

OASiS

Open the Access to Life
Science Infrastructures for SMEs



Spanish Photonics in Life Sciences



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Table of contents

The OASIS Project.....	4
Spanish Photonics in Life Sciences.....	5
R&D Infrastructures.....	13
Manufacturers.....	23
Engineering, Integration and Distribution Companies.....	30
Networks and Associations.....	34
Conclusions	36
SECPhO- Light Technologies Cluster.....	37

OASIS – Open the Access to Life Science Infrastructures for SMEs

The OASIS project aims to improve the links between life science facilities, research projects and product development. The previous large investments in Photonics in Life Sciences are made more accessible to SMEs to allow a competitive advantage in new product development and validation.



Large scale research facilities and technology platforms are usually sets of laboratory equipment that are mainly available to academia and to a certain extent to industry. It can be very large-scale equipment, unique to a country or a continent as well as technological halls shared by a wide scientific and technological community, which develops competencies in a specific area.

In the field of the life sciences, the management of open access for researchers and world-class research programmes between these facilities is under consolidation through existing programmes like Instruct, EuroBioimaging, Biophotonics Plus and the network of excellence Photonics4Life.

Large companies have established strong collaborations with these facilities. However, there is still room for improving the economic outputs and the involvement of SMEs in order to create more value and jobs from early scientific results.

By February 2015, the OASIS consortium has inventoried and analysed about 120 companies, unmet needs from 14 hospitals and 14 agrifood companies and more than 70 Life Science facilities. Nine workshops are organised at each partners' premise during the life time of the project to promote exchanges and spread the information and results from the project.



Technical info about the OASIS EU Project

Type of project: Coordination and Support Action (CSA) project from FP7-ICT-2013-11 objective 3.2 Photonics. Grant agreement no: 619230

Website: <http://www.fp7-oasis.eu>

Partners: Optitec (Marseille, France); CNR – Optoscana (Florence, Italy); PhotonicSweden; OptecBB (Berlin-Brandenburg, Germany) ; Politecnico di Milano (Italy); SECPhO (Southern European Cluster in Photonics & Optics Association, Barcelona, Spain); Photonics NL (The Netherlands); Photonics Bretagne (Lannion, France) and Swansea University (UK).

Duration : 30 Months (Dec. 2013 to May 2016)

Coordination: Katia Mirochnitchenko, OPTITEC, Marseille.

1. Introduction

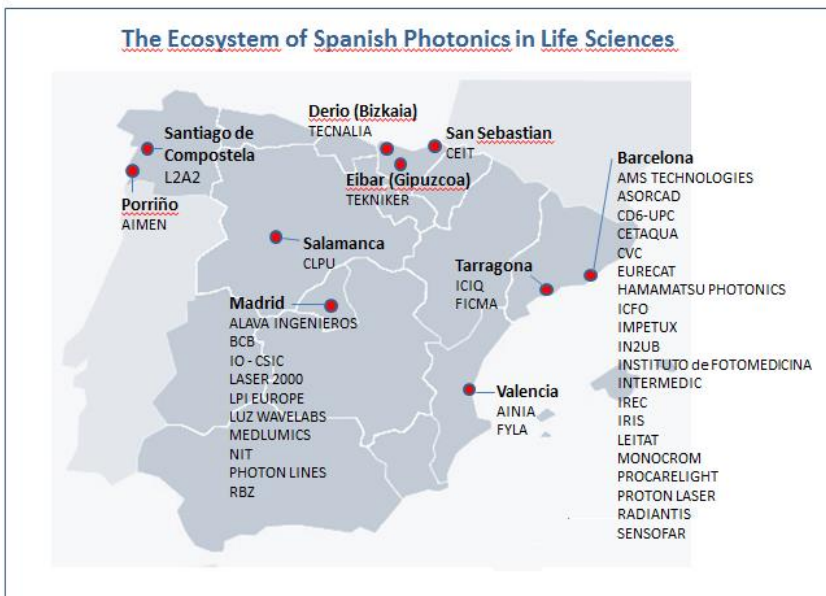
The term Life Sciences in this report refers to 8 specific areas of photonics applications that are analysed within the **OASIS project**. These are the following:

- Medicine/ Healthcare
- Pharmaceuticals
- Food and Water Safety
- Agriculture
- Biology
- Cosmetics
- Veterinary Medicine
- Forensic Science

This report is based on the analysis of SECPhO cluster members which represent the major part of the Spanish industrial photonics sector with 60 members along the value chain. There are 40 organisations in Spain that identified Medicine, Photonics in Life Sciences, Agriculture or Food and Water sectors to be their major market of interest where their products and services are (or can be) applied. This corresponds to 70% of the whole SECPhO network.

2. The current ecosystem in Spain

The main poles of activity are distributed around different areas of Spain. Catalonia, Madrid, Basque Country, Valencia and Galicia represent the most active areas where majority of the actors are concentrated (also seen in the map below).



3. Value Chain of Spanish Photonics in Life Sciences

The photonics industry in Spain is represented through the whole value chain in Life Science applications.

Value Chain of Spanish Photonics in Life Sciences



R&D

Spain counts with world famous R&D centers that are investigating various applications of photonic technologies and phenomena that are further applied in Life Sciences.

For example, the two major photonics institutes, the **Institute of Photonic Sciences (ICFO)** and the **Institute of Optics (CSIC)** are performing basic research on nanophotonics, single molecule biophotonics, fluorescence imaging and biophysics. Besides fundamental research, both have applied photonics groups as well.

ICFO has a dedicated Medical Imaging group which develops new technologies based on diffuse optical monitoring and tomography which uses photon diffusion to probe “deep” (0.1-10cm) into tissues. A new spinoff “Hemophotonics” has been recently launched by the group.

Meanwhile, the **Institute of Optics (CSIC)** manages the VIOBIOLAB that is developing imaging techniques for investigation of the human visual system and new vision correction alternatives.

Another R&D group **FICMA** from the University of Rovira i Virgili is focusing on physics and crystallographic obtention of new materials for laser and photonic technology as well as the development of (micro-nano) optics and photonics devices. Some examples of applications in life sciences: a new technology for lasers in ophthalmology or diagnosis of cancer via liquid biopsy.

The Institute of Chemical Research of Catalonia (ICIQ) gathered the profound knowledge on catalysis. The institute’s objective is to discover new catalytic processes to tackle challenges such as sustainability, health and energy using various techniques amongst which photonics plays crucial role.

