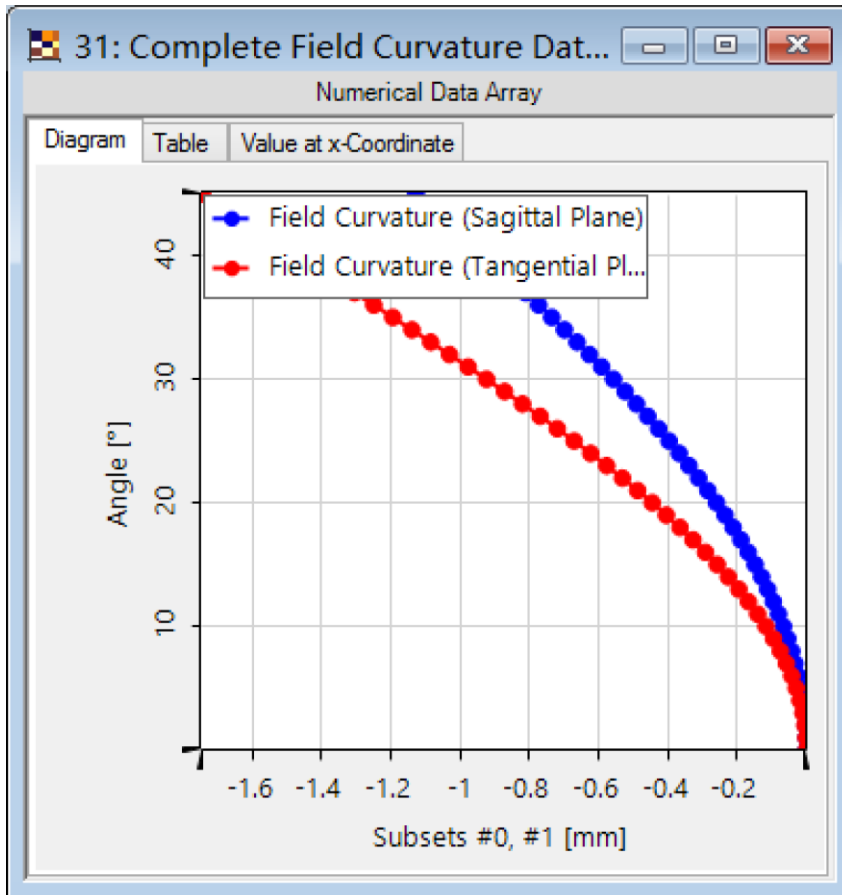


Usage of Field Curvature Analyzer

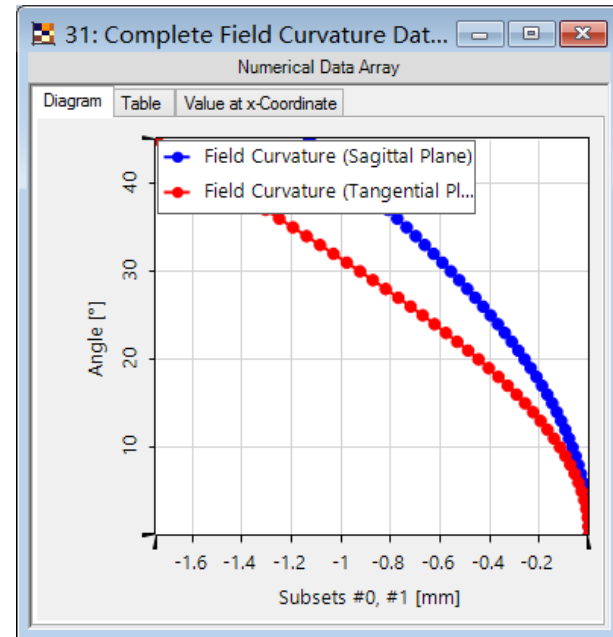
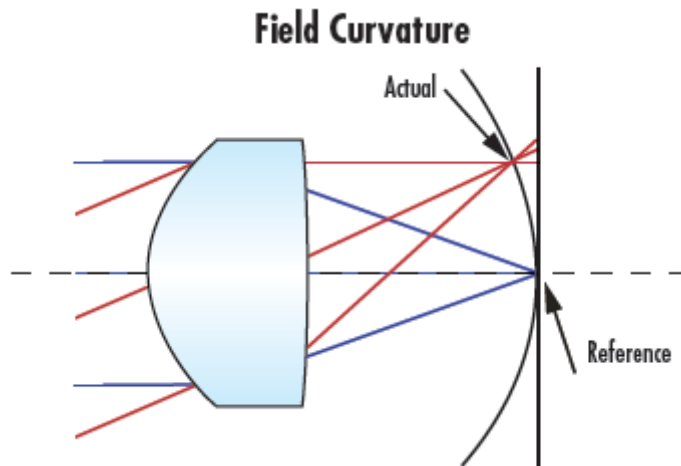
Abstract



