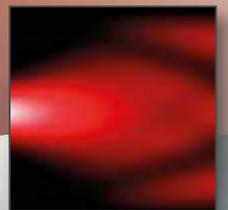
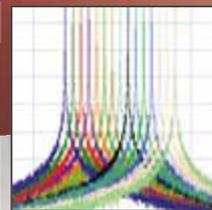
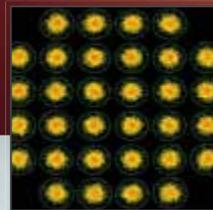


# Photonic Design Automation for Components, Systems & Networks

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Professional Simulation Tools & Expert Design Services



*Simulate, Validate, Innovate  
the World of Photonics!*

## VPIphotonics™ – Overview

VPIphotonics sets the industry standard for end-to-end photonic design automation comprising design, analysis and optimization of components, systems and networks.

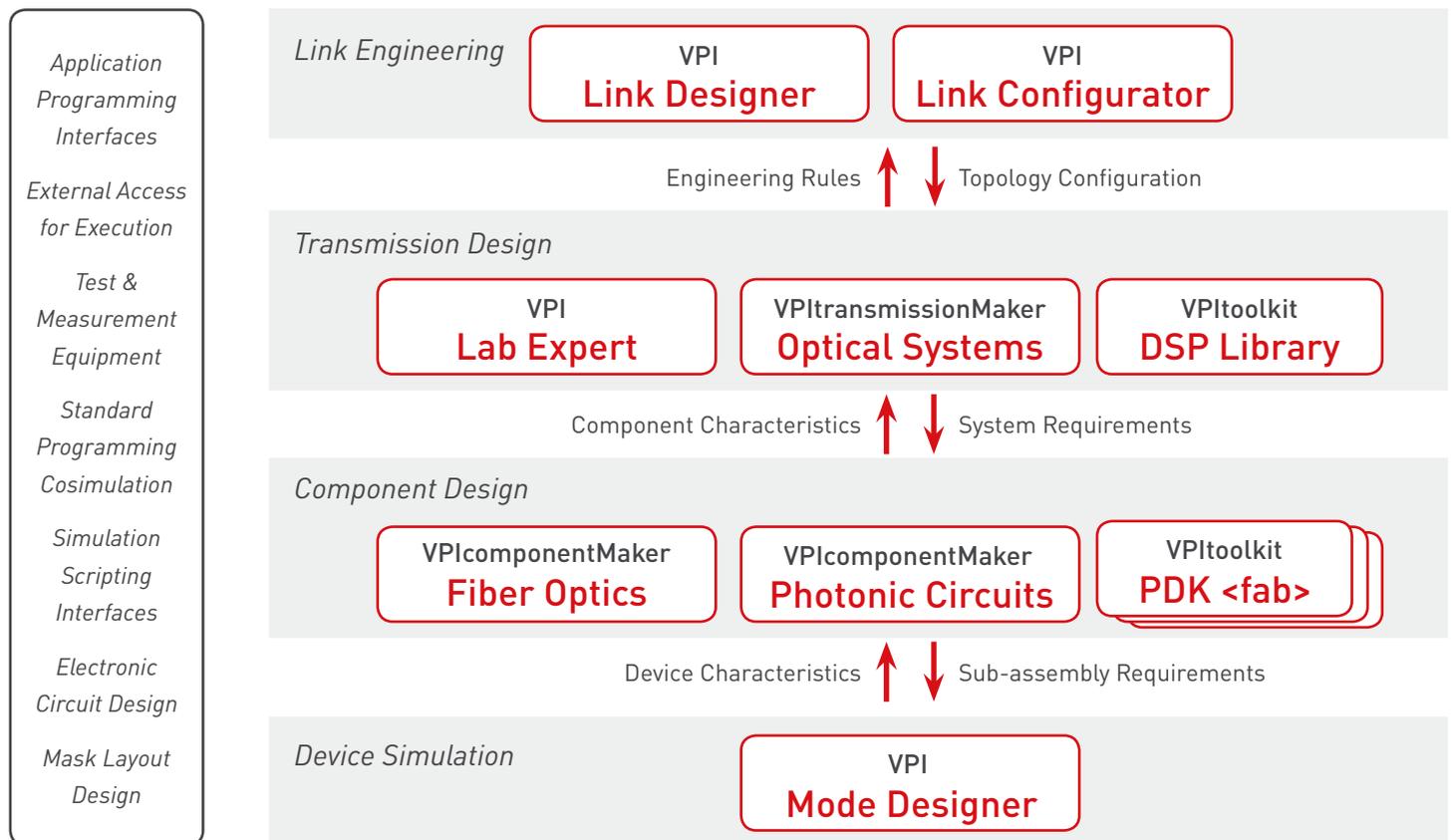
We provide professional simulation software supporting requirements of integrated photonics, optoelectronics and fiber optics applications, optical transmission system and networks, as well as link engineering and equipment configuration.

