VPIphotonics Design Suite – Version 11.2

New release of industry-leading design software for optical transmission systems and photonic components

VPIphotonics Design Suite Version 11.2 provides access to professional application-specific simulation tools and pluggable toolkits. They offer common usability, design process and data analysis capabilities.

Version 11.2 delivers advances in simulation and design flow for many applications, such as encoding and digital signal processing for high-speed coherent systems, analysis of signal metrics for intensity modulated direct detection systems, free-space optical communications and multimode

coupling, integrated photonics with nonlinear waveguides and microring modulators. Integration with a version control system allows to track changes of the design project in a collaborative environment.

Our software solutions have proven their benefits in winning and successfully performing many research and design projects. With the improved capabilities that are provided in Version 11.2, our design suite is set to deliver the same outstanding results in the future.
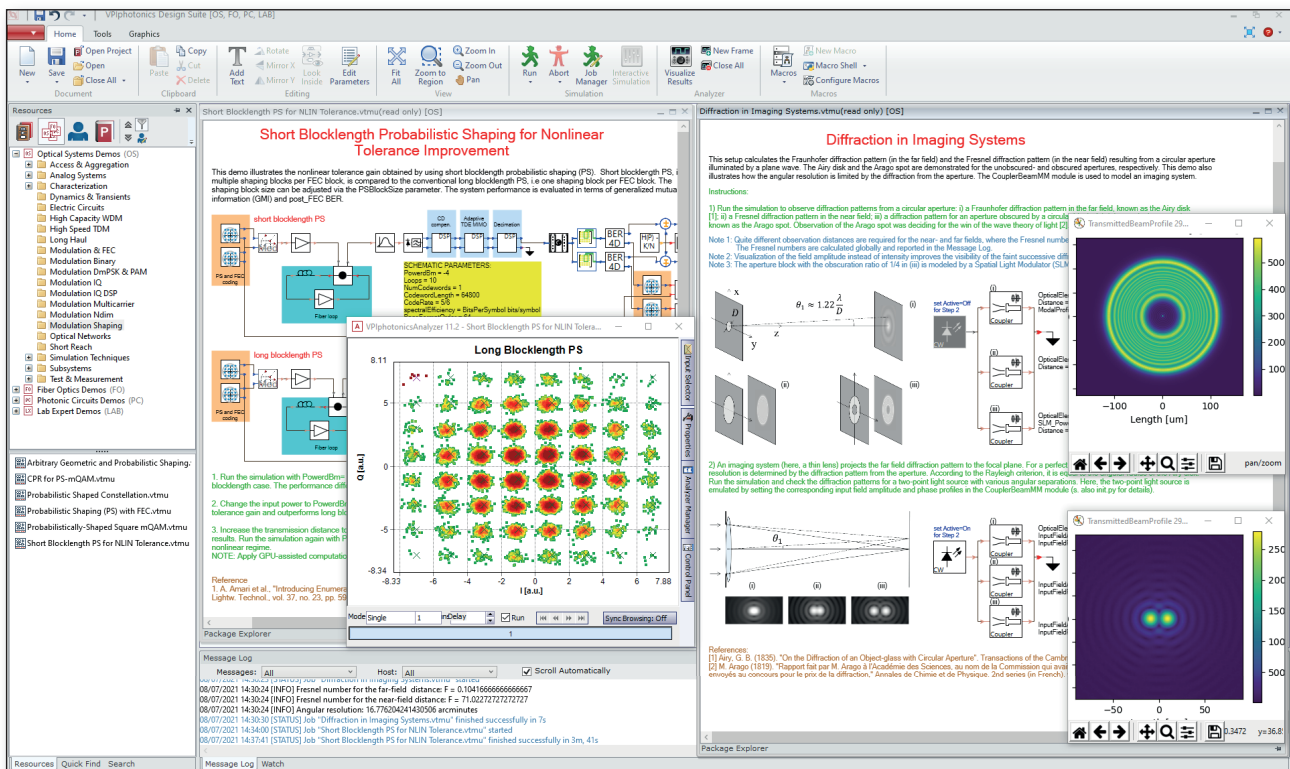
Photonic Design Environment (PDE) of Version 11.2

Short list of key features in Version 11.2

- **TDEC for NRZ** — Transmitter and Dispersion Eye Closure for NRZ signals; allows to vary sampling window positions and photodiode type
- **Analysis of PAM4** — PAM analysis with extended list of PAM4 metrics: signal-to-noise and distortion ratio (SNDR) and several Jitter metrics included
- **MLSE transitions** — Display of transition PDFs created by the MLSE-based decision and BER estimation for NRZ and PAM4

- **Probabilistic shaping (PS) with FEC** — LDPC-IRA codes for PS-mQAM with FEC; better performance and lower complexity than regular LDPC codes
- **Short blocklength PS** — Generation of multiple short shaping blocks per FEC codeword for higher nonlinear tolerance of encoded signals
- **PS power scaling** — Optional output signal scaling to deliver constant output PS encoded drive signals for any specified modulation format

- **Data-aided TDE-MIMO** — Data-aided TDE-MIMO DSP algorithm for robust channel equalization for high-order modulation formats and severe signal impairments (low SNR, large PMD)
- **Electrical SSB QAM** — Transmitter to generate an electrical single side-band mQAM signal
- **Digital Subcarrier Multiplexing** — Transmitters to generate electrical and optical polarization-multiplexed mQAM signals that employ DSCM

