

How can clusters accelerate regional ecosystems in the recovery of Finland?

Developing an international cluster from scratch

Juha Purmonen, Executive Director, Photonics Finland

26 November 2020



Europe's age of light!

How photonics will power growth and innovation



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

Photonics Ecosystem Promised to 2030 -> A million new jobs
Finland - 1 000 new jobs to 2025

An Overview of Photonics Innovation Clusters and National Technology Platforms in Europe

June 2010

... Photonics Unit



Executive Summary

Photonics is today a key innovation driver in many established applications like communications (fast Internet), measurement and security, and laser-assisted manufacturing. Photonics also provides solutions to upcoming global challenges such as energy (photovoltaics; energy efficient lighting) and health-care (bio-photonics for early disease detection).

European photonics production now accounts for 20.3% of global production (according to [1] below, the photonics world market was 270 BC in 2008). There are more than 5,000 photonics companies in Europe, mostly small and medium enterprises (SMEs), directly employing about 300,000 people.

The European photonics landscape is characterised by the presence of high-level research groups in public research centres and universities and also by strong industries in both SMEs and large companies. Most of these are clustered around so called "regional clusters" and "national technology platforms", which play a catalytic role in the further development of photonics in Europe.

This report provides an overview of the actual state of play of these regional clusters and national technology platforms in Europe. The main findings are as follows:

- In an attempt to better organise the optics and photonics community in Europe, at least two types of networks have been created in the last two decades:

1. Photonics innovation clusters have been the first entities organised on a regional basis. Partners in such clusters are: large companies and SMEs, start-up companies, public and private research centres, universities, specialised suppliers, investors, consultancies, and regional and government agencies. In particular, such agencies, together with cluster networks, often act as intermediaries between the cluster and national or regional governments. Usually, the members of the cluster work in partnership under a common

development strategy and in mutual interest in order to generate synergy in Research, Development and Innovation (RDI) in one or more given markets.

2. National technology platforms for photonics have existed since 2005, following the successful launch of the Photonics21 European Technology Platform (ETP)¹. Such national consortia are networks of public and private players sharing strategic topics in photonics. They work together in order to overcome the fragmentation of resources, to define a common strategy and to achieve visibility at political level for the domain. Possible follow-ups for national platform activities are national R&D funds and innovation policy measures specific to photonics, and increased national and international visibility.

- The RDI potential in photonics has not yet been fully exploited in Europe. Direct and visible links between academic research and industries are sometimes lacking at national level, leading to a waste of expertise and potentiality for RDI. This somewhat fragmented national landscape results in only partial recognition for photonics at political level and very few specific regional/national funding programmes.
- National and regional clusters and platforms are promoted by the EU as an effective mechanism for RDI. Their role and importance for Europe is stressed in the European Commission's communication COM(2008) 652 of 17 October 2008², which calls for efforts to facilitate "world-class" clusters in the EU in order to achieve the critical mass and innovation capacity to face global competition. Also related to this COM is the European Commission decision of 22 October 2008³ on setting up a European Cluster Policy Group.

¹ <http://www.photonics21.com/>

² "Towards world-class clusters in the European Union: Implementing the broad-based innovation strategy", COM(2008) 652

³ Commission Decision 2008/824/EC

the regional and local public authorities (Regional Development Agencies or Devolved Administrations) and to influence the economic and innovation policies in that area. Both regional clusters and national technology platforms can also complement the activity of the Photonics21 ETP: they provide further inputs to strategic RDI issues to promote at EU level and help Photonics21 in further advancing the photonics field by supplying it with information on the local photonics community and by providing political support at local level. Furthermore, examining the main activities of the existing photonics clusters and platforms, they can also play a catalytic role in giving support to the European Commission's policy of training and education in photonics.

In what follows, a brief SWOT analysis of photonics clusters and national technology platforms is carried out.

