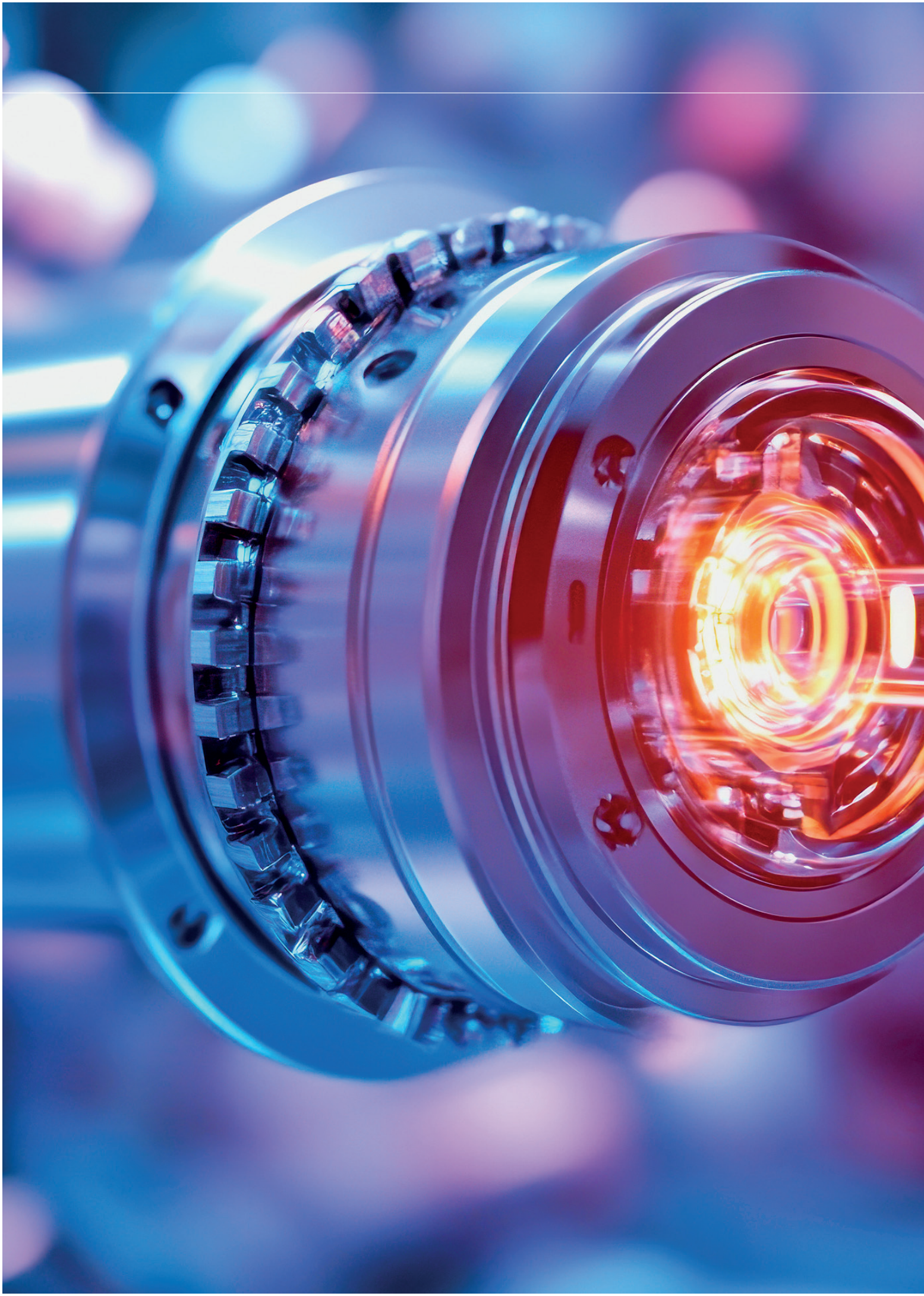
PHOTONICS
SWITZERLAND

SWISS PHOTONICS



THE SWISS PHOTONICS COMMUNITY

Photonics is key for technical and digital sovereignty, to solve societal challenges and to improve prosperity and equality. A new analysis by SPIE showed that 13% of all globally published innovation depends on photonics.

In 2022 the global photonics market was valued at €820 billion. It is expected that the photonics market will continue to annually grow by 6–7 % over the coming years. With a photonics revenue of €5.6 billion, Switzerland accounted for around 4% of the European production and a workforce of around 12'000 employees. Specifically, a recent study showed that Switzerland is globally number 4 in the export of laser cutting machines and by far the largest in terms of CHF/capita.

Switzerland has a very long and strong tradition in photonics research with strong players in the ETH domain, Universities and Universities of Applied Sciences. This lead to an increased number of start-ups that were founded over the last few years, specifically also addressing new topics such as photonic integrated circuits and quantum photonics. The Swiss photonics ecosystem is therefore strong, and very divers.

Around Switzerland, the support for photonics continues to strongly increase, including photonic pilot lines, semiconductor (photonics) chip production and quantum technologies. Switzerland needs to strengthen its support for photonics substantially to be able to compete on an international level.

The Photonics Switzerland brochure 2025 will showcase the strength of Switzerland in photonics, both as printed and digital versions with implemented animations and videos, optimized for mobile applications. The brochure is aimed primarily at members, players in politics and business, and customers.

We hope you find this brochure valuable to promote the Swiss photonics activities in Switzerland, Europe and worldwide.

Enjoy reading!

Christoph Harder
President Swissphotonics

Christian Bosshard
Managing Director
Swissphotonics

WE ARE SWISSPHOTONICS –

WELCOME

Swissphotonics is a non-profit association with more than 210 paying members. The declared goal of Swissphotonics is to improve the competitiveness of its members through the support of innovation forces.

What is it, that we actually do? We organize events such as workshops to foster the interaction within the innovation community, roundtables to address challenges and we support conferences to provide opportunities for communicating leading edge information. Also, we carry out 40 lunch chats per year addressing new technological developments in photonics. Our mission is to provide a network for individuals and groups so that they can pursue and strengthen their specific innovation efforts.

We inform about Swiss and European strategic research agendas, research platforms and initiatives and we provide information about funding opportunities as well as the support on how to access them. Our yearly Swissphotonics prize recognizes outstanding EPFL master theses in photonics.

Swissphotonics serves the full field of photonics, starting from materials for light generation and detection all the way to the application of light such as photonic manufacturing (material processing with a laser beam: cutting, welding and 3D additive), imaging, life sciences, sensing, communication, photovoltaics and illumination.

Recent activities started or supported by Swissphotonics include

- Photonic integrated circuits and quantum photonics, two areas with great potential for Switzerland
- Swiss PIC, the new Swiss Photonics Integration Center supporting industry with photonic integration and packaging services
- The promotion of industrial participation of Swiss companies in aerospace, security and defence procurement projects of the Swiss Confederation abroad, through direct and indirect offset transactions.

The industry members of Swissphotonics are active in many different markets. The graphs below show the percentage of these companies (by number of companies) addressing different applications.

% OF SWISS COMPANIES INVOLVED PER SEGMENT

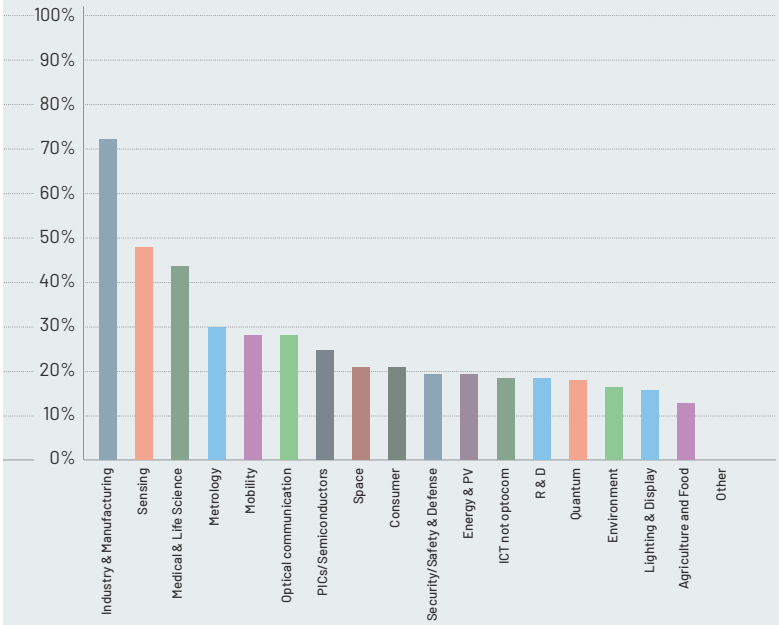


Figure 1: *Percentage of of Swissphotonics companies (by number of companies) addressing different applications.*

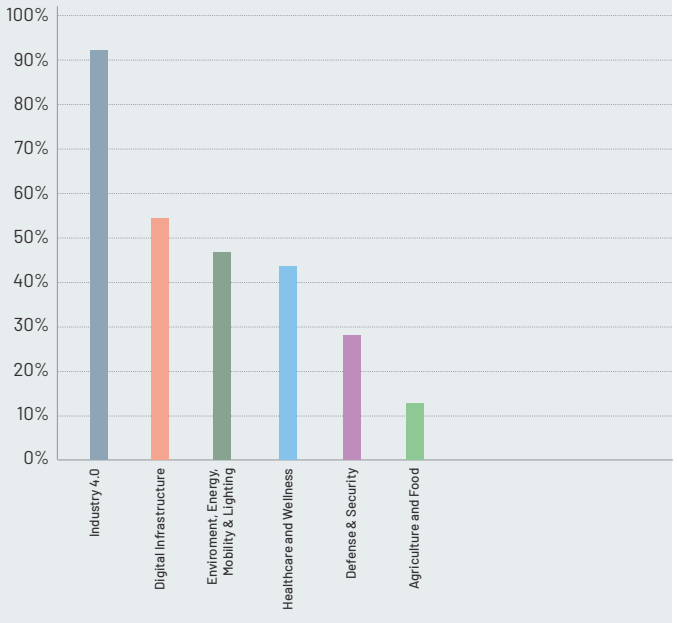


Figure 2: *Photonics 21 proposes different application categories: percentage of Swissphotonics companies (by number of companies) addressing these categories.*

We serve companies, research organisations and universities in the field of photonics in basic and applied science, technology development, manufacturing and promotion of photonics components and applications. We support the industry as well as research institutes in finding research partners and the necessary funding.

Finally, we encourage networking within Switzerland and establish international contacts within Europe (Photonics21, EPIC) and worldwide (OPTICA). We work with Innosuisse, Euresearch and Swissmem to support innovation in photonics.

PHOTONICS INDUSTRY

The old classic technology of working with light has been limited to deflecting light through lenses or mirrors, as utilized in telescopes, magnifiers or spectacles or guiding light, as first demonstrated and published by Professor Daniel Colladon at the University of Geneva in 1841, in a water jet.

The fabrication of materials which transmit light without noticeable loss and materials which can transform light into current or current into light during the last 50 years, revolutionized and expanded the possibilities of light.

We all have become accustomed to harvesting energy (solar cells), capturing pictures (cameras), monitoring (sensing), lighting up rooms (LED lamps), communicate across the world with the internet (glass fibers, lasers and photodiodes), cut steel (fiber lasers), watch TV and work on laptops (OLEDs, micro LEDS, etc.). This industry which makes use of this light-current transformers and lowloss transmission devices is called "Photonics" and has grown to over 1000 billion USD/year and continues to grow faster than the rest of the economy.

Photonics worldwide market size

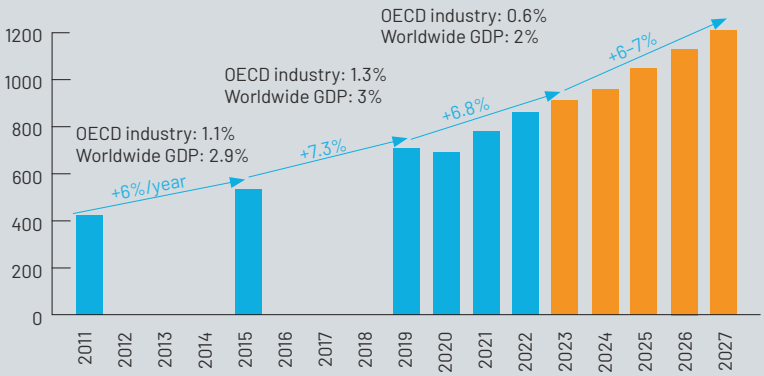


Figure 1
*Photonics worldwide market ($ billion) from 2011 to 2027, OECD industry index and World GDP in constant 2015 US$ * Note: CAGR 2019-2022: 4.3% with deflator. Source: Tematys/Photonics21, 2023.*

Unlike electronics, whose success lies within the miniaturization of a basic device, described by (or better: managed to follow) Moore's law on silicon, photonics is based on a large variety of materials and completely different devices. This is also reflected in the industry, electronics being dominated by big and few expensive facilities, photonics based on some big companies based on mature materials and many small companies fighting to introduce the next generation of materials and devices. While this is very demanding, it makes photonics very interesting for physicists and engineers pushing the technological boundaries to develop yet new materials, most recently to even manage single and entangled photons, being the basis for quantum computing, sensing, and communication.

EUROPEAN INDUSTRY

European revenue in photonics has been kept over the last years to around one sixth of the world production, by continued innovation in industry 4.0, novel components, healthcare, defense, and instrumentation.

Most of the initial technologies and initial markets were developed in the USA or Europe. As soon as a market has grown big, the underlying technology needs vast (government) investments in development and production. Thus, the production for mobility, telecommunications, consumer, and lighting have moved away from Europe, in earlier years to Taiwan, Korea and Japan, later to China and now starting, to the rest of the world.

Global Photonics market size

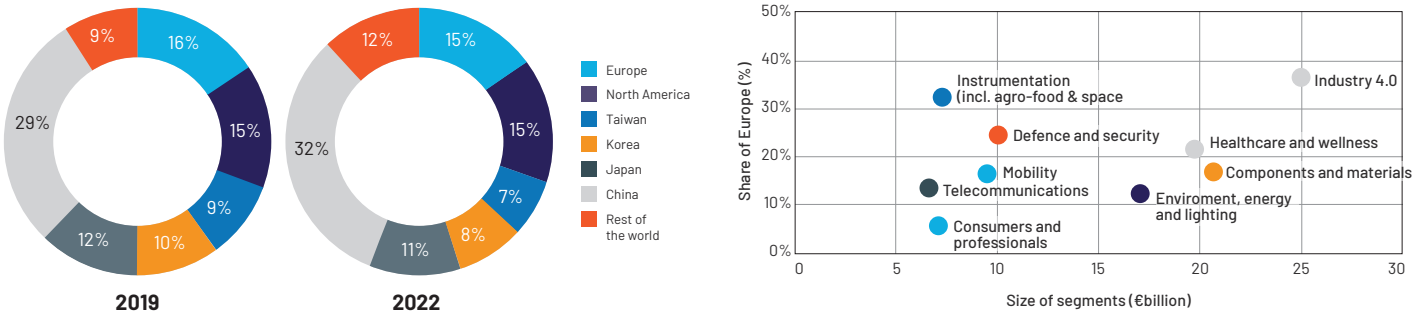
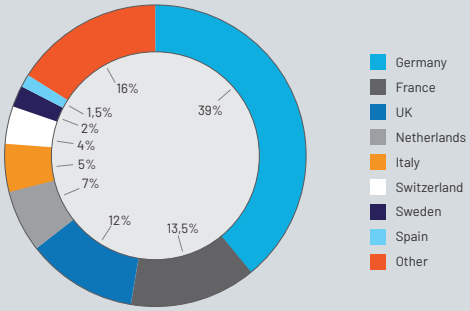


Figure 2
Global Photonics industry – Left: Breakdown by geographical area (2019-2022). Right: Size of the main segments (€ billion) versus market share (%) of Europe - Source: Tematys/Photonics21, 2023.

SWISS INDUSTRY

Switzerland has established itself as a significant player in the global photonics industry, leveraging its rich history of precision engineering and innovation and has a market share of 4% within Europe.

Switzerland is a Photonic cluster as evident in leading revenue in photonics per capita as well as the highest revenue per employee in the industry.



Country	Photonics revenue (Billion EUR)	Share of Photonics within Europe	Number of employees in Photonics (persons)	Photoics Revenue per employee (EUR)	Population	Photonics Revenue per capita (EUR)
Germany	48.1	39%	188000	255'851	83'237'000	578
France	16.8	14%	60000	280'350	67'872'000	248
UK	14.5	12%	58000	250'000	66'971'000	217
Netherlands	8.4	7%	24000	350'000	17'591'000	478
Italy	6.3	5%	16000	393'750	59'030'000	107
Switzerland	5.6	4%	12000	**466'667**	8'739'000	**641**
Rest of Europe	24.9	20%	70000	355'714	437'605'000	57
Europe	124.6	100%	428000	291'121	741'045'000	168

Figure 3
The European photonics industry – breakdown by country Source: Tematys/Photonics21, 2023.

As of recent assessments, the Swiss photonics sector comprises over two hundred companies, small and medium-sized enterprises (SMEs). These companies are engaged in the development, manufacturing, and commercialization of photonic components and systems. The industry is characterized by a strong export orientation, with approximately 90% of its production destined for international markets. This global reach underscores Switzerland's reputation for high-quality and innovative photonics products. The photonic efforts, academia, engineers, RTOs, and companies have organized themselves in the network "Swissphotonics".

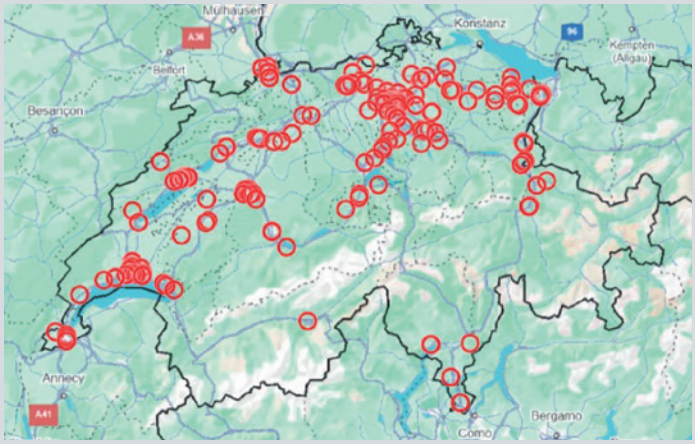


Figure 4
Location of paying members of the association "Swissphotonics" across Switzerland.

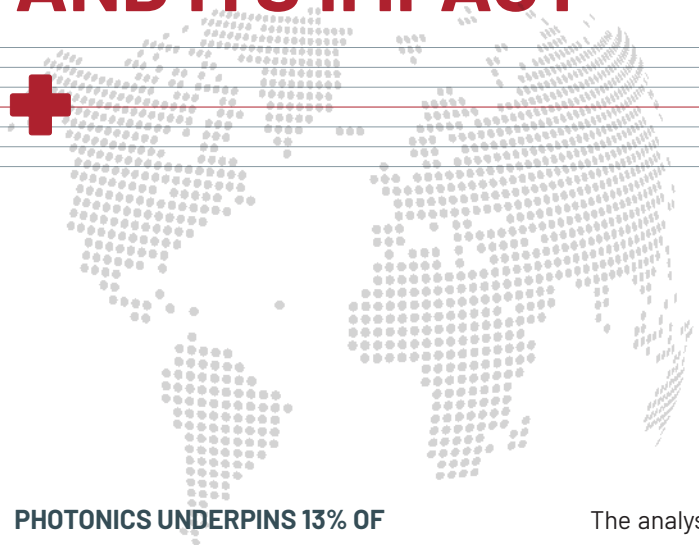
Within Switzerland, driven by the federal institutes of technology in Zürich and Lausanne, as well as national institutions such as PSI, EMPA and CSEM, by cantonal Universities and regional Universities of Applied Sciences, the boundaries of technology of photonics are pushed beyond classical photonics into the quantum photonics age, making use of peculiar properties of light.

