VPIphotonics
DESIGN AUTOMATION

Single Design, Multiple Fabs: Modelling and Design Strategies for Hybrid PICs

EPIC Online Technology Meeting on Hybrid Photonics Integration

Andrzej Połatyński

18 September 2023

We empower you to
define the cutting edge.

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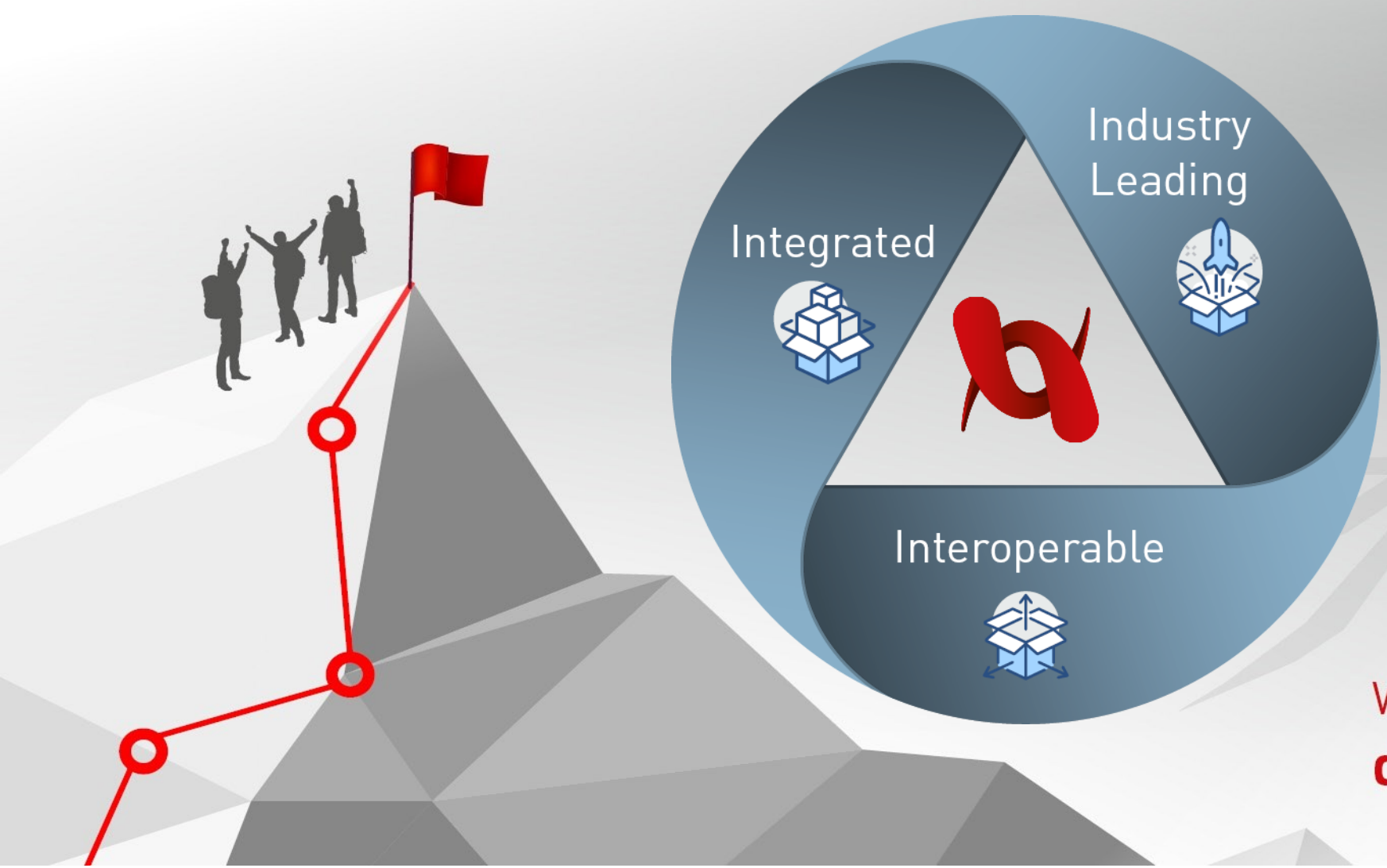
SOFTWARE AND SERVICES

for Photonic Design & Analysis



- Market leader with 25+ years of experience
- Regional offices in Europe and North America
- Global network of resellers and representatives

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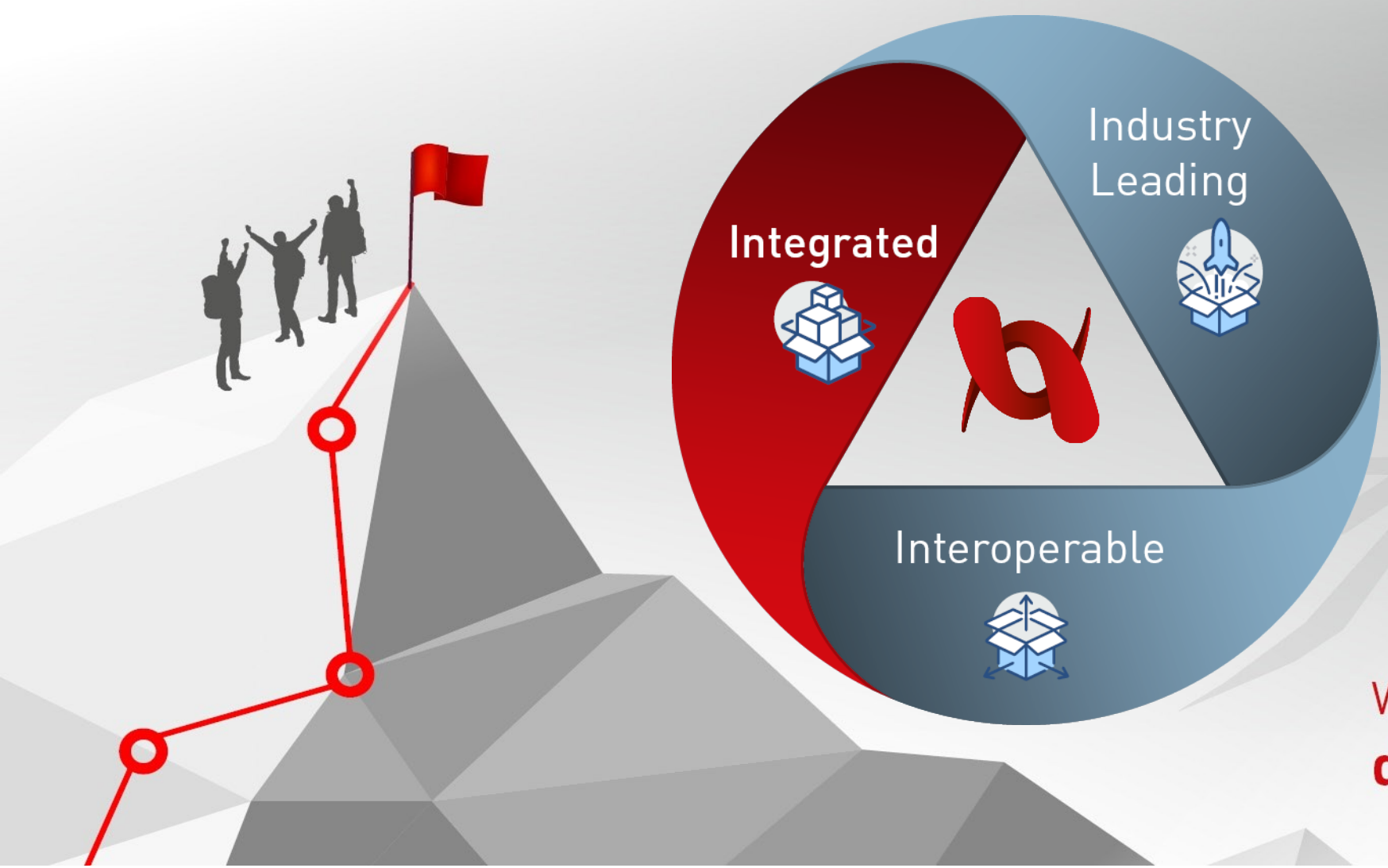

