

INSTRUMENTATION MARKET OVERVIEW

Markets Day

May 14, 2024

Paul Silverstein

Senior Vice President, Investor Relations & Corporate Communications

HOST



Paul Silverstein
Senior Vice President,
Investor Relations &
Corporate Communications

FORWARD-LOOKING STATEMENTS

This presentation contains forward-looking statements relating to future events and expectations, including our expectations regarding (i) our future financial and operational results; (ii) growth and opportunities, and trends in the markets we serve including industrial, communications, electronics, and instrumentation (and, in particular, in the biotechnology and analytical instrumentation markets and the medical market); (iii) the growth in health care wearables and their use in enabling personalized medicine, each of which, is based on certain assumptions and contingencies. The forward-looking statements are made pursuant to the safe harbor provisions of the U.S. Private Securities Litigation Reform Act of 1995 and relate to the Company's performance on a going-forward basis. The forward-looking statements in this investor presentation involve risks and uncertainties, which could cause actual results, performance or trends to differ materially from those expressed in the forward-looking statements herein or in previous disclosures.

The Company believes that all forward-looking statements made by it in this presentation have a reasonable basis, but there can be no assurance that management's expectations, beliefs, or projections as expressed in the forward-looking statements will actually occur or prove to be correct. In addition to general industry and global economic conditions, factors that could cause actual results to differ materially from those discussed in the forward-looking statements in this presentation include but are not limited to: (i) the failure of any one or more of the assumptions stated herein to prove to be correct; (ii) the risks relating to forward-looking statements and other "Risk Factors" discussed in the Company's Annual Report on Form 10-K for the fiscal year ended June 30, 2023, and additional risk factors that may be identified from time to time in filings of the Company; (iii) the substantial indebtedness the Company incurred in connection with its acquisition of Coherent, Inc. (the "Transaction"), the need to generate sufficient cash flows to service and repay such debt and the Company's ability to generate sufficient funds to meet its anticipated debt reduction goals; (iv) the possibility that the Company may not be able to continue its integration progress on and/or take other restructuring actions, or otherwise be able to achieve expected synergies, operating efficiencies, including greater scale, focus, resiliency, and lower operating costs, and other benefits within the expected time-frames or at all and ultimately to successfully fully integrate the operations of Coherent, Inc. ("Coherent") with those of the Company; (v) the possibility that such integration and/or the restructuring actions may be more difficult, time-consuming or costly than expected or that operating costs and business disruption (including, without limitation, disruptions in relationships with employees, customers or suppliers) may be greater than expected in connection with the Transaction and/or the restructuring actions; (vi) any unexpected costs, charges or expenses resulting from the Transaction and/or the restructuring actions; (vii) the risk that disruption from the Transaction and/or the restructuring actions materially and adversely affects the respective businesses and operations of the Company and Coherent; (viii) potential adverse reactions or changes to business relationships resulting from the completion of the Transaction and/or the restructuring actions; (ix) the ability of the Company to retain and hire key employees; (x) the purchasing patterns of customers and end users; (xi) the timely release of new products, and acceptance of such new products by the market; (xii) the introduction of new products by competitors and other competitive responses; (xiii) the Company's ability to assimilate other recently acquired businesses, and realize synergies, cost savings, and opportunities for growth in connection therewith, together with the risks, costs, and uncertainties associated with such acquisitions; (xiv) the Company's ability to devise and execute strategies to respond to market conditions; (xv) the risks to realizing the benefits of investments in R&D and commercialization of innovations; (xvi) the risks that the Company's stock price will not trade in line with industrial technology leaders; and/or (xvii) the risks of business and economic disruption related to worldwide health epidemics or outbreaks that may arise. The Company disclaims any obligation to update information contained in these forward-looking statements, whether as a result of new information, future events or developments, or otherwise. Unless otherwise indicated in this presentation, all information in this presentation is as of May 14, 2024.

SPEAKERS



Dr. Sanjai Parthasarathi
Chief Marketing Officer



Dr. Kim Netzeband
Director, Instrumentation
Marketing



Dr. Karlheinz Gulden
Senior Vice President, Laser
Components and Subsystems

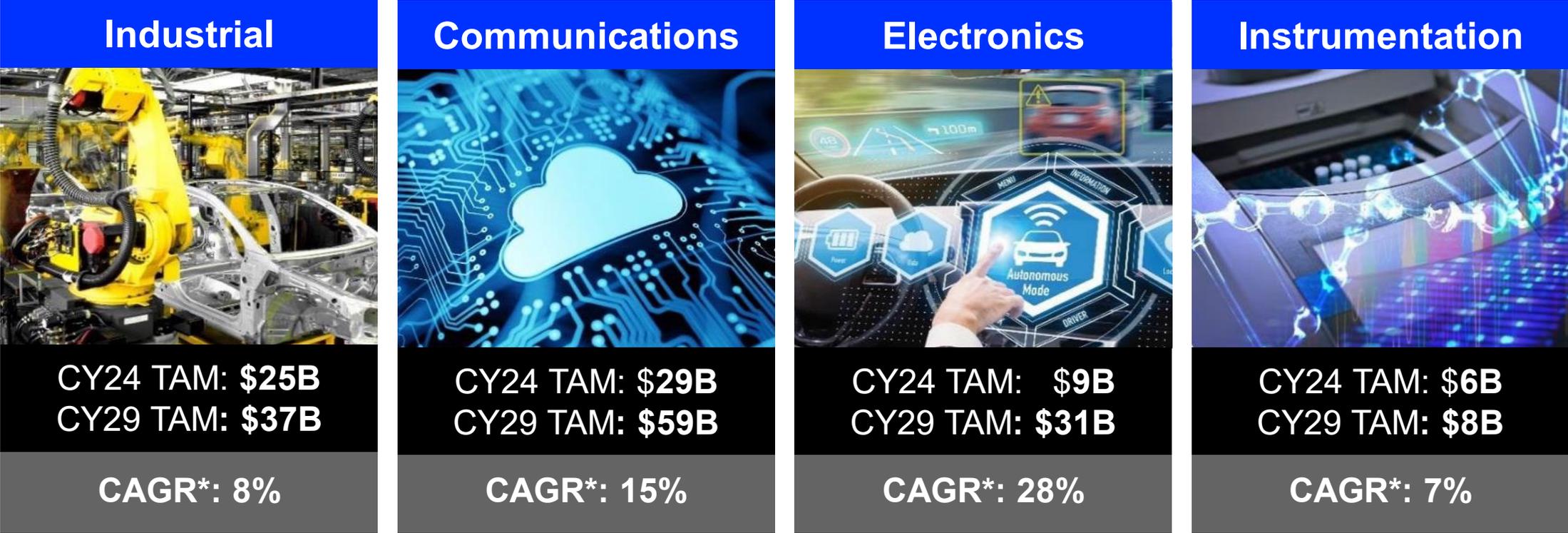


Darryl McCoy
Vice President & General
Manager of Coherent Scotland

INSTRUMENTATION MARKET OVERVIEW

Dr. Sanjai Parthasarathi - Chief Marketing Officer

COHERENT MARKETS ARE HEALTHY AND GROWING OVER THE LONG TERM

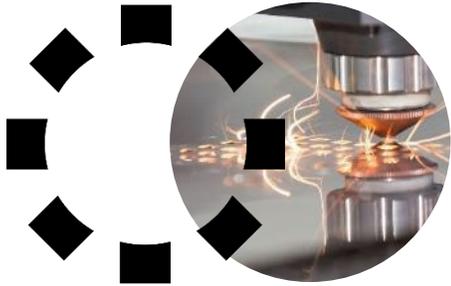


Combined CY24 TAM of \$69B growing to \$135B within five years

Note: *CAGR is a 5 year CAGR from CY24 to CY29

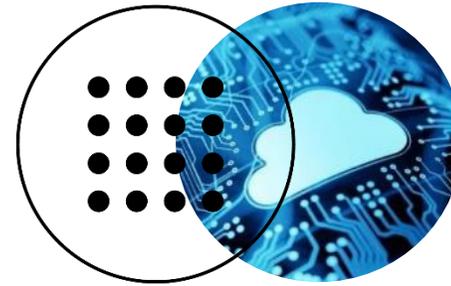
OUR MARKETS AND VERTICALS

Industrial Market



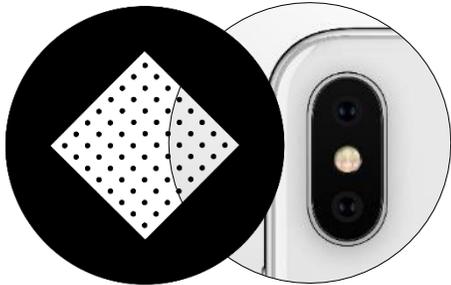
- **Precision Manufacturing**
Components, Lasers and Systems
- **Semiconductor Capital Equipment**
Optics, Materials, and Lasers
- **Display Capital Equipment**
Optics, Materials and Lasers
- **Aerospace & Defense**
Optics, Materials and Lasers

Communications Market



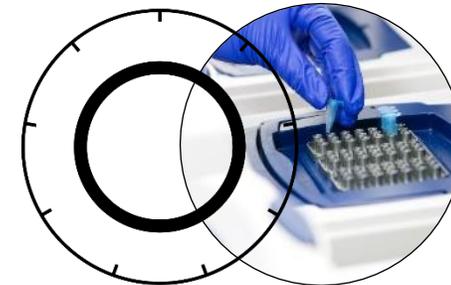
- **Datacom**
Lasers, Optics, ICs and Transceivers
- **Telecom**
From Materials to Systems

Electronics Market



- **Consumer Electronics**
Lasers, Optics, and Materials for Devices
- **Automotive**
SiC Devices, Lasers and Materials

Instrumentation Market



- **Life Sciences**
Materials, Optics, Lasers and Subsystems
- **Scientific Research**
Lasers and Optics

Focus of Today's Event

HEALTH CARE: DRIVERS & TRENDS

Aging Population

- Age 80+ will triple by 2050*
- Non-communicable diseases
- Dementia-related diseases

Technology

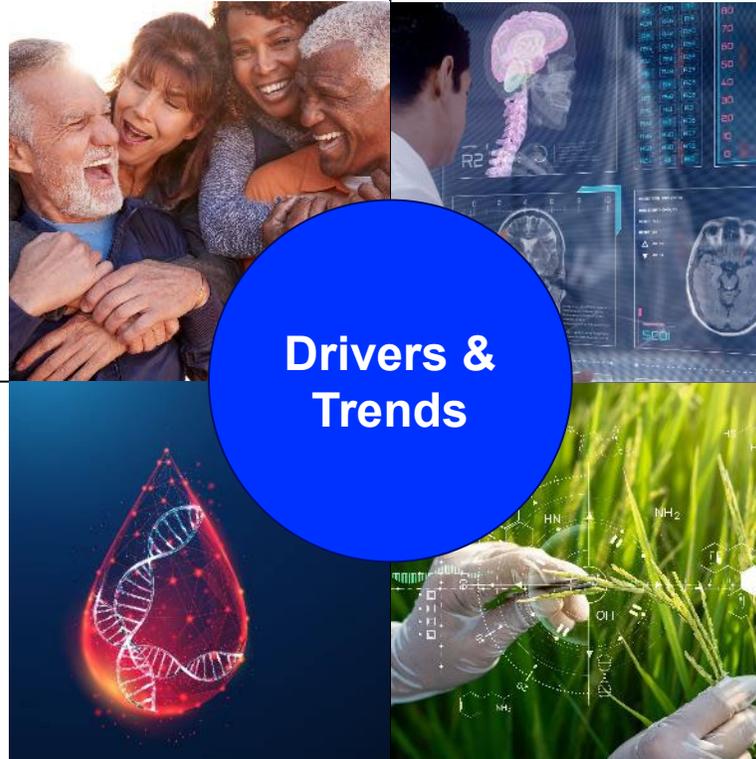
- POC (Point of care)
- Virtual health/telehealth
- Wearables, sensors, biometrics, AR/VR
- Nanotechnology

Personalized Care

- Predisposition, screening, diagnosis, prognosis, pharmacogenomics, monitoring

Environment

- Air & water
- Food & beverage
- Agriculture
- Pharmaceuticals



* Source: World Health Organization (WHO)

OUR INSTRUMENTATION OPPORTUNITY - MARKET SIZING

Worldwide Health Spending
>\$ 10 Trillion

Life Sciences
included Medical
\$808B+

Instrumentation
Solutions
\$350B+

Optical &
Thermal
Applications
Our TAM
\$5.6B

Coherent Market Focus

Markets and Solutions

- Healthcare services
- Pharmaceuticals
- Medical equipment
- Biologics
- Instrumentation
- Software



MARKET SEGMENTATION

Biotechnology

- Flow cytometry
- Sequencing
- PCR
- Diagnostics/POC
- Microarrays
- Nucleic acid prep
- Cell Separation
- Electrophoresis
- In Vivo animal Imaging
- Cell counters
- High content screening
- Diagnostics/POC
- Immunoassays
- Analyzers

Analytical

Environmental Testing

- Air & water
- Food/beverage
- Pharmaceuticals
- Agriculture

Spectroscopy

- NMR
- UV-Vis/IR/NIR
- Color measurement
- Raman

Medical

Medical Laser

- Cosmetic
- Dermatology
- Ophthalmic
- Dental

Medical Imaging

- Endoscopy
- OCT

Point of Care

- Diabetes testing

Thermal

- Hospital bedding
- Therapy
- Migraine relief

Scientific

Microscopy

- Multiphoton/confocal
- Neuroscience, cell biology, disease studies

Physical Chemistry

- Femtochemistry
- Spectroscopy

Applied Physics

- Material studies
- Atomic/molecular

INSTRUMENTATION TAM

	CY24	CY29	5 YR CAGR
Life Sciences	\$4.9B	\$7.0B	7%
Biotechnology & Analytical	\$2.4B	\$3.4B	8%
Medical	\$2.5B	\$3.6B	7%
Scientific	\$0.7B	\$0.9B	5%
Scientific	\$0.7B	\$0.9B	5%
Total Instrumentation	\$5.6B	\$7.9B	7%

Note: Numbers in this summary presentation were rounded for simplicity.

Sources:

Strategies Unlimited 2021
 Internal Estimates
 Markets & Markets
 Market watch
 Verified Market Research

Transparency Market Research
 Market Research Future
 SDI 2021 Global Assessment Report
 Data Bridge Market Research
 Mordor Intelligence

INSTRUMENTATION – MARKET DYNAMICS

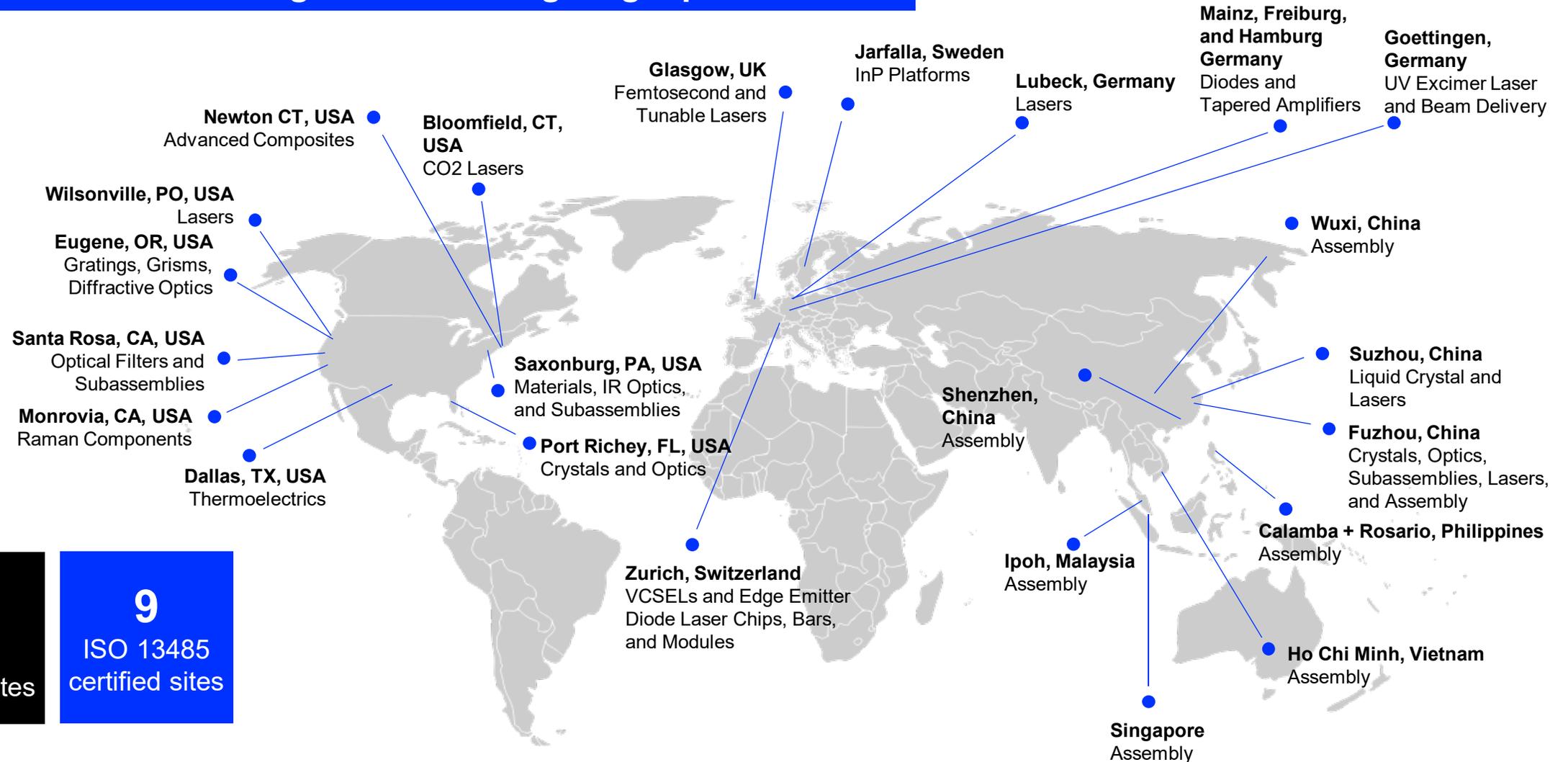
- **Diverse** - rapidly expanding sub-verticals and applications
- **Conservative** - long qualification cycles (1-2 years), but faster prototyping requirements
- **High Degree of Stickiness** - continues
- **Performance Biased** - generally, but growing pricing pressures at the component level
- **Varying Volume Requirements** - from hundreds to millions depending on application
- **Higher-Levels of Integration** - continues, along with more outsourcing, geographical preferences
- **Rapidly Evolving Next Generation Platforms** - recently, driven by COVID-related and technology-based solutions
- **Geopolitical Dynamics** - IP protection & diversity of manufacturing locations

- 1 Conservative
- 2 Speed To Market
- 3 Global Network Of Service Centers
- 4 Geopolitical Dynamics



DIVERSIFIED GLOBAL MANUFACTURING FOOTPRINT

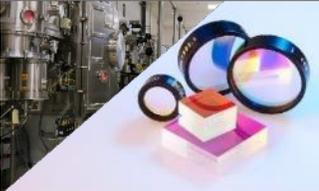
Diversified manufacturing locations mitigate geopolitical risk



70
ISO
certified sites

9
ISO 13485
certified sites

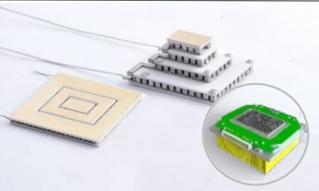
COHERENT IS A LEADER IN THE INSTRUMENTATION MARKET



