LASERLAB-EUROPE

The Integrated Initiative of European Laser Research Infrastructures IV

Grant Agreement number: 654148

Work package 5 – Training and Development of User Communities

Deliverable D5.1
Intermediate Report on “User Training Schools”

Lead Beneficiary: 11 – ILC

Due date: M24

Date of delivery: M24

Project webpage: www.laserlab-europe.eu

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 1

In order to make optimum use of the potential and opportunities of Laserlab-Europe’s access programme, dedicated activities are pursued to train new users from scientific communities with little experience in laser research, but with high socio-economic potential such as (bio)material analyses, (bio)medical diagnosis and treatment, communication and data processing, or new emerging interdisciplinary fields like nano/biophotonics, nano/biotechnology, etc. Training schools focus on specific topics and provide hands-on training in experimental techniques on research installations in laboratories.

Lead partner: ILC

3 Laserlab-Europe Training Schools

For the selection of Laserlab-Europe user training schools, the Networking Board has developed a procedure based on calls for proposals, issued once a year. Selection is made by the Networking Board. From the proposals submitted to the first two calls, the following training schools were selected and organised:

CLF Laserlab Training School in High-Power Laser Experiments, 21 November - 2 December 2016, Rutherford Appleton Laboratories, UK

The event, jointly organised by the Central Laser Facility (CLF) and Laserlab-Europe, provided a unique opportunity for the participants to learn the key skills required to run experiments on High Power Laser facilities such as Vulcan or Gemini. The broad range of topics covered in the course included laser and plasma diagnostics, optics characterisation, laser safety, vacuum and cryogenic systems, targetry, and overall project management of a typical experiment. In addition, the participants had the opportunity to put their skills to the test by setting up and performing their own experiment in the Vulcan Petawatt target area. With many new to the field this was an extremely useful exercise in working collaboratively with experimenters from other laboratories and universities.

Session 1 (1 week) took place within the Vulcan Petawatt target area, setting up an experiment from 1st principles – defining target center, aligning beamlines, optimizing parabolas & lenses, building references and assembling, installing and aligning diagnostics and targets. The session brought together all the basic practices and finishes by firing shots to target and analyzing provisional data.

Session 2 (1 week) dealt with other key skills required such as laser systems, diagnostics, vacuum and gas, safety systems, basic optical principles, diagnostics and an introduction to plasma physics codes.

Participants in the hands-on training

12 scientists from 8 different European institutions (including ELI-NP) attended the course, which also featured guest talks and tutorials from leading academics in the field of laser-plasma interactions. As well as hands-on and classroom learning provided by the CLF, the Training weeks also provided an excellent opportunity for the participants to network with other members of the EU high power laser community.

Attendees and staff for the Laserlab / CLF Training Weeks

Training School on Laser Applications for Biology and Biomolecular Systems: an authentic hands-on experience, 3-7 July 2017, Coimbra, Portugal

Aims and Scope

The Training School on Laser Applications for Biology and Biomolecular Systems was focused on the application of laser-based techniques to biologically relevant molecules and systems. A selected number of significant lectures on the School field of application were given by renowned invited scientists. Spectroscopic, time-resolved and microscopy techniques were not only presented but available for selected hands-on experiments.

The main aims of the School were to contribute for an integrating view of experimental laser-based methods applied to biomolecular sciences; improve the awareness on safety and responsible use of laser sources in biomolecular sciences; present cutting-edge laser-based techniques and applications; and train young researchers on laser based tools with application in relevant biology and biomolecular systems.

