

State-of-the-art Dispersion Management, Optical Filtering, and Low Noise Lasers for QKD Systems

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EPIC Online Technology Meeting on Quantum Communication

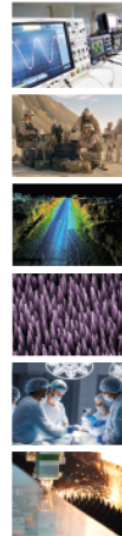


Extensive Market Coverage

Industries

TELECOM/DATACOM
COMPUTING/AI
DEFENSE
AEROSPACE
AUTOMOTIVE
ENERGY
INDUSTRIAL
SECURITY
MEDICAL
ACADEMIC

Applications



Optical Modules Testing
RF Communications
Data Centers Interconnects
DWDM Networks
Automotive and Industrial Lidar
Wind Sensing
Distributed Optical Fiber Sensing
Material Processing
Imaging
Spectroscopy
Urology
Surgery & Aesthetics

Optical Communications

Optical Sensing

Ultrafast Lasers

High-power Lasers

Technological Expertise / Experience

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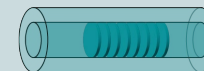
Design

Integration

Testing

Fiber Bragg gratings

State-of-the-art tailored fiber Bragg gratings



Semiconductor lasers

Narrow linewidth DFB semiconductor lasers



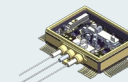
Electronics

Low noise drive and locking electronics



Packaging

Packaging for prototyping: Die bonding, wirebonding, micro-optics, pigtailed, etc.



Silicon photonics

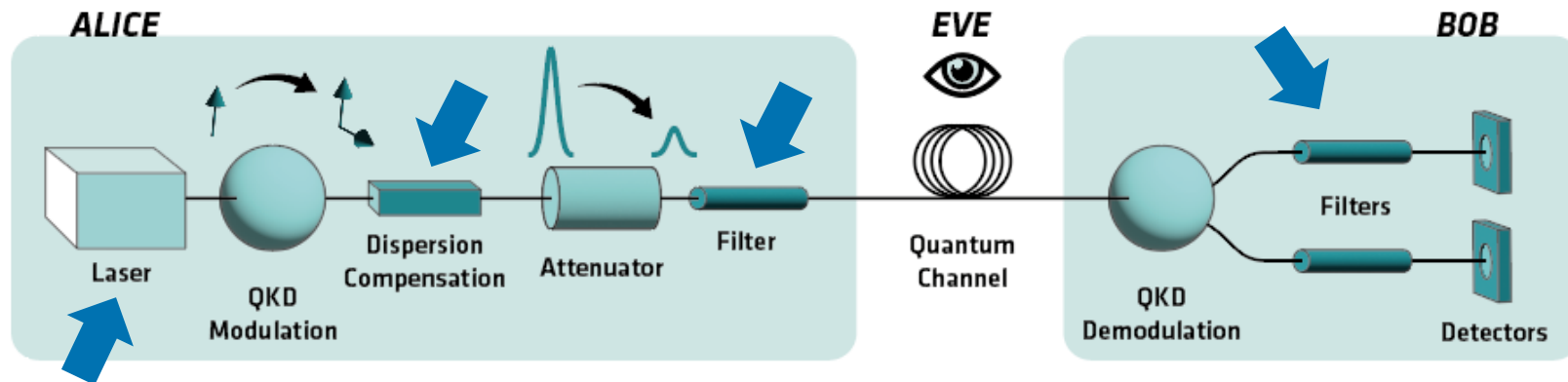
Silicon photonics optical functions



Innovative Photonics Components, for QKD

STANDARD & TAILORED PRODUCTS

- » Chromatic dispersion management
- » Optical filters
- » Lasers



Chromatic Dispersion Management

COMPENSATION AND EMULATION

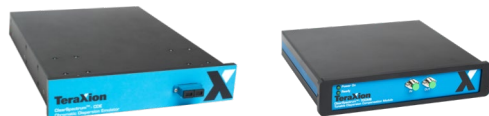
DCML and TCDMX-SM

- To control the time envelope of an attenuated pulse and maximize SKR for long links
- C and L bands (DWDM)



CDE and TDCMB

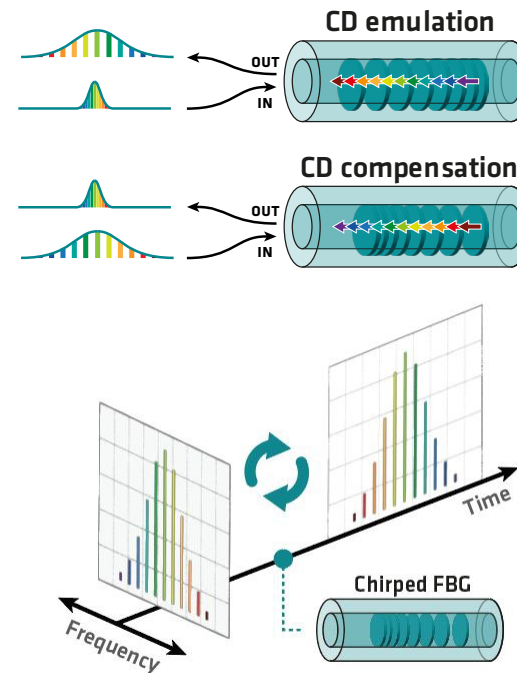
- To test new concepts or system designs as part of R&D projects
- Can emulate 100's to 1000's of km
- C and L bands (DWDM)



