

**FOCUSLIGHT**

Never stop exploring

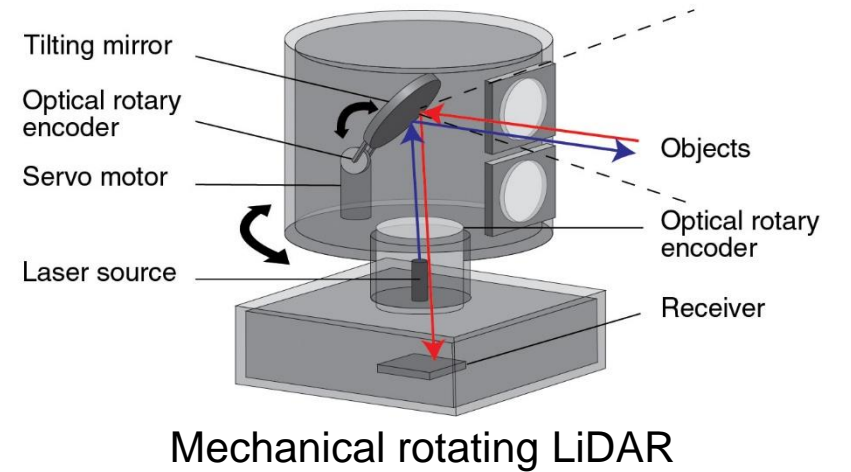
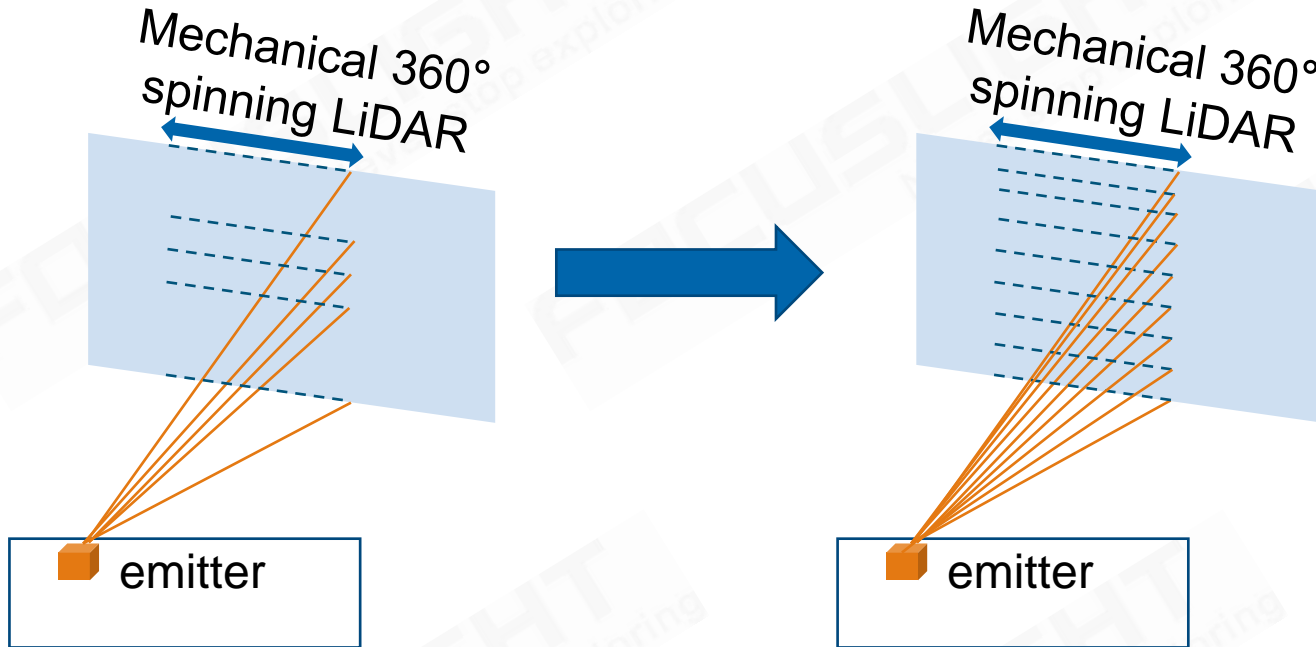
**Short pulsed high peak power 905nm laser transmitter  
for beam-steering LiDAR system**