Strengths: As illustrated in the previous paragraphs and in the annex, the main ingredients of successful clusters or platforms are the following:

- Talking directly to and getting support from local, regional and national governments;
- Direct involvement of local industries and mainly SMEs, including strong support to SMEs in their innovation activities;
- Efficient networking of regional and national actors across the value chain (including industry and academia), which consists of:
 - Pooling resources together around commonly agreed RDI targets;
 - Coordination of a number of operational activities (e.g. through promotion of innovation and technology transfer activities; support to R&D projects, business consulting or financing; training and education, etc.) at regional / national level.
 - Coordination of the effective implementation of the jointly agreed regional or national strategic development plan.

Best practise examples of such qualities are the UK, Germany, France but also smaller countries like Slovenia.

Weaknesses that have emerged in the photonics clusters/platforms include:

- Difficulties for academia and industry in networking efficiently at regional and/or national level;

- Narrow focus on rather small, local or regional niche markets; limited capabilities, because of lack of sufficient local markets; lack of ambition or inability to extend targets and cooperation at national or cross-border level;
- Important actors missing along the value chain (e.g., lack of big end-users for the utilisation of innovative photonic solutions)²⁰.

Opportunities that the creation of clusters and platforms are offering to their members are the following:

- Offering visibility for photonics activities at political level: photonics recognition as a key enabling technology at regional and/or national level;
- Developing new areas of excellence in R&D that combine local strengths in academia and industry and developing regional and national employment strategies;
- Enhancing their national visibility and European dimension through a larger and easier access to European and international R&D programmes and a better role in EU policy definition;
- Teaming up with appropriate partners along the whole value chain in order to fill knowledge gaps, access to the right support in terms of necessary infrastructure, business experience and consulting and finally, helping SMEs, in particular in their innovation efforts to develop products addressing local, national or international markets.

Threats to the further development of existing photonics clusters and national platforms or to the creation of new clusters/platforms are the following:

- A poor political recognition of photonics and a weak national policy with regard to RDI in general and to innovation clusters and technology platforms in particular;
- A too fragmented national landscape for photonics;
- Reduced competitiveness and loss of market segments to competitors from Asian countries because of reduced ability to respond swiftly to changes, market evolution, etc.
- Inappropriate competition between clusters due to local government strategies versus European industrial strategies.

²⁰ It is to be noted here that as photonics is a global industry, it is rather difficult for a regional or even a national cluster to have a full value chain of companies within its geographic boundaries.

Threats

A poor political recognition of photonics and a weak national policy with regard to RDI in general and to innovation clusters and technology platforms in particular;

A too fragmented national landscape for photonics

Reduced competitiveness and loss of market segments to competitors from Asian countries because of reduced ability to respond swiftly to changes, market evolution, etc.

Inappropriate competition between clusters due to local government strategies versus European industrial strategies.



Figure 1: Distribution of Photonics clusters (yellow stars) and National Technology Platforms (orange stars) in Europe.

Starting point

- Finnish Optics Society – academic optics association estb. 1992
 - 19 Company members and around 200 individual members
- In 2012 there are not any photonics industry association in Finland
- **Finnish photonics companies knew that they competitors in Europe got a lot of benefits from regional/national photonics clusters**
 - > **Photonics industry had big need for photonics cluster in Finland**
- Pirkanmaa ELY-Centre funded project (universities co-funded) 2012
 - Creates an Industry-driven "innovation ecosystem"
 - Uses a common voice towards the funding organizations and other decision makers
- The Centre of Expertise Programme (OSKE) – closed 2013
 - Nanotechnology Cluster Programme