As engineers we are very familiar with the dual nature of light, as we calculate propagation based on waves and detection based on particles. This "classical" treatment of light, depending on propagation or detection, is a manifest that we encounter and deal with light's quantum nature in our daily lives. Recently, a whole new branch of research and products has been started to make more sophisticated use of this particle – wave nature of light, spanning from quantum computers, quantum cryptography, gravitational sensors, super clocks and to use it for the new definition of the units of measurements. Photonics companies in Switzerland are already providing tools and devices based on quantum photonics and on the path to make use of these peculiar properties of light, they will one day also become an important part within our daily life and work.

LIST OF MEMBERS

The list of all members of Swissphotonics can be found here

THE PHOTONICS INDUSTRY AND ITS IMPACT



PHOTONICS UNDERPINS 13% OF GLOBAL INNOVATION WITH SWITZERLAND A SIGNIFICANT CONTRIBUTOR.

Analysis of 160 million global publications over 35 years, covering all research fields shows 13%, ~21 million academic publications, include at least one photonics term (laser, optics, etc) in the article text. This bottom-up quantitative assessment of photonics impact, indicates photonics underpins 13% of global innovation. With a consistent fraction of this innovation pulled into products over time this indicates photonics underpins at least 13% of products and thus global economic activity.

These 21 million articles can be divided by country of origin (based on publishing institute) and time. Over 35 years the most prolific publisher of articles including photonics terms are Europe (30%), USA (21%) and China (12%). Switzerland generated 1.4% of all such articles and thus contributes to 1.4% of all photonics application innovation over the last 3.5 decades.

Despite there being over a seven-fold increase in the number of publications including photonics terms over the last 35 years – an illustrating of the rising importance of photonics, the Swiss share of these articles, along with most European countries, has remained constant. Meanwhile the share generated in the US has more than halved and the share from China increased by over tenfold in the same time.

The analysis used a taxonomy of photonics terms based on the most frequent technical words appearing in a sample of 0.5 million SPIE publications (www.spie.org) that were taken as a representative sample of photonic innovation. Within photonics the most common terms used are optics (40%), imaging (26%), lasers (19%).

When looking in the broader database of 160 million articles in all fields, optical imaging is referred to most frequently, followed by lasers and spectroscopy. The impact of imaging has also doubled over the last 30 years. The lower prevalence of component terms e.g. optics is attributed to broader innovators wider use of photonic systems e.g. microscopes rather than individual optical elements.

This analysis provides insights on the structure of the photonics industry and its impact. It explains the proliferation of optics, imaging and laser companies within the industry providing the components used by photonics innovators and the products they generate. It also indicates the areas where photonics has greatest impact on global innovation and how the loci of that innovation is shifting in time and place, vital as we adjusted to changing geopolitics.

LOCATION OF INSTITUTE/ORGANISATION, PUBLICATIONS REFERENCING PHOTONICS 1990–2024

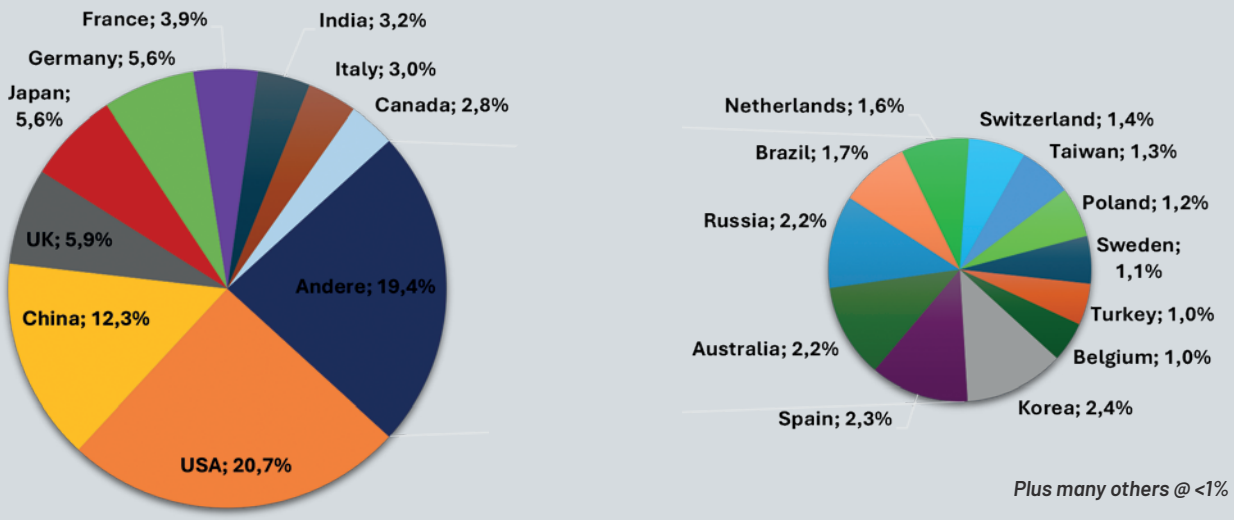


Figure 1:
The global distribution of publications in all fields including at least one photonics term over the last 35 years (based on analysis of OpenAlex.org)

PHOTONICS INNOVATION BUILDING BLOCKS, 12 YEARS OF PHOTONICS PUBLICATIONS

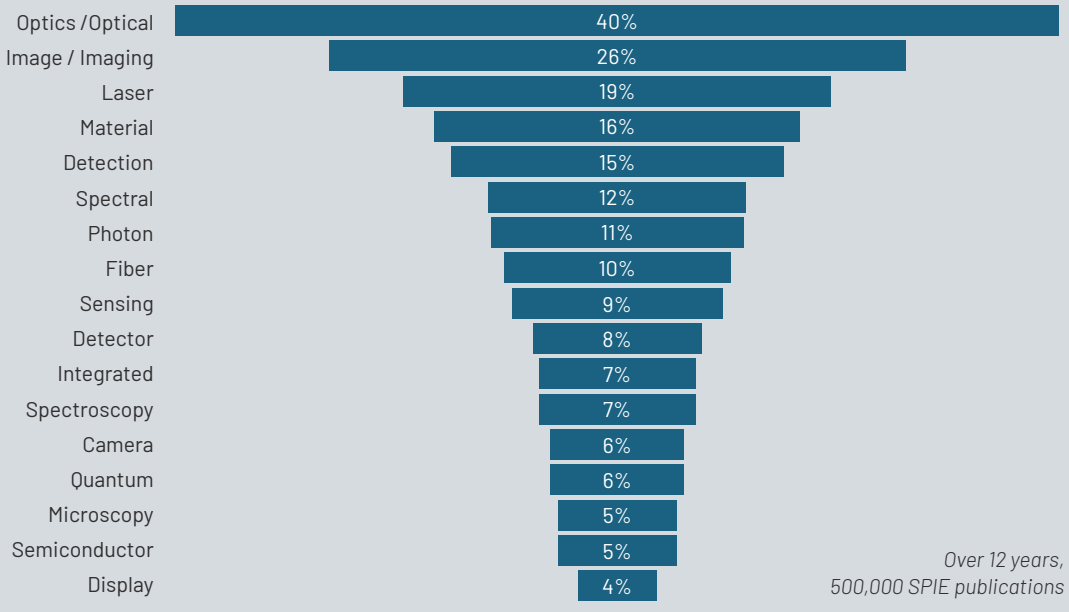


Figure 2:
The most frequent technical terms included in a representative sample of global photonic publications (source: SPIE)

OUR PARTNERS

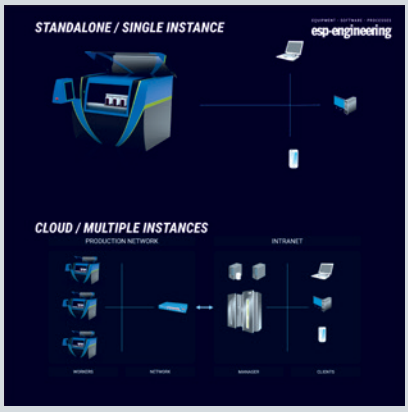
ESP-ENGINEERING – PRECISE INSPECTION SOLUTIONS, FLEXIBLY INTEGRATED

ESP-Engineering provides high-resolution inspection systems for glass substrates and optical lenses (e.g., FAC, SAC). With pixel sizes down to 0.3 µm and adjustable illumination setups, our systems detect even the smallest defects – precisely tailored to your inspection needs.

Our detection algorithms – whether classical image processing or AI-based – reliably identify defects according to ISO 10110-7, including edge chips, scratches, scuffs, pits, particles, bubbles, inclusions, fibers, and coating blemishes. All defects are automatically detected, classified, and accurately mapped.

Our systems can be used as standalone units or fully integrated into your production line. They enable fast comparison between test samples, provide immediate process feedback, enhance traceability, and improve overall efficiency. As a result, you increase quality and throughput – while significantly reducing scrap.

ESP-Engineering – Precision that integrates seamlessly into your workflow.



Standalone - Cloud

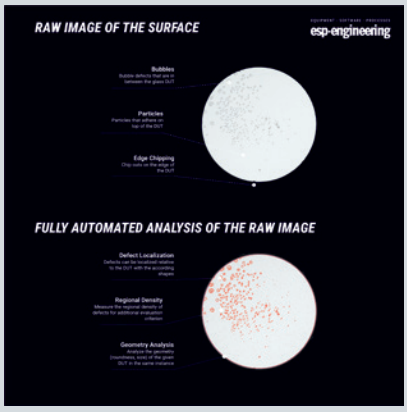


Image analysis

optotune

WHAT CAN WE LEARN FROM THE HUMAN EYE?

The human eye inspires high-performance vision systems with its simple yet effective design. Three optical components mimic its capabilities: liquid lenses for fast auto-focus, fast-steering mirrors for wide field of view, and pixel shifters for enhanced resolution.

Optotune's Gigapixel imaging kit comprises a wide-angle camera (left) and a narrow-angle camera (right, looking down at the mirror), which uses the liquid lens EL-16-40 for focusing and the fast-steering mirror MR-15-30 to expand the field of view to 100°.

Liquid lenses adjust focus in milliseconds by changing shape of a membrane covering a container filled with optical fluid and an actuator on top. This enables fast, reliable autofocus across wide working ranges. They are used in industrial scanners, medical diagnostic devices, microscopes, and various inspection systems.

Fast steering mirrors tilt along two axes to acquire high-resolution images over large areas quickly. A small sensor can cover a 100° field-of-view using this approach, useful for area of interest selection, surveillance, and gigapixel stitching.

Pixel shifters increase resolution by shifting the image slightly between exposures, mimicking the eye's micro-saccades. This is ideal for color, mono, and thermal cameras, especially when resolution matters more than speed.

Inspired by biology, these technologies boost vision system flexibility, resolution, and speed – often at lower cost and with long-term reliability.

BEYOND BOUNDARIES OF FIBER-TO-CHIP CONNECTIVITY:

FEMTOprint's Advanced Solutions for Integrated and Quantum Photonics

The world of photonics is rapidly evolving, driven by integrated photonics and quantum computing. At the core lies the challenge of fiber-to-chip connectivity, essential for seamless integration and top performance of photonic devices.

FEMTOprint, a leader in ultrafast laser micro-fabrication of high-precision glass components, offers advanced solutions combining design innovation, engineering precision, and industrial scalability.

Tackling the Connectivity Challenge
Efficient alignment of optical fibers to photonic integrated circuits (PICs) and quantum chips requires sub-micron accuracy to ensure signal integrity and low latency. FEMTOprint meets this with three product categories:

- **Fiber Ferrules & V-Grooves:** 1D/2D fiber array units with ultra-precise holes and grooves for mechanical stability and accurate positioning.
- **Waveguides:** Enable low-loss routing from fiber to chip and between chips, supporting spot size converters, couplers, and more.
- **Micro Optics:** Enable beam shaping through compact, free-form optical structures, reducing system complexity while boosting performance.

From Concept to Scalable Production
FEMTOprint's value lies in engineering expertise, scalability, and market-driven innovation. Its process covers proof of concept, feasibility, manufacturability, and volume production—ensuring both technical viability and commercial success.

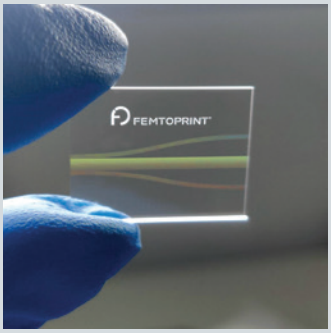
Key strengths:
- **Submicron Fiber Alignment:** Achieved via advanced manufacturing and 10+ years of metrology know-how.
- **Monolithic Integration:** Reduces assembly complexity in high-volume manufacturing.
- **Superior Optical Performance:** Precision components enable efficient packaging and minimal losses.

Design for Manufacturing (DFM)
FEMTOprint bridges the gap between design and mass production through its DFM platform, which includes: Redesign and performance comparison, functional testing, pilot scale-up and volume manufacturing

Early manufacturability focus leads to faster time-to-market and cost-efficiency.

Why Choose FEMTOprint?
FEMTOprint empowers future-ready optical and quantum technologies by delivering high-precision, scalable glass components. With operations in Switzerland, the US, Korea, and Israel, it supports innovators worldwide in bringing photonic products to market – fast and efficiently.

Learn more at www.femtoprint.ch



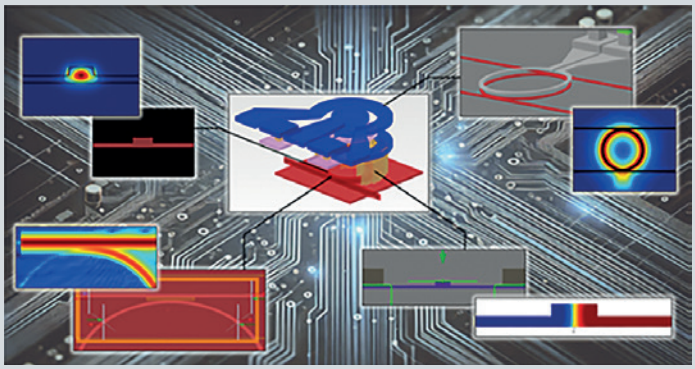
ACCELERATING PHOTONICS INNOVATION WITH SIMULATION

Whether it's reducing the energy consumption of advanced AI models by providing lower loss data communications or enabling more immersive experiences through Augmented Reality, photonics plays a crucial role in many of the cutting-edge technologies that are set to transform our future.

Due to the prototyping cost and precision required, simulation is a key facilitator for the development of these technologies. Furthermore, those working at the forefront of these fields will recognize that for advanced photonic applications, a multiphysics approach is required to create truly state of the art systems. CADFEM engineers, empowered by Ansys multiphysics software solutions is the successful combination to help you tackle these complex challenges.

PIONEERING PHOTONIC INTEGRATED CIRCUITS WITH ANSYS LUMERICAL

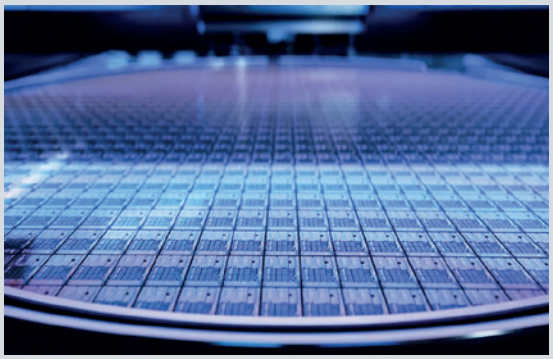
Lumerical software provides advanced solutions for designing and simulating photonic integrated circuits (PICs). Tools such as layer builder enables designers to easily create their simulations from GDS files while adhering to the foundry process of their chosen fabrication partner. Using Lumerical, engineers can accurately model light behaviour within complex elements to optimize components such as modulators, interferometers, and detectors. A key point here is that both passive and active components can be accurately simulated within the Ansys Lumerical ecosystem. Recently, GlobalFoundries certified the Ansys Lumerical multiphysics photonics design Tools for their GF Fotonix™ platform.



GlobalFoundries Certifies Ansys Lumerical for GF Fotonix™ Platform

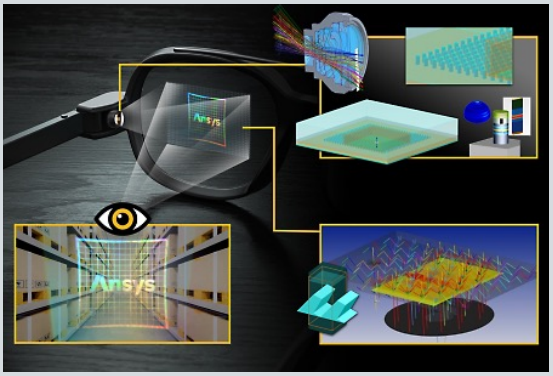
In addition to industry leading accuracy, GPU acceleration in Lumerical FDTD drastically reduces the simulation time, often resulting in simulations completing in mere minutes where hours were previously required. The immediate benefits of this are clear, but such a drastic speed up also enables new possibilities by the leveraging Lumerical Python API and other tools from the Ansys Portfolio such as OptiSlang.

Integrated with the broader Ansys portfolio – including Zemax OpticStudio, HFSS, Icepak, Redhawk, RaptorX, and Ansys Mechanical – Lumerical helps PIC designers ensure efficient optical coupling, electro-optical signal integrity, and thermal and structural reliability in multi-die 3D-IC packages. This supports data centers and high-performance computing systems for AI training and inference enabling superior performance while reducing energy consumption.



INTERFACING WITH THE MACROSCOPIC

Transitioning from the photonic integrated circuit regime, Ansys Lumerical also seamlessly couples with ray tracing tools such as Ansys Zemax OpticStudio and Ansys Speos to enable truly multiscale simulations. Direct coupling between Ansys Lumerical RCWA and Ansys Zemax OpticStudio enables designers to simultaneously optimize both the macro and micro scales of their design. Full system level performance can then be assessed by importing the constituent optical elements, from Lumerical and Zemax, into Ansys Speos, so that they can be combined with powerful human vision simulations. The abilities of the full Ansys Optics & Photonics suite are tailor made for a range of inherently multiscale optical systems such as optical sensing, metalens design, LiDAR, and much more.

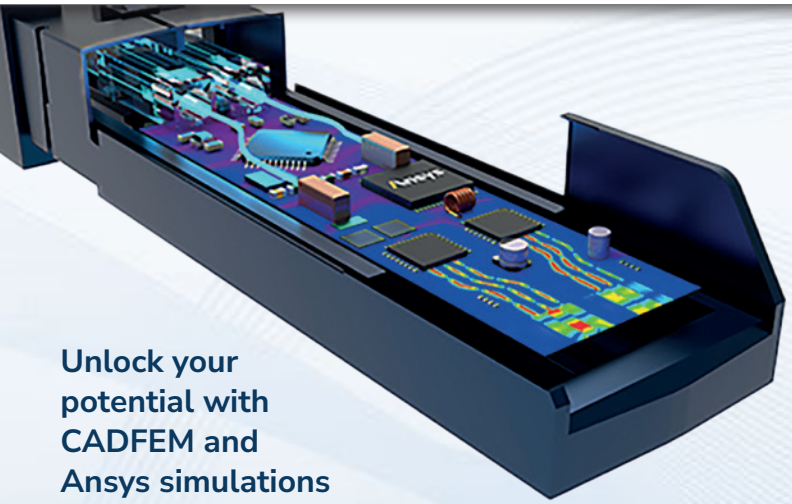


ILLUMINATING THE PATH FORWARD

With decades of expertise in simulation-driven engineering, CADFEM provides best in class software and comprehensive training, consulting, and support. By working closely with engineers, CADFEM helps companies accelerate product development, reduce risks, and incorporate a broader range of critical multiphysics phenomena into their development workflow. Contact CADFEM to explore how Ansys simulations can transform your photonics applications.