Zhe HE (PM), Focuslight Auto BU

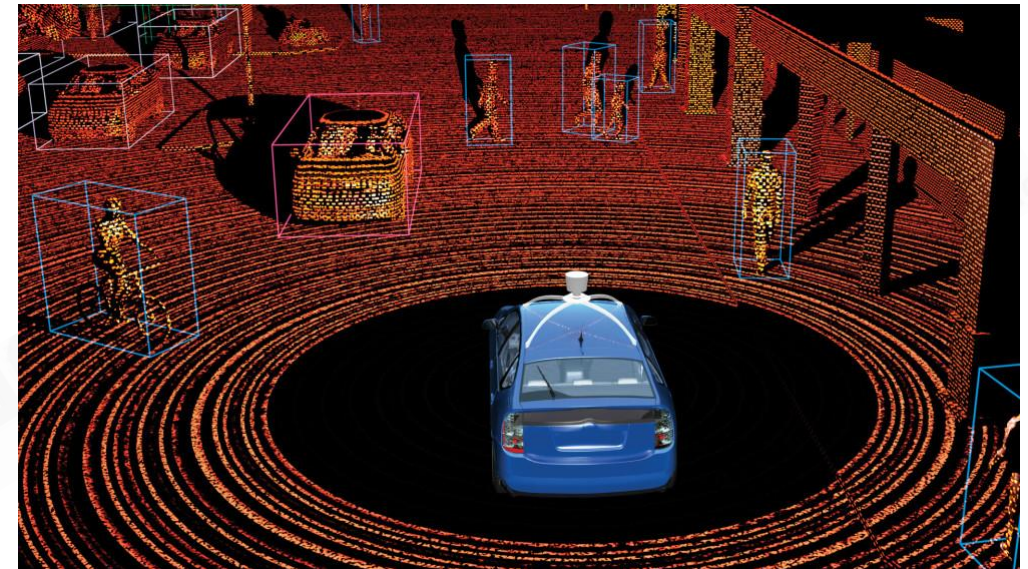
2020.12



# LiDAR Technique Review



Mechanical rotating LiDAR

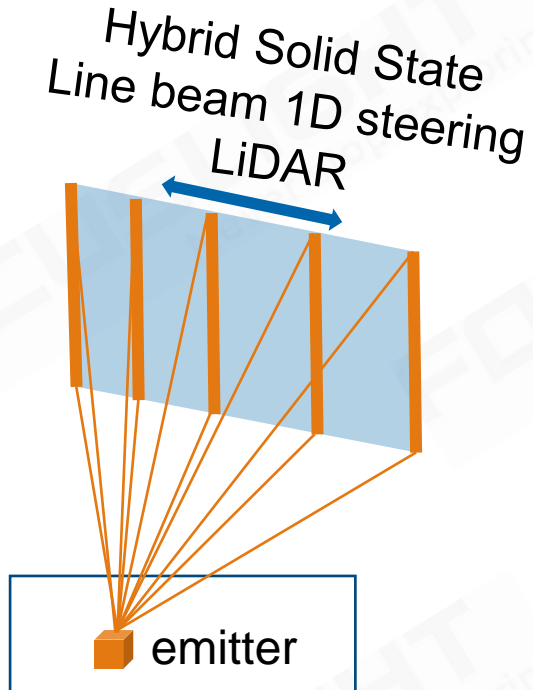


Point cloud

## Mechanical rotating LiDAR:

- Higher accuracy: 16 → 32 → 64 → 128 channels
- Higher density higher cost

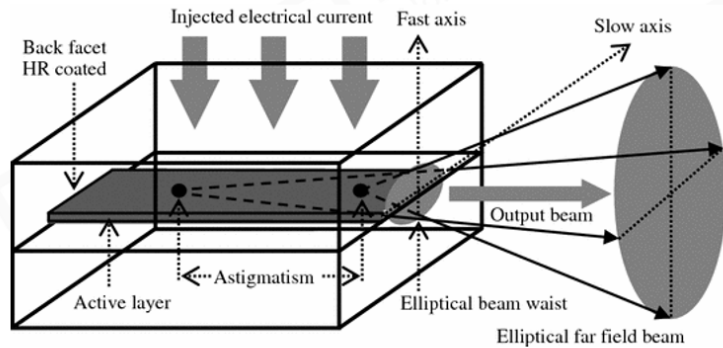
# Focuslight LiDAR Laser Transmitter Solution



