LASERLAB-EUROPE

The Integrated Initiative of European Laser Research Infrastructures IV

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Work package 5 – Training and Development of User Communities

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Final report on “Joint training events”

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Deliverable Type	
R = Report DEM = Demonstrator, pilot, prototype, plan designs DEC = Websites, patents filing, press & media actions, videos, etc. OTHER = Software, technical diagram, etc.	R
Dissemination Level	
PU = Public, fully open, e.g. web CO = Confidential, restricted under conditions set out in Model Grant Agreement CI = Classified, information as referred to in Commission Decision 2001/844/EC	PU

1 Introduction

The training of new generations of future users is considered as one of the main tasks of Laserlab-Europe. The objectives of Work Package 5 “Training and Development of User Communities” are:

- Train a new generation of researchers and technical staff to enable them to make optimum use of laser facilities, to exploit new experimental and theoretical approaches in photonics and laser-related science and to use them in novel applications with high industrial and societal impact;
- Develop new laser user communities in domains of science such as bio photonics, medicine, pharmacy, ICT, material research, environment, in industry, and in European regions where laser user communities are still less developed;
- Increase efficiency in these activities through cooperation with externally funded activities, aiming at a similar development of human resources, and in close collaboration with other European facilities, networks, projects and industry, such as FELs of Europe, ELI, EuroBioImaging, Photonics21, EOS, etc.

2 Objectives of Task 3

Under Task 3 “Cooperation with External Projects, Organisations, Industry and Existing Training Programmes”, Laserlab-Europe cooperates with existing specific training programmes organised by leading European institutions and organisations in laser science as well as by other networks and projects such as ELI, EuroBioImaging and FELs-of-Europe, thus creating and enhancing synergies between Laserlab-Europe and external training schools and workshops. Not only Laserlab-Europe’s users benefit from the cooperation with such external training programmes, but also the development of human resources needed for the pan-European large-scale infrastructures will be enhanced. In addition, such interaction helps to promote Laserlab-Europe and its access opportunities in diverse scientific communities.

A call for applications for cooperation with international training and summer schools is published annually on the Laserlab-Europe web page. The proposals are evaluated and selected by the Networking Board.

3 Work performed

During the second period of 24 months, two calls were issued and six proposals for training events were received, out of which five events were selected and co-funded by Laserlab. The events cover diverse topics relevant for the different fields of research addressed by the Laserlab-Europe consortium.

Lasers in Medicine and Life Sciences – LAMELIS 2018, 11-20 July 2018, Szeged, Hungary

The city of Szeged has been chosen as the site of one of the four pillars of a massive European laser project entitled ELI (Extreme Light Infrastructure). ELI-ALPS (Attosecond Light Pulse Source), a facility dedicated to ultra-short laser pulses, is now up and running: in January 2018, a Swiss research group successfully generated high-order harmonics in noble gases, and the complex is getting ready to offer beamtime to external users. Our summer school, Lasers in Medicine and Life Sciences (LAMELIS), started out as a promotional event to popularise ELI-ALPS, but has since become a tradition in its own right, a regular forum to establish a knowledge base on modern applications of lasers in life sciences. It was the fifth time the University of Szeged hosted LAMELIS, between 11th and 20th July 2018.

A one-day satellite workshop complemented the summer school, devoted to recent developments in laser science, with special emphasis on the interaction between laser light

and biological samples. Leading scientists from recognised laser laboratories all over the world gave invited talks, and the poster session provided LAMELIS students with the opportunity to present their scientific achievements.

The summer school was open to both medical students and physics students. Although the theoretical depth of talks was tailored for medical students, the programme could also benefit physics students as they could learn of medical applications of lasers directly from distinguished experts of the field and receive first-hand information on the current status of ELI-ALPS.

