

System-aware PIC Design for LiDAR

EPIC Online Technology Meeting on LiDARs on Chips

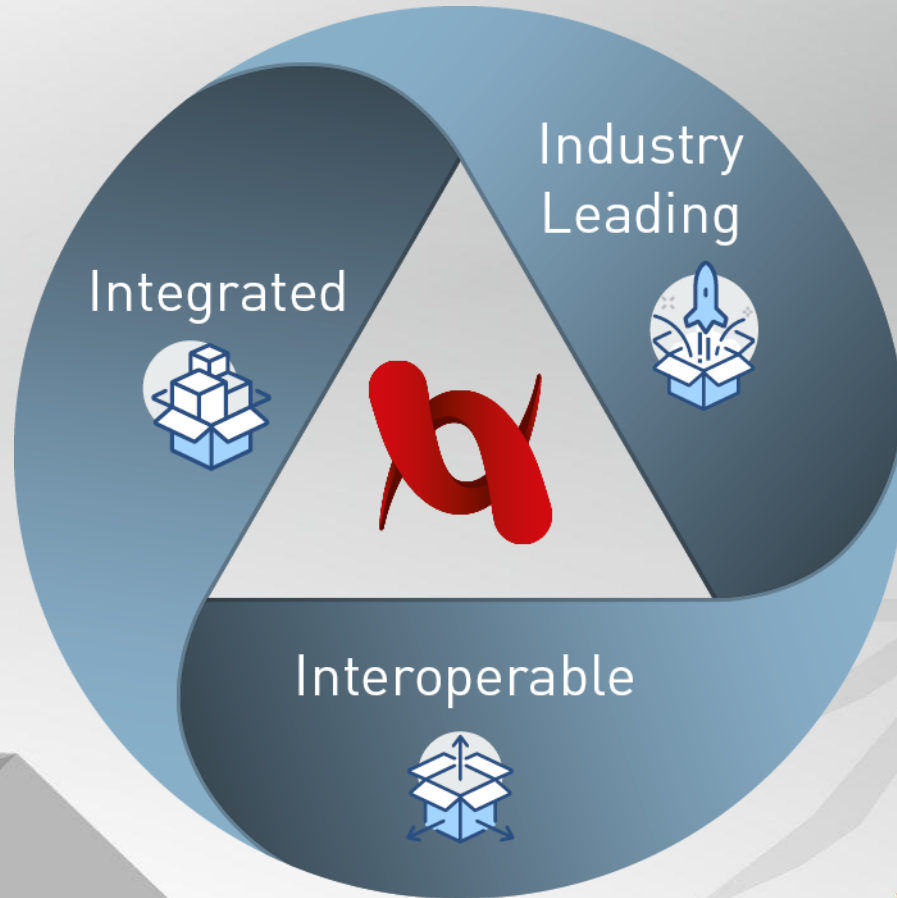
Chris Maloney, Director of Business Development

