# INVESTOR GUIDEBOOK

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# Safe Harbor Statement

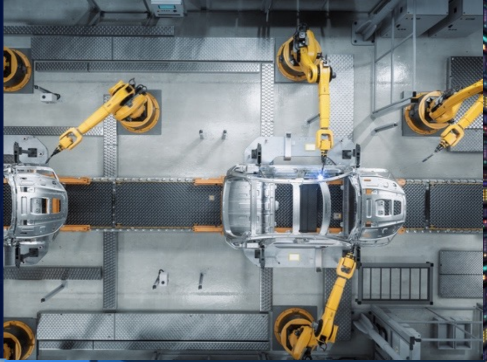
The statements in this guidebook that relate to future plans, market forecasts, events or performance are forward-looking statements. These statements involve risks and uncertainties, including, risks associated with the strength or weakness of the business conditions in industries and geographic markets that IPG serves, particularly the effect of downturns in the markets IPG serves; uncertainties and adverse changes in the general economic conditions of markets; IPG's ability to penetrate new applications for fiber lasers and increase market share; the rate of acceptance and penetration of IPG's products; inability to manage risks associated with international customers and operations; changes in trade controls and trade policies; foreign currency fluctuations; high levels of fixed costs from IPG's vertical integration; the appropriateness of IPG's manufacturing capacity for the level of demand; competitive factors, including declining average selling prices; the effect of acquisitions and investments; inventory write-downs; intellectual property infringement claims and litigation; interruption in supply of key components; manufacturing risks; government regulations and trade sanctions; and other risks identified in the Company's SEC filings.

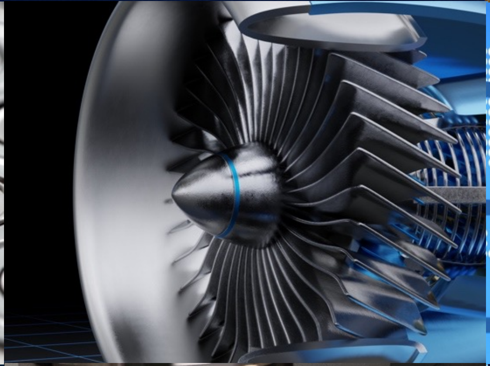
Readers are encouraged to refer to the risk factors described in the Company's Annual Report on Form 10-K and its periodic reports filed with the SEC, as applicable. Actual results, events and performance may differ materially. Readers are cautioned not to rely on the forward-looking statements, which speak only as of the date hereof. The Company undertakes no obligation to release publicly the result of any revisions to these forward-looking statements that may be made to reflect events or circumstances after the date hereof or to reflect the occurrence of unanticipated events.

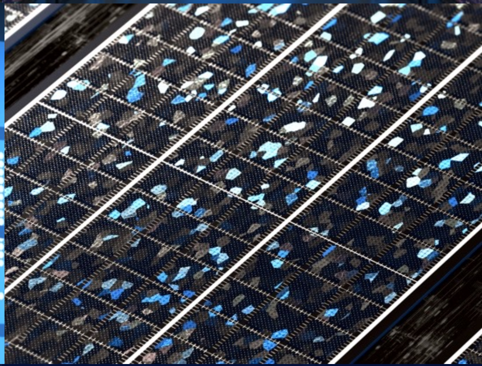
# OUR MISSION

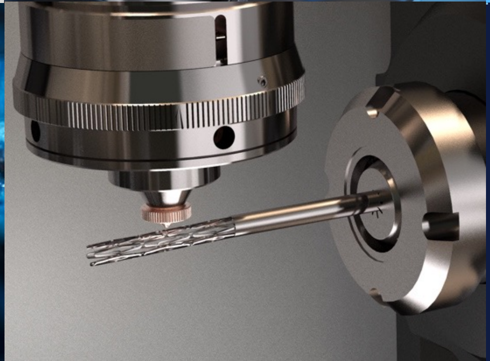
**Making our FIBER LASER technology the tool of choice in mass production**

# PRODUCTS ACROSS
# **ALL INDUSTRIES**







are made better AND at lower cost with

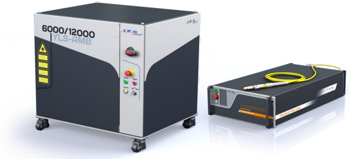
## **IPG FIBER LASERS**

# Revolutionizing I the Laser Industry

## IPG FIBER LASERS

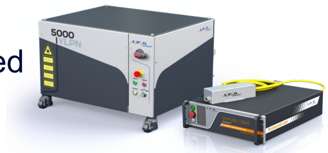

Ultra High Power
Continuous Wave (CW) Lasers

Ultra Compact Lasers



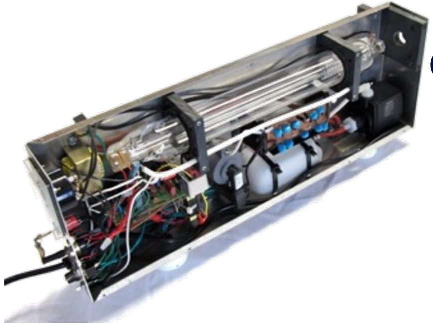

Adjustable Mode Beam and
QCW Lasers

High Power Nanosecond Pulsed
Pico and Femtosecond Pulsed




- Higher Productivity
- Compact
- Reliable
- Robust
- Efficient
- Minimal Maintenance
- No Consumables
- Scalable

## TRADITIONAL LASERS



**Carbon Dioxide ($CO_2$)**

**Lamp-Pumped Nd: YAG**

- Expensive
- Bulky
- Unreliable
- Difficult to Operate
- Inefficient
- Frequent Maintenance
- Costly Consumables
- Not Scalable

# Key Takeaways

1. Global market leader in fiber laser technology across multiple end markets & applications

2. Vertical integration, manufacturing scale & technology driving best-in-class margins

3. Expanding multi-billion dollar addressable market opportunity

4. Industry-leading earnings and cash flow

# The Pioneering Force I Behind Fiber Lasers

## IPG Photonics Overview

IPG Photonics is the inventor and world's leading producer of high-power fiber lasers, which enable greater precision, higher-speed processing, more flexible production methods and enhanced productivity within industrial, semiconductor, instrumentation, medical, scientific, defense and entertainment applications. Fiber lasers combine the advantages of semiconductor diodes, such as long life and high efficiency, with the high amplification and precise beam qualities of specialty optical fibers to deliver superior performance, reliability and usability. IPG has continually pioneered the development and commercial production of numerous unique technologies related to fiber lasers combining deep materials science expertise and process know-how with a vertically-integrated business model. The company produces all key components of its fiber laser technology in-house, enabling: (1) better performing, higher quality solutions; (2) faster product development; (3) more efficient production methods with high yields throughout the process; (4) industry-low product delivery times; and (5) rapid ongoing cost reduction with an industry-best margin profile.

## IPG'S HISTORY OF INNOVATION

1990 – 2022

- **1990:** IPG first to propose high-power fiber laser solution at OSA Conference, first 5 W fiber laser
- **1991:** first 2 W single-mode fiber laser
- **1993:** first single-mode pumping solution powered by multi-mode diodes and 200-500 mW erbium-doped fiber amplifier
- **1996:** first 10 W single-mode fiber laser and nanosecond pulsed ytterbium fiber laser
- **2000:** first 100 W single-mode fiber laser
- **2001:** first erbium doped fiber laser for medical applications
- **2002:** first single emitter diode pumping and 1 kW, 2 kW and 6 kW ytterbium fiber lasers
- **2003:** first multi-chip on submount diode packages
- **2004:** first 1 kW single-mode and 10 kW multi-mode fiber laser
- **2005:** first 2kW single-mode and 20kW multi-mode fiber lasers and 40 W/110 W thulium doped fiber lasers for medical applications
- **2006:** first 3 kW single-mode fiber laser
- **2008:** first 5 kW single-mode fiber laser and 50 kW multi-mode fiber laser
- **2009:** first high-brightness 100 W fiber-coupled laser diode and 10 kW single-mode fiber laser
- **2010:** first QCW lasers with 1.5 kW single-mode beam quality
- **2013:** first 100 kW multi-mode fiber laser
- **2014:** first kW class fiber lasers with wall plug efficiency >45%
- **2017:** first 120 kW multi-mode fiber laser
- **2018:** first continuous wave lasers with QCW-mode and adjustable mode beam
- **2019:** first ultra-compact high-power fiber lasers
- **2020:** Introduction of Light**WELD** handheld laser welding system
- **2021:** Introduction of Light**WELD XC** handheld laser welding & cleaning system
- **2022:** Introduction of Light**WELD XR** handheld laser welding & cleaning system

# The Pioneering Force I Behind Fiber Lasers

## Leading Technology Development

**Distributed Side Pumping**
uniquely enables fiber lasers with high beam quality, superior electrical efficiency and a completely monolithic design without alignment or vibration concerns and with no free space optics (more on slide 10).

**Thin film Technologies**
includes highly-reflective and anti-reflective coatings and narrow line filters of industry-leading quality and performance.

**Acousto-Optic Crystal Technology**
employ unique crystal growth processes to produce acousto-optic modulators (used in pulsed lasers) and other components not available in the commercial market.

**Active Optical Fiber**
produce active optical fiber of varying core diameter with higher efficiency, lower loss and greater protection against photo darkening and light scattering than competing solutions.

**Laser Diodes**
produce multi-mode laser diodes that are more efficient than competing solutions. Today we produce more than 10 million tested diode chips, significantly more than the next largest producer of these diode chips.

**Volume Bragg Gratings**
leading-edge technology for pulse compression within ultrafast pulsed fiber lasers.

**Assembly, Splicing, Testing**
employ low-loss assembly and splicing techniques throughout our core technologies while utilizing unique IPG-designed testing solutions that improve reliability at a significantly lower cost per channel than commercially available solutions.

**Distributed Single Emitter Pumping Solution**
allows for significantly higher coupling and wall-plug efficiency, along with greater reliability vs. diode bar technology.

**Nonlinear Crystals**
crystal growth technology for producing nonlinear crystals for visible and UV lasers with uniquely low absorption and near 100% high-quality material yield vs. competing technologies with ~50-70% material yield.





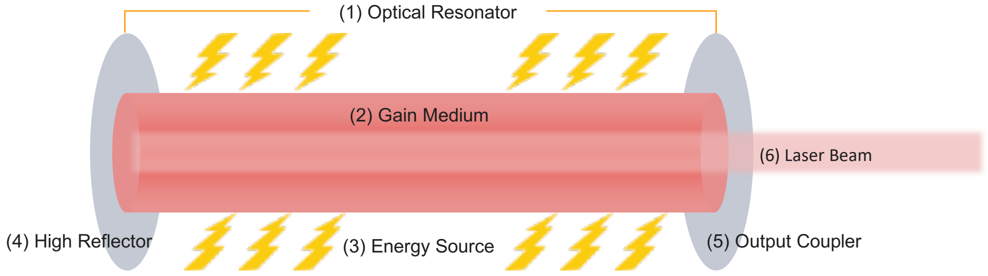
IPG PHOTONICS

# Laser 101

**L**ight
**A**mplification by
**S**timulated
**E**mission of
**R**adiation

## What is a Laser?

An optical amplifier that converts energy into highly concentrated beams of light by stimulated emission of photons (light particles) from excited matter. The unique properties of laser light enable more powerful, precise and flexible processing within numerous industries and applications.




## How a Laser Works

A laser consists of: **(1) an optical resonator**, typically two mirrors between which a coherent light beam travels in both directions; **(2) a gain medium** material within the resonator with properties that allow light amplification by stimulated emission; and **(3) an energy source** of light or electric current that excites atoms in the gain medium, known as **pumping**. Light in the gain medium travels back and forth between the two mirrors – the **(4) high reflector** and the **(5) output coupler** – being amplified each time. The output coupler is partially transparent, allowing some of the photons or **(6) laser beam** to exit.

## Types of Lasers

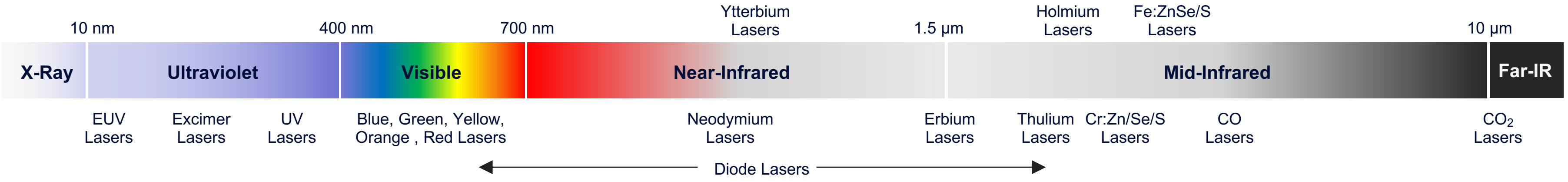
Lasers are often categorized by the type of gain medium (gas, crystal, fiber, semiconductor) but are also distinguished according to: (1) wavelength of operation (typically ~0.3 µm to ~10 µm); (2) pump energy source (electrical discharge, flashlamp, laser diode); (3) mode of operation (continuous wave or pulsed); (4) power (typically milliwatts to kilowatts); and (5) beam quality.

# Laser 101

**Unique properties of Laser Light**

- **Collimated/non-divergent** beam, consisting of parallel light waves traveling in a single direction with minimal divergence, allowing laser light to be focused to very high intensity or over long distances
- **Monochromatic** (single frequency or wavelength) enabling specific light energy to be delivered for a precise application
- **High energy density** enables materials processing and advanced applications
- **Coherent** nearly identical photons/waves that move together in both space and time, allowing holographic and interferometric applications
- **Mode of operation** can be continuous wave (constant power over time) to ultrashort pulses, which are much shorter than non-laser sources

## Wavelengths of Commercially Available Lasers



# Laser I Technologies

## Semiconductor Lasers

**Laser diodes** are electrically-pumped semiconductor lasers in which the gain medium is the p-n junction of a semiconductor diode, similar to light-emitting diodes (LED). Laser diodes are compact, inexpensive and commonly used in communications, optical storage, consumer products and as the light source within fiber and other types of lasers.

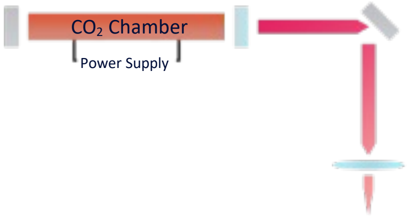
## Fiber Lasers

**Fiber lasers** are monolithic devices that use high-power semiconductor diodes to pump an active optical fiber, which serves as the gain medium and the optical resonator (see slide 10 for diagrams and additional detail). The active fiber core is infused or doped with rare-earth atoms (e.g. ytterbium, erbium, thulium) and contains fiber Bragg gratings at both ends that serve as mirrors. Within IPG fiber lasers, light emitted from semiconductor diodes is inserted into the external layer (cladding) of an active gain fiber. The pump light undergoes multiple reflections within the fiber cladding while frequently intersecting the fiber core, generating highly-focused light of exceptional efficiency. Use of diodes as a pumping source enable fiber lasers to achieve power conversion (wall-plug efficiencies) of 50% or better. Fiber lasers are compact and deliver high output power because of: (1) the scalability of the technology and (2) the high surface area to volume ratio of optical fiber. The monolithic design of a fiber laser eliminates the need for free space transmission and mirrors to guide the light. Instead, as the light amplification happens within the glass fiber, the output light can be coupled directly into a flexible delivery fiber, which can be easily integrated with a moveable focusing element and combined with automated production processes that move in multiple dimensions (e.g. robotics). Finally, ytterbium fiber lasers produce light at 1 μm wavelength, which is better-absorbed in metals. Because of these advantages, fiber lasers are rapidly gaining share within materials processing and other applications.