• Audience: undergraduate and postgraduate students of medicine, physics or biology

• Training goals:

- to present a compilation of modern laser applications in medicine and life sciences and discuss what new possibilities ELI-ALPS may open up in these
- to bring together future users and future developers of lasers and encourage continuous communication between them as early as the undergraduate years

• Topics and issues discussed:

- the status of the ELI project
- Laserlab-Europe access opportunities
- optical coherence tomography
- dentistry and oral surgery
- micromanipulation
- lasers in dermatology
- lasers in microcirculation
- hadron therapy
- transient absorption and fluorescence spectroscopy
- total internal reflexion fluorescence (TIRF) microscopy
- ultrafast two-dimensional spectroscopy
- 3D printing

• Laboratory visits:

- ELI tour
- High-intensity Laser Laboratory (HILL)
- super-resolution microscopy laboratory
- two-photon polymerisation laboratory (Biological Research Centre – BRC –, Szeged)
- direct laser writing to photopolymer layers (BRC)
- ultrafast fluorescence kinetics of biomolecules (BRC)
- differential polarisation laser scanning microscope (BRC)

• Clinical facility visits:

- lasers in dermatology
- OCT in ophthalmology

• Extracurricular activities:

- sightseeing in Szeged by ‘small train’ (a bus imitating a train)
- sightseeing in Szeged by boat
- Ópusztaszer heritage park
- Szeged zoo

• Training format: 90-minute lectures, combined with laboratory visits and extracurricular programme with speakers and students together.

• Number of participants:

– 19 students – 13 international and 4 Hungarian
– 22 speakers – 7 international and 18 Hungarian

Speaker and participants in LAMELIS 2018

ELI Summer School, ELISS2018, 27-31 August 2018, Szeged, Hungary

The first Summer School at ELI-ALPS was organized from 27 to 31 August 2018 in Szeged with the contribution of Laserlab-Europe.

The school is designed to be an interactive space where leading academic lights in theoretical and experimental physics could teach, inspire and consult with the next generation of Laser-based scientific researchers. The School was attended by over 80 people from across the whole of Europe and overseas.

The plenary talk was given by Sándor Varró (ELI-ALPS) and was a recapitulation of the history of the discovery of Planck's constant, one of the four fundamental universal constants. Sándor described how the discovery of the proportional constant which linked the energy and associated electromagnetic radiation was rooted in Maxwell's theory and inspired by Boltzmann and statistical mechanics. The subsequent expansion of this theory to light quanta by Einstein led to the birth of quantum mechanics and subsequent major milestones were also reviewed.

Other highlights from the twenty-four sessions include Eric Cormier's (ELI-ALPS) two-part session looking at laser pulse characterisation and applications; Marcus Dahlström

(University of Stockholm) described experimental and theoretical studies in the attosecond delay occurring from photoionisation from different electronic orbitals. The principles and applications of free electron lasers, which operate in the X-ray regime were presented by Kevin Price (Elettra). Plasma states physics was also studied in detail and subsequent laser-driven ion and electron acceleration methods were discussed by Luca Volpe (CLPU), Christos Kamperidis (ELI-ALPS) and Jörg Schrieber (LMU Munich). A novel approach of using incoherent diffraction imaging which used coincidence measurements and originally originated in astrophysics was presented by Joachim von Zanthier (Universität Erlangen-Nürnberg). The school ended with a detailed explanation and physical applications of plasmonics by Daniele Brida (University of Konstanz)

Two poster sessions were held and the ELISS summer school poster prize was won by Jonathan Jarret with his poster "Diagnosing plasma temperature via the reflection of intense laser light from microstructured solids".

Participants spent a memorable, adventurous afternoon at the Heritage Park in Ópusztaszer and a networking social dinner highlighted the week. This year the organization of the event was supported by Laserlab-Europe.

The next edition of ELISS is coming to ELI Beamlines in 2019.

Participants of the ELI Summer School 2018

MONDAY 27 AUGUST					
Time	**Session**	**Chair**	**Speaker**	**Title**	**Affiliation**
11:00	REGISTRATION				
12:00	Lunch				
13:15		Katalin Varjú	Katalin Varjú	WELCOME	ELI-ALPS, Hungary
13:30			Sándor Varró	Planck's constant, Einstein's light quanta and multiphoton processes in retrospective	ELI-ALPS, Hungary
14:30			Daniel Ursescu	ELI-NP overview	ELI-NP, Romania
15:30	Coffee break				
16:00		Sándor Varró	Dimitris Charalambidis	ELI-ALPS overview	ELI-ALPS, Hungary, FORTH, Greece
17:00	Social dinner – pizza party				