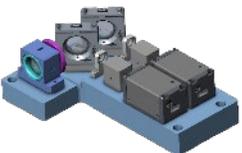
Materials & Optics



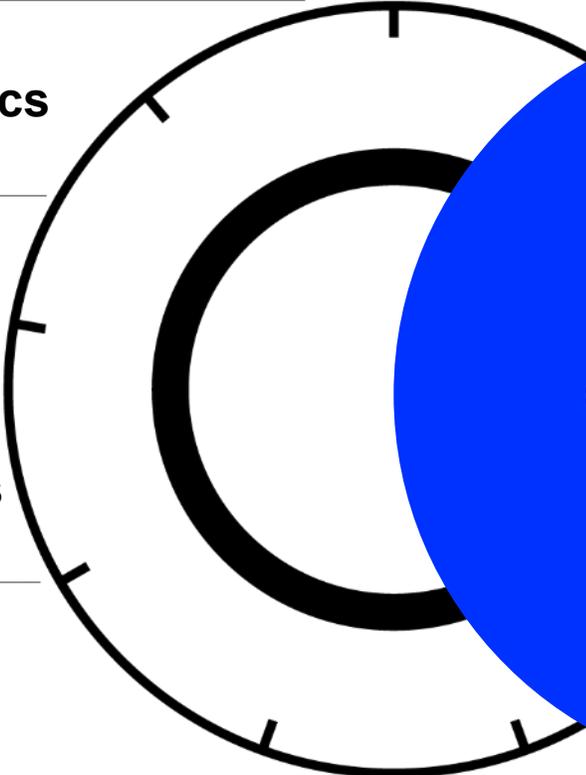
Lasers



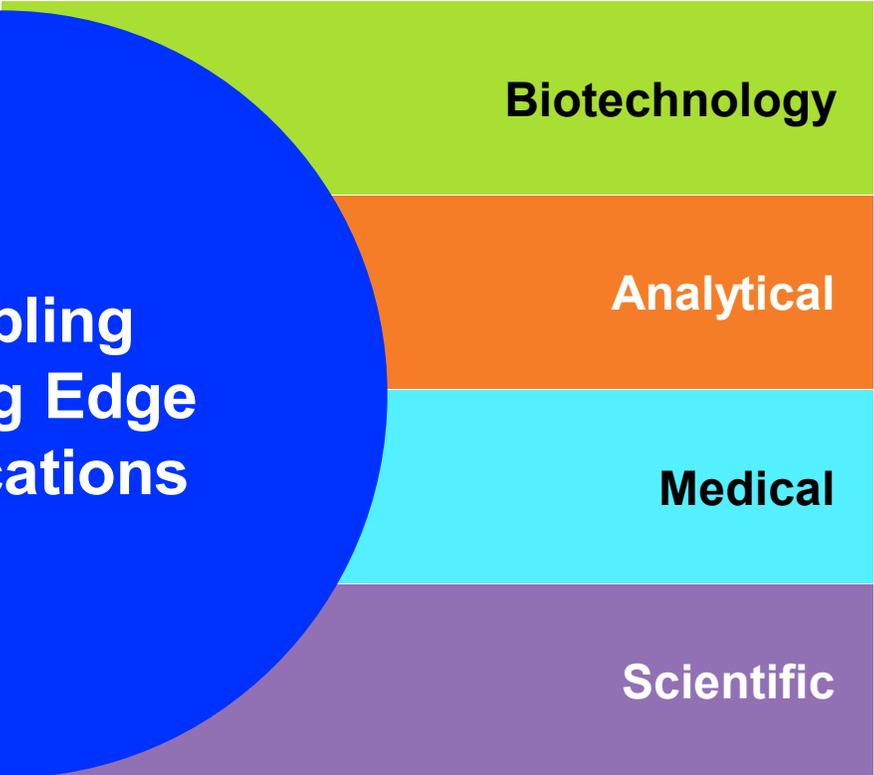
Thermoelectrics



Subassemblies



**Enabling
Cutting Edge
Applications**



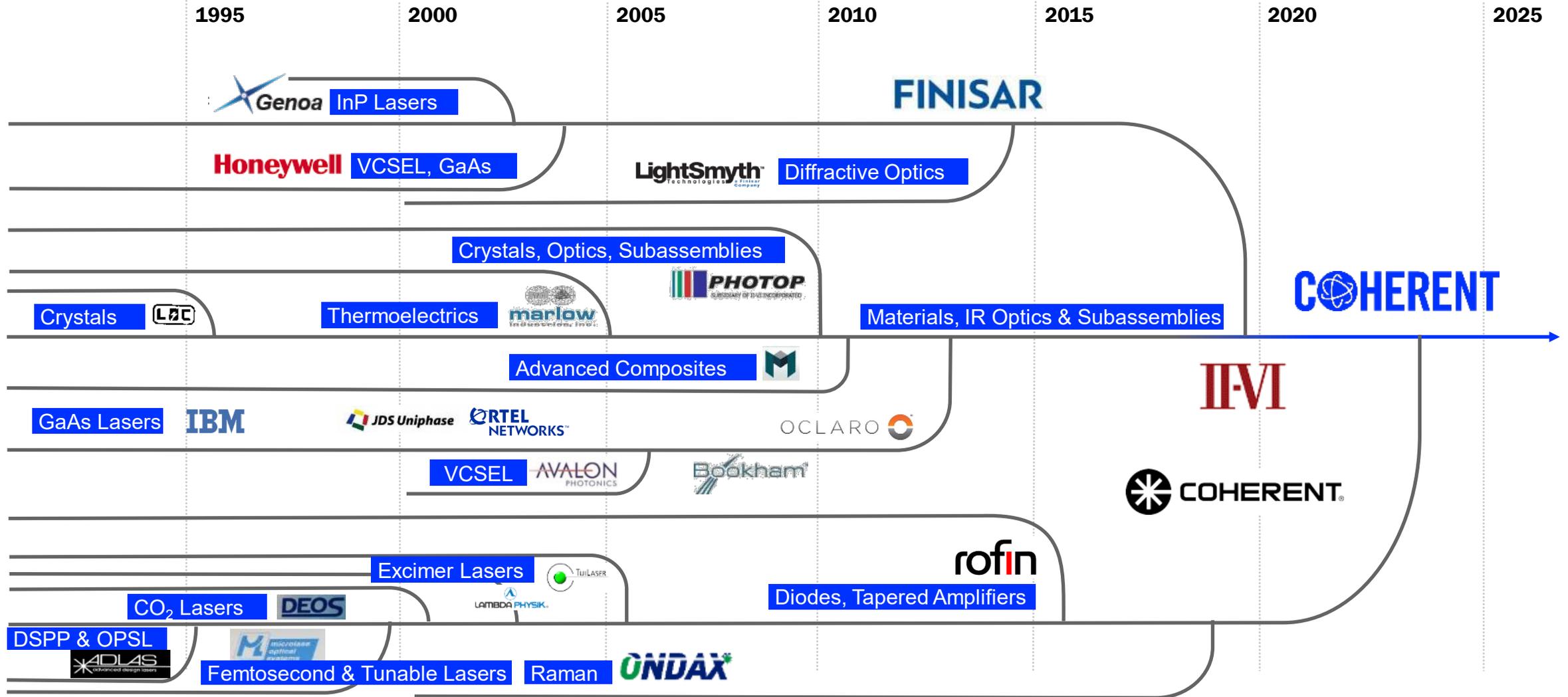
Biotechnology

Analytical

Medical

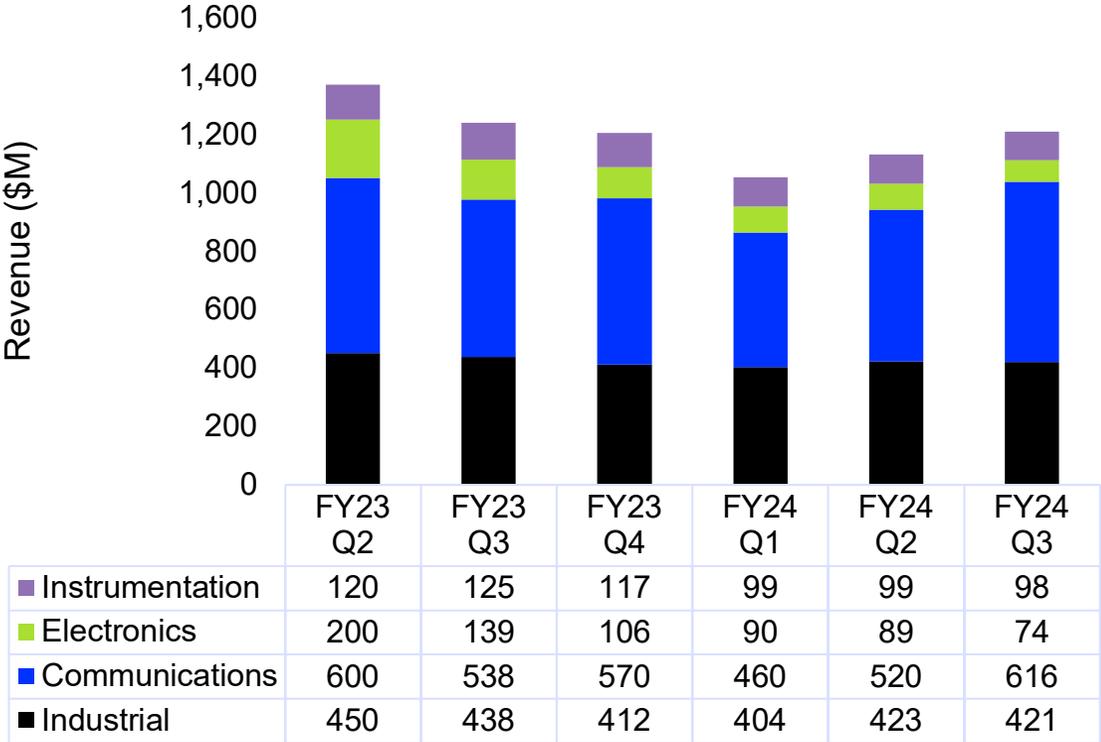
Scientific

EXPANSIVE HERITAGE OF SUPPORTING THE INSTRUMENTATION MARKET

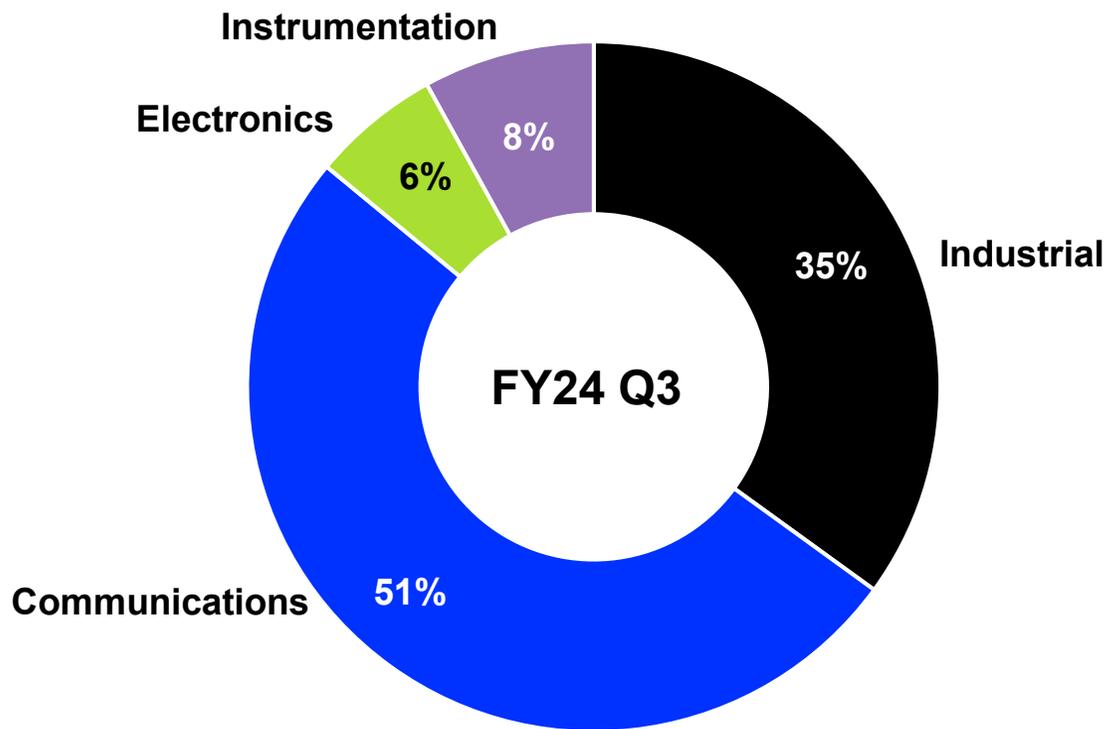


REVENUE TRENDS BY MARKET

Quarterly Revenue Trend

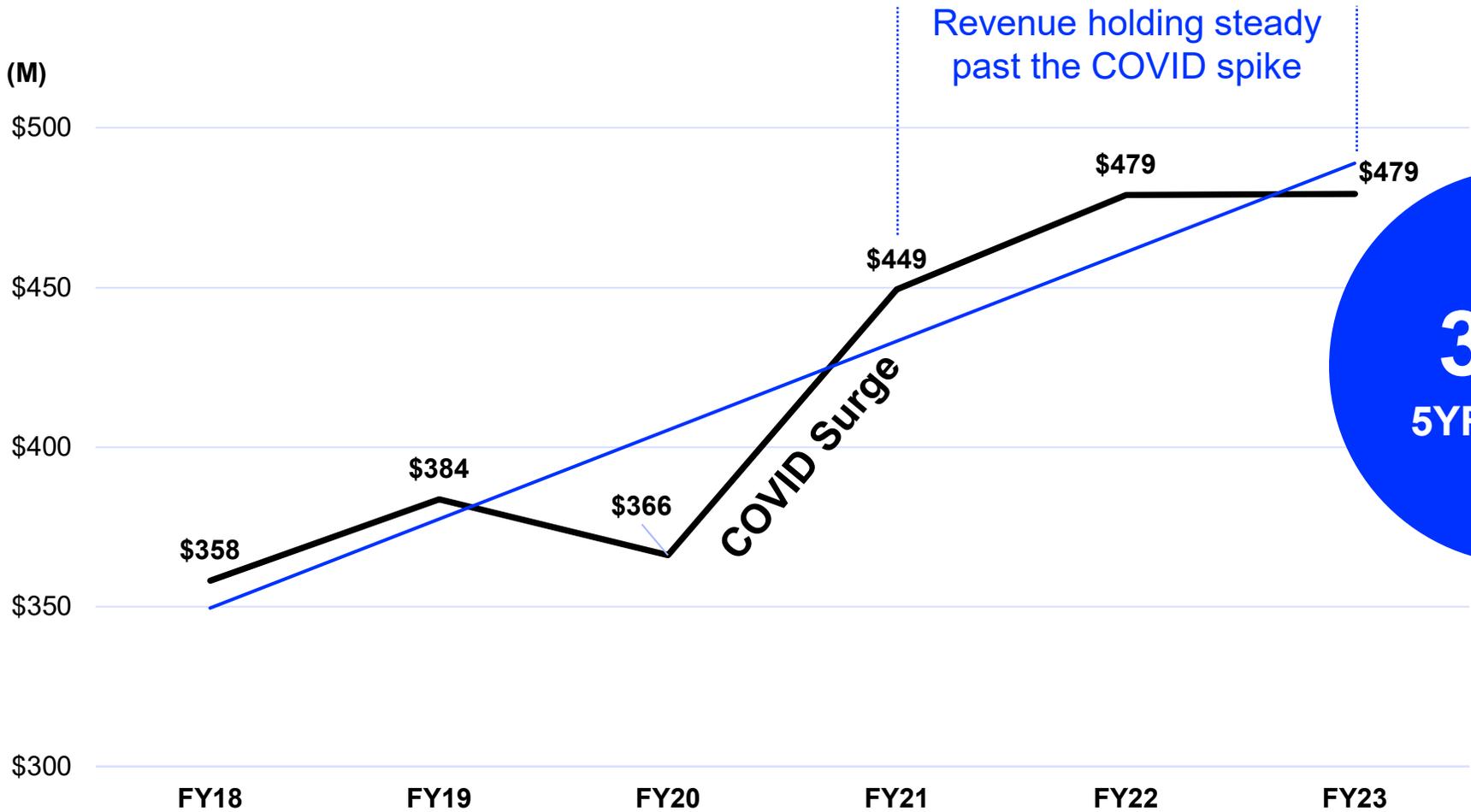


Revenue Distribution*



* Amounts may not recalculate due to rounding.

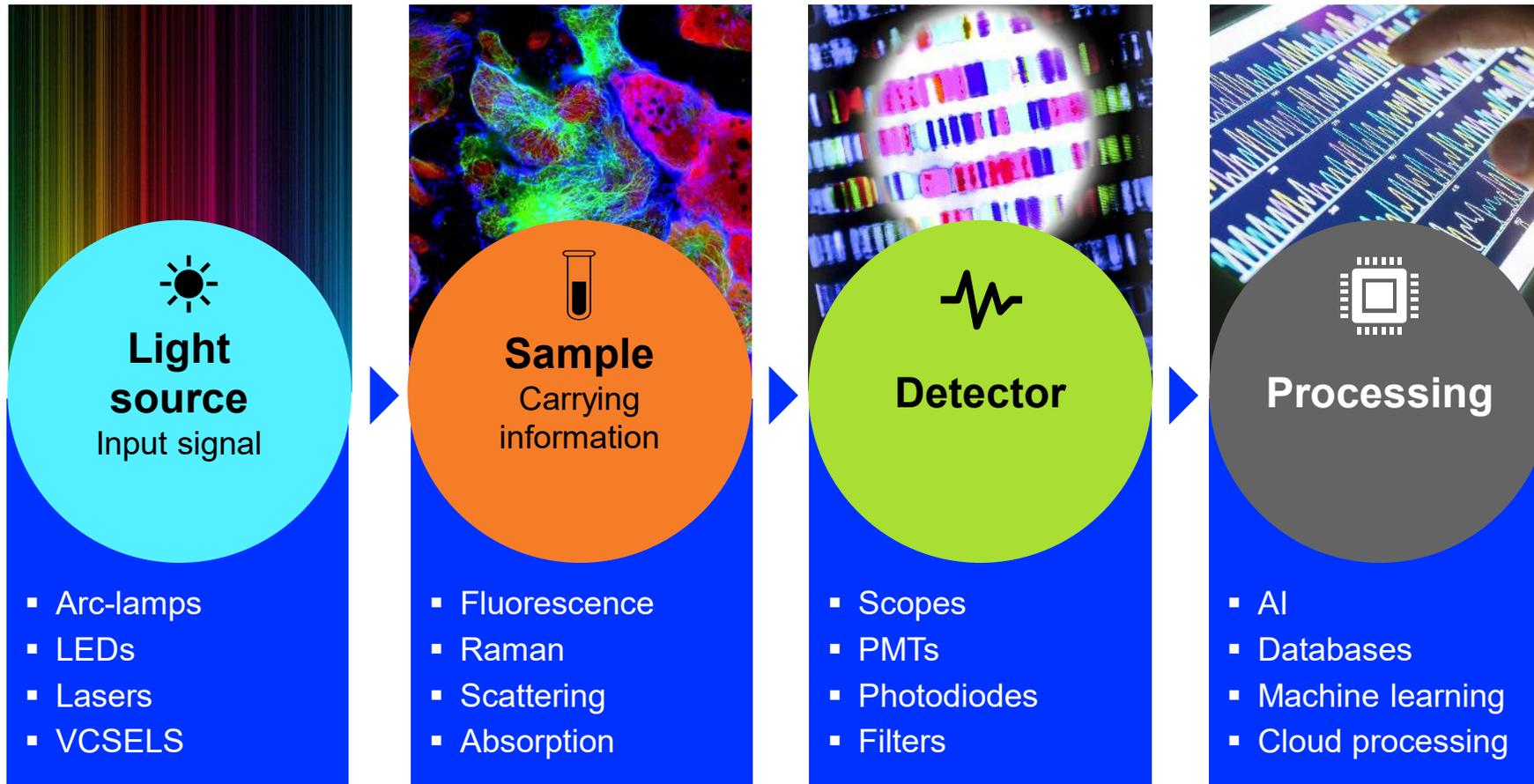
PROFORMA INSTRUMENTATION REVENUES 34% 5 YR CAGR (FY18 - FY23)



