QD LASER

Explanatory Material on Potential for Growth

July 2023

Mission

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

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.

Company Highlights

1 Business Overview

2 Semiconductor Laser Devices

Solid earnings base and high growth potential due to expansion of global laser market

⇒ Achieved operating profit for eight consecutive terms. Expanding sales of global niche products and starting to grow in the emerging silicon photonics market.

3 Laser Retinal Projection Technology

Commercialization of eyewear utilizing the world's first retinal projection technology

⇒Achieved increased sales by launching three new products that apply retinal projection technology. The "Vision Health Check Service" business started, and the development of smart glasses progressed.

4 Business Growth

Fiscal year ending March 2023, fiscal year ending March 24, medium-term, and medium- to long-term

5 ESG initiatives

Working on business areas directly linked to solving social issues

⇒”With my eyes” project in collaboration with Sony

01

QD LASER

Business Overview

Company Profile

Spin-off venture from Fujitsu. Feb. 2021 TSE Mothers (currently Growth) listing (Securities code: 6613)

Two businesses: semiconductor laser devices and laser retinal projection

Company Name	QD Laser, Inc.
Foundation	April 24, 2006
Fiscal year-ended	March 31
Representative	Mitsuru Sugawara, President and CEO
Number of Persons *1	45
Location	Headquarter: 1-1 Minamiwatarida-cho, Kawasaki-ku, Kawasaki-shi, Kanagawa
Business	・Semiconductor Laser Device business ・Commercialization of state-of-the-art semiconductor lasers for communication, processing, and sensors. ・Development and commercialization of quantum dot lasers for silicon photonics ・Laser Retinal Projection business ・Commercialized the world's first "RETISSA" utilizing laser retinal projection technology ・Entrustment, joint development and commercialization of prototypes utilizing our technology and know-how
Licenses	• Class II Marketing License for Medical Devices • Registration of medical equipment manufacturer • ISO 9001 • EN ISO 13485

QD LASER

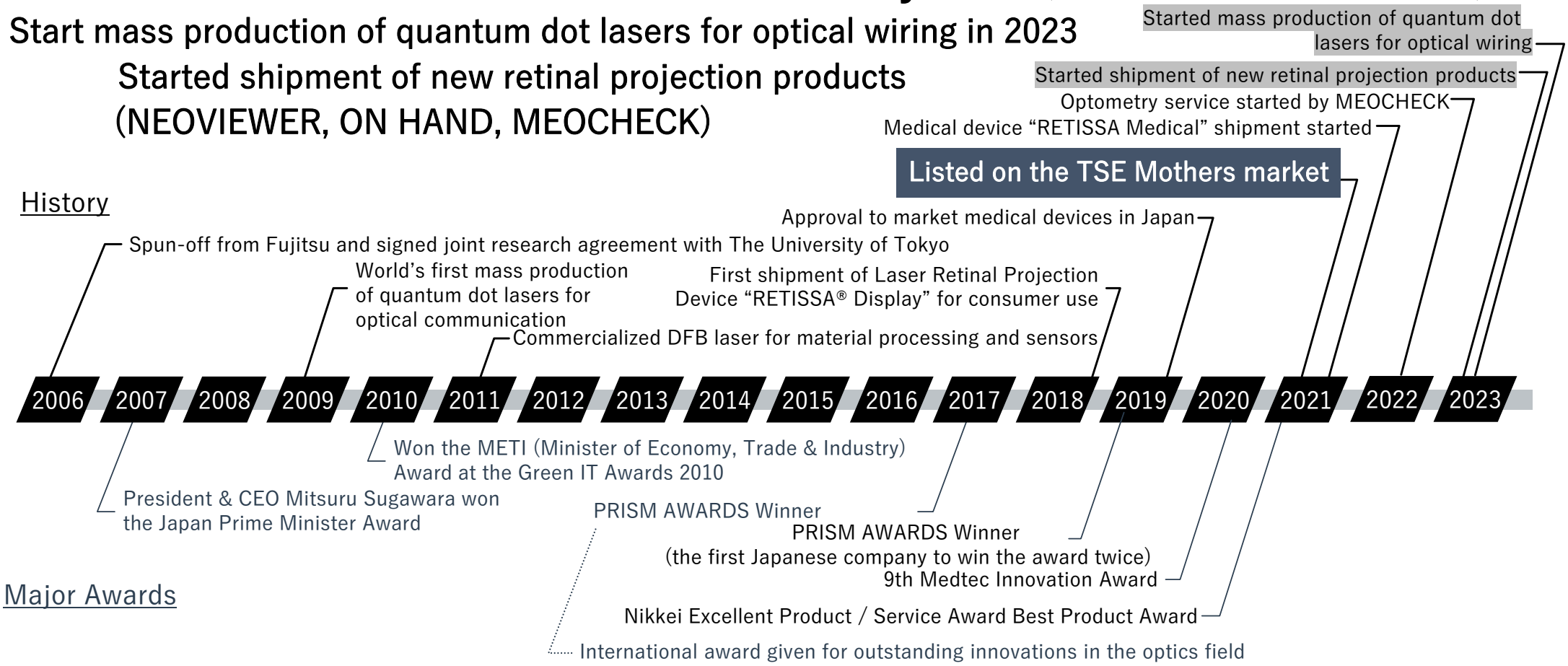
*1: As March 31, 2023. Including 1 employee and officer, excluding 14 dispatched employees.

Company History

Listed on the TSE Mothers market in February 2021 (Securities code: 6613)

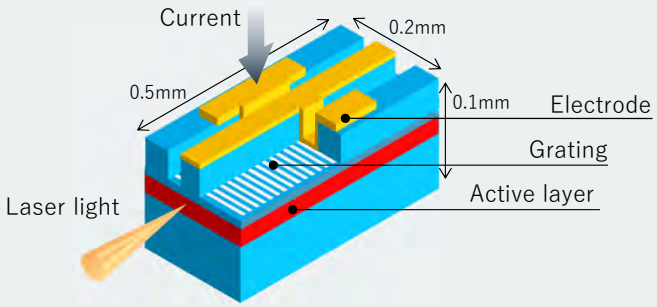
Start mass production of quantum dot lasers for optical wiring in 2023

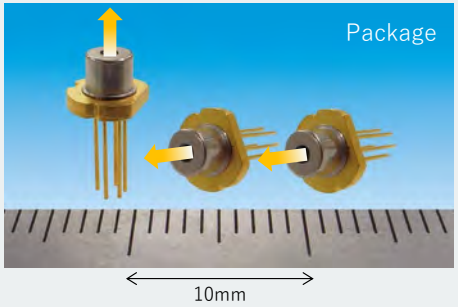
Started shipment of new retinal projection products (NEOVIEWER, ON HAND, MEOCHECK)



What is a Semiconductor Laser?

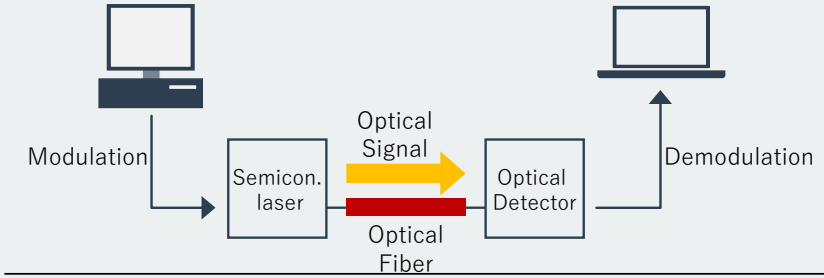
A tiny device to provide laser light by injecting an electric current through a semiconductor.



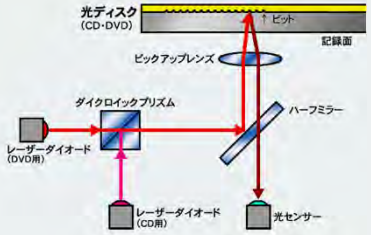


First Large-Scale Applications of Semiconductor Lasers: Optical communication and optical recording have significantly contributed to the global information and communication infrastructure.

Optical Communication@1310, 1550 nm



Optical Recording@660nm, 450nm



CD/DVD/Blu-ray

Expected Role of QD Laser, Inc.

Semiconductor Laser History and Our Position in the 3rd Phase

1st 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.

2nd 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.

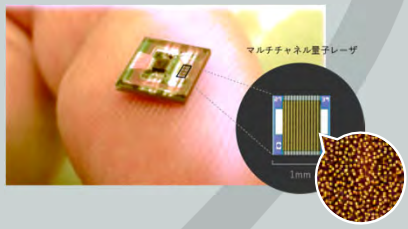
3rd phase
Accelerating the Integration of Humans and Information(2020s~)

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

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.

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**

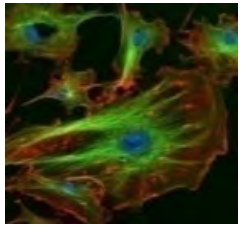
■ **Display ⇒AR/VR/XR**

Smart Glasses

Head-up display

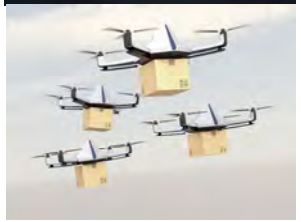
■ **Sensor ⇒ Precise detection of human and material (shape, position, velocity)**

Biomedical



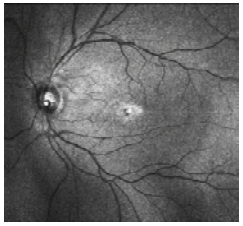
Face recognition

LiDAR（Automotive, Robotics, Drone）



Motion recognition

Fundus, Sight, Field of view



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

02

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Semiconductor Laser Devices

Solid earnings base and high growth potential due to expansion of global laser market

⇒ Achieved operating profit for eight consecutive terms. Expanding sales of global niche products and starting to grow in the emerging silicon photonics market.

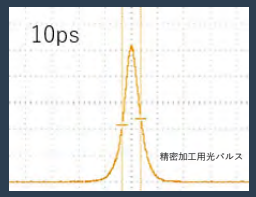
Our Core Technologies and Competitive Advantages

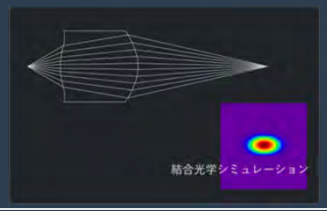
Material Creation, Design, and Control

Cutting Edge Semiconductor Laser Technology with Several Unique Features

Laser Design

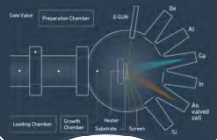
A technology to design lasers suitable for each use.
World's fastest (10ps)*3 semiconductor laser
for precision material processing
utilizing optical communication technology,





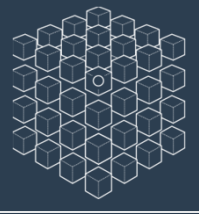
Semiconductor Crystal Growth

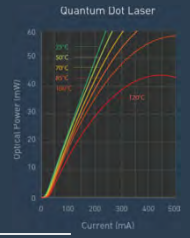
Technology to grow
each atomic layer of semiconductor crystals
on a semiconductor substrate

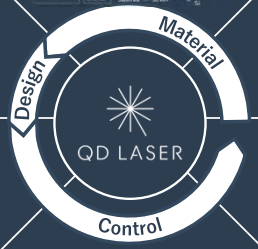


Quantum Dot

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







Small Module

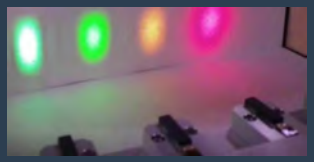
A technology to make DFB lasers ultra compact.
Our yellow/orange laser modules led us
to become one of the finalists at the Prism Awards 2014.

VISIRIUM Technology

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

Diffraction Grating

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



*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

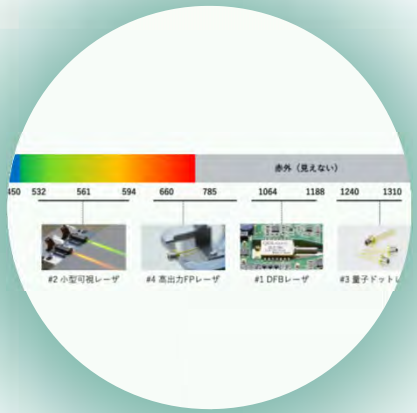
*5: Japan/U.S. PATENT JP5362301/US8896911

Features of semiconductor lasers developed and offered by QD Laser

01

Flexible arrangement

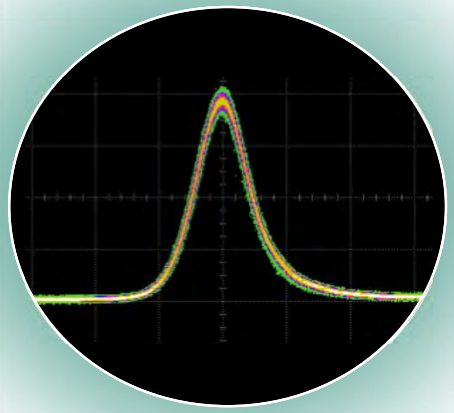
Providing semiconductor lasers with any wavelengths suitable for applications



02

Stable short pulse

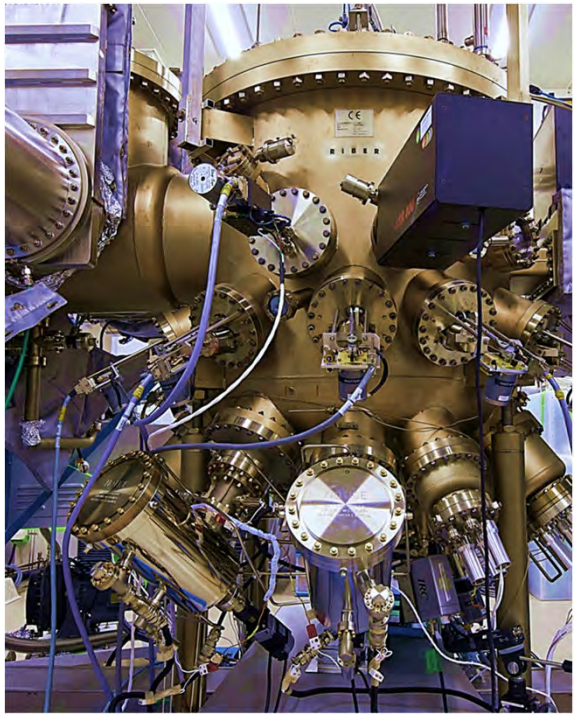
Leading to precision in various applications due to low noise in time and spectrum



