Performance Analysis of Laser Scanning System
Laser scanning systems, with the help of e.g. a galvanometer, is capable of deflecting laser beams into predefined directions. And, in combination with focusing optics, such systems are often used for precise laser material processing. A scanning system consisting a dual-axis galvanometer and an aspherical focusing lens is modeled in VirtualLab Fusion. The rotation of the mirrors are modeled as in the practical case, and the focused laser spot at different scanning angles are examined.
Modeling Task

Simulation of spots on detector under different scanning angle, and the scanning process when the mirrors rotate.

- light source: fundamental Gaussian
- wavelength 532 nm
- full divergence angle 0.04°

aspherical lens
NA = 0.23

screen

dual-axis
galvanometer

scanning
mirror Y

scanning
mirror X

light source

x''=x'
y''
z''
x'=x
y'=y
z'

x''
y''
z''

x'=x
y'=y
z'
Ray-tracing analysis gives a fast access to 3D view of the complete system.
Results

on-axis theta = 0°

Physical-optics simulation of the complete system takes only 3 seconds.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
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<tbody>
<tr>
<td>focus spot diameter</td>
<td>69.04 μm × 69.04 μm</td>
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</tbody>
</table>
Results

off-axis
theta = 25°

detector plane normal to optical axis (not tilted)

Parameters | Values
---|---
focus spot diameter | 182.70 μm × 469.77 μm
Results

Here

Off-axis theta = 25°

Detector plane tilted according to beam direction

Parameters | Values
---|---
focus spot diameter | 182.76 µm × 431.11 µm
<table>
<thead>
<tr>
<th>title</th>
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<td>category</td>
<td>Application Use Case</td>
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