In VirtualLab Fusion, the field curvature of a lens component can be analyzed precisely, with the field curvature analyzer. The field curvature curve can be calculated with respect to angle or object height, and shows the aberration in both sagittal plane and tangential plane. This use case shows how to set up the parameters in the field curvature analyzer.

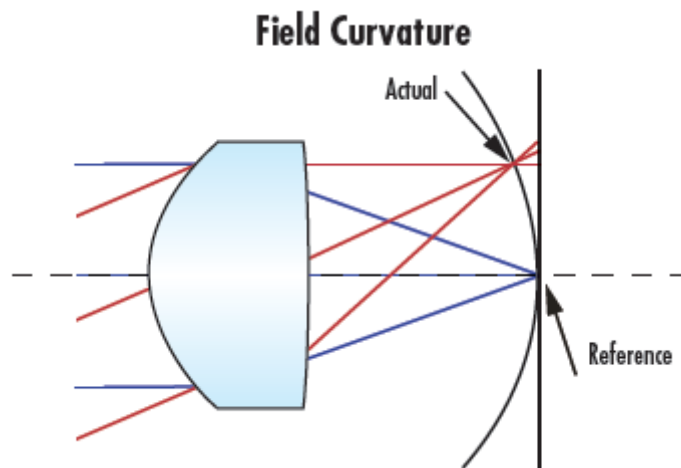
Modeling Task

- What is the definition of field curvature
- How to set the field curvature analyzer in VirtualLab



What is Field Curvature?