CADFEM

www.cadfem.ch
CADFEM (Suisse) AG
Wittenwilerstrasse 25 | 8355 Aadorf | Switzerland
+41 (0)52-36801-01 | info@cadfem.ch

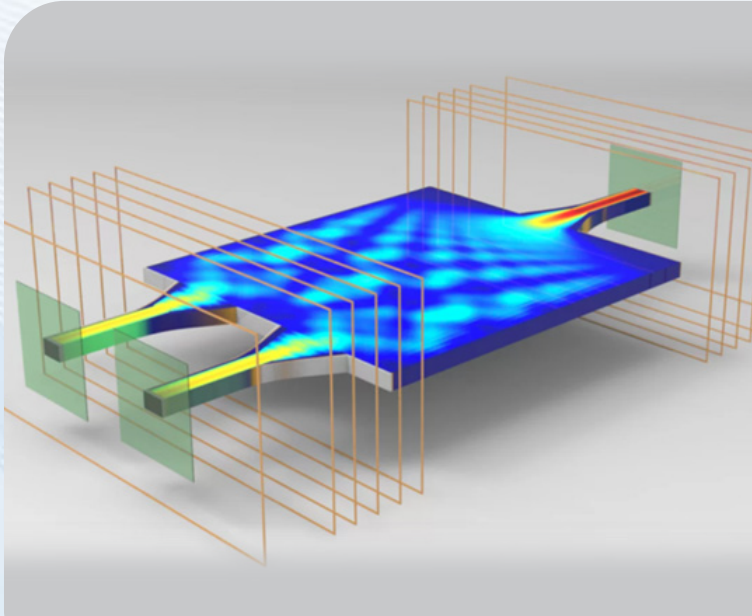


BE A PIONEER IN PHOTONICS

Unlock your potential with CADFEM and Ansys simulations

To remain at the forefront of technology and design best-in-class products, a comprehensive Multiphysics approach is required.

CADFEM, with Ansys software, provides a one-stop-shop for all your simulation needs to achieve the demanding performance required to create truly cutting-edge devices.



CASSIO-P
All-Glass Optical Systems

CASSIO-P: ALL-GLASS MINIATURE FEMTOSECOND LASER SOURCES.

Cassio-P pioneers ultra compact, reliable, robust, high-performance femtosecond laser oscillators operating at gigahertz repetition rates, tailored for industrial, medical, telecommunications, and scientific systems.

Designed around low thermal expansion glass miniature optical benches with precise and permanent alignment, enabled by our proprietary All-Glass manufacturing technology. A cost-effective and time-efficient approach developed for scalable production.

Our Alpha 1030 provides kilowatt peak power in a palmtop format, with low power consumption and passive cooling. It is perfect for OEM integration in applications like GHz burst materials processing, LiDAR, or 3D tissue imaging.

Our Beta 515 generates intense green light with short coherence for specific imaging applications. Its compact size and multi-mode fiber interface make it well-suited for OEM integration in microscopes, to deliver uniform illumination over a wide field.

Get in touch with us at info@cassio-p.com, and explore ways to collaborate.

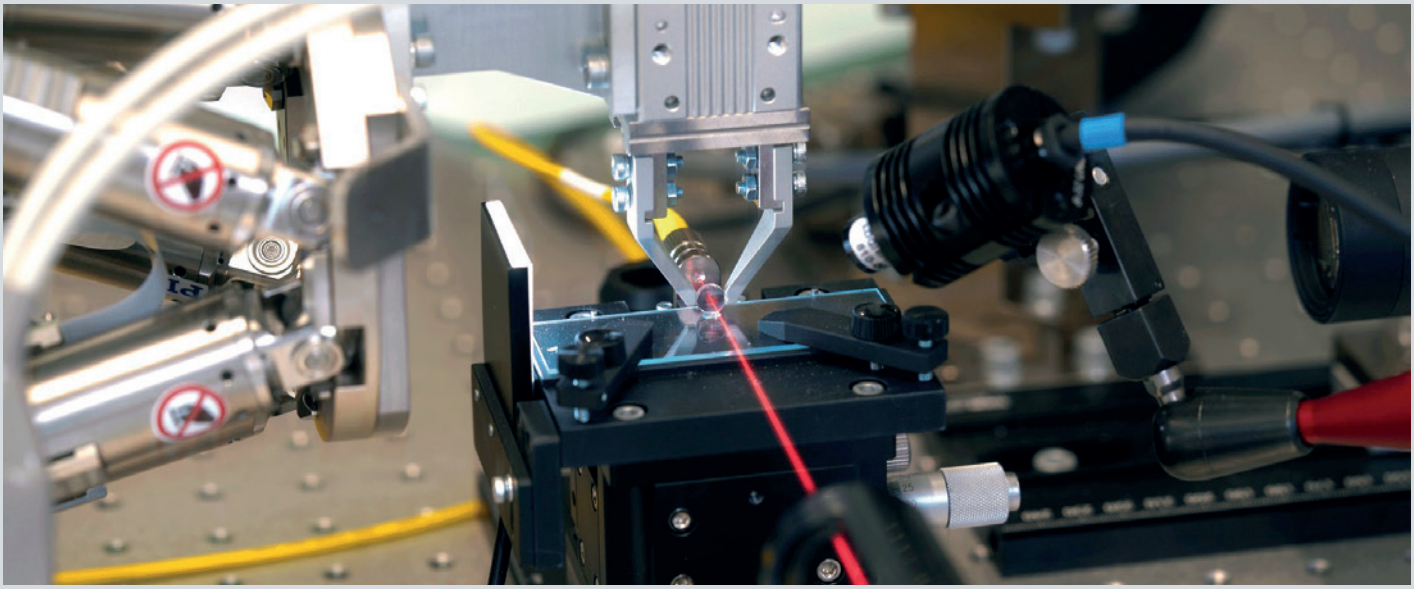
CASSIO-P
All-Glass Optical Systems

Miniature Femtosecond Lasers

Our lasers are built to be reliable and deliver exceptional performances in a compact package. They are designed for seamless integration into all kinds of equipment.

CASSIO-P SA | Espace de l'Europe 2, c/o Microcity SA | 2000 Neuchâtel | Switzerland | **www.cassio-p.com**

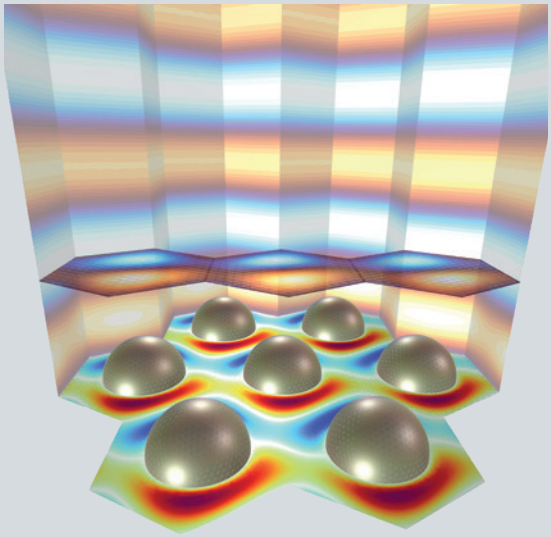
CIPOSA'S BREAKTHROUGH IN OPTICAL PACKAGING TECHNOLOGY



Ciposa is developing an innovative packaging machine designed for the manufacturing of 2D optical interconnects. This advanced system features high-precision alignment arms capable of achieving submicron accuracy, ensuring reliable and accurate component placement. It integrates a novel laser-based solder reflow process, entirely replacing the need for epoxy. This approach offers a cleaner, faster, and more consistent assembly of surface-mounted optical connections directly onto PIC chips.

By enhancing manufacturing efficiency and reliability, this technology sets a new standard for optical packaging. Ciposa's solution also supports greater scalability and performance, making it a strong contender in the evolving field of precision manufacturing. With this development, Ciposa aims to provide cutting-edge solutions to meet the growing demand for robust and efficient optical interconnect applications, reinforcing its position as a key player in the industry.

INNOVATING OPTICAL SYSTEMS MADE EASY – WITH MULTIPHYSICS SIMULATION



The current breathtaking progress of lightbased technologies would be impossible without continuous improvement of experimental and manufacturing workflows and groundbreaking theoretical work. However, today's third pillar of innovation is optical modeling and simulation, empowering engineers and scientists to predict product behavior accurately and optimize designs before the first prototype is built. Testing and improving ideas virtually has fundamentally changed the way of engineering and dramatically reduced costs and time-to-market.

The integrated simulation platform COMSOL Multiphysics helps R&D engineers to design optical systems over a vast range of dimensions and power, ranging from single-photon technologies on the quantum scale to Megawatt concentrated solar power plants hundreds of meters in size.

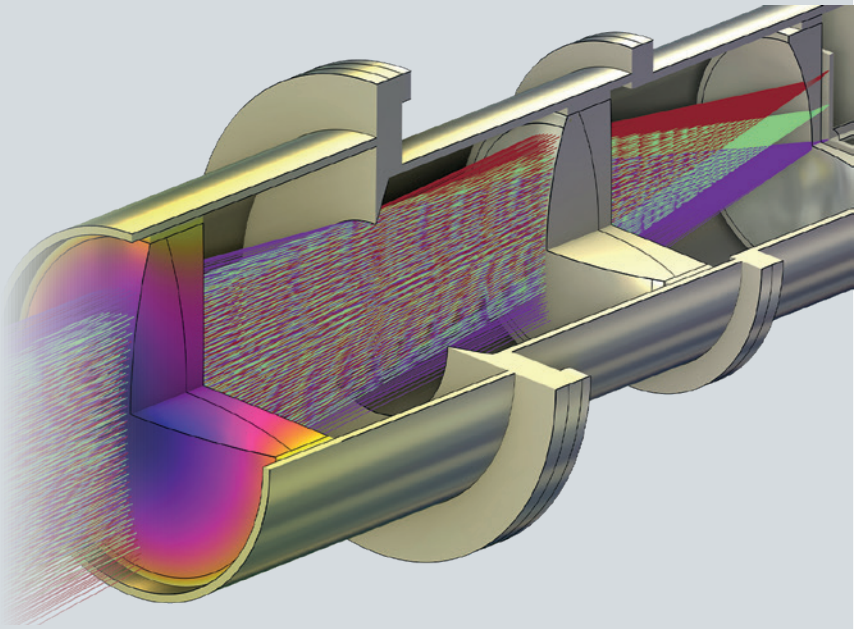
Wave optics simulations ensure the reliable modulation of light in photonic integrated circuits, complex fiber and waveguide designs, optoelectronic devices, and novel sensor technologies based on optical nanostructures.

Optical ray tracing is vital in designing lens systems in micro-cameras, LIDAR sensors, telescopes, laser cavities, and spectrometers. Also, the interaction of high-power laser beams with materials for 3D printing, welding, or tumor ablation is optimized today with fully coupled structural thermal optical performance analysis.

Indeed, the most exciting technologies today are based on the interaction of light with other physical fields. Emerging disciplines like optomechanics, electrooptics, photochemistry, optofluidics, optoacoustics, magnetooptics, photophoresis, quantum optics, and many more exploit coupled effects. On the other hand, there is a ubiquitous need to reduce unwanted couplings, for instance, distortions in optics caused by thermal or mechanical effects.

Understanding, predicting, and optimizing couplings is key to success in creating increasingly complex optical systems in a fastpaced economy. Multiphysics simulation provides a powerful and efficient way to improve designs by coupling different physical field equations in one platform transparently in a user-friendly manner. With the rise of AI, we even offer integrated chatbot capabilities to push your model to the next level with ease.

The three pillars of innovation would be impossible without human creativity. Therefore, we at COMSOL think of simulation from the perspective of collaborative work between simulation specialists, design engineers, lab technicians, and managers. Today, engineers can embed their mathematical models in dedicated GUIs and build simulation apps that can be operated by all stakeholders in the innovation process. Multiphysics simulation apps allow R&D teams to communicate technical information in a fundamentally new way and unleash synergies on all levels. Our latest surrogate capabilities enable immediate and interactive results to explore in simple to use apps or to perform rapid optimization studies on. Get in contact and try it out now!



MINIATURIZATION OF OPTICAL SYSTEMS WITH INTEGRATED MICRO-OPTICS

Micro-optics technology is at the heart of modern innovation, driving breakthroughs in industries ranging from consumer electronics to telecommunications. From ultra-compact smartphone sensors to the fiber-optic backbone of the internet, micro-optics have become essential in achieving better performance, compactness, and efficiency.

For over 30 years, CSEM has been at the forefront of developing and delivering cutting-edge micro- and nano-optical solutions. With a heritage of precision engineering, we collaborate with industries worldwide to revolutionize optical systems for applications in watchmaking, banknote security, lighting, and beyond. Today, micro-optics are transforming even more sectors, enabling lighter, more compact, and energy-efficient systems.

PIONEERING MINIATURIZATION

CSEM's expertise in miniaturization shines in innovations like our Miniaturized Atomic Clock (MAC). Combining advanced technologies—including custom ASIC design and a MEMS-based rubidium vapor cell—we reduced the optical system's thickness from over 5 mm to under 1 mm. By integrating nano-grating couplers on a single glass chip, we achieved unparalleled compactness and manufacturing efficiency. These advancements make groundbreaking technologies accessible to a range of industries, from telecommunications to aerospace.

UNLOCKING MICRO LENS ARRAYS

Another leap in optical engineering is the development of On-Chip Lenses (OCL) and Micro Lens Arrays (MLA), which enhance the efficiency of micro-displays, LIDAR systems, photon detectors, imagers and the interfacing of Photonic Integrated Circuits (PICs). At CSEM, we offer specialized MLA engineering and foundry services designed for companies seeking customized solutions – even for small production volumes. Our support ensures faster adoption and a competitive edge for startups and established firms alike.

EXPANDING CAPABILITIES

CSEM's commitment to innovation is backed by a state-of-the-art infrastructure, offering:

- Processing of wafers up to 200 mm in diameter, from mastering to complete metrology.
- Compatbility with multi-project wafers with customizable specifications.
- High-accuracy UV-imprinting for substrates up to 300 mm and beyond by roll-to-plate, for both rigid and flexible materials.
- Design and production of freeform microlens arrays through European collaborations.

These capabilities position us as a leader in providing uniquemicro-optical solutions, enabling industries worldwide to overcome challenges and seize opportunities in photonics.

ADVANCING APPLICATIONS

From aerospace and life sciences to high-tech manufacturing, micro-optics are driving innovation:

- **Aerospace:** Advanced imagers and sensors for space exploration.
- **Quantum:** Boost the quantum efficiency of sensors with cryo-tested micro-optics
- **Life Sciences:** Enhanced fluorescence imaging for medical and biotech research.

CSEM's flexible technology platform empowers companies to adopt and leverage micro-optics for industry-specific challenges. With a focus on delivering non-standard, high-performance components not commercially available elsewhere, we are your partner for turning complex visions into reality.

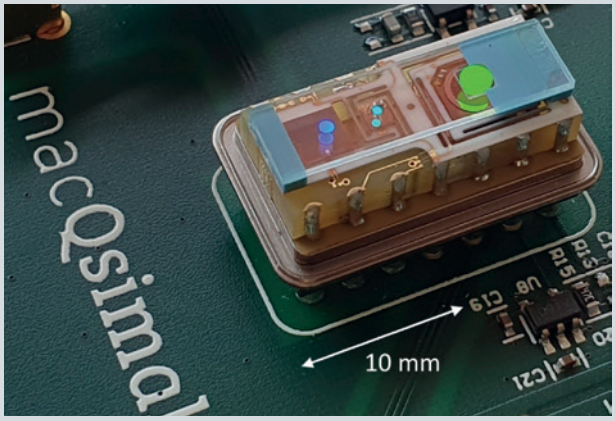


Figure 1: Miniature rubidium Atomic Clock measuring less than 5 cm³ fabricated at CSEM. The light redirection, distribution and the beam expansion are realized through a glass chip with nano-grating couplers.

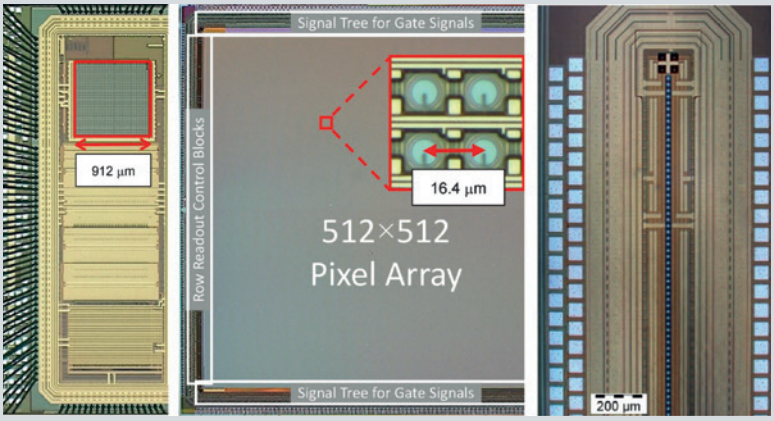


Figure 2: Microscopy images of 3 different Single Photon Avalanche Photodiode (SPAD) detectors and imagers from a single wafer reticle, the largest one being 512×512 pixels, all equipped with CSEM's MLA/OCL. C. Bruschini et al., Optics Express, 31(13), 21935-21953 (2023)

METAS
Your reference.

METROLOGICAL TRACEABILITY FOR PHOTONICS IN SWITZERLAND

The Federal Institute of Metrology METAS serves as the federal centre of competence for all issues related to measurement and for measuring equipment and measuring procedures. It compares the measurement standards with those of other national metrology institutes and conducts the requisite scientific and technical investigations and development work for the upkeep of the national measurement basis. Our Photonics, Time and Frequency laboratory is active since more than 30 years in the metrology of fibre optics components and measuring instruments. With the aid of research and development projects, we keep our measurement facilities and expertise at the forefront of technology, especially to address new domains like quantum communication and metrology for photonic integrated components. Our services address all relevant quantities in this field, like optical power and linearity, spatially resolved reflectance and loss measurements, wavelength and optical frequencies, waveguide properties, like dispersion, mode field diameter and polarisation dependant quantities.

By way of example, we present here our system for spectral measurements [1]. It allows to perform, in a wide spectral domain and with a narrow spectral width, the calibration of the spectral responsivity of detectors and power meters as well as the spectral transmission of passive fibre optics components. The system is continuously tunable from 700 nm to 1800 nm and generates a narrowband signal with a full width half maximum (FWHM) of about 1.3 nm (Fig.1). This allows achieving measurement uncertainties of 0.9 %. In the frame of a European project for quantum key distribution safety, we measured the spectral transmission of an interferometric band pass filter centered at 1551.72 nm, with a FWHM spectral width of 0.6 nm (Fig.2). The spectrum shows a transmission peak at the specified wavelength as well as unexpected out-of-band transmission features that may be detrimental in strategic fields like quantum communication systems.

Potential key applications of this versatile system include the spectral characterisation of single photon detectors and photonic integrated components, axes in which are actively working.

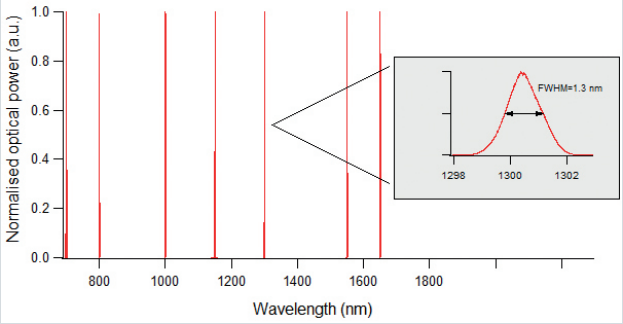


Fig.1: Typical spectra obtained at different wavelengths; the inset shows the spectrum measured at 1300 nm.

