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# Quarterly Financial Results Briefing 1st Quarter of FY2023

QD Laser, Inc.  
August 2023

## Mission

**With the power of the semiconductor laser,  
“I can’t” becomes “I can”.**

### Contents

01 Financial Results for FY2023-Q1

02 Semiconductor Laser Devices

03 Laser Retinal Projection

04 ESG Initiatives

What was once thought to be impossible is now a reality; we have become the only company in the world to successfully mass produce Quantum Dot LASERs.

Our laser technology will enable dramatic improvements in our ability to process information, support visually impaired people, prevent eye diseases, and enhance vision, continually pushing the boundaries of human possibility.

# 01

Financial Results for FY2023-Q1

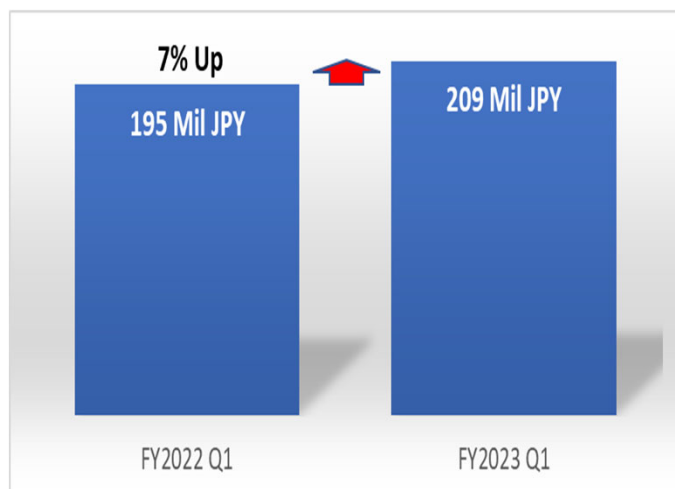
## Financial Results Highlights for FY2023-Q1 vs FY2022-Q1

01 LD business sales increased by 7% YOY to 209 mil yen and LEW business sales increased by 161% YOY to 45 mil yen. Company-wide sales increased by 20% YOY to 255 million yen.

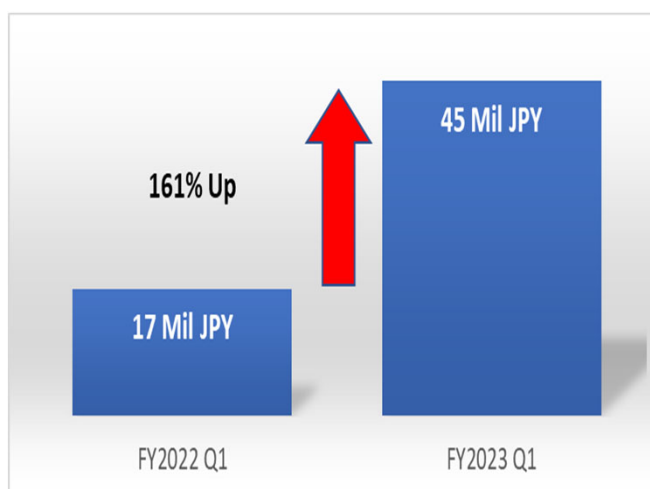
The LD business increased by 7% due to increases in high-power lasers and quantum dot lasers, while DFB lasers and compact visible lasers decreased.

The LEW business increased significantly by 161% due to the start of US sales of RETISSA NEOVIEWER and eye health check services.

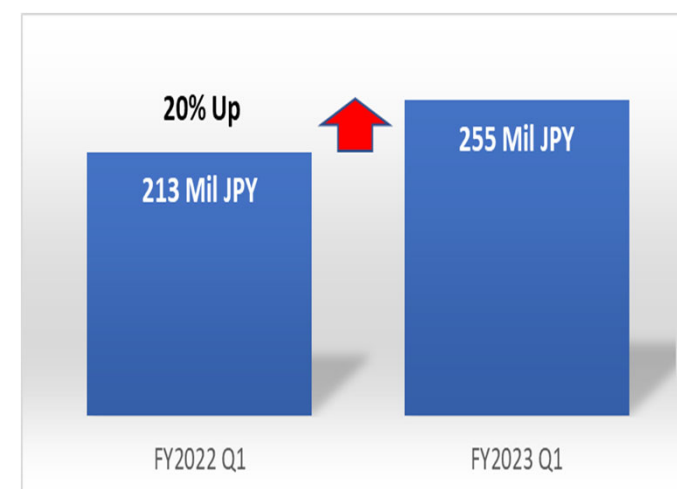
LD sales



LEW sales



Company-wide sales





# Financial Results Highlights for FY2023-Q1 vs FY2022-Q1

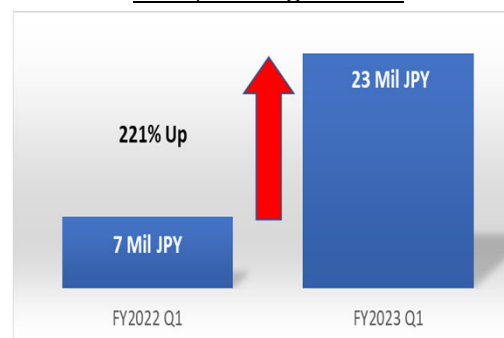
## 02 LD business operating income increased by 221% YOY to 23 mil yen. Company-wide operating loss improved by 36 mil yen (22%) YOY.

Gross profit increased in the LD business due to increased sales, and operating profit increased 221% YOY to 23 million yen.

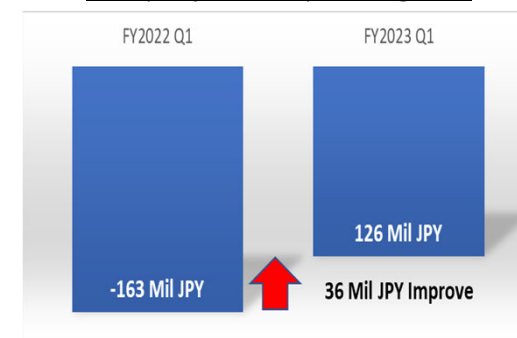
Gross profit also increased in the LEW business due to increased sales, so the operating loss improved from the same period of the previous year.

Operating loss improved by 36 million yen from the same period of the previous year due to an increase in gross profit on a company-wide basis due to an increase in sales.

LD operating income



Company-wide operating loss

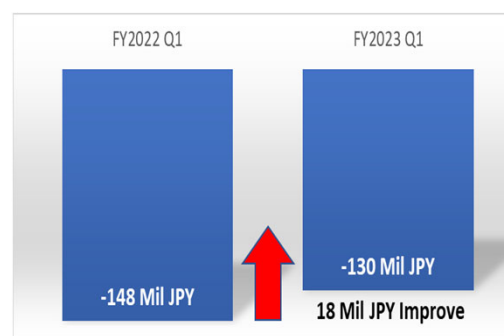


## 03 Ordinary loss improved by 18 mil yen (13%) YOY, and net loss improved by 18 mil yen (12%) YOY.

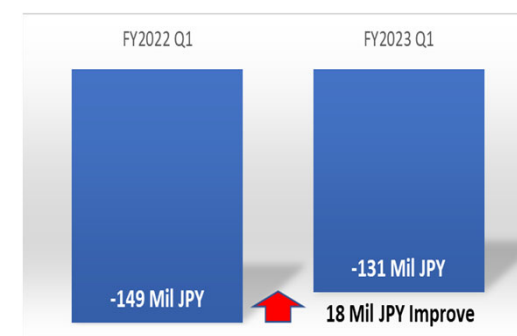
Ordinary loss improved by 18 million yen YOY, less than the improvement in operating loss, as foreign exchange gains decreased YOY and expenses were incurred due to the exercise of stock acquisition rights.

Net loss also improved by 18 million yen, similar to the improvement in the ordinary loss.

Ordinary loss



Net loss



# Financial Results Highlights for FY2023-Q1 vs FY2022-Q1

## Increase in sales and decrease in losses compared with the same period of the previous year

Sales increased by 7% YOY for the LD business and by 161% YOY for the LEW business, resulting in a 20% YOY increase for the entire company. Operating income increased by 221% YOY to 23 million yen in the LD business, and the LEW business improved by 13 million yen YOY. Operating loss improved by 36 million yen (22%) YOY.

### Performance Summary

(Million JPY)	FY2023 Q1	FY2022 Q1	YOY
Sales	<b>255</b>	213	+ 20% (+ 42)
(LD)	<b>209</b>	195	+7%
(LEW)	<b>45</b>	17	+161%
Operating Profit or Loss (△)	△ <b>126</b>	△163	+36
(LD)	<b>23</b>	7	+15
(LEW)	△ <b>67</b>	△81	+13
Ordinary Loss (△)	△ <b>130</b>	△148	+18
Quarterly Net Loss (△)	△ <b>131</b>	△149	+18



### Sales by Product Group

(Million JPY)	FY2023 Q1	FY2022 Q1	YOY
DFB Laser	<b>77</b>	79	△2%
Compact Visible Laser	<b>41</b>	64	△36%
High-Power Laser	<b>46</b>	39	+19%
Quantum Dot Laser	<b>44</b>	12	+246%
<b>LD Total</b>	<b>209</b>	<b>195</b>	<b>+7%</b>
<b>LEW Total</b>	<b>45</b>	<b>17</b>	<b>+161%</b>
<b>Grand Total</b>	<b>255</b>	<b>213</b>	<b>+20%</b>

# Balance Sheet

Total assets increased by 1,581 million yen due to increased cash and deposits, etc. Total liabilities decreased by 73 million yen due to a decrease in A/P(trade) and A/P(other), and the equity ratio was 93.7%<sup>\*1</sup>(90.1%<sup>\*2</sup> at the end of the previous fiscal year).

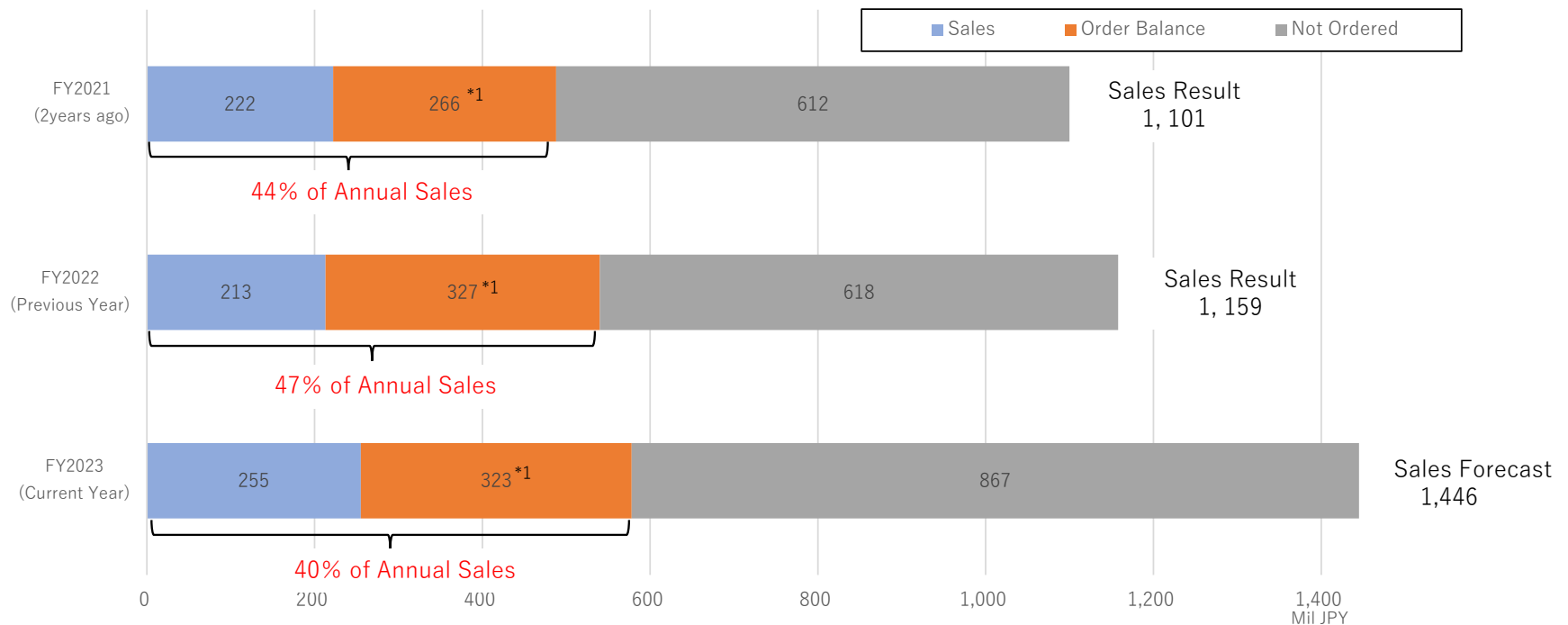
Balance Sheet

(Million JPY)	End of June 2023	End of March 2023	YOY
Current Assets	6,190	4,617	+ 1,573
Fixed Assets	309	300	+ 8
<b>Total of Assets</b>	<b>6,499</b>	<b>4,918</b>	<b>+ 1,581</b>
Current Liabilities	367	436	△68
Fixed Liabilities	37	42	△4
<b>Total of Liabilities</b>	<b>404</b>	<b>478</b>	<b>△73</b>
<b>Net Assets</b>	<b>6,094</b>	<b>4,439</b>	<b>+ 1,655</b>
<b>Total Liabilities and Net Assets</b>	<b>6,499</b>	<b>4,918</b>	<b>+ 1,581</b>

# Order Status

As of the end of the first quarter, sales + order backlog (scheduled sales within the fiscal year) accounted for 40% of the annual sales forecast.

