



D6.6.5. Report of 2nd Workshop

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Dissemination Level

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List of abbreviations

DIN: Deutsches Institut für Normung

LPS: LED Professional Symposium

QR-code: Quick response code

SSL: Solid State Lighting

VLC: Visible Light Communications

WS: Workshop



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SECTION 1 – Overview

The second workshop HI-LED was held on September 21st in Bregenz, Austria, in the framework of the LED Professional Symposium, LpS 2016:

http://www.led-professional-symposium.com/event_program.

The workshop event, organized by the Lighting Group of IREC (Catalonia Institute for Energy Research) and funded by the FP7 Framework Programme HI-LED-project, focused on the benefits provided by spectrally-tunable solid-state light sources on three different application fields: art-work and museum lighting, horticulture and human-centric lighting.

This activity aimed at attracting attention of stakeholders in the Lighting field. Designers, manufacturers, installers, researchers and end-users related to the proposed application fields (museum, horticulture and Human-centric) were called to participate in our workshop. HI-LED-2016 workshop provided an international forum to learn about the last advances in the field of the smart-SSL and discuss about new trends in this exciting field.

6TH INTERNATIONAL EVENT ON SOLID-STATE LIGHTING TECHNOLOGIES & INNOVATIONS

LED SYMPOSIUM + EXPO

20-24 SEPTEMBER 2016 | BREGENZ - AUSTRIA

EARLY BIRD TICKETS AVAILABLE UNTIL JULY 1ST

In the framework of the LpS - 2016, LED PROFESSIONAL SYMPOSIUM:

2ND HI-LED PROJECT WORKSHOP

SPECTRALLY - TUNABLE LED AND OLED LIGHTING

FREE ACCESS

REGISTRATION

For poster presenters

For general public

Connect with us via our QR code and send your abstract before September 1st, 2016

Connect directly to the LpS Symposium through the QR code provided. Select the option "VISITOR - WS/Forum" and introduce the following promo-code: HI-LED-WS_LpS2016

More info: jehiguera@irec.cat

HI·LED www.hi-led.eu

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Figure 1. Flyer of the event



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SECTION 2 – Description

The 2nd Workshop HI-LED: “Spectrally-tunable LED and OLED lighting” was held in the framework of the LED professional symposium, LpS 2016, in the Festspielhaus of Bregenz, Austria during the afternoon of the last 21st of September. The event was organized under an international perspective and had the participation of six reputed speakers in the European arena. A Poster session and three different demo sessions were developed. In the event were discussed novel advances in tunable LED sources and experimental light engines were shown during different short Demo sessions.

The workshop was organized in the framework of the LED Professional Symposium conference. The attendance to the workshop was open the people but a prior a registration in the LPS website was designed. To do so, direct connection to the LpS Symposium website was needed, which could be done by using the QR-code below. All the attendance had to use the option “VISITOR- WS/Forum” and introduce the following promo-code: “HI-LED-WS_LpS2016”.



Figure 2. Promo-code for the workshop registration

Poster session: attendance through poster presentation was also possible. The session encouraged the participation of students and researchers in the field of solid-state lighting, smart lighting system, horticulture, human-centric lighting and museum lighting.

Authors were invited to submit an abstract of a half to one page (font 11, including figures and references) briefly explaining their scientific/technological work. Such contributions were accepted for poster presentation. The required poster size was DIN A0 (841 x 1189 mm, MAX) preferably in a portrait format (not landscape format). Abstracts were sent by following the QR-code below or directly by sending an email to (jehiguera@irec.cat).

LIST OF POSTERS



Session: Human centric lighting

P.01: Gaurav Gupta, Yvonne Lai, Naomi Gross, Michael Catt, and Anya Hurlbert. Analysis of the effects of light spectra on human activity, alertness and body temperature. Institute of Neuroscience, Newcastle University, UK.

P.02: Aleksandra Cvetkovic, Simone Sorgato, Maikel Hernández, Julio Chaves, Ruben Mohedano, Juan Vilaplana. Advanced color mixing for a new generation of SSL lamps. LPI-Europe, Madrid, Spain.

P.03: Aleix Llenas, Francisco. J Campoy, Josep Carreras. Feedback controller for accurate spectral fidelity against thermal junction variations and LED luminous flux depreciation. Ledmotive Technologies. Lighting Group, Institut de Recerca en Energía de Catalunya (IREC), Barcelona, Spain.

