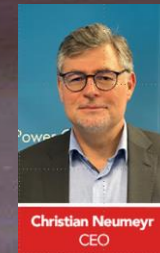
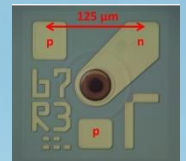


# Vertilas GmbH InP Long Wavelength VCSELs



**Monday, 13 June 2022, 15:00 - 17:00 CEST**

**EPIC Online Technology Meeting on VCSELs Technology  
and Applications**



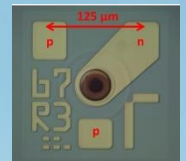
# Single Mode and Multi Mode Long Wavelength VCSELs

## for Optical Communications and Sensing

Christian Neumeyr  
CEO, Vertilas GmbH

## Agenda

- InP BTJ VCSEL Structure
- Markets
- Tunable VCSELS for Gas Sensing TDLS
- High data rate VCSELS for optical communications
- 2D VCSEL arrays for 3D Sensing
- Summary and Outlook



# VERTILAS – 20 Years of VCSEL Innovation

Leading supplier of 1w VCSELs  
(Vertical Cavity Surface Emitting Lasers)

World Wide  
Customer Base

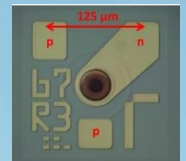
Garching  
(near Munich),  
Germany



QMS ISO9001

Founded in 2001

Spin-Out from  
TUM/WSI

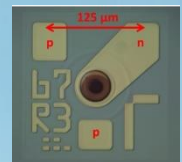
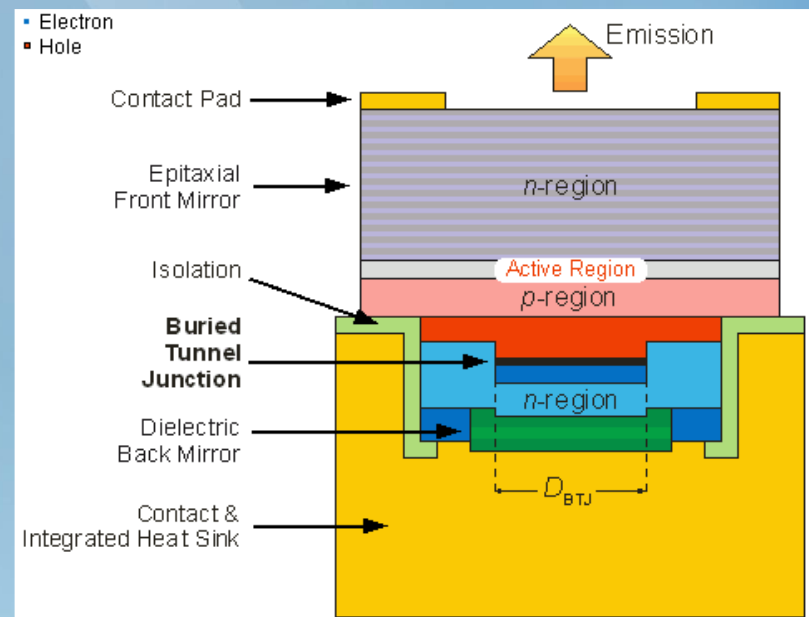


# Vertilas InP BTJ VCSEL

## InP BTJ Technology

- Same III-V material as DFB
- Current confinement by BTJ (not oxide)
- Passed 25000 hrs accelerated aging
- Telcordia compliant qualification

## VCSEL Structure



# Markets for Single Mode Long Wavelength VCSELs



Optical Communications



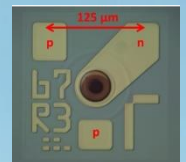
NIR VCSEL



NIR Sensing TDLS

(Tunable Diode Laser Spectroscopy)

**New: 2D VCSEL arrays for 3D sensing**



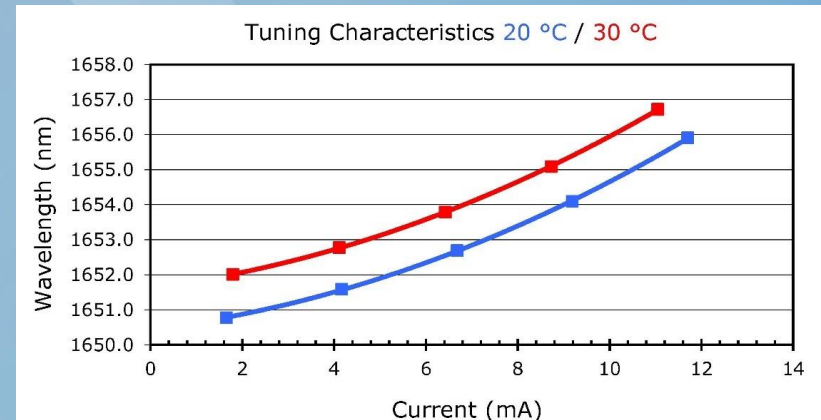
# Tunable VCSELs for Gas Sensing TDLS

## Wavelengths Range

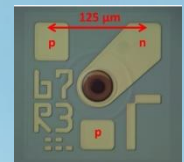
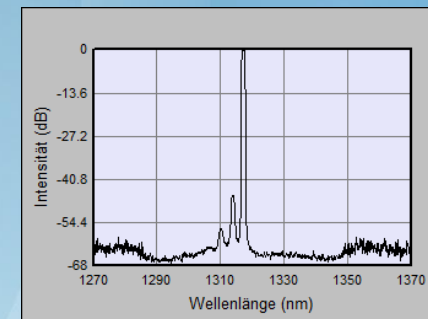
Wavelength in nm	Gas
1278	HF
1392	H <sub>2</sub> O
1512	NH <sub>3</sub>
1564	CO
1651, 1654, 1680	CH <sub>4</sub>
1742	HCl
1854, 1877	H <sub>2</sub> O
2004, 2008	CO <sub>2</sub>

Any wavelength from 1.3 μm to 2.3 μm can be manufactured on demand

## Wavelength Tuning



## Single Mode SMSR

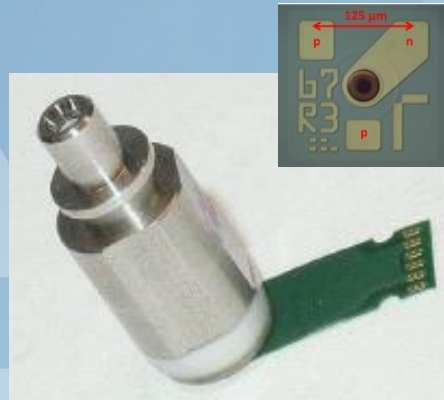


# High Speed InP VCSELs for Communications

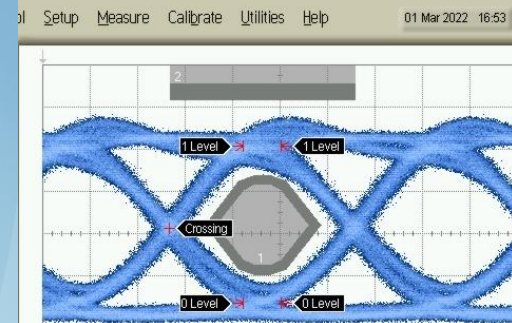
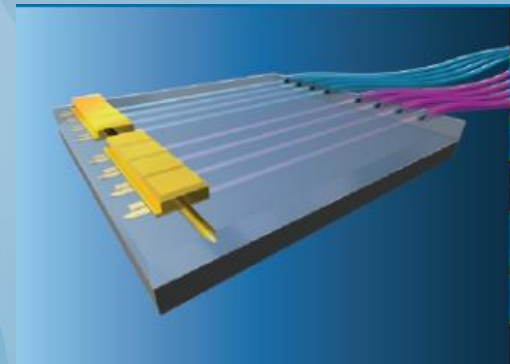
Data Center



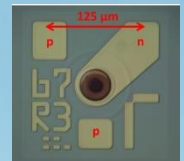
1.3  $\mu\text{m}$  to 1.6  $\mu\text{m}$   
O-, C-, L-Band



Integration with  
Silicon Photonics



25G to 40G

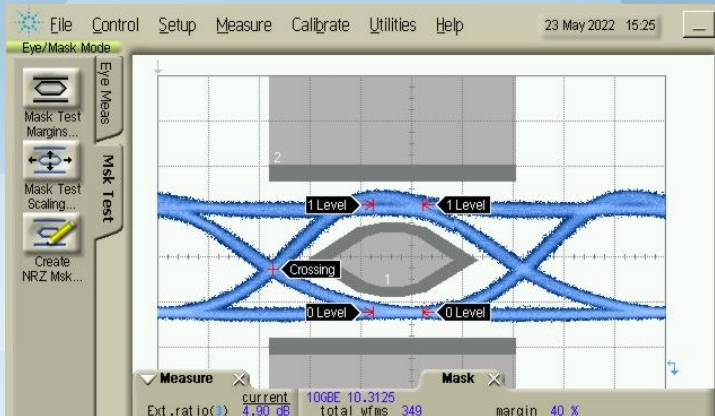




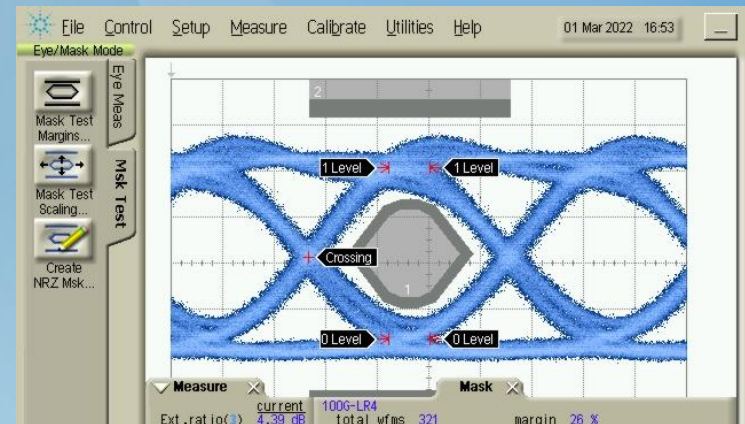
# LW VCSEL Record Performance for Single Mode Data Communications (NRZ)

NRZ Modulation  
Eye Diagram 10G and 25G VCSEL

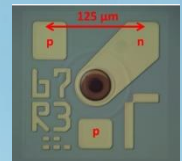
**10 Gbps – 1310nm, 75°C**  
**EMM 40%**



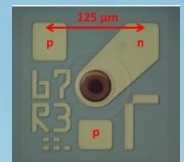
**25 Gbps - 1550 nm, RT**  
**EMM 26%**



With equalizer 50 Gbps demonstrated



# LW InP 2D VCSEL Arrays for 3D Sensing: 1.27 $\mu\text{m}$ to 2 $\mu\text{m}$



# 3D Sensing and LW VCSEL Arrays

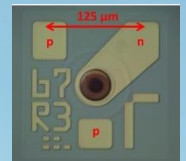
## ➤ Target applications

- Illumination
- Health care
- Building Automation
- Robotics
- AR/VR
- Automotive (e.g. LiDAR)
- Consumer electronics



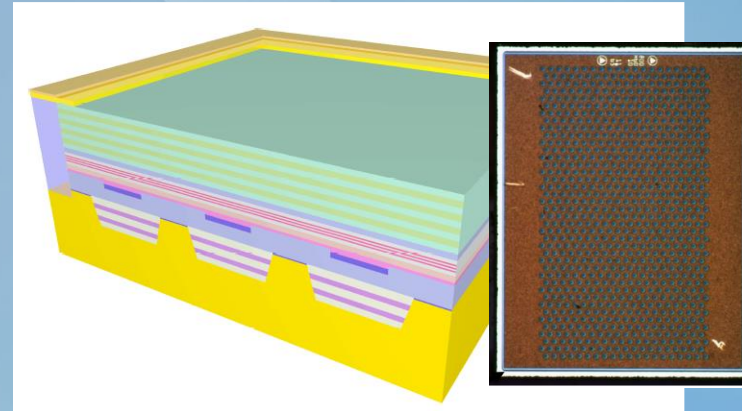
## ➤ Application Scenarios / Requirement for LW VCSEL Arrays

- Eye safety
- Reduced sunlight interference
- Special applications / markets requiring wavelengths  $> 1 \mu\text{m}$

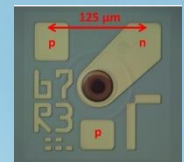
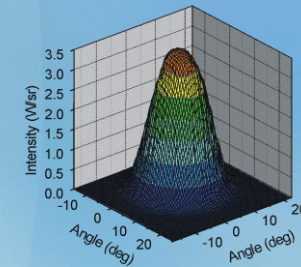


# 2D Array Examples 1.3 $\mu\text{m}$

# of emitters	Po (qcw)
12	0.125 W
24	0.25 W
48	0.5 W
160	1.5 W
300	3 W
480	5 W
800	8 W

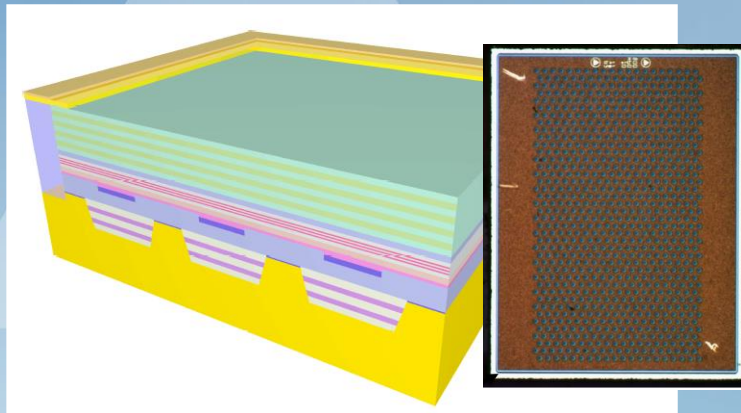


- From single emitter to > 1000 emitters
- From few mWs to 10s of Watts (pulsed mode)
- Single mode and multi mode versions
- Configurations can be designed per demand



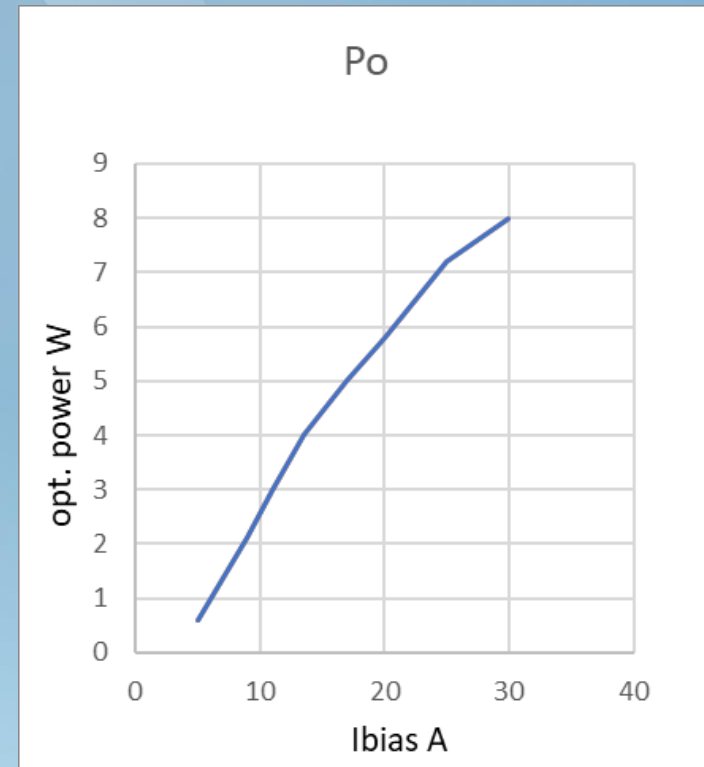
# 800 Emitter 1.3 $\mu\text{m}$ 2D VCSEL Array

## 2D VCSEL Array Cross Section

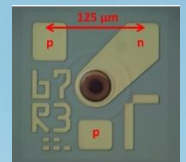


800 emitters

> 8 W optical power (qcw)

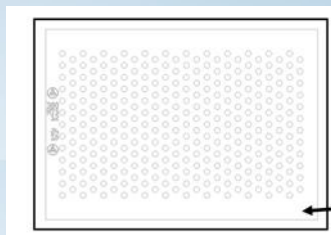
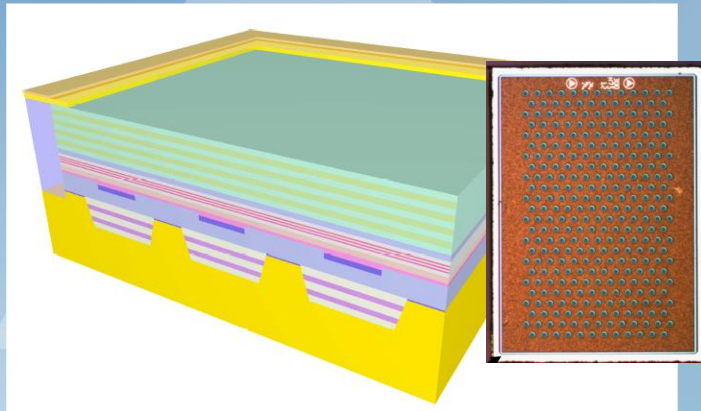


300  $\mu\text{s}$  pulse



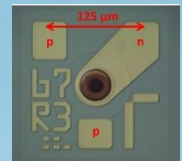
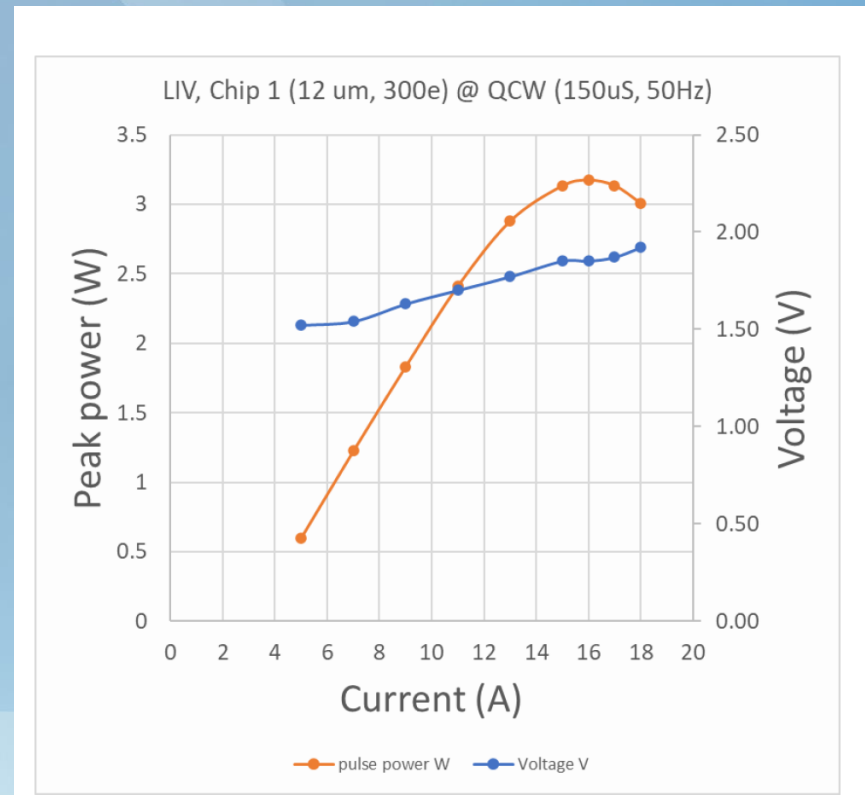
# 300 Emitter 1.3 $\mu\text{m}$ 2D VCSEL Array

## 2D VCSEL Array Cross Section



300 emitters

## 3.2W optical power



# LW InP VCSEL Outlook and Roadmap

**10G – 100G  
Optical Communications**

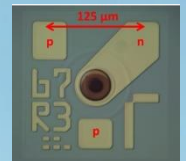
**Wide tunable  
VCSEL**



**Integration with  
Silicon Photonics**

**Wavelengths  
> 2.3  $\mu\text{m}$  (GaSb)**

**High Power  
2D VCSEL Arrays**



Thank you



## Vertilas Laser Products enable Smart City Systems and Green Photonics