## Net sales for FY2023-Q1 and order backlog as of the end of the FY2023-Q1










# Exercise of the Stock Acquisition Rights Completed

Exercise completed on April 20, 2023. There are no unexercised balances of the 14th to 15th stock acquisition rights.

		16th Stock Acquisition Rights	Results of exercise
Issuing method		Third-party allotment to Credit Suisse Securities (Japan) Limited ("Credit Suisse Securities") (With strike price adjustment clause and exercise suspension clause)	Same as left
Outline of Issuance	Exercisable period	January 4, 2023 to January 6, 2025	Approx. 2,875 million yen
	Estimated finance amount (net proceeds)	Approx. 3,526 million yen	
	Number of stock acquisition rights	51,360 units	
	Number of potential shares	5,136,000 shares	
	*Dilution %	14.30%	
Strike Price	Initial strike price	686 yen	Same as left
	Strike price revision	Amount equivalent to 91.5% of the closing price on the trading day before the effective date of each exercise request	
	Maximum strike price	—	
	Minimum strike price	480 yen	
Others	Ancillary provisions	Exercise suspension clause (At our discretion, we can specify a period that the stock acquisition rights cannot be exercised. However, it will be issued with the exercise suspension with the entire excisable period, and the exercise suspension will be removed when the Trigger Event or the Revocation Resolution is disclosed)	
	Acquisition clause	<ul style="list-style-type: none"> <li>• All remaining stock acquisition rights can be acquired at our discretion</li> <li>• Acquire all remaining stock acquisition rights on the last day of the exercisable period</li> </ul>	
	Transfer restrictions	The transfer of stock acquisition rights requires the approval of the Board of Directors	

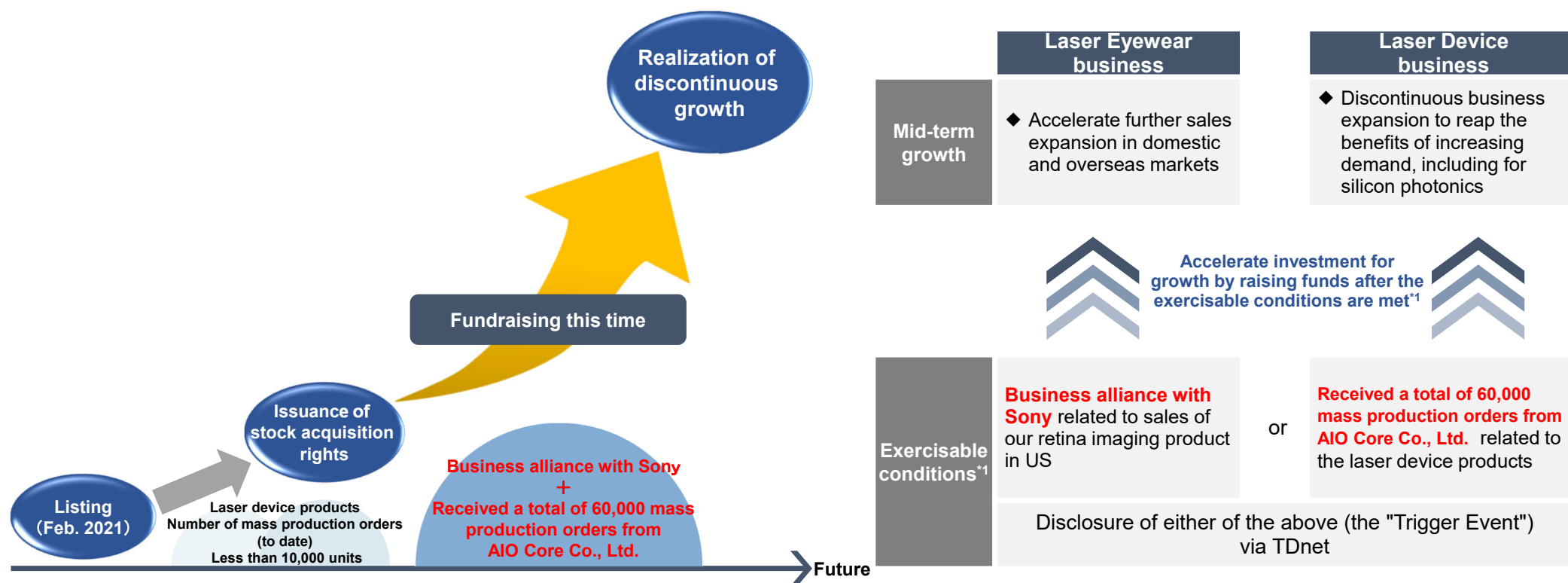
## Estimated financing amount and spending time

Description	IPO (2/2021)	Original plan	Current results	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025-	Remarks
Manufacturing cost for the mass production in the laser eyewear business	2,926	—	—							As for progress, 535 mil yen was allocated for material and outsourcing costs by 6/2023
① Production capacity reinforcement	—	2,426	2,300							Decrease financing amt as a result of a review and given that we raised 651 mil yen(+56mil yen) from the Previous Stock Acquisition Rights
② Labor costs	—	300	175							3 people in Laser Device business 3 people in Laser Eyewear business 1 person in headquarters
③ Advertising expenses	—	200	100							Decrease financing amt as a result of a review
④ M&A, capital and business alliance investment	—	600	300							Decrease financing amt as a result of a review
total	2,926	3,526	2,875							

- Along with the procurement amount this time, we have changed the amount of each use. Our basic growth strategy has not changed, and we will utilize it to grow our business in line with the increase in demand.

# The highlight of the Stock Acquisition Rights

Equity financing linked to business milestones to be achieved in the future



The above graph is shown as an image and does not necessarily promise the growth as shown in the above image.

# DFB Lasers for Precision Machining and Measurement : Sales in FY2023-Q1

**77 million JPY sales, decreased by 2% YOY.**

- **Measurement(semiconductor wafer inspection): 38%**

- Europe: Sales of light sources for inspection equipment in the semiconductor wafer process increased by 81% YOY.

- **Micromachining: 29%**

- North America: Postponed due to overstock of lasers for processing equipment.

- Europe: Sales of lasers for processing equipment decreased by 84% YOY due to overstocks.

- China: Sales of 10,994K yen due to new orders for lasers for processing equipment

- **Measurement(Sensor system): 12%**

- Japan: Sales of 3,366K yen due to orders for measurement light sources

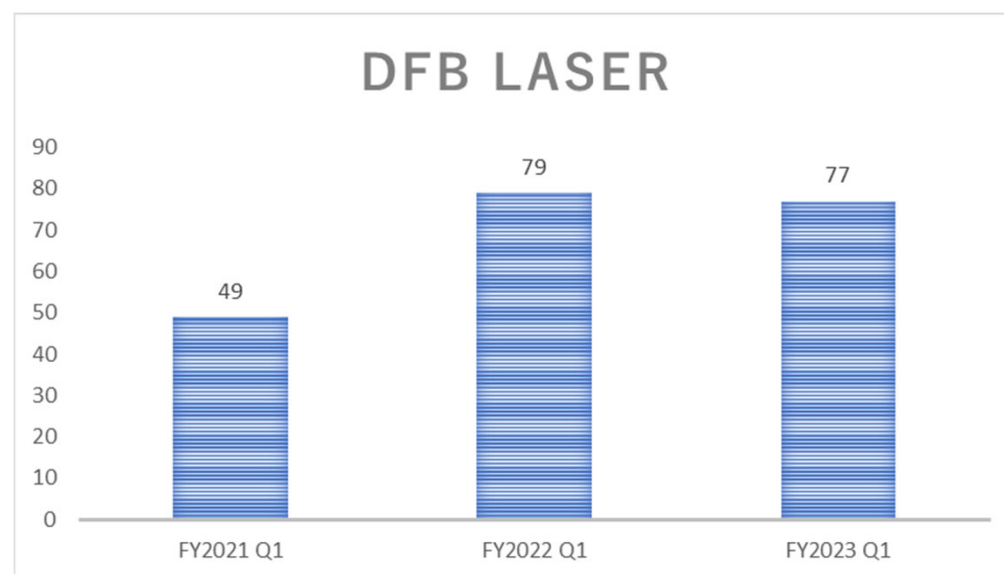
- Europe: Sales of 2,997K yen due to orders for measurement light sources

- **Medical equipment: 21%**

- Japan: Sales of light sources for ophthalmic diagnosis increased by 107% YOY.

- Europe: Sales of light sources for medical inspection increased by 675% YOY.

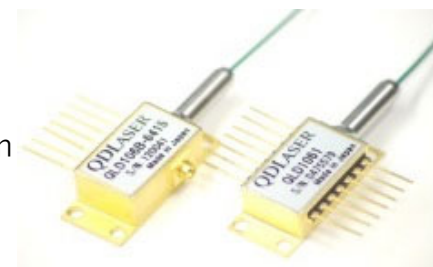
Sales of Q1 in FY2021, 2022 and 2023



DFB lasers

Left : for 15 ps pulsed operation

Right : for 50 ps pulsed,  
ns pulsed, and CW operations





# Compact Visible Lasers : Sales in FY2023-Q1

**41 million JPY sales, decreased by 36% YOY.**

- **Blood/cell analysis(Flow cytometer/cell sorter\*1): 58%**

- China: Sales decreased by 67.5% YOY due to delayed orders by sluggish demand for biomedical equipment and excess inventory.

- North America: Sales increased by 110% YOY with the start of mass production for biomedical applications.

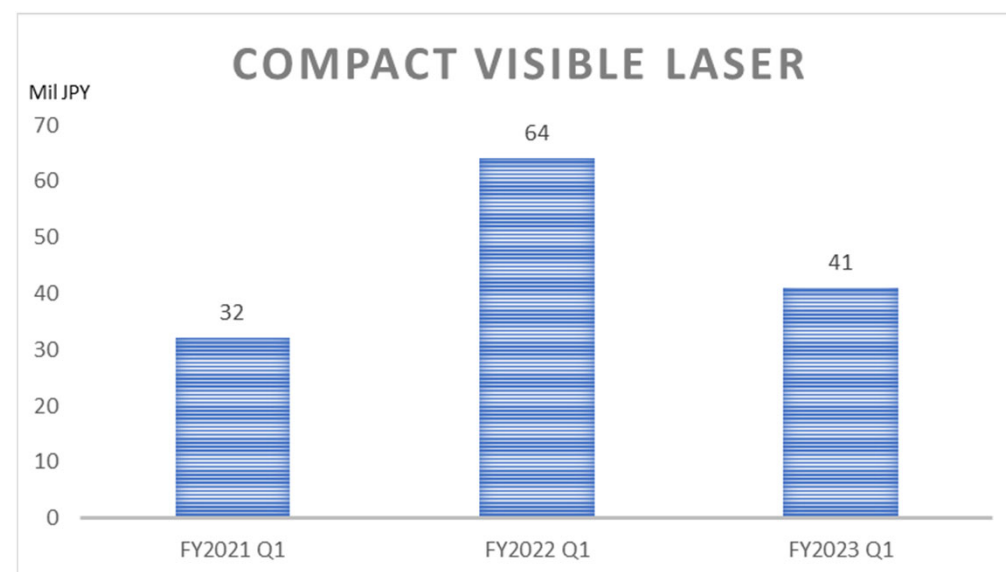
- **Microscope: 40%**

- Europe: Orders from a biomedical STED\*2 microscope manufacturer resumed last fiscal year, with a forecast of 100pcs in 2022-2023. 52 units were shipped in 2022. Fifty unit orders were received for shipment from Q2 onwards.

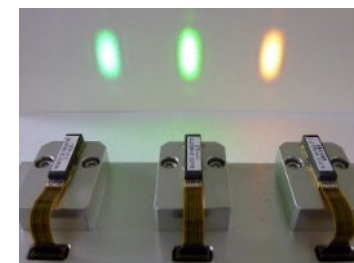
- Europe: Sales increased by 539% YOY with the start of mass production for biomedical applications.

- Japan: Sales increased by 125% YOY with the start of mass production for biomedical applications.

Sales of Q1 in FY2021, 2022 and 2023



Compact visible lasers  
Left: green,  
Middle: yellow-green, and  
Right: orange.

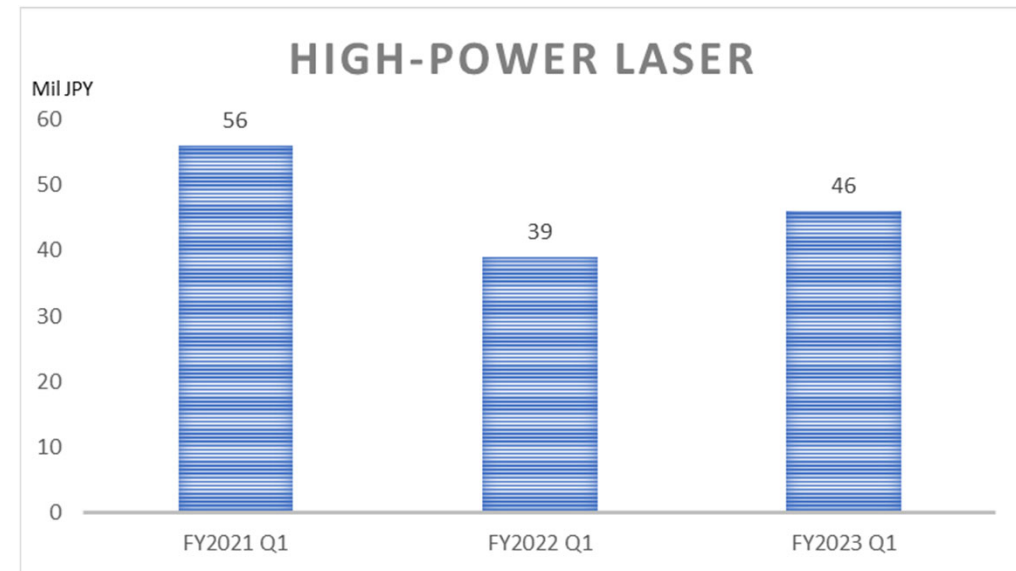


# High-Power Lasers : Sales in FY2023-Q1

**46 million JPY sales, increased by 19% YOY.**

- Leveler for construction/DIY and sensor: 51%
- China: A light source for sensors and levelers. Sales increased by 20% YOY, despite the impact of the suspension of factory operations due to the COVID-19 in the previous fiscal year.
- North America: Sales of 3,400K yen for light sources for sensors.
- Japan: Sales of 2,817K yen for light sources for sensors.
- Sensor in semiconductor factories: 20%
- Japan: Sales of light sources for sensors of wafer transfer machines to be used in semiconductor factories increased by 63% YOY.
- Japan: Sales of 1,872K yen with the start of mass production for light sources for sensors of wafer transfer machines.
- Japan: Sales of light sources for particle counters in semiconductor factories increased by 21% YOY.
- Machine vision and data communication in factories: 20%
- North America: Sales of lasers for machine vision increased by 179% YOY.

