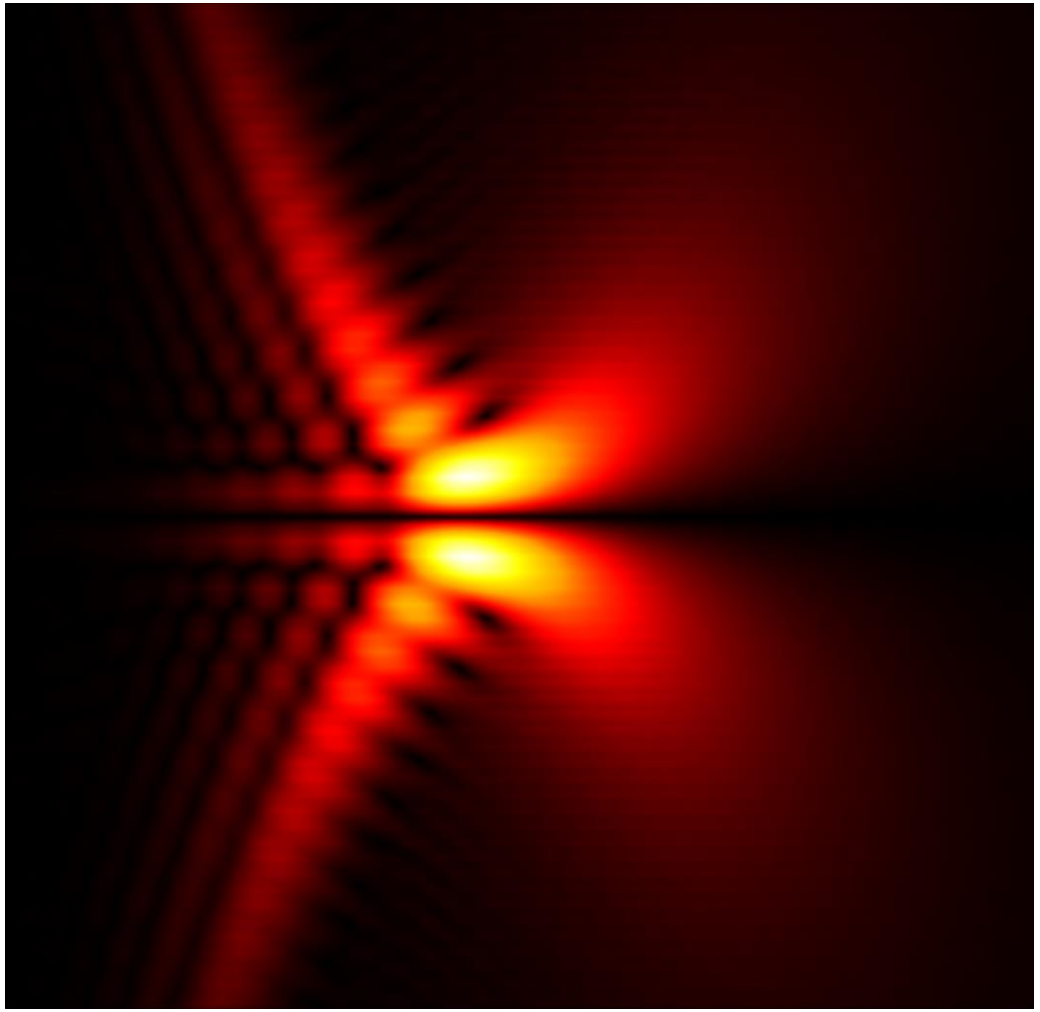
Pulse Focusing with High-Na Lens

Abstract



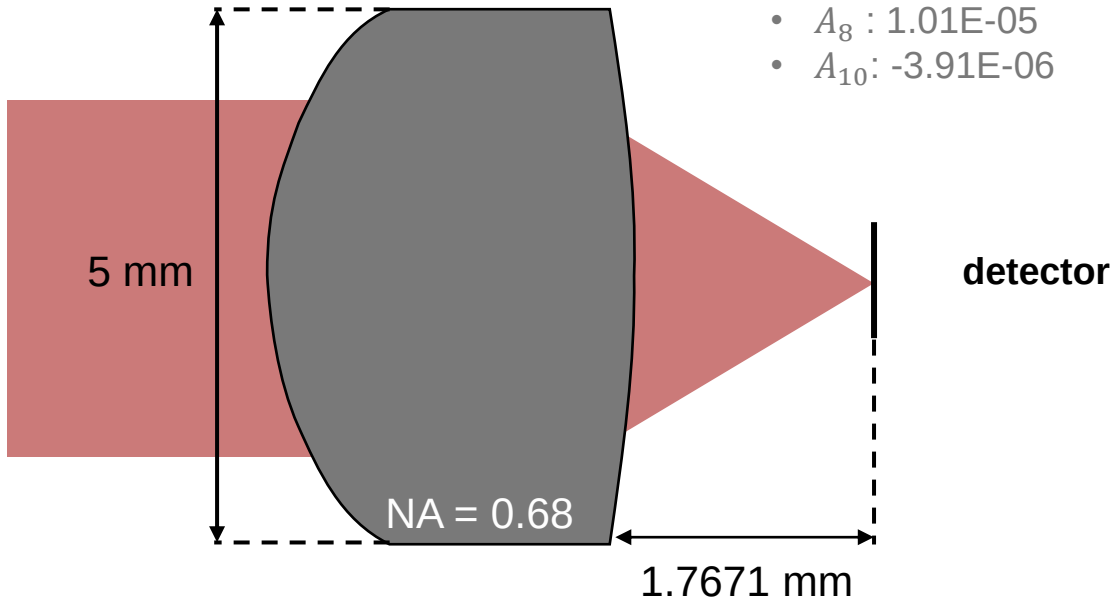
While for most other types of sources it is often accurate enough to labour under the stationary approximation, ultrashort pulses require a somewhat more nuanced approach, where the correlation between the different spectral modes is taken into account. We investigate here the effects of subjecting one such pulse to propagation through a lens with high numerical aperture, in terms of its spatial, as well as of its temporal, profile.

