

## Daphne SOARES

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**From:** Decaan IR  
**Sent:** vrijdag 21 december 2018 10:42  
**To:** Daphne SOARES; Decaan IR  
**Cc:** Vicerector Onderzoeksbeleid; Mieke GIJSEMANS; 'K. Vanderkerken'  
**Subject:** RE: Bonus voor bijzondere verdienste inzake maatschappelijke valorisatie: Oproep 2018/2019

Geachte Voorzitter Onderzoeksraad, Geachte prof. Vanderkerken, Beste Karin,  
Geachte mevrouw Soares, Beste Daphne,

Conform onderstaand verslag, bevestig ik u graag dat de faculteit voor de effectieve voordracht de voorkeur geeft aan het dossier van collega prof. Thienpont.

Vriendelijke groeten, en alvast fijne feesten aan u en uw medewerkers,



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**From:** Daphne SOARES  
**Sent:** vrijdag 21 december 2018 8:45  
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**Subject:** RE: Bonus voor bijzondere verdienste inzake maatschappelijke valorisatie: Oproep 2018/2019

Geachte decaan

Op verzoek van de voorzitter van de Onderzoeksraad en conform onderstaande oproepmail vragen we u vriendelijk om maximum 1 laureaat voor te stellen voor de Bonus Maatschappelijke Valorisatie.

Met vriendelijke groet



Daphné Soares voor **Prof. Dr. Karin Vanderkerken**  
Voorzitter Onderzoeksraad  
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**From:** Decaan IR  
**Sent:** woensdag 19 december 2018 9:45  
**To:** Daphne SOARES <[Daphne.Soares@vub.be](mailto:Daphne.Soares@vub.be)>  
**Subject:** RE: Bonus voor bijzondere verdienste inzake maatschappelijke valorisatie: Oproep 2018/2019

Geachte mevrouw Soares, Beste Daphne,

Hieronder vindt u een uittreksel uit het verslag van de faculteitsraad van 13 december, alsook de twee betreffende dossiers (dat van prof. H. Thienpont in twee delen).

Wij staan graag te uwer beschikking voor nadere toelichting.

#### I.4. Voorstel vanuit IR 'Bonus Maatschappelijke Valorisatie'

De decaan werd eind augustus 2018 in kennis gesteld van de oproep tot suggestie van mogelijke laureaten voor de tweejaarlijkse **Bonus voor Maatschappelijke Valorisatie**.

De bonus is bestemd voor ZAP-leden waarvan het onderzoek in de afgelopen 5 jaren (2013-2018) bijzonder verdienstelijk aanleiding gaf tot maatschappelijke valorisatie in brede zin, aantoonbaar op basis van concrete output van het ZAP-lid op dat vlak (cf. de betreffende outputcategorieën aangeduid in de ZAP-opdrachtmatrix, 7.8. Appendix 8. Valorisatie van het onderzoek).

De faculteit overweegt twee kandidaturen:

- Prof. H. Terry, vakgroep MACH
- Prof. H. Thienpont, vakgroep TONA

De beide kwaliteitsvolle dossiers tonen aan dat de faculteit ingenieurswetenschappen niet alleen op het gebied van economische maar ook op het vlak van maatschappelijke valorisatie en relevantie uitblinkt. Er wordt voorgesteld de twee dossiers voor te leggen aan R&D en bij de voordachten te vermelden dat de faculteitsraad de voorkeur geeft aan het dossier van collega prof. Thienpont. Betrokkene tracht sinds 1996 met zijn onderzoek een tastbare impact te realiseren op onderwijs, innovatie en maatschappelijk welzijn in Vlaanderen, Europa en daarbuiten. Het rijkelijk gestoffeerde dossier toont die impact kwalitatief en kwantitatief aan, ook in functie van de hier relevante outputcategorieën aangeduid binnen de ZAP-opdrachtmatrix.

De faculteitsraad stemt unaniem in met het overmaken van de twee dossiers aan de Onderzoeksadministratie om de maatschappelijk impact van de faculteit ingenieurswetenschappen in de verf te zetten. Daarbij wordt aan R&D meegegeven dat de faculteit voor de effectieve voordracht de voorkeur geeft aan het dossier van collega prof. Thienpont.

Met vriendelijke groeten,



**TANJA THIJNS VOOR/FOR PROF. DR. S. CAENEPEEL**

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THINKING MUST NEVER SUBMIT ITSELF.

# “Photonics as key enabling technology for a better world”

A focus on the societal impact of the photonics research and innovation work of Prof. Hugo Thienpont

In this report we briefly highlight the main photonics research and innovation realizations of Prof. Thienpont with which he made a profound and durable impact on our society. We focus on the pioneering vision for photonics and on the different disruptive instruments he has developed and implemented during the last decades to create a tangible impact on education, research, innovation, wealth and societal well-being in Flanders, Europe, and beyond.

