

micro nano Mag

MICRONARC

SENSORS & MEASURING DEVICES
AERONAUTICS & SPACE
MACHINES, INDUSTRIAL EQUIPMENT
& AUTOMATION
AUTOMOBILE
ELECTRONICS, MICRO-ELECTRONICS
MEDICAL
ENERGY
WATCHMAKING
TELECOMMUNICATIONS
MATERIALS
R & D + SERVICES
SUB-CONTRACTING
SECURITY



The Magazine of the micro-nanotech Cluster of Western Switzerland

I - 2014



MicroRobots



Ultimate machining



Light & nanomaterials

Time

Precision

Western Switzerland



The future of microtech

Reliability

Innovation

Non-circular watch gears



Turtle Automata



New micro-surgery



Flying gyrotourbillon



The new Swatch



Dear reader,
With this inaugural issue of our newly-branded *micro & nano magazine*, Micronarc will take you on a fantastic journey! The only journey that starts with a step, and entirely fits in the very first footprint!



Danick Bionda,
Secretary General
of Micronarc

We will travel together into the world of the invisible, the unthinkable, the undoable; a world rarely reached by humans. By the time you arrive, you will be amazed to discover an entire community of pioneers, workers, scientists and entrepreneurs, from Western Switzerland, measuring the invisible, shaping the unthinkable, and assembling the undoable. Each of them focuses on a very specific aspect of micro and nanotechnology:

- some are developing new artificial materials that offer unique performances and properties;
- smart micro-motors to assist surgeons;
- others built a culture for innovation to incrementally reduce size and consumption in order to drastically increase mobility and autonomy;
- some are sensing almost imperceptible pressure, accelerations, or chemicals;
- adding clever CLR-LIGA motifs readable by a laser to avoid counterfeiting;
- using Digital Holography Microscopy to read 3D topography at nano-scale resolution;
- all this is supported by prestigious institutes, Technology Transfer centers and facilitators for business expansion in Western Switzerland;

- plus the vast network of microtechnology experts and companies which represent a fertile heritage, acting as the economic matrix that is nourishing and keeping alive the beating heart of this Swiss ecosystem.

In parallel, constant efforts are made in the development of more accurate, reliable and cost effective, processes to manufacture microsystems. Then, when the final product is completed, it might require a specific coating to adapt and resist to its environment so that it can be integrated, for specific applications, into the human body.

An important breakthrough, where Western Switzerland acquired and consolidated unique experience and tradition, is the area of high precision machines and tools; the need to process, cut, drill and polish all kind of materials and micro-components, as well as to assemble them in a fast and accurate way.

This entire community shares the same spirit to challenge and expand the limits of their daily activities through one key word: **multidisciplinary**. They are driven by passion but also by patience, which is pragmatism and perseverance, because working at the micro or nano-scale is a complex task that takes time, money and numerous failures to achieve reliable results.

Fruitful interactions between industry and the educational system are in place and crucial – not only to prepare the coming generations of new talents but also to listen intensively to their needs – because let's not underestimate the fact that the young generation might soon represent the majority of early adopters for high-tech products and interfaces built with microsystems and nanotech-

nologies. Specifically among them: tablets, smartphones, Google Glass, and internet of things' devices (estimated by ABI Research as 30 billion devices wirelessly connected to the internet by 2020).

To conclude this journey, we also invite you to come back to the source, re-visiting the roots of Swiss' microtechnology, with the «Turtle Automata» and the inside cover of our magazine: ingenious beauty in slow motion and magnificent Art Pieces! These are exceptional accomplishments to illustrate the traditions and endless quest for perfection of Western Switzerland.

If you want to meet us or participate to some events, please check the «Events» section that includes our coordinates.

On behalf of the Micronarc Team, I wish you to **be inspired** by this first issue of our micro&nano Mag.

Happy reading!



New technologies, innovation, diversification, economic and scientific cooperation are topics that appear regularly in the economic development programmes of public authorities, both in Switzerland and abroad. However, these topics are often approached in a rather conceptual way, and transforming them into concrete actions is not always easy.



Michel Probst, Chairman
Conference of
the Departments of the
Public Economy of Western
Switzerland

The position of the Conference of Cantonal Departments of the Public Economy of Western Switzerland (CDEP-SO), of which I have been Chairman since 2012, is to encourage pragmatism, while keeping in line with a clear vision. A public economic policy is all the more relevant and sustainable when it can on the one hand anchor itself within the local economic fabric and contribute to its development and, on the other hand, integrate into a network of business relationships rich in complementary features and opportunities. The heirs of a centuries-old tradition of highly developed industrial culture, over 2,000 specialised companies, resolutely international and multilingual, employ tens of thousands of highly qualified professionals in the micro & nanotechnology sectors. These constitute the dense fabric that is essential for creating very high level innovative research,

whether in watchmaking, electronics and microelectronics, telecommunications, security, or the measuring instruments and sensors and biomedical tools sectors. The skills of this exceptional industrial network are manifested as well, of course, in the essential areas of machines, industrial equipment and automation, and also for the benefit of the fields of automobiles, aeronautics, space technologies, new materials and energy. Today, microtechnologies occupy a strategic position in industry worldwide, representing one of the most dynamic sectors. With innumerable fields of application and the possibility of transferring their technologies from one sector to another, microtechnologies hold an undeniable advantage which enables businesses to diversify and open themselves up to new markets.

Coming from a canton that has a strong watchmaking tradition, I cannot ignore the significant technological innovations that arise from this sector. These are often due to subcontractors, who are a goldmine of new ideas and applications for the watch brands.

The techniques related to measuring time and its by-products are now well-known. The watchmakers have exploited them thoroughly. Innovation can come only from the improvement of these inventions through new materials or new miniaturisation techniques. In this respect I would cite as an example, without naming the brand, a manufacturing firm in the Jura which has developed and put on the market the watch with the lightest-weight mechanical mo-

vement (20 grams including the watch-band) ever produced in the world with a tourbillon movement.

Another example of the use of microtechnology know-how is a company that uses its expertise in working with ceramics not only in watchmaking products but also in the medical field with the production of dental implants. Aware of these assets, and in order to foster the emergence of a real skills centre in micro and nanotechnologies in western Switzerland, the French-speaking cantons created the Micronarc Platform in 2009. Its mission is to:

- develop and promote its companies, the regional scientific, technological and economic positioning in the area of micro and nanotechnologies, its infrastructures for training, R&D, technology transfer and services;
- promote the best possible interaction of all its players;
- attract other creative forces, encourage vocations, and provide a successor generation there;
- offer a source of information that is regular, reliable and accessible, a tool for the transmission of knowledge and exchanges, both professional and public.

The magazine that you hold in your hands aims at achieving these objectives and, more generally, at making a contribution to strengthening the economic position of western Switzerland.

I wish you pleasant reading!

An expert in integrated wireless systems, on January 1st 2013 Professor Christian Enz was appointed Director of the Institute of Microengineering (IMT) in the prestigious Ecole polytechnique fédérale de Lausanne (EPFL). In this interview, Professor Enz considers the potential for the ever-increasing interconnectivity of microcomponents as well as a recent merging between research institutes.

▲▲ BY JEAN-LUC RENCK

Turning points in the micro - nano world



1. *Microcity, Neuchâtel*

2. *Swisscube has been in orbit since September 23, at 720 km above Earth.*

Heading to its forties, the IMT has experienced a big leap in recent years?

A significant change, indeed! A former institute from the University of Neuchâtel, founded in 1975, the IMT was integrated into the EPFL's School of Engineering in 2009. The IMT includes 28 professors, 25 laboratories employing 545 researchers and collaborators. The IMT is active in every domain concerning micro & nanotechnologies, including health equipment, greentech and energy, space technologies, watchmaking, robotics, security challenges, communication, imaging and so on... The Neuchâtel site of the IMT is involved in applications and feasibility in phase with the needs of the Swiss industry, while our site in Lausanne is oriented more towards fundamental research and education.

Will the IMT in Neuchâtel also benefit from the brand of the new building «Microcity»?

Another important step: with CHF 70 million of public funding from the Neuchâtel State, Microcity is one more strong sign for the future of high-end micro & nanotechnologies in Western Switzerland. Microcity allows the IMT to consolidate on one unique site existing labs, while developing new ones by increasing the number of academic chairs from 10 to 14. Some of these focusing on watchmaking and medtech and privately sponsored.

One interesting role of academics is to take the risks of exploring new areas, developing new methods and principles, then transferring them for implementa-



«Microcity: one more strong sign for the future of high-end micro & nanotechnologies in Western Switzerland»

Christian Enz,
Director of IMT

tion to other facilities. Soon, 300 IMT researchers will work fruitfully in a unique concentration of structures and competences: the CSEM (Centre suisse d'électronique et de microtechnique) is in very close proximity, as is the Neode incubator for start ups. Furthermore, we are surrounded by the specialized Schools of Applied Sciences and a world-class industrial sector with a tradition of excellence. The IMT is involved of course in larger networks, firstly through collaborations with more distant specialized Schools for Applied Science: for instance in Fribourg (domotics) in Bienne (biomed) or in the Valais (new energies). Neuchâtel itself is growing, with greentech and energy, with one of the biggest – and oldest – labs for photovoltaic (PV-LAB) which will play an eminent role in the Swiss Federal Strategy 2050 for energy.

A context particularly suited to tackle new challenges in a new era?

There was a quick but tremendous evolution in the performances, size and energy consumption of microcomponents, say atomic microclocks with ulti-

mate precision, sensors, processors, information storage and communication elements... Presently all of these achievements are converging in complex systems of the smallest sizes. Furthermore, these systems themselves are more and more linked to each other forming interconnected, intelligent systems at larger scales through the wireless «internet of things».

In a sense, microsystems are coming closer to living organisms?

They are sensing a vast array of parameters in various environments. They are computing, making choices, communicating, functioning autonomously and efficiently with low-power energy. Through many tiny interconnections we can now imagine smart and safer buildings for instance – the EPFL buildings are already a model in this respect! And microsystems come still closer to life while sensing and working for us in the most direct way. For example, through very small auditory prostheses, sensitive artificial skin or muscles. The IMT has many projects converging towards the life sciences inside the «nano-tera» pool of projects which gathers many academic, institutional and industrial partners from throughout Switzerland. These projects focus not only on health but also on the management aspects of energy, environmental issues and security. Research and implementation players also form an organism, with cells and organs which communicate and work together, with evolutionary forces at work. This is why and how the IMT can take up the challenge to make important contributions to the future.

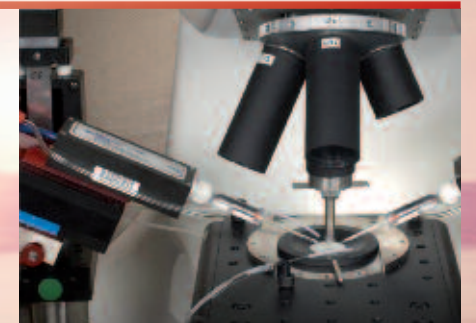


Life is much about sensing. Living creatures need to perceive what is pertinent, useful and vital to them. Human societies too.

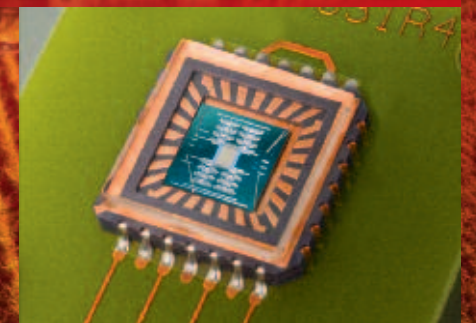
Today, technology is producing small sensors and smart sensing systems in quantities measured by billions. These devices can assess in finite detail the quality of our environment, our health, while ensuring the quality of our products as well as the accuracy of other devices...

Western Switzerland is a preeminent place in this new stage of global evolution.

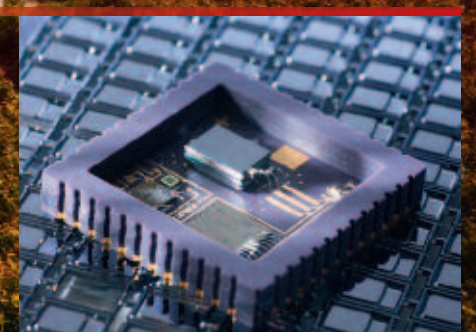
Photo: The Lavaux-Oron, Vaud



Digital Holographic Microscope, coupled to a electrophysiology platform



Limitless applications for enhancing our interaction with the world



Harsh Environment MEMS motion sensor

Several technological keyholes have been solved to provide a unique and efficient system for dynamical 3D optical profilometry: Digital Holography Microscopy (DHM). The DHM provides many new research and industrial solutions from measurement to analysis in both material and life sciences.

▲▲ BY YVES EMERY, CEO LYNCEE TEC SA

TRUE real time 3D measurement solutions



How to measure complex 3D movements of MEMS moving at several tens of MHz?

- How to characterize the dynamical behavior of a microfluidic device?
- How to measure in real time the deposition of nanometer-thick transparent patterns?
- How to monitor changes of dielectric constants associated with an electromagnetic field?
- How to quantitatively characterize in situ corrosion or dissolution processes, or wear at high temperature and high humidity?
- How to characterize dynamical deformation of parts due to mechanical constraints?
- How to measure on-flight industrial parts on the convey tray with nanometer vertical precision without stopping it?

The keyhole for all these measurements is the need for a strictly non-scanning method which obtains information in a very short lapse of time, so that the displacement or the deformation of the sample during that short time is small compared to the spatial resolution of the system. Exploiting the power of holography, Lyncée Tec SA provides a unique solution for this type of applications with its **Digital Holographic Microscopes (DHM)**. They are the world's fastest 3D optical profilometers with nanometer scale resolution.

Holography is a Nobel prize-winning technology which enables one to simultaneously record on a support which is sensitive only to intensity (such as cameras) both the intensity and the phase of the wave. The phase of the wave is concretely the position of the wave as a function of time. It enables to measure distances along the optical path direction, with sub-nanometer resolutions.



«Making the invisible visible»

Etienne Cuche, COO

At the end of the 1990s, taking advantage of the efficient use of the increasing power of **Digital** processing, researchers at the EPFL developed a method to retrieve the phase information out of a single grab of hologram by using a standard camera. Before this patented invention, the acquisition of several holograms was needed to retrieve the same phase information.

Lyncée Tec was created in 2003 to exploit this technology and by applying it to **Microscopy** and thus started to commercialize **DHM**. Joint fundamental research and technology transfer (CTI) projects with the EPFL and UNIL (University of Lausanne), combined with Lyncée Tec's 10 years of industrial experience integrating customers real needs and issues have further increased the robustness of the system, from its beginnings as a key invention at the EPFL to its evolution into a mature system at customer sites. Lyncée Tec now proposes a full range of complete solutions, from raw measurements to complete analysis, responding to the customer's precise needs. A worldwide distribution network now covers nearly 40 countries. and microscopes manufactured by Lyncée Tec are now installed throughout the world. They are used for general 3D optical profilometry and as a unique tool for novel dynamical investigations in both material and life sciences.

One of the originalities of the unique optical design of DHM, contrary to traditional white light interferometers, is its ability to make use of the full range of standard microscope objectives. This includes the possibility to measure with

immersion objectives in liquids, or to measure with optimal quality through glass in a vacuum, in high temperatures, or more generally in any environmental conditions.

DHM is widely used currently for MEMS analysis. It is seen as the successor of laser Doppler vibrometry. Dedicated electronics enable synchronized measurements and MEMS excitation for frequencies up to 25 MHz. Full 3D measurement is a real need for characterization of complex movements, and for microsystems with complex geometries (i.e. presence of sacrificial holes, flexure joints, or combs).

Micro and nanofabrication often entails superimposing conductive and isolating patterns with thicknesses ranging from a few nanometers to a few microns. Optically, some of these layers are totally or partially transparent, while others are reflective. Laser scanning microscopes as well as white light interferometers fail in this range of dimensions in retrieving the real 3D topography of transparent layers. It has been demonstrated that multiple wavelength DHM combined with advanced reflectometry-based algorithms provide a unique, efficient and precise solution for such problems.

Measurement up to a rate of 100 measurements per second and on-flight measurement capabilities ensure ideal applications for industrial inspection such as defect detection in the watch industry, surface finish measurements on prostheses, or 3D topography measurement in semiconductors industry.

Coming from a major company specialising in sensors and high-precision industrial scales, Philippe Fischer joined the Swiss Foundation for Research in Microtechnology (FSRM) in 1990 and was appointed director in 2007. Since 1994 he has been President of the association sensors.ch, a meeting point for players in the domain of high-end sensors in Switzerland.

▲▲ BY JEAN-LUC RENCK

Connections that make *sense*



When did sensors.ch have its start?

Sensors.ch was founded in 1987 with the goal of organizing the 1989 edition of the international congress IEEE Transducers, being held in Montreux. After the event the association carried on since the terrain was fertile and hence the industrial atmosphere was pretty favourable: Switzerland had rapidly gained a worldwide reputation in the domain of sensors and systems devoted to measuring flows, pressure, acceleration or detect vibrations, light, chemicals, etc. Some manufacturers sell 90 to 100 % of their production abroad. One can also assess Swiss reputation in this field by the numbers of institutes and enterprises attending important international meetings like «Sensors + test» in Nuremberg, IEEE MEMS, Eurosensors, and IEEE Transducers, just to name a few examples.

What feature role does sensors.ch play today?

The Swiss sensor industry has two very dense clusters, one in western Switzerland and one around the Zurich-Winterthur region. The 130 members that comprise the association are both enterprises and individuals from throughout Switzerland. Furthermore, sensors.ch favours regular contacts between representatives from the two clusters, thus acting as a precious information pathway and a meeting point between two powerful networks of swiss competences.

Although the association is not commercially oriented, bringing together researchers, manufacturers and potential customers provides fine opportunities to meet the right partners for joint ventures. sensors.ch can also be an entry for

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«Connectivity is everywhere largely due to the integration of intelligent sensors».

*Philippe Fischer,
President of the association
Sensors.ch*

external customers looking for a specific partnerships.

Some other involvements?

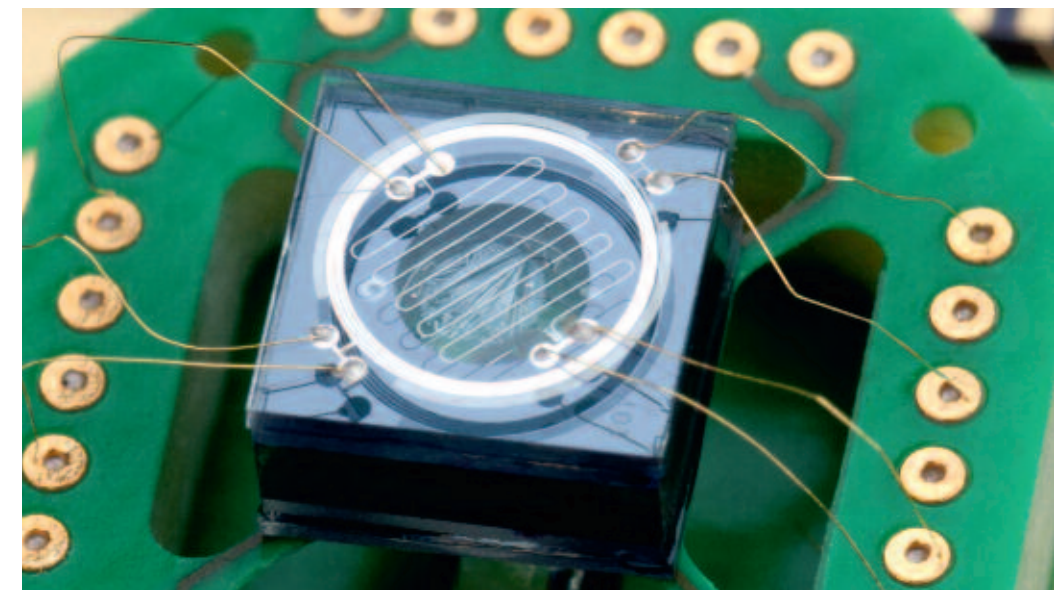
Annually, sensors.ch proposes approximately six visits to manufactures in the field of sensors and integrated systems. And in the same spirit in which we favour contacts between today's actors in the field we also encourage the next generation through prizes to young researchers – in 2013 we were happy to reward the designer of a 360° camscope using ingenious distance sensors. As well, sensors.ch also provides material support to some promising bachelor projects - one of them is presently developing a flock of artificial ducks where individual moves are in coordi-

nation with the others through ultrasonic signals.