October 23rd 2023



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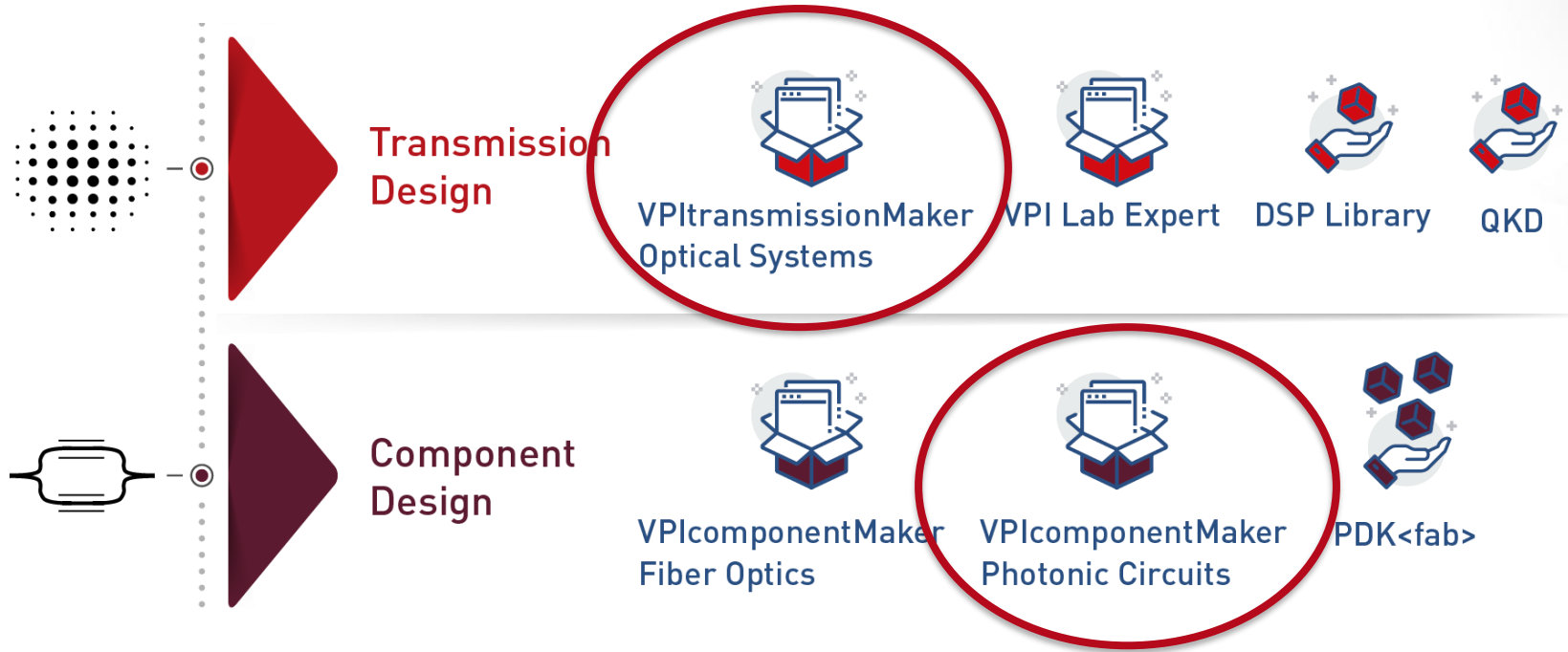
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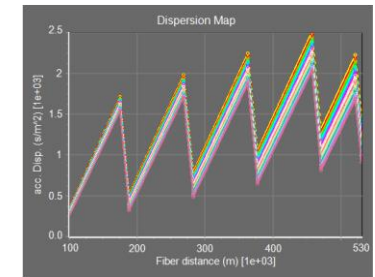
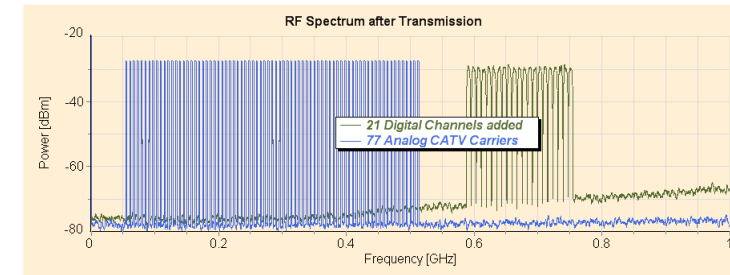
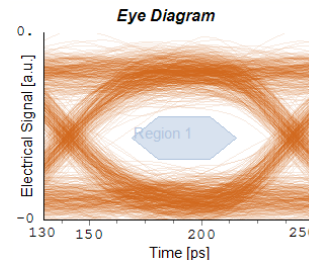
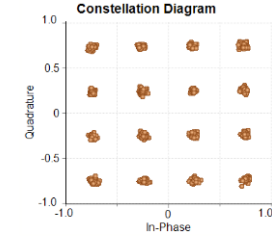
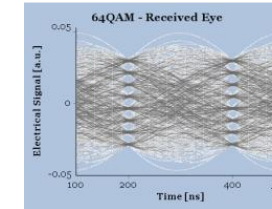