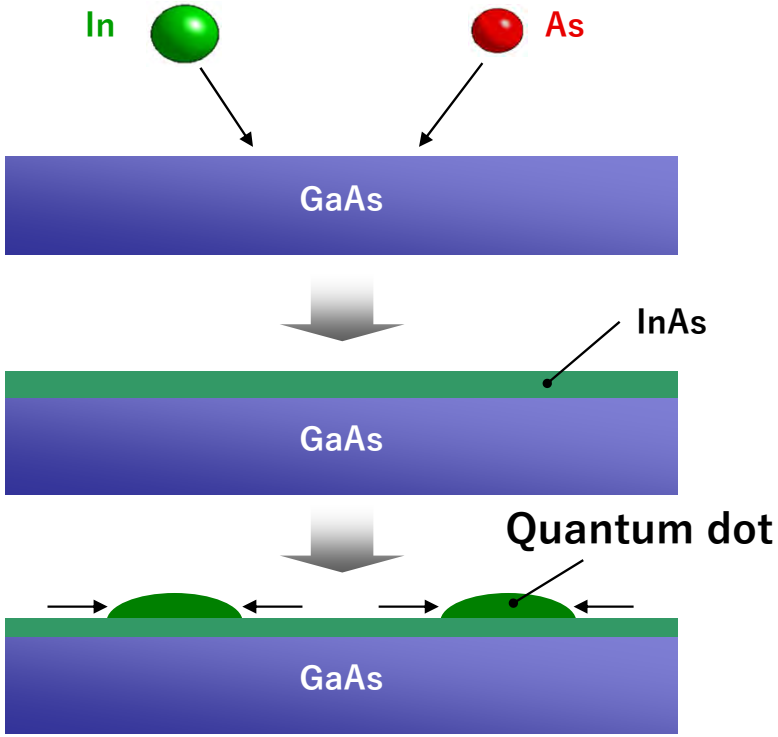
QDLaser's World Only-One Mass-Production Technology of Quantum Dot Lasers

- 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)

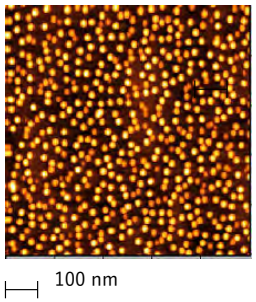
Mass production MBE system



Growth sequence of quantum dots (illustration of side view)



Atomic force microscope (top view) of quantum dots



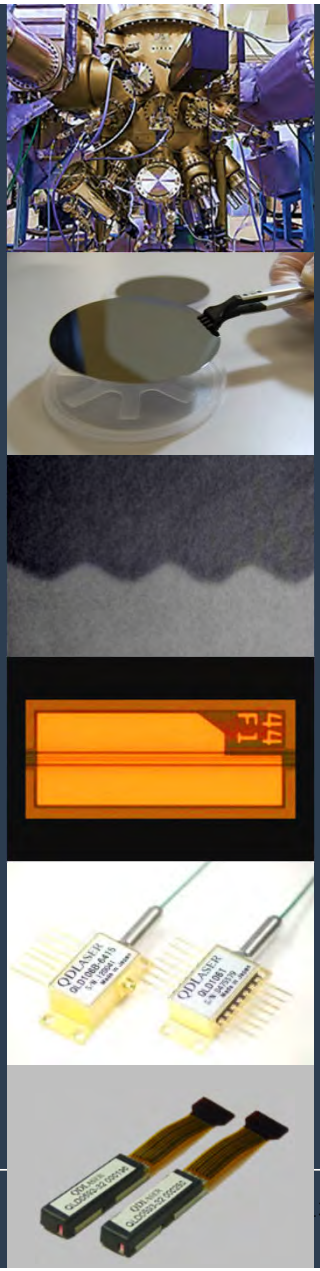
Unique manufacturing process by QD Laser

The only semi-fabless system in semiconductor laser industry

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

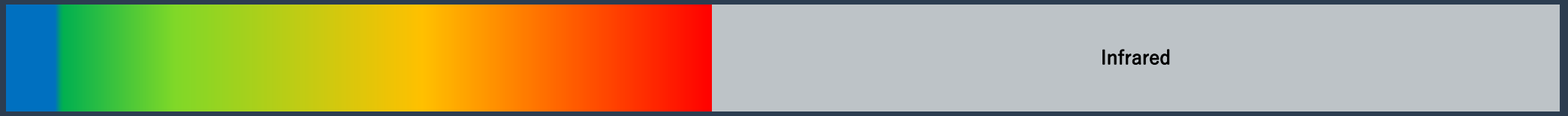
- Flexible manufacturing scale of several units to tens of millions units
- Converting fixed costs into variable costs
- Mass production and diverse product offering lead to beyond breakeven point

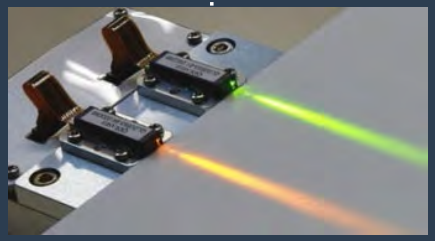
Product design Quality control	QD LASER
Epitaxial growth	QD LASER
Laser chip process	Partner company
Chip test	QD LASER
Module assembly	Partner company
Final test	QD LASER
Product shipment	QD LASER



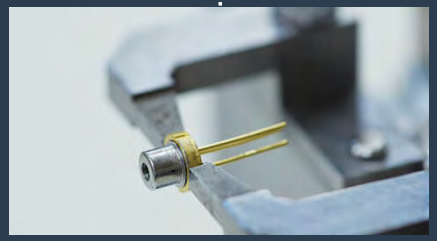
Variations on semiconductor lasers developed and sold by QD Laser

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





#2 Compact Visible Laser

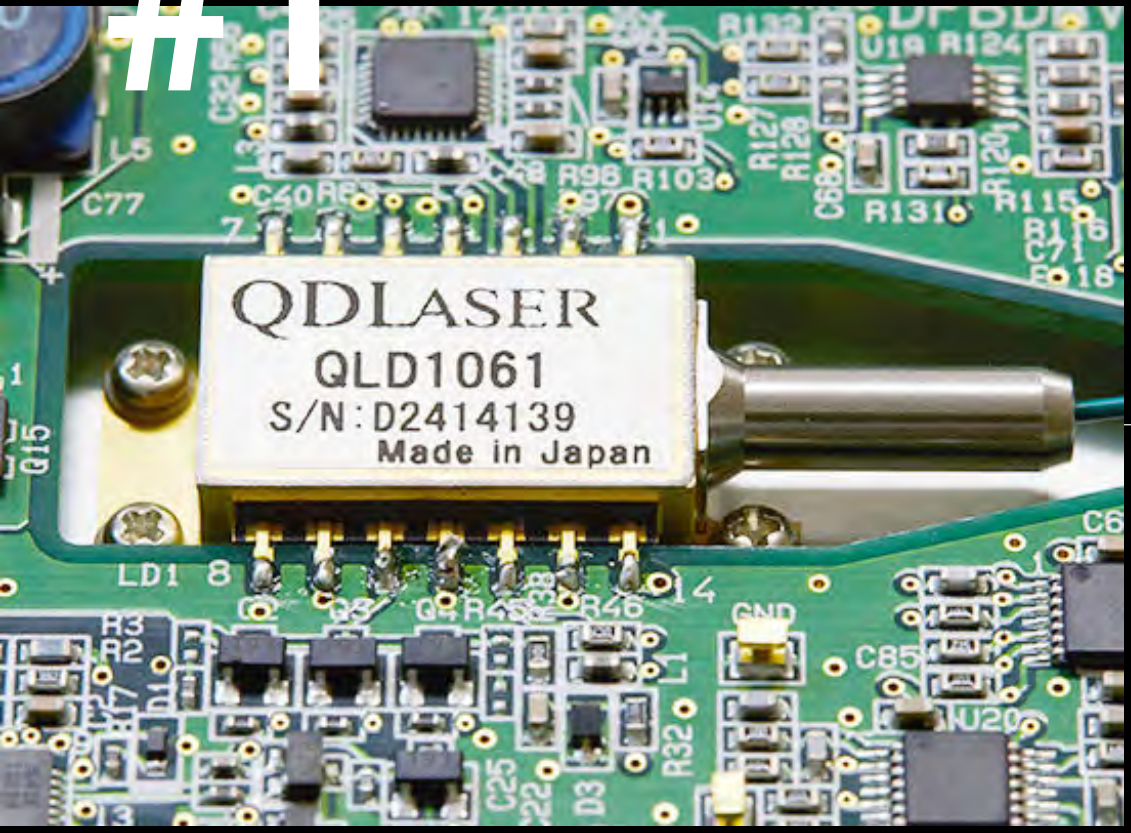


#4 High Power Laser

#1 DFB Laser

#3 Quantum Dot Laser

#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.

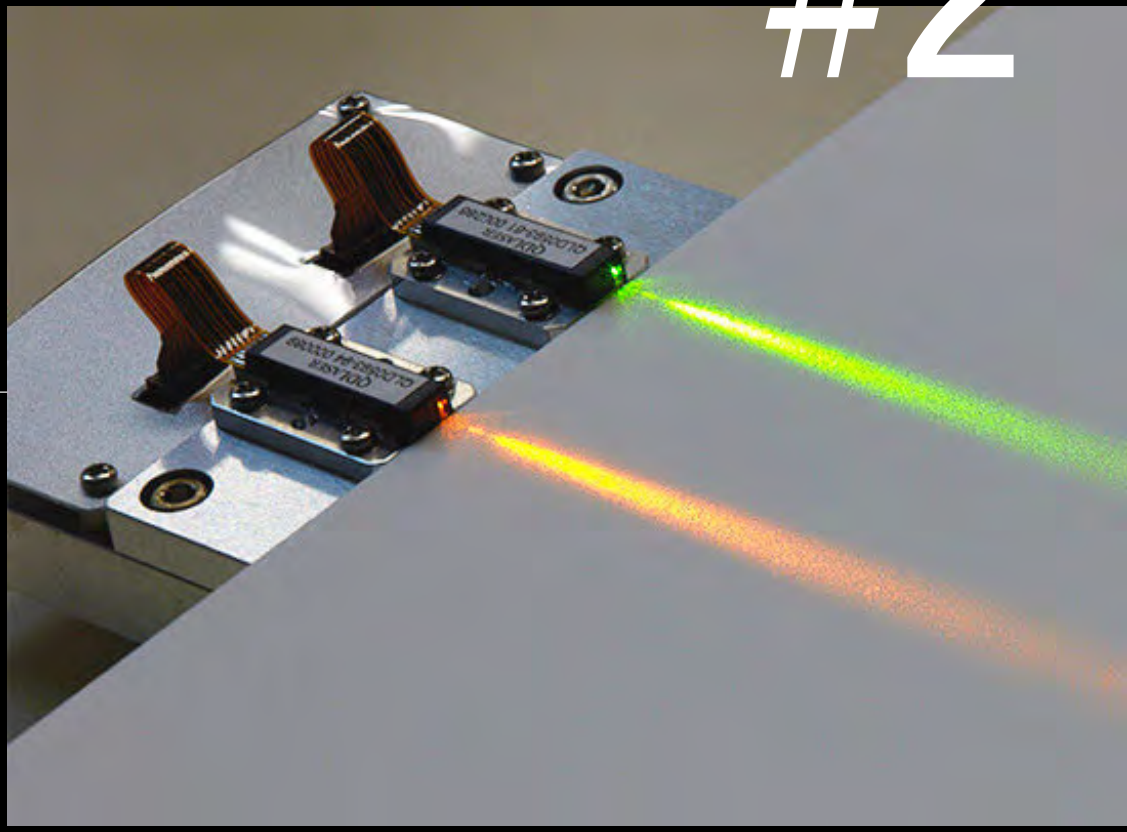
- **Wavelength lineup of**
  1030, 1053, 1064, 1080, 1120, 1180nm
- **Provided in 1nm unit**
- Non-heated processing is possible by **short-pulse operation in picoseconds.**
- **Highly stable and low noise** enables high-precision machining and measurement.
- Only a few companies worldwide can manufacture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

#2

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

Wavelenth (nm)	Color	FY2022 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 *1	18%

※less than1%

- Aiming for annual growth of 30% from FY2011 ⇒ 3 measures ⇒ Market share 44% @ FY2027*2

1. Promotion

・Increase in client companies: 8 ⇒ 13 companies

・Increase of introduced equipment: 9 ⇒ 26 models

2. New laser development

・New wavelengths*3 (488nm, 552nm): Market of 11,500 units

・High output power*4 (30 ⇒ 50mW): Market of 3,800 units

3. Solution

・Box module*5: Market of 10,600 units

・Multicolor light sources*6(next page) : Market of 12,500 units

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*1: Not a simple total because there are customers with overlapping wavelengths
*2: Optical output 50mW or less
*3: Scheduled for commercialization in FY2024
*4: Production increase planned for FY2024
*5: Scheduled for commercialization in FY2024
*6: Scheduled to start mass production in FY2025

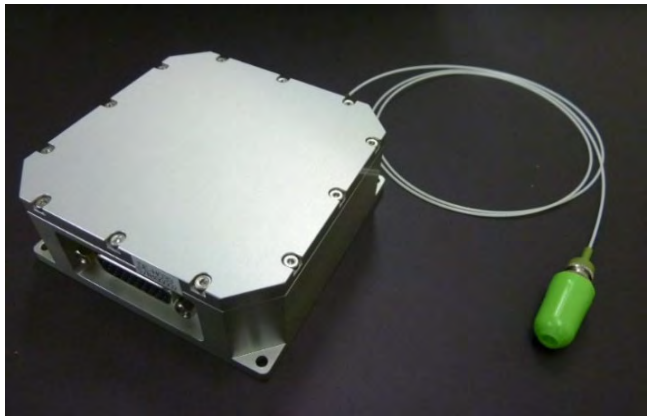
Launch of Palm-Sized Multi-color Compact Laser Light Source for Biomedical Equipment