A wide range of interfaces to the tools used by peers, third-party software, laboratory equipment, and existing databases are available.

We enable corporations to manage intellectual property and reduce operating expenses by streamlining processes, from R&D to technical sales and marketing.

Our solutions support the seamless information exchange of component characteristics and system requirements, as well as engineering rules and topology configuration within a team or between corporations.

VPIphotonics' experts perform consulting services addressing customer-specific design and configuration requirements, and deliver training courses on adequate modeling techniques and advanced software capabilities.



VPIphotonics' products are used in engineering departments, by forward-looking groups, product design and marketing teams from over 100 commercial corporations. Over 1000 engineers have completed courses of the VPIphotonics training programs.

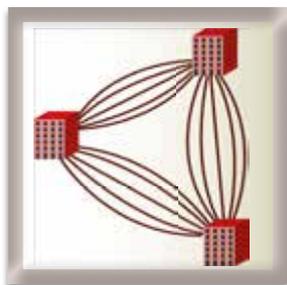
The worldwide University Partner Program supports photonics research and curriculum at hundreds of universities and research institutes. Hundreds of registered users exchange ideas and insights online on the VPIphotonics Users Forum. VPIphotonics' award winning software is cited in over 1200 technical conference and journal papers.

## Design & Engineering Solutions

VPIphotonics provides comprehensive Photonic Design Automation (PDA) solutions for 20+ years comprising of design methodologies, software tools and services used to engineer complex photonic networks and products. VPIphotonics' software solutions embed expert knowledge in flexible working environments supporting many applications in various fields of operation.

VPIphotonics brings efficiency gains as it supports a streamlined design process:

- ✓ Enable collaborative designs via supply chains
- ✓ Stimulate innovation by expanding available resources
- ✓ Reduce the need for physical experimentation
- ✓ Capture and distribute knowledge of design processes
- ✓ Establish and support robust decision-making processes

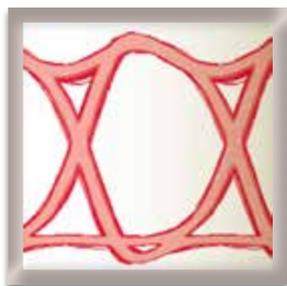


### Link Designer

*VPIlinkDesigner™* is a cost-effective, easy-to-use tool which enables fast and optimum network design and provisioning for those who design and configure links in optical networks and sub-networks.

### Link Configurator

*VPIlinkConfigurator™* provides an intuitive graphical interface and powerful algorithms for optical network engineering including automatic equipment placement and a thorough system wide performance assessment.

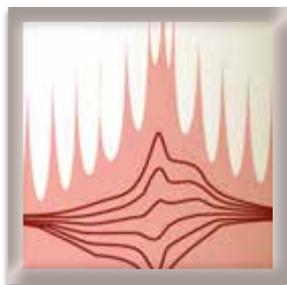


### Optical Systems

*VPItransmissionMaker™ Optical Systems* accelerates the design of new photonic systems and subsystems for short-range, access, metro and long-haul transmission systems. Further, it supports the assessment of technology upgrade and component substitution strategies that are to be developed for existing network plants.

### Lab Expert

*VPIlabExpert™* addresses the specific requirements of experimentalists for data pre- and post-processing and signal analysis functions for optical communications. It reduces efforts in the laboratory by applying ready-to-use advanced functionalities and virtualizing lab equipment through the emulation of component characteristics.