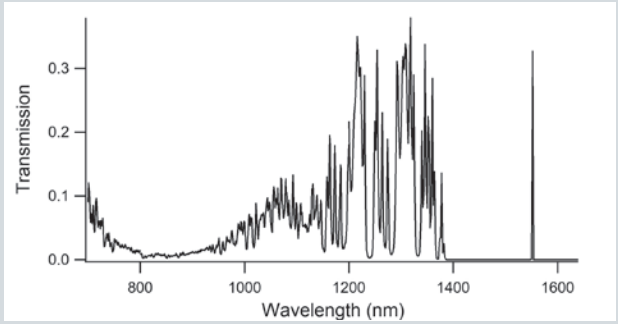
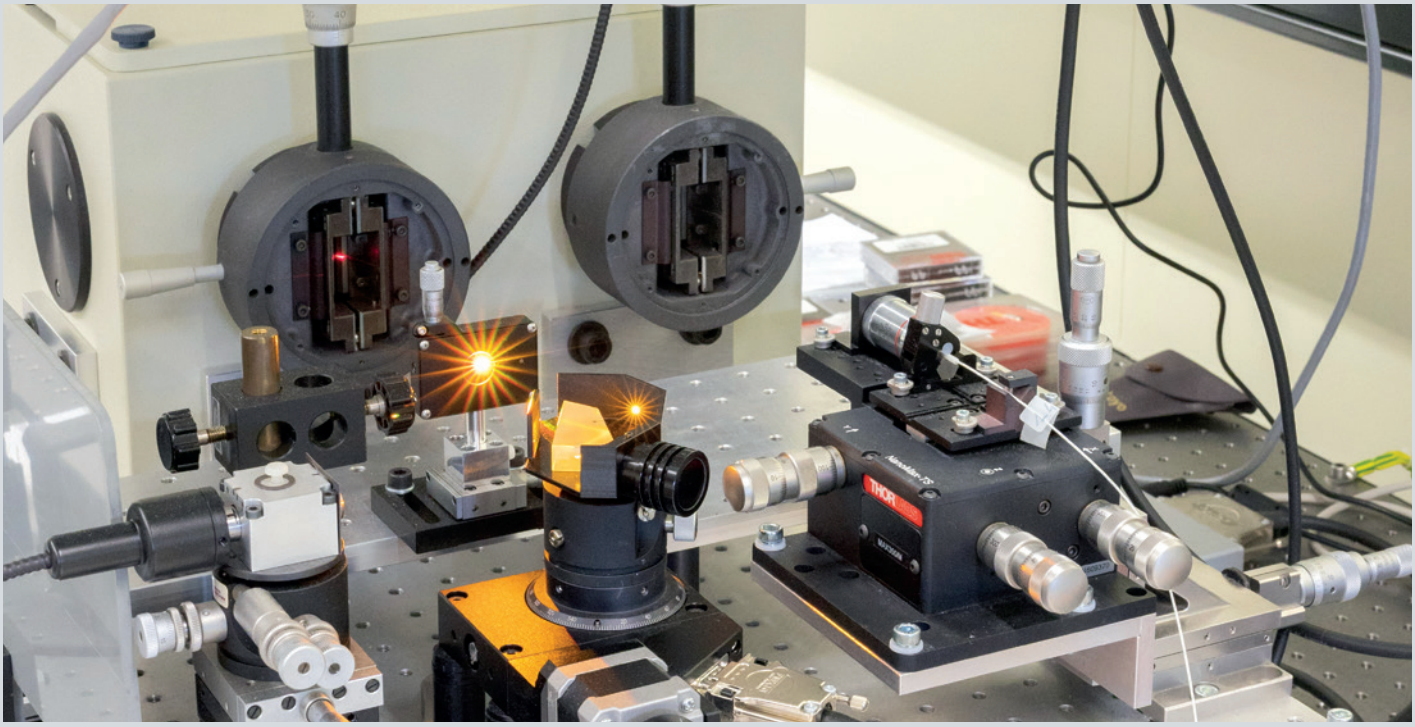


Fig.2: Spectral transmission of an interferometric band pass filter. Note that, the transmission measured at the central wavelength is limited by the wavelength resolution of the measurement setup.

Reference: [1] Natascia Castagna and Jacques Morel 2022 Metrologia 59 035005



OPTICAL SOLUTION FOR MAJOR AI PROBLEM

A new multicolor laser from Swiss startup Enlightra replaces 100 conventional lasers in data transmission. This will drastically reduce costs and energy consumption while providing more bandwidth in and between data centers. And it solves a major problem for AI computing. Enlightra is already working with customers to introduce their comb laser to mass production.

Most forecasts predict continued growth in computing power for AI computing. That comes with a similar growth in energy consumption. A problem they share with all data centers, which are also expected to grow. Experts estimate that AI alone will require energy in the order of PWh per year in 2030, which is the demand of countries like Germany. By then, data centers and AI could account for 10% or more of global energy consumption.

A major reason is the nature of data transfer between processing units, such as NVIDIA's GPUs. On the board and within racks, connections are electrical; outside the rack, they are optical, using fiber optics. Electrical connections have some resistance, where electrical energy is lost as heat. Fiber does not heat up, so optical transmission is much more power efficient. Still, they require myriads of laser diodes to generate the various optical signals.

A chip-to-chip interconnect might require 64 or 128 laser diodes. For a transatlantic cable, the problem is worse, requiring tens of thousands of laser diodes per cable.

NVIDIA's engineers are aware of the problems, and in March 2025, Jensen Huang announced the introduction of switches with co-packaged optics. Their Spectrum-X Photonics switches will be available in multiple configurations with up to 2048 ports and up to 400 Tb/s bandwidth. The light source will be an array of DFB lasers. Huang talked about 3.5 times less power consumption.

Swiss startup Enlightra has developed an integrated laser solution that generates a special laser beam containing up to 100 different colors simultaneously. Its spectrum shows evenly distributed lines, which is why it is called a „comb laser". One comb laser can replace up to 100 regular laser systems for data lines. In a chip-to-chip interconnect, one comb laser on each side replaces all the laser diodes that are currently required. For switches with co-packaged optics, this will be the next technology step.

In a long-haul connection such as a transatlantic cable, the number of lasers is reduced by a factor of 100 and the power consumption by a factor of 10. Enlightra was founded in 2022 by Dr. John Jost and Dr. Maxim Karpov. They started with a bold vision: „We always had the idea to develop the comb laser for large scale applications," says Jost, co-CEO of Enlightra. Having this vision in mind, they secured a solid IP portfolio. And they worked hard to reduce size and cost while improving reliability and manufacturability. Today, their laser is made as a photonic integrated circuit in a contracted semiconductor fab. Several devices are currently being tested by the world's largest datacom equipment manufacturers.

While these tests are running, the team at the Lausanne-based company has streamlined development processes. "This way we were able to reduce our response times for change requests to a few weeks instead of months" says Dr. Maxim Karpov, co-CEO. They have already partnered with large semiconductor fabs to optimize manufacturing steps.

For the coming years, Enlightra prepares to enter the multi-billion market of data interconnects in telecom and datacom. Their comb lasers would significantly reduce energy consumption in and between data centers. Furthermore, these lasers decrease hardware costs in telecom systems by replacing large numbers of laser diodes. At the same time, they offer more bandwidth for higher transmission capacity.

ABOUT ENLIGHTRA

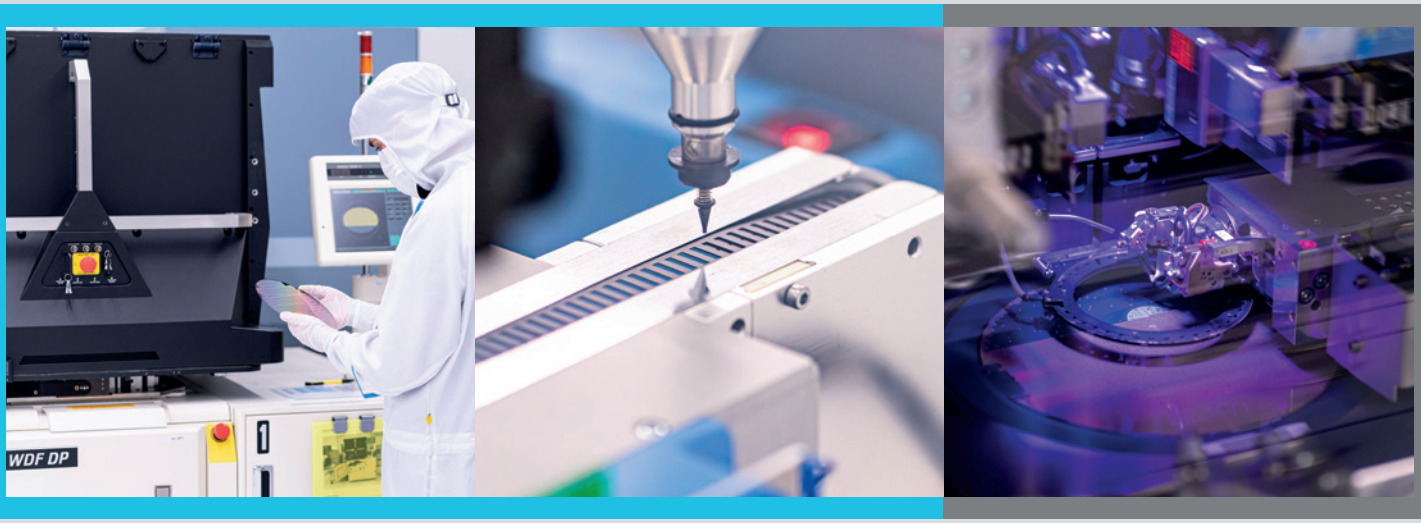
Enlightra develops cost- and energy-efficient comb lasers for high-capacity data transmission in and between data centers. The startup's lasers are based on "micrcomb" technology, which is more effective and efficient than existing solutions: Enlightra's optical micrcombs can replace hundreds of high-quality lasers used in today's optical communications while being up to 10 times more energy-efficient and allowing 100 times higher data transmission rates.

For more information, visit **www.enlightra.com.**

Enlightra's comb lasers deliver laser pulses of up to 100 different colors. They supply optical interconnects on various levels, from chip-to-chip up to transatlantic cables. (© Enlightra)

Swiss startup Enlightra works with the world's largest datacom equipment manufacturers to optimize their multicolor laser source for mass production. It will enable substantial cost and energy savings in next generation datacom systems. (© Enlightra)

UNIQUE CCD/CMOS HIGH PERFORMANCE PHOTONICS CHIPS



Precise optoelectronic sensor solutions play a central role in fields such as robotics, building automation, and drone technology, where fast decisions and accurate depth data are essential. Founded in 2006 in Sargans (Switzerland), ESPROS Photonics AG has established itself as a leading provider of Time-of-Flight (TOF) technology. With its expertise in optoelectronics and CMOS technology, ESPROS develops and produces TOF chips and camera modules that provide precise 3D data even under challenging lighting conditions. This makes them a key technology leader for navigation and object recognition in dynamic environments. The company focuses on three core business areas: ASIC design, standard TOF chips, and TOF camera modules.

In the field of ASIC design, ESPROS develops custom chips tailored precisely to the specific requirements of its customers. The company's proprietary CMOS/CCD technology and the expertise of its highly specialized employees enable the creation of sophisticated designs with an optimal balance between performance, energy efficiency, and cost. This technology allows for efficient signal processing and ensures that even demanding applications operate reliably and accurately under difficult conditions.

ESPROS' standard TOF chips are based on a monolithic CMOS/CCD architecture with backside illumination, which ensures particularly high light sensitivity and precise distance measurement even in low-light conditions. The high sensitivity and fast response time make the chips ideal for demanding applications, regardless of lighting conditions. Direct signal processing on the chip reduces computational load and enables immediate response. This is highly advantageous in dynamic environments such as robot collision avoidance or object recognition. Since TOF technology does not rely on conventional camera sensors, the privacy of detected individuals remains protected. This

aspect is particularly important for sensitive applications such as patient monitoring and crowd flow analysis.

ESPROS also offers fully integrated TOF camera modules that combine TOF chips with custom optics, electronics, and software. Simple integration and the company's Python repository enable fast embedding into existing systems. This gives customers maximum flexibility in adapting the modules to specific applications.

The combination of custom ASIC design, highly sensitive TOF chips, and integrated camera modules makes ESPROS solutions a versatile platform for numerous applications. ESPROS' customers operate globally across diverse industries, each with unique requirements. The company's technological expertise and fast decision-making processes make ESPROS a strong and agile development partner for customized TOF sensor solutions.

With TOF technology from ESPROS, future challenges are already being solved today. ESPROS' success is based not only on technological excellence but also on maintaining full control over the entire value chain. Thanks to extensive inhouse production, the company ensures consistently high quality and short development cycles. By combining innovation with reliability, ESPROS continues to set new standards in sensor technology, helping its customers navigate complex environments with confidence and precision.

LOW-COST OPTICAL LITHOGRAPHY FOR HIGH-RESOLUTION PERIODIC PATTERNING

Figure 2: The PhableS step-and-repeat lithography tool allows for the fully automated processing of 300 mm wafers and beyond.

Many cutting-edge technologies in photonics, optics, optoelectronics, and augmented reality rely heavily on high quality periodic nanopatterns. Eulitha's proprietary Displacement Talbot Lithography (DTL) technology enables low-cost and high-throughput exposure of one and two-dimensional periodic nanostructures, as seen in Figure 1. It is a revolutionary photolithography technique for printing features down to 60 nm in size, combined with large, singleshot exposure areas up to 140×140 mm^2.

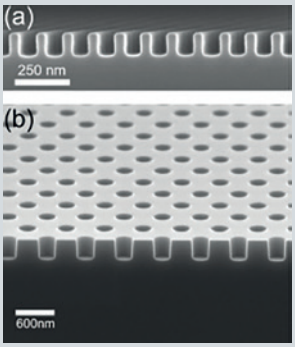


Figure 1: Cross-sectional SEM images of a 1D line-and-space grating (a) and a 2D array of holes (b). Both patterns are exposed into photoresist using DTL and subsequently etched into the Si substrate.

DTL is a contact-free printing technique. This, especially in contrast to nanoimprint lithography, drastically reduces the danger of mask degradation and improves process yield and reliability. Furthermore, the absence of complex projection optics makes DTL a far lower-cost method compared to traditional projection lithography. At the same time, it takes full advantage of the vast infrastructure, materials, and process technologies developed for the photolithography methos used in the semiconductor industry.

In DTL, collimated, monochromatic light impinging on a grating (i.e., the photomask) creates an image of the original grating at certain distances away from the mask. This image, also called a self-image, is repeated at regular intervals, referred to as a Talbot length. In DTL, the photoresist-coated substrate is displaced perpendicularly to the diffraction grating by a Talbot length, resulting in an integration of the diffracted light field. This results in an effectively "infinite" depth of focus, allowing for photolithography on non-flat substrates; another key advantage compared to projection lithography.

Eulitha offers three different lines of lithography tools. The manual PhableR system is geared towards R&D and academic applications. It allows users to access the full power of DTL in a compact tabletop system at a very attractive price point. Stepping things up, the PhableX is designed for industrial customers who require large volume production capabilities with semi-automated mask and wafer handling. Finally, the PhableS combines DTL with a step-and-repeat approach allowing for the processing of 300 mm wafers and beyond in a fully automated platform (Figure 2).

Beyond offering Phable lithography tools, Eulitha serves as a full solution provider. As a strategic product development partner, Eulitha offers its customers an application-focused R&D department with extensive expertise in integrating DTL into existing production lines. Our Swiss headquarters is equipped with modern clean room facilities where we offer comprehensive demonstration services. This encompasses all steps of lithographic patterning from the modeling and design of a photomask to the final printing in photoresist.

FLUXiM
boosts your R&D - www.fluxim.com

ENABLING INNOVATION IN DISPLAYS AND PHOTOVOLTAICS WITH ADVANCED R&D TOOLS

The display and photovoltaic industries are evolving fast. Demand for efficient OLED screens and clean energy drives the need for better LEDs and solar cells. Fluxim's R&D tools support next-generation devices based on organics and perovskites.

Faster Development:
Simulations by Setfos (Fig. 1) and Laoss reduce costly trial-and-error and enable fast scaling of devices from lab to market.

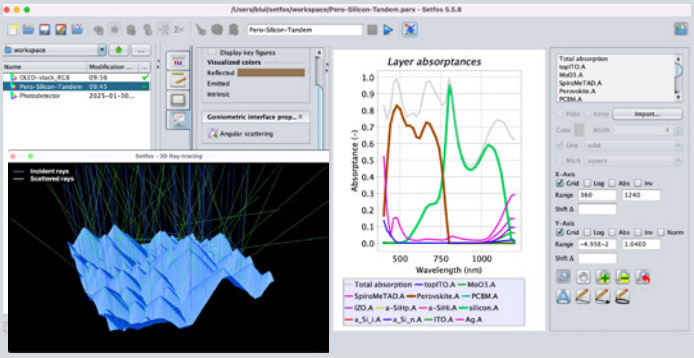


Fig. 1 Setfos GUI showing 3D ray-tracing of light scattering (left) and absorptance analysis in a perovskite-silicon tandem solar cell (right).

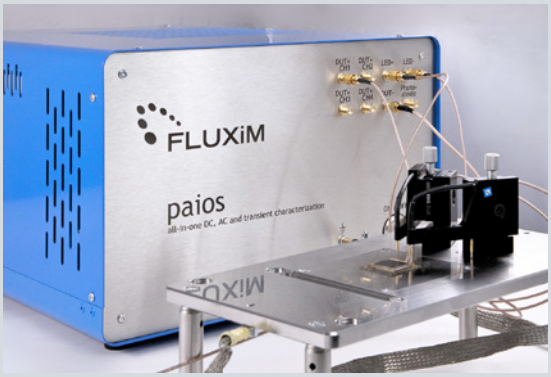


Fig. 2 Paios measures opto-electronic device performance in DC, AC and transient state.

Precise Characterization:
Paios and Phelos deliver insights into device physics and material properties, essential for OLEDs, solar cells, photodetectors, and luminescent films.

Fig. 3 Phelos analyzes angle and polarization dependent electro- and photoluminescence spectra of OLED devices and emitter films.

Stability Testing:
Litos and Litos Lite provide powerful solutions for analyzing degradation and improving device longevity.

Behind Fluxim's software and hardware R&D tools there is a diverse team of experts in semiconductor physics, computational science, software engineering, and measurement technologies.

From its headquarters in Winterthur, Switzerland, Fluxim delivers cutting edge R&D tools that advance display and solar technologies worldwide.

Discover how Fluxim can accelerate your innovation at **www.fluxim.com.**

FISBA Innovators in Photonics

ADVANTAGES OF TOP-HAT BEAM ILLUMINATION IN FLOW CYTOMETRY

Flow cytometry is a cornerstone of modern cell analysis, providing rapid, high-throughput measurements of cellular properties. One critical factor in achieving accurate and consistent results is the laser illumination. While Gaussian beams typically have a bell-shaped intensity profile, top-hat beams provide a flat, even distribution and therefore offer several advantages in flow applications.

KEY ADVANTAGES OF TOP-HAT BEAM ILLUMINATION

1. Uniform Excitation
Top-hat beams ensure consistent excitation across the interrogation area, boosting accuracy and repeatability.

2. Efficient excitation
The steep edges of the top-hat profile allow for efficient excitation with a minimal amount of stray light that could interfere with measurements.