Finally, the **Institute of Nanotechnologies from the University of Barcelona (IN2UB)** examines the functionalisation of surfaces, quantum dots and nanotechnology which can be further applied in various OASIS analysed areas of application.

Technology Transfer

Innovation in micro-, nano- photonic devices is a field where Spain has reached notable results and pioneers the collaboration with industry.

For example, **AIMEN** is collaborating internationally in different areas, such as development of new manufacturing techniques, based on micromoulding, specific for biomedical microdevices or development of bioactive coatings and nanostructured ceramic scaffolds for bone regeneration, besides others.

Three technology transfer centers (**TEKNIKER, TECNALIA and CEIT**) based in Basque region are known for their close collaboration with hard industry. Nevertheless, photonics applications in life sciences is not an exception either.

The **TECNALIA** research & innovation center is offering various solutions to its' industrial clients based on micro- and nano-photonic devices, biomaterials, bioprocesses & preservation applied to Health and Well-Being.

TEKNIKER in the biomedicine sector works in four main areas: identification and quantification of biomarkers, tissue engineering, health products manufactured by microinjection and equipment for the bio industry.

Lastly, **CEIT** activity is centered on BioMEMS, biorobotics and software for biomedical applications, bioinformatics and biomaterials. One of examples could be the development of a smart packaging biosensor for olive oil that is being developed under the project called ETIVOL.

On the eastern side of Spain, 3 major industrial partners reside near to each other in Catalonia. These facilities offer the development of application driven photonics systems to their clients.

One of them, the **CD6** center is designing optical systems and sensors for optical metrology, biomedical instrumentation and studies optical techniques for nondestructive testing (NDT). The best example could be the collaboration between the CD6, Tekniker and Monocrom (to be described further) that resulted into a new company creation (DavalorSalud) that are developing a visual diagnostic system that will revolutionise the way how visual problems are identified in near future.

The **LEITAT** technological center is oriented to photonics applications in cancer therapy, diagnostics, prognosis and illness monitoring. Also, they work in specific areas such as bioservices, toxicology, migration determination and development of markers, development of bioprocesses, extraction of active principles and others.

The **EURECAT** technological center is expert in smart product development, E-health solutions, personalised medicine and m-health. After the union of 5 separate research centers, Eurecat is now able to offer an extended expertise in these fields.

Besides previously described facilities, SECPhO gathers centers that offer their labs for various industrial and research experiments with the state of the art ultrafast laser equipment mainly orientating to medical imaging.

The **L2A2 lab** at the University of Santiago de Compostela will be using their 45 TW laser built in the framework of the project LaserPET for the acceleration of particles for PET (Positron Emission Tomography) imaging.

On the other hand, the **CLPU** at the University of Salamanca are always open for collaborations and new experiments for medical imaging applications using their petawatt laser that is a unique infrastructure in the world.

The software, computational part is addressed by **the Computer Vision Center (CVC)** where applications for Medical Imaging, Neurocomputation and Biological Vision areas are being developed. Latest examples vary from 3D Endoscopic Navigation, to Image-guided Atherosclerotic Characterization, Intestine Motility Analysis by Wireless Endoscopy and others.

Finally, the **INSTITUTO DE FOTOMEDICINA** serves as a facility (belonging to the hospital) that is open and very interested in collaborating and investigating novel laser applications for health (dermatology in particular) in clinical trials, developing and testing new applications with patients.

Besides medical applications, SECPhO members like **Cetaqua and AINIA** work in water treatment and food areas correspondingly.

The Cetaqua research center integrates, manages and executes research projects in all aspects of the integral water cycle. The areas where Cetaqua is using photonics: water quality, treatment, information and communications.

AINIA technological center mainly focuses on R&D+I in food area and is a reference point in research about food. Besides that, other areas of investigation are environment and energy, packaging, chemical products, cleaning and disinfection, cosmetics and body care, pharmaceuticals.

To conclude, lighting applications in Life Sciences are investigated by **the Catalonia Institute for Energy Research (IREC)**. IREC is investigating and developing advanced lighting solutions and how it is affecting the horticulture, greenhouses and human health as well as works on the development of new devices for phototherapy and characterisation of membrane proteins.

Manufacturing

Going further along the value chain, Spain has some of world class manufacturers whose markets are established all over the world. Laser and laser component manufacturers whose products are used in Life Sciences is one of the groups.

The new startup **FYLA** is producing supercontinuum fiber lasers whose major market of interest is big medical, analytics equipment companies that need novel ultrafast light sources. Possible applications vary from orthopedic surgery to ophthalmology, OCT.

MONOCROM is manufacturing high power diode lasers and advanced solid-state lasers that have been used in missions in Mars. Nevertheless, their main market currently is laser depilation equipment producers.

Another manufacturer **RADIANTIS** is offering advanced frequency conversion systems for laser tuning. Besides the laser equipment, other products reach from optical power meters to super compact and fast spectrometers (Seawave).

Finally, **PROTONLASER** is a company developing ultra-short and ultra-intense laser sources with one of recent goals to develop a table top TW laser accelerator for medical imaging isotope production.

Another group of manufacturers produce various photonic components for later applications of photonics in Life Sciences.

The Madrid based **LUZWAVELABS** is developing THz sources for oncology, dermatology, oral healthcare and medical imaging besides many other possible applications where THz sources are used.

In the meantime, **NIT** is a producer of novel IR sensors for health monitoring as well as food industry. One of later examples could be the last project of implementation of NIT sensors for industrial process monitoring during wine production.

The last group of Spanish manufacturers produce solutions directly applied in Life Sciences.

INTERMEDIC is a producer of laser platforms for medical and aesthetic use. For example, the latest new product launched in the company was the system "Gynelase" used for urinary incontinence treatment.

Another company, **MEDLUMICS** is developing photonics systems for dermatology. Their recently launched device is combining clinical camera, OCT and digital dermatoscopy techniques and is called Dermalumics NITID.

SENSOFAR MEDICAL specialises in production of surface metrology platforms. Their product Q Six is specifically designed for assisted inspection of stents.

A spin-off **IMPETUX** has commercialized its' patented force measurement systems in optical trapping and manipulation with product names Lunam T- 40i and Deimus T- 10i.