Scenario

laser pulse

- collimated gaussian profile
- diameter: 2.5 mm x 2.5 mm
- linearly polarized in x-direction

- Gaussian spectrum
- 800 nm central wavelength
- 5 fs pulse duration



high NA aspheric doublet

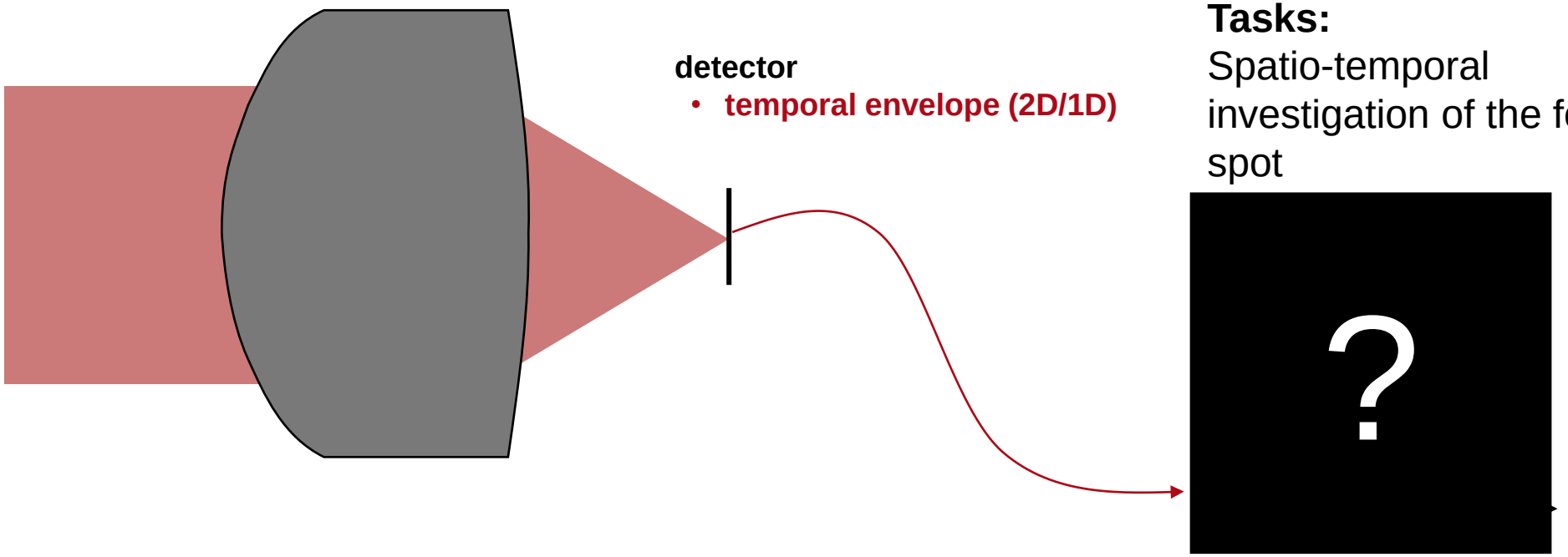
asphere 1:

- radius of curvature: 2.75 mm
- conical constant: -0.61
- asphere coefficients:
  - A_4 : 0.000589
  - A_6 : -1.76E-05
  - A_8 : 1.01E-05
  - A_{10}: -3.91E-06

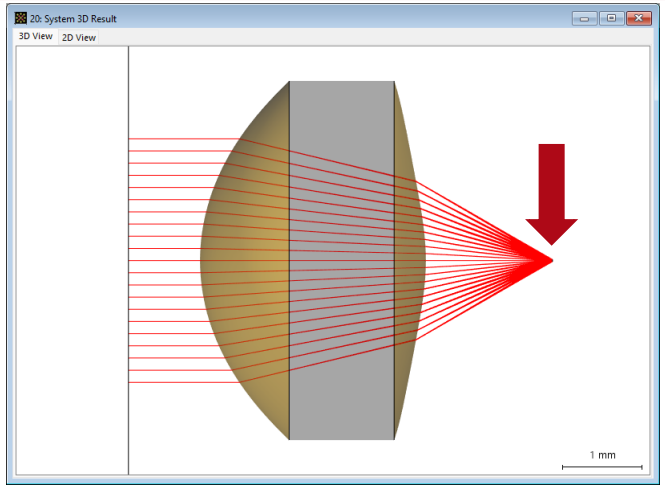
asphere 2:

- radius of curvature: -3.19 mm
- conical constant: -12.7
- asphere coefficients:
  - A_4 : 0.0124
  - A_6 : -0.00371
  - A_8 : 0.000512
  - A_{10}: -3.11E-05