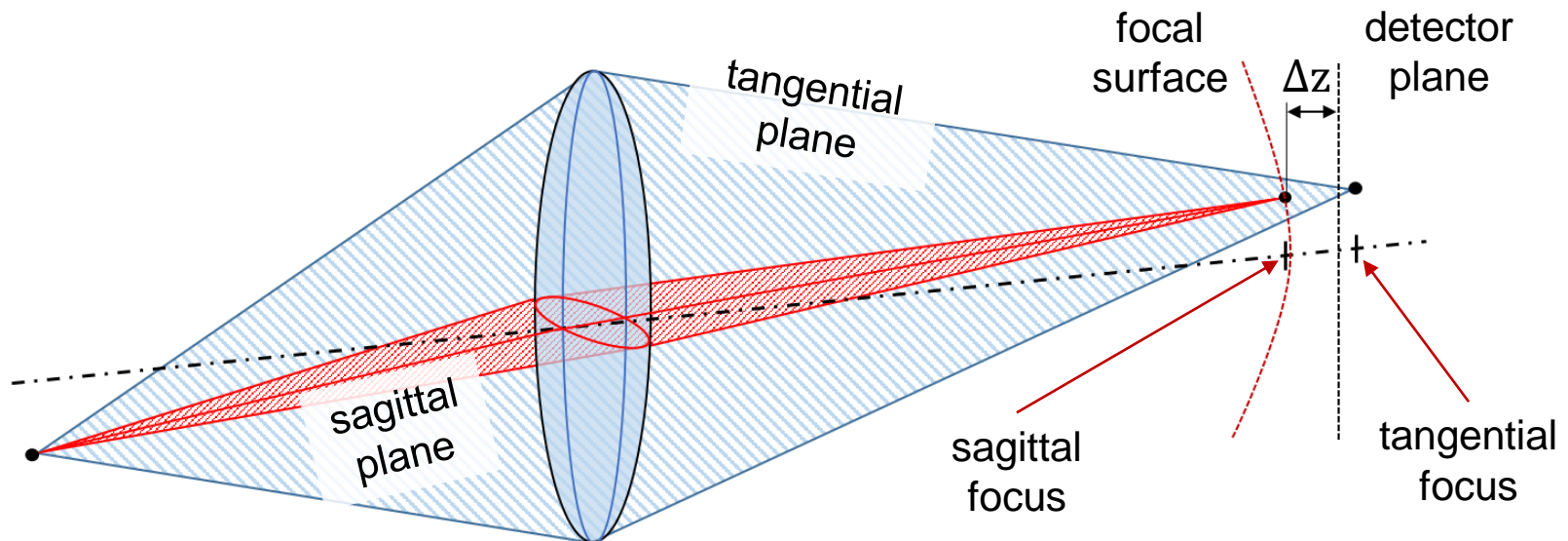
- Field Curvature, also known as “curvature of field” is a common optical problem that causes a flat object to appear sharp in a certain part(s) of the frame, instead of being uniformly sharp across the frame. This happens due to the curved nature of optical elements, which project the image in a curved manner, rather than flat.



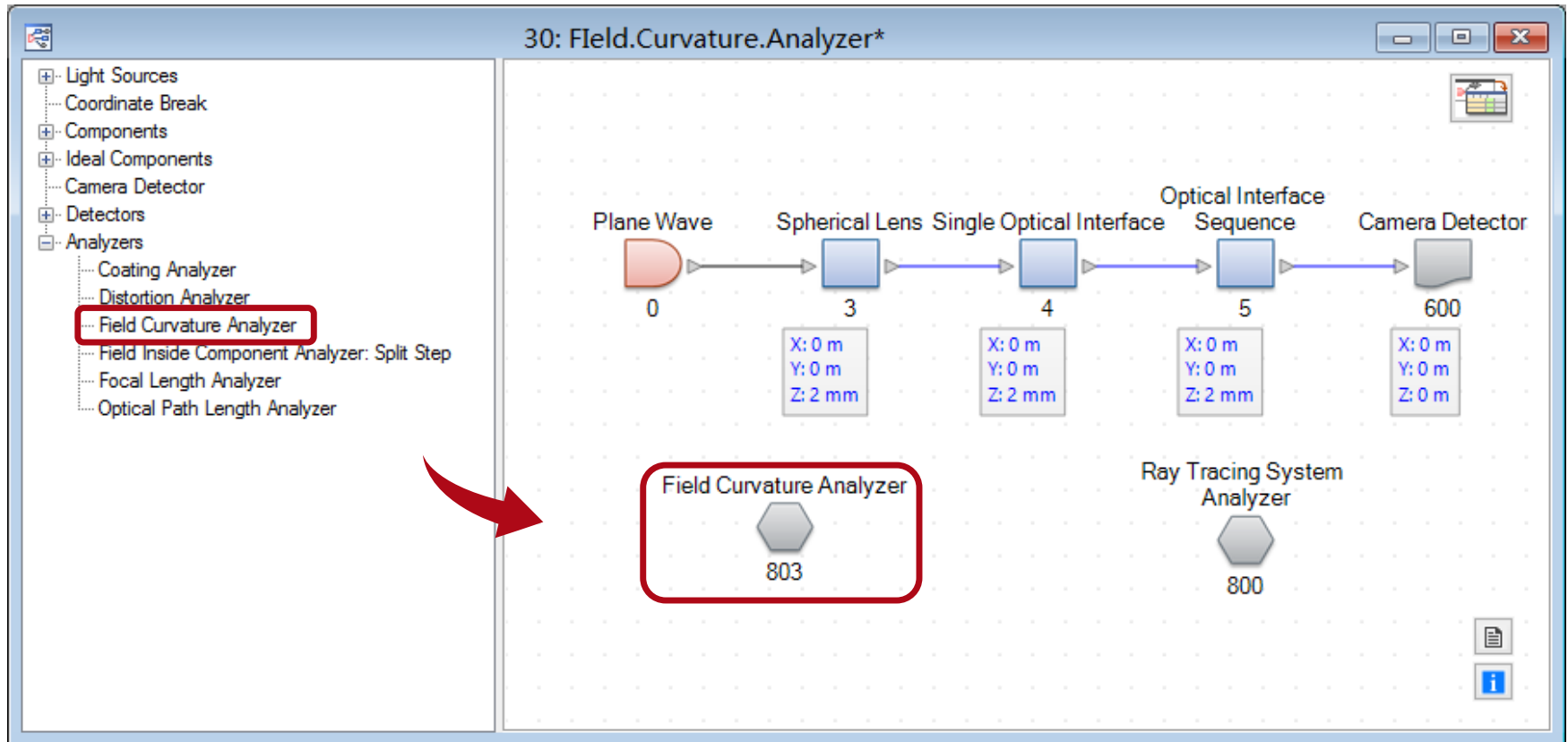
Field curvature is the aberration that describes the magnitude to which the image plane wants to be naturally curved.

