Parallelsession 12th June 2018
High Tech Agriculture: Photonics for Food Safety
High Tech Agriculture: Photonics for Food Industry

Todays Menu (Safety)

- Photonics and EPRISE project
- **New Miniaturised, Intelligent Spectral Sensors and Their Possibilities in the Food Sector**, Jarkko Antila – Spectral Engines, Finland
- **What makes hyperspectral imaging a revolutionary solution for food fraud and safety detection?**, Esko Herrala - Specim, Finland
- **Synthetic light catalysis cleans air and surfaces**, Petteri Jauhiainen - LED TAILOR INNOVA7ION, Finland
- **UV laser for food industry**, Slava Vanykov - HyacinthLUX, Finland
What is Photonics?
Lighting, vision systems, autonomous vehicles, internet & datacenters, smart phones, AR/VR, medical imaging systems, TVs

Materials, LEDs, lasers, detectors, image sensors, lenses, prisms, optical filters, gratings, optical fiber

LED lamps, cameras, displays, optical scanners, markers, manufacturing and inspection systems
Enabled Services

Internet, streaming video and audio (music), cloud storage services, e-commerce, car,
Photonics is the generation, transmission, and utilization of light and other electromagnetic radiation. Photonics offers solutions to the global challenges of our time.

- Climate Change
- Energy
- Clean Water and Food
- Digitalization
- Health and Medical
- Lighting
Europe's age of light!

How photonics will power growth and innovation

A new quality of urban life
Photonics for smart homes and liveable cities

Empowering Industry 4.0
Photonics in manufacturing and production

Zero emission, less waste
Photonics for sustainability and a clean environment

Keep our traffic flowing
Photonics for connected mobility

Live longer, feel better
Photonics in life sciences and healthcare

Feed the world
Photonics for safe, nutritious and affordable food

A million new jobs to 2030

Photonics will help supply **safe, nutritious and affordable food** for all and establish a sustainable value chain from farm to fork. By using ever more **precise sensors and measuring devices**, farmers, food processors and ordinary consumers will be able to monitor and certify the safety, quality, content and even the origin of food.

**Photonics technology is a powerful toolbox - enabler**

Relevant tools include lasers and LiDAR, hyperspectral imaging and many other kinds of sensors, energy-efficient LEDs.
Soil health analysis: soil health is often indicated by soil bulk density. Low bulk densities indicate more organic matter and therefore more nutrient-rich soils. Using 3D-laser scanning, one can determine the volume of grains of soil and together with their weight determine their density. Soil health is also sometimes analysed through multi-spectral imaging from airplanes.

Crop analysis: Maybe the oldest optical technique used to analyse crop quality is the grape wine refractometer used to measure the concentration of sugar in the juice of grapes. Optical spectroscopy is used in many different ways, e.g. to measure the nitrogen level in leaves or grains or to identify levels of bruising in fruits and vegetables.

Controlling watering: Lasers and telescopes are used in optical farming to detect evapotranspiration and help farmers decide when to irrigate. The system is based on computer-controlled analysis of the scintillation induced by the evapotranspiration.

Automatic cow milking and milk analysis: Imaging or even simpler systems based on lasers and detectors can be used to control the automatic milking of cows ensuring the proper flow of the cows along the milking chain. At the same time, optical spectroscopy can be used to on-line measure the quality of the milk.

Plant growth stimulation through smart lighting: Efficient lighting can help controlling plant growth and quality. It is apparently possible to reduce the energy consumption by as much as 50% and at the same time produce healthier plants by controlling spectrum, intensity and timing.
Photonic Markets
Target Applications

The project aims to promote and support Photonics as a Key Enabling Technology. It focuses on Life Science applications in markets where Europe holds a leading position: Medical Technologies, Pharmaceuticals, Agriculture and Food.
**Collaborative partnership**

EPRISE has bought nine European photonic leaders together to support SMEs working in the Photonic Industry and overcome the market barriers.

- Expert database
- Events
- SME support
- Networking

**Key objectives of the ÉPRISE project**

1. Raising awareness of targeted regions about the underexploited potential of photonics based technologies and applications in 4 targeted markets in relation with the regional RIS3
2. Promoting co-funding initiatives and synergies between regional and EU resources and strategies
3. Assisting Photonics SMEs trying to enter 4 target markets through expert advice specific to those markets and tailored to each company’s needs
4. Stimulate and strengthen collaborations along the value chain by fostering collaboration between different stakeholders

D3.3 Booklet of expert information relating to Agriculture market (M16)
D3.4 Booklet of expert information relating to Food market (M16)
Stockholm
Photonics in Healthcare
Monday, 11 June 2018
Tuesday, 12 June 2018