34%
5YR Growth



PHOTONICS IN BIOTECHNOLOGY



Size from benchtops to wearables

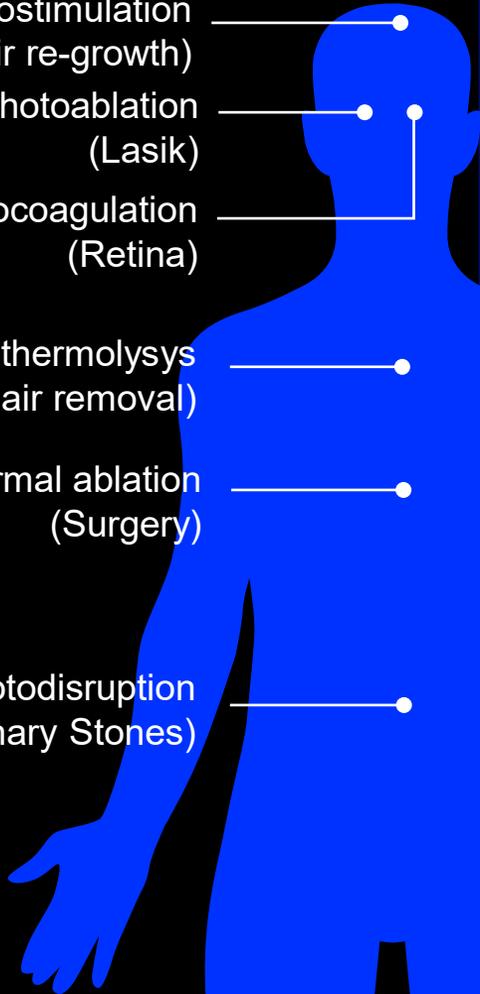


PHOTONICS IN MEDICAL THERAPEUTICS

Broad portfolio of lasers, optics and beam delivery fibers



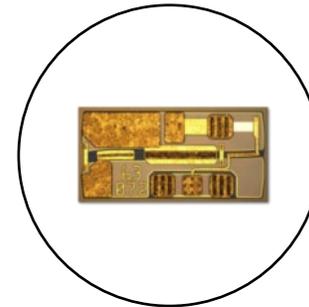
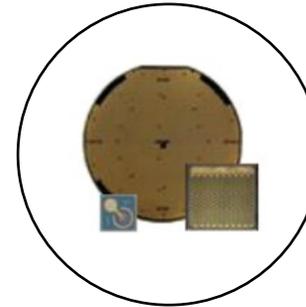
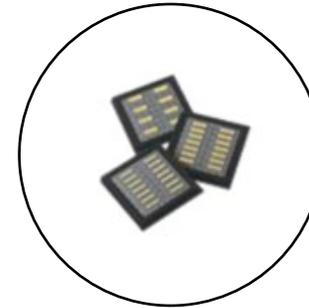
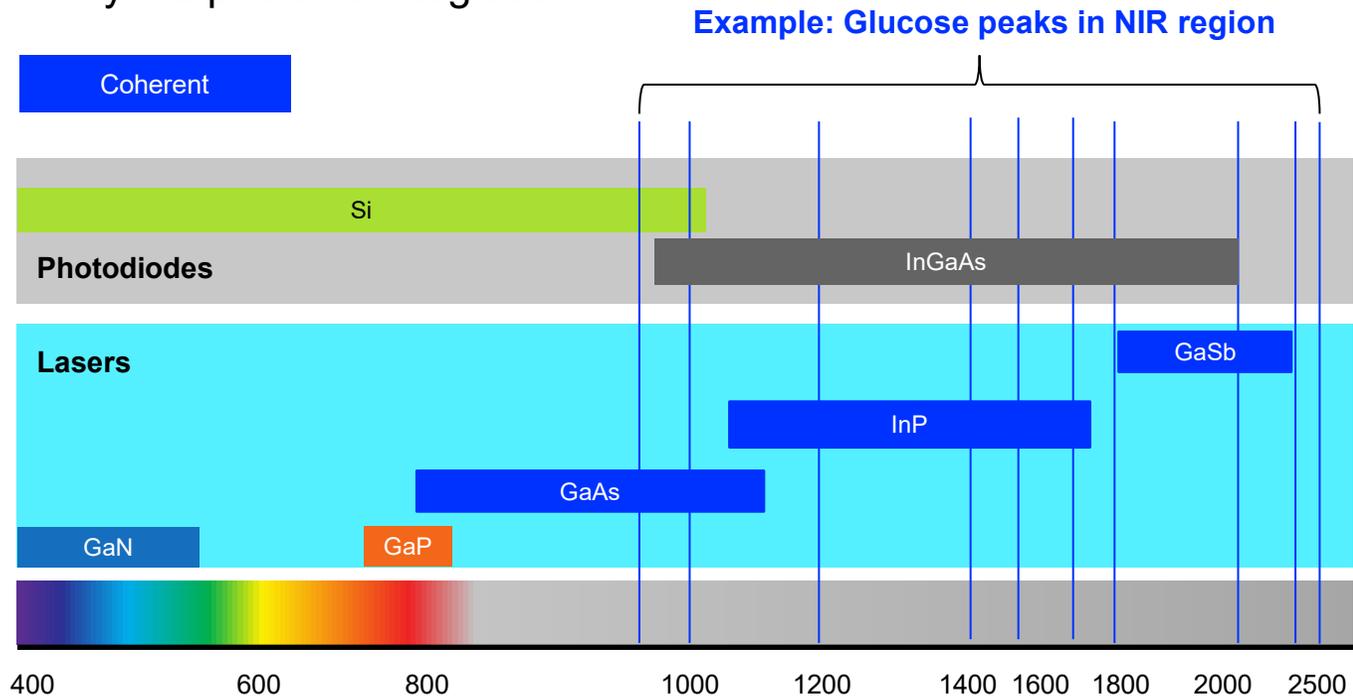
- Photobiostimulation (Hair re-growth)
- Photoablation (Lasik)
- Photocoagulation (Retina)
- Photothermolysis (Hair removal)
- Thermal ablation (Surgery)
- Photodisruption (Urinary Stones)



MONITORING PERSONAL HEALTH WITH WEARABLES

Semiconductor lasers and photonic integration are key enablers for wearable biosensors.

- Wavelength and linewidth choices
- Size and power consumption
- Hybrid photonic integration



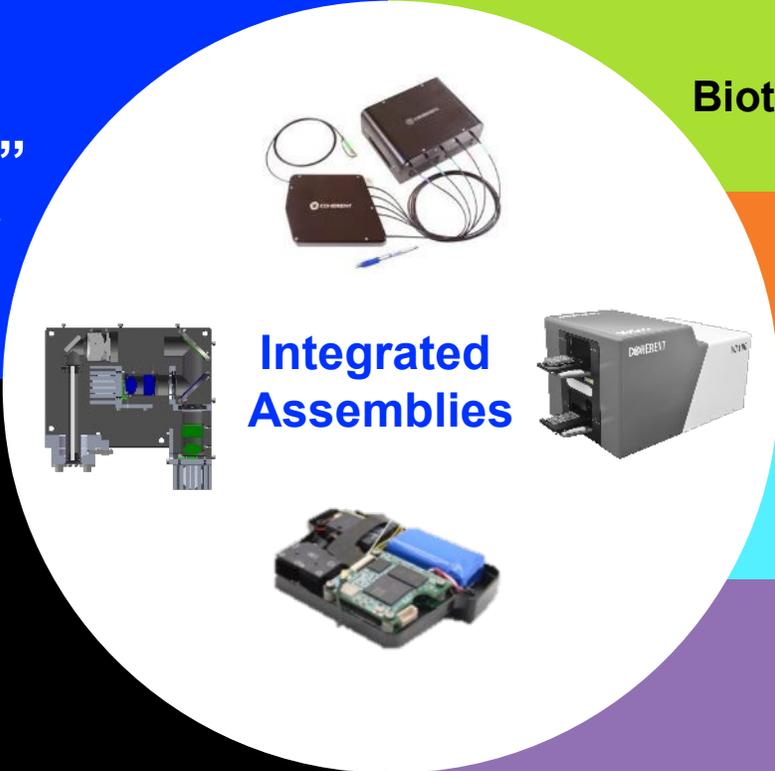
COHERENT DIFFERENTIATION

Coherent is providing
“Solutions for Life Sciences”

...from materials to components to subassemblies & systems
...leveraging global manufacturing and vertical integration to meet performance, quality and cost reduction requirements

Coherent is a
“Systems Level Partner”

...from proof of concept to design and volume manufacturing

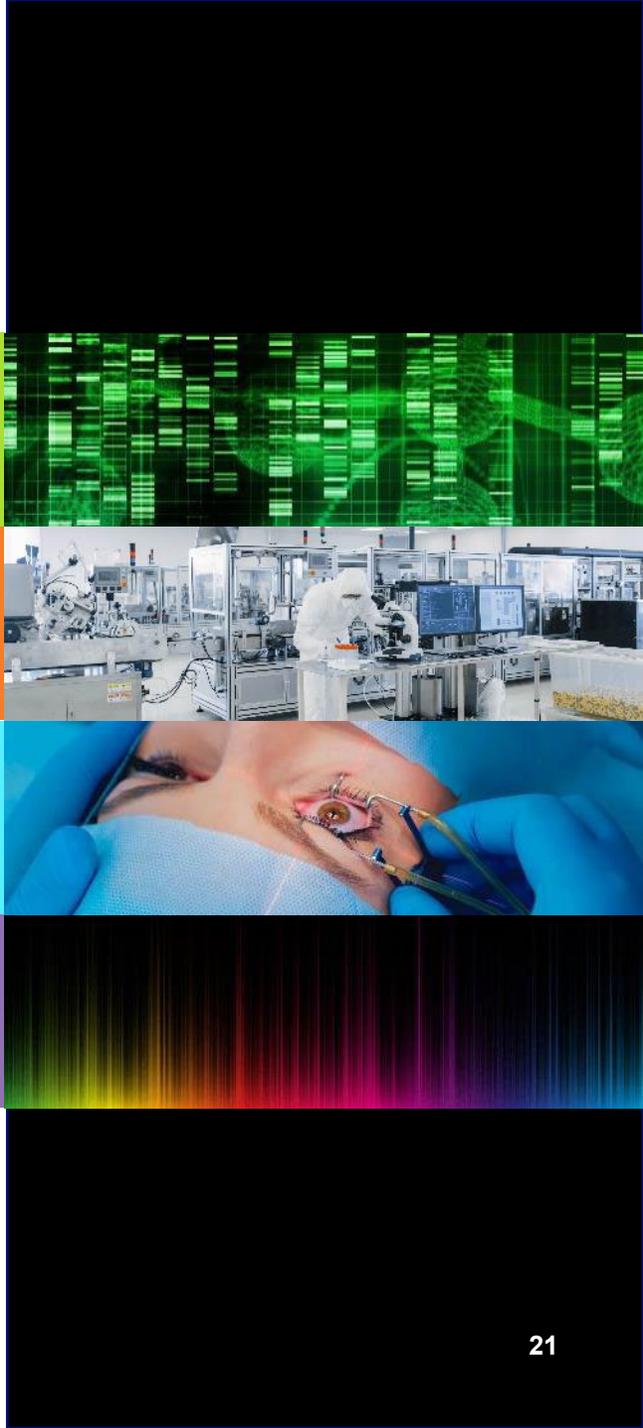


Biotechnology

Analytical

Medical

Scientific



BIOTECHNOLOGY & ANALYTICAL INSTRUMENTATION MARKETS

Dr. Kim Netzeband - Director, Instrumentation Marketing

COHERENT FOCUS: INSTRUMENTATION FOR BIOTECHNOLOGY & ANALYTICAL MARKETS

Healthcare



- Aging population & lifestyle
- Chronic & infectious disease
- Diagnostics
- Drug discovery
- Genomics & personalized Medicine

Environment & Safety



- Air & water
- Food & beverage
- Pharmaceuticals
- Agriculture
- Material sciences

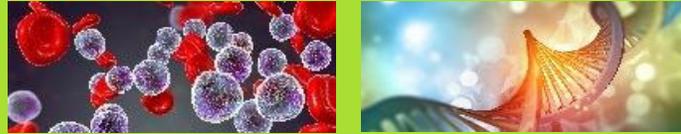
Coherent's Photonic & Thermal based technologies are driving next generation platform innovations!

BIOTECHNOLOGY & ANALYTICAL TAM & REVENUE

Life Sciences Instrumentation Segmentation

Biotechnology

Using living organisms (or their parts) for research, industrial, or diagnostic purposes



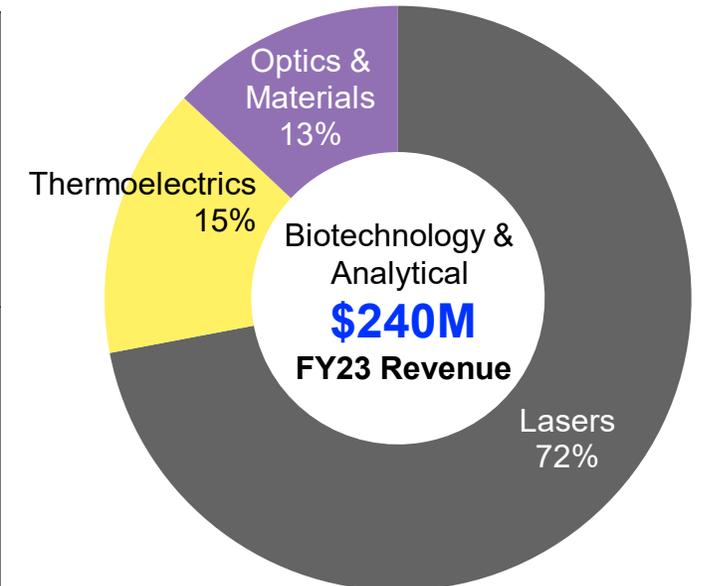
Analytical

For environmental applications and analytical sciences



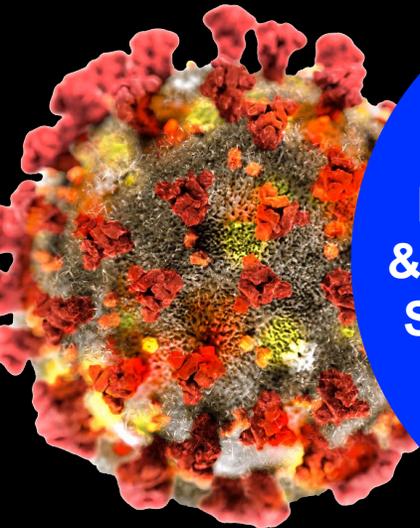
Medical

Biotechnology & Analytical		
TAM		CAGR
2024	2029	
\$2.4B	\$3.4B	8%



Components & Subassemblies

COVID - CATALYST FOR HEALTHCARE, ENVIRONMENT & SAFETY TRANSFORMATION



Photonic & Thermal Solutions

Exponential Advances In Biomedical Sciences

Diagnostics/Sequencing



Medical Laser Therapy



Advances In Sterilization & Monitoring

UV Sanitation /Thermal Monitoring



Prevention & Wellness

POC (Point of Care)



Informed & Empowered Consumers

Wearable



Environmental Impact Awareness

Environmental Testing
Food/Bev Testing



Jan 2020

Technology Transformation

2024+ exponential growth expected

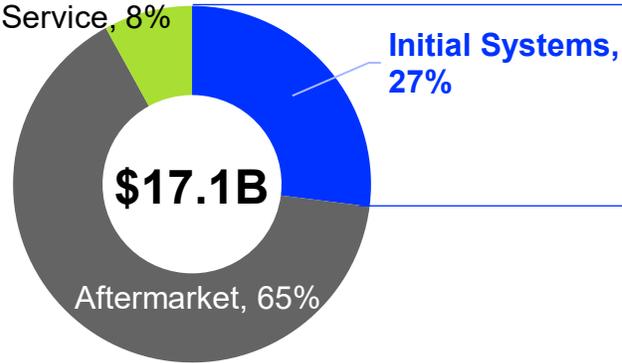
4 KEY INSTRUMENTATION MARKET TRENDS

1

Generally, consumable and aftermarket driven

Life Science Instrumentation

\$17B (2021) | 6.1% CAGR
 \$23B (2026)



Initial Systems/ Instrumentation

\$4.6B (2021) | 4.6% CAGR
 \$5.8B (2026)

* Source: SDI Global Assessment Report 2022

2

Distinct Biotechnology focus areas

Research

Predisposition

Diagnosis

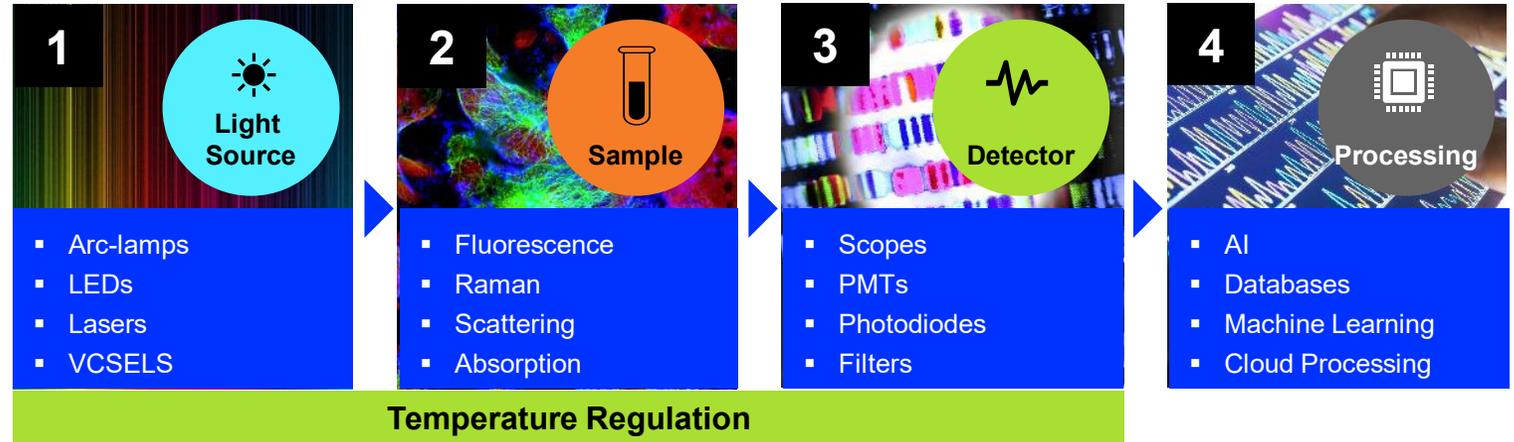
Treatment

Monitoring

4 KEY INSTRUMENTATION MARKET TRENDS

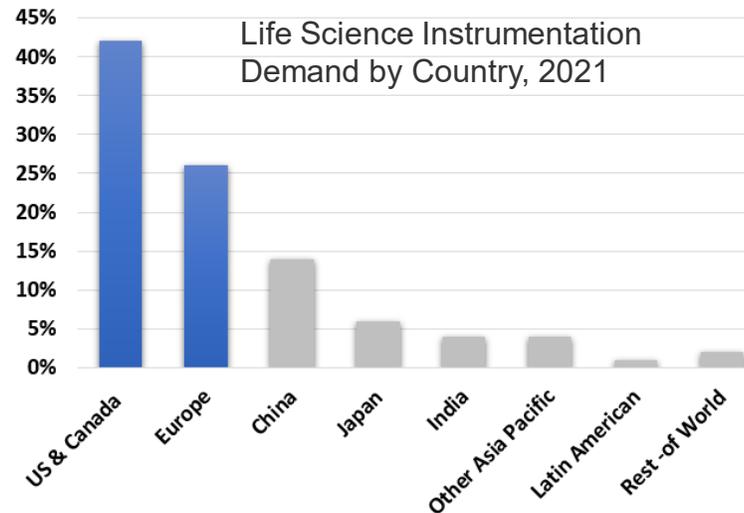
3 Similar Platform or Instrumentation Architectures

