Focus Investigation behind Aspherical Lens
High-power laser diodes often show asymmetric divergence and astigmatism between two directions. As an example, a laser diode is firstly collimated by an objective, then focused by an aspherical lens, and the evolution of the field in focal region is investigated in VirtualLab Fusion. The influence from the astigmatism on the field in focal region is clearly presented, with comparison to the case without astigmatism.
Modeling Task

Laser Components
WSLD-1064-050m-1-PD
- fundamental Gaussian
- wavelength 1064 nm
- linear polarized in y-direction
- divergence (FWHM) $20^\circ \times 10^\circ$
- astigmatism 11.6 µm between x- and y-plane

What is the field in focal region behind an aspherical lens? Especially, the astigmatism of the laser diode must be taken into account.
System Analysis with Ray Tracing

Ray-tracing analysis provides a fast overview of the system in space.
Investigation on Focal Plane

- Physical-optics simulation of whole system, including collimation and focusing lenses, takes only 2 seconds!

<table>
<thead>
<tr>
<th>diameter</th>
<th>without astigmatism</th>
<th>with astigmatism</th>
</tr>
</thead>
<tbody>
<tr>
<td>x direction</td>
<td>11.3 µm</td>
<td>11.8 µm</td>
</tr>
<tr>
<td>y direction</td>
<td>19.0 µm</td>
<td>21.9 µm</td>
</tr>
</tbody>
</table>

Diameters of focal spots

- focal spot
- phase of $E_y$ component
Focal Region Investigation (without Astigmatism)

high-NA laser diode without astigmatism

changes of spot diameters along both $x$ and $y$ directions

field evolution in $z$-$x$ section

field evolution in $z$-$y$ section
Focal Region Investigation (with Astigmatism)

Minimum beam diameters appear at different positions along x and y directions, due to astigmatism.
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---|---
document code | MISC.0030
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toolbox(es) | Starter Toolbox
VL version used for simulations | 7.4.0.49
category | Application Use Case

further reading | - Collimation of Astigmatic Diode Laser Beam by Objective Lens
               - Simulation of Laser Beam in Focal Region of High-NA Asphere