# Laser I Technologies

## Gas Lasers

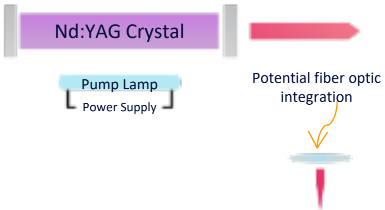
**$CO_2$ lasers**, traditionally used in materials processing applications, produce light in the infrared (IR) spectrum (10.6 µm) by stimulating electrons in a gas mixture and delivering the beam through free space using mirrors to provide direction. As a result, they occupy a much larger footprint and are more delicate to handle compared with fiber lasers. Wall-plug efficiency of these lasers is typically 7-8% including the cooling element (chiller); thus a 6 kilowatt $CO_2$ laser requires at least 75 kilowatts of input power. $CO_2$ lasers operate at a wavelengths that are optimal for use on many non-metallic materials, including organic materials like wood and fabrics.




**Excimer lasers** use combination of noble gases and a halogen, which produce a molecule called an excimer when stimulated. The excimers act as a gain medium and generate nanosecond pulses in the UV range. These lasers are primarily used in microelectronics applications including photolithography and flat panel displays.

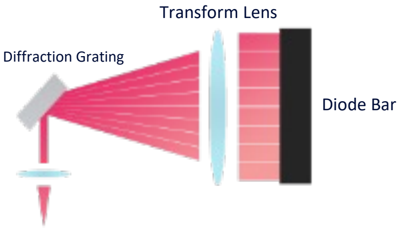
## Crystal Lasers

Employing artificial crystals infused with rare-earth atoms as the gain medium, crystal lasers are used in a variety of materials processing, scientific, medical and advanced applications. **Nd:YAG lasers** (yttrium aluminum garnet infused with neodymium) produce light at 1 µm wavelength, utilizing mirrors and lenses to focus the light output., which can be integrated into a fiber optic system or delivered to the work surface with mirrors. Although well-suited for metals, Nd:YAG wall-plug efficiency is extremely low at ~2% for lamp-pumped lasers and in the 20% range for diode-pumped devices. **Disk lasers** use small diode pumps outputting multi-mode light. This light is reflected by mirrors onto a small disk crystal (typically Ytterbium doped YAG). Many of these diode-crystal modules are combined to create the final laser output. Wall-plug efficiency is typically in the 20% range, but with a much larger form factor compared with fiber laser technology.




## Direct Diode Lasers

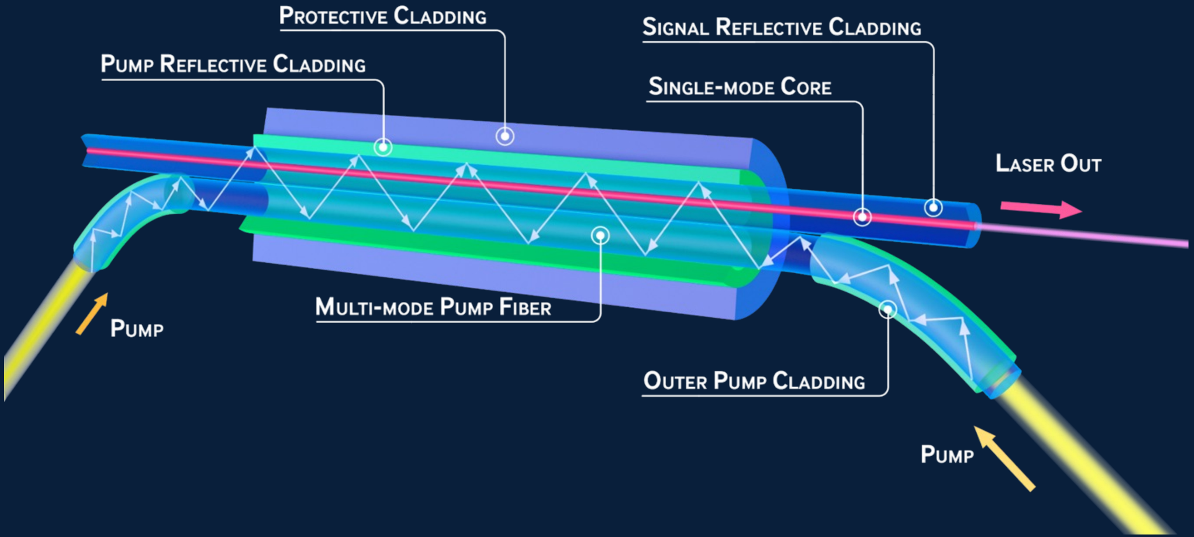
In an effort to move into higher-power applications, **direct diode lasers** have been developed that focus light from diode bars directly into an output fiber, rather than using diodes for pumping another laser, such as in fiber or crystal laser technology. Although this theoretical simplification of laser architecture could potentially result in improved efficiency, it has drawbacks as well. Most direct diode lasers use diode bar emitters, which are less reliable, have no inherent cost advantage, and may emit light at slightly different wavelengths making coherent combining of the light a challenge. In addition the beam quality of a diode laser is inferior to a fiber laser and the technology is less scalable.



# IPG Patented Side Pumping Technology

## Cladding (Side) Pumping

IPG fiber lasers use a proprietary side- or cladding-pumping process to transfer energy from a large number of multi-mode single-emitter semiconductor diodes into a small (single-mode) fiber core for amplification. In cladding pumping, IPG uses a dual fiber construction consisting of a multi-mode pump fiber and a single-mode doped core fiber. The light from many pump diodes is coupled into the multi-mode pump fiber and undergoes multiple reflections while frequently intersecting the single-mode core. During these intersections, the pump light is absorbed and re-emitted by rare-earth ions, converting multi-mode diode light into single-mode fiber laser light with exceptional efficiency and high brightness. This approach enables a completely monolithic design without alignment or vibration concerns and with no free space optics. Other fiber lasers generally use end pumping, which is less efficient, reduces beam quality, often requires the use of mirrors to focus the light source into the fiber and may require maintaining positive air pressure within the laser to avoid dust and other contaminants.




## Complete Portfolio of Components

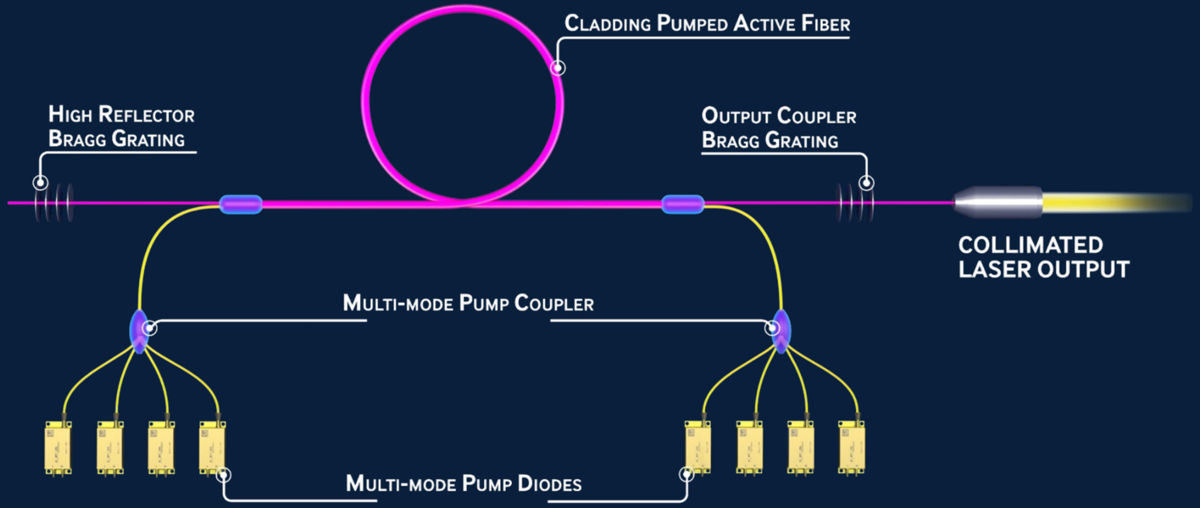
IPG fiber laser components are designed and manufactured internally, at higher-performance, smaller form factor and lower cost than competing products.

- Acousto-optic Modulators
- Isolators
- Beam Couplers
- Pump Combiners
- Collimators
- Laserline Narrowing and Stabilization
- Spectral and Spatial Filters
- Raman Filters
- Multiband Filters
- Compressors for fs and ps lasers
- Spectral Beam Combining
- Coherent Beam Combining
- Wavelength Multiplexing
- High-Power Beam Splitting
- Beam Steering and Deflection
- Angular Magnifiers
- Single Photon Counting
- Wavelength Tunable Lasers

# IPG Single-Emitter Diode Architecture

## Single-Emitter Diode Architecture

In IPG fiber lasers, the energy source is comprised of many multi-mode, or broad area, single-emitter diodes. IPG's single-emitter semiconductor diodes together form an assembly of independent light-generating elements that provide an electrically efficient and reliable light source, as the failure of any single-emitter pump does not affect the performance of the remaining pump assembly. Other fiber lasers often use diode bars or stacks, which combine multiple emitters (10-100) along a large-area chip, forcing all emitters to share an electrical current source and a complex thermal management system consisting of expensive and unreliable microchannel coolers using high-pressure deionized water. While packaging costs can be lower with diode bar technology, thermal and electrical cross-talk limits bar lifetime and constrains performance. In addition, our single-emitter diodes have significantly higher coupling efficiency (90-95%) and wall-plug efficiency (50-60%) vs. bar-stack alternatives at 50-75% and 25-35%, respectively.




## Leading-Edge Modular Platform

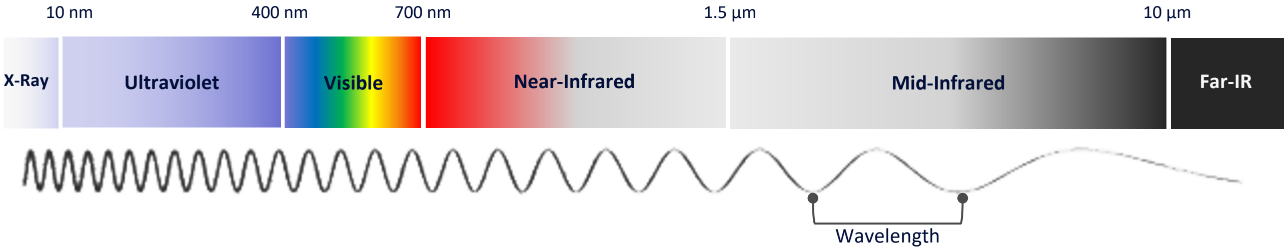
- Master oscillator power amplifier (MOPA) architecture with fully integrated (spliced) multiple cascades
- Multi-chip high-power pump laser diode packages
- Darkening-free optical fiber, which is highly doped and produced in industry-leading quantities
- Multi-port facet couplers with no-loss multi-mode coupling techniques
- Beam combining techniques including single-mode to multi-mode couplers
- Splicing mode matching of different fiber types
- Leader in fiber Bragg gratings with volume Bragg grating technology for ultra-short pulse compression
- Power scaling by parallel combining of fiber resonators

# Categorizing Lasers I by Key Attributes

## WAVELENGTH

Electromagnetic radiation can be viewed as waves or photons and measured by: (1) wavelength; (2) photon energy; or (3) oscillation frequency. Wavelength is the distance between two successive points in the wave with the same phase of oscillation (e.g. crest to crest or trough to trough). The shorter the wavelength, the higher the frequency; that is, more crests within a second. Because laser light is monochromatic (single wavelength), lasers are often characterized by the wavelength of light they emit.

IPG Photonics produces lasers from 0.3 to 4.5 μm and the majority of the lasers we sell for materials processing applications contain active fibers infused with ytterbium, which produces light at a wavelength of 1 μm. $CO_2$ lasers produce light at 10.6 μm. The shorter wavelength possible with fiber lasers compared to their $CO_2$ counterparts makes them more efficient at metal processing as metals more readily absorb the laser's energy, reducing the power needed to heat the metal to cut or weld. We also infuse active fibers with erbium and thulium to producing lasers with wavelengths of 1.5 μm and 2 μm for a variety of telecom, medical, R&D and non-metal processing applications. Furthermore, we produce nonlinear crystals for frequency doubling and frequency tripling of the 1064 nm beam from our ytterbium fiber lasers to produce 532-nm green and 355-nm UV lasers, also known as second-harmonic generation and third-harmonic generation, respectively.



# Categorizing Lasers I by Key Attributes

## MODE OF OPERATION

Lasers can run in a variety of modes, each effectively representing a compromise between average and maximum power. With a continuous wave mode, the laser is continuously producing the same wattage, making its average power equal to its maximum. Other modes rely on pulses of varying lengths to increase maximum power by reducing the time in which this maximum power is available; with incredibly short pulses, very high amounts of power are possible, reducing as pulse length increases.

IPG produces continuous wave (CW), quasi-continuous wave and pulsed lasers, with pulse durations ranging from milliseconds (thousandths of a second) to femtoseconds (quadrillionths of a second).

## POWER

The output power of a laser is its wattage (joules per second), which is the rate at which power is transferred to the workpiece. The higher a laser's power, the more rapidly one can deliver energy to the workpiece (e.g. cut or weld materials). However, as laser power increases, the electricity needed must increase as well. As cutting speeds improve, other mechanical components in which the laser is integrated must also keep up, making systems investments in linear motors and gantry speeds necessary to fully make use of higher powered lasers.

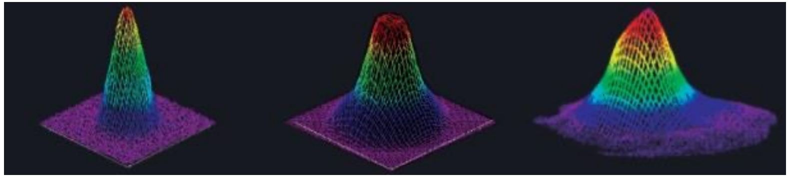
Today we produce lasers at power levels from milliwatts to kilowatts, with our 120 kW multi-mode ytterbium fiber lasers the highest-powered continuous wave laser commercially produced on the market by an order of magnitude. We also have the ability to make even higher-powered lasers to meet specialized customer-specific application needs.

## BEAM QUALITY

$M^2$ or the beam quality factor represents the degree of variation between a laser beam and the ideal single-mode or diffraction-limited Gaussian beam where $M^2 = 1$. $M^2$ indicates how well a beam can be focused on a small spot and remain focused over longer-distances. In most lasers, beam quality is sensitive to output power, with $M^2$ increasing as output power increases. However, in fiber lasers, the output beam is virtually non-divergent over a wide power range. A non-divergent beam enables higher levels of precision, increased power densities and the ability to deliver the beam over greater distances to where processing can be completed. The superior beam quality and greater intensity of a fiber laser's beam allow tasks to be accomplished more rapidly, with lower-power and with greater flexibility.