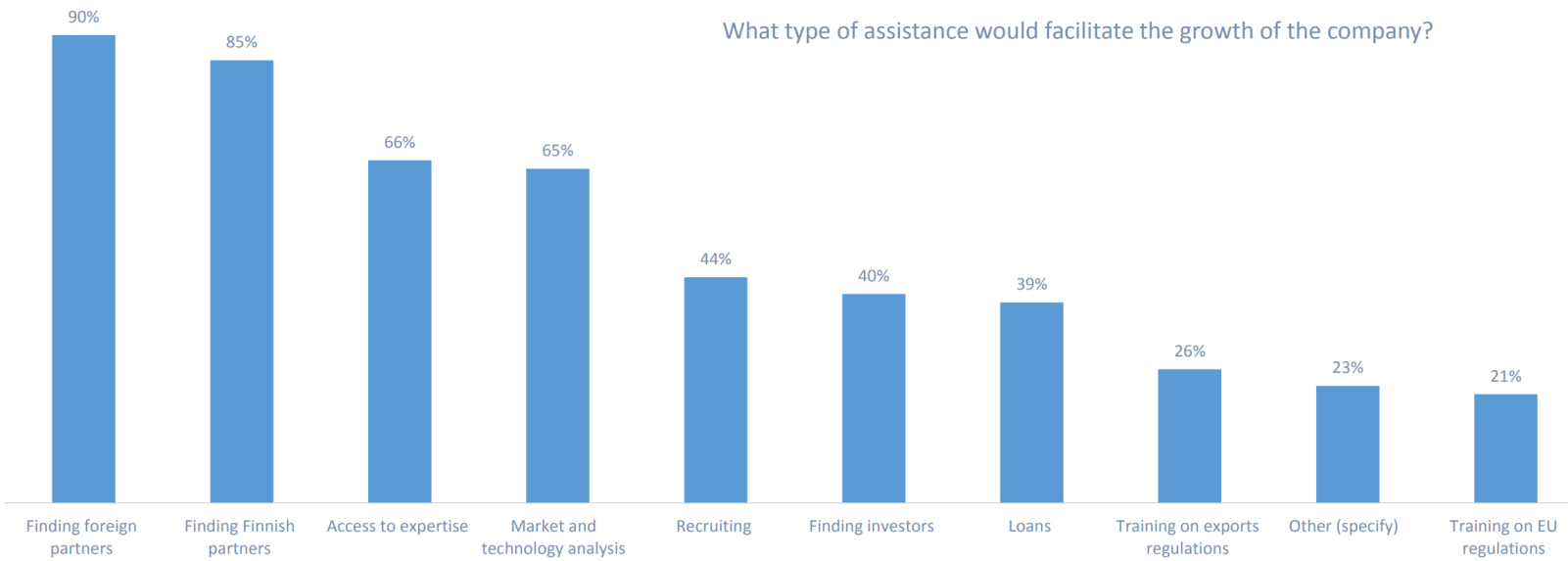
Big thanks to Sweden!

- Photonics Sweden was founded couple years earlier
 - We took good practices and avoided challenges
- Probably the biggest things
 - Academic and industry should be in the same cluster
 - Still even nowadays in Sweden there are two Photonics platforms
 - Sweden Optics Society – SOS
 - Photonics Sweden
 - National wide cluster – no regional
 - Regions are are two small (at least in Photonics) in Finland

The first industry survey 2015



Photonics companies call for assistance in finding partners both in Finland and foreign markets to boost their growth



Together with Tekes – 2015

- 200 companies
- 850 Million euros
- 3 500 employees
- Growth expectations for next 3 years
 - Photonics business ~20%
 - Revenue ~27%
 - New employees ~18%

~30 Companies in Photonics Finland

PHOTONICS IN FINLAND 2020

COMPANIES



- ✓ TOTAL 260 COMPANIES
- ✓ +60 COMPANIES / +30% SINCE 2016
- ✓ NEW COMPANIES FOUNDED +9% YEARLY

TURNOVER



- ✓ TOTAL 1,2 BILLION EUROS
- ✓ +350 MILLION EUROS / +40% SINCE 2016
- ✓ COMPANIES TURNOVER GREW +12% YEARLY

EMPLOYEES



- ✓ TOTAL 4 200 EMPLOYEES
- ✓ +700 EMPLOYEES / +20% SINCE 2016
- ✓ AMOUNT OF EMPLOYEES GREW +7% YEARLY



Why? How?