Determination of Field Curvature

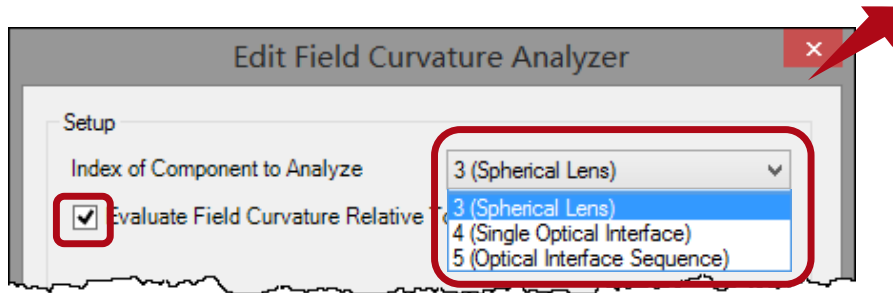
- The field curvature is measured along the z-axis (Δz is the distance between focus of the ray bundle and detector plane).
- The position of focus is determined via the RMS spot radius in two separated planes: the tangential and the sagittal plane (see figure below).
- It is a criteria for defocusing of off-axis beams regarding a flat image plane. The perfect image describes a curved surface instead. This fact has to be taken into account for example in laser scanning applications.



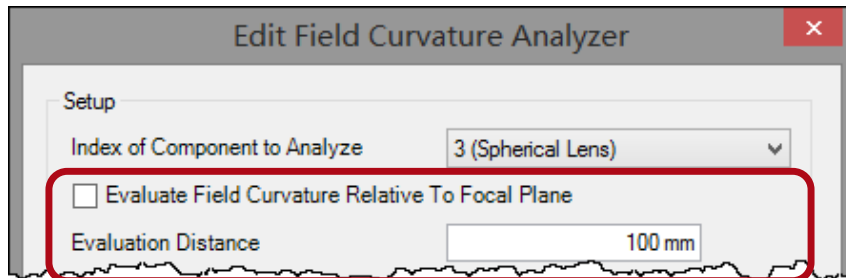
Field Curvature Analyzer in VirtualLab



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* according to user's requirement

