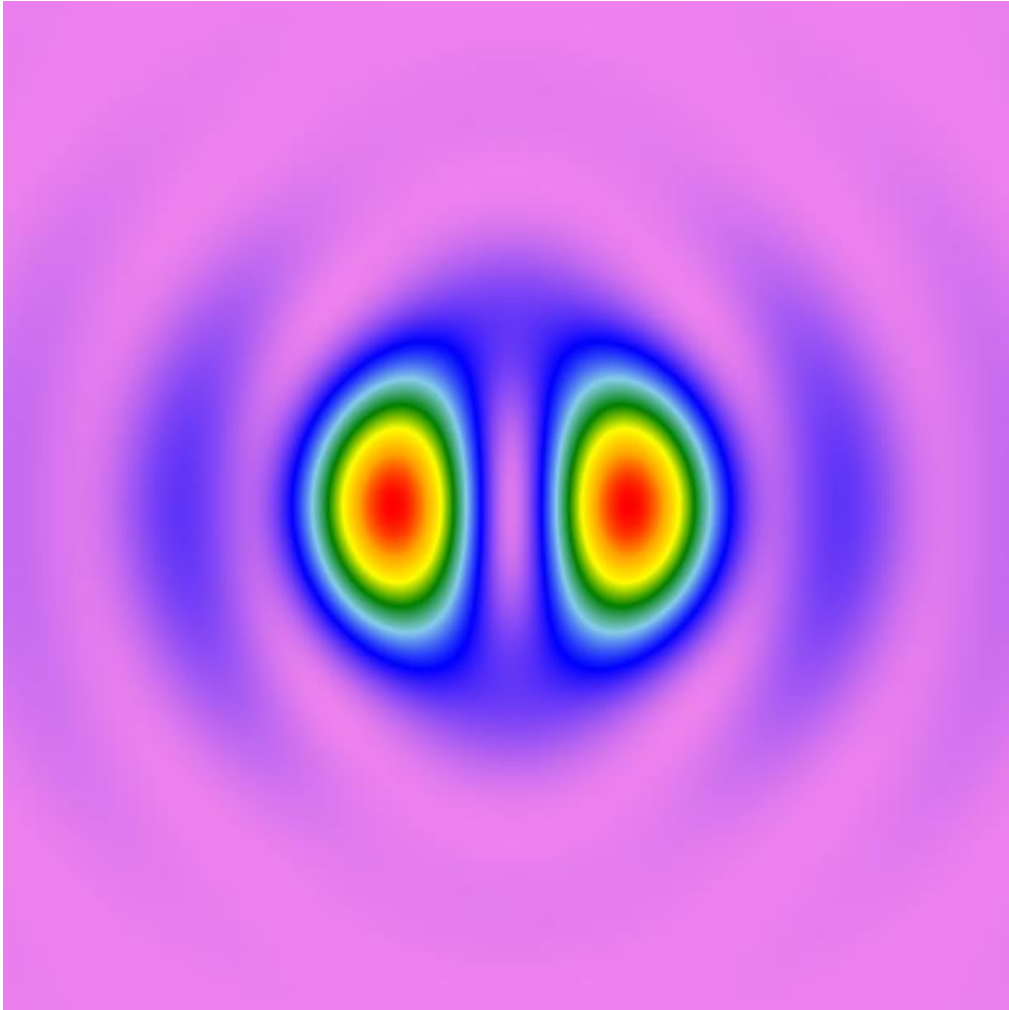# Focusing of Femtosecond Pulse by Using a High-NA Off-Axis Parabolic Mirror

# 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 the possible coupling amongst all the above. As an example, the focusing process of a 10-fs pulse by using a high-NA parabolic mirror is modeled in VirtualLab Fusion, and both the spatial and temporal behaviors are investigated.