In 2012, sensors.ch celebrated its 26th anniversary. To mark the occasion we sponsored the realisation of an interactive hand force measurement system in the Swiss Science Center Technorama.

To summarize: what is the essence of sensors.ch?

Every day sensors are being integrated into innovative, cutting-edge micro-nano devices of all kinds with high degrees of increased complexity, often combined with increased connectivity between devices and networks in a phenomenon called the «Internet of Things». Connectivity is everywhere, largely due to the integration of intelligent sensors. Every step in innovation in this sector multiplies the connections not only between devices, but also people and companies... sensors.ch is committed to this fruitful sharing of information, ideas and vision.



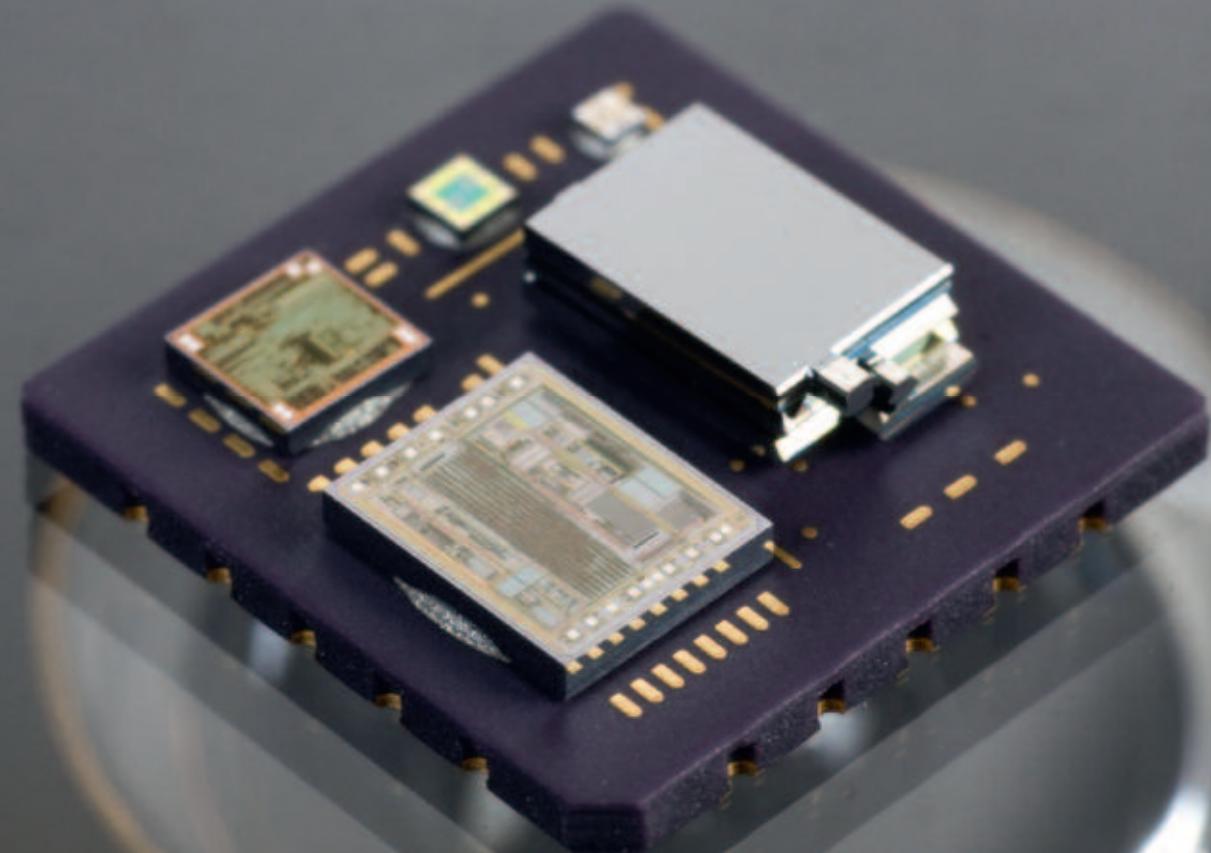
Colibrys is a world-leading supplier of standard and semi-custom, high-end MEMS-based motion sensors for Energy, Mil/Aerospace and Industrial & Instrumentation markets, especially for use in harsh-environment and/or safety critical applications.



1. Open view of an open loop MS9000 accelerometer from Colibrys.

2. E-Space located in the Y-Park of Yverdon-les-Bains.

High-end MEMS based accelerometers



Resulting from a spin-off from CSEM in Neuchâtel, Colibrys had developed its activity for more than ten years before being successfully acquired in January 2013 by the group Sagem (Safran), the European leader in navigation systems.

After more than 25 years of MEMS manufacturing and development in Neuchâtel, the company is currently moving to a new facility in the E-Space building (located in the Swiss Technopole Y-Park in Yverdon-les-Bains). The move will take place during the last quarter of 2013 and the new facility will be back to full production in April 2014.

MEMS accelerometers

The success of MEMS accelerometers started in the early 90's with the acceptance of the product by the automotive industry. Today, the adoption of MEMS motion sensors is continuously growing thanks largely to the generalized use of accelerometers and gyroscopes in consumer electronics as well as high-end Industrial and Mil/Aerospace applications. While in the early phases of development MEMS accelerometers replaced existing devices, they recently have become real enablers for new functionali-

ties previously not possible. Stabilization, guidance and control are examples, but now MEMS devices can boast also a huge presence in cell phones and gaming consoles. The key success factors in these applications are performances, reliability, size and weight and cost.

Today, high-end Colibrys MEMS accelerometers are well recognized on the market and find growing success in various applications in Mil/Aerospace, Testing, Industrial & Instrumentation and Energy markets.

High-end motion sensors

Colibrys is a one-stop-shop manufacturer, offering the full supply chain from design to manufacture and final testing of high precision, Swiss made, state-of-the-art accelerometers. This guarantees independent sourcing to our customers, providing optimization of performance, cost and time to market.

Contract Manufacturing

Colibrys also undertakes «contract manufacturing» for select customers with mature demand for volume manufacturing of silicon MEMS chips, or assemblies that are compatible with established processes and infrastructure.



«We like to consider ourselves as a 1-stop shop for high-end motion sensors»

Philippe Krebs, Product Line Manager, Inertial, Colibrys SA

Worldwide presence

Colibrys is represented worldwide by professional distributors and local agents, supporting all key markets and applications with a very high focus on customer service. The regional support provided by Colibrys sales representatives is reinforced by a website providing on-line access to exhaustive lists of documentation on products and services, application specific notes, technical and company presentations, relevant news and contact information of all our worldwide partners.

Colibrys is continuously increasing its quality of services and bringing its high-end products into your application through its global presence.

www.colibrys.com

Switzerland's best kept industrial secret finally revealed

Photo: «La Gruyère», Fribourg



Western Switzerland has rather unknown assets for international business. Why have hundreds of international companies already established an affiliate in the so-called *Greater Geneva Berne area*?

▲▲ BY MARLYSE WEINBERGER

The *Greater Geneva Berne area* (GGBa) was founded in 2010 when six cantons of Western Switzerland (Berne, Fribourg, Vaud, Neuchâtel, Geneva and Valais) took the strategic decision to unite their strengths in boosting their attractiveness towards international companies. In order to better understand how this organization can be useful to international companies, we interviewed Philippe D. Monnier, Executive Director of the *Greater Geneva Berne area*.

Concretely, what is the role of the Greater Geneva Berne area (GGBa)?

Philippe D. Monnier: In broad terms, our role is to facilitate the expansion of international business. More precisely, our job is to make it easy for foreign companies to establish an affiliate in Western Switzerland and to start successfully their business operations in our region. Our services are of strategic and practical nature as well as confidential and free of charge.

How many international companies are already established in the GGBa?

PM: Several hundreds foreign companies have established affiliates in the GGBa. Recently, we supported a combination of small high-potential businesses and large groups in different industrial sectors. The majority of these companies originate from surrounding countries such as France, Germany and Italy, from the US, and increasingly from the BRICS (Brazil, Russia, India and China).

Do you target particular sectors?

PM: We typically target the sectors where we have strong clusters such as micro & nanotechnologies, medical technologies, biotechnologies and information & communication technologies. Naturally, many of these sectors are interconnected.

Which functions do these international companies perform in the GGBa?

PM: Typical functions are international sales and after-sales services, research & development (often in collaboration with local universities), intellectual property management, high-value added manufacturing and regional headquarters.



«our job is to make it easy for foreign companies to establish an affiliate in Western Switzerland»

Philippe D. Monnier,
Executive Director of GGBa

Why did these international companies choose the GGBa?

PM: A key reason is the strength of our clusters. Other reasons are the good business conditions of Switzerland: overall stability, pro-business liberalism, high productivity and reasonable costs (including taxation). Besides, in the GGBa, traditional Swiss values such as innovativeness and quality are of special

importance. Finally, our region is particularly known for its very international environment.

Switzerland is not a member of the European Union (EU). What does it mean for international companies?

PM: It means an advantage. Economically speaking, Switzerland is completely integrated into the EU which is the major market for Swiss companies. Besides, between Switzerland and the EU, there is a free movement of goods and people. Considering technical aspects, Switzerland participates actively in the definition of most European norms (e.g. CE marks) and abides by them. At the same time, Switzerland remains politically independent and this makes it easier to keep its current pro-business approach including a very flexible labor legislation.

info@ggba-switzerland.ch
www.ggba-switzerland.ch



Nanosurface engineering is among the main activities of the CSEM (Centre suisse d'électronique et de microtechnique). Technology Development Manager for the Nano-Surface Engineering activity Raphaël Pugin evokes the context behind the innovative solutions that CSEM continuously brings in that domain.

▲▲ BY JEAN-LUC RENCK

40 projects in nano-surface engineering

To start – what is nanosurface engineering?

Modern applications require components with optimized surfaces. The optical, chemical, and biological properties of a surface are to a large extent determined by its nanometer-scale characteristics. CSEM's established nanotechnology methods include numerous techniques to generate nanoscale structures with a high level of precision and reliability, and with a chemical composition of choice. CSEM's nanosurface engineering activity contributes to novel solutions in many different areas, including the fabrication of optical components, security features, biosensors, membranes for ultrafiltration, new substrates for cell culture and smart coatings. It is a key consideration in nanosurface engineering not only to provide lab-scale solutions and demonstrate their applicability, but also to invest in the development of upscaling technologies that make possible the economically viable production of nanoscale functional surfaces. The methods available at CSEM include replication techniques such as embossing and injection molding, and printing and coating techniques (dip, bar, inkjet, slot die, aerosol-jet and Molecular Vapor Deposition MVD), as well as classical clean-room techniques such as etching and micromachining. This complete chain of modeling, prototyping, and upscaling allows CSEM to optimize any component's surfaces for the widest range of applications.

Some 80 R&D engineers and scientists in 5 to 6 teams are presently bringing some

1. Nanostructured inserts to be used for the replication of nanopillars into plastic components by injection molding.
2. Compact filtration systems integrating an ultrathin nanoporous membrane, with turbisc micro-pump and battery. The high selectivity of the membranes allows the filtration of colored sub-micrometer beads and can be visualized by comparing the absorption of both the filtrate (right-hand container) and retentate (left-hand container).

40 projects from lab-scale solutions to the stage of economically viable mass-production.

For instance? Fascinating solutions to improve public health?

In the biotech domain one objective of our activity is to develop integrated cost-effective solutions for the detection of biomolecules and the determination of their toxicity or pharmacological activity in vitro conditions. These integrated so-

lutions – all designed to contribute to the improved health of the population – differ greatly in their form and complexity. Among them are functional smart clothing for the continuous monitoring of biological parameters for health care or prevention - microfluidic systems for drug screening using cells cultures on beads or tissue spheroids - devices for improved model biological barriers allowing in vitro study of both nanotoxicity and nanomedicine - new methods for food-process control allowing the detection of toxin or antibiotic contamination of raw foodstuffs and nanoporous membranes for biomolecules separation, concentration and detection. The potential present in such integrations can only be realized if the design is optimized at the product level and not at the single component level, and if the production and assembly of the single components is compatible with industrially relevant manufacturing processes. CSEM's core competencies in micro-/nano-technology, electronics and system engineering place the center in a unique position to provide integrated solutions addressing the markets of life sciences, clinical diagnostics, toxicology and pharma as well as food and environmental monitoring.

What are the sources of CSEM's creativity and innovative power?

Some impulses are provided by specific industrial needs and problems. Furthermore, Western Switzerland is very well endowed with top academic research and the CSEM is in close interaction with



the key actors in this field: such interaction allows the flow of ideas and creation of new concepts. The CSEM is committed to developing innovative products and solutions from its most promising achievements. The CSEM spontaneously challenges some of today's technological limits in the spirit of conceiving new products. We are a multidisciplinary company, and an organization that is horizontally built rather than vertically. This structure highly favours innovation-sharing and idea-sharing between departments and thereby between projects.

Which other fields are gaining from CSEM multiplicity of approaches?

The development of the nanosurface activity is also strongly supporting innovation in other technology platforms from CSEM. An example is the creation of light management structures for printable electronics devices [organic photovoltaics (OPV), lighting based on organic light emitting diodes (OLED) and organic transistor arrays (OTFT)].

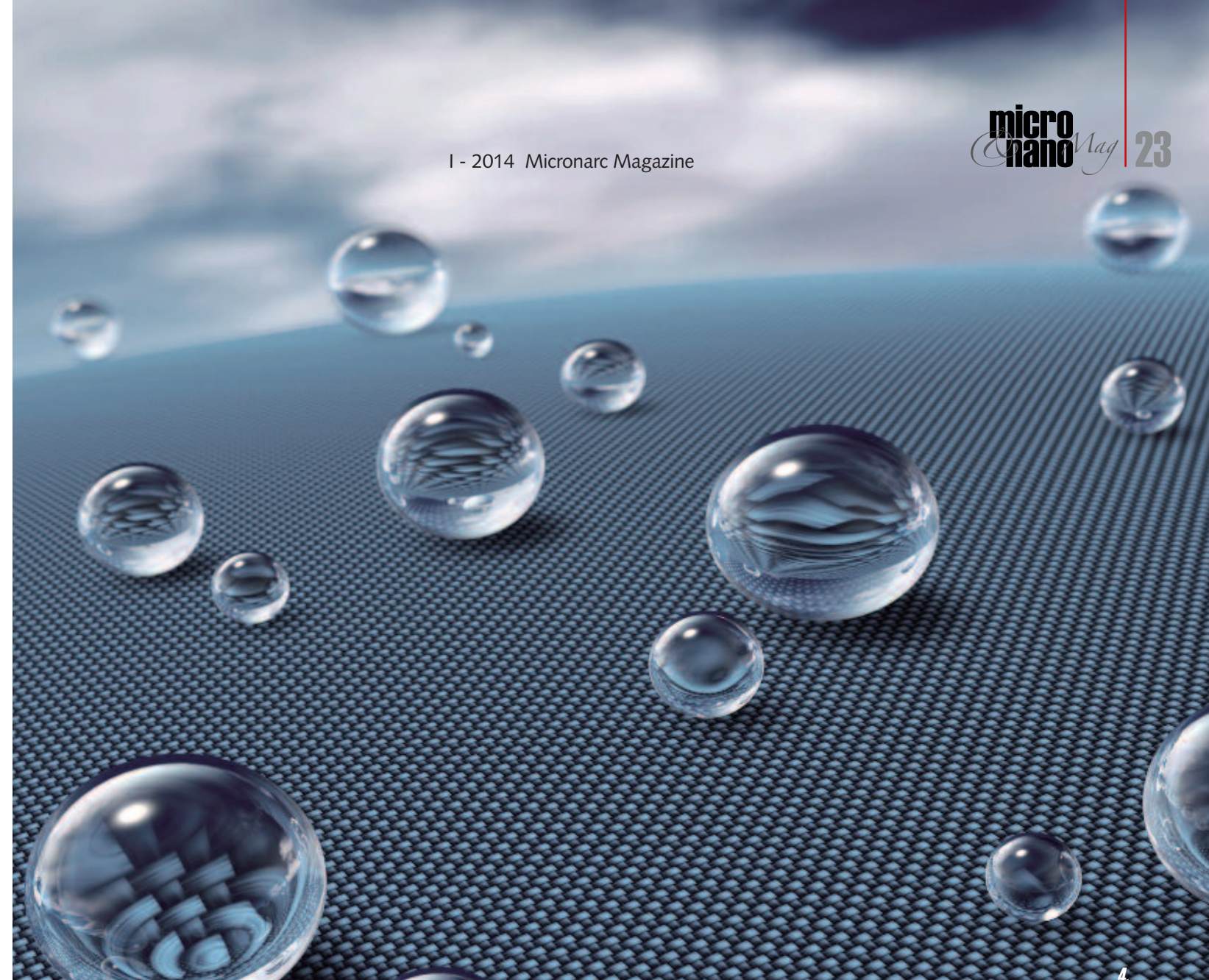
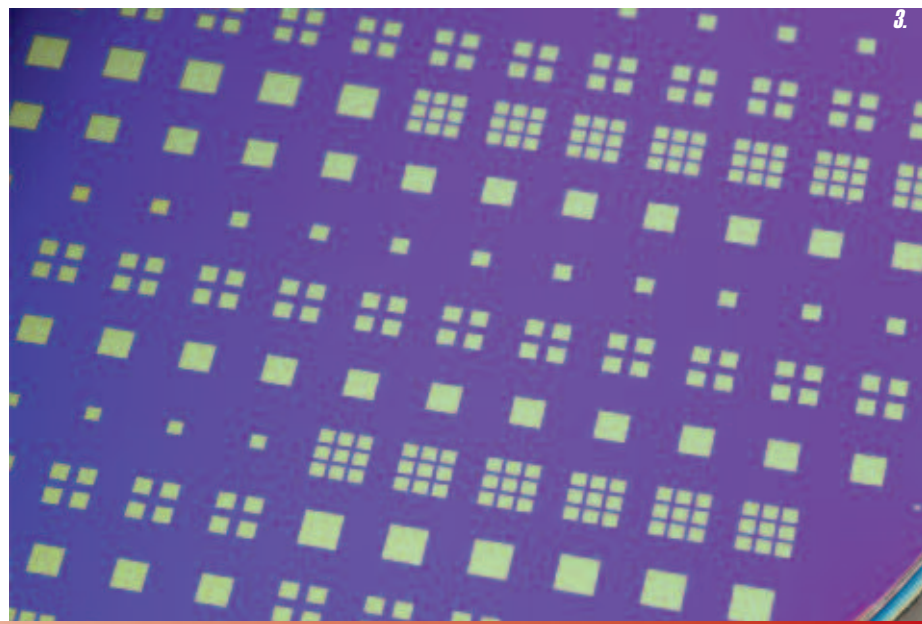
In addition, the CSEM also considers inorganic photovoltaics from a nanoe engineer's point of view, considering the entire production chain of photovoltaic cells based on thin film and crystalline silicon in nanometer-thin layers. At the heart of the most efficient PV devices, nanometer-thin layers control the electrical and optical properties of the solar cells. Our multi-layer, anti-reflective coatings, rough nano-textured layers, surface passivation films, and conformal coatings are instrumental in obtaining the highest solar-cell performances. Moreover, we develop specific coatings and transparent conductive layers for displays, efficient lighting, and new applications. In the optical domain the CSEM develops components such as waveguides, microlens arrays and polarization filters (one such filter was cleverly used

to provide a view on the double-action mechanism in a luxury watch). Our innovative efforts in the emerging field of optoelectronic systems using new cost-effective materials are embedded in international programs of standardization. Our international collaborations are numerous. In aeronautics one very challenging project with French aerospace lab ONERA is dedicated to the development of new pressure-sensitive paintings (PSP) as unique tools for providing pressure measurements over the entire surface of a model subjected to aero-dynamic testing in wind tunnels. In this project, the main objective is to design a specific PSP able to measure fast pressure variations observed in an unsteady aerodynamic flow. CSEM's technological contribution complements the technical wind tunnel expertise and experience of ONERA. And last but not least: the design and creation of new forgery proof security features for anticounterfeiting and traceability also find applications in pharma and luxury industry.

