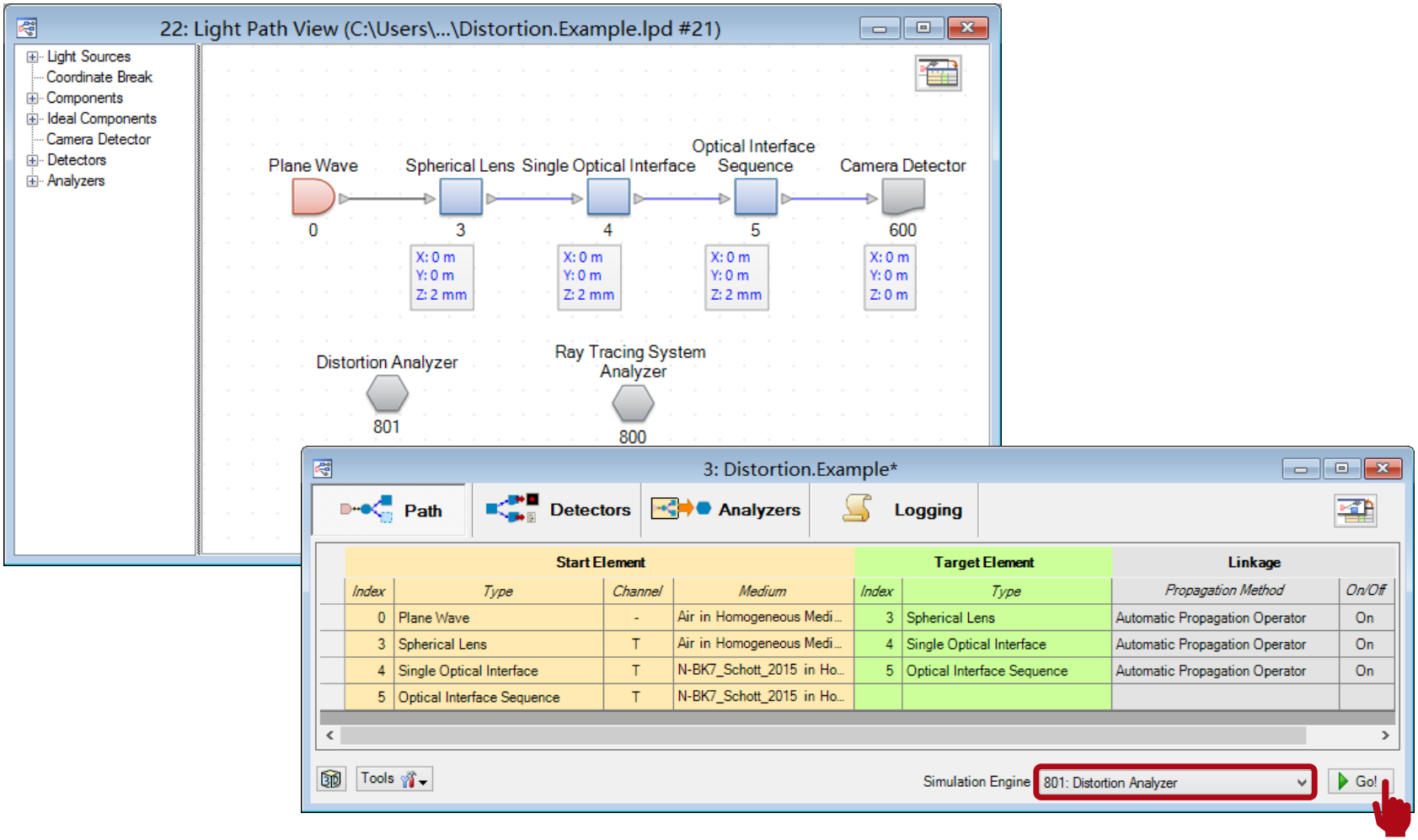
- Select a lens component to be analyzed. The analysis is independent of the system.
- Check the option to set the detector plane at effective focal length
- Determine the *Evaluation Distance* by the user's requirement.

