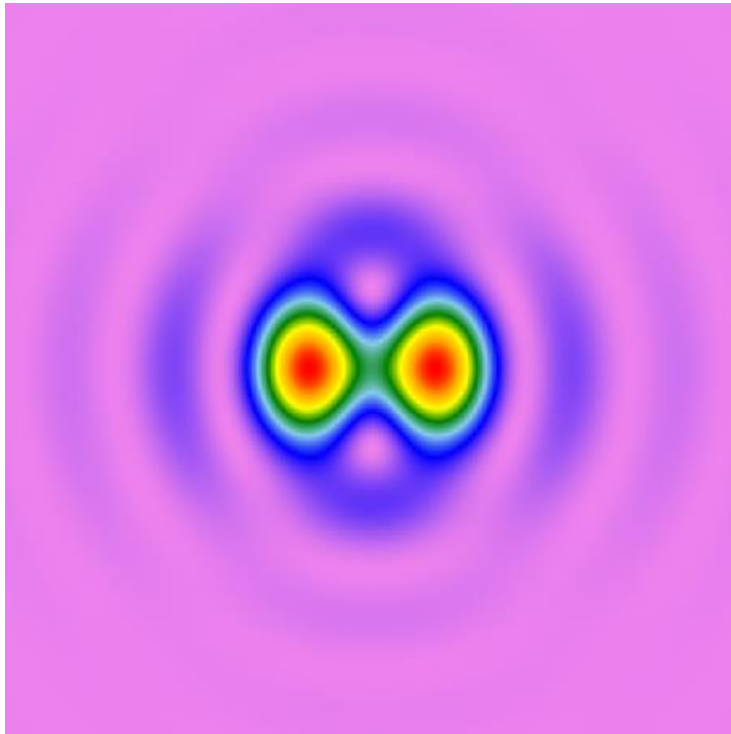# Focusing of Femtosecond Pulse by Using a High-NA Off-Axis Parabolic Mirror

Abstract

To fully characterize the focusing behavior of an ultrashort pulse, different electromagnetic properties must be considered. That includes both spatial distribution, temporal / spectral distribution, vectorial effect, and also the possible coupling amongst all the above. As an example, the focusing process of a 10fs pulse by using a high-NA parabolic mirror is modeled in VirtualLab, and both the spatial and temporal behaviors are investigated.
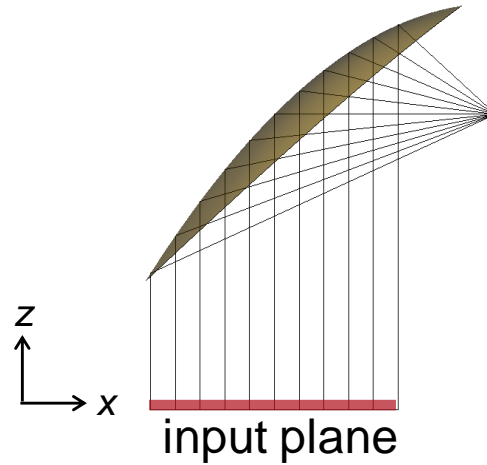
Modeling Task

