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## **Ultracompact Microchip Lasers for 3D Sensing**

Antti Penttinen

CEO & Co-Founder

[antti.penttinen@picophotonics.com](mailto:antti.penttinen@picophotonics.com)

11<sup>th</sup> of March, EPIC – Photonics for Defence

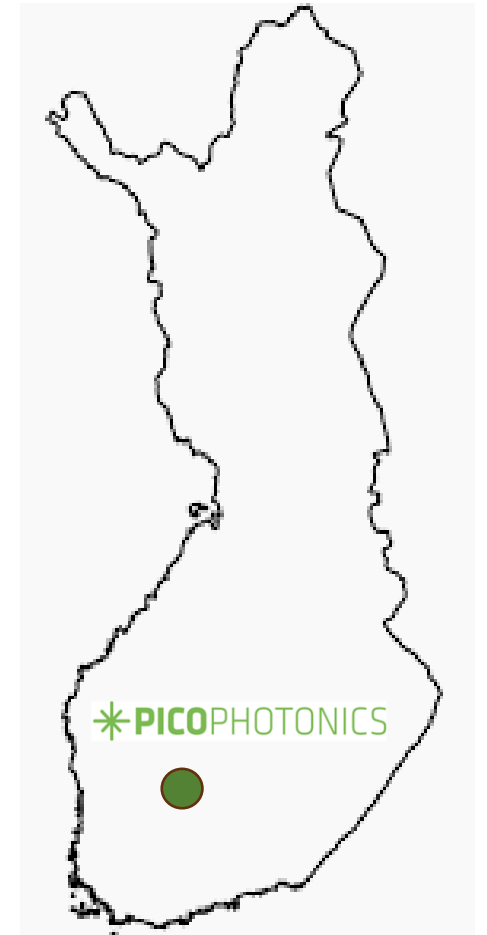
# \* PICO PHOTONICS

Specialized in Q-switched microchip laser technology

Proprietary, in-house semiconductor technology

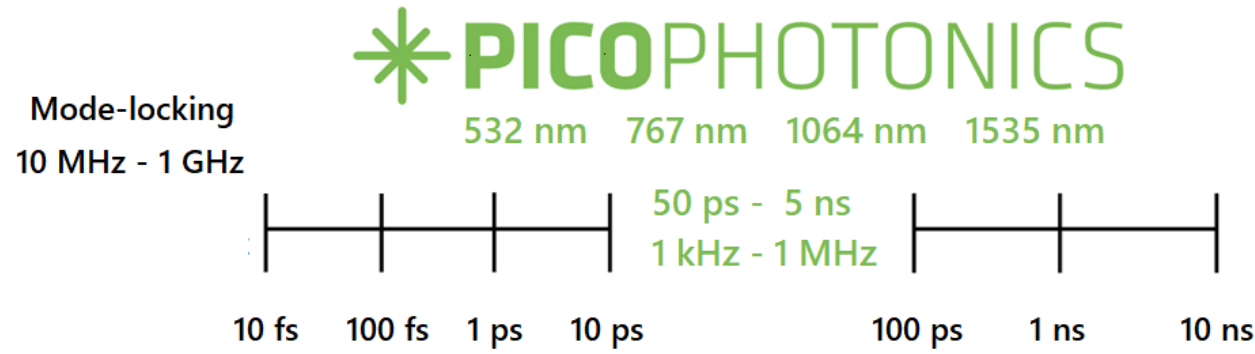