Modeling Task



Simulation Results



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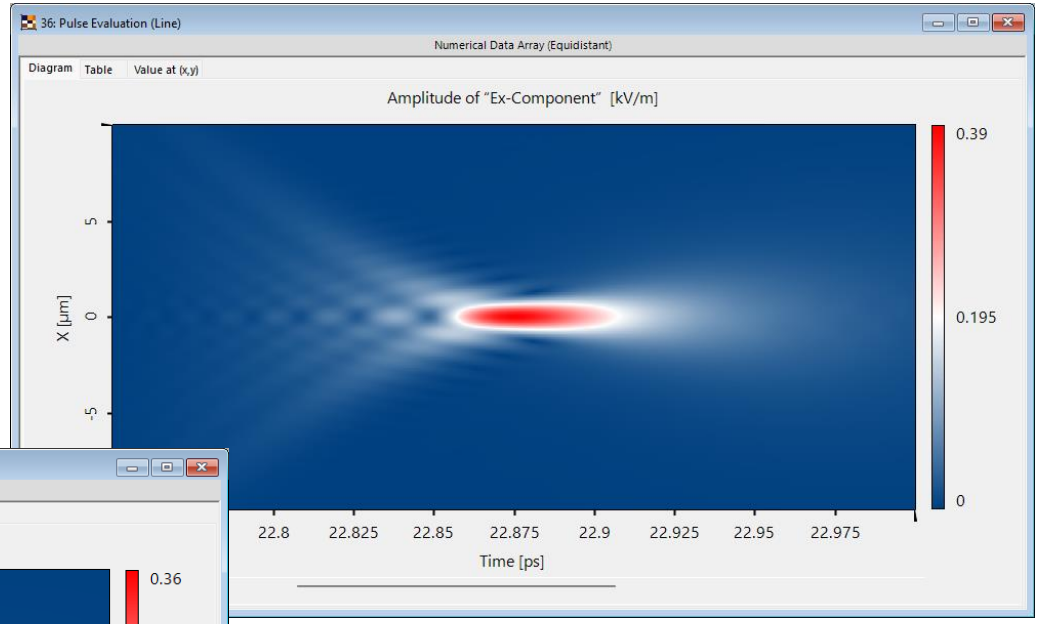
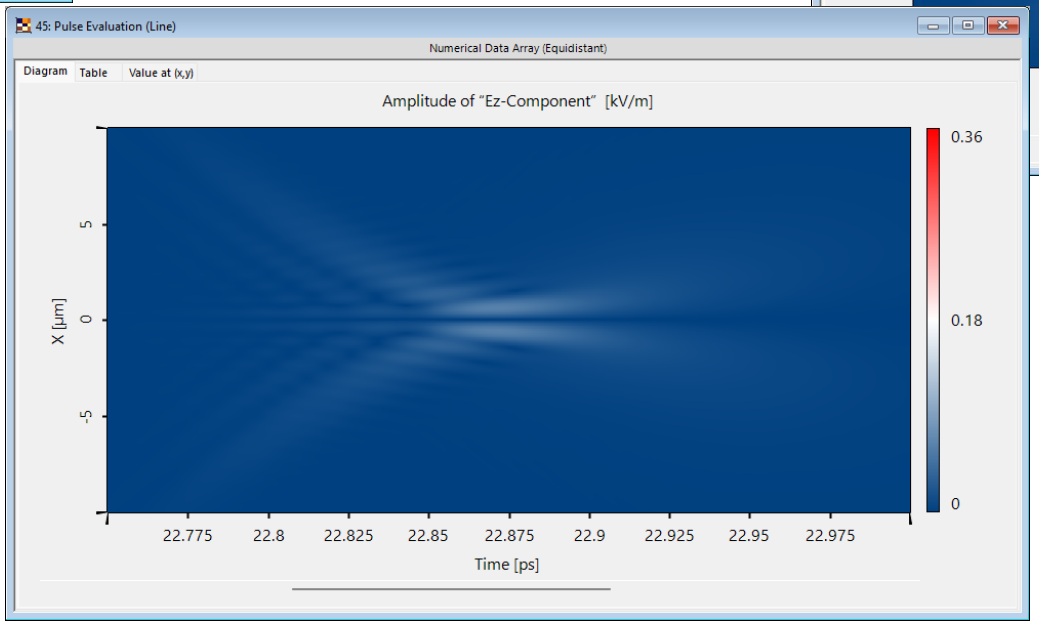
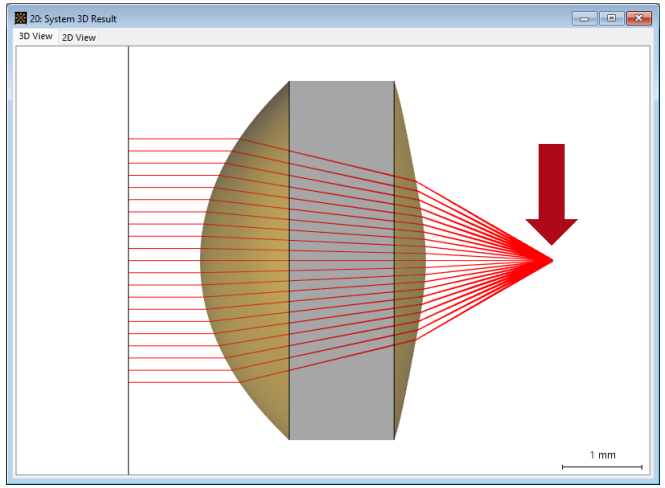




Ez-component

Simulation Results



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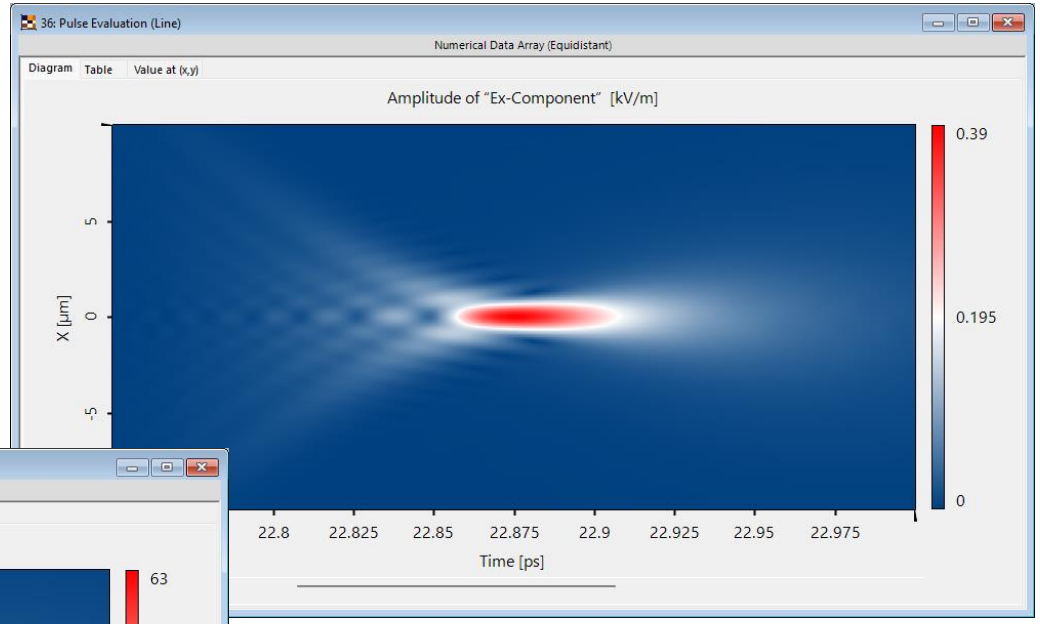