Together with Tekes – 2015

- 200 companies
- 850 Million euro
- 3 500 employees
- Growth expectations for next 3 years
 - Photonics business ~20%
 - Revenue ~27%
 - New employees ~18%

Photonics Finland members
2015 - ~30 Company members
2020 - ~80 Company members

PHOTONICS IN FINLAND 2020

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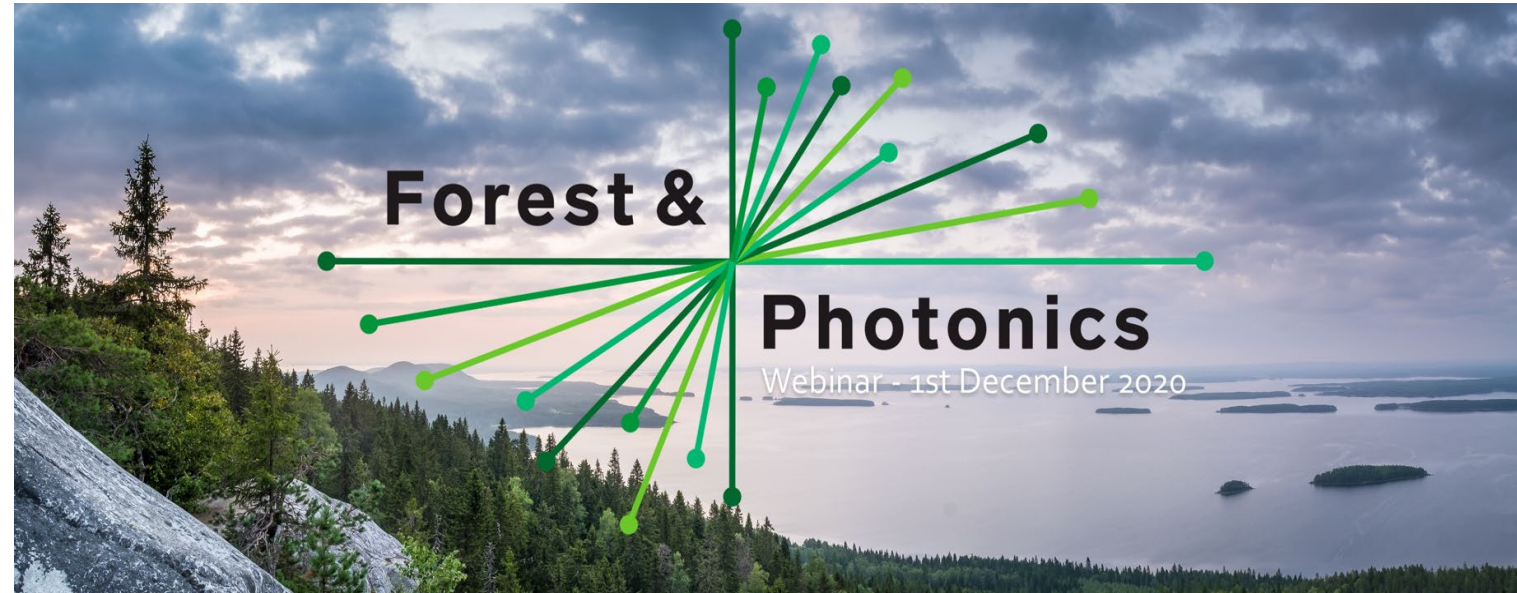
- ✓ TOTAL 4 200 EMPLOYEES
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Photonics for X

- Photonics for Forestry
- Photonics for Food
- Photonics for Healthcare
- Photonics for Lighting
- Photonics for Clean Water
- Funding for Photonics
- IPR for Photonics

Maybe in the near future?