– produced in Finland

**Facilitating to the need of compact single-frequency picosecond lasers for 3D sensing and analysis applications**

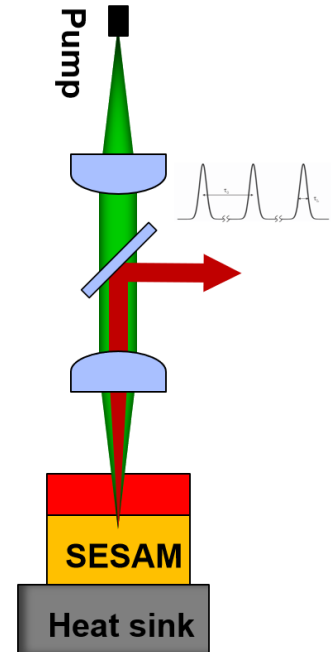


# Key differentiation: proprietary semiconductor saturable absorber mirrors (SESAMs)

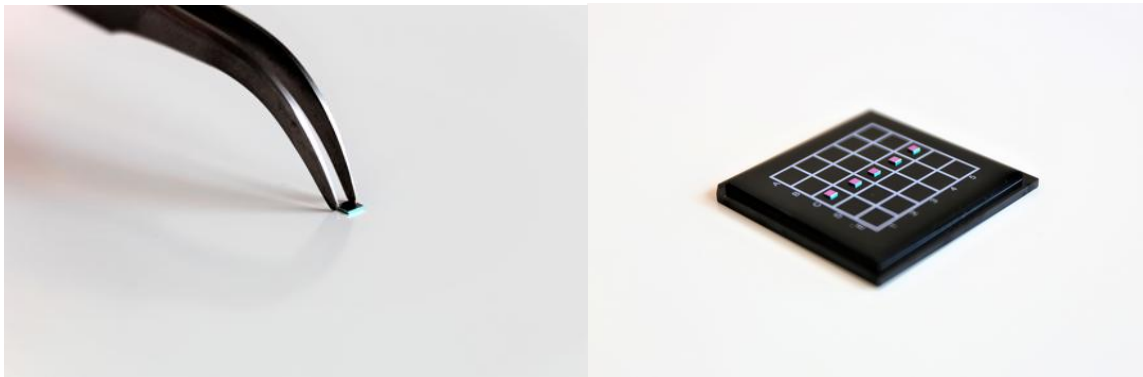
**Key features:** compact, high-repetition rate, high-energy



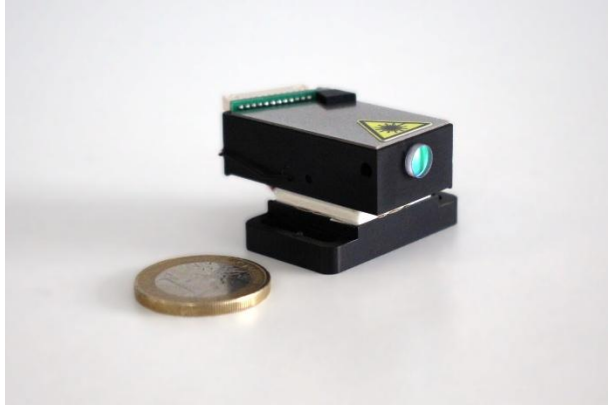
Q-switched  $\mu$ -chip  
with bulk absorber  
1 Hz - 1 kHz



