SWISS PHOTONICS

EPIC Members Event Report
BioPhotonics – Photonics in Life Science

Muttenz, Switzerland
19 March 2014
www.swissphotonics.net/workshops.html?698

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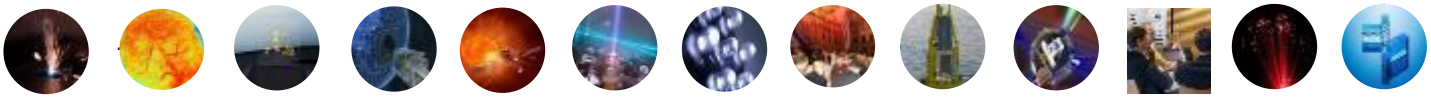
About the EPIC Members Event Reports

Initiated by the founder of EPIC Dr. Thomas Pearsall in 2003, these reports are prepared by members of EPIC to the benefit of the wider community. If you did not have a chance to attend the event but would like to know some key highlight, this report is for you. Emphasis is placed on exploring technical and business opportunities for the members of EPIC.



This joint symposium was organized by the EPIC member association SwissPhotonics, the national thematic network (NTN) for photonics, in collaboration with EPIC member CSEM (Swiss Center for Electronics and Microtechnology) and the association Inartis (Network for Swiss life sciences community). It took place at University of Applied Sciences and Arts Northwestern (HLS-FHNW).

The event started with a table-top exhibition of the photonics and printable electronics activities of CSEM. CSEM demonstrated its ability to offer flexible proof of concept and prototyping lab for micro technologic innovations. Different demonstrators of integrated sensors were presented: a screen printed biosensor for online Glucose, Lactate and Glutamate measurement in bioreactor (today it's a C-CIT Ag product) and a photonic platform for multi assay and parallel analytic detection of cardiac markers; Optical microsystems engineering with surface functionalization like colors without pigment, color filtering or color switching effect used for security features, optical filtering and light management; printable large area (100 cm^2) optoelectronics on rigid or flexible substrates.

The oral presentations were opened by the welcome talk by Gerda Huber, Director of the HLS-FHNW which groups together 4 Institutes: for Chemistry and BioAnalytics, for Medical and Analytical Technologies, for Ecopreneurship and for Pharma Technology.

Free download of the workshop presentations
www.swissphotonics.net/workshops.html?698

Christian Bosshard welcomes the participants

The introduction to the workshop was done by Christopher Harder and Christian Bosshard, President and Managing Director of SwissPhotonics. They presented the Swiss

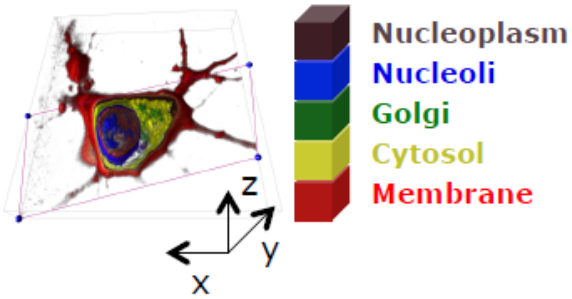
Innovation landscape, the financing of innovation and the activities of SwissPhotonics (Direct SME support, Support for technical developments, support to national Labs, Networking activites, Workshop (6 in 2014)…).

A very interesting main Keynote was given by Pr Jerome Faist from the Institute for Quantum Electronic, ETH Zurich about the "Quantum Cascade Laser for biophotonic". After having explained that the motivation is molecular sensing by means of spectroscopy, and that now things are moving from gas to liquid sensing, and that the needs for a lot of applications are for low cost sensing device. Professor Faist continued with the fact that QCL take into account the wavelength range (2.5 to 25 µ) are the good light sources for mid IR spectroscopy and THz light source. Indeed, with their broad tuning range, it is possible to sense many gases simultaneously. There are already some commercialized products but they need mechanical tuning. On other side, Pr Faist explained that it is possible to obtain spectrally

agile QCL and comb operation. By using two comb devices combined on one detector and one laser passing through absorbing sample, they have a direct and very fast radio frequency-optical frequency link with no moving part. Pr Faist has shown results of a small set up: 100 lines, spectral coverage 25 cm-1 with 100 kHz linewidth. To conclude: Pr Faist spoke about the project IrSens, which uses QCL and microfluidic implement on one chip device to detect cocaine in saliva. The lowest concentration detected 250ng/ml (just 10 times above the requirement) is obtained by using direct absorption in a tube with optical fiber.