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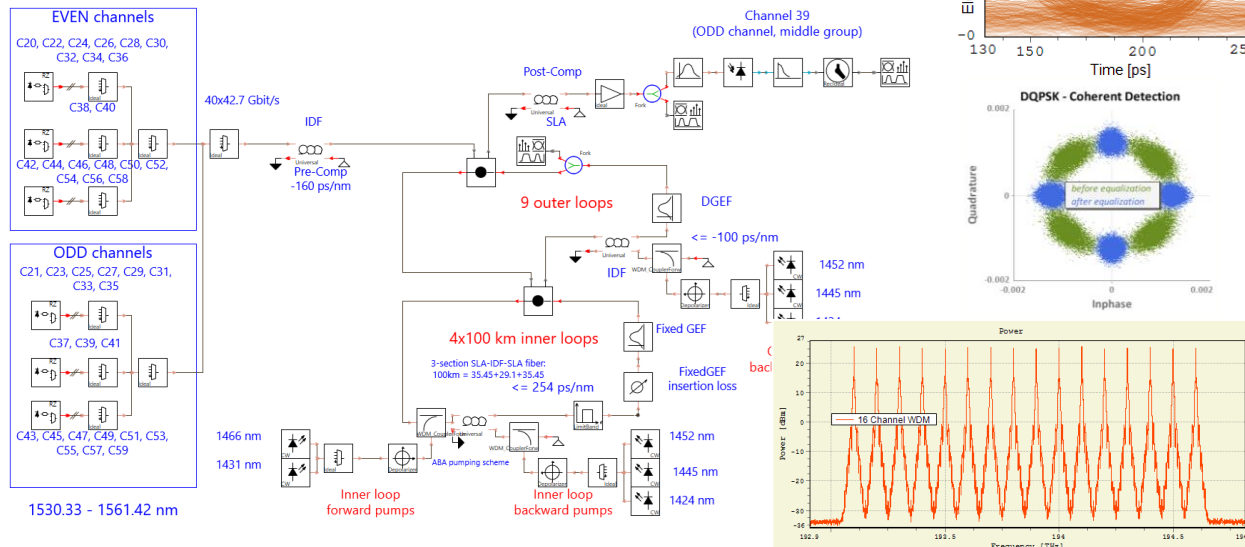
Applications

- Short-reach, Optical Interconnects
- Aggregation, metro, core networks
- Ultra-long haul DWDM
- High capacity, high-speed
- Optical networking
- HFC, RoF, Microwave photonics
- LiDAR, Satellite Communications

- Component characterization
- MM/SM transmission, amplification
- Amplification, regeneration
- Coding, modulation, DSP
- Compensation, equalization



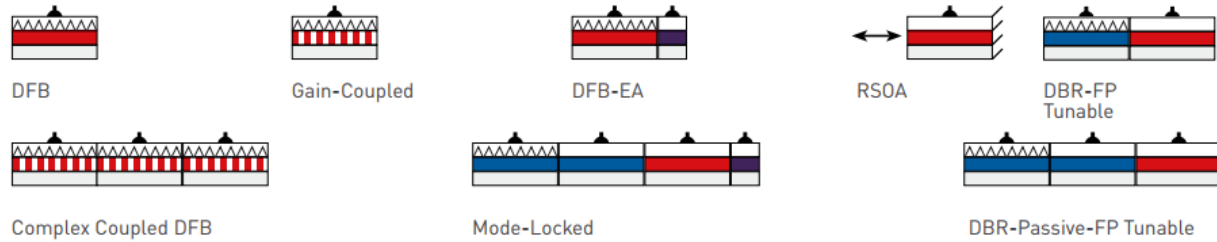
1.6 Tbit/s (40x42.7 Gbit/s) Transmission over 3600 km UltraWave Fiber