Patent pending on a new laser design for scalable, low-cost OEM microchip

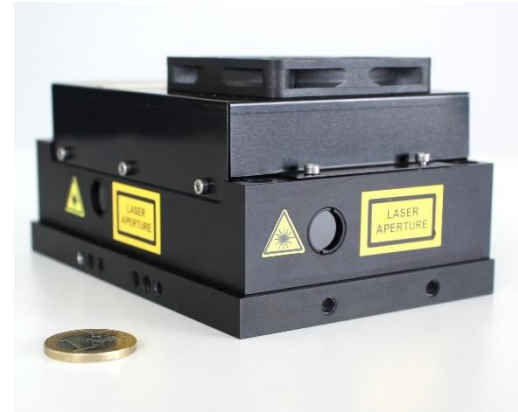


# Product Platforms



## OEM sub-system

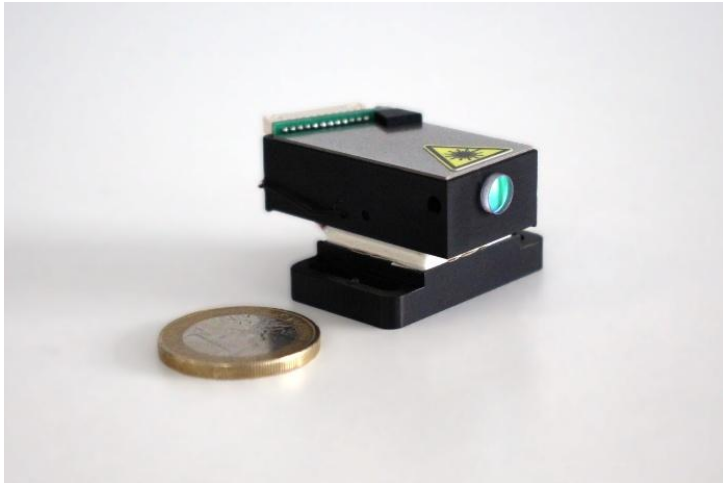
- High precision sensing
- Range-finding
- Seed lasers for amplifiers



## System level turn-key solutions

- High energy LIDAR
- Satellite Laser Ranging
- Time gated Raman spectroscopy

# Ultracompact picosecond OEM lasers at 1064 nm and 532 nm

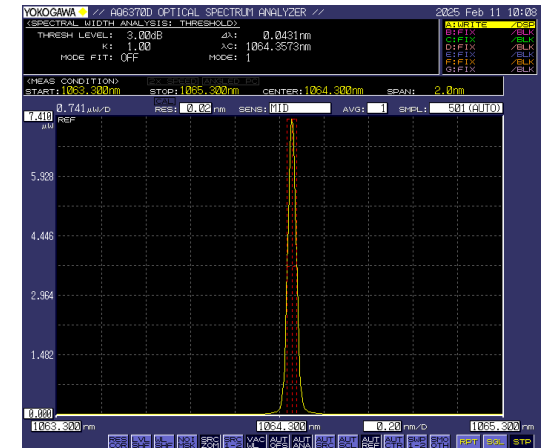
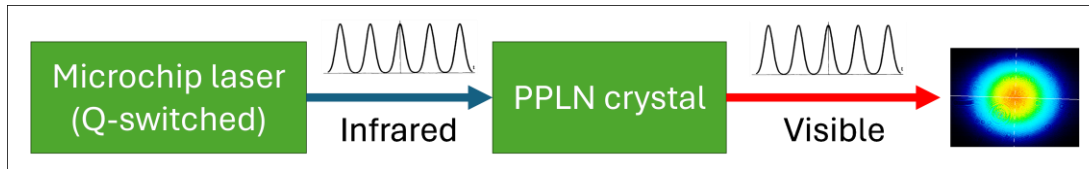
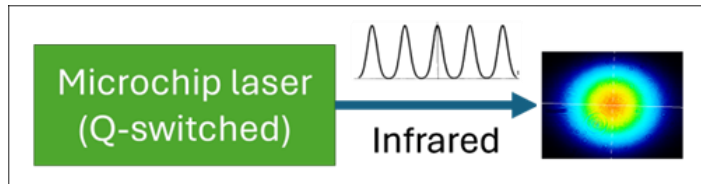


Matching application need in terms of optical performance

- Picosecond pulse duration (50 ps – 300 ps)
- Tunable repetition rate from single pulse to 200 kHz
- Narrow, single-frequency spectrum (< 50 pm)
- Excellent beam properties ( $M^2 \leq 1.2$ )
- Robust and scalable structure

One of the best SWaP-C in the market

- **1064 nm:** 20x15x10 mm<sup>3</sup>, < 100 g
- **532 nm:** ~75 x 50 x 20 mm<sup>3</sup>, ~200 g
- **1535 nm:** 5 ns, kHz, > 20  $\mu$ J



# High-energy picosecond MOPA system



Picosecond pulses, narrow spectrum

Tunable repetition rate (single pulse to 200 kHz)

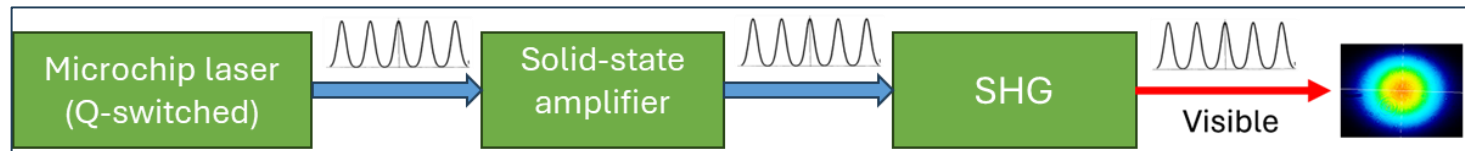
Tunable pulse peak power up to **50 kW - 532 nm / 80 kW - 1064 nm**

Integrated electronics with computer interface or API connection

TTL trigger in for pulse initiating, precise trigger out for

Free-space or fiber coupled

One of the best **weight – price – performance** ratios for high precision measurement systems and gated spectroscopy



# Main Applications and Requirements

## Raman Spectroscopy

Explosives detection  
Material identification

## High precision LIDAR

Eye-safe range-finding  
Bathymetric LIDAR  
Underwater LIDAR  
Drone detection

## Satellite Laser Ranging

High precision, portable systems  
Low-cost of ownership

### Optical Requirements

Narrow, single frequency spectrum  
High, tunable pulse repetition rate

Picosecond or sub-ns pulse duration  
High peak powers

# Future advancements and challenges

Advancements in novel gating and detection methods (e.g. SPADs etc.) open new opportunities

Need for faster measurements and improved resolution

Increasing need for portable, low-weight devices

- For drones, space and portable devices

SWaP-C will be key when maturing and advancing to wider adoption



Raman  
Spectroscopy

Satellite  
Laser  
Ranging

LIDAR &  
Ranging

# Conclusions

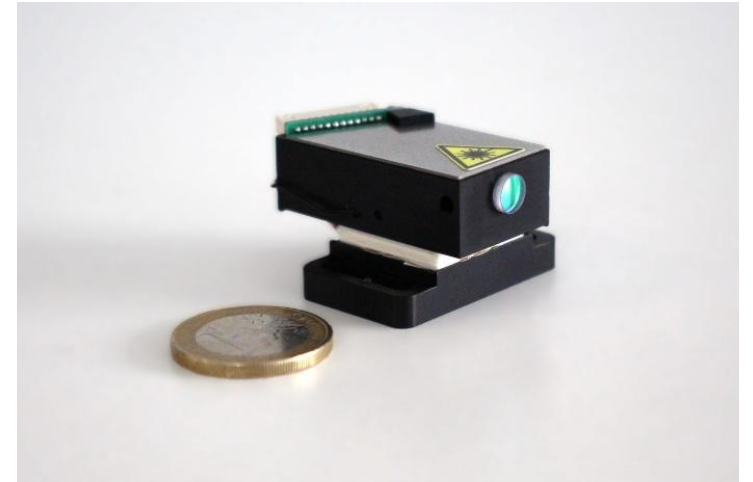
Ultracompact pico-and nanosecond solution for high precision sensing and analysis applications

Increasing need for improved compactness but not at the expense of performance and cost:  
**Performance – Compactness – Cost**

## Call to Action:

Collaboration with integrators for next generation system development (SLR / Sensing)

Joint development with detector companies





**Thank you!**  
**Questions?**

Antti Penttinen, CEO & Co-Founder  
[antti.penttinen@picophotonics.com](mailto:antti.penttinen@picophotonics.com)

[www.picophotonics.com](http://www.picophotonics.com)