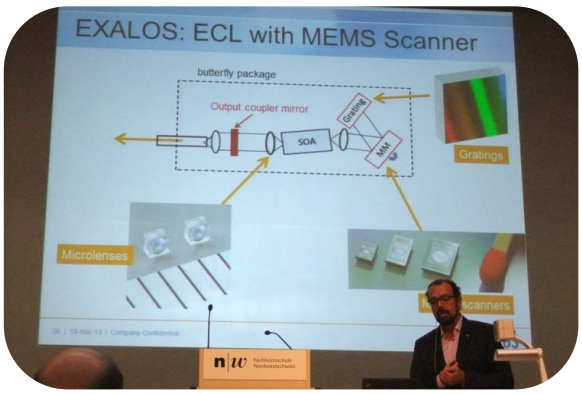
The first session vas devoted to Instrumentation, Monitoring and Imaging.

First talk was done by Dr Y.Cotte from Nanolive, who discussed their holographic technology and system: the 3D cell explorer. This system, in comparison to traditional microscopy should allow seeing, without sample preparation, inside cells without damaging them, with 3D tomography and real color only based on contrast. They plan to have prototypes in Q4 2014 and to deliver the products in Q2 2015.



The second talk was given by Dr Martin Forrer from Fisba Optik AG. Established in 1957, Fisba focused on micro optics in 1995 mainly for medical applications like endoscopy. Now there are 300 employees and they are ISO 9001 certified. They work for Systems manufacturers and OEM customers. They have and master the competency of all the value chain for micro optical systems. As an example they have developed the fiber coupled illumination for endoscopic fluorescence lifetime imaging (Flendos) and molded lenses for rigid endoscopes.

The last talk of this session was given by EPIC member Dr Christian Velez from Exalos AG. Exalos is a SME focused on engineering, sales and marketing of light sources for Optical Coherence Tomography (OCT). Dr Velez traced the OCT evolution from Time domain OCT to Fourier domain OCT with its two variants spectral domain OCT and Swept-source OCT. Dr Velez showed the Exalos swept-source based on external cavity laser using micro lenses, semiconductor amplifier (SOA), grating and mems scanner to sweep the wavelength. Thanks to this, Exalos plans to be a key player in the OCT light source market.



Christian Vélez, CEO, EXALOS

Before the second oral session, two lab tours were organized.

(1) Lab tour "Nanotechnology" by Prof. Dr. Uwe Pieles, Hochschule für Life Sciences FHNW

The Nanotechnology lab of FHNW studies the chemistry of surfaces and interfaces. The lab claims to be an applied science research lab as they have strong connections with industrial partners (names of the partners is a confidential information!) and realize many studies on new materials for them. They work on polymers, coatings, biomaterials, study of chemical composition of surfaces ... The main area of application is biomaterials and polymer encapsulation which represents half of their job. The other half is on new materials for applications such as pipelines, paper, etc.

The lab possesses the following equipment:
- 1 SEM (Scanning Electron Microscope)
- 1 "special" SEM that allows working on living cells without preparation
- 1 confocal microscope

- 1 confocal-based Raman microscope allowing analysis of chemical composition at very high resolutions
- 1 IR imaging system
- 1 AFM (Atomic Force Microscope)

All these instruments complement each other, for example a same sample will be studied under the Raman microscope to get chemical information and then with the AFM to get structural information at the nanometer level.

(2) Lab tour "MedTech" by Dr. David Radetzky, Hochschule für Life Sciences FHNW

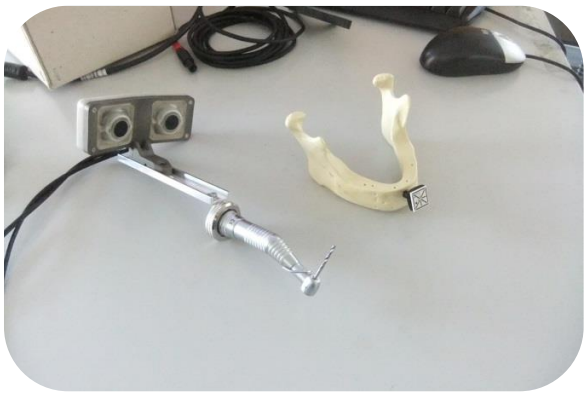
The Medical systems and devices lab of FHNW is focused on patient-specific solutions and the analysis of medical data. They work in research fields as: Implants and surgical systems, Biomedical IT systems and medical image and signal processing. For example, by using segmentation of image data they can realize models for preoperative planning for all surgical interventions with rapid prototyping. They have developed computer assisted surgical systems and medical additive prototyping. For navigated surgery, the challenge is that tracking systems should be compatible with the complex OR environment with a high degree of ergonomic avoiding some recurrent problems as size, line of sight and insufficient accuracy. They are working on miniaturized handheld tracking system with optical markers attached to the tracked objects. With 2 or 3 cameras and image processing algorithms they are able to determine a 6D locations.