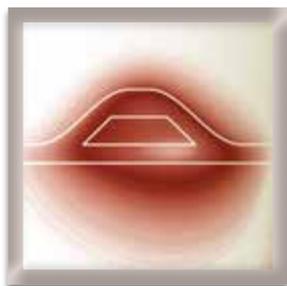


### Photonic Circuits

*VPIcomponentMaker™ Photonic Circuits* is a simulation and design environment for photonic integrated circuits (PICs). It provides advanced device libraries integrated with a scalable time-and-frequency-domain simulation framework for fast and accurate modeling of large-scale PICs with a mix of photonic, electrical and optoelectronic devices.

### Fiber Optics

*VPIcomponentMaker™ Fiber Optics* provides professional means for modeling, optimization and design of fiber-based optical devices such as doped-fiber, Raman and parametric amplifiers, continuous-wave and pulsed optical fiber sources, optical signal processing for telecommunication, high-power and ultra-fast applications.



### Mode Designer

*VPImodeDesigner™* is a versatile simulation framework for the analysis and optimization of integrated photonic waveguides and optical fibers. This design tool offers full-vectorial finite-difference mode solvers for the accurate and efficient calculation of guided and leaky modes and their properties.

# Design Suite

VPIphotonics Design Suite™ embeds expert knowledge from our component and transmission design tools in one shared, flexible software environment to support requirements in design, analysis and optimization providing you with the most powerful numerical algorithms tailored for your applications.

## Photonic Design Environment (PDE)

The flexible and intuitive graphical user interface of VPIphotonics Design Suite delivers access to sophisticated component, subsystem and photonic system design functions.

VPIphotonics supports design processes along the design chain of optical equipment, from conceptual studies to yield optimization. Comprehensive libraries with hundreds of demonstrations and sample equipment, system and network models accelerate learning and the execution of design tasks.

Design process tools such as Interactive Simulations, (Tuning, Sweeps, Optimization, Monte-Carlo), Macros, Wizards, Simulation Scripting, Parameter Estimators, and third-party interfaces make VPIphotonics' products the backbone of the photonics simulation world.