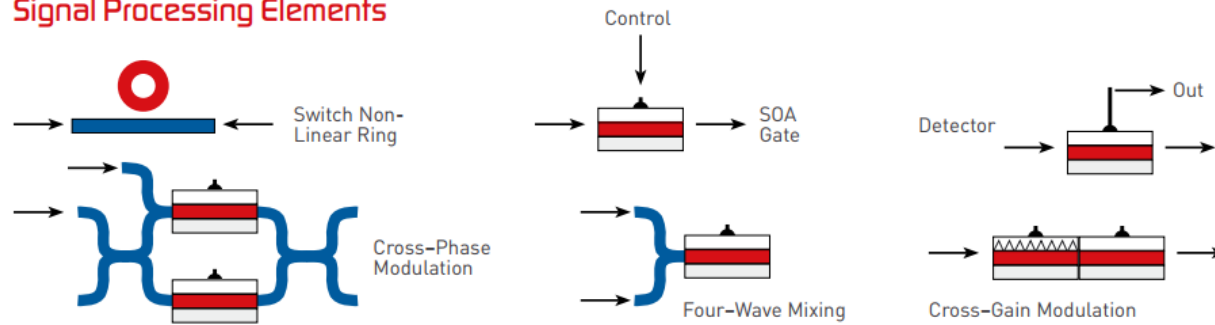
Benefits

- ✓ Analyze OSNR, Q, BER, TDECQ, ...
- ✓ Evaluate component performance and impairments
- ✓ Compare technology choices and upgrade strategies
- ✓ Optimize equipment placement and mitigation techniques

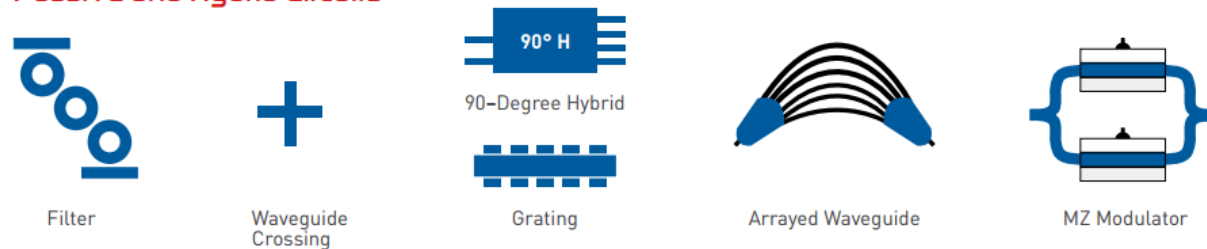
Semiconductor Lasers and Transmitters



Signal Processing Elements

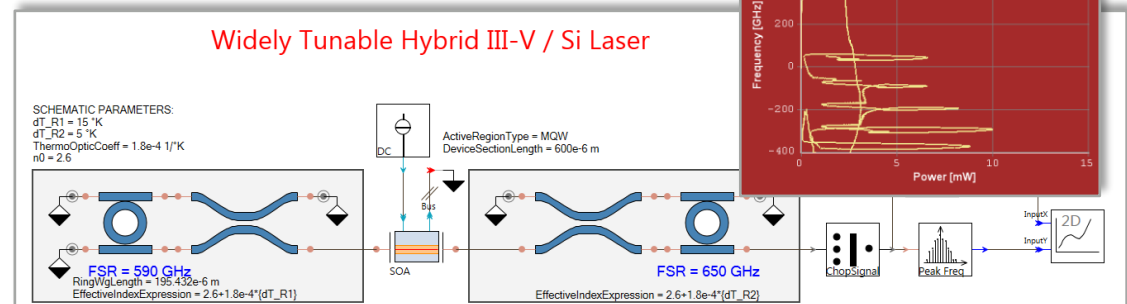
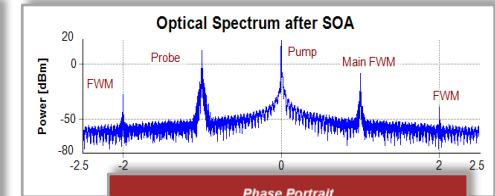
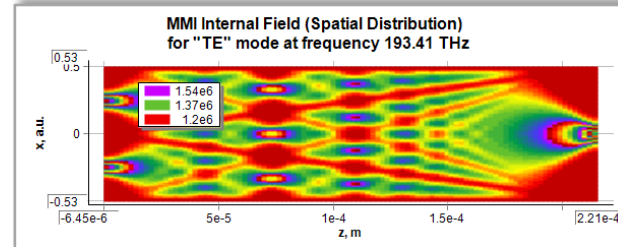