TUESDAY 28 AUGUST					
8:45	Mid-IR THz I / Ultrafast dynamics I	Giuseppe Sansone	Fabian Langer	High-order harmonic generation by intense THz fields	University of Regensburg, Germany
9:45			Marcel Mudrich	Probing complex light-matter interactions with helium nanoplasmas	Aarhus University, Denmark
10:45	Group photo				
11:00	Coffee break				
11:30	Free Electron Laser I	Kevin Prince	Gianluca Geloni	Schemes for attosecond pulse generation using FELs	XFEL, Germany
12:30			Tommaso Mazza	New research opportunities at XFEL	XFEL, Germany
13:30	Lunch				
15:00	Particle beams I	Tommaso Mazza	Luca Volpe	Laser plasma driven by high-intensity laser pulses	CLPU, Spain
16:00			Christos Kamperidis	Electron acceleration	ELI-ALPS, Hungary
17:00	Poster Session (with fingerfood dinner)				
17:30	Facility tour (group 1)				

WEDNESDAY 29 AUGUST					
9:00	Free Electron Laser II	Gianluca Geloni	Kevin Prince	Coherent control experiments with FELs	Elettra, Italy
10:00			Joachim von Zanthier	Incoherent diffractive imaging	Universität Erlangen-Nürnberg, Germany
11:00	Coffee break				
11:20	Attosecond/Nuclear Physics	Christos Kamperidis	Ovidiu Tesileanu	Nuclear processes for astrophysics at ELI-NP	ELI-NP, Romania
12:20	Lunch				
13:00	Free Afternoon - excursion to Ópusztaszer				
18:30	Social Dinner - Kastélykert restaurant				

THURSDAY 30 AUGUST					
9:00	Particle beams II	Subhendu Kahaly	Jörg Schreiber	Fundamental physics of ion acceleration	LMU Munich, Germany
10:00			Daniele Margarone	Medical application of laser driven accelerators	ELI-Beamlines, Czech Republic
11:00	Coffee break				
11:30	Mid-IR THz II	Antonino Di Piazza	Eric Cormier	High average power near and mid-infrared few-cycle lasers	University of Bordeaux
12:30			Daniele Brida	Optical parametric amplifiers	University of Konstanz, Germany
13:30	Lunch				
15:00	Attosecond/Plasma Physics	Daniele Margarone	Giuseppe Sansone	Generation, characterisation and application of attosecond pulses	Albert-Ludwigs-University Freiburg, Germany
16:00			Subhendu Kahaly	Fundamentals of laser plasma interaction	ELI-ALPS, Hungary
17:00	Poster Session (with fingerfood dinner)				
17:30	Facility tour (group 2)				

FRIDAY 31 AUGUST					
9:00	Laser-Matter Interaction Theory	Daniele Brida	Eric Cormier	Atoms and molecules in intense laser fields	University of Bordeaux
10:00			Antonino Di Piazza	High-energy quantum electrodynamics	Max Planck Institute for Nuclear Physics, Heidelberg, Germany
11:00	Coffee break				
11:30	Ultrafast dynamics II	Eric Cormier	Marcus Dahlström	Attosecond time-delays in photoionisation	University of Stockholm, Sweden
12:30			Daniele Brida	Plasmonics	University of Konstanz, Germany
13:30	Takeaway lunch packs				
14:00	Departure				

Zakopane School of Physics Breaking Frontiers: Submicron Structures in Physics and Biology, 21-25 May 2019, Zakopane, Poland

The Zakopane School of Physics is organized by the Institute of Nuclear Physics Polish Academy of Sciences in Krakow every two years. The event has been organized since 1963.

In 2019 the School covered the following topics:

- Magnetic nanostructures: from design through characterization to applications
- Biophysics and medical applications
- Current progress of advanced spectroscopy methods
- New research opportunities with the use of Extreme Light Infrastructure facilities
- Studies of topological materials

The School program is directed to students and young scientists to give them the opportunity to present their work, exchange their knowledge and to discuss the scientific problems with experienced lecturers.

The scientific program consisted of 17 lectures (30 minutes each) presented by invited specialist in the topics of the School and 28 seminar oral presentations by young scientists and doctoral candidates (15 minutes).

