Polarization Ellipses
Abstract

As light is more than just power and flux, the full vectorial representation as electromagnetic wave in VirtualLab Fusion enables to reveal all its characteristics. One parameter that is of high interest in modern applications, is the polarization state at certain locations inside the regarding optical system. In order to visualize the polarization state of a considered complex wave in a depictive way, VirtualLab Fusion utilizes so-called polarization ellipses. This visualization option indicates the strength and type of polarization for waves that comprise at least two field components. Moreover, various options to customize the shown ellipses in color, size, etc. are available.
How to Visualize the Polarization State of Light – Detector

The Universal Detector enables to visualize the polarization of light by polarization ellipses. The corresponding option can be found in the settings dialog of the Electromagnetic Field Quantity Add-on.

Please note, that for the visualization a field with at least two components is required and detected.

More information for the Universal Detector under: Universal Detector
How to Visualize the Polarization State of Light – Data Array

It is also possible to retroactively visualize the polarization state of light, represented as *Data Array*, where at least two field components are stored in subsets.

This can be done by using the *Add Polarization Ellipses* option in the *Graphic Add-ons* section of the *Manipulations* ribbon.
For the demonstration of the available features of this tool, a donut mode is used, that consists of two Hermite gaussian (1,0) modes (one is linearly polarized in x and the other in y-direction).
The Jones vector generated by this source is radially symmetric around the origin. This can be shown in the field data directly by using the function *Show xy-Ellipses* found in the *Graphics Add-ons* section of the *View* ribbon.
The visualization options for the polarization ellipses can be accessed from the main menu by clicking on the small blue cog wheel or by clicking on Configure All.

The Graphic Add-on can be customized in various ways, including changing the thickness and color of the lines. It is also possible to add small arrows and use two different colors to visually distinct clockwise and counterclockwise orientation.

Finally, the Minimum Cell Size (Screen Pixels) parameter determines how many detector pixels shall be grouped together for the visualization of a single polarization ellipse, as in most cases it is too confusing to display one ellipse per sampling point. For visual impressions of the options, please have a look on the following pages.
Configuration – Change Line Thickness
Note: If different colors are used to indicate the orientation, the arrows of the polarization ellipses can be deactivated.
Configuration – Minimum Cell Size
Extrapolation Info – Nearest Neighbor

There are two options to extrapolate the polarization ellipses from a unit cell. If the option *Nearest Neighbor* is chosen, only the polarization ellipse that belongs to the point closest to the center of the unit cell will be shown.

When *Draw Grid* is checked, the borders of one unit cell are visualized.
If **Average** is chosen instead, the Jones vectors of all points inside the unit cell will be averaged. This value then will be used to visualize the polarization ellipse of the entire unit cell.

When **Draw Grid** is checked, the borders of one unit cell are visualized.