Barcelona
Photonics in Food
Thursday, 27 September 2018
Friday, 28 September 2018

Berlin
Photonics in Healthcare
Wednesday, 17 October 2018
Thursday, 18 October 2018

Marseille
Photonics in Healthcare
Monday, 19 November 2018
Tuesday, 20 November 2018

Amsterdam
Photonics in Agriculture/Food
Thursday, 14 February 2019
Friday, 15 February 2019

Newcastle
Photonics in Healthcare / Pharmaceuticals
Thursday, 4 April 2019
Friday, 5 April 2019
Optics and photonics clusters are concentrations of optics-related firms and universities that maintain strong research and workforce ties, create quality jobs, share common economic needs, and work with government and stakeholders to strengthen the industry. SPIE

SPIE, the international society for optics and photonics, was founded in 1955 to advance light-based technologies.

Serving more than 264,000 constituents from approximately 166 countries, the not-for-profit society advances emerging technologies through interdisciplinary information exchange, continuing education, publications, patent precedent, and career and professional growth.

SPIE annually organizes and sponsors approximately 25 major technical forums, exhibitions, and education programs in North America, Europe, Asia, and the South Pacific.
Global Photonics Industry

Global Segments Growth compared to Global GDP Growth – except for Information Technology and Photovoltaics all Segments grow faster

Global Photonics Segments 2015 Data on Euro basis

Growth CAGR 2011–2015

Segment Share on Global Photonics Market in %

Data Sources: Eurostat / DB Research / Optech Consulting, Market Research Study 24.1.2017

European Photonics Industry

The Segments View: Most European Segments were able to outgrow Global and European GDP Levels

European Photonics Segments

Growth CAGR 2011–2015

European Segments – Global Share in %

Source: Optech Consulting, Market Research Study 24.1.2017

2015 European Photonics Production

Total: EUR 69.2 Billion

Data Sources: Eurostat / DB Research / Optech Consulting, Market Research Study 24.1.2017

Source: Optech Consulting
Photonics Finland is a technology oriented association that drives the photonics industry in Finland. It gathers Finnish photonics companies, academia, industries that apply and adapt photonics and public authorities under the national network.

Photonics Finland develops practices to coordinate and develop Finnish photonics internationally by working closely with other European photonic clusters which are sustained by European Union Photonics Platform (Photonics21).
Photonics in Finland

- 200 companies
- Photonics business in Finland is Billion euro
- Directly employs about 4 000 workers in Finland

- Key target markets to grow 20.9% annually for the next 3 years
- Photonics related turnover to grow 27.1% annually for the next 3 years
- Employees is estimated to grow 18.3% annually for the next 3 years

OptoFidelity integrate optical sensor technology in OptoFidelity's precision robot platforms. Optical measurement technology is also used to measure performance of VR / AR devices.
Key Photonics Competences in Finland

- **Optical Sensing and Imaging**
  - Machine vision, spectral images, ...

- **Micro- and Nanophotonics**
  - R2R, solar cells, 3D printed optics, MOEMS, silicon photonics, VR/AR optics, ...

- **Lasers and Fiber Optics**
  - Fiberlasers, semicomtactor laser, ...

*Ecosystem including*
- Leading companies
- SMEs
- Research groups
- Facilities
- Government support
Events

End user workshops

• *Photonics for Lighting, Helsinki, 31. August 2017*

• Photonics for Food Industry, Seinäjoki, 12. June 2018
• Photonics for Forestry, Joensuu, 10.-11. October 2018

• *Optics&Photonics Days (OPD) 2018 – Jyväskylä, 28.-30. May 2018*
• Northern Optics Photonics (NOP) 2018, Lund, Sweden 12.-14. September 2018
Forest&Photonics 2018, 10th – 11th October, Koli National Park, Finland

Themes for the Forest&Photonics 2018
- Drones & Big Data
- Robotics & Automation
- Photonics Technologies for Biorefineries

https://www.photonics.fi/event/forest photonics-2018/
What is Photonics?
Precision Farming
High Tech Agriculture: Photonics for Food Industry

Today's Menu

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C. 15 min presentation and 10 min active discussion
Kiitos!

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Photonics Finland
Forest&Photonics 2017 in a nutshell

Themes for the seminar
• Forest Data
• Smart Machines
• Photonics Future Technologies

During the event
• Virtual Forest AR/VR demo
• Virtual Industry Environment VR demo
• Evening Program with excellent networking opportunities

After the seminar
• All the presentation videos are available http://bit.ly/2mt0tPP
• All the presentation pdf-materials are available http://bit.ly/2wDVdNx
• The challenges and opportunities from seminar are processed and new collaboration projects with companies are developed.