Integration & Engineering

The other group of SMEs is technology, system developers whose business model is based on integrating solutions for specific problems contracted by industry or in collaboration with End Users.

The **LPI** works on developing lighting for medical applications: surgeon's headlamps, cannula surgical illumination systems. Another area of their work is the advanced lighting solutions in horticulture, greenhouses and human health via collaboration with IREC (described above).

IRIS develops and integrates key enabling and novel technologies in the fields of advanced monitoring, automation, decontamination, advanced materials and waste valorization, Raman handheld spectroscopy and near IR, hyperspectral imaging. IRIS is proud to be one of the first companies to have implemented PAT (Process Analytical Technology) systems in wine industry.

BCB is currently collaborating with CD6 on the development of a wearable system for monitoring fetal heartbeats within the SME Instrument phase 2 funding by the EU. The previous project of BCB within Life Science applications covers the development of intraoral scanner for 3D dental modelling amongst others.

Another SECPHo member that works in 3D field is **ASORCAD**, a company that provides engineering services in 3D digitizing and reverse engineering also used in applications in Life Sciences.

Different type of activity is performed in **RBZ Embedded Logics**. The company specialises in electronic equipment design where various photonic components serve for sensing, signalling and lighting solutions. One of examples of their work is the design of a Spirometer for medical diagnostics.

Finally, **PROCARELIGHT** is offering light and laser safety solutions performing various courses and consultations daily in hospitals, laser eye clinics, dental clinics and cosmetic centers.

Distribution

Spain has industrial players along the whole value chain including the distributing companies which perform an important role in product development offering various photonic components and systems from numerous producers from around the world.

There exist two groups of distributors, ones that are official distributors of a specific brand and ones that offer products from various providers.

The first group starts with **HAMAMATSU** which is famous worldwide for their quality products used in almost all areas of medicine, from sources for all types of medical imaging to cameras and other sensors.

LASER2000 is specialising in selling laser safety products in life Science applications for different labs and companies that are using laser systems.

The following companies are included in the second group of distributors.

AMS TECHNOLOGIES is providing lasers, optics and optical components, as well as electronic drivers and power supplies used in ophthalmology, dermatology, aesthetics and in treatment centres in general.

PHOTON LINES is specialising in solutions for label-free cell imaging, light sheet fluorescence microscopy, various cameras and light sources.

Finally, **ALAVA INGENIEROS** offers numerous solutions and instrumentation for medical, agrofood, aquiculture fields to both the laboratory and company.

4. Main areas of application:

- **Dermatology** – speciality with both medical and surgical aspects dealing with the skin, nails, hair and its diseases;
- **Ophthalmology** – the branch of medicine concerned with the study and treatment of disorders and diseases of the eye;
- **Gynecology** – from photonics use in aesthetics applications to surgical tools used in this field;
- **Endoscopy** – a nonsurgical procedure used to examine person's digestive tract;
- **Medical imaging** – the technique and process of creating visual representations of the interior of a body for clinical analysis and medical intervention;
- **Cancer treatment** – covers surgery and radiotherapy where photonic sources are used for cutting, irradiation or illumination;
- **Surgical tools** – usually photonics sources used to cut tissues or in medical imaging and lighting;
- **Sensors for telemedicine/ wearables** – photonics provides key components for telemedicine and wearable solutions;
- **Microfabrication of stents** – cutting stents out of metal sheets using ultrafast laser systems;
- **Sensor systems for planting and irrigation** – analysis of the concentration of different chemicals in the soil;
- **Cattle control** – using imaging techniques (i.e. cameras on drones) to visualize the distribution of cattle in the field;
- **Analysis of various parameters of fruits and vegetables** – various photonic sensor systems enable continuous surveillance of flow of products in production lines;
- **Safety during food processing** – same photonic systems can be configured so that it would detect various parameters indicating if products are safe for consumption or not;
- **Biosensors in food packaging** – development of specific dyes that react with various gasses and other compounds indicating the state of the product inside the packaging;
- **Water quality measurement** – use of photonic sensors and radiation sources for the analysis of water quality;
- **Aquaculture** – illumination used in farming of aquatic organisms such as fish, crustaceans and aquatic plants;
- **Forensic analysis** – use of advanced illumination and chemical characterization systems;
- **Monitoring colonized species, pests and diseases of crops** – various control techniques using photonics for controlling the crops;
- **Improvement of phytosanitary product dosing** – photonic components allow more detailed and accurate dosage in agrofood industry;
- **Surgical equipment sterilization** – UV light source use for sterilization.
- **Detection and correction of visual diseases** – optical components and photonic detection systems allow more accurate and specified detection of various visual problems.

5. Main capabilities and technologies:

- **Spectroscopy** – the study of the interaction between matter and electromagnetic radiation;
- **Laser cutting and ablation** – accurate ablation of material by irradiating with ultrafast laser pulses;
- **Fiber laser applications** – in this type of laser the active gain medium is the fibre itself;
- **Terahertz applications** – also known as submillimeter radiation, has tremendously high frequency, consists of electromagnetic waves within the band of frequencies from 0.3 to 3 terahertz;
- **Optical Coherence Tomography (OCT)** – medical imaging technique that uses light to capture micrometer-resolution, three-dimensional images from within optical scattering media (e.g., biological tissue);
- **Metrology** of Medical devices (i.e. stents) – measurement and analysis of surface structures, in particularly in micro- and nano scale while using photonic solutions;
- **Microscopy** – technical field of using microscopes to view objects and areas of objects that can not be seen with the naked eye. There are three well-known branches of microscopy: optical, electron, and scanning probe microscopy;
- **Multi-, hyper- spectral cameras** – cameras that analyse spectra of light after interaction with material;
- **Thermography** – the study of heat distribution in structures or regions, for example in the detection of tumours using photonic sensors and cameras;
- **Artificial/ computer vision** – field that includes methods for acquiring, processing, analyzing, and understanding images and, in general, high-dimensional data from the real world in order to produce numerical or symbolic information;
- **LED/OLED lighting** – semiconductor (organic) sources of light that are based on electroluminescence;
- **Photonic sensors (visible, IR, UV, X-Ray)** – radiation detection systems that react to light sources and transform it to quantifiable signal;
- **Positron Emission Tomography (PET)** – functional imaging technique that produces a three-dimensional image of functional processes in the body. The system detects pairs of gamma rays emitted indirectly by a positron-emitting radionuclide (tracer), which is introduced into the body on a biologically active molecule. Photonics is used in acceleration of positrons in this medical imaging technique.