- **FSO communications** — Model for Gaussian beam propagation through terrestrial free-space optical channel; accounts for atmospheric scintillation, beam divergence, and weather conditions
- **Multimode couplers** — Support launch systems with different media between input plane, optical elements' planes, and output plane

- **Measured SOA** — Semiconductor optical amplifier with arbitrary nonlinear gain saturation
- **Circuit-level MRM** — Bidirectional microring modulator; any voltage dependence for effective mode index, attenuation, junction capacitance
- **Dispersion slope in PIC modules** — Accurate description of dispersive properties of photonic waveguides in much broader wavelength range
- **Nonlinear waveguide** — Bidirectional model of dispersive nonlinear waveguides; accounts for dispersion, Kerr and two-photon absorption

- **Demo modules** — Library of specific or experimental modules that were previously undocumented and hidden
- **Matrix calculations in Python** — Perform simple math on rectangular floating-point matrices, especially useful for coding, DSP, data analysis
- **Access to matrix data** — Send matrix data to the simulation script or Simulation Engine Driver; for iterative control and optimization algorithms

- **Multiple objects operations** — In one operation, activate multiple instances on your schematic, or change the format of several graphical objects
- **Compact mode** — Convenient mode to extend the usable design space for schematics that collapses or hides User Interface panels
- **Version control** — Basic support of version control systems (Mercurial, Git); allows to track changes of the design project in a collaborative environment
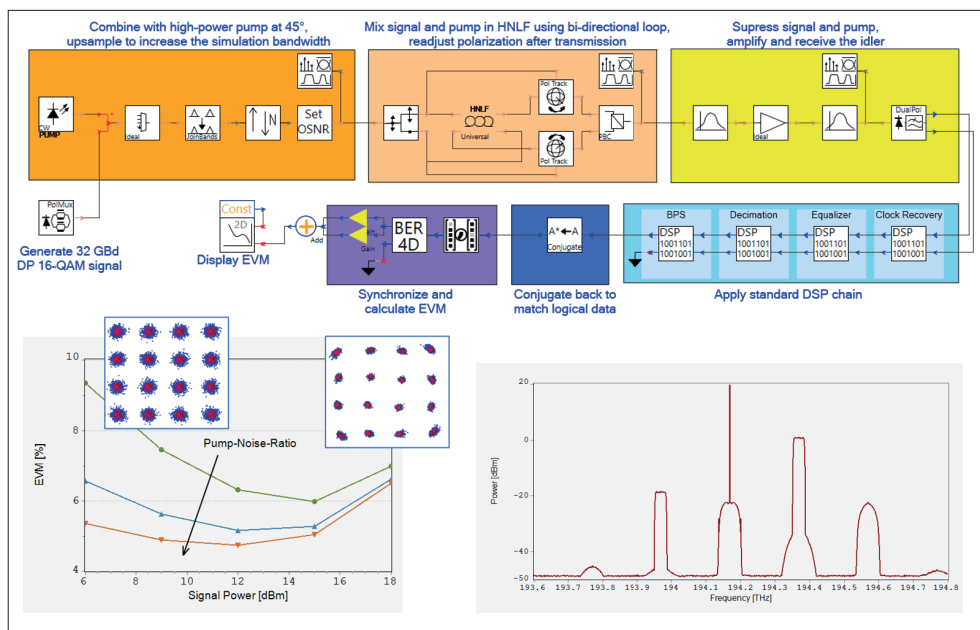
Design Example – All-Optical Wavelength Conversion

This example illustrates how a dual-polarization wavelength converter (WC) / optical phase conjugator (OPC) can be realized based on single-pump four-wave-mixing (FWM) in a highly nonlinear fiber (HNLF) using a bi-directional loop configuration [1]. All-optical WC and OPC have applications in future networking [2] and nonlinearity suppression [3].

The input to the converter is a DP-16QAM data signal. The output (called idler) is a replica of the input, but frequency-shifted by 200GHz and with conjugated field amplitude. The idler is subsequently detected using a standard coherent receiver, followed by DSP, digital back conjugation and EVM estimation.

References
[1] M. Stephens et al., Optics Express 22(10), 11840-11848 (2014).
[2] M. Saleh et al., Proc. IEEE, 100(5), 1105-1117 (2012).
[3] P. Minzioni, Fiber Int. Optics 28(3), 179-209 (2009).

Setup and results for All-Optical Wavelength Conversion of DP-16QAM signal

About VPIphotonics

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 optoelectronics, integrated photonics and fiber optics applications, optical transmission system and network applications, as well as cost-optimized equipment configuration. Our team of experts provides professional consulting services addressing customer-specific design, analysis and optimization requirements, and delivers training courses on adequate modeling techniques and advanced software capabilities.

VPIphotonics' award-winning off-the-shelf and customized solutions are used extensively in research and development, and by product design and marketing teams at hundreds of corporations worldwide for 20+ years. Over 160 academic institutions joined our University Program enabling students, educators and researchers an easy access to VPIphotonics' latest modeling and design innovations.

For further information, please visit us at www.VPIphotonics.com.