



LASERLAB-EUROPE

The Integrated Initiative of European Laser Research Infrastructures IV

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Work package 7 – Foresight and Sustainability Activities

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Second Foresight Workshop

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<i>Deliverable Type</i>	
R = Report DEM = Demonstrator, pilot, prototype, plan designs DEC = Websites, patents filing, press & media actions, videos, etc. OTHER = Software, technical diagram, etc.	R
<i>Dissemination Level</i>	
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 Objectives of WP7

Lasers and photonic-based techniques are omnipresent and indispensable in modern society and their role will even increase in the future. Foresight Activities act as Laserlab-Europe's "think tank", aiming to anticipate future strategic scientific, technological and innovation-related challenges with regard to laser science, technology and applications, to adjust Laserlab-Europe's strategic positioning within the European research landscape of photonic-related installations, clusters of infrastructures and societies, and to enhance the long-term sustainability of cooperation within the Consortium.

2 Objectives of the task "Future Laser-Based Technologies"

Lasers and laser-based technologies have revolutionised scientific research as well as our everyday lives. Due to constant and rapid scientific and technological developments, this revolution is ongoing and is expected to drastically change also our future, including our ability to tackle Grand Challenges of society. While the "Bridge workshops" in WP4 bridge between LASERLAB-EUROPE and neighbouring communities and explore synergies there, the Foresight Workshop on Future laser-based technologies, addressed in this Task, bridges to the future in a visionary way. This workshop addresses the ever-timely issue how the laser community, and LASERLAB-EUROPE in particular, can prepare to most efficiently meet and explore the opportunities that come with these emerging and future types of lasers and laser-based technologies. How can they be incorporated in the Access offer to Users and how can they be applied in industry and society, and, not the least, how can they be applied to tackle Grand Societal Challenges?

3 Foresight Workshop Report

Workshop "Visions on Future Laser-based X-ray Science and Technology", 19-20 November 2018, Barcelona, Spain

We are currently witnessing spectacular advances in laboratory and facility-based x-ray sources which enable a wide range of investigations with unprecedented time resolution and element specificity. The aim of this Laserlab-Europe foresight workshop was to assess the state of the art and to discuss visions for future opportunities in laser-based x-ray science through technological developments and novel methods for scientific investigations.

The two-day workshop was held at ICFO – The Institute of Photonic Sciences in Castelldefels (Barcelona) and was attended by more than 80 participants, bringing together leading scientists of the relevant laboratories of Laserlab-Europe and of other European and international institutions as well as representatives from industry.

The workshop was divided into three main sessions, covering state of the art scientific applications, sources, and the requirements of industry:

The session on scientific applications covered a wide area of investigations and methods including atomic and molecular physics, chemistry and solid state physics, surface science and catalysis, chemical dynamics and photosynthesis, energy harvesting and information processing, magnetism, x-ray optics and metrology.

The session on sources covered both laboratory and facility-based sources such as plasma x-rays in gas and liquid targets, high harmonic generation and attosecond sources, free-electron lasers, betatron radiation, x-ray lasers, laser-Wakefield acceleration and seeded FELs.

The industry session included representatives from ASML and pnSensor GmbH. ASML is a key manufacturer of lithography instrumentation for semiconductor industry. PnSensor GmbH is a key manufacturer of detection systems for x-rays. The session included presentations on the needs of industry, the identification of bottlenecks and the knowledge chain in which fundamental research feeds best into industry.

At the end of each day, a round table session was organised with lively discussions about opportunities for future collaboration and synergies between the communities as well as options for industrial involvement.

4 Conclusions and outlook

The workshop reached all of its goals and led to a clear overview of the existing and emerging research landscape in addition to a comprehensive insight into the needs of industry. The wide range of discussed applications clearly highlighted the importance of a continued development of x-ray sources and their methodologies. Quick consensus was reached that there exists no single source or application that serves all purposes. On the contrary, the seeming heterogeneity of the scientific landscape was identified as strategic strength that is ideally tailored to the complementarity of investigations and applications. New areas were identified that are currently emerging together with improved sources but also together with novel data treatment methodologies. These diverse areas provide a fertile ground for future fundamental research and direct applications in, e.g., advanced materials and quantum technologies. The round table discussion provided a direct insight into the needs of industry and how the connection to fundamental research leads to the development of advanced technology, which directly benefits industry and secures the competitiveness of the European community.

