

# Optical Packaging at EXALOS

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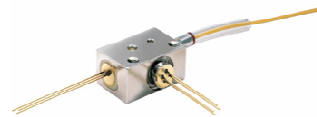
Alpnach, May 16th, 2012

# Agenda

- EXALOS, Markets & Products
- Different Optical Packaging Technologies at EXALOS
  - Cooled DIL & Butterfly packaging
  - Low Cost, uncooled packaging
  - Hybrid Optical Packaging Platform
- Summary

# Company Background

- EXALOS founded 2003
  - Private held company headquartered in Schlieren (Zürich) / Switzerland
  - Employees: 27
  - More than 195'000 Devices shipped
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- Focused on engineering, sales and marketing of
  - Superluminescent Light Emitting Diodes (SLEDs)
  - External Cavity Sweeping Lasers (Swept Sources)

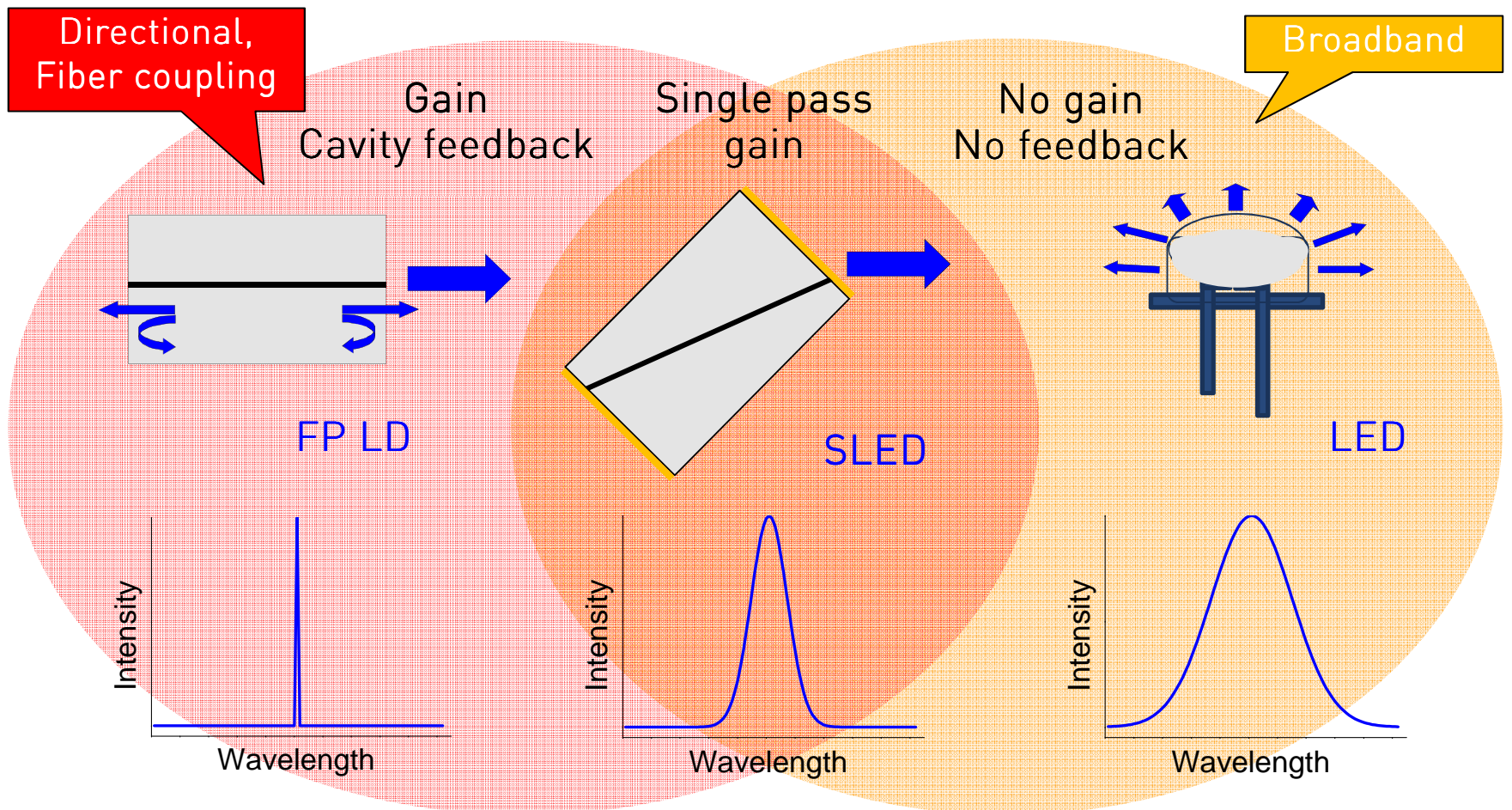


# What are SLEDs?

SLEDs: a bridge between LDs and LEDs

Stimulated emission

Spontaneous emission



# Markets

- Medical Optical Coherence Tomography
- Diagnostic Tools
- Wavefront & Aberration Analyzer
  