The scientific topics covered were the following:

- Laser safety
- Time-resolved spectroscopy and imaging to study structure-function relationships in biological systems
- Biocompatible molecules for treatment and diagnostic
- Spectroscopic analysis of biological samples
- Ultrafast IR transient absorption of relevant biological molecules
- Light interaction with biological tissues
- In-vivo Photoacoustic imaging

The training hands-on topics covered were the following:

- Biomolecules and biocompatible compounds spectroscopic characterization;
- Steady-state spectroscopy: Absorption, fluorescence, IR and Raman spectroscopy;
- Time-resolved spectroscopy: Transient absorption (fs up to ms), Single photon counting, Singlet oxygen phosphorescence, Photoacoustic calorimetry;
- Data Analysis: Convolution, Fitting functions, Statistics, Data treatment;
- Imaging/Diagnostic: Photoacoustic tomography, Multiphoton microscopy, Raman mapping, Spatially Offset Raman Spectroscopy;
- Therapy: Photodynamic therapy.

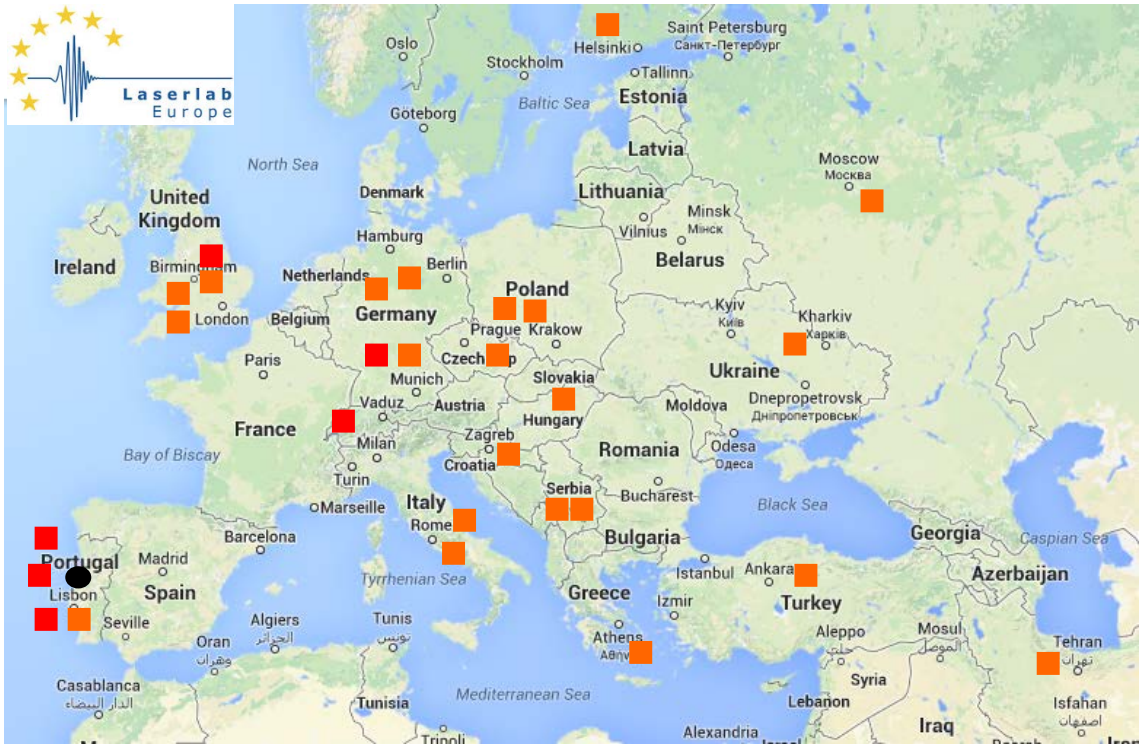
The Training School was designed to enthrall and educate new laser users from the biology, pharmacy and medical scientific communities with limited knowledge and experience in laser-based research, but with high potential for effective use of laser-based science and technology and laser facilities, namely in the biomedical diagnosis and treatment field. Students with background in physics or chemistry with the objective of studying biomolecules and biocompatible molecules by spectroscopic, time-resolved and microscopy techniques were also welcomed.

Selection procedure

The School was advertised on the Coimbra Laser Lab and LaserLab Europe web pages.