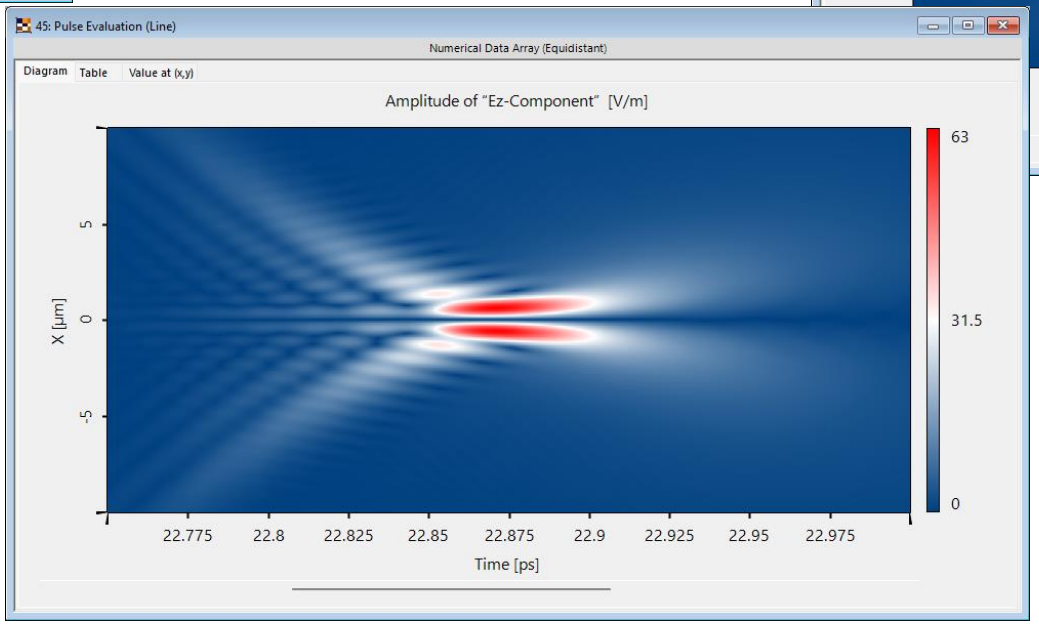

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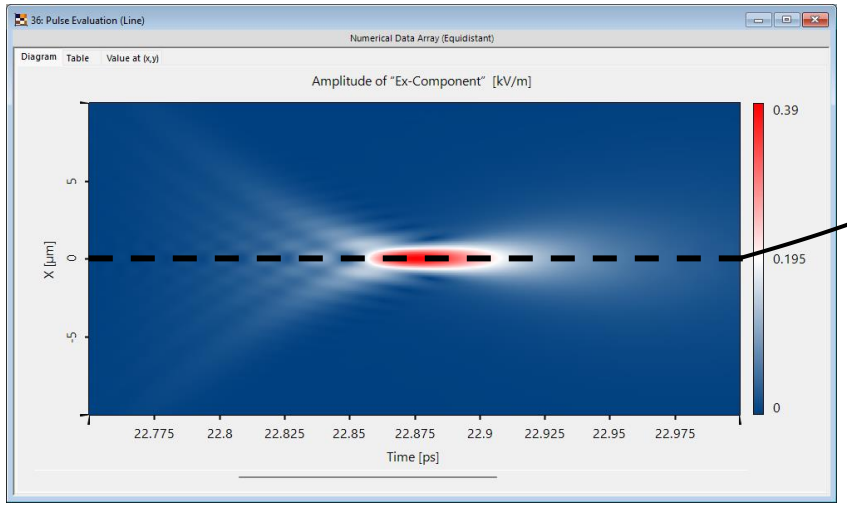
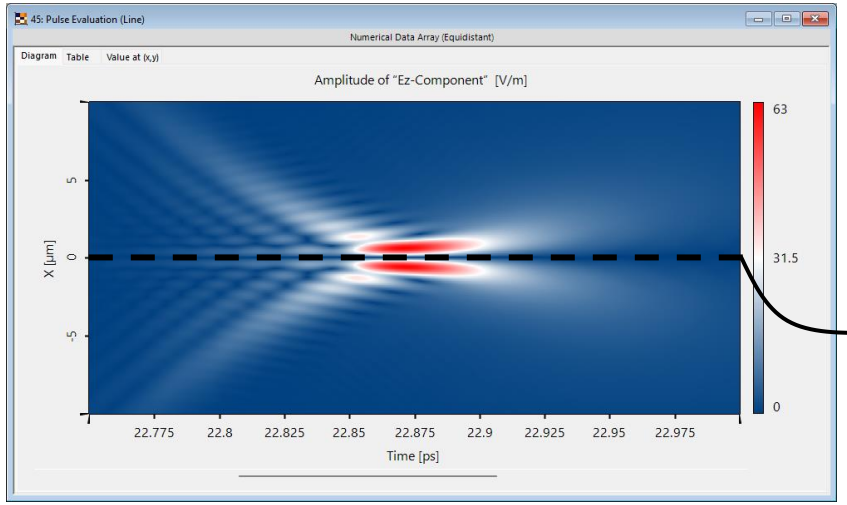
Spatio-Temporal Investigation: On-Axis