- Industrial OCT
- Fiber Optics Gyroscopes
- Metrology
  
- Fiber-Optic Current Sensor
- Fiber-Optic Stress Sensor
- Optical Component Testing
  
- CD & PMD Measurements
- Microscopy & Machine Vision
- Imaging & Projection Systems



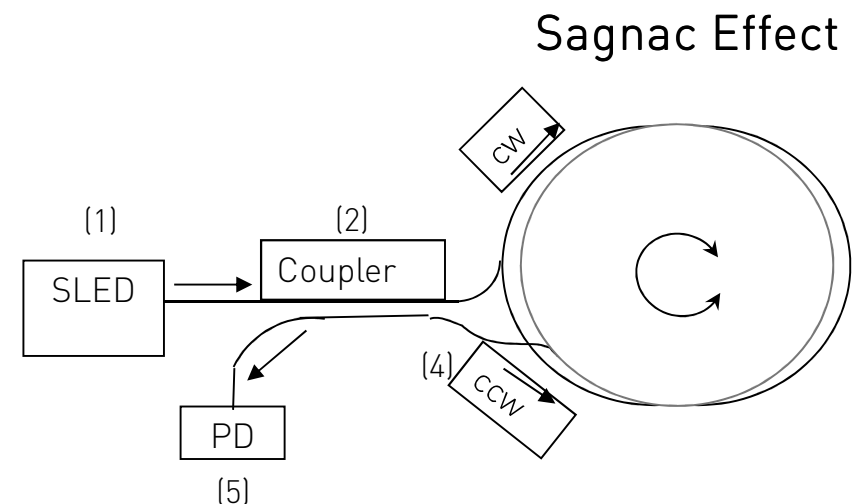
# Application - FOG

## Fiber Optic Gyroscope (FOG)



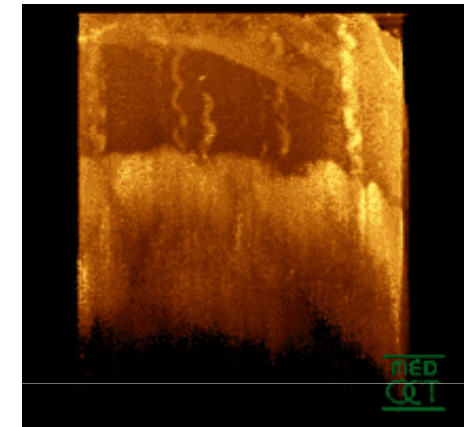
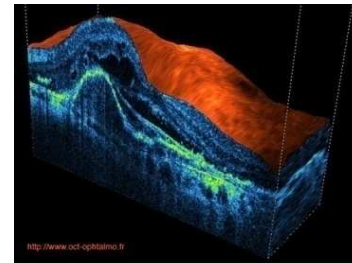
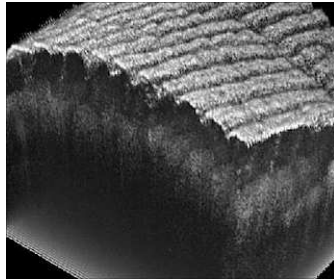
The SLED is the key optical component defining the accuracy of navigation systems

- > The SLED drives the FOG with light
- > The coupler sends the light into the fiber coil in counter rotating directions
- > The fiber coil is sensitive to rotation
- > Coupler separates the returning light to the detector.
- > The phase difference of cw/ccw travelling light is a measure for the rotation