4 key elements



4 Geographic Commonalities

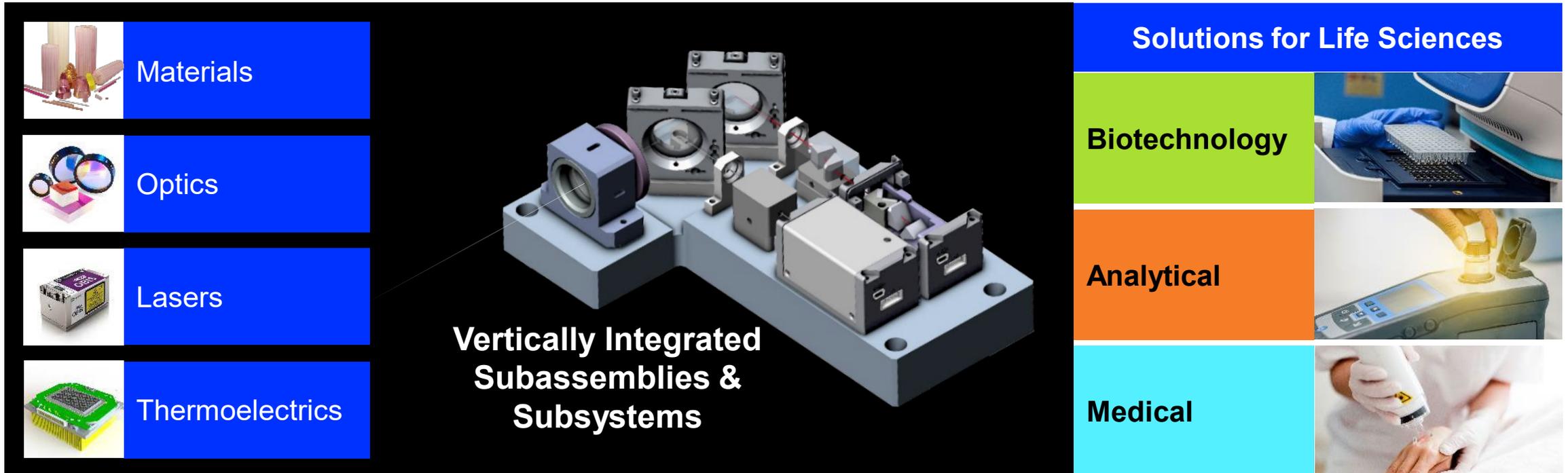
- NA & Europe – largest market
- China & India – largest growth



Region	5Y CAGR
US & Canada	6.6%
Europe	4.5%
China	8.8%
Japan	3.9%
India	4.0%
Other Asia Pacific	5.3%
Latin America	3.3%
Rest of World	3.4%

* Source: SDI Global Assessment Report 2022

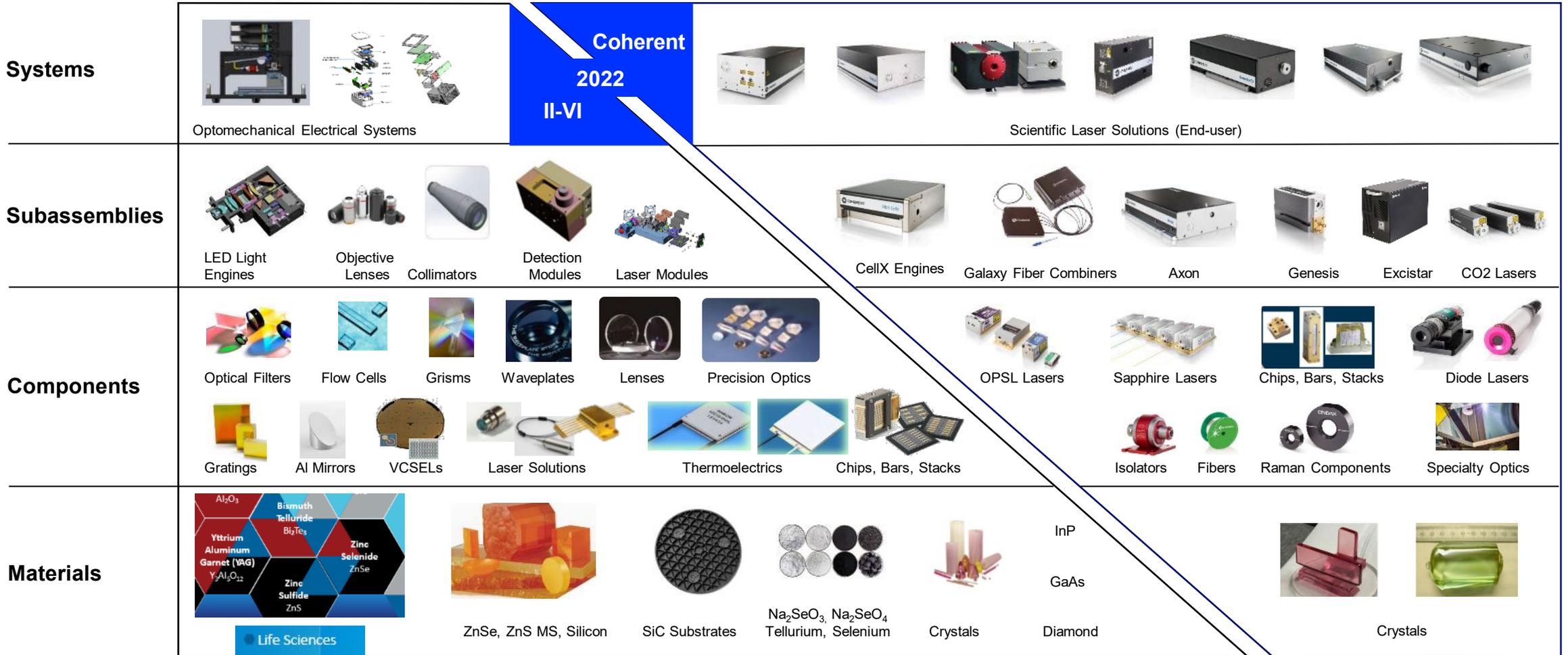
COHERENT – LIFE SCIENCES MARKET FOCUS



**Enhanced portfolio scale –
reduces cost, increases competitiveness**

**Complementary technology platforms –
opens exciting new opportunities**

PORTFOLIO SYNERGIES TO SUPPORT LIFE SCIENCES



Materials & Optics

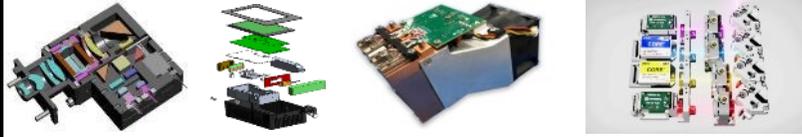
Lasers

Thermal Control

ISO13485 Subassemblies

COHERENT LIFE SCIENCES – VERTICAL INTEGRATION EXPERTISE

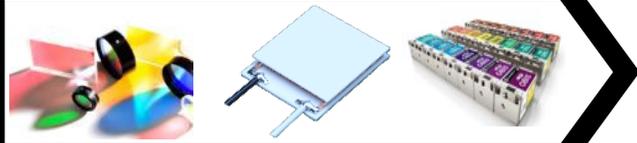
Systems



Subassemblies



Components



Materials



Clean &
Dark Room
Environments
(100, 1K, 10K)

ISO 13485
ISO 9000:2015
ISO 4001:2004

- Optical
- Mechanical
- Electrical
- PCB layout
- Firmware
- Test development
- Reliability testing

Customer
Requirements

Design &
Engineering

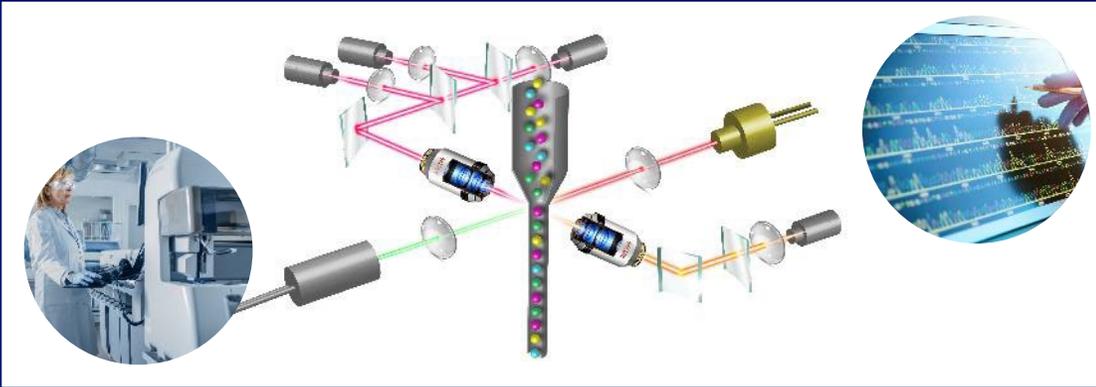
Prototyping

Pilot Production

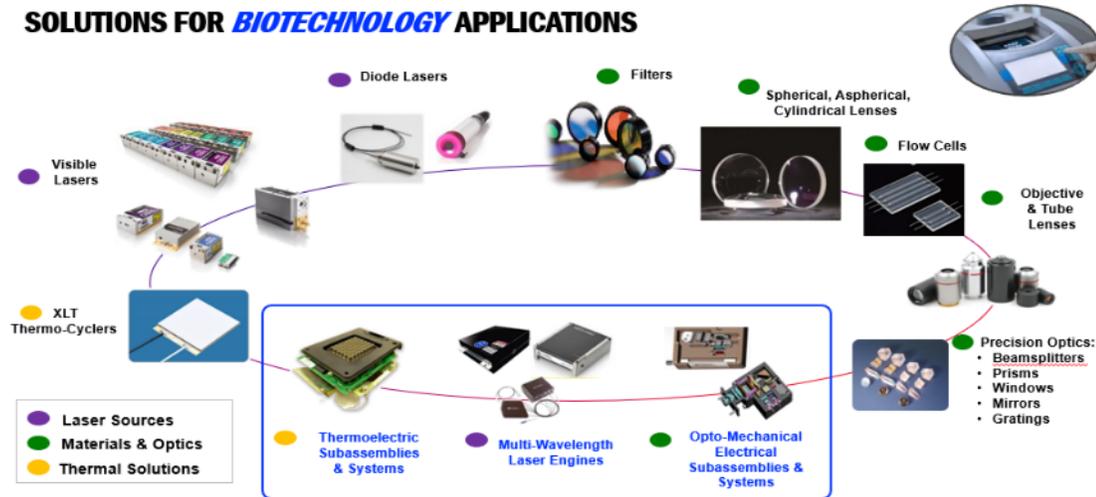
Volume
Production

COHERENT LIFE SCIENCES – APPLICATION-SPECIFIC SOLUTIONS

Biotechnology – Flow Cytometry



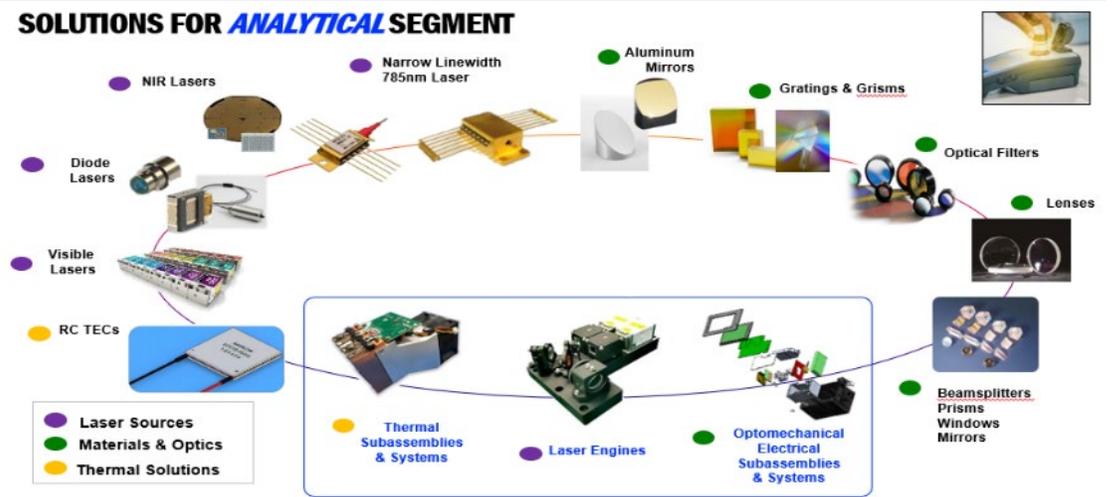
SOLUTIONS FOR BIOTECHNOLOGY APPLICATIONS



Medical – Aesthetic Laser



SOLUTIONS FOR ANALYTICAL SEGMENT



Differences in samples, architecture, integrated components, and critical system parameters

BIOTECHNOLOGY INSTRUMENTATION MARKET

Biotechnology



Diverse instrumentation, similarities in optical paths



Analytical Instrumentation

\$76B 2021
\$98B by 2026
CAGR of 5%*

Technologies

- PCR
- Sequencing
- Flow cytometry
- Electrophoresis
- Microplate readers
- Microscopy
- In Vivo animal imaging
- Capillary electrophoresis
- High-content analysis
- Multiplex/HT ELISA
- Cell counters
- Microarrays
- Automated synthesizers
- Surface analyzers

Trends

- Small, faster, more sensitive
- Automation, user friendly
- Modular architecture
- Multiplexing
- Micro-fluidics, bioinformatics

Diagnostics Instrumentation

\$95B 2022
\$157B by 2026
CAGR of 7%**

Technologies

- Molecular
- Immunoassays
- Clinical chemistry
- Hematology
- Microbiology
- Urinalysis
- Coagulation

Trends

- FDA/CLIA approvals – strict regulations
- Increased speed/throughput
- Per test cost
- Point of care solutions (POC)
- Automation, user friendly

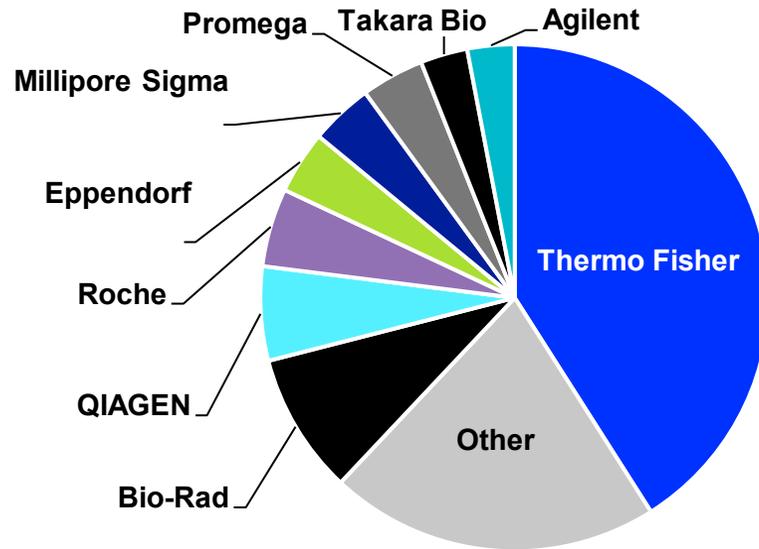
Source: * SDI Global Assessment Report 2022 ** Source: In Vitro Diagnostics Market, Fortune Business Insights

PCR (POLYMERASE CHAIN REACTION)



\$4.8B 2021 to \$5B 2026, 1% CAGR
 Initial Systems/Instrumentation
 \$1.1B 2021 to \$1.0B 2026, -.5% CAGR
 (research only)

Top Market Players



(SDI Global Assessment Report 2022)

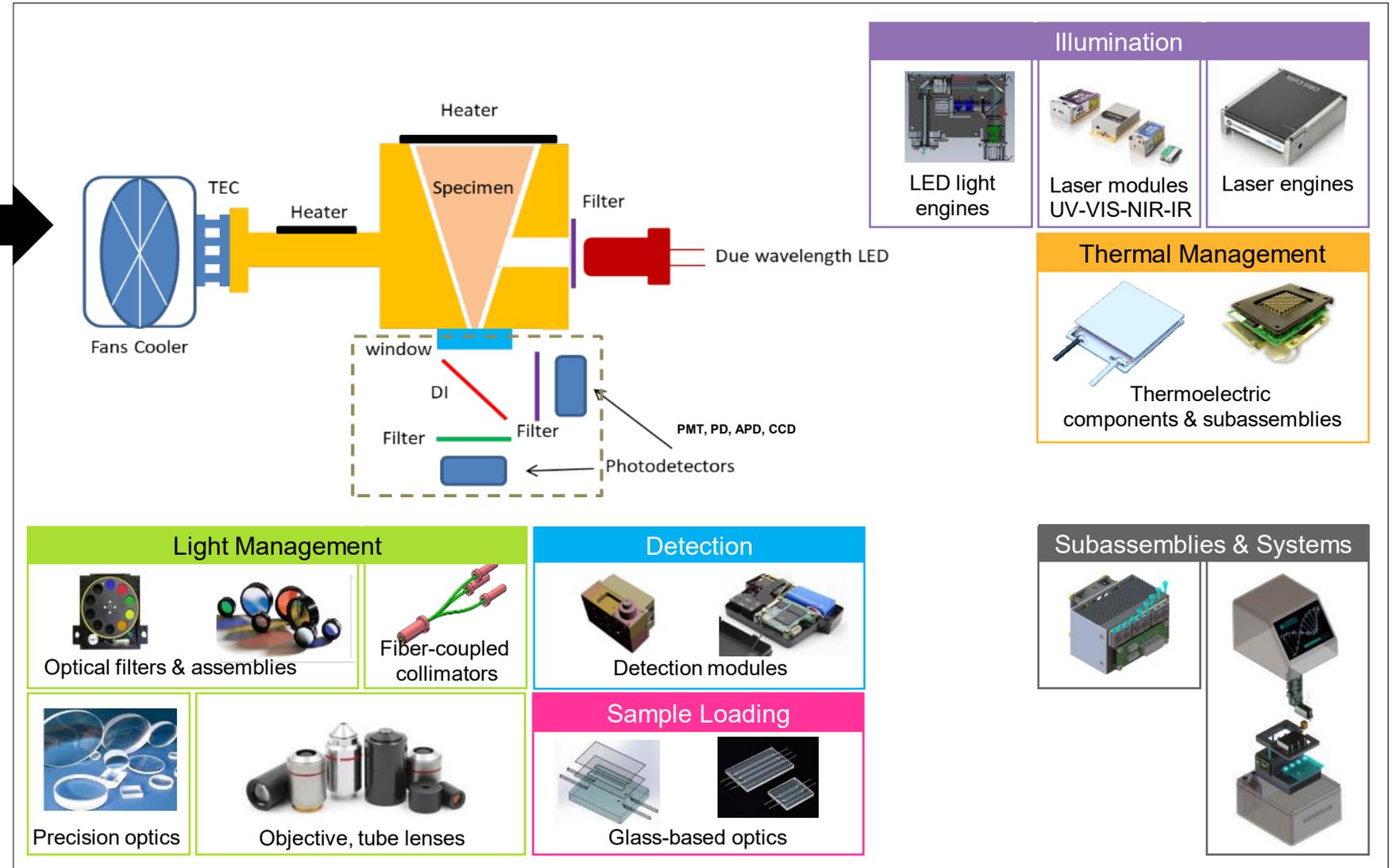


- Diagnostics
- Sequencing
- Genotyping
- Cloning
- Gene Expression Analysis
- Environmental Monitoring
- Agriculture
- Pathogen Detection
- Forensics
- Paternity Testing

Trends: Highest growth expected for Digital PCR (~11%), applications will pivot and expand into non-covid areas

Coherent Solutions: (1) Illumination (2) Light Management (3) Thermal Management (4) Sample Loading (5) Detection