Passive and Hybrid Circuits



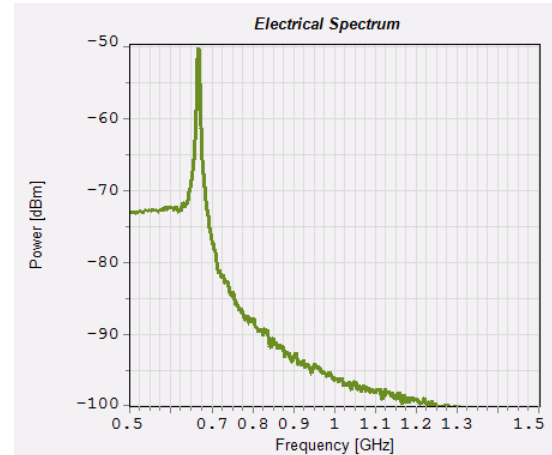
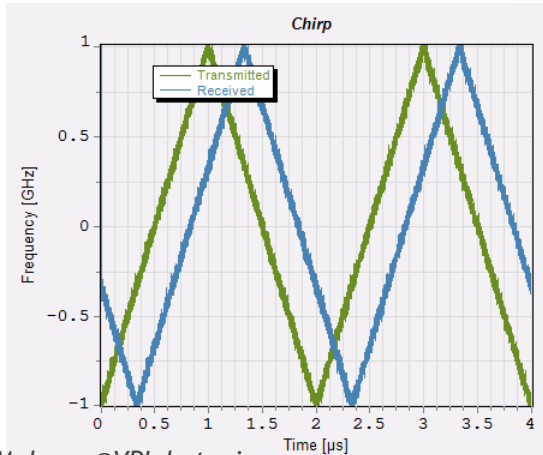
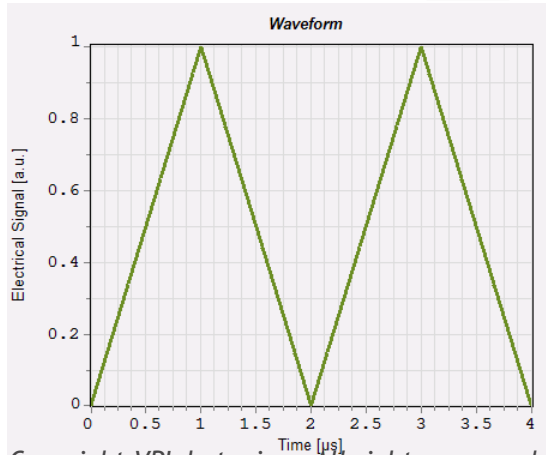
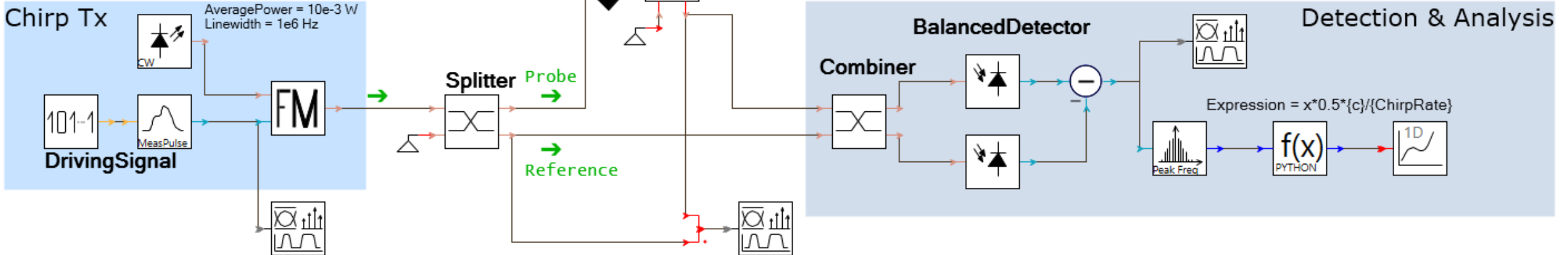
Benefits