How would you summarize CSEM facilities?

The CSEM is a powerful tool to implement mature technologies, to manufacture and test prototypes and to develop mass-manufacturing processes. When needed by our customers we can even produce at small scale: this should be seen as a service to our customer, to demonstrate the market and therefore bridge the ramp-up phase before mass production (which is always realized by our customers). Our compatibility with the modus operandi of industry is still enhanced through our reactivity and flexibility to new challenges : goals which were a matter of years in a near past must now be completed in several months. Professional structures and permanent personnel converge also towards such compatibility.

3. Differences in cell morphology are observed between cells grown on flat or nanostructured surfaces: 3T3 cells grown on flat quartz (bottom) had a spread morphology with a mean diameter of 50 μm . In contrast, spherical morphology was observed on nanostructures (top) with a mean diameter of 30 μm .



4. Self-cleaning & superhydrophobic properties obtained by combining surface nanostructuring and surface functionalization. Typical characteristics are very high water contact angle ($> 170^\circ$) and very low roll-off angle ($< 10^\circ$).

The CSEM: tomorrow's routines as a daily challenge

Since 1994, the CSEM established its position as a strong and dynamic link between academic researches and the hi-tech industry in micro and nanotechnologies and integration into smart systems. The CSEM delivers its technological and strategic expertise to more than 150 customers per year mainly in Switzerland as well as worldwide increasing their competitiveness in markets as diverse as industrial monitoring, medtech, food and environmental monitoring, cleantech, energy, transportation, telecommunications, watchmaking, security, etc. All of these contributions imply one or more of five CSEM strategic programs: systems (for instance wearable and implantable systems or cleantech systems), microsystems, ultra-low power systems (eg. wireless systems or vision systems) and surface engineering (nano, bio and polymer material) and last but not least Photovoltaic systems.

The CSEM employs 450 highly qualified collaborators in its headquarters in Neuchâtel, Switzerland, as well as four specialized research facilities elsewhere in Switzerland. Two extensions now also now in Brasil and the Emirates. The CSEM also created the HTA (Heterogeneous Technology Alliance) together with CEA/Léti in France, the Fraunhofer Gesellschaft (Mikroelektronische Allianz) in Germany and VTT in Finland to prepare to the next generation of technology.

The living world is a place of ingenious solutions at every stage of its complexity – from the molecular level to organisms and ecosystems.

Micro & nanotechnology is an entire universe of engineered solutions, shaping manufacturing tools with the ultimate precision, from their smallest parts to full production chains. Within this field, Western Switzerland is continuously improving its solid tradition in industrial equipment of world renown.

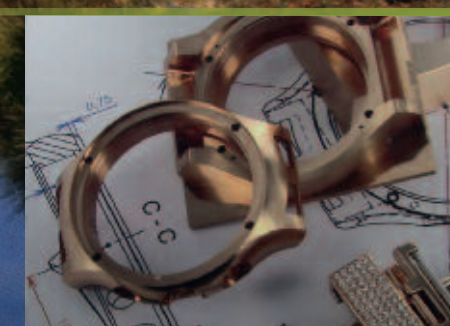
Photo: Cervin-Matterhorn, Valais



Asyrl miniaturized feeder



Willemin-Macodel – a micro-machining breakthrough



Crevoisier SA – Watchmaking

Since 2007, Asyrl has been supplying its internationally renowned customers with compact and high performance assembly and packaging systems. The miniaturization of high-tech products is continuous. Asyrl plays a leading role in accompanying its partners in this trend, developing the constituent elements of their automation.

The miniaturized feeder



I - 2014 Micronarc Magazine

1. Flexible handling of watch stones.

2. Asyfeed Pocket Palletizing Cell.

There is a clear trend towards miniaturization of products. This can be seen either in the size reduction of the device itself or in the integration of more functions into the same volume. This opens new challenges for the manufacturing of equipment in terms of precision, speed, compactness and cleanliness. On the other hand, product customization demands more flexibility from the equipment in order to cope with a variety of product options. These are the needs to which Asyrl would like to respond: to deliver compact, reliable and cost-effective solutions for the automated assembly of microtechnology-based products.

Asyrl products can be organized in three categories:

- Robots
- Small Parts Feeders
- Palletizing and conditioning cells

Asyrl robots are based on the DELTA parallel kinematics. Three different sizes are available (Pocket, Power and Desktop). The smallest one, the Pocket-Delta, is still considered as the smallest industrial robot in the world. They are especially well-suited for fast and precise handling and assembly of tiny components. The reduced weight in motion and the well-engineered mechanics increase considerably the robots perfor-

mance in speed (up to 3 pick & place movements per second) and repeatability (down to +/- 2 micrometers for the most precise one).

The small parts feeders are based on an innovative, patented vibration system: Asycube. It sets a new standard in flexible feeding of small components that are provided as bulk good. Its platform can vibrate in one, two or three dimensions according to the type of component to be presented to a robot equipped with a vision system. Asycube doesn't require any mechanical adjustments and is the perfect alternative to traditional feeder-systems, i.e. vibrating bowls.



«With Asycube, Asyrl provides its customers with an unequalled solution for flexible feeding of small components»

*Alain Codourey,
CEO Asyrl SA*

Asycube, combined with the DELTA robots, gives birth to the Asyfeed modules and cells. The Asyfeed Module has been designed to be integrated as subunit into automated machines. Its main function is to load small components (supplied as bulk good) precisely to a chosen target. Typical applications can be found in the watch industry, as well as in the medtec, pharma and electronics sectors. Flexible feeding onto a rotary table is one example of many. The cells are

compact table-top systems for fast sorting and palletizing of micro-components provided as bulk goods. They can be easily configured for various types of receptacles such as: tubes, tapes, pallets, gelpaks and more.

Asyrl products have already been installed successfully in many industrial applications in internationally renowned companies. In one of the latest cases, ruby stones used by the Swiss watch industry are inserted with high precision into short calibrated tubes. The stones varying from 0.5 to 2.2 mm in diameter are initially supplied in bulk by the operator, and then poured into the reservoir of the Asycube. The operator then places a rack of twenty empty tubes into the workspace of the robot. The small machine starts its work at an impressive speed as soon as the operator has selected the corresponding program. The idea of conditioning small components in tubes is widely spread in the Swiss watch industry. It is a very convenient way to store, transport and to exploit a large amount of small components that need to be supplied to an automated process. In other applications, the Asyfeed module is used to precisely place components on a rotating glass table for quality inspection. Several cameras located around the table take images that are analyzed with dedicated algorithms to sort the good parts from the bad ones, thus contributing to the high quality standards set by the Swiss Made label.

By using Asyrl products, customers can rely on innovative solutions to help them improve their quality and productivity.

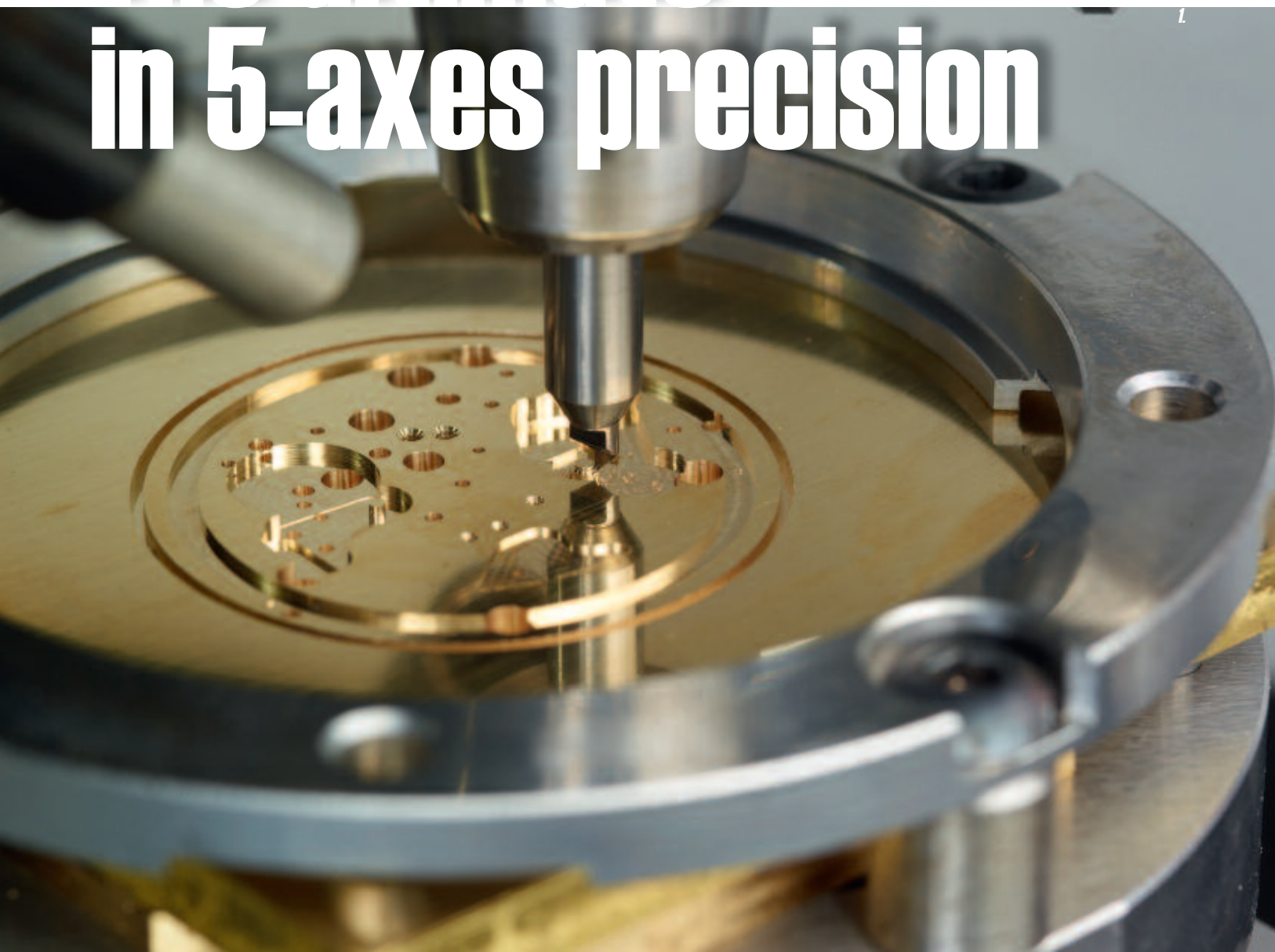


A pioneer in the design and manufacturing of machining centres – particularly simultaneous 5-axes – the company Willem-Macodel of Delémont in the Swiss Jura has become known for its expertise in the field of high precision.



INTERVIEW WITH PATRICK HAEGELI, DEPUTY GENERAL MANAGER
BY ROLAND KELLER

The ultimate in 5-axes precision



1. The 701S, a dedicated solution to producing micro-parts: sub-micron precision.

2. The new 701S offers 36 rotating tools in a very confined space.

3. Compact, the new 3-axes machine 701S boasts a footprint of only 1 square metre.



«Our multi-process machining / turning centres are capable of manufacturing very complex parts, on 6 sides and in one single cycle».

Patrick Haegeli,
Deputy General Manager

On what basis has your company built its reputation?

Patrick Haegeli: We're always listening to our customers, offering them high precision solutions with a high degree of customization that fits best in their workflow. We also attach great importance to ensuring quality service and availability. The two key aspects concerning the reputation of our machines: the quality of the machines, as well as the fact that they retain their characteristic precision throughout their entire life cycle.

What is your primary area of expertise, your *savoir-faire*?

PH: In-house, we master all the necessary and key areas of expertise, whether its mechanical, electrical, software or programming skills. In addition, our services are global, so we offer a high degree of customization: programming, adjustments, specific equipment, inspection during production and automation. We are also able to monitor the machines throughout their life cycle.

Who have been your main competitors and what sets you apart from them?

PH: Given the sectors and the number of countries in which we operate, we have to compete with many machine manufacturers. We can not stand out only by simply providing solutions that offer greater productivity for our customers. We favour the proximity to our customers, so in essence we are talking about partners rather than customers. It is also thanks to this close relationship that we strive to anticipate market trends in order to offer the most advanced technical solutions.

What are your current flagship products and what is your primary expertise?

PH: The multi-process machining milling/turning centres from bars, which allow the manufacturing of very complex parts, on 6 sides and in one single cycle, contribute greatly to our success. Our 5-axes machining centres have also won wide acclaim because of their high accuracy and high degree of flexibility and dynamics.

What is your most promising sector in terms of *savoir-faire* and sales?

PH: The history of the company is closely related to watchmaking. This remains a very important market for Willem-Macodel. We have actually developed special machines for machining parts for watch movements, as well as the finishing.

What are your goals for further growth?

PH: We always build on what has made us successful so far: staying close to our customers, quality products and services, and innovative technological development.

Sub-micron precision

Premiering at the EMO Hannover fair for machine tools (16-21 September), Willem-Macodel presented its new 701S machining centre. Stacked full of highly innovative technology, this machine by design provides out-of-class performance standards for precision, quality and trajectory tracking. Extremely accurate, dynamic and compact, the 701S machining centre maintains sub-micron precision and can accelerate up to 5G, drastically reducing machining time – all while consuming less than 3 kW, with a footprint of only about 1 square metre.

A family-owned company of 280 collaborators

Founded in 1974 by three people, Willem-Macodel of Delémont now employs 225 employees in Switzerland and about sixty in its foreign subsidiaries. Initially, the company's primary activity was distributed shape copiers for milling watch parts. An independent family-owned company, Willem-Macodel was founded by Blaise Haegeli, who is still Director and President, accompanied by his two sons Olivier and Patrick, the deputy general managers.

The development of the company has been based on three pillars: diversification (initially active in the watch industry and now in medical, aerospace, dental, jewellery, mould industry); internationalization in Germany, France, Italy, USA, China, Russia and also in India, where it has its own structure of sales and service; and the in-house control of all aspects of machining solutions and other subset of automation systems.

Willem-Macodel was a pioneer in simultaneous 5-axes machining and milling/turning from bars with automatic recovery in order to provide real autonomous production units.



«The movements of the polisher are recorded instantly by an acquisition unit»

Philippe Crevoisier,
Director of Crevoisier SA

Last June, the watch subcontracting trade fair in Geneva (EPHJ) awarded the machine manufacturer Crevoisier SA with the prestigious Exhibitor's Prize which hails major innovation. With 55 employees, this company in the Swiss Jura has developed a concept that allows a robot to learn the gestures of a human polisher. It's revolutionary!

▲▲ INTERVIEW WITH PHILIPPE CREVOISIER, DIRECTOR
BY ROLAND KELLER

The robot that teaches itself to polish



1. The robot that teaches itself to polish – in action, in the machine.
2. The most fruitful sector for Crevoisier SA: Watchmaking.

On what basis has your company built its reputation?

Philippe Crevoisier: We have built our reputation with innovative and reliable products. With our customers, we have relationships as genuine partners.

How has your business developed over the years?

PC: The development happened very naturally and the number of customers gradually increased. Our know-how, the constant development of new machines and improvements to existing products are the main drivers of this growth.

Who have been your main competitors and what sets you apart from them?

PC: We do not talk about our competitors. We propose new concepts that enable us to stand out.

What are your current flagship products and what is your primary expertise?

PC: Our flagship products are polishing stations comprising a multitude of configurations. Also, our Terminal Centre C-400 B, and the new machine C-480. The C-480 in particular, being very rigid, can rectify ceramic, sapphire, hard metal, stainless steel, etc... We have had very good results and feedback with this model.

The versatile C-60 robotic palletizers are installed on virtually any machining equipment, not only on our production machines.

Also, special machines are developed according to the specifications of the end customer.

What is your most promising sector in terms of *savoir-faire* and sales?

PC: The watchmaking industry...

What is your polishing robot... is it as revolutionary as you claim?

PC: It's a brand new concept, very easy to use, the movements of the polisher are recorded instantly with an acquisition unit (POLIcapture®). This unit sends the information to the polishing robot. One acquisition unit can control multiple robots. Actually, it's not even necessary to have specific training to program the system.

Can your machine be adapted for high polishing rates and for a high volume of parts?

PC: This innovative concept can be used for both small series and for large productions. The rate is faster than that of the polisher; only movements in contact with the tool, cotton and brush are taken into account.

What are your goals for further growth?

PC: Growth is not our main objective. We want to be a key player of the economy where there is constant innovation in ensuring reliable products. Our progress is linked to the company's values. We are a company that is constantly evolving, in ensuring the sustainability of our achievements.

But, how does it polish?

There is nothing pretentious about it. The system, developed by Crevoisier is truly revolutionary because no machine in the field has the dexterity of a human polisher, since the art of polishing is all in the human wrist movement. Collaborating with the School of Engineering in Sion and the company des Genevez (Franches Montagnes) we have been able to recreate a polisher's movements, recorded instantly by the POLIcapture® acquisition unit. The adopted solution is based on techniques of «motion capture», used notably in the field of cinematic animation. The piece is polished normally by a experienced polisher, under the eye of three cameras. The images they produce are analysed by special software that reconstructs the trajectory of the part during polishing. This raw trajectory is then processed to extract only the useful sequences. These are then connected together and adapted to the geometric characteristics of the production unit, and specifically to the dimensions of the polishing pad. Finally, the software generates the program for the robot that is designed to reproduce the trajectory, which then loads the program directly. Note that the polisher is free to subsequently modify the program by adding, deleting or replacing portions of the trajectory based on the results obtained in production. Obviously, the process applied to any type of surface treatment, and technical specifications have been the subject of a patent of Crevoisier SA.

As a breath-taking landscape hides all the infinite elements that contribute to make it pronounced, much of our daily life masks the myriad of interconnected tiny parts which make it efficient... informed... comfortable... For but a moment, think of the intense activity behind all of this! In Western Switzerland – birthplace of micro & nanotechnology - thousands of researchers and developers are continuously bringing ideas to light, contributing to making both local and global worlds smarter.

Photo: «Plateau de Diesse», Bern



Innovative MEMS-based devices at CSEM



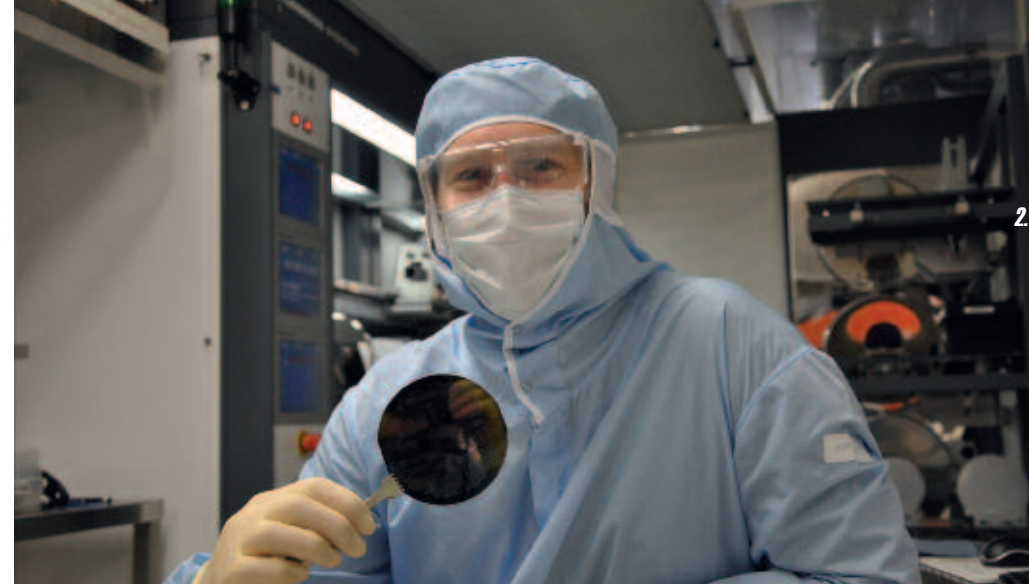
Quantum cryptography at IDQ



GPS chip developed by u-blox and the CSEM as part of a CTI project.