**Nota Bene: This report does not cover Prof. Thienpont’s realizations and impact as vice-rector for innovation and industrial policy.**

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## I. Pioneering photonics research, education, and innovation in Flanders

- **Photonics pioneer:** Prof. Thienpont is one of the pioneers of photonics in Europe. In the 1980’s, when lasers were science-fiction props and light from incandescent bulbs illuminated our rooms, he was one of the few researchers in Europe, who recognized the potential impact of the science and technology of light and its unique properties to perform groundbreaking research and to innovate products. He was one of the first to actively promote photonics as a new research and engineering discipline in Flanders and as a key-enabling technology for Europe.
- **The creation of Brussels Photonics:** To implement his vision, he created Brussels Photonics (VUB B-PHOT), a research and innovation team focusing on disruptive, applied and industrial research with the goal to positively impact our society. From 1990 onward, he organically grew the B-PHOT team, which today counts 70 scientists, engineers, and administrative and technical staff, featuring 17 nationalities and 35% female researchers and professors. Today B-PHOT is one of the most successful research and innovation teams of VUB. Prof. Thienpont (WoS h=37), awarded in 2008 with the “VUB Methusalem” status, contributed with his research to the success of B-PHOT with more than 900 high impact WoS cited papers, 360 WoS Core Collection cited high impact journals, totaling more than 6500 citations of which 4450 without self-citations. Hugo is co-inventor of 21 patents, several of which are licensed to companies or jointly exploited with industry. Under his leadership, B-PHOT obtained since 2005, the Industrial Research Project status “IOF Group of Excellence in Applied Research” and is currently completing its third IOF roadmap generating annual revenues of 5 M Euro, of which 90% originates from external funding and 40%

(or 2M Euro) through the highly-competitive EU project calls. Prof. Thienpont (co-) promoted 124 successful master thesis students and 43 successful PhDs.

- **Pioneering a photonics engineering curriculum in Europe:** In 1993 Prof. Thienpont initiated and realized at VUB a pioneering Photonics Curriculum for Engineers, the first on the European mainland. It was the start of a new generation of Engineers in Europe: photonic engineers. With this disruptive curriculum B-PHOT has put VUB in pole position for photonics education in Flanders and in Europe for decennia. Since 1994 more than 300 photonic engineers graduated from VUB, boosting Flemish and European photonics research and industry.
- **Cutting-edge long-term research to improve the quality of life:** After accomplishing his PhD in 1990, Prof. Thienpont, as first post-doc researcher of the Applied Physics and Photonics Department TONA-FirW, laid the foundation of a new research team with which he would focus on long-term photonics research. His aim was to push the boundaries of photonics research fields and whenever possible to turn them into practical applications. During the last 30 years he started and tackled a variety of research topics, most of which have led to very successful scientific breakthroughs with publication in very-high impact journals (Nature Photonics, Scientific Reports, Phys Rev Letters, etc.) or that formed the starting point of successfully filed patents. Many of these results have meanwhile be applied in practical applications with industry. Here are some of the most noteworthy research topics and their applications:
  - *Optical interconnects and optics in computing: where optics, opto-electronic components, and photonic systems are developed to speed up data-communication in computers and as such enhance the processing power of high-performance computing systems.*
  - *Micro-lasers: where micro-miniaturized ultrafast micro-lasers are modelled, fabricated, characterized, and demonstrated and subsequently used in high-bit rate serial or parallel data-communication applications*
  - *Organic materials for nonlinear optics: where organic polymers and carbon-based monoatomic layered materials such as graphene are explored to generate new wavelengths through nonlinear optical phenomena such as four-wave mixing and self-phase modulation.*
  - *Optical fiber sensors: where optical fibers enhanced with fiber Bragg gratings are used to create optical pressure, temperature, and strain sensors with unprecedented sensitivities and characteristics. These sensors are currently used to smartly monitor mechanical structures such as bridges and buildings, they are embedded in composite materials to monitor the structural health of the propeller blades of windmills or airplane fuselages, and they are used to monitor the structural health of high-pressure flanges in the chemical industry.*
  - *Optical lab-on-chips and organ-on-chips: where optical metrology, spectroscopy, and monitoring tools are micro-miniaturized on micro-fluidic chips for early medical diagnosis, for the screening of bacteria in food and liquids, for the authentication of noble products such as honey and olive oil, or for the testing of new medical drugs on chip-grown human micro-organs.*
  - *Free-form optics: where a disruptive new generation of highly-functional optical components are designed, prototyped, characterized, and tested to outperform the classical spherical lenses and lens systems with respect to specifications, volume, weight, and cost. Applications are multifarious: medical endoscopes, augmented and virtual reality goggles, head-up displays, microscopy, space telescopes, and micro-satellites to name but a few.*