R&D INFRASTRUCTURES



AIMEN Technology Centre is a private non-profit research institute focused on material and manufacturing processes. AIMEN develops the following activities in the field of material processing with laser: Cutting 2D and 3D, Welding, Thermal treatments, Manual and automated cladding processes, Laser forming and laser assisted forming, Surface cleaning, coating removal, Microprocessing, Surface treatment by laser peening, Process monitoring and control, Systems design.

www.aimen.es



R&D INFRASTRUCTURES



AINIA is a technology centre with more than 25 years of experience that works to promote the competitiveness of companies through innovation. We work mainly for companies in the food sector but our technologies can also be applied to other sectors such as Environment and Energy, Packaging, Chemical products, cleaning and disinfection, Cosmetics and body care, Pharmaceuticals and biomedicine. AINIA offers solutions covering the entire typology of innovation needs of small, medium and large companies.

www.ainia.es





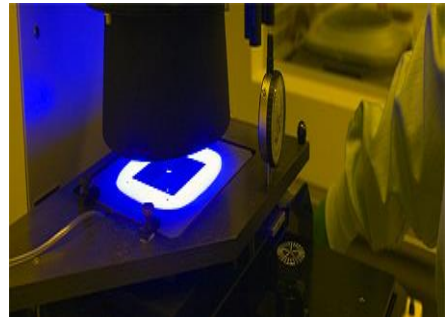
The Centre for Sensor, Instrument and Systems Development (CD6) is a research centre belonging to the Technical University of Catalonia (UPC). Its purpose is to provide services to companies and to carry out technological innovation projects in the field of optical engineering. The centre's researchers are working on four major areas of research: Metrology, Visual Optics, Optical design and simulation and Colour. Moreover, the knowledge gained in these lines, results in applications that are transferred to industry.

www.cd6.upc.edu



CEIT (Centre of Studies and Technical Research) is a non profit research centre that was created by the University of Navarra in 1982. The Centre's main aim is to carry out applied industrial research projects through close collaboration with Industrial R&D departments on a contractual basis. CEIT promotes high added value solutions through research projects and by training young researchers within a commercially productive framework. Our main capabilities in the Health & Food sector are: BioMEMS, Biorobotics and Software for Biomedicine, Bioinformatics, Biomaterials, Cell and Tissue Engineering.

www.ceit.es





www.cetaqua.com

CETAQUA integrates, manages and executes research projects in all aspects of the integral water cycle. However, the selection of researchers and the projects developed have led to high specialisation and have highlighted the following areas and specific capacities: sustainability, water quality, treatment, alternative resources, information and communications, technology, water economy, asset management, energy. We operate in 4 areas: city, environment, industry and agriculture. For each area we pursue the same common goal: optimisation of resources, water and energy saving and the guarantee of future sustainability.



R&D INFRASTRUCTURES



www.clpu.es

The Spanish Pulsed Laser Center (CLPU) is a new research facility that has been created as a Consortium of the Spanish Ministry of Education and Science, the Regional Government of Castilla y León and the University of Salamanca, as part of the implementation of the Spanish Scientific Infrastructures Roadmap. The objectives of the Consortium are:

- To build and operate a Petawatt Laser in Salamanca.
- To develop ultra-short-pulse technology in Spain.
- To make significant advances in intense, compact laser technology.
- To promote the use of such technology in several fields: Physics, Engineering, Chemistry, Biology, Medicine, Energy, etc.
- To open the facility to the domestic and international scientific community.





The Computer Vision Centre is a non-profit institution and leading research and development centre in the Computer Vision field. The CVC was established in 1995 by the Generalitat de Catalunya and the UAB with the purpose of generating quality knowledge in the field and transferring added-value technology to the industry and to society. On account of its good practices, the CVC has positioned itself as an authority in the Computer Vision field and is regarded as a reference of knowledge generation for society.

www.cvc.uab.cat



Eurecat is the leading Technology Centre of Catalonia, and our objective is to be supplier for the business and industries of innovative and differential technology to solve their innovation needs and boost their competitiveness. SERVICES: Technology transfer. Applied R&D. Identification of opportunities. Product, services and systems conceptualization, development and industrialization. Technology services. Technology consulting. Highly specialized training. Areas of activity in health sector: smart product development, E-health solutions, Personalised medicine, M-health.

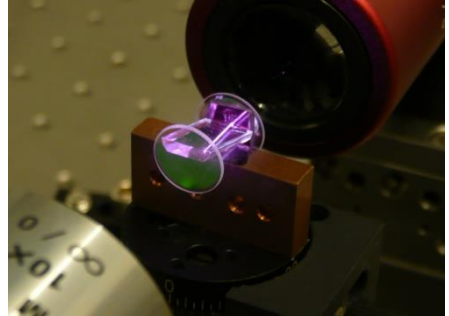
www.eurecat.org





FiCMA (Physics and Cristallography of Materials) is an interdisciplinary research group led by the Professor Francesc Díaz and Professor Magdalena Aguiló at the University Rovira i Virgili. The group's research activity focuses on physic and crystallographic obtention of new materials for laser and photonic technology as well as the development of (micro-nano) optics and photonics devices. New volumic, epitaxial and nanostructured material for the solid state laser equipment and photonics in general is the core focus of the applied research conducted at FiCMA. One of group's research lines is Photonic Biosensors.

www.urv.cat/dquimfi/ficma

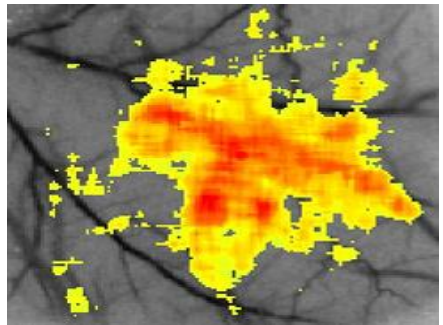


R&D INFRASTRUCTURES



ICFO – The Institute of Photonic Sciences was created in 2002 by the regional government of Catalonia and the Technical University of Catalonia. It currently hosts more than 250 researchers, including group leaders, post-doctoral researchers, PhD students and research engineers, working in 60 state-of-the-art research laboratories, equipped with the latest experimental facilities and supported by a range of cutting-edge facilities for nanofabrication, characterization, imaging and engineering.