- Photonics for Energy
- Photonics for Circular Economy



Forest&Photonics is a unique event that brings together the forest and technology experts to network, collaborate and share challenges, opportunities and solutions. Started 2015.

2015 - 30 participants

2019 - 160 participants

<https://www.businessjoensuu.fi/en/events/forestphotonics-2020/>

SPIE. **PHOTONICS
WEST 2020**



Photonics Finland
Pavilion North Hall, Booth #5279



brighterwave

SENOP



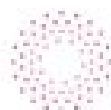
dispelix



INKRON

EMBERION

SPECTRAL ENGINES
MEMBER OF THE NYNOMIC GROUP



Ladimo

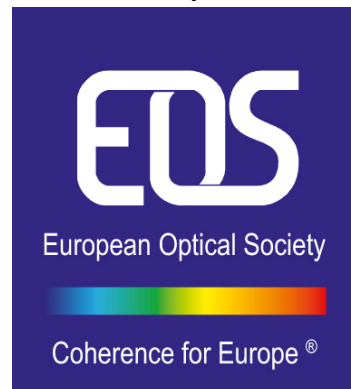


NomiCam



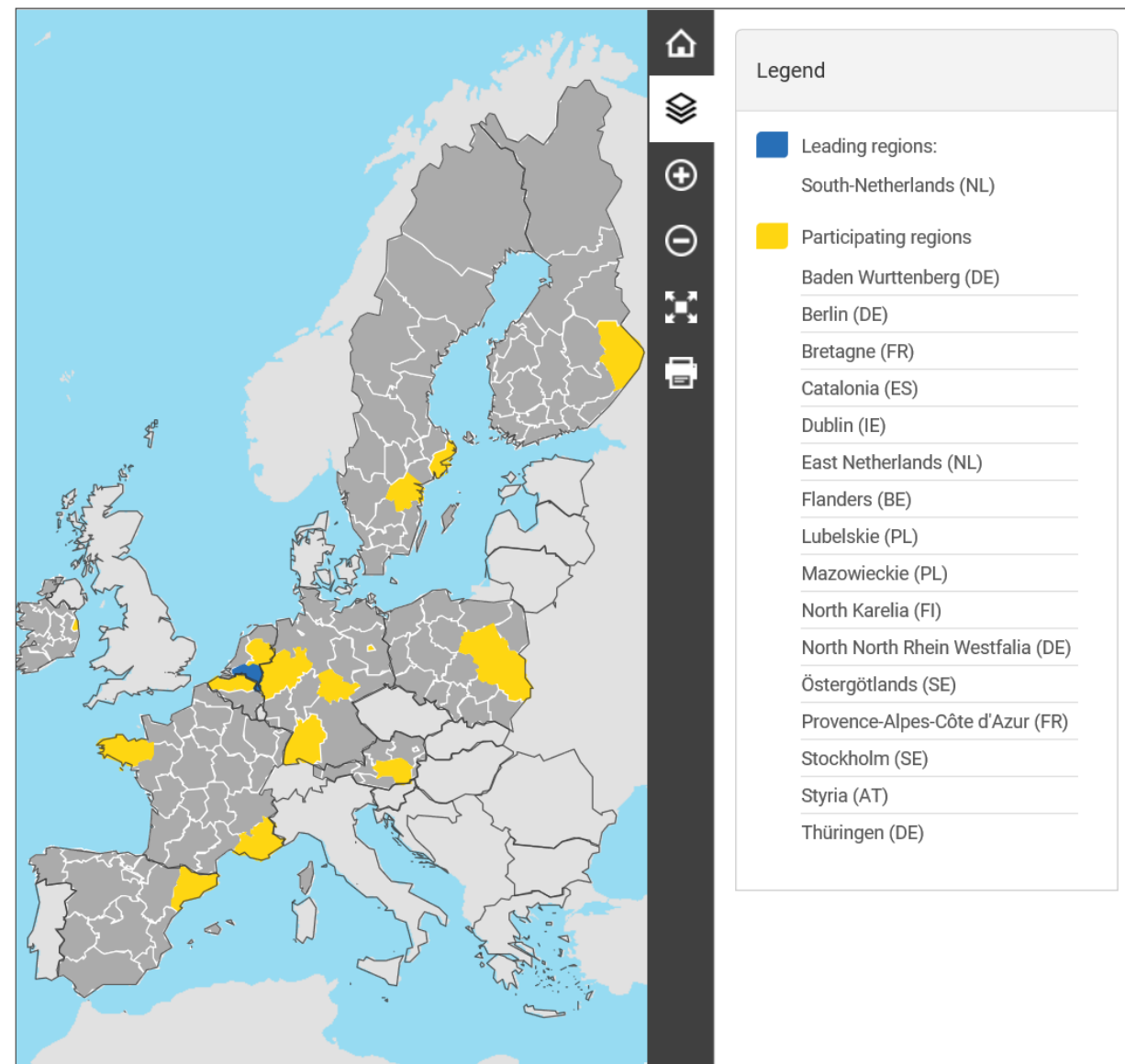
A-Photonics

National Optical Society



European Photonics Alliance

List of Regions involved



Collaboration

National Photonics Cluster

PhotonicsNL, Netherland

Photonics Sweden

Photonics Austria

Photonics France

Fotonika21, Slovenia

PCO, Photonics Platform Poland

Swissphotonics, Photonics Platform Switzerland

AIET, Photonics Platform Italy

FORTH, Photonics Platform Greece

Other Clusters

Triple Steelix, Sweden

Produtech, Portugal

AFIL – Assosiation Intelligent Industry Lombardia, Italy

Aero Cluster - Czech Republic

IFAC/CNR - Italian National Research Council

Centre for Process Innovation (CPI), UK

Regional Photonics Clusters

Optics Valley, Tucson, US

Rochester Photonics, US

Photonics Hub, Wetzlar, Germany

Optonet, Jena, Germany

Optitec, Marseille, France

Route des Lasers, Bordeaux, France

SecPho, Barcelona, Spain