- **Collaboration with Flemish industry for societal and economic impact:** To initiate a route to societal impact, Prof. Thienpont and his team participated in the Flanders Technoland exhibition in 1996 with a 120m<sup>2</sup> booth “Focus on Photonics”. At this occasion photonics was showcased to a very large audience for the first time in Flanders. This bold move for a young research group as B-PHOT also created a great deal of genuine interest from major companies, such as Barco, Agfa, and Umicore, and was the stepping stone towards B-PHOT’s long track record of large-scale industrial research contracts with Flemish companies on topics with considerable societal impact. The following industry-driven projects, coordinated by Prof. Thienpont, are but a few examples of how these projects not only created economic impact in Flanders with photonics as technology driver, but especially how the commercial products that resulted from these joint collaborations dramatically and durably impacted society and the health, safety, and well-being of citizens around the world:
  - *The development of food sorting systems that optically detect and remove harmful objects, polluting defects, or products contaminated with carcinogenic substances from the food stream and as such contribute to the food safety of millions of people on a daily base. As example we give aflatoxine-contaminated nuts and acrylamide-precursor containing potatoes that would lead to carcinogenic French fries. The optical engines of these systems were jointly developed during the last 20 years for the companies Barco Elbicon, Best, and Tomra Sorting.*
  - *The development of an optical monitoring device enabling the consistent high-resolution and high-contrast displaying of medical X-Ray and PET-scan images to support more reliable medical diagnosis of tens of thousands of patients all over the world. The optical engine of this system was jointly developed with Barco Medical.*
  - *The development of high-laser-power-based, high-resolution computer-to-plate lithosetters for the on-demand direct digital printing of fliers, magazines, or books. This new type of digital printers no longer relies on the dangerous and poisonous silver-based photographic printing process, but on water-soluble ink, making the printing of newspapers and magazines a much eco-friendlier process. The optical engines of these systems were jointly developed with the companies Xeikon, Strobbe Graphics, and Punch Graphics.*
  - *The development of high-resolution, high contrast, ultrabright large-area LED displays and extreme brightness laser-based projectors for entertainment purposes. These LED displays are currently used on large-scale sporting events and music concerts attended by tens of thousands of supporters and fans, while the 60.000 lumen projectors are used for 3-D digital movie experiences in cinemas and IMAX theaters for millions of visitors per year worldwide. The optical engines of these systems were jointly developed with Barco Vision and Barco Projection Systems.*
  - *The development of new energy efficient LED-based luminaires for indoor lighting with the Flemish company ETAP providing a much better illumination of indoor spaces.*
  - *The development of high-end infrared optical components with the Flemish company UMICORE for automotive night vision cameras to increase safety for pedestrians, bikers, and animals*
  - *The development of low-loss high-precision connectors enabling fiber-to-the home high-bandwidth data-communication for all with the company TE Connectivity, now Commscope.*

- **Creating the Photonics Roadmap for Flanders:** In 2013 Flanders adopted the European Commission's (EC) policy of "smart specialization" and of the "key-enabling technologies" and launched a call for Key-Enabling-Technology-Inspired Roadmaps for Flanders. Prof. Thienpont took up this challenge, created the Flanders Photonics Consortium, and coordinated, co-authored, and co-edited Flanders' multiannual strategic research and innovation roadmap 2014-2020 entitled "Towards 2020-Photonics as a Key Enabling Technology for the advancement of society and economic growth in Flanders". The roadmap formed the basis of a deep transformation in Flanders' Research and Innovation policy and shifted the focus of applied research to societal impact, with topical themes such as healthcare, manufacturing, communications, security and safety, and energy. Today the Flanders' 2020 photonics roadmap continues to be an important document guiding the photonics research policy of Flanders.

## II. Boosting photonics education and research at the European level

- **Rolling out Photonics Engineering in Europe:** Immediately after the creation of the unique photonics engineering curriculum at VUB, Prof Thienpont participated in EU-funded projects to roll out the best practices of this newly-developed educational approach in Europe. First, in 1994-1995, through the TOSCA-TEMPUS project, courses and modules of the VUB photonics curriculum were implemented in Eastern-European Universities such as Warsaw University of Technology and Marie-Curie Skłodowska University in Lublin, creating a new generation of entrepreneurial optical scientists and photonics engineers in Poland, with which B-PHOT VUB would continue to collaborate until this very day. Next, in 2004 Prof. Thienpont introduced, together with his colleagues from the Vrije Universiteit Brussel and the Universiteit Gent, the first interuniversity engineering curriculum "Master in Photonics" which received the EC Erasmus Mundus quality label. This quality label attracted at first very many European students and was the start of today's world-wide dimension.
- **Creating the pan-European network of excellence for micro-photonics research and innovation NEMO:** The fragmented European photonics research and innovation landscape encouraged the EC to create a new large-scale instrument, the so-called Networks of Excellence that would aim at structuring and integrating the expertise, the infrastructure, and the research and innovation efforts of the best research teams in Europe in important research domains. In 2003 Prof Thienpont took this opportunity to initiate and create the Network of Excellence on Micro-optics "NEMO", and to coordinate the research and innovation efforts of 30 top-research groups from 13 European countries. His proposal was granted, received 6,4 Meuro of EU funding, and his coordinating efforts from 2004 to 2009 profoundly and durably reshaped the European micro-photonics research scene into a strong and efficient community with world-impact. It became a "best practices" flagship for the EC and was the seed for various new large-scale EU-funded initiatives that are currently reshaping the mindset and attitude of European researchers towards increased valorization of their research results with positive impact on wealth-creation and well-being in Europe.
- **Creating the pan-European research and innovation network of excellence in biophotonics Photonics 4 Life:** With the expertise of the NEMO NoE Prof. Thienpont was invited in 2006 as vice-coordinator to create, initiate, mentor, and coordinate the European Network of Excellence on Biophotonics "Photonics for Life". The challenge of this European network of excellence was to leverage biomedical technologies with the innovating power of photonics and create a new interdisciplinary research field biophotonics. The project received a €4 M EC budget to structure and integrate the efforts of 12 top partners from 10 European member states. It successfully ran from 2008 till 2012, has put Europe in a pole position in photonics-driven biotechnology and

biomedicine, and currently creates major technology breakthroughs in new monitoring tools for early-diagnosis of life-threatening diseases, optically-enhanced lab-on-chip, and organ-on-chip which will contribute to the health and safety of millions of people in Europe and all around the globe.