# Modeling Task



**off-axis parabolic mirror**
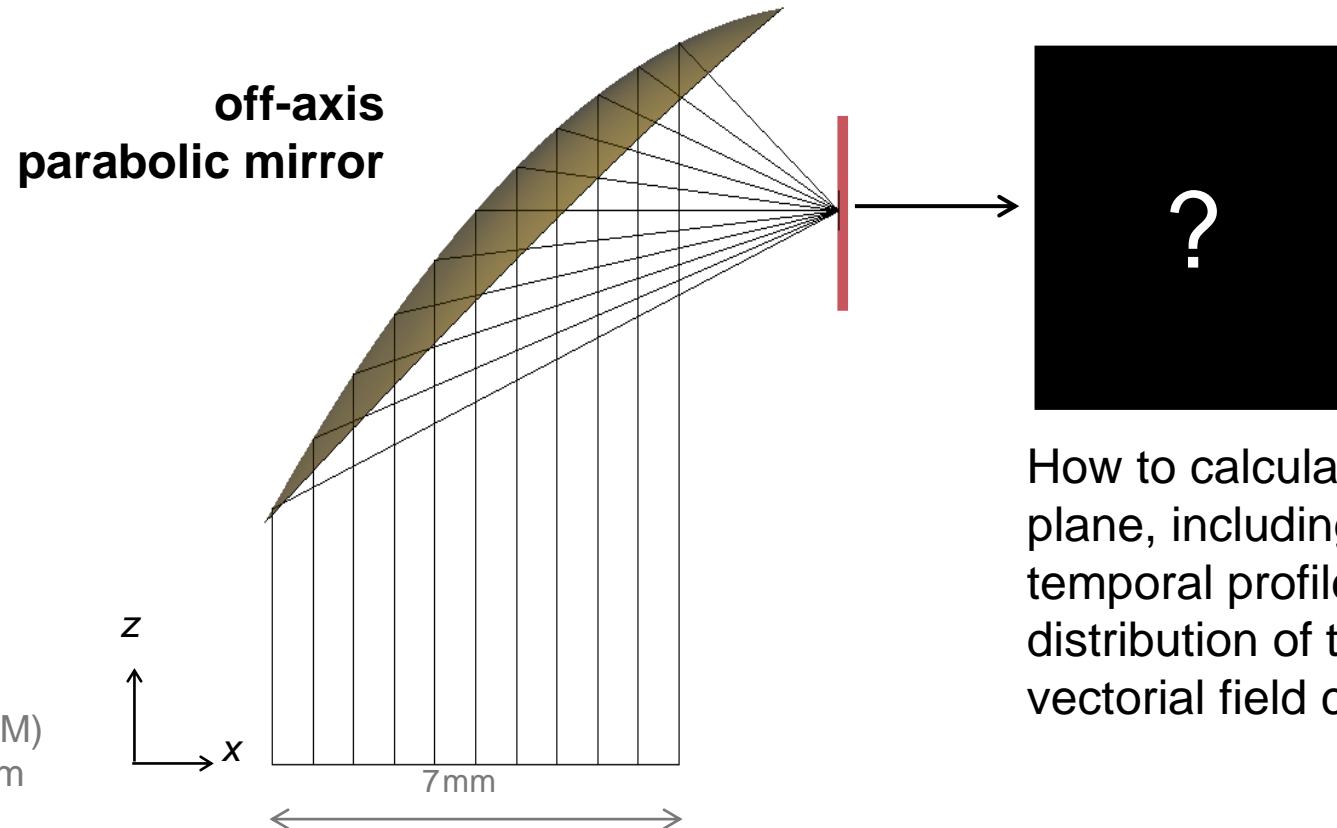
a) **monochromatic source**
- beam diameter 7 mm
- linearly polarized in $x$ direction
- wavelength 800 nm

b) **pulse source**
- time duration 10 fs (FWHM)
- carrier wavelength 800 nm
- beam diameter 7 mm
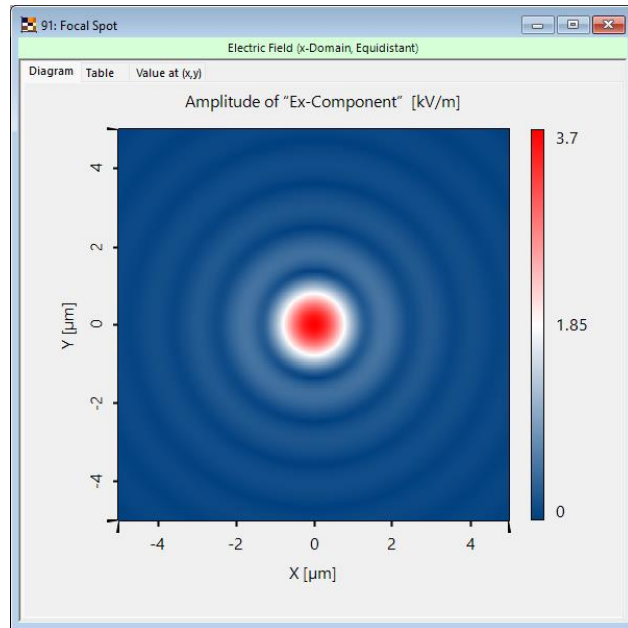- linearly polarized in $x$ direction