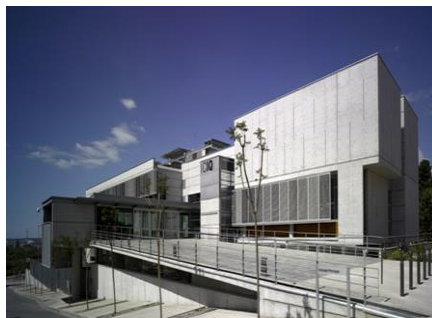
www.icfo.eu





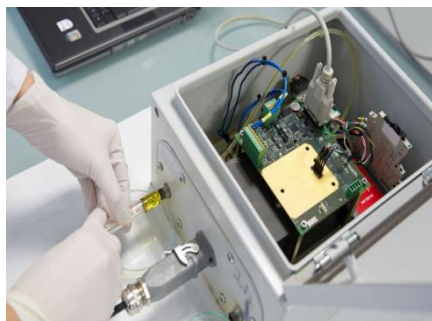
The Institute of Chemical Research of Catalonia is a foundation created in 2000 by the Government of Catalonia and it started its research activities in 2004. ICIQ research groups focus their work on applying chemistry at the frontiers of knowledge in two main areas: Catalysis, which aims at discovering new and useful catalytic processes to tackle challenges such as sustainability, health and energy, and Renewable energies, focused on the generation of hydrogen from water through sustainable processes, the development of more efficient photovoltaic devices and the CO₂ conversion into liquid fuels and feedstock for the chemical industry.

www.iciq.es



IK4-Tekniker is an independent research organization, whose main working focus is to improve manufacturing technologies, that includes all the situations that characterises a product life cycle, from conception and design, until the end of working life. IK4-Tekniker mainly specialises in: designing consumer and industrial products, solving problems relating to friction, wear and lubrication, incorporating information technologies and communications in the plant, high precision, miniaturisation and micro/nanotechnologies. IK4-TEKNIKER provides the biomedicine sector in four main areas: Identification and quantification of biomarkers, Tissue engineering, Health products manufactured by microinjection, Equipment for the bio industry.

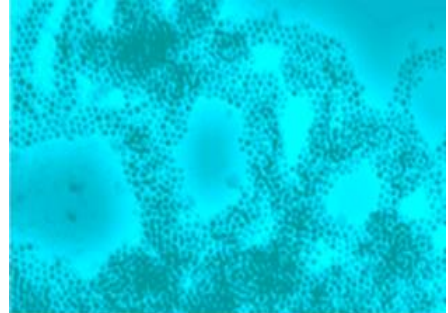
www.tekniker.es





The Institute for Nanoscience and Nanotechnology of the University of Barcelona (IN2UB) was created in 2006 with the purpose of encouraging research and promoting its outcome within society. A part of IN2UB research is focused on photonics and optics, with outstanding results. The Institute offers services such as polarimetric characterization and laser direct writing techniques for microfabrication, as well as design, modeling and fabrication of novel photonic structures and devices and comprehensive characterization of photonic performance.

www.ub.edu/in2ub



R&D INFRASTRUCTURES



Instituto de Fotomedicina started its activity in 1996 under the name Laser Multidisciplinary Platform. After twelve years of technological innovation and professional excellence, it is renamed to Instituto de Fotomedicina (IF), which adds to the charitable activities serving the new platform challenges in the field of research and teaching. The IF has medical and technical staff in Photonics Medicine, Photobiology and Biomedical Engineering, and masters most of the high-tech light sources, especially the laser. The IF stands as a meeting point for professionals from all specialties to access these advanced equipment used for diagnosis and treatment of various medical and surgical problems both.

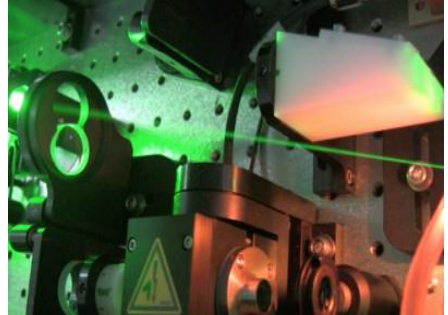
www.fotomedicina.com





Institute of Optics (IO) belongs to the state agency Consejo Superior de Investigaciones Científicas (CSIC). It is a dynamic institute comprising scientists of high international prestige. Its scientific and technological production contributes significantly to the CSIC mission to create a visible impact on science and society. Research carried out at the institute covers many areas, among which visual optics, bio-photonics, image science, optical metrology, nonlinear dynamics of optical systems, photonic systems, fibre optics, nano-photonics, photonics with high energy ions, nanostructure photonics and ultrafast science are included.

www.io.csic.es



The Catalonia Institute for Energy Research was created to contribute to the objective of creating a more sustainable future for energy usage and consumption, keeping in mind the economic competitiveness and providing society with the maximum level of energy security. IREC's lighting research group focuses on Innovative materials and concepts, intelligent lighting, photometry and thermal management. The group is currently active in research of how advanced lighting is affecting the horticulture, greenhouses and human health.

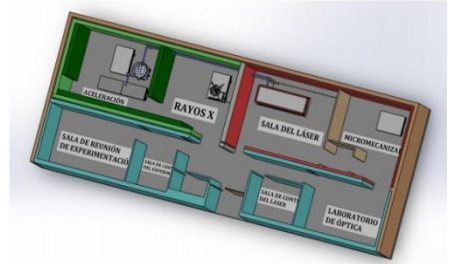
www.irec.cat





L2A2 laboratory facility from the University of Santiago de Compostela is conceived as a platform for R&D at the service of technology-based companies that develop projects and/or require technology services based on applications of femtosecond laser technology, the production of new radiotracers for medical or industrial applications, treatment of nanostructured surfaces and materials.