P.04: Alonso Rodríguez Trujillo, Jorge Higuera. Multifunction VLC light engine for human centric lighting and data communication. Universitat Politècnica de Catalunya (UPC), Barcelona Spain, Smart Lighting Laboratory, Lighting Group, Institut de Recerca en Energía de Catalunya (IREC), Barcelona, Spain.

Session: Horticulture lighting

P.05: Daria Casciani, Fulvio Musante, Maurizio Rossi. LEDs lighting + food growing: design application for domestic indoor agriculture. Politecnico di Milano, Italy.

P.06: Xavier Aranda, Juan Ignacio Montero, Pere Muñoz, Assumpció Anton. Tuneable luminaires for tomato quality enhancement. IRTA, Environmental Horticulture Program. Cabrils, Spain.

P.07: Gamze Cakirer, Koksal Demir. Light color mixing. Ankara University Faculty of Agriculture Department of Horticulture, Turkey.

P.08: A. Elings, E. Meinen, J.A. Dieleman and P.H.B. de Visser. The modelled photosynthetic effects of different light colours on tomato crop growth and production. Wageningen UR Greenhouse Horticulture, The Netherlands.

P.09: J.A. Dieleman, K. Weerheim. Applications of spectral composition of light in greenhouse horticulture. Wageningen UR Greenhouse Horticulture, The Netherlands.

P.10: P. Hendrix, M. Brok. Development of HORTILED Top modular Light engine. Hortilux Schröder, The Netherlands.



Session: Museum lighting

P.11: Ferenc Szabo, Kéri Renáta, Péter Csuti. Impact of LED lighting on the selected historical pigments. Department of Electrical Engineering and Information Systems, University of Pannonia, Veszprém, Hungary.

P.12: Péter Csuti, Ferenc Szabó. Photometric and Colorimetric Properties of the HI-LED Luminaire for Museum Lighting Light and Colour Science Research Laboratory, Faculty of Information Technology, University of Pannonia, Veszprém, Hungary.

P.13: Mariano Perálvarez, Andres Chueca, Sara Fuertes, Jorge Higuera, Pilar Borja, Marc Torrell, Violeta Sicilia and Josep Carreras. Tunable White-light emission based on cyclometalated Pt(II) complexes. Lighting Group, Institut de Recerca en Energía de Catalunya (IREC), Barcelona, Spain.

Session: OLED Lighting

P.14: Michael Törker. Peak wavelength adjustment in green top emitting OLED structures. Fraunhofer FEP, Germany.

Technical committee

Despite the fact that the logistic part of the workshop was organized by IREC, a technical committee was built in order to assure the quality of both speakers and poster presenters:

Josep Carreras - Catalonia Institute for Energy Research, Spain
Mariano Perálvarez - Catalonia Institute for Energy Research, Spain
Jorge Higuera Portilla - Catalonia Institute for Energy Research, Spain
Rubén Mohedano – LPI, Spain
Julio Chaves – LPI, Spain
Ferec Szabo - University of Pannonia, Hungary
Anja Dieleman - Wagenigen UR, Netherlands
Tom Dueck - Wagenigen UR, Netherlands
Michael Törker - Fraunhofer FEP, Germany
Xavier Aranda – IRTA, Spain
Juan Ignacio Montero – IRTA, Spain
Pere Muñoz – IRTA, Spain
Marco Brok - Hortilux, Netherlands
Anyá Hurlbert - Newcastle University



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Best Poster Award

At the end of the event, Best Poster Award was organized. This year the winner poster was chosen from the different categories. The awards were presented to Gaurav Gupta, Yvonne Lai, Naomi Gross, Michael Catt, and Anya Hurlbert for his poster entitled "Analysis of the effects of light spectra on human activity, alertness and body temperature", from Institute of Neuroscience, Newcastle University, UK.