## VPIphotonics Design Suite™

### Transmission Design

VPI  
Lab Expert

VPItransmissionMaker  
Optical Systems

Component Characteristics ↑ ↓ System Requirements

### Component Design

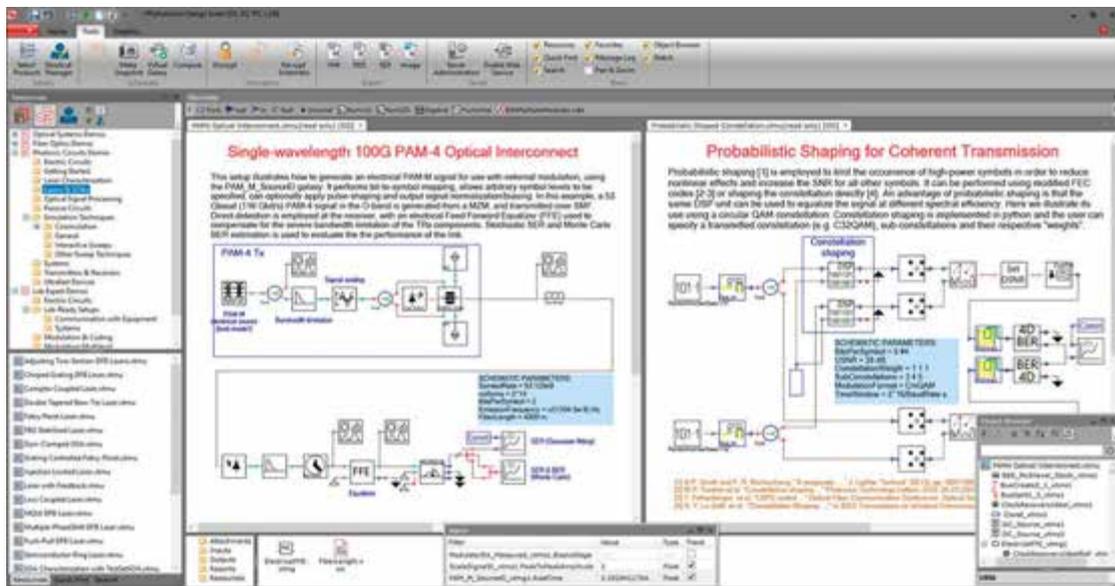
VPIcomponentMaker  
Fiber Optics

VPIcomponentMaker  
Photonic Circuits

Parameters for any schematic or model can be managed with interactive controls or driven by sweeps and random number generators. The outputs of controls and sweeps can be combined and manipulated with mathematical expressions, and then applied to multiple parameters.

Simulations can be run in parallel on multiple cores or farmed out to remote machines. They can be driven by a flexible simulation scripting language to control large-scale numerical experiments.

Proprietary content of subsystems can be encrypted and password-protected, so that simulations of proprietary models can be executed by end users, while the underlying schematics are locked from view. Data file attachments can be encrypted so that unauthorized users are unable to read the file.



## Supporting Design Processes

### Interactive Simulation Controls

An Interactive Control enables design processes utilizing multidimensional tuning and sweeping of parameters, and supporting automatic optimization as well as yield estimation and Monte-Carlo experiments including the confidence estimation of final results. Control ranges are defined by intervals with increments, random number generators or arbitrary lists. Control definitions can be combined and manipulated using mathematical expressions before being applied to simulation parameters.

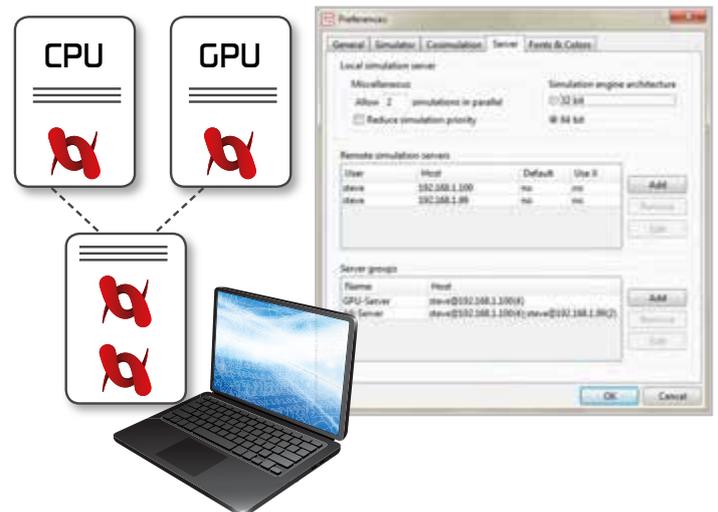
### Macros

Macros synthesize system designs for given specifications and ease the creation and adaptation of schematics. They can be used to build a schematic by selecting modules, wiring them together, and setting parameters by emulating keyboard and mouse actions.

Macros can be created by adding interactive comments and mathematical calculations, or calling a third-party program to an existing design. They can also verify it by performing a defined set of standard tests. Creating user-defined Macros is made easy with a separate shell.

### Multiprocessor & GPU-based Operation

VPIphotonics' flexible licensing scheme supports the execution of multiple simulation processes on multicore machines, and remote execution on external simulation servers. Results can be stored on the remote computer, or provided directly in the correct order to the local user interface for data analysis and post-processing. The GPU-assisted simulation mode (fibers, FFT) and parallelized algorithms (fibers, FFT, active semiconductors, gratings) help to maximize simulation efficiency.

