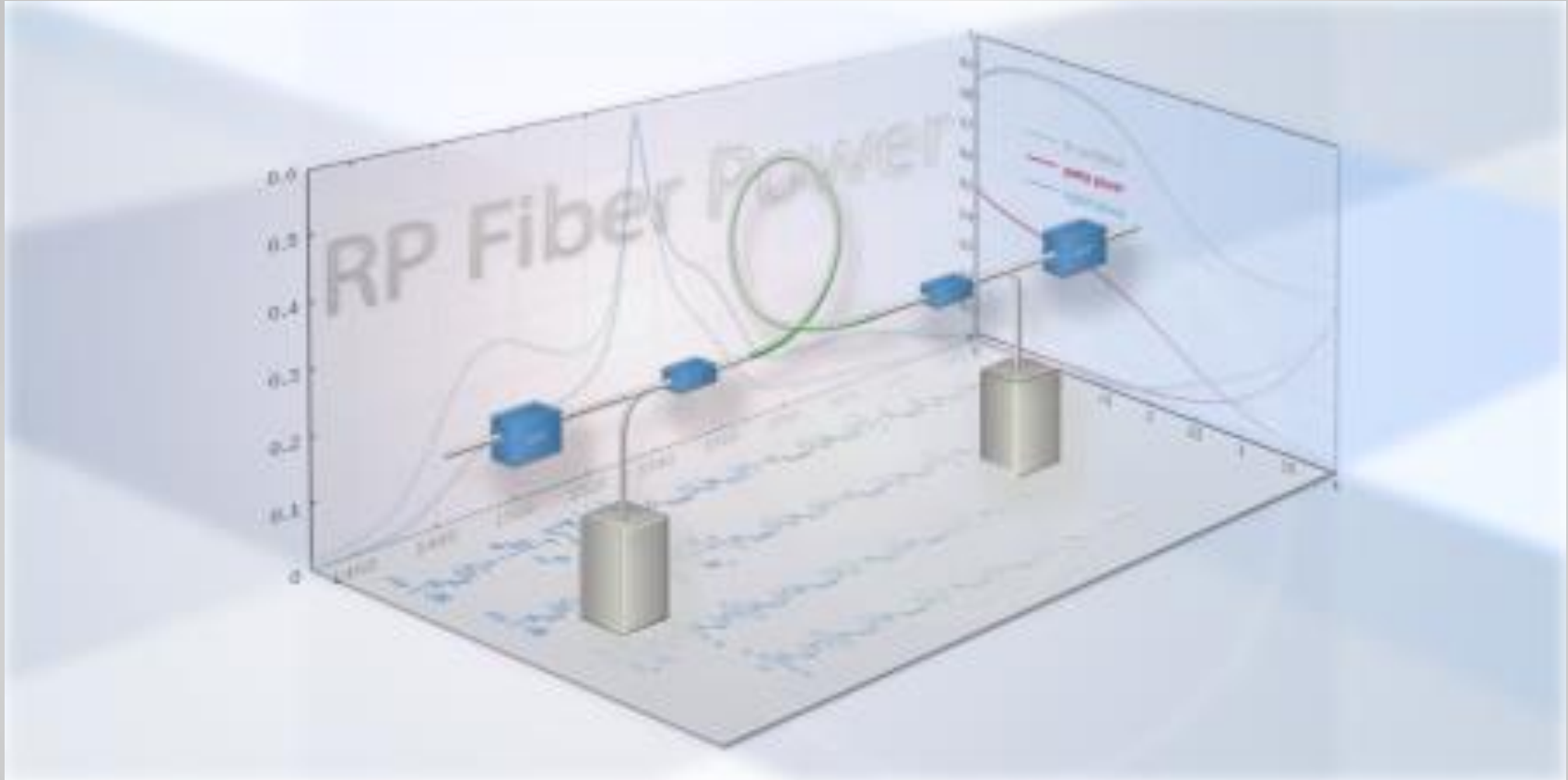


RP Fiber Power V8



a software product of
RP Photonics

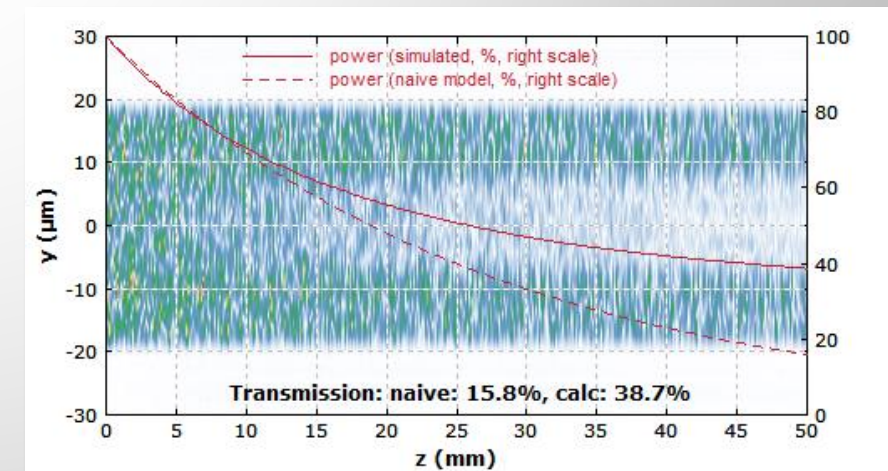
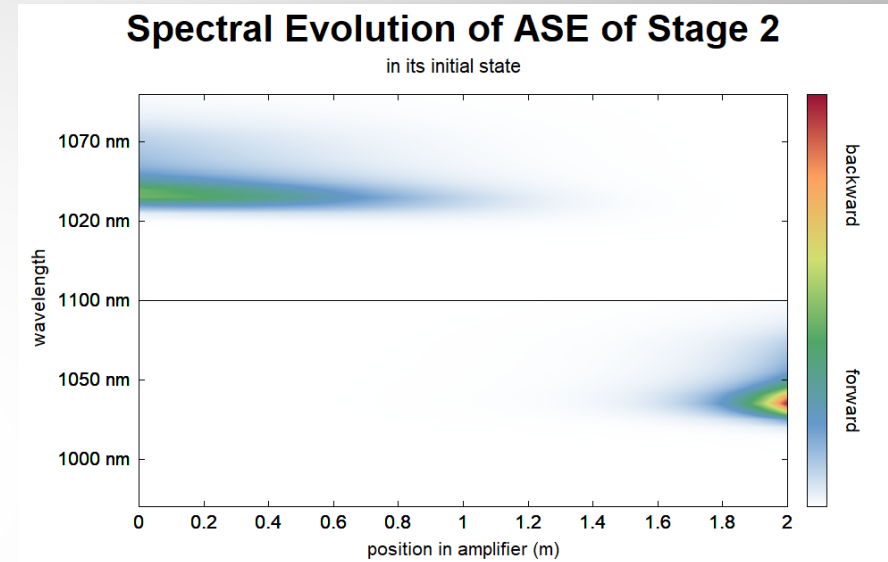
www.rp-photonics.com/rp_fiber_power.html

What are Simulations in Fiber Optics Good For?

- ▶ Simulations **produce detailed insight into the inner workings** of devices – far more than measurements – and without much effort!
- ▶ That insight helps a lot:
 - ▶ Understand performance limitations and find optimized device designs.
 - ▶ Thoroughly check designs before buying the parts and building a prototype or an improved version.
 - ▶ Find out the cause of unexpected behavior.
 - ▶ Get inspired for new ideas when playing with a model.
- ▶ **Get quality results of your R&D work faster and cheaper!**
- ▶ Lab work stays necessary but is reduced and becomes more efficient.

The Most Powerful Simulation Tool

- ▶ Get deep insight: calculate fiber modes, simulate power propagation, full beam propagation, ultrashort pulses, laser dynamics, etc.
- ▶ Easily work with a graphical user interface, which is also highly flexible!
- ▶ Enjoy high-quality comprehensive documentation.
- ▶ Get reliable results and competent technical support.
- ▶ **RP Fiber Power offers all that. It is the industry-leading solution.**



Combining Usability and Flexibility

The traditional trade-off:

Form-based User Interface

- ▶ Easy to start.
- ▶ But: not sufficiently flexible for real work.