Sales of Q1 in FY2021, 2022 and 2023



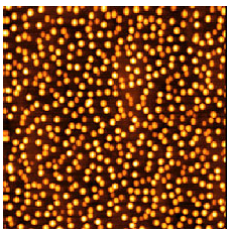
High-power lasers  
TO package

# Quantum Dot Lasers<sup>\*1</sup> : Sales in FY2023-Q1

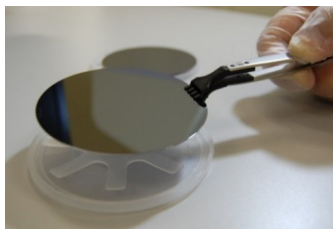
**44 million JPY sales, increased by 246% YOY.**

Working on quantum-dot lasers for silicon photonics with nine customers in Japan, the US, and Europe.

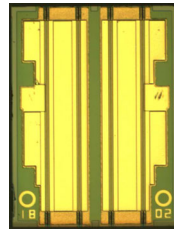
- Japan: Shipped chips for optical connector and chip-to-chip communication. Continuing activities to reduce costs. Mass production started in May 2023, and 60,000 units have been ordered from 2023 to 1Q in 2024.
- North America: Shipment of wafers for optical connector and chip-to-chip communication.
- North America: Shipped after receiving repeat orders from the customer of optical connector and chip-to-chip communication shipped in the previous fiscal year.
- Three universities and research institutes in Europe, the US, and Asia: Inquiries about quantum dot wafers for research and under discussion about new orders.



Quantum dot

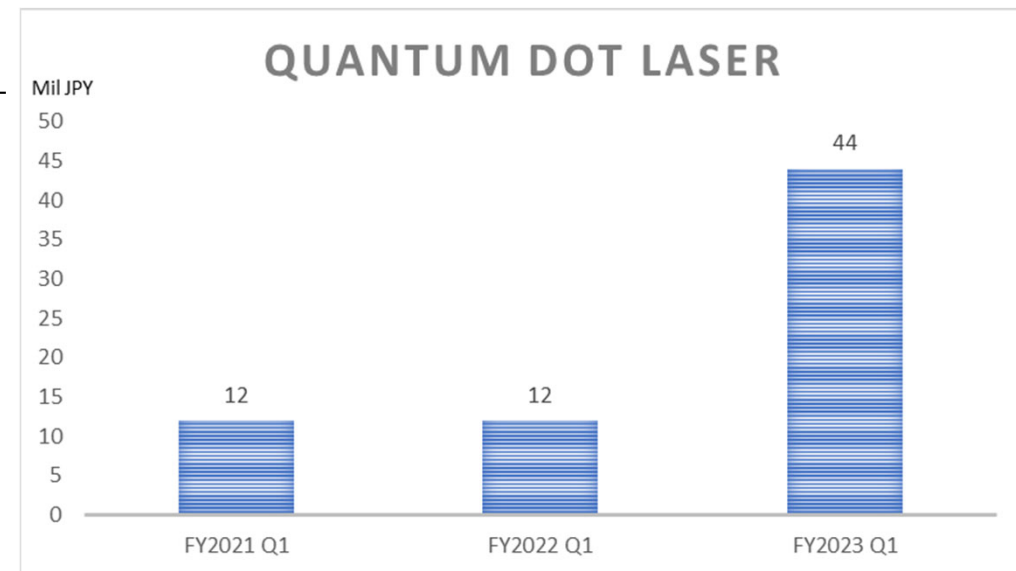


Quantum dot wafer



Quantum dot laser chip

Sales of Q1 in FY2021, 2022 and 2023

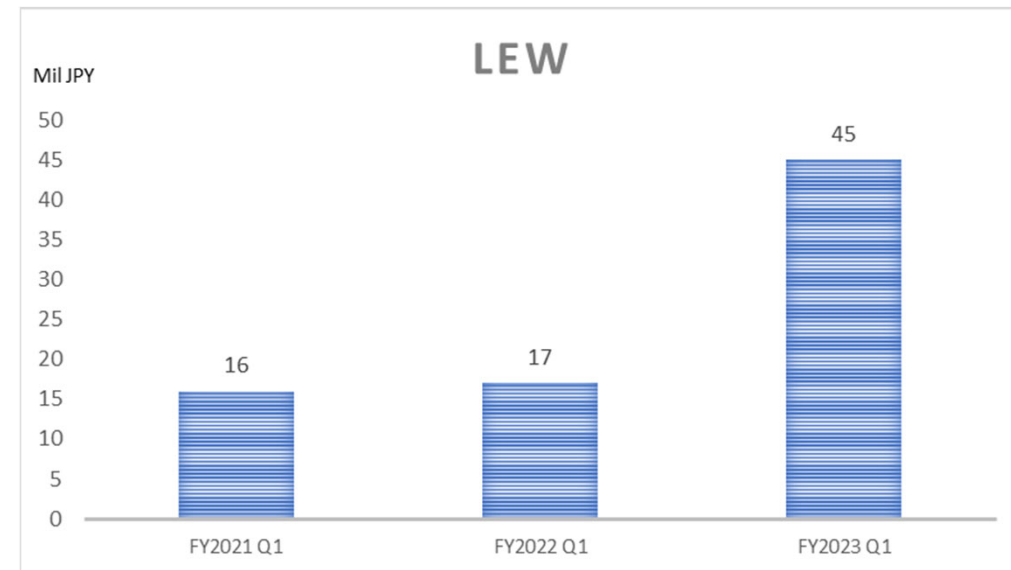


# Laser Eyewear (LEW) : Sales in FY2023-Q1

**45 million JPY sales, increased by 161% YOY.**



Sales of Q1 in FY2021, 2022 and 2023



## ■ Released three new products “MEOCHECK,” “NEOVIEWER,” and “ON HAND.”

- RETISSA MEOCHECK (Released on February 1<sup>st</sup>.)
  - Sales through NIHON GANKA IRYOCENTER CO., Ltd. as a sole agent
  - "Vision Health Check Service" to 3,000 staff of Nihon Kotsu Co., Ltd.
- RETISSA NEOVIEWER (Released on March 24<sup>th</sup>)
  - Released as a bundle "DSC-HX99 RNV kit" with a Sony digital camera
  - Available at five Sony stores nationwide
  - Shipped to SONY USA in June
- RETISSA ONHAND (Released on March 25<sup>th</sup>)
  - Sales through domestic sole agents in the field of government and welfare
  - Promoting to public facilities such as libraries

## ■ RETISSA Display II+RD2CAM

- Sold through distributors such as SEED and various EC channels
- Gradual expansion of certification and informal offers on subsidies for daily life tools - Setagaya, Nakano, Edogawa

## ■ Commissioned development

- Undergoing elemental technology development for next-generation retinal laser imaging eyewear (smart glass) under collaboration with TDK, NTT Laboratories, mobile device manufacturers, etc.
- Development of fundus imaging camera (SLO) for medical device application under the partnership with University Tohoku COI-NEXT.



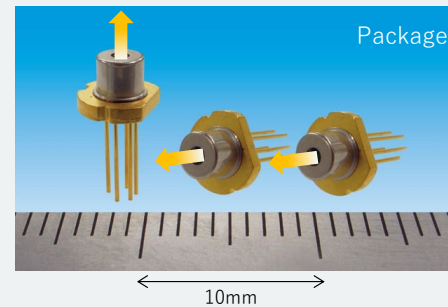
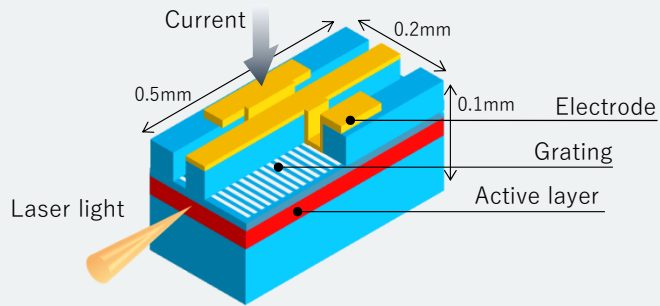
# 02

## Semiconductor Laser Devices

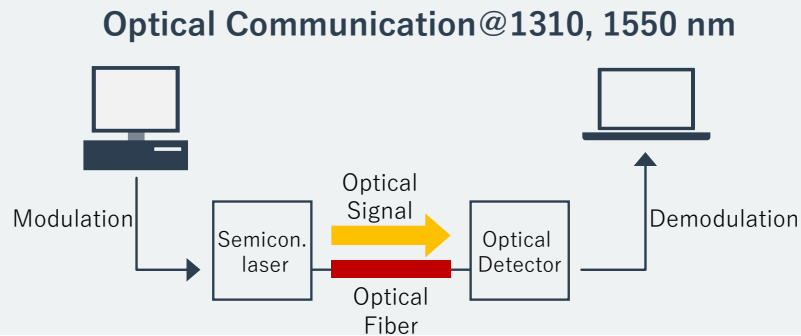
Solid Earnings Base and High Growth Potential  
under Global Laser Market Expansion

# What is a Semiconductor Laser?

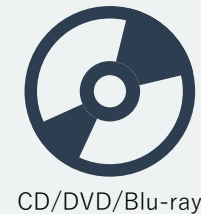
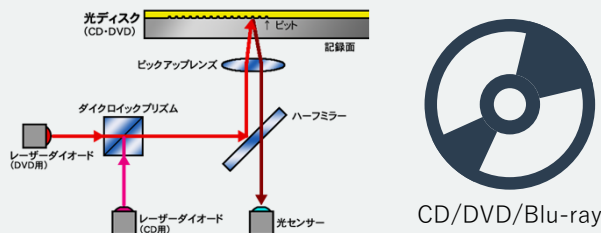
A tiny device to provide laser light by injecting an electric current through a semiconductor.



**First Large-Scale Applications of Semiconductor Lasers: Optical communication and optical recording have significantly contributed to the global information and communication infrastructure.**



**Optical Recording@660nm, 450nm**



# Expected Role of QD Laser, Inc.

## Semiconductor Laser History and Our Position in the 3<sup>rd</sup> Phase

### 1<sup>st</sup> phase

#### Proposals of Scientific Principles and Invention of Laser (1960s)

##### Laser

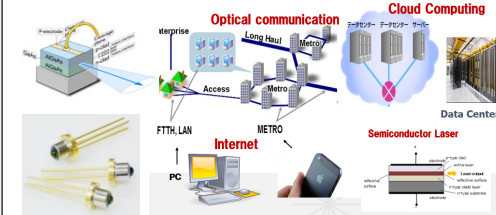
A technology used in recording, communication, processing and sensing.

Applied in various industries such as medicine, home appliances, automobiles, manufacturing and entertainment.

### 2<sup>nd</sup> phase

#### Invention of Semiconductor Lasers, Building out Optical Communication and the Internet (1995~)

##### Semiconductor lasers and packaging



##### Semiconductor laser:

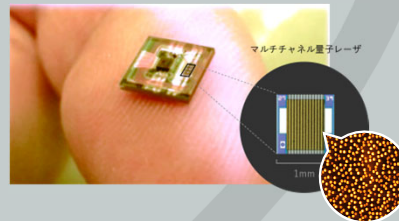
A small element with a length of about 1 mm that causes a laser to oscillate by passing a current through a semiconductor. Compared with other lasers, possesses excellent properties such as ultra-small size, high-speed modulation characteristics reaching several 10s of GHz, high power-to-light conversion efficiency (in several 10s of %), and wavelength controllability, etc.

### 3<sup>rd</sup> phase

#### Accelerating the Integration of Humans and Information (2020s~)

#### **Nanotechnology of QD laser to generate and control laser light**

Image of quantum dots taken by an atomic force microscope and a quantum dot laser equipped on fingertip-sized silicon chip as 100Gbps optical transceiver



##### Quantum Dot Laser:

A semiconductor laser adopting a quantum dot structure which has a semiconductor nano-sized microcrystal in its active layer. Compared with existing semiconductor lasers, these lasers are superior in temperature stability, temperature resistance, and low noise.