High value-added solution for biomedical equipment *1

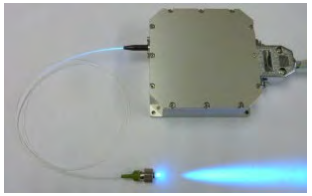
- This light source provides manufacturers with all laser wavelengths required for any biomedical equipment in one palm-sized compact module *2 with stable output power and plug-and-play operation.
- This product enables manufacturers to miniaturize their equipment and shorten the development and production 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

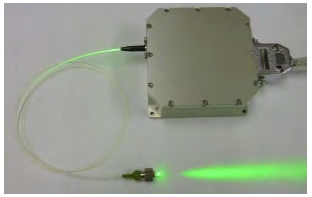
Integrated into



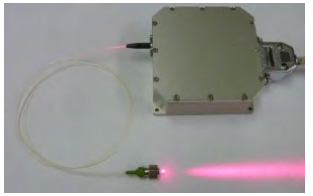
Palm-Sized Multi-color Compact Laser Light Source (80 x 80 x t30mm)



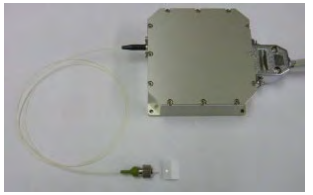
488nm



561nm



660nm



785nm

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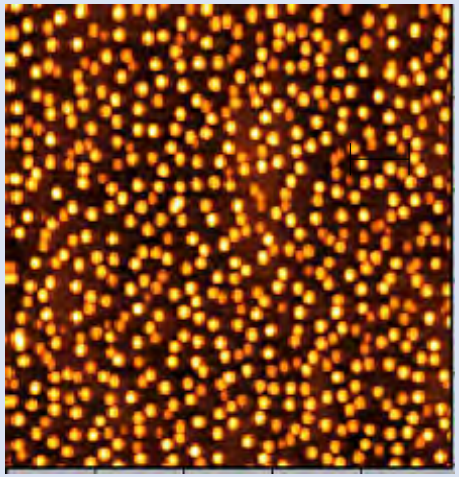
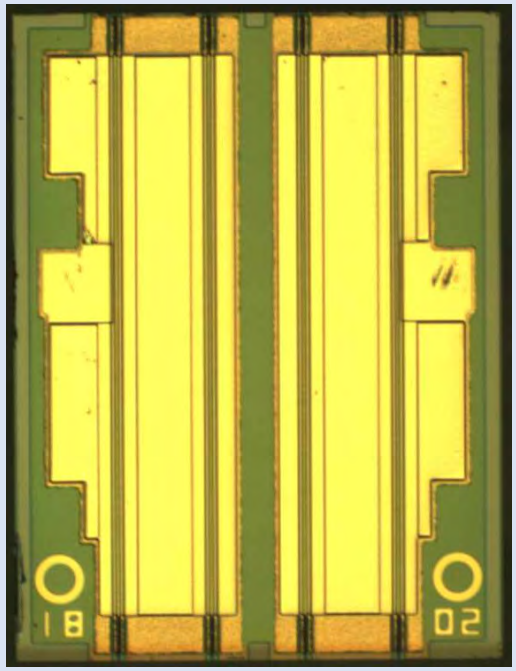
*1: Biomedical equipment is flow cytometers, ophthalmic examination equipment, fluorescence microscopes, and the like.
*2: The total volume of the driver integrated light sources is less than 50% of other company's products.
*3: Estimated annual accessible market size is 12,500 units. (8,000 out of 16,000 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.

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

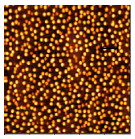
2012
Started development of quantum dot laser for silicon photonics

2017
Established mass production system of quantum dot lasers for silicon photonics (supplied to AIO Core Co., Ltd.)

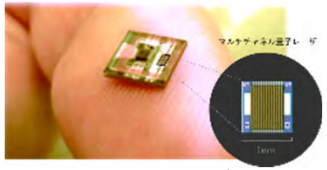
2019
Our products installed in the "Ultra-thin connector integrated active optical module (I-PEX EOM)" developed by I-PEX

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.

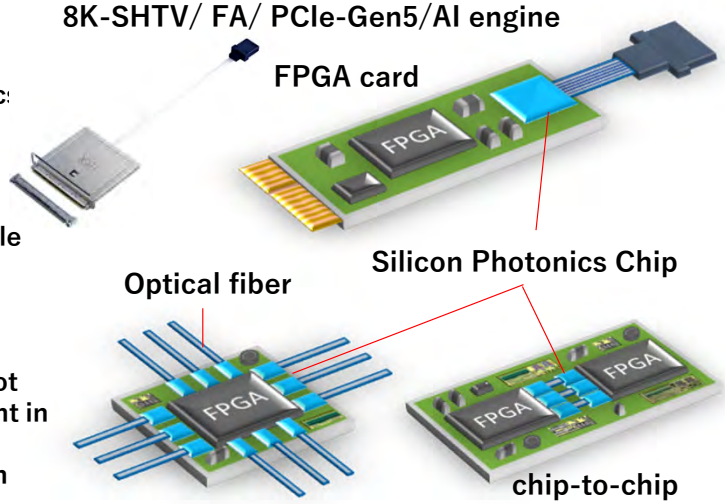
Quantum Dots



100Gbps optical transceiver with quantum dot lasers as light sources



Optical Connector(EOM *1,CPO *2) :
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 (2025-)

2025-26
Investment for increasing production capacity to 1million pcs per year
Place PO for mass production MBE machine #3

2027
Install mass production MBE machine #3

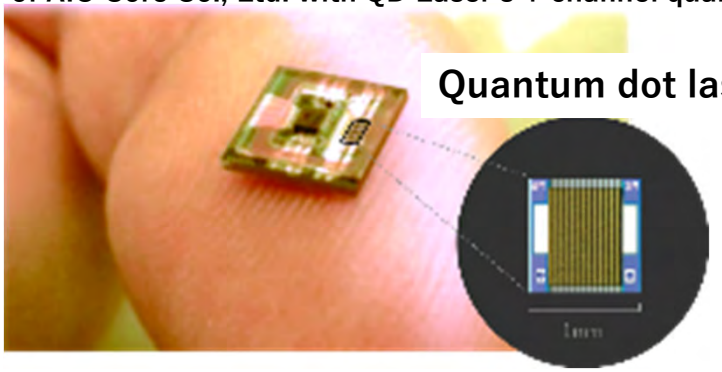
2028
Start mass production with two MBE machines

*1 EOM:Electro-Optical Module
*2 CPO:Co-Packaged Optics

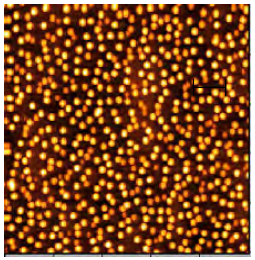
IOCore ™ with Quantum-Dot Laser Launched for Mass Production

- **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**

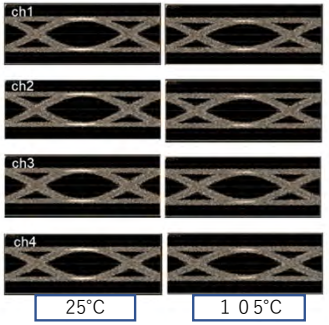
100Gb/s Silicon photonics chip named IOCore™
of AIO Core Co., Ltd. with QD Laser's 4-channel quantum dot lasers

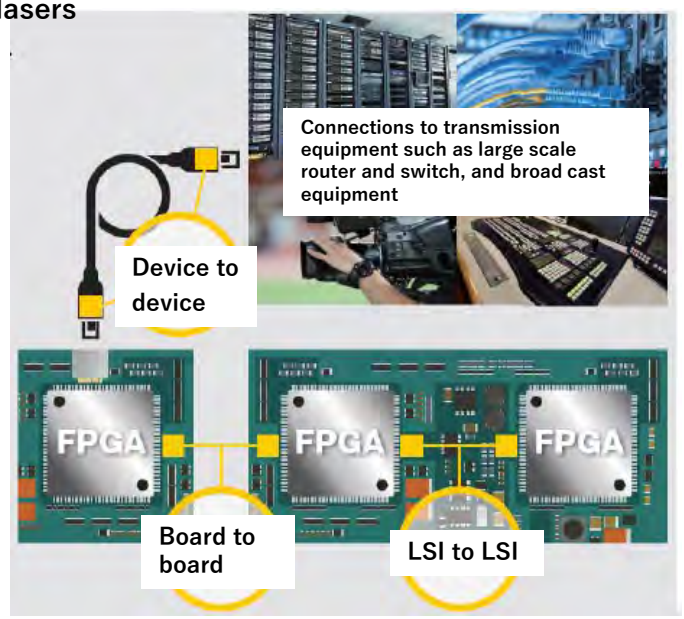


Quantum dots



Optical eye diagrams at 25Gbps



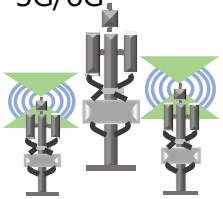


Courtesy of AIO Core Co., Ltd.
Note: Yellow squares show 100Gb/s transceiver Silicon chip

Data center, Server, Super Computer

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

5G/6G



FA、Medical

Automatic Driving

*1: Near Packaged Optics. It is a photoelectric conversion element for optical wiring that is placed and mounted near packages such as FPGA and ASIC and has entered the practical stage.

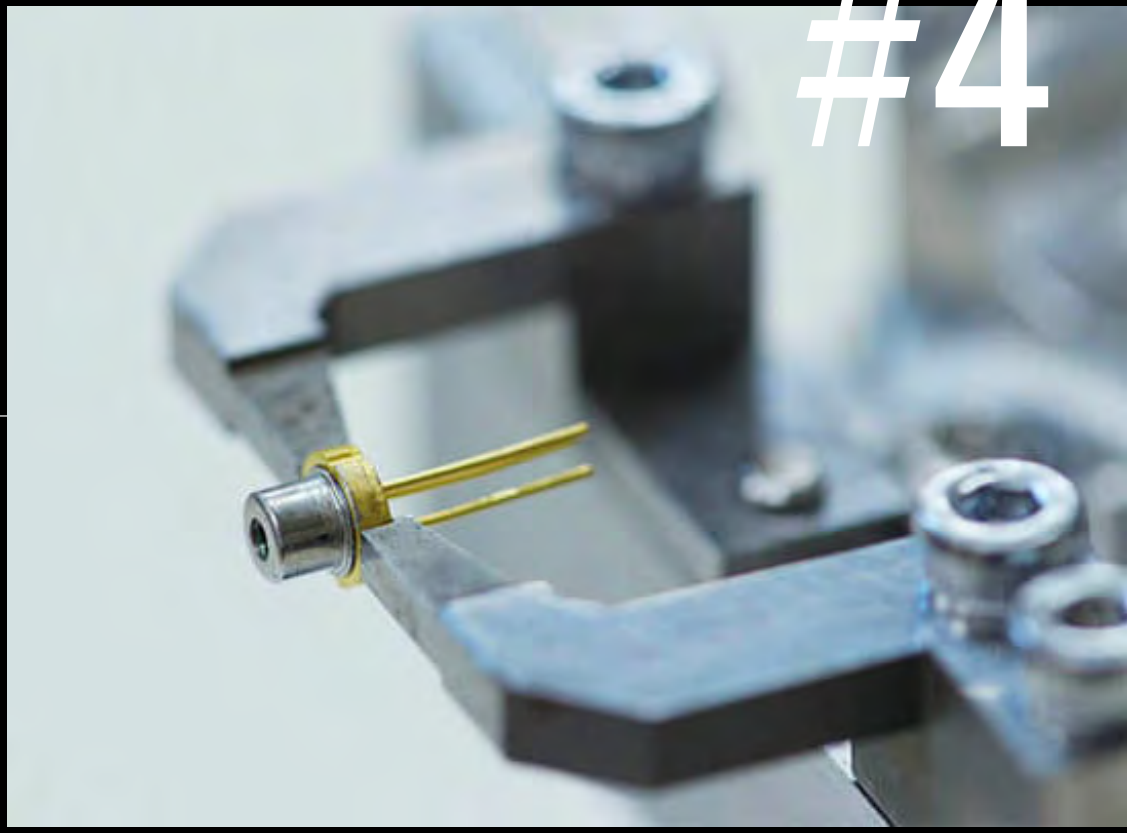
High Power FP Laser

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

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

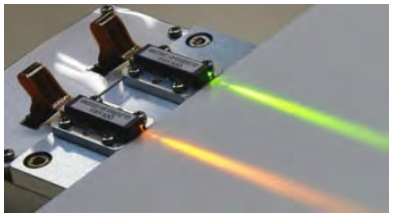
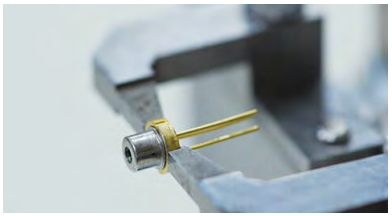
Providing services that meet customer requirements, such as usage conditions and small-quantity support.

- 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.



#4

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

	Compact visible lasers	High power laser	DFB laser	Quantum dot laser
Produccts				
Wavelength	**532, 561,594 nm**	**640-940nm**	**1030, 1053, 1064, 1080, 1120, 1180nm** **1020-1120nm provided 1nm by 1nm**	**1200-1330nm**
Features	● Miniature size, low power consumption, stability, short pulse generation, and high-speed modulation, etc. ● World's first current injection yellow-green and orange lasers	● High power Fabry Perot laser ● Providing products and solutions according to applications. ● Supports various wavelengths, small quantities, and custom production.	● Precise control of wavelength with stable operation under continuous, nanosecond, and picosecond modes. ● High beam quality, small size, lightweight, high electricity-light conversion efficiency, and long life compared to existing solid-state lasers. ● Extensive product lineup that meets the various needs of customers.	● Quantum dots are used for the active layer (light-emitting part) of semiconductor lasers. ● Excellent temperature stability, high-temperature resistance, and low noise performance compared to existing semiconductor lasers.
Use		Measurement	Measurement Processing	Measurement Communication Silicon photonics
			Bio.	