Scripting-based Approach

- ▶ Highly flexible. Can program about anything conceivable.
- ▶ But: substantially harder to learn.

Our new solution: Power Forms for the main application areas:

- ▶ Easy to start: select the suitable form, fill it out, execute it.
- ▶ Great flexibility:
 - ▶ The forms provide many options.
 - ▶ For additional outputs, put a little script code into the form.
 - ▶ For even more flexibility: can make tailored versions of any of those forms!

The Power Forms

- Simply pick the suitable Power Form. Example:

Fiber Amplifier for Ultrashort Pulses

Input parameter set: Fiber amplifier for ultrashort pulses - demo 1.cf.fpj

Input pulses

Pulse 1	Pulse 2	Pulse 3	Pulse 4	Pulse 5	Pulse 6	Pulse 7	Pulse 8	Pulse 9	Pulse 10
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Activate this pulse

Pulse energy: Central wavelength:

Pulse shape

Pulse shape:

Duration: Chirp:

Coupling loss: $L(1) :=$ %

Time trace

Width of pulse grid: Number of amplitudes: Resolution:

Simulation cycles

Repetitive operation

Repetition rate: Repetition period:

Preparatory cycles

Number of cycles: Step size:

Stop if steady state is reached Allowed change: (of pulse energies)

Number of cycles:

Pumping resolution:

- The input data may be stored either in some standard folder or in your work folder.

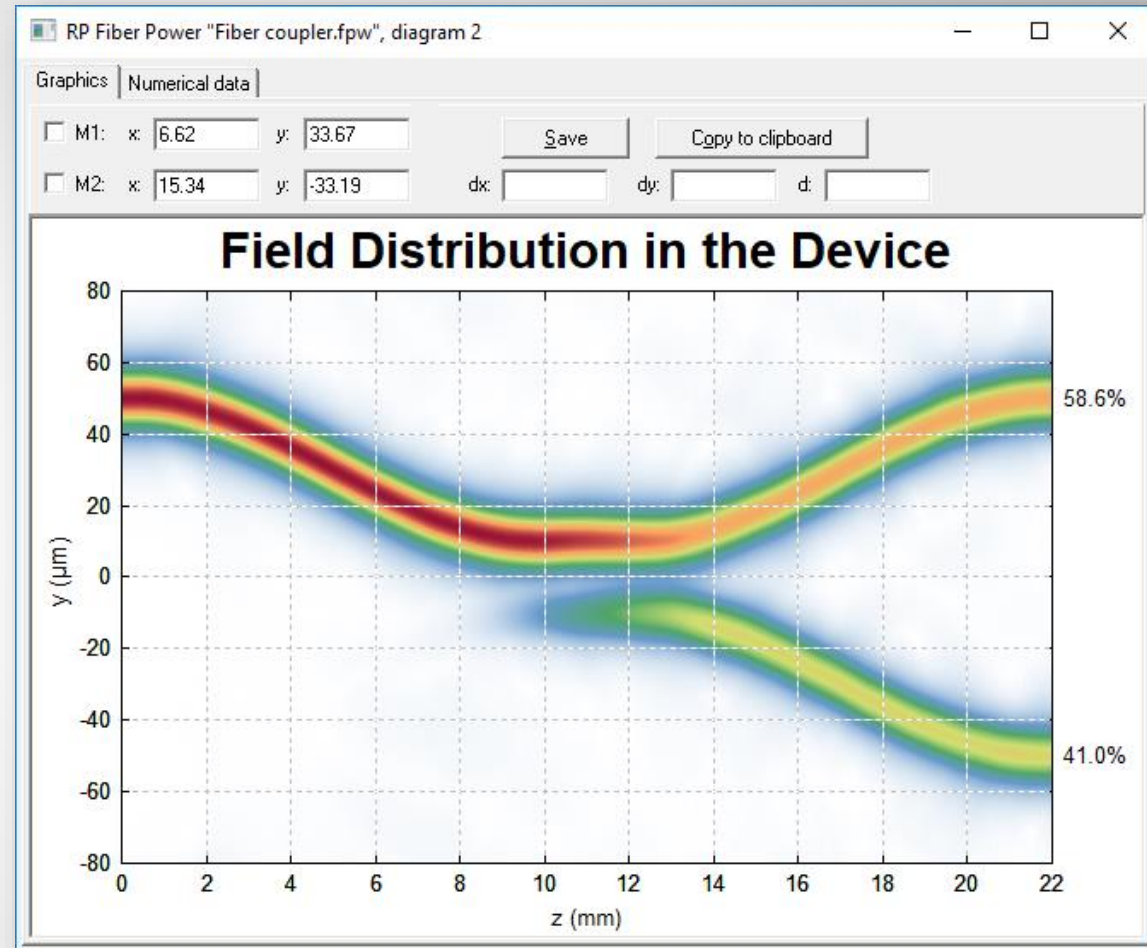
The screenshot displays the RP Fiber Power V8 software interface. At the top, there are menu options (File, Edit, View, Execute, Help) and a toolbar with icons for file operations and simulation. Below the toolbar, the 'Power Forms' section is active, showing a list of simulation models:

- Power Forms**: These power forms provide easy access to powerful simulation models out of the box.
- Fiber lasers and amplifiers**:
 - Fiber amplifier for continuous-wave signals**: Version: 2024-05-11. Diagram shows a chain of amplifiers (1 to n) with pumps (1 to 5) and signals (1 to 10). Features include continuous-wave operation, up to 5 stages, broadband signals/pumps, and double pass amplifiers.
 - Fiber laser and amplifiers**: Version: 2024-05-11. Diagram shows a laser stage followed by amplifiers (1 to n) with pumps (1 to 5) and signals (1 to 10). Features include continuous-wave operation, laser stage, up to 5 amplification stages, and double pass amplifiers.
 - Fiber amplifier for pulses**: Version: 2024-05-11. Diagram shows a chain of amplifiers (1 to n) with pumps (1 to 5) and signals (1 to 10). Features include pulsed signals, up to 5 stages, broadband, time-dependent signals/pumps, and find steady state.
 - Fiber amplifier for ultrashort pulses**: Version: 2024-04-30. Diagram shows a chain of amplifiers (1 to n) with pumps (1 to 5) and signals (1 to 10). Features include nonlinearities, dispersion, ultrashort pulsed signals, up to 5 stages, broadband, time-dependent signals/pumps, and find steady state.
 - Passive fiber for ultrashort pulses**: Version: 2024-05-01. Diagram shows an input pulse passing through a chain of fibers (1 to n).

Diagram Windows

Graphical output windows

- ▶ high-quality graphics, directly usable for publications: copy to clipboard or save to file
- ▶ can make animated graphics
- ▶ adjustable resolution
- ▶ markers for doing measurements
- ▶ export of numerical data