COHERENT SOLUTIONS FOR PCR



Illumination

- LED light engines
- Laser modules UV-VIS-NIR-IR
- Laser engines

Thermal Management

- Thermoelectric components & subassemblies

Light Management

- Optical filters & assemblies
- Fiber-coupled collimators

Detection

- Detection modules

Precision optics

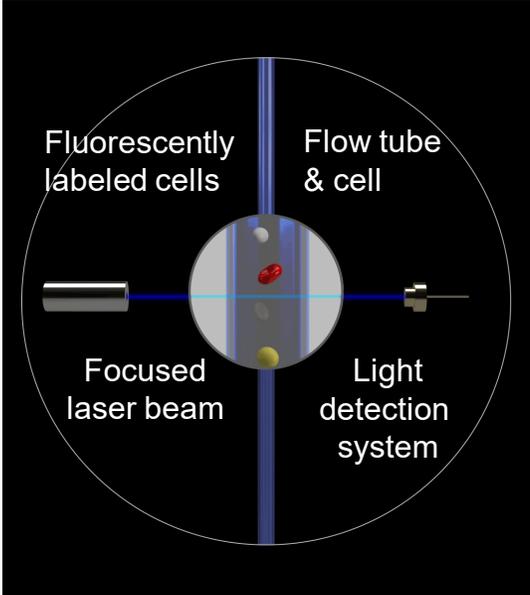
Objective, tube lenses

Sample Loading

- Glass-based optics

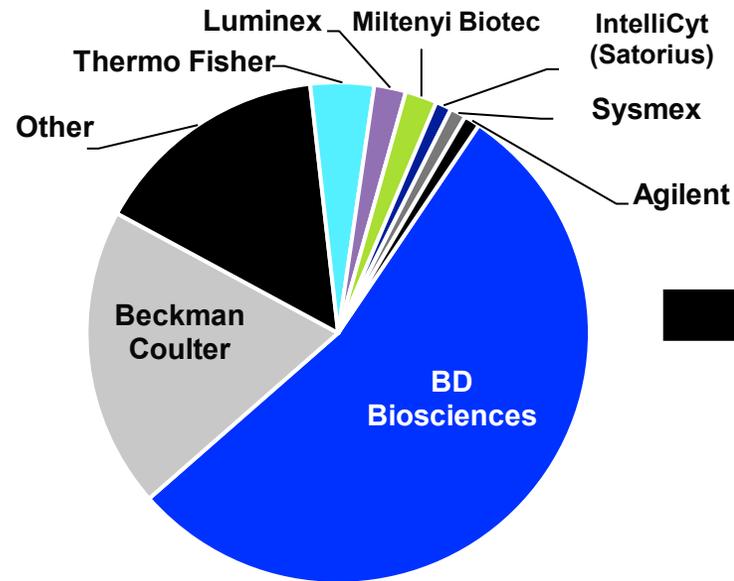
Subassemblies & Systems

FLOW CYTOMETRY

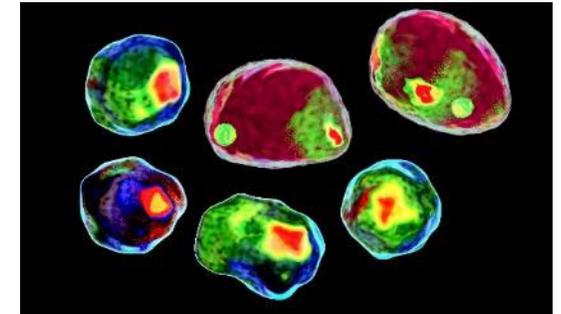


\$2.5B 2021 to \$3.4B 2026, 6% CAGR
 Initial Systems/Instrumentation
 \$699M 2021 to \$931M 2026, 6% CAGR
 (research only)

Top Market Players



(SDI Global Assessment Report 2022)



Disease detection & diagnosis

Cell sorting & counting
 (ex: valuating cells from bone marrow, peripheral bloods & other fluids)

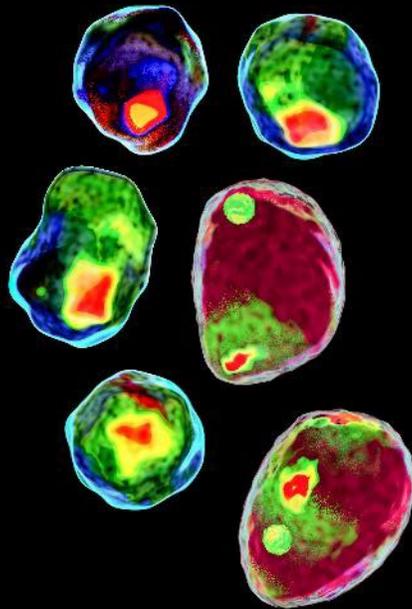
Biomarker detection

Drug candidate screening

Trends: Spectral reach, single cell analysis, single use on-chip microfluidics, AI/Data/Cloud intersection, therapeutic intersection

Coherent Solutions: (1) Illumination (2) Light Management (3) Thermal Management (4) Sample Loading (5) Detection

COHERENT SOLUTIONS FOR FLOW CYTOMETRY



Illumination

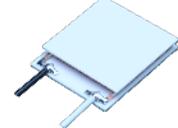


Laser modules

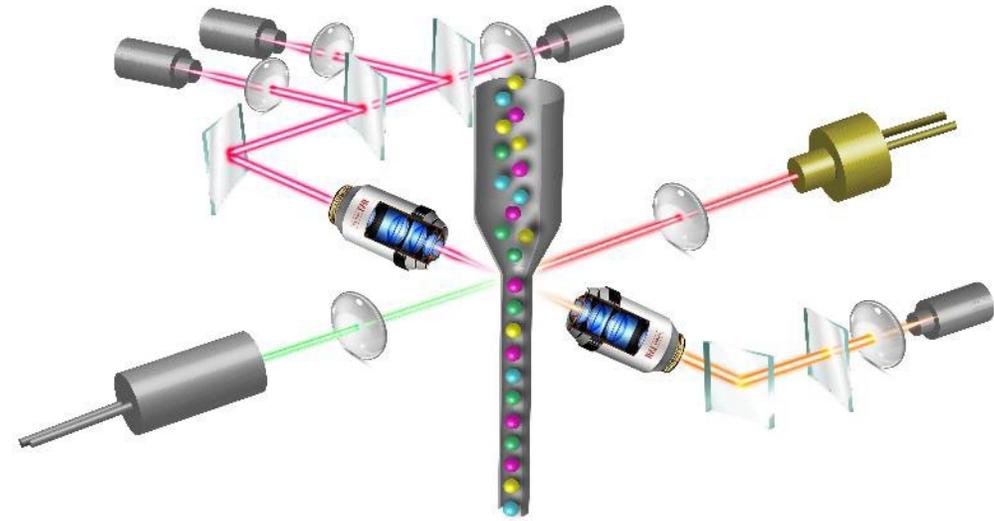


Laser engines
UV-VIS-NIR-IR

Thermal Management



Thermoelectric coolers



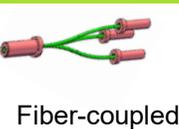
Light Management



Optical filters



Gratings



Fiber-coupled
collimators

Detection



Detection modules

Precision optics



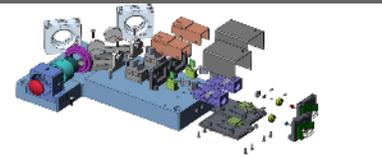
Objective, tube lenses

Sample Loading



Glass-based optics

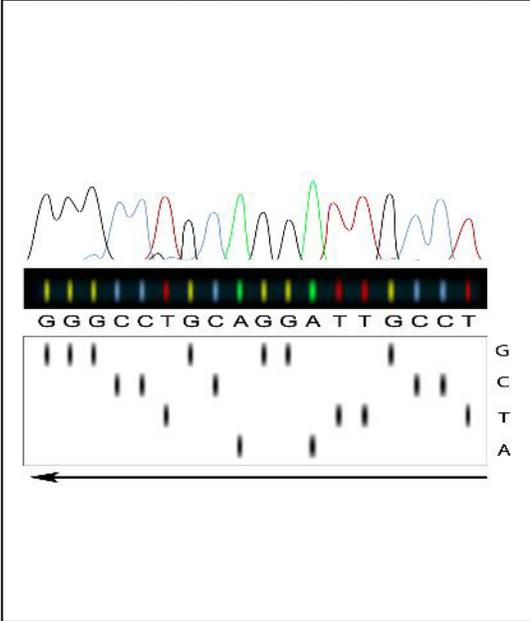
Subassemblies & Systems





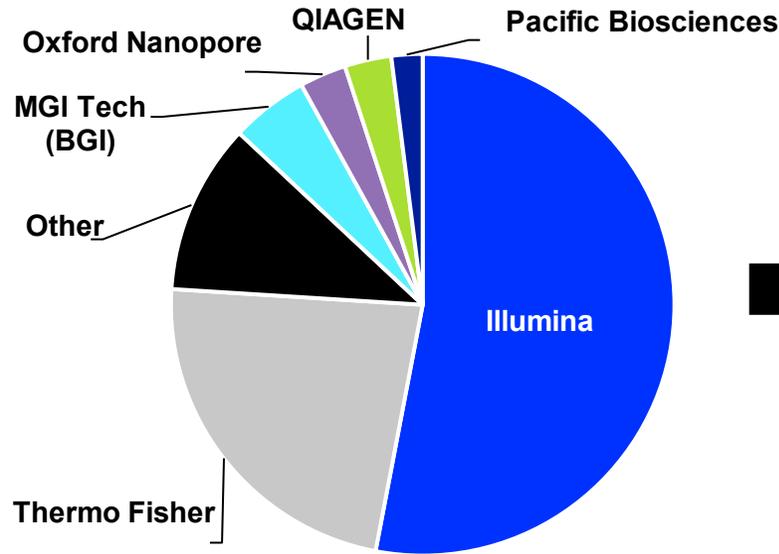


SEQUENCING



\$4.2B 2021 to \$7.0B 2026, 11% CAGR
 Initial Systems/Instrumentation
 \$678M 2021 to \$1,017M 2026, 8% CAGR
 (research only)

Top Market Players



(SDI Global Assessment Report 2022)

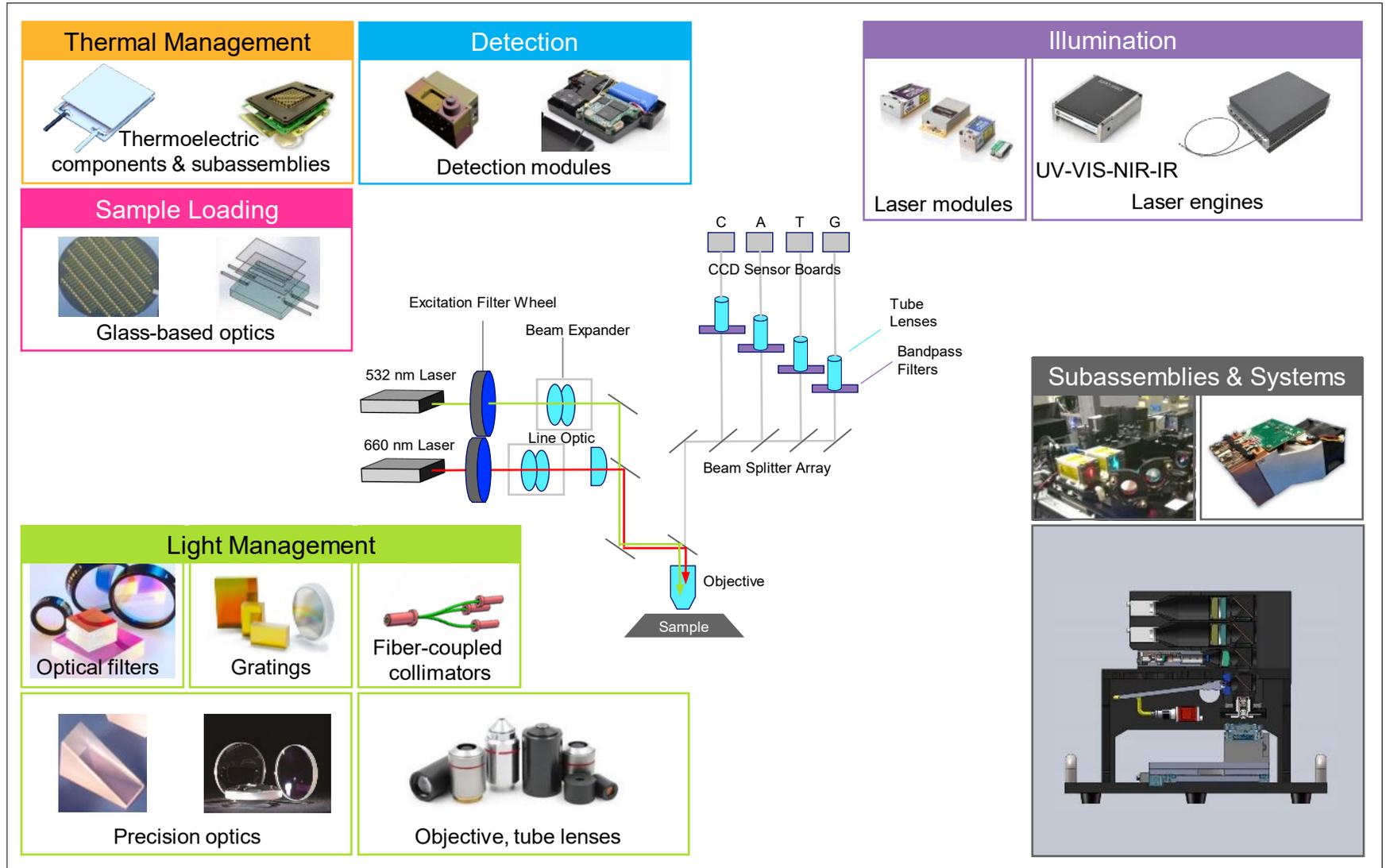


- Cancer & Disease Research**
- Personalized Medicine**
- Microbiology Research**
- Reproductive Health**
- Newborn & Pediatric Diseases**
- Drug Trials & Pharmacogenomics**
- Population Studies**

Trends: New entrants, litigations, drive to \$1 genome, public access worldwide, clinical intersection, personalized medicine, unique sample interfaces

Coherent Solutions: (1) Illumination (2) Light Management (3) Thermal Management (4) Sample Loading (5) Detection

COHERENT SOLUTIONS FOR SEQUENCING



DIAGNOSTICS - FROM LAB INSTRUMENTATION TO POINT-OF-CARE TECHNOLOGY

Instrumentation Trends

- Portability & miniaturization
- Rapid turnaround time
- Simplicity of operation
- Robustness & durability
- Affordability & global access
- Accuracy & precision
- Broader disease detection capabilities



**Coherent
Solutions**

Illumination

**Light
Management**

**Thermal
Management**

**Sample
Loading**

Detection

ANALYTICAL INSTRUMENTATION MARKET

Analytical



Diverse end applications, similar detection techniques

Environmental Testing

\$9.4B 2022
\$13.9B 2027
8% CAGR*

Applications

- Air
- Water
- Food
- Beverage
- Pharmaceuticals
- Agriculture

Drivers

- Safety concerns
- Pollution/environmental concerns
- Pharma quality control
- Regulations

Spectroscopy

\$5.3B 2021
\$6.6B 2026
5% CAGR**

Molecular Spectroscopy Technologies

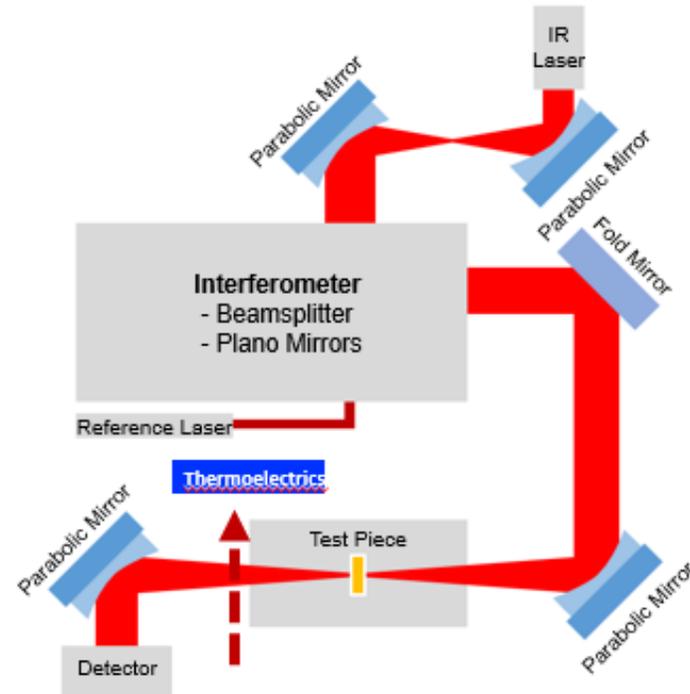
- NMR
- UV-VIS
- NIR, IR
- Color measurement
- Raman

Instrumentation Developments

- Miniaturization
- Field use
- Increased ruggedness
- Sample variety

Source: * Environmental Testing Market, MarketsandMarkets ** SDI Global Assessment Report 2022

COHERENT SOLUTIONS FOR ENVIRONMENTAL (SPECTROSCOPY)



Lasers	
Optics	
Thermoelectrics	
Subassemblies & Systems	

COHERENT SOLUTIONS FOR PHARMACEUTICAL

Drug Development

- Flow cytometry
- High throughput imaging
- Sequencing



Optics, Lasers
and Raman products
for all stages of Pharma
Research, Development, and
Manufacturing!