3. Simplified Adjustment
The precision of the beam excitation position on the flow cell is less critical.

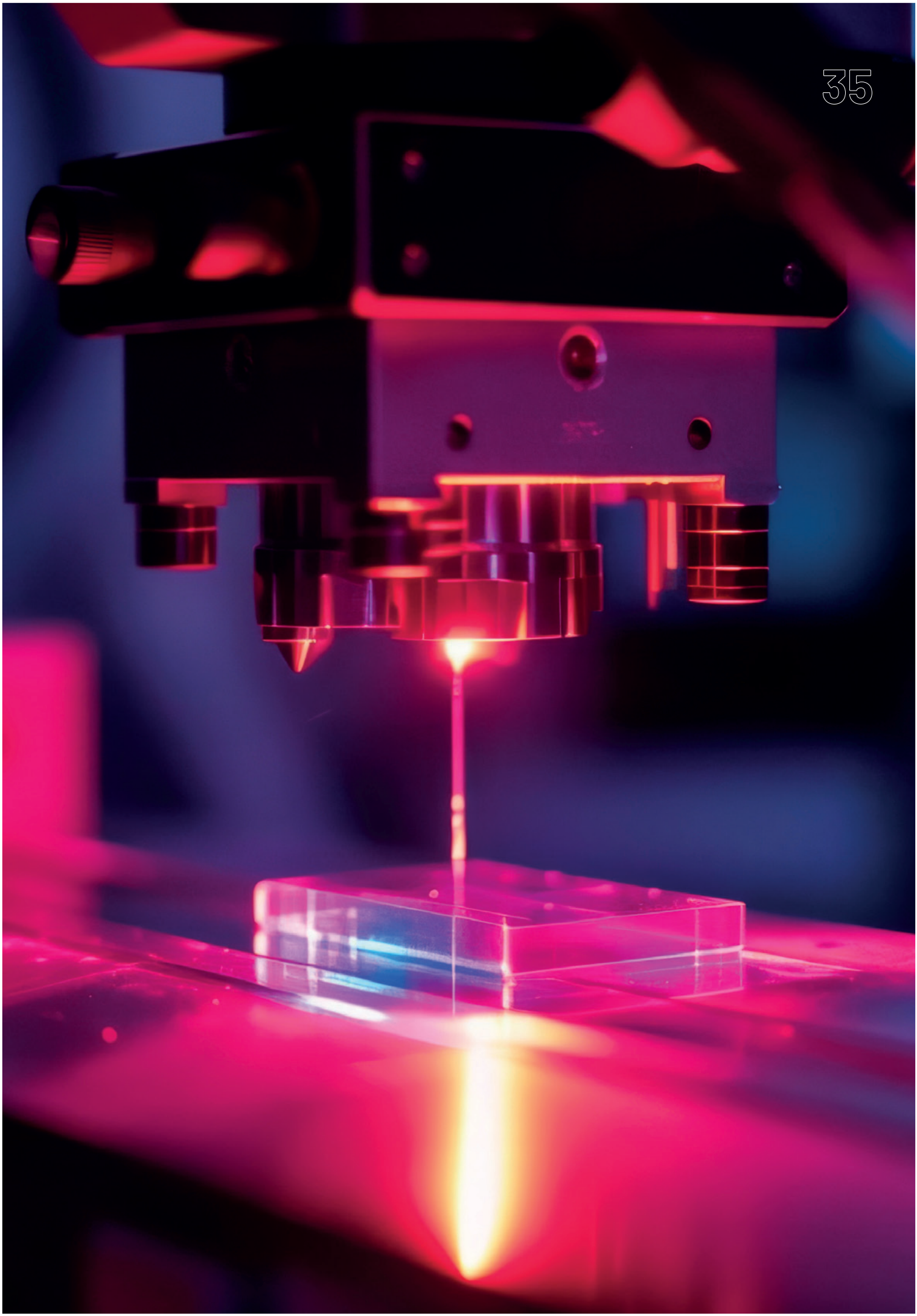
4. Enhanced Data Quality
A uniform beam profile improves automated cell segmentation, increases reproducibility, and raises confidence in results.

CORE COMPETENCE: FISBA BEAM SHAPING TECHNOLOGY

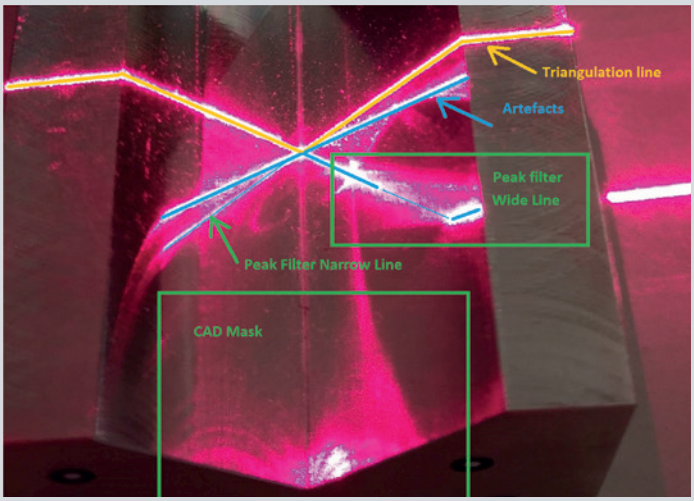
At the heart of this top-hat beam solution is the FISBA beam shaping technology, by which a Gaussian laser beam from single-mode fiber is transformed into a uniform top-hat beam. This powerful technology is integrated into the FISBA READYFlow module which provides a customizable, compact, multi-wavelength solution for generating top-hat beam arrangements.

Conclusion
A top-hat beam can significantly improve the performance of flow cytometer applications. By ensuring even illumination, researchers gain more accurate measurements, improved sensitivity, and higher data quality.

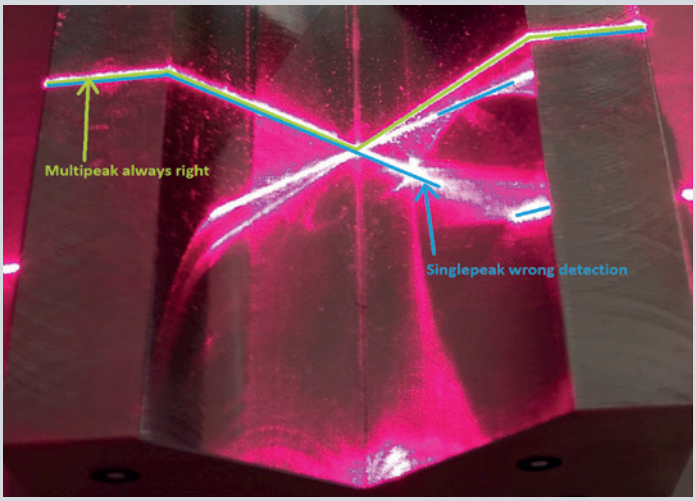
The FISBA READYFlow module offered either as Gaussian or as Top-Hat version is providing a practical, compact and flexible solution, making it easier than ever to integrate custom designed and specified laser illumination into existing or new flow cytometry systems.



3D REAL-TIME LASER INSPECTION OF HIGLY REFLECTIVE MATERIALS.



Which is the correct laser line to choose for the application?



Multipeak Line Finder algorithm identifies the correct laser line

GMP is very pleased to present our partner Photonfocus, a Swiss innovator in CMOS image sensors since 2001, that offers a cutting-edge solution for 3D laser inspection of highly reflective materials—an area traditionally plagued by inaccuracies due to multiple surface reflections. The advanced MultiPeak LineFinder algorithm within our camera's FPGA image processor, enables real-time detection of up to four laser line profiles with subpixel precision, while significantly reducing processing load on host systems. Unlike conventional methods such as Center of Gravity (COG), the MultiPeak LineFinder delivers up to 10x higher accuracy, even on specular surfaces like polished metals.

Common challenges in laser triangulation—such as surface texture, color variation, and environmental interference are handled through robust in-camera filtering. Key filtering methods allow developers to eliminate unwanted reflections and noise based on laser peak dimensions, adjustable via the free PFSDK API. This flexibility ensures that only relevant data is processed and transmitted, maintaining measurement integrity in complex environments.

With speeds up to 80,000 profiles per second, makes this suitable for fast moving objects, integrated real-time processing, and customizable interference suppression, Photonfocus cameras are ideally suited for industrial machine vision tasks including object recognition and quality control, where precision and reliability are critical.

photon focus *Photonfocus 3D Modular Concept Camera*

GMP
PHOTONICS & MICROTECHNOLOGY

Since 1977 GMP SA has successfully and trustfully served its customers by helping them succeed in their photonics projects.

In the field of scientific research and industry, GMP SA has always supplied the most innovative and best available photonic products and solutions.

We are present all over Switzerland, at less than 1 hour distance from most of our customers. The CEO and its team have a wide range of many years of scientific and industrial expertise, that is put to the benefit of our customers.

You have a need for products or systems in Lasers, Spectroscopy, Vibration suppression, Positioning stages, Controllers, Light and Beam measurements, Testing and analysis instruments, Particle sizing, Microscopy, we are the right partner for you.

Please check out our product guide at ***www.gmp.ch***

45 YEARS EXPERIENCE

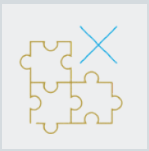
45 ANS DE RAYONNEMENT
LASERPIONIERE SEIT 45 JAHREN
LASER PIONEERS FOR 45 YEARS

EMPOWERING BUSINESSES THROUGH THE NEW PILOT LINE SERVICE

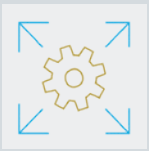
Researchers, original equipment manufacturers (OEMs), SMEs and start-ups sometimes face a multi-faceted challenge involving integrating sophisticated photonics components into complete, functional modules ready for mass production. These modules may also need to integrate products from various manufacturers to meet specific project requirements.

SEVERAL FACTORS ADD TO THE COMPLEXITY OF THIS INTEGRATION:

The need for diverse optical components such as fibers, lenses, gratings, shutters, and scintillators, along with the requisite integration expertise.



A lack of inhouse expertise or human resources, necessitating a reliance on external consulting companies to design these intricate modules.



The project's scale, which demands mid-to-high volume manufacturing capabilities.

The necessity for funding to support the project's execution.

HAMAMATSU'S SOLUTION A PILOT LINE SERVICE

Hamamatsu's one-stop-shop Pilot Line service in partnership with PhotonHub Europe stands out in providing a multi-faceted solution which includes:

Technical Expertise
Assistance in research, development, and implementation of advanced technologies, prototyping, and access to vast experience in producing market-ready, mass-produced solutions.

Business Resources
Hamamatsu's Pilot Line offers strategic business resources in conjunction with our partner, Photon Hub Europe, that aid businesses in improving operational efficiency.

Mentorship and Guidance
Hamamatsu and partners provide invaluable mentorship by connecting businesses to industry experts who offer tailored technical solutions, helping concept creators to make informed decisions.

Access to Funding
While capital is essential, applying for EU financial support is another aspect of Hamamatsu's Pilot Line commitment to supporting start-ups and SMEs. We partner with PhotonHub Europe to make this simpler.

Addressing these challenges requires a strategic approach that combines technical proficiency, project management, and financial resources to deliver an integrated solution that meets the specifications and timeline. OEMs, SMEs, and researchers frequently struggle with these issues resulting in promising ideas failing to reach their full potential. Our service was created specifically to tackle this, by bridging the gap between lab and full-scale manufacturing of photonics modules and integrated systems.

Visit pilot-lines.com to learn more!

IMPACT ON BUSINESSES

By addressing both financial and non-financial needs, Hamamatsu significantly enhances the chances of success for the development of photonic-related product or technology concepts. The combination of investment, technical resources and experience, and mentorship creates a powerful support system to turn a vision into reality.

Submit your idea by May 2025

As businesses continue to shape the future of innovation, having a robust support structure for making new photonics concepts a reality is crucial. Hamamatsu's Pilot Line service offers a unique approach that not only addresses the immediate needs of start-ups, researchers and OEMs, but also contributes to a flourishing entrepreneurial ecosystem.

Contact us if you have any questions: pilot.line@hamamatsu.eu

SWITZERLAND INNOVATION PARK INNOVAARE

SWITZERLAND INNOVATION PARK INNOVAARE: A THRIVING HUB FOR PHOTONICS AND QUANTUM TECHNOLOGY

At Switzerland Innovation Park Innovaare, deeptech companies specializing in photon sciences benefit from direct access to the Paul Scherrer Institute PSI's worldclass research environment. Colocated with PSI's Photon Science and Accelerator Divisions, as well as the advanced 450m2 cleanroom PICO (Park Innovaare Cleanroom for Optics and Innovation), companies gain access to toptier equipment and expertise.

"The proximity to PSI is key for us, which is why we make extensive use of the infrastructure at PICO for our optics," states Florian Döring, founder and CEO of XRnanotech. His company, a PSI spinoff, provides nanostructured X-ray optics such as apertures, gratings, X-ray lenses, or beam blocks required for imaging, microchip inspection, drug research, or material analysis.

One of the general challenges not only for Swiss industry is the assembly, packaging, testing and qualification of photonic systems. The Swiss Photonic Integration Centre (Swiss PIC) is a major player in the photonics field in the Innovation Park. Peter Moselund, CEO of Swiss PIC, explains: „At Park Innovaare, we offer our customers high-precision assembly and packaging solutions – from prototyping to volume production."

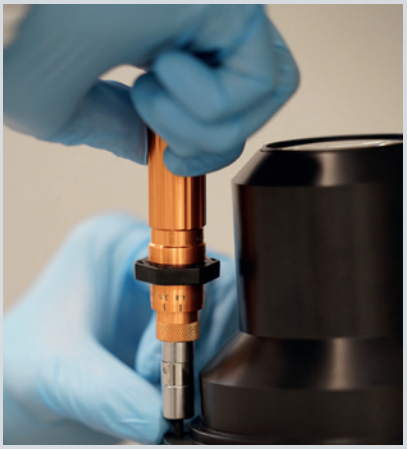
Equally critical are tools for controlling the design and manufacturing process. This is where Qnami, also based at Park Innovaare, sets new standards for high-precision sensors. Mathieu Munsch, co-founder and CEO of Qnami, explains: "Tools for controlling the design and manufacturing process of submicron materials are needed

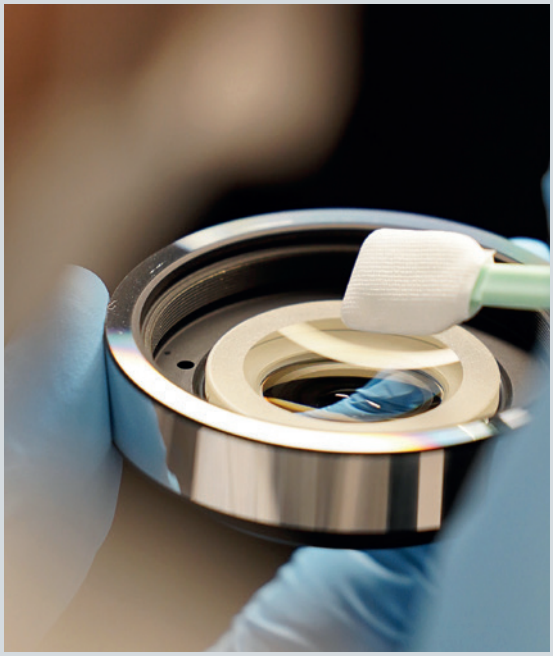
PICO (Park Innovaare Cleanroom for Optics and Innovation) cleanroom is also open to external companies.

to enhance product development and improve manufacturing yields."

Over 25 companies and 350 professionals operate at Park Innovaare alongside PSI. This unique ecosystem enables innovation not only in photonic and quantum technologies but also in the fields of life sciences, advanced manufacturing & semiconductor technologies and energy & sustainability. Switzerland Innovation Park Innovaare is one of six parks and a total of 16 locations of Switzerland Innovation.

FROM ENGINEERING TO MANUFACTURING





Founder Dr. sc. Daniel Iwaniuk with some sexperts from his team.

lentiltec is redefining the boundaries of optomechanical engineering. Evolving from a specialized engineering consultancy, the company now offers prototype and small-series manufacturing, meeting the highest industry standards. Equipped with a state-of-the-art cleanroom for precision lens assembly, lentiltec ensures unmatched quality in optical manufacturing.

OPTICAL AND MECHANICAL DESIGN

Serving a broad range of industries – including medical technology, industrial applications, defense, space, and semiconductors – lentiltec combines optical and mechanical design expertise with electronics and software integration. The team specializes in precision mounting technologies, adhesive techniques, and advanced manufacturing processes to deliver turnkey solutions.

BUILD-TO-PRINT MANUFACTURING

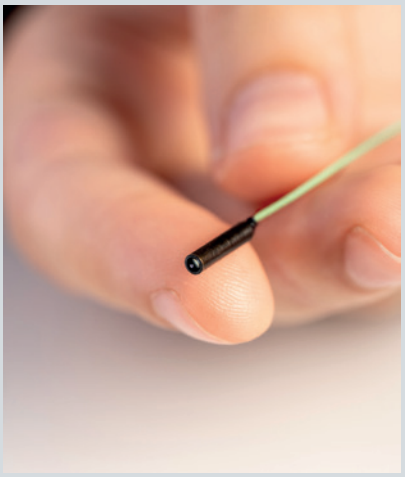
In addition to custom optical designs, lentiltec provides build-to-print manufacturing, producing optical components and systems according to existing customer drawings. Companies with pre-developed optics can also rely on lentiltec's expertise for efficient and precise production.

LENTILTEC – "CHALLENGE US"

With a commitment to innovation and precision, lentiltec invites businesses to put them to the test. Challenge them with your most demanding optical projects.

www.lentiltec.ch/know-how

PRECISION IN MICRO-OPTICS – EXCELLENCE IN MEDICAL IMAGING



Mikrop is a global leader in the miniaturization of high-precision optics with diameters starting from 0.3 mm. Since 1981, Mikrop has been developing, manufacturing, and assembling highly complex optical systems in close collaboration with its customers. With over 40 years of experience, the company sets benchmarks in the miniaturization of optical assemblies and offers integrated solutions for optical micro-components as well as custom micro-lenses and micro-systems.

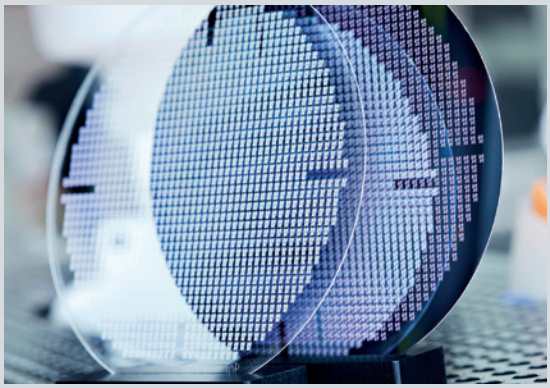
The product portfolio includes optical design, development, manufacturing, assembly, and functional testing of high-precision micro-optics from a single source. These products are used in medical technology, endoscopy, micro-sensor technology, and digital imaging.

Mikrop is headquartered in Wittenbach, Switzerland, with production sites in Switzerland and Serbia. The company employs around 200 dedicated professionals with extensive expertise in the development and production of micro-optics.

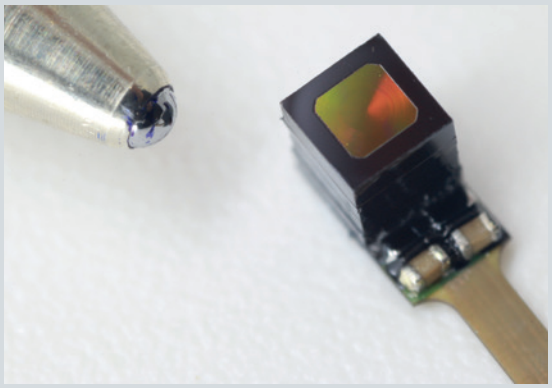
Mikrop values precision, efficiency, and reliability. The company works in a solution- and result-oriented manner, thinks future-oriented and open-minded, and fosters teamwork. These values are reflected in daily operations and contribute to the company's success.