03

QD LASER

Laser Retinal Projection Technology

Commercialization of eyewear utilizing the world's first retinal projection technology

⇒Achieved increased sales by launching three new products that apply retinal projection technology. The "Vision Health Check Service" business started, and the development of smart glasses progressed.

Vision and Technology

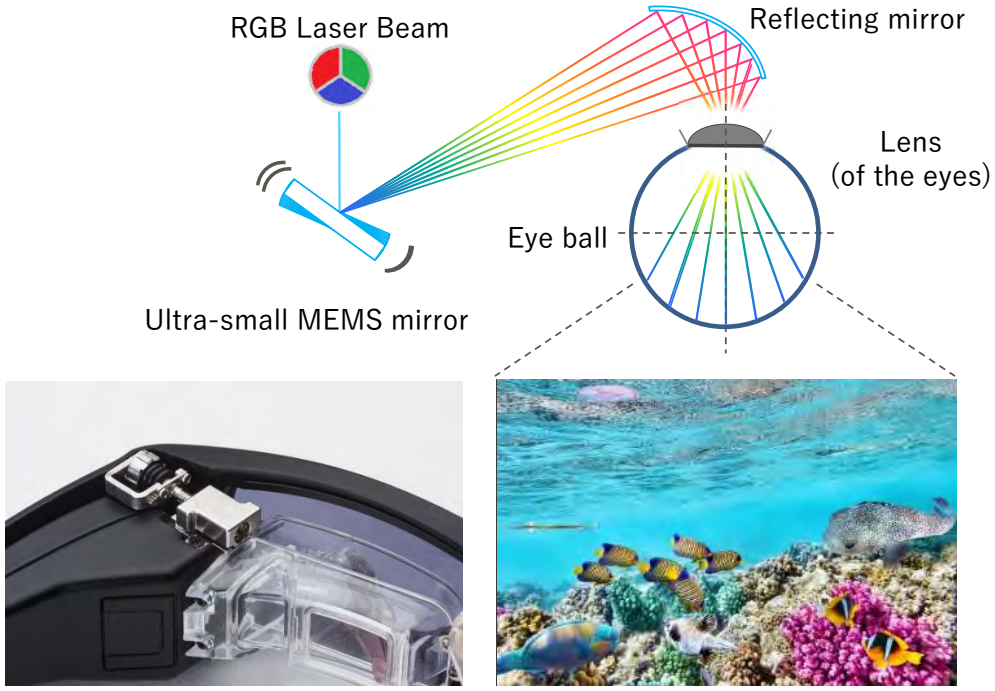
Humans perceive 83%*1 of information through vision.

Since the invention of glasses in the 13th century, sight correction*2 technology has not evolved.

*1: Educational Equipment Editorial Committee, JUSE Press, Ltd. "Industrial Education Equipment System Handbook" (1972), "Taste 1.0%, Tactile 1.5%, Olfaction 3.5%, Hearing 11.0%, Visual 83.0%"
*2: Including eye glasses and contact lens

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.

*1: At major airline company and National University Corporation Tsukuba University of Technology, a systematic demonstration study is currently underway.

Three Areas based on Retinal Projection Technology

Under the Sales

Commercialized in 2022

Strengthening Alliance

World's First Laser Retinal Projection Eyewear

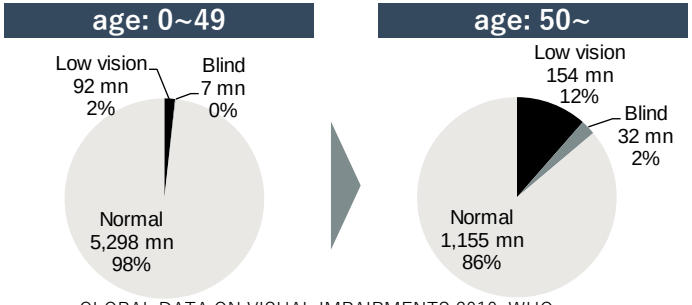
In the Low Vision Aid Space where Innovation has been Minimal, Laser Technology makes a Breakthrough

250 mn people

with Low Vision Globally*1

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


WAZ SEITE 3 ESSEN

Fast Blinder kann mit Super-Brille wieder sehen

Mit 15 Jahren hat Dominic Schmitz bei einem schweren Unfall seine Sehkraft fast völlig verloren. Mit einer neuartigen Sehhilfe, die am Uniklinikum getestet wird, hat er nun ein gestochen scharfes Bild der Welt

„Papa, du bist aber alt geworden, ich kann die Falten auf deiner Stirn sehen."

"Papa, you have grown old, I can see the wrinkles on your forehead."*2

*1: 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.
*2: Translated from German

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

Japan — Population of people with low vision **1.45 million**[*1]

Europe (EU) — (our estimate) **18.77 million**[*2]

U.S. — (our Estimate) **12.00 million**[*2]

Estimated percentage of applicability (our estimate)[*3]: **11%**

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

Japan — Population of People over 65 years old **36.08 million**[*4]

Europe (EU) **102.76 million**[*4]

U.S. **52.79 million**[*4]

Estimated percentage of applicability (our estimate)[*5]: **1%**

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.

RETISSA Series：Eyewear Products

- 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

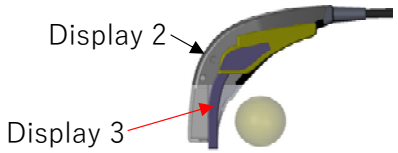
・Wearable display equipped with the 2nd generation VISIRIUM technology, announced in December 2019 and released in March 2020.

・With improved image quality, reduced size and weight, reduced power consumption, and improved usability.

・Optional camera RD2CAM released in August 2021

Retinal Imaging Product "Retissa" Roadmap: Laser Eyewear

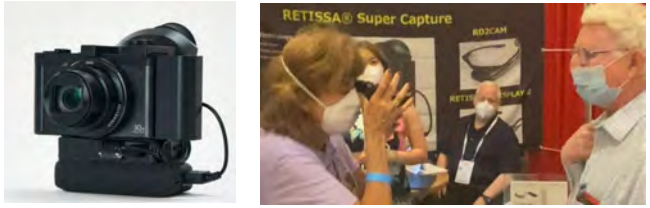
- Medical Equipment "Medical": Being promoted by Santen Pharmaceutical and Seed to 479 hospitals on corneal diseases. Eleven domestic medical institutions are now introducing the device to patients.
- Consumer Product "Display / Display2": Cumulative sales of 800 units via EC, domestic and overseas distributors. Local Municipality Subsidy with 90% benefit starting to be registered.
- Display 3: Under development to realize a compact, lightweight, and low-price eyewear with improved operability.

	Medical	Display/Display 2	Display 3
			
FY2018-2021	・Domestic manufacturing and marketing approval. ・Introduction to low vision and corneal outpatient. ・Treated in 11 medical institutions.	・Free focus / high resolution (equivalent to 0.8 visual acuity) / full color ・Launch of accessory camera RD2CAM ・Cumulative sales of 800 units	・Jointly developed with a domestic electronics manufacturer.
FY2022	・Continue sales activities ・Expansion of application range through clinical research (Clouding, retinopathy) ・Strategy in Europe	・Subsidy, administrative budget acquisition activity (already certified by 6 municipalities) ・Overseas expansion US in-house EC Korean subsidy acquisition activity Resume Chinese agency activities	・Development and Marketing Flat mirror (thinner and wider FOV) Built-in camera Low-cost design Compact controller BOX Eye Track
FY2023-2026[*1]	Consolidation of sales channels and know-how to comply with various regulations (Pharmaceutical Equipment Law, Consumer Product Safety Law, Welfare Equipment Law, etc.)		Commercialization 100,000 yen selling price 100,000 units sales target after launch

**1: The schedule changed from June 2022 publication materials to form a global development and manufacturing ecosystem aiming for the ultimate smart glasses with low power consumption, eye tracking, and high image quality.

Retinal Imaging Product "Retissa" Roadmap：Three New Products

- **Commercialization of three new laser retinal imaging devices for various usage scenarios**
  https://www.qdlaser.com/uploads/2021/12/20211214-1.pdf

	ONHAND	Super Capture	MEOCHECK
	Hand-held devices used by visitors in public spaces (libraries, museums, theaters, etc.)	Digital cameras viewfinders that extend the vision and behavior of low vision users	Self-measuring simple checkers to help people recognize eye diseases
			
FY2021	Prototype ・Questioned and deliberated as a device to comply with the Reading Barrier-Free Act*1 at four congresses in the Tokyo metropolitan area.	Prototype ・Exhibited with Sony Corporation at CSUN, an accessibility exhibition in the U.S. ・Successful crowdfunding	Prototype ・Conducted eye examinations on 500 drives at cab companies in Japan under collaborative research with medical universities. ・Obtained evidence of highly sensitive detection of glaucoma, cataract, etc. (to be published)
FY2022	Product launched May 25th, 2023 ・Introduction to administrative services like libraries, art galleries, museums, theaters, etc. ・Sales collaboration with three distributors.	Product launched May 24th, 2023 ・Announced in camera exhibition CP+ ・Joint exhibition with SONY atCSUN2023 ・On sale at five Sony stores nationwide	Product launched Feb 1st, 2023 ・Sales collaboration with medical equipment distributors nationwide ・Eye check service pilot operation with Tohoku University and DX companies at transportation companies, drug chains, extensive private facilities, nursing care facilities, etc.
FY2023 ~FY2024*2	・Preparation for overseas expansion including China ・Assumed sales of 1,000 units/year	・Launch also in the US this summer ・Assumed sales of 1,000 units/year	・Assumed sales of 1,000 units/year ・Full-scale operation of eye check service

*1Reading Barrier-Free Law: "Law Concerning the Promotion of the Reading Environment for the Visually Impaired and Others", effective June 28, 2019. A law to ensure that all people, regardless of disability, can benefit from the written and printed culture through reading.

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

3rd 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).

・Scheduled to launch in the US this summer at the planed special price of $600.

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.

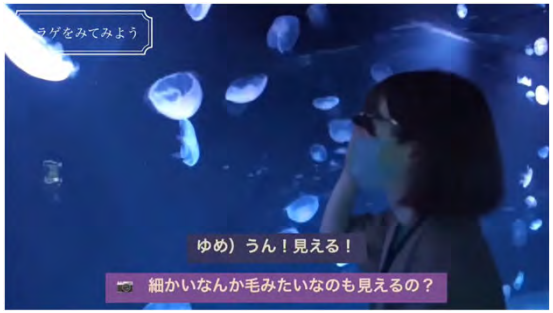
Reimbursement

・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.

In addition to the above, we will promote development and sales expansion activities in anticipation of overseas expansion of ON HAND and RNV.

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

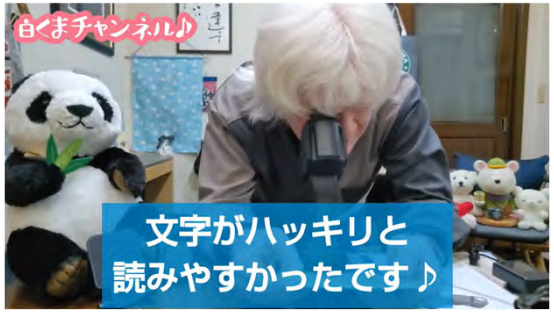
- **Promotional content with the cooperation of Mirairo Co., Ltd. and influencers**



Using RD2 at Sunshine Aquarium
Channel name： Mirairo Co., Ltd.
https://youtu.be/MOtONIOt_fE

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/7wDlhm6pjEQ



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.

RETISSA MEOCHECK Self-health check for eyes introduced to corporate health checkups

Inexpensive and quick self check by the unique retinal projection technology and optimized algorithm.

Without experts

Without eyedrops for pupil dilation

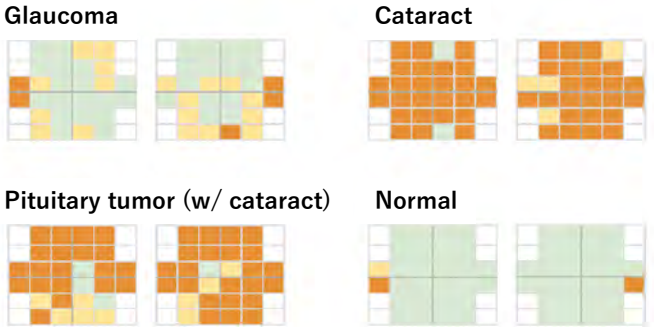
Within one minute for an eye

By promoting early awareness of ocular diseases, such as glaucoma, the leading cause of blindness in Japan

Contributes to safety operation and prolongation of driving life

Anyone can easily check in 3 steps:

(1) Follow the guidance and adjust the head position for correct measurement.
(2) Press the trigger of the main unit when the point is displayed.
(3) Display the measurement results in a diagram → If the results are worrisome, ophthalmologist consultation is recommended.



