

Laserlab-Europe AISBL:

Advancing Laser Science through the Lasers4EU Project

Laserlab-Europe AISBL unites 48 infrastructures across 22 countries to sustain a cohesive European laser landscape. Its core project, Lasers4EU, provides academic and industrial users with coordinated access to 27 top-tier facilities. Supported by a diversified user-friendly access offer and a set of training activities, Lasers4EU empowers scientists, fosters innovation, and strengthens Europe's competitive edge in modern photonics.



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Photonics plays a strategic role in addressing modern societal challenges, ranging from sustainable energy and advanced manufacturing to healthcare and fundamental physics. To meet these demands, Lasers4EU serves as a cornerstone of Europe's photonics ecosystem by bringing together leading laser research infrastructures and offering open access to high-performance systems that individual institutions could not sustain independently. By providing access to these research infrastructures, the project fosters interdisciplinary research and reinforces European leadership in the field.

Lasers4EU: a central platform for accessing European laser research infrastructures

Lasers4EU is a Horizon Europe co-funded project and the latest phase of a long-standing European effort, initiated in 2001, to integrate and coordinate laser research facilities. Building on the achievements of five successive Laserlab-Europe projects, from 2003 to 2025, the strength of the consortium lies in its diversity and in its coordinated activities to keep Europe at the forefront of laser science and technology. The project brings together 29 leading laser research institutions across Europe, 27 Access Providing Infrastructures (APIs) alongside ELI ERIC and the Laserlab-Europe AISBL¹, with all their members participating as associate partners (Fig. 1).

By combining the expertise and resources of its APIs, the project offers a coordinated and highly efficient platform for researchers. Whether scientists are seeking specialised facilities for cutting-edge scientific investigations or applying advanced laser technologies to industrial innovation, Lasers4EU serves as a comprehensive gateway to Europe's leading laser research infrastructures.

Beyond providing direct access to facilities and services, the project also aims to strengthen and structure the wider European laser research landscape. This is achieved by expanding geographical coverage, promoting science

¹ Association Internationale Sans But Lucratif (international not-for-profit association)

diplomacy, and fostering closer collaboration and synergies with other European and international networks.

A further core objective of Lasers4EU is the development of the next generation of laser scientists. The project implements comprehensive training activities designed to equip researchers with essential skills, paying particular attention to scientists from emerging research fields and regions with developing scientific communities. In doing so, Lasers4EU supports a more inclusive, connected, and dynamic future for laser science in Europe.

Building a User community: Access, Training, Outreach and cross-facility activities

Now firmly in its operational phase, Lasers4EU has achieved significant milestones by streamlining the way researchers interact with Europe’s most advanced laser facilities. Central to this success is a diversified framework comprising three distinct routes for transnational access. The single-instrument route supports curiosity-driven projects requiring a specific laser-based setup, whatever the scientific topics tackled (Fig. 2).

The industry-focused route provides companies and medical centres with the advanced instrumentation and expertise necessary to develop or improve tools and products, while the multi-instrument route, introduced in late 2025, enables parametric studies requiring repeated experiments within a single project or complex experimental campaigns that require the sequential use of multiple instruments through a single proposal. The introduction of this route represented a move towards a more diversified and user-friendly access offer for researchers, these latter being no longer constrained by the technical limits of a given laboratory and benefiting from a reduced administrative burden. This seamless integration of complementary techniques across different European APIs provides a comprehensive understanding of complex physical phenomena, drastically accelerating the pace of discovery in photonics.