The list of the lecturers and titles of their presentations is as follows:

No	Lecturer's name	Affiliation	Lecture title
1	Jakob Andreasson	ELI Beamlines Project Division, Březany, Czech Republic	Femtosecond spectroscopy and diffraction in applied science at the ELI Beamlines facility
2	Wojciech Błachucki	Institute of Physical Chemistry Polish Academy of Sciences, Warszawa, Poland	Quantum control and ultrafast catalytic studies at Extreme Light Infrastructure (ELI)
3	Hugh J. Byrne	FOCAS Research Institute, Technological University Dublin, Ireland	Towards structure activity relationships governing Nanoparticle toxicology
4	Russell Cowburn FRS	Department of Physics, University of Cambridge, Cambridge, UK	Lithographically defined magnetic nanostructures for biomedical therapy and detection
5	Ariane Deniset-Besseau	Université Paris-Sud 11, Laboratoire de Chimie-Physique, Orsay, France	Biophysics and medical applications*
6	Aneta Frączek – Szczypta	AGH University of Science and Technology, Krakow, Poland	Carbon based materials for medical applications
7	Hans Hertz	KTH Royal Institute of Technology, Stockholm, Sweden	High-spatial-resolution laboratory x-ray bioimaging
8	Gregor Hlawacek	Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany	Analytic possibilities in the Helium Ion Microscope
9	Dariusz Kaczorowski	Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wrocław, Poland	Topological semimetals
10	Daniil Karnaushenko	Institute for Integrative Nanosciences, Dresden, Germany	Shapeable magnetoelectronics
11	Maria Rosa Lopez Ramirez	Department of Physical Chemistry, University of Malaga, E-29071 Málaga, Spain	Fundamentals and applications of Surface-Enhanced Raman Spectroscopy (SERS)
12	Björn De Samber	Ghent University, Gent, Belgium	Nanoscale X-ray imaging and spectroscopy at third generation

			synchrotron sources
13	Valerio Scagnoli	Mesoscopic Systems, ETH Zurich - Paul ScherrerInstitute, Villigen PSI, Switzerland	Magnetism and Synchrotron Radiation
14	Anna Semisalova	Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany	Ion beam patterning of magnetic landscapes and nanostructures
15	Marcin Sikora	AGH University of Science and Technology, Kraków. Poland	X-ray spectroscopy of magnetic nanoparticles in solution
16	Dieter Süss	Vienna University of Technology, Wien, Austria	Magnetic nanostructures: from magnetic simulations to sensor and storage applications
17	Gyorgy Vanko	Wigner Research Centre for Physics, Hungarian Academy of Sciences, Budapest, Hungary	Tracking light-induced ultrafast transformations of transition metal complexes

Shorter oral seminar presentations were selected from the submitted abstracts. Contributions not accepted for the oral presentation were presented during the poster session (26 posters).

83 participants took part in the event, including 44 academic staff and experienced scientists, 29 doctoral candidates, and 10 students. Thanks to the co-financing by the Laserlab-Europe project 8 young researchers and students were waived from the participation fee.

The exhibition stand with two roll-up posters and information leaflets presenting the Laserlab-Europe project has been organized in the lobby of the School venue The Laserlab-Europe poster was also presented in the lecture hall. The Laserlab-Europe leaflets and notebooks have been placed in the information briefcase of the School given to each participant.

Group photo of the participants of the LIV Zakopane School of Physics

Lasers in Medicine and Life Sciences – LAMELIS 2019, 4-12 July 2019, Szeged, Hungary

The city of Szeged is proud to have been chosen as the site of one of the four pillars of a massive European laser project entitled ELI (Extreme Light Infrastructure). ELI-ALPS (Attosecond Light Pulse Source), a facility dedicated to ultra-short laser pulses, is now up and running, and the complex is getting ready to offer beamtime to external users. Our

summer school, Lasers in Medicine and Life Sciences (LAMELIS), started out as a promotional event to popularise ELI-ALPS, but has since become a tradition in its own right, a regular forum to establish a knowledge base on modern applications of lasers in life sciences. It is now the sixth time the University of Szeged is hosting LAMELIS, between 4th and 12th July 2019.