- We integrate efficient simulation techniques and professional design functions for devices, components and systems.

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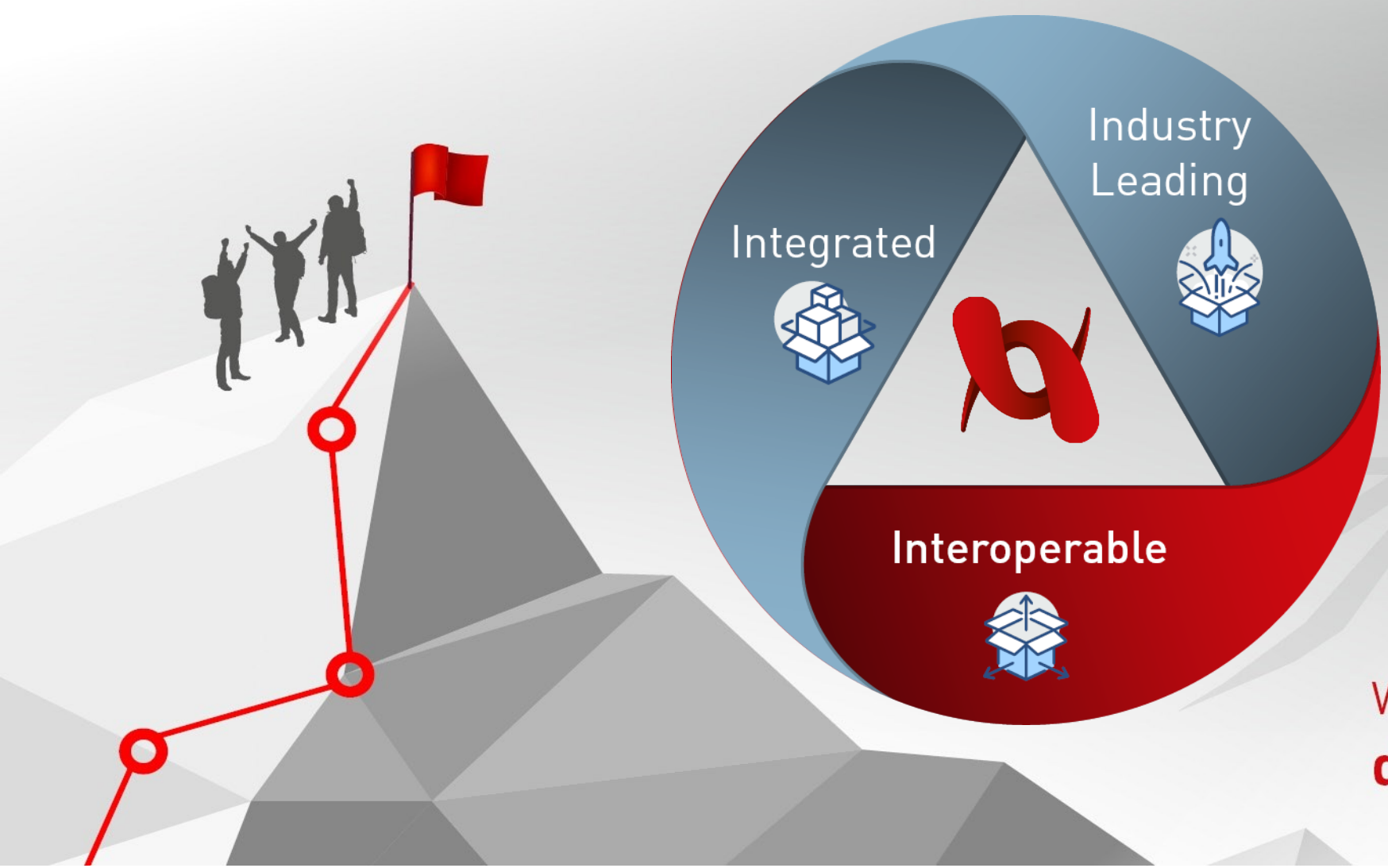

- We enable **interoperability** with 3rd party simulation, design and programming software, and test & measurement equipment.