www.usc.es



R&D INFRASTRUCTURES



LEITAT is a Technological Center, member of TECNIO and recognized by the Ministry of Economy and Competitiveness, that aims to collaborate with companies and institutions by adding technological value both to products and processes, and focuses its activity on research, development and industrial innovation (R+D+2i). As Technological Partner, the Center is clearly committed to adaptation to transform the technological challenges into economic and social value. Since its foundation in 1906, LEITAT has prioritized its vocation of proximity by strengthening the principles of professionalism and respect to people and environment at the same time

www.leitat.org





Tecnalia is the leading private research and technology organisation in Spain and the fifth largest in Europe, employing 1,500 people (192PhDs) and with an income of 116 Million € in 2011. Tecnalia operates in the following market sectors: Industry and Transport, ICT, Sustainable Development, Innovation Systems and Health and Quality of Life. Tecnalia's activities in photonics, included within the ICT division, pursue the comprehensive development of micro- and nano-photonics devices: from fundamental studies to the micro- and nano-fabrication phase, passing through rigorous design and intensive simulation. Some of our most recent lines of research are photonic crystals, plasmonics, optical buffering, and biosensing.

www.tecnalia.com



MANUFACTURING & ENGINEERING



BCB Informática y Control is a Spanish engineering company founded in Madrid in 1996, specialized in system integration in the fields of communications, automatic test equipments (ATEs), machine vision, thermography, industrial automation, instrumentation and data acquisition systems. Focusing in electronic systems, BCB is specialized in IT and in aerospace and automotive industries (CAN/ LIN buses, clusters, infotainment, durability tests, ADAS, etc.). Also, BCB has worked in R&D European (FP5 and FP7) and Spanish projects (CDTI, Avanza, CENIT). In healthcare sector BCB is currently working on an Horizon2020 SME Instrument phase 2 project "Baby Beat" that aims at developing a continuous measurement system for non-invasive fetal heartbeats.

www.bcb.es



MANUFACTURING & ENGINEERING

FYLA

FYLA is originated from the merge between a world leading Industrial group within the Laser sector and a world referred research group in the areas of In-Fiber Laser technology. As a result, FYLA has synergistic unified the manufacturing and industrialisation capacity with full integration and control of the supply chain, with the excellence in R+D from a world top scientific group, becoming a unique One-Stop-Shop for generating the more powerful and novel In-Fiber Laser based Technologies for wide range of Industrial sectors, as well as for the Scientific community.

www.fyla.com





IMPETUX was incorporated in July 2012 as spin-off company of the University of Barcelona. The activity of this research unit takes place in the field of optical trapping and optical manipulation. One of its main research lines is the adaptation and study of direct force measurements with single beam traps using light momentum changes. The goal of IMPETUX is to make available the technology we have developed during the last 7 years, which provides clear advantages when measuring optical forces (previous calibration is no longer needed for example). Our systems are a perfect complement to current single-beam optical trapping systems for easy and powerful measurements in a wide range of applications.

www.impetux.com



INTERmedic

INTERmedic is a company with extensive experience in the development of high technology laser platforms for medical and aesthetic use. Thousands of clinics and doctors in more than 20 countries rely on our advanced systems for its efficacy, safety and versatility. Our commitment to innovation and quality of people's lives pushes us to expand and continually improve our portfolio of medical platforms based on laser, radiofrequency, ultrasound and other technologies, to offer the most advanced solutions to the most demanded medical and aesthetic treatments.

www.inter-medic.net





www.iris.cat

IRIS is an international developer and integrator of high value added key enabling and novel technologies in the fields of advanced monitoring, automation and data mining, surface activation, decontamination, advanced materials and waste valorisation to improve production processes, efficiencies and product quality, as well as to increase sustainability in manufacturing industries. IRIS combines a solid background in science and research, with an engineering capacity to bring high value added solutions that give a dynamic and competitive edge to our industrial clients from the agriculture, food, pharmaceutical, chemical and other key process industries.



MANUFACTURING & ENGINEERING



www.lpi-llc.com

Light Prescriptions Innovators Europe S.L.U (LPI) is a consolidated European SME leader in the design and prototyping of high-end optical devices specialized in the efficient transfer of light between a source and a target, with application mainly in two specific business areas: low energy consumption illumination and solar photovoltaic energy. The optics for different technologies outstands with a portfolio of over 20 patents and the corresponding commercial products developed with industrial partners. LPI's Design and R&D group includes some of the most prominent talent in the fields of Nonimaging Optics. These experienced optical scientists, combined with its extensive fabrication know-how, make LPI uniquely capable of conducting developmental projects with minimum time-to-market.





Luz WaveLabs is a spin-off from Universidad Carlos III de Madrid (UC3M) created in 2013. Luz WaveLabs provides technological solutions in the Terahertz and Photonic regions to allow our customers a reliable and efficient exploitation of these frequency ranges. Oncology, dermatology, oral healthcare, medical imaging..., all these biomedical areas may benefit from the non-ionizing properties and high resolution of pure/T. THz radiation permits for example an efficient and non-hazardous identification and visualization of human tissues for biomedical purposes as well as detecting the degree of water content and other markers of cancer and other diseases.

www.luzwavelabs.com



Medlumics is a medical device start-up born in 2009 with the goal of translating the latest technological and scientific developments in the Photonics in Life Sciences field into innovative and quality products for improving quality of life. Our activities are focused on one of the most successful light-based diagnostic techniques, Optical Coherence Tomography, which is currently undergoing a fast expansion and growth process. NITID is a breakthrough & cutting-edge diagnostic imaging solution for Dermatology. It combines three imaging modalities in one (clinical camera, Digital Dermatoscopy and an Optical Coherence Tomography system) in a truly portable device.

www.medlumics.com



monocrom

Monocrom designs and manufactures low and high power diode laser devices, mainly for medicine, aesthetics, material processing, pumping, science, defense, aero-space, instrumentation and graphic arts industry. Monocrom has been recognized throughout the laser industry for supplying high performance products at a competitive price due to our patented “clamping” technology. Our products are alike appreciated for their custom-fit characteristics, high reliability and long lifetime. Monocrom is presently working for the European Space Agency to develop an ultra-light weight and resistant green laser device for the future ESA Exomars mission to Mars.

www.monocrom.com

Laser
Diode Modules



MANUFACTURING & ENGINEERING

NIT
New Infrared
Technologies

New Infrared Technologies (Manufacturer of uncooled MWIR imaging sensors) is the only company in the world manufacturing Lead Selenide (PbSe) imaging FPA and uncooled MWIR imaging systems. Our Focal Plane Arrays show a great performance, achieving the fastest detection rate of uncooled sensors in the market: over 1,600 images per second are reached with the MATRIX 1024 CAMERA. NIT manufactures a whole line of products based on self-designed, self-produced single element detectors, linear arrays and imaging FPA. We also deliver customized detectors and cameras to adapt our standard products to our customers solutions, adding their requested functionality.