The summer school is open to both medical students and physics students. Although the theoretical depth of talks is tailored for medical students, the programme can also benefit physics students as they can learn of medical applications of lasers directly from distinguished experts of the field and receive first-hand information on the current status of ELI-ALPS.

• Audience: undergraduate and postgraduate students of medicine, physics or biology

• Training goals:

- to present a compilation of modern laser applications in medicine and life sciences and discuss what new possibilities ELI-ALPS may open up in these
- to bring together future users and future developers of lasers and encourage continuous communication between them as early as the undergraduate years

• Topics and issues discussed:

- the status of the ELI project
- Laserlab-Europe access opportunities
- optical coherence tomography
- oto-laryngeal surgery
- dentistry and oral surgery
- micromanipulation
- lasers in dermatology
- lasers in microcirculation
- hadron therapy
- transient absorption and fluorescence spectroscopy
- total internal reflexion fluorescence (TIRF) microscopy
- ultrafast two-dimensional spectroscopy
- 3D printing

• Laboratory visits:

- ELI tour
- super-resolution microscopy laboratory
- two-photon polymerisation laboratory (Biological Research Centre – BRC –, Szeged)
- direct laser writing to photopolymer layers (BRC)
- ultrafast fluorescence kinetics of biomolecules (BRC)
- differential polarisation laser scanning microscope (BRC)

• Clinical facility visits:

- lasers in dermatology
- OCT in ophthalmology

• Extracurricular activities:

- sightseeing in Szeged by ‘small train’ (a bus imitating a train)
- sightseeing in Szeged by boat
- Ópusztaszer heritage park
- Szeged zoo

• Training format: 90-minute lectures, combined with laboratory visits and extracurricular programme with speakers and students together.

• Number of participants:

– 14 students – 9 international and 5 Hungarian

– 29 speakers – 8 international and 21 Hungarian

Group picture of the participants of the LAMELIS 2019

ELI Summer School – ELISS2019, Dolní Břežany, 25-30 August 2019, Czech Republic

ELISS 2019 took place in the ELI Beamlines facility during the last week of August 2019.

The main goal of the summer school is to spread the information about laser technologies and to educate students in the field of laser technologies and optics.

The school was attended by more than 70 participants from many countries in Europe and all over the world. The programme consisted of presentations, poster sessions and hands-on activities.

Topics of the school:

- High-power ultrafast lasers
  - Generation and amplification of ultra-short laser pulses
  - High Average Power (HAP) DPSSL technology
  - High Energy (HE) DPSSL technology and applications
- Generation of bright coherent and incoherent X-ray pulses using short pulse lasers
- Free electron lasers from IR to x-rays
- Ultrafast imaging techniques with short x-ray pulses
- Function and applications of short x-ray pulses (including synchronizations)
- Particle acceleration by lasers and applications: proton therapy
- Physics of dense plasmas and warm dense matter, laboratory astrophysics
- Ultra-intense laser matter interaction
- Nuclear physics with high-intensity lasers
- Femtoscience: applications in biology, chemistry and solid-state physics
- Generation of attosecond pulses: Attoscience photonics

There were presented almost 20 presentations.

The best evaluated presentations:

- S. Espinoza: Time-Resolved Ellipsometry in the Optical and VUV Region
- C. Riconda: Plasma Physics and Laser-Plasma Interaction

Topics of hands-on activities

- High field Science with Lasers
- Atomic Diagnostic
- Lasers at ELI

The hands-on activities were very popular. The participants were divided into small groups and activities were organized directly in the experimental and laser halls for them, so that the participants had a unique opportunity to work in the clean area halls.

The programme included a poster session where the participants presented posters showing their work. The best posters were awarded the Wolfgang Sandner Poster Prize. The winners were Diana Gorlova and Ivan Tsymbalov, both from Lomonosov University, Moscow, Russia.

The ELISS 2019 was considered as a great success by the participants and speakers. The ELISS summer school 2020 will be organized in the Hungarian branch ELI Alps.