Photonics Bretagne

OpTecBB, Berlin, Germany

Quebec Photonics, Canada

Parliament of Finland - Committee for the Future

The Committee for the Future is an established, standing committee in the Parliament of Finland. The Committee consists of 17 Members of the Finnish Parliament. **The Committee serves as a Think Tank for futures, science and technology policy in Finland.** The counterpart cabinet member is the Prime Minister. The Committee was established in 1993.

Photonics Survey

Photonics for Finland economy

Bioeconomy (forest&food), Cleantech, Digitalization, Healthcare, Circular Economy, AI, Education

Photonics for Global needs

Industry 4.0, Smart City, Transportation, Tourism, Mining, VR/AR/MR, Cyber Security and Basic Research

Recommendations for future programs

Editors & authors

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Authors: professors & CTOs from the companies

EDUSKUNNAN TULEVAISUUSVALIOKUNNAN JULKAISU 5/2018

FOTONIIKASTA VALOA SUOMEN HYVINVOINTIIN

Selvitys alan vaikuttavuudesta ja kasvunäkymistä



Flagships – high research and impact



FLAGSHIP PROGRAMME

FLAGSHIPS – High-impact competence clusters

- ▶ Six flagships selected
- ▶ Each flagship has a long-term plan for eight years
- ▶ Flagship term: 2019–2026
- ▶ Collaborators include large corporations, SMEs and startups, educational institutions, hospitals and other public organisations

8 years of activity within the flagships areas, with an estimated total worth of 9 billion euros.

Most of this is financed by business companies.