Industries today are looking for complete solutions. Innovative products, in particular, exhibit a technological complexity, which can seldom be handled by a single technology provider. One of CSEM's strengths is that it offers this wide spectrum of technologies «under one roof.»

CSEM Microsystems: functional, reliable, and sophisticated



© CSEM

1. MEMS enable CSEM to offer its industrial clients a rich portfolio of technologies and sound know-how in how to apply and realize innovative products based on micro- and nanotechnologies.

2. Development of MEMS-based devices involves the commitment of several disciplines. CSEM is able to offer its customers and partners a full solution including MEMS, ASIC, system integration, packaging, and testing, as well as training, all with the guarantee of the utmost reliability. CSEM also offers industry small-scale production of MEMS components as well as packaged microsystems.

Founded in 1984, CSEM is a private Swiss research and technology organization (RTO) with the mission to develop microtechnologies and transfer them to the industrial sector, thereby reinforcing the sector's competitive advantage. Under contract to the Swiss Confederation, CSEM develops innovative technology platforms through four specialized research programs – **microsystems, ultra-low-power integrated systems, surface engineering, and systems** – corresponding to domains in which it has acquired over the years a national and international reputation.

CSEM develops, integrates custom and in some cases produces in small series, standard innovative micro-systems (sensors, actuators, etc.) and miniaturized smart systems, exploiting its advanced technologies to provide new solutions for industrial and institutional customers. This concentration on specialisms, and the process of comparing and consolidating the internal vision with that of the dedicated scientific advisory board, allow the RTO to efficiently use its resources to develop innovative technology platforms poised to meet industry's future needs. Targeted markets and applications include automotive, telecommunications, security, healthcare, biotechnology and environmental – markets in which system miniaturization and integration are a «must».

CSEM offers maximum flexibility, enabling to react promptly and efficiently to new product developments thanks to reliable, reproducible and qualified pro-

cesses and quality control lab operations. The activities of the MEMS (micro-electro-mechanical systems) program aim to build competencies in the application fields of watch making technologies, scientific instrumentation and lab automation, optoelectronics, and medical device technology, and require contributions from diverse technical disciplines.



«Our industry needs increasingly complex systems, smart systems that are cost competitive and reliable. This is precisely what we do every day at CSEM – with professionalism and passion.»

Mario El-Khoury,
CEO CSEM

Cross-disciplinary work between microelectronics and systems integration, and reliability and quality control are key elements of CSEM's concept in MEMS, and a differentiator from its partners in academia. CSEM's activity is focused on the development, production and integration of custom or standard innovative microsystems: Applications of MEMS as watch parts are very important, as well as MEMS for fluidic channels, space and many other applications. The flexibility of CSEM's clean rooms for the production of small quantities of prototypes continues to be attractive to industry and their R&D activities. Cus-

tom satisfaction is the RTO's top priority. To guarantee the reliability of its MEMS parts and devices, CSEM applies quality control at each process or development step. Reliability and testability, as well as aging, are essential concepts in the industrialization of MEMS. CSEM has moved one step further to industrialization by combining the services of micro- and nanoscopy with the x-ray service. Currently, a program on lifetime estimation of specific Si-based devices is running under different environmental conditions.

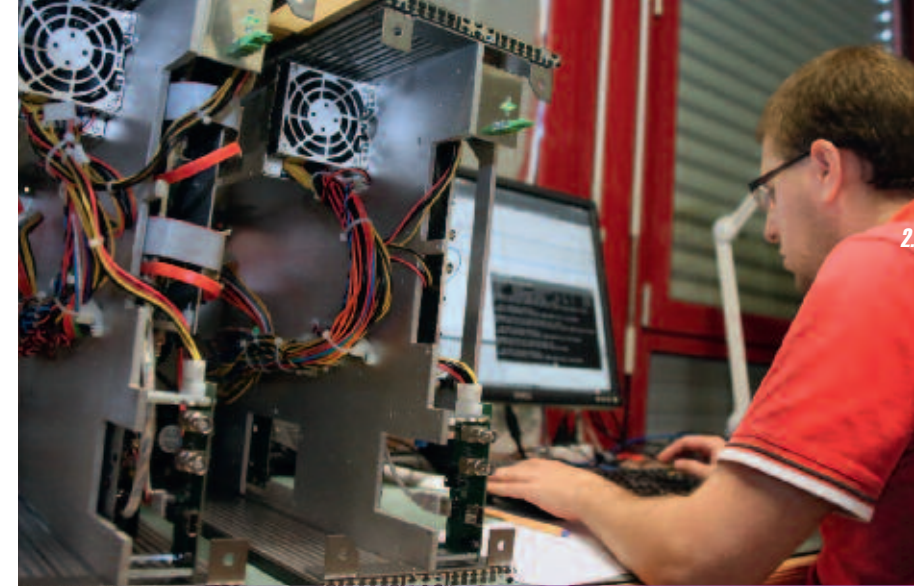
CSEM SA, founded in 1984, is a private Swiss research and technology organization (RTO) specializing in microtechnology, nanotechnology, microelectronics, systems engineering, and communications technologies. In 2012, CSEM played again a leading role in the development and transfer of advanced technologies to the industrial sector, thus helping industry to prepare for the future. The process of innovation and diffusion requires greater and greater interaction between the world of science and technology and the marketplace. Around 400 highly qualified and specialized employees with industrial backgrounds, mostly top-level engineers and holders of PhDs from various scientific and technical disciplines work for CSEM in Neuchâtel, Zurich, Alpnach, Landquart, and Muttensz.

© CSEM

The Geneva company ID Quantique (IDQ) dissects light rays in order to create secret keys based on quantum cryptography. This newly-controlled process is destined to improve the security of fiber optic networks and, as a result, almost absolute reliability.

▲▲ BY ROLAND KELLER

Progress is achieved by controlling light



Conventional cryptography is not a new concept, being defined as the science that comprises the set of techniques that ensure the confidentiality and integrity of information exchange. Nearly two thousand years ago, Julius Caesar was already using in his secret writings and it has carried through to the present day with the Einstein's Nobel Prize on the photon in 1921. Until recently, however, cryptography has often remained confined to military and diplomatic applications.

With the intense development of telecommunications in the last twenty-five years cryptography has somehow become the norm, with online banking applications being a very well known example. Our valuable data are encrypted upon transmission and then decrypted upon reception by an algorithm. So far this is nothing revolutionary, and an especially clever spy can intercept a message in transit, descramble and thus interpret it.

Increasing security

Quantum cryptography, however, ensures a much tighter level of security, thanks largely to the laws of quantum physics. These days, modern communication systems exchange information using light pulses traveling on fibre optic networks. However, for each bit of data a pulse is emitted and transmitted via optical fibres to a receiver which then detects and converts it into an electronic signal. In quantum cryptography, the same principle is followed, with the exception that the pulses are actually composed of a single photon.

«Quantum cryptography can transmit a

message through an optical fibre and see if this message was intercepted or not. This verification is done after the fact, thus the technology is not used for a direct exchange of sensitive information, but rather a sequence of random numbers. We can confirm that this sequence hasn't been intercepted, and if this is the case, use it as an encryption key. This technology thus offers an alternative, in some cases, to the public-key cryptography,» explains Gregory Ribordy, director of ID Quantique (IDQ).



«With the intense development of telecommunications in the last twenty-five years cryptography has somehow become the norm, with online banking applications being a very well known example».

Grégoire Ribordy,
Director

The Swiss advantage...

For now, the principal competition comes from the world of conventional cryptography. In this context, IDQ bases its differentiation on long-term security solutions that quantum technologies cannot offer. Of course, being a Swiss company is an advantage in the field of security. And now, companies active in the field of cryptography are rather its

1. ID Quantique prefers a hands-on approach to digital challenges.
2. High-flying engineers for photon manipulation.

allies for market development. «Quantum cryptography offers long-term security that conventional technologies based on mathematics are not capable of, but it requires specialized equipment and is more expensive. It's up to the users to ask what is the criticality of the information they wish to exchange and for how long the information will remain critical» he adds. So, if this period is for more than a few years, quantum cryptography is a very good approach.

A good approach

The Geneva company (based in Carrouge) can pride itself on its progress thanks to... *light*. In just two years, since 2011, IDQ has increased from one to twenty employees. IDQ was founded in 2001 by Nicolas Gisin, Hugo Zbinden, Olivier Grégoire and Guinnard Ribordy. The current Chairman of the Board of Directors is Mark Thorsen, representing venture capitalist i2i. Geneva-based cryptography is therefore doing quite well. It is currently generating interest in the financial, government and health-care sectors and the expertise is increasingly gaining popularity wherever safety is a hot topic.

The most economical GPS module in the world



Photo: «Les Franches-Montagnes», Jura

GPS uses satellite signals to determine position. The company u-blox in Thalwil develops receiver modules that form the core of navigation systems and allow these systems to always know where they are. Together with the Swiss Center for Electronics and Microtechnology (CSEM), u-blox has succeeded in developing the most economical GPS receiver module in the world.

▲▲ BY LUKAS KAUZ, CTI



All navigation devices are equipped with a module that calculates the location using satellite data. The GPS receiver chip was developed by u-blox and the CSEM as part of a CTI project.

Navigation systems help us to find our way through the urban jungle. There is no more having to rummage through the glove compartment for a map thanks to voice instructions that lead us easily to our destination. At the core of these navigation systems is a GPS module. GPS, or global positioning system, uses satellite data to determine the position of the receiver. At least 24 GPS satellites orbit the Earth, constantly transmitting their current position and the exact time. GPS modules need to receive data from at least four satellites in order to determine their position. Based on the signal propagation time, GPS modules calculate their distance to each of the satellites and so their own position.

Successful ETH spin-off

GPS receiver modules are used in many electronic devices. In navigation systems, they help drivers reach their destination; in cameras, they record the exact location where a particular picture was taken; in toll systems, they ensure that everyone pays for the roads they have used.

The company u-blox is a leader in the development of these GPS modules. Founded as a spin-off of the ETH in 1997, the company initially focused on integrating individual components into modules. The company's success has allowed it to broaden its base and develop its own GPS chips. Today the company employs 400 people who develop both the hardware and the software of the positioning and mobile communications products.

Smaller and more economical

GPS modules are increasingly being built into mobile applications, such as mobile phones, cameras and mobile navigation systems. Since the batteries for these devices need to last as long as possible, it is important that the power consumption of the modules is minimal.

«In developing the latest generation (u-blox 7), we reduced the power requirements by 50% and reduced the size of the chip. This may not sound spectacular, but it is a big step,» says Thomas Brauner, project manager at u-blox. To achieve this aim, the company worked together with the CSEM in Neuchâtel with the support of the CTI. The CSEM is an innovation centre that specialises in technology platforms in micro, nano and information technologies. It was established by the federal government in the 1980s to support Swiss industry. The aim of the innovation centre is to develop highly innovative platforms and transfer them to Swiss companies to keep them competitive.

Expensive development process

Developing chips costs a lot of time and money. In order to manufacture a test chip, entire set of masks have to be produced. It takes a factory three months to produce an experimental chip. Trying something out quickly is not an option in this field of development. All the different elements need to work. u-blox therefore sought and found an experienced partner in the CSEM, which has many years of experience in the design of complex microelectronic chips, especially for applications that need to

consume as little energy as possible. This meant that u-blox could make use of tried and tested designs. The CSEM also holds patents for significantly reducing circuit power consumption. This principle has already been applied in other projects. The CTI project has made it possible for u-blox to use the CSEM's patented inventions in its products.

During the project, u-blox did not only benefit from its partner's experience alone. «The great advantage of working with the CSEM is that the design is ours. This allows us to build on the design and modify the circuit,» says Thomas Brauner. This does not go without saying. If the chip had been developed with an outside company, they would have delivered the finished circuit. As a result, u-blox would not have gained an insight into the design of the chip. Companies want to protect their own know-how. It would have been difficult to fix problems and develop the circuit. However, this is not an issue in working with the CSEM. Not only is the design itself well documented, but the u-blox development team can follow the design process and continue to optimise the module on their own.

Know-how transfer

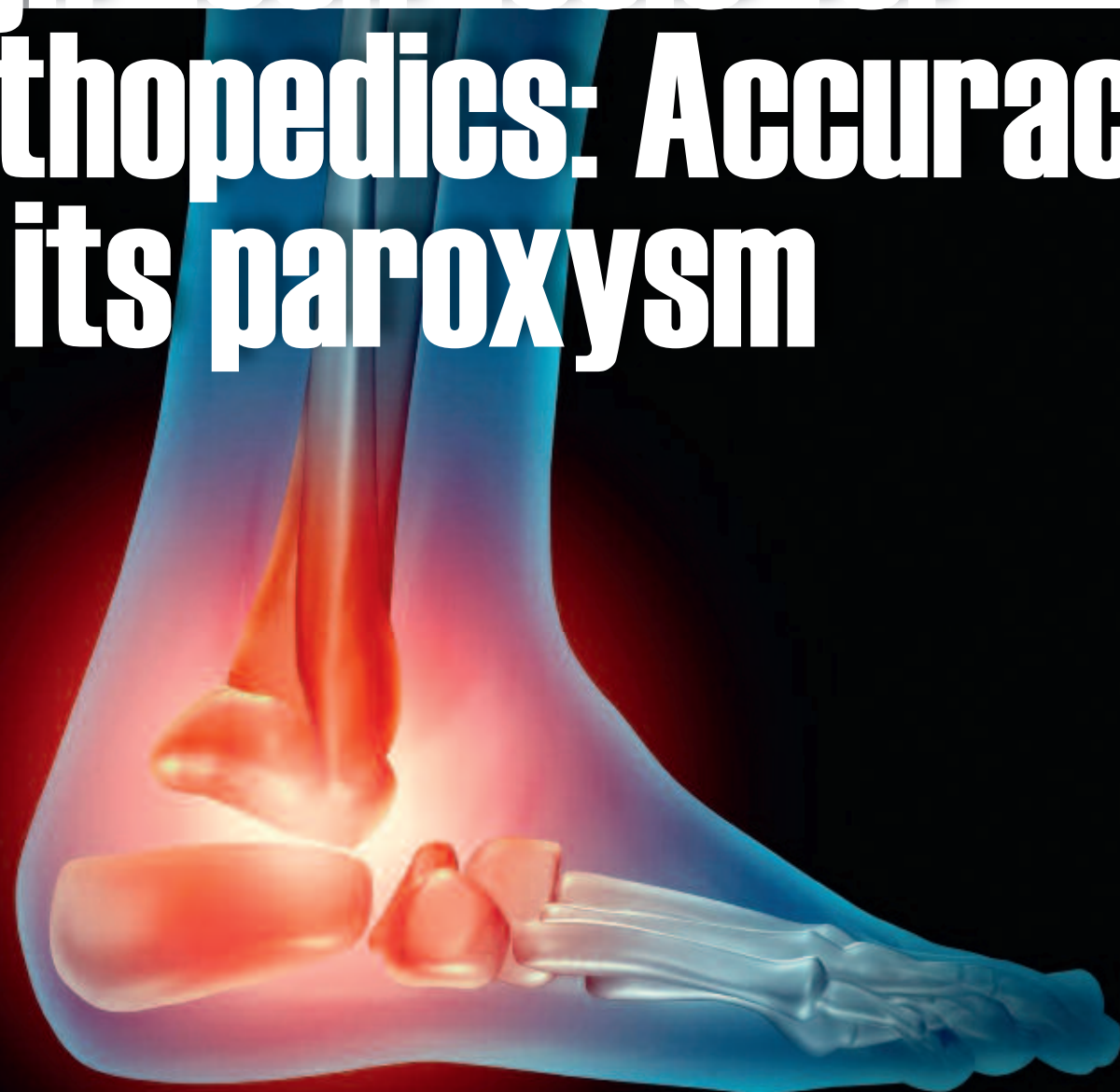
The aim of the project was not only to develop the new chips, but also to transfer the CSEM know-how to u-blox. To achieve this aim, the teams worked closely together, using common databases and solving high-frequency block design tasks together.

The joint project was a positive experience for both teams. «The research results made it possible for us to develop the most economical GPS receiver in the world,» says Thomas Brauner. «This would not have been possible without the CTI's support.»

A start-up of the Vaud and Jura Swiss cantons creating smart micro-motors to help surgeons during surgical operations. Their aim is the placement of an implant with a suitable tool, with maximum safety for the patients.

▲▲ BY ROLAND KELLER

High-tech tools for orthopedics: Accuracy to its paroxysm



1



2

1. Bones, joints, muscles, tendons and nerves treated with the dexterity of always better equipped surgeons.

2. The micromotor MM951 more specifically adapted to hand and upper limb surgery.



«The natural high-tech extension of the surgeon's hand».

Jean-Pierre Py, Founder and Director of MedicMicro

It is essential: Surgeons need high-tech tools to operate on patients. Even with the regular assistance of computers, it is still necessary to develop the proper instruments for the job. Large companies such as Stryker, Synthes, Medtronic or Aesculap develop implants which are associated with very complex instrumentation. Over the years, these tools have been developed and improved. The aim of MedicMicro is to facilitate the work of practitioners by continuously increasing accuracy and reliability for these complex tools and procedures. In 2005, having become aware of this high-tech issue, Jean-Pierre Py, originally from the southwest of France, decides to create a start-up in the country where as a child he spent his holidays: Switzerland.

At the Technopôle of Sainte-Croix

After a long search for the right location, he settled in the Jura and founded MedicMicro, a company specialized in the design and development of medical devices for orthopedic surgery of the extremities (hand and foot). Very rapidly, an intelligent micro-motor is developed and placed on the market in order to facilitate the placement of implants. However, in order to be closer to hospitals in the western region - the Lake Geneva arc - a move was necessary.

Admittedly, in this field, Jean-Pierre Py did not reinvent the wheel, as one says, but he was intent on meeting the current demands and needs of the market. «The development of devices by a small company is usually very fast. When collaborating with the surgeons, they rely on our flexibility and proximity», analyses the director of MedicMicro, who confirms that his products are not exclusive, but they correspond very well to a specific demand and high expectations. Hence their development...

Five engineers at Sainte-Croix

The MedicMicro team then developed the MM900, an intelligent on-board electronics motor. The MM900 is renowned for its power, accuracy, silent operation. As well, being lightweight and ergonomic, it is a real extension of the surgeon's hand when safely positioning and placing an implant. The company has moved into the premises of the Technopôle of Sainte-Croix where five engineers now work on these famous high-tech devices. «Our micro-motors are intelligent as they can detect attached instruments and then self-regulate the torque and speed - without assistance!» exclaims Jean-Pierre Py, who further states that these tools are not robotic, but they can be.

MedicMicro has already designed and manufactured several instruments, such as a complete kit for forefoot surgery along with its suitable motor. Currently, a more powerful motor is being developed in order to meet the ever increasing demand.

Promising niche market

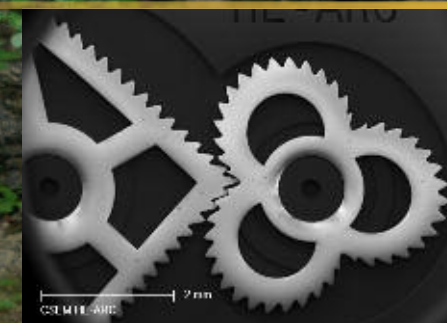
«The development potential of our devices is estimated at several million Swiss francs. We work principally for export», adds the director of the Jura-Vaudois start-up and further says that they are currently working on a robotically-guided and navigated device. Thus, MedicMicro works for a hyper-specialized niche market.

MedicMicro wishes to expand its range of devices to other applications such as maxilla-facial (jaw and face) or spine surgery. The company expects that using their technology with these types of surgery will have interesting long term benefits for them. As the high-tech company in vogue at the moment is Helvetia, Jean-Pierre Py believes that he is in the right place!

www.medicmicro.ch

Two and a half centuries ago, as the industrial revolution was breaking, timekeeping started to inspire Western Switzerland and there awoke some brilliant technical skills. These proficiencies matured toward micro and now nano-technologies of the highest demands. These investments in early innovation and technology are giving back. Western Switzerland has the most accomplished and prestigious watchmaking industry in the world.