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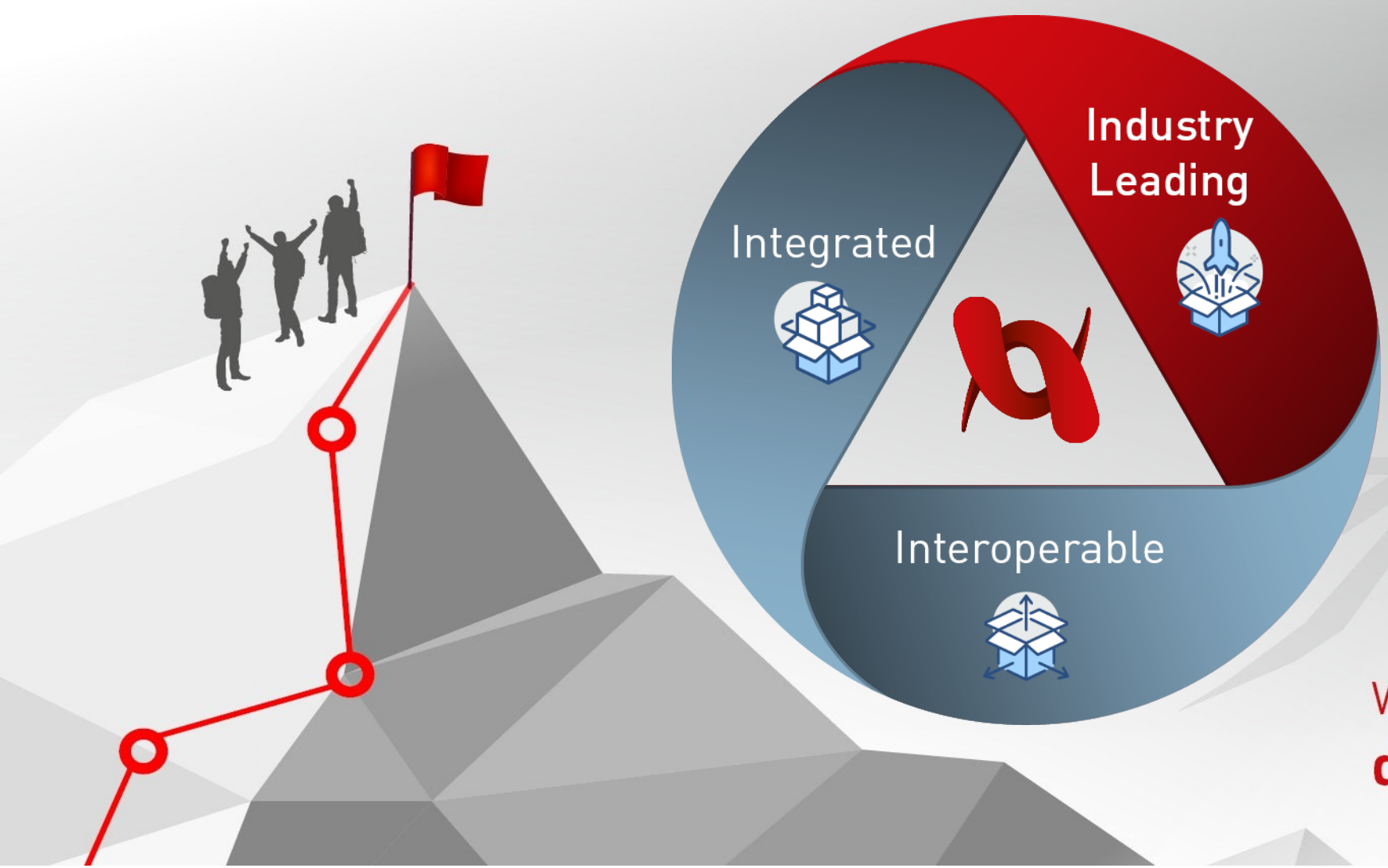

- We seek industry leading solutions to chart new frontiers via forward-looking industrial and research collaborations.

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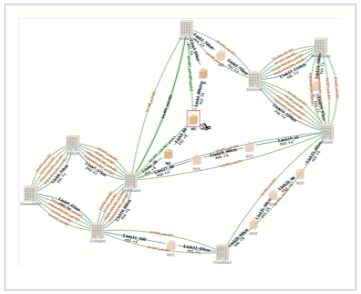
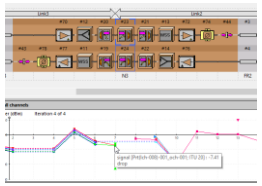
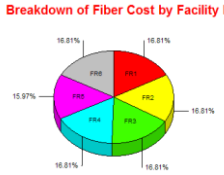
for Photonic Design & Analysis

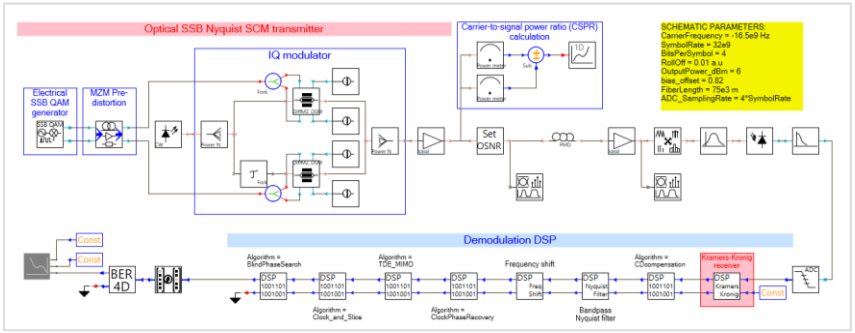
Link Engineering

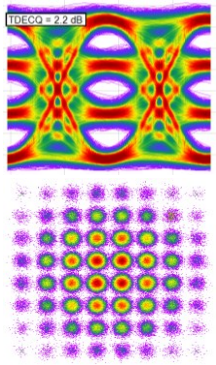




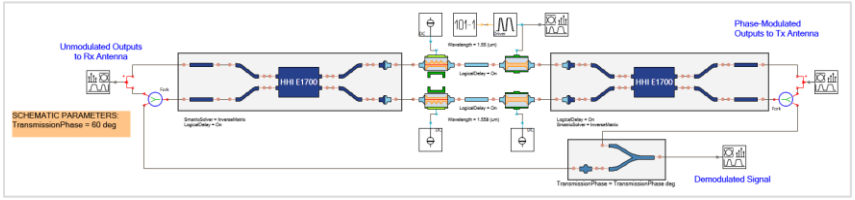


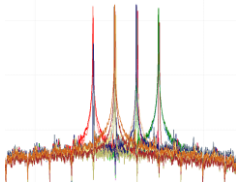
Transmission Design



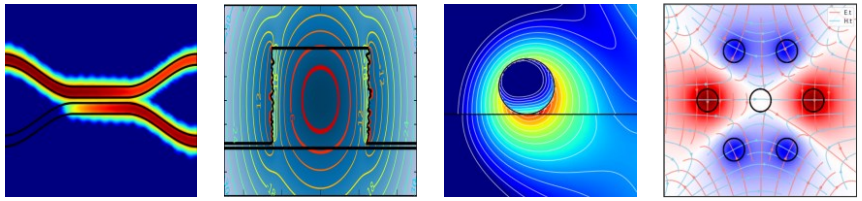


Component Design





Device Simulation



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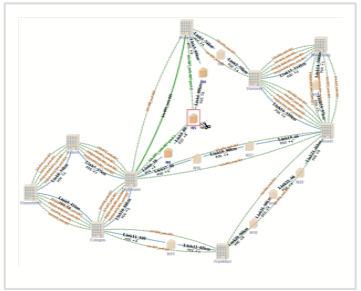
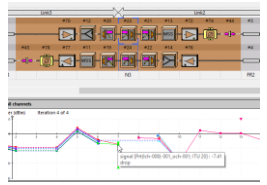
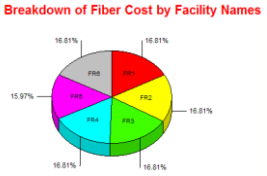
Our Software Solutions