off-axis
parabolic mirror

z

x

7 mm
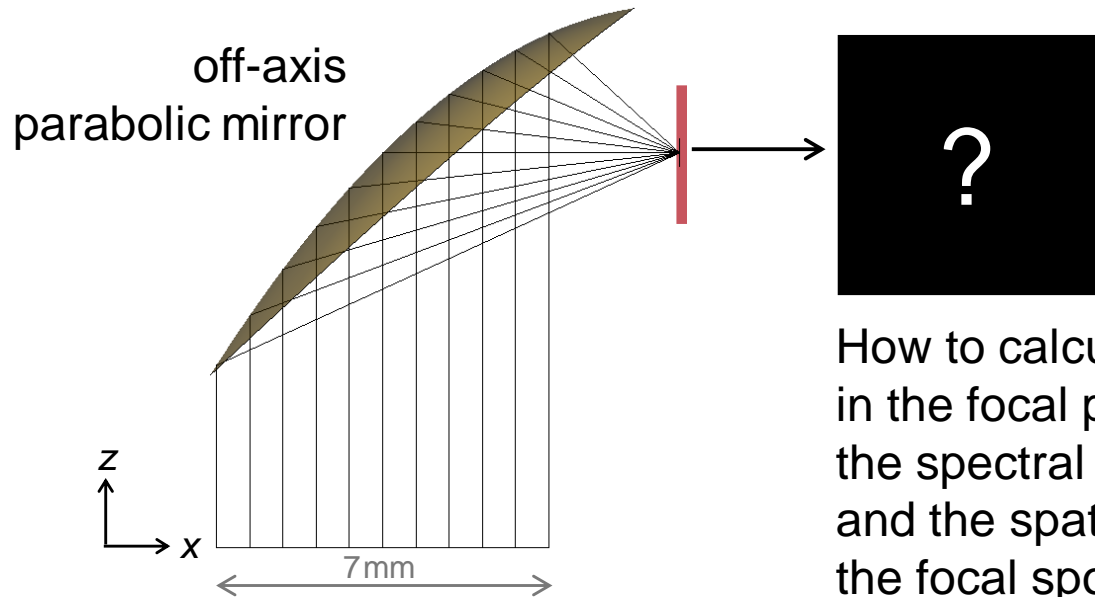
input pulse

- time duration 10 fs (FWHM)
- carrier wavelength 800 nm
- beam diameter 7 mm
- linearly poalrized
  in *x* direction

?

How to calculate output pulse in the focal plane, including the spectral / temporal profile and the spatial distribution of the focal spot for all vectorial field components?
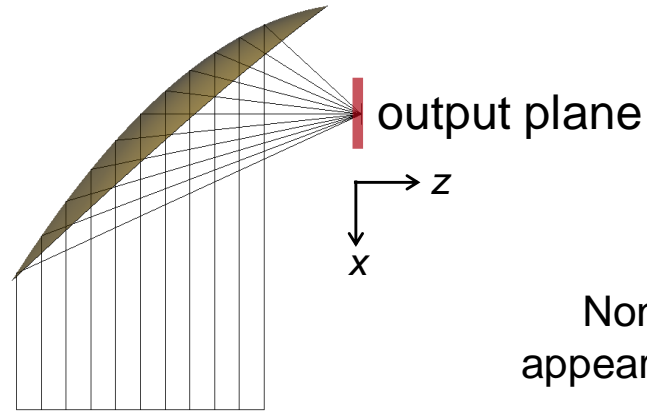
Results

input plane

The linearly polarized input pulse has an E_z component with almost zero amplitude.