Manufacturing

- Molecular structures
- Raw materials
- Chemical compositions



Bioprocessing

- Monitoring & sensing



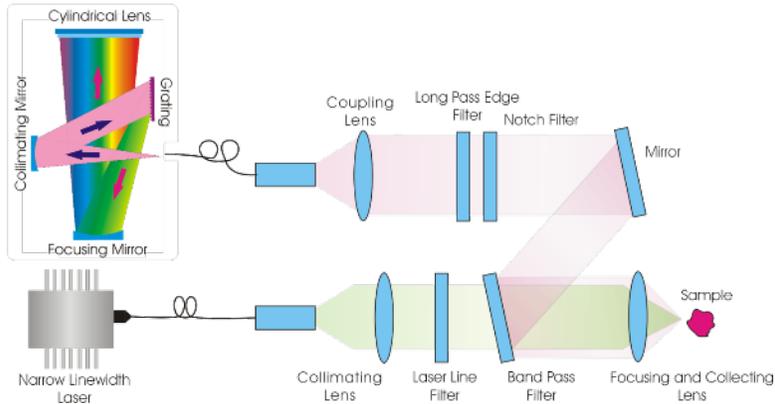
Quality Control

- Contaminants
- Counterfeit detection
- Surety testing



COHERENT SOLUTIONS FOR PHARMACEUTICAL - RAMAN SPECTROSCOPY

Custom OEM Solutions (Laser + Optics + Detection)

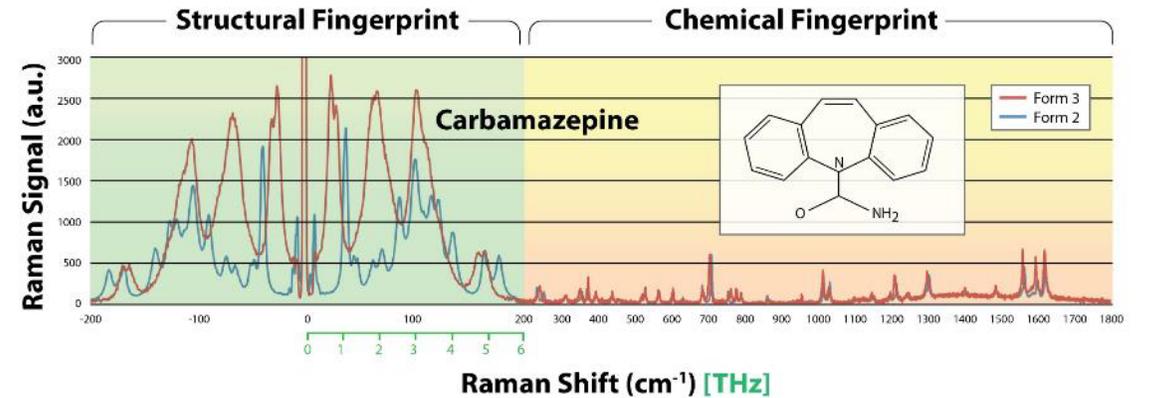
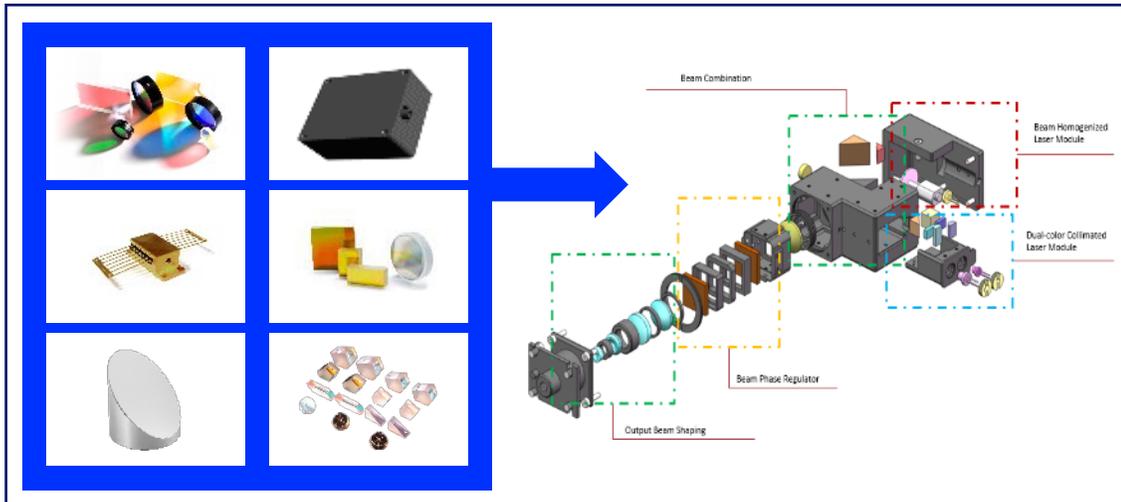


THz-Raman™ Spectroscopy Product Line



Versatile TR-Probe with accessories for inline, bench and microscope applications

WALDO - High Throughput Screening



COHERENT LIFE SCIENCES AND ARTIFICIAL INTELLIGENCE (AI)

Drug Discovery, Pharmaceuticals & Clinical Trial



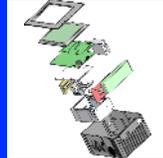
Scientific Research



Genomic, Diagnostics, Personalized Medicine



Environmental



Coherent enables new instrumentation platforms that leverage AI

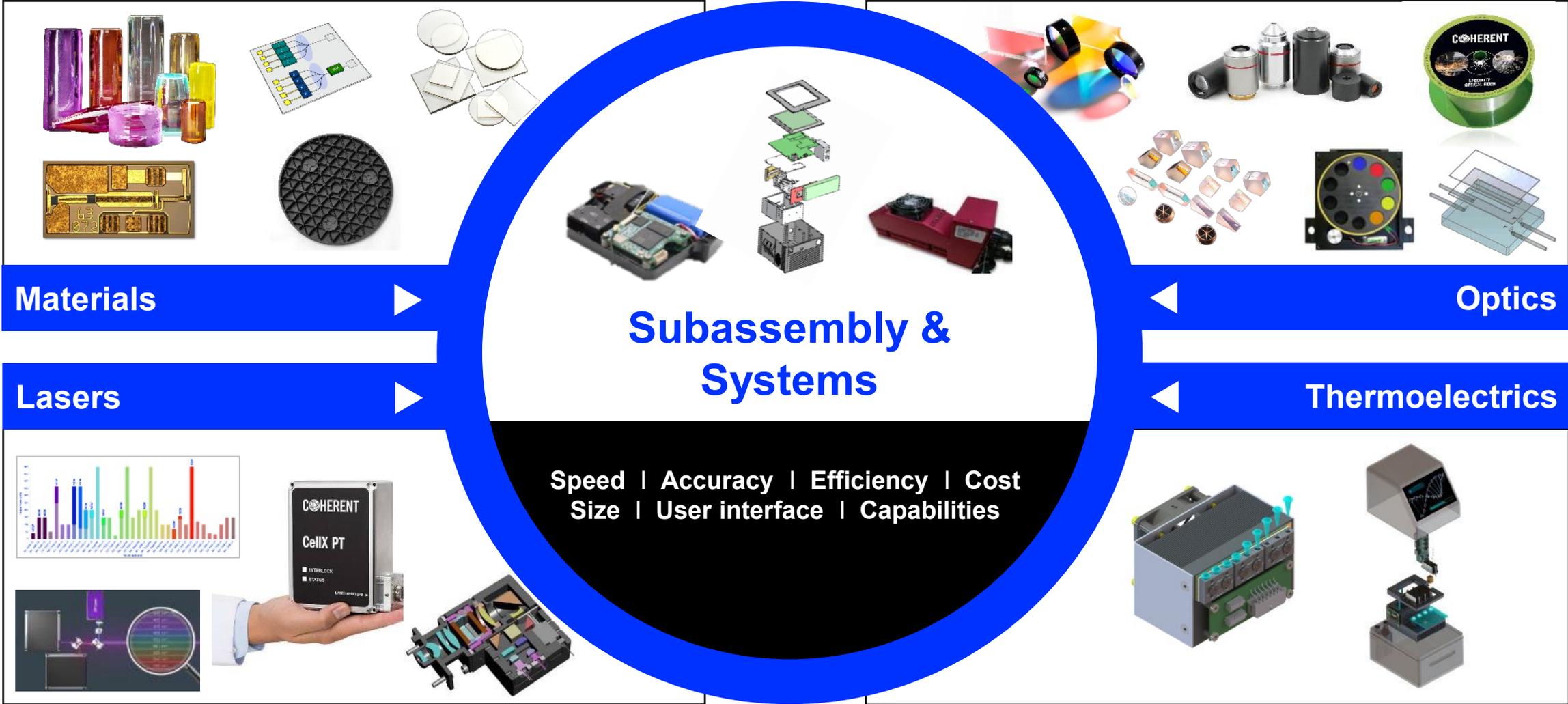
Surgery



Healthcare Services



COHERENT IS DRIVING NEXT GENERATION INSTRUMENTATION TECHNOLOGIES



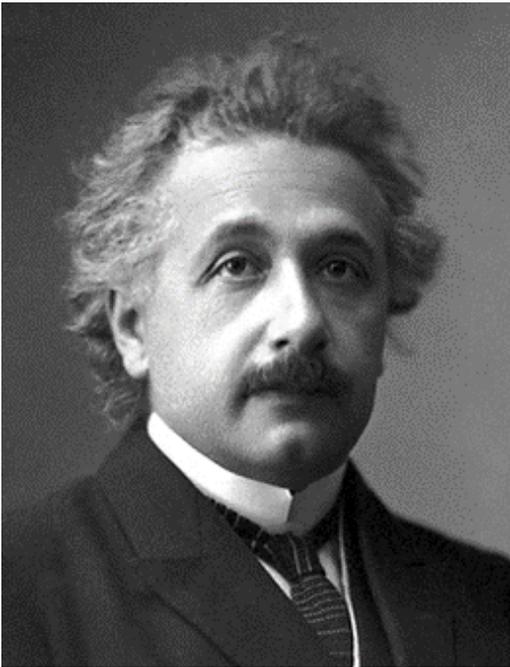
MEDICAL

Dr. Karlheinz Gulden CFA – Senior Vice President, Laser Components and Subsystems Business Unit

LIGHT AMPLIFICATION BY STIMULATED EMISSION OF RADIATION

1905 -1917

Albert Einstein



Theory of Light Amplification

1958

Arthur Schawlow and
Charles Townes



Laser Concept
Bell Labs refused patent
Reason: no application

1962

Robert N. Hall



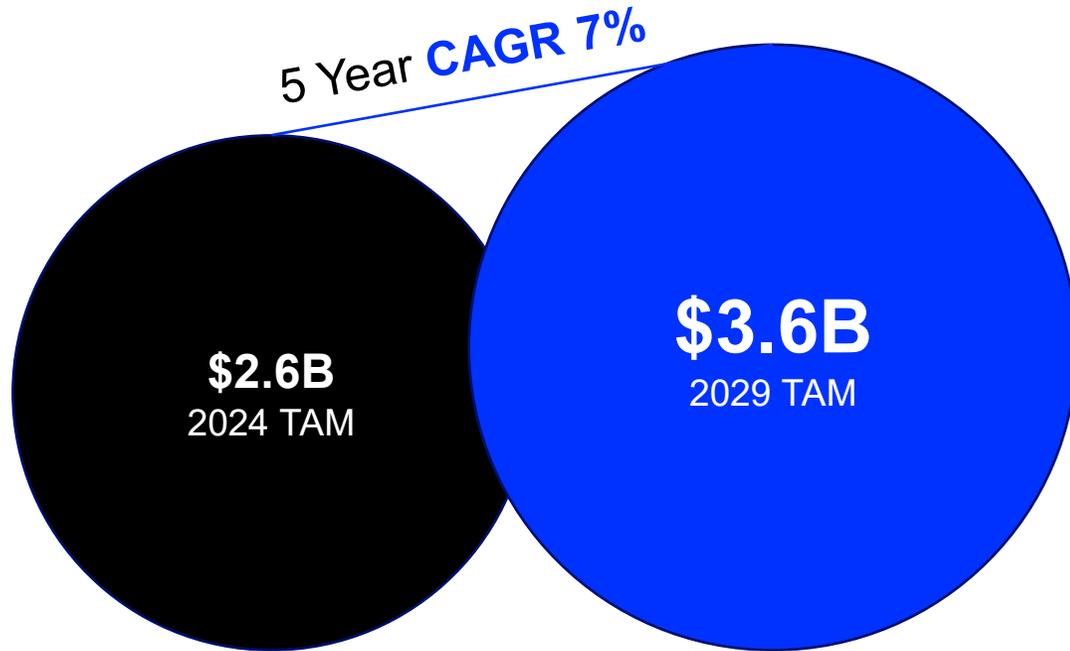
Diode-Laser

2024

Medical applications of Coherent Lasers

- Hair removal
- Wrinkle removal
- Tattoo removal
- Acne treatment
- Body fat removal
- Ophthalmology
- Dental treatment
- Photodynamic therapy
- Endovascular treatment
- Surgery
- Diagnostics

COHERENT LIFE SCIENCES - MEDICAL



Coherent Advantages

- Technical differentiation
- Intellectual property protection
- Diversified product and application/technology portfolio
- Precision and reliability
- Quality leader
- Capacity to Scale
- Vertical integration
- Integrated solutions decrease time to market
- Global manufacturing footprint
- Brand reputation
- Regulatory compliance: ISO 13485 certified where required

Medical Laser



- Ophthalmic
- Cosmetic
- Dermatology
- Photodynamic therapy
- Surgical
- Dental

Medical Imaging



- Endoscopy
- OCT

Point of Care



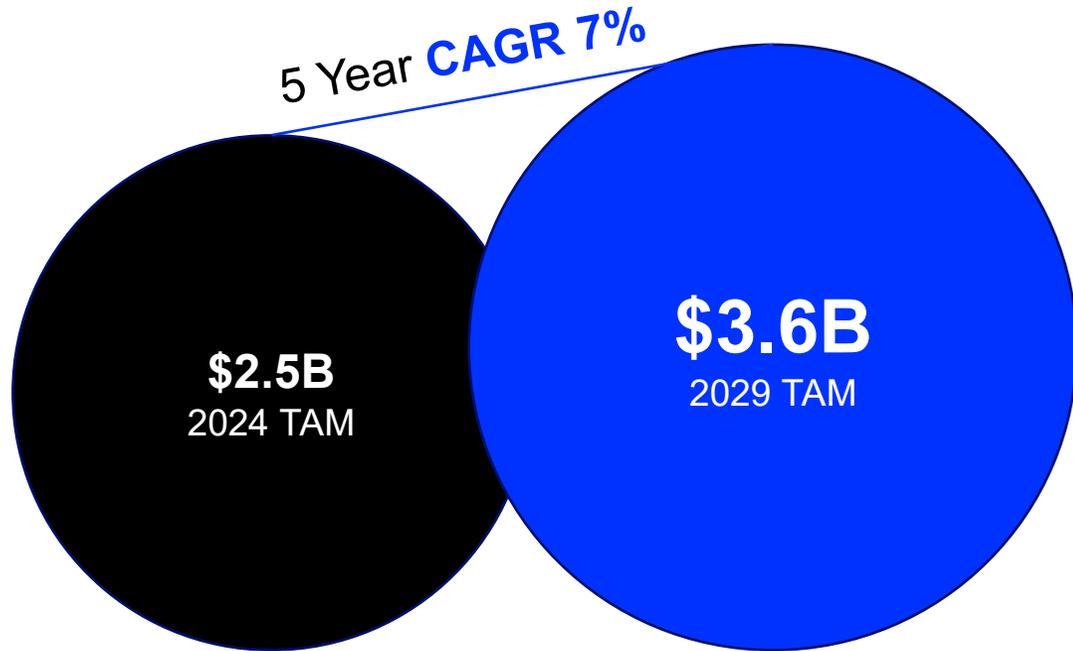
- Diabetes Testing

Thermal



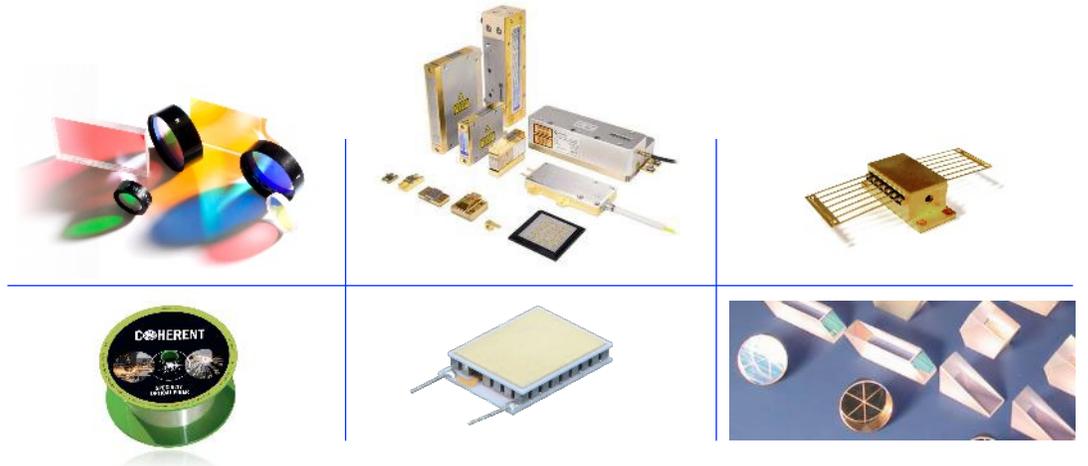
- Hospital Bedding
- Therapy
- Migraine Relief

COHERENT LIFE SCIENCES - MEDICAL



Coherent Products

- Laser diodes
- Fiber lasers
- Solid state lasers
- Gas lasers
- Fibers
- Optics
- Crystals
- Gratings and filters
- Thermoelectrics



Competitors

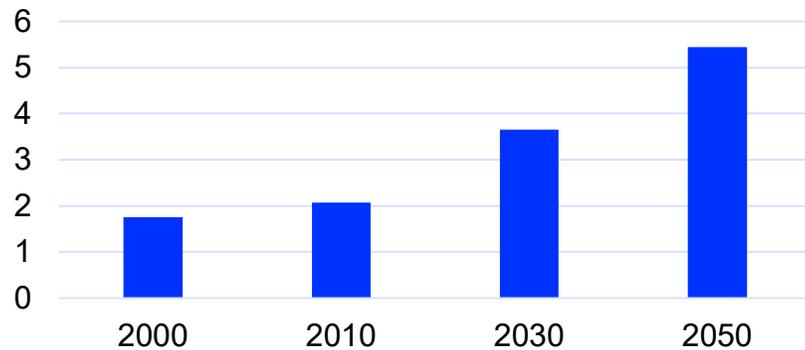
- Lasers: MKS, IPG, NKT
- Optical Components: Newport, Edmund, Thorlabs
- Fibers: Molex, CeramOptec, Corning
- Crystals/Materials: Northrop Grumman, Synopsis, Laser Materials

OPHTHALMOLOGY

Photocoagulation – Restoring Vision

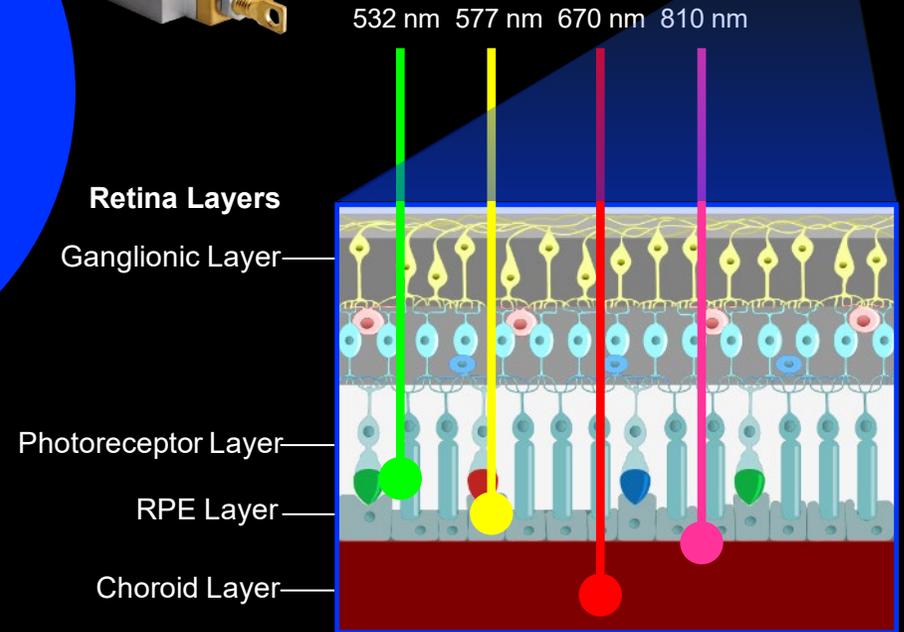
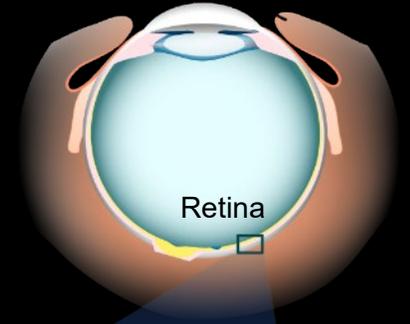
- Stop bleeding of blood vessels in the retina (AMD)
- Laser light matches Hemoglobin absorption peak
- Wavelength scalability to select 532 nm, 577 nm
- Complementary diode laser wavelengths at 675 nm and 808 nm
- Micropulsing capability

Prevalence of age-related macular degeneration in the USA, 2000-2050(Millions)



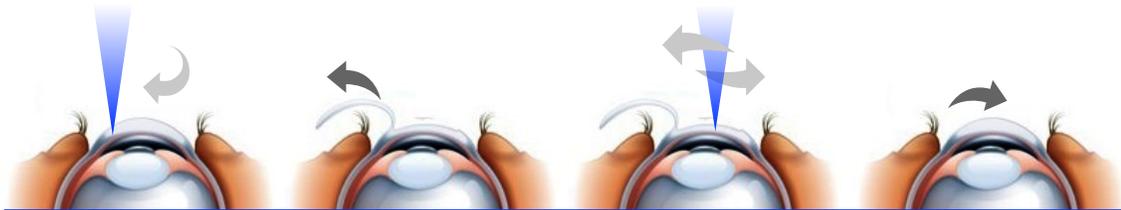
Source: National Eye Institute, US

\$200M
Laser Systems
in Ophthalmology
Annual TAM



OPHTHALMOLOGY - LASIK

LASIK (Laser Assisted In Situ Keratomileusis)