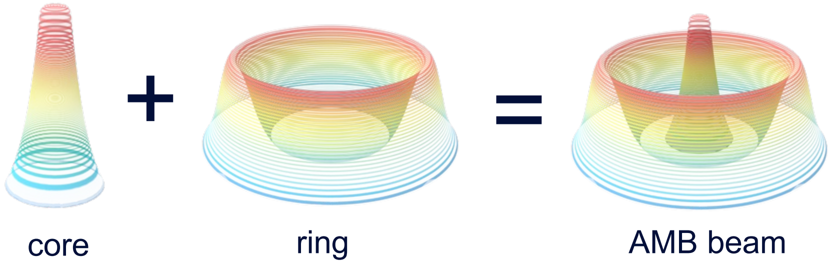
Diffraction-limited single-mode beams with $M^2$ factors nearing 1 are required for certain telecommunications, sensor, directed energy and remote materials processing applications. Other types of materials processing, including many cutting and welding applications, will use laser sources with $M^2$ factors of 10 and above depending on the application. IPG produces both single-mode lasers with an $M^2$ factor <1.1 as well as multi-mode lasers with higher $M^2$ factors to meet a variety of application- and industry-specific needs.

$M^2 = 1$ $M^2 = 9$ $M^2 > 20$



# Adjustable Mode Beam (AMB)

- **Broadest range of beam profile tune-ability:** programmable, independent control of size and intensity of the core and ring beams
- **Single & Multi-Mode:** beam options for consistent, high-quality welds including high-speed welding in EV battery manufacturing
- **Virtually eliminates welding spatter:** molten material is deflected towards the bottom of weld pool where large keyhole openings allow molten vapor to escape
- **High-speed welding for e-Mobility and automotive applications:** 300 mm/s or higher speeds welding Al battery enclosures and drivetrains
- **Maximizes uptime:** less rework of parts, drastically reduces sensor contamination

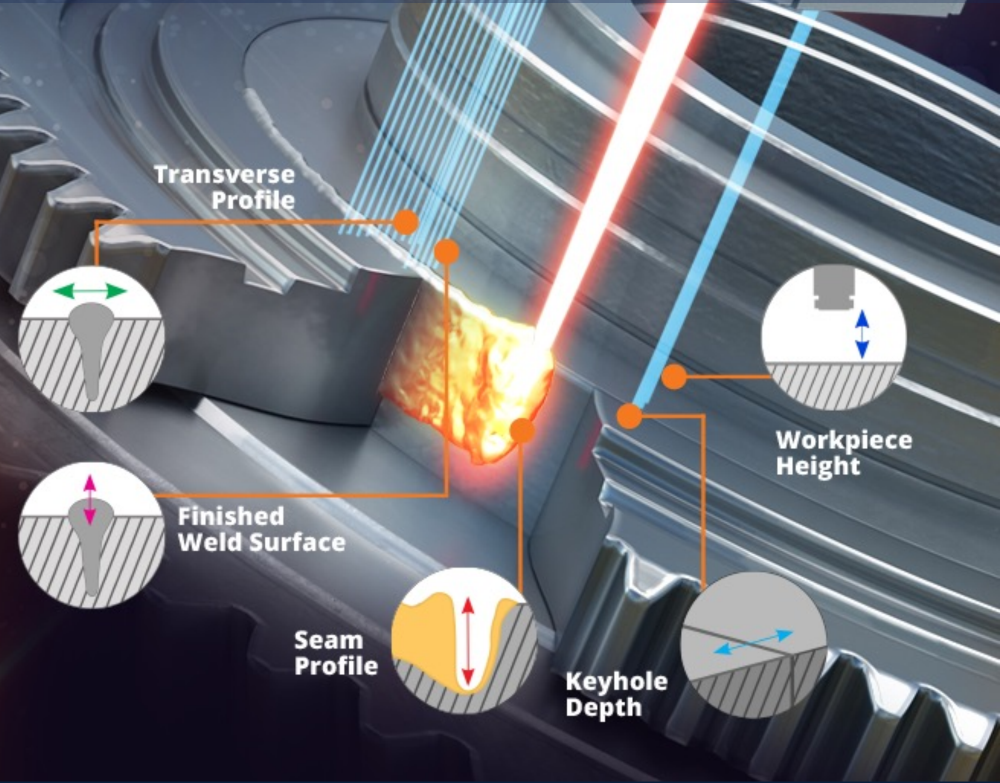




**Any combination of a small-spot high intensity bright core and a larger ring-shaped beam**

# Real-Time Laser Weld Monitoring for Unmatched Weld Quality Assurance

Using **real-time inline coherent imaging (ICI) the LDD-700 weld monitoring system** consolidates weld results into concise and actionable quality data from a single system.

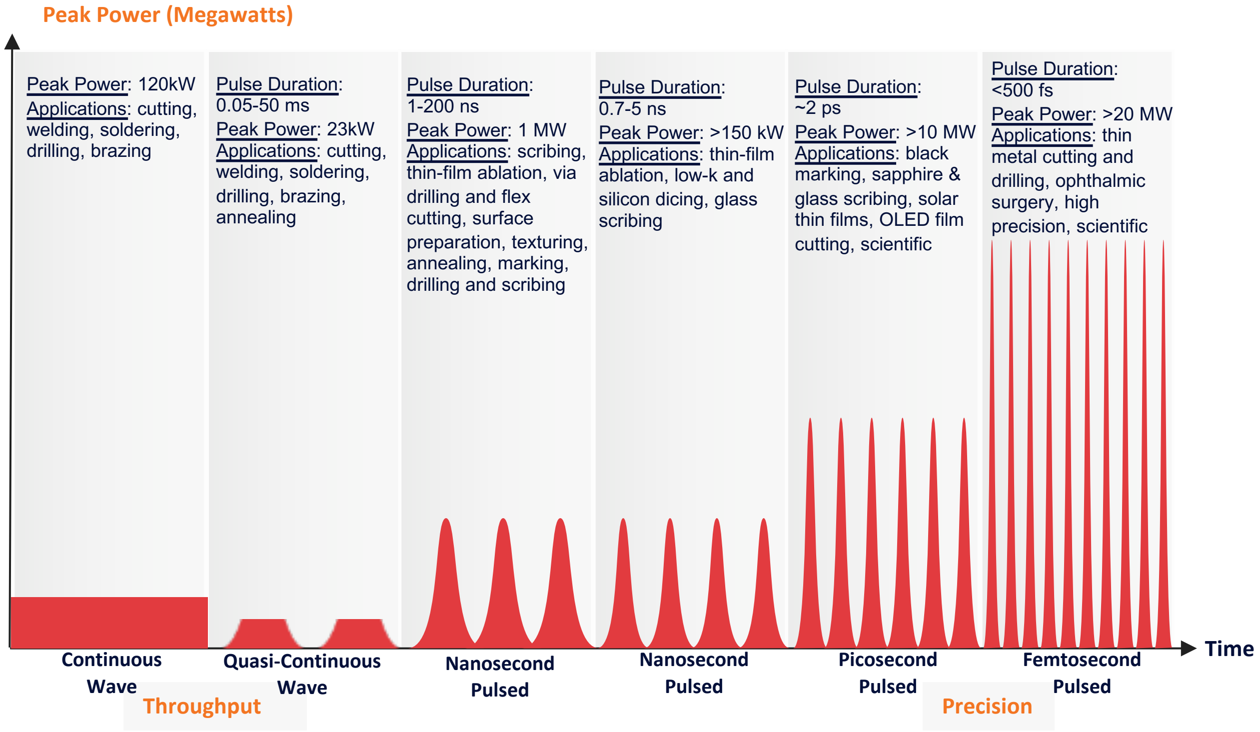





IPG PHOTONICS

# Broadest Portfolio I of Fiber Lasers

## Delivering any wavelength, mode of operation, power, beam quality or application

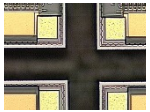




Thick steel cut with a continuous wave laser


Drilling using a quasi-continuous wave laser

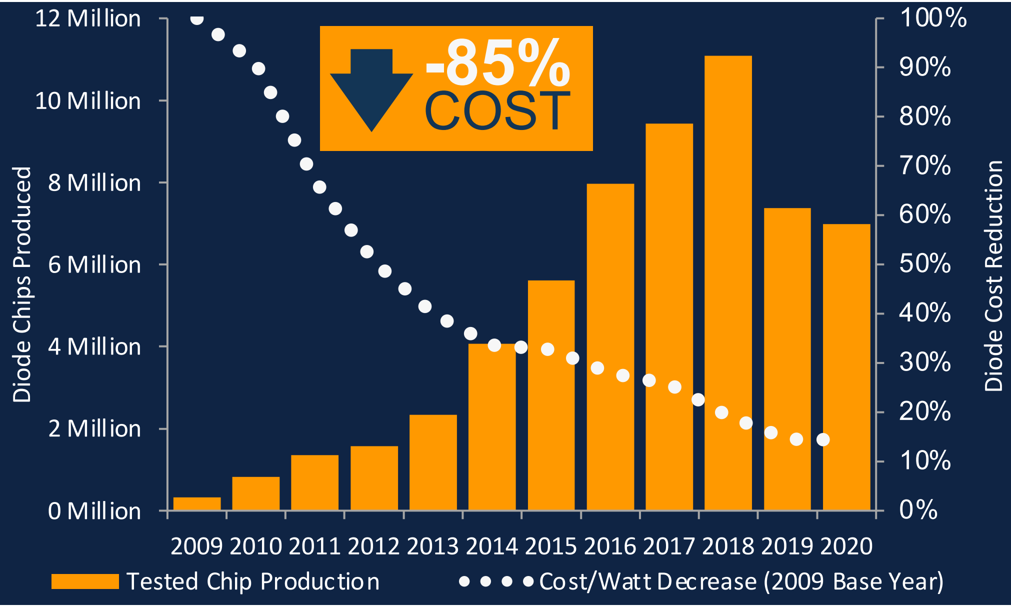

Surface Cleaning using a pulsed laser

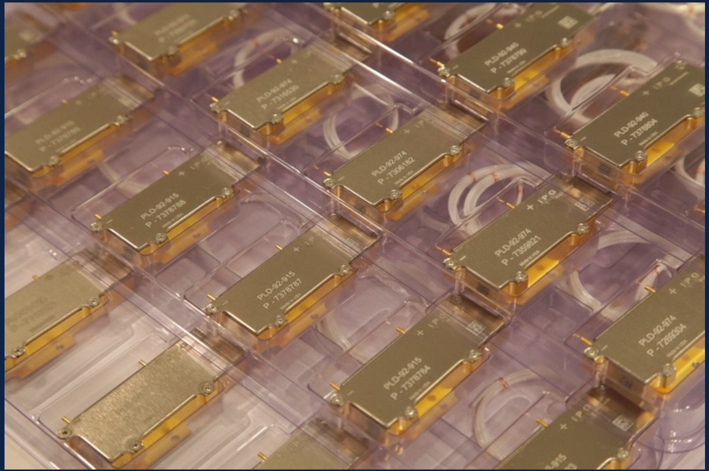

Micromachining using an ultrafast laser

# IPG Fiber Laser Advantages

Highest Powers
Record Energy Efficiency
Industry Leading Reliability
Smallest Form Factors
Easy System Integration
Lower Operating Costs
Best-in-Class Portfolio
Modular & Scalable
Leading-Edge Beam Quality

# Diodes I the Power Behind the Fiber Laser

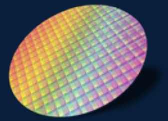


Source: IPG Photonics Corporation

- IPG diodes are the lowest cost in the industry, empowering our Customers with the **HIGHEST power** fiber lasers for **the LOWEST cost** per watt
- In 2019 IPG transitioned to a new higher power chip reducing cost per watt and the level of required production to support a given level of revenue

# IPG Vertical Integration



**Fab Operations**

Semiconductor wafer growth

Diode processing, chip mounting & burn-in

**Laser Diode Packaging**

Up to 200 Watts of power

**Optical Fiber**

Silica based glass doped with rare earth ions

**Fiber Blocks**

Fiber Bragg Gratings

Isolators, Modulators

**Laser Modules**

Up to 3 kW

**Power Supplies**

Control Electronics


**Industrial Lasers**

Coupling | Final burn in | Shipment

**Process Heads, Monitoring and Switches**

All fiber beam delivery

**INTEGRATED SYSTEMS**

**WELDING | ABLATION**
**DRILLING | CLADDING**
**CUTTING | CLEANING**

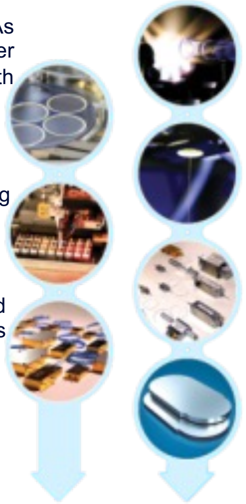
## DEEP IN TECHNOLOGY
## DEEP IN EXPERIENCE

# Benefits of I Vertical Integration

**We view our in-house component supply and process know-how as crucial competitive advantages, providing us an enhanced ability to increase the power and functionality of our products at an industry-low cost point.**

## Diodes

- In 2019 we produced more than 10 million tested semiconductor diode chips for our pump laser diodes (PLDs) that power all our fiber lasers. IPG PLD's come in 1-, 3-, 6- and 9-chip-on-submount (COS) configurations.
- We utilize multiple molecular beam epitaxy (MBE) wafer growth systems, along with proprietary recipes and reactor settings to grow gallium arsenide (GaAs) wafers. We believe MBE yields high-quality optoelectronic material for low-defect density and high uniformity of optoelectronic parameters as compared to other techniques like MOCVD.
- Within our wafer fab operation, we employ proprietary wafer process equipment and facet passivation and coating techniques to ensure industry-best performance and reliability. IPG produces submounts internally, with COS assembly performed using in-house automated equipment and proprietary processes.
- We have the industry's largest test and burn-in operation to ensure long-term PLD reliability. Test and burn-in equipment is designed and manufactured internally at a significantly lower cost per channel than the market, with every COS undergoing rigorous high-temperature and high-current screening.
- Our PLD packaging operation utilizes equipment designed and manufactured internally with better performance and lower cost than open market alternatives. We also produce micro optics and package mechanical subcomponents internally, enabling a lower packaging cost compared with overseas contract manufacturing.



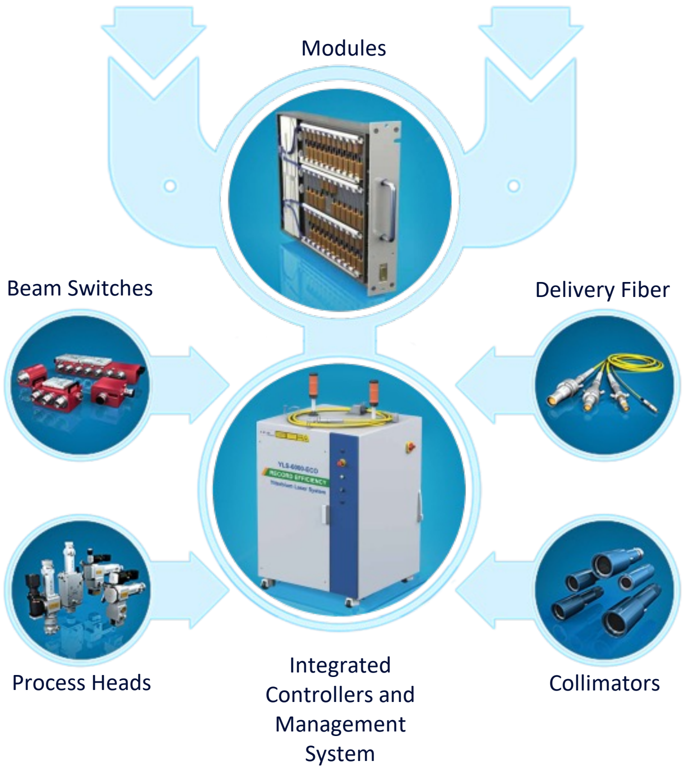

## Specialty Optical Fiber and Components

- We are a leading global producer of **active optical fiber**, which is used internally in our products. Active optical fibers with embedded mirror gratings form the laser cavity or gain medium in which lasing or amplification of light occurs in our products. Our active fibers consist of an inner core that is infused with rare earth atoms, such as **ytterbium**, **erbium** or **thulium**, and outer cores of un-doped glass having different indices of refraction. We believe that our large portfolio of specialty optical fibers has a number of advantages including: (1) higher concentrations of rare earth ions; (2) improved reliability; (3) higher lasing efficiency; and (4) a greater ability to achieve single-mode outputs at high powers while withstanding the high optical energies at these power levels.
- We have developed a wide range of **advanced optical components** that are capable of handling high optical power levels and contribute to the superior performance, efficiency and reliability of our products. In addition to fibers and diodes, our optical component portfolio includes fiber gratings, couplers, isolators, combiners, bulk-optics, micro-optics and crystals among others. We also developed special methods and expertise in splicing fibers together with low optical energy loss and on-line loss testing.