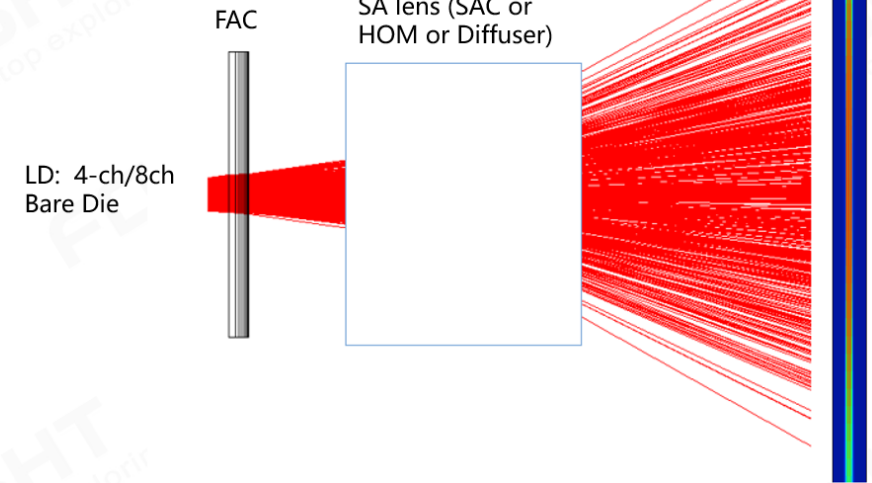
LiDAR-Tx L – Laser Tx  
Module for Line Steering

LiDAR-Tx OA – Optical  
Component & Assemblies

Side view (single channel EEL)



Top view (Laser Beam Shaping)



## Focuslight LiDAR Laser Transmitter Solution

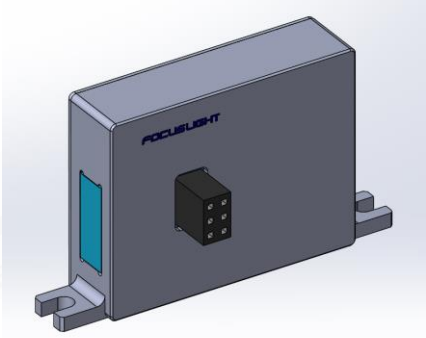
- **One single line** + SPAD array
- Compatible with 16 lines – 64 lines - 128 lines – 200 lines
- Suitable for 1D MEMS or Steering Mirror



