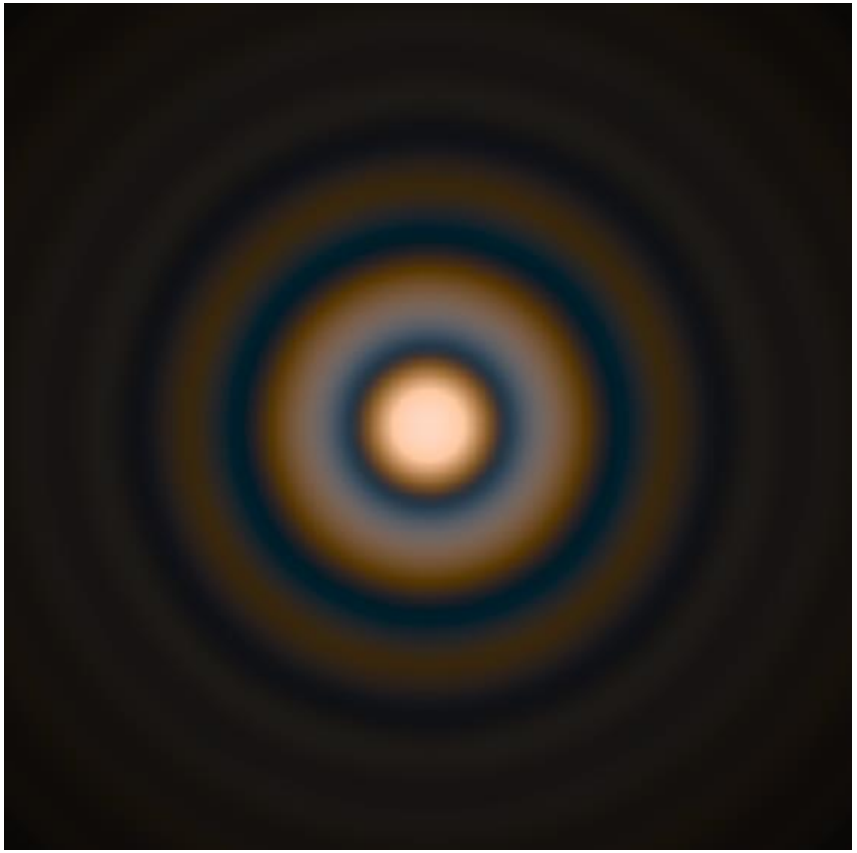
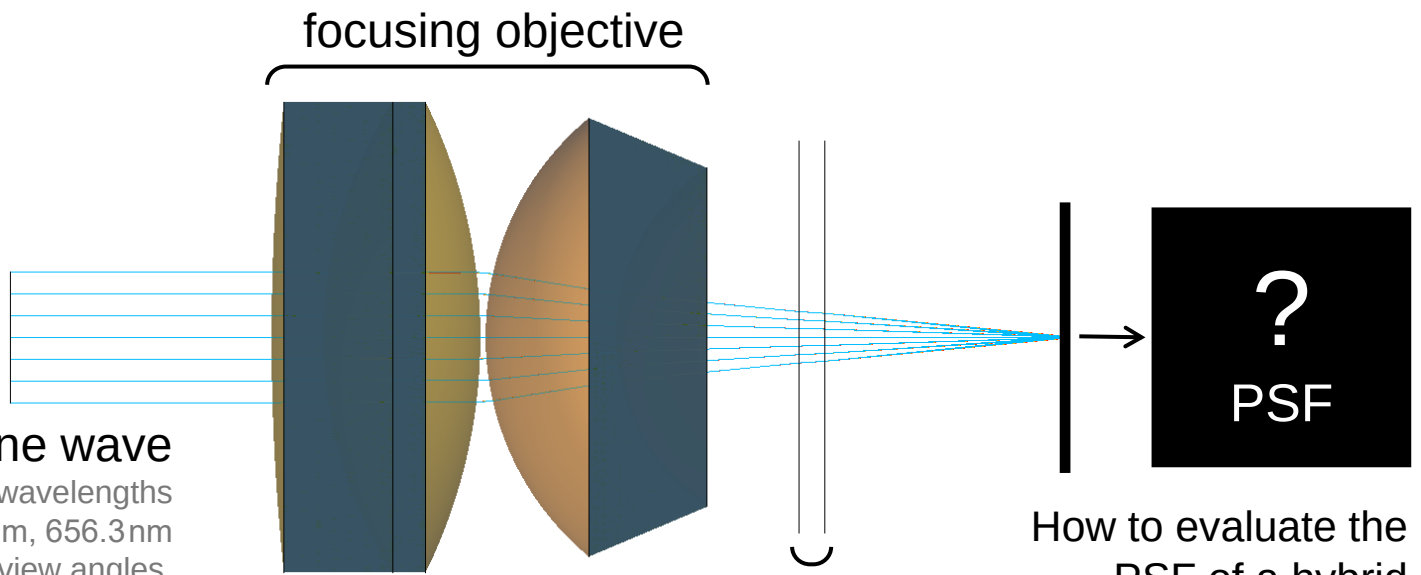
Correction of Chromatic Aberration by Using a Diffractive Lens