## Fiber Blocks

- We splice our specialty active optical fibers with other optical components and package them in a sealed box, which we call a **fiber block**. The fiber blocks are compact and eliminate the risk of contamination or misalignment due to mechanical vibrations and shocks as well as temperature or humidity variations.

# Benefits of I Vertical Integration




## Modules

We package hermetically-sealed **pump laser diodes** and **fiber blocks** into **pump modules**. Our module design is scalable and modular, permitting us to make products with high output power by coupling a large number of diodes with fiber blocks. Characteristics such as the ability of the package to dissipate heat produced by the diode and withstand vibration, shock, high temperature, humidity and other environmental conditions are critical to the reliability and efficiency of the our modules.

## Fiber Laser

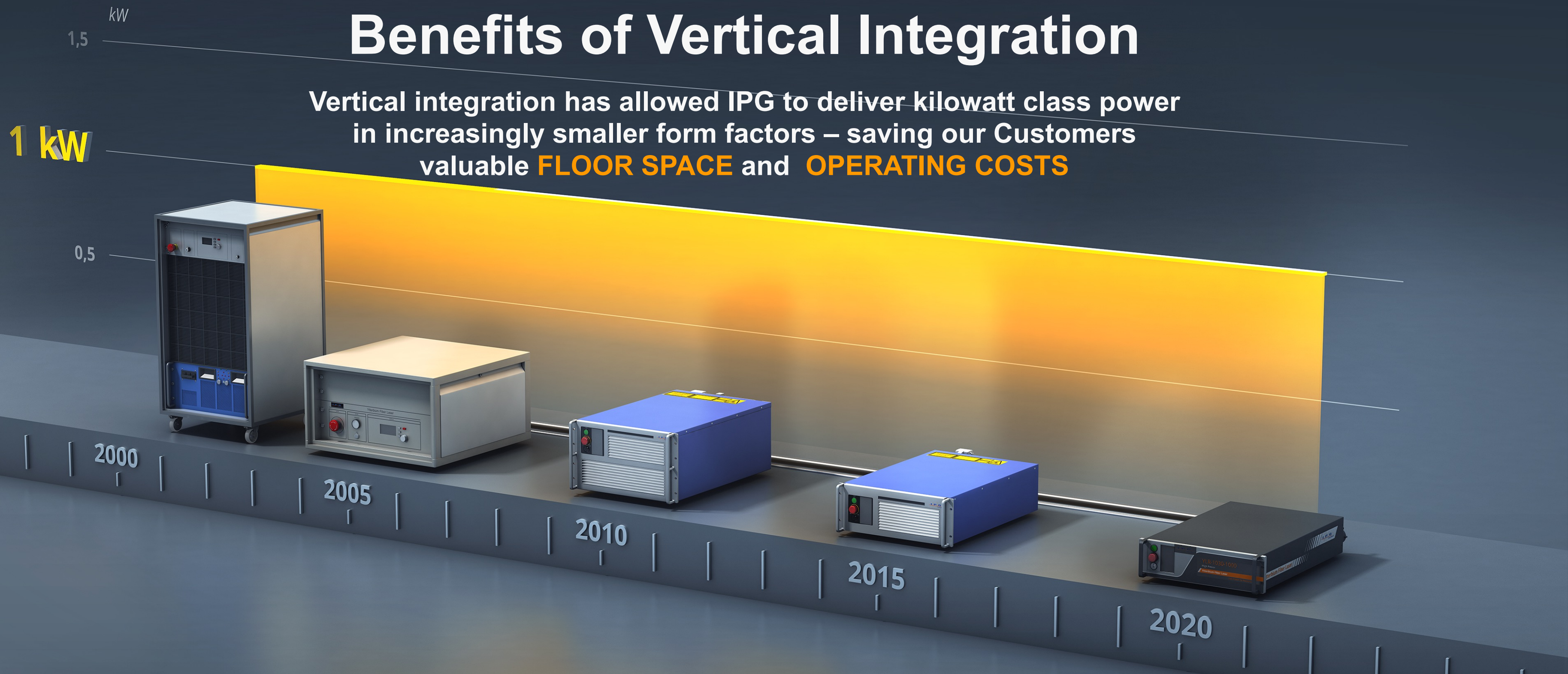
We produce **high-power fiber lasers** by combining multiple **modules** together with associated **power supplies**. Our proprietary process for combining fiber modules allows us to produce industrial-grade fiber lasers at over 100 kilowatts of power. We build, design and assemble fiber laser modules and power supplies in-house, enabling a more robust, compact and efficient design at low cost.

## Complementary Products

**Optical delivery fiber cables** bring the light source to the work surface. We produce delivery fiber with core diameters from 50 μm to over 1000 μm at lengths of more than 100 meters. Within certain applications, it is necessary to transform light output from an optical fiber into a free-space collimated beam, and IPG produces both water or air cooled **collimators**. IPG also manufactures a complete line of **couplers**, **beam shutters** and **multi-channel beam switches** that dramatically expand functionality. They enable the use of a single laser at multiple working cells, increasing process speed and maximizing throughput by allowing multiple applications simultaneously. Finally, IPG produces a wide range of **process heads**, including cutting and welding heads and optical scanners that enables applications like welding, precision cutting, marking and surface treatment.

# Benefits of Vertical Integration

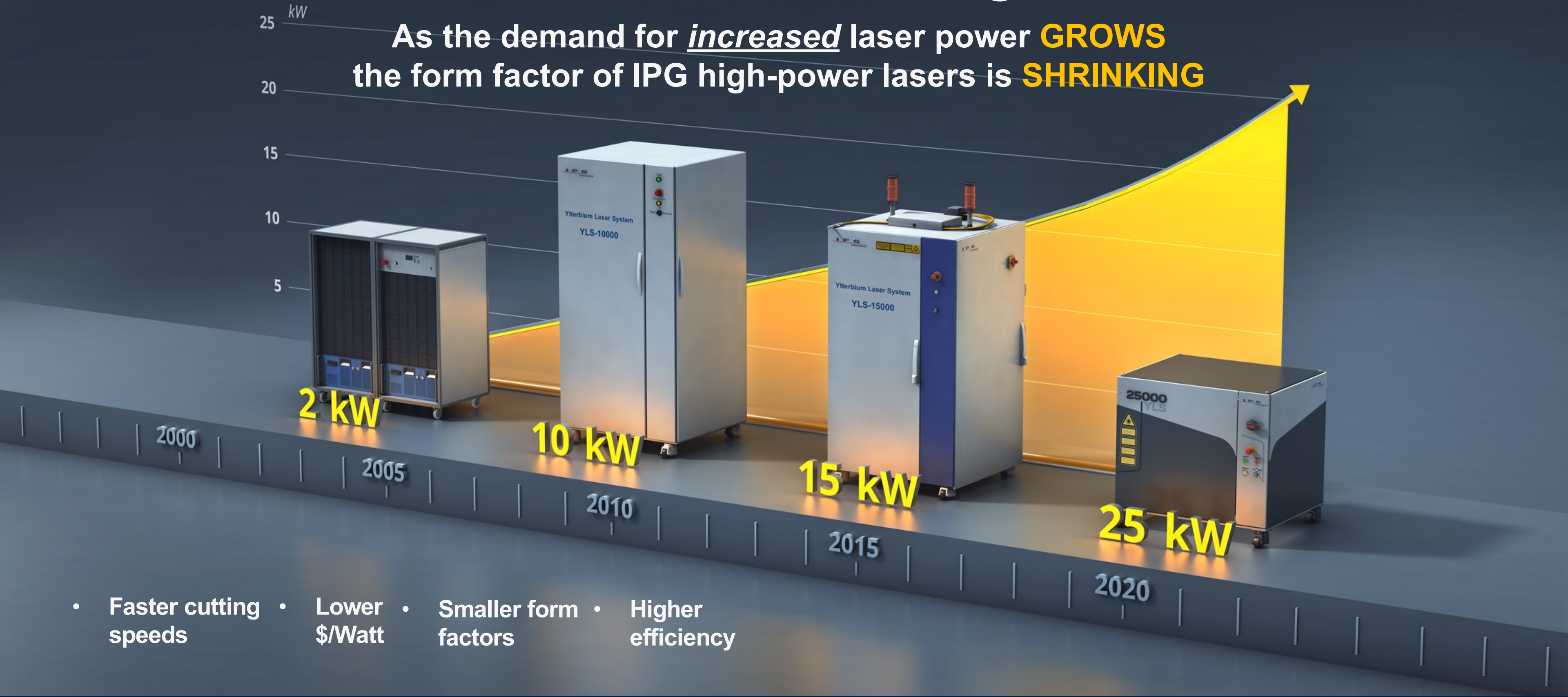
**Vertical integration has allowed IPG to deliver kilowatt class power in increasingly smaller form factors – saving our Customers valuable FLOOR SPACE and OPERATING COSTS**




**>75% form factor REDUCTION over the past 20 years**
**Always providing RELIABLE IPG kilowatt power**

# Benefits of Vertical Integration

**As the demand for *increased* laser power GROWS the form factor of IPG high-power lasers is SHRINKING**



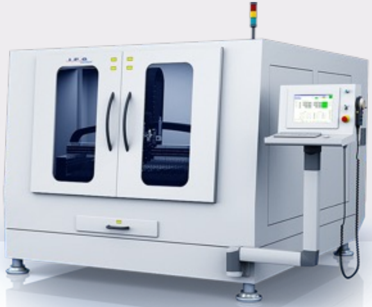

- Faster cutting speeds
- Lower $/Watt
- Smaller form factors
- Higher efficiency

# IPG Laser I Systems

Robotic Laser Cells
for Larger Parts

Fully Automated EV
Battery Welding Systems

Multi-Axis Laser
Workstations
for Industrial Parts



Turnkey Flatbed Laser
Cutting Systems

Precision Laser Systems
for Medical Parts

Compact & Flexible
Precision Laser
Welding

# Applications

Cutting and Drilling

## 45-50% OF REVENUE

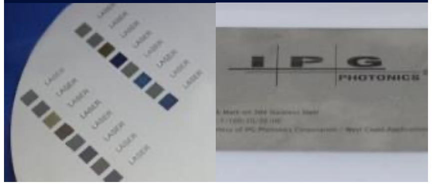
Lasers cut and drill material not through mechanical grinding, but by focusing a high-powered beam and rapidly heating the material, which either melts or vaporizes it. There is no contact between the machinery and the item, with the laser working at a distance. There is still a kerf (material removed through cutting) as with traditional methods, but the kerf can be greatly reduced in size by using a laser.

Welding | Brazing

## 20-25% OF REVENUE

The ability of a laser to rapidly heat a small section of material makes it more efficient than traditional materials processing methods, even more so in the case of welding and brazing where consumables are used and heat transfer to the workpiece is an important concern. The high power density provided by a laser system allows welding of: (1) different alloys together; (2) high-strength and multi-layered steel; and (3) aluminum, which was traditionally riveted.

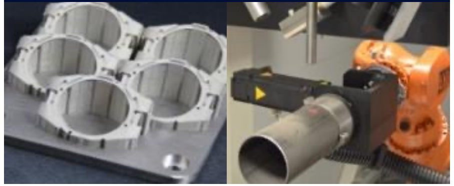
Marking | Engraving



## 7-9% OF REVENUE

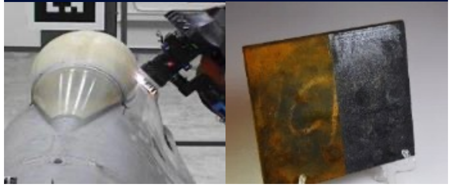
Fiber lasers can be used to oxidize surfaces, darkening sections to form a design. Different colors can be attained through the addition of powders, which when heated bind to the workpiece and create the intended shape. Engraving involves the vaporization of a shallow layer, leaving behind a permanent and low maintenance mark.

Additive Manufacturing | Cladding



Cladding and additive manufacturing function in largely the same way, heating metallic powders until they bind to one another or to the workpiece when cladding. Additive manufacturing enables the construction of unique, completely metallic parts and cladding allows for repair and increased functionality of components through the addition of a protective layer.

Ablation | Cleaning



In ablation, the exterior coating absorbs the energy and vaporizes, leaving behind only the underlying material which has a higher vaporization temperature. Lasers can also be used to clean rust, paint and other coatings from surfaces without any chemicals through pulsed laser emissions which vaporize the surface damage or coating but keep the underlying material intact.

Advanced | Medical

Our products are used in a variety of advanced applications including obstacle warning and light detecting and ranging, directed energy applications for security and defense, scientific projects and research and cinema projection systems. We also produce multiple laser types for medical applications including general surgery and urology, dental and skin rejuvenation and wrinkle removal.

Telecom, Systems, Service and other – due to their monolithic and largely maintenance free design, fiber lasers require little servicing compared to other laser technologies.

# Products

High Power CW


## 45-50% of revenue

High Powered Continuous Wave ytterbium fiber lasers make up the majority of IPG revenue and have average powers from 1 to 120 kW, ideal for materials processing applications like cutting and welding. They present a flexible manufacturing solution since they not only operate at their peak power, but can also be used for low power applications with ease. Their modular design enables redundancy as failure of any one module can be compensated by the others, decreasing service time significantly. IPG high power lasers are the most efficient on the market with wall plug efficiencies from 40-50%-plus, reducing cooling needs significantly. In addition, we also produce single-mode ytterbium fiber lasers with power levels up to 10 kW for advance applications.

Pulsed


## 15-20% of revenue

Pulsed lasers deliver high peak power with much lower average power use, making them very useful for applications where material integrity is important. Pulsed lasers allow for applications like ablation, marking, trimming, drilling. Pulsed lasers are offered in a wide range of wavelengths: .36 - 5 µm with adjustable repetition and peak power rates making a single laser flexible for many different uses with lower energy consumption and a smaller footprint than a CW laser.

Mid Power CW

## ~5% of revenue

Mid power lasers have output ranges below 1 kW, and those under 500 W are generally air cooled, further reducing costs. They have the same leading efficiency as high powered ytterbium fiber lasers and the same high beam quality. IPG produces these units as OEM modules or as easily integrated rack units directly for the end consumer. These lasers present an economic choice for additive manufacturing, R&D, scientific and commercial uses with a wide range of wavelengths available, from .5-5 µm, including erbium and thulium fiber lasers with output power levels up to 500 W.