Link Engineering

- VPI Link Designer
- VPI Link Configurator

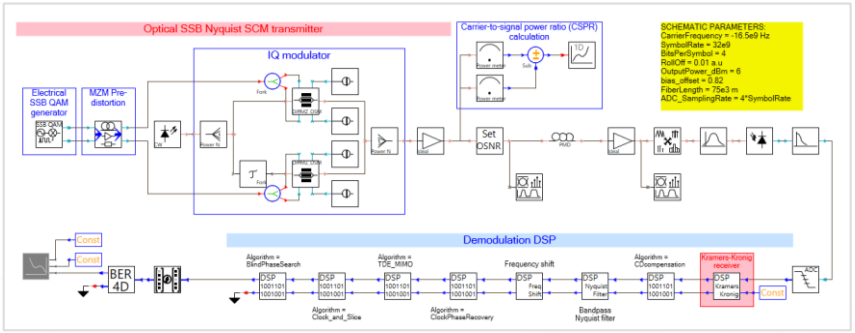


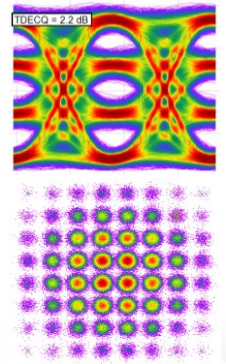




Transmission Design

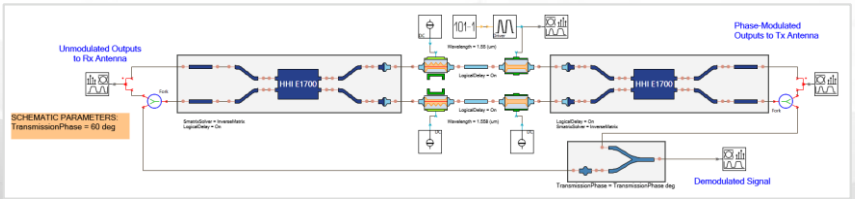
- VPItransmissionMaker Optical Systems
- VPI Lab Expert
- DSP Library
- QKD

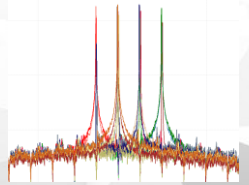




Component Design

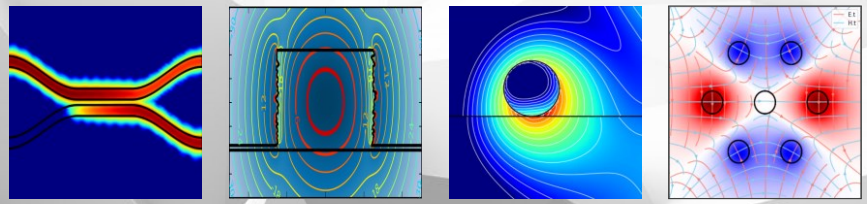
- VPIcomponentMaker Fiber Optics
- VPIcomponentMaker Photonic Circuits
- PDK<fab>