With its long-standing experience and broad service portfolio, Mikrop is a reliable partner for customers worldwide seeking innovative and integrated solutions in the field of micro-optics.

BRINGING REVOLUTIONARY META-LENSES TO MASS MARKETS



NILT masters provide the highest quality AR waveguides for high-volume consumer wearables.



The metaEye™ camera, next to the tip of a pen, showcasing the real power of meta-optics.

Electronics have evolved remarkably over the decades, achieving extraordinary advancements in both performance and miniaturization. Optics, on the other hand, have looked the same for centuries.

Meta-optics is about to change that. Using lithographic defined structures (called meta-atoms) on a glass surface, optical lenses can be replaced by a completely flat surface, built at the nanometer scale. This technology is referred to as meta-optics, nano-optics, or metalenses – and it's the perfect revolutionary solution for miniaturization of next-generation smartphones, consumer electronics, and AR/VR.

NIL Technology (NILT), with headquarters in Denmark and an engineering center in Switzerland, is a pioneer in the commercializing of meta-optics. To demonstrate the power of meta-optics, NILT launched a series of ultra compact cameras using its metaCamera™ technology, which includes the award winning metaEye™ camera, specifically for eye-tracking purposes.

„I think that meta-optics will be everywhere, and it will happen sooner than many might think," said Theodor Nielsen, CEO of NILT, "and we are in a unique position to make it happen".

NILT is owned by Radiant Opto-Electronics Corporation (www.radiant.com.tw).
Learn more at www.nilt.com.

pointcloud

MAPPING A 3D WORLD IN MOTION

SEMICONDUCTOR TECHNOLOGY FOR HIGH PERFORMANCE 4D IMAGING

Pointcloud of office scene > 20,000 pixels

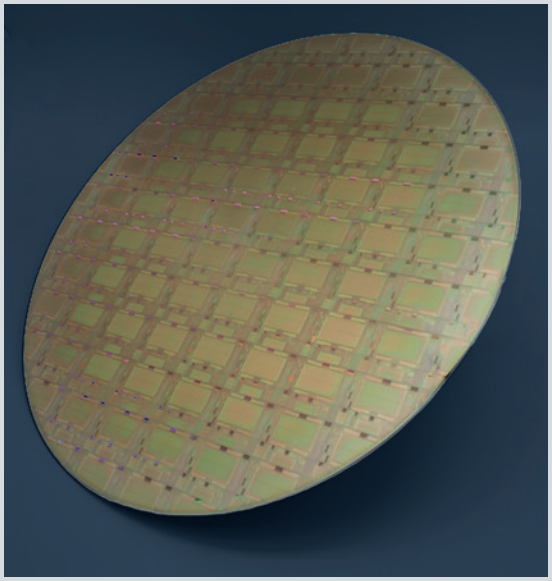
Ubiquitous, real time three dimensional (3D) mapping of our world in motion, with the same level of detail and accuracy as digital video and photography has achieved, is expected to have impact across all aspects of our lives. It accelerates the use of robots and drones by helping them reliably navigate their surroundings. It makes interactions with our environment safer, whether by improving the safety of our cars or the mutual awareness in environments where industrial machinery and robots operate in close proximity with human operators. In metrology, accessible 3D mapping allows us to measure objects faster and more precisely, whether for an interior design project, creation of a 3D printable object, or manufacturing of large aircraft parts and civil infrastructure projects.

Accurate motion detection and measurement enables new insights into human behaviors, health metrics and optimization in elite sports.

FMCW (Frequency Modulated Continuous Wave) LiDAR is emerging as the key technology that can deliver the precise and reliable spatial and velocity information necessary for sensing and understanding our environment. While many approaches have been pursued, the Coherent Focal Plane Array (CFPA) concept is emerging as the most promising option for viable commercial devices. The CFPA combines the performance of FMCW LiDAR ranging, with the scalability of a 2D focal plane array of pixels with each pixel acting as an FMCW LiDAR transceiver. The optical architecture is similar to a regular camera, with no moving parts ensuring reliability and simplicity of manufacturing. The result is a uniquely versatile and manufacturable platform that can deliver detailed 3D environmental maps and tracking of motion in real time in a wide variety of form factors, specification options and price points.

Supported by 300mm commercial Silicon CMOS manufacturing processes, the platform takes full advantage of the scalability and cost-effectiveness of advanced semiconductor manufacturing. By leveraging existing silicon CMOS manufacturing and progressively higher levels of integration, cutting-edge 4D sensing chipsets with increased performance can be delivered at lower cost. As the pioneer and leader in the development of CFPA technology Pointcloud provides an advanced

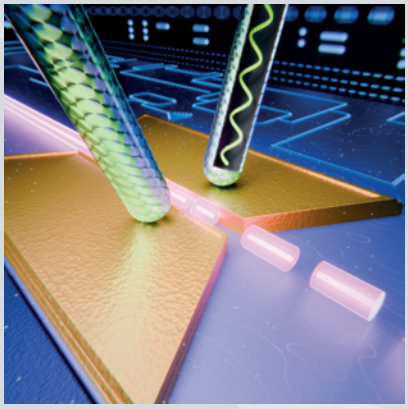
platform with flexible and scalable design options. With high resolution up to hundreds of thousands of pixels, millimeter accuracy, wide-angle coverage, and long-range detection to over 200m, Pointcloud's LiDAR chipsets are suited to meet the specific needs of each application. Compact, high-performance LiDAR systems can be designed for easy integration into application platforms for various industries, such as autonomous vehicles, industrial automation, mapping, mobile applications and more.



Short, mid and long range LiDAR photonic chips manufactured on 300 mm wafers

POLARITON

PLASMONICS: REVOLUTIONIZING HIGH-SPEED DATA COMMUNICATION

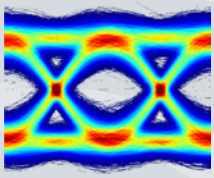


Plasmonics exploits the interaction between light and metal surfaces to achieve exceptional modulation efficiency by confining light at the nanoscale. Plasmonic electro-optic (EO) modulators operate at extremely high frequencies and are compact, offering significant advantages in cutting-edge data communication. A recent publication demonstrated a record-breaking 3-dB EO bandwidth of 1 THz measured on modulators fabricated by Polariton Technologies AG.

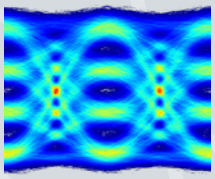
Enabling data rates exceeding 400G per lane addresses the growing demand for high-bandwidth applications, such as those required in AI clusters and data centers.

As the industry works towards ramping 3.2T-DR8 transceivers by 2027, plasmonic modulators provide the required performance today. Together with the right combination of electronics, drivers, and digital signal processors, ring resonator modulators (RRMs) offer high-speed operation (above 145 GHz), low insertion loss (sub 2 dB device loss), and low power dissipation. Plasmonic technology ensures future-proof performance for 800G per lane and compact footprint while maintaining scalability and integration benefits of silicon photonics.

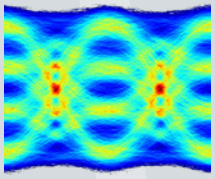
400G PER LANE FOR 1.6T AND 3.2T TRANSCEIVERS



224 Gbit/s, NRZ



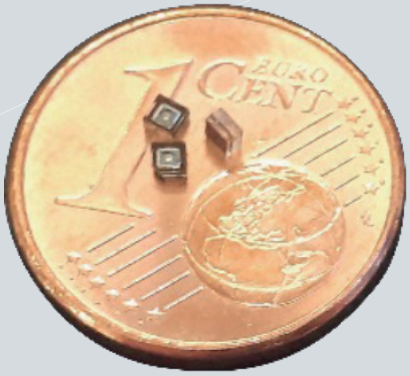
360 Gbit/s, PAM4



400 Gbit/s, PAM4

ENABLING THE FUTURE OF EMBEDDED INFRARED SENSING

4K-MEMS –
In the right light,
it all makes sense.



4K-MEMS specializes in broadband infrared emitters, designed for compact, embedded SWIR sensing solutions. By leveraging wafer-scale fabrication and packaging, 4K-MEMS introduces the smallest, most efficient, and cost-effective thermal micro-emitter available —unlocking new possibilities for gas sensing, embedded spectroscopy, hyperspectral imaging, and beyond.

4K-MEMS emitter chip advantages:

- Ultra-compact: An emitter package with a footprint of 2 mm^2, ideal for miniaturized devices.
- Broadband NIR and SWIR emission, optimized for spectroscopy, covering the range of 0.8 up to 5 microns.
- High-intensity point source for simple optical integration.
- Seamless integration of microlenses and filters increases optical efficiency and reduces system size.
- Rapid turn-on time, enabling real-time sensing in portable applications.
- Low power consumption.
- Surface-mount package for streamlined assembly.
- Scalable, low-cost wafer-based production, supporting high-volume markets.

By combining a broad spectral range, ultra-small footprint, and low power consumption, the technology bridges the gap between traditional spectroscopy and next-generation embedded sensor platforms. This makes high-performance infrared technology accessible for applications in the consumer, medical, and industrial markets.

RHYSEARCH: DELIVERING CUTTING-EDGE SOLUTIONS FOR THE PHOTONICS INDUSTRY THROUGH EXPERTISE IN OPTICAL COATINGS, CHARACTERIZATION, AND ULTRA-PRECISION MANUFACTURING

From high- and ultra-precision manufacturing to optical coatings and digitalization, this is where innovation begins! RhySearch, the Rhine Valley Research and Innovation Centre, is a partner of industry as well as academia and carries out research as a service to initiate high-tech projects.

RhySearch has a technical infrastructure that is unique in Switzerland and offers unrivalled expertise in ultra-precision manufacturing and optical coating at one location.

The Optical Coating and Characterization Lab offers innovative solutions along the optical manufacturing chain from design and production to the characterization of complex, high-quality optical coatings. The Ultra-Precision Manufacturing Lab has expertise ranging from high-performance milling and diamond turning to laser micromachining of steels, non-ferrous metals, ceramics, and carbides. The two labs are supported by the Digital Innovation Lab as a key cross-cutting technology.

RhySearch collaborates with Swiss and international partners to achieve the best possible outcomes for industrial projects. It is recognized by Innosuisse, as a research institution eligible for funding. Since 2025 RhySearch receives federal funding as research facility of national importance.

OPTICAL COATING AND CHARACTERIZATION LAB

RhySearch's infrastructure and expertise in optical coatings, combined with advanced characterization capabilities, enable the institute to support the industry in innovation projects, feasibility studies, prototype development and characterization services.

By focusing on complex coating designs, the thinnest conductive layers, 3D-shaped optics and new processes and materials, RhySearch improves the capabilities of its industrial partners and drives their innovations. State-of-the-art coating machines enable newly developed processes to be transferred seamlessly to industrial partners.

RhySearch uses Ion Beam Sputtering (IBS) to produce high-quality dielectric optical coatings. This technology allows the production of particularly dense, stable, and low-loss coatings on various substrates.

Atomic Layer Deposition (ALD) enables the precise deposition of materials in the sub-nanometer range on free-form geometries (e.g. highly curved lenses). RhySearch explores the use of this technology for optical applications with its sophisticated systems and develops new processes for its customers of the optical industry. In addition, RhySearch is working on a highly flexible coating tool to explore novel materials and processes.

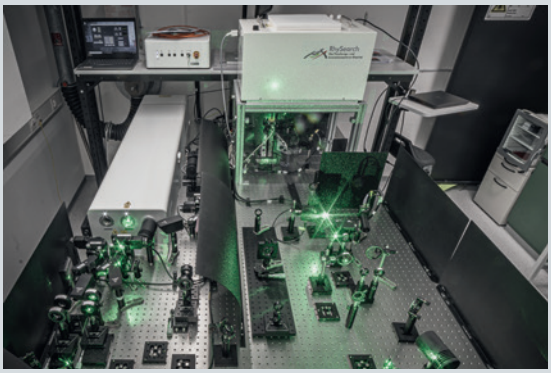
The Characterization Center, which is equipped with unique measurement tools for low-loss coatings and surfaces, enables in-depth analysis of the coatings produced in-house and provides immediate feedback for further optimization. Moreover, the equipment and expertise are also available to our partners to meet their analysis requirements.

Figure: Ion beam sputtering

HIGH- AND ULTRA-PRECISION MANUFACTURING LAB

The lab specializes in ultra-precision machining, achieving sub-micron tolerances and optical-grade surfaces (Ra <10 nm) without the need of polishing – crucial for optical applications, molds, and metrology. RhySearch uses a micro-turning center, enabling single-point diamond turning of various materials, ranging from aluminum to hardened stainless steel.

Figure: LIDT measurement setup by RhySearch

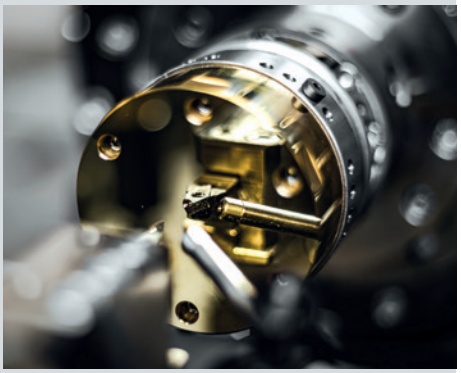


Another key area of expertise is high-performance milling, particularly for hard and brittle materials such as ceramics and carbides. The advanced 5-axis machining center strikes an optimal balance between precision and productivity, delivering both exceptional surface finishes and high material removal rates.

Laser micro-machining with femtosecond pulses serves as a bridge between micro-machining and surface structuring, seamlessly complementing the already-mentioned cutting technologies. The ultra-short, pulsed laser enables "cold" ablation, making it possible to machine a huge variety of materials with high precision – even transparent materials such as glass or polycarbonate.

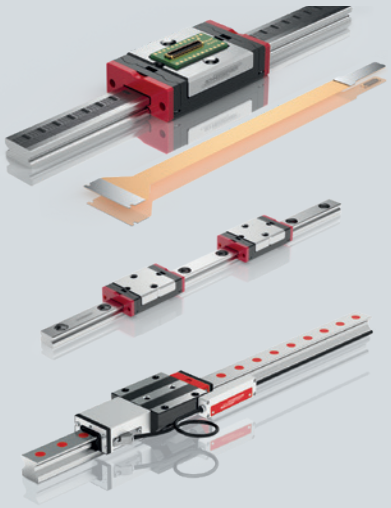
To support process characterization, the lab is equipped with cutting-edge measurement technologies, including dynamometers, one of the most precise multisensory coordinate measuring machines, and a scanning electron microscope.

Figure: Ultra precision turning center



The applied research focus lies in process optimization, machining hard and brittle materials, cutting tool development, automation, digitalization, and prototype support.

PRECISION LINEAR TECHNOLOGY AND INTEGRATED MEASUREMENT SYSTEMS FOR PHOTONIC APPLICATIONS



SCHNEEBERGER delivers precision mechanical solutions for demanding photonics applications. These solutions stand out due to their high repeatability, compact design, and dynamic performance. Our linear bearing, miniature guideways, microsystems, and integrated measurement systems are engineered for positioning and motion tasks in the micrometer range.

Miniature guideways MINIRAIL
MINIRAIL miniature guideways impress with their compact dimensions, high rigidity, and outstanding running characteristics. Featuring ball recirculation tracks, MINIRAIL is designed for dynamic load changes and multi-axis applications—particularly in optical alignment units, positioning systems, and modular platforms.

Miniature tables MINISLIDE & MINISLIDE with Integrated Measuring System MSQscale
The MINISLIDE miniature tables offer play-free, low-friction motion guidance in minimal installation space. The MSQscale variant integrates an optical measuring system directly into the guiding system, enabling high-precision position feedback without increasing system footprint. This makes it ideal for compact laser systems, optical scanners, or micromechanical actuators.

MEASURING SYSTEMS (SAM, MSQSCALE, MINISCALE, AMS)

1. **SAM – Absolute Optical Measuring System:** A high-resolution, absolute measuring system directly integrated into the profile rail. Ideal for dynamic applications requiring high precision and repeatability.
2. **MSQscale – Incremental Optical Measuring System Integrated in MINISLIDE:** Optical measuring system (analog or digital) built into the compact MSQ micro frictionless tables. Perfectly suited for tight installation spaces, such as optical alignment units or microsystems.
3. **MINIscale plus – Incremental Optical Measuring System**. Integrated directly into miniature guidways (with balls), enabling highly accurate incremental position detection. Available in digital or analog versions.
4. **AMS – Magnetoresistive Measuring System (Analog or Absolute) for Roller or Ball Guideways:** A robust measuring system designed for environments with harsh conditions. Available as AMSABS (absolute) and AMSAnalog/AMSDigital (incremental), it offers versatile use in mechanical and plant engineering.

PRECISION AND SYSTEM INTEGRATION AT THE HIGHEST LEVEL

The combination of compact linear guideways, low-friction microsystems, and directly integrated measuring systems provides seamless solutions for advanced positioning tasks in photonics applications.

SCHNEEBERGER – Precision motion and measurement technology from a single source.

SWITZERLAND'S OPPORTUNITY TO LEAD IN PHOTONIC CHIPS

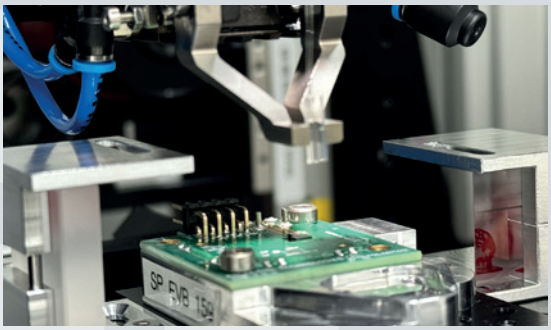
We are at a turning point. Photonic chips offer Switzerland with a unique opportunity to lead in deep tech, much like the early days of semiconductors. While Swiss startups are advancing photonic integrated circuits, scaling production remains a critical challenge.

Without industrial-grade manufacturing, even the most advanced technologies risk being overtaken by global competitors. Switzerland has the research and talent, but securing market leadership will require coordinated efforts between startups, investors, and industry partners.

One example of Swiss innovation in this space is CCRAFT, a startup developing cutting-edge photonic integrated circuit solutions. We recognize the significance of such initiatives and the broader opportunity they represent for Swiss deep tech.

At QBIT Capital, we strongly believe in Switzerland's potential to lead in this field. With world-class research institutions, scientific excellence, and precision engineering, this is a pivotal moment for Switzerland to establish itself as a global leader. Achieving this vision will require strategic collaboration and bold action. Now is the time to build the foundations for long-term leadership in photonic chips.

ENABLING INNOVATION IN PHOTONIC PACKAGING WITH SWISS PIC



As evidenced throughout this brochure, photonics technology is revolutionizing industries, enabling compact, high-performance solutions that push the boundaries of what is possible. From telecommunications to biomedical devices, photonic integrated circuits (PICs) and micro-optics play an increasingly vital role in modern technology. Switzerland has established itself as a global hub for photonics innovation, with numerous companies and research institutions developing cutting-edge photonic products. However, transitioning from laboratory prototypes to scalable, manufacturable, and cost-effective solutions presents significant challenges. One of the most critical yet often underestimated aspects of this process is photonic packaging.

Even when optical products reach mass production, packaging can account for 50 to 70 percent of total manufacturing costs. For low-volume or highly specialized products, the cost impact can be even greater. This is due to the complexity of integrating optical, electrical, and thermal management components with the sub-micron precision required for high-performance photonic devices. Unlike electronic packaging, where well-established industry standards exist, photonic packaging solutions often need to be tailored to each specific application. As a result, companies working on new photonic products face a steep learning curve, requiring expertise in precision alignment, bonding techniques, and thermal stabilization.