Setting of the Analyzer



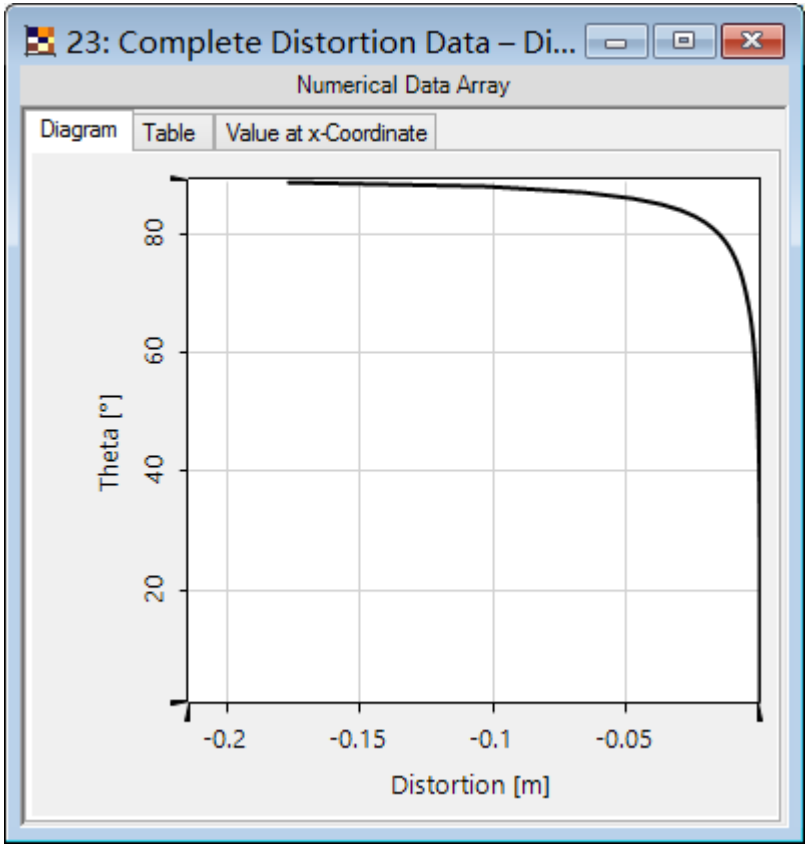
- Positions (distortion type)
  - Reference position
  - Calculated ray bundle position
- Output (Result display)
  - *Absolute Distortion* ([m]) or *Relative Distortion* ([%])
  - *Angle Range*: 4 scan options (x, y, -x, -y)
  - *Distortion Data Array* or *Single Distortion Values*

Distortion of Spherical Lens

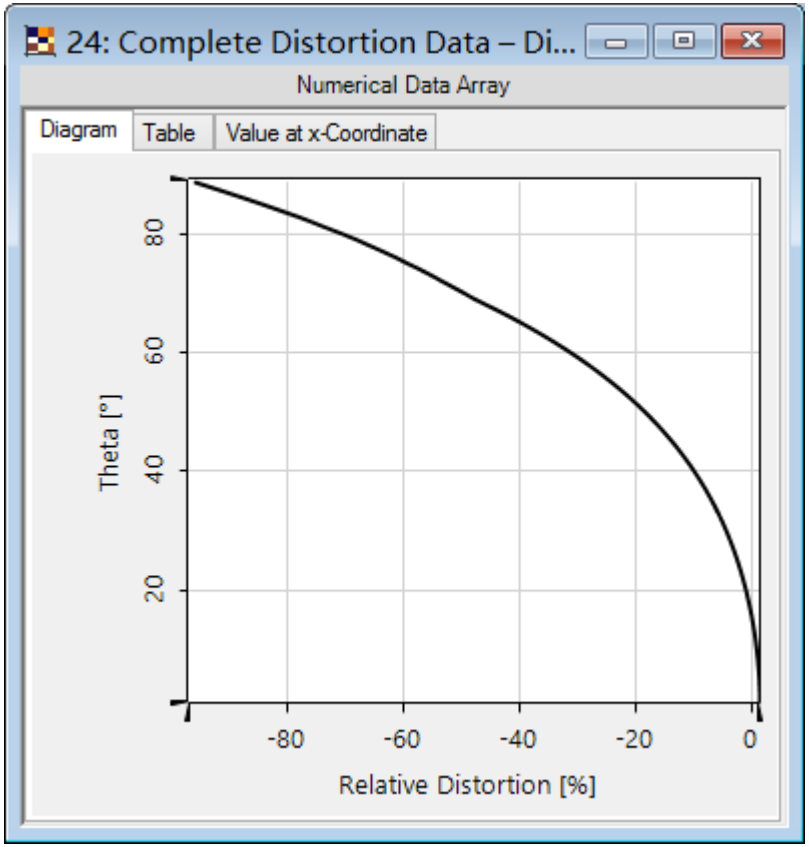


Distortion of Spherical Lens

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