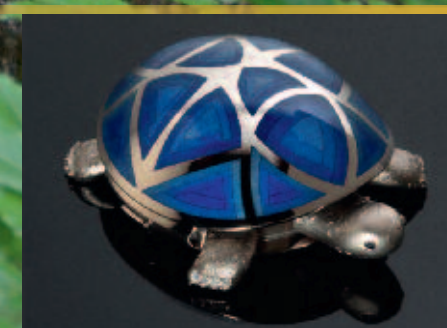
Photo: «Les Gorges de l'Areuse», Neuchâtel



Silicon, non-circular watch gears.



CLR-LIGA – a veritable shield against counterfeiters



A meticulously constructed automata.

Founded in 1998, Mimotec SA is a leader in the manufacture of micro-components via the LIGA process. This technology creates interesting opportunities in the field of component miniaturization. Widely present in the luxury watchmaking industry, Mimotec has just perfected an innovative authentication solution.

▲▲ BY ADRIAN HÄUBI, MARKETING & SALES MANAGER, MIMOTEC SA

Micro-parts for great ideas

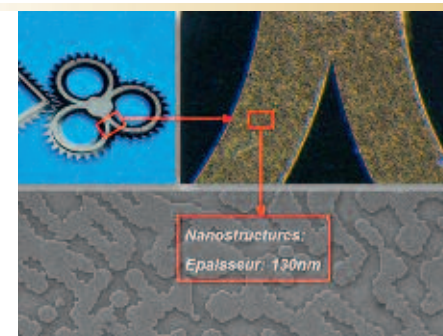


The idea⁽¹⁾ is to combine different technologies such as CLR⁽²⁾ and LIGA⁽³⁾ to produce micro-mechanical components with diffractive nanostructures on one surface.

(1) Patent pending

(2) CLR: Covert Laser Readable

(3) LIGA: Lithographie, Galvanisierung und Abformung



«Say STOP to counterfeiting... say YES to simplified authentication.»

Dr. Hubert Lorenz, CEO of Mimotec SA

SUMMARY

- A simple and efficient solution
- Means of authentication directly in the product
- Unforgeable components (Pooling of technologies)
- No database required
- Suitable for a large number of applications
- Authentication within everyone's grasp



Say STOP to counterfeiting... say YES to simplified authentication.

Many products that are considered luxury items are the target of counterfeiters. The forgers' technical progress is such that even the most complex products are now sometimes reproduced with a likeness to the authentic model that is disconcerting. These counterfeit products are sold at the same prices as the originals. In order to fight against this scourge, Mimotec SA, in collaboration with the Haute Ecole Arc, has developed a concept that drastically reduces occurrences of this phenomenon.

By exposing this surface to a laser beam, a pre-defined pattern will appear. The example to the left shows a watch that has a seconds indicator in its face (square wheel) on which nanostructures have been coded, representing the manufacturer's logo in the center and «Swiss made» on the outside edge.

Unforgeable components

In order to manufacture these components, it is necessary to master a succession of special technologies in the fields of micro- and nano-manufacturing. These state-of-the-art technologies have required years of research and the pooling of results obtained in various fields. We have observed that industrial

mastery of LIGA technology has already created a veritable barrier for counterfeiters: there are still no authentic LIGA parts in counterfeit products.

Built-in authentication

The market currently offers a variety of ways to avoid counterfeiting, which can be sorted into two categories:

1. Card systems;
 2. Security engraving on the product.
- Card systems require an IT infrastructure that can be difficult to manage and offer an insufficient guarantee that the product is an original. Indeed, there is no physical link between that authenticator and the product. Security engraving systems are linked to a single machining procedure and can be rapidly rendered obsolete.

With CLR-LIGA technology there is no administrative burden as the method of authentication is within the product and does not need verification via a database. A simple laser pointer aimed at the diffractive surface makes the motif appear (logo, serial number, etc.) at the speed of light. Therefore, the final purchaser, the retailers and customs officials can easily verify the authenticity of the product without the help of experts.

Extended fields of application

The CLR-LIGA motifs can be applied to different types of medium:

1. Functional or decorative mechanical components.
2. Pastille with blind engraving that can be pushed in, glues or surface-molded onto all medium.
3. Mold inserts for plastic injection.

By introducing a CLR-LIGA insert in the injection mold, it is possible to duplicate the diffractive motif on the injected component's surface. Like a fingerprint, the product can be authenticated in the same way as a mechanical component.

CLR-LIGA can be applied to a great number of products and constitutes a veritable shield against counterfeiters.

Industrial Microtechnology was born in the Jura Mountains. Initially focusing primarily on businesses related to watchmaking, it has diversified into a wide range of precision products with high added value, particularly in the fields of medical technology, micro-electronics or production equipment. HE-Arc Engineering (Haute Ecole Arc – an Applied Sciences University) perpetuates this momentum through the formation of specialized engineers and four research institutes, oriented towards rapid transfer of cutting-edge technology directly into the industrial fabric, and especially to SMEs.

HE-Arc Engineering, the key to innovation for small and medium-sized companies



30 µm

1. 3D microstructures obtained by lithography through a stencil mask on a substrate of PTFE by means of the particle accelerator at the IMA-Arc.

2. In stereotactic surgery, the Stereopod offers an innovative and lightweight solution for accurate 3D positioning of instruments.

3. Non-circular silicon gear, designed by the Haute Ecole Arc and manufactured by the Centre suisse d'électronique et de microtechnique (CSEM).



«Our role is to ensure that the latest technologies can be quickly put into practice by our industrial partners, in particular SMEs...»

Max Monti, Head of R&D and technology transfer at HE-Arc Engineering

Did you know that La Chaux-de-Fonds, a town declared as a World Heritage site by UNESCO for its unique watchmaking urban planning is home to one of the rarest ion accelerators available in Europe for the development of new products? It is one example of the state-of-the-art equipment with which researchers and partners of HE-Arc Engineering (Member of the University of Applied Sciences Western Switzerland - HES-SO) can expect to innovate. The engineers of the Institute of Applied Microtechnologies (IMA-Arc) use this ion accelerator for the characterization of surfaces for their functionalization or their micro- and nano- structuration.



Design (IHC-Arc), based in Le Locle, specializes in the design and multi-body simulation of watch movements and micro-movements – traditional or silicon – as well as measuring devices of latest generation, particularly in terms of vibration and acoustics. The issues of automation, optimization and microtech assembly systems are also at the heart of the expertise of this institute.

Modalities of collaboration

Collaboration between companies and research institutes of the Haute Ecole Arc can take different forms:

- Student diplomas, Bachelor or Master;
- Large-scale innovation projects supported by public funding;
- Direct mandates for research or development;
- Long-term framework contracts.

For more information:

<http://ingenierie.he-arc.ch/rad-ing>
Contact: max.monti@he-arc.ch

Another example of advanced equipment made available to industrial partners is the femtosecond ultraviolet laser at IMA-Arc, which allows machining of all materials with very extreme precision, without burrs, smudges or thermal effects, thanks largely to its ultra-short pulses and a frequency that can reach up to 300 000 light pulses per second. Much of the facilities, skills and know-how are also present in the fields of microfluidics, implantable medical technology, microelectronics or decorative and functional coatings.

Microtech and watchmaking

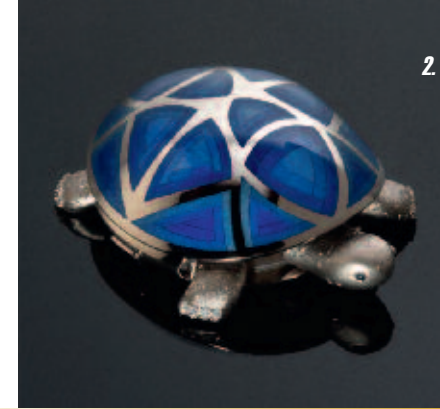
The Institute of Industrial Microtechnology (IMI-Arc) is very active in micromechanical applications, specifically in design and simulation, microinjection of polymers, moulding of micro-electronic systems and 3D metrology and X-Ray. A large, ISO Class 7 cleanroom is dedicated to this purpose in a new building in Saint-Imier.

The team of engineers and scientists from the Institute of Watchmaking and

A Neuchâtel watchmaker has unveiled its first very and special «home-grown» creation. The «Turtle Automata» comes alive through a mechanism very similar to a mechanical watch movement. With this unique piece, fully manufactured in Switzerland, Raúl Pagès revives the forgotten tradition of prestigious automata.

▲▲ BY ROLAND KELLER

The Turtle Automata



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Master watchmaker Raúl Pagès specializes in prestigious automata, works of art brought to life by a mechanism very similar to fine watch movements. The animal automata consist of micro-mechanisms that mimic the natural movements of the featured animal, such as its gait or head movements. The ingenuity of the mechanism complements the sumptuous decor of the outer shell, made of precious materials (gold, diamonds, precious stones) and whose engraving, enamelling and crimping are applied by skilled craftsmen. The mechanism components also benefit from finishing of the highest quality: hand-bevelled parts, screw polishing, embossing and rhodium plating.

Already in the 17th century

The first machines of this type were created during the 17th century. For the next two centuries automata experienced a *period of glory*, thanks primarily to well-known pieces created by ingenious watchmakers. Some well-known examples are Jaquet-Droz, specializing in songbirds and androids, Henri Maillardet, author of numerous *zoïds* or Karl Fabergé, embedding animal automata into some of his famous eggs. Primarily intended for world leaders - European kings, Chinese emperors, Russian tsars and Turkish sultans - Automata also fascinated crowds that filled exhibitions devoted to these exceptional objects. The manufacturing of these prestigious machines came to a halt in the early 20th century. Driven by the desire to revive this old tradition, Raúl Pagès creates pieces with contemporary designs, inspired by masterpieces of the past. Each Pagès-signed automata is a piece with unique finishing, distinguished by the quality of the movement and its meticulous finishing.

1. A meticulously constructed automata.
2. The mechanical turtle, showing its form.
3. The shell – engraved and enamelled by artisans of the region; the legs and head are made of 18 carat gold.

More than 300 parts...

The «Turtle automata» is thus the culmination of many years of work that is essentially the search for excellence. The components of the movement - more than 300 in total - have been handcrafted with the utmost respect for watchmaking traditions. Great care has been taken to finish: hand-bevelling, engraving, damaskeening (Côtes de Genève/Geneva stripes). The shell is engraved and enamelled by artisans of the region and the legs and head are made of 18 carat gold. The claws are set with diamonds and eyes are adorned with sapphires. The «Turtle» is wound with a key and then advances by moving its legs and head. A unique piece, it launches a line of a very limited number of turtles, each of which will have a unique finishing. A symbol of longevity, wisdom and perseverance, the turtle embodies values that Raúl Pagès wants to express in his automata.

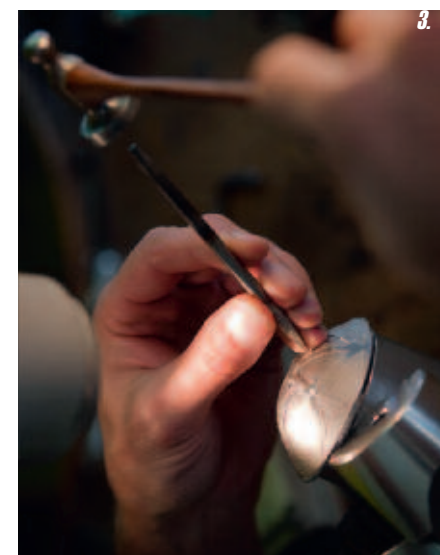
An independent brand

Raúl Pagès, born in 1983 in the Val-de-Ruz (Neuchâtel), has acquired a thorough knowledge of automata through watch restoration work at Parmigiani, including the Fabergé eggs. His passion for quality movements and fine ornamentation sparked a desire to revive the tradition of the 19th century. In 2012, Raúl Pagès and his brother founded PAGÈS as an independent brand in La Chaux-de-Fonds.

www.pages-automates.com

«More than 300 parts of the movement are handcrafted with the utmost respect for watchmaking traditions.»

Raúl Pagès



The Platinum GMT by Greubel Forsey

Preview SIHH 2014

In 2011, Greubel Forsey revolutionized the field of GMT (dual time zone) watches with their innovative timepiece and its original technique, aesthetics and practicality. Its exceptional precision movement, featuring the 24-second tourbillon with 25° inclination, now comes set against a platinum backdrop.

The acronym 'GMT', or Greenwich Mean Time, the benchmark meridian time, refers in watchmaking terminology to a (dual or) second time zone indicator. Driven by a spirit of research, Robert Greubel and Stephen Forsey have gone well beyond this conventional time zone display using a window or a hand, by incorporating into their timepiece a terrestrial globe completing each anti-clockwise rotation in 24h - the same direction in which our planet spins.

This planisphere presents all the global time zones in real time from the perspective of the North Pole where they converge. All the information can be viewed at a single glance. It is midday in the United Kingdom, and the beginning of the afternoon in Rome or Geneva. The eastern coast of the United States will soon be awakened by the early sunlight, while the Orient is still immersed in darkness... Our first contact with the timepiece offers an epic transcontinental

journey. The GMT by Greubel Forsey is much more than a watch. It has evolved into a portable time map.

A lateral window set in the case offers a viewpoint over the Southern Hemisphere. The South Pole does not appear since it is the anchor point of the globe, which houses a «flying» pivot system. Greubel Forsey chose titanium, engraved with extreme precision in three dimensions to represent the continents in miniature.

The globe stands prominent at 8 o'clock, while the 24-second Tourbillon also protrudes at 5 o'clock. The platinum case has a third protrusion at 1 o'clock: the main time indications are clearly displayed, overlaid in a cascade across this area of the dial side, with a small seconds at 2 o'clock and then a sectorial power reserve indicator at 3 o'clock. At 10 o'clock is the GMT display for the second time zone.

The back of the timepiece displays universal time for 24 time zones, through

an original rotating disc. This bears the names of 24 cities, and providing a particularly legible display, light-colored cartouches differentiating summer time (for cities which follow this system). As a final touch, a symbolic midday sun at the zenith of the world time disc illuminates the case-back, leaving centre stage of the dial side to the Earth.

Naturally, and in this too we can recognize the «Greubel Forsey signature», the utmost care is taken with the decoration of the components, down to the smallest details. The hand finishes take in the entire range of traditional techniques, from frosting to hand-bevelling, as well as the subtleties of hand-polishing, lapping, and straight graining with flat black polished finishes. The domed crystal, the case-back and lateral window are made from sapphire crystal. The hand-stitched black alligator strap has a platinum folding clasp. A magnificent demonstration of expertise harnessed for the pursuit of fine craftsmanship.





The GMT calibre is powered by two barrels providing a 72-h power reserve with a frequency of 21,600 vibrations/hour. The calibre comprises 443 components. It features a 24-second tourbillon with 25° inclination, comprising 87 components for a total weight of 0.36 g.

Besides its chronometric properties and reliability, this regulator system was adopted for its small size, which meant that a calibre diameter of 36.40 mm (16 ½ lines) could be kept. This makes for a new medium-sized case, 43.5 mm wide with a total height of 16.14 mm.

Made from 950 platinum, it has a slightly lighter hue than the previous white gold version.

For further information please contact:
press@greubelforsey.com
www.greubelforsey.com



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Faculty Position in Multi-scale Manufacturing Technologies at the Ecole polytechnique fédérale de Lausanne (EPFL)

The Institute of Microengineering (IMT) within the School of Engineering at EPFL invites applications for a faculty position at the level of tenured professor or tenure-track assistant professor in **multi-scale manufacturing technologies** for its Neuchâtel site. This new position is aimed at reinforcing the leading position of the Swiss microengineering industry by giving it the means to further strengthen its competitiveness by continuous innovation.

Specific areas include, but are not limited to:

- **high-precision additive manufacturing technologies;**
- **multi-scale micro-precision** manufacturing;
- **high throughput** manufacturing;
- manufacturing of **complex 3D** mechanical components;
- **advanced manufacturing processes** compatible with standard materials used for micro-mechanics in watchmaking and other applications.

Experience in successful collaborative research programs with industry is highly desirable. The Neuchâtel site of IMT-EPFL offers a particularly advantageous position for this chair due to its central location in the Jura Arc, which is the home to many of the key watchmaking companies, and to its historically very strong links to the diverse and well-established local high-technology industry.

As a faculty member of the School of Engineering, the successful candidate is expected to initiate an independent, creative research program, participate in undergraduate and graduate teaching and establish strong links with industrial partners. Internationally competitive salaries, start-up resources and benefits are offered.

Applications should include a cover letter with a statement of motivation, curriculum vitae, list of publications and patents, concise statement of research and teaching interests, and the names and addresses of 5 references. Applications must be uploaded in PDF format to the web site: **manufacturing.epfl.ch**

Formal evaluation of candidates will begin on **15 December 2013** and continue until the position is filled.

Enquiries may be addressed to:

Prof. ChristianENZ

Search Committee Chair

E-mail: **manufacturing-search@epfl.ch**

For additional information on EPFL, please consult the web sites **www.epfl.ch**, **sti.epfl.ch** and **imt.epfl.ch**.

EPFL is committed to increasing the diversity of its faculty, and strongly encourages women to apply.

The Swiss Tech Convention Center - EPFL
(Richter · Dahl Rocha & Associés architectes SA)



In 2013, Jaeger-LeCoultre celebrates its 180th anniversary and presents the Master Grande Tradition Gyrotourbillon 3, the tenth work in the Hybris Mechanica series dedicated to the Grande Complication models from the Manufacture.

A new pinnacle of the watch-making art



The Jaeger-LeCoultre gyrotourbillon is an authentic 21st century horological sensation that now appears for the first time with a flying tourbillon, a blued gold balance and a spherical-shaped balance-spring. The Master Grande Tradition Gyrotourbillon 3 also achieves another feat by combining the prodigious precision of the spherical tourbillon with the first instantaneous digital-display chronograph presented within a Grande Complication watch.

As the masterpiece of the «Tribute to Antoine LeCoultre» Jubilee trilogy, this new timepiece combines the extreme technical sophistication of the Manufacture and the finishes characteristic of time-honoured watchmaking art with an aesthetic directly inspired by the pocket watches produced by the Manufacture during the 19th century.

The gyrotourbillon scales new peaks of perfection

The enhanced compensation for positional errors due to the influence of gravity is rendered especially fascinating by this meticulously synchronised double rotation. The spherical tourbillon immediately catches the eye at first glimpse of the face of this Master Grande Tradition Gyrotourbillon 3 Jubilee model. Nonetheless, even for certain devotees of horological innovation who have already attempted to probe the secrets of the first two spherical tourbillons developed by the Manufacture, this mechanism appears in an

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entirely new light: for the very first time, the absence of an upper bridge invites the gaze to wander freely through this entrancing miniature universe.

It is composed of two carriages, respectively rotating in one minute and 24 seconds – meaning 2.5 times a minute – and does not owe its existence exclusively to the inventiveness of the engineers and watchmakers of the Manufacture, but also to the use of cutting-edge equipment such as the five-axis machining centre. Finally, it takes nothing less than ultra-light materials such as aluminium to achieve an authentic micromechanical feat by creating an ensemble composed of around one hundred parts and yet weighing less than one gram.

The Jaeger-LeCoultre engineers and watchmakers have combined technical inventiveness with a degree of refinement demonstrating a mastery of all aspects of the watchmaking art: the aluminium carriage of the gyrotourbillon has undergone a surface treatment that enhances its ability to reflect the light. The lightness and sturdiness of aluminium generally result in diminished radiance that considerably reduces the reflection of light rays. In this case, the material boasts reflective properties that enable light to stream into the very heart of the spherical tourbillon.

Within this construction, a distinctive new element also naturally draws attention. In association with a 14-carat blued gold balance, the movements of the balance-spring create a surprising three-dimensional effect. After the cylindrical balance-spring of the Gyrotourbillon 2, the watchmakers of the Manufacture have developed a spherical balance-spring fitted with two terminal curves guaranteeing the best possible 'chronometric' or precision-timing performances.