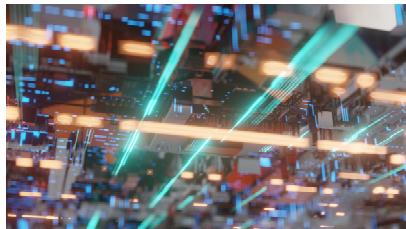
##### Fields where our lasers are applied (being Developed or Commercialized)

- 5G base station
- Supercomputer
- Visual Aid
- Smart Glass
- Optical Interconnect
- Facial recognition
- Fundus photography
- Micromachining
- In-Vehicle communication
- LiDAR for autonomous cars
- Biophotonics
- Visual field testing

# New Era for Semiconductor Lasers

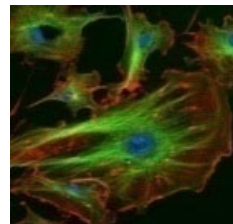
We are developing products for all applications shown below and have launched a part of them.

- **Optical interconnect** ⇒ enhancing the computing and data processing power



- **Sensor** ⇒ Precise detection of human and material (shape, position, velocity)

Biomedical



Face recognition



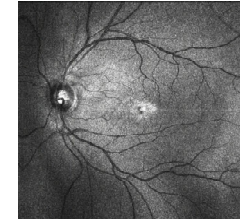
LiDAR (Automotive, Robotics, Drone)



Motion recognition



Fundus, Sight, Field of view



- **Micromachining** ⇒ Highly functional/high precision device manufacturing



- **Display** ⇒ AR/VR/XR

Smart Glasses



Head-up display





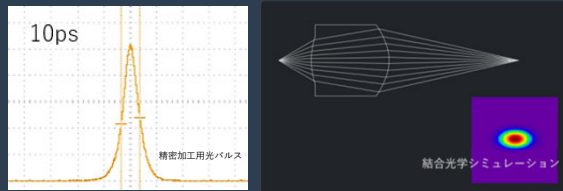
# Our Core Technologies and Competitive Advantages

## Material Creation, Design, and Control

## Cutting Edge Semiconductor Laser Technology with Several Unique Features

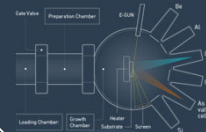
### Laser Design

A technology to design lasers suitable for each use.  
**World's fastest** (10ps)<sup>\*3</sup> semiconductor laser  
 for precision material processing  
 utilizing optical communication technology,



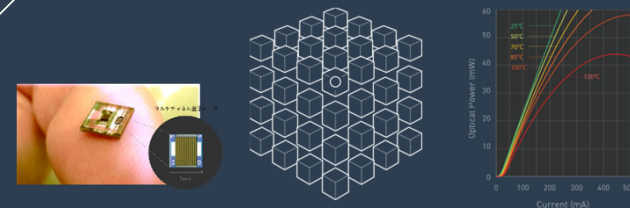
### Semiconductor Crystal Growth

Technology to grow  
 each atomic layer of semiconductor crystals  
 on a semiconductor substrate



### Quantum Dot

Succeeded in the mass production of  
 quantum dot lasers with **world's highest operating temperature**<sup>\*1</sup>  
 and developed **world's smallest silicon-based optical transceiver**<sup>\*2</sup>



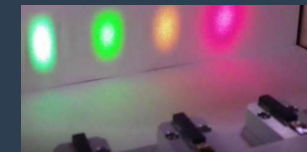
### Small Module

A technology to make DFB lasers ultra compact.  
 Our yellow/orange laser modules led us  
 to become one of the finalists at the Prism Awards 2014.



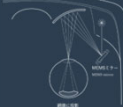
### Diffraction Grating

Technology to form periodic refractive index change inside the laser  
 enabling arbitrary wavelength control.  
**World's first**<sup>\*5</sup> commercialization of yellow/orange semiconductor laser



### VISIRIUM Technology

A technology to project  
 images directly on the retina  
 through ultra small laser projectors.  
**World's First Commercialization**<sup>\*4</sup>



\*1: "Extremely high temperature (220° C) continuous-wave operation of 1300-nm-range quantum-dot lasers",  
 Published in 2011 Conference on Lasers and Electro-Optics Europe and 12th European

\*2: Developed the world's smallest 5mm square ultra-high-speed, low-power-consumption optical transceiver – Achieved the world's best, 25Gbps / ch transmission speed –

\*3: 2017 PRISM Award in Industrial Lasers - QD Laser (2nd Feb 2017)

\*4: Prism Awards honour photonic innovations at Photonics West 2019

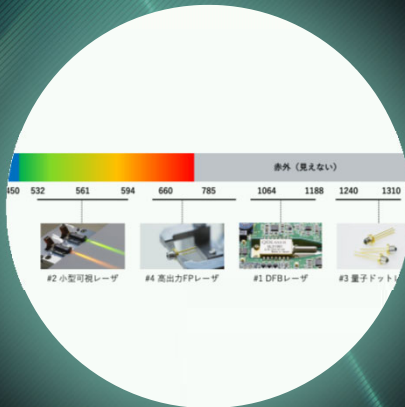
\*5: Japan/U.S. PATENT JP5362301/US8896911

Features of semiconductor lasers developed and offered by QD Laser

01

## Flexible arrangement

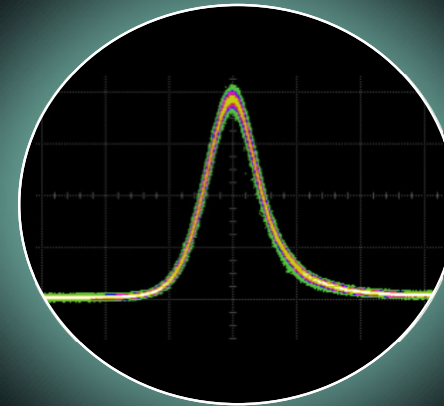
Providing semiconductor lasers with any wavelengths suitable for applications



02

## Stable short pulse

Leading to precision in various applications due to low noise in time and spectrum



Unique manufacturing process by QD Laser

# The only semi-fabless system in semiconductor laser industry

"Horizontal specialization" powered by our core competency of epitaxial growth technology

- Flexible manufacturing scale of several units to tens of millions units
- Converting fixed costs into variable costs
- Mass production and diverse product offering lead to beyond breakeven point



Product design  
Quality control

● Epitaxial growth



● Laser chip process

Partner company

● Chip test



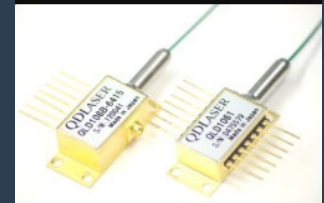
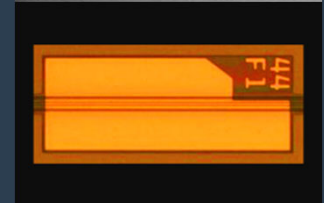
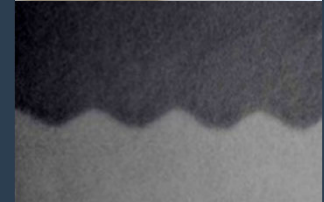
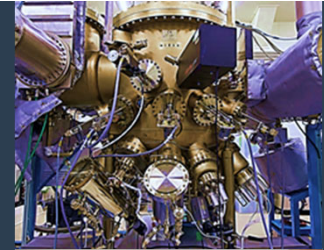
● Module assembly

Partner company

● Final test

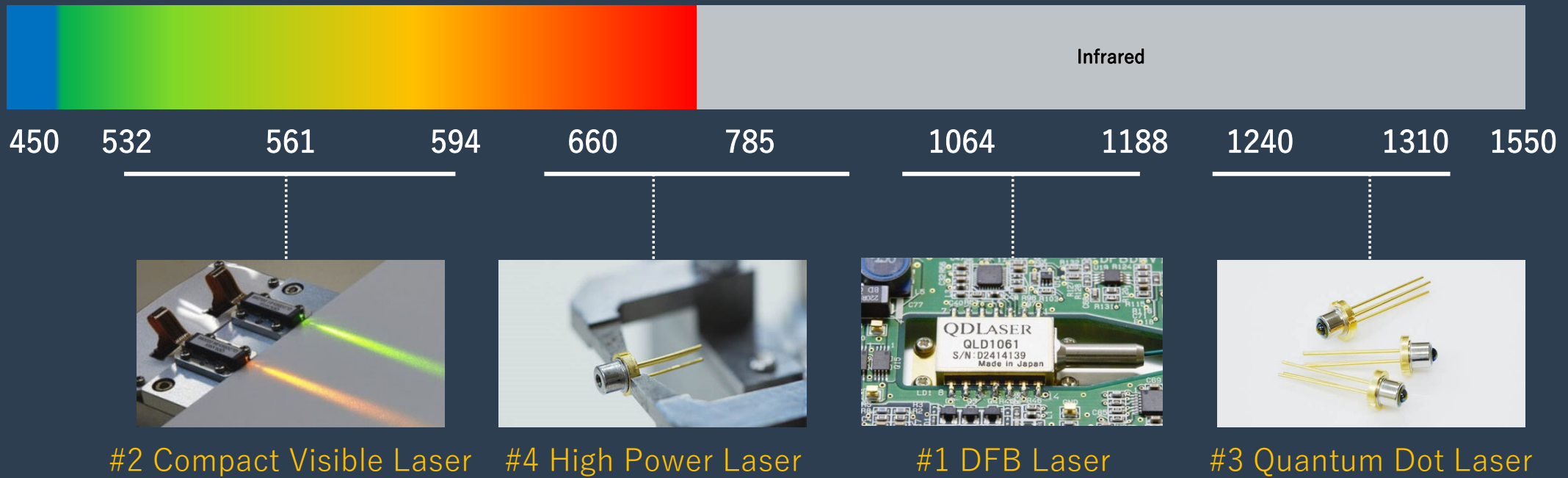


● Product shipment



## Variations on semiconductor lasers developed and sold by QD Laser

QD Laser provides a wide range of semiconductor lasers with wavelengths suitable for each application





# #1



## DFB Laser

- Applications: Laser processing, measurement, and LiDAR.

Amplifies only the wavelength selected by the diffraction grating. **High output power, high stability, and low noise.** Provides the optimum wavelength for a wide range of applications and required performance.

- **Wavelength lineup of** 1030, 1053, 1064, 1080, 1120, 1180nm
- **Provided in 1nm unit**
- Non-heated processing is possible by **short-pulse operation in picoseconds.**
- **Highly stable and low noise** enables high-precision machining and measurement.
- Only a few companies worldwide can manufacture DFB lasers in this wavelength band.

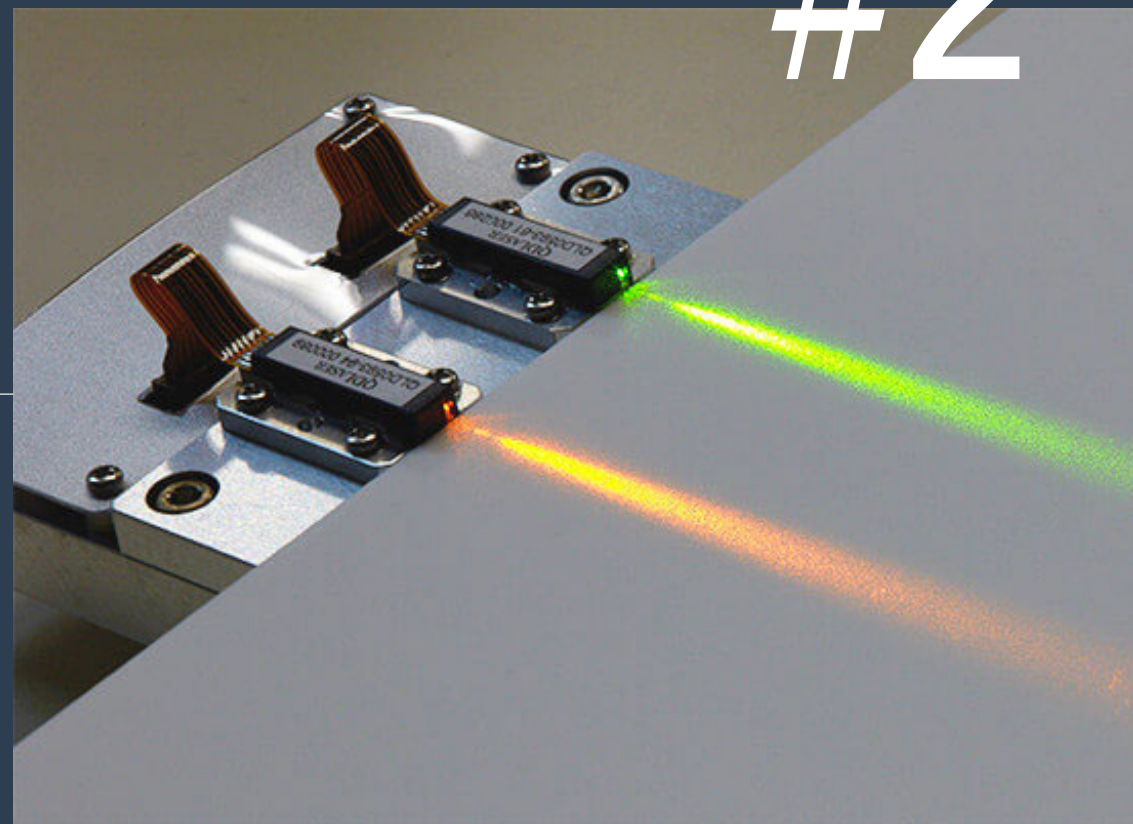
## Compact Visible Laser Small Multi-Color Laser Light Source

- Application : Biomedical

Green, Yellow-Green, and Orange visible laser

The **patented technology** \* 1 realizes a **small device that other companies cannot manufacture**.

- Wavelength lineup of **532, 561, and 594nm**.
- Used for **"flow cytometer", "cell sorter", "laser microscope", "fundus diagnostics"** etc.
- Wavelength range where there is no direct emitting semiconductor lasers.
- Wavelength doubling with a nonlinear optical crystal.
- Unique semiconductor laser chip and wavelength conversion crystal package achieves miniaturization.
- **Low noise and excellent pulse stability**.