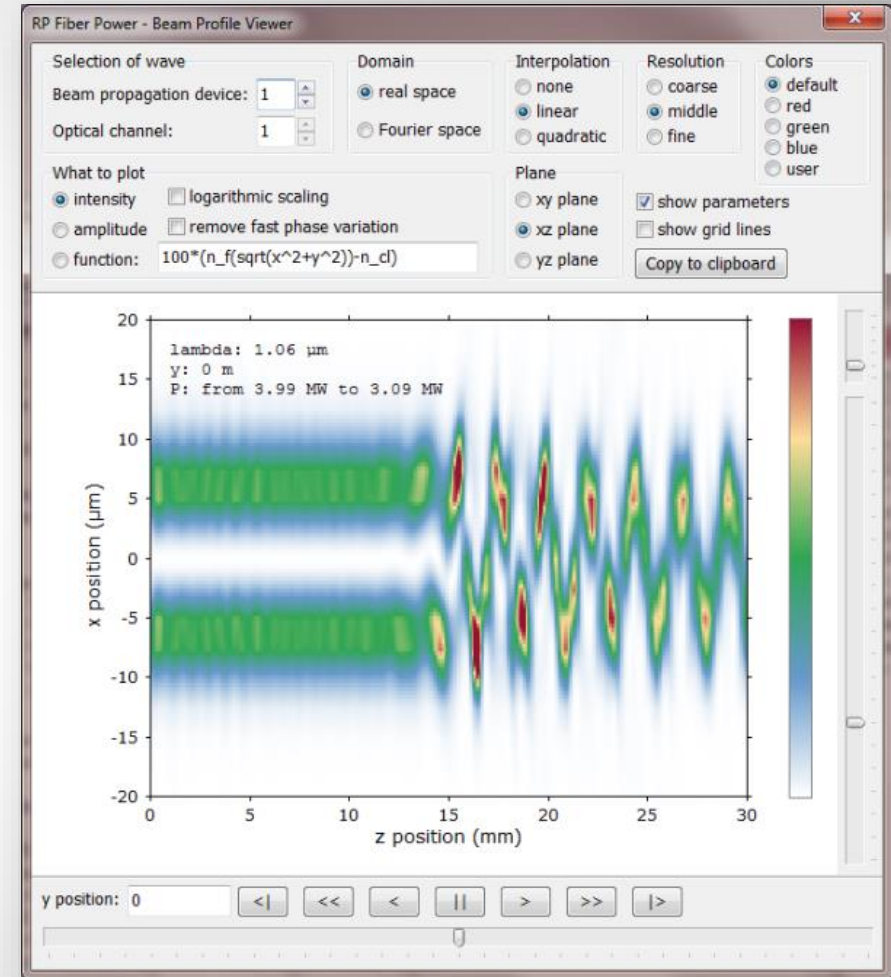


Also have flexible options for generating output in text form!

Put that into diagrams or files as you like.