Abstract



Modern optical systems often consist of components with different working principles. For example, a diffractive lens can be used to correct the chromatic aberrations from traditional refractive lenses. Diffractive lenses are usually designed to work at a certain diffraction order; however, undesired orders do exist in practice. In this example, the PSF of a hybrid imaging system consisting of both refractive and diffractive lenses is investigated, especially, with the undesired diffraction orders taken into account.

Modeling Task



input plane wave

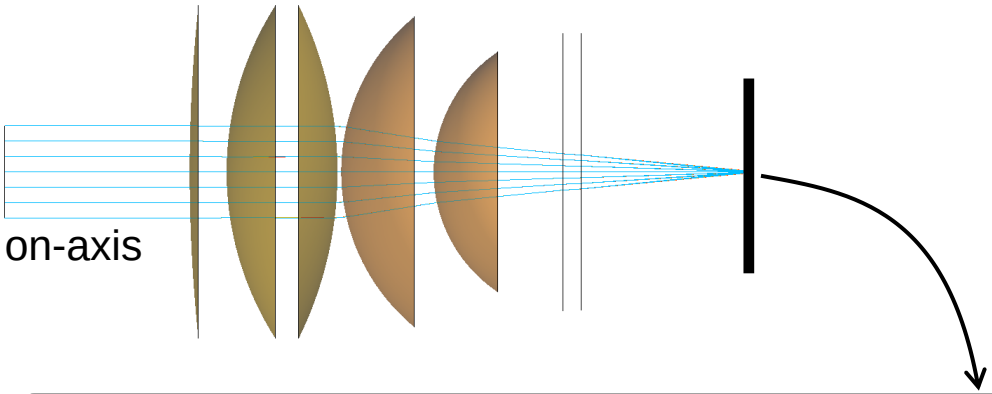
- wavelengths
486.1 nm, 587.6 nm, 656.3 nm
- field of view angles
0°, 10°, 20°
- diameter 5 mm

diffractive lens

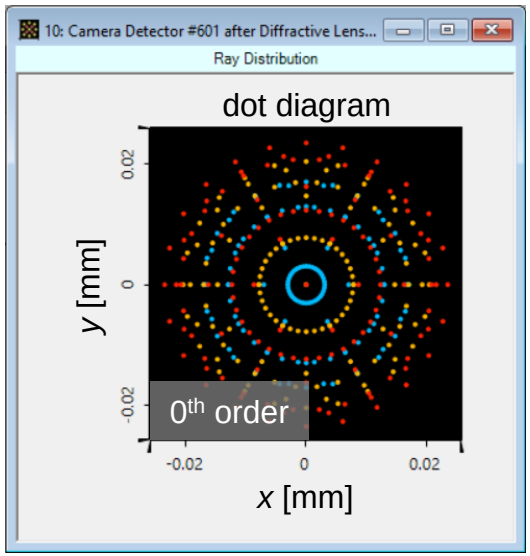
- polynomial phase function
(radial symmetrical)
- diffraction efficiencies
1st order: 80%
0th order: 20%

How to evaluate the PSF of a hybrid imaging system with both refractive and diffractive lenses?