\*1 : Japan/U.S. PATENT JP5362301/US8896911

## Growth Strategy of Compact Visible Laser

### ● Current product sales volume and market share

Wavelength (nm)	Color	FY2023-Q1 Sales in units	FY2023 Planned Sales in units	Number of customers	Market share	
532	green	24	24	2	※	
561	Yellow green	1,438	1,697	6	36%	
594	Orange	10	10	1	※	
Total		1,472	1,731	8	18%	※less than1%

### ● Aiming for annual growth of 30% from FY2011 ⇒ 3 measures ⇒ Market share 44% @ FY2027\*

#### 1. Promotion

- Increase in client companies: 8 ⇒ 13 companies
- Increase of introduced equipment: 9 ⇒ 26 models

#### 2. New laser development

- New wavelengths (488nm, 552nm): Market of 11,500 units
- High output power(30 ⇒ 50mW): Market of 3,800 units

#### 3. Solution

- Box module : Market of 10,600 units



- Multicolor light sources(next page) : Market of 12,500 units

\*1For all the devices with the power of less than 50mW

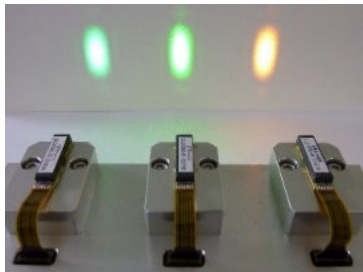


# Launch of Palm-Sized Multi-color Compact Laser Light Source for Biomedical Equipment

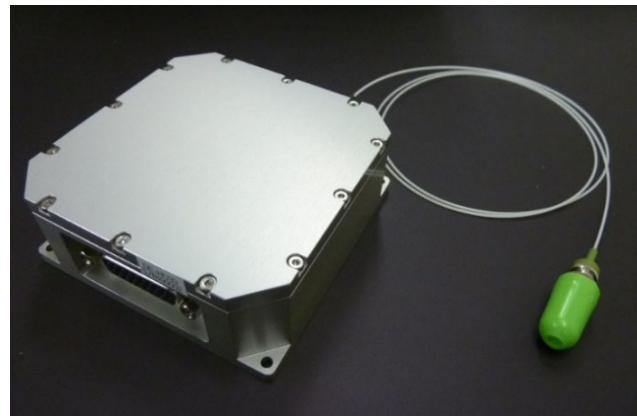
## High value-added solution for biomedical equipment \*1

- This light source provides manufacturers with all laser wavelengths required for any biomedical equipment in one palm-sized compact module \*2 with stable output power and plug-and-play operation.
- This product enables manufacturers to miniaturize their equipment and shorten the development and production period as a new solution.
- Under testing by equipment manufactures.
- QD Laser aims for an industry share of \*3 20% in light sources for biomedical equipment in five years.

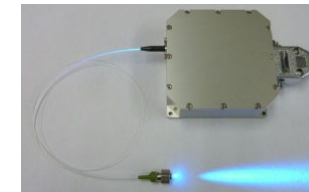
### Compact Visible Lasers



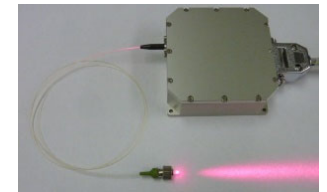
Integrated  
into



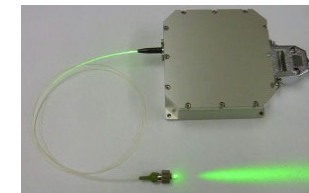
**Palm-Sized Multi-color  
Compact Laser Light Source  
(80 x 80 x t30mm)**



488nm



660nm



561nm



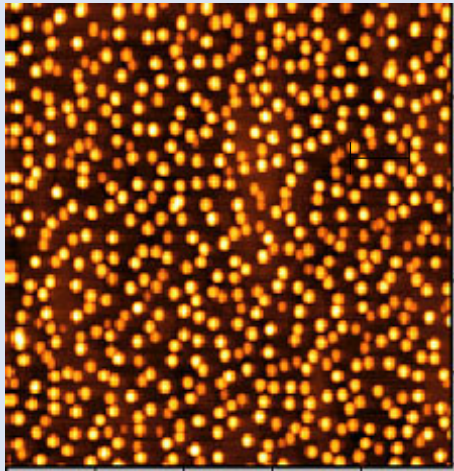
785nm

\*1: Biomedical equipment is flow cytometers, ophthalmic examination equipment, fluorescence microscopes, and the like.

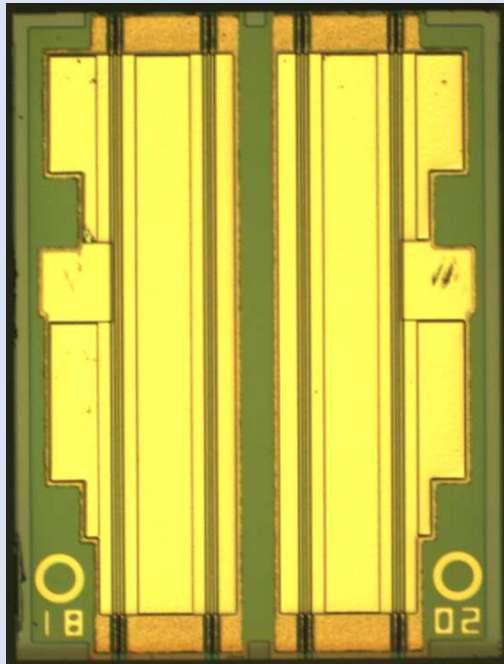
\*2: The total volume of the driver integrated light sources is less than 50% of other company's products.

\*3: Estimated annual accessible market size is 12,500 units. (8,000 out of 16,000 units for flow cytometer based on the "Global Flow Cytometer Market 2020-2024", and 4,500 units for an ophthalmic medical device)

# #3



100 nm



## Quantum-dot laser

- Application : Optical communication, LiDAR, and Silicon photonics.

**Mass-produced** by our world's only technology.

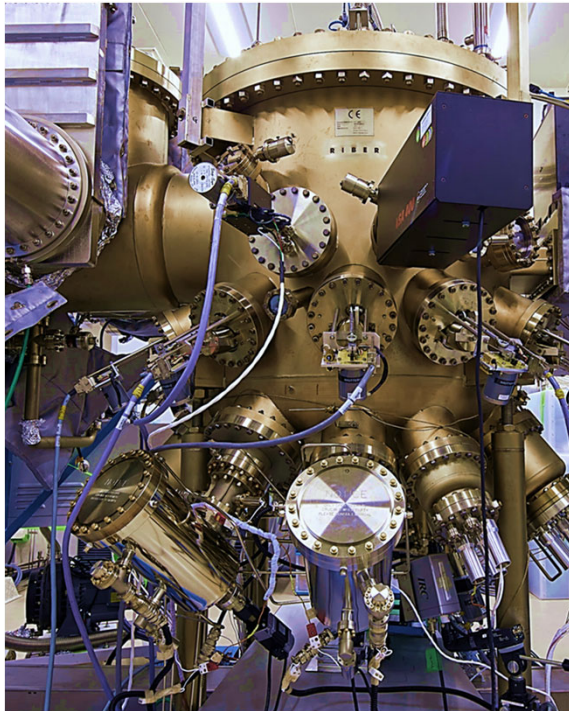
Achieved the **world's highest operating temperature** with excellent temperature stability at 1300nm.

- The wavelength lineup is **1200-1330nm**.
- **Silicon photonics** (optical connector-chip communication, LiDAR) is evolved by quantum dot laser.
- Can operate even in a high temperature environment **of 150-200 ° C** . The operating limit temperature of a normal semiconductor laser is 80-100 ° C.
- Can be used in **high-temperature environments such as servers, wireless base stations, and automobiles**.
- **Excellent reflected return light resistance**, leading to miniaturization by eliminating isolators.

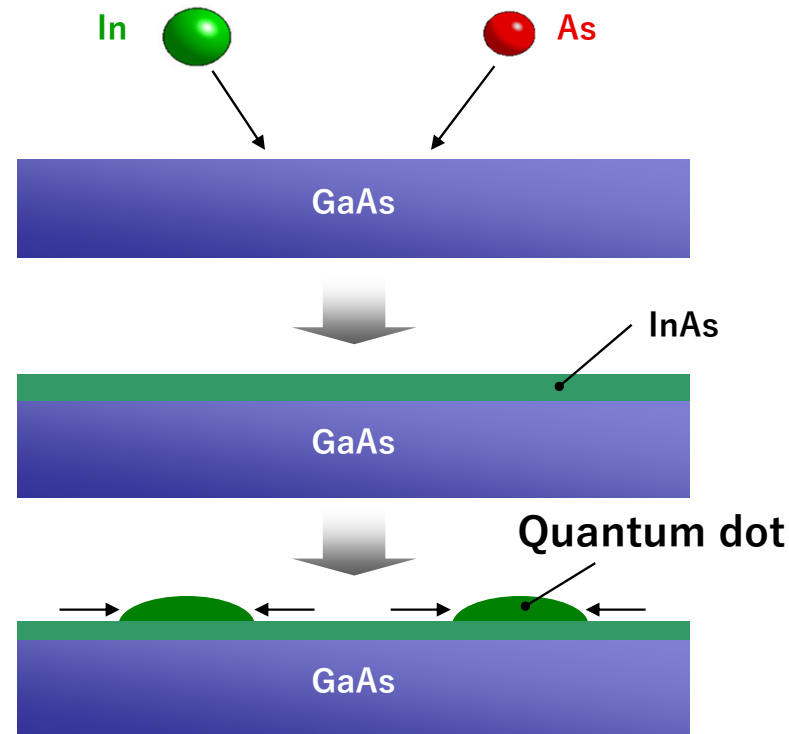
# QDLaser's World Only-One Mass-Production Technology of Quantum Dot Lasers

- Introduction of mass-production MBE (Molecular Beam Epitaxy) system
- Control of temperature, indium source supply, and arsenic pressure at each second.
- Material recipe and know-hows for optimum growth conditions with several-tens-of-years experience (secret internal techniques which are intentionally not patented)

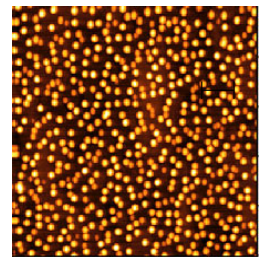
Mass production MBE system



Growth sequence of quantum dots (illustration of side view)



Atomic force microscope (top view) of quantum dots



100 nm

# Tangible Silicon Photonics Market as Electronic / Optical Integrated Circuit Technology Platform

Received orders of 60,000-unit quantum dot lasers for mass production.

Customizing quantum dot lasers for Japan/US/EU silicon photonics vendors.

## Development and production

2010

World's first mass production of quantum dot laser for optical communication

2012

Started development of quantum dot laser for silicon photonics

2017

Established mass production system of quantum dot lasers for silicon photonics (supplied to AIO Core Co., Ltd.)

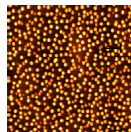
2019

Our products installed in the "Ultra-thin connector integrated active optical module (I-PEX EOM)" developed by I-PEX

2023

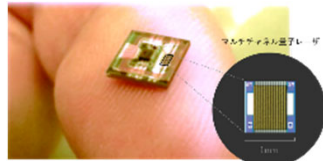
Received orders of 60,000pcs quantum dot lasers for mass production. Start shipment in May 2023.  
Working on joint development with silicon photonics vendors around the world.

## Quantum Dots

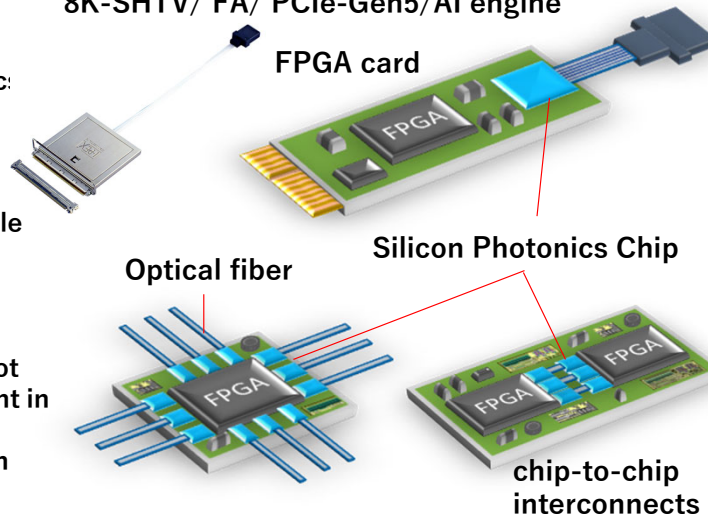


100 nm

100Gbps optical transceiver with quantum dot lasers as light sources



Optical Connector(EOM<sup>\*1</sup>,CPO<sup>\*2</sup>) : 8K-SHTV/ FA/ PCIe-Gen5/AI engine



## Roadmap of mass production

### Phase 1: Lower production cost (2023-2024)

2023

Started mass production of quantum dot lasers for AIO Core Co., Ltd.  
Lower cost of back-end process

2024

Increase wafer diameter of quantum dot lasers

### Phase 2: Increase production capacity (2024-)

2024

Place PO for mass production MBE machine #3

2025

Investment for increasing production capacity to 1million pcs per year  
Install mass production MBE machine #3