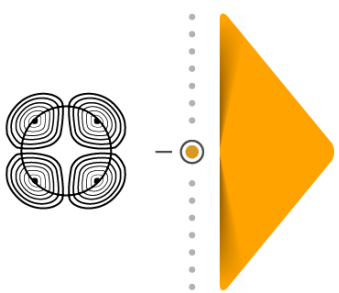


Device Simulation

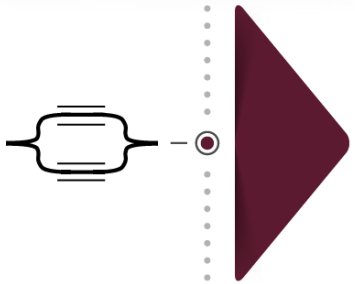
- VPI Device Designer



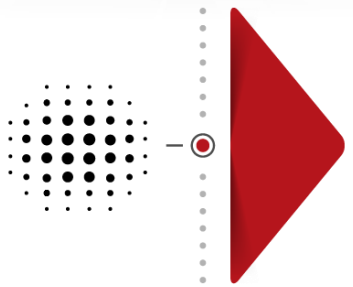
Photonic Design Workflow



Device Simulation



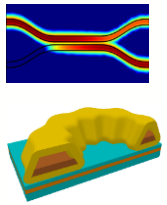
Component Design



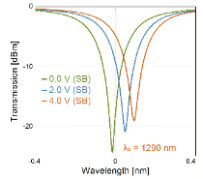
Transmission Design

VPIphotonics Design Suite

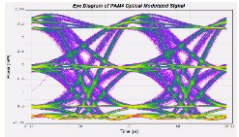
VPIdeviceDesigner



VPIcomponentMaker Photonic Circuits



VPItransmissionMaker Optical Systems



VPItoolkit PDK <foundry>

LIONIX INTERNATIONAL
SMART PHOTONICS
LIGENTEC
Infinera
HHI PDK

Layout Design Tools

Nazca design
LUCEDA PHOTONICS
SIEMENS
SYNOPSYS®

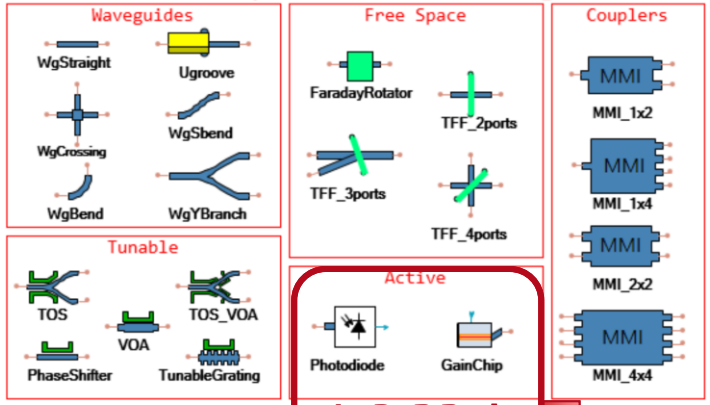
Electronic Design Automation

KEYSIGHT TECHNOLOGIES

From Circuit Schematic to Assembled Chip

Polymer-based Hybrid Tunable Laser

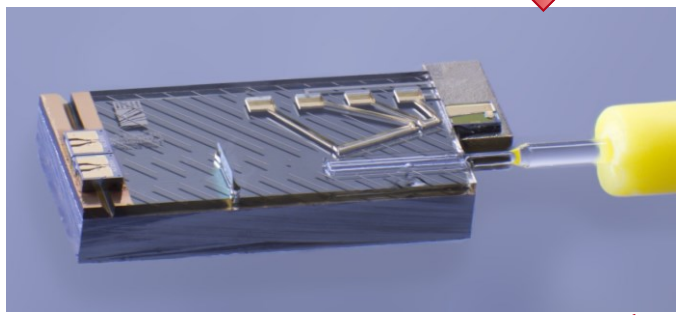
List of HHI Polymer-based Building Blocks



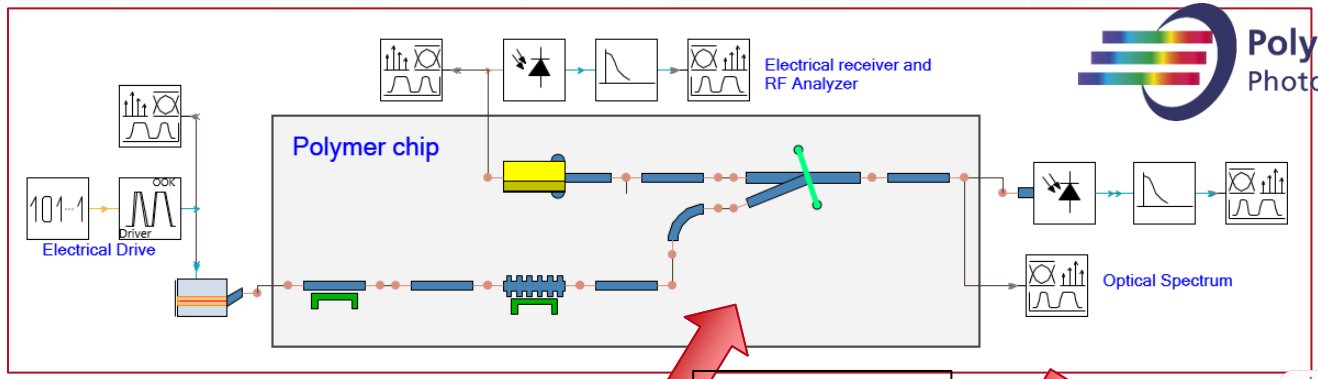
InP BBs!

???

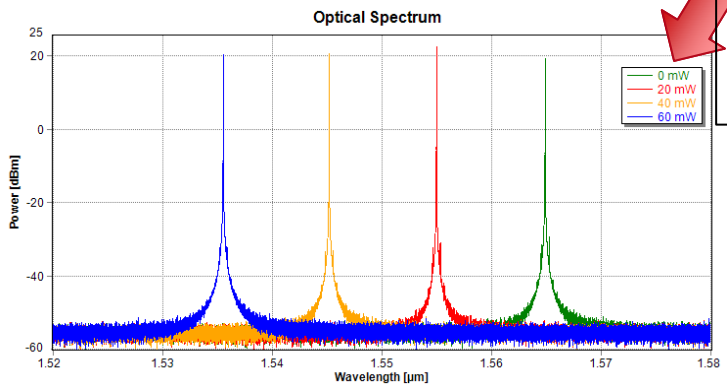
Assembled Transceiver



VPI circuit simulation view



PolyChrome Berlin
Photonics for Sensing



Optimization and Tolerance Simulation

Export netlist or layout file

Layout View

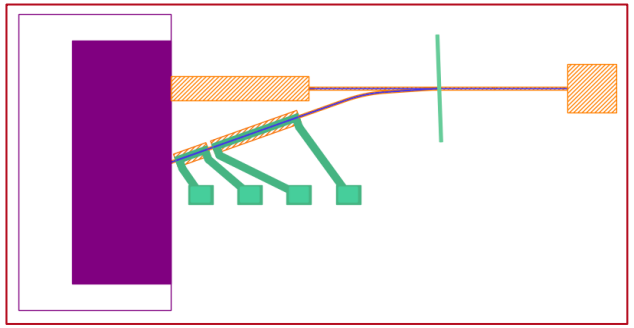
Export to JSON

Export

Export

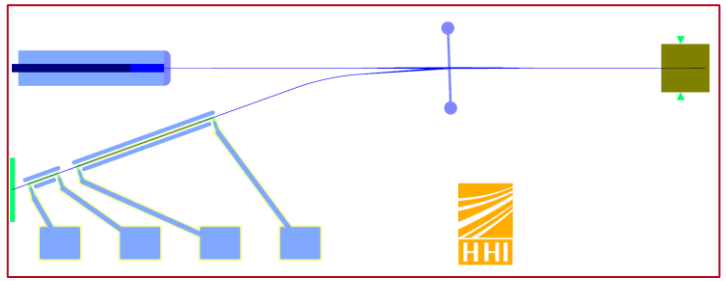
Export

VPI layout view



GDS extraction using given layout tool

Exported GDS (in Klayout)