Results



Different diffraction orders are clearly visualized in the ray tracing dot diagrams.



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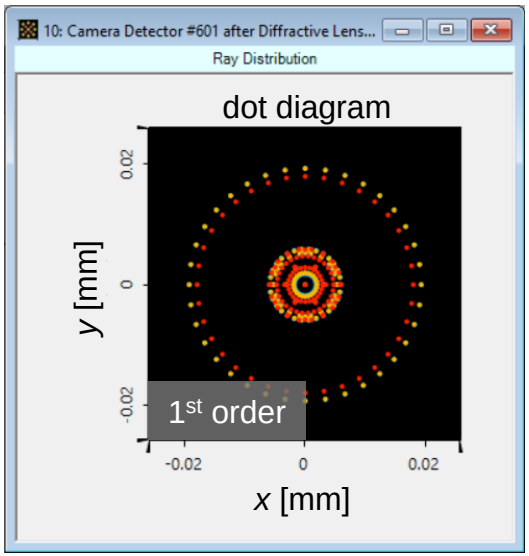

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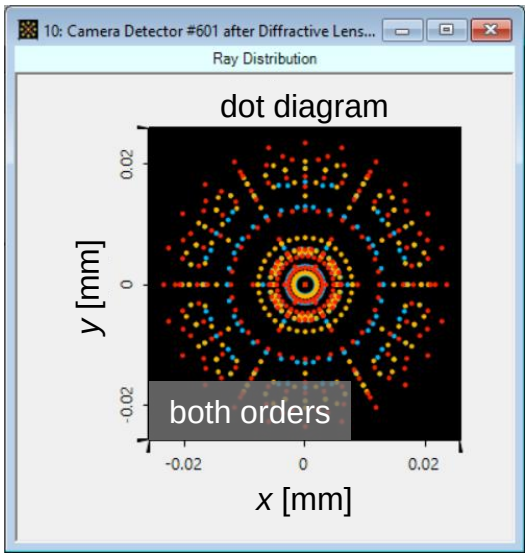
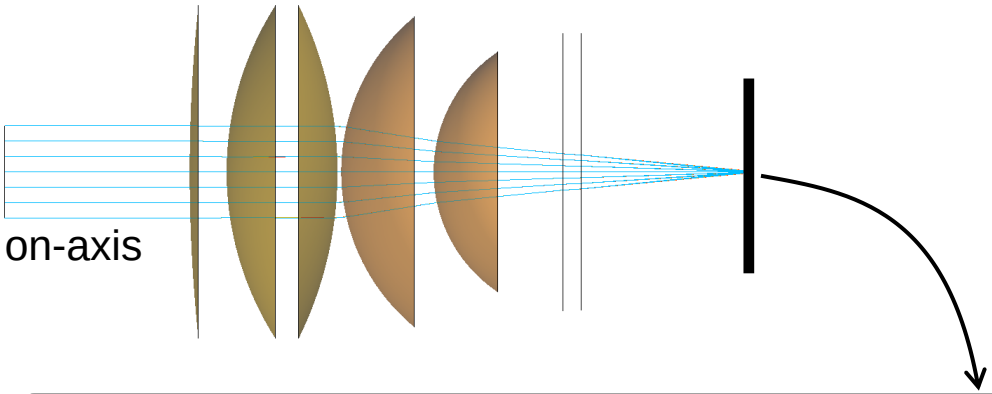
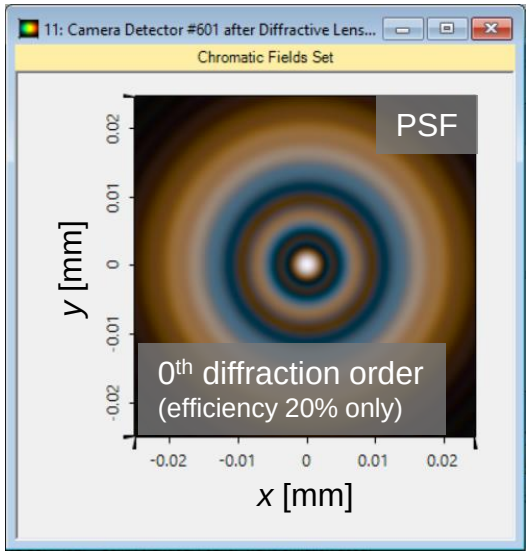