$z$

$x$

7 mm

**?**

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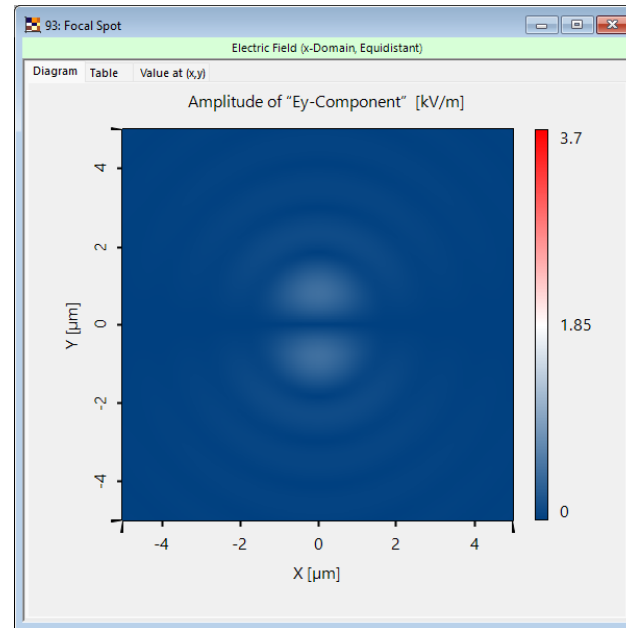
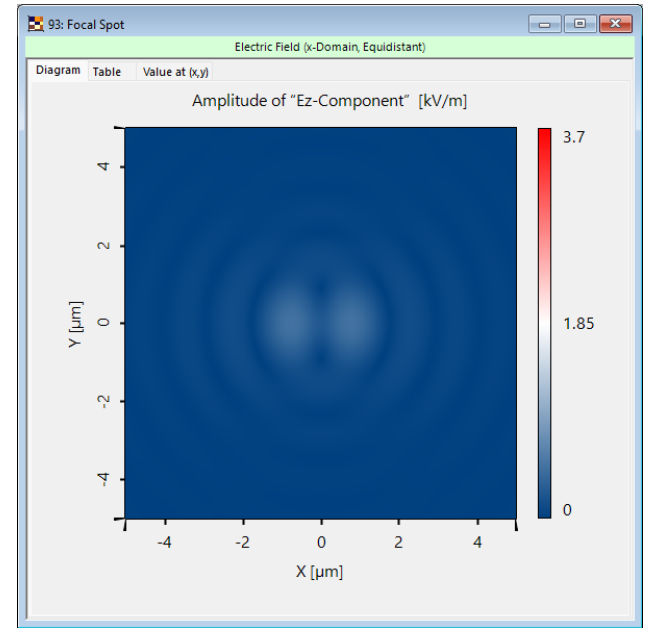# Results – Monochromatic Source
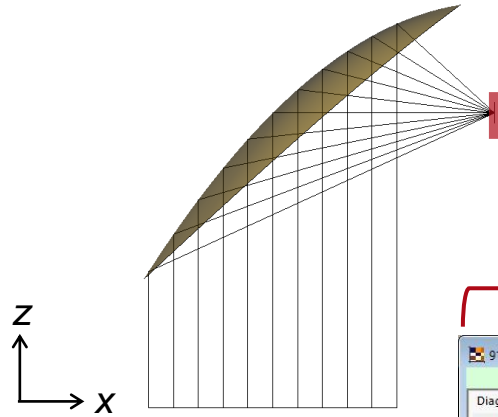