www.niteurope.com





Protonlaser is a Spanish company founded in 2010 that specializes in the development of ultra-short and ultra-intense laser sources for medical applications. We are pioneers in innovative medical and industrial applications in the field of Pulsed Lasers. In Protonlaser we transform knowledge into revolutionary, breathtaking products that have considerable socio-economical impact. Our core business is the R&D investigation in high-power laser applications. Project development and laser prototyping are carried out in our clean room facilities by a highly qualified team.

www.protonlaser.com



RADIANTIS

Radiantis is a specialist manufacturer of both, advanced frequency conversion systems for laser tuning and instrumentation for optical diagnostics. The Company focuses on compact, fully-automated and reliable products including optical parametric oscillators (OPOs), harmonic generators, spectrometers, optical power meters, laser beam stabilisers and autocorrelators for the scientific and OEM markets. Radiantis' technical capability regarding frequency conversion systems expands across the CW, pulsed and ultrafast time-scales, and its current product portfolio includes femtosecond and picosecond instruments with high conversion efficiencies at MHz repetition rates, as well as high-power CW systems covering a broad spectral range from 200 to 8000 nm.

www.radiantis.com



SENSOFAR.

SENSOFAR is a leading-edge technology company operating at the highest quality standards within the field of non contact surface metrology. We provide high-accuracy optical profilers based on interferometry and confocal techniques. Sensofar Medical has developed the Q six, a system for assisted stent inspection. The Q six has been designed as a comprehensive solution for simplifying and streamlining stent assessment and approval. The Q six's proprietary technology provides high quality images of outer and inner surfaces as well as the sidewalls of stents. These high resolution images are used for dimensional analysis as well as defect identification and classification.

www.sensofar.com



INTEGRATION AND DISTRIBUTION

INTEGRATION AND DISTRIBUTION



Alava Ingenieros Group is an entirely privately owned group which has been providing high technology solutions in the Testing, Measurement, Communications Security, Defence and Preventive Maintenance fields since it was first founded in 1973. The group offers consultancy, engineering, distribution, training and technical services, providing turn-key projects for several sectors including Aerospace, Automotive, Security, Defence, Communications and Finance, as well as Testing and Research Centres, Universities, Public Services and Industry in general.

www.alavaingenieros.com



AMS Technologies is a leading solution provider and distributor of high-tech, leading-edge components, systems and equipment, with almost 30 years of experience to date and currently serving more than 1000 European customers. We are the specialists in both componentry and complete solutions for Optical technology and Thermal Management fields. Optical Technologies is our key competency field with the broadest and most widely varying product offering, ranging from optical components and systems for the most differing of applications, over cameras for machine vision and on to capital equipment for fiber optic applications.

www.amstechnologies.com





With our extensive career in the industrial world and 3D digitizing and reverse engineering, and equipment and our various partners, we provide the best solution for you and your business needs to be more competitive in your business. We are the only company in the domestic market, with the right for each of your needs in 3D digitizing scanner. With our experience and means we got to where each client needs, to achieve the best accuracy and resolution in 3D digitized process needed.

www.asorcad.es

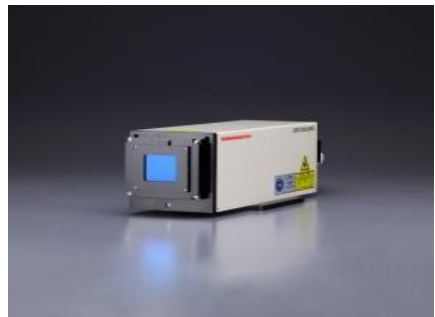


INTEGRATION AND DISTRIBUTION

HAMAMATSU
PHOTON IS OUR BUSINESS

Hamamatsu is known for its research into both the basic and applied aspects of the science of light. Working in our labs and through collaborative partnerships with a variety of research organizations, Hamamatsu sees light and its research not only as a springboard for new knowledge and technologies but for the improvement of life itself. This philosophical commitment to research is backed by a strong financial commitment. Over a five year period the company's overall ratio of R&D expenses to net sales averaged 13%. Hamamatsu provides from X-ray and UV sources to MEMS solutions, MWIR detectors and emitters and smart sensors.

www.hamamatsu.es





As the specialist supplier of photonic sources, components and instrumentation, Laser 2000 is committed to excellence in the quality of service and products that we provide to customers throughout Europe. We are the largest European source of photonic products for industry and research and want our customers to benefit from our cross-country experience. Some of our key markets: Science and Research, Medical/Biotechnology, Nanophotonics, Automotive, Machine tool, Photovoltaics, Aerospace & Defence, Safety & Security, Vision, Communication.

www.laser2000.es



Distributor of cameras, lasers, imaging solutions and now a supplier for forensic science equipment. Photon Lines supply a range of cameras (including CCD cameras, CMOS and sCMOS cameras, streak cameras, intensified cameras) into low light level, high speed vision and imaging applications as well as high technology lasers and laser components into the fields of machine vision, life sciences, military, aerospace, semiconductor, pharmaceutical and scientific research. We also supply advanced scientific imaging solutions primarily into the area of Photonics in Life Sciences.

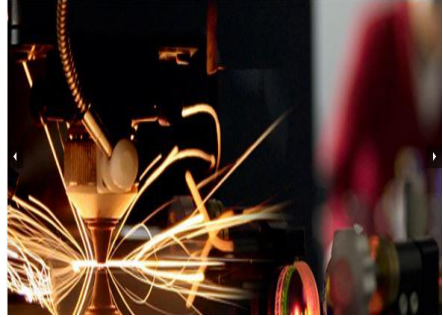
www.photonlines.es





ProCareLight was founded in 2012 by a team of scientists with extensive experience in safety and quality auditing as well as in depth knowledge of laser and light emitting systems. It is a spin-off of ICFO's (The Institute of Photonic Sciences, Barcelona, Spain) extensive expertise in safety issues using laser (class 3B and Class 4) and light emitting systems (IPLs, LEDs and optic fibres). We specialise in the provision of laser and intense light safety services and products for: Hospitals, Laser eye clinics, Dental clinics, Cosmetic clinics, Industry, Research institutes & Universities, Illumination and Entertainment industry.

