NEWSLETTER

Issue 4, December 2016

Dear HEPTech members,

Our newsletter is about to turn the first year of its existence. Initiated by Ian Tracey, Secretary-General of HEPTech, it has been presenting the latest achievements of the HEPTech nodes and has made the whole network feel proud of them. Thanks to the news you share, we all become aware of your success stories and good practice, which is the added value of our networking.

This issue offers a glimpse of the Open Day at the Technical University of Kosice and of the first Beam Emission Spectroscopy summer school in Budapest, co-organised by Wigner RCP. It reveals amazing outcomes of the research endeavours at DESY and invites you on a journey beyond the limits with ELI-ALPS.

I would like to express my sincere gratitude to all the nodes that contributed with so much enthusiasm to the four issues of the newsletter!

Sending season's greetings for health and prosperity to you and your families, I also wish you plenty of news worth sharing that I will be delighted to publish next year!

Merry Christmas and Happy New Year!

Eleonora Getsova
Editor-in-chief,
HEPTech Communication Officer

Around the members

Deutsches Elektronen-Synchrotron (DESY), Germany

Technical University of Košice, (TUKE), Slovakia

Wigner Research Centre for Physics, Hungary

In focus: ELI Attosecond Light Pulse Source (ELI-ALPS), Szeged, Hungary

The interview: David Bereczkei, Project Management Coordinator at ELI-ALPS, Hungary

HEPTech events: Academia Meets Industry Forum at IEEE NSS/MIC, Strasbourg

Around the members

DESY's Technology Transfer Office in service of the NanoLab

DESY NanoLab is a facility providing access to advanced nano-characterization, nano-structuring and nano-synthesis techniques which are complementary to the advanced X-ray techniques available at DESY's light sources. Its unique instrumentation and high-level expertise bear a great potential for industrial users.

In close cooperation with scientists from the NanoLab, DESY's Technology Transfer Office has developed a strategy to promote these services and techniques to companies and secure easy access. In a market survey, possible future customers were identified and approached. Based on the results of these interviews, several marketing and communication materials were designed and a campaign to find pilot customers from industry has been launched.

Additionally, the recently funded European Union programme *Nanoscience Foundries and Fine Analysis* (NFFA) provides free industrial access to 20 European nanotechnology centres and - in a limited amount - to large scale facilities, including DESY NanoLab and PETRA III. Since this offer is primarily directed to small and medium enterprises (SMEs) it usefully complements the overall strategy to promote industrial access and foster innovation.

A new innovation centre in favour of start-ups and spin-offs is underway

The innovation centre jointly planned by DESY, the University of Hamburg and the City of Hamburg is getting underway: the three partners have set up a limited company that will run the centre, which is to be established on the research campus at Hamburg-Bahrenfeld. This paves the way to begin construction work and provide additional funding for the innovation centre aiming at research spin-offs, technology start-ups and small companies that want to settle near DESY. At 44%, DESY holds the largest share in the newly founded limited company, followed by the city with a 30% and the University of Hamburg with a 26% stake. The innovation and start-up centre will offer an attractive environment for young businesses, which will promote the transfer of know-how and information from the excellent research conducted by DESY and its partners.

A new building is to be erected on a 5000-square-metre plot of land offering about 2600 sq. m. of usable space. Construction work is to begin next year and should be completed in 2018. To make it easy to start new companies, some of the office spaces will be made available to potential start-ups rent-free for a certain period of time. The young businesses will benefit from low rents.

(Architectural concept of the new innovation centre. Credit: DFZ Architekten / DESY)

Commissioning of the world’s largest X-ray laser begins

The world's largest X-ray laser European XFEL, an international research facility with eleven European member countries, has begun the commissioning of the 3.4-km long underground complex.

Around 350 guests from politics, administration, the diplomatic corps, scientists from around the world, and employees of European XFEL and its closest partner institute DESY celebrated this big milestone in October, on the new research facility’s campus in Schenefeld in the metropolitan area of Hamburg, Germany.

In the underground tunnel near the facility’s experiment hall, representatives of the partner countries mounted an approximately two-metre-long beamline tube, as a symbolic act of installing one of the final still-missing pieces of the X-ray laser.

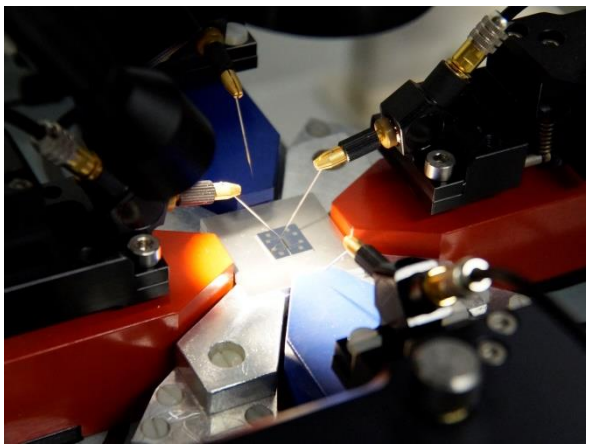
(Photo: Fred Dott / European XFEL)

DESY is the main shareholder of the European XFEL and led the consortium that built the linear accelerator.

The commissioning will take place over the following next few months. External scientists will be able to perform experiments at the facility for the first time in summer 2017. The X-ray laser will then generate extremely short and bright X-ray light flashes that will enable new views of the structure and fast processes of the nanocosmos. Applications range from structural biology, chemistry, physics, and materials science to environmental and energy research or explorations of conditions like those found inside of planets.

DESY’s novel magnetic sensors trigger the interest of industry

Magnetic field sensors are becoming increasingly popular in the computing and automotive industry, for example to measure engine speeds in ABS systems. Their sensitivity and comparatively small size make so-called magnetoresistive sensors particularly interesting. Industrial users are always calling for new types of sensor concepts, in order to expand their areas of application and to branch out into new markets. However, conventional magnetoresistive sensors are only partly able to cover these needs, since their potential functionality is limited.



A new manufacturing process, which has been developed at DESY’s laboratories and for which a patent is pending, changes all this by using a new coating procedure, whereby the layers of the magnetoresistive sensors are not applied vertically from above, but rather at an angle, allowing the properties of the sensor to be adjusted flexibly and to be tailored to various applications.

(Photo: Kai Schlage, DESY)

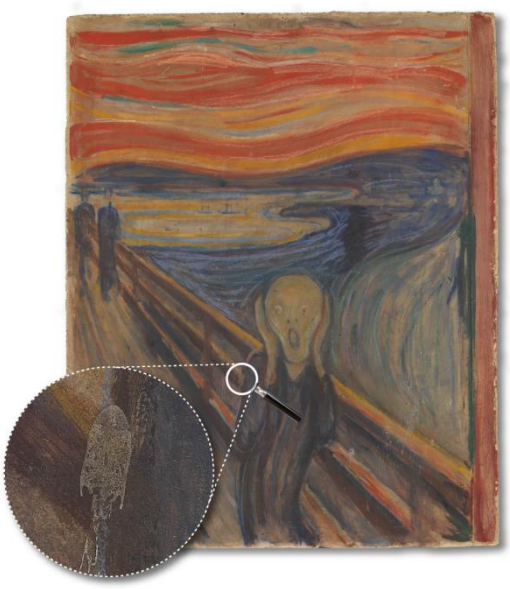
“Until now, it has often been necessary to adjust the