2026

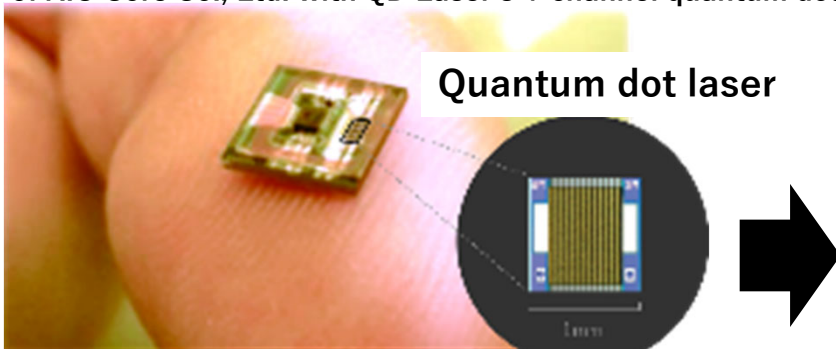
Start mass production with two MBE machines



# IOCore™ with Quantum-Dot Laser Launched for Mass Production

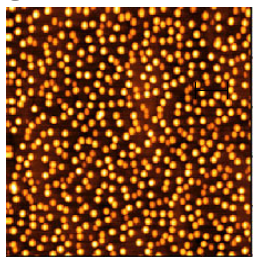
- Installed in IOCore's silicon photonics chip for optical wiring "IOCore™" (commonly known as NPO \*1 )
- Implementation of optical wiring technology contributes to dramatic improvements in computer information processing capabilities essential for AI and the Metaverse

100Gb/s Silicon photonics chip named **IOCore™**  
of AIO Core Co., Ltd. with QD Laser's 4-channel quantum dot lasers



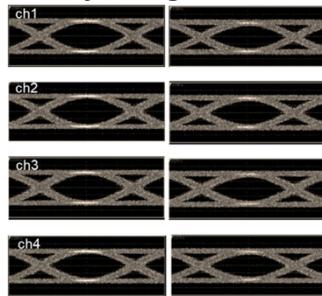
Quantum dot laser

Quantum dots



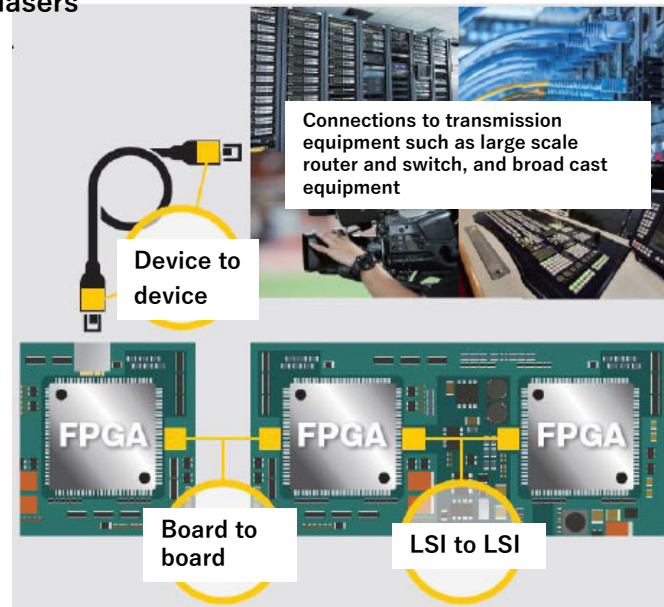
100 nm

Optical eye diagrams at 25Gbps



25°C

105°C



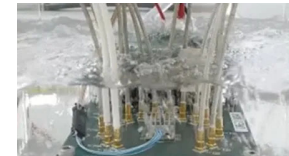
Courtesy of AIO Core Co., Ltd.

Note: Yellow squares show 100Gb/s transceiver Silicon chip

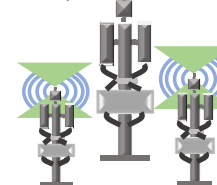
Data center, Server,  
Super Computer



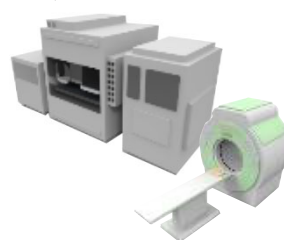
Demonstration of immersion cooling by  
AIO Core Co., Ltd.



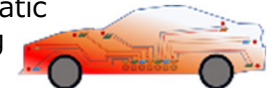
5G/6G



FA, Medical



Automatic  
Driving



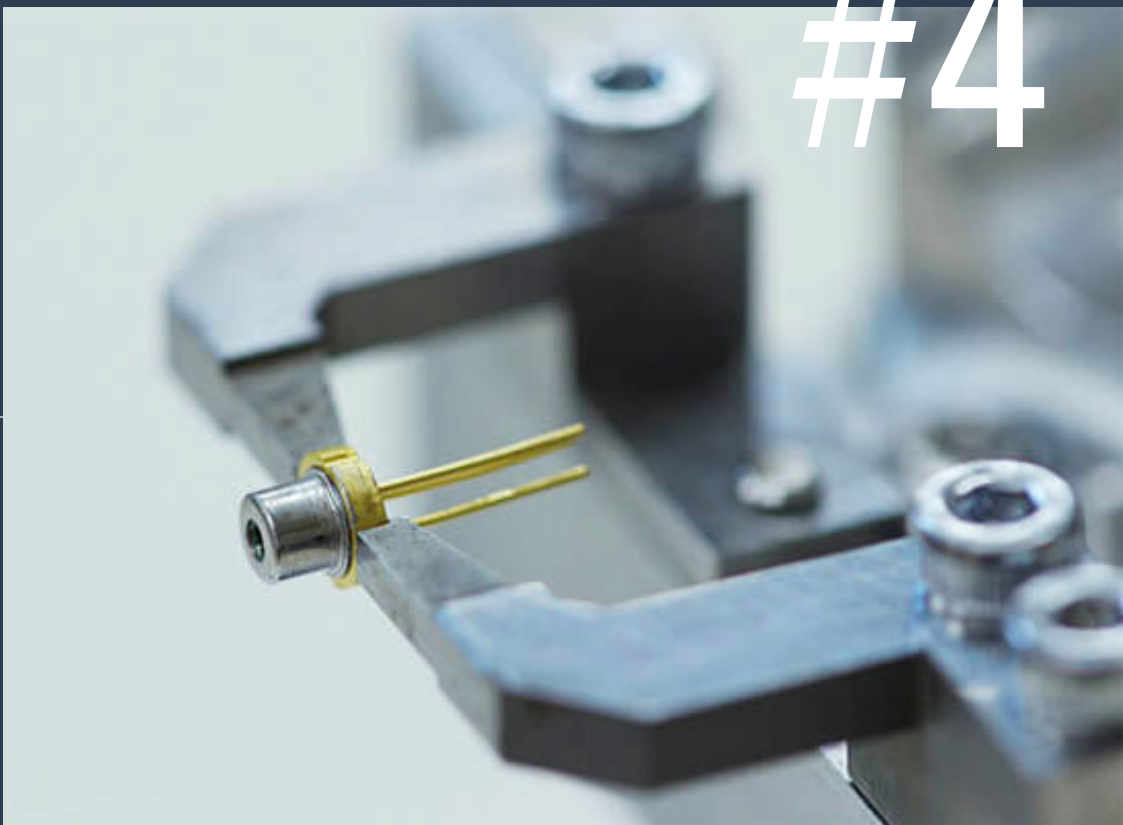
## High Power FP Laser

- Applications : Particle Counter, Leveler, Machine Vision and Factory LiDAR.

Highly reliable and high-quality CW / nanosecond pulse high power laser.

Providing services that meet customer requirements, such as usage conditions and small-quantity support.

- The wavelength lineup is 640-940nm.
- CW and high-power nanosecond pulse drive for a wide range of sensor applications.
- Hearing customer needs on pulse, optical output, reliability, wavelength, and control method to propose optimal products and solution.
- Small quantity production possible.



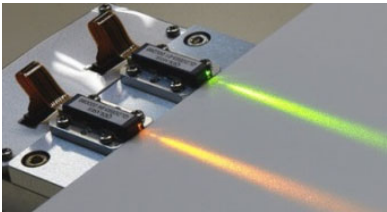
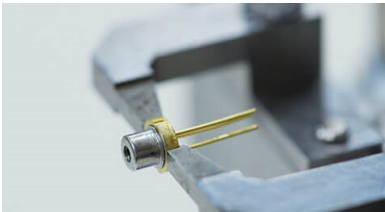


# Our Major Laser Device Products, Wavelengths, Features, and Uses

Compact visible lasers

High power laser

DFB laser

Quantum dot laser

Products				
Wavelength	532, 561,594 nm	640-940nm	1030, 1053, 1064, 1080, 1120, 1180nm 1020-1120nm provided 1nm by 1nm	1200-1330nm
Features	<ul style="list-style-type: none"> <li>Miniature size, low power consumption, stability, short pulse generation, and high-speed modulation, etc.</li> <li>World's first current injection yellow-green and orange lasers</li> </ul>	<ul style="list-style-type: none"> <li>High power Fabry Perot laser</li> <li>Providing products and solutions according to applications.</li> <li>Supports various wavelengths, small quantities, and custom production.</li> </ul>	<ul style="list-style-type: none"> <li>Precise control of wavelength with stable operation under continuous, nanosecond, and picosecond modes.</li> <li>High beam quality, small size, lightweight, high electricity-light conversion efficiency, and long life compared to existing solid-state lasers.</li> <li>Extensive product lineup that meets the various needs of customers.</li> </ul>	<ul style="list-style-type: none"> <li>Quantum dots are used for the active layer (light-emitting part) of semiconductor lasers.</li> <li>Excellent temperature stability, high-temperature resistance, and low noise performance compared to existing semiconductor lasers.</li> </ul>
Use	<div>Measurement</div> <div>Bio.</div> <div>Processing</div> <div>Communication</div> <div>Silicon photonics</div>	<div>Measurement</div>	<div>Measurement</div> <div>Processing</div>	<div>Measurement</div> <div>Communication</div> <div>Silicon photonics</div>



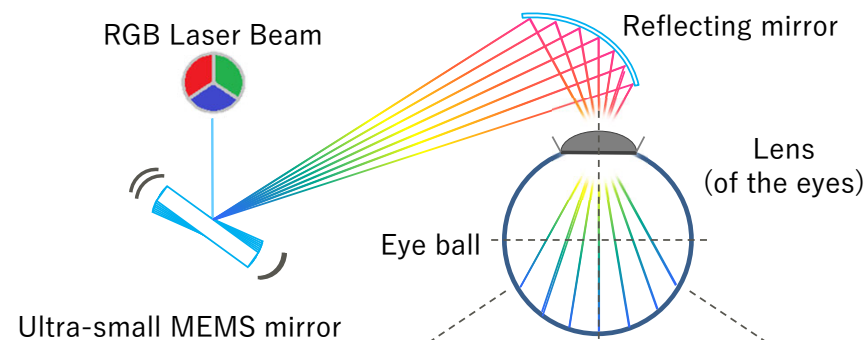
# 03

## Laser Retinal Projection

World's First Commercialization of Laser Retinal Projection Eyewear

# VISIRIUM TECHNOLOGY®

## Unique Laser Technology bringing Innovation to Vision

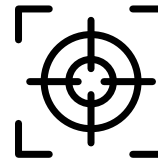


### Direct Image Projection onto Retina



#### Visual experience independent of the condition of your cornea or lens

You can recognize an image clearly even with myopia, hyperopia, astigmatism, or ametropia.



#### Free focus

The focus of both the landscape you see with the naked eye and the image projected by our glasses can be superimposed on the retina. This is a unique feature not found in other AR glasses.



#### Enables vision even in the periphery of the retina\*1

Since the image is in focus even over a wide area of the retina, we expect that it can also be effective for patients with retinopathy.

## Three Areas based on Retinal Projection Technology

Transforms  
“hard to see”  
to “visible”

**Low Vision Aid**

Extend the healthy  
lifespan of your vision

**Vision Health Care**

The power of  
“vision” broadens  
your world

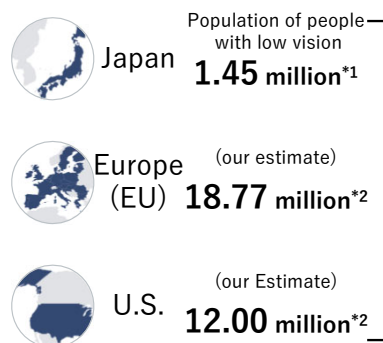
**Augmented Vision**

# Low Vision Aids : Total Addressable Market (※Anterior eye disease patients only : Ametropia and corneal opacity)

**JPY 900 bn (USD 8.6 bn) Market in Japan, U.S. and Europe**

**Plan to Expand into Other Countries like China further behind in Ophthalmic Technologies**

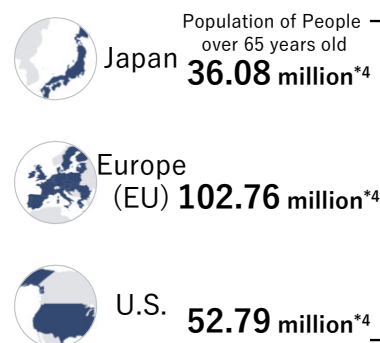
## Low Vision Market



Estimated percentage of applicability (our estimate)\*3  $\times$  **11%**  $\times$  Product Price per Unit (our assumption)\*6 **JPY 200k (USD 1.9k)**

Total market size of advanced countries (Our estimate)  
**JPY 708.7 bn (USD 6.7 bn)**

## Senior Citizens Market



Estimated percentage of applicability (our estimate)\*5  $\times$  **1%**  $\times$  Product Price per Unit (our assumption)\*6 **JPY 100k (USD 950)**

Total market size of advanced countries (our estimate)  
**JPY 191.7 bn (USD 1.8 bn)**

**JPY 900 bn (USD 8.6 bn)**

\*1: Japan Ophthalmologists Association "Social costs of visual impairment in Japan"

\*2: Calculated by multiplying the ratio of persons with low vision sourced from WHO "Visual Impairment and Blindness 2010" by the current population in each region (Europe: Eurostat "Population on 1 January", U.S.: United States Census Bureau "Annual Estimates of the Resident Population for the United States")

\*3: According to the survey by Santen Pharmaceuticals, the number of keratoconus patients in Japan is estimated to be 60,000 to 120,000; also, as the data on p.39 shows that the prevalence per 100,000 people of keratoconus is almost the same as that of corneal opacity, it is assumed that the number of corneal opacity patients in Japan is similar to that of keratoconus patients. Assuming the number of patients suffering from each of these diseases to be an intermediate value of 80,000, the total is calculated to be 160,000; then, we apply the estimated percentage of applicability of 11%, calculated by dividing 160,000 by the population of persons with low vision (1,450,000), to each country's population of low vision persons. This percentage only takes into account anterior eye diseases; therefore, if our product is also effective for patients with retinal disease, the estimated percentage of applicability is expected to increase.