In the Valley of Complications, the quest for precision is destined to continue

unabated, and the dexterity of the Jaeger-LeCoultre watchmakers reaches new heights with this new creation.

The new movement – Jaeger-LeCoultre Calibre 176

The latest of the 1,242 calibres built by the Grande Maison in the Vallée de Joux is named Calibre 176. Developed, crafted and assembled in the Grande Complication workshops of the Manufacture, it combines the gyrotourbillon with a chronograph function.

Jaeger-LeCoultre has developed an instantaneous digital-display chronograph boasting extraordinary precision that destine it to become a new watchmaking legend, since it is the first chronograph to be associated with a flying spherical tourbillon. Once again, the essence of this model – the perfection of the function – is clothed in pure beauty beautifully expressed on its round dial. The latter is swept over by a single seconds hand that begins running as soon as the chronograph is activated, and of which the tip, when it stops, points to the subdivisions on a classic 0 to 60 scale bearing 10-second numerals for enhanced clarity. Nonetheless, rather than counting its rotations on a subdial, the Jaeger-LeCoultre watchmakers have opted for an instantaneous digital display, composed of two generously sized apertures appearing side by side at 3 o'clock on the dial of the chronograph.

It is also worth noting that the chronograph function of the Master Grande Tradition Gyrotourbillon 3 Jubilee is of the single push-piece type, an historical feature reflecting that characteristic of late 19th century models.

The epitome of horological tradition

The tenth creation in the Hybris Mechanica series is distinguished by the presence of three independent dials. Each bears a traditional Fine Watchmaking finish intended to reveal its singular nature. The hours and

>> WATCHMAKING

minutes dial is characterised by its traditional opaline silvered decoration. It is swept over by new Dauphine-type hands entirely in harmony with the other features of this timepiece. Meanwhile, the chronograph display has a sunray rhodium-plated finish endowed with a classic aesthetic entirely dedicated to ensuring immediate readability; while the dial displaying the day/night indication features a hand-punched background and the night section has been coated with a translucent blue lacquer. The mainplate has been patiently manually hammered, according to an ancient technique rediscovered and meticulously applied in the workshops of the Manufacture. These skills requiring peerless dexterity and constancy are inspired by a pocket-watch made in 1898 by Jacques-David LeCoultre in order to celebrate his admission into the select circle of exceptional watchmakers who have gone down in history as the masters of their art. This remarkably complex work already combined a number of functions including a perpetual calendar, a moon-phase display and a minute repeater equipped with a silent governor. The latter innovative device, which earned one of the 400 patents awarded to the Manufacture since its founding, is still used to this day.

The dial centre bears the Jaeger-LeCoultre logo and signature, as well as the mention of the date 1833, a reminder of the historic year when Antoine LeCoultre opened his watchmaking workshop in the Vallée de Joux.

The Master Grande Tradition Gyrotourbillon 3 Jubilee comes in a new extra-white platinum case measuring 43.5 millimetres in diameter and 15.5 millimetres thick. The superbly elegant bezel and lugs are adorned with a polished finish creating a delicate contrast with the satin-brushed case sides.

The breathtaking beauty of the Master Grande Tradition Gyrotourbillon 3 Jubi-

lee stems from this unique alliance between historical inspiration and cutting-edge technical innovation. It is fitted with a white gold folding clasp comprising a device enabling millimetre-accurate length adjustment according to the temperature and the humidity rate in order to guarantee a perfectly comfortable fit in all circumstances. Nonetheless, a mere description of this distinctive feature does not do justice to the work accomplished by the Jaeger-LeCoultre engineers, whose inventiveness is not confined to the technical watchmaking aspects of their timepieces. In actual fact, the additional mechanism incorporated within the folding clasp to enable perfect adjustment forms a complex construction made up of around one hundred parts. All of which serves to confirm that comfort, an essential feature of any timepiece destined to encircle the wrist, is also a matter of precision.

This model in the «Tribute to Antoine LeCoultre» Jubilee collection will be produced in a limited edition of 75.
www.jaeger-lecoultre.com



TECHNICAL CHARACTERISTICS

Movement:

- Mechanical manually-wound movement, Jaeger-LeCoultre Calibre 176, crafted, assembled and decorated by hand
- Frequency: 21,600 vph (3 Hz); Two barrels
- 48-hour power reserve
- 592 parts; 92 jewels; 11.15 mm thick

Flying spherical tourbillon:

- Rotation speeds
 - Outer carriage in extra-bright aluminium: 1 rotation/minute
 - Inner carriage in extra-bright aluminium: 2.5 rotations/minute
- Blued spherical balance-spring
- Blued 14-carat gold balance
- Number of parts: 112
- Weight: 0.43 grams

Hands:

- Hours and Minutes: blued Dauphine-type
- Chronograph second hand: blued baton-type

Functions:

- Hour, minute
- Flying gyrotourbillon
- Instantaneous digital-display chronograph activated by a single push-piece at 2 o'clock
 - Digital display of the minutes (from 00 to 59)
 - Pointer-type indication of the chronograph seconds
- Day/Night & 24-hour indication.



ENVIRONNEMENT
PROFESSIONNEL
HORLOGERIE
JOAILLERIE



ENVIRONNEMENT
PROFESSIONNEL
MICROTECHNOLOGIES



SWISS MEDICAL
TECHNOLOGIES

INTERNATIONAL TRADE SHOW HIGH-PRECISION LEADER

WATCHMAKING AND JEWELLERY - MICROTECHNOLOGIES - MEDTECH

11 TO 14 JUNE
2014
GENEVA



Sistem51, the new Swatch self-winding mechanical movement, is to be assembled and adjusted entirely by machine. This groundbreaking development seems destined not only to give Swatch a major boost, but also to raise a lot of questions about the mechanical watch sector in general.



BY MICHEL JEANNOT, PUBLISHER & EDITOR IN CHIEF
OF WTHERJOURNAL.COM

Just How Far will the Revolution Go?



Nick Hayek, the CEO of Swatch Group, had already given advance warning of this new revolution. It was at Baselworld that he first unveiled the Sistem51, a self-winding mechanical movement including 51 components – just like the first quartz Swatches, back in 1983 – that is assembled and adjusted entirely by machine. This ultra-simplified watch movement represents a spectacular breakthrough for Swiss mechanical watchmaking. It is also undoubtedly the most spectacular leap forward in the history of Swatch since their plastic watch model was first launched 30 years ago.

The new Swatch self-winding movement thus represents a major innovation, not only for the features of the system in itself but also for the manufacturing process that has been put in place to produce it. This high-tech jewel – which involved the registration of no less than 17 different new patents – has been designed to attain an objective that is as simple as it is clear: that of producing a 100 % Swiss-made mechanical movement as cheaply as possible.

Sistem51 is quite simply the first mechanical watch movement in the world produced by a 100% fully-automated assembly process. Its high-tech escapement has no regulating organ, since it is regulated by laser in the factory during production; it contains 51 components (including just one screw), and has a power reserve of 90 hours for a frequency of 3Hz. The Sistem51 movement is made entirely of ARCAP, an alloy of nickel, copper and zinc which up to now had been found only in Richard Mille movements (!) but which has excellent anti-magnetic qualities. As for the oscillating mass, it is totally transparent and made from a synthetic alloy derived mainly from tungsten. Another

significant feature is that Swatch has indicated a precision of -5/+5 seconds per day for these watches, which came onto the market in December 2013 at a sales price of 150 Swiss francs.

Over and above these technical characteristics, the new Swatch Sistem51 also has major symbolic importance as the first new product developed entirely in the post-Nicolas G. Hayek era, given that it has taken less than two years to pass from the original concept to the presentation of the first working model. These groundbreaking new watches clearly bear the hallmark of Nick Hayek (an enthusiastic champion of all manifestations of domestic «Swiss Made» production activity) and of the teams of engineers working for the different companies inside the Group such as ETA, Nivarox and Comadur. This Sistem51 movement is thus also in many ways the expression of the Swatch Group's entire R&D potential.



A «modern-day Roskopf watch»

Will this «modern-day Roskopf watch» and the technology that accompanies it put the Swatch brand firmly back at center stage? While the launch will almost certainly be a major success, the Swatch Sistem51 nevertheless seems unlikely to allow the brand to re-experience the periods of out-and-out euphoria of the late 1980s, when the rarity of the new Swatches was in proportion to the length of the lines of potential purchasers forming in front of the stores.

The plain fact is that this Swatch Sistem51 marks a significant upheaval in the current watchmaking order, in that it blurs a number of basic distinctions hitherto generally accepted. There was a time when the watch industry was divided into two quite distinct sectors: quartz watches (which were cheap) and mechanical watches (which were more expensive). With its Sistem51, Swatch is now changing the picture and blurring the gap between these perceived categories, with the result that it is now possible to produce a 100 % Swiss Made mechanical watch and sell it at 150 Swiss francs, while still making a profit.

From now on, however, a lot of time and effort is going to be needed to explain the difference between these new Swatches and existing cheap-to-medium range mechanical watch models (especially once the latter have started to include the new technology put in place for the Sistem51). A lot of skill is also going to be required to explain exactly why mechanical watches driven by several hundred components are less precise, less reliable and much more expensive than a watch with 51 components. Is the Swiss watchmaking industry really capable of playing these two different ball-games – and winning in both? That's the challenge that the Swatch Group is really setting.

The invention of the Swatch

The story began with a huge crisis. The one that destabilized the whole watch-making industry, causing severe unemployment rates and the bankruptcy of many companies and suppliers. This happened between 1970 and the beginning of the 1980s, with the loss of massive market shares and jobs in Switzerland. A pillar of the Swiss economy was shaking.

The Swatch was born in this tough context (official market release: March 1983), defining itself as «**The fashion-watch that provides time!**». People liked it: it was a joyful and fun product! And it came just in time: everybody was desperately looking for some good news in order to balance the trauma of the whole Swiss watchmaking industry that was in danger to disappear.



1.

Nevertheless, at its release, all the professionals were deeply shocked by several disruptive aspects of the Swatch... Up to the point that, as I like to call it, the Swatch was considered then as a «**No-watch**»! The whole Swiss watchmaking industry was so proud about offering top quality after sale and repair services worldwide (with 20 years of spare parts guaranteed), but the Swatch was going in the opposite direction: **It couldn't be neither opened nor repaired!** Imagine the reaction of a reseller that has been trained for decades to repair

Elmar Mock is named as inventor in more than 150 patents families. He founded his own company, Creaholic SA (www.creaholic.com), in 1986 in Biel Switzerland, transforming ideas in commercial realities with his team of innovators, thinkers and designers. Creaholic elaborated wood welding and bones welding technologies, amongst other radical innovations (www.woodwelding.com). Elmar Mock & Gilles Garel are the authors of the reference book «La Fabrique de l'innovation», published in 2012, available on Dunod.com and Amazon.fr.



Since 1983, the Swatch Group:

- has sold more than 400 million Swatch;
- is the world's largest watchmaker. 2012: record turnover > 8 billion CHF, operating margin > 25%, 30'000 employees with > 16'000 in Switzerland;
- has acquired several prestigious watchmaking brands including Breguet (in 1999) and more recently the jewelry and watch brand Harry Winston (in 2013 for US\$ 750 million + pro format net debt of US\$ 250 million).

watches in his own boutique... At first they refused to sell it! Then, facing increasing market demand, they did. The Swatch represented a radical innovation in technology as well as busi-

ness model and we promoted it using guerilla marketing, even before this notion was invented! Fashion existed of course, but with the Swatch, fashion could give time too!

EXCLUSIVE: FIRST INTERVIEW OF ELMAR MOCK ABOUT THE NEW SWATCH SISTEM51 - REFLEXIONS ON THE LATEST TRENDS IN THE WATCHMAKING INDUSTRY



2.

The new Swatch Sistem51

In 1984, Ernst Thomke already asked Jacques Müller and myself «Would it be possible to invent a "mechanical Swatch"?». He wanted a mechanical watch **in line with the Swatch's spirit**: Reduced number of parts, simplifications from design, no repair, no maintenance, optimal production costs... Sincerely, at that time, with the materials and technologies that were available, we couldn't find a solution to obtain a quality movement, with adequate chronometric precision, crossing the new frontiers set by the Swatch itself!... Exactly 30 years later, Swatch made it possible and I believe there is a real market for it. It is brand new and I have not had the chance to dismount one of these yet! But I will, as soon as I get one, like any kid or engineer, fond of microtechnology! (*Laughs*)

Potential buyers of this new Swatch desire a **trendy, reliable watch**, which will work for years, **without having to change the battery**, because there is simply no electronics in it! Women typically love to assort their watch with the colors of their clothes and accessories! So they have several «fashion-watches that provide time». They keep them for years, but when they want to wear them, they are often very disappointed to discover that the battery has run out. Following that first frustration (immediately associated with the watch), having

to go to a shop, to change the battery is neither a positive nor a pleasant experience, mostly just a waste of time. **If that watch would come to life again simply by shaking it, that would fulfill their need!**

The fact that there are 51 parts, exactly like the original Swatch, or only one screw (which could have been replaced by any other assembly process, because I don't know who will want to dismount this new Swatch except me for fun!), is not what gets my attention. I value precision, quality, reliability and image. For me a watch is a «talisman», as I'll explain later. How does the watch resist through the years? Is there any lubricant or did they finally suppress them? Were isochronism and loss of amplitude solved in a proper way?... About market size, does it represent hundreds of millions of watches to be sold?... This is what I am interested in! I think it **completes** very well the current products' offer within the Swatch family, and it is a nice one. Will we see more than 15 or 20 millions sold? Maybe, let's wish the best to this new Swatch.

Other interesting developments were made in the past to obtain the same result (a mechanical Swatch, affordable, reliable and precise): The most relevant solution was a hybrid one, using the energy of a spring to power a micro-generator that supplied electricity to the quartz. Then, without battery you get both benefits of longer lifetime and excellent precision (provided by the quartz). These developments were not completed and therefore never released to the market.

Segmentation of the watchmaking industry

There is of course the high-end segment where Switzerland is definitely the world leader without any question. We sell exceptional pieces at exceptional prices! This is a lifetime's dedication of an extremely small number of amazing micro-technology specialists, artisans and

1. *Swatch Techno-Sphere 1985.*
2. *Swatch Sistem51 2013.*
3. *Swatch Lisa Fan 2013.*

artists. This represents in total approximately 5 million watches per year, on a total for the worldwide market of 1.2 billions watches per year! So only 0.4 % of the market, the very top of the iceberg!

Having said that, customers sometimes do not truly realize that mechanical watches, with hundreds of parts, truly play with the limits of physics in order to measure time! Critical parts are built with special alloys and sophisticated solutions to compensate and reduce many issues, even the dilatation coefficient of the metals! **If not, any change of temperature at this scale, would have drastic consequences in such complex micro-systems...**

What is a watch?

For me: «**A watch is not a time instrument, it is a talisman**».

It is charged with emotions, power and memories, as a purchase or as a gift from people we love. It is an emotional bond with who we love, who we are and/or who we want to be or to display that day. It is a symbolic representation of oneself, and on the side, it provides time!

Editor's note: Source Wikipedia: Talisman, from the Greek «Telesma» or Arabic «Tilasim»: «A magical figure charged with the force which it is intended to represent.»



3.



History of the watch

The first watches were pocket watches. Let's not forget that they represented half of the market up to 1940. The first wristwatches were bought at the beginning of the 19th century, by elite sportsmen (rare car owners or first aviators) as well as military officers, who needed to know the time at a glance, in a fast and convenient way, not having to remove the watch from their pocket. So, to use **the wrist, as a convenient spot, is a proven concept that remains a brilliant idea.** To focus on that matter, Switzerland has acquired, a unique and extremely valuable knowledge about shapes, geometry, design, materials, mechanisms, locking systems, as well as beauty, to ensure a perfect wrist fitting. This represents an important asset that Swiss watchmaking brands underestimate.

New generations of watches

When I look at my own children, mobi-



lity, Internet access and interconnectivity are key needs that shape their world. The smartphone became their favorite tool and an extension of themselves. They keep in constant touch with their family and friends to share emotions and life, using it like, what I would call a **«virtual umbilical cord»**. This virtual umbilical cord is also a direct link with their Twitter or Facebook's clans! In one quick look, people can see on their new watch if their loved ones tried to call, how they are, if they are reachable in case of emergency, etc.

Like mentioned before, the two concepts: position on the wrist and talismanic symbol, combine convenient access with emotional message, to gather in one product comfort, mobility and interconnectivity. I'll then have at my wrist an interactive hub that I can consult at a glance in a fast and elegant manner.

You can call it: Apple iWatch, Samsung Galaxy Gear or SmartWatch... For me, this is **ingenious and logical. This is definitely watchmaking, a «wrist-Talisman and a modern communication hub»!**

That's why I am surprised to hear sometimes, from certain leaders of our watchmaking industry: «This is not competition», «not relevant for us», «the only watch is the mechanical watch», «tradition = guaranteed profits», etc. This is exactly how the watchmaking industry was thinking in 1970! Then, not paying attention, we started to lose market shares, the industry almost collapsed, and a «No-watch», like the Swatch, came and changed the game. In my opinion, we are once again missing the point: There is tremendous knowledge in many aspects, about how to fit a watch on the wrist (as mentioned before), as well as other skills that we have developed to a very high level. This represents a **real tangible asset and a truly amazing competitive advantage for**

Switzerland, compared to any new entrant in the wristwatch's field.

I never expected Switzerland to become a high volume producer of touch screens or electronic components of course, however, **I was truly waiting for a visionary joint venture** between a key Swiss watchmaker and Apple or Samsung! The resulting products would have been esthetically far more elegant than what I have seen so far. And I am talking about middle range products, easily affordable by heavily connected people: like most teenagers, as well as 45 year-old managers.



Even if I am not saying that it is THE future of the watchmaking, I am convinced this is a segment in development in the watchmaking industry, which will soon represent not less than 100 to 500 million watches! We own the top of the iceberg, but we lost some of its base, where we were once the leaders. Let's continue together to put Switzerland on the map as the best location for innovation, precision and quality.

4. *Swatch 700 years Confoederatio Helvetica 1991.*

5. *Swatch Black Ghost 2013.*

6. *Swatch Skin 1998.*

SMT: A key Medtech event in 2014

Acknowledged as a major professional trade show, EPHJ-EPMT-SMT gives suppliers an efficient platform to boost their businesses. The 2014 event is a unique opportunity for Medtech to promote itself, implement dialogue and take up synergies from among all the sectors represented.



Focusing exclusively on design and manufacture of medical devices, the Swiss Medical Technologies sector of the EPHJ-EPMT-SMT Trade Show is a meeting point for the entire chain of businesses in this industry, from research to subcontracting. It promotes an encounter between well-known companies and young start-ups for effective cross-marketing, while simultaneously reaping the benefits of synergies with the EPHJ and EPMT sectors.

«This complementary function among sectors streamlines the activities of exhibitors and visitors on the lookout for innovative solutions», says André Colard, co-founder of the EPHJ-EPMT-SMT Trade Show. Obviously there are more and more examples of medical technologies that are also valid for the watchmaking industry: lasers, clean rooms or ceramic processing are just a few of these.

Since 2011 the Show has been bringing together more than 160 major players in the Medtech sector, giving them the chance to strike up professional relations and boost their microtech expertise. It is also a venue for R&D professionals, materials manufacturers, suppliers of machinery and production equipment, manufacturers and subcontractors supplying technical parts and components, and providers of specialist medical services.



A highly prized sector with strong potential

The Medtech industry is one of Switzerland's most dynamic sectors. It produces turnover of CHF 23 billion, features 3,700 major groups, SMEs and start-ups, and accounts for almost 100,000 direct and indirect jobs. Many companies operating in this sector are usually the best placed in terms of innovation, and are keen to develop and export their know-how.

An event that brought together over 750 exhibitors and 18,000 professional visitors in 2013 makes it a preminent showcase for this industry.