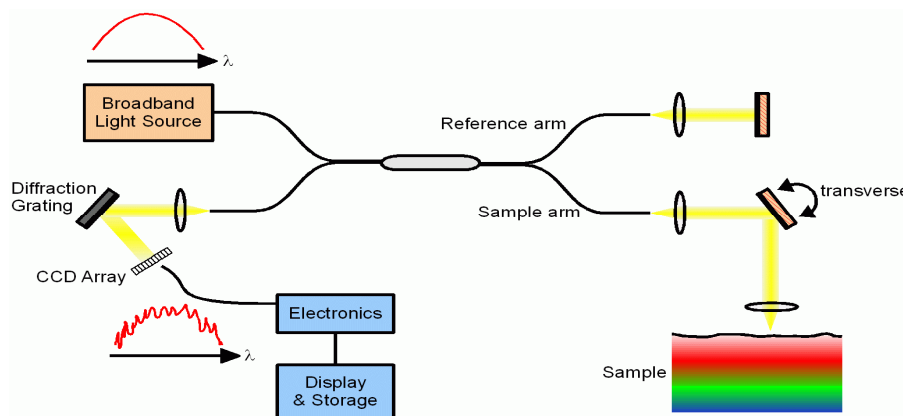


# Application - OCT

## Optical Coherence Tomography (OCT)



The SLED is the key optical component defining the maximum resolution of OCT systems



| OCT  | Ultrasound | MRI    | Fluoroscopy | Angioscopy |
|------|------------|--------|-------------|------------|
|      |            |        |             |            |
| 1-15 | 80-120     | 80-300 | 100-200     | <200       |
| 140  | 700        | N/A    | N/A         | 800        |
| No   | No         | No     | Yes         | No         |

# Agenda

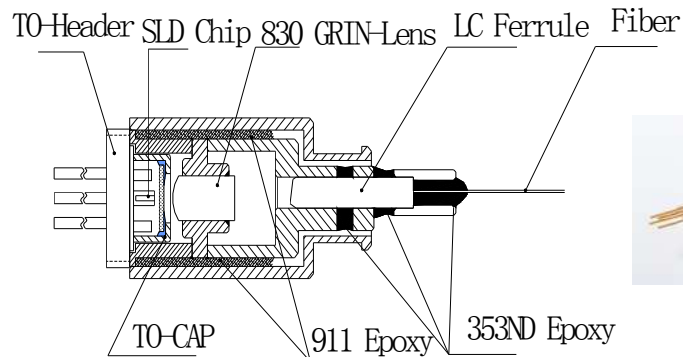
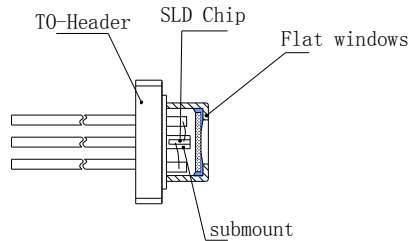
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# Different Optical Packaging Technologies

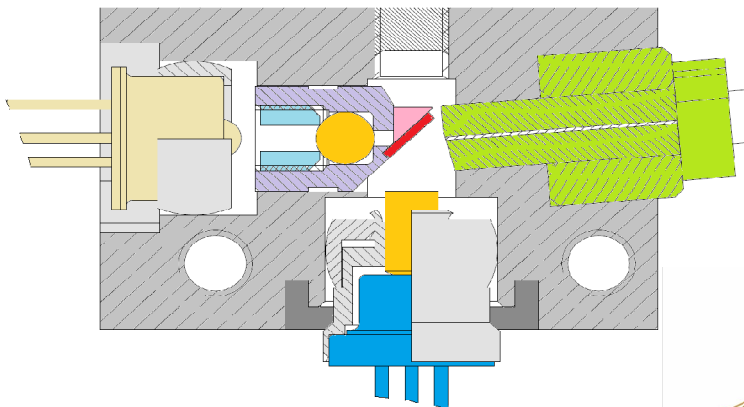
- Need to serve different Markets with different requirements
  - Medical, higher end, higher powers, higher price
    - Fiber pigtail **cooled DIL & Butterfly** type of devices
  - FOG, high reliability, higher volumes, lower cost
    - **Uncooled TO-CAN** and Butterfly
  - Sensor, low cost low power, still low volume
    - Uncooled fiber coupled TO-CAN -> **TOSA (Tx Optical Assembly)**
  - Customer which just want all
    - Hybrid Optical Packaging Platform (**HOPP**)

# TO-CAN/TOSA/BOSA

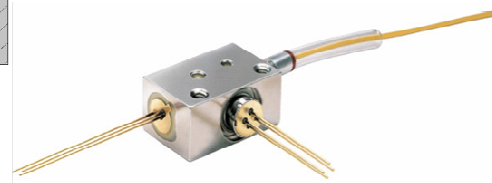


TO-CAN most well established optical Packaging technology today, but uncooled!:

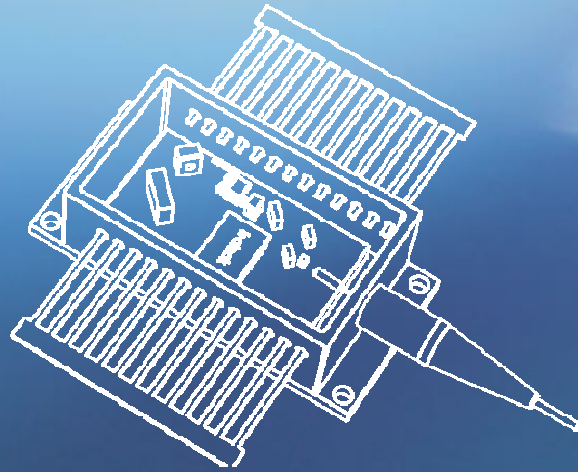
- Highest volumes (100k's/months)
- Lowest cost (few USD)
- Main building block for more integration



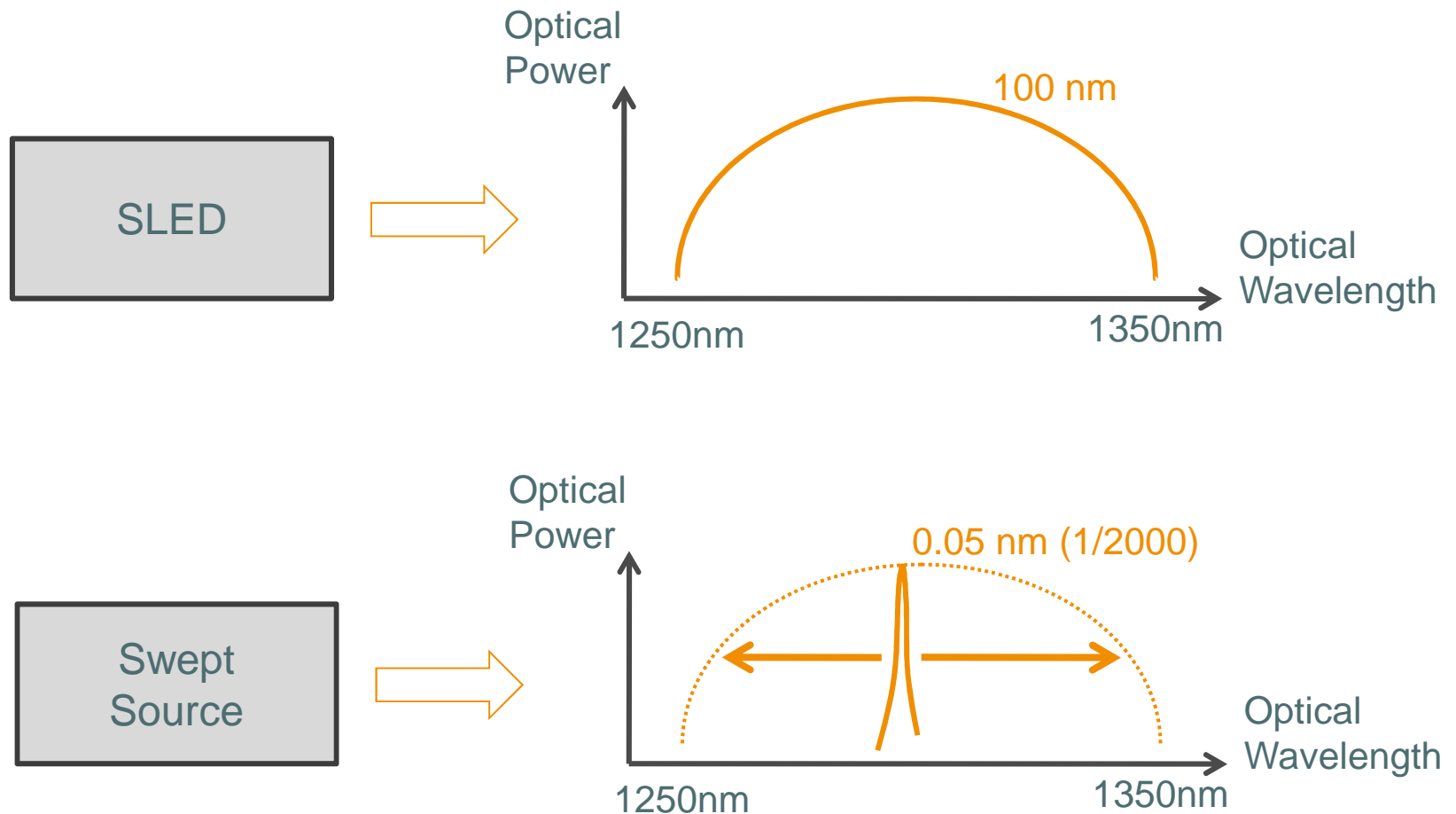
- Fiber pigtailed -> TOSA (Tx Optical Sub-assembly)
- Combine Tx and Rx -> BOSA (Bidirectional OSA)