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 FY2022 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

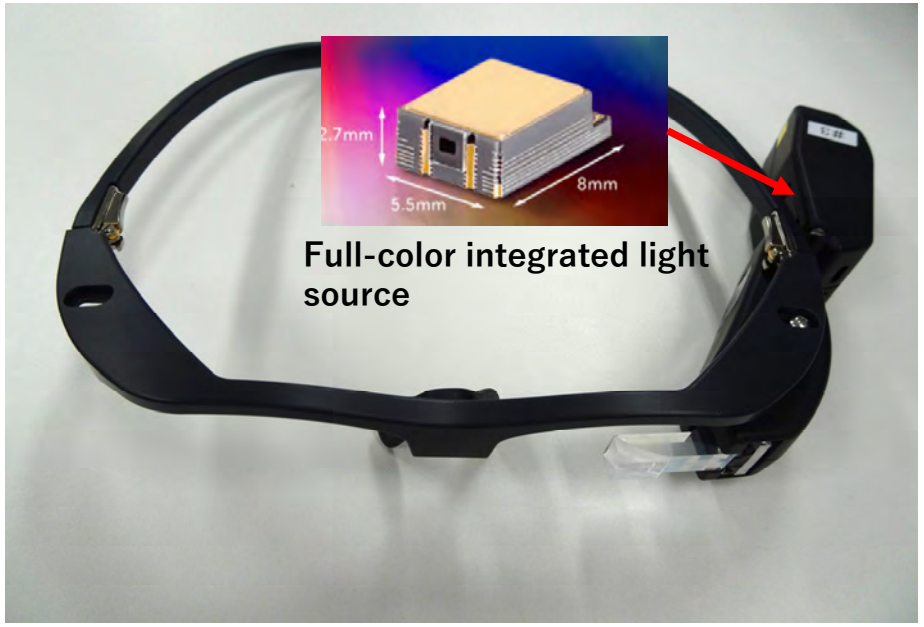
Elemental technology development for next-generation laser eyewear

- 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

QD LASER

Business Growth

Fiscal year ending March 2023, fiscal year ending March 24, medium-term, and medium- to long-term

Business Highlights for FY2022

Significant progress in both businesses toward company-wide operating profit shortly and subsequent explosive growth

Laser Device (LD) Business

Operating profit

consecutive 8 years

Operating profit of
64 million yen (+5% YoY)

Certified customers

68 institutions

Contributions of compact visible lasers for biosensing, DFB lasers for wafer sensing, and high-power lasers for sensing in semiconductor factories

QD lasers for silicon optical wiring. Mass production order of

12,000units

Cumulative orders of more than 60,000 units received this April 2023[*1]. QDLaser is starting to build a full-scale mass production system

Laser Eyewear (LEW) Business

YoY sales

183%UP

Sales of 268 million yen (12% higher than forecast[*2]). Contributions from new product launches and commissioned developments.

New retinal projection devices

3 Models released

Bundle sales in collaboration with Sony.[*3] Strengthened sales by cooperating with domestiv agencies.

Vision Health Check Service

Service started[*4]

From trial to the full-scale introduction in a major taxi operator

QD LASER

*1 : Published on April 17, 2023 “Received orders of 60,000-unit quantum dot lasers”
*2 : Published on February 14, 2023 “Quarterly Financial Results Briefing 3rd Quarter of FY2022” Page 13
*3 : Refer to "Announcement regarding the conclusion of a collaborative agreement with Sony Corporation on the sale of retinal projection equipment," announced on February 21, 2023.
*4: Announced on November 15, 2022, "We have developed a new device called "MEOCHECK" that allows you to self-check your eye health in 2 minutes. Implementation of a trial to introduce it to the regular health checkup of Nihon Kotsu taxi drivers."

Major Business Target for FY2023

Updating business for early company-wide operating profit and subsequent explosive growth

Laser Device (LD) Business

Operating profit

Consecutive **9** years

Operating profit of 67 million yen.
Net sales 1.01 billion yen.
(up 14% year-on-year)

New LD product development

7 products

High-speed DFB laser for processing and measurement, new wavelength/module of compact visible laser, and quantum dot DFB laser

QD lasers for silicon optical wiring. Starting mass production of

> **60,000** units

Mass production starting in May.
Constructing mass production system for 1 million units/year.

Laser Eyewear (LEW) Business

YoY sales

61% UP

Sales of 432 million yen.
Expansion of sales of new products, progress in commissioned development of smart glasses

New retinal projection devices

Overseas expansion

RNV sold by Sony in the United States.
Preparation for sales of ON HAND in the U.S. and China, and low-cost production.

Vision Health Check Service

Service expansion

Full-scale introduction by major taxi operators, cross-industry expansion and the implementation of subscription model.

Mid-term business target (about 3 years)

Achieve company-wide turn around and establish the foundation for explosive growth thereafter

Laser Device (LD) Business

Operating profit

Consecutive **10-11** years

Launch of global niche products and the transition from joint research to mass production for silicon photonics products

Operating Profit >300 million yen
(Gross margin >40%)

New products for global niche

Net sales >**400mil.** yen

Contribution of new products scheduled in 2023
- Value added visible laser modules
- DFB laser for semiconductor wafer/mask inspection
- DFB laser for fast and precise machining

QD lasers for silicon optical wiring mass production order

60k units[*1] → **200~400k** units

Increased market for silicon photonics by joint research partner's mass production, a milestone for the introduction of 3rd MBE to expand mass production capacity

Laser Eyewear (LEW) Business

Net sales

260mil.[*2] → > **1bil.** yen

Contribution of 3 new RETISSA and vision health check service by expanding sales partnership

Three new RETISSA	>800mil. yen total
Vision health check service	>200mil. yen

Three new RETISSA

500units[*2] → **5,000** units

Establishment of sales capability in JP/US/EU/CN with partners including Sony during FY2023-2024.
Compliance to safety regulation in each region.
Establishment of global mass production capability.

Vision health check service

4,000 users[*1] → **70,000** users

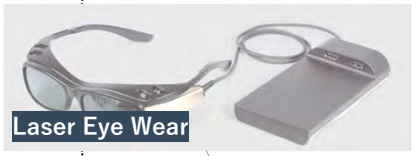
Expansion by penetration to health check in transportation industry such as taxi and freight.
Nationwide expansion of drugstore franchise.
Launch of data service to administrator/individual viewer.

*1 : Received orders as of June 22, 2023
*2 : Results in FY2022

Expected growth potential in mid to long term

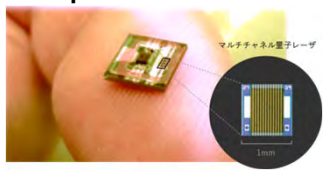
01 Through R&D of various laser technologies and stable profits from laser device business, strengthen business base for dramatic future growth.

02 Establish mass production and sales channels of consumer/medical eyewear
Three new RETISSA as the growth driver in the short to mid term



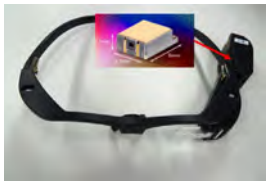
03 In the mid to long term, in addition to the laser eyewear business, plan to expand sales of vision health check service and silicon photonics.

- QD lasers for optical wiring (silicon photonics)
  Mass production in FY2023



- Vision health check service
  Full service-in in FY2023

- RETISSA Display3
  Progress in R&D, launch in 2026-27



IPO

Mass production of 3 new RETISSA (FY2022)

Plan to national and international sales growth

5,000 units/y for 3 RETISSA (FY2025 target)

Now

Future

*1： The graph is shown as an image

05

QD LASER

ESG Initiatives

Working on business areas directly linked to solving social issues
⇒”With my eyes” project in collaboration with Sony

Business Development from an ESG Perspective

Social

Estimated economic cost in Japan due to visual impairment in 2030[*1]
USD105bn
JPY11tn

Global prevalence of people with low vision[*2]
250mn

Estimated number of glaucoma patients in Japan[*3]
4mn

- World's first laser retinal projection technology for low vision aids
- Through the spread of laser eyewear, provide visual support for the elderly
- Through the spread of more affordable optometers, contribute to the early detection of various eye diseases including glaucoma, etc.
- Employment support for people with low vision

Environmental

Energy savings from semiconductors with silicon photonics[*4]
90%

- Silicon photonics with quantum dot lasers improve semiconductor performance dramatically

Governance

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*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=p5bIfs94Oys

#2 Let's go and see the invisible world.
https://www.youtube.com/watch?v=ZM52dax_5yc

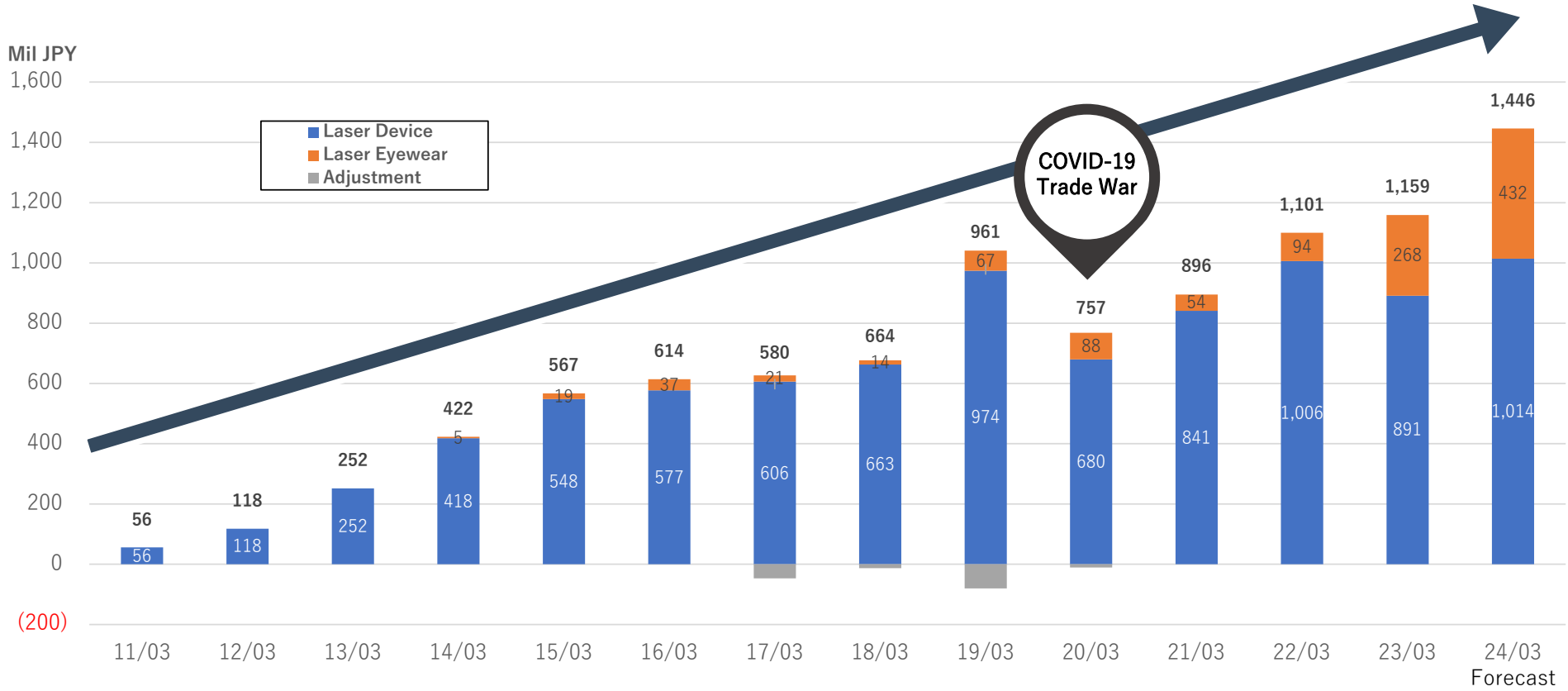
#3　- Discovering a World of My Own –
https://www.youtube.com/watch?v=Ip6a5h6UfxA&t=37s

QD LASER

Financial Highlights

Sales Trend

Continuous growth for over ten years.
Exceed one billion yen for the first time in FY2021、Record high sales in FY2022.



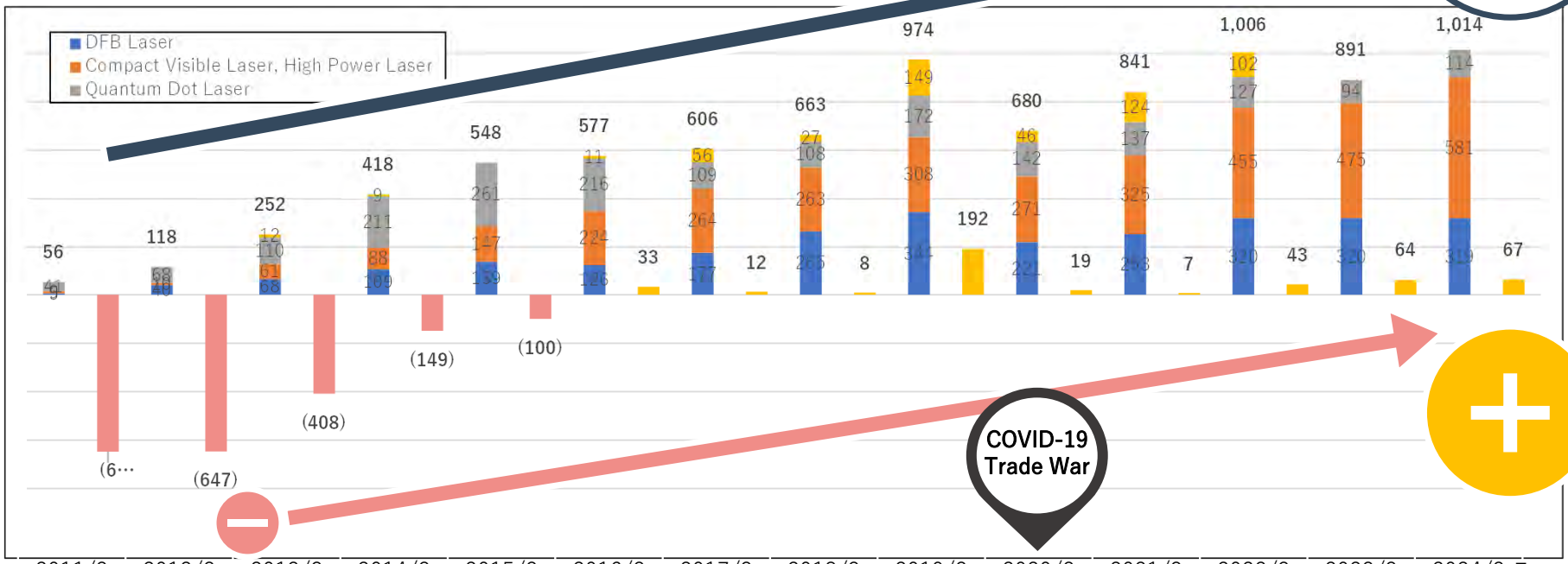
Laser Device Division Sales Trend

Under the expansion of the global laser market, record-high sales forecast for this term.