Femtosecond lasers cuts flap to open stroma

Flap is lifted with mechanical tool

Excimer laser remove material to correct vision

Flap is placed back in place

- **800k LASIK procedures/year**
- Supplier of Excimer lasers for majority of vision correction systems worldwide
- Wavelength 193 nm fs pulse
- Developing Ultrafast laser for use as a laser keratome as well as other applications



Femtosecond precision



Deep UV ablation

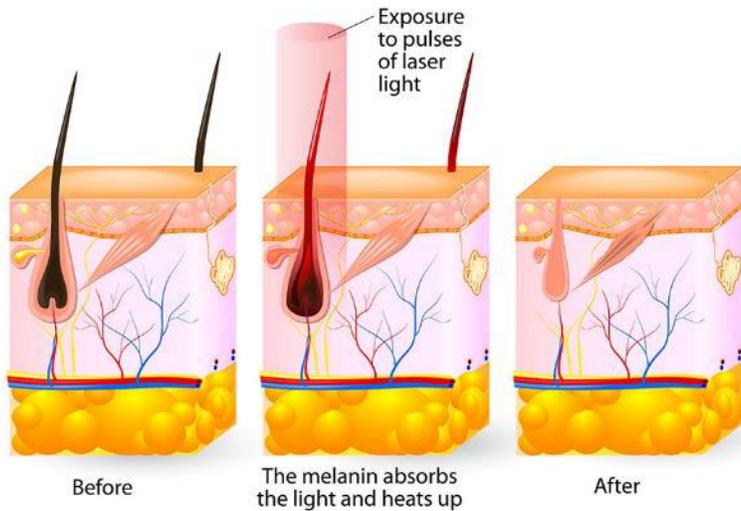


ExciStar

- 193 nm pulsed UV Laser
- Industry standard, used in **500+** new tool installations per year

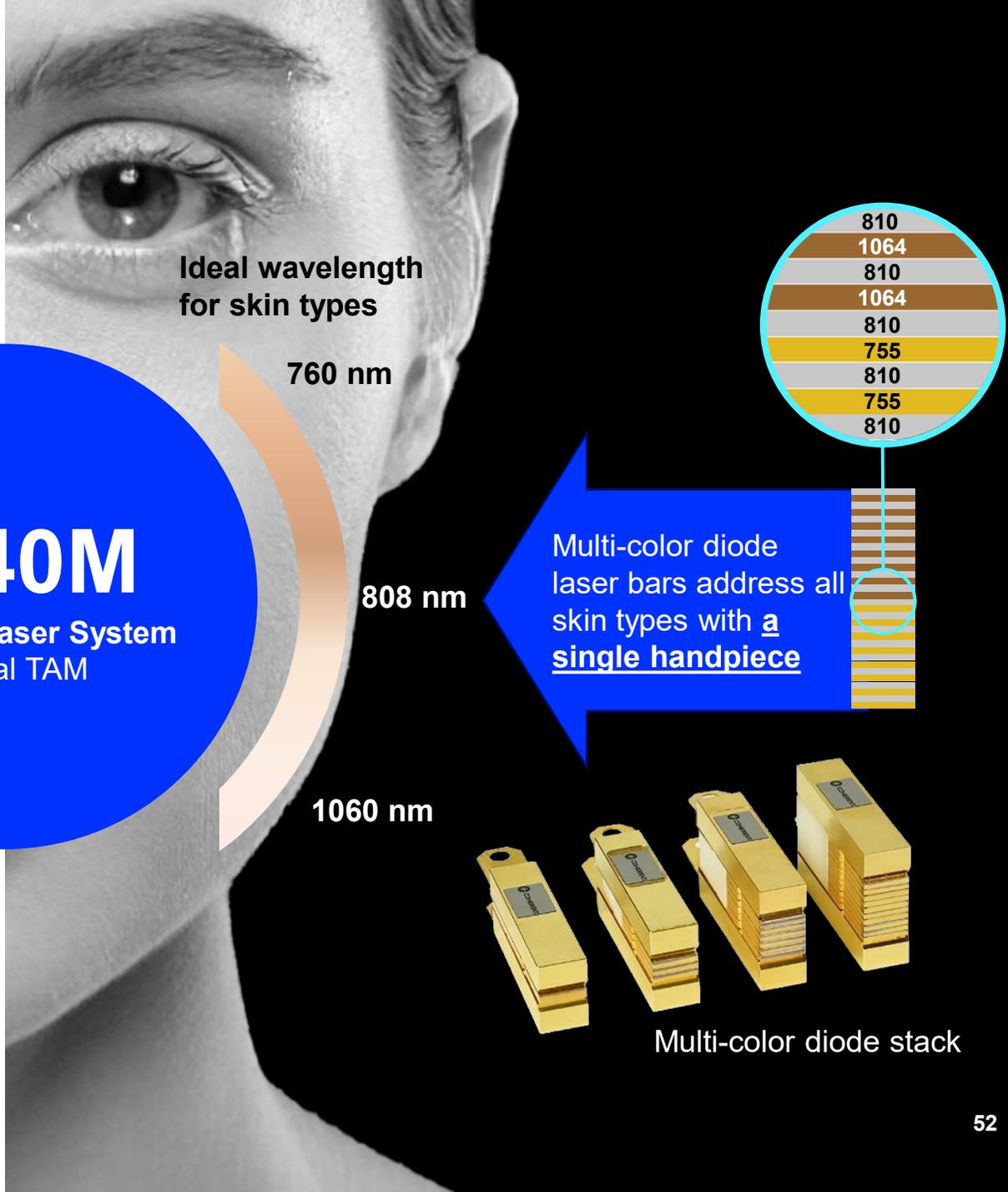
LASER HAIR REMOVAL (EPILATION)

- Worldwide market for epilation is growing in each region
- Efficacy and pain depend on skin absorption of light



- Melanin absorbs laser light and heats up
- Hair follicle dies
- Wavelengths: 755 nm, 810 nm, 940 nm 1060 nm
- Power: 100 W - kW

\$640M
Cosmetic Laser System
Annual TAM

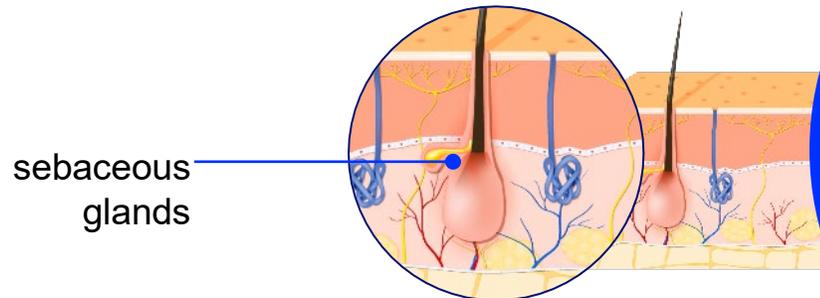


LASER ACNE TREATMENT

Novel Acne Treatment

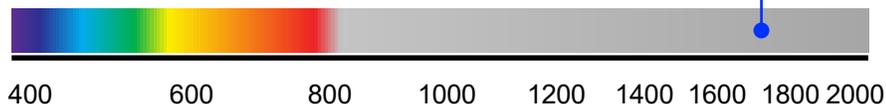
Laser treatment used to reduce scars rather for prevention

- In 2012 a research team used a free electron laser of FEL (**Thomas Jefferson Accelerator Facility**) to identify the ideal wavelength to eliminate sebaceous glands that cause Acne



1726 nm
Magic Wavelength
for Acne treatment

- Thanks to the wavelength agility of the FEL they identified a **“magic wavelength: 1726 nm”**



- After 10 years at least two US companies offer dermatology lasers at this hard-to-reach wavelength



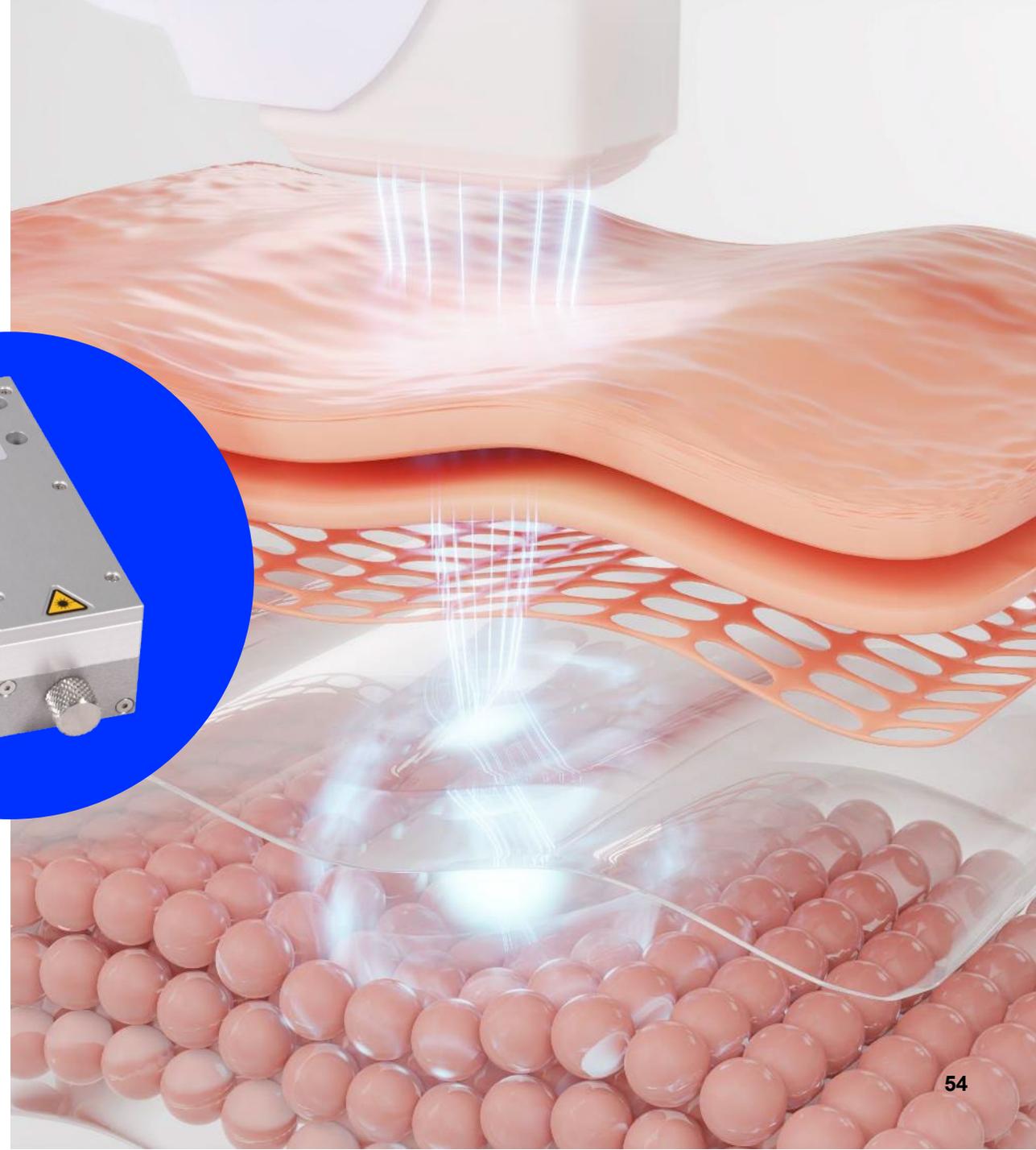
- Sebum absorbs laser light and heats up
- Sebaceous gland dies
- Wavelength: 1726 nm, power: 100 W

TISSUE TIGHTENING/WRINKLE REMOVAL

Laser based wrinkle removal

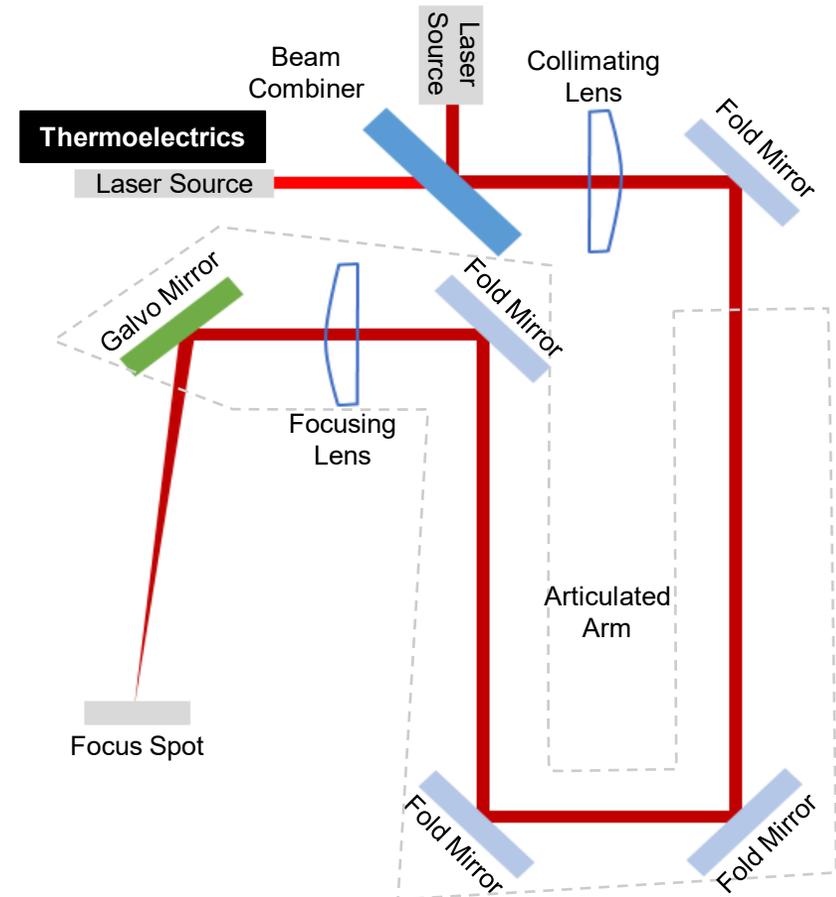


- Laser light passes through epidermis
- Dermis absorbs laser light
- Heats up
- Triggers formation of new collagen
- Wavelength determines penetration depth
- Typical diode wavelengths include: 1540 nm, 1940 nm
- Power: ca. 10 W
- Pilot lasers in the visible spectrum
- Safety features



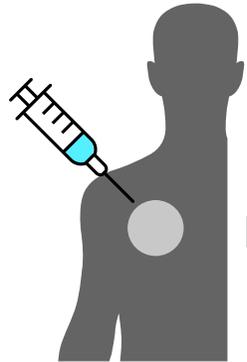


PHOTONIC COMPONENTS IN THE MEDICAL LASER

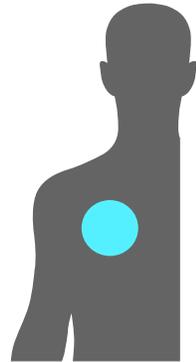


Example Components	Common Materials
Galvo Mirrors	Low Roughness Aluminum, Copper, Silicon
Fold Mirrors (Concave & Plano)	
Beam Combiner	Fused Silica Zinc Sulfide Multi-Spectral, Sapphire, Zinc Selenide
Spherical and Aspheric Lenses	
Protective Windows (DOC Coated)	
Subassemblies & Subsystems	

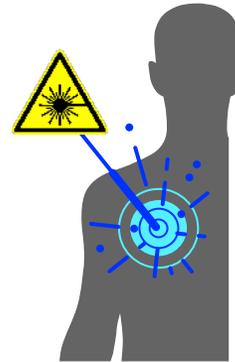
PHOTODYNAMIC THERAPY



Injection of photosensitizer



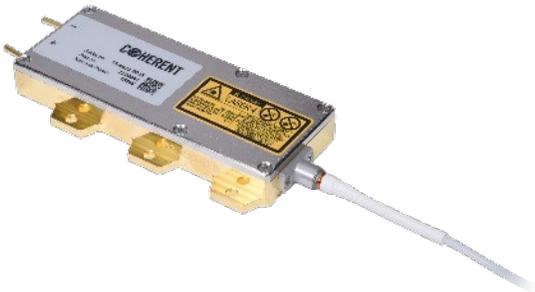
Accumulation in tumor



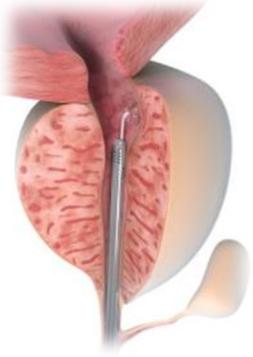
Light activation



Selective destruction of tumor cells

Laser Wavelength	Laser Power	Photosensitizer	Disease	
450 nm	0.5 – 5 W	Flavin Mononucleotide	Melanoma	
630 nm		Porfimer Sodium	Lung/esophageal cancer	
650 nm		Purlytin®	Breast cancer	
652 nm		Temoporfin	Squamous cell carcinoma	
664 nm		Talaporfin Sodium	Bile duct/esophageal cancer	
672 nm		Silicon Phthalocyanine	Cutaneous T-cell lymphoma	
689 nm		Verteporfin	Age-related macular deg.	
732 nm		Motexafin Lutetium	Superficial cancer	
753 nm		Padeliporfin	Prostate cancer	

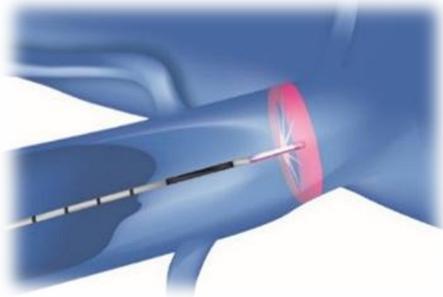
SURGERY, ENDOVASCULAR, TREATMENT



Prostate Treatment



Kidney Treatment



**980 &
1470 nm**
Optimized for
Surgical Laser System



Pictures: Copyright of Biolitec

\$200M

**Surgical Laser System
Annual TAM**

- Fibers for beam delivery
- Treatment of varicose veins: 30 W @ 980 nm or 20 W at 1470 nm
- Cutting tissue: Similar wavelengths, but 10 times more power needed



DENTAL

- CO₂ lasers used in hard tissue (e.g. drilling teeth) and soft tissue (e.g. frenectomy) dental procedures
- Anesthesia-Free, Blood-Free, Suture-Free, Pain-Free
- Dramatic reduction in procedure time

9.3 μm
Optimized for
Dental Laser System



\$250M | **Dental Laser System Annual TAM**

- 9.3 μm CO₂ laser with potential to drive adoption as a laser drill as it services both the soft and hard tissue
- 150 W average, 375 W peak power
- We shipped > 3000 in the last 12 years
- FDA approved in the US, geographic expansion planned

AFFORDABLE DIODE LASERS WILL ENABLE PERSONALIZED MEDICINE

- Smart watches and other wearable devices are evolving into personal health monitors
- Ideally non-invasive, continuous monitoring
- Trend towards pro-active and preventive medicine, instead of "sick-care"
- Monitoring Applications:
 - Heart rate
 - Blood-oxygen
 - Hydration
 - Glucose
 - Lactate



\$97B*

Wearables
2028 TAM

5%*

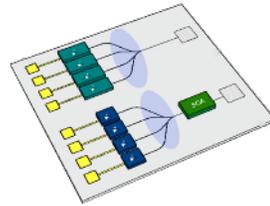
CAGR
2022-2028

Source: Market Data from International Data Corporation (IDC)