The dissemination of information about the School also used the Dyna e-mail contacts (a former European project on ultrafast spectroscopy that keeps and updated mailing list) across the European photophysics, photochemistry and photobiology community. The site of the European Society for Photobiology displayed an advertisement about the School.

Forty eight candidatures were received from which twenty two students were selected. The selection of students was based on the information provided in the application form. The School was aimed to enhance the knowledge and understanding of young graduate, PhD and post-doctoral students of Biology, Biochemistry, Medicinal Chemistry, Pharmacy and related Medical fields. Students with background in Physics or/and Chemistry but with the objective of studying biomolecular systems were also considered. With this in mind the students were chosen taken in consideration both their backgrounds and their future projects. The selection procedure sought to choose the students for whom the School could make a difference. Already experienced applicants were not chosen, nor the students too early on their studies. Students not necessarily specialized in laser light sources, but with the prospective of using lasers in their applied work on biosystems were chosen.



Provenience of the participants of the Training School. The orange squares represent the provenience of the students and the red squares the provenience of the speakers.

Twenty two students from fifteen different countries were selected and attended the Training School: Hungary, England, Wales, Greece, Italy, Germany, Portugal, Poland, Ukraine, Serbia, Croatia, Czech Republic, Iran, Russia and Turkey. Students were offered full accommodation and lunches during the School period. A joint dinner was organized. The

school activities took place at the Coimbra Laser Lab facilities and laboratories. Travel grants were available upon request and we were able to provide travel support for six students.

Photograph of the Training School participants.

Training activities

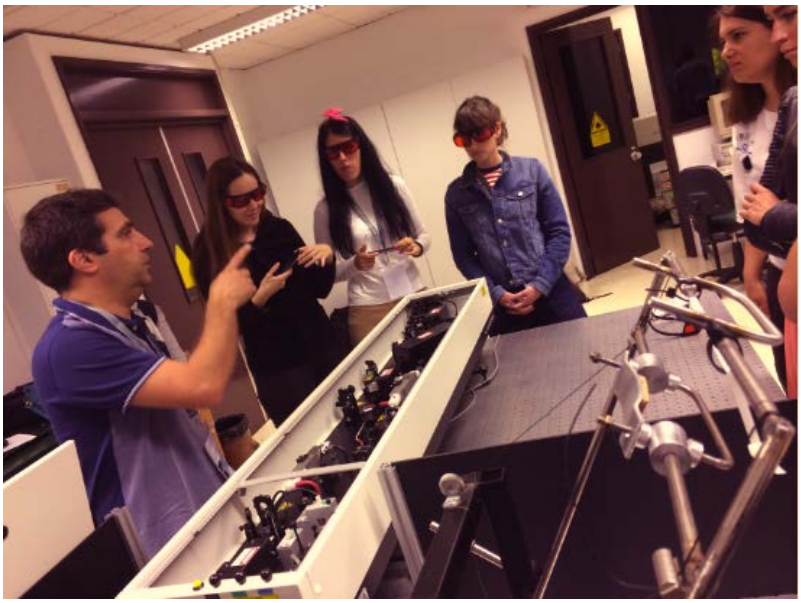
The School featured three distinct types of activities: i) 6 lectures by invited speakers with sponsoring from external companies; ii) introductory talks on the concepts of the experimental techniques to be used and sessions on results analysis; and iii) hands-on experimental sessions. The last two activities were provided mostly by CLL staff and by technicians from the sponsoring companies.