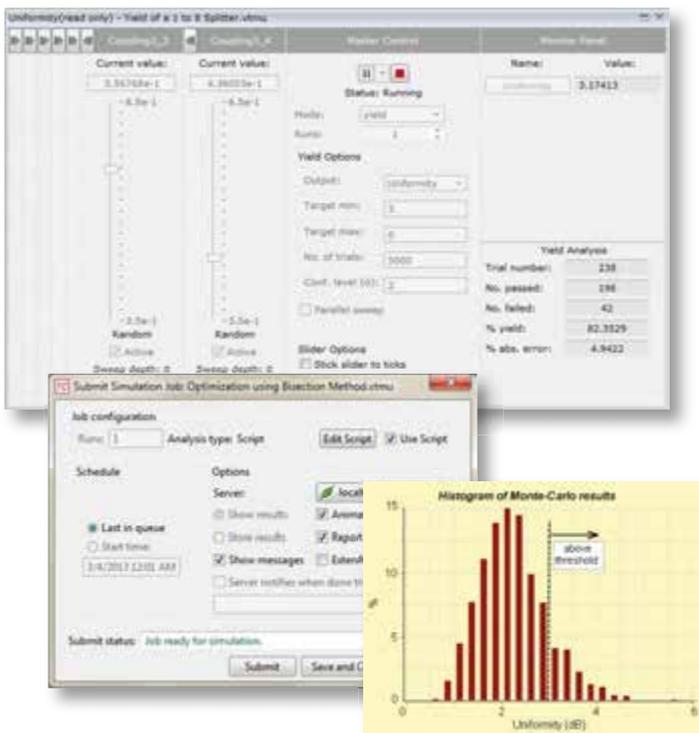


### Simulation Scripting

With the help of scripting the simulation engine, simulations can be performed automatically, parameters manipulated based on previous results, and files created and modified without supervision – an essential feature when simulating over large parameter spaces. Examples are provided to run simulations within control loops, abstract a full EDFA model to a black box amplifier, perform optimizations, read files, and send results to multiple files.

### Demo Applications

More than 760 demo applications are provided in VPIphotonics software illustrating the various modeling capabilities, functionalities of PDE features, data-processing techniques, and simulation concepts. Additional ones are available on the VPIphotonics Users Forum ([forums.vpiphotonics.com](http://forums.vpiphotonics.com)).



## Data Visualization & Analysis - VPIphotonicsAnalyzer™



VPIphotonicsAnalyzer™ establishes a universal framework for data display and analysis. It allows maximum freedom in the display, arrangement, export and analysis of simulation results from VPItransmissionMaker, VPIcomponentMaker, VPIlabExpert and third-party software.

VPIphotonicsAnalyzer framework provides visualizers and analyzers that accurately represent laboratory Test & Measurement equipment for detailed results display, component characterization and system performance analysis functions.

The LinkAnalyzer, for instance, offers means for tracking signal properties along the fiber link without the need to run long-lasting simulations, and evaluating them versus position, distance or frequency.

- Multi-input optical, electrical oscilloscope
- Eye plots featuring color-grading, BER contours and customizable masks
- Optical spectrum analyzer with Stokes, phase, delay and dispersion plots
- RF spectrum analyzer with phase and delay
- Numerical 1D, 2D, 3D analysis with plot or text display and histogram mode
- Link Analysis (GVD, noise/distortion/signal power, Kerr, DGD, OSNR-, Q-, BER-limit vs distance, frequency, time)
- Constellations, CATV characterization
- Optical amplifier test set with gain, NF, BER
- Two-port electrical signal analyzers
- BER estimators for various receiver architectures
- Poincaré sphere with markers
- PMD test set (PSP, PCD, DGD, Jones)
- Laser characterization tools