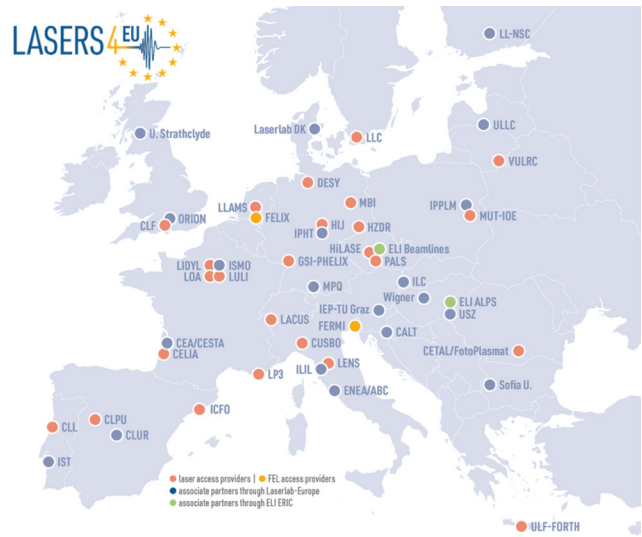
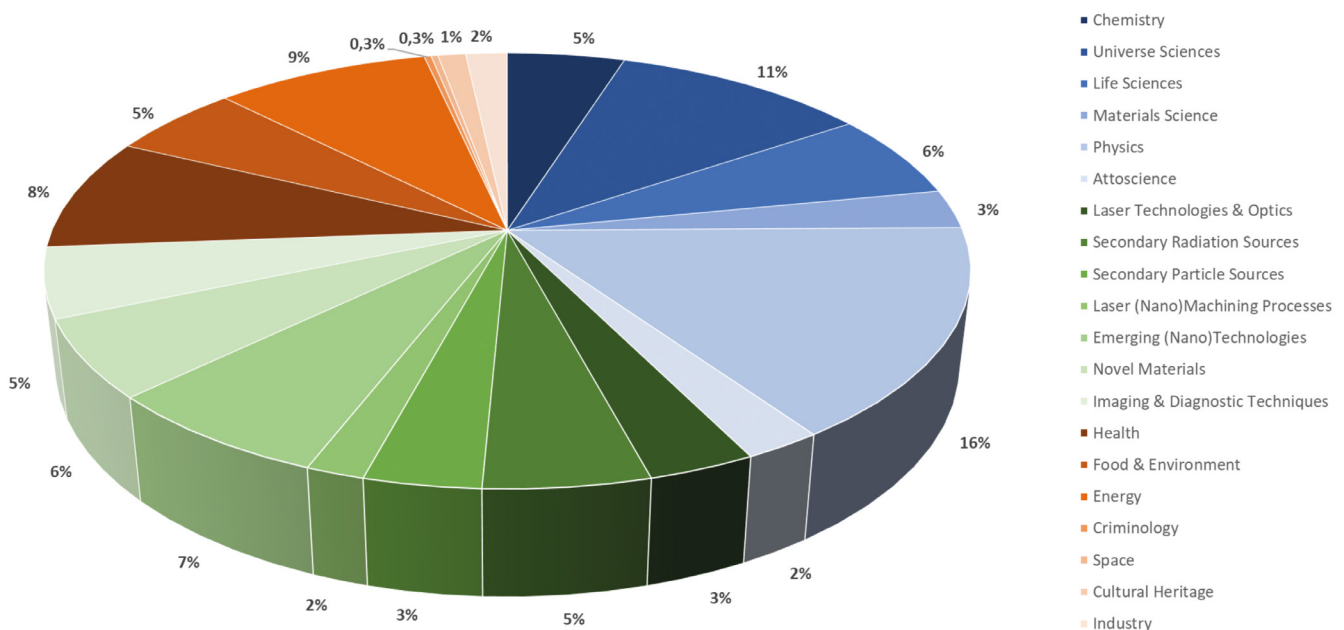


Figure 1: the Lasers4EU network.

To facilitate the access schemes, the project launched the Access Search Tool, a platform that allows users to navigate the consortium’s vast resources by matching their scientific interests with detailed laboratory profiles.

Recognising the complexity of operating such equipment, experimental setups, data acquisition systems, and analysis methods, Lasers4EU created a pre-project training scheme. This allows early-career researchers to visit host laboratories for up to one week prior to their official access period to gain ●●●

Figure 2: scientific topics, explored by the Laserlab-Europe access projects for the 2020-2024 period, aiming at deepening fundamental knowledge (blue), developing novel laser-based instruments and exploring societal applications.



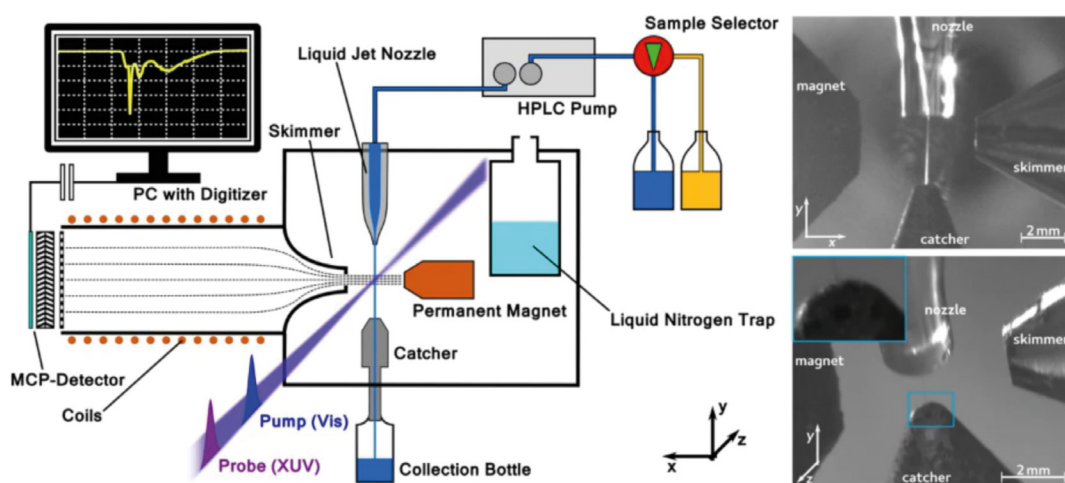


Figure 3: MBI experimental setup [A. Khodko *et al.*, "Ultrafast dynamics of metanil yellow studied by time-resolved transient absorption and XUV photoelectron spectroscopies in solution," Proc. SPIE PC12992, PC129920G (2024); <https://doi.org/10.1117/12.3022547>].

hands-on experience. This preparation strengthens technical skills, shortens the learning curve, and improves the efficiency of subsequent experimental campaigns.