Many companies do not have the in-house expertise or expensive equipment to efficiently package photonic devices, and investing in the necessary infrastructure before a product reaches market viability can be financially risky. To bridge this gap, the Swiss Photonic Integration Center (Swiss PIC) provides state-of-the-art photonic packaging services, offering companies access to world-class infrastructure and technical expertise. Located at the Paul Scherrer Institute campus near Zurich, Swiss PIC specializes in the high-precision assembly of micro-optical systems and photonic integrated circuits.

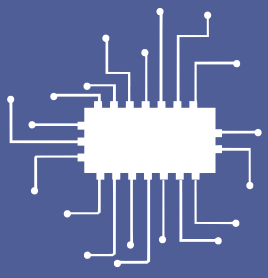
By combining advanced packaging technologies with deep engineering know-how, Swiss PIC enables innovators to develop, refine, and scale their photonic products.

One of the key challenges in photonic packaging is ensuring precise alignment of optical and electrical interfaces. Achieving sub-micron accuracy in fiber-to-chip and chip-to-chip connections or in the arrangement of micro optical elements is essential for minimizing losses and maximizing device performance. Swiss PIC provides solutions for these complex integration processes, ensuring robust and repeatable assembly that meets the demands of high-performance applications.

Additionally, electrical packaging techniques such as wire bonding, flip-chip bonding, and die attachment are critical for establishing reliable electrical and mechanical connections in photonic devices. Swiss PIC offers expertise in these areas, helping companies develop packaging solutions that balance performance, cost, and scalability.

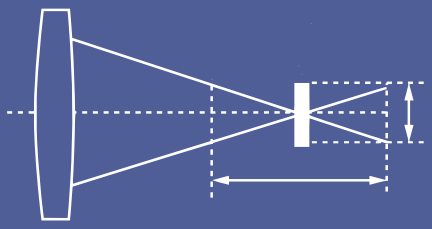
Early engagement with Swiss PIC can significantly improve the manufacturability and long-term reliability of photonic products. Many companies face costly redesigns when packaging is addressed too late in the development cycle. By integrating packaging considerations from the outset, businesses can avoid unexpected challenges and streamline the path to commercialization. Swiss PIC not only supports early-stage prototyping, starting from order quantities down to single units, but also facilitates the transition to scalable production. As products mature, Swiss PIC helps companies establish inhouse manufacturing capabilities or identify high-volume production partners, ensuring that packaging remains cost-effective and sustainable as the demand grows.

By providing access to specialized photonic packaging technologies, Swiss PIC lowers the barriers to innovation and accelerates the development of next-generation photonic devices. Whether for start-ups, research institutions, or established companies, Swiss PIC serves as a critical enabler of technological advancement, helping transform groundbreaking ideas into market-ready solutions.



PIC Packaging

Quantum Photonics Packaging



Micro optical bench

Swiss PIC offers photonic assembly and integration services for companies in Switzerland and beyond. Our focus is on active alignment processes achieving sub-micron precision such as fiber attach for photonic chips or assembly of micro optical systems. We combine this with electronic chip assembly services such as die bonding, wire bonding and soldering to build a complete system package. We serve industry and academia within diverse applications such as optical communications, sensing, quantum technology and space technology.

www.swiss-pic.com

COHERENT IN SWITZERLAND: DRIVING INNOVATION IN PHOTONICS AND LASERS

Coherent Corp. is a global leader in photonics related materials, networking, and lasers for the industrial, communications, electronics, and instrumentation markets. Headquartered in Saxonburg, Pennsylvania, the company was founded in 1971 to manufacture high-quality materials and optics for industrial lasers. Today, Coherent operates in more than 20 countries and employs over 26,000 people worldwide.

With two locations in Switzerland, Coherent plays a key role in the development and manufacturing of advanced photonics products.

Our team of over 400 employees drives innovation in optical and laser technologies, supporting industries from communications to precision manufacturing and consumer electronics.

Our Zurich facility houses a state-of-the-art compound semiconductor fab specializing in GaAs- and InP-based semiconductors. We develop and produce laser diodes and detectors for communications applications, powering optical transceivers that enable fast and reliable data transmission worldwide. From last-mile access to long-distance metro and undersea links, to short-range high-speed interconnects within data centers, our technology is fundamental to modern digital infrastructure. This includes enabling AI systems such as ChatGPT and Gemini, where vast amounts of data move seamlessly between GPUs and TPUs for model training or real-time inference.

In addition to communications, our Zurich facility manufactures laser diodes that power fiber lasers and DPSS (diode-pumped solid-state) laser systems used in myriad scientific and precision manufacturing applications. Industrial lasers are critical for

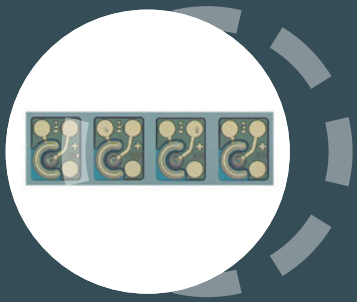


Fig 1a: VCSEL array for high-speed data transmission, enabling AI-driven computing and optical communication networks.

Fig 1b: Pluggable transceiver powered by laser diodes for high-speed optical data transmission.

Fig 1c: Optical interconnects enable high-speed communication between processors in a data center.

Fig 2a: Fiber laser processing head for precise copper welding in EV battery manufacturing.

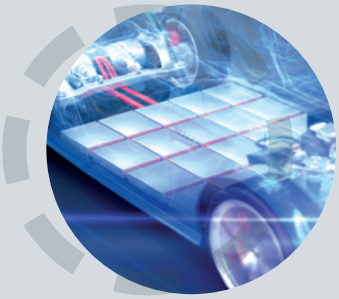


Fig 2b: Laser welding ensures precise and reliable assembly of battery packs in electric vehicles.

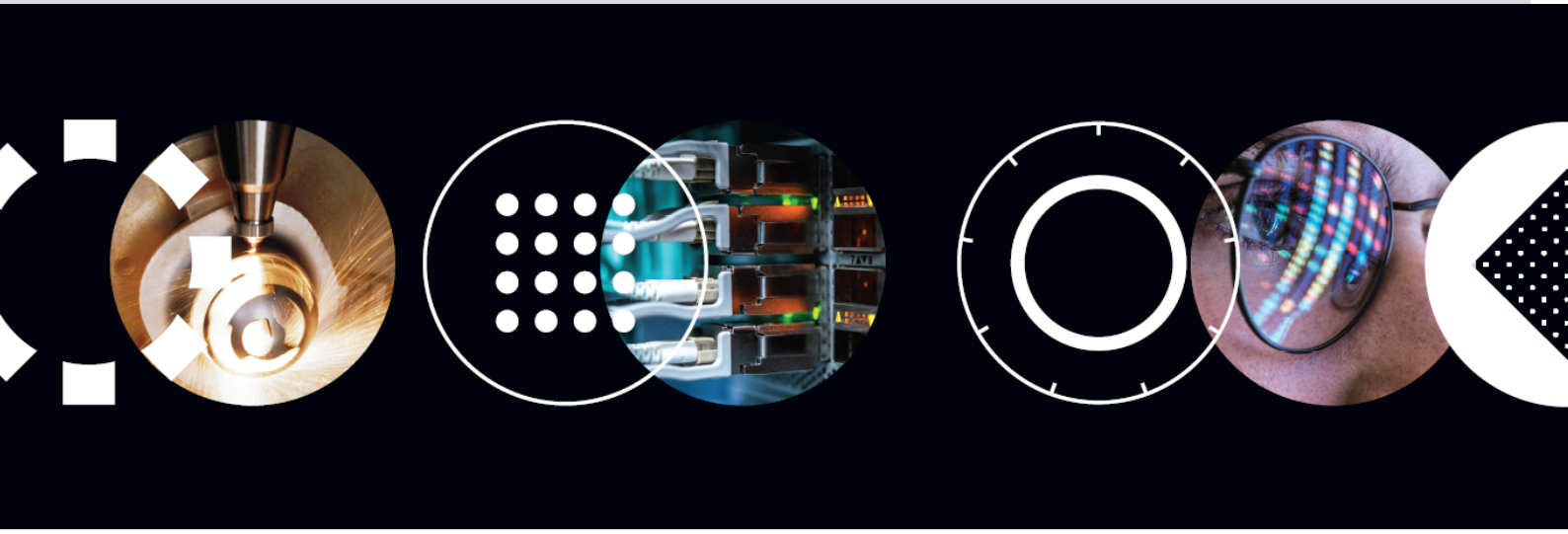
precision welding, cutting, cleaning, and marking, ensuring process efficiency and the highest possible yield.

Our technology also plays a key role in consumer electronics. Laser diodes developed in Zurich are integrated into facial recognition systems in smartphones, ensuring fast and secure user authentication. These compact, high-performance lasers enable structured light patterns for precise depth mapping and biometric scanning, shaping the way users interact with their devices.

Our Belp facility focuses on the development and manufacturing of advanced laser subsystems, processing heads, and sensor systems that deliver, and control laser beams for precision industrial applications. Coherent beam delivery solutions are integral to many precision manufacturing processes, including laser welding for electric vehicle (EV) battery production. As the auto industry moves toward sustainable transportation, our laser welding solutions provide the accuracy, durability and the high process yield required for next-generation EV battery packs.

Another key application of our laser technology is in the medical sector, where we develop laser systems for micro-precision drilling and finishing of medical devices. Our laser drilling technology is used to create eyeless needles for microsurgery, ensuring perfectly rounded blind holes with exceptional precision. These ultra-fine needles support delicate surgical procedures, improving patient outcomes and advancing medical technology.

With a strong commitment to research, innovation, and sustainability, Coherent continues to expand the boundaries of laser and optical technologies. From enabling global digital communications to advancing life-saving medical applications, our expertise and broad portfolio of solutions position us at the forefront of photonics technology.



PUSHING THE LIMITS OF PRECISION IN HIGH-SPEED AND NANO-POSITIONING

Located 30 km North of the city of Bern in Switzerland, MPS is providing innovative custom optomechanical solutions for the optics and photonics industry. The company counts 500+ employees spread over 3 locations in Switzerland and 1 location in Boston MA, USA. The solutions proposed to the market are usually based on technology platforms developed internally and customized to fit our customer requirements. Over the last two years, MPS Microsystems has achieved a breakthrough in ultra-precise motion control thanks to two innovative technology platforms: 1) high-speed positioning at micrometer precision (DynOptX) and 2) nano-positioning (NanoLinx). These innovations not only enhance the performance of optical and industrial systems but also open doors to a multitude of applications demanding unparalleled precision and reliability.

ULTRA-FAST HIGH-PRECISION MOTION (DYNOPTX)

This new generation of high-speed positioning systems is capable of achieving extreme speeds while maintaining micrometer-scale precision. These solutions enable minimal incremental motion below 50 nm, offering a cost-effective yet highly dynamic alternative to conventional piezoelectric solutions. Unlike piezo-driven actuators, MPS' technology provides ease of control, high force capabilities, and improved efficiency, making it suitable for demanding industrial applications.

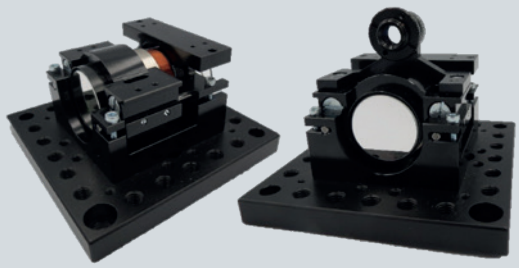


Figure 1: DynOptX reaches position accuracy below 1µm in a lap time below 10ms.

Key applications of ultra-fast high-precision motion include:

- Laser Cutting and Marking: Enabling ultra-precise beam positioning for higher processing quality.
- Liquid Chromatography-Mass Spectrometry (LC-MS): Improving sample analysis accuracy in pharmaceutical and chemical industries.
- Laser Eye Surgery: Facilitating delicate and high-precision corneal corrections.

NANO-POSITIONING SYSTEMS (NANOLINX)

The ultra-precise nano-positioning system Nanolinx achieves true nanometric accuracy. It is best suited for applications where even the smallest deviation can compromise performance.

Key applications of nano-positioning include:

- Confocal Microscopy: Enhancing imaging resolution and focus stability in biomedical research.
- Laser Tracking Systems: Enhancing spatial measurement capabilities in scientific and industrial applications.
- Optical Calibration: Improving precision alignment in high-tech optical instruments.

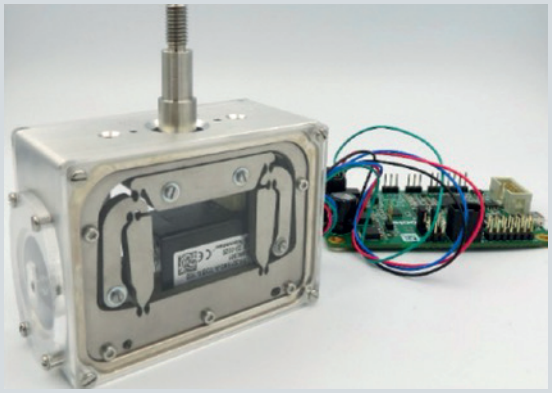


Figure 2: NanoLinX is dedicated for high load capacity like 500N, high accuracy with MIM of 50nm and small stroke applications like ±0.1mm

INTERFEROMETRIC QUALIFICATION AND INDIVIDUAL CALIBRATION (OPTITUNEX)

To further enhance precision, MPS has integrated an advanced interferometric measurement bench, allowing for precise qualification of each system. In addition to this, MPS has realized a calibration bench dedicated to individual system calibration through lookup tables. This approach not only ensures unmatched accuracy but also enables the generation of lookup tables that compensate for any residual errors. By systematically characterizing the motion behavior of each unit, MPS provides customers with precalibrated solutions that deliver repeatable and reliable performance in critical applications.

With these state-of-the-art solutions, MPS Microsystems continues to drive the future of high-precision motion control, delivering innovative technologies that redefine the limits of what is possible in high-speed and nanometric positioning. By constantly pushing the boundaries of speed, accuracy, and reliability, MPS ensures that industries relying on extreme precision can meet their most demanding challenges with confidence

A PHOTON ABACUS FOR QUANTUM NETWORKS AND QUANTUM COMPUTERS

Detecting and counting single photons is hard. Not because they are quantum objects, but because we literally bathe in them. Counting them without any error requires a superb level of precision from carefully designed devices. Interestingly, such detectors have the potential to unleash the power of quantum networks and photonic quantum computers.

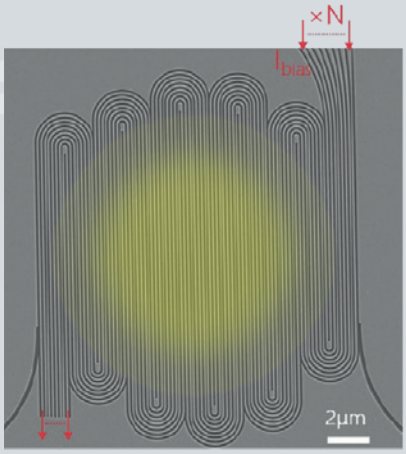
It is a relatively simple task to turn a single particle of light into a signal. Human eyes can rapidly turn a single photon into a large number of electrons. The state of the single-photon detection art, however, lies with superconducting nanowire single-photon detectors (SNSPDs).

SNSPDs work by biasing a single meandering line of superconducting material close to its critical current. A single photon will rapidly create a localised resistive hotspot, and the transition yields a sharp voltage pulse.

This technology provides near-perfect efficiency, picosecond-precise timing and ultra-low noise. This allows researchers, and now quantum technologies startups, to see ever-smaller gaps in time, and making previously impossible photonic applications possible.

While a standard SNSPD design can detect a single photon with >95% efficiency, they still reset in a time that is much longer than the actual time precision. Recent developments also show that they can differentiate between one and two photons. However, quantum networks and photonic quantum computer need much more than this.

Since 2018, ID Quantique has been pioneering the development and the commercialization of a new type of SNSPD using a novel design based on interleaved pixels, and this has several advantages. Several pixels bring the ability to resolve up to 8 photons.



Multi-pixel SNSPD design. N interleaved pixels can detect the light carry one or several photons found in the mode (in yellow) brought in by an optical fiber.

IDQ's Enterprise-ready ID281 Pro cryogenic system, designed to be integrated in quantum computers or quantum networks in data centres to remotely operate SNSPDs.

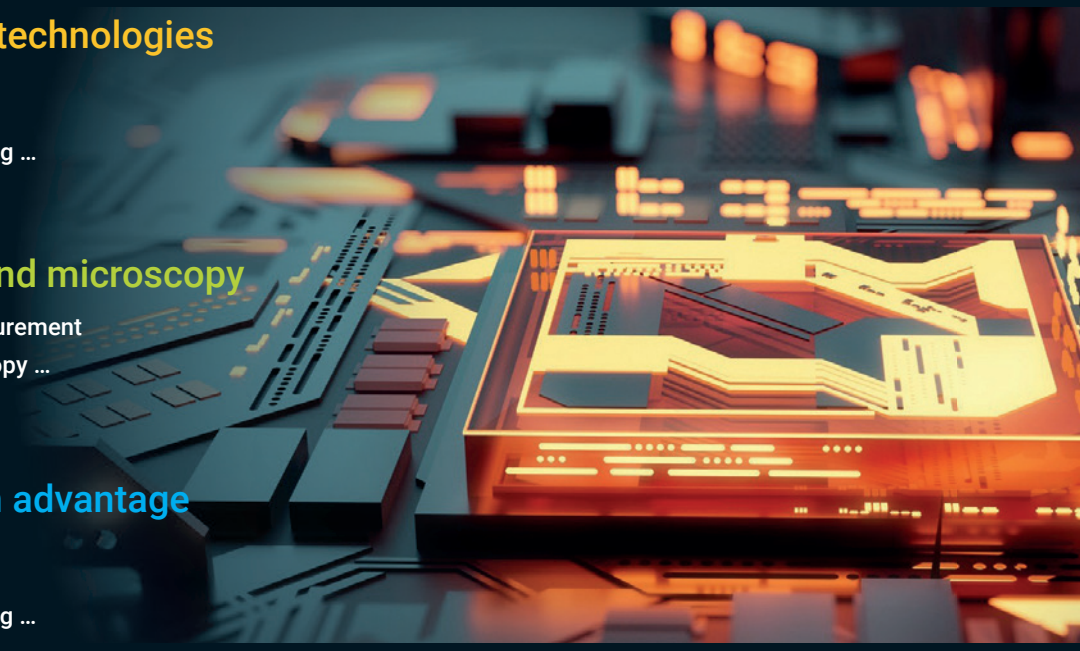
Several pixels also means that they all count simultaneously. We have thus developed the most precise and the fastest quantum abacus for photons up to date. It confers IDQ a leadership position in this type of detector.

Today, IDQ's SNSPDs end users are building quantum networks with detectors operating at more than 1 Gcps, a feature that was unthinkable just a few years back. Moreover, we partnered with quantum computing companies such as ORCA Computing's to deliver machines that offer new computing capabilities thanks to IDQ's photon-number resolving SNSPDs.

These features and our continuously improving detector and cryogenic system technologies promise to enable a quantum revolution that is moving fast in the commercial sector, with an immediate impact in the quantum computation space.

Enabling Quantum Technologies through **Photonic Sensing Solutions**

Empowering you to create the building blocks for a Quantum Internet



Driving emerging technologies

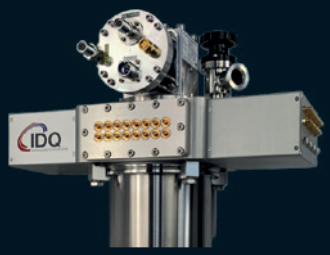
Quantum key distribution
Quantum relays & repeaters
Photonic quantum computing …

Honing imaging and microscopy

Fluorescence lifetime measurement
VIS, NIR and MIR spectroscopy …

Enabling quantum advantage

Quantum optics
Single photon sources
Metrology and manufacturing …



SNSPDs: the very best in single-photon detection

Compact and effective single-photon avalanche detectors

Picosecond precision measurement and control

Versatile and easy to use picosecond lasers

IDQ

Switzerland | USA | South Korea

Talk to us today info@idquantique.com
Find out more www.idquantique.com

sercalo microtechnology ltd

SERCALO – PRECISION OPTICAL MEMS FOR A CONNECTED FUTURE

Celebrating over 25 years of Swiss engineering excellence, Sercalo Microtechnology Ltd. has established itself as a global leader in the field of fiber-optic MEMS components.