A book of abstracts is available at

<https://www.laserlab-europe.eu/events-1/laserlab-events/2018/future-laser-based-x-ray-science>



Group picture in front of ICFO

Laserlab-Europe Workshop
"Visions on Future Laser-based X-ray Science and Technology"
19-20 November 2018, Barcelona, Spain



Monday 19.11. Applications		
09:00 - 09:10	Welcome	
09:10 - 09:40	Rolles, D. (Kansas State)	Imaging Ultrafast Electronic and Nuclear Dynamics in Molecules
09:40 - 10:20	Natan, A. (SLAC)	Ultrafast imaging of atomic and electronic motions using x-rays
10:20 - 10:40	coffee break	
10:40 - 11:10	Chergui, M. (EPFL)	X-ray spectroscopy in chemistry
11:10 - 11:40	Techert, S. (Göttingen/DESY)	Structural Dynamics in Complex Chemical and Biochemical Systems
11:40 - 12:10	Wolf, M. (FHI Berlin)	Ultrafast dynamics of solids: Interfaces and correlated materials
12:10 - 12:40	Dürr, H. (Uppsala)	Non-equilibrium nanoscale control of charge, spin & lattice motion in magnetic materials
12:40 - 14:00	lunch	
14:00 - 14:30	Fiedorowicz, H. (MUT)	Application of laser plasma EUV and soft X-ray sources in nanoimaging, pulsed radiography and tomography and absorption spectroscopy
14:30 - 15:00	Williams, G. / Fajardo, M. (Lisbon)	X-ray based plasma diagnostics
15:00 - 15:20	coffee break	
15:20 - 15:50	von Zanthier, J. (Erlangen)	Quantum imaging with incoherently scattered x-rays
15:50 - 16:10	Poletto, L. (Padova)	X-ray photon handling
16:10 - 16:30	Hartmann, R. / Strüder, L. (pnSensor GmbH)	High-resolution X-ray detection with pnCCD detectors
16:30 - 16:50	Brussaard, S. (ASML)	Soft X-ray Metrology for Semiconductor Manufacturing
16:50 - 18:00	round table	
Tuesday 20.11. Sources		
09:00 - 09:30	Sansone, G. (Freiburg)	FEL control
09:30 - 10:00	Penco, G. (FERMI)	Opportunities with seeded FEL
10:00 - 10:20	Bressler, C. (XFEL GmbH)	XFEL science
10:20 - 10:40	coffee break	
10:40 - 11:10	Johnsson, P. (Lund)	HHG sources
11:10 - 11:30	Stiel, H. / Kanngiesser, B. (Berlin)	X-ray spectroscopy and imaging with laser plasma sources and tailor-made X-ray optics
11:30 - 12:00	Zeitoun, P. (LOA)	Considering the laser driven X-ray sources to develop bio-medical applications
12:00 - 12:30	Sebban, S. (LOA)	Laser-plasma SXR
12:30 - 13:30	lunch	
13:30 - 13:50	Wachulak, P. (MUT)	Laser plasma sources for application in material and biomedical engineering, plasma physics and technology, and radiobiology

13:50 - 14:20	Jaroszynski, D. (Strathclyde)	Laser-wakefield
14:20 - 14:40	coffee break	
14:40 - 15:00	Tzallas, P. (FORTH-IESL and ELI-ALPS)	Quantum optical spectroscopy
15:00 - 15:20	Stutman, D. (ELI-NP)	Phase-contrast imaging for biomedicine
15:20 - 15:40	Steiniger, K. (HZDR)	Traveling-Wave Thomson-Scattering
15:40 - 17:00	round table	