

SPG MITTEILUNGEN

COMMUNICATIONS DE LA SSP

AUSZUG - EXTRAIT

Physicists in Industry (3)

Physics Career between curiosity driven research and leading edge applications
Reto Holzner (IMES Management AG)

This article has been downloaded from:
http://www.sps.ch/fileadmin/articles-pdf/2017/Mitteilungen_Industry_3.pdf

© see http://www.sps.ch/bottom_menu/impressum/

Physicists in Industry (3)

Our third interview partner is Dr. Reto Holzner, a laser specialist who also developed and applied smart physical concepts e.g. for exploring oil fields. Currently he is engaged by combining regenerative energy sources with decentralized energy storage systems, a promising solution not only for Switzerland.

BB

Physics Career between curiosity driven research and leading edge applications Reto Holzner (IMES Management AG)

Q: Reto, during your career you worked with larger companies and with SMU. What were the main differences? What do you recommend to physics students?

RH: Working with an SMU or even starting one certainly is an exciting experience. You are more personally involved in the every day business both in physics and in company matters. Your decisions are of more importance than in the case of a larger company, both in positive and negative directions, and the timescale on which ideas can be realized is usually very short due to flat communication structures. A large company provides usually more job security and the

availability of financial means for projects is better than in a SMU. It is probably not a bad idea to join an established company right after University education in order to learn about business habits, especially concerning legal issues. However, before you get too adapted to the daily routine, change to or found a small company but only together with an excellent team.

Q: You changed in the past the field from Nonlinear Laser Dynamics to Laser based Communications, to Seismic Array Metrology and now to Regenerative Energies. Obviously only a physicist can cover successfully those different action fields. What were your motivations, the questions and what were the achievements?

RH: Dealing with nonlinear dynamics was completely curiosity driven. It was the time when Benoît Mandelbrot published his famous mathematical curiosities related to fractals. I was fascinated to realize how simple systems can show such complex and unforeseeable behaviour. Thanks to the support of a visiting professor at our Physics Institute with whom I collaborated during the last phase of my thesis about "Nuclear Magnetic Resonance Laser", I could extend this work to real lasers as a post doc down under in New Zealand. There we also worked towards Bose-Einstein Condensation. After my post doc time I was offered an appointment as associate professor back at my University in Switzerland.

Nevertheless after about ten years of successful and pleasant research work, an exciting opportunity turned up to develop a laser based communication system between geostationary satellites. So I joined the company "Contraves Space", later part of RUAG AG and continued part of the work of R. Czichy, who had just left a few months before¹. After successful completion of the project, unfortunately the "communication bubble" just burst and the follow-on project which would have tested the system in space was stopped.

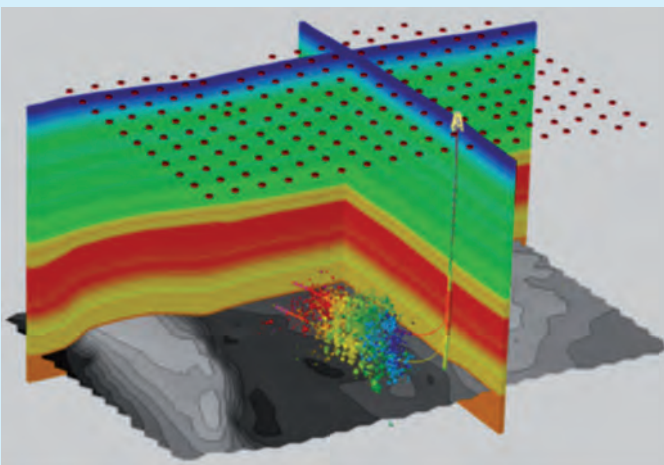
Q: And how did you react?

RH: Just at that time I was asked to help to build up a company for using seismic background noise to identify geological structures which may contain oil or gas.

Our idea was to use arrays of seismographs or geophones sensitive to the noise spectrum between 0.01 to 30 Hz, which is typical for most oil or gas containing geological structures worldwide. We significantly reduced the measurement efforts, but improved the detection probability by introducing and developing so called "time reverse spectroscopy TRS" (see Infobox 1), which impressed big oil companies. We

Seismic investigations

Naturally occurring seismic background noise, also called microseism, can interact with geological layers and according to their properties (density, viscosity, damping, fluid content) the spectrum as well as the wave propagation direction can be influenced. Astonishingly, by far the strongest microseism sources are oceanic waves hitting the shores. They produce seismic signals at a frequency of about 0.1 Hz which can easily be measured everywhere, even far inland of a continent. If the seismic signals are recorded simultaneously at the surface by an array of seismographs or geo-microphones the scattering source can be located by "time reverse spectroscopy", a technique which has been developed by our company "Spectraseis" which is now incorporated in "esg solutions". (<https://www.esgsolutions.com/technical-resources/microseismic-knowledgebase/time-reverse-imaging-tri>).