Setting of the Analyzer

Field Curvature vs. Angle

The screenshot shows the 'Edit Field Curvature Analyzer' dialog box. The 'Setup' section includes a dropdown for 'Index of Component to Analyze' set to '3 (Spherical Lens)' and a checked checkbox for 'Evaluate Field Curvature Relative To Focal Plane'. The 'Finite Object Distance' checkbox is unchecked and highlighted with a red box. A red arrow points from this box to the 'Output' section. The 'Output' section has checked checkboxes for 'Results for Sagittal Plane' and 'Results for Tangential Plane'. The 'Angle Range' dropdown is set to 'Positive x-Range' and is highlighted with a red box. Below it, the 'Field Curvature Data Array' radio button is selected. The 'Maximum Angle' is set to 45° and the 'Scanning Step Size' is set to 1°. The 'OK', 'Cancel', and 'Help' buttons are at the bottom.

Field Curvature vs. Object Height

The screenshot shows the 'Edit Field Curvature Analyzer' dialog box. The 'Setup' section is identical to the first image. The 'Finite Object Distance' checkbox is checked and highlighted with a red box. A red arrow points from this box to the 'Distance to Object Plane' text box, which contains '100 mm'. The 'Output' section is identical to the first image. The 'Object Height Range' dropdown is set to 'Positive x-Range' and is highlighted with a red box. Below it, the 'Field Curvature Data Array' radio button is selected. The 'Maximum Object Height' is set to 2 mm and the 'Scanning Step Size' is set to 40 μm. The 'OK', 'Cancel', and 'Help' buttons are at the bottom.

Field Curvature of Spherical Lens

The image shows a simulation software interface with two windows. The top window, titled "30: Field.Curvature.Analyzer*", displays an optical layout on a grid. The layout consists of the following elements from left to right:

- Plane Wave** (Index 0): A red semi-circular source.
- Spherical Lens** (Index 3): A blue square component with coordinates X: 0 m, Y: 0 m, Z: 2 mm.
- Single Optical Interface** (Index 4): A blue square component with coordinates X: 0 m, Y: 0 m, Z: 2 mm.
- Optical Interface Sequence** (Index 5): A blue square component with coordinates X: 0 m, Y: 0 m, Z: 2 mm.
- Camera Detector** (Index 600): A grey detector component with coordinates X: 0 m, Y: 0 m, Z: 0 m.

Below the layout, two analyzer components are visible: "Field Curvature Analyzer" (Index 803) and "Ray Tracing System Analyzer" (Index 800).

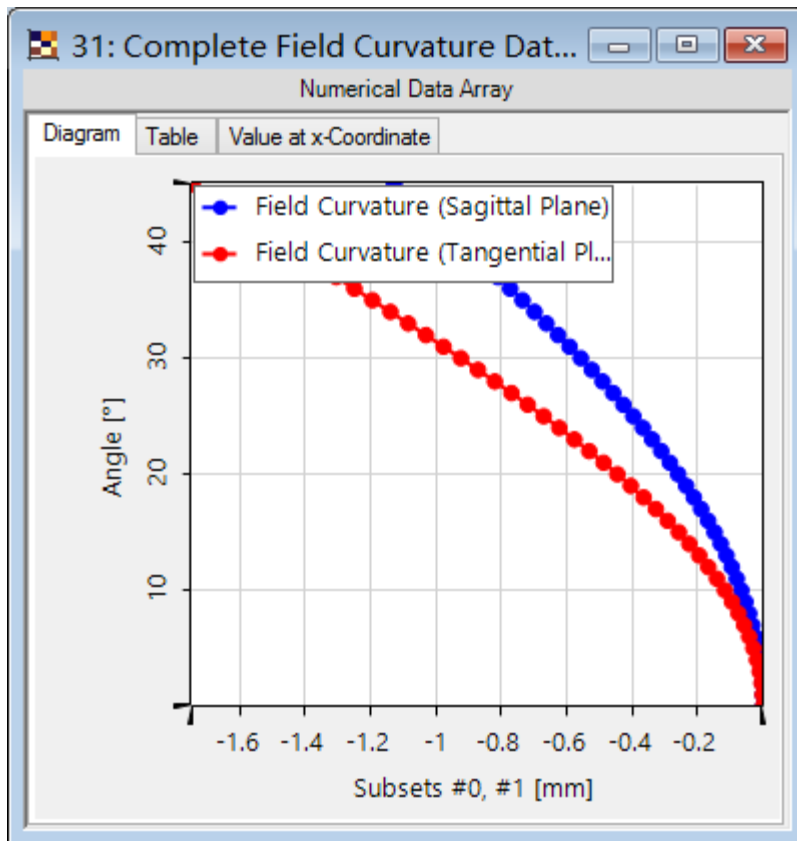
The bottom window, titled "29: Field.Curvature.Analyzer*", shows the configuration for the "Field Curvature Analyzer". It has tabs for "Path", "Detectors", "Analyzers", and "Logging". The "Analyzers" tab is active, displaying a table with the following data:

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...				

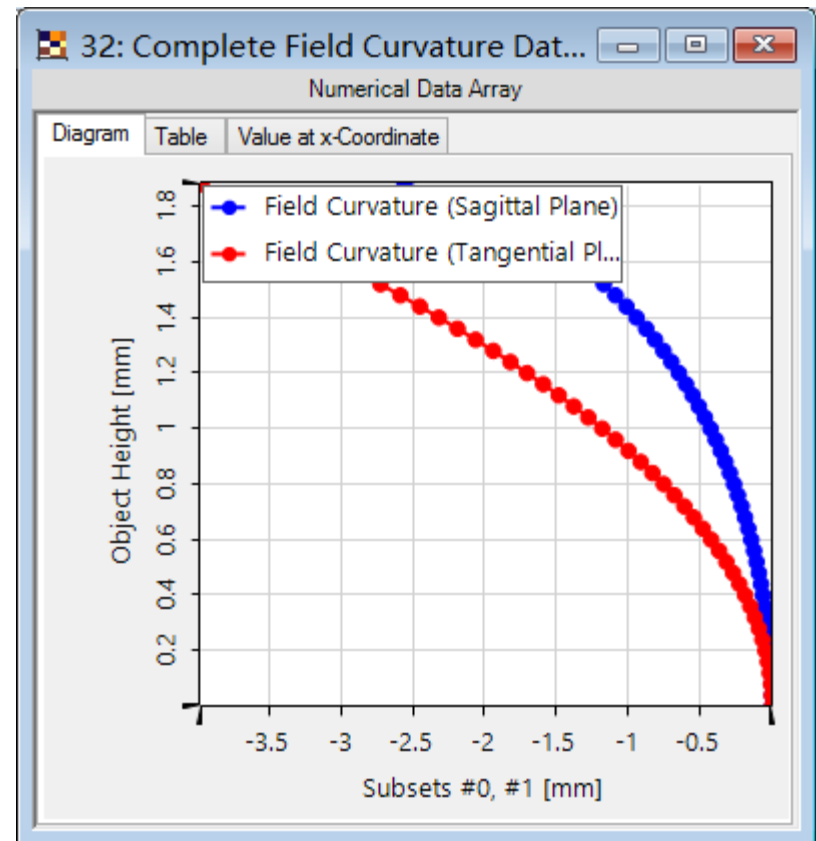
At the bottom of the window, the "Simulation Engine" dropdown menu is set to "803: Field Curvature Analyzer", which is highlighted with a red box. A red hand icon is pointing at the "Go" button.

Field Curvature of Spherical Lens

Field Curvature vs. Angle



Field Curvature vs. Object Height



Document Information

title	Usage of Field Curvature Analyzer
version	1.0
VL version used for simulations	7.0.3.4
category	Feature Use Case