Ultrafast

## <5% of revenue

A fast growing range of advanced applications require ultra-short pulse durations in the $10^{-11}$ (picosecond) to $10^{-13}$ (femtosecond) range. Based on a master oscillator power amplifier (MOPA) architecture, IPG ultrafast fiber lasers generate very short pulses at extremely high power, which are particularly well suited for micro materials processing since they enable drilling and dicing with no thermal damage to surrounding materials. Our ultrafast lasers can also be used in a variety of medical and scientific applications.

# Products

QCW


## ~5% of revenue

Quasi-continuous wave lasers produce pulses in the millisecond to microsecond range, similar to Nd:YAG lasers but with greater power efficiency and flexible beam delivery. Even the relatively long pulses of a QCW laser enable a peak power ~10x higher than average power. The smaller variation in output compared to other pulsed lasers makes them practical for fine welding, percussion hole drilling and fine cutting in the consumer electronics and aerospace industries.

Accessories

## <5% of revenue

In order to expand the capabilities of fiber laser technology, IPG manufactures a complete set of optical beam delivery components. Products include state-of-the-art welding heads, cutting heads and scanning-based processing systems. In addition, IPG sells delivery fiber and optics, beam couplers, switches and sharers, collimators and process control and tooling solutions.

Systems

## ~10% of revenue

IPG not only produces laser modules for OEMs and end users, but also manufactures complete machine tool systems, integrating laser modules with motion systems, optics, beam switches, processing heads and software. These integrated precision systems allow for easy automation and are customizable to meet consumer needs as well as providing unified readymade solutions suitable for most typical needs.

Medical


## 3-5% of revenue

IPG is at the forefront of laser-based solutions for medical device and contract manufacturers. Laser cutting, drilling, welding and marking systems for both metal and polymer machining are adaptable across many product lines and processes. Applications include pacemakers, implantable devices, endoscopic instruments, surgical devices, dental tools, medical tube welding, medical probes, guide wires, microfluidic sensors, catheters and stents.

**Service and other — 5-10% of revenue**

# Markets Served by Our Products

## Materials Processing

| End Market | Applications | Principal Products |
|---|---|---|
| General manufacturing | Flat sheet, tube and 3D cutting<br>Welding, brazing and hardening<br>Marking, engraving and printing<br>3D printing<br>Ablation and cleaning | Continuous Wave ("CW") lasers (1-20 kW)<br>CW lasers (1-50 kW)<br>Nanosecond ("NS") pulsed lasers (10-100 W)<br>CW lasers (200-1,000 W)<br>NS pulsed lasers (100-2000 W) |
| Automotive | Cutting of high-strength steel and aluminum<br>Welding tailored blanks, frames and auto parts<br>Seam welding and brazing<br>Electric vehicle battery processing | CW lasers (1-20 kW)<br>CW lasers (1-50 kW)<br>CW lasers and IPG systems<br>CW lasers and NS pulsed lasers |
| Consumer goods | Micro welding, cutting and marking<br>Marking of plastic and non-metal material | Quasi-CW ("QCW") lasers and NS pulsed lasers<br>Ultraviolet pulsed lasers |
| Medical devices | Stent, pacemaker and device manufacturing | CW lasers and NS pulsed lasers |
| Energy | Hardening and welding of pipes<br>Cladding of turbine blades and drill bits | CW lasers (4-50 kW)<br>CW lasers (1-20 kW) and IPG systems |
| Aerospace, rail, shipbuilding | Welding titanium and welding/cutting thick plates<br>Percussion drilling of parts<br>Non-destructive inspection | CW lasers (1-50 kW) and IPG systems<br>QCW lasers<br>Genesis systems |
| Micro electronics | Wafer inspection and annealing<br>Solar cell processing<br>Processing of glass, ceramics, sapphire, silicon | CW lasers and NS pulsed lasers<br>Green pulsed lasers<br>Picosecond ("PS") pulsed lasers |

## Other Markets

| End Market | Applications | Principal Products |
|---|---|---|
| Aerospace and defense | Directed energy | Single-Mode CW lasers, amplifiers and diodes |
| Entertainment | Laser cinema projection | RGB luminaire laser system |
| Scientific | Sensing, spectroscopy and research | Mid-infrared and other lasers |
| Medical procedures | General surgery, urology and soft tissue<br>Skin, wrinkle/hair removal and dental | Thulium lasers<br>Erbium and diode lasers |
| Communications | Datacom and telecom network infrastructure<br>Terrestrial and satellite broadband | Optical transceivers<br>Optical amplifiers and raman lasers |

**Revenue by Channel:**

- 70% to 75% direct sales to machine tool original equipment manufacturers
- 20% to 25% direct sales to end users or integrators working with end users

**Revenue by End Market:**

Because 70% to 75% of our sales are to original equipment manufacturers of laser-based systems and not to the end users of those systems, we do not have good visibility into our revenue split by end market. In addition, lasers systems sold in the cutting market (our largest application) may be used to process materials in a variety of end markets.

**Our largest end markets include:**

- General Manufacturing
- Automotive
- Household Appliances, Building, and Housing Equipment
- Industrial Machinery
- Electrical Equipment
- Aerospace, Shipbuilding, Railcar, and Other Transportation
- Consumer Electronics

# IPG Total I Addressable Market

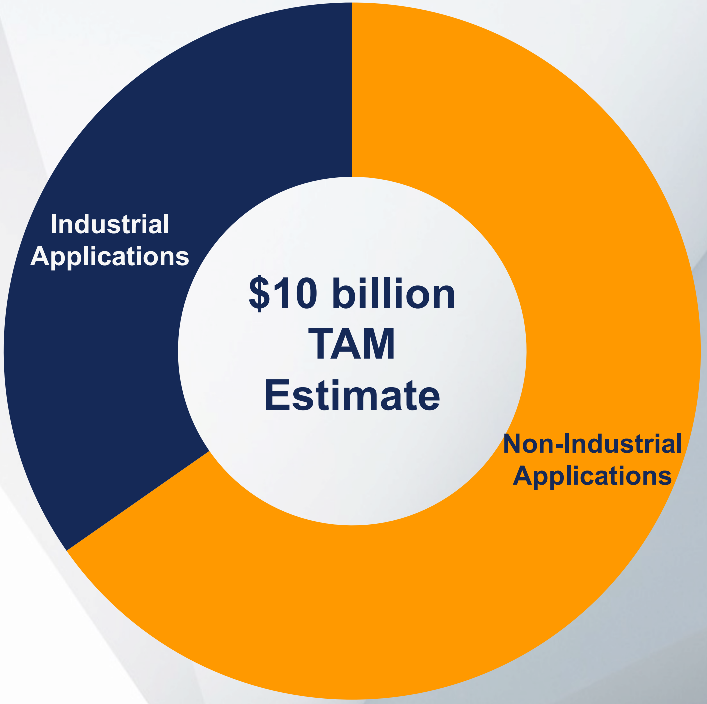
## IPG Holds Leading Share in Industrial Applications

High-Power Cutting and Welding

Marking and Engraving

Additive Manufacturing

Precision Processing




## Future Growth Opportunities

Medical

Microprocessing

Sensors and Instruments

R&D and Scientific

Aerospace & Defense

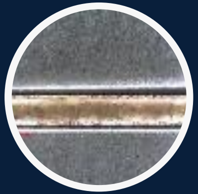
Source: Optech Consulting, Strategies Unlimited and IPG Photonics Corporation

# Laser Penetration in Industrial Applications

**Continued adoption of laser tools in many industrial applications**

CUTTING

WELDING



BRAZING

DRILLING

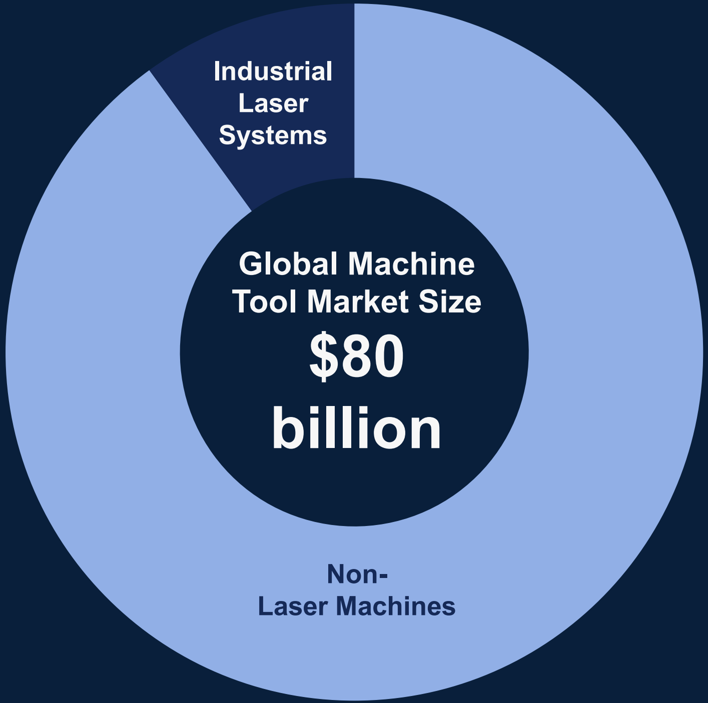
ABLATION

ADDITIVE MFG



MARKING

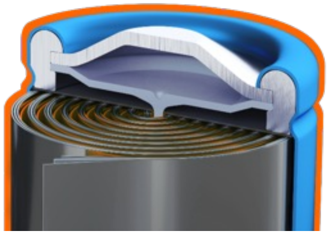
CLEANING





Source: Optech Consulting, Strategies Unlimited and IPG Photonics Corporation

# Laser Applications in I Electric Vehicle Manufacturing

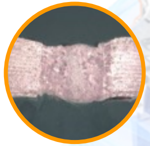


**Laser Welding, Cutting & Marking of Battery Cells:**

Cap to Can Welding

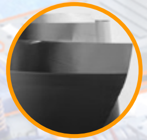
Tab to Pole Welding

Foil Welding



Injection Pin Welding

Foil Cutting



Pressure Relief Valve Welding

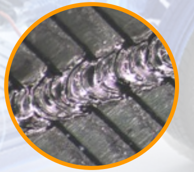
Tab to Terminal Welding

Battery Cell Marking

Hairpin Welding

**Laser Welding, Cutting & Ablation for Electric Motors:**

Rotor and Stator Stacks Welding



Electrical Steel Sheet Cutting

Hairpin Ablation

# IPG Solutions for I Electric Vehicle Manufacturers

IPG laser welding technologies enable battery welding that is **10X faster and more reliable** than traditional bonding methods

Battery laser welding system for EV, electrified transportation, motive, industrial, and commercial battery applications

These combined technologies create the only battery welding solution with integrated process monitoring, traceability and non-destructive testing

### ADJUSTABLE MODE BEAM (AMB) LASERS

- Spatter reduction on EV batteries for **improved reliability** and **safety**
- **Superior welding quality** of challenging dissimilar materials
- **Faster, more uniform high-speed welding**

### MID & HIGH POWER SCAN HEADS

- **Consistent, precise, high-speed** welding of cells to bus bars
- **High strength welds** with **no seal damage**
- **Consistent** penetration depth

### INLINE WELD MONITORING

- In-weld real-time monitoring and control for **optimal battery welds**
- **Eliminates the need** for destructive testing
- **Reduces scrap** and **increases overall throughput**
- **Identifies problems before processing begins**

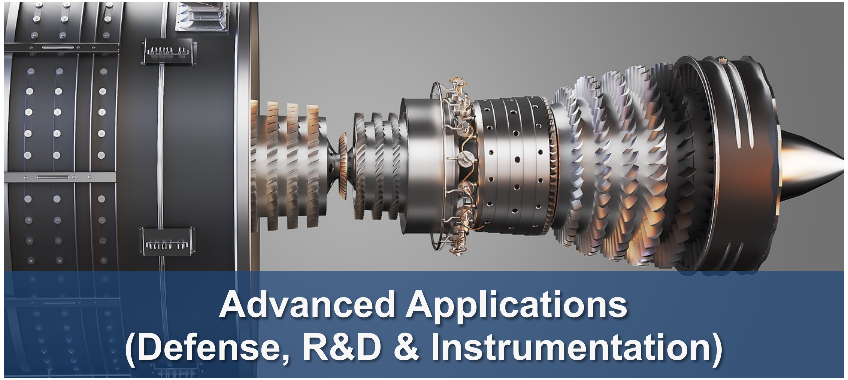
### WOBBLE WELDERS

- **Reliable, high-speed** welds for battery enclosures
- **Superior aesthetic finishes** with **no pitting or cracking**
- **Pressure-tested** hermetic seals

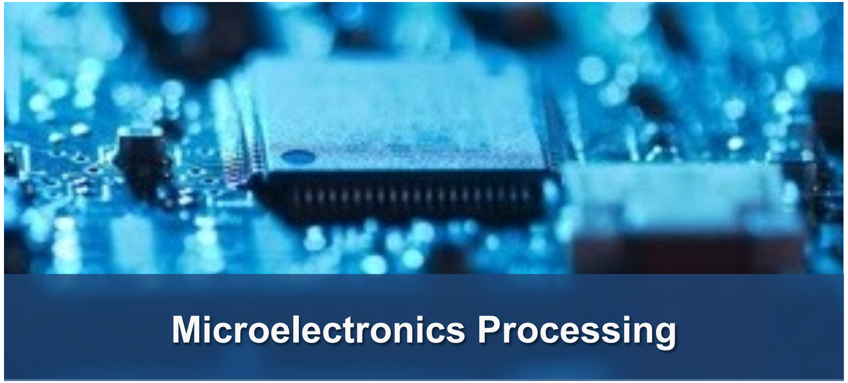
Safe and reliable production of EV batteries, motors and other components rely on these technologies for their unique ability to deliver:

- Weld quality control and depth consistency
- Spatter-free and porosity-free welds
- High throughput manufacturing and high-quality results

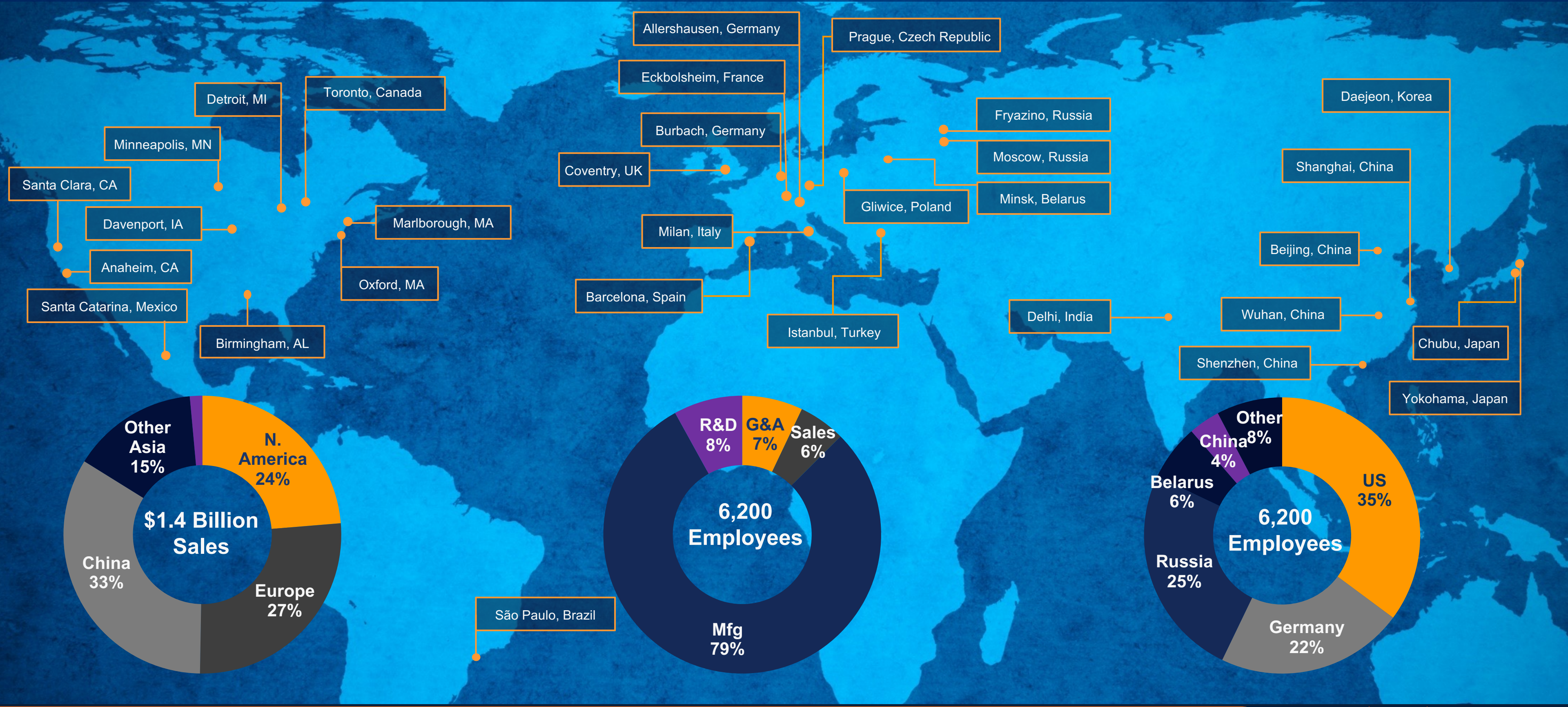
# Expanding Market Opportunities I in New Applications