PULSE STRETCHERS

PSR and TPSR

- Chirped FBGs to create/correct for delays for entanglement-based protocols
- To convert a multi-channel signal to multiple time-bins, for sequential detection
- All wavelengths



Narrowband

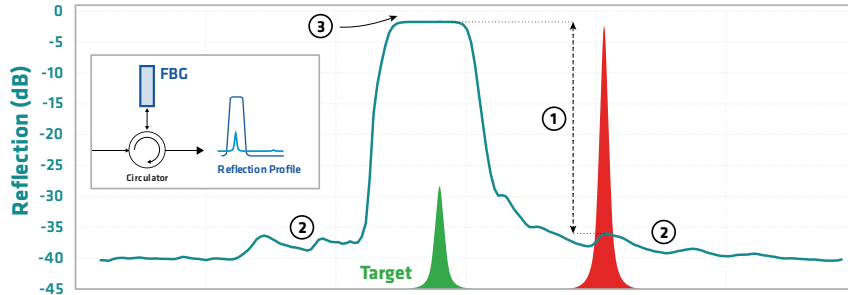
Flat-top + Steep-edge

High Isolation

Low Insertion Loss

High Reflectivity

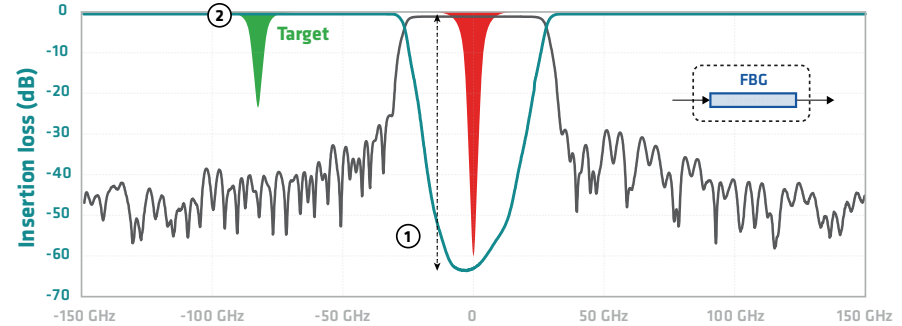
Reflection mode (w/ circulator)



- ① Isolation, as Side Mode Suppression Ratio (SMSR)
- ② Side Modes
- ③ IL from circulator

- To clean pulses from unwanted spectral noise
- To maximize contrasts between signals

Transmission mode



- ① Isolation
- ② Insertion loss

- To strongly suppress unwanted signal(s) (up $R\% = 99.9999$ with single FBG) and provide high isolation (up to 60 dB)
- To avoid the use of a circulator (< 0.1 dB insertion loss)

Optical Filters – The Importance of Packaging!

RECOATED



- The recoat protects the FBG
- Wavelength vs T° : $\sim 10 \text{ pm}/^{\circ}\text{C}$
- Suitable for all types of FBGs
- The most economical choice!

ATHERMAL



- Stable wavelength from -5 to 75°C (mechanical T° compensation)
- Wavelength vs $T^{\circ} = 0.7 \text{ pm}/^{\circ}\text{C}$
- Packages for reflection or reflection + transmission
- Multiple lengths to adapt to different FBGs
- Available for SM and PM FBGs