$|E_x|^2$

wavelength [μm]
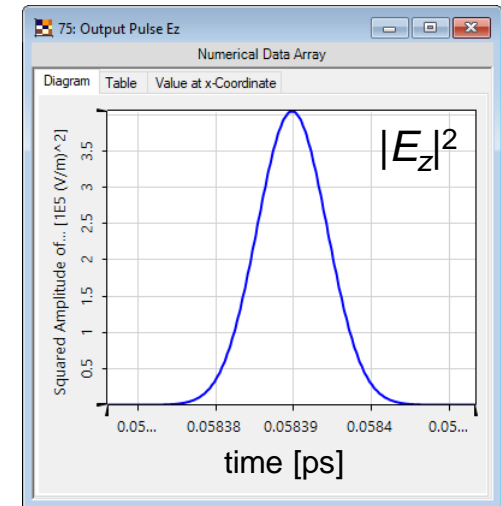

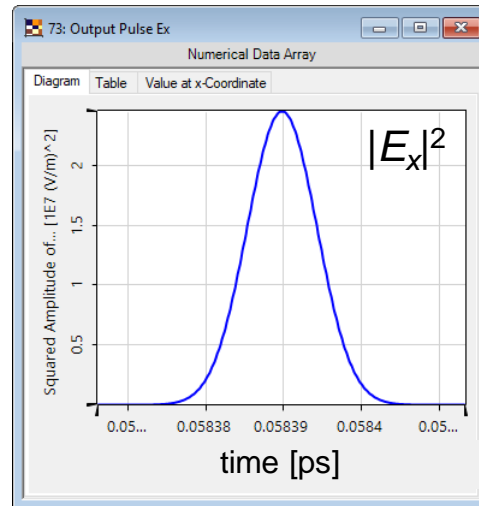$|E_x|^2$
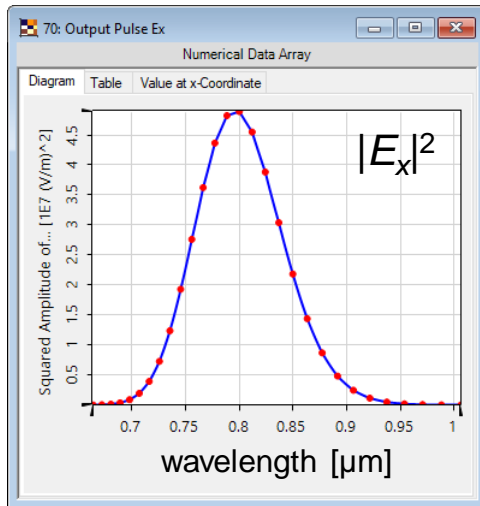
time [ps]

$|E_z|^2$

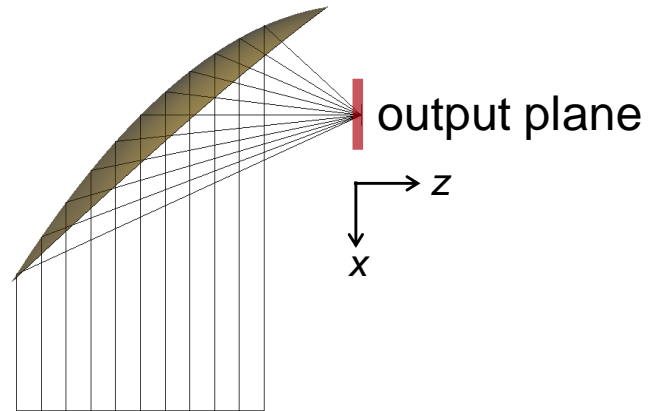time [ps]

Results

output plane
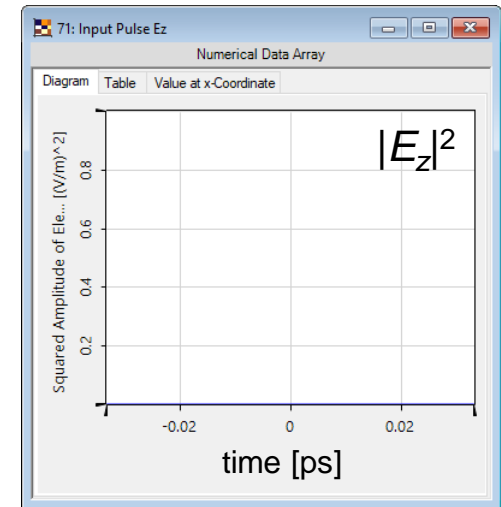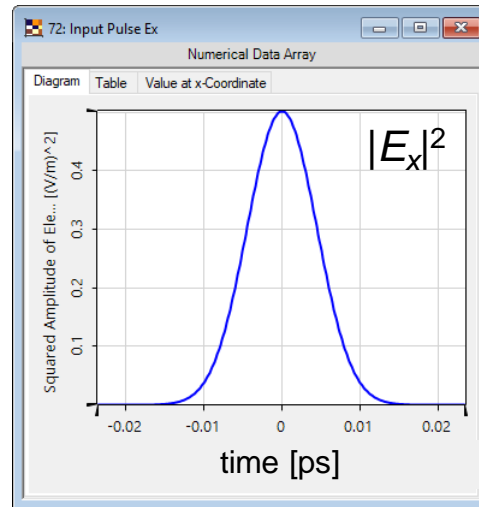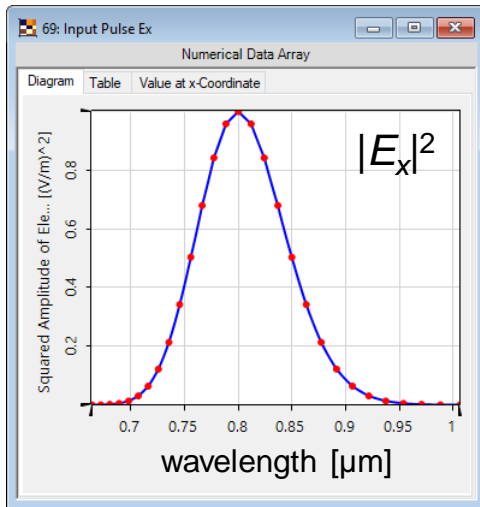
The slight change in the output spectrum is due to different focus size of different wavelength.