Source:

a) **monochromatic (800 nm)**

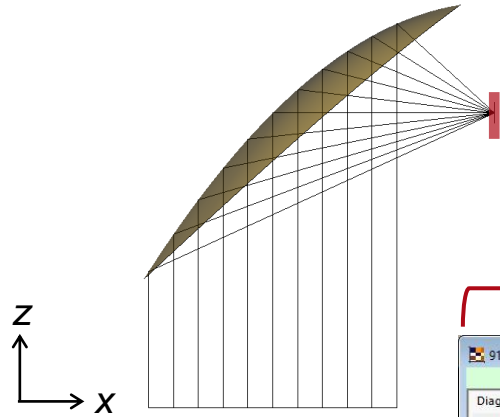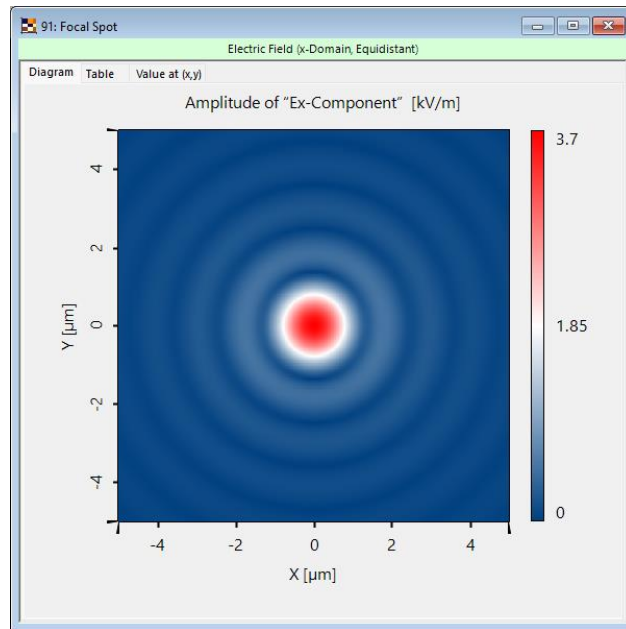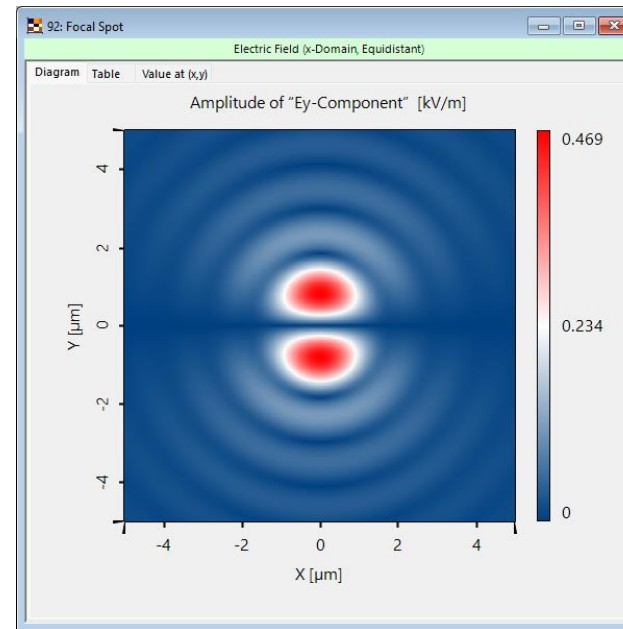b) Pulse (800 nm central wavelength, 10 fs pulse duration)

x - component

y - component

z - component

# Results – Monochromatic Source



Source:

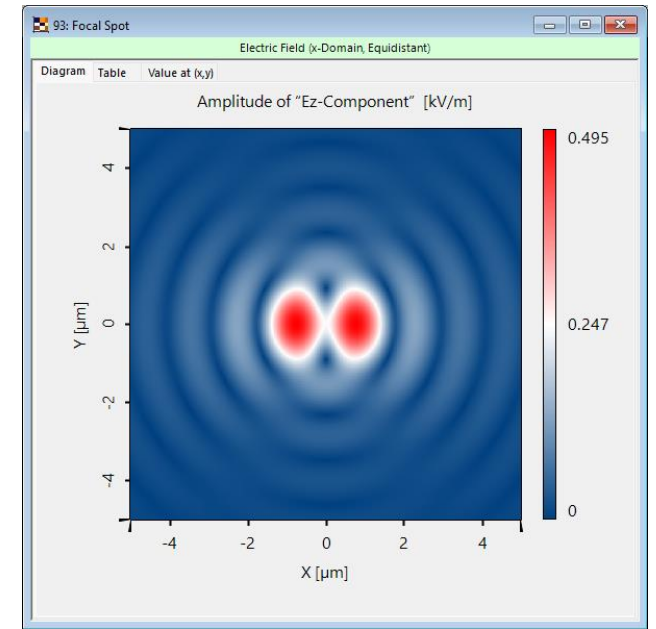a) **monochromatic (800 nm)**

b) Pulse (800 nm central wavelength, 10 fs pulse duration)