TUNABLE

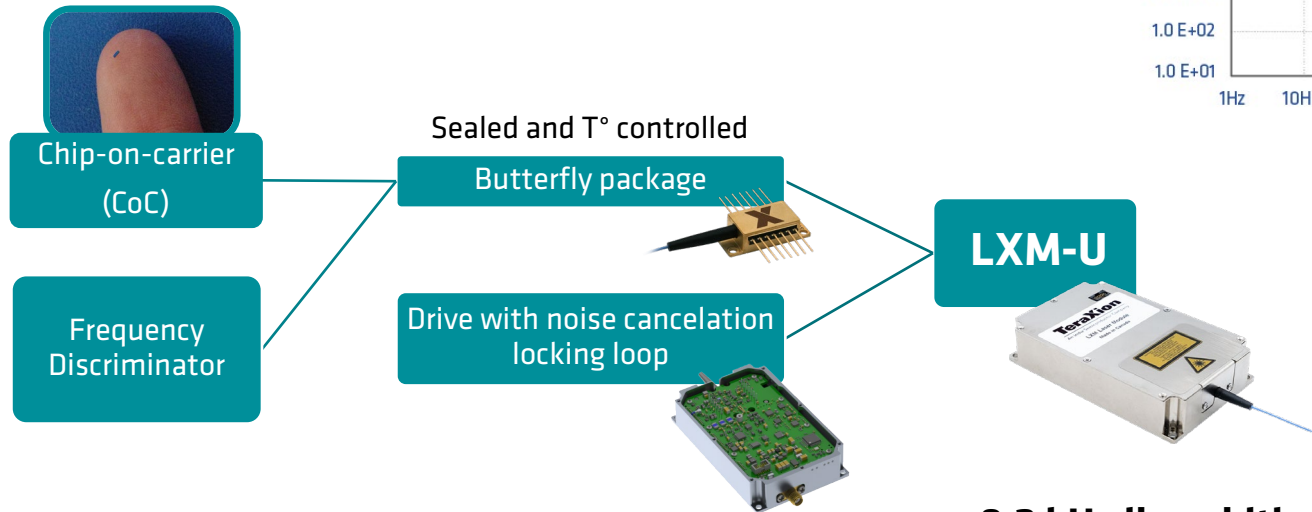
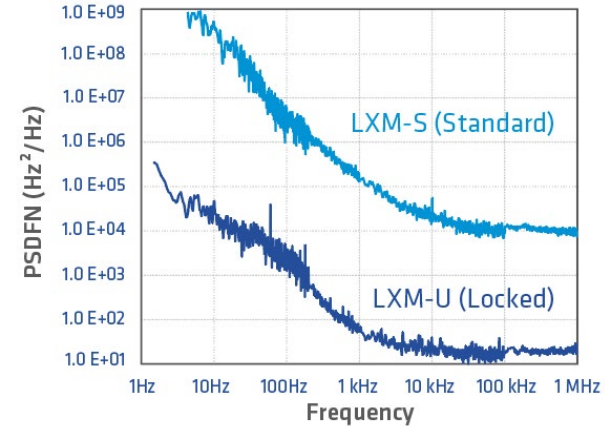


- Temperature-controlled FBG
- Tunable over $\pm 30 \text{ GHz}$
- 2 pm accuracy
- $40 \text{ MHz}_{\text{p-p}}$ stability over 24 hours at room T
- Modules for reflection, transmission, or both, with or without circulator
- Suitable for all types of gratings

A New Generation of Narrow-Linewidth Lasers

From Proprietary DFB Laser Chip to Laser Module

- Compact industrial laser for first generation products
- Narrow linewidth to minimize excess noise
- Previous generation is used in commercial systems and for R&D purposes



Narrow linewidth
of a fiber laser
+
low RIN
of a DFB laser

<0.2 kHz linewidth

SILICON PHOTONICS

Optical Circuits & Functions

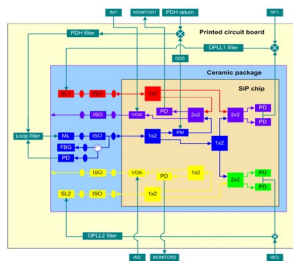
- **Active components**

Amplitude and phase modulators, photodetectors, variable optical attenuators, etc.

- **Passive components**

Couplers, splitters, low-loss waveguides, etc.

- **Complex optical circuits**

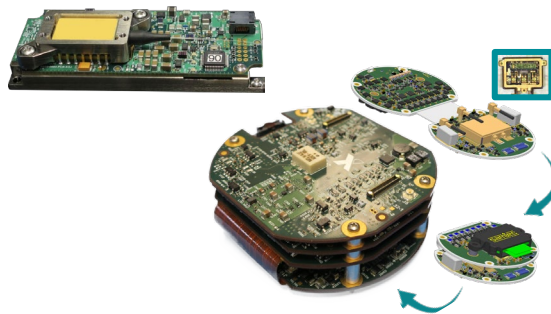


ELECTRONICS

Low Noise Drive and Locking Electronics

Locking on:

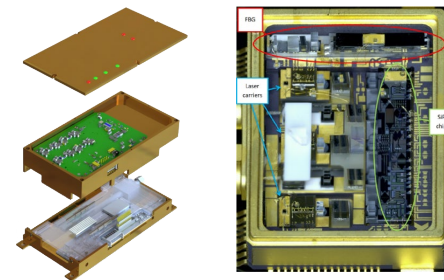
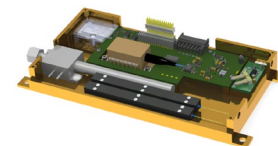
- **Other laser** (Optical Phase Locking Loop - OPLL)
- **Frequency discriminator** (FBG optical filter, etalon, optical frequency comb, ...)
- **Quantum transition** (atom, ion, ...)



PACKAGING

In-house Packaging for Prototyping

- **Die Bonding,**
- **Wirebonding,**
- **Micro-optics**
- +++



Our Mission

Staying at the forefront of technological development

TeraXion can help

- » Laser development
- » Locking/phase stabilisation
- » Integrated photonics



Design for manufacturing
Optical packaging
Module integration

YOU can help

- » Micro-optic components
- » QKD standardization
- » Insights and discussions

Contact Us

INNOVATIVE PHOTONIC COMPONENTS

- Standard Products
- Tailored Products
- Engineering Projects

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TeraXion
An indie Semiconductor Company

EXALOS 
The bright light source company