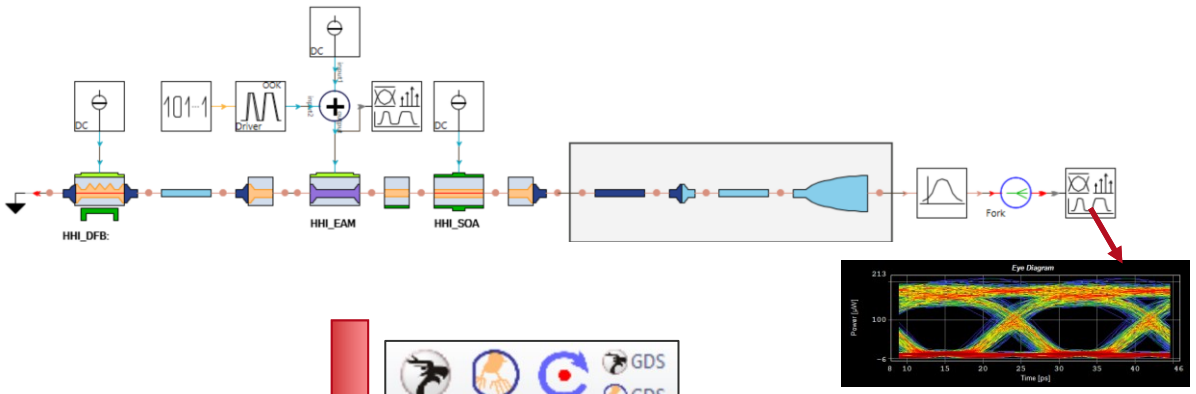


Fabrication processes and assembly

Different PDKs, different designs

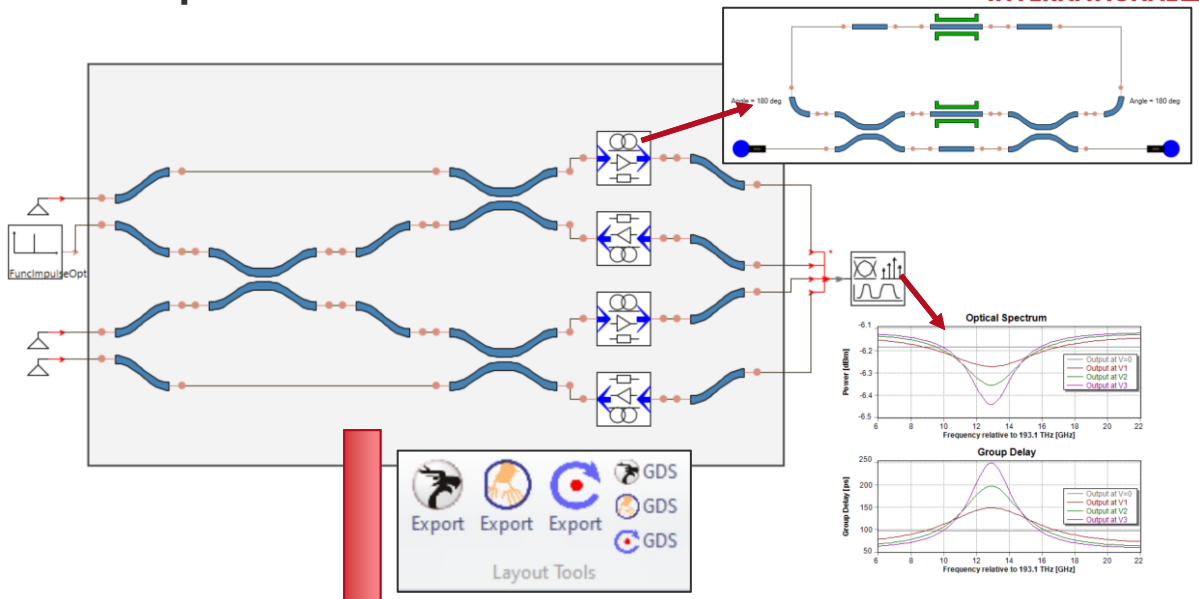
HHI PDK

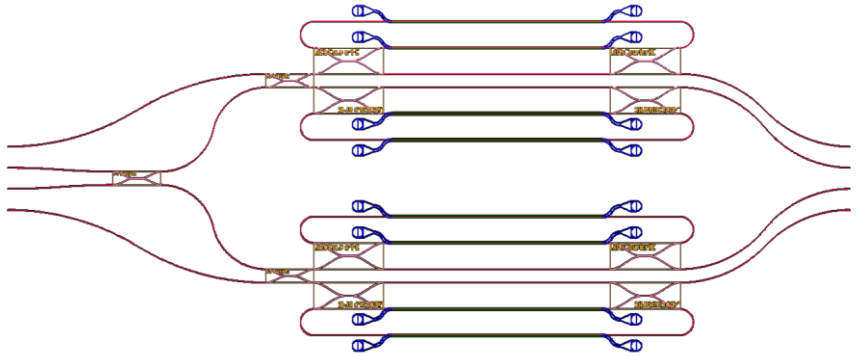
InP Externally Modulated Laser



SiN Optical Beam Network Former

LioniX International





- ✓ Simplified design process
- ✓ Suitable for any foundry run
- ✗ Two layouts and two GDS files
- ✗ No possibility to verify the final performance

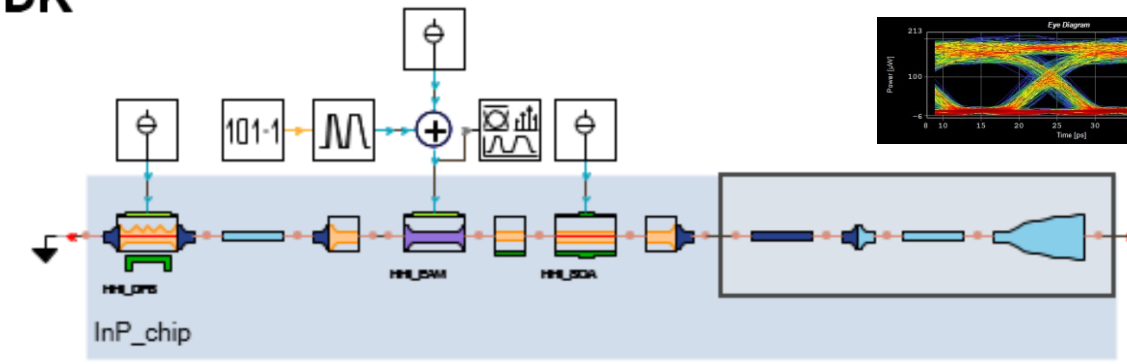
+

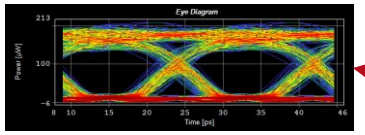
= ?