LiDAR Tx Module



LE01 module



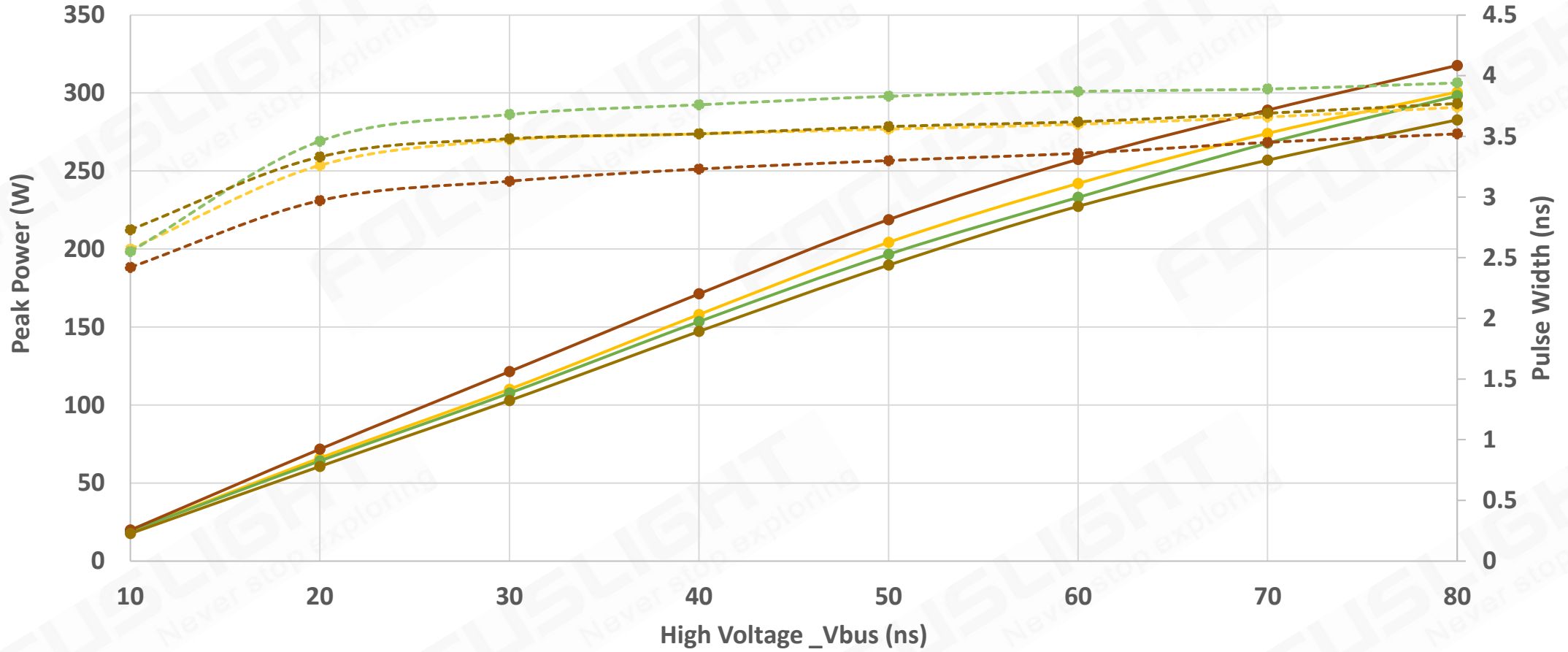
LE02 module

	LE01	LE02
Dimensions	89mm*75mm*28mm	Much smaller (45*35*12.5mm)
Laser diode	Support LD 4-ch laser bar	Support LD 8-ch laser bar
Peak power	> 300W@10kHz	> 800W@10kHz
LD pulse width	<4ns	<5ns
Divergence in fast axis	<0.4deg@FW 1/e2	<0.1deg@FW 1/e2
Sample available	3~4 weeks	Available in 2021 Q1*