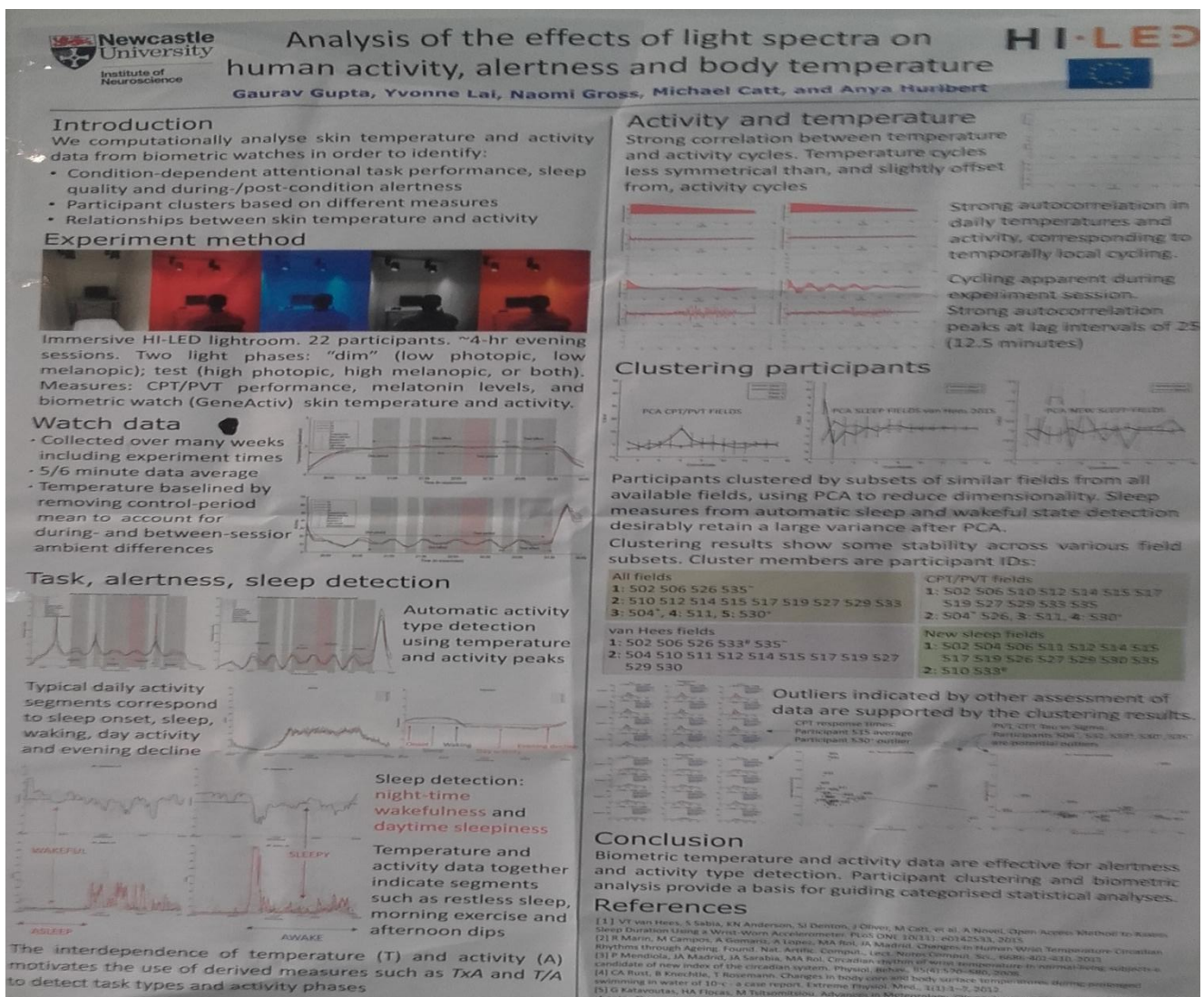


Figure 3. Poster winner "Analysis of the effects of light spectra on human activity, alertness and body temperature"



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Agenda:

The activities of the workshop were distributed according to the following schedule:

Workshop opening (14.00h)	
Dr. Josep Carreras , IREC (Catalonia Institute for Energy Research), SPA	
<i>"HI-LED EU-Project"</i>	
Session 1: Human-centric lighting (14:10h)	
Keynote 1	Professor Anya Hurlbert , Newcastle University, UK <i>"Sculpting the spectrum of light to influence human visual and non-visual behaviour "</i>
Keynote 2	Prof. Dr. Christian Cajochen , Head Centre for Chronobiology, University of Basel, CH <i>"Light beyond vision: effects on the human body clock, alertness and sleep "</i>
Demo session 1	Tuneable digital light-engines for human-centric purposes
Session 2: Horticulture (15:10h)	
Keynote 3	Dr. Phillip Davis , Stockbridge Technology Centre, UK <i>"Plant light responses and their manipulation for horticultural purposes"</i>
Keynote 4	Dr. Tom Dueck , Wagenigen UR, NL <i>"Optimizing horticultural production with light spectra"</i>
Demo session 2	Tuneable digital light-engines for horticulture
Poster session and coffee break (16.10h)	
Session 3: Art-work and museum lighting (16:30h)	
Keynote 5	Dr. Ferenc Szabo, Pannonia University, HU <i>"LED museum lighting: challenges and solutions"</i>
Keynote 6	Dr. Sérgio Nascimento, Department of Physics, University of Minho, PT <i>"Best lighting for visual appreciation of artistic paintings"</i>
Demo session 3	Tuneable digital light-engines for museum lighting and hybrid LED-OLED engine
Round table and poster award (17:30h)	
End of the event (18:00h)	



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SECTION 3 – The Speakers

Human centric lighting



Anya Hurlbert is Professor of Visual Neuroscience and Director of the Centre for Translational Systems Neuroscience at Newcastle University. She trained as a physicist (BA 1980, Physics, Princeton University), physiologist (MA 1982, Cambridge University), neuroscientist (PhD 1989, Brain and Cognitive Sciences, MIT), and physician (MD 1990, Harvard Medical School). Her main research interest is in understanding the human brain, through understanding the human visual system. She focusses on colour vision and its role in everyday visual and cognitive tasks, in normal development and ageing as well as in developmental disorders such as autism. She has particular research interests also in applied areas such as digital imaging and novel lighting technologies. One of her current research projects (HI-LED), funded by the EU FP7 programme, aims to understand how novel lighting technology may be used to optimise human health and performance. In 2004, she co-founded the Institute of Neuroscience at Newcastle, one of the UK's foremost academic units focused on neurosciences, uniting clinicians and basic scientists, and was Institute Director until 2014. Professor Hurlbert is active in the public understanding of science, and has devised and co-curated several science-based art exhibitions, most recently an interactive installation (a film, lighting demonstration and mass public experiment) at the National Gallery, London, for its 2014 summer exhibition. She lectures widely on colour perception and art, and contributes to media programmes on visual perception. She is past Chairman of the Colour Group (GB) and currently Scientist Trustee of the National Gallery.



Prof. Christian Cajochen is heading the Centre for Chronobiology at the University of Basel. He received his PhD in natural sciences from the ETH in Zürich, Switzerland, followed by a 3-y postdoctoral stay at the Harvard Medical School in Boston, USA. His major research interests include investigative work on the influence of light on human cognition, circadian rhythms and sleep, circadian related disturbances in psychiatric disorders, and age-related changes in the circadian regulation of sleep and neurobehavioral performance. He has held a number of honours and has authored more than a 100 original papers and reviews in his career.



Josep Carreras is the coordinator of the EU FP7 HI-LED project. He holds a PhD. (cum Laude), (Hons.) in Physics from the University of Barcelona, Barcelona, Spain. He has authored over 50 articles in several SCI journals, holds several patents, and has participated in more than 15 different projects at the national and international level. He is also the President, Founder and Chief Technology Officer of the spin-off Ledmotive Lighting. Since 2009, he has been with the Catalonia Institute for Energy Research, Barcelona, as the Leader of the Lighting Group, where he leads research on novel concepts for energy efficient lighting, colour science and technology, simulations, photometry, and intelligent lighting with advanced communication and computation functionalities.



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Horticulture lighting



Dr Tom Dueck is senior scientist in the team Crop management, Physiology and modelling in the unit Wageningen UR Greenhouse Horticulture in The Netherlands. He has 15 years of experience in research on natural and artificial lighting in greenhouse horticulture. He is devoted to the optimization of artificial lighting systems using LEDs in experimental facilities as well as in the field of practical horticulture. He has published over 60 scientific papers and 100 papers in professional journals.



Dr. Phillip Davis. He is a scientist from Stockbridge Technology Centre in UK. His main research interest is in plant light responses and their manipulation for horticultural purposes".