13yrs CAGR*1
25%

Revenue

Operating Profit

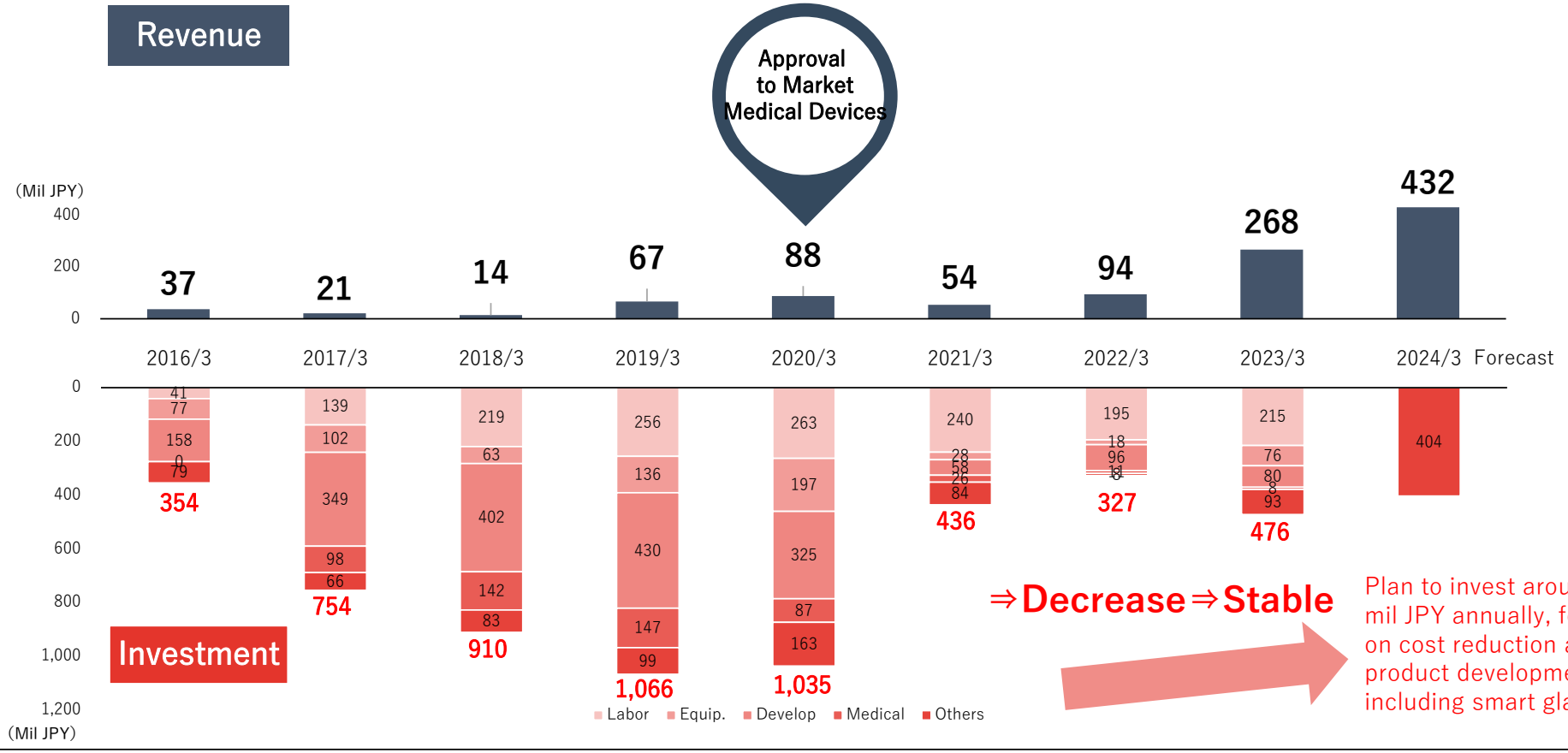


	2011/3	2012/3	2013/3	2014/3	2015/3	2016/3	2017/3	2018/3	2019/3	2020/3	2021/3	2022/3	2023/3	2024/3 Forecast
Sales of Segment	56	118	252	418	548	577	606	663	974	680	841	1,006	891	1,014
Adjustment	0	0	0	0	0	0	(47)	(13)	(80)	(11)	0	0	0	0
Sales of Segment after adjustment	**56**	**118**	**252**	**418**	**548**	**577**	**559**	**650**	**894**	**669**	**841**	**1,006**	**891**	**1,014**

*1 : Compound annual growth rate in segment sales after internal adjustment.

Laser Retinal Projection: Profit Structure

Shifting from R & D to the recovery phase.
Increase sales with three new products and optometry[*1] business.



*1： Refer P65—69

Business plan achievement status

Sales increased and the loss improved compared to the plan and the previous year.

Compared to the plan, sales increased by 3% and the operating loss improved by 10 million yen. Compared to the previous year, the sales of the LD business decreased by 11% due to the transfer of NRE, but the sales of the LEW business increased by 183%, and the company as a whole increased by 5%. Profits increased in the LD business and improved losses in the LEW business, resulting in a company-wide loss improvement of 374 million yen.
In addition, due to changes in the customer development schedule and the lockdown due to China's zero-corona policy,, business plan was revised on February 14, 2023[*3] from the initial plan (announced on May 12, 2022).

(Mil JPY)	FY2022 Result	FY2022 Plan*1	Result vs Plan	FY2021 Result	YOY	FY2022 Plan(2)*2
Sales	**1,159**	1,129	+3% (+30)	1,101	+5% (+58)	1,277
(LD)	**891**	889	+0%	1,006	△11%	1,037
(LEW)	**268**	239	+12%	94	+183%	239
Operating Profit or Loss(△)	**△556**	△567	+10	△931	+374	△567
(LD)	**64**	64	+0	43	+20	+100
(LEW)	**△338**	△348	+9	△693	+355	△367

*1 : Published on February 14, 2023
*2 : Published on May 12, 2022
*3 : Refer to "Notice Concerning Revision of Full-year Earnings Forecast for the Fiscal Year Ending March 2023 and Recording of Non-Operating Income and Non-Operating Expenses" published on February 14, 2023 (Only in Japanese).

Fund allocation plan

Main purpose of raised fund by IPO and stock acquisition rights

(1) Production cost of LEW business

(2) Production capacity reinforcement and capital and business alliance costs in the LD business

内容	Raised Amt[*1] (Spent Amt)[*2]	FY2021	FY2022	FY2023	FY2024	FY2025 onwards
Manufacturing cost for the mass production in the LEW business	2,926					
	(355)					
Production capacity reinforcement in the LD business	2,927					
	(0)					
Labor costs	175					
	(0)					
Advertising expenses	100					
	(0)					
M&A, capital and business alliance investment	300					
	(0)					
Total	6,428					
	(355)					

*1： The Raised amount is the total amount of IPO raised amount of 2,926 million yen, 14th stock acquisition rights raised amount of 651 million yen, and 16th stock acquisition rights raised amount of 2,875 million yen.
*2： The spent amount is the amount spent by the end of March 2023.

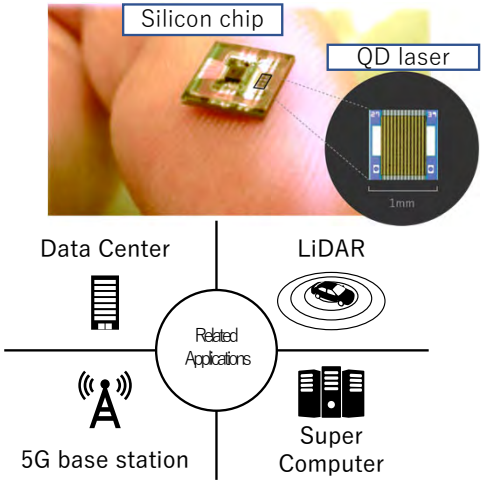
Appendix

QD LASER

Laser Devices based on Our Core Technology

Evolution of Silicon Circuit

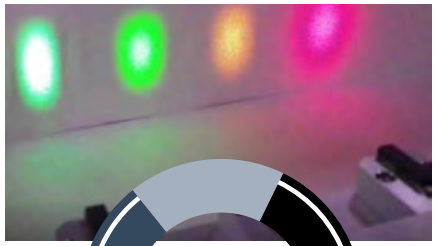
- Silicon electronic and optical Integrated circuit is now a reality owing to quantum dot lasers with stable performance even in high temperatures over 100 ℃.
- See a photo of a commercialized fingertip-sized silicon chip as 100Gbps optical transceiver with quantum dot lasers as light sources.

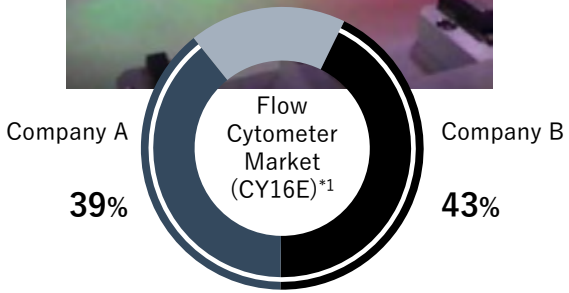


- Cumulative sales of silicon photonics chips: **25,500 units**[*2]

Evolution of Sensing

- Unique lasers with various wavelengths are applied to a variety of technologies such as biosensing equipment (flow cytometers, etc.) machine vision, and facial recognition, etc.

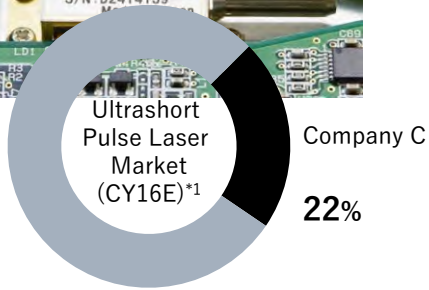




- A certified supplier for Top 2 companies that occupy **82.7%** of Flow Cytometer **Global Market (JPY 77 bn*1/ approx. USD 73mn)**
- Cumulative sales of laser devices for bioinstrumentation such as flow cytometers: **6,100 units**[*3]

Evolution of Laser Processing

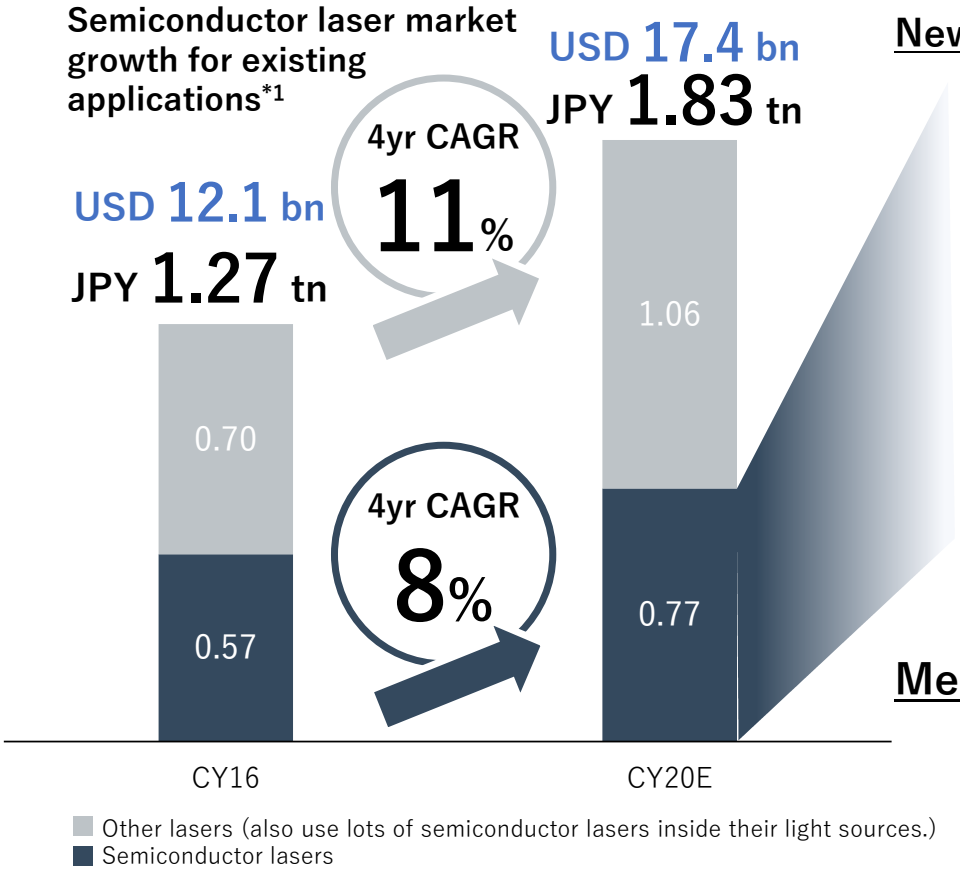
- Ultrashort pulse (10 ps) lasers enable unheated high-precision processing
- Currently used to process smartphone electronic circuit boards



- A certified supplier for the second largest company that occupies **22.4%** of Ultrashort Pulse Laser **Global Market (JPY 46.6 bn*1 / approx. USD 424mn)**
- Expanding into Airplane LiDAR
- Cumulative sales of ultrashort pulse laser devices: **9,300 units**[*4]

*1: Fuji Chimera Research Institute "2016 High-efficiency Laser Market Survey"
*2: March 2018 – August 31, 2021
*3: 532-594nm LD (1064 SHG laser), November 2, 2011 - August 31, 2021
*4: 1064nm BFY (1064 DFB laser), October 10, 2010 - August 31, 2021

The Semiconductor Laser Market Continues to Expand, Even for Existing Applications Alone
Achieved 19% Increase of the Certification Number (Customer X Product) in FY2021 from 57 to 68



New target market of QDLaser via new product development

Quantum-Dot Laser in Silicon Circuit :
- Interconnect(368M$) : Data centers, 5 G base stations, HPC, Automobiles
- LiDAR(28M$) : Robotics, Drone, Security, and Self-driving cars

Laser Processing & Measurements
- Fiber lasers for micromachining(11M$) : Composite electronic circuit boards, glass, ceramics, semiconductors, etc.
- LiDAR(3M$) : Aircrafts, meteorological and terrain observation

Sensing
- Biosensing(64M$): Flow cytometer, cell sorter, and various microscopes
- Ubiquitous sensor(339M$): train, automatic transport device, level sensor, particle counter

* Numbers are our accessible market forecast in FY2025

Measures to achieve 20% increase of Certification Number

- New product development based on industry trends and market analysis
- Device customization for adding value to customer products
- Proposal activities to customers based on market trends and needs
- Issuance of White Paper on new product/technology development

*1: Laser focus world "Annual Laser Market Review & Forecast 2020" Converted at an exchange rate of JPY/USD = 110 yen
*2: Laser focus world "Annual Laser Market Review & Forecast 2020" and Markets and Markets "Laser Processing Market with COVID-19 Impact Analysis by Laser Type (Solid Lasers, Liquid Lasers, Gas Lasers), Configuration (Fixed Beam, Moving Beam, Hybrid), Revenue (System Revenue, Laser Revenue), Application, End-user Industry, and Region - Global Forecast to 2025 ", estimated by calculating the percentage of semiconductor laser products built into "Others" in the report

Trends in the amount of orders received of the LD business

Orders decreased by 7% YOY

Orders for quantum dot lasers and high power lasers decreased due to changes in the development schedules of silicon photonics customers and the impact of China's lockdown. The decrease in the number of orders received is due to the shift to high value-added products.