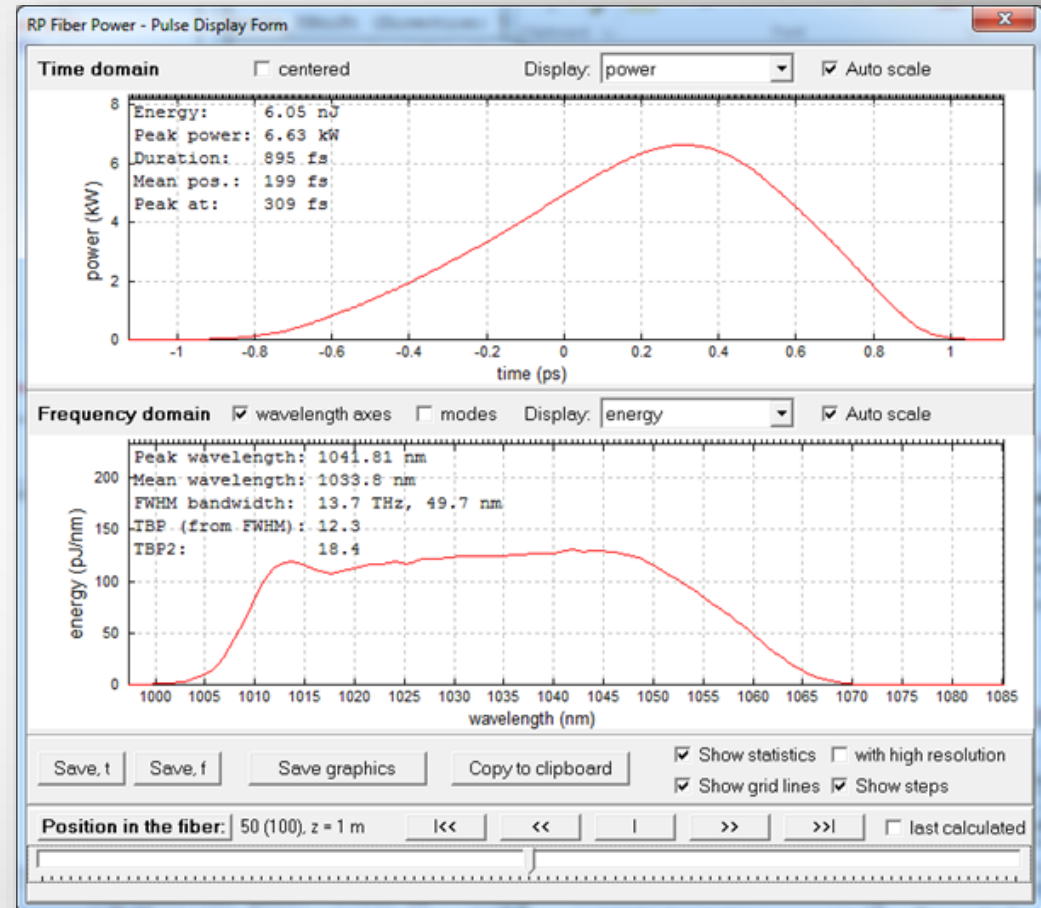
Beam Profile Viewer

- ▶ Inspect calculated beam profiles in numerical beam propagation.
- ▶ Switch between different wavelength components, displayed with different colors.
- ▶ Show profiles in xy , xz or yz plane.
- ▶ Change scaling or use logarithmic display in order to reveal weak satellites.
- ▶ Get parameters like center position and beam width displayed.



Pulse Display Window

- ▶ Browse the pulses along the fiber, or pulses stored in an array.
- ▶ Display a variety of properties in the time and frequency domain.
- ▶ Get pulse parameters such as energy, duration, peak power, bandwidth, time–bandwidth product, etc.



Documentation

- ▶ comprehensive **PDF manual**
- ▶ detailed **interactive help system** (displaying content in your web browser)
- ▶ comprehensive explanations of the used physical models, underlying assumptions, details of the script language, etc.
- ▶ dozens of **demo files**, demonstrating many different possibilities
- ▶ detailed explanations also for each Power Form

The screenshot shows a web browser window displaying the RP Photonics documentation. The page title is "Optical channels" and it includes a "Contents" section with a list of links. The main content area describes optical channels in an erbium-doped fiber amplifier, mentioning a pump channel, two signal channels, and 16 ASE channels. A graph plots intensity versus wavelength (nm) from 1460 to 1620 nm, showing a red "pump" peak at approximately 1480 nm, a grey "ASE" region between 1520 and 1600 nm, and two blue "signal" peaks at approximately 1550 nm and 1580 nm. The page also lists properties of an optical channel and includes a mathematical formula for the transverse intensity distribution.

Tags: #fiber model

Optical channels

The software allows the user to define some number of optical "channels", representing the light propagation in the fiber. The figure below illustrates the optical channels in an erbium-doped fiber amplifier: a pump channel, two signal channels, and 16 ASE channels:

An optical channel has the following properties:

- It has some wavelength, and in the case of an ASE channel (for calculating **amplified spontaneous emission**), it also has a wavelength bandwidth, and in addition the user specifies the number of propagation modes. The latter can be 2 for a single-mode fiber, when both **polarization** directions are accounted for.
- It has a propagation direction, which is forward or backward.
- There can be some **background loss**, specified in dB/m, resulting e.g. from absorption by impurity or from scattering at the core/cladding interface.
- There can be **reflectances** for some channel and both fiber ends, which couple this channel to a channel with the opposite propagation direction. (This is particularly used for fiber lasers.) See the page on **reflections and laser resonators**.
- There can be additional parasitic losses at both ends, inside and/or outside the reflector.
- There is a transverse intensity distribution, characterized with a function. (The software automatically normalizes that function.) For single-mode fibers, the intensity distribution can normally be well approximated with a Gaussian mode function:

$$\Psi(r) = \exp\left(-2\frac{r^2}{w^2}\right)$$

Technical Support

Any remaining technical issues can be addressed with the technical support:

The price for a **commercial user license** contains **8 support hours** (non-commercial licenses: 4 hours).

The support is done by Dr. Paschotta, who is a distinguished expert in this area and has originally developed the software, and by Dr. Gareth Moore. They will make sure that you become another very satisfied user of the software!