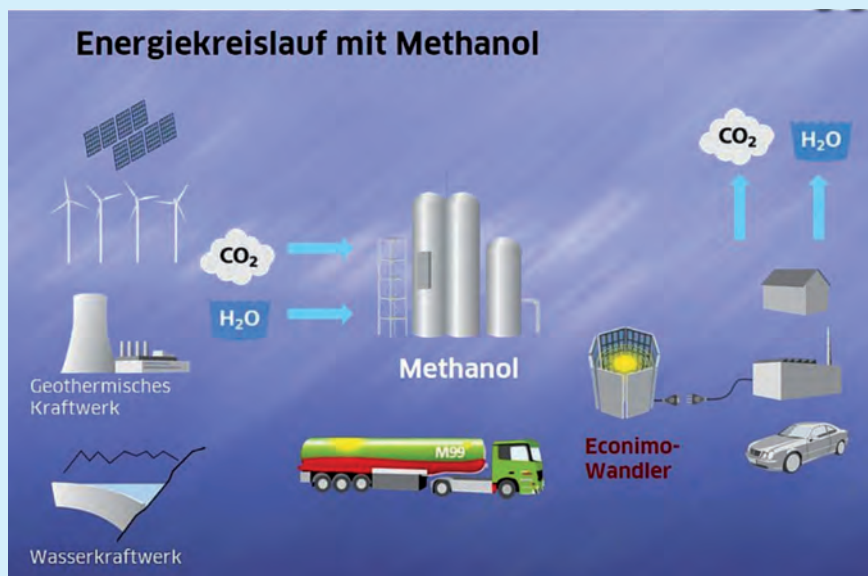


The picture shows arrays of sensors monitoring the acoustical noise emitted by cavities filled with a oil gas mixture. This phased array technology allows to locate the cavity. Picture source: <https://www.esgsolutions.com/oil-and-gas/hydraulic-fracture-mapping-and-monitoring>

¹ <http://www.sps.ch/artikel/physiker-in-der-industrie/optical-space-communication-information-transfer-from-point-to-point-reinhard-h-czichy-synopta-gmbh-st-gallen-2/>

CO₂ neutral energy cycle based on methanol

The idea of a methanol based energy economy goes back to George A. Olah who received the Nobel Price for Chemistry in 1994. CO₂ can be taken from the air where the abundance is about 400 ppm. By a catalytic process CO₂ can be combined with H₂ to form Methanol (CH₃OH). H₂ is produced from water by electrolysis using regeneratively produced electrical current. Methanol can easily be stored over a long period of time at ambient conditions similar to gasoline. Methanol is a very versatile energy storage medium and can be used as basic feedstock for the chemical industry, as fuel for cars as well as to produce electricity and heat. It releases its stored chemical energy when burned leaving CO₂ and H₂O as the only exhausts to the environment from where the components can again be recovered in order to close the CO₂ neutral energy circle.



Picture Source: <http://www.marktspiegel.ch/branchen-news/artikel/methanol-minikraftwerk-ging-ans-netz-der-wwz/>

started the company with three people and built it up to the size of thirty. Then we installed a "proper" management with professional experience in the oil business, which allowed me to look for new opportunities.

Q: Then you moved into the business of regenerative energies, a field with a lot emotional discussions in the public. What were the drivers? New concepts?

RH: The production of regenerative energies by photovoltaic and wind installations suffers from their strong fluctuation rate which requires fast and efficient energy storage techniques, especially in the lowest voltage grid system. A central storage is problematic since the fluctuations destabilize the net and need complicated control mechanisms. Therefore it is wiser to implement decentralized, autarkic and CO₂ neutral energy systems (see Infobox 2). Autarkic means that surplus energy, which is produced during summer e.g. by photovoltaic or wind technologies, is locally stored to be used in winter. The energy is stored e.g. as chemical energy in synthetically produced methanol. Burning methanol to water and CO₂ yields 5 kWh per liter, which is 50% of that of Diesel. On the other side the catalytic synthesis of methanol needs CO₂ and H₂, which is obtained from the electrolytic dissociation of water by the surplus energy in summer. Such autarkic systems can be locally installed and directly coupled to the photovoltaic installation. The required technologies are more or less available and there are no big political, legal and financial obstacles if the local community can decide.

Q: What do you recommend generally and especially for Switzerland?

RH: Building up such decentralized, autarkic and CO₂ neutral energy systems as soon as possible, e.g. now. The

existing energy infrastructure can be reduced accordingly as such systems grow on a natural timescale, not only in Switzerland but world wide. Switzerland is ideal for pioneering such developments due to its high educational as well as financial and democratic standards. Once the first systems work here, Switzerland can export them world wide. This brings not only economic benefits but may also help to reduce energy related conflicts world wide. And certainly it bans global warming.

Reto Holzner (*1954) got his PhD at the Physics Department of the University of Zürich. After his Post Doc time at the Otago University, Dunedin, New Zealand, he came back to the University of Zürich and became Associate Professor for Experiments and Theories in Nonlinear Dynamics and Laser Physics.

Later he changed to industry where he had positions in several companies:

- Contraves Space AG, Zürich: Project Manager: Laser based communication link between geostationary satellites
- Huber + Suhner AG, Pfäffikon: R&D Senior Scientist: Communication systems based Microwave and Laser components
- Spectraseis Technology AG, Zürich: CSO (Chief Scientific Officer): Hydrocarbon detection based on low frequency seismic array measurements
- IMES Management AG (International Management & Engineering Services), Cham: CSO (Chief Scientific Officer)

In total he has more than 20 years of experience in industrial and academic R&D management.