- ✓ Fast design & optimization of PICs and multi-section semiconductor devices
- ✓ Study alternative design options
- ✓ Tune and optimize circuit parameters
- ✓ Investigate fabrication tolerances
- ✓ Perform sensitivity analysis



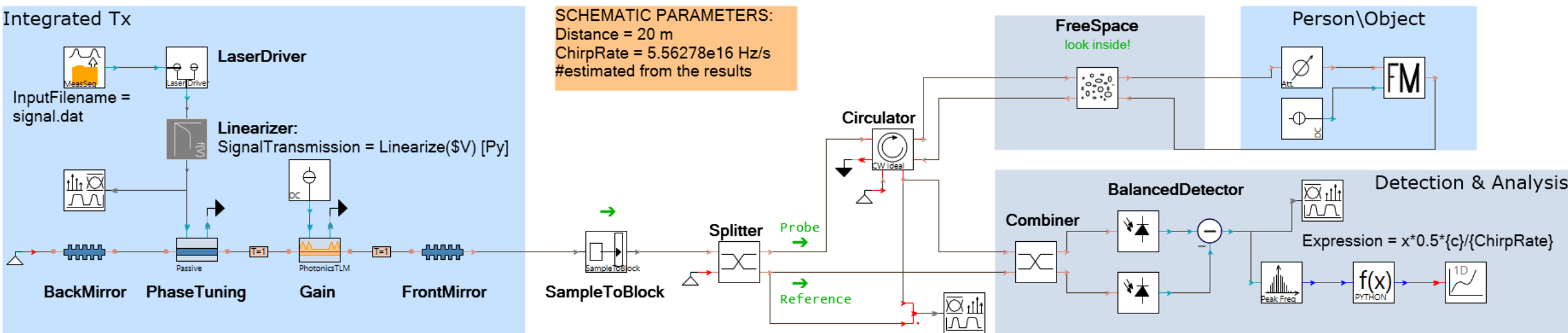
Designing PICs for LiDAR Systems

SCHEMATIC PARAMETERS:
 EmissionFrequency = 193.1e12 Hz
 Distance = 50 m
 Speed = 0 m/s #20
 ChirpRate = 2e15 Hz/s
 WeatherConditions = On