# Hybrid Optical Packaging Platform - HOPP



# Shift from SLED to Swept Sources



A high-speed narrowband optical filter with wide tuning range is needed

# Automated Micro-Optic Assembly

## Specifications



*Automated assembly station*

- Motorized stages: 21
- Cameras: 4 visible, 2 Infra-red
- Dual micro-gripper stages for precise alignment (6 degree of freedom per gripper)
  - Active alignment  $\pm 0.05\mu\text{m}$ ,  $\pm 10$  arcsec accuracy
  - Passive alignment  $\pm 10\mu\text{m}$ ,  $\pm 300$  arcsec accuracy
- 2 optical components alignment optimization
- Beam characterization micro-probe
- Epoxy dispensing and curing
- Components (un)loading capabilities
- Machine vision with generic pattern recognition
- Custom programming interface to code the different assembly processes

*Note: in service since September 2010*

# Micro-Optic Assembly Capabilities

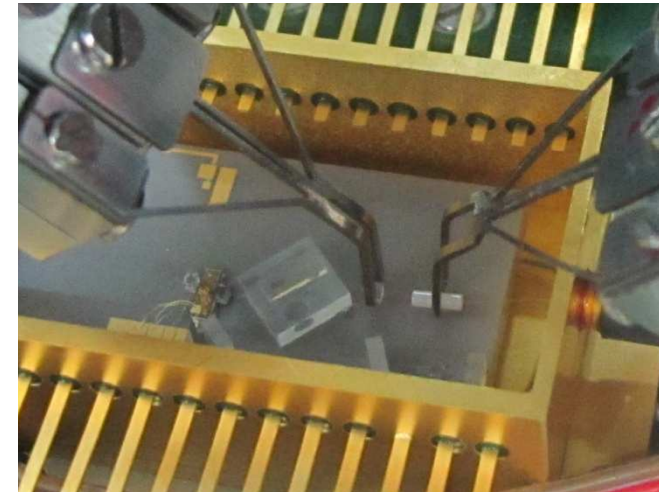
## Automated assembly

- Micro-component UV epoxy attachment (MEMS mirror, filters, isolators, submounts,...)
- Six degree of freedom optical active alignment (lenses, mirrors, fibers, PLCs, prisms, MOEMS,...)

