

Tutorial 3 – Simple Nonlinear Amplification

- A simple nonlinear propagation with gain



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 - Setup the data array with the following parameters:
 - 100 fs pulse, +/-10ps window, 2k, 1nJ @ 1060 nm
 - For the linear and nonlinear effects choose only dispersion and SPM, with the following parameters:
 - MFD=10 μm , L=1 m
 - gain=20dB/m, with gaussian gain profile at 1030 nm, 40 nm width
 - dispersion 0.02 ps²/m@1030 nm

The image displays five overlapping screenshots of the OptiBPM software interface, showing various configuration windows for optical pulse propagation simulations.

- Pulse Profile and Data Array:** This window shows the setup for a Gaussian pulse. Key parameters include:
 - array center wavelength: 1060 nm
 - half interval: 10 ps
 - vacuum length (full interval): 0.00599584916 m
 - fit all parameters to the closest value of the array: checked
 - Type: Gauss
 - pulse duration (FWHM): 0.1 ps (sets spectral width)
 - TempShift: 0 ps
 - phase: 0 rad
 - wavelength: 1060 nm (checked: same as array)
 - 2nd order spectral phase: 0 fs²
 - 3rd order spectral phase: 0 fs³
 - energy: 1e-09 J
- dispersion term:** This window displays the Taylor expansion series for the dispersion term:

$$\frac{\partial A}{\partial z} = \dots + \sum_{n \geq 1} \beta_n \frac{i^{n+1}}{n!} \frac{\partial^n}{\partial T^n} A$$
 The Taylor expansion series is selected, and the "Use dispersion" checkbox is checked.
- Gain:** This window shows the gain profile setup. The "use SPM and TPA" checkbox is checked. The saturation power is set to 1 W. The gain profile is defined by a Gaussian shape with a center wavelength of 1030 nm and a width of 40 nm.
- Dispersion Setup:** This window shows the Taylor series coefficients for the dispersion model:
 - Beta1: 0 ps/m
 - Beta2: 0.02 ps²/m
 - Beta3: 0.0 ps³/m
 - Beta4: 0.0 ps⁴/m
- effects and numerics:** This window shows the simulation effects and numerical parameters:
 - effects: dispersion, SPM / TPA, Raman, self-steepening, LLE (all checkboxes are checked).
 - numerics: steps: 100, stepsize: 0.01 m, distance: 1 m, adaptive local error: 1e-06, presets: (dropdown menu).
 - performance: no background propagation file, no live screen update (both checkboxes are unchecked).

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 - Results