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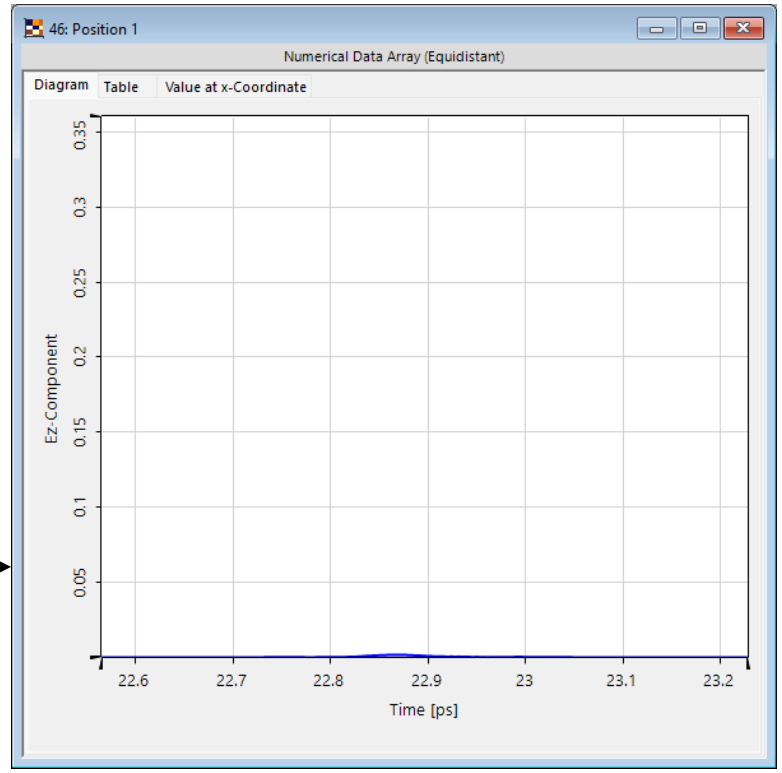

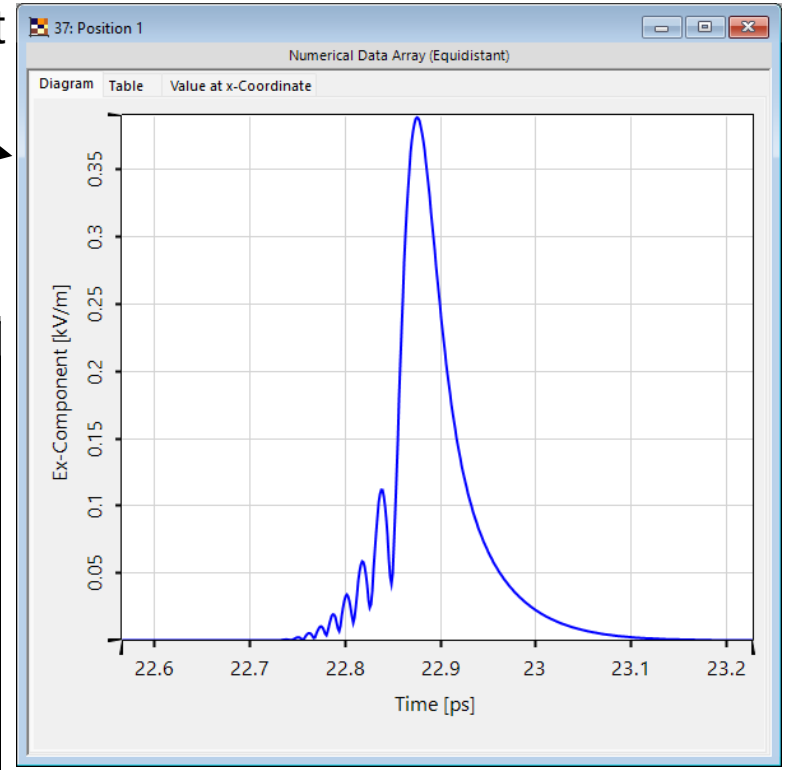

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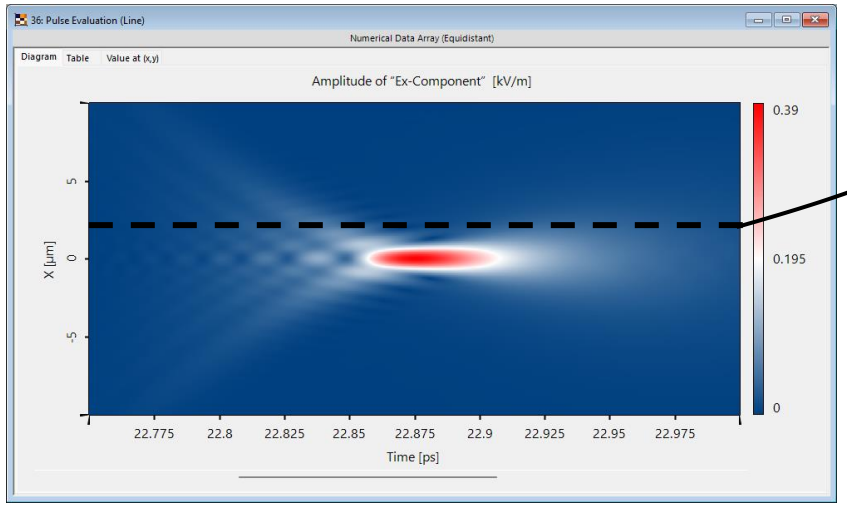
Spatio-Temporal Investigation: Off-Axis