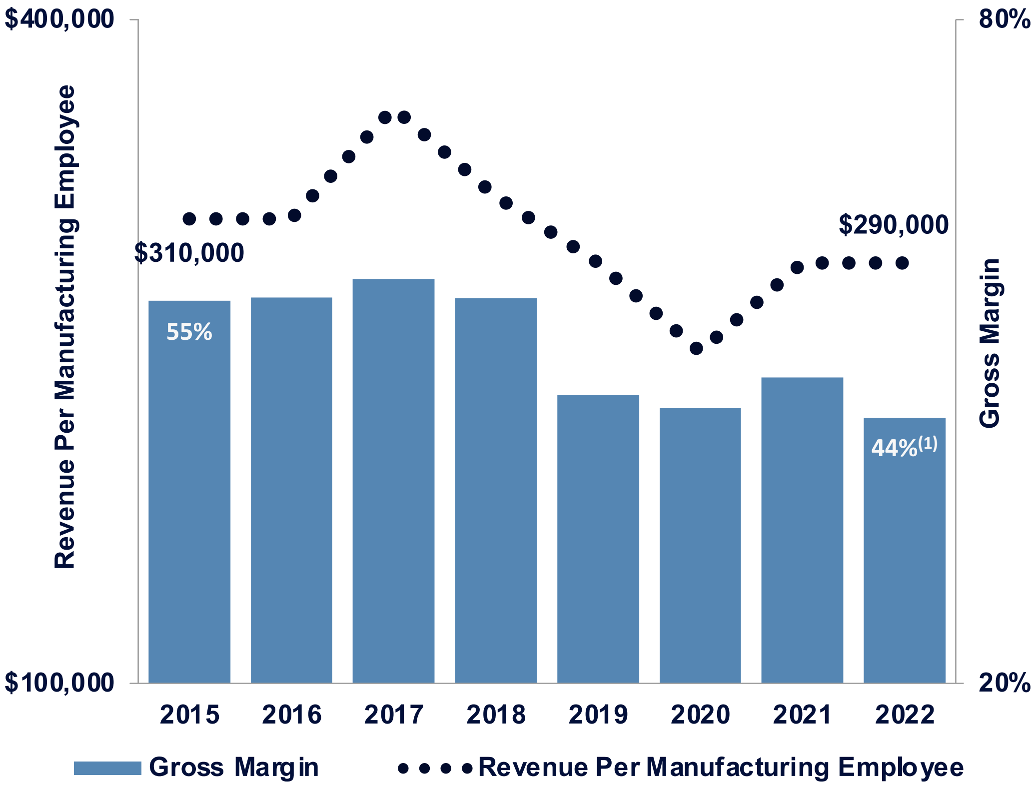




# Global Presence



# Gross Margin and I Cost of Goods Sold

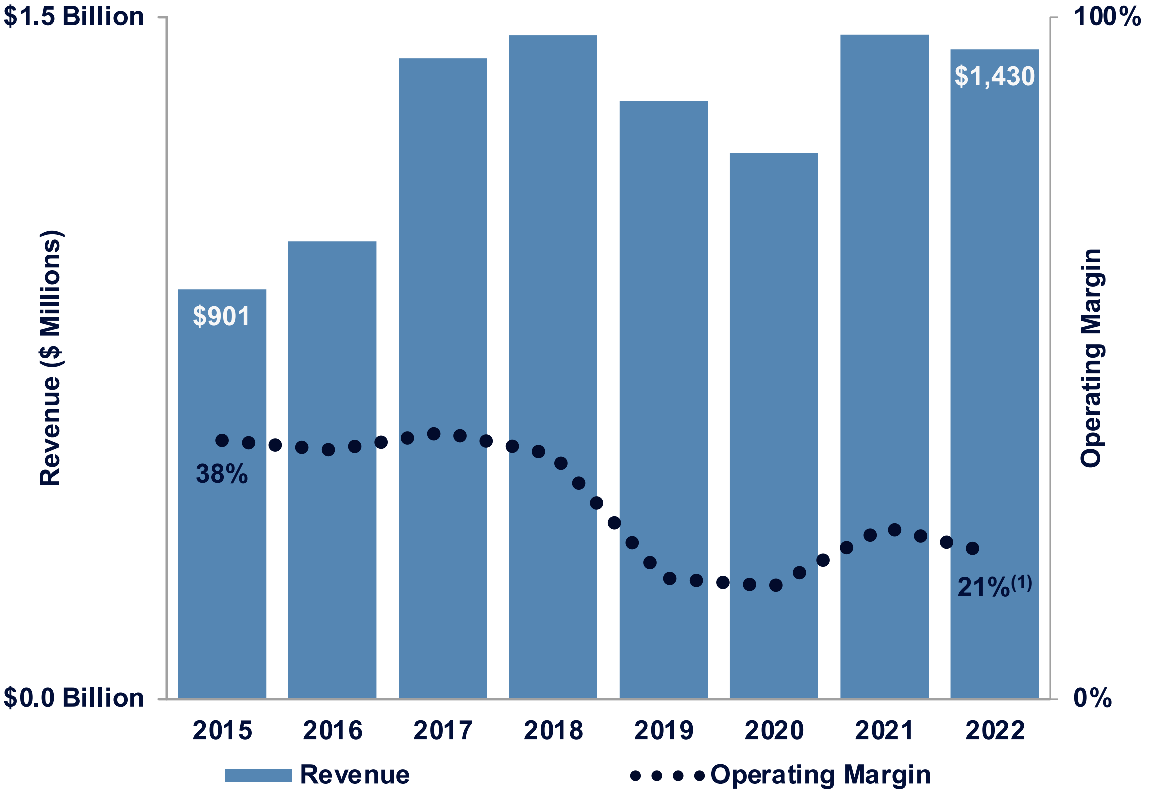



(1) Excludes inventory related charges of $74 million

- Gross margin primarily affected by product mix, competition and absorption of fixed costs
- Labor costs represent the majority of manufacturing expenses; manufacturing employees account for ~75% of total headcount
- Purchased materials represent ~10% to 15% of total cost of goods sold, which include common and specialized mechanical, electrical and optical parts and raw materials; IPG's proprietary manufacturing processes drive significant value-add
- Fixed costs <10% of cost of goods sold

Diode Production in Oxford, Massachusetts

# Operating Margin and I Expenditures



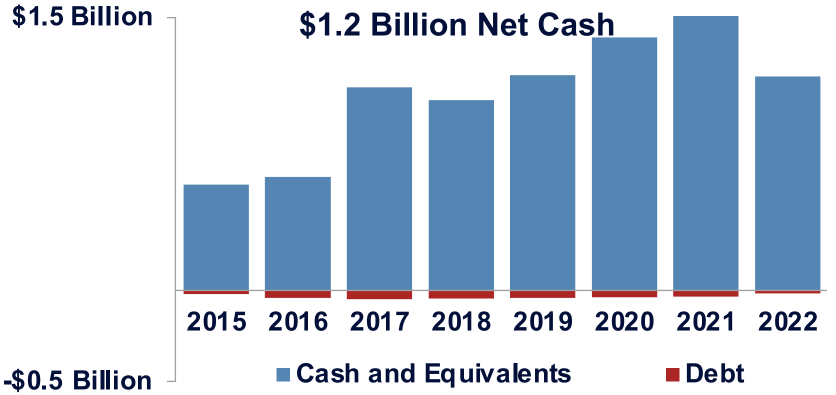

**Sales and Marketing Expenses**
- Primarily compensation, trade shows, professional and technical conferences, travel, facilities and depreciation of demonstration equipment

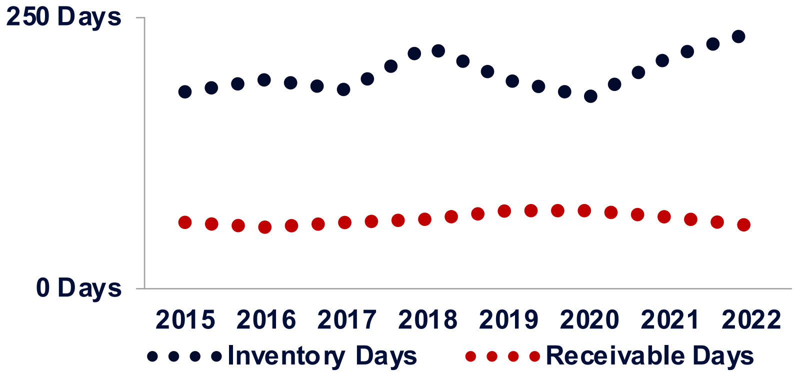
**Research and Development Expenses**
- Primarily compensation, product and component design development, cost of prototype materials, testing and facilities costs

**General and Administrative Expenses**
- Primarily compensation, executive management, finance, legal, IT, professional services, facilities costs and charges and benefits related to the change in allowance for doubtful debt

(1) Excludes gains and losses on foreign exchange, inventory related charges of $74 million, impairment of long-lived assets of $79 million and the gain on sale of assets, primarily related to the disposal of the Company's aircraft, of $10 million

# Balance Sheet I Metrics




**Net Cash**

- IPG maintains a strong balance sheet with ample cash and liquidity.
- Investment in R&D and capital expenditures to grow our business and increase our share of the global laser market remains our highest priority given the large opportunity and the high returns this investment has generated historically for our shareholders. We also prioritize acquisitions that accelerate innovation and enhance our competitive positioning. In addition, we are buying back stock.

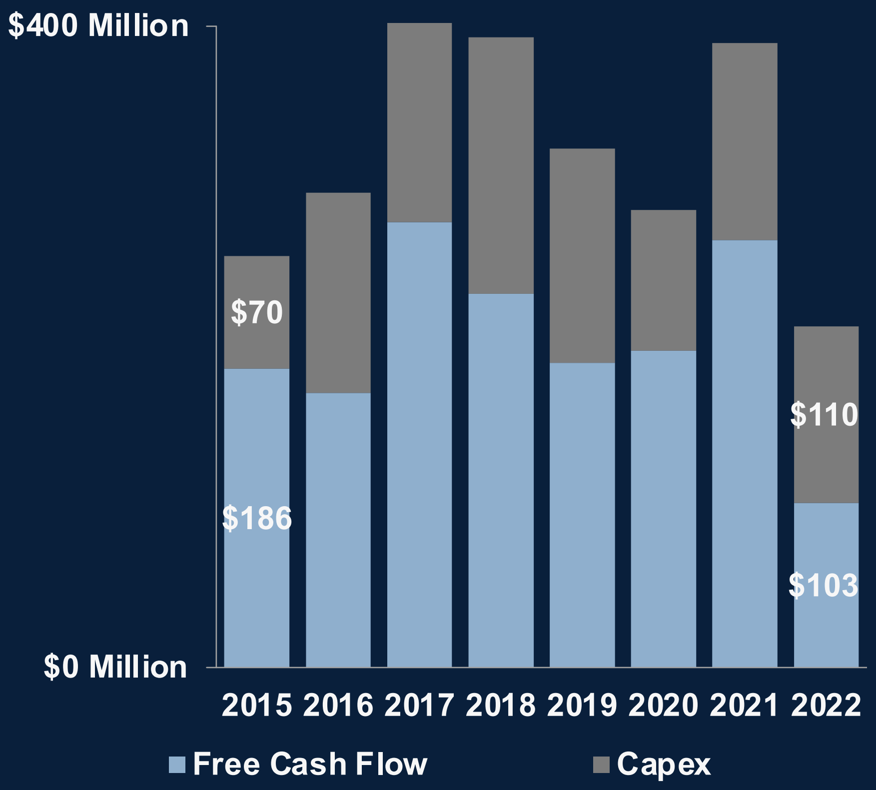
**Inventory**

- The rate at which we turn inventory has historically been about **2x per year or 180 days** due to our vertical integration, rigorous and time-consuming testing procedures and the lead time required to manufacture components used in our finished products. We invest in inventory in order to provide short delivery times to our customers, providing what we believe is a competitive advantage.

**Receivables**

- Our receivables balance is affected by the timing of when revenue is recognized during the quarter and can fluctuate from period to period. We target days sales outstanding of 60 or lower.

# Strong Cash Returns




## 2022 Return on Equity (1)

**10%**

## 2022 Return on Invested Capital (1, 2)

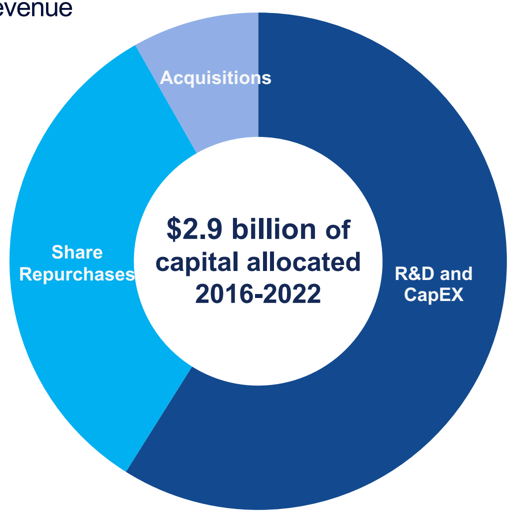
**19%**

[1] Exclude gains and losses on foreign exchange, inventory related charges of $74 million, impairment of long-lived assets of $79 million and the gain on sale of assets, primarily related to the disposal of the Company's aircraft, of $10 million
[2] excludes cash

# Cash Flow and I Capital Allocation

## Cash Flow and Capital Expenditures

- Capex ~8% to ~12% of revenue since 2010, in keeping with our long-term target range
- Majority of our capex related to expansion of our manufacturing capacity, including the acquisition, build-out and preparation of our facilities and new product introductions
- Historically, every $1.00 of fixed investment (net PPE) yields over $2.50 of revenue




## Capital Allocation

- We are committed to allocating capital in a manner that maximizes returns and increases shareholder value.
- There are few companies that possess the growth opportunity, balance sheet strength and free cash flow generation of IPG, providing us a unique opportunity to deploy capital to enhance and accelerate this growth opportunity.
- We believe organic investment in our business will continue to deliver the greatest return to shareholders, and this remains our highest priority. Since 2016 we have spent approximately $900 million on capital expenditures and $800 million on research and development to grow our business.
- We also recognize that we cannot capitalize on our tremendous growth opportunity through organic investment alone. Maintaining a strong balance sheet provides us maximum flexibility to pursue value-creating acquisitions that accelerate time to market, as well as transformative deals during times of market disruption. Since 2006 we have spent approximately $250 million on select technology acquisitions.
- In addition to these internal investments, we completed over $900 million of share repurchases since 2016.