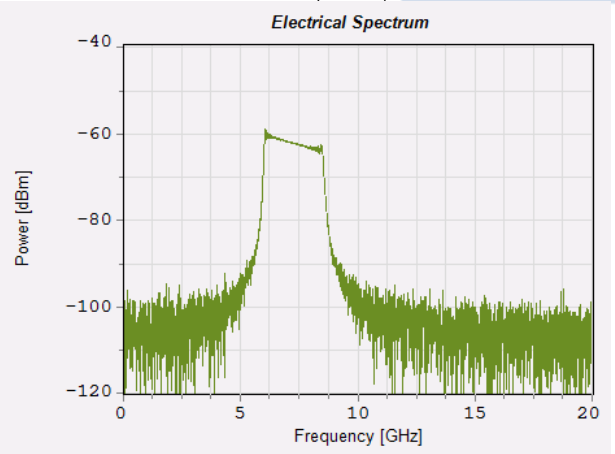
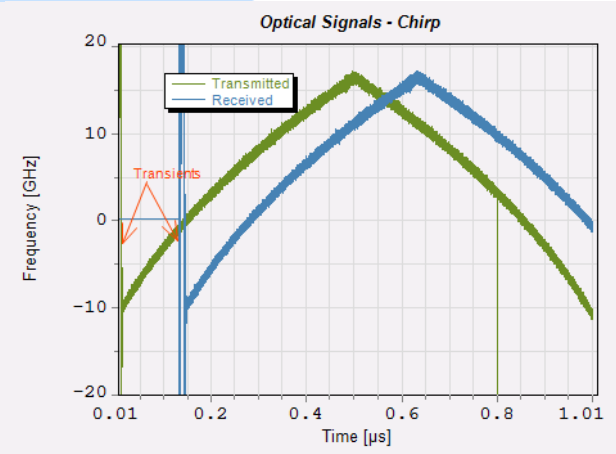
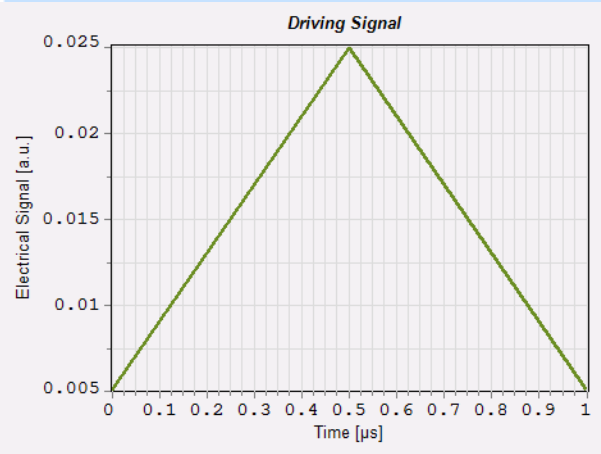


Idealized FMCW System simulation demonstrates ranging and detection operation of the system

This demo shows a sampled-grating distributed Bragg reflector (SG-DBR) laser used for frequency-modulated continuous wave (FMCW) LiDAR systems. It illustrates one of the challenges in developing a functional FMCW LiDAR - the residual nonlinearity of the laser, and demonstrates how digital predistortion can help mitigate this effect. To learn more about FMCW LiDAR, please check the application example [1].

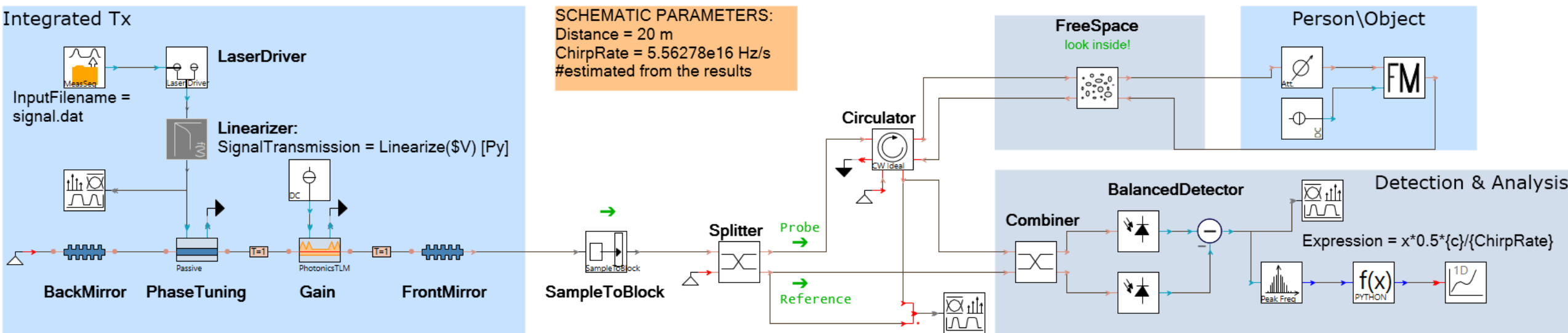


SCHEMATIC PARAMETERS:
 Distance = 20 m
 ChirpRate = 5.56278e16 Hz/s
 #estimated from the results