- **Creating the European photonics flagship symposium “Photonics Europe”:** One of the major achievements of Prof. Thienpont was the conception, initiation, and growth of a unique pan-European photonics flagship symposium called “Photonics Europe” that would enable all researchers from the European academic and industrial world to exchange their findings and share their knowledge. Prof. Thienpont tested his concept in 2003 in Bruges with the support of the International Society for Photonics SPIE with a test-conference “Photonics Fabrication Europe”, which he chaired and that successfully attracted 750 attendees. In 2004, as general chair, he transformed the conference into a full-fledged symposium called SPIE “Photonics Europe”. It was moved to Strasbourg, where it featured 15 conferences, attracted 1200 attendees, and continued to be organized biannually until 2008. In 2010 Prof. Thienpont proposed to move the symposium to Brussels where it could continue to grow to 2500 attendees. Prof Thienpont was general chair of Photonics Europe until 2014 and was succeeded by his VUB-colleague Prof. Berghmans. The symposium has grown to the largest photonics symposium in Europe, and among the largest in the world. It is recognized by the European Commission as the high-quality dissemination platform par excellence for the European Photonics Research and Innovation Community and a driver for the economic and societal impact of photonics.

### III. Supporting the international photonics research societies

- **Serving the world-wide photonics community through the international optics and photonics societies SPIE, IEEE PHOTONICS, EOS, OSA, and ICO:** Prof. Hugo Thienpont is appreciated by his peers for his 25 years long-term service to the photonics community through its various international societies SPIE (the international society for optics and photonics), IEEE PHOTONICS, OSA (Optical Society of America), EOS (European Optical Society) and ICO (International Commission for Optics). Indeed, since 1994 Hugo has been an active member of dozens of technical and scientific program committees and local organizing committees of photonics conferences for the international societies SPIE, IEEE, OSA, EOS and ICO. As such he has greatly contributed to the world-wide organization of top-level conferences and the dissemination of the research results of thousands of photonics researchers. He also served as associate editor or guest editor for a variety of their scientific journals. He was for example associate editor for three years of 'SPIE: Optical Engineering' and of 'Opto-Electronics Review' and was guest editor of several special issues for Applied Optics (OSA) and of IEEE JSTQE (IEEE Photonics society). Hugo served for 6 years (2004-2010) as director on the board of SPIE and chaired SPIE’s Advisory Committee for Europe from 2006 until 2010.
- **Editor-in-Chief of the first interdisciplinary photonics research journal:** As a key-enabling technology, photonics is becoming a driver and enabler of interdisciplinary research and innovation. In fact, more and more researchers from non-photonics research fields are using photonics techniques or photonics technologies to create breakthroughs in their disciplines. To boost this photonics-enabled interdisciplinary research and to provide an opportunity to the researchers to publish their interdisciplinary work, Prof. Thienpont created and launched -in collaboration with the Institute of Physics IOP- the International Journal of Physics Photonics of which he became the first Editor-in-Chief in 2018. The new open access journal is showcasing the most significant and impactful research in the field of photonics, with a particular focus on multi-

and interdisciplinary studies, is as such the first in its kind, and will serve the next generation researchers for decades to come.

#### IV. Building a European Research and Innovation Strategy to impact economy and society

- **Creating and growing Photonics 21: a European Public Private Partnership for photonics:** With the increasing importance of photonics in Europe, the European Commission motivated the academic, industrial and political players to create a triple helix public private partnership (PPP) that would foster the growth of photonics research and innovation in Europe, stimulate the creation of new revenues and the growth of jobs in European industry, and that would prepare the Photonics Strategic Research Agendas for Europe for the next decennia. In 2005 Prof. Thienpont was elected as member of the Board of Stakeholders to conceptualize and create this PPP. He contributed to dozens of high-level meetings, negotiations, legal paperwork, and roadmap activities, to be one of the co-founders of the Photonics21 PPP. It became the sounding board for the EC to prepare the role of photonics in the Framework Programs and is today the European platform where more than 2500 research institutes, universities, and companies combine their forces to lay out the future of Photonics in Europe.
- **Creating Europe's Strategic Research Agendas with Photonics as a Key-Enabling Technology:** As Photonics 21 member of the Board of Stakeholders, Prof. Thienpont was elected to co-coordinate the workgroup on fundamental research that was responsible to prepare the topics for future EC calls in FP6, 7, H2020 and now in Horizon Europe and as such played a significant role in the research strategy of Europe during the last 15 years. Prof. Thienpont has significantly contributed to the three Photonics Roadmaps for Europe that determined the strategic research agenda for photonics in Europe and its financing, directly impacting the life of thousands of researchers and entrepreneurs in Europe and indirectly influencing the science policy in those European regions that adopt the EU science policy locally. The three strategic research agendas to which he contributed are: "Photonics: Towards a Bright Future for Europe" (2006-2010), "Photonics: Lighting the way ahead" (2011-2016), and "Photonics: Europe's age of Light" (2017-2021). Prof. Thienpont was a member of the high-level group who proposed photonics as one of the six Key-Enabling Technologies to the EC and who endeavored to have it accepted as such, thus creating a solid basis for the future of photonics and a photonics-enhanced society. This led to a substantial investment in photonics research, innovation, and industry in Europe of several billions of Euros during the last 15 years. As a result, the foundation was laid for the development and acceptance of a variety of new technologies that improved the quality of daily life in Europe, such as energy efficient LED lighting, solar panels, micro-cameras for minimally invasive surgery, high bandwidth photonic chips for ultrafast data communication, and many more.
- **Policy advisor to the EU and its member states:** Today Prof. Thienpont is vice-president of Photonics 21 and is research strategy and policy advisor to several directors and head-of-units at different Directorates-General of the EU, such as DG GROW (Internal Market, Industry, Entrepreneurship, and SMEs), DG RTD (Research and Innovation), DG REGIO (Regional and Urban Policy). Since 2013 he is also on a regular basis key-note speaker and panel member at a variety of EU top-events all over Europe providing his pioneering vision on the societal impact of research and innovation, entrepreneurship, Digital Innovation Hubs, smart specialization, and regional co-funding to strengthen society and well-being. In 2017 he was invited by the EC as representative of the academic world to join the Independent High-Level Group on Industrial Technologies and to be a co-author and co-editor of the highly influential 2018 report "Re-Finding Industry: Defining Innovation". This report lies at the origin of the uptake of Artificial Intelligence and Cybersecurity,