# Financial Performance and I Target Model

| GAAP Metrics | 2012-17 | 2018 | 2019 | 2020 | 2021 | 2022 | Long-Term |
|---|---|---|---|---|---|---|---|
| Revenue Growth | 20% CAGR | 4% | (10%) | (9%) | 22% | (2%) | Double-Digit Growth * |
| Gross Margin | 55% Average | 55% | 46% | 45% | 48% | 44%(1) | 45%-50% * |
| Operating Margin | 37% Average | 36% | 18% | 17% | 25% | 21%(2) | 25%-30% * |

(1) Excludes inventory related charges of $74 million
(2) Excludes gains and losses on foreign exchange, inventory related charges of $74 million, impairment of long-lived assets of $79 million and the gain on sale of assets, primarily related to the disposal of the Company's aircraft, of $10 million
* Revenue growth and margins can be below long-term targets during periods of macroeconomic weakness that give rise to lower demand for our products

# Promoting I Stakeholder Engagement

- We engage with key stakeholders to communicate our efforts to protect the planet and to secure a safe working environment
- We continue to evaluate the concerns of our customers, employees and stockholders to ensure that our sustainability strategy is consistently updated to prioritize industry-specific as well as global material issues
- In 2021, we commenced our first materiality assessment involving our key stakeholders and expect to share in our next sustainability report

## Our Key Stakeholders

### Customers

Dedicated to helping our customers grow their businesses while helping them achieve their energy reduction goals from using our efficient and environmentally-friendly lasers

### Employees

We focus on attracting and retaining talent from diverse backgrounds and experiences

### Stockholders

Our sustainability activities are inspired by the ideals and values of our stockholders

***IPG recognizes the value of transparency and accountability to our various stakeholders***

# Company History

1990: **IPG was founded in Russia by Chairman and CEO, Dr. Valentin Gapontsev**, a physicist and pioneer in the field of fiber lasers. The company was originally named NTO IRE-Polus but soon became known known as IPG, an acronym for IRE-Polus Group.

1993: **IPG won its first significant contract** from the large Italian telecommunications carrier Italtel for a high-power fiber amplifier. Italtel convinced Dr. Gapontsev to transfer component production to Italy. Thus, the first subsidiary in Europe was formed.

1995: **IPG Laser GmbH was formed in Burbach Germany**. This was a result of a contract with DaimlerBenz Aerospace, who needed a solution for their helicopter obstacle warning system. Dr. Gapontsev proposed a new fiber solution which DBA agreed to fund if it was produced in Germany.

1996: **IPG launched a 10 watt industrial class fiber laser** and pulsed fiber lasers for marking and micromachining applications.

1997: **IPG acquired its first large OEM** customer win for high-power amplifiers with Reltec Communications, a manufacturer of fiber-to-the-home (FTTH) systems being deployed by US telecommunications carrier BellSouth. To satisfy demand from Reltec and BellSouth, as well as a growing number of US-based customers, IPG decided to begin operations in the US.

1998: **IPG incorporated in the US**

1999: **IPG began operations in Massachusetts**

2000: **IPG obtained $100 million in venture financing and undertook a reorganization**. IPG Photonics became the parent company and majority owner of IPG Laser in Germany, IPG Fibertech in Italy and NTO IRE-Polus in Russia. IPG also began constructing its primary US manufacturing and research facility in Oxford, Massachusetts. It is here, the company would begin to manufacture their own pump laser diodes, a major component of IPG fiber lasers and amplifiers. The year 2000 was also the year that IPG released the first 100 watt fiber laser, launching into the materials processing market. Erbium and thulium fiber lasers followed soon after, allowing IPG to enter the medical market.

2002: **IPG incorporated a vertically integrated business model.** This was in response to the evaporation of telecom spending by the end of 2000. By 2002, revenue had declined significantly, from $52 million to $22 million. As a result, IPG decided to invest much of its remaining capital in the development of: (1) high-power products; (2) mass production lines; and (3) high-power pump laser diode technology. This vertical integration strategy enabled IPG to produce all the fundamental parts of a fiber laser at costs significantly below those of their leading suppliers and competitors. With a vertically integrated model IPG was able to continue to raise its maximum wattage affordably.

2006**: sales grew from $22 million in 2002 to $143 million in 2006 when IPG raised $93 million in an initial public offering.** At this time, IPG was able to achieve power levels on ytterbium fiber lasers up to 50 kilowatts and producing single-mode output fiber lasers with power levels up to 2 kilowatts (ytterbium) and 200 watts (erbium and thulium). Offices began opening across the US and China.

2010: **IPG introduced its first quasi-continuous wave lasers** into the market

2013: **IPG sold its first 100 kilowatt commercial fiber laser** to NADEX Laser R&D

2014: **IPG introduced a new line of kilowatt-class ytterbium fiber lasers** with wall-plug efficiencies exceeding 45%, as well as visible light and high-power pulsed laser products. In addition to expanding its Oxford manufacturing facility, IPG acquired three buildings in Marlborough, Massachusetts for capacity expansion, new products and additional office space.

2016: **IPG exceeded $1 billion in annual sales**, introduced its Laser Luminaire RGB light source for the digital projection and display market and acquired Menara Networks.

2017**: IPG increased revenue 40% and acquired OptiGrate, ILT and LDD.**

2018: **the company introduced a family of ultraviolet and ultrafast pulsed lasers** and a new generation of high-power fiber lasers including QCW mode CW lasers, adjustable mode beam capability, and ultra compact designs.

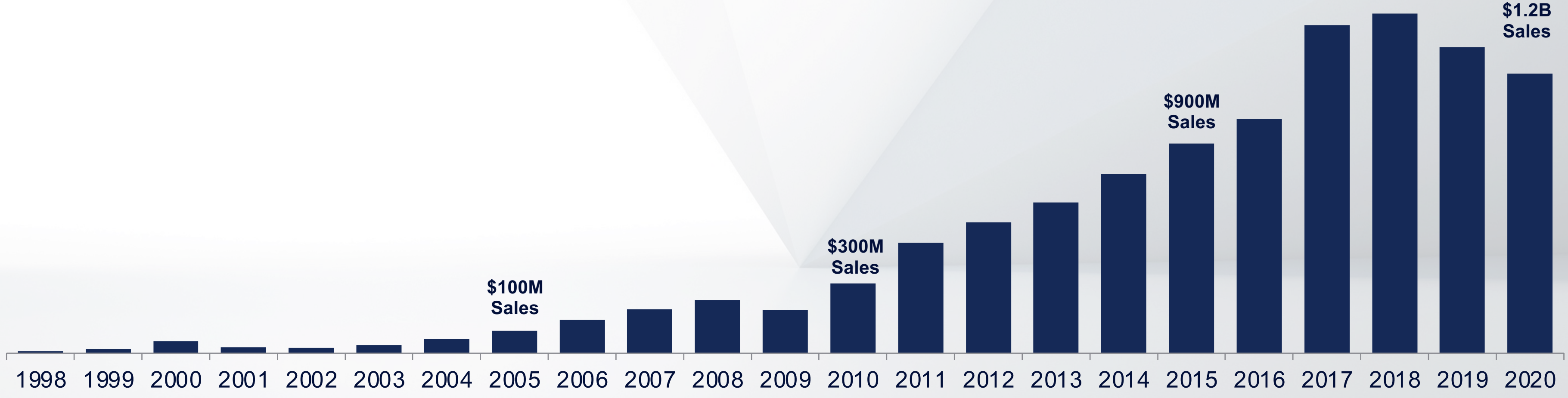
2018: **IPG acquired Genesis Systems Group**.

2019: **IPG megawatts of high power lasers shipped reached a record level**, and the company sold a **120 kilowatt solution for the first time**.

2021: **Eugene A. Scherbakov Ph.D.**, Chief Operating Officer, Managing Director of IPG Laser GmbH, Senior Vice President, Europe and Director, **succeeds Valentin P. Gapontsev, Ph.D.**, as IPG Photonics CEO.

2022: IPG **announces the passing of beloved founder** and Chairman and former CEO **Dr. Valentin P. Gapontsev.**

# Company History I Continued




1991 – 2022

**1991**
- NTO IRE-Polus formed in Russia

**1992**
- First fiber lasers produced

**1993**
- First major contract with Italtel
- IPG Fibertech founded in Italy

**1994-95**
- Contract with DaimlerBenz Aerospace
- IPG Laser founded in Germany

**1997**
- Contract with Reltec

**1998-99**
- IPG Photonics incorporated in US
- US operations begin in Massachusetts

**2000**
- First 100 W fiber laser produced

**2002**
- IPG begins producing pump laser diodes in-house

**2004**
- 1 kW single-mode ytterbium fiber laser introduced
- IPG opens office in Japan

**2006**
- Initial Public Offering

**2007**
- IPG opens office in China

**2009**
- Silicon Valley Tech Center opened
- First 10 kW single-mode laser

**2010**
- QCW lasers introduced
- Photonics Innovations & Cosytronic acquired

**2012-13**
- JPSA acquired
- 100 kW laser sold
- Mobius Photonics acquired
- Facilities expansion in Oxford, MA

**2014**
- Facilities expansion in Russia and
- Marlborough, MA

**2016**
- Menara acquired
- German facilities expansion

**2017**
- OptiGrate, ILT and LDD acquired
- First 120 kW laser

**2018**
- New high-power lasers introduced
- Genesis acquired

**2019**

Dr. Eugene A. Scherbakov succeeds Dr Valentin P. Gapontsev as CEO

**2022**

IPG mourns the passing of Dr Valentin Gapontsev





IPG PHOTONICS

# Acquisitions of I Emerging Technology Groups

Nearly all of IPG's growth has been driven by organic investment in our business. From time to time, we have supplemented this investment with the acquisition of emerging technology groups to expand our technology breadth, vertical integration capabilities and product offering.

## 2010

**PII**

Photonics Innovations, Inc., based in Birmingham, Alabama, produces middle-infrared (~2-5 micron) laser technology for scientific, biomedical, technology and eye-safe range finding applications.

**COSY**

Cosytronic KG, based in Wissen, Germany, specializes in automated laser welding equipment including a fiber-based seam stepper.

## 2011

## 2012

**JPSA**

JPSA Laser, based in Manchester, New Hampshire, manufactures specialized laser systems for fine-processing, precision cutting, drilling and micromachining of non-metals, including glass, semiconductors and ceramics.

## 2013

**mobius PHOTONICS**

Based in Mountain View, California, Mobius Photonics provides high-power pulsed ultraviolet (UV) lasers for micromachining, such as dicing and scribing of wafers and VIA drilling and solar hybrid panel processing.

## 2014

## 2015

**RuchTech**

Based in Minsk, Belarus, RuchTech produces automated multi-axis laser systems for macro- and micro processing of metals and composite materials.

## 2016

**Menara NETWORKS**

Menara Networks, based in Dallas, Texas, develops high-speed optical transmission modules based on proprietary mixed signal ASIC and DSP technology. Menara pluggable transceivers and transponders are deployed in leading telco and data center networks.

**Biophotonic SOLUTIONS INC**

Based in East Lansing, MI, BSI's proprietary MIIPS technology provides automatic measurement and compression of laser pulses, improving the utility of ultrafast lasers.

## 2017

**OptiGRATE HIGH EFFICIENCY FOR HIGH POWER**

OptiGrate, based near Orlando, Florida, pioneered volume Bragg Gratings for pulse compression in ultrafast lasers, enabling improved performance and cost reduction.

**INNOVATIVE LASER TECHNOLOGIES ILT**

Based in Minneapolis, Minnesota, ILT produces high-precision laser systems for the medical device industry, incorporating significant automation and software expertise.

**LaserDepth DYNAMICS**

Based in Ontario, Canada, LDD provides in-process quality monitoring and control solutions for laser-based welding applications.

## 2018

**Robot concept**

Located near Munich, Germany, Robot Concept is an integrator of laser-based systems.

**Genesis Systems Group**

Based in Davenport, Iowa, Genesis is a leader in the integration of robotic welding and automation solutions in the transportation, aerospace and industrial end markets.

## 2019

## Our Values

We are committed to providing our customers with laser solutions that are industry-leading in their performance, quality and efficiency.

IPG operates around our three central pillars of corporate ethics: environment, governance and communities. IPG values our diverse and highly talented employees who allow us to develop new solutions and provide the best possible service to our global customer base.
IPG is committed to being accountable and transparent when interacting with our customers, employees, suppliers and stockholders. We are dedicated to supporting local organizations and conducting business with the highest integrity.

# Governance

IPG is committed to running an ethical business where all of our employees are given the respect and professionalism they need to thrive. IPG upholds uncompromisingly high ethical standards that are defined by our Code of Business Conduct. Every day, IPG employees implement our values into their operations and interactions. IPG employees and board directors receive comprehensive ethics training upon hire and bi-annually in their local language

Code of Business Conduct

Corporate Governance Guidelines





IPG PHOTONICS

# Planet

IPG Photonics values innovation, accountability and transparency, which is why we continually strive to advance our sustainability strategy to align with the fundamental principles of our stakeholders and local communities. We integrate safety, reliability and sustainability fundamentals within our operations and product development initiatives. It is our responsibility to utilize our unique innovation capabilities in response to societal and environmental challenges.