\*4: Assuming that all the elderly aged 65 and over use near-sighted, presbyopic or bifocal glasses, we can estimate that each country's population aged 65 and over can be the potential population of persons with gap vision (Japan: Statistics Bureau of Japan "Population Estimates May 2020", EU: Eurostat "Population on 1 January by broad age group and sex", U.S.: United States Census Bureau "Population by Age and Sex: 2019").

\*5: Due to the products' similarity in characteristics to hearing aids (used by the elderly on a daily basis, wearable equipment, sold at glasses stores, etc.), the hearing aid market is used as a reference to estimate the percentage of applicability. Given that the number of hearing aids shipped in Japan in 2017 numbered 562,747 (Japan Hearing Instruments Manufacturers Association "2018 Shipment Volume of Hearing Aids"), this number divided by the number of elderly people in Japan will give us an estimate that 1.7% of the elderly purchased a hearing aid, which we then adjust conservatively to assume an estimated percentage of applicability of 1.0% which can then be applied to each country's population of gap vision persons.

\*6: Expected price per unit after the mass production is realized.

# World's First Laser Retinal Projection Eyewear

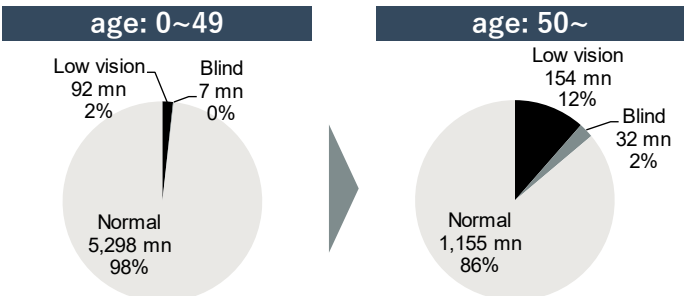
In the Low Vision Aid Space where Innovation has been Minimal, Laser Technology makes a Breakthrough

# 250mn people

with Low Vision Globally<sup>\*1</sup>

Currently they use magnifying glasses, video magnifiers, and telescopes daily. These tools are limited in use, have operational, issues and are not suitable for all users.

Here, we will make a breakthrough with our laser retinal projection technology.



GLOBAL DATA ON VISUAL IMPAIRMENTS 2010, WHO



"Papa, you have grown old, I can see the wrinkles on your forehead."<sup>\*2</sup>



QD LASER

\*1:  
\*2:

WHO Definition: Low vision is defined as the best-corrected visual acuity of less than 0.3 in the better-seeing eye. Blindness is defined as the best-corrected visual acuity of less than 0.05 in the better-seeing eye. Translated from German

# RETISSA Series : Eyewear Products

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## Continued sales of RETISSA Display II as a main product



### RETISSA Display

- Announced in January 2018 and released in July 2018 as the first commercialization of VISIRIUM technology.
- The world's first commercial launch of a wearable display with a built-in retinal scanning projector using semiconductor lasers.



### RETISSA Medical

- Obtained manufacturing and marketing approval in January 2020 as a medical device with the laser retinal projection technology.
- Corrects low vision due to irregular astigmatism by projecting images of the built-in camera (clinical trial completed in JAPAN, October 2018)
- Conducted a clinical trial for corneal opacification in Europe and confirmed its efficacy.



### RETISSA Display II

- Wearable display equipped with the 2nd generation VISIRIUM technology, announced in December 2019 and released in March 2020.
- With improved image quality, reduced size and weight, reduced power consumption, and improved usability.
- Optional camera RD2CAM released in August 2021



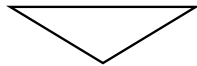
# RETISSA Series Development Status: New Product Launch

---

Released three products equipped with the 3rd generation VISIRIUM technology with wider viewing angle as the main feature, which is a major technological breakthrough in the field of Low Vision Aid.

## 1st/2nd generation

Horizontal viewing  
angle of 26 degrees



## 3<sup>rd</sup> generation

Horizontal viewing  
angle of 60 degrees





# RETISSA ON HAND



## Released in March 2023 as a "retinal projection video magnifier"

- Visual assistance with up to 7x digital zoom and wide viewing angle retinal projection.
- All-in-one design with built-in battery, portable as well as desktop use.
- Sales are being expanded through general domestic agents in the government and welfare fields.  
13 local governments provide benefits as the welfare equipment of daily necessities as of April 2023.
- Promoting introduction to public facilities such as libraries and museums as devices that comply with the Reading Barrier Free Act in JAPAN.
- Collaboration with TRC Library Service Inc. working on contracted operation of 562 public libraries and 19 museums, etc.



# RETISSA NEOVIEWER (RNV)



**Released in March 2023 as a bundle "DSC-HX99 RNV kit" with a Sony compact digital camera**

- Products from the "With My Eyes" project that changes the vision of the low vision into visible.
- Providing the enjoyment of shooting with a high-performance camera equipped with a high-magnification (up to 28x) optical zoom.
- Available for sale at five Sony stores nationwide at the special price of 109,800-yen, tax included<sup>\*1</sup>).
- Launched in the US this summer at the special price of \$599.99<sup>\*1</sup>.



# Sales expansion strategy for products in the Low Vision Aid field

---

## Implement sales expansion activities that match the characteristics of each product in cooperation with partners

### Awareness

- Total renewal of the special site retissa.biz
  - Information dissemination through official Twitter, testimonials, e-mail magazine operation, and influencers
  - Crowdfunding and events with Albinism groups
  - Participation in two COI-NEXT programs (Tohoku University, Tokyo University of the Arts)
- ⇒ We will enhance the content, including videos such as With My Eyes, and continuously disseminate information and spread awareness.

### Touch-point

- Collaborate with partners at exhibitions revived in real life (CEATEC, CES, CP+, etc.)
  - Exhibitions and hands-on events for low-vision (TECHSHARE PRO in the UK, CSUN in the US, etc.)
  - Securing and expanding bases nationwide where equipment can be experienced (Sony stores, optical stores, support facilities for the visually impaired)
- ⇒ In addition to increasing opportunities for hands-on experiences, including rentals, we will enhance purchase routes.

### Reimbursement

- Steadily increasing the number of certifications/provisional offers as daily life tools like enlarged reading devices by local governments.
  - With the efforts of Kaga FEI (agency), RD2 + CAM was selected as a subsidized device candidate in South Korea.
  - As part of the With My Eyes project, a special price was realized by the support of Sony. (RNV)
- ⇒ We will continue our efforts to reduce manufacturing costs and aim to provide products at even more affordable prices.

# Activities to expand sales of products in the Low Vision Aid field

## Promotional content with the cooperation of Mirairo Co., Ltd. and influencers



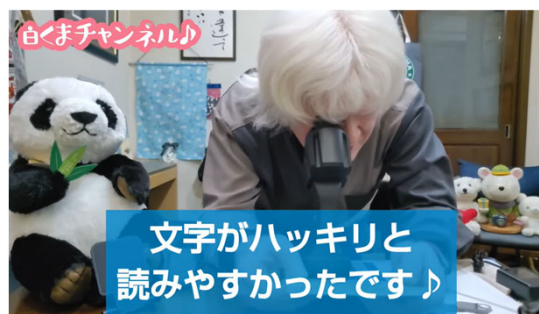
Using RD2 at Sunshine Aquarium  
Channel name : Mirairo Co., Ltd.  
[https://youtu.be/MOtONIOt\\_fE](https://youtu.be/MOtONIOt_fE)



ON HAND at Aeru Observatory in front of  
Sendai Station  
Channel name: Asahi traveling low vision  
<https://youtu.be/q4msEw8856w>



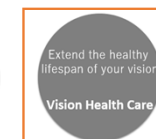
ON HAND in Adventure World  
Channel name: Mirairo Co., Ltd.  
<https://youtu.be/7wDIhm6pjEQ>



ON HAND fastest review  
Channel name: Shirokuma Channel  
<https://youtu.be/ekyH6Ccwfog>



# RETISSA MEOCHECK



## Full-fledged launch of vision healthcare field with eye health check equipment in February 2023

- Aiming for early awareness of eye diseases such as glaucoma, which is the leading cause of blindness in Japan and visual field abnormalities.
- Self-check method that can check vision in about 1 minute per eye to show eye age score.
- In addition to equipment sales through the Nihon Ganka Iryocenter Co., Ltd. (agency), we are launching a service business.
- Nihon Kotsu and Hiroshima Tsubame Kotsu have introduced vision health checks for employees.



## Launch of Vision Health Care field



### **Vision health check service goes through concept verification to the stage of actual introduction.**

- Launched the MEOCHECK service promotion project
- From the trial introduction in FY2023-Q1 to the regular checkups in FY2023

#### Tsubame Kotsu (Hiroshima)



Conducted eye health checks for 300 employees. Encouragement to see an ophthalmologist leads to disease detection and treatment.

#### Nihon Kotsu (Tokyo)

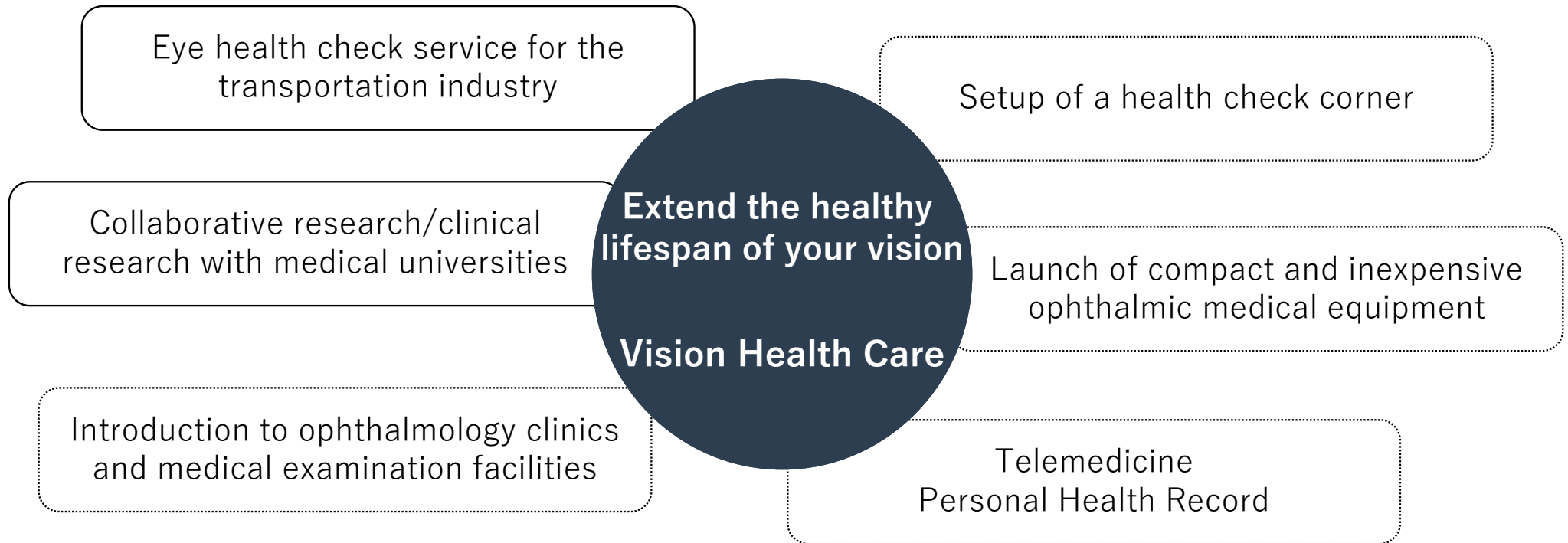


Eye health checks during regular health checkups for approximately 1,000 employees at two business locations, moving toward the full-scale introduction



## Initiatives in the Expanding Vision Health Care Field

Using eye health check device “MEOCHECK” commercialized in FY2023-Q1, and fundus imaging device SLO under development.