ELISS 2019 participants

ELI BEAMLINES, DOLNÍ BŘEŽANY, CZECH REPUBLIC
AUGUST 25 - 30, 2019

ELISS 2019
PROGRAMME

Sunday, August 25, 2019

			Arrival & accommodation of participants

Monday, August 26, 2019

Chairman: **Michael Vích**

9:00			Registration of participants
9:45	9:50	**Roman Hvězda**	Opening ELI summer school
9:50	11:45	**Georg Korn ELI Beamlines, Dimitris Charalambidis ELI ALPS**	Overview of ELI project
11:45	12:00	COFFEE BREAK	Café on the 1st floor
12:00	12:45	**Martin Smrž**	Overview of HiLASE
12:45	13:30	LUNCH	Canteen on the ground floor
13:30	15:15		Poster session with ELI & HiLASE directors (Atrium)
15:15	15:30	COFFEE BREAK	Café on the 1st floor
15:30	18:00		ELI Tour
		FREE EVENING	

Tuesday, August 27, 2019

Chairman: **Daniele Margarone**

9:30	10:30	**Jonathan Tyler Green**	Introduction to high power CPA lasers
10:30	11:00	COFFEE BREAK	Café on the 1st floor
11:00	11:45	**Daniele Margarone**	Laser based ion acceleration and ELIMAIA
11:45	12:30	**G.A.P. Cirrone**	Laser based hadrontherapy
12:30	13:15	**Gabriele Grittani**	Laser electron acceleration
13:15	14:15	LUNCH	Canteen on the ground floor
			Pick up your afternoon snacks!
14:15	15:00	**Peter Dombi**	ELI-ALPS: Nanoplasmonics / surface science
15:00	18:00		**Hands-on activities**
		FREE EVENING	

Wednesday, August 28, 2019

Chairman: **Jaroslav Nejdl**

9:00	9:45	**Kim Ta Phuoc**	Laser driven particles and X-ray sources
9:45	10:30	**Jaroslav Nejdl**	Laser driven X-ray sources and their applications
10:30	11:00	COFFEE BREAK	Café on the 1st floor
11:00	11:40	**Stefano Bonetti**	Ultrafast dynamics through X-ray pump-probe experiments
11:40	12:05	**Maria Krikunova**	Scientific end station for gas phase targets at the ELI Beamlines HHG source
12:05	12:30	**Shirly Espinoza**	Ultrafast ellipsometry in the optical and VUV energy region
12:30	13:00	**Miroslav Kloz**	Ultrafast optical spectroscopy at ELI Beamlines
13:00	14:00	LUNCH	Canteen on the ground floor
			Pick up your afternoon snacks!
14:00	18:30		**Hands-on activities**
19:00			Bus transfer to Prague
19:30			Festive dinner in Prague (Café Vítkov)

Thursday, August 29, 2019

Chairman: **Jakob Andreasson**

9:45	10:30	**Marcel Mudrich**	ELI-ALPS: Ultrafast dynamics of clusters and nanodroplets
10:30	11:00	COFFEE BREAK	Café on the 1st floor
11:00	11:45	**Katalin Hideghéty**	ELI-ALPS: Radiobiol applications
11:45	12:30	**Mousumi Upadhyay Kahaly**	Theoretical/computational approaches towards applications of intense lasers
12:30	14:00	LUNCH	Canteen on the ground floor
14:00	15:30	**Sergei Bulanov**	High field science with lasers
15:30	16:00	COFFEE BREAK	Café on the 1st floor
16:00	16:45	**Catarina Riconda**	Laser-Plasma Interaction
		FREE EVENING	

Friday, August 30, 2019

Chairman: **Stefan Weber**

9:00	9:45	**Vladimir Tikhonchuk**	Inertial confinement fusion
9:45	10:30	**Evgeny Gelfer**	Relativistic motion in strong laser fields
10:30	11:00	COFFEE BREAK	Café on the 1st floor
11:00	11:45	**Edwin Chacon-Golcher**	Scientific computing & simulation
11:45	12:30	**Marcelo Ciappina**	Atomic Diagnostic for UHI laser pulses
12:30	13:00		**ELISS 2019 BEST POSTER AWARDS & THE EVALUATION OF ELISS 2019**
13:00		LUNCH	Canteen on the ground floor
			THE END OF ELISS 2019

http://indico.eli-beams.eu/e/ELISS2019