Different PDKs, single design

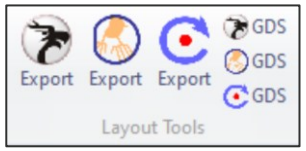
HHI PDK

InP Externally Modulated Laser

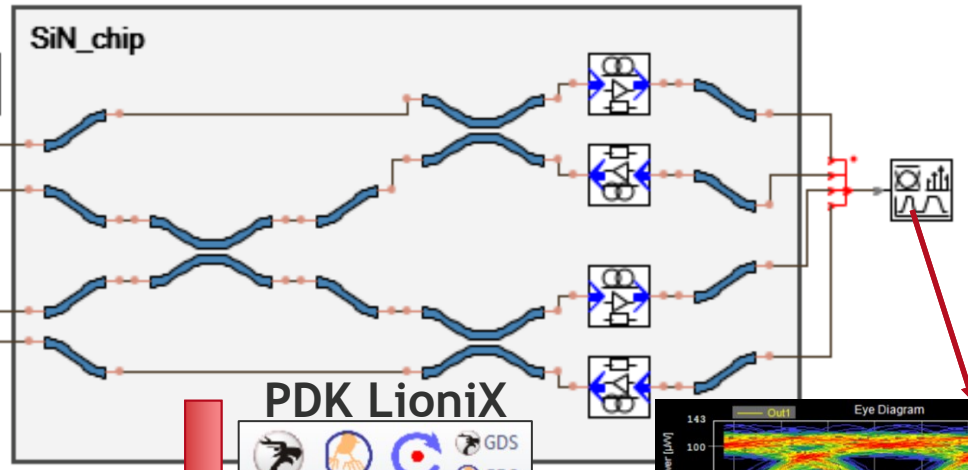




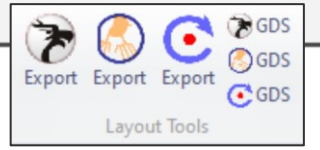
PDK HHI

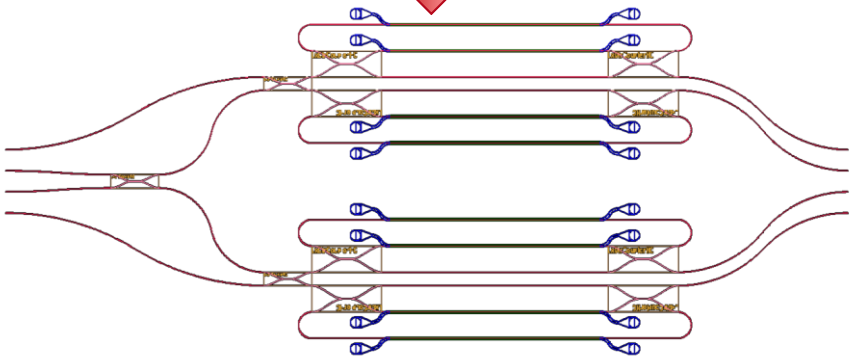


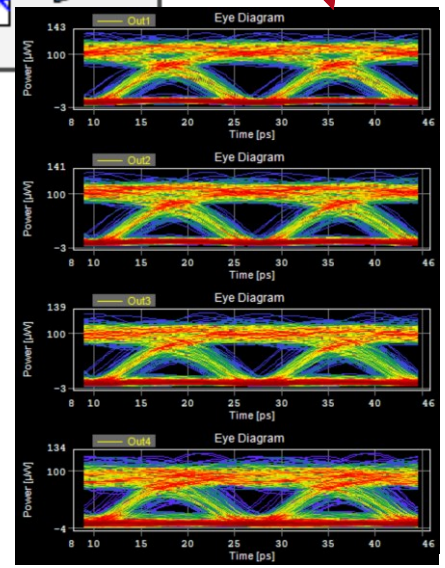
SiN Optical Beam Network Former



PDK LioniX

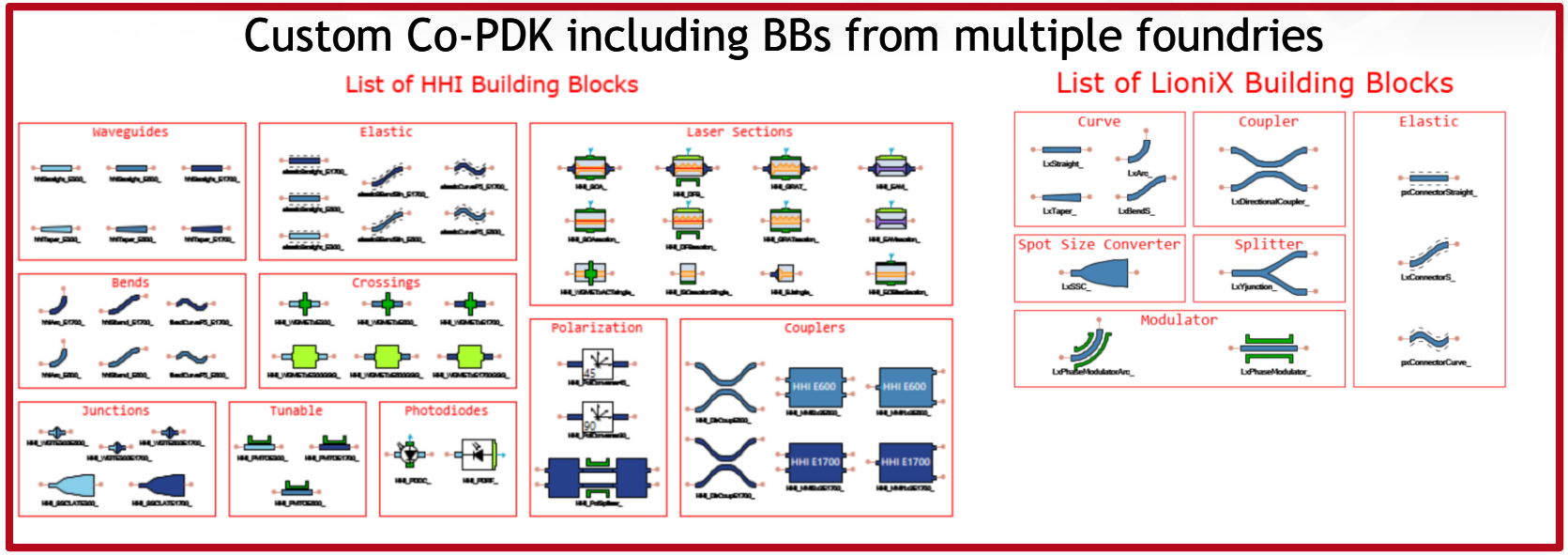






- ✓ Single design
- ✓ Optimization of final chip performance
- ✓ Suitable for any foundry run
- ✗ Two layouts and two GDS files

Custom-process PDK
Multiple PDKs as single library



Most foundries neglect layers with non-default names!

