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The Industry Liaison Office represents the interests of the Swiss industry at International Research Organisations. This gives the office a privileged view of a specific focused industry sector, oriented towards the physics-based research market. To find out more, our editor *Antoine Pochelon* asked ***Michel Hübner***, Head of the Swiss ILO Office to talk about his activity.

To optimise Swiss industry outlets for major large-scale international research projects and infrastructures, the need to establish a liaison body between Swiss industry and these major international players was identified. Who initiated the installation of the Industry Liaison Office (ILO)?

Officially, the Liaison Office was set up in 2015, on the initiative of SERI (State Secretariat for Education, Research and Innovation) with the support of two laboratories: the Swiss Plasma Center at EPFL, (national competence centre for fusion technology), and the PSI (national competence centre for accelerator-related technology). Later joined the University of Geneva, (representing the astronomy national science) and SWISSMEM, the Swiss umbrella association for machine-tool, electronics, and metallurgy.

The role of the ILO is to support the Swiss industry in obtaining contracts at these projects (measured as the geo-return factor) This in two modes: on one hand, to identify within the public *Invitations to Tender* regularly published, those which would suit the competences of Swiss companies. On the other hand, to promote Swiss technologies among the various engineering teams inside the research organisations. In marketing terms, we would call this a push and a pull mode. Either the industry develops a product that fits the needs of the research facility, or the industry suggests a new product/service to attract the client by locking the tender procedure in its favour. Switzerland, with its high prices and an industry culture of innovation and quality must, more than any other country, be proactive in suggesting its pioneering technologies.

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1986: EPFL Physics Master's degree
1986-2007: works for different telecom companies in France and Switzerland
2007: joins CSEM as Section leader
2012: joins SERI as ILO for ITER
Since 2015: ILO for eight International Research Organisations.

However, didn't the role of ILO already exist before 2015 with the ITER project?

Indeed, fifteen years ago the ITER project was virtually unknown, both in Switzerland and in Europe. The first official ILO position in Switzerland was opened simultaneously with the creation of the European ITER agency F4E (Fusion for Energy) to disseminate information about the ITER project. Today it has become almost a standard business practice, having every participating country nominating an ILO function for each large European research organisation.

How is the management of the Swiss ILO organized? For instance, what are the roles of SERI and the other members? Are the PSI, the SPC (EPFL), UNI GE and SWISSMEM advisory bodies?

A convention fixes the rights and obligations of all partners forming the Swiss ILO Steering Committee. SERI animates the Steering Committee and provides the secretariat. SERI supports financially the activity, though in-kind contributions are provided by each member such as: office accommodation, travel expenses, support for communication, website and other marketing activities. In the current four-year term, EPFL is providing the accommodation for the ILO office.

Who are the members of the steering committee?

To date, members include directors of the national academic centres whose scientists are already cooperating with the international organisations in question. It should be borne in mind that in many cases, solutions provided by Swiss industry on our national installations are subsequently used as a springboard to obtain contracts for equivalent needs on international physics installations.

A typical example is the development for the TCV tokamak at EPFL of specific plasma heating power supplies implemented first on national scale, and afterwards, on the larger-scale ITER project.

What are the major international research organisations in which Switzerland participates? And which ones are the most profitable for the industry?

They fall basically into three categories: fundamental, applied and energy research (see box).

Figure 1: The ESO VLT site in Chile (with nine optical telescopes visible here). © ESO

Fundamental research (Elementary particles and Universe observatories)
- CERN (European Organization for Nuclear Research) – Geneva, Switzerland
- ESO (European Southern Observatory) – Munich, Germany
- SKA (Square Kilometre Array) – Manchester, United Kingdom

Applied research (Material sciences)
- ESRF (European Synchrotron Radiation Facility) – Grenoble, France
- Eu-XFEL (European X-Ray Free Electron Laser) – Hamburg, Germany
- ILL (Institut Laue Langevin) - Grenoble, France
- ESS (European Spallation Source) – Lund, Sweden

Energy (Fusion research)
- ITER (International Thermonuclear Experimental Reactor) – St Paul-lez-Durance, France

The total financial value of contracts acquired by Switzerland per year at these facilities is about 100 million CHF. As a comparison, the return of contracts from ESA (European Space Agency) to Swiss companies is at the level of 150 million CHF. CERN picks up most of this value for two reasons. The available procurement budget at CERN is ten times higher than that of any of the other facilities. Switzerland is a host state to CERN, and many procurements for commodity services and infrastructures are therefore going to companies located in the Geneva area. The ITER program, with its substantial procurement budget, has generated revenues of the order of ten million CHF every year for Swiss companies in the last fifteen years.