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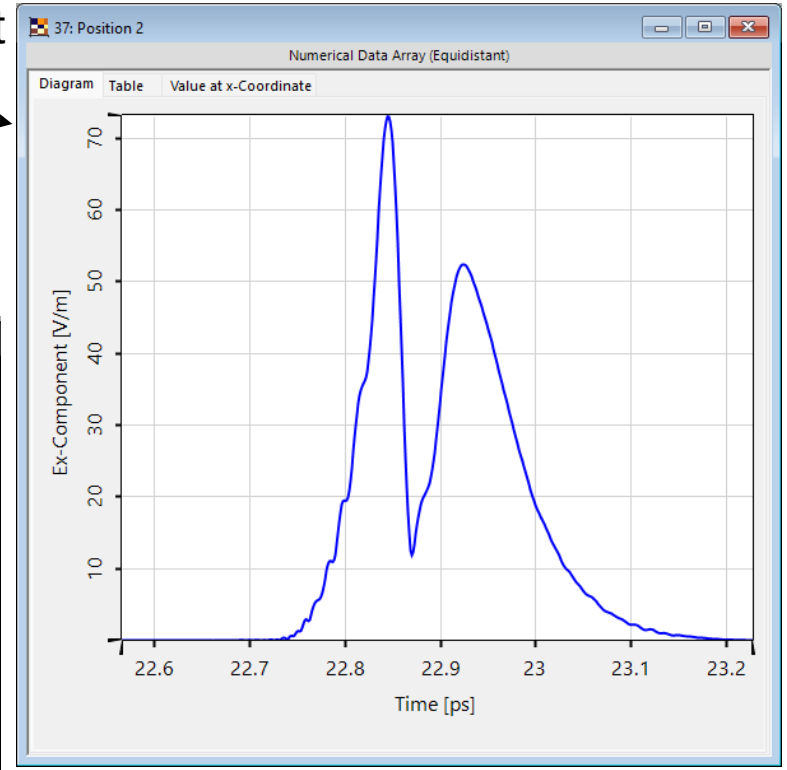