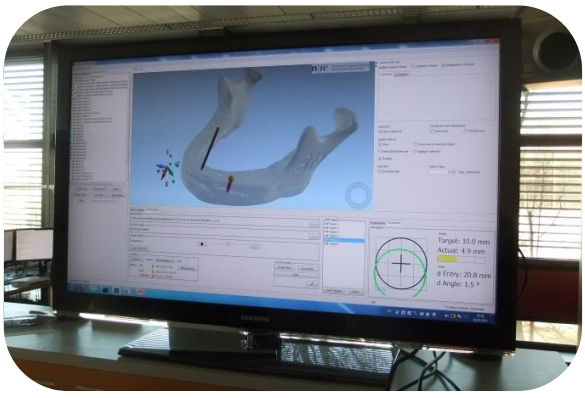
The second session was devoted to Diagnostic, Treatment and Therapeutics

The first talk was “Printable Bio sensors” given by Dr Marc Schnieper from CSEM in Muttenz.

After having presented the technologic programs, markets of CSEM, he explained the position of CSEM between Research and production, CSEM handle development and integration of technologies, and then the transfer to industry. The talk showed different disposable sensors based on the electrochemical monitoring: the ion selective electrodes (Ion detection), the enzymatic sensors (glucose, lactate, and glutamate detection), the electrochemical immunoassays (amylase detection); all these systems are based on screen printing. They also develop optical sensor based on structured film where combination of dye film and waveguide grating allows detecting for example ammonia by color change with a high contrast.

The second talk was given by Dr Frédéric Mallard from Biomérieux SA. He presented how optical methods could accelerate medical decisions and increase the medical value of tests. For example, Raman spectroscopy gives information after 6h growth instead of 20h before classical analysis. This is performed with 94% of correct classification rate even in presence of growth medium. Sensibility to different antibiotics could be obtained after 2h incubation. The main issue is to manage complexity and variability due to a lot of particles which are present in raw sample; they need a huge data bank of Raman spectra.



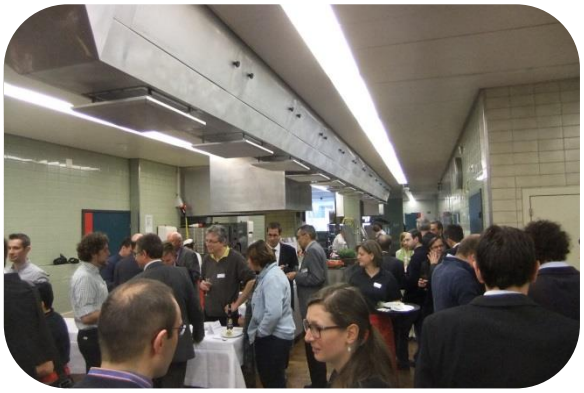


Round Table Discussion

Drs F.Mallar, M. Ehrat, M. Forrer participated to the round table driven by Dr Nicolaus Traitler.

- About landscape of photonics in life sciences, all answered: simplification, new applications, low cost and miniaturization.
- About Technological transfer, M.Ehrat indicated molecular diagnosis and that biologist and physicist work together on a project defined by diagnosis company. F. Mallard pointed out multidisciplinary, biomarker and needed collaboration whatever the company size.
- About technology research; M.Forrer indicated active optics and his wish that the FDA approval should be less difficult and time consuming. F.Mallard mentioned the problem „that what will you do with the information if you aren't able to interpret those", for example difference between a surgeon and an anatomopathologist. M. Ehrat and F.Mallard mentioned point of care and M. Forrer technology for histology and pathology.

After closing remarks, discussion between attendees took place during "Apero riche" a very enjoyable and appreciated cooking show in the kitchen!!



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