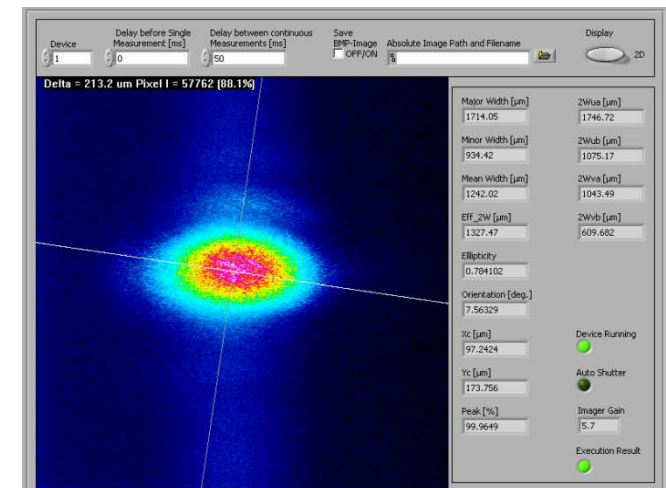
## Automated measurements

- Optical power \*
- Beam profile\*
- Wavelength
- Coherence\*
- Metrology

\* Used as alignment feedback



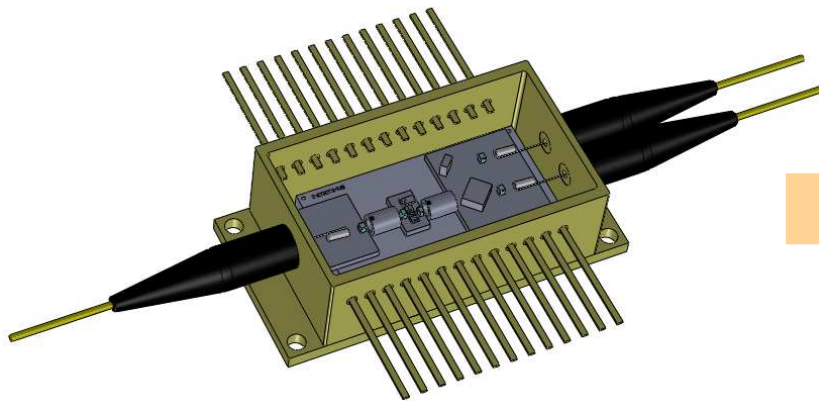
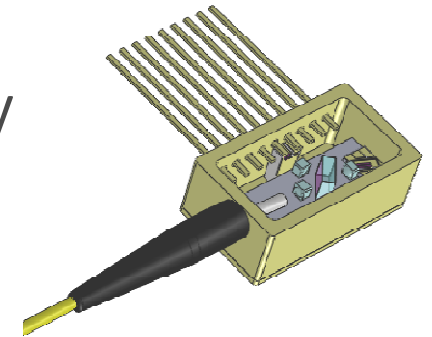
Dual components alignment



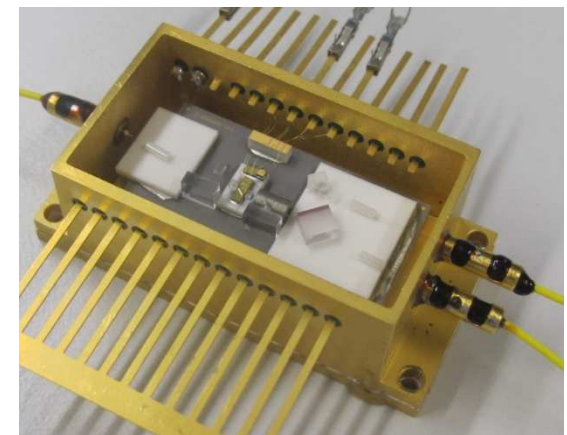
Beam Profile captured by optical probe

# Hybrid Optical Packaging Platform Benefits

- Rapid opto-electronic development and prototyping
- Submicron optical alignment (after curing and ungrip)
- Precise „in-situ“ optical characterization
- Large spectrum of micro-assembly availability
- Controlled assembly processes
- Volume production ready



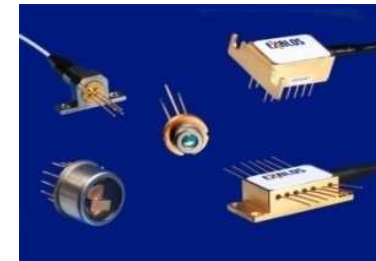
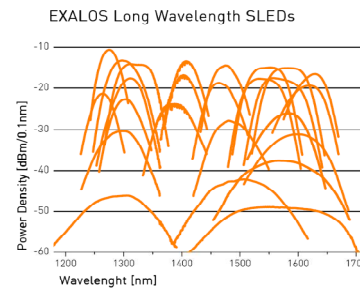
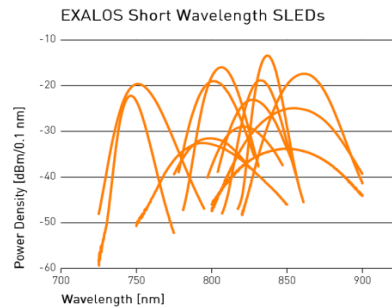
*3 Dimensional CAD Design*



*Rapid Prototyping*

# EXALOS – Summary

- > Near-Infrared SLEDs: wavelength range from 750 nm to 1600 nm with typical bandwidth ranging from 8nm to 100nm, output power between 0.4mW and 25mW in TO-56, TO-8, TOSA, DIL, BTF, etc.



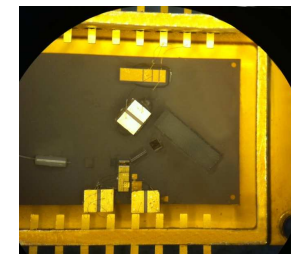
- > SLEDs in the visible wavelength range (today Red and Blue)



- > Driver boards/OEM subsystems
- > Broadband Light Sources as benchtop instruments



- > Bellcore GR-468-CORE and MIL STD 883 C certified
- > Cooled/uncooled Transceivers
- > Swept Sources





Thank You!  
[www.exalos.com](http://www.exalos.com)