## Sustainability Achievements

**34 million metric tons** less $CO_2$ emissions when operating IPG lasers compared to traditional lasers 2012-2021

**65 terawatts hours** of electricity savings since 2012 from customer use of IPG lasers

IPG fiber lasers are **>45%** energy efficient with efficiency & compactness improving each year

Charitable giving of **~$2.8 million** since 2018

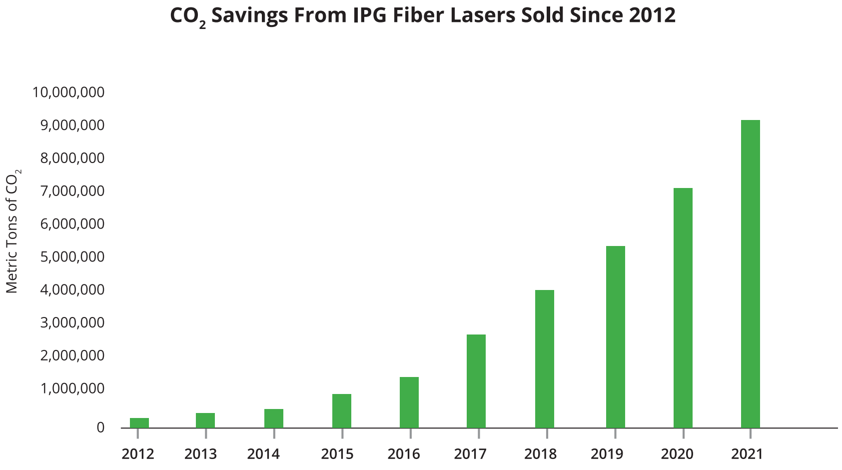
IPG recycled **2,300 metric tons** of metals since 2010

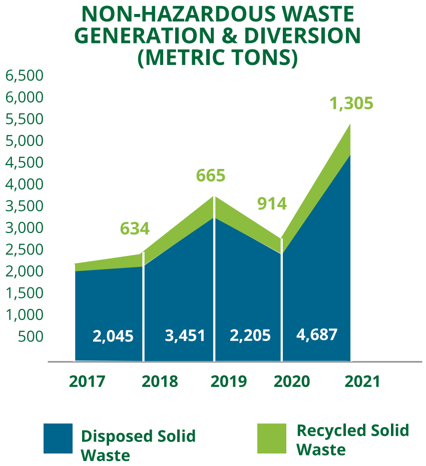
**Approximately 9 million metric tons** of $CO_2$ saved from using IPG lasers

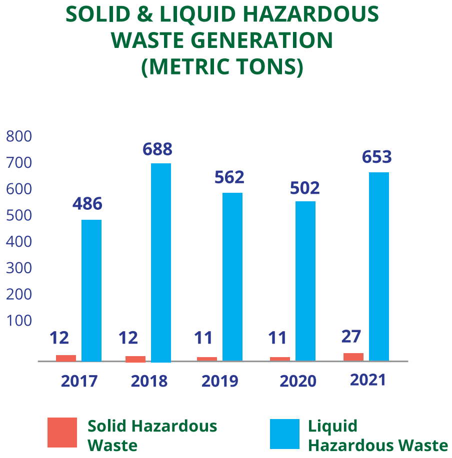
**555 metric tons** of recycled metals a **43% increase** in 2021 only

Water usage comparable with 2017 despite 81% increase in optical power manufactured

# Energy & Resource I Conservation




IPG Photonics fiber lasers are much more energy efficient than competing products and have resulted in savings of approximately 34 million metric tons of emissions and 65 TW of electricity since 2012 as compared to using other laser technologies.

•Electricity savings calculation based on IPG total megawatts of power sold, and assumes IPG fiber lasers are replacing lamp-pumped and diode-pumped Nd:YAG, $CO_2$ and disk lasers.
•According to the World Bank, ~2/3 of world energy is produced from oil, gas and coal.
•We use the $CO_2$ conversion rated provided by the U.S. Environmental Protection Agency

# Energy & Resource Conservation

## Since 2017, our energy intensity decreased 37%

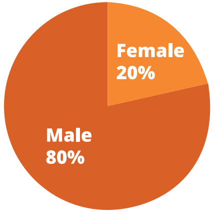
IPG has increased laser production over the last three years, but is actively lowering greenhouse gas emissions and preserving natural resources to protect balanced ecosystems.

| | | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| **Energy Consumed MWh** | Heating Oil | 323 | 265 | 341 | 203 | 196 |
| | Natural Gas | 73,811 | 66,515 | 86,631 | 74,321 | 72,019 |
| | Electricity | 99,443 | 91,728 | 87,766 | 88,777 | 113,531 |
| | Diesel | 0 | 0 | 16 | 33 | 0 |
| **Total Energy Consumption** | | 173,577 | 158,508 | 173,754 | 163,332 | 185,746 |
| **Emissions Metric Tons** | Greenhouse Gas Emissions | 53,522 | 48,350 | 49,658 | 48,107 | 61,565 |
| **Laser Production kW** | | 34,436 | 40,384 | 48,963 | 53,746 | 62,447 |
| **Carbon Intensity** | GHG Emissions per Laser Sold (t/kW) | 1.55 | 1.20 | 1.01 | 0.90 | 0.99 |
| **Water Consumption Cubic Meters** | Freshwater | 196,540 | 176,546 | 180,843 | 190,605 | 200,723 |
| **Water Intensity** | Water/kW Lasers Sold | 5.7 | 4.4 | 3.7 | 3.5 | 3.2 |

IPG reports on its GHG emissions for its primary manufacturing facilities in the US, Germany, Russia and Belarus, and facilities in Italy together representing 86% of our total square footage which include the most significant resource consumers from manufacturing and R&D. Data since 2019 includes Genesis Systems.
We use the $CO_2$ conversion rates provided by US Environmental Protection Agency (EPA).

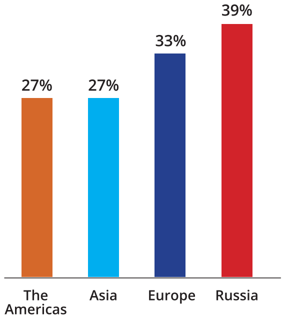
# People

Our employees are our most valuable asset and are the definition of IPG Photonics. We are committed to attracting and retaining the best talent, and we believe that an engaged, diverse and thriving workforce will drive a sustainable future for our company and society. IPG is proud of our supportive culture, innovative spirit and workplace programs.

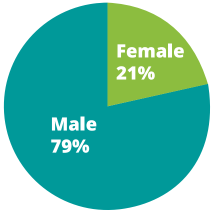



**Global Optics & Photonics Industry**

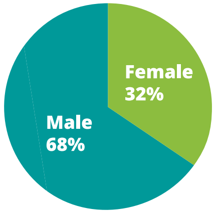
SPIE 2017:GENDER EQUITY IN THE OPTICS & PHOTONICS WORKPLACE



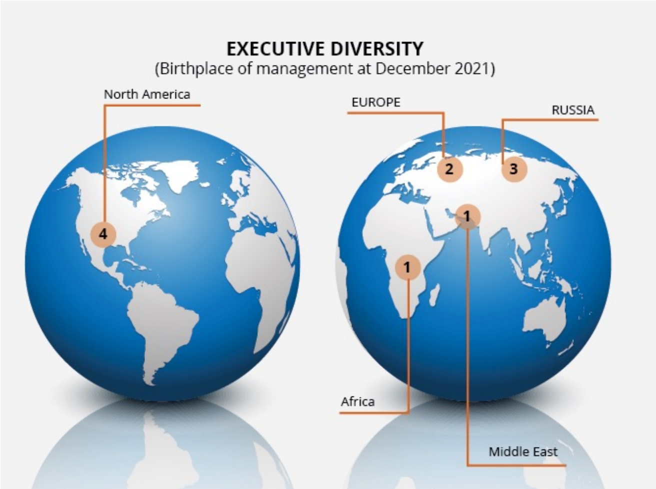

**Female Employees by Region**




**IPG Senior Leaders & Managers**



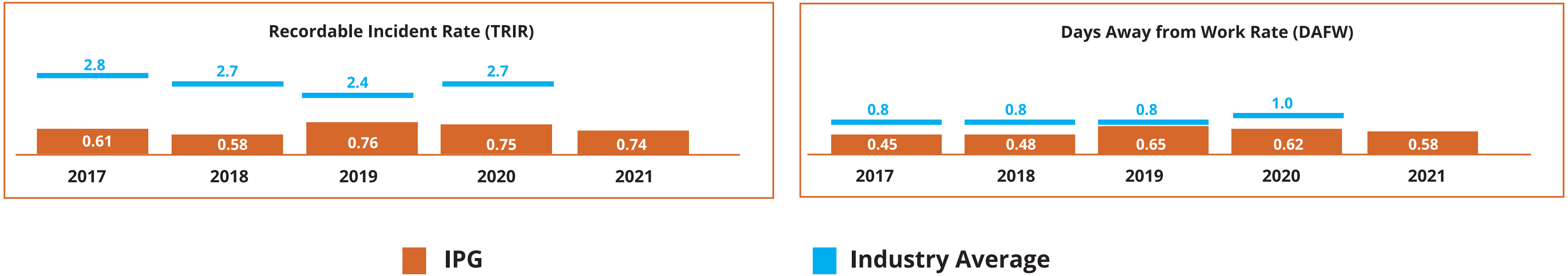

**IPG Global Workforce**




## Diversity, Equity & Inclusion

We recruit and develop diverse candidates for available leadership and other positions at IPG by posting on national and local diversity job boards and maintaining partnerships with organizations and community groups that focus on the needs of minority candidates. We require our search firms to seek female and diverse candidates.

# Safety in the Workplace




Data includes facilities in US, Germany, Italy, Russia and Belarus. TRIR = Recordable cases x 200,000 / total hours worked by all employees; DAFW = Lost time cases x 200,000 / total hours worked by all employees.
Industry average represents goods-producers with more than 1,000 employee published by US Bureau of Labor Statistics. 2021 BLS data not available at time of publication.

# Senior I Management Team

### Eugene Scherbakov, Ph.D.
**CEO and Director**

Dr. Scherbakov has served as CEO of the Company since May 4, 2021. He previously served as Chief Operating Officer from February 2017, Managing Director of IPG Laser GmbH, our German subsidiary, from August 2000 and Senior Vice President - Europe from February 2013. He served as the Technical Director of IPG Laser from 1995 to August 2000. From 1983 to 1995, Dr Scherbakov was a senior scientist in fiber optics and head of the optical communications laboratory at the General Physics Institute, Russian Academy of Science in Moscow. He has an M.S. in physics from the Moscow Physics and Technology Institute, a Ph. D in Quantum Electronics and a Dr.Sci.degree in Laser Physics from the Lebedev Physical Institute.

### Timothy P. V. Mammen
**CFO and SVP**

Mr. Mammen has served as CFO since July 2000 and SVP since February 2013. Previously he was CFO and VP from 2000. Between 1999 and 2000, Mr. Mammen served as the Group Finance Director and General Manager for IPFD a commodities trading firm in the UK. In addition, Mr. Mammen was Finance Director and General Manager of United Partners Plc from 1995 to 1999 and worked in the finance department of E.I. du Pont de Nemours and Company. Mr. Mammen holds an Upper Second B.Sc. Honours degree in International Trade and Development from LSE. He is also a member of the Institute of Chartered Accountants of Scotland.

### Felix Stukalin
**SVP, COO and Director**

Mr. Stukalin has served as SVP, COO since February 2022 and director since March 2022. He previously served as SVP of US Operations from 2013 and VP, Devices from 2009. Prior to joining IPG, he was VP, Business Development of GSI Group Inc. between 2002-2008.  From 2000-2002 he was VP, Components and President of the Wave Precision division of GSI Lumonics. He has a B.S. in Mechanical Engineering from the University of Rochester and graduated from the Harvard Business School General Management Program.

### Angelo P. Lopresti
**General Counsel, Secretary and SVP**

Mr. Lopresti was partner at the law firm of Winston & Strawn LLP from 1999-2001 before coming to IPG. He was also a partner at Herzog, Calamari & Gleason between 1998-1999 and an associate between 1991-1998. He has a Bachelor's in Economics from Trinity College and a J.D. from New York University School of Law.

### Alexander Ovtchinnikov, Ph.D.
**SVP and CTO**

Dr. Ovtchinnikov has served as SVP and Chief Technology Officer since February 2022. He previously served as VP, Components from September 2005 and Director of Material Sciences since 2001. He was previously Material Science Manager at Lasertel, Inc. from 1999-01 and developed high power diode pump technology at the Ioffe Institute, Tampere Institute of Technology, Coherent Inc. and Spectra-Physics Corporation for 15 years. He has an M.S. in Electrical Engineering from the Electrotechnical University of St. Petersburg and a Ph. D from the Ioffe Institute at the Russian Academy of Sciences.

### Trevor D. Ness
**SVP, Sales and Strategic Business Development**

Mr. Ness has served as SVP, Sales and Strategic Business Development since February 2022. He previously served as SVP of World Wide Sales since February 2013. He became Vice President of Asian Operations in 2011. Prior to joining IPG, he was Director of GSI Precision Technologies China between 2005 and 2010. He has a B.S. in Geology from Imperial College, a H.N.C. from Bournemouth University and an M.B.A. from the Open University.

### Igor Samartsev, Ph.D.
**SVP and Chief Scientist**

Mr. Samartsev has served as SVP and Chief Scientist since February 2022. Since 2011, he served as CTO. From 2005-2018 he also served as Deputy General Manager of IGP's Russian subsidiary, NTO IRE-Polus. He also holds an M.S. in Physics from the Moscow Institute of Physics and Technology and is one of the founders of IPG.

Oxford, Massachusetts Headquarters

# Board of Directors

**John R. Peeler**
**Chair since 2021**
**Director since 2012**
Former CEO and Chairman of Veeco. He was EVP of JDS Uniphase Corp. and President of the Communications Test & Measurement Group of JDSU. He holds a B.S. and an M.E. in Electrical Engineering from the University of Virginia

**Michael C. Child**
**Director since 2000**
Has worked at TA Associates, Inc., a private equity investment firm, since 1982, where he serves as Senior Advisor and was previously Managing Director. He holds a B.S. in Electrical Engineering from UC Davis and an MBA. from the Stanford University.

**Gregory P. Dougherty**
**Director since 2019**
Former CEO and director of Oclaro until its 2018 acquisition by Lumentum. He also served as a director of Avanex and Picarro and COO of JDSU. Prior to JDSU, he was COO of SDL. He received a bachelor's degree in optics from the University of Rochester.

**Thomas J. Seifert**
**Director since 2014**
Currently CFO of Cloudflare. He was previously CFO of Symantec and Brightstar Corp. and was interim CEO and CFO at AMD. He has a Bachelor's and Master's degree in Business from Friedrich Alexander University and a Master's in Mathematics and Economics from Wayne State University.

**Eugene Scherbakov, Ph.D.**
**Director and CEO**
See senior management team biography

**Agnes K. Tang**
Director since 2022
Currently a founding partner at Ducera Partners LLC. She was previously managing director of Perella Wineberg Partners.

**Natalia Pavlova**
**Director since 2021**
A significant stockholder with family association to founders of the Company.

**Felix Stukalin**
Director since 2022
Currently SVP, COO of IPG since February 2022. He was previously SVP of IPG, North America Operations. Prior to that he was VP of IPG Devices.

**Jeanmarie F. Desmond**
**Director since 2021**
Former Executive Vice President and Chief Financial Officer of DuPont. Serves on the board of Trinseo S.A and Sylvamo Corporation. She has earned a B.S. in Accounting from Mt. St. Mary's University and is a certified public accountant (inactive).

**Gregory R. Beecher**
**Director since 2023**
Previously served as a Vice President and Chief Financial Officer of Teradyne, Inc. ("Teradyne"), a supplier of automation equipment, from March 2001 to April 2019.

**Eric Meurice**
**Director since 2014**
Was President, CEO and Chairman of ASML and EVP of Television at Thomson. Currently on the board of NXP Semiconductors. Earned a Master's in mechanics and energy generation at École Centrale de Paris, a Master's in Economics from Sorbonne University and an MBA from Stanford.

| Board Member | Role | Audit Committee | Compensation Committee | Nominating and Corporate Governance Committee |
|---|---|---|---|---|
| John R. Peeler | Chair of the Board | | Member | Member |
| Gregory R. Beecher | Independent Director | | | |
| Michael C. Child | Independent Director | | | Member |
| Gregory P. Dougherty | Independent Director | Member | Chair | |
| Jeanmarie F. Desmond | Independent Director | Member | | |
| Eric Meurice | Independent Director | | Member | Chair |
| Natalia Pavlova | | | | |
| Eugene Scherbakov, Ph.D. | | | | |
| Thomas J. Seifert | Independent Director | Chair | | Member |

# The IPG Difference


**FUTURE**
GROWTH
OPPORTUNITIES

**HIGH**
**QUALITY**
SOLUTIONS

BROADEST PORTFOLIO
**FIBER LASERS**

**WORLD LEADER**
FIBER LASERS

**INDUSTRY**
**LEADING**
MARGINS

**STRONG**
BALANCE
SHEET



PHOTONICS

# THANK YOU