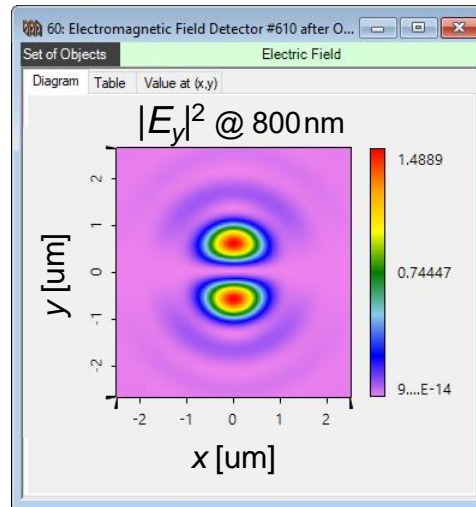Non-zero E_z component appears due to polarization crosstalk in high-NA focusing situation.
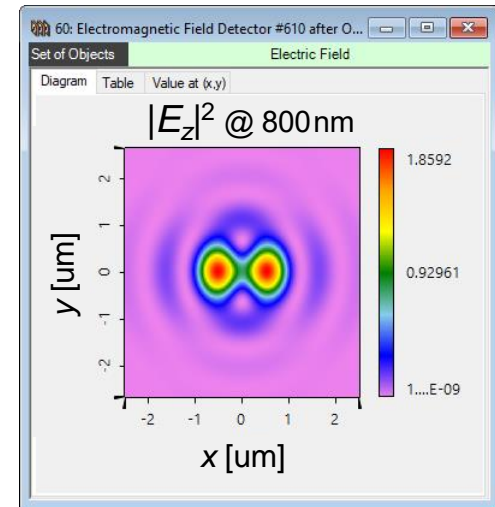

$|E_x|^2$

$|E_x|^2$

$|E_z|^2$

Results

output plane

z

x

$|E_x|^2 \overset{\text{def}}{=} 100\%$

$|E_y|^2 = 3\%$

$|E_z|^2 = 4\%$

$|E_x|^2$ @ 800 nm

$|E_y|^2$ @ 800 nm

$|E_z|^2$ @ 800 nm
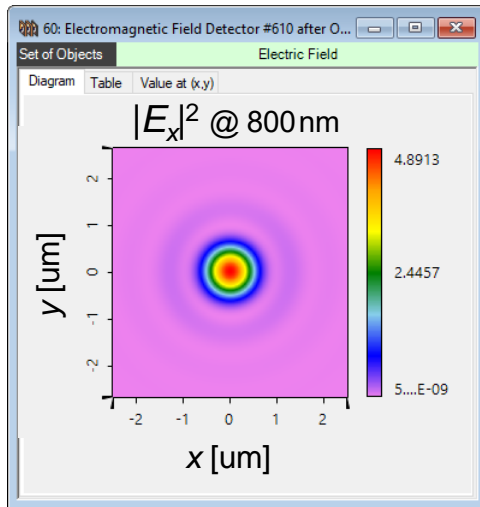
Document Information

title	Focusing of Femtosecond Pulse by Using a High-NA Off-Axis Parabolic Mirror
version	1.0
VL version used for simulations	7.3.1.5
category	Application Use Case