In our current relationship with the European Union, i.e., the rejection of the framework agreement in May 2021 by the Swiss government, what is the impact on these various research infrastructures? Have they been affected?

Switzerland's agreements with these research infrastructures are governed either by inter-governmental agreements, or by agreements between Switzerland and the European Union. The only organisation impacted at the institutional level by the rejection of the framework agreement is the ITER project. It is the Euratom Agreement, a bilateral agreement signed 1973 falling under the jurisdiction of the European Union, related with nuclear energy research, that could not be renewed for 2022. This means that Swiss companies are not anymore eligible in tendering procedures arising within the ITER project.

Figure 2: The ITER construction site (with the 60-meter-high tokamak assembly hall). © ITER

Luckily, many pre-studies were made by Swiss industries over the first ten years of the project so that Swiss technologies, now in production phase, can hardly be circumvented or replaced at this late project phase. Exceptions to include extra-member state technologies always do exist. Today, up to six Swiss strategic technologies are considered as essential for the first ITER plasma phase.

Your work as a liaison between international organisations and Swiss industry undoubtedly gives you a privileged viewpoint on the qualities, strengths and perhaps also the weaknesses of Swiss industry. Can you give us a picture of Swiss industry as you see it from the role of ILO?

Yes, of course. In fact, you can look at things in different ways. Let's start with the highlights.

First of all, Switzerland has a long tradition of participation in European organisations and related scientific projects, such as ESA, JET, CERN. The past cooperation experience between scientists and industries in these programs is a very strong asset. We weren't born yesterday! Then, Switzerland is renowned for delivering products and services with remarkably high added value. In the big science market, we need components, with the highest reliability and excellent level of maintenance. A component delivered to CERN might not be as critical as the one going on a space program, however, in a complex accelerator chain such as LHC, with most equipment operating in a radioactive protected zone, a high MTBF (Mean Time Before Failure) and fast troubleshooting is a prerequisite for any component. The lifetime of an accelerator is at least 20 years.

Moreover, for many components performance is more important than price. The construction cost of a new facility or an infrastructure upgrade are typically in the cost range of 1 billion CHF. When it comes to implementing complex optical, electrical, or precision mechanical based sub-systems, and here I refer to components such as sensors or actuators, where the Swiss industry excels, only the best product on the market will be considered. No compromise will be taken for the ultimate quality of science made at these facilities. A cost difference of a few ten thousand CHF on a sub-system will be seen as affordable. The Swiss-made label works!

In the same perspective not to be forgotten is our know-how in machine tooling and material engineering. Switzerland is per capita the strongest machine-tool export country, after Germany. Due to the harsh physics environment (high radiation, high magnetic fields, ultra-high vacuum, extreme heat or extreme cold) in physics-based facilities, the demand goes at the extremity of the technology scale for many material machining and assembling tasks. There is a fantastic cumulative knowledge in Switzerland of all types of materials, metal alloys, ceramics, and handling processes.

Switzerland's advantage in this market is also that the industrial landscape is made up of small to medium size enterprises (SMEs), everywhere between lake and mountains! These companies, because they are limited to small production series, are very project-oriented and dedicated to their customer. These qualities fit the scientific project culture: unique, complex, engineering-focused, co-operative, long lasting, multi-cultural and multi-disciplinary, requiring trust and commitment. I like to say that in Switzerland every worker on the shop floor knows the end customer!

Now coming to the drawbacks.

The research applications are seen as prestige projects. A project reference on, let us say CERN, is rewarding for any company. Engineers are enthusiastic to work on projects that push technology to the limits with a high international exposure. Nevertheless, an entrepreneur will observe that the time scale for project acquisition is slow in comparison to the private sector. He may complain about the administrative burdens related to the international / European Union public tendering environment. Furthermore, there can be a perception of uncertainty on the return on investment. This is due to the strong international competition as well as the low and rather cyclic production volumes.

In a strong economy country like Switzerland, these unfavourable arguments can be decisive for declining interest. Projects are seen as a distraction from the more immediate and profitable markets in which the high-tech companies are usually active (semiconductor, consumer goods, energy, MedTech, automotive, etc..). Then when an offer has been placed and when it comes to the commercial negotiations, I have sometimes the feeling we lack the necessary fighting spirit. Research projects are by nature first of a kind and can be a bit unpredictable, typically with an incomplete technical specification at project launch. This does not always match with the Swiss conservative and risk-averse mentality. Here we can learn from the Southern European countries that have more proactive attitudes when doing sales in the big science market.

And perhaps, to conclude, tell us about the areas in which Swiss industry makes a particularly important contribution.

It is true that in the supplier network, there are strong areas of excellence recognised at the international level. You will see that they are also distributed somehow along geographical regions in the country.

Instrumentation would be one of these. One can typically think of a particle detector, where multiple skills are required to design a product. A combination of know-how in semi-conductor chip design, in optics, in fast signal processing electronics and system control. An emblematic company in this field would be *Dectris*, a spin-off from PSI, in Baden, offering state of the art X-ray detector systems to most synchrotron facilities all around the world.

Another Swiss supplier strength would be *power electronics*. Accelerator systems use very specific electronic devices to accelerate particle bunches. High-power amplifiers require special design techniques, with a deep understanding of electromagnetic phenomena. The excellence of our polytechnical schools and the historical heritage of the Brown Boveri group in high voltage electrical engineering keep this activity alive, mostly in the greater Zurich area. In this field, *Ampegon* delivers high-power pulsed amplifiers to drive the accelerating RF cavities in many research centres.

A further area of competence relates to *vacuum and cryogenic* components. This industry know-how is very densely distributed along the Rhine River, sometimes called the “Swiss Vacuum Valley”. Whenever it comes to selling the highest quality vacuum valves, bellows, gauges or pumps, strong Swiss industries such as *VAT*, *Weka*, *Mewasa*, *Inficon* or *HSR* will be invited to participate in tenders or team up for

Figure 3: A forged and rolled Aluminium magnet body at Imbach AG (prepared for the CERN High Luminosity LHC project). © CERN

the design of advanced vacuum systems. This very regional expertise stems from the former *Balzers* company (the name of a town in Liechtenstein) which was progressively split into smaller entities in the 90’s.

As well mostly in Eastern Switzerland in the *optics* domain, companies such as *WZW*, *Fisba*, *Swissoptic* or *Schott* in Yverdon have an international reputation for the ultra-fine machining of glass and the engineering of thin films layers on top, to be integrated as lenses or mirrors in diverse scientific instruments. As an integrator of these components, *Leica Geosystems* sells Laser Trackers to most research facilities helping them guiding precisely and visualize over distance very big structures to be assembled.

In the *precision mechanisms* domain, we find some outstanding Swiss firms that develop ad hoc solutions designed for the complex environments of physics, where sensors or actuators are to be positioned at micrometre accuracy. As an example, *MPS Microsystems* in Bienne/Biel has developed micro-positioners that can quickly and simultaneously place 1000 fibre optics points across the focal image of any optical telescope instrument.

Finally Swiss timing matters. A non-disputable asset of the Swiss industry is *timing devices* for the control and synchronization of the many heterogeneous and distributed equipment found along a large-scale science infrastructure and through which particles will fly at almost the speed of light. For this purpose, we find atomic clock manufacturers in Neuchâtel such as *T4Science* and *Oscilloquartz* or ultra-short pulse laser manufacturers in the Zurich region such as *NKT Photonics Switzerland* (ex *Onefive*) or *Menhir Photonics*.

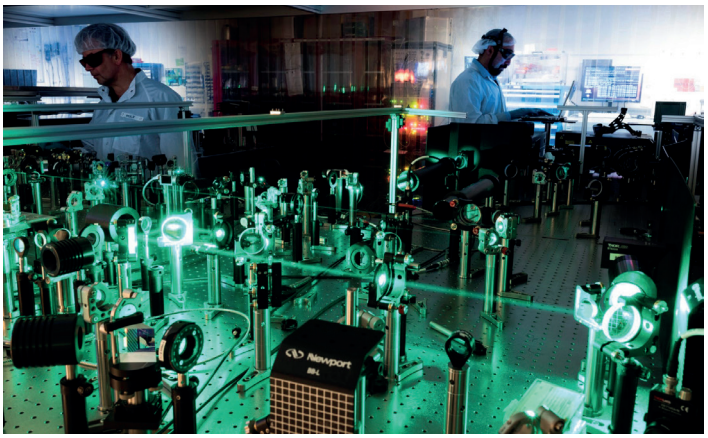

Figure 4: The optical set up with NKT Photonics lasers at Eu-XFEL (triggering chemical reactions at the femtosecond level). © Eu-XFEL