At the core of Sercalo's technology lies its pioneering expertise in micro-electro-mechanical systems (MEMS). MEMS technology allows for the miniaturization of mechanical elements to microscopic scales, enabling the precise movement and control of light with minimal power consumption and exceptional repeatability. Compared to traditional optical switching technologies, MEMS offers superior scalability, faster switching speeds, lower losses, and unmatched durability.

Sercalo's early decision to focus on MEMS was driven by a vision to enable the next generation of optical networks and sensing systems. Today, this strategic choice positions the company at the forefront of innovation as industries increasingly demand miniaturized, highly integrated, and ultra-reliable photonic solutions.

A Unique Environment for Innovation Sercalo's location in Neuchâtel, a historic center of Swiss watchmaking, provides a natural foundation for excellence in microfabrication. The region combines world-class research institutions, a highly skilled workforce, and a tradition of mechanical precision, fostering the perfect environment for cutting-edge MEMS solutions.

A Comprehensive Product Portfolio

Sercalo's addresses a broad range of needs within the photonics sector. Their optical switches are recognized for ultra-low insertion loss, high return loss, and rugged design. Their variable optical attenuators combine fast response times with outstanding optical performance, ideal for dynamic power control in networks and sensing applications. Sercalo's beam steering MEMS mirrors are vital for free-space optical links, lidar systems, and advanced imaging applications.

Reliability That Reaches Beyond Earth

Sercalo's components are tested and qualified for use in the most demanding environments, including satellite communications and spaceborne sensing missions. Their MEMS devices are radiation-hardened and environmentally ruggedized, ensuring flawless operation where failure is not an option. This proven reliability has earned Sercalo a strong reputation among aerospace, defense, and industrial customers worldwide.

Innovation Driving the Future of Photonics

As photonics transitions toward higher integration, lower power consumption, and new application frontiers like photonic integrated circuits (PICs) and quantum communications, Sercalo continues to lead with next-generation solutions. Its ongoing investment in R&D focuses on further miniaturization, faster response times, and enhanced system integration, ensuring that Sercalo's products remain enablers of tomorrow's optical and quantum systems for a faster, smarter, and more connected world.

COOPERATIONS THAT WORK!

SWISS NATIONAL PHOTONICS LABORATORIES

In order to stengthen the coordination between various institutes working on the same topic we have decided to form and support the collaboration and coordination between institutes who work in the same field. We do call these cooperations Swiss National Photonics Laboratories, as they are designed to drive the research results through applications into SMEs.

PHOTONICS@BFH-TI

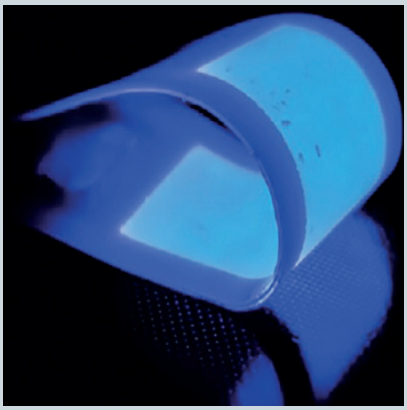
With +25 years of experience, BFH has a strong tradition in applied photonics and laser processing, supported by numerous Innosuisse/EU projects and industry mandates.

- Laser micro-processing with ultrashort pulses, from process development to high-throughput scaling with top quality
- Fiber technologies, operating a fiber draw tower with SIP Biel/Bienne, enabling rapid prototyping of custom fiber designs
- Optical coherence tomography (OCT), developing systems with cutting-edge optics and lasers for fast feasibility studies and sensing tests
- Compact, fiber-based and other specialized laser systems

Our expertise is part of bachelor programs, and we contribute to master's in Precision and Biomedical Engineering (with Uni Bern) and the Photonics profile of the MSE.

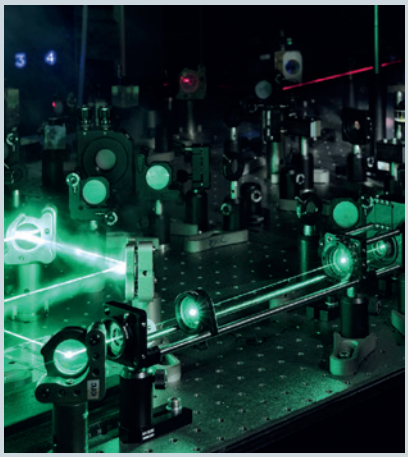
Contact person: beat.neuenschwander@bfh.ch
https://alps.bfh.ch, https://huce.bfh.ch/optolab

PHOTONICS@EMPA



Empa's photonics research spans a wide range of cutting-edge technologies. We develop graphene-based infrared photodetectors and miniaturized waveguide spectrometers, as well as enhanced perovskite quantum dots with phospholipid layers to boost lighting and display efficiency. Our mid-infrared laser spectroscopy enables precise gas analysis for environmental, industrial and medical use. We create photonic textiles for personalized healthcare and engineer piezoelectric and ferroelectric thin films for photonic integrated circuits. Our scalable methods support flexible perovskite solar cells and photodetectors for IoT, building- and vehicle-integrated photovoltaics, and space applications. Additional work includes organic thin-film detectors, plasmonic light-emitting and up-conversion devices.

Contact Person: frank.nueesch@empa.ch

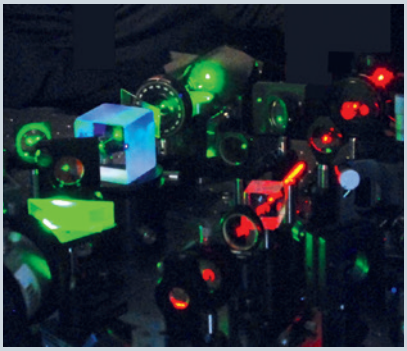


©Catherine Leutenegger

PHOTONICS@EPFL

EPFL is a major hub for photonics, with 30+ research labs ~ 300 PhD students and postdocs. Each year, 2–4 photonics-related startups emerge from EPFL, supported by a strong local ecosystem of nearly 100 companies active in photonics. EPFL plays a key role in the European photonics community through flagship EU projects like PhotonHub and 360 CARLA and holds a seat on the Board of Photo nics21. Notably, EPFL's president, Prof. Anna Fontcuberta i Morral, leads one of the photonics labs. Research spans nanophotonics, photonic integration, laser manufacturing, quantum photonics, ultrafast optics, bioimaging, biophotonics, optical computing, and solar energy. As part of our academic offerings, we provide a well-established master's minor in Photonics and a thriving doctoral program.

Contact person: pierre-yves.fonjallaz@epfl.ch
https://www.epfl.ch/research/domains/photonics/

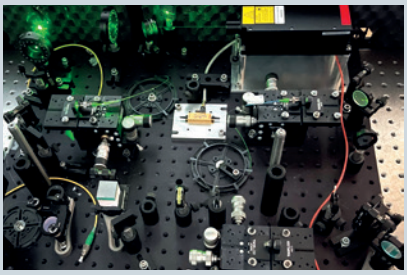


PHOTONICS@ETHZ

Research and teaching at ETH Zurich covers a broad spectrum of Optics, Photonics and Optoelectronics. It includes faculty from different departments specializing in optical materials, nanophotonics, nonlinear and ultrafast optics, biophotonics, optical communications, quantum optics and optical instrument design. Research activities at ETH benefit from joint programs, such as the ETH Zurich Optics Chapter (a student association), and from a state-of-the art nanofabrication (FIRST) and characterization (ScopeM) infrastructure.

Contact person: lukas.novotny@ethz.ch

PHOTONICS@FHNW



We design and prototype ultrafast lasers and optical systems, including Optical Coherence Tomography. Our work in laser micromachining supports advanced process development. In quantum sensing, we use time-correlated photons for precise clock synchronization and timing in quantum networks. We enable secure quantum (QKD) and high-speed classical free-space optical links, including ground-to-drone and high altitude platforms. Our fiber-optic interferometry enables precise vibration sensing, while photonic particle sensing supports air quality, environmental monitoring, and clean-room applications.

Contact person: Ronald.Holtz@FHNW.ch

PHOTONICS@HE-ARC INGÉNIERIE*

Bringing applied research to the Swiss industry

Photonics is transforming industry by enabling advanced measurement and inspection solutions. Many companies lack resources to develop such technologies – this is where academic partners bring value. Haute Ecole Arc Ingénierie has a strong record of industrial collaboration. We develop smart vision systems, fiber optic sensors, and interferometric devices across sectors like instrumentation, biomedical, and watchmaking. With expertise in signal and image processing, optical design, and machine learning, we deliver complete solutions and prototypes tailored to our partners' needs.

Contact person: Miguel.Llera@he-arc.ch
www.he-arc.ch/en/engineering/research-groups/metrology-and-industrial-vision/

Fiber optic pressure sensor based on a tip-Fabry-Perot interferometer.

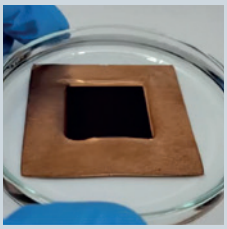
ESYLidar system + its green 532nm laser beam

PHOTONICS@HEIG-VD

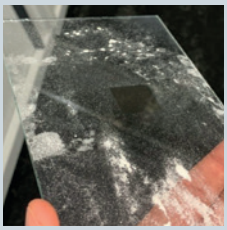
At HEIG-VD, there are several projects related to optics and photonics. These range from the simple use of optical and photonic sensors in R&D projects to specific topics like adaptive optics on large telescopes (AO), which could help us see through the blur of atmospheric turbulence for an unlimited view of the stars (Prof. Laurent Jolissaint). Among these projects, the attached photo shows interdisciplinary work combining mechanical design with optical/photonics systems for emission and detection in a LIDAR-type system. This work was carried out through several bachelor projects under Dr. I. Balin.

Contact Person: gilles.courret@heig-vd.ch

Diffraction grating



Hydrophobic surface



Self-cleaning surface

PHOTONICS@INSPIRE AG, ZURICH

Laser-based surface texturing for bio-inspired functional surfaces*

inspire AG, a Swiss research and technology organization affiliated with ETH Zurich, drives innovation in production technologies with a strong industry focus. With over 30 researchers in the field of laser technology, one core innovation domain is ultrafast laser ablation to develop scalable, high-impact industrial solutions. By creating micro- and nanostructures using advanced beam shaping, the team enables surface functionalities that improve wear resistance, friction control, wettability, bacterial resistance, and aesthetics – translating cutting-edge research into competitive advantages for industry.

** https://inspire.ch/de/forschung-fuer-die-industrie/fertigung-prozesse-qualitaet/laserablation/*

Contact person: Schroeder Nikolai, Nikolai.Schroeder@inspire.ch

PHOTONICS@FACHHOCHSCHULE OST

Sensor Innovation Hub and Photonics

Discover the Sensor Innovation Hub, Eastern Switzerland's competence center for miniaturized sensors and compact photonic solutions. Serving as a link between industry and research along the sensor value chain. We offer access to cutting-edge microtech infrastructure and specialized staff training.

Partner with OST – Fachhochschule of Eastern Switzerland and its Institute for Microtechnology and Photonics (IMP) for advanced research in photonics. Our expertise spans optical metrology, fiber optics, and laser processing, focusing on high-precision glass microfabrication and system integration. Young talents are trained in the MSE master's program "Photonic and Laser Engineering". Join us to innovate and excel!

Contact person : tobias.lamprecht@ost.ch

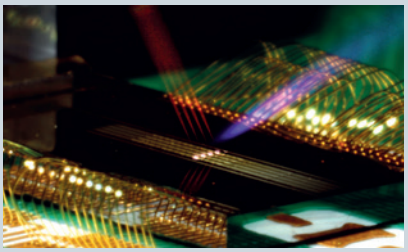
PHOTONICS@PSI

Photonics for Quantum and X-ray Science

The Paul Scherrer Institute has a long tradition in photonics. X-ray photons from the beam-lines are exploited for fundamental science and spectroscopy of advanced materials. In our 8" cleanroom PICO academic and industry partners work on the fabrication of diffractive optics and integrated photonics for a wide range of applications. The development of X-ray detectors for the beamlines at SLS 2.0, SwissFEL and internationally is a core competence.

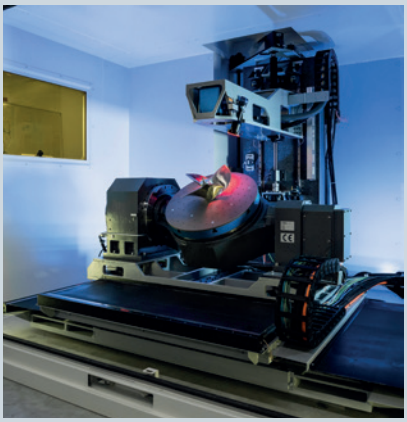
Since 2020 we have extended our focus to different quantum computing technologies – superconducting qubits, neutral atoms and trapped ions, within individual groups and as part of the ETHZ-PSI quantum computing hub, which is physically located at PSI. Integrated photonics is key to achieve scalability of ion trap quantum computing.

Contact person: kirsten.moselund@psi.ch



© Tereza Viskova and Noah Tajwar (PSI)

The image shows laser light at two wavelengths emerging from an integrated photonics ion-trap developed in collaboration with Lionix and ETHZ. Integrated photonics is key for scalable ion-trap quantum computing.

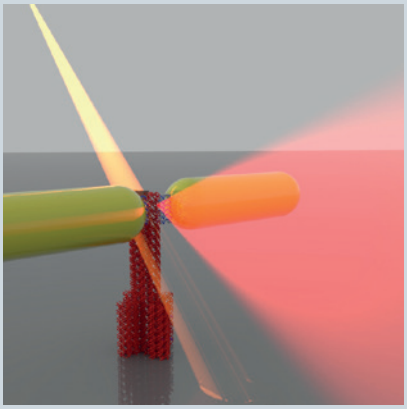


PHOTONICS@SUPSI

SUPSI applied research in Photonics

SUPSI is a leading Swiss R&D hub in photonics with over 50 active collaborations and a key player in the MSE Photonics and Laser Engineering profile. The Department of Innovative Technologies, through the Automation Robotics and Machines lab and the Applied Photonics and Optoelectronics Scientific Area, drives innovation in laser systems and machines, femtosecond and Additive Manufacturing processes, and advanced industrial 3D optical inspection. In Photonics, applied research is pursued at both the national level, with Innosuisse projects like AOI3DSCAN, and the European level, with Horizon Europe funded projects like Femtosurf and Mesomorph, developing high-precision, high-productivity manufacturing systems for complex microsystem fabrication in microfluidics, sensing, and biomedicine.

Contact person: federico.mazzucato@supsi.ch
www.supsi.ch/en/web/isteps/automation-robotics-and-machines
www.isea.supsi.ch/en/applied-photonics-and-optoelectronics

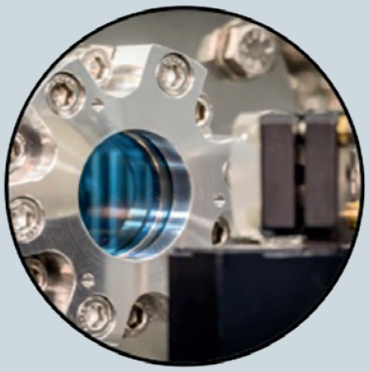


PHOTONICS@UNIVERSITY OF FRIBOURG

The University of Fribourg is a dynamic center for photonics research, known for combining interdisciplinary expertise across physics, materials science, and bio-inspired technologies. Its core strengths include nanophotonics, plasmonics, optical antennas, bio-inspired photonic materials, and advanced optical characterization methods. Active leadership of Switzerland's National Center of Competence in Research (NCCR) „Bio-Inspired Materials" underscores its prominent role in innovative photonic materials development, aiming to translate insights from nature into practical applications. This integrated research environment enables impactful contributions to photonics at national and international levels.

www.unifr.ch/phys/en/research/groups/scheffold/
www.ami.swiss/physics/en/groups/bioinspired-photonics/
www.unifr.ch/phys/en/research/groups/acuna/

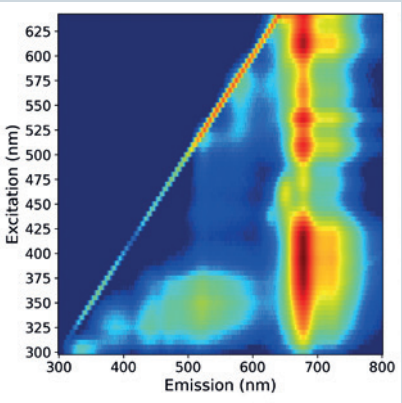
PHOTONICS@THE UNIVERSITY OF NEUCHÂTEL (UNINE)



UNINE is a leading center for photonics research, specializing in ultrafast lasers, optical frequency combs, photonics for time-frequency research and precision metrology. UniNE develops cutting-edge technologies such as high-power ultrafast lasers, GHz-repetition-rate sources, laser stabilization systems, and advanced optical coating solutions. These innovations span from the extreme ultraviolet to the mid-infrared, supporting breakthroughs in spectroscopy and high-power laser science. Moreover, the team has pioneered original techniques for frequency noise analysis and comb stabilization, both theoretically and experimentally. UniNE plays an active role in national and worldwide photonics initiatives, fostering strong academic and industrial collaborations.

Contact person: thomas.sudmeyer@unine.ch

PHOTONICS@ZHAW



Applied photonics research for sensing, imaging, and energy technologies

At the Zurich University of Applied Sciences ZHAW the research in photonics drives innovation in time-resolved spectroscopy applied to analytics, diagnostics, and sensing. We develop focus-adjustable optics and micromechanical actuation and are active in researching cryogenic measurement techniques and quantum sensing applications. Our work includes fabrication, characterization, and simulation of organic solar cells, OLEDs, and memristors using organic and perovskite materials. We advance biomedical optical sensors, terahertz photonics for non-destructive testing, and integrated RF- and optoelectronics. Imaging research spans RGB, IR, multispectral, event-based camera, alongside 3D-ToF and LiDAR systems for precision spatial sensing.

Contact person : Francesca Venturini, vent@zhaw.ch
https://www.zhaw.ch/en/engineering/research/platforms/photonics

WE SAY THANK YOU

We would like to thank all our partners who have made this brochure possible. We value your trust, support and engagement for the Swiss Photonics community.

COMSOL

csem

EQUIPMENT · SOFTWARE · PROCESSES
esp-engineering

FEMTOPRINT

FLUXiM
boosts your R&D - www.fluxim.com

GMP
PHOTONICS & MICROTECHNOLOGY

HAMAMATSU
PHOTON IS OUR BUSINESS

IDQ

NIL TECHNOLOGY

optotune

pointcloud

POLARITON
TECHNOLOGIES

SWITZERLAND
INNOVATION
PARK INNOVAARE

pic
Swiss Photonics
Integration Center

4K-MEMS


Why is chip scale development important?
This is st
art for ac
labs, and
IonQ star
10 years


ate of the
ademic
it is where
ted almost
ago.
PHOTONICS

WHERE WE ARE

SWISSPHOTONICS

Sihleggstrasse 23
CH-8832 Wollerau
info@swissphotonics.net

WWW.SWISSPHOTONICS.NET

SWISS PHOTONICS

JS/SCHWEIZ • Concept: JS/MEDIA TOOLS A/S • 182493 • www.jsschweiz.ch