- Create a custom PDK
- Define your components
  - by creating a custom module library
  - by merging other PDKs
- Avoid layer names overlap – if both PDKs have the same layer numbers -> rename them!

(e.g. “Layer HHI1” and “Layer LioniX1”)

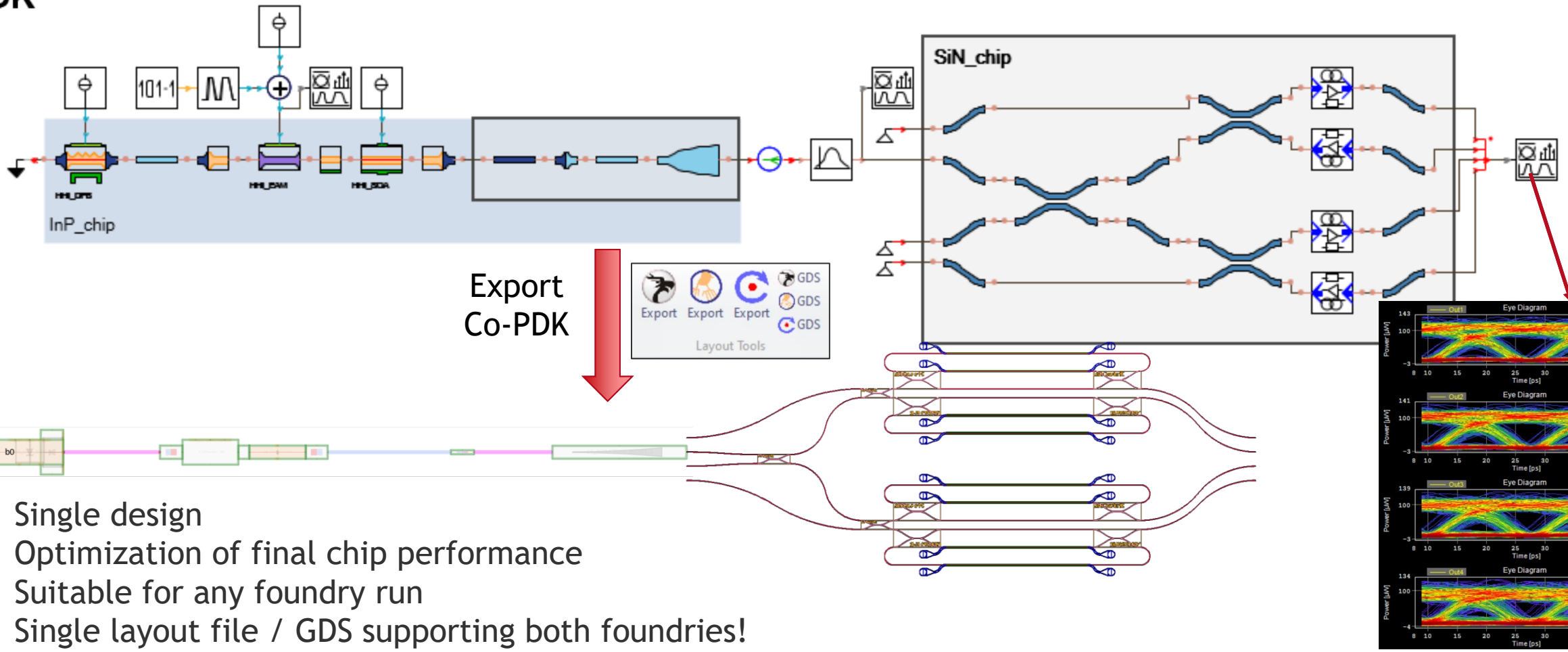
- Create a mapping file for changed layer names (available in most layout tools)

Custom-process PDK: 2 PDKs = 1 GDS

HHI PDK

Self-created Co-PDK (including HHI and LioniX BBs)

LioniX INTERNATIONAL



- ✓ Single design
- ✓ Optimization of final chip performance
- ✓ Suitable for any foundry run
- ✓ Single layout file / GDS supporting both foundries!
- ✗ Requires additional mapping of GDS layers (available in most layout tools) – Standardization required!

Summary

What can you do for us?

- ✓ Help in the standardization!

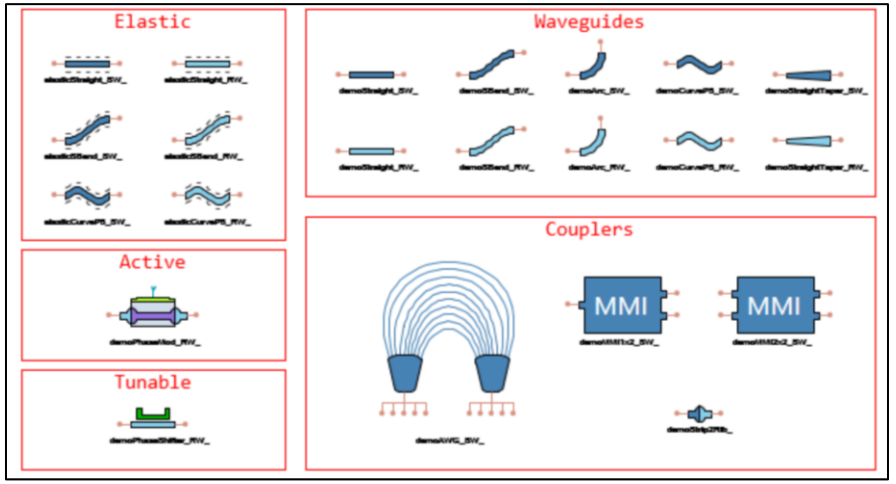
How can we help you?

- ✓ Enable various strategies to design hybrid PICs
- ✓ Simulate and optimize your designs
- ✓ Use bidirectional design workflow:

  Devices ⇔ Circuits ⇔ Systems

- ✓ Custom PDK integration framework
  - ⇨ Easy to build, use, and share PDKs
- ✓ Design acceleration via automated export of the layout

Build your PDK with us!



Contact us to learn more about:

- *Simulation and Optimization of PICs*
- *Design workflow from Devices to Systems*
- *Support of fabrication tolerances*
- *Schematic-driven layout-aware design methodology*
- *Electronic/Photonic Co-Simulation*
- *Design of custom PDKs*

Contact Us!

Product enquiries: Sales@VPIphotonics.com
Technical support: Support@VPIphotonics.com

VPIphotonics.com
software & services for photonic design & analysis