as well as a reinforced investment in the existing 6 Key Enabling Technologies. The report asks that the EC would focus its policies on “inclusive growth” and the sustainable protection of the planet. The report will remain a significant instrument in the next few years to determine the research and innovation strategies for Horizon Europe (2021-2027).

## V. Collaboration with European Industry for Economic and Societal impact

- **Creating a European Access Center for Photonics Innovation to effectively support industry and entrepreneurial researchers and impact economy and society:** Although SMEs are the lifeblood of European economy, the European Commission was unable to install effective innovation support instruments, adapted to the particular needs of SMEs, to boost their route to market and to leverage societal impact and increase the quality of life with their products. In 2010 Prof. Thienpont conceptualized a new innovation model to support SMEs and large-scale companies at a European level. He introduced, tested, and showcased the model from 2011-2013 with the 1,5 M Euro EC-supported project ACTMOST which he coordinated. The project resulted in the successful support of 30 European companies and convinced the EC that this model contained best-practices for SME innovation support and that it should be scaled-up. To do so Prof. Thienpont enlarged his European consortium to 25 top research institutes and created ACTPHAST. The project was supported by the EC with 8 M Euro and ran from 2014 to 2018. It supported 100 SMEs with photonics innovation, created 750 new high-tech jobs, 750 M Euros of new revenues for the companies, and raised 80 M Euros of venture capital with 15 start-ups. More importantly it convinced the EC that the model that was introduced contained very many best practice ingredients that should be transferred to other technology innovation domains driven by key-enabling technologies. The model became a flagship for the EC and Prof. Thienpont is currently coordinating two new large-scale projects that further grow and optimize this pan-European SME innovation support instrument. A first one is ACTPHAST 4.0 (10 M Euro) with the aim to support from 2018-2022 more than 120 companies with photonics innovation in a variety of application domains, such as health, food safety, Datacom, renewable energy, etc. The second one, ACTPHAST 4R (6 M Euro), aims at supporting more than 100 entrepreneurial researchers from 2019-2023 with photonics expertise and technology innovation support and turn their proof-of-concept demonstrations into prototypes, that can be mass manufactured and marketed by newly created spin-offs. The latter approach is an eye-opener for the scientific world and is currently creating a paradigm shift because it is a new route to start exploiting the enormous amount of European research results that are otherwise would never see economic and societal validation. The creation, implementation, and scaling of these instruments by Prof. Thienpont is profoundly impacting the European strategy for research and innovation support and will do so for many years to come. It is dramatically changing the entrepreneurial spirit of thousands of new-generation PhD and Post-Doc researchers, it is continuously creating new jobs and new revenues in European photonics and non-photonics SMEs and will soon impact other industry sectors that innovate with other key-enabling technologies. The new innovation model has laid and will generate countless new inventions and products that will improve our quality of life. Prof. Thienpont is currently adapting and applying the model in Japan to revive the local photonics industry, that was severely impacted by the low-cost mass-manufacturing of photonics components and systems in China.
- **Co-creating the spin-off company LUCEDA Photonics NV. for Integrated Photonics Designers:** In 2014 Prof. Thienpont co-founds LUCEDA Photonics NV, a joint VUB B-PHOT - UGent – IMEC spin-off, that develops design software and provides services for Designers of Integrated Photonic

Circuits. Today the company counts 10 employees and its software is supporting researchers and companies from all over the world to ensure they can surf the wave of photonics integrated circuit innovation.