Results



Physical-optics calculation of the PSF including both diffraction orders and all colors takes 50 seconds.



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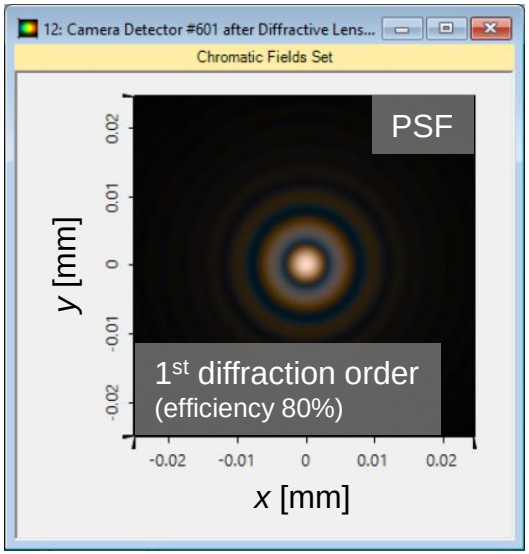

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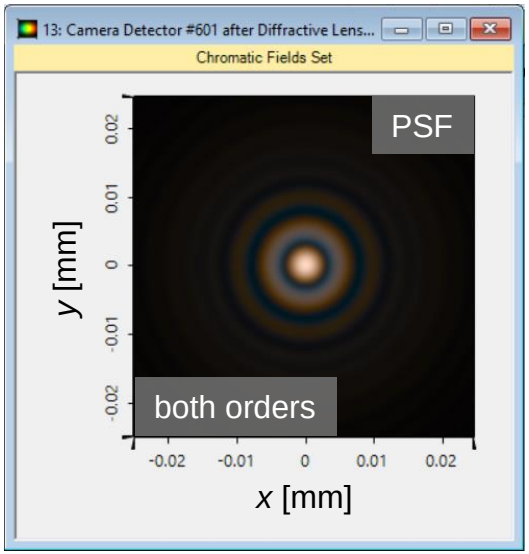
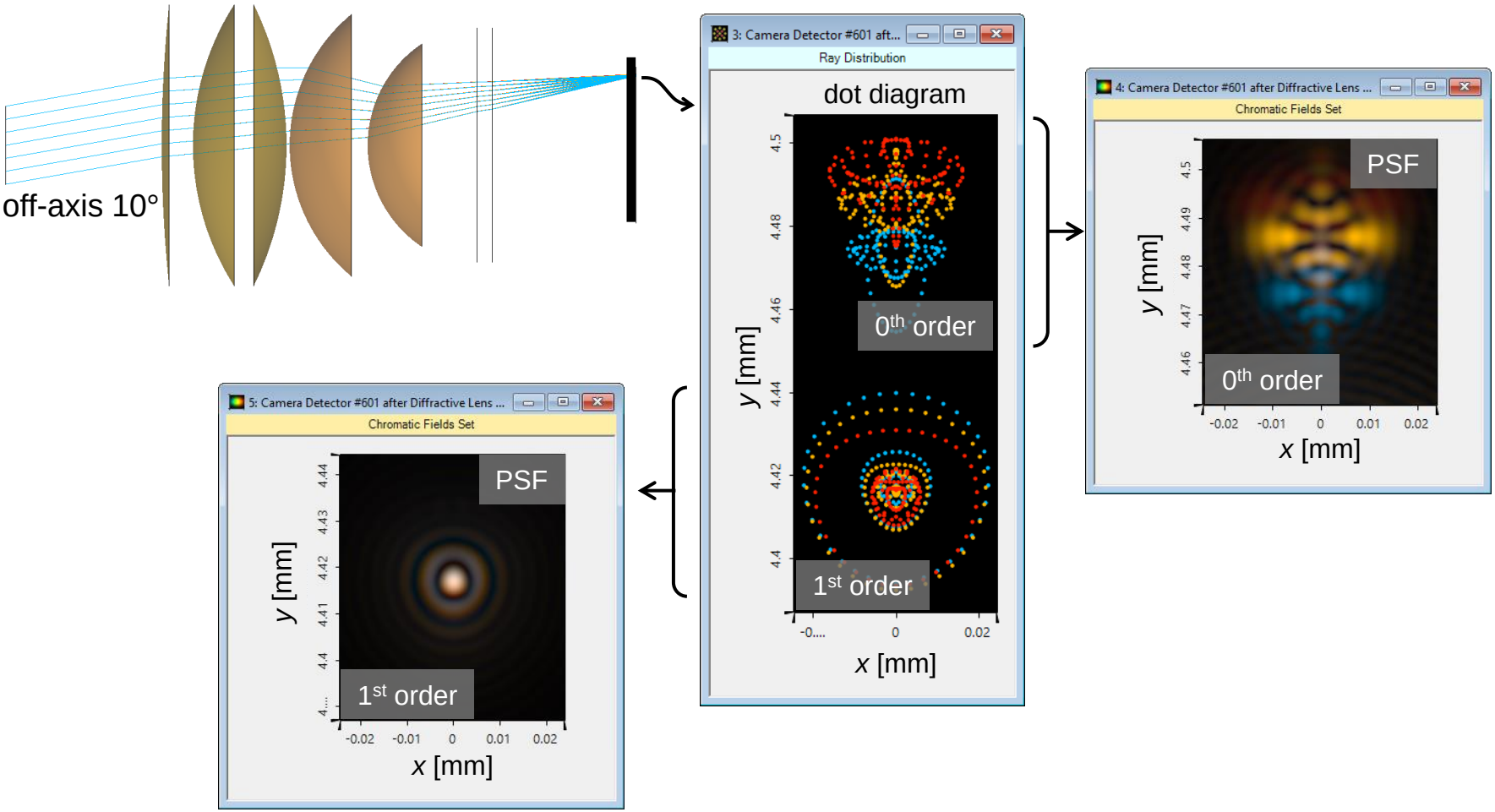
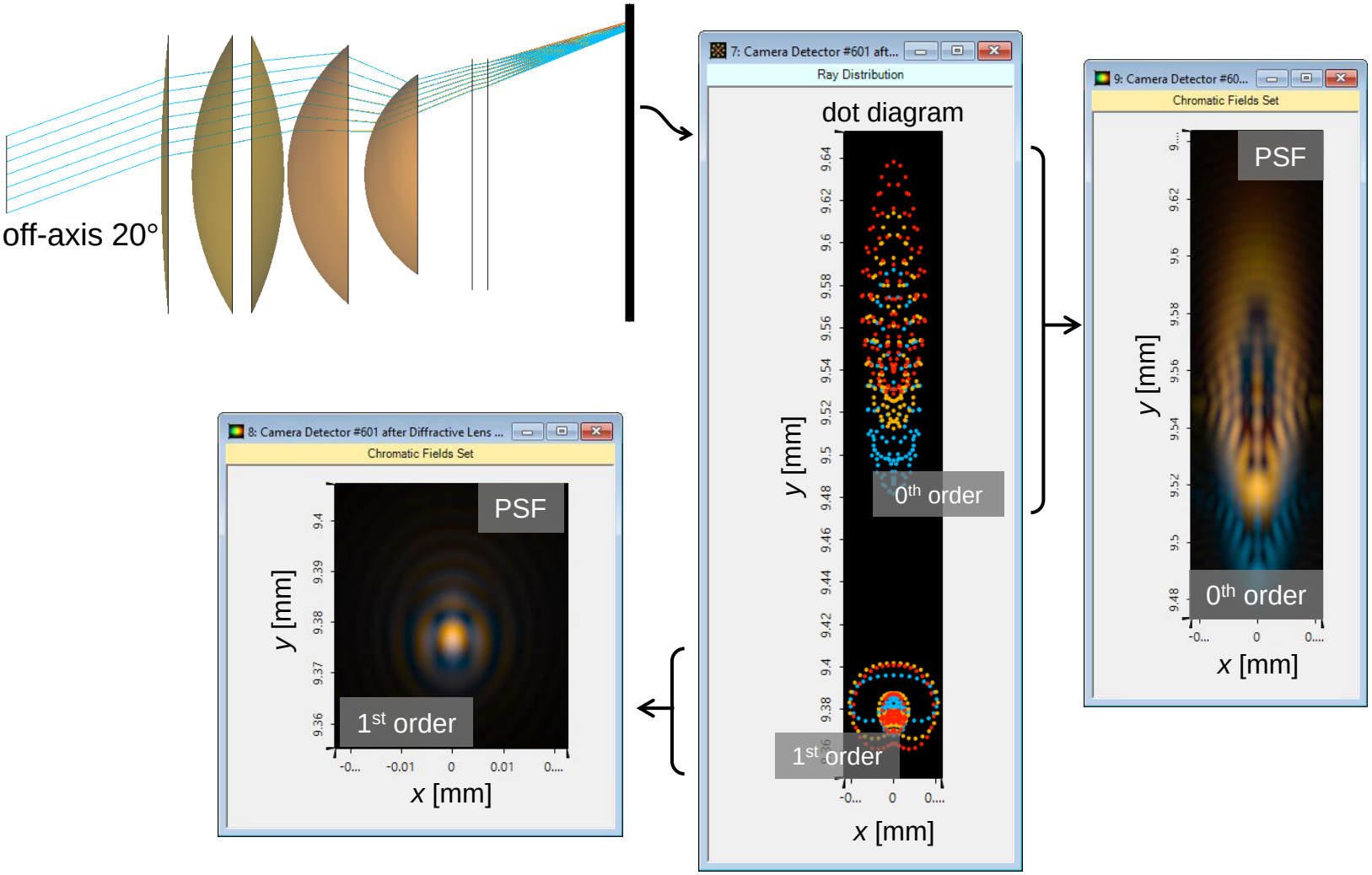


Results


off-axis 10°
3: Camera Detector #601 aft...
Ray Distribution
dot diagram
0th order
1st order
y [mm]
x [mm]
4: Camera Detector #601 after Diffractive Lens ...
Chromatic Fields Set
PSF
0th order
5: Camera Detector #601 after Diffractive Lens ...
Chromatic Fields Set
PSF
1st order

Results


off-axis 20°
7: Camera Detector #601 aft...
Ray Distribution
dot diagram
0th order
1st order
y [mm]
x [mm]
9: Camera Detector #60...
Chromatic Fields Set
PSF
0th order
y [mm]
x [mm]
8: Camera Detector #601 after Diffractive Lens ...
Chromatic Fields Set
PSF
1st order
y [mm]
x [mm]

Document Information

title	Correction of Chromatic Aberration by Using a Diffractive Lens
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VL version used for simulations	7.3.0.41
category	Application Use Case