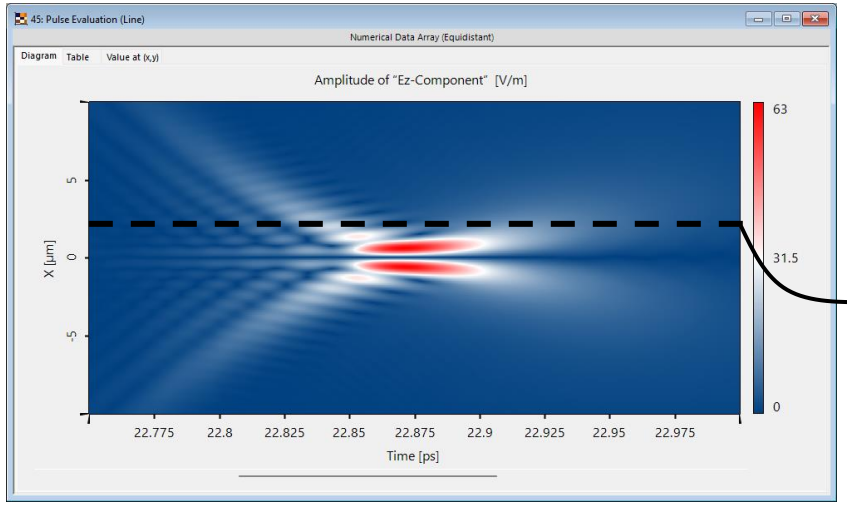

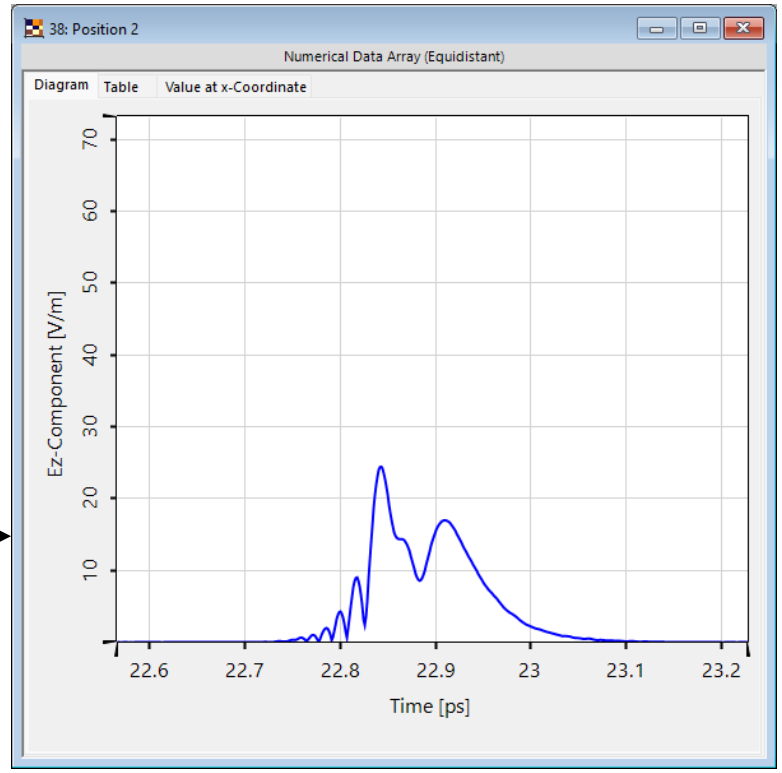

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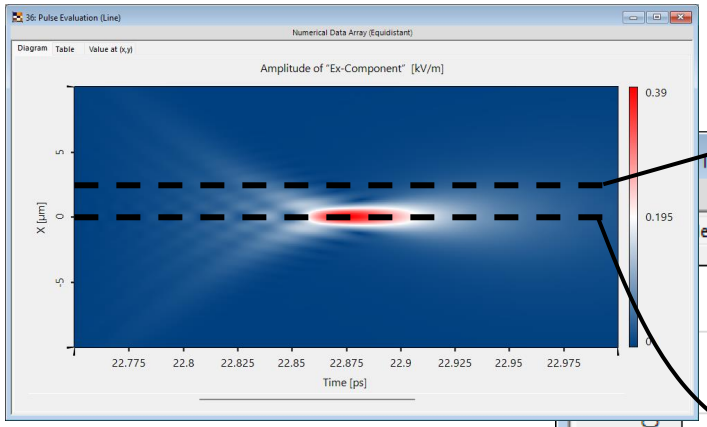
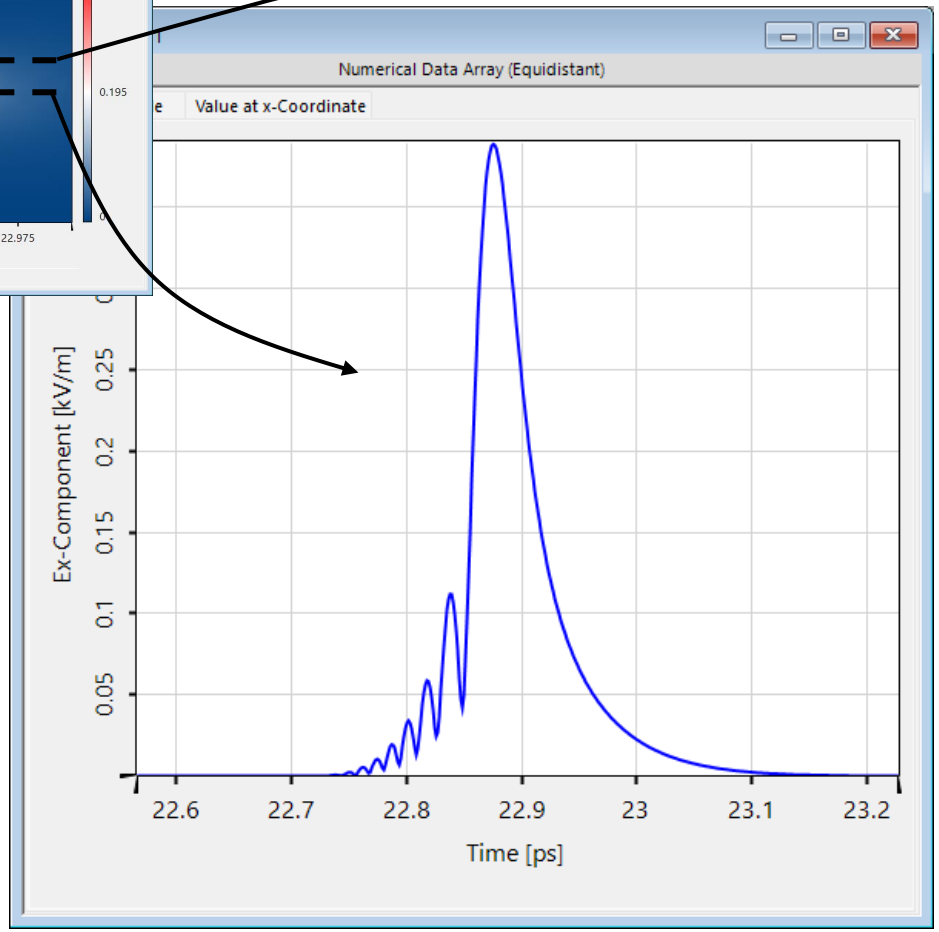
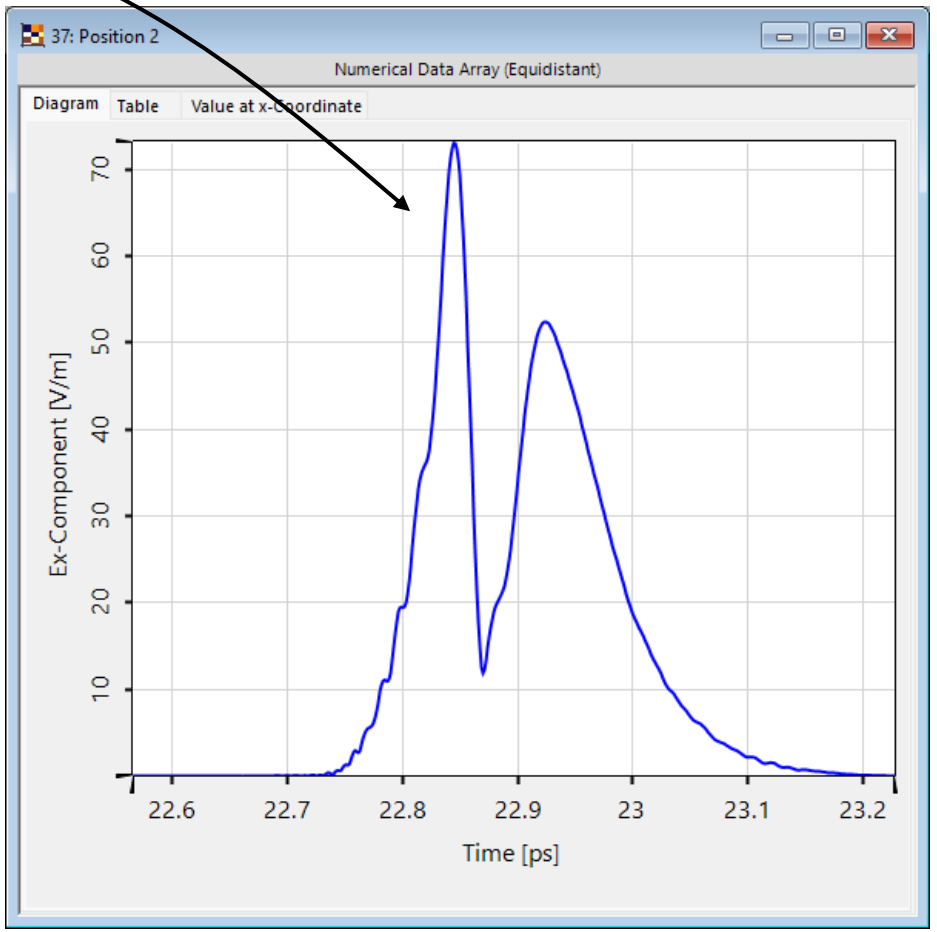
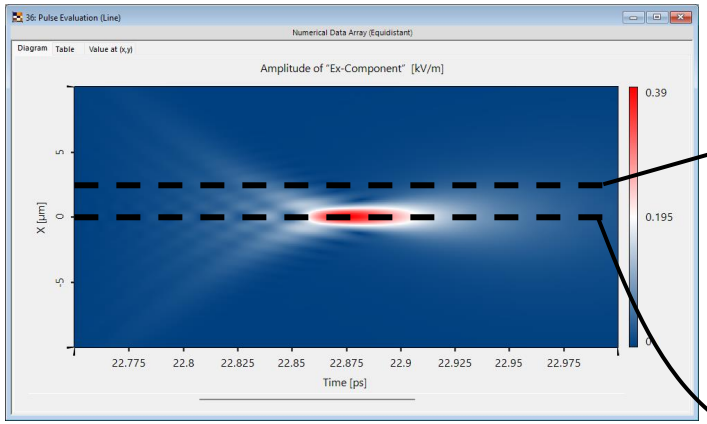
Spatio-Temporal Investigation: Comparision