Art-work and museum lighting



Ferenc Szabo is an assistant professor at University of Pannonia, Veszprém Hungary. He holds a PGD in information Sciences (2012). He is expert in new color quality metrics based on Harmony Rendering of light sources. He has participated as expert in EU projects SSL4EU, LED4ART and HI-LED. His fields of research are color quality of light sources, mesopic vision, street lighting, human centric lighting and museum lighting. He has participated in the reconstruction of the LED lighting of the frescoes of the Sistine Chapel.



Dr. Sérgio Nascimento, Colour Laboratory of the Department of Physics, University of Minho, Braga (Head: Prof. Dr. Sérgio Nascimento). His main research interest is in Colour vision-physics and psychophysics. Colour perception. Colorimetry methods. Colour appearance models. Colour reproduction.



SECTION 4 – The event

The workshop started according to the schedule. The average number of attendants was around 50 people, among them around 30 people were previously registered:

#	Name	Last name	Institution
1	Peter	Hendrix	Hortilux
2	Regina	Hugas	DWO Creative
3	Daniel	Garside	UCL
4	Toni	Bonàs	Grupo Luxiona
5	Juan	Vilaplana	Light Prescriptions Innovators Europe SLU
6	Aleix	Llenas	Ledmotive
7	Brian	Faiola	Jam Film Kft.
8	Geza	Molnar	Jam Film Kft.
9	Rubén	Mohedano	Light prescriptions innovators Europe
10	Josep	Carreras	IREC
11	Xavier	Aranda	IRTA
12	Michael	Toerker	Fraunhofer FEP
13	Tom	Dueck	Wageningen UR Greenhouse Horticulture
14	Kees	Weerheim	Wageningen UR Greenhouse Horticulture
15	Anja	Dieleman	Wageningen UR Greenhouse Horticulture
16	Jorge	Higuera	IREC
17	Mariano	Peralvarez	IREC
18	Anya	Hurlbert	UNEW
19	Christian	Cajochen	Universitäre Psychiatrische Kliniken Basel, Switzerland
20	Phillip	Davis	Stockbridge Technology Centre
21	Sergio	Nascimento	Department of Physics, University of Minho. Portugal
22	Ferenc	Szabó	Pannonia University



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23	Peter	Csuti	Pannonia University
24	Aleix	Llenas	IREC
25	Daria	Casciani	Politecnico di Milano, Italy
26	Pere	Muñoz	IRTA
27	Gamze	Cakirer	Ankara University Department of Horticulture, Turkey
28	Michael	Törker	Fraunhofer FEP, Germany
29	Aleksandra	Cvetkovic	Light-TEC

The rest of the workshop attendants came from the LpS general meeting conference.

During the human centric lighting session, keynote speakers focused on the influence of light on human cognition, circadian rhythms and sleep, circadian related disturbances in psychiatric disorders, and age-related changes in the circadian regulation of sleep and neurobehavioral performance.



Figure 4. Human centric lighting session

The museum lighting session showed how LED-based lighting systems are being widespread in many museums due their favorable properties such as high luminous efficiency, long lifetime or reliable operating characteristics. Keynote speakers showed how LED lighting solutions avoid damages in pigments for paints avoiding the damaging radiation (ultraviolet, UV and infrared).



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Figure 5. Museum lighting session

In horticulture demo session, keynote speakers evaluated how different light colours trigger different plant responses, resulting in changes in plant morphology and physiology to benefit greenhouse horticultural production systems



Figure 6. Horticulture lighting demo session



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SECTION 5 – Conclusions

Alongside the LED professional Symposium was programmed the 2nd HI-LED workshop that lighting community enjoyed in Bregenz, Austria. Top Keynote speakers from all over the world presented latest innovations in spectrally- tunable lighting systems, OLEDs, museum lighting and horticulture lighting. The poster expo showcased a complete range of state-of-the art and researching in the main user market segments of the HI-LED project.

Among the different demos there was also a digital and portable multi-channel sun and the latest spectrally-tunable LED light engines for Horticulture, art work and human centric lighting developed under the project. Another highlight this year was the number of companies and industrial partners interested in our novel prototypes that brought new and innovative ideas to the workshop.