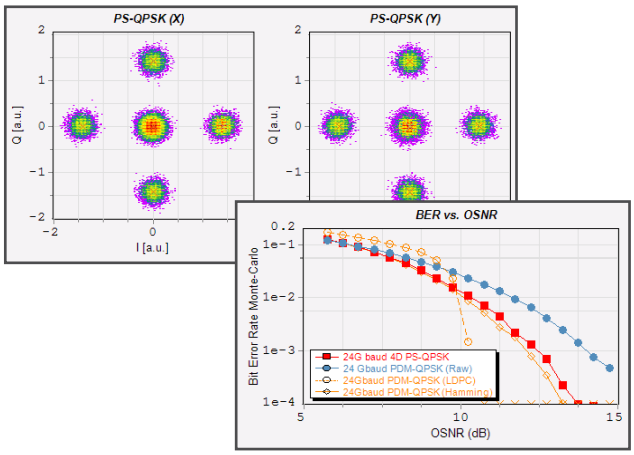
VPIphotonics DESIGN AUTOMATION

DSP Library for Coherent Optical Systems

VPIphotonics teams up with the Photonic Networks and Systems department of the *Fraunhofer Heinrich-Hertz-Institute* to provide lab-proven electronic Digital Signal Processing algorithms. This extensive DSP library is available as pluggable toolkit to VPItransmissionMaker™ Optical Systems version 9.1.

VPItransmissionMaker Optical Systems is the market-leading simulation platform for optical transmission systems. The recently released Version 9.1 offers several new simulation modules and modeling improvements to support arbitrary 4D and conventional 2D modulation formats, bit stream encoding and decoding using linear FEC codes, design of linear electric circuits and many more features and enhancements.



The new toolkit for coherent optical systems enables to perform a diversity of DSP functions, among them

- I/Q imbalance correction
- Blind CD estimation and compensation
- Clock recovery and deskew
- Carrier frequency and phase recovery
- Polarization demultiplexing
- PMD compensation

These algorithms support a wide range of modulation formats including dual-polarization BPSK, QPSK, and mQAM as well as polarization-switched QPSK. They are developed and tested in Fraunhofer HHI's lab environment for many different application scenarios.

Combined with the unique modeling features of VPItransmissionMaker Optical Systems the new toolkit enables users to design, compare and optimize high-speed transmission systems based on the digital–coherent technology under real-world conditions.

ECOC 2013
Live preview demonstrations at booth 318!

HHI DSP

Benefits

- Lab-proven DSP algorithms
- On-the-fly DSP simulations
- Extensive library of DSP algorithms
- Support of wide-range of modulation formats
- Seamless integration into VPItransmissionMaker Optical Systems

Applications

- Benchmark DSP algorithms
- Design next-generation transceivers
- Address trade-off between DSP complexity and its performance
- Compare modulation formats
- Perform system performance analysis
- Define component requirements

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NEW TOOLKIT

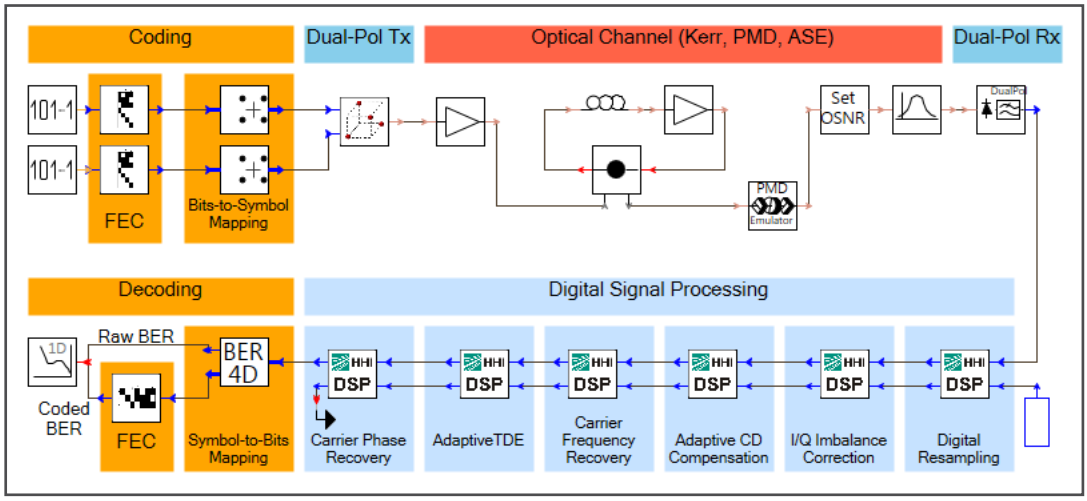
Example Design: 400Gb/s DP-32QAM

At the transmitter, 8-bit DACs are used to generate the electrical signals driving the dual-polarization IQ modulator. The optical signal is transmitted over a non-dispersion managed SSMF-based transmission link of variable length.

Beside transmission effects (chromatic dispersion, Kerr-effect, PMD and ASE noise) the following system limitations are considered as well:

- Phase and insertion-loss imbalance at the optical front-end
- Phase and frequency mismatch between the transmitter laser and the local oscillator
- Low-pass response (30GHz 3dB bandwidth) and limited resolution of ADCs (8 bits)

All these impairments can be successfully mitigated by combining several of the DSP algorithms available in the new toolkit.



Below, the X-tributary of the signal is displayed at the input of the DSP unit, after I/Q imbalance correction, after carrier-phase estimation and adaptive time-domain equalization.

Additionally, forward-error-correction (FEC) using a 4000 bits-long low-density-parity-check (LDPC) code with 18% overhead is considered in order to ensure error-free transmission.