\* Auto-grade design possible according to customers' demands

# LE01 LIV Test Result

### Peak Power(W) & Pulse width(ns) vs. Vbus (V)

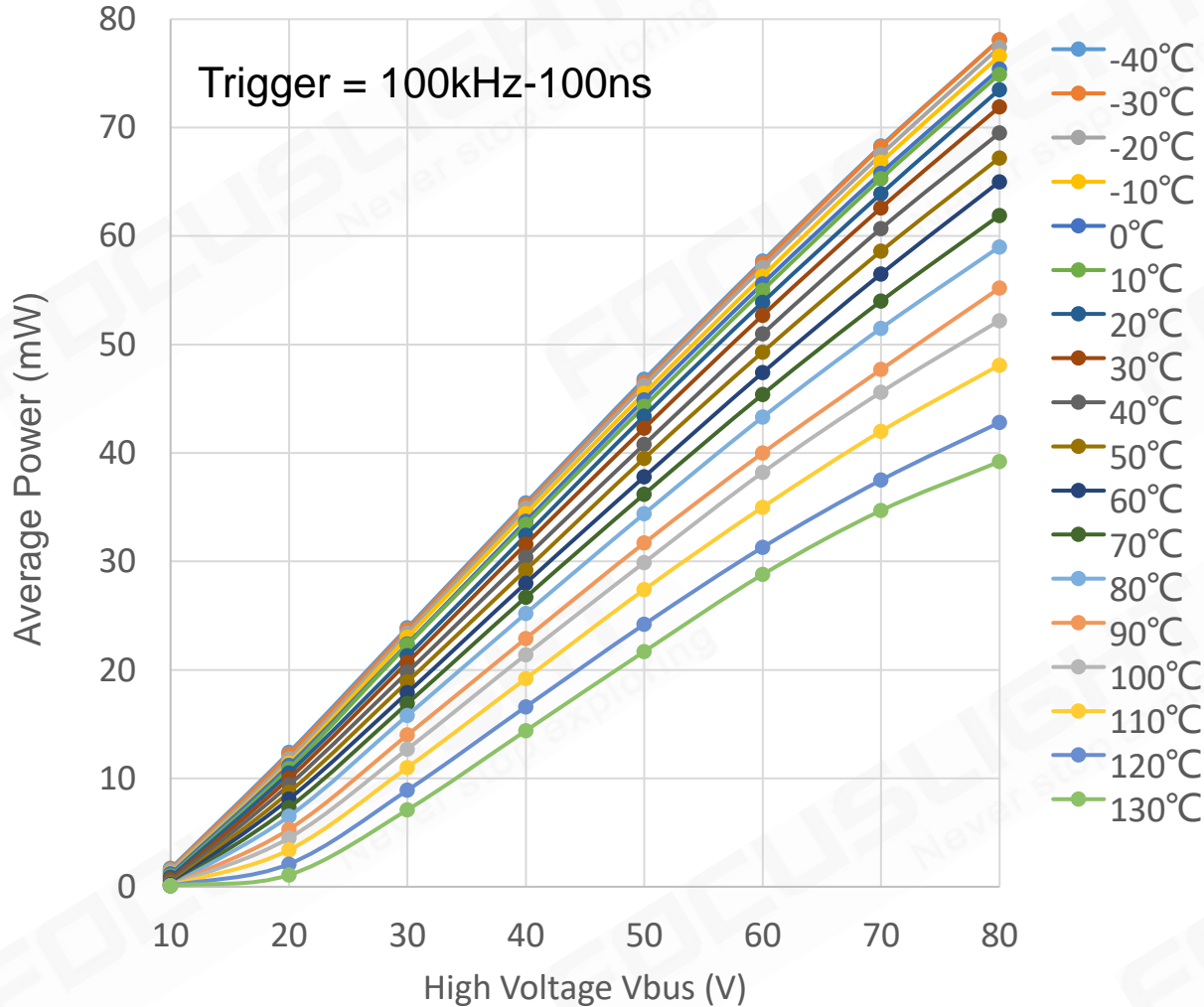


- Peak power(W)-01#
- Peak power(W)-02#
- Peak power(W)-03#
- Peak power(W)-04#
- Pw (ns)-01#
- Pw (ns)-02#
- Pw (ns)-03#
- Pw (ns)-04#