www.procarelight.com

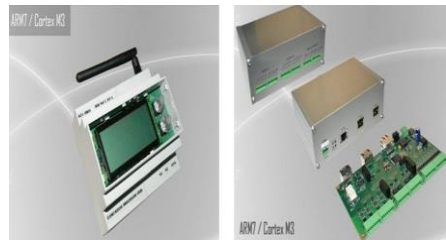


INTEGRATION AND DISTRIBUTION



Founded in 2003, the goal of RBZ is to design electronic equipment fulfilling the needs of our customers and to complement their research and development departments. To accomplish this goal, RBZ works to be at the leading edge in electronics and embedded systems and to offer our knowledge to you. The company provides the following services: specifications, design, programming, integration, qualification, production.

www.rbzrobotdesign.com



NETWORKS AND ASSOCIATIONS

NAME	GEOGRAPHICAL COVERAGE	CORE EXPERTISE	WEBSITE
SECPhO	National	Photonics	www.secpho.org
Fotónica21	National	Photonics	www.fotonica21.es
The Spanish Platform for Innovation in Healthcare Technology	National	Healthcare technology	www.plataformatecnologiasanitarias.es
Fenin – Spanish Federation of Healthcare Technologies	National	Healthcare technology	www.fenin.es
Arahealth	Aragon	Healthcare technology	www.arahealth.com
CVIDA – The Association for Life Quality Care	Valencia	Healthcare technology	www.cvida.com
Cluster de la Salud de Extremadura	Extremadura	Healthcare technology	www.clustersalud.es
Health Tech Cluster	Catalonia	Healthcare technology	www.healthtechcluster.com
TicBioMed	Murcia	eHealth	www.ticbiomed.org
BIOCAT	Catalonia	Health and Life Sciences	www.biocat.cat
BioIB	Balearic Islands	Biotechnology and biomedicine	www.bioib.org
CataloniaBIO	Catalonia	Biotechnology	www.cataloniabio.org
Andalucía BioRegión	Andalusia	Biotechnology	www.adaluciabioregion.es
Madrid Biocluster	Madrid	Biotechnology	www.madridnetwork.org

Bioaratec	Aragon	Biotechnology	www.bioatec.com
BioBasque	Basque Country	Biotechnology	www.biobasque.org
FEMAC	Catalonia	Food and Agriculture	www.femac.org
AINS	National	Nutrition and Health	www.ainscluster.cat
Aragon Food Cluster	Aragon	Food and Agriculture	www.aragonalimentacion.org
Acuiplus	Catalonia	Aquaculture	www.acuiplus.org
Agrofood Murcia	Murcia	Food and Agriculture	www.agrofoodmurcia.com
ACAL	Andalusia	Food and Agriculture	www.asociaionacal.es
Inoleo	National	Food and Agriculture	www.inoleo.es
Vitartis	Castile and Lion	Food and Agriculture	www.vitartis.es
Cluster Alimentario de Galicia	Galicia	Food and Agriculture	www.clusteralimentaciodegalicia.org
Asincar	Asturias	Food and Agriculture	www.asincar.com

*Source: <http://www.clustercolaboration.eu>

CONCLUSIONS

The aim of this booklet is to promote the industrial and academic excellence of Spanish photonics applied in Life Sciences in order to improve its visibility at the European level. The portfolio of Spanish Photonics in Life Sciences stakeholders presented in this booklet will also facilitate the envisaged future collaboration with existing platforms and networks.

Spanish photonics sector is estimated to reach 4 000 million euros of turnover representing 0.3% of country's GDP and employing over 15 000 people directly. It's importance is recognised nationally and supported in various levels: from providing funding for research and innovation directly to the industry players and universities to supporting national and regional associations and platforms related to photonics such as awarding the SECPHO cluster with the label AEI (Business Innovation Association) or the national technology platform of photonics – Fotonica21. The stable growth is assured by high level technologies developed by Spanish photonics companies and world-wide known research facilities that attract the most promising talent from various countries.

Expected achievements of OASIS project in Spain:

Three important challenges in Europe and in Spain are drawn in the OASIS project roadmap:

- Improve the process of technology transfer from the phase of clinical and medical research to the development and market introduction phase;
- Foster involvement of big industrial companies and consolidate collaboration with SMEs in order to facilitate their access to a highly regulated medical market which demands important financial investments;
- Help SMEs to position themselves in the sector.

This booklet can serve as a tool box for SMEs in the field of Photonics in Life Sciences or new-comers.

SECPhO

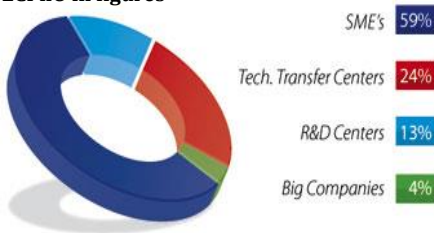
Light Technologies Cluster

SECPhO was founded in 2009 in Terrassa (Barcelona), Spain. The cluster brings together companies, innovation centers and research groups in the photonics and optics sector in Spain. Currently it is comprised by 58 members and growing continuously. The mission of the cluster is to facilitate and improve the competitiveness of the Spanish Optics and Photonics sector by reaching major growth and profitability.

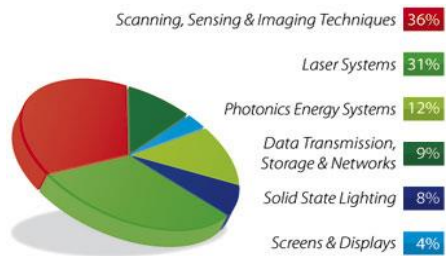
SECPhO's main objectives:

- To foster innovation in the field of photonic and optic technologies;
- To generate business opportunities for companies;
- To provide technology centres and research groups with access to projects.

SECPhO in figures



Type of members



Technologies and capabilities

SECPhO is the first photonics cluster in Europe which initiated inter-cluster workshops, where photonics companies are generating numerous new products and projects in collaboration with end-user markets such as

- railway,**
- food packaging,**
- olive oil,**
- automotive,**
- agricultural machinery,**
- health tech,**
- wine,**
- wine cork,**
- rubber,** besides many others.

Cross-sectorial innovation: product/project generation through proven original SECPhO methodology of workshops with end user/market-oriented clusters. Visit our website to see the **success stories!**

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