## VI. STEM activities, science communication and outreach

- **Creating photonics STEM instruments with impact in Flanders, Europe, and world-wide:** the growing need for highly-educated personnel with scientific and technological skills and the declining interest of the new generations for science, technology, engineering, and mathematics (STEM) inspired and motivated Prof. Thienpont to develop several new STEM instruments that could not only be rolled-out in a large number of Flemish schools, but that also could be deployed in Europe and world-wide. His goal since 2004 was to reach the largest possible student audience in Europe and beyond, and excite them for STEM with the fascinating world of photonics by creating durable and scalable STEM tools. In addition, he wanted to increase the visibility of VUB in Flanders' secondary schools, win the favor of secondary school teachers for VUB, and increase the visibility of VUB in Europe for STEM. **Tool N°1:** In 2006, in the framework of the EU NEMO network of excellence in micro-optics, he initiated the development of an educational kit on diffractive optics to provide secondary schoolteachers with low-cost high-quality material to explain diffraction and interference in the class-room. More than 2000 kits were distributed to physics teachers and students in 40 countries worldwide with the help of the SPIE student-chapters. **Tool N°2:** With this successful experience Prof. Thienpont started his second STEM initiative in 2010 with financial support of the EC and initiated and coordinated the development of the "Photonics Explorer". This educational kit took three years to be developed and tested. Each kit contains hundreds of optics and photonics components (lenses, gratings, color filters, polarizers, etc) sufficient to give 30 secondary school students, alone or in small groups, the opportunity to perform their own optical experiments and to acquire knowledge via evidence-based learning and hands-on experience. The production costs of the Photonics Explorer kit are covered by donations from companies. The kit is given to teachers free of charge after they have received a full-day hands-on training. During the training it is explained how to best use the kit in the classroom and how to best guide students during the hands-on experience. The Photonics Explorer is a great success, motivating girls and boys for a career in science and technology. Prof. Thienpont created the non-for-profit company EYEST (Excite Youth for Engineering, Science and Technology) to raise funding for the Photonics Explorer kit, to provide the teacher trainings, and to distribute the kit worldwide. Today more than 750 kits have already been distributed in Belgian schools and more than 3200 kits have been distributed in Europe, annually reaching 160.000 secondary school students with in class-room hands-on experience. In total more than 0,5 million students have enjoyed working with the photonics explorer kit. The manual for the teacher as well as the worksheets for the students have been translated in 16 languages. **Tool N°3:** to also create opportunities for hands-on photonics experience outside the classroom, Prof. Thienpont started the EC-funded project Phablabs 4.0 in 2016. It aims at introducing photonics in the hundreds of fab-labs that are spread all over Europe based on 30 different photonics workshops in which youngsters can build their own system based on optical principles, with photonic components. Prof. Thienpont and his team finished the development of the 30 workshops and they are currently being introduced to dozens of fablabs Europe-wide. It is expected that within a few years, tens-of-thousands of young minds will have had the Phablabs4.0 experience and as such will have been encouraged to choose for a STEM-based profession.
- **Creating a European Center for Outreach in Photonics:** To coordinate STEM and outreach efforts in optics and photonics at a European level Prof. Lluís Torner (Director of ICFO, Barcelona) and

Prof. Hugo Thienpont decided to set up the European Center for Outreach in Photonics ECOP in 2014. Today ECOP is the hub of all photonics outreach activities in Europe and is the initiator of the major new photonics-related STEAM activities at the European level, connecting tens of thousands of European citizens with the science and technology of light.

- **The creation of Photonics Science Communication events to impact society at large:** Prof. Thienpont invests the saldi of his research and innovation projects in the creation of new and major Science Communication events with the aim to reach out to the broadest possible audience and explain the innovation power of optics and photonics to young and old. Besides a large amount of science communication events, such as Science Week, Supernova, Science Days at the European Commission, and many others, Prof. Thienpont and his team have created great visibility for photonics with the introduction and organization of major science communication events. **Major Event 1:** He hosted in 2007 the EC-supported travelling exhibit “Fascination of Light” at VUB. The interactive demos and booths were staffed by B-PHOT PhDs and post-docs and for two weeks drew more than 2000 visitors. **Major Event 2:** His next initiative was the creation of the Photonics Science Show in 2008. This 90 minutes interactive science show annually performed by B-PHOT PhDs and Post-Docs targets secondary school students and teachers with the aim to explaining the fascinating physics behind the different unique phenomena of light and their applications in everyday life. The show is performed once in the morning and once in the afternoon for two days and is complemented by science and technology workshops. For 10 years in a row it is attracting annually around 1600 students and 50 teachers to the VUB Etterbeek Campus and greatly increases the visibility of VUB and its Engineering Faculty with secondary schools. The VUB B-PHOT photonics science show was performed at the occasion of the 85<sup>th</sup> anniversary of FWO, and, upon invitation of UNESCO, it was performed as the highlight of the First International Day of Light ceremony in 2018 in front of a world-class live audience in the UNESCO headquarters in Paris. **Major Event 3:** At the occasion of the UNESCO 2015 International Year of Light, Prof. Thienpont mobilized his VUB B-PHOT team to create a unique interactive exhibit with a focus on light technology to explain the impact of photonics in daily life to the broadest possible audience. The exhibit was hosted in the Atomium and attracted 280.000 visitors.
- **Co-founder and national contact point for the International Year and the International Day of Light:** To continue drawing attention to the importance of light in daily life Prof. John Dudley took the initiative to apply to UNESCO and make 2015 the International Year of Light (IYL 2015). Prof. Thienpont immediately backed this idea and joined in 2013 the International Year of Light international board of scientists and societies. Together they would endeavor to turn this unique opportunity to inform the world about the societal impact of light and light technologies to reality. UNESCO accepted the bid for IYL 2015 and Prof. Thienpont became Belgian contact point and coordinator of a variety of national activities in the framework of the IYL2015 and brought “Photonics at VUB” to the attention of hundreds of thousands of people in Belgium with a.o. the massively successful “Light exhibit” at the Atomium, and with Radio1 and EEN prime-time interviews. In 2017 the UNESCO IYL2015 board, with Prof. Thienpont as a member, decided to install the International Day of Light (IDL). This annual event kicked off in 2018, at the UNESCO headquarters, featuring VUB B-PHOT’s photonics science show as one of the inauguration highlights. From now on the IDL will be celebrated every year on 16 May with science events, exhibits, open door days, and other activities that focus on light and light applications for improving the quality of life.