The training pillar also includes events designed to prepare the next generation of scientists in advanced laser technologies and laser science. These events support non-specialist users from diverse scientific backgrounds in navigating the complexity of the Lasers4EU capabilities, while also helping experienced researchers deepen their knowledge of different laser processing methods. Through hands-on sessions, they give to participants the opportunity to observe laboratory work directly, which enhances understanding beyond what can be gained from reading or lectures alone. Ultimately, they aim to attract new users from emerging fields and regions with developing laser research communities, promoting a more inclusive and multidisciplinary research environment.

ACCESS

A team of scientists from the Center for Collective Use of the Femtosecond Laser Complex at the National Academy of Sciences of Ukraine successfully applied for Lasers4EU access at the Max Born Institute (MBI). The experimental campaign aimed at studying an aminoazobenzene derivated by XUV time-resolved photoelectron spectroscopy in order to understand the role of the environment on the molecular dynamics. Experiments were carried out with two different excitation wavelengths (370 and 490 nm) to investigate the non-hydrated and hydrated forms of the molecule and reveal differences in their dynamics. Apart from its scientific interest, the project was particularly important for the user team, given the challenges posed by the current geopolitical situation.

Lasers4EU organises several thematic "Laserlab-Europe Talks" every year, which present and promote research and applications enabled by laser-based technologies, fostering a better understanding of the links between research and innovation. The project also addresses topics at the intersection of laser science, research infrastructure, innovation, and research services through the Lasers4EU Webinar Series. Furthermore, within the project's framework, the consortium publishes the Laserlab Forum newsletter, highlighting the impact of lasers across diverse areas, from cultural heritage preservation to industrial innovation.

Lasers4EU supports knowledge exchange not only externally and but also internally by promoting initiatives such as staff exchanges and joint experiments, with a strong focus on integrating expertise within the participating institutions. These activities are designed to create lasting impacts that extend beyond the project's duration. Many participants emphasise how valuable these experiences are to grow their expertise in the targeted subject, be this high-energy ultrafast laser systems or advancing expertise in single-molecule and super-resolution microscopy.

Overall, the activities developed by the consortium ensure a coordinated offer for a broad user community. Whether seeking specialised laser facilities for advanced scientific research or aiming to apply cutting-edge laser technologies to industrial innovation, Lasers4EU provides a central point of access to Europe's laser research infrastructures.

Laserlab-Europe AISBL: connecting laser research infrastructures across Europe

The Laserlab-Europe association was founded in 2018 to ensure the continued collaboration of its members in response to evolving European Commission funding priorities. The participating institutions had long valued the scientific opportunities and synergies created through earlier EC-funded projects. To maintain these benefits beyond individual funding cycles, they established a self-funded legal entity that would sustain collaboration, exchange, and strategic coordination even in the absence of major European funding programmes.

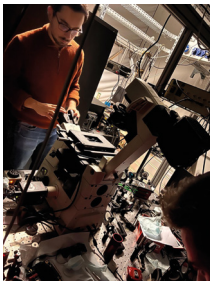
Today, Laserlab-Europe is an association of 48 leading laser research infrastructures in 22 European countries, going far beyond the membership in joint transnational access and technology projects. While Lasers4EU remains a central pillar, the association's reach is amplified through a robust portfolio of EU-funded initiatives. The RIANA project connects 69 facilities to provide cutting-edge nanoscience and nanotechnology tools, while ReMade@ARI focuses on characterising sustainable materials to support the circular economy. In the biological and medical fields, nanoSCAN develops 3D imaging for cancer immunotherapy and fastMOT creates high-efficiency sensing cameras for deep body imaging. The association also prioritises technical innovation through projects like THRILL, which advances high-repetition-rate intense laser technologies.

Finally, Laserlab-Europe maintains a commitment to international solidarity and infrastructure coordination. For instance through the EURIZON project, which specifically supported Ukrainian researchers and institutions. This multifaceted approach ensures that the association remains at the heart of European photonics, driving both scientific discovery and societal impact.

To conclude, Lasers4EU exemplifies the power of European cooperation, providing unparalleled access to advanced tools that drive both scientific and technological discovery. These achievements underscore the value of shared infrastructures in tackling complex global challenges. The project's success is a testament to the strong framework provided by Laserlab-Europe AISBL, which ensures sustained excellence regardless of shifting funding priorities. By integrating emerging technologies and strengthening industrial links, the consortium ensures that Europe maintains its leading role in the global photonics landscape.

More information on <https://laserlab-europe.eu/> and <https://lasers4.eu/>. ●

STAFF EXCHANGE



A recent staff exchange supported by the project has for instance strengthened collaboration between the Centre for Ultrafast Science and Biomedical Optics (CUSBO) at Politecnico di Milano and the Institute of Molecular Sciences of Orsay (ISMO). "The exchange confirmed that integrated photonic devices can effectively upgrade conventional microscopy setups into super-resolution instruments. At the same time, it played a key role in establishing shared experimental protocols and defining follow-up activities for the development of integrated optical systems for nanoscopy," says Andrea Bassi, one of the CUSBO participants.

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