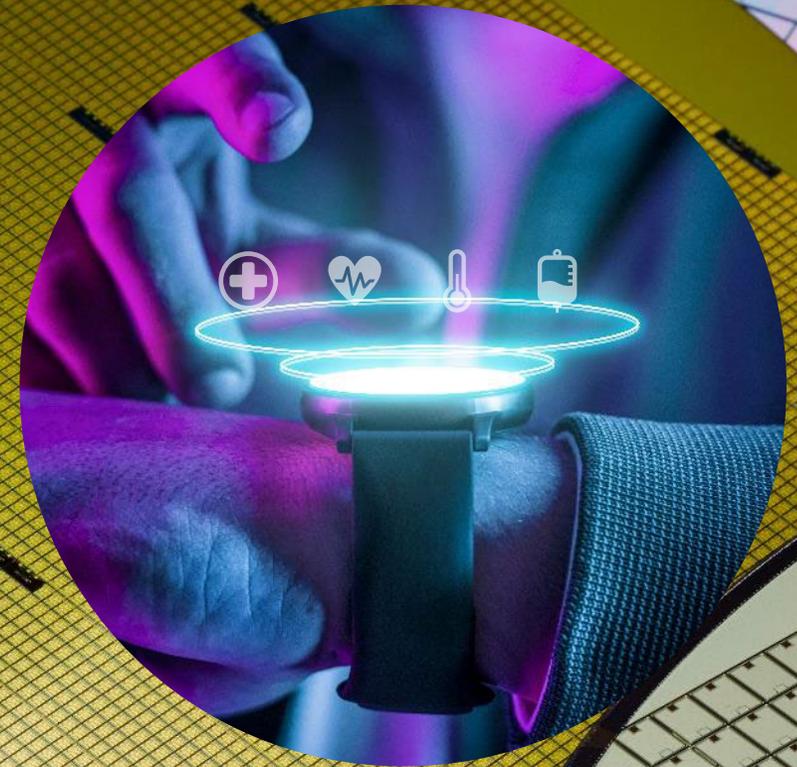
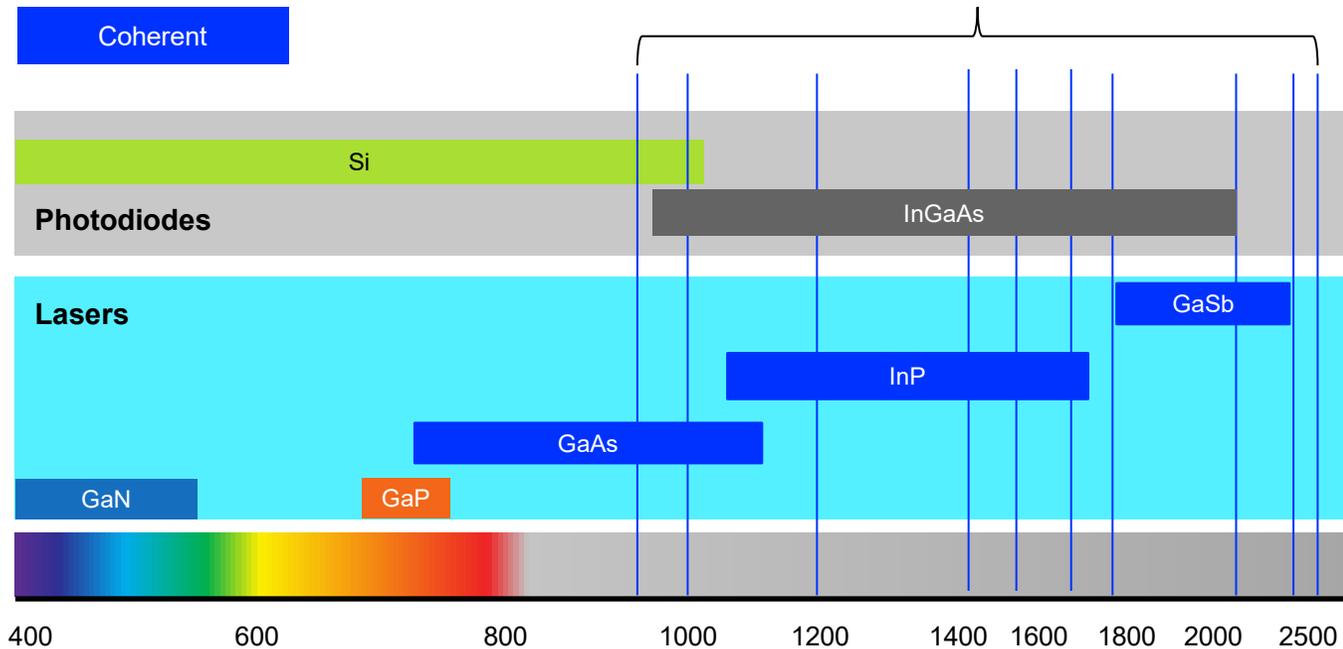
WEARABLE BIOSENSING: COMPOUND SEMICONDUCTORS HOLD THE KEY!

Semiconductor lasers and photonic integration are key enablers for wearable biosensors

- Wavelength and linewidth choices
- Size and power consumption
- Hybrid photonic integration



Example: Glucose peaks in NIR region



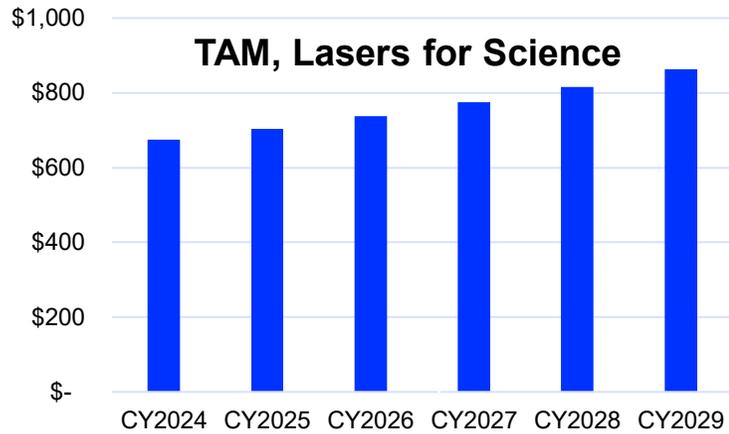
Semiconductor based lasers will make wearable biosensors a reality!

LASERS AND OPTICS FOR SCIENTIFIC RESEARCH

Darryl McCoy - VP & General Manager of Coherent Scotland

LASERS AND OPTICS FOR RESEARCH

- Our revenue in scientific research is primarily from lasers
- Market leading position driven by complex, high value-add solutions
- Importance to Coherent extends beyond strong revenue and sustained profitability



Region	CAGR
North America	4%
Europe	3%
Japan	2%
China	7%
Korea	6%
Taiwan	6%

Source: Strategies Unlimited

\$700M

**Scientific Research Systems
Annual TAM**





Courtesy Júlia Ferrer Ortas, Laboratory for Optics and Biosciences, Polytechnique/CNRS/Inserm, Palaiseau, France

MULTIPHOTON MICROSCOPY

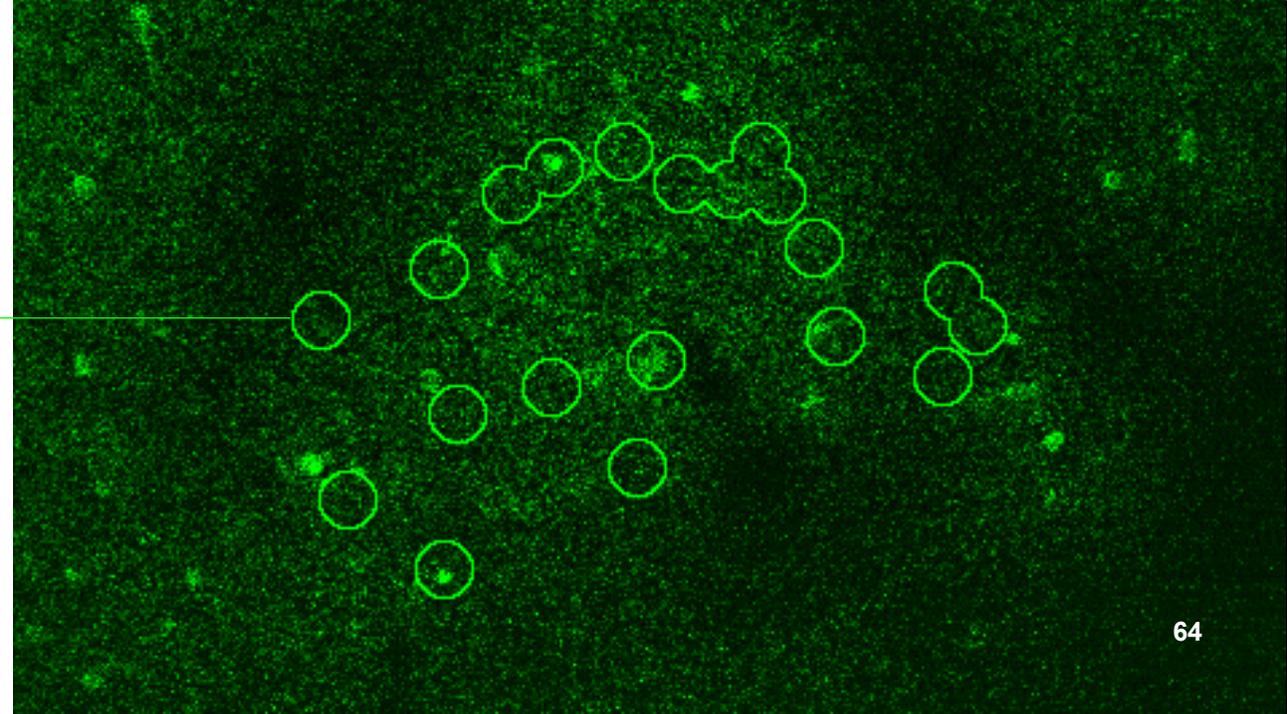
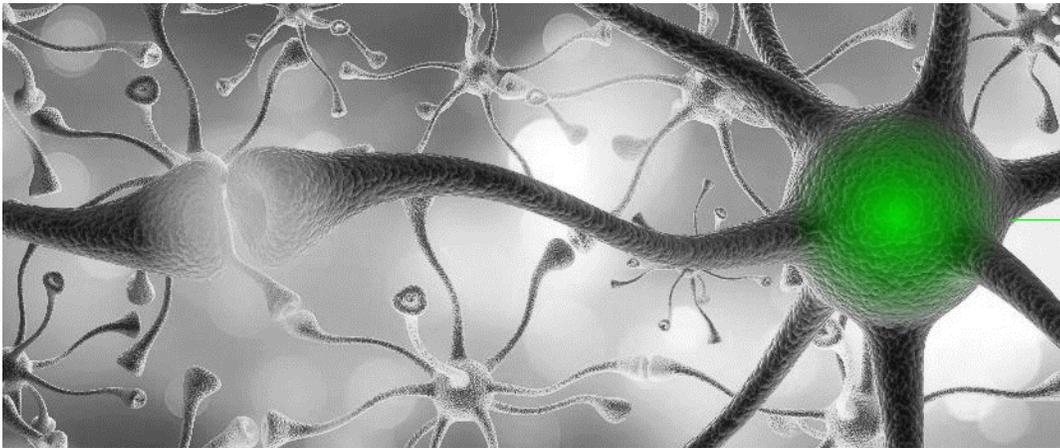
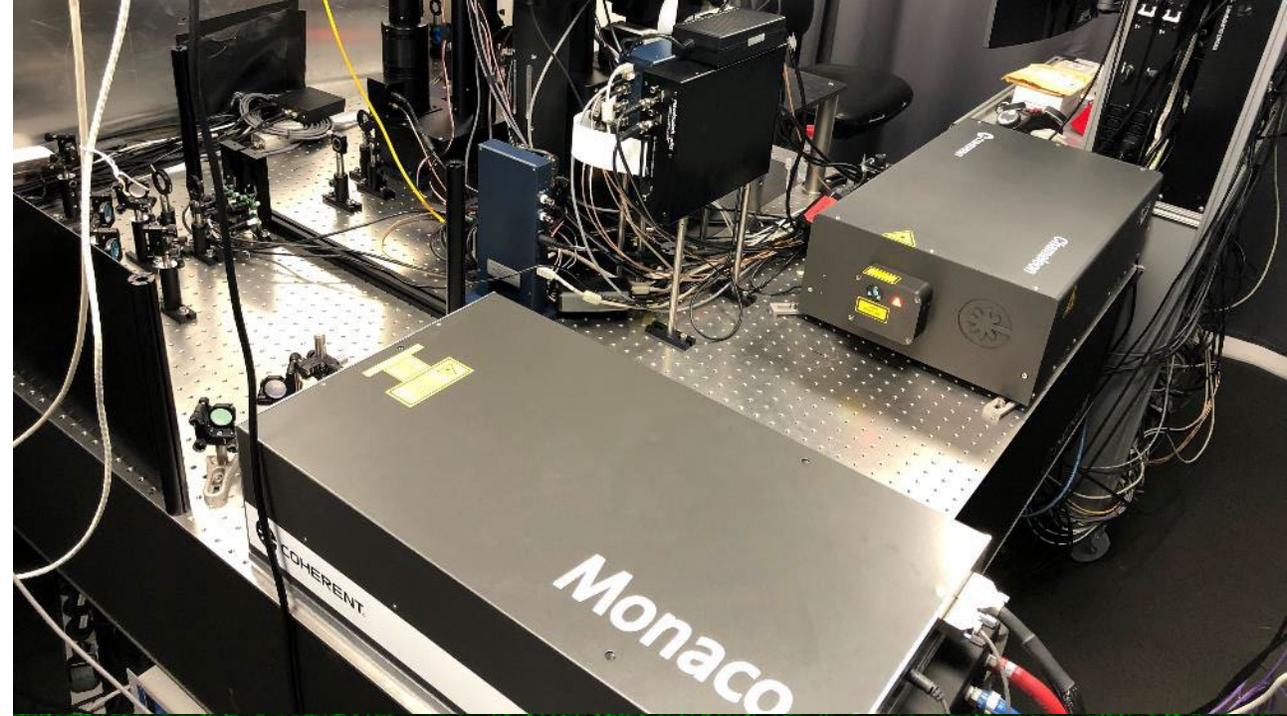
- Enables deep imaging in biological tissues
- Total SAM estimate at \$80M for Lasers
- Total sales since 2002 **exceeded \$750M**
- Requires complex femtosecond lasers, example Chameleon Family
- Strongest growth in neuroscience applications, driven by funding into neurodegenerative disease

\$80M

**Femtosecond Lasers
Annual SAM**

OPTOGENETICS

- Manipulation of neuronal activity using light and genetic labelling
- Multiphoton setups require multiple lasers
- Moving from “read only” to “read/write” interaction with neurons to probe the brain functions of learning and memory



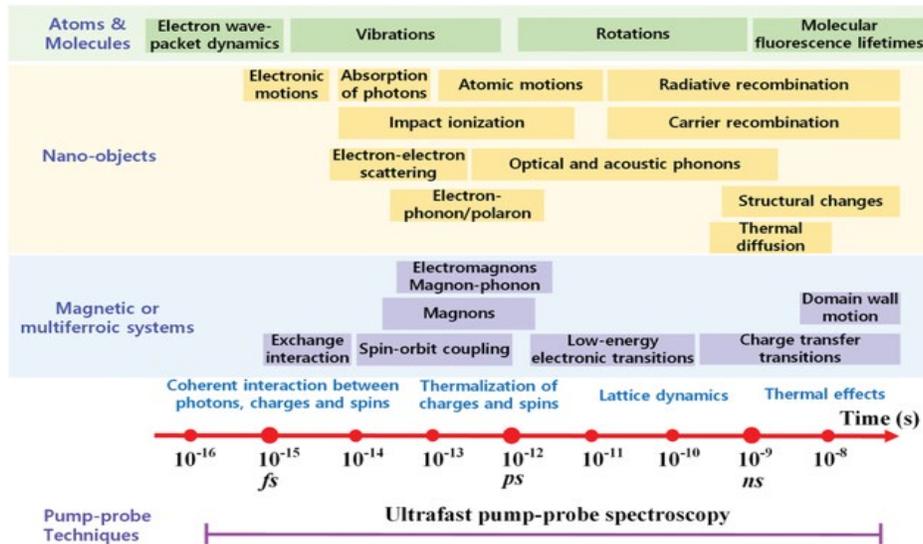
TRANSLATIONAL RESEARCH

- The adoption of multiphoton microscopy into clinical applications
- Strongly regulated, double digit growth from 2029
- Generally, requires “Label Free” imaging techniques
- Coherent’s Axon product range perfectly suited due to size and precisely matched performance



LASERS IN PHYSICAL CHEMISTRY

- Dominated by ultrafast lasers
- Femtosecond pulses enable analysis of the fastest sub-atomic processes
- Applications include materials science, EUV generation and fusion research
- Vertical integration key to the development of highly complex lasers like Coherent's Astrella laser
- Increasing the pulse rate enables faster data collection, enabled by fiber lasers like Coherent's Monaco laser

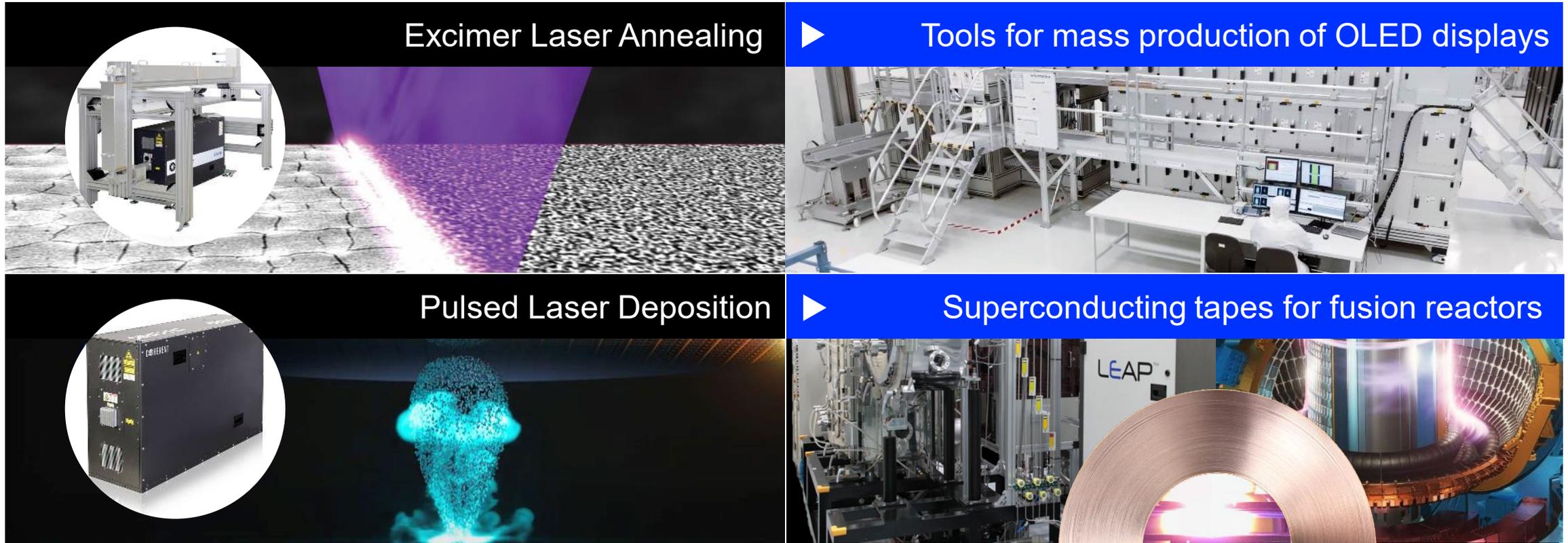


Astrella: mJ class Ti:Sa Ultrafast Amplifier



FROM LAB TO FAB

- Excimer laser technology has evolved from a scientific instrument to a mass production display tool
- New technologies are constantly emerging from science to tackle some of the greatest challenges facing our planet



Q&A



Paul Silverstein
Senior Vice President, Investor
Relations & Corporate
Communications



Dr. Giovanni Barbarossa
Chief Strategy Officer and
President, Materials Segment



Dr. Christopher Dorman
Executive Vice President
Lasers Segment



Dr. Sanjai Parthasarathi
Chief Marketing Officer



Dr. Kim Netzeband
Director, Instrumentation
Marketing



Dr. Karlheinz Gulden
Senior Vice President, Laser
Components and Subsystems



Darryl McCoy
Vice President & General
Manager of Coherent Scotland

COHERENT