## VII. Creation of a Photonics Innovation Campus in a smart village

- With the expansion of B-PHOT's human resources and the successful acquisition of large-scale photonics equipment via the FWO Hercules Foundation, Prof. Thienpont and his team were obliged to find new housing for their optical metrology equipment and their ultra-precision prototyping equipment. The location had to suit the high demands of the cutting-edge equipment: free of vibrations and high stability. In 2010 Prof. Thienpont took the initiative to refurbish a large old agricultural building in Gooik, a countryside village in Vlaams-Brabant, near Brussels. The building was inaugurated in 2013, part of the research team was relocated there, and became VUB's Photonics Innovation Center. In 2017 Prof. Thienpont acquired an adjacent building and expanded the Photonics Innovation Center to a 3000m<sup>2</sup> infrastructure. That same year the VUB Board of Directors decided to officially accept the location as a VUB Campus. The unique location in the heart of VUB's student recruitment area created an exclusive opportunity to invite Belgian companies to visit the photonics laboratories and to learn about the enabling power of photonics. Since 2013 around 500 industry R&D managers and CEO's have visited the B-PHOT labs to find out what photonics technologies can do for their business, leading to service, research and innovation contracts for B-PHOT, and growing its economic and societal impact. At the same time Prof. Thienpont understood the great opportunity to use the infrastructure and the location to reach out to the public at large by creating open door events at regular time intervals. Open door days are organized annually reaching out to hundreds of residents and interested citizens, while organizations such as Agoria, VOKA, Unizo, Kiwanis, Lions Club, Probus and many others visit the center on a regular basis. This creates great visibility for VUB and informs influential people about the capacity of photonics to impact the local economy and to be a durable economic motor for the region.
- At this moment Prof. Thienpont is creating a plan with the politicians of the village, the stakeholders of the region, ministries, and companies to turn the village in a "smart" village by using the region as a pilot test bed for new, durable, and energy-friendly technologies, such as smart LED-based outdoor lighting. As such he creates a win-win situation for the village, its residents, and for the VUB photonics center showcasing the positive impact of technology on people's safety and security in an energy friendly way.

Prof. Thienpont is currently also working on the creation of a "Young Academy" in Gooik, a place where young minds can discover, learn, explore and experience science, technology, engineering, and art as their first steps towards a STEM career. The facilities would include a fab lab and interdisciplinary chemistry, biology, materials and physics laboratories for primary and secondary school students and young entrepreneurs. The VUB "Young Academy" in Gooik targets to become the science and technology hands-on experience center for the region Halle-Vilvoorde. It will kick-off in 2020.

## Prof. Dr. Ir. Hugo Thienpont



**Hugo Thienpont** (20-08-1961) is a full professor at the Faculty of Engineering of the Vrije Universiteit Brussel (VUB). He chairs the Applied Physics and Photonics Department and is director of its photonics research group B-PHOT (Brussels Photonics Team), which he built over the years and which today counts more than 60 scientists, engineers, and administrative and technical staff. He graduated as an Electrotechnical Engineer with majors in Applied Physics in 1984 and received his PhD in Applied Sciences in 1990, both at the VUB. Since 2012 Hugo is also VUB Vice-Rector for Innovation and Industrial policy.

**Scientific Output:** Hugo has made research efforts in fundamental, applied and industrial photonics. He authored more than 900 Web of Science cited papers. He was promotor of more than 40 PhDs, edited 22 conference proceedings or special journal issues, authored 10 chapters in books, was invited speaker at more than 50 international conferences, and is co-inventor of 21 patents.

**Scientific Awards:** Hugo's research work was internationally recognized with several awards. In 1999 he received the International Commission for Optics Prize ICO'99 and the Ernst Abbe medal from Carl Zeiss for "his noteworthy contributions in the field of photonics and parallel micro-optics". In 2003 he was awarded the title of "IEEE LEOS distinguished lecturer" for serving as international lecturer from 2001-2003 on the theme "Optical Interconnects to Silicon Chips". In 2005 he received the SPIE President's Award 2005 for meritorious services to the Society and for his leadership in photonics in Europe. In 2006 he was nominated SPIE Fellow for his research contributions to the field of micro-optics and micro-photonics. In 2007 he received the award "Prof. R. Van Geen" for his scientific achievements during his research career at VUB and was nominated as EOS Fellow. In October 2007 he received the International Micro-Optics Award MOC '07 from the Japanese Optical Society. In 2008 he obtained the prestigious status of Methusalem top-scientist from the Flemish government for his research track record in photonics. In 2011 he received the University Medal "Alma Mater Bene Merentibus" of the Warsaw University of Technology". In 2012 he was elected member of the Royal Flemish Academy for Sciences and the Arts and in 2013 he becomes the first recipient of their science communication award. In 2016 KULeuven honors Hugo with the "Belgian Franqui Chair" for his achievements in Photonics.