SMT will be Switzerland's only Medtech event next year. It will be attended by all professionals operating in the sector to showcase their expertise. «On the strength of a programme open to an ever-increasing circle of professionals and specialists in these industries, we are striving to position each sector vis-à-vis the decision-makers and the right authorities in Switzerland and abroad», enthuses Olivier Saenger, co-founder of the EPHJ-EPMT-SMT Trade Show.

The next EPHJ-EPMT-SMT event has been scheduled from 17 to 20 June 2014. Almost 85% of bookings have already been finalised, thus indicating another resounding success at the 13th show.

To allow creatures to swim, walk, fly, and to interact with matter and energy, protect themselves... nature has invented so many materials, finely designed and tuned to such a variety of functional surfaces... Indeed, in nature, countless games have been played out rewardingly with innumerable molecules.

Still, engineers in Western Switzerland continue to imagine and design new innovative materials at the micro & nano-scale for applications that reach into every part of society.

Photo: Geneva



Operator loads Parylene precursor in Comelec coating plant.



Cutting tools for gear teeth generation have proven to be a very specific series of tools.



UV crosslinking of web coated adhesives on Collano's pilot coating line.

Parylene is the trade name for poly(p-xylylene) polymers family. Surprisingly, parylene is still not well known and intended for cutting-edge technologies, even if it was already discovered in the 1940's. Indeed, seeing the potential of the molecule, Franklin Gorham, a Union Carbide Corporation scientist, developed an innovative synthesis process, known as Vacuum Deposition Polymerisation (VDP). Parylene coating obtained by VDP process was first commercialised in 1965.

▲▲ BY JEAN-FRANÇOIS LAITHIER, PHD MATERIALS SCIENCE, COMELEC

An unmatched conformal coating in progress



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1. Medical devices prepared under laminar flow for Parylene coating.

2. Operator loads Parylene precursor in Comelec coating plant.

The VDP process: The material precursor, the solid dimer (a white powder) is sublimated under vacuum (10^{-2} - 10^{-1} mbar and 100-150 °C). Vapour gas of dimer going through a pyrolysis area (650 °C) is cracked to become a reactive monomer diradical gas. Arriving into the deposition chamber at room temperature, as a highly-reactive monomer gas, it absorbs and polymerised spontaneously on all exposed surfaces of all parts inside the coating chamber, in turn producing linear poly(p-xylylene), a high molecular weight thermoplastic polymer taking the physical form of a transparent semi-crystalline film.



«With 35 years of Parylene coating knowhow, Comelec is the key partner for applying this type of protective coating.»

Denis Erni, PhD Physics,
Comelec Director

The Parylene polymerization process delivers useful benefits

This distinctive deposition method results in special properties. In particular: perfect conformity with the substrate, including recesses, sharp edges or flat surfaces and excellent penetration into the substrate's open pores and deep recesses, with no discontinuities or pinholes even at ultra-thin thicknesses (generally considered pinhole-free from 50 nm). Its thicknesses, definitely adjustable, can vary from completely closed

to one hundred microns for specific application (it will continue growing, as long as monomer is available, at the range rate of 10 µm per hour for parylene C). The film is free from imperfections such as beads, discontinuities, bridges, etc. – issues commonly encountered with liquid processes.

There are no solvents or catalysts involved in the formation sequence. Being produced directly from a gaseous state, the polymer is highly pure and is a result of green polymer chemistry. Because of the growing at room temperature, the film is free of thermal stress between the coating and the substrate.

Other advantageous properties

The polymer is extremely chemically inert; making it is resistant to the vast majority of organic solvents, and even strong acids and bases. Subsequently, due to its chemical stability, parylene is a long-term, implantable material and accepts sterilisation processes. It is thus biocompatible and biostable.

Parylene film is used mainly as an electric and / or environmental barrier. With a dielectric permittivity in the order of 2 to 3, it is a so-called «low-k» material. Coupled with a low dissipation factor, a very low leakage current and high dielectric strength, it is an excellent electrical insulator. The film has low permeability to gases and liquids in polymer coating family, it is free from defects and pinholes and provides outstanding chemical resistance, making parylene the coating of choice for protecting components that are sensitive to their operating environment.

From an optical standpoint, parylene is transparent throughout the visible spectrum. However, it does absorb UV rays, so it has certain vulnerability when exposed to UV light in the presence of oxygen (except Parylene F-AF4).

Parylene's low surface energy makes it highly hydrophobic. It has also a low coefficient of friction.

Applications

Parylene is a primary choice as an environmental protection for high techno-

logy, conformal coating requirement. However, it has become more and more accessible for common applications. Parylene combines the dual properties of dielectric insulation and environmental protection (moisture, solvent, acidic and base solutions), the properties of electronic sensors and PCB and ferrites, as well as consolidating them.

Approved by the FDA, Parylene C (and N) is used on certain long-term implantable medical devices. The film can be employed as solid lubricant and electrical insulator on wire guides, as well as stents, implantable electrodes, pacemakers and hypodermic needles. Applications in the medical and pharmacology fields are growing almost daily.

Comelec expertise

Established in La Chaux-de-Fonds in 1979, Comelec SA has unrivalled and continually improving know-how, mainly in the parylene deposition service, but also in the manufacturing of dedicated systems. Comelec can deliver solutions for the most complex needs. Indeed, the R&D team supports production for customer special requests as much as improving processes and developing new solutions. Comelec has formed a partnership with a plasma supplier (a complementary technology of parylene) and also with local Applied Sciences schools (patent sharing) and European research institutes such as IMEC and the Fraunhofer Institute. Comelec is also a partner in a second European project (FP7).

Parylens: www.parylens.eu.

To know more about Parylene, training is regularly scheduled with the FSRM in Neuchatel (www.FSRM.ch)

www.comelec.ch

A family business of a hundred people, Louis Bélet SA in Vendlincourt (North of Porrentruy), has been manufacturing form tools and micro-cutting tools in Tungsten carbide or PCD since 1948. An interview with the President of the Board, Arnaud Maître.

▲▲ INTERVIEW WITH ARNAUD MAÎTRE, CEO DE BELET SA
BY ROLAND KELLER

A tool that can drill square holes

1. *Cutting tools for gear teeth generation have proven to be a very specific series of tools.*

2. *Louis Bélet SA in Vendlincourt (Ajoie).*

3. *Roxane Piquerez (Director) and Arnaud Maître (President and Director) of Louis Bélet SA.*

In 1948, what motivated Mr. Louis Bélet to found in Vendlincourt, the first and only regional shop for producing cutting tools?

Arnaud Maître: Like many of his contemporaries, Mr. Louis Bélet first started working as a watchmaker-farmer. Having noted the difficulty of obtaining tools for machining his timepieces, he simply decided to make his own.

Why has your business been able to develop steadily while remaining at the same site in Vendlincourt?

AM: The company is located in the heart of a village to which it is closely linked. Actually, Louis Bélet has also been the mayor of Vendlincourt. Continuing to produce and create jobs on this site are particularly close to the heart. The environment is very pleasant and the production conditions are ideal. So far we have always been lucky to find available space for our extensions, and we can always count on constructive relations with political authorities and neighbours

Who have been your main competitors and what sets you apart from them?

AM: The majority of our competitors are companies in Western Switzerland. Due to the problem of the strong Swiss Franc, our competitors in neighbouring France have become more strongly represented, and their prices have quickly become much more competitive. A

competitive relationship also exists with the leading international manufacturers of instruments, such as the Japanese. We distinguish ourselves by a particular expertise that allows us to make very complex tools. We strive to be very reactive and constantly endeavour to meet the needs of a client.

What are your current flagship products and how do you apply your know-how?

AM: Hob cutters for gear grinding have proven to be a very specific series of tools that are among the finest products made by our company. We have also developed a drill for drilling composite materials that has proven to be the most



«We have designed a drill for drilling composite materials that has been proven to be the most effective!»

Arnaud Maître,
CEO Belet SA

effective during tests carried out by our client during which the tools of twelve manufacturers were evaluated. We put a lot of effort into tools for *superfinishing* and have also developed a tool to drill square holes.

In which sector do you see the greatest need for your products?

AM: The watch industry is easily our best sector. We collaborate with a lot of manufacturers and therefore we have acquired a special know-how, thanks to highly demanding customers in this area. The electronics and telecom markets are also very interesting and extremely rigorous, and we are currently positioning ourselves in both.

What is the current global envi-

ronment for manufacturing cutting tools? And how is business in these uncertain times?

AM: Business is particularly good at the moment. In Switzerland, we have the good health of the watch industry and abroad we have identified significant potential for our products, primarily in North America and China.

What are your goals for further growth?

AM: We have no specific growth targets. Our primary goal is to manufacture excellent products...

www.louisbelet.ch

Sustainable strategy

The company Louis Bélet SA is not only creative and strong technically, but it is part of a sustainable development initiative that reconciles the needs of the economy with those of the environment and society.

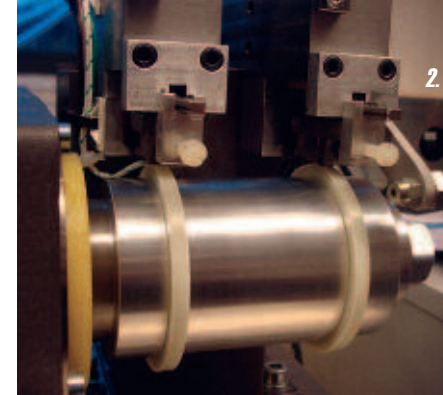
Thus, it has developed its strategy by focusing on three primary areas: economic (thoughtful and proactive investment), social (maintaining jobs in the region) and especially environmental (separation and recovery of waste, cutting oil closed circuit network, construction of a new building with the energy label *Minergie*).



With the Swiss Prealps as an inspiring background, the historical city of Fribourg and its region has cleverly turned its privileged position along the Lausanne – Bern axis into a strong economical force. Key elements to this eminent techno-scientific hub are innovative university and HES programs, the rapid growth of high-end industries, political willpower and a particular focus on micro & nanomaterials.

▲▲ BY JEAN-LUC RENCK

A nanomaterials & mega-networking hub



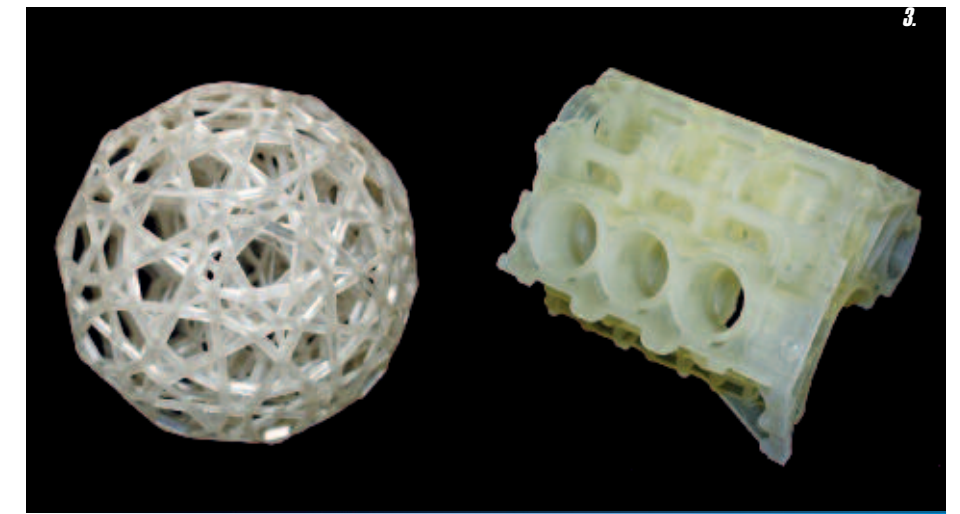
1. Researchers from the Adolphe Merkle Institute (AMI) have designed various stimuli responsive materials which are of very high interest to a company such as Collano Adhesives AG. For example, Collano and AMI work on novel UV cured adhesives where the adhesives properties can be controlled by external stimuli. Pictured here: UV crosslinking of web coated adhesives on Collano's pilot coating line.

2. In the «Plastics Cluster» several companies are working with teams in chemistry and platurgy at the College of Engineering and Architecture (EIA-FR) in projects focusing on surfaces and nanodesigned coatings with special properties: anti-adhesives, anti-scratch, anti-fingerprints, low-friction, etc. Pictured here: plan-disk wear test during such a collaborative project (Resuplast).

3. 3D Systems SA received assistance from the AMI to improve the mechanical properties of special resins. For example; based on the famous «Accura Bluestone» resin used in the shaping of Formula 1 prototypes tested in a wind tunnel - through blending of novel micro and nanometric fiber additives (pictured here).

On the border between German and French regions of Switzerland, Fribourg has been for centuries a lively crossroad for trade and knowledge. It is still so. Taking full advantage of its geographical situation, the Fribourg area has resolutely built up its academic and economical resources into a powerful technological network appealing to a growing number of companies. One particular milestone is the Fribourg Science and Technology Hub (PST-FR), created in 2009 to tightly link the public and private sectors. «The PST-FR promotes knowledge and know-how, supports applied research and technology transfer, stimulates the growth of local economy and constant creation of high-added-value employ-

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ment and competences» explains Jacques Bersier, R&D director in the College of Engineering and Architecture (EIA-FR) and vice-president and coordinator of the PST-FR. The hub merges industrial, commercial, institutional and academic partners around three thematic clusters: «Plastics», «Energy & construction» and «Information & telecommunication systems (known as IT Valley)», all initiated by the College of Engineering and Architecture with its array of dedicated labs.

Sharing knowledge in nanotechnologies

Also integrated in the EIA-FR, a special team manages the «Nanotechnology Network». This knowledge platform strives to provide companies with information and access to nanotechnology. The Adolphe Merkle Institute (AMI) and the Fribourg Center for Nanomaterials (FriMat), both in the University of Fribourg (UNIFR), are both active members in the network.

The AMI was born in 2008, bearing the name of its very generous sponsor, as an independent center of expertise at UNIFR. Boasting expertise in macromo-

lecular and polymer chemistry, bionanomaterials, nanoparticles self-assembly, soft matter physics and scattering, the AMI focuses on fundamental and application-oriented research in «soft nanomaterials».

Unique to Switzerland and its surrounds, this niche focus renders AMI a worthy partner for international scientific collaboration in both academia and industry. «Interdisciplinary collaborations between our researchers is an enabler for the successful and efficient execution of complex research projects which transcend the boundaries of traditional scientific disciplines. This holistic approach is especially important for designing new materials for medical applications», points out Dr. Marc Pauchard, Associate Director & Head of Technology Transfer at AMI.

Hosted by the University as a virtual interdisciplinary research institute within the Faculty of Sciences, the Fribourg Center for Nanomaterials FriMat has been continuously growing since 2006, incorporating research teams from the Departments of Physics, Geosciences, Chemistry and Medicine and AMI.

4. Several institutes in Fribourg are testing light as a means to «nanochange» the properties of materials. At the Faculty of Sciences of the University and the Fribourg Center for Nanomaterials (FriMat), Prof. Christian Bochet has designed ultraviolet light sources to be used in chemistry which are now developed within a start-up company.

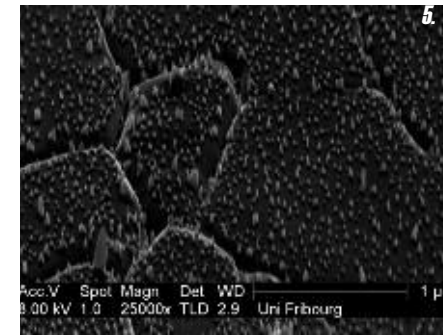
5. UNIFR: The strategic plan of the University of Fribourg drives the priorities of the natural science faculty for both nanomaterials and life sciences. Current director of the Fribourg Center for Nanomaterials (FriMat) Prof. Katharina M. Fromm and her team develop, among other projects, nanoscopic antimicrobial implant coating.

Through its activities, FriMat supports the strategic plan of UNIFR to set the research priorities of the natural science faculty around the themes of nanomaterials and life sciences. «In a natural partnership with the AMI and local industries, FriMat members are dealing with materials close to applications such as nanoparticles and their use in medicine, responsive polymers, surfaces designed at the nanoscopic scale to get new properties, , like superconducting or antimicrobial devices, etc» , explains Prof. Katharina Fromm, current director of FriMat.

Accompanied companies

By organising conferences around industry-relevant subjects, providing members with evaluations of feasibility and facilitating partnerships and projects with academic partners, the «Nanotechnology network» acts as a bridge between cutting-edge research and novel business opportunities. To name only a few among the companies which have found an ideal environment and expert partners in the local Fribourg area:

- Collano Adhesives AG (a leading company in innovative specialty adhesives);



- 3D Systems SA (specializing in 3D printing and chemicals for rapid prototyping).

Recently, AMI researchers designed various stimuli responsive materials of very high interest to Collano who, for example, can control adhesives properties through external stimuli. In another research area AMI showed that defects in polymers can be corrected through light exposure. 3D Systems got help from AMI to improve the mechanical properties of special resins - for example based on the famous «Accura Blue-stone» resin used in shaping of Formula 1 prototypes tested in a wind tunnel - through blending in of novel micro and nanometric fiber additives. Some of these resins are produced exclusively in Marly near Fribourg. «The Fribourg's Science and Technology Hub, the nanotechnology network, the proximity of the AMI, personal contacts... all of this facilitates synergistically the design of our products», says Dr. Manfred Hofmann, Director of technical development in 3D Systems SA.

Also several companies from the «Plastics cluster» have worked or are currently working with teams in chemistry and platurgy from EIA-FR in several projects dealing with anti-adhesives surfaces and nanodesigned coatings with anti-scratch, anti-fingerprints or low-friction properties.

Healthy coherence

Already a strong trend in Fribourg area, synergies between nanomaterials science and medical applications received a further boost recently with the launch of the Swiss Integrative Center for Human Health (SICHH) in 2012 by UNIFR, the Fribourg Hospital and several local - such as EIA-FR – and external partners. SICHH is settled in a former emblematic brewery, now known as the «BlueFACTORY Innovation Park», promoted by the canton and town of Fribourg. Companies, scientists and clinicians will have access to top-notch equipment and highly specialized competences in MedTech and BioTech, thanks to public-private partnerships.

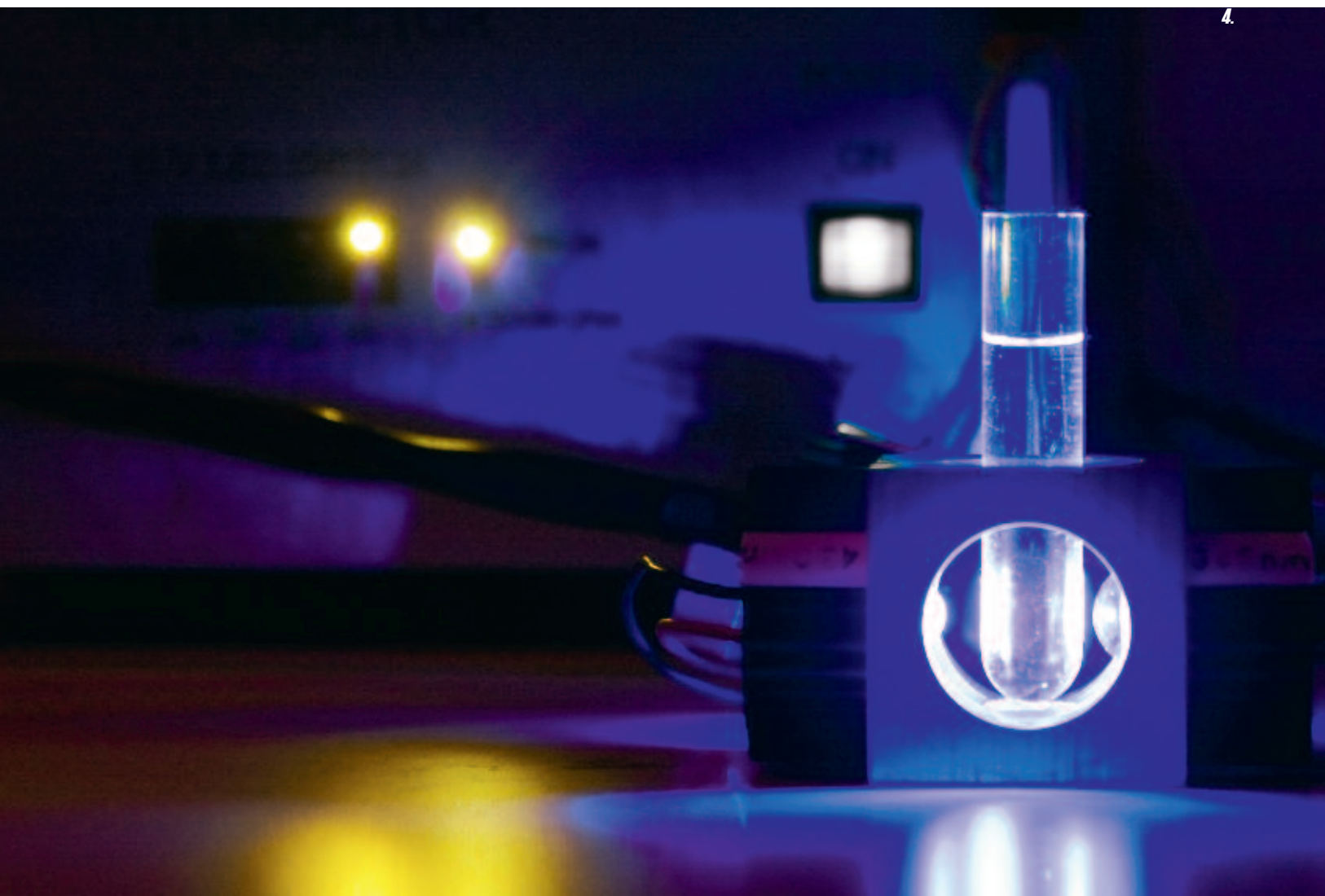
Nanomaterials and health!

Personal health, the economical health of the Fribourg area, and also the health of society and environment at large: last but not least Fribourg's Science and Technology Hub includes a supporting counselling structure for companies under a «Cleantech Fribourg» label, whose mission is «to ensure a sustainable economic growth and facilitate a societal transition to more environmentally respectful use of resources». From the nano world to daily living, with coherence and harmony.

6. Left: This picture shows the gaz evacuation channel of a polymer injection mould after 90'000 injection cycles. This photo clearly shows deposits impairing the correct gaz evacuation that can result in a production of faulty parts.

Right: In the context of a collaborative project the College of Engineering and

architecture of Fribourg aimed at identifying adequate surface coatings for this common problem of the platurgy industry. Many tested surface coatings were products coming out of nanotechnology. This picture shows a surface coated mould after 90'000 injection cycles. A clear diminuation of the deposits could be achieved.





Swiss-ePrint: «e» for...

- **Electronic...**
- **Emerging...**
- **Enabling...**
- **Eco-friendly...**
- **Etc...**

The second edition of the **Swiss Conference for Printed Electronics and Functional Material** will be held in Basel from November 21-22, 2014.

e-Printing is a key enabling technology that goes well beyond the established paper printing. In recent years, novel areas have matured, where printing techniques find increasingly a pathway from R&D to industrial manufacturing. These areas not only include organic and printed opto-electronics, but also micro-optical, bio-medical, MEMS fabrication and packaging, 3D rapid prototyping, flexible substrate and roll-to-roll technologies.

Switzerland already has many activities in the E-print field, and the Swiss -ePrint conference will allow active professionals to identify potential complementary partnership in this upcoming manufacturing discipline that spans across several disciplines from tools, ink materials, surfaces, chemistry & physics, electronics and optics, among others.

Micronarc is a sponsor of Swiss-ePrint 2013.

More information at: www.swiss-ePrint.ch



Congratulations to the Swiss team from ETHZ Zurich – Marie Francine Lagadec, Kanika Dheman and Alexandre Lagadec – who represented Switzerland at the iCAN'13 finals in Barcelona, Spain. The team took home a second prize for their iLid project.

iCAN is an annual, global contest for young university students interested in micro-nano technology, by using micro-

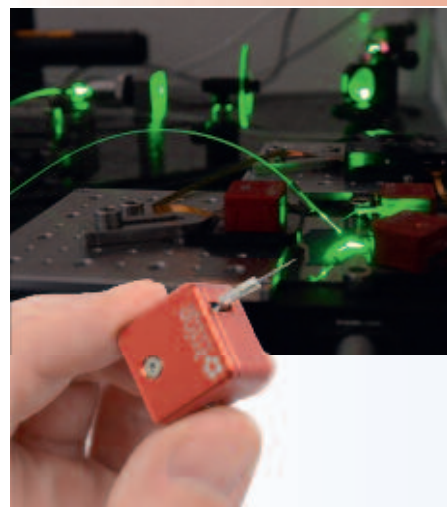


nano devices from sponsoring companies to create new applications. iCAN is the first large-scale, high-tech innovation contest initiated by scientists from both academy and industry in the micro/nano fields.

Micronarc is a sponsor of the Swiss iCAN Contest.

Next year's world final will take place in Sendai, Japan in July, 2014.

More information at: www.ican-contest.ch



Localized characterizations of photovoltaic materials using the miBot micromanipulators from Imina Technologies

Characterization is a critical part in the research of novel solar cells and photovoltaic (PV) materials. Because the PV properties can be affected at small scales, it is important to be able to characterize these devices locally.

Imina Technologies, a Swiss company based in Lausanne, has recently published an application note which describes

the use of the miBot micromanipulators to precisely bring laser light coupled in an optical fiber above the solar cell surface and electrical probes to contact this device. Typical characteristics of the sample can be measured with a standard semiconductor analyzer.

Find more about Imina Technologies' products and download the full application note on.

More information at: www.imina.ch

Lemoptix released latest hud prototype

Significantly enhancing the capabilities of its first generation HUD architecture, Lemoptix, a Lausanne/Switzerland based company, released its latest HUD prototype.

«Scanning MEMS-based laser projection displays are the future of automotive HUDs», says Marco Boella, CEO of Lemoptix. «Lemoptix consistently hears that from leading automakers and tier 1 suppliers, many of which the company actively engages with. We already received purchase orders for the second generation HUD prototype from two major Tier 1 automotive suppliers.



These prototypes will demonstrate the capabilities of MEMS laser scan based HUD to leading car makers in Europe, US and Asia.»

Nicolas Abelé, Lemoptix CTO adds that «this second generation HUD prototype represents a technology breakthrough. It has a field of view of 12.8 degrees ho-

izontally and 3 degrees vertically. Resolution has increased to 1024x240 pixels, representing an angular resolution of 80 pixels per degree. The viewed image size is 50 cm x 12 cm at 2.25 m distance from the viewer, and a virtual image luminosity of 40,000 cd per sq. m.»

About Lemoptix

With headquarters in Lausanne, Switzerland, Lemoptix SA is a privately held corporation poised to revolutionize high resolution miniaturized projection displays. Lemoptix has developed multidisciplinary and world-leading expertise in MEMS mirror modeling, design and fabrication; system and module development, including optical and electronics subsystems. Lemoptix focus markets include wearable displays, automotive head up displays, mobile devices and 3D motion tracking systems. Lemoptix licenses its technology to leading OEMs, tier suppliers and chip makers.

More information at: www.lemoptix.com



Earlier this year, machine-tools manufacturer **Tornos** launched its new **SwissNano** machine - an innovative design noted for its extreme precision and small footprint. The **SwissNano** paves the road to a new production era for watch parts, both in terms of precision and quality of finish. The machine is noted for its symmetrical cast iron structure which gives it remarkable thermal stability and excellent rigidity. The machine took less than a year to develop – a feat which reflects the reactivity and innovation of the company. One more thing... you can choose from a variety of colours!

More information at: watchme.tornos.ch

Launch of the Swiss Integrative Center for Human Health (SICHH)

The recent creation of the Swiss Integrative Center for Human Health (SICHH) as a limited company shows its dynamism and the will to move forward.

The SICHH Forum will assure the networking of all partners and clients of the center. It will organize regular events to showcase projects, companies or new developments in technology.



In 2014, the SICHH will make its skills and advanced equipment available to clinicians, researchers and companies active in MedTech, BioTech and more general human health. It will thus promote the exchange and creation of new knowledge.

Driving innovation at the heart of the center, the technical part consists of a high-tech platform, divided into four «facilities»: Health, ergonomic, materials and arithmetic. This afternoon will be an opportunity to highlight the strengths of the centre and to explore its premises.

More information at: www.sichh.ch

With its headquarters in Bienne in the canton of Bern, the Precision Cluster constitutes an efficient precision mechanics and tooling network which identifies potential synergies and innovations that can be exploited and transformed into economic success.

A practice-oriented platform



1. Transfer Line: Harting

2. Motors: Bien-Air

3. Disks: Feintool

4. Stamped strips: Harting



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The Precision Cluster offers a platform for companies, suppliers, training and research institutes which are active in the field of industrial precision and microtechnology.

As an intermediary between the applied science schools, universities and technical schools in the region, the Precision Cluster educates businesses of the importance of technology transfer between academia and industry. In particular, the cluster promotes the initiation and implementation of CTI (Commission for Technology and Innovation) development projects.

Cluster cooperation and technology transfer

In addition to the relationship with the four «Bern Cluster» (Consulting Cluster, Medical Cluster, TCBE and Energy Cluster), the Precision Cluster maintains beneficial contacts with Micronarc, ManuFuture-CH as well as other Cluster organizations both in Switzerland and abroad.

For several years, the Precision Cluster has been extending its network of member, as well as its activities beyond the canton of Bern. Partnership and collaboration are in place with the canton of Solothurn in the areas of development of Cleantech products and technology transfer.

The Precision Cluster is directed by Patrick Roth, who also doubles as a technology transfer specialist, managing the Competence Center for Medical Technology, (CCMT) in Bern.

Dr. Claudio Penna, director of the Jewellery, Watches, Metals, Refining at Cendres+Métaux SA, presides the Precision Cluster. The executive secretary for the Precision Cluster is managed by the Chamber of Commerce for Bienne-Seeland.



Thanks to its network, which extends well beyond its immediate members, the secretariat of the Precision Cluster can provide rapid assistance for the formation of development consortia as well as provide contacts with appropriate financial partners.

A wide range of offers

With nearly 100 members, the Precision Cluster offers a wide range of services and offers. The inter-member networking is one of the principle missions the cluster. Through regular events, the exchange of experiences is encouraged and forms the basis for future cooperation.

With company visits and thematic manifestations, the Precision Cluster continues to inform its members and to provide solutions to current issues.

At the World Medtech Forum in Lucerne, and within the framework of the mediSIAMS suppliers trade fair, the Precision Cluster has assumed the patronage and management of the Speakers Corner. The *Speakers Corner* offers suppliers and manufacturers in the fields of medical technology and precision mechanics, a free platform for the presentation of projects, innovative new products and services.

Contact:
Patrick Roth, Director
www.cluster-precision.ch

Equipment for microproducts

Microsystems have entered the age of high volume production for consumer applications, especially **mobile phones, ICT, watchmaking and medical disposable devices**. The issues associated with the production of these are of continued interest to manufacturers. These include tooling in high volume fabrication of precision parts, making highly efficient and reliable automated assembly lines and test systems for microproducts. There is a fast growing market for such components and products.

In 2014, the Micronarc Alpine Meeting will continue its focus on **equipment for manufacturing microproducts**. This 2-day conference intends to stimulate networking and discussions in the casual atmosphere of Villars, a charming village and ski resort located at 1250 meters of altitude. The event is a high-level, niche workshop which provides participants with an excellent overview of state-of-the-art manufacturing technologies.

Due to limited space, only a limited number of participants will be able to attend the event. Don't miss it!

More information at: www.mam2014.ch

EARLY PROGRAM

See web site for the most up-to-date information

Sunday 19 January 2014

18:00 **Registration open**
Welcome drink at the hotel (dinner afterwards on your own)

Monday 20 January 2014

09:00-09:30 **Welcome Session**
09:30-10:15 **Invited keynote on Micro-manufacturing** 1 feature keynote presentation
10:15-10:45 *Coffee break + exhibition visit*
10:45-12:15 **Micro-manufacturing Applications I – Watchmaking** 1 keynote + 2 speakers
+ 1 company presentation
12:15-14:00 *Lunch in the hotel*
14:00-15:30 **Micro-manufacturing Applications II – Medtech** 1 keynote + 2 speakers
+ 1 company presentation
15:30-16:00 *Coffee break + exhibition visit*
16:00-17:30 **MEMS**
Keynote speaker to be announced
Poster session: next generation microfabrication and MEMS
19:00 *Conference Dinner – Meet in hotel lobby at 19:00*

Tuesday 21 January 2014

08:30-10:00 **Assembly and Automation** 1 keynote + 2 speakers + 1 company presentation
10:00-10:30 *Coffee break + exhibition visit*
10:30-12:00 **Novel Manufacturing Technologies I** 1 keynote + 2 speakers + 1 company presentation
12:00 *Lunch in the hotel*
13:30-14:30 **Novel Manufacturing Technologies II** 1 keynote + 2 speakers + 1 company presentation
14:30-15:00 *Coffee break + exhibition visit*
15:00-16:15 **Invited Keynote on the Future of Micro-manufacturing** 1 keynote + 2 speakers + 1 company presentation
16:15-16:30 **Final Remarks**
16:30 *Conference adjourns – Farewell reception*

Contact: welcome@mam2014.ch

Micronarc is an initiative of the Cantons of Bern, Fribourg, Vaud, Valais, Neuchâtel, Geneva and Jura. Supported by the Swiss State Secretariat for Economic Affairs (SECO) under the NPR.

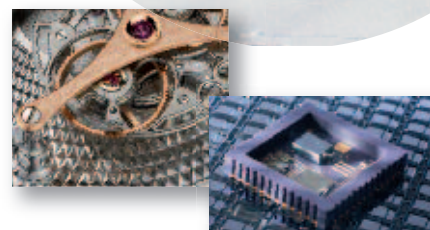
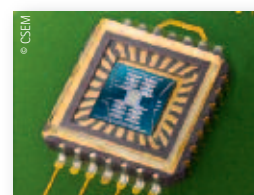
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Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs FDEA
State Secretariat for Economic Affairs SECO

19–21 January 2014

🇨🇭 Villars-sur-Ollon, Switzerland



Micronarc – The communication platform
of a unique hub of competence

MICRONARC
Micro-nanotech Cluster of Western Switzerland

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A Micronarc event organised with
MANCEF Micro and Nanotechnology
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MICRONARC
Micro-nanotech Cluster of Western Switzerland

A mission at the heart of micro and nanotechnologies

A unique hub of competence

Micronarc covers a region with a highly developed industrial culture that has evolved into a centre of excellence in micro and nanotechnologies. Solidly anchored in a centuries-old tradition, the passion for innovation and extreme precision is reflected in a dense network of educational, research and business institutions. This translates into optimum performance in terms of symbiosis in research and applications, transfers of technology, and innovation cycles.

A communication platform

Micronarc is a communication platform created by the governments of the seven cantons that constitute Western Switzerland (Berne, Fribourg, Vaud, Valais, Neuchâtel, Geneva and Jura). Its mission is to contribute towards:

- developing and promoting a regional scientific, technical and economic base in the micro and nanotechnology sectors, as well as related educational structures, R&D facilities, technology transfers, inward investment and business structures;
- encouraging seamless interaction between all participants;
- attracting other creative and innovative forces, generating jobs and ensu-

ring future generations of a qualified workforce;

- acting as a source of reliable and accessible information, serving as an instrument for the dissemination and exchange of knowledge, both in the professional and public arenas.

To achieve these objectives, Micronarc:

- manages and operates the internet portal www.micronarc.ch;
- establishes a strong presence at the international level, notably through the organisation of grouped stands at industry trade shows;
- organises professional and public events;
- provides information, networking structures, and business introductions.

Executive Office

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CH-2001 Neuchâtel – Switzerland
Tel. +41 32 720 09 00
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www.micronarc.ch



The Micronarc team

The Micronarc Expert Committee was set up in 2008. Its mission is to establish strategy guidelines for the Micronarc platform, to direct the platform, initiate new activities, and serve as liaison between the various participants.

It is made up of the following people:
Vincent Rivier, **President**
Director of the Registre du Commerce

Serge Amoos
Administrative Coordinator, The Ark Foundation

Dr Stefan Hengsberger
Professor, EIA Fribourg

Antonio Rubino
Secretary-General GIM-CH

Alain Codourey
Managing Director Asyrl SA

Jean-Baptiste Descourvières
Technical Representative Biwi SA

Philippe Fischer
Director FSRM

Jacques Jacot
Professor EPFL

Reynold Jaquet
Member of the Berne Precision Cluster Committee

Georges Kotrotsios
Vice President CSEM SA

Daniel Loeffler
Directeur du Service de la promotion du Canton de Genève

Fabienne Marquis Weible
Director of the Association Suisse pour la Recherche Horlogère

Max Monti
Research Director, Haute Ecole ARC

Martial Racine
ad personam

Micronarc is managed by its Executive Secretariat, the Swiss Foundation for Research in Microtechnology (FSRM) in collaboration with the GIM-CH / Swiss-mechanic.

Contacts

Danick Bionda
Secretary General

Cira Miley
Project Coordinator



Micronarc is an initiative of the Cantons of Bern, Fribourg, Vaud, Valais, Neuchâtel, Geneva and Jura. Supported by the Swiss State Secretariat for Economic Affairs (SECO) under the NPR.

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs FDEA
State Secretariat for Economic Affairs SECO



Events 2014

micro
nano Mag 83

You are cordially invited to exhibit with Micronarc at our 2014 events, or simply to drop by and visit our stand. Contact us at +41 32 720 09 00 or by e-mail at events@micronarc.ch

19 to 21 January 2014

MAM 2014 - Micronarc Alpine Meeting 2014. Equipment for Microproducts (flagship event). 5th edition. Villars-sur-Ollon, Switzerland. www.mam2014.ch

26 to 30 January 2014

IEEE MEMS 2014. 27th International Conference on Micro Electro Mechanical Systems (conference and exhibition). San Francisco, USA. www.mems2014.org

29 to 31 January 2014

NANOTECH JAPAN - International Nanotechnology Exhibition and Conference (with OSEC/Swiss Nanotech). Tokyo, Japan. www.nanotechexpo.jp

26 to 27 March 2014

SSI 2014. Smart Sytems Integration (conference and exhibition). Vienna, Austria. www.mesago.de/en/SSI/

9 to 10 April 2014

Medtec France - Medical technology trade fair, Lyon, France. www.medtecfrance.com

6 to 9 May 2014

SIAMS 2014 - 14th Edition. Leading Swiss Microtech Trade Fair, Moutier, Switzerland. www.siams.ch

21 to 22 May 2014

SWISS NANOCONVENTION 2014 - The Swiss NanoConvention is the prime showcase for nanotechnology in Switzerland. Brugg, Switzerland. www.swissnanoconvention.ch

17 to 20 June 2014

EPMT-EPHJ-SMT - Professional Microtechnology Environment Show + Micronarc conferences. Palexpo, Geneva, Switzerland. www.epmt.ch

23 to 26 June 2014

EFTF 2014 - European Frequency & Time Forum. Neuchâtel, Switzerland. www.eftf-2014.ch

22 to 25 September 2014

MNE 2014. 40th Micro and Nano Engineering conference. Lausanne, Switzerland. www.mne2014.org

23 to 26 September 2014

MICRONORA. 20th International Microtechnology Trade Fair. Besançon, France. www.micronora.com

October 2014

COMS 2014. 19th annual conference on commercialization of micro- and nano-systems (conference and exhibition). Utha, USA. www.mancef.org/coms2014

9 October 2014

Forum Plasturgie. Fribourg, Switzerland.

12 to 16 October 2014

MS&T'14 - Materials & Science Technology. The leading forum addressing structure, properties, processing and performance across the materials community. In collaboration with OSEC/Swiss-Nanotech. Pittsburgh, USA. www.matscitech.org

12 to 14 November 2014

Compamed - Important Medical subcontracting trade fair. Düsseldorf, Germany. www.compamed-tradefair.com





technology integration
for the products
of tomorrow



www.csem.ch
info@csem.ch

Neuchâtel
Alpnach
Muttenz
Landquart
Zürich