## Elemental technology development for next-generation laser eyewear

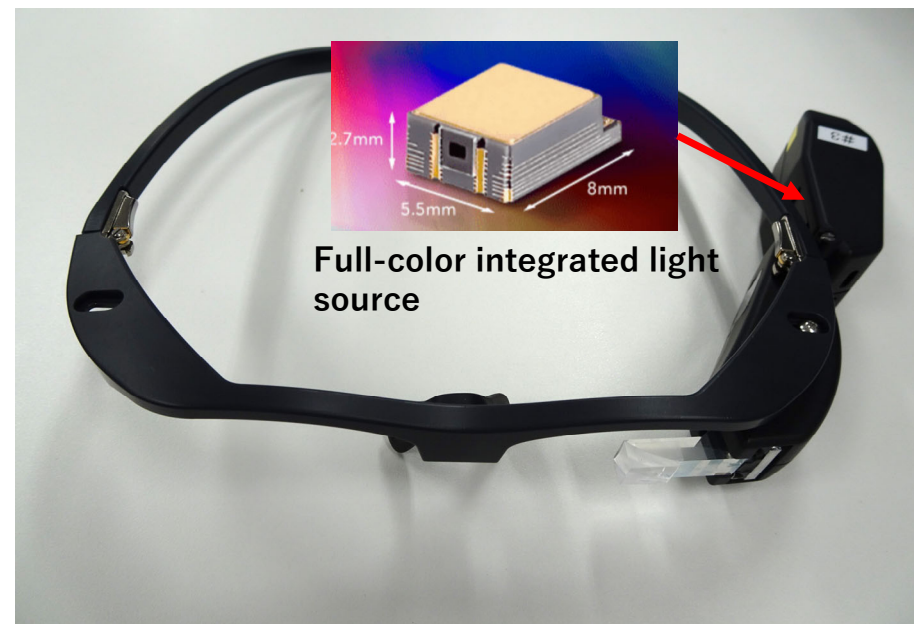


Continuing technical development aimed at the ultimate smart glasses as a commissioned development. Under joint development with many partners such as TDK and mobile device manufacturers.

Compact, low-power integrated scanning light source as a standardized module

High image quality (1080P)

Eye tracking drive system



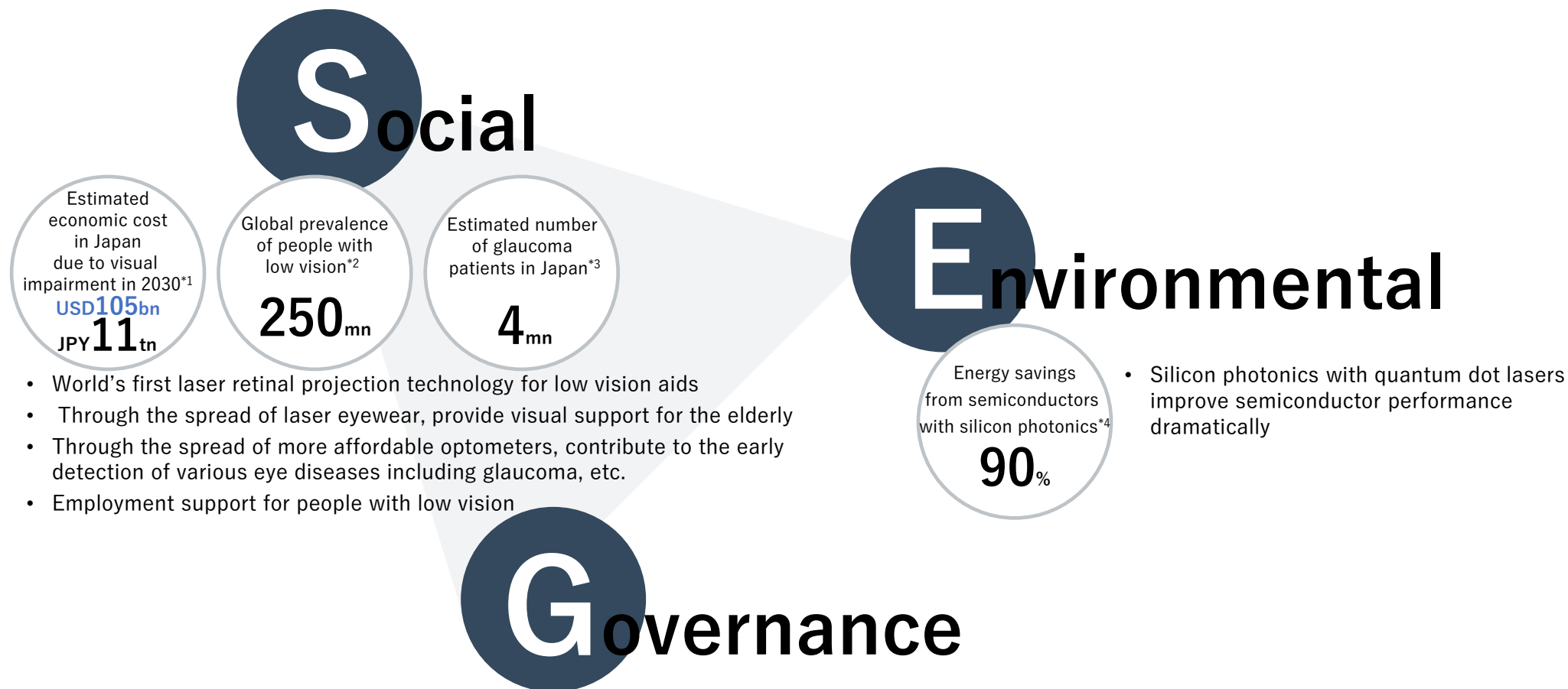
Prototypes exhibited at CEATEC and CES

\*This product is under development, and the timing and price of commercialization are to be determined.

# 04

ESG Initiatives

# Business Development from an ESG Perspective



\*1: Japan Ophthalmologists Association "Economic Cost of Visual Impairment in Japan" and "Prevalence of Visual Impairment in the Adult Japanese Population by Cause and Severity and Future Projections"

Economic cost = Direct health costs + Other financial costs + monetary converted number of loss of well-being from visual impairment (measured in disability-adjusted life years (DALYs))

\*2: WHO "GLOBAL DATA ON VISUAL IMPAIRMENTS 2010"

\*3: Santen Pharmaceutical "Annual Report 2017"

\*4: Target numbers in "Development of Technologies for Super Energy-Efficient Optical Electronics Implementation Systems" Promoted by METI, The Institute of Electronics, Information and Communication Engineers "Opt-Electronics Packaging Technology for Silicon Photonics"

# With My Eyes project

#1 Photographs by low vision people.

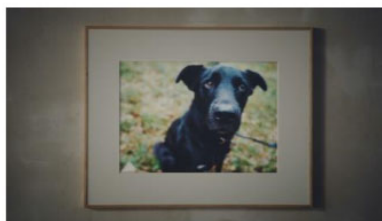
<https://www.youtube.com/watch?v=p5blfs94Oys>

#2 Let's go and see the invisible world.

[https://www.youtube.com/watch?v=ZM52dax\\_5yc](https://www.youtube.com/watch?v=ZM52dax_5yc)

#3 - Discovering a World of My Own -

<https://www.youtube.com/watch?v=lp6a5h6UfxA&t=37s>



# Company Profile

## Spin-off Venture from Fujitsu

## Tier 1 Medical Companies such as Nikon/Santen joined as Shareholders

Company Name	QD Laser, Inc.
Foundation	April 24, 2006
Fiscal year-ended	March 31
Representative	Mitsuru Sugawara, President and CEO
Location	Headquarter: 1-1 Minamiwatarida-cho, Kawasaki-ku, Kawasaki-shi, Kanagawa
Number of Persons*1	43
Business	Planning, design, development, production and sales of semiconductor laser and its application products
Licenses	<ul style="list-style-type: none"><li>• Class II Marketing License for Medical Devices</li><li>• Registration of medical equipment manufacturer</li><li>• ISO 9001</li><li>• EN ISO 13485</li></ul>

**Science and Technology  
Award from the Minister  
of MEXT**

**Prime Minister's Honorary  
Award for Achievement in  
Industry-Academia-  
Governmental Collaboration**



- Graduated from The University of Tokyo; Doctor of Engineering
- 1984: Graduated with a master's degree in Physical Engineering from the Department of Applied Physics, School of Engineering, University of Tokyo; joined Fujitsu Laboratory Ltd.
- 1995: Assumed the role of Senior Researcher at Optical Semiconductor Device Laboratory, Fujitsu Laboratory Ltd.; obtained degree in Eng. from The University of Tokyo
- 2004: Assumed the role of non-tenured professor at the Institute of Industrial Science, University of Tokyo
- 2005: Assumed the role of Deputy Head of Nanotechnology Research Center, Fujitsu Laboratory Ltd.
- 2006: Launched QD Laser Inc.; assumed the role of President and CEO

# Laser Retinal Projection: Diseases and Applicable Rate

Parts of Eye	Major diseases	# of patients per 100k people*1	Total per eye part *1		Possible Efficacy*2	Estimated applicability %*3	Future Outlook	
Anterior eye	Cornea	Corneal angiogenesis	4,000	4,104	◎	Effective on astigmatism and moderate opacity	50%	• May not be applicable in cases of severe opacity  • Focused on obtaining the approvals to marketing medical devices by targeting diseases for which high efficacy can be expected.  • Plan to expand the scope of application with RDII and RDIII on page 25 and the wide-angle viewfinder on page 27.
		Keratoconus	54					
		Corneal opacity	50					
	Crystalline lens	Cataract	47,800	52,900	◎	Effective on near/far-sightedness, astigmatism, opacity, etc. and as the technology does not depend on the function of the crystalline lens	40%	
		Aphakia	5,100					
		Phacocoele	<50					
	Uvea	Uveitis	714	714	△	Effective on astigmatism developed as a complication	10%	
Choroidal neovascularization		<50						
Vitreum	Vitreous opacity	NA	-	○	Effective on low to moderate opacity	20%		
Retina	Epiretinal membrane	28,900	55,614	○	Enlargement and black and white inversion features are effective on macular diseases	30%	• Adaptable to central scotoma by changing the projection position and increasing magnification  • May not be applicable in cases with severe symptoms	
	Lattice degeneration of retina	10,600			Some efficacy is seen in cases where anterior eye disease is also present			
	Hypertensive retinopathy	9,100						
	Age-related maculopathy	3,900						
	Diabetic retinopathy	3,114						AE camera feature is exceptionally effective on photophobia, night blindness, etc.
	Retinitis pigmentosa	<50						
Optic nerve	Glaucoma	3,550	3,865	△	Image downsizing feature is effective on tunnel vision	10%		
	Optic nerve head drusen	200						
	Optic neuritis	115						
Other	High myopia	3,000	3,000	◎	Exceptionally effective	50%	• Can improve by processing images taken by camera	
	Color amblyopia, color blindness	2,500	2,500	○	-	20%		

\*1: These numbers were calculated by research company Lampe & Company in a report we commissioned with reference to scholarly papers published by governments and research institutions from each country. Figures for "# of patients per 100k people" and "Total per eye part" reflect the general research conducted across several jurisdictions and are not necessarily indicative of the number of potential cases in the markets in which we currently operate.

\*2: Based on our assumptions

\*3: Evaluated the "expected efficacy" using a scale: ◎ = 40-50%, ○ = 20-30% and △ = 5-10%.



# Terminology

<b>Semiconductor laser</b>	A compact device with an approximate length of 1mm that causes laser oscillation by passing an electric current to a semiconductor. In comparison with a solid-state laser or gas laser, more micro-miniature in size; higher speed modulation characteristics up to 10GHz; higher photoelectric conversion efficiency achieving several tens of percent and better controllability of wavelength, among other things. Became widely used in the 1980s as a light source for communication systems and optical recording media, such as CDs and DVDs, etc.
<b>Quantum dot laser (QDL)</b>	A semiconductor laser using a quantum-dot structure comprising nanocrystalline semiconductors in its active layer. QD Laser is the only firm in the world to mass-produce QDLs for optical communications and silicon photonics. In comparison to existing semiconductor lasers, it is superior in temperature stability, high-temperature endurance and low-noise properties.
<b>DFB laser</b>	Distributed Feedback Laser: QD Laser's DFB laser is equipped with a diffraction grating which enables laser oscillation at a single wavelength. It is suitable for applications where the light output needs to be concentrated into a narrow wavelength range, such as the seed light of a fiber laser.
<b>Silicon photonics</b>	A technology which integrates an optical circuit with a silicon electronic circuit that has signal processing and memory functions, thus enabling a breakthrough in the processing capacity limitation of the conventional electronic circuit system (achieving 100 times faster processing speed and lower power consumption) and high-capacity data transmission between LSI chips (10Tb/s).
<b>VISIRIUM technology</b>	A technology that projects images onto the retina using precise optical systems, creating different colors flexibly from the three primary laser light colors - red, green and blue.
<b>Diffraction grating technology</b>	A technology that freely and precisely controls the wavelength of semiconductor lasers to fit into various applications by forming periodic irregularities inside the laser.
<b>Ultrashort pulse</b>	A laser with a very short pulse width (duration). It is used for microfabrication and other processes as it can prevent shape distortion due to thermal effects.
<b>Retinal projection</b>	To project images onto the retina
<b>Simple perimeter</b>	A device to assess the visual field of human eyes
<b>CE marking</b>	A certification mark that indicates conformity with standards required to be met by products exported to the EU. The CE mark is granted when a product meets standards in all EU member states.
<b>Flow cytometer</b>	A device capable of measuring certain properties of cells. By irradiating a cell suspension in a tube with a laser beam, it can measure the number and size of a large volume of cells over a short period of time using fluorescence and scattered light parameters. It is used in various fields including molecular biology, pathology, immunology, plant biology and marine biology.
<b>LiDAR</b>	LiDAR (Light Detection and Ranging) is a technology which irradiates an object and uses a light sensor to detect the reflection to measure the distance. It is expected to be used in autonomous driving systems in the future.
<b>Heads-up Display</b>	A technology that projects information and images onto various surfaces, such as glass, within the field of view. It is expected one day to project necessary information for drivers onto the windshield and the like.

## Caution When Handling This Document

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- These statements are based on expectations, forecasts and risk assumptions as of this presentation's publishing, and contain uncertainties that could lead to results that are substantially different from these statements.
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