**Peak power up to 300W with short pulse (<4ns)**

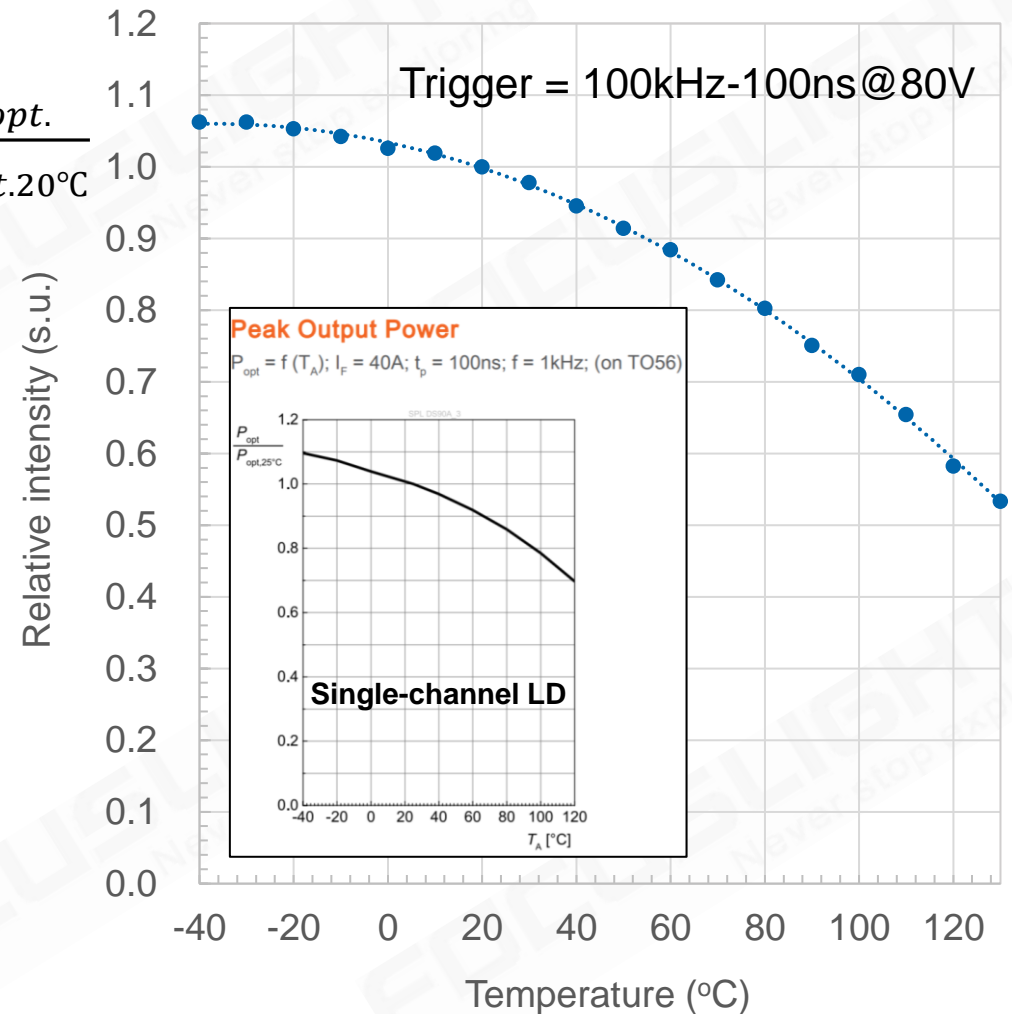
# LE01 High & Low Temperature Test (Power)

Power v.s. Temperature variation



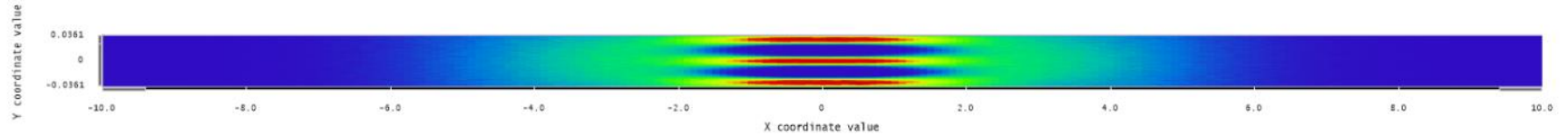
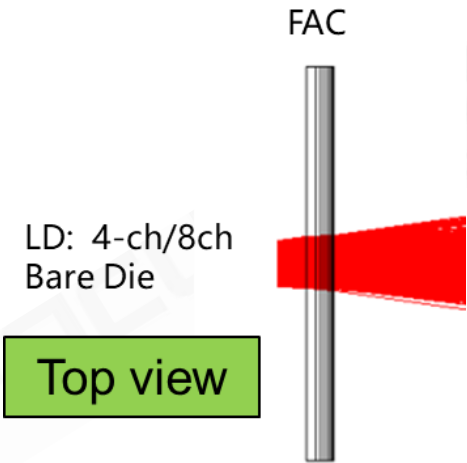
$$\frac{P_{opt.}}{P_{opt.20^{\circ}C}}$$

Power v.s. Temperature variation (80V)



Performance change within operating temperature (-40°C - 130°C)

# Line Laser Generation – Horizontal Direction



Simulation after FA collimation (far field)



Real test after FA collimation (far field)

FA lens configuration	Effective focal length EFL	FA divergence (FW 1/e <sup>2</sup> )
FAC1500	1.5mm	0.44deg
FAC3000	3.0mm	0.22deg
FAC7700	7.7mm	0.12deg
Customized	...	<0.1deg

Collimation technique:

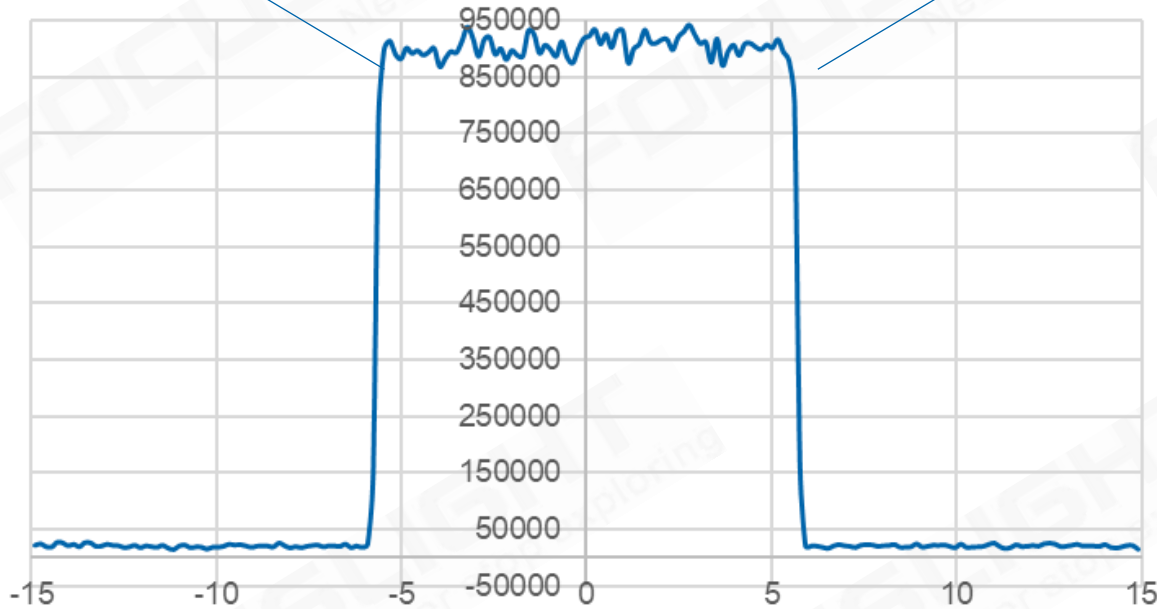
- Very small divergence in fast axis (horizontal direction)
- Auto-grade operating temperature (-40°C - 105°C)



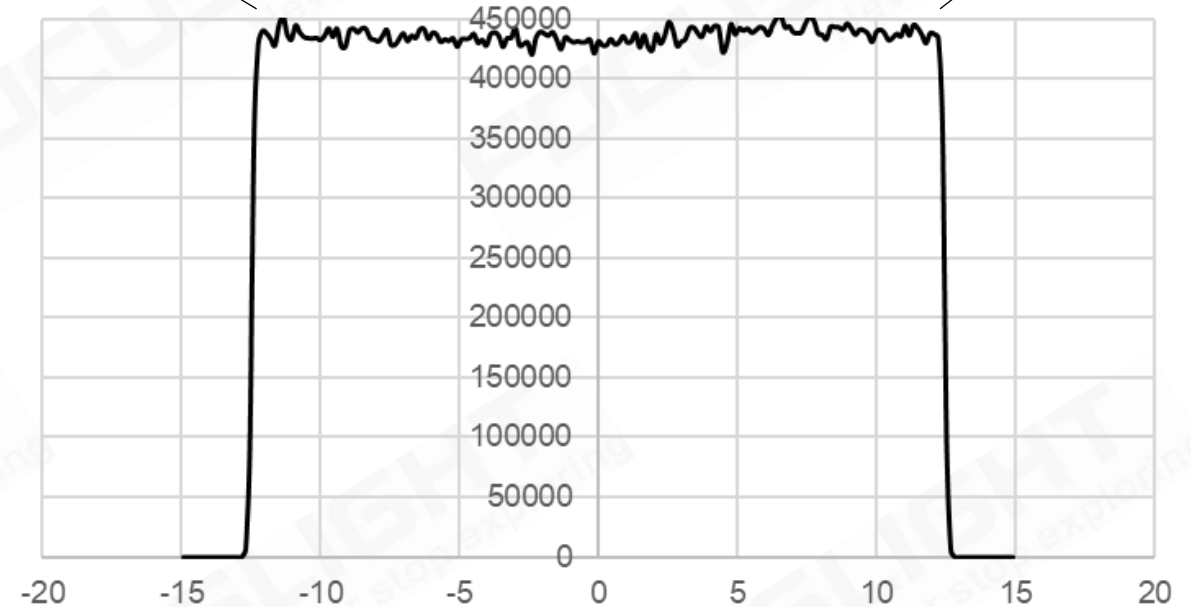
# Line Laser Generation – Vertical Direction