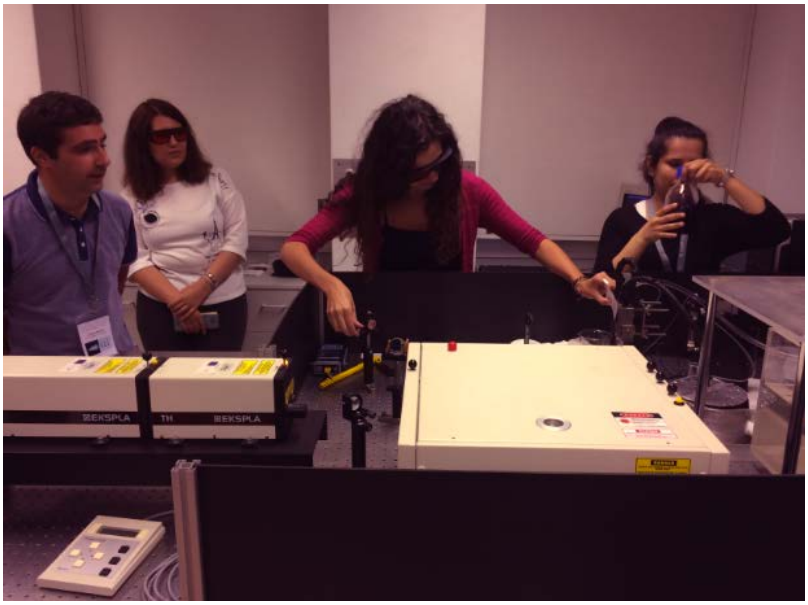
- The invited talks were given on July 3 and July 7, the first and last days of the School. Sponsors, presenters from four countries (England, Germany, Switzerland and Portugal) and the topics of the invited talks were the following:
- ADLaser talk by Margarida C. Pires (UL, Lisbon, Portugal): Laser safety first
- MTBrandão talk by Tony Parker (STFC-CLF, UK): Time-resolved spectroscopy and imaging to study structure-function relationships in biological systems
- Sarspec talk by Goreti Sales (IPP, Porto, Portugal): Spectroscopic analysis of biological samples
- LaserLeap talk by Luis G. Arnaut (CLL-UC, Coimbra, Portugal): Biocompatible molecules for treatment and diagnostic
- Spectra Physics talk by Peter Hamm (University of Zurich, Switzerland): Femtosecond TA IR of relevant biological molecules
- iThera Medical talk by Steven Ford (iThera Medical, Munich, Germany) In-vivo Photoacoustic imaging

The School greatly took advantage of the presence of the invited speakers. Tony Parker stayed for the entire duration of the School and enrolled in various activities. Peter Hamm and Steven Ford arrived earlier than their talks had been scheduled and actively participated in the experimental activities during the preceding day.

Three full days were dedicated to hands-on experimentation and demonstrations. In order to involve the students into an authentic laboratory experience, on each day the students were divided in two main groups, dedicated to two distinct experimental modules:

A: IR + Steady-state toolbox	and	B: Raman;
C: Microscopy	and	D: Photodynamic Therapy;
E: Fast Spectroscopy	and	F: Photoacoustics.





Photographs of experimental hands-on activities

All hands-on sessions were preceded by a lecture on the principal concepts, set-up information and experimental details related with the activity. Most experimental activities were followed by a very open-to-discussion session on results analysis. The following lectures were presented:

- IR Spectroscopy and Photochemistry in Cryogenic Media by Igor Reva (module A);
- Raman Spectroscopy in Science, Art and History by Tony Parker (module B);
- Introduction to Fluorescence Microscopy by Luísa Cortes (module C);
- A primer on PDT by Hélder Soares (module D);
- Fast Dynamics of Biomolecular Systems by João Pina (module E);
- Photoacoustics by Carlos Serpa (module F).

Achievements and impact

Feedback from the participants was generally very positive both about the general organization, hosting personnel and experimental conditions, and also about the level of lectures and experimental activities. The given opportunity to establish new connections with fellow colleagues from distinct countries was also highlighted.

The School was able to provide a good and friendly learning environment to the selected young scientists with potential to use lasers and related instruments in their research. The Training School exposed the students to new experimental techniques and methods, giving the opportunity to learn new things and find new techniques to be used in their future research. Being focused on the experimental hands-on activities the School was also able to present very good lecturers. Very good organization was pointed out by the attendees.