## VPIplayer™ & Interfaces to Third Parties

### VPIplayer™

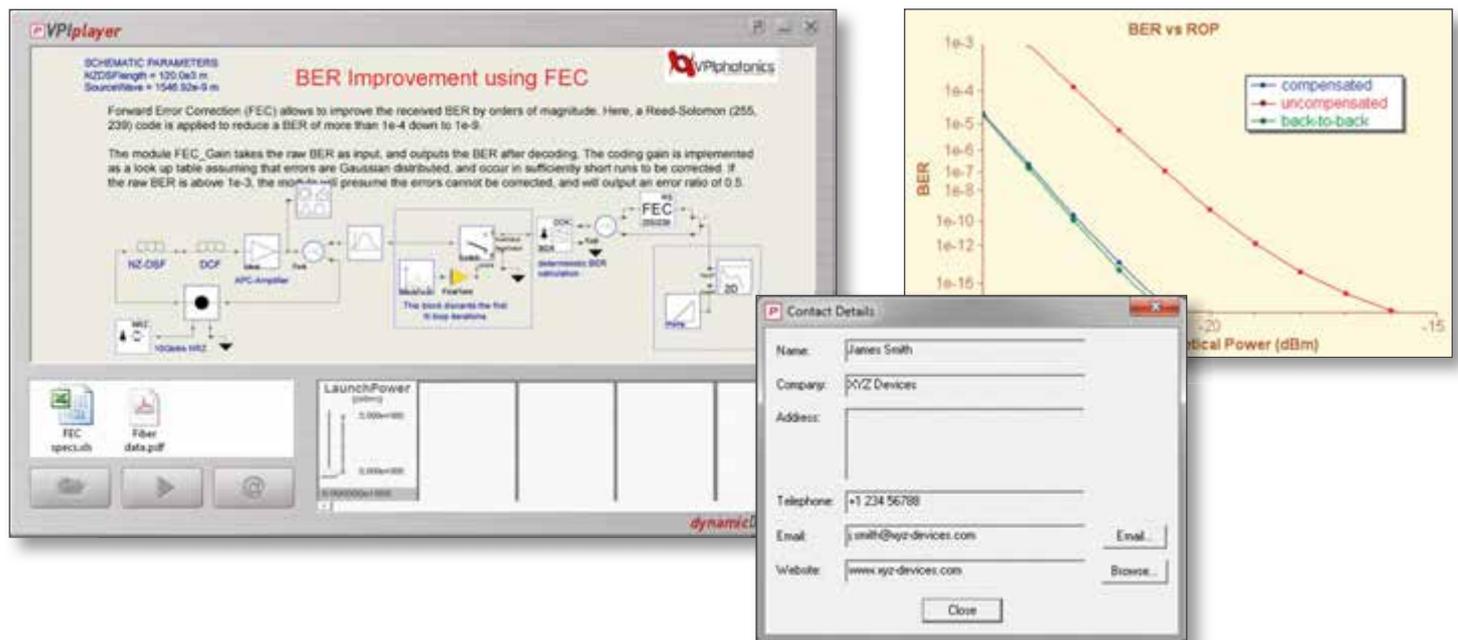
The communications tool provides a format to exchange photonic designs by running complex simulations while protecting intellectual properties of the owner.

VPIplayer empowers engineers to present their ideas to colleagues and customers who have less technical knowledge, and no need for detailed design and simulation software.

It is downloadable for free from: [www.VPIphotonics.com/Tools/VPIplayer](http://www.VPIphotonics.com/Tools/VPIplayer)

VPIplayer runs a *DynamicDataSheet™* (DDS), which captures product specifics as a simulation schematic generating results on data visualizers and analyzers. A DDS can be created by exporting a simulation setup from VPItransmissionMaker / VPIcomponentMaker.

Your company logo, contact details and supporting information can be included. Interactive settings allow users to adjust parameters via predefined sliders.



### Third-Party Interfaces

Cosimulation allows parts of a simulation schematic to be modeled using third-party or in-house code. Live interfaces to MATLAB, Python, C++ and any software supporting the COM interface are provided, so simulations seamlessly interact with models in these formats.

Vice versa, the Simulation Engine Driver (SED) provides access to the simulation engine of VPIphotonics Design Suite for external systems and third-party tools.

Electronic circuit models from Keysight's Advanced Design System (ADS) can be called and their parameters controlled directly from VPIphotonics' design tools allowing to assess the performance of high-speed electronics in photonic link designs.

VPIphotonics simulations can import data from component characterizations and systems measurements. Various interfaces exist; new formats can be defined using customizable Data Type Converters and Macros.

## Training & Design Services

Training courses are conducted on site, or at VPIphotonics' locations in the USA and Germany. A training manual and certificate of completion is awarded to all successful participants. Courses can be tailored to meet individual demands, ranging from beginners to advanced-level participants and addressing general or highly specialized applications.

Additionally, VPIphotonics offers customized modeling and design services in various fields of photonics and optical communications.

Please contact us and tell us about your design challenges and project requirements. Our experts will get back to you.

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