**Contributions to Education:** Hugo Thienpont is recognized for his contributions to Photonics in Education. In 1993 he initiated and introduced the pioneering Photonics Curriculum for Engineers at the VUB, the first on the European mainland. In 2004 he introduces, together with his colleagues from the Vrije Universiteit Brussel and the Universiteit Gent, the interuniversity engineering curriculum "Master in Photonics" which received the EC Erasmus Mundus quality label. Since 1994 Hugo lectured a variety of optics- and photonics-related courses at VUB, such as Introduction to Photonics, Optical Communication Systems, and Recent Trends in Photonics.

**Project Coordination:** Hugo Thienpont built up a track record as initiator, promotor or coordinator of many strategic research and networking projects, which are financially supported by regional, national and international bodies such as the Fund for Scientific Research Vlaanderen (FWO), the Institute for the Promotion of Innovation by Science and Technology in Flanders (IWT/VLAIO), the Belgian Federal Science Policy Office (IAP/EOS), and the European Commission. The largest network he initiated is the 6,4 Meuro EC funded Network of Excellence on Micro-optics "NEMO". In this network Hugo Thienpont coordinated the integration and research efforts of 30 top-research groups from 13 European countries. From 2008-2012 he was vice-coordinator of the European Network of Excellence on Biophotonics "Photonics for Life" (12 partners from 10 European countries and €4 M budget). In 2010 he conceptualized and coordinated the Access Center To Micro-Optics Services and Technologies ACTMOST. This Coordination and Support Action to assist SMEs with photonics innovation has been the pilot project to the €8 M EU Integrated Project ACTPHAST (2013-2017), which Hugo now coordinates. Recently the scaled up projects ACTPHAST 4.0 and ACTPHAST 4R have been granted with Hugo as consortium coordinator for respectively 10 M€ and 6 M€ budgets (3,5 M€ and 2M€ of which for VUB).

**Industrial Valorization:** Besides academic-oriented research projects Hugo Thienpont has successfully managed more than 20 large-scale photonics-related industrial projects with companies such as Barco, Agfa-Gevaert, TE Connectivity, Punch Graphix, TOMRA, and Umicore, and several tens of projects with SMES. In 2005, under his leadership, the B-PHOT team received

the nomination 'VUB Spearhead for Industrial Valorization' and renews this recognition and accompanying funding in 2010 and 2015. Since then B-PHOT is VUB's best performing research group for tech transfer to industry with a direct income from industrial and EU-projects that has been steadily growing with 15% per year over the last 10 years and that attained €3,5M in 2017. Hugo is co-inventor of 21 patents, several of which are licensed to companies or jointly exploited with industry. In 2012 Prof. Thienpont becomes Vice-Rector for Innovation and Industrial Policy of the Vrije Universiteit Brussel. In 2014 he supports the creation of LUCEDA Photonics NV, a joint B-PHOT - UGent - IMEC spin-off. Since 2014 Prof. Hugo Thienpont and his B-PHOT colleague Prof. Francis Berghmans hold the research chair for optical telecommunications financed by TE Connectivity.

**Services to the Community:** Hugo Thienpont is appreciated by his peers for his service to the photonics community. Indeed Hugo has been member of many technical and scientific program committees of photonics-related conferences organized by international societies like SPIE, IEEE, OSA, EOS and ICO. One of his major achievements is the conception and initiation of SPIE's flagship symposium "Photonics Europe", which today draws more than 2500 attendees. Hugo has been general chair of this pan-European conference, which was held in Strasbourg from 2004 until 2008 and from 2010 to 2014 in Brussels. He has served as associate editor of 'Optical Engineering' and 'Opto-Electronics Review' and was guest editor of several special issues for Applied Optics and IEEE JSTQE. Hugo served for 6 years on the board of directors of the International Society for Optics and Photonics SPIE (2004-2010), and chaired SPIE's Advisory Committee for Europe from 2006-2010. He is also Vice-President of the European Technology Platform "Photonics21" and has played an active role in this high-level advisory board for optics and photonics to the European Commission since its foundation in 2005. Since 2018 he is editor-in-chief of the new interdisciplinary Journal Physics Photonics (IOP).

**Scientific Outreach:** Hugo Thienpont has been active in the field of scientific outreach with contributions to the EC-funded traveling exhibit "Fascination of Light", the NEMO educational kit on diffractive optics, the initiation and coordination of the "Photonics Explorer" intra-curricular kit for secondary schools, the creation of the non-profit organization "EYEST" which is responsible for the fundraising and distribution of the "Photonics Explorer" kits worldwide, the 'Photonics Show' which is performed daily during the Science Week to hundreds of secondary school students, and the UNESCO 2015 International Year of Light and the UNESCO 2018 International Day of Light initiative. Currently, in the framework of the EU project Phablabs 4.0 Hugo coordinates the introduction of photonics in fablabs and maker spaces all over Europe.