x - component
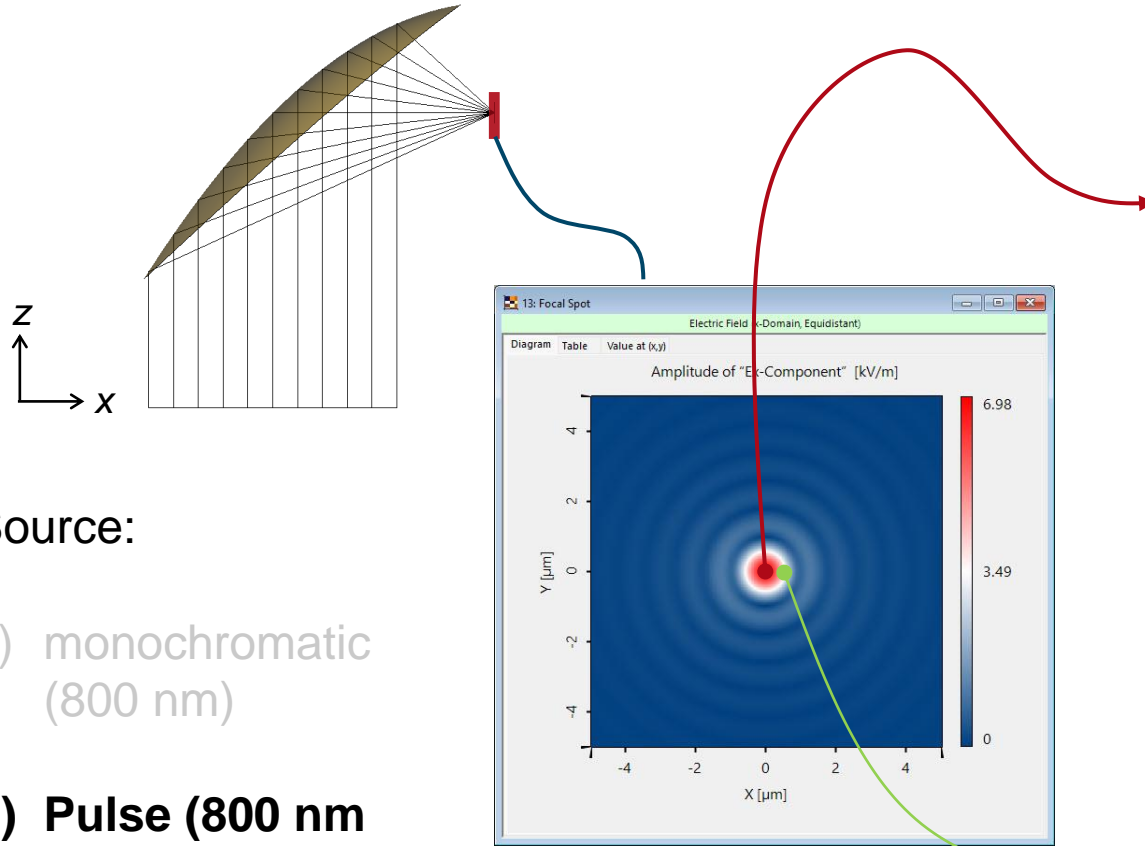
y - component

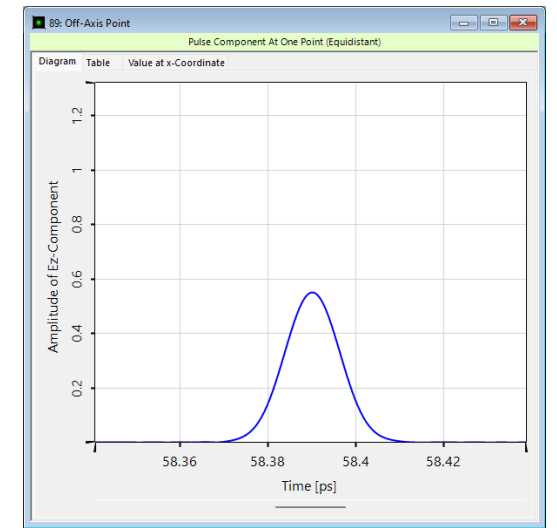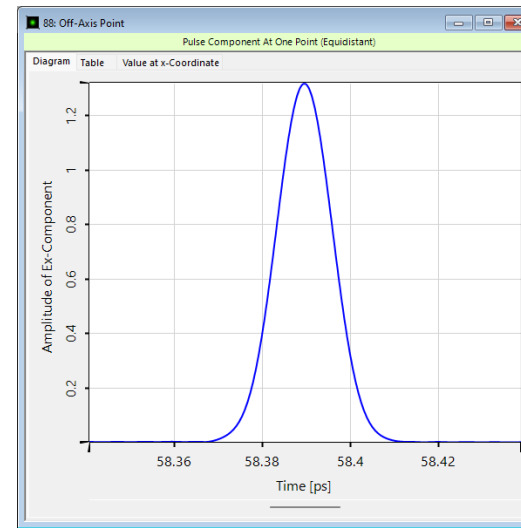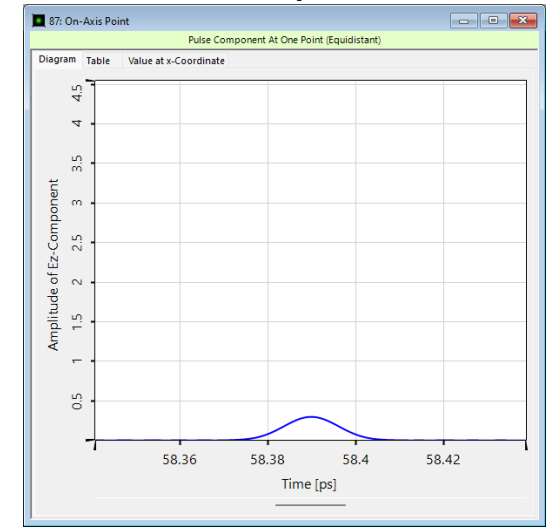z - component

# Results – Puls Source



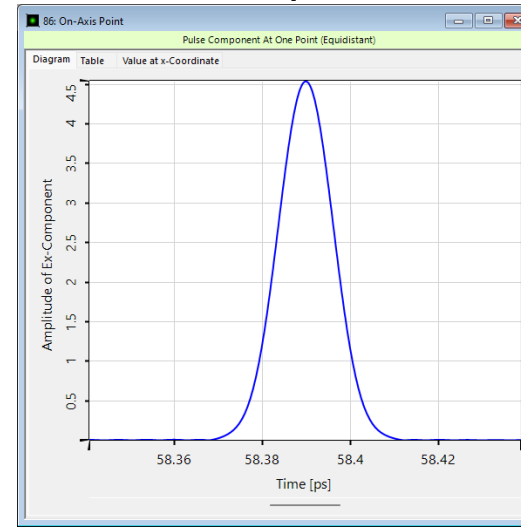x - component

z - component

Source:

a) monochromatic (800 nm)

b) **Pulse (800 nm central wavelength, 10 fs pulse duration)**

# Document Information

| | |
|---|---|
| title | Pulse Front Tilt in SSTF – Setups |
| document code | USP.0008 |
| version | 1.1 |
| edition | VirtualLab Fusion Basic |
| software version | 2020.2 (Build 1.116) |
| category | Application Use Case |
| further reading | - Grating Stretcher for Ultrashort Pulses<br>- Pulse Focusing with High-NA Lens |