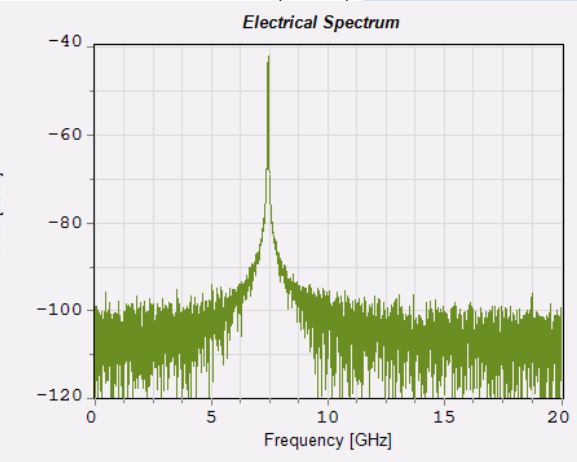
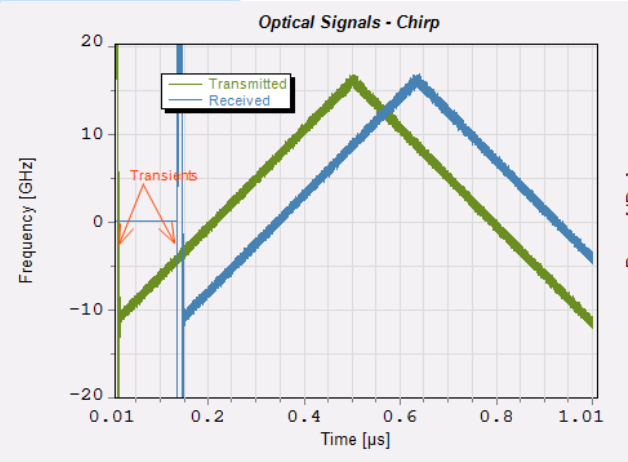
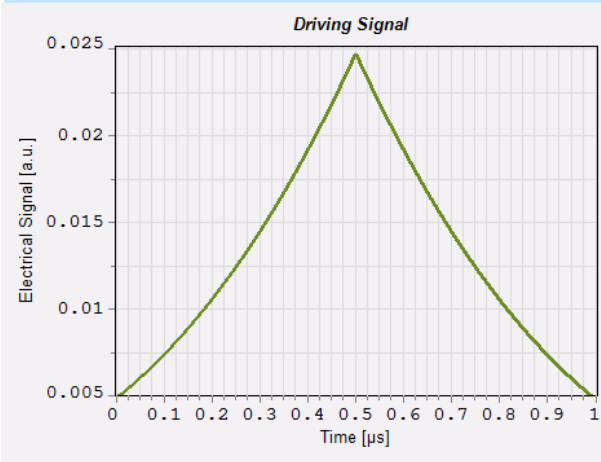


Adding PIC components to the simulation introduces non-linearities and noise impacting ranging performance

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 Distance = 20 m
 ChirpRate = 5.56278e16 Hz/s
 #estimated from the results



System-level mitigation strategies can be explored to compensate for PIC-based impairments

Contact us for a free demo or software evaluation!

✉ chris.maloney@VPIphotonics.com

🏠 www.VPIphotonics.com



- Integrated design workflow enables the investigation of non-linearities and impairments of LiDAR PIC designs at the system level
- We want to work with partners to better understand the challenges PIC designers have in fabricating chips for different types of LiDAR systems



← Start an evaluation

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