

Swiss Photonics

Photonics is recognised worldwide as one of the key technologies of the 21st century. Switzerland is no exception, quite the contrary. This small country in the heart of Europe, without being part of the EU, with very modest natural resources, has managed to distinguish itself over the centuries and especially since the beginning of the 20th century by a fabulous commercial, banking and technological know-how in a stable and peaceful environment and by its capacity to innovate.



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Thanks to its leading position in precision engineering and the machine industry, Switzerland was active in optics at an early stage. Traditional optics are manufactured by the precision engineering industry. Conversely, the laser is an ideal tool for the precision industry.

Precision engineering, microtechnology and the most sophisticated machines can only be qualified by optical measurement and analysis procedures. The Swiss photonics industry, with almost 10,000 employees, currently generates a turnover of CHF 4 billion (€4 billion), which is about 5% of the European market and almost 1% of the world market. Considering the leverage effect of the photonics industries on the entire Swiss economy, a turnover of about CHF 40 billion is made possible by photonics in Switzerland. The Swiss photonics industry consists of a few large players such as Oerlikon, Leica, Trumpf, Bystronic and ASML, but above all of more than 200 highly innovative small and medium-sized companies. These companies have a very high export rate and very high added value products. Nothing very original, no doubt, for those who know the sector, but these characteristics are pushed to the extreme in Switzerland. Despite the high value of the Swiss franc, Swiss products, especially photonics, are very attractive to foreign customers.

Many of these companies obviously have their origin in the academic world and research institutes. In Switzerland, the Swiss Federal Institutes of Technology in Zurich and Lausanne (ETHZ and EPFL) and the institutes of CSEM, EMPA and PSI (to which one can add the IBM research centre in Rüschlikon) are the main drivers of major discoveries in photonics and their commercialisation. The universities of Geneva and Bern and a network of universities of applied sciences also play a very important role (HES-SO). We will focus later on the French-speaking part of Switzerland, the Romandy. In the meantime, here are some examples of well-known companies in German- and Italian-speaking Switzerland: II-IV Laser Enterprise, Axetris, Cedes, Diamond, ESPROS, Exalos, Femtoprint, Fisba, NKT Photonics, Regent Lighting, Huber&Suhner, IMT, Optotune, Reichle de Massari, Safran, Volpi and WZW. Towards the end of the 1990s, Swiss photonics was strongly reinforced by national programmes of the Swiss Federal Institutes of Technology (ETH Board) to fund research in the field, OPTIK I/II. ● ● ●

The aim of these programmes was to close a gap in industry with the help of academic expertise. Collaboration between research and industry in the field of photonics was promoted and the necessary technologies were developed. It was particularly thanks to this support that Switzerland became a world-class photonics cluster at that time. This was followed by the collapse of the telecom bubble around the turn of the millennium and a strong diversification into other application areas, but this type of public funding unfortunately came to an end despite the significant benefits recognised by all parties involved. To quote the White Paper - Photonics Switzerland of Swiss MEM: "When new technological approaches develop rapidly and disruptively, and entirely new product possibilities are opened up, and at the same time other fields of technology are influenced, a broad-based, jointly executed national programme is necessary and useful.

The disruptive aspect is still present and we believe that government support continues to be justified, as many countries around the world have understood very well (especially China, South Korea and Singapore). The Swiss government has in any case recently decided to continue to support Swiss photonics through the organisations Swiss MEM and Swissphotonics within the framework of the Innosuisse programme entitled "National Thematic Network Innovation Booster". Swiss MEM is the Swiss association of the machinery, electrical and metal industry (MEM industry), and photonics is one of its key components. Swiss MEM estimates that the share of its members' products with photonic functions will increase from 40% in 2017 to 70% in 2025. The Swissphotonics association is the national platform for Swiss photonics and is primarily active in the field of networking and strategic development of the field. The association is fully integrated in European efforts within the framework of the European technology platform Photonics21 and EPIC, in particular with regard to the organisation of events to propagate photonics in the main application areas.

Photonics in Romandy

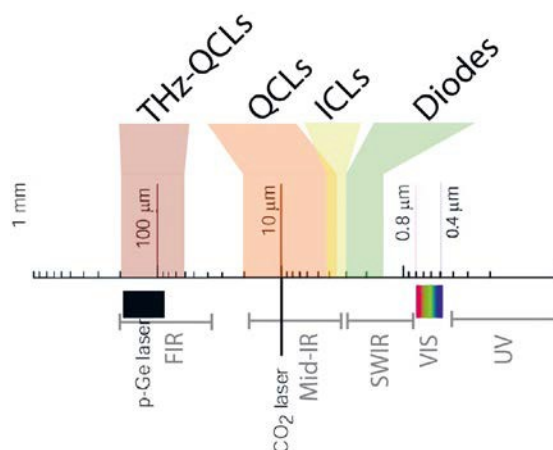
The French-speaking part of Switzerland has a population of 2 million (a quarter of Switzerland). Apart from the well-known example of the multinational Logitech and a few large users such as Bobst and Swatch Group, the photonic sector in French-speaking Switzerland is based on at least 70-80 small companies, not always SMEs (CP Automation, LASEA, Sercalo, Solaronix, Synova, Silitec, Tech-Laser, etc.). The École Polytechnique Fédérale de Lausanne (EPFL), a young university with very high university rankings (3rd in WURR 2020), is a powerful driver of innovation and produces 2 photonic start-ups per year (Abionic, Attolight, CREAL 3D, Fastree 3D, Gamaya, Innoview,

Ligentec, Lyncee Tec, MicroR, Miraex, Morphotonix, Nanolive, Rayform, Samantree, Viventis, etc). Many of these start-ups are integrated into the EPFL Innovation Park in Lausanne, a city where more than half of all photonic companies in French-speaking Switzerland have their headquarters. Among more than thirty professors in photonics, Michael Graetzel, inventor of the solar cell of the same name, and Tobias Kippenberg with his quantum components, are the best known. EPFL's specialities in photonics are biophotonics, nanophotonics, micro-optics (the Jura's watchmaking heritage has something to do with it) and photovoltaics. Swissphotonics has an antenna at EPFL and will be happy to provide you with more details on the players in French-speaking Switzerland.