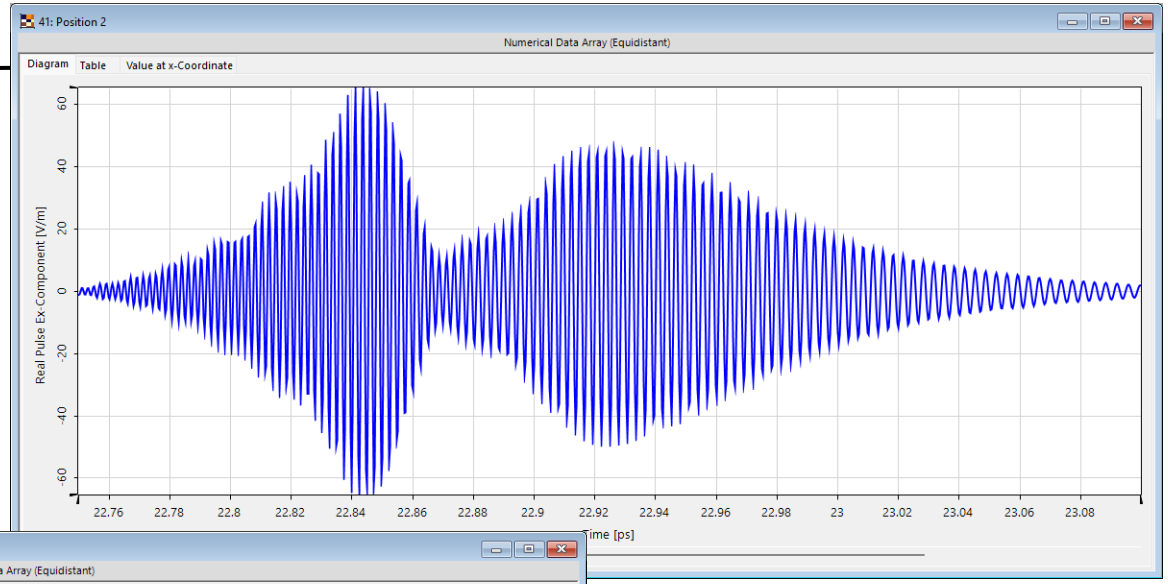


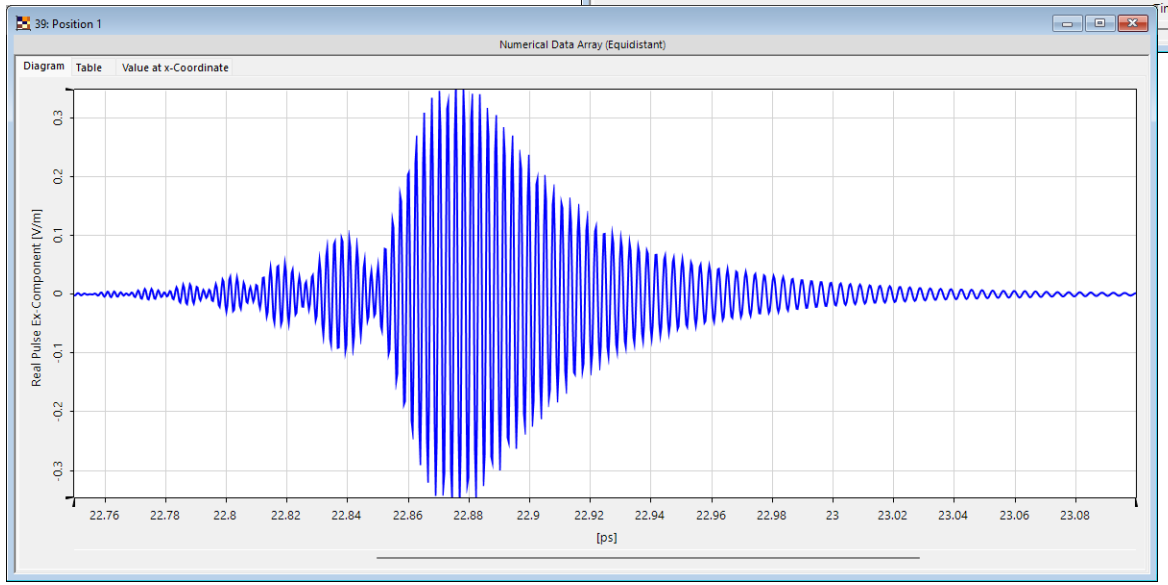




Spatio-Temporal Investigation: Real Pulse







Document Information

title	Pulse Focusing with High-NA Lens
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further reading	- Femtosecond Pulse Propagation through Dispersive Seawater - Focusing of Femtosecond Pulse by Using a high-NA off-Axis Parabolic Mirror