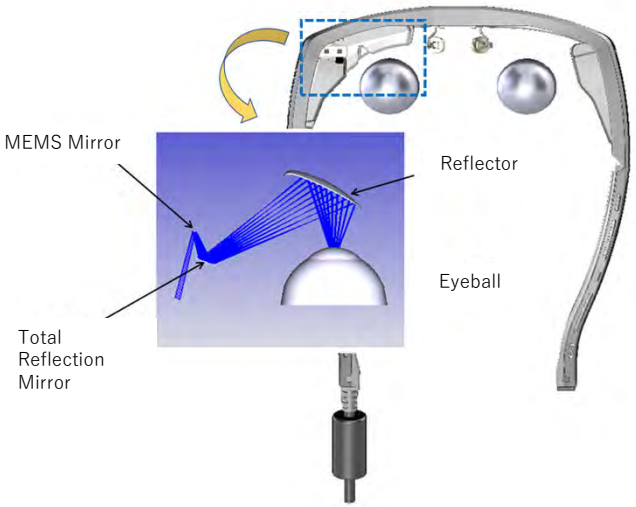
Order amount

Order Quantity

Laser Retinal Projection Technology

Details of the Core Technology

Asymmetric Optics for HMD



01 Optical Design

- Resolution control based on beam diameter / NA control
- Reflection / transmission optics selected and designed for each application
- Optimized shape and size through the selection and design of optical materials for each application

02 MEMS

- MEMS design and prototype products provided with the size and frequency required for optical design

03 RGB Laser Modules & Drivers

- Precisely combined and collimated small RGB laser module for images
- Driver chip suitable for displaying image information

04 Solution

- An operating projection optical system integrating the technologies above
- Retinal projection / fundus photography system

Laser Retinal Projection Competitive Advantages/Barriers to Entry

First to commercialize laser retinal projection technology globally

- Owing to cultivated and commercialized laser and optical technology
- At present, we recognize there are no other companies in the world which have succeeded in commercializing the same level of retinal projection

Patent strategy

- By applying for various essential patents like basic / improvement patents, employing essential patent portfolio and top niche strategy*1
- Compared to competitors, maintain advantage in terms of intellectual property
  - -Applied for basic patents related to core optics and improvement patents for improved imaging quality and mounting operability
  - -Completed competitive patent landscape analysis
  - -Applied for 44 in-house patents (applied by 9th Mar 2020)
    29 patents registered including 7 essential patents*2 (in-house evaluation, registered by 17th Feb 2020)
  - -About 2,300*3 related patents held by other companies registered by end of March 2020, among which none have been identified as barriers within the markets our products launch (in-house evaluation)

Obtained a variety of licenses such as approval to market medical devices

- In order to sell medical devices, necessary to obtain licenses or approvals from authorities of each country
- We have already obtained approval to market medical devices in Japan and are currently in the process of applying for approvals in the EU and the US. We estimate it will take at least several years for new entrants to complete these processes.

*1: "Essential Patent" Portfolio Strategy: Strategy whereby a company holds several "essential patents" which will limit competitors entering the market. This will make it possible for the company to continue its business through cross-licensing even if a competitor files for patent infringement against the company
"Essential patent" is a technology that has been adopted as an official standard in a certain product / technical field (here, laser retinal projection technology) , a technology that has become a so-called de facto standard or an already patented one that has been actually implemented by a competitor
"Top of Niche" Strategy: Strategy which excludes competitors from entering market by holding core patents and any improvement patents relating to a particular product
*2: Obtained patents which we regard as highly demanded and difficult to avoid for other companies
*3: Number of cases in Japan

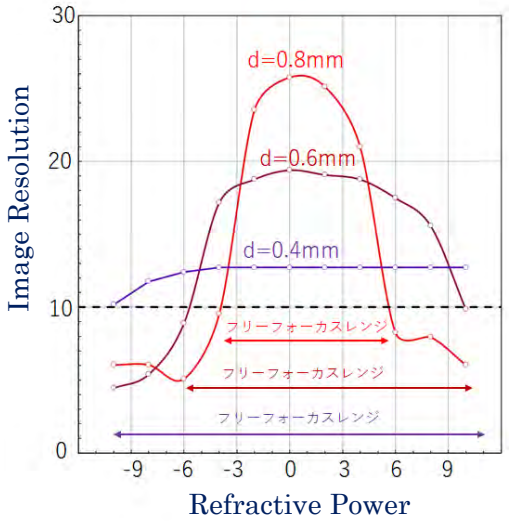
IEC (International Electrotechnical Commission) officially published an international standard that defines how to evaluate the overall image quality of scanning retinal projection devices

QD Laser Co., Ltd. is the only company to have commercialized the laser scanning retinal projection product globally. On June 20th, the IEC [Note 1] officially issued the international standard on scanning retinal projection devices. This document covers a general image quality evaluation method, including the free focus characteristics. As a result, the performance of our products to provide "clear images that do not depend on eyesight" has come to be evaluated objectively and quantitatively. With this standardization, QDLaser expects the guarantee of product quality and the elimination of inferior products in the market, accelerating the worldwide spread of our products and forming a healthy industry and market.

International Standard
IEC 62906-5-5:2022
・Laser displays – Part 5-5
・Optical measuring methods of raster-scanning retina direct projection laser displays
・https://webstore.iec.ch/publication/60142

Note 1: IEC is an abbreviation for International Electrotechnical Commission.
Note 2: Free focus means that the visibility of the image projected by the scanning retinal projection device does not depend on the refractive power of the eyeball or the focus position. The performance of free focus changes depending on the beam diameter and divergence angle of the laser incident on the eyeball.

Free Focus Range Evaluation



The refractive power of the eyeball determines the resolution of the retinal projection image with the diameter of the parallel laser beam as a parameter. This international standard states that the range of refractive power of the eyeball to provide free focus is determined according to the diameter. When commercializing a scanning retinal projection device, it is required to specify the range of refractive power to provide free focus.

Marketing License Status for Medical Devices

Japan: Medical device manufacturing and sales approval acquired. Sales started.
Europe: Clinical trial follow-up completed in June ⇒ Confirmed long-term safety.

License and approvals in each country can be major barriers to entry

2018 | 2019 | 2020 | As of now ▼

Japan

Clinical Study (Ametropia)

Approval Review
- Obtained approvals to Market Medical Devices

Sales
- Insurance coverage/certification as welfare equipment
- Expand target market using next-generation products

Europe

Clinical Study (Corneal opacity)
Completed in October 2019

Follow Up
Completed
- in June 2021

Review by designated institution
(Preparation for application in FY21)
- CE marking by MDR (Medical Device Regulation)

Sales
- Planning to launch in Germany
- Insurance coverage
- Expand sales to new countries and expand range of indications

U.S.

Pre-submission discussion with FDA*2

Additional safety tests
- To meet U.S. standards
- Received results at the end of September 2019

Documentation preparation scheduled for completion by Dec 2020

Review
(Preparation for application in FY21)
- De novo application (New medical device)

Sales
- Support audit
- Insurance coverage and expand applications

*1: The future timelines shown above are plans and assumptions made by QD Laser as of the date of preparation of this presentation, and the actual state of progress may differ from the above timelines due to various factors.
*2: Food and Drug Administration

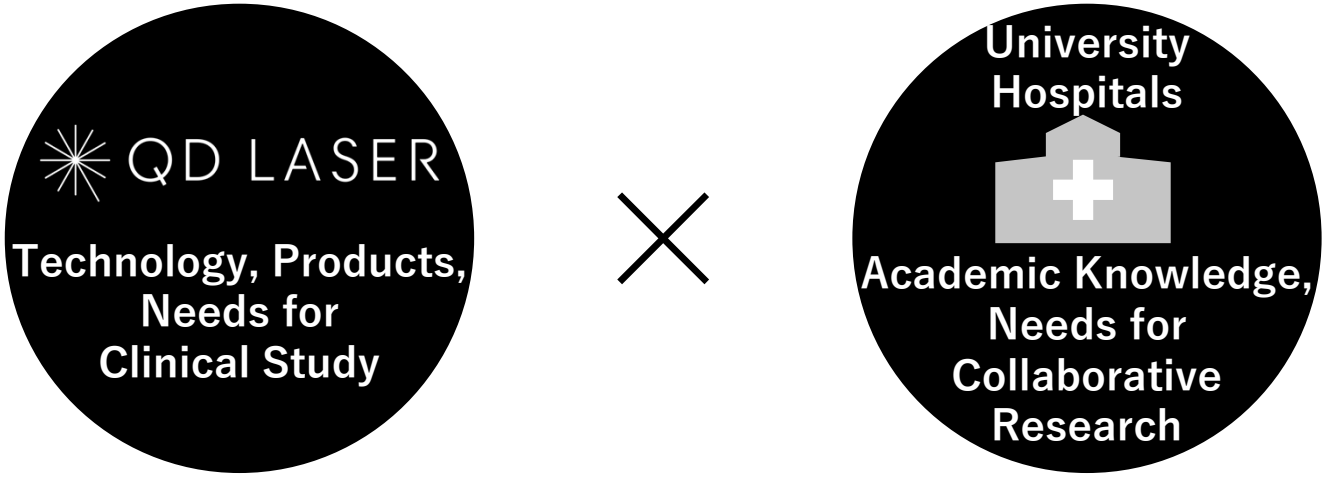
Laser Retinal Projection: Diseases and Applicable Rate

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					
		Phacocele	<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 • Adaptable to tunnel vision through wide-angle imaging • May not be applicable in cases with severe symptoms
		Lattice degeneration of retina	10,600					
		Hypertensive retinopathy	9,100			Some efficacy is seen in cases where anterior eye disease is also present		
		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%	• May not be applicable in cases with severe symptoms
		Optic nerve head drusen	200					
		Optic neuritis	115					
Other		High myopia	3,000	3,000	◎	Exceptionally effective	50%	
		Color amblyopia, color blindness	2,500	2,500	○	-	20%	• Can improve by processing images taken by camera

*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%.

Low Vision Aid＆Vision Healthcare: Industry-University Cooperation

Research and Development for Laser Retinal Projection Technology in Collaboration with Universities and Hospitals



▶ Gaining social recognition and sharing knowledge through sponsorship of conferences, etc.

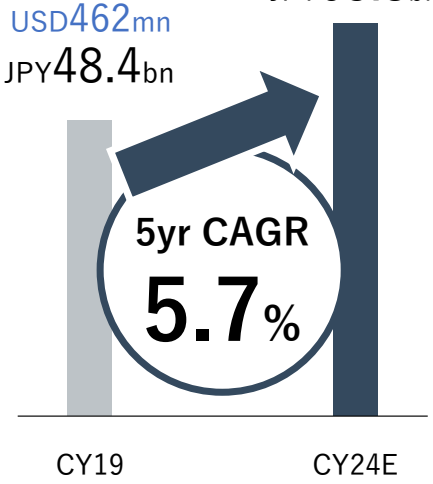
▶ Ongoing clinical research with universities and hospitals:
Low vision aide for clouding and retinopathy at two institutions
Visual field testing and fundus photograph at seven institutions

Large Growth Potential in Optometry Market

Utilizing Laser Retinal Projection Technology, Developed New Optometry Prototypes and Working with Partners to Launch in FY2022-2023

Estimated economic loss in Japan due to visual impairment*1

Fundus photography equipment market size*2



Conventional optometry equipment → New optometry equipment

Large / expensive / Requires medical staff

Medical resources are available mainly in urban areas.
Given the time and the financial cost, people miss the chance to go to their optometrist and end up detecting their glaucoma late

Small / low cost / short time / self-examination possible

Enables an environment where anyone can easily examine their eyes, increasing the early detection rate of glaucoma and expecting to extend the healthy lifespan of the eye

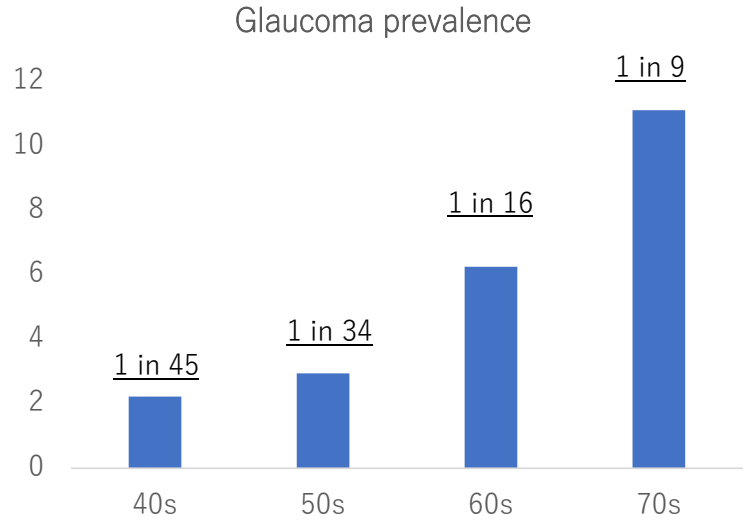
*1: Japan Ophthalmologists Association (2009) "Economic Cost of Visual Impairment in Japan" and "Prevalence of Visual Impairment in the Adult Japanese Population by Cause and Severity and Future Projections"
Economic cost = Direct health costs + Other financial costs + monetary converted number of loss of well-being from visual impairment (measured in disability-adjusted life years (DALYs))
*2: TechNavio (2020) "Global Ophthalmic Diagnostic Devices MARKET 2020-2024" Converted at an exchange rate of JPY/USD = 110 yen
*3: The approximate measurement time of the Goldmann perimeter and Humphrey perimeter, which are typical perimeters in conventional perimeter measurement.