Portraits of photonic companies in Romandy

Alpes Lasers, St-Blaise

Alpes Lasers is a Swiss engineering company that



is a pioneer in the field of lasers, in particular infrared lasers used in various applications such as gas detection. In 1994, Prof. Jérôme Faist (currently at ETH Zurich) demonstrated the quantum cascade laser (QCL) experimentally for the first time with his colleagues at Bell Labs. Back in Switzerland, he started up Alpes Lasers, a company that has succeeded admirably in growing organically and occupies a central position in Switzerland and Europe. Alpes Lasers strives to promote its medium IR and THz lasers to customers in a wide range of markets, from civil and industrial security to defence. Alpes Lasers participates in, or coordinates, a large number of European projects, which allows it to constantly investigate new horizons and connect with many new customers.

Omnisens SA, Morges

Omnisens produces distributed fibre optic sensors and offers reliable solutions for monitoring energy infrastructures, enabling early detection and precise location of events that could damage the installation.



These measurement techniques provide information on operating conditions and allow monitoring by measuring variations in temperature (DTS), stress (DSS) and vibration (DAS) along the fibre.

Omnisens is a Swiss company active worldwide in offshore wind generation for the monitoring of electrical cables, in the oil industry for the monitoring of oil and gas pipelines, both onshore and offshore. It is a leader in long-distance distributed fibre optic measurement. Omnisens' products are based on stimulated Brillouin scattering.

Ziemer Ophthalmic Systems AG, Port



Manufacturer of state-of-the-art medical devices in the field of ophthalmology and precision mechanics for the watch industry. The product range currently includes devices for refractive surgery and laser cataract surgery as well as precision instruments for diagnosis. Among the many innovations, Ziemer produces the only mobile femtosecond laser on the market.

This system is used daily by medical personnel in sterile environments. The system requires little training to operate as all essential steps of the image-guided laser process are automated and computer-controlled. A patented low-energy laser process provides excellent clinical results that cannot be achieved with traditional surgical instruments and techniques.

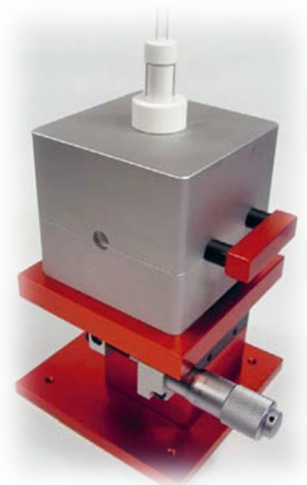
GMP SA, Renens

Distributor of high-tech systems and instruments in the fields of lasers, spectroscopy, microscopy and anti-vibration. In addition to this,

GMP markets its own integrating sphere for the measurement of quantum efficiency.

Designed by qualified and experienced spectroscopy specialists at EPFL, the G8 sphere has been developed to have an excellent signal-to-noise ratio, to avoid backscattering of the excitation light and possible contamination of the sphere during sample handling, and to provide a high level of protection against contamination and to facilitate the calibration process. The result is a neat, practical and easy-to-use device for high

precision and repeatable measurements. Sample changeover in a few seconds. The GMP SA G8 sphere allows the determination of the quantum yield with a reproducibility of a few percent and an accuracy of less than 10%.



Insolight, Ecublens

Develops a new type of solar panel for agrivoltaics to combine agricultural and electrical production on the same land. In the context of the energy transition, a major challenge is to deploy solar power plants without sacrificing agricultural land. Agrivoltaics offers interesting deployment prospects for installers, as well as synergies on mounting structures (in greenhouses). Conventional panels, however, degrade agricultural yields due to their opacity and are struggling to break into this market.



Insolight panels solve this problem by combining high efficiency with translucency. The optical technology allows direct light to be collected with 29% efficiency while allowing diffuse light desirable for photosynthesis to pass through.

The company, which has 15 employees, has just launched its pre-series of modules for the first installations with customers, with 1000 modules expected in 2021. It is focusing on design and marketing - while production is outsourced to industrial partners in Europe.

And also:

Agie Charmilles New Technologies SA, Geneva. A world leader in the machine tool sector, especially electro-erosion, high-speed milling and high-performance (with clamping and palletising systems). Agie Charmilles has innovated with its range of machines for 3D laser texturing.

ID Quantique SA, Geneva. Founded by scientists from the University of Geneva, ID Quantique is the world leader in quantum cryptography for network encryption, quantum key generation and random number generation.

H. Glass SA, Villaz-Saint-Pierre and EPFL. Aesthetic and transparent solar panels based on coloured solar cell technology (DSSC) developed by Dr. Michael Grätzel (EPFL).

Suss Microoptics SA, Hauterive. High quality refractive and diffractive microoptics for fibre coupling, collimation and beam homogenisation.

SCHOTT Suisse SA, Yverdon. Manufacturer of quality optics used in industrial applications such as laser systems, optomechanical and optoelectronic devices, metrology and medical devices, as well as in aeronautics, space applications and the watch industry. ●