ACADEMY OF FINLAND



FLAGSHIP PROGRAMME

FLAGSHIP HOST ORGANISATIONS

- **6Genesis** – 6G-Enabled Wireless Smart Society & Ecosystem | University of Oulu
- **FCAI** – Finnish Centre for Artificial Intelligence | Aalto University, University of Helsinki & VTT
- **FinnCERES** – Competence Centre for the Materials Bioeconomy | Aalto University & VTT
- **iCAN** – Digital Precision Cancer Medicine Platform | University of Helsinki & Helsinki University Hospital
- **INVEST** – Inequalities, Interventions and New Welfare State | University of Turku & National Institute for Health and Welfare
- **PREIN** – Photonics Research and Innovation | University of Tampere, Aalto University, VTT & University of Eastern Finland



ACADEMY OF FINLAND

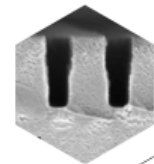
ADDED VALUE



LIGHT SOURCES
OPTOELECTRONICS

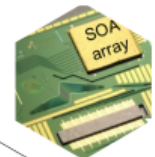


DIFFRACTIVE OPTICS
OPTICAL STRUCTURES



- Long-term unified research goals and vision
- Strengthen international competitiveness

INTEGRATION
INSTRUMENTATION



- Diverse profiles
- Complementary infrastructure (past 80M€ investment)

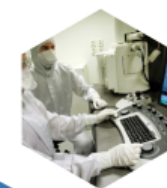


PREIN

VTT

A! Aalto University

NANOMATERIALS
DEVICES



Tampere University

Photonics education in Joensuu – TOP EXPERTS FOR THE GROWING LABOUR DEMAND

Photonics is an enabling and modernising key technology that provides artificial intelligence and automation with eyes and sensors.

Photonics applications are utilised in various fields, such as industry, consumer and health technology, AR/VR technology, solar cells, LED lighting and food production.



RIVERIA

Vocational continuing education provided in a versatile and practical manner.



KARELIA UNIVERSITY OF APPLIED SCIENCES

Vocational continuing education for product manufacturers, product development and testing, and expert services.



UNIVERSITY OF EASTERN FINLAND

The unique Institute of Photonics boasts world-class facilities and provides education from summer courses to doctoral studies.

**PHO
TO
NICS**

Projects

MIRACLE project is combining photonics technology to empower orthopaedic surgeons with quantitative and accurate evaluation of cartilage tissue. The decision-making during arthroscopy is highly subjective, relying on visual and probe inspection. <http://miracleproject.eu/project/>



BestPhorm21 project is Boosting Europe's Sovereignty in Technology by driving Photonics from Research to Market – Photonics21 **together with 14 national Photonics clusters**. Starting at January 2021.

PhotonHub Europe project is One-Stop-Shop Open Access to Photonics Innovation Support for a Digital Europe. PhotonHub Europe will establish a single pan-EU Photonics Innovation Hub which integrates the best-in-class photonics technologies, facilities, expertise and experience of 53 partners from all over Europe, including the coordinators of EU pilot lines and local photonics hubs representing 18 regions, as a one-stop-shop solution offering a comprehensive range of supports to industry for the accelerated uptake and deployment of photonics. **Photonics Innovation Hub in Europe**. Starting at January 2021.

Summary

- Photonics Finland Funding

- 1/3 European projects
- 1/3 Membership fees
- 1/3 Events

- Targets

- To 100 members
- New jobs
- New projects (even from Finland???)
- More collaboration together with international clusters – not only Photonics
- More Photonics for X events – see more events <https://www.photonics.fi/events/>

Photonics is the science and technology of light. Photonics deals with generating, guiding, manipulating, amplifying and detecting light. Photonics is behind many of the innovations which have transformed the way we lived in the last few years. We are on the verge of a new photonics era.

Juha Purmonen

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Impact Manager, PREIN – Photonics Flagship

Photonics Business Development Manager, Business Joensuu



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@JuhaPurmonen



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Photonics Finland



**BUSINESS
JOENSUU**

JOE
WITH

