

FOOD SAFETY 2020

June 11th–13th 2018 | Seinäjoki, Finland

Paraller session 12th June 2018

High Tech Agriculture: **Photonics for Food Safety**

Juha Purmonen
Executive Director

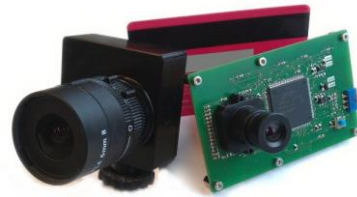
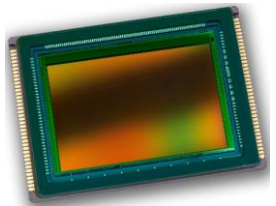
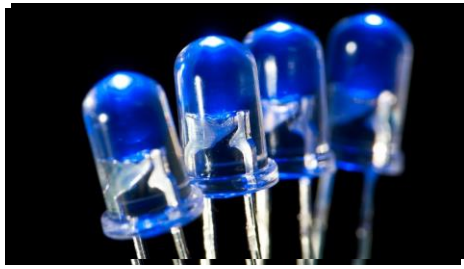


Photonics Finland

High Tech Agriculture: Photonics for Food Industry Today's Menu (Safety)

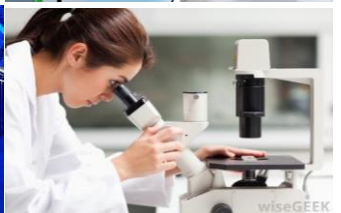
- Photonics and EPRISE project
- **New Miniaturised, Intelligent Spectral Sensors and Their Possibilities in the Food Sector**, Jarkko Antila – Spectral Engines, Finland
- **What makes hyperspectral imaging a revolutionary solution for food fraud and safety detection?**, Esko Herrala - Specim, Finland
- **Synthetic light catalysis cleans air and surfaces**, Petteri Jauhiainen - LED TAILOR INNOVATION, Finland
- **UV laser for food industry**, Slava Vanykov - HyacinthLUX, Finland

What is Photonics?



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

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



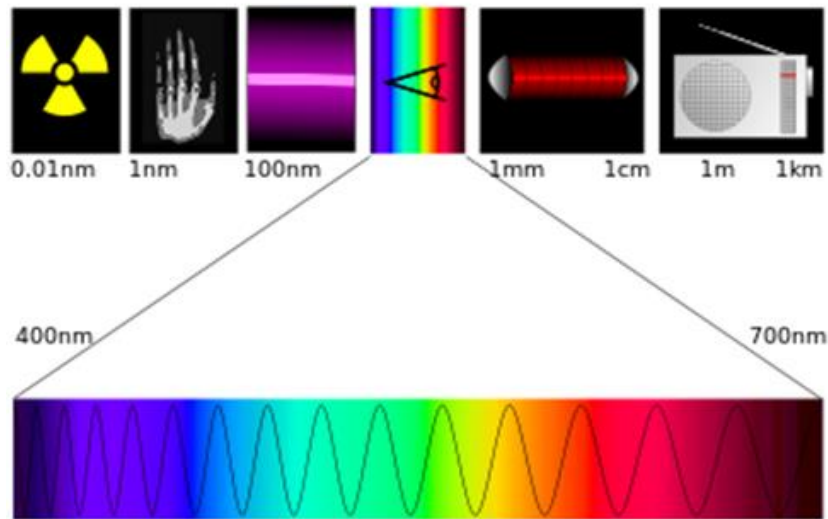
Lighting, vision systems, autonomous
vehicles, internet & datacenters,
smart phones, AR/VR, medical
imaging systems, TVs

Enabled Services

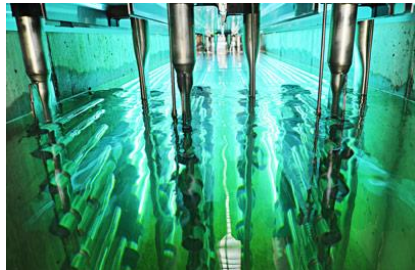


Internet, streaming video and audio (music), cloud storage services, e-commerce, car,