Problem: Unrecognized symptoms

While the risk of blindness is expected to increase in the aging society, Glaucoma, the number one cause of blindness in JAPAN, can hardly be self-recognized.

People who are not aware of their glaucoma

90%



World blindness and severe myopia risk population in 2050 *1

1 billion people

2030 visual impairment costs in Japan

1.1 trillion yen

*1 : OECD: Health at a Glance 2007

Solution

World's only laser retinal projection technology and optimized algorithm enables you to scan retinal conditions in a short time by yourself without opening your pupils with mydriatics

1: Promote awareness

No medicine, Self-check

2: Less burden on the subject

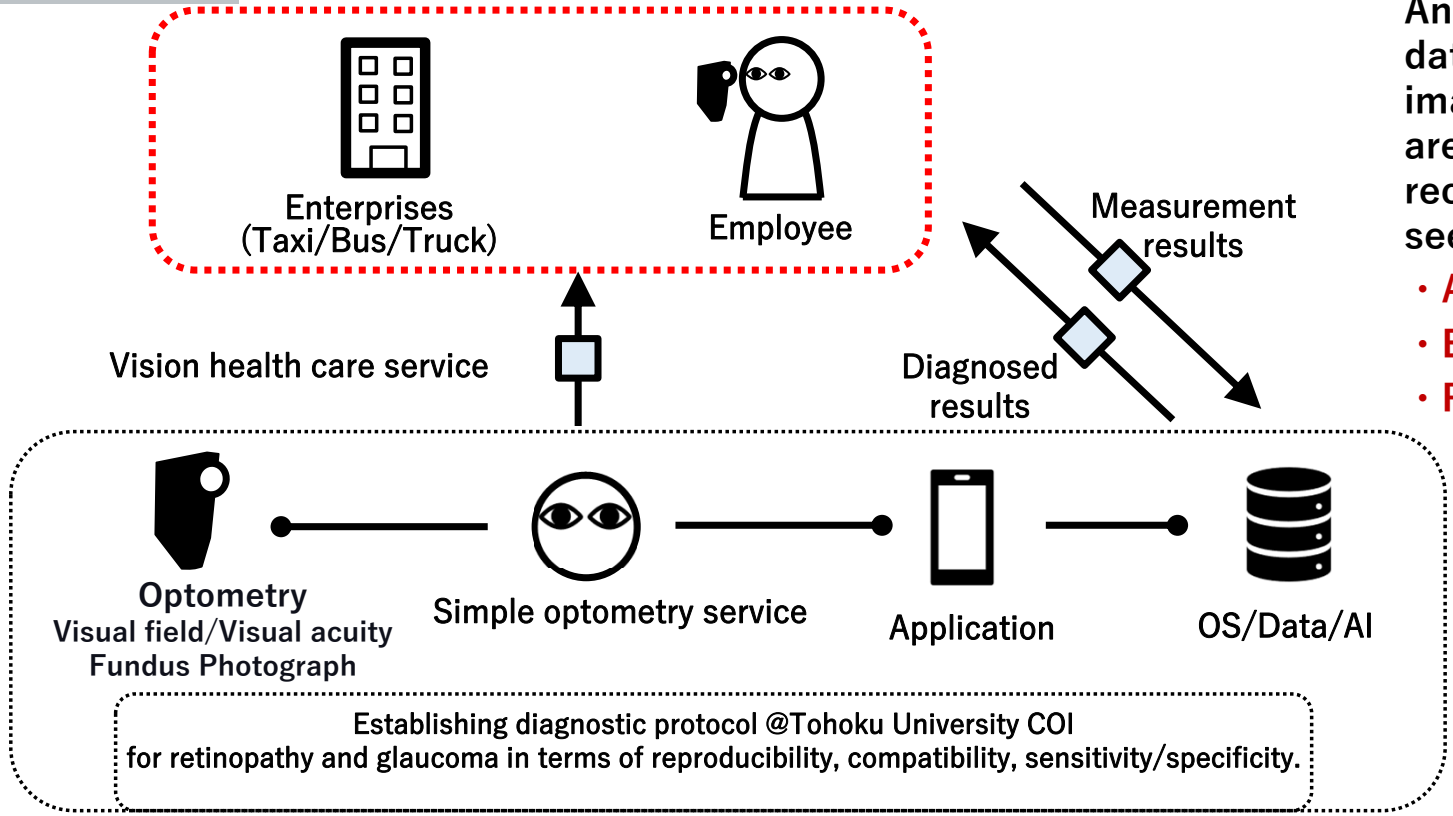
Less time

3. Inspection anywhere

Portable size

Date platform for vision health care in the concept stage

QDLaser is developing a service to provide simple optometry diagnostics for companies in industries where eyes are critical, like taxi. The optometry equipment was prototyped under the contract development on page 30. In partnership with a data management company, QDLaser is to offer trial operation in FY2022 and full-scale operation in FY2023.



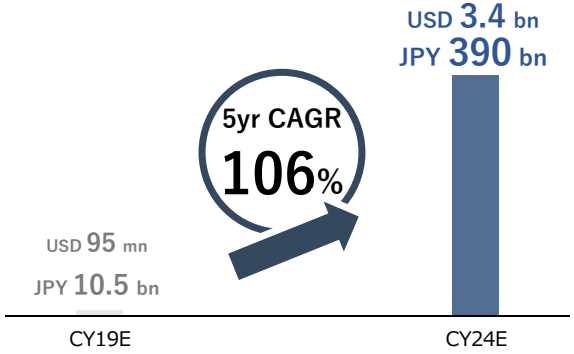
An algorism judges optometry data acquired by our retinal imaging equipment. If symptoms are observed, the system recommends stopping driving and seeing an ophthalmologist.

- Accident prevention
- Employment maintenance
- Prevention of blindness

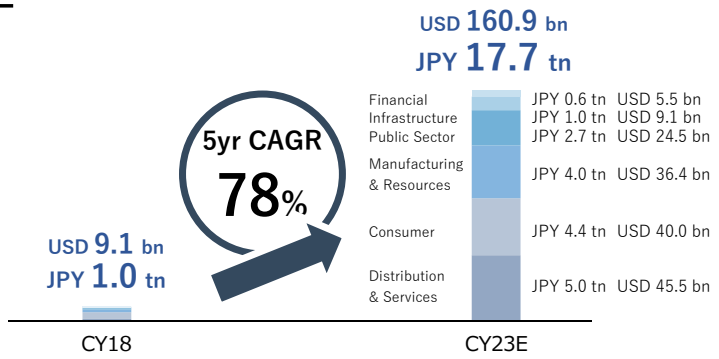
AR Market Potential

Making the Best Use of Unique Technical Features, Began Demonstration Experiments with Partner Companies in Each Field

Forecast of global smart glasses market*1



Forecast of global AR/VR market*2



Possible laser eyewear applications

Sports watching and live entertainment
- Close-up of players / artists
- Display bird's-eye view of the field or the scores

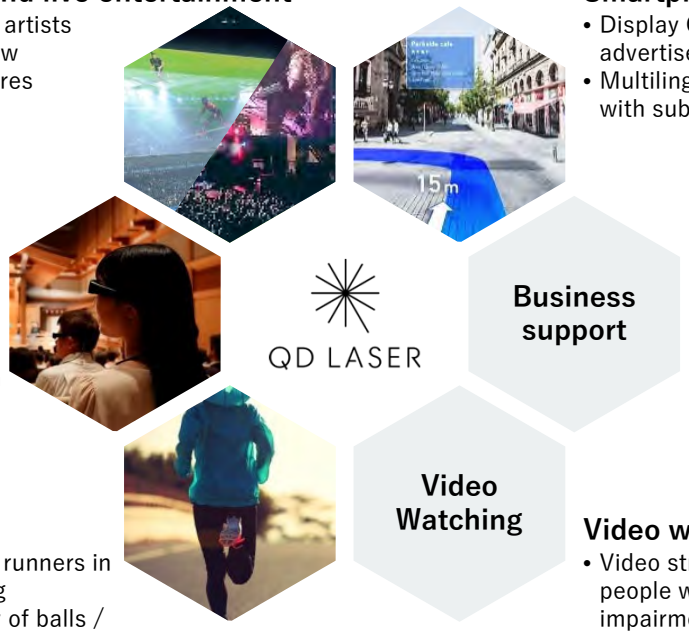
Smartphone link
- Display GPS navigation, advertisements
- Multilingual translation with subtitles

Arts appreciation
- Subtitles display when watching entertainment, at multi-view theater
- Display of commentary in the museum

Business support
- Work support in the manufacturing industry
- Support for drivers of heavy machinery and vehicles

Sports
- AR display of leading runners in long-distance running
- Display the trajectory of balls / arrows, and quantify qualitative adjustments to improve practice efficiency

Video watching
- Video streaming for people with visual impairment
- Watching movies and videos



*1: Fuji Chimera Research Institute, Inc. "Wearable/Healthcare Business Research 2020"
*2: IDC "Worldwide Semiannual Augmented and Virtual Reality Spending Guide, 2018H2"

Management Profiles

President and CEO
Mitsuru Sugawara

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

Director and CFO
Shinji Konoya

- 1991: Joined Fujitsu Ltd.
- 2015: Assumed the role of Senior Manager of the Business Strategy Department, Fujitsu, Ltd. and General Manager of Corporate Planning at QD Laser, Inc. (current role)
- 2016: Assumed the role of Director and CFO and concurrently serves as General Manager of Corporate Planning at QD Laser (current role)

Outside Director
Tsutomu Yoshida

- 1980: Joined Mitsui & Co., Ltd.
- 2013: Assumed the role of Director of QD Laser (current role)
- 2022: Director, Corporate Development Department, at Mitsubishi Chemical Holdings Corporation (current role)

Outside Director
Kaoru Hatano

- 2001: Joined Semiconductor Energy Laboratory Co., Ltd.
- 2021: Assumed the role of Department of Intellectual Property & New Business Development, at Cardio Intelligence Inc.(current role)
- 2022: Assumed the role of Director of QD Laser (current role)

Technical Advisor
Yasuhiko Arakawa

- Serves as Head of Institute for Nano Quantum Information Electronics, and Director of Center for Photonics Electronics Convergence, Institute of Industrial Science, University of Tokyo
- Notable awards:
  - Reona Esaki Award
  - Prime Minister's Honorary Award for Achievement in Industry-Academia- Governmental collaboration
  - Medal with Purple Ribbon

Possible Risks

The main business risks we are aware of and their countermeasures are as follows.

＜Business Risks*1＞	＜Possibility/ Time＞	＜counter-measure＞
Economic trends • The laser-related market in which we are entering is expected to continue its growth trend, mainly for industrial and medical equipment such as precision processing equipment and bio medical equipment. If market growth slow down due to economic trends and the accompanying decline in capital investment motivation, our business performance and financial position may be affected.	Middle/ Medium to long term	• Promote the construction of a business model that is resistant to economic fluctuations by entering a wide range of markets
Management deterioration of manufacturing contractors and quality accidents • We have a fabless manufacturing policy, so we outsource manufacturing to an external partner company. Considering the characteristics of each company, we decide the manufacturing items to each company according to the manufacturing capacity of our products. • For each company, we carry out quality inspections and confirmation of business conditions. If the management of the contractor deteriorates or a quality accident occurs, it is possible to easily change the contractor, but it will affect our business performance and financial position until the new production system is rebuilt.	Low/ Medium to long term	• Disperse risks by securing multiple outsourcers
Cash flow and financing • With the progress of our R&D activities, a large amount of R&D expenses have been recorded in advance. It is expected that the demand for working capital, R&D investment, capital investment, etc. will continue to increase as the business progresses. We will continue to strengthen our financial position in the future. But depending on the status of profits or raising funds, it may affect our business performance and financial position. • In addition, regarding the use of funds raised through the public offering, we plan to allocate it to the manufacturing cost of Laser Eyewear, but due to sudden changes in the business environment, etc., it may be used for purposes other than the originally planned use of funds and the return on investment may not be as expected.	Middle/ Medium to long term	• Secure financing means by promoting the establishment of bank credit lines such as commitment lines and overdrafts
Partnership with other companies in laser eyewear business • Each device in the laser eyewear business is sold to end users through sales agents such as optical stores, pharmaceutical and medical device manufacturers, and specialized trading companies, as well as EC sites operated by agents. In addition, we provide equipment, parts, and modules to business partners, who commercialize or package them for sale. • The sales plan for the laser eyewear business is created based on the sales targets of these partners and the agreements that have already been concluded. These sales targets were set based on marketing activities, etc., prior to market launch. However, retinal projection devices are almost unprecedented products in the market. Any changes, etc., may affect our business performance.	Middle/ Medium to long term	• Disperse risks by diversifying alliances

*1: For risks other than the above that we recognize, please refer to “Business Risks” in the securities report (Only in Japanese).

Terminology

Semiconductor laser	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.
Quantum dot laser (QDL)	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.
DFB laser	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.
Silicon photonics	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).
VISIRIUM technology	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.
Diffraction grating technology	A technology that freely and precisely controls the wavelength of semiconductor lasers to fit into various applications by forming periodic irregularities inside the laser.
Ultrashort pulse	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.
Retinal projection	To project images onto the retina
Simple perimeter	A device to assess the visual field of human eyes
CE marking	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.
Flow cytometer	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.
LiDAR	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.
Heads-up Display	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.

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