FAC7700 + 11°HOM



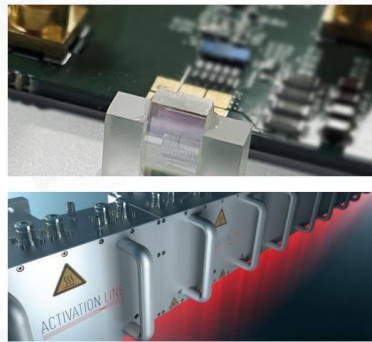
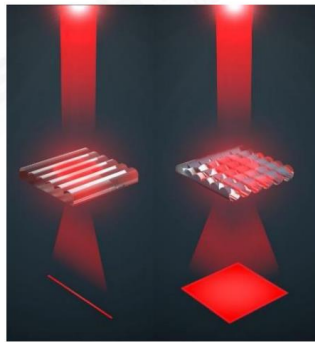
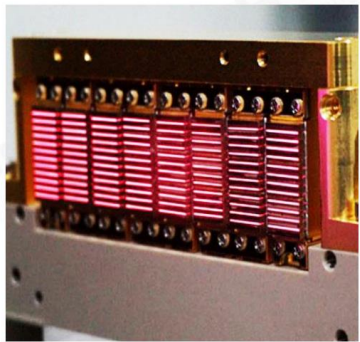
FAC7700 + 25°HOM



Homogenizer technique:

- High uniformity (>90%)
- Large FOV design (<160°)
- No hot spot (No energy concentration)
- Auto-grade operating temperature (-40°C - 105°C)

# Focuslight Overview



Photon  
Generation



Photon  
Control



Photonics  
Application  
Solutions

## Focuslight Technologies

Diode  
Laser  
BU

Laser  
Optics  
BU

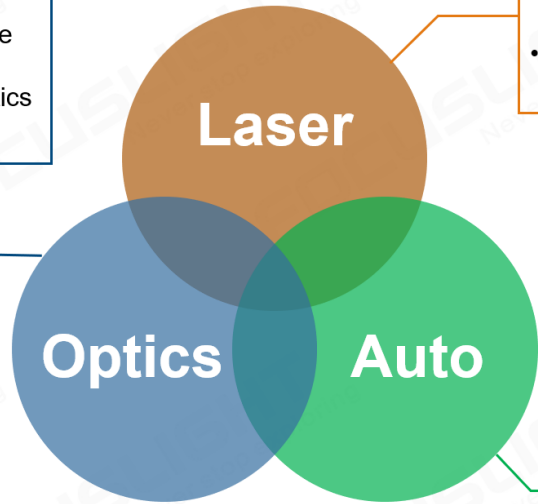
Auto-  
motive  
BU

Optical  
Systems  
BU

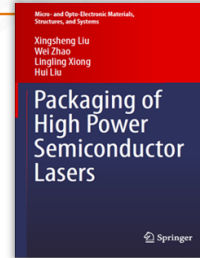
Unified  
Corporate  
Function &  
Shared  
Service  
Center

# Focuslight Overview- Automotive BU

- 28 years beam shaping expertise
- Auto grade glass optics
- World renowned glass micro optics design and manufacturing



- 13 years high power diode laser packaging and commercialization
- World's first academic book on high power diode laser packaging



- Auto grade product design and development
- Auto qualified mass production and quality system

**AL01 (Mass Production)**



Developed for a top Tier-1

## Optically driven one stop solution provider for Auto LiDAR & DMS

### Highlights of Automotive BU

- FL's first full solid-state Laser module AL01 (in mass production for a Global Tiers-1)
- ACE-Q102 verification
- IATF 16949 certificate

**CERTIFICATE**

**Quality Management System**  
IATF16949

**CERTIFICATE**

**Environmental Management System ISO14001**

**CERTIFICATE**

**Occupational Health and Safety Management System ISO45001**

**THANK YOU**



**FOCUSLIGHT**  
Never stop exploring

**LIMO**  
A Focuslight Company