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

PHOTONICS²¹



Live longer, feel better
Photonics in life sciences and healthcare

Keep our traffic flowing
Photonics for connected mobility

Empowering Industry 4.0
Photonics in manufacturing and production

Feed the world
Photonics for safe, nutritious and affordable food

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

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

A million new jobs to 2030

Feed the world

Photonics for safe, nutritious and affordable food

Our mission:
quality food from
farm to fork

Field
Monitoring

Soil
Monitoring

Machine
Operation

Water
Management

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

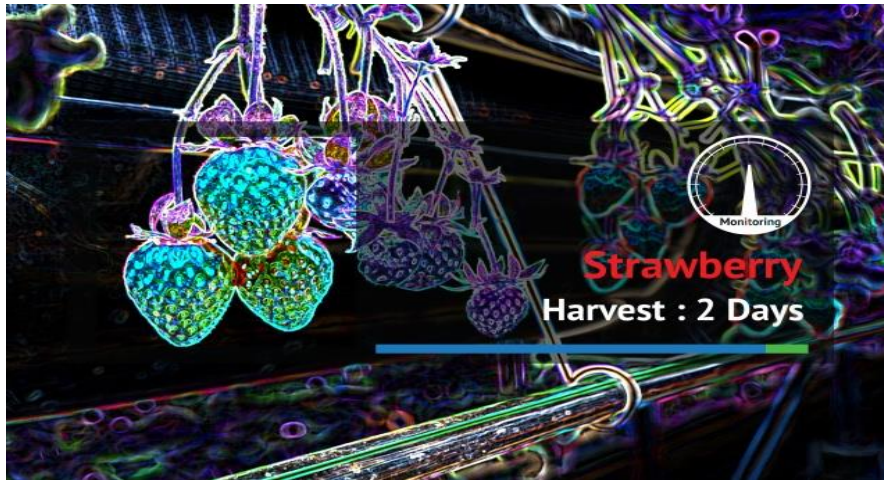
Photonics technology is a powerful toolbox - enabler

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.

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.



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.

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.



Medical Technology



Pharmaceuticals



Agriculture



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

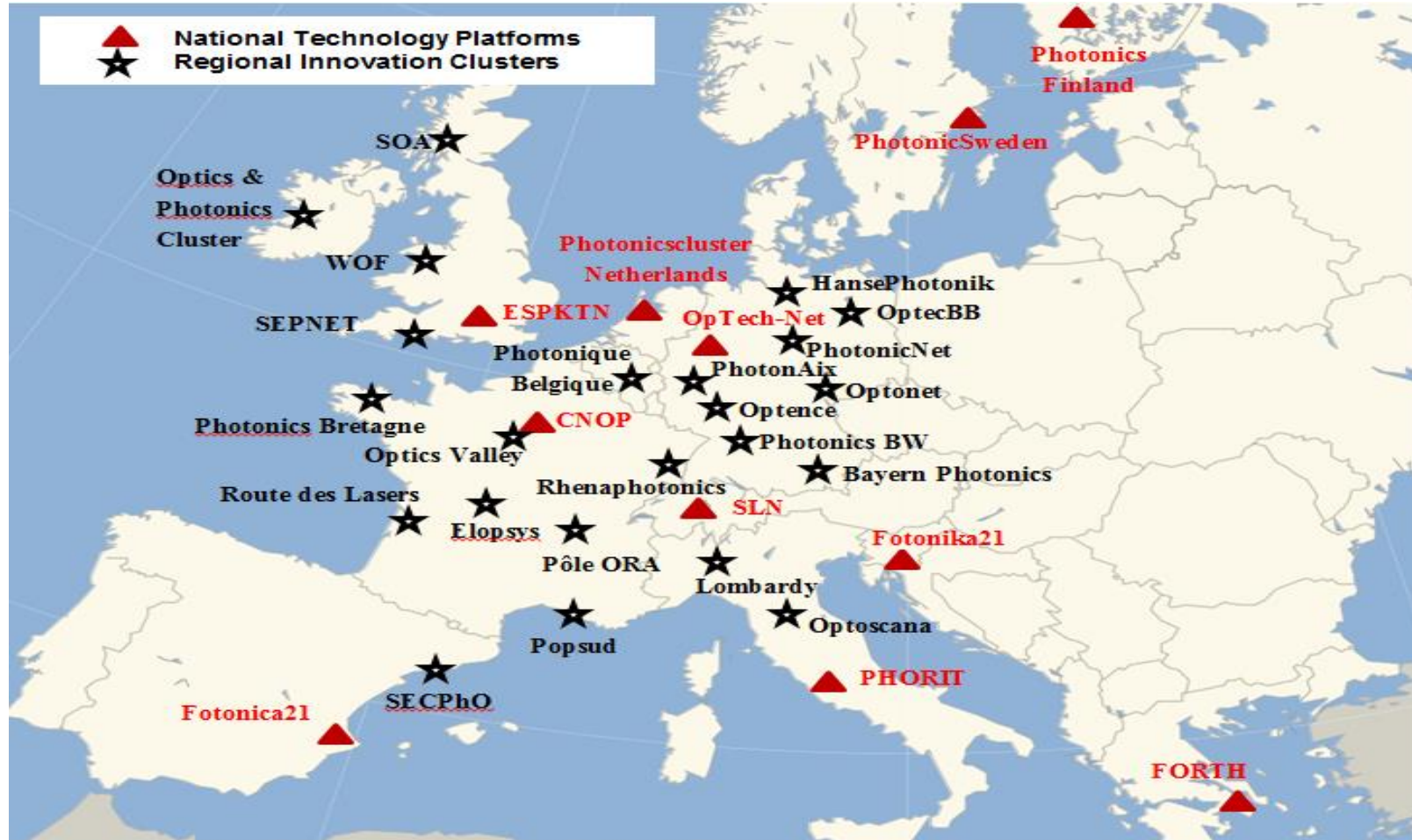
Thursday, 14 February 2019
Friday, 15 February 2019

Newcastle

Photonics in Healthcare /
Pharmaceuticals

Thursday, 4 April 2019
Friday, 5 April 2019

European Photonics Clusters 2016



Photonics innovation ecosystems in Europe

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.

2015 Global Photonics Market
Total: EUR 447 Billion

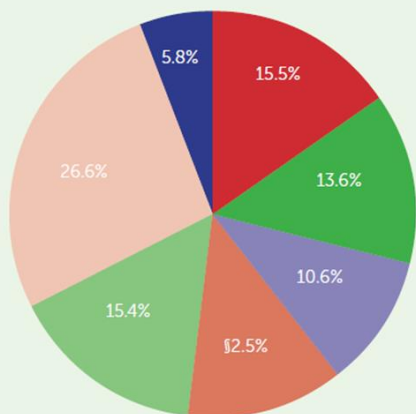


Diagram 6: Global Photonics

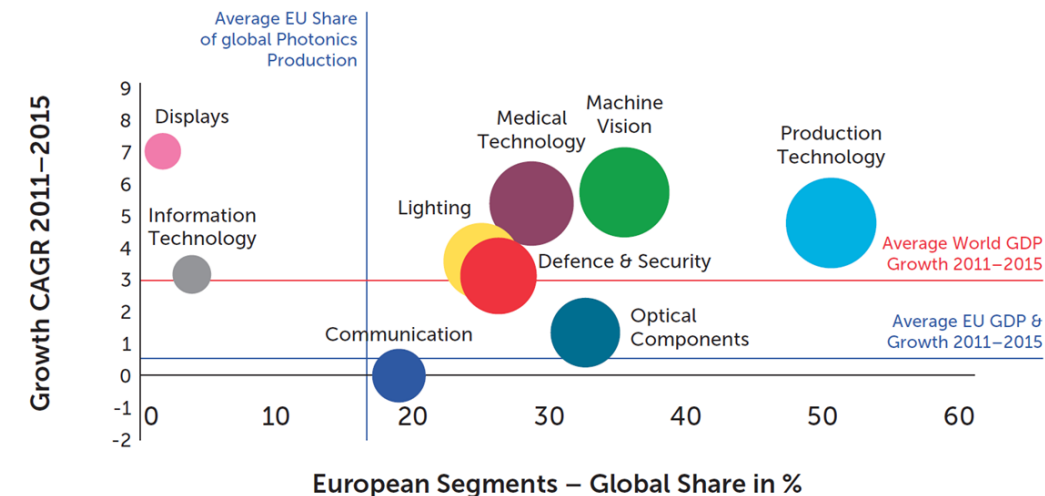


Source: Optech Consulting

European Photonics Industry

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

European Photonics Segments

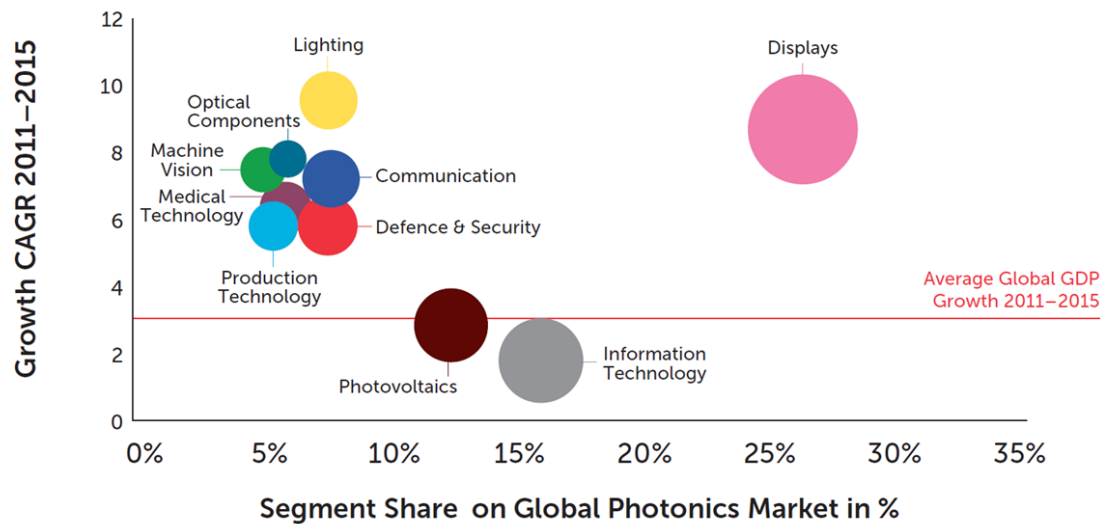


Source: Optech Consulting, Market Research Study 24.1.2017

Global Photonics Industry

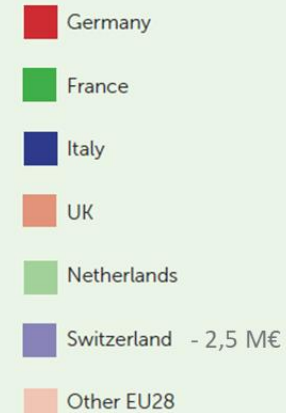
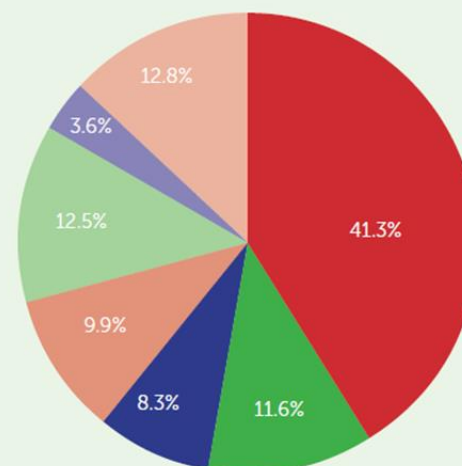
Global Segments Growth compared to Global GDP Growth – except for Information Technology and Photovoltaics all Segments grow faster

Global Photonics Segments 2015 Data on Euro basis



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

2015 European Photonics Production
Total: EUR 69.2 Billion



Source: Optech Consulting

The logo consists of four overlapping circles in blue, red, green, and yellow, arranged in a cross pattern.

Photronics Finland

Photronics 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.

Photronics 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 Finland



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



Company of the Year 2017

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, semiconductor laser, ...

Ecosystem including

- *Leading companies*
- *SMEs*
- *Research groups*
- *Facilities*
- *Government support*



Photonics Finland 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

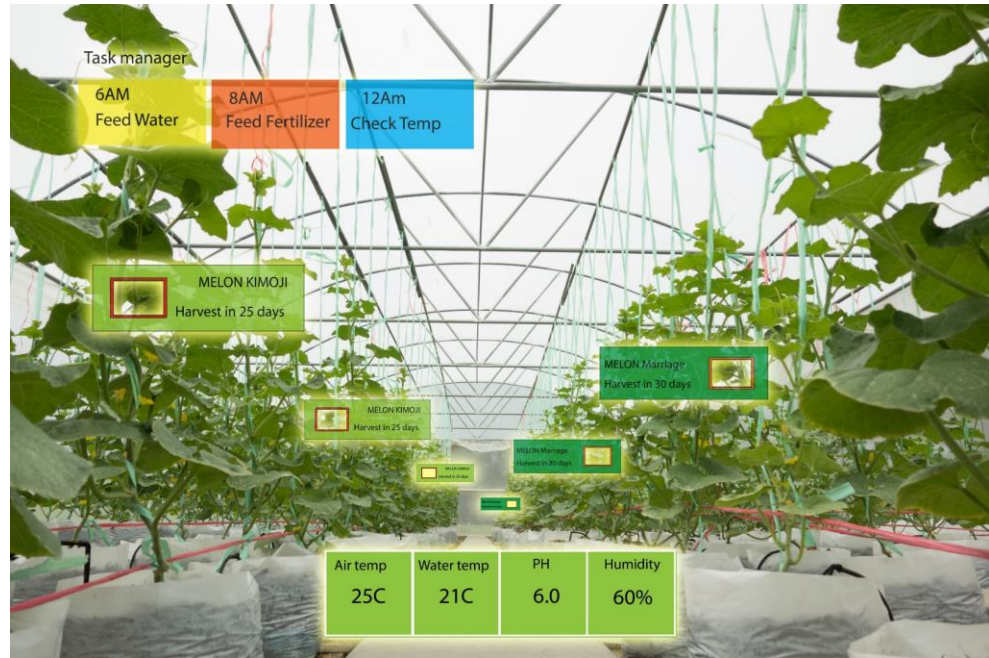
Themes for the Forest&Photonics 2018

- Drones & Big Data
- Robotics & Automation
- Photonics Technologies for Biorefineries

<https://www.photonics.fi/event/forestphotonics-2018/>

What is Photonics?

Precision Farming



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- **C. 15 min presentation and 10 min active discussion**



@PhotonicsFin @EPRISE_EU



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Kiitos!

Juha Purmonen

Executive Director

Tel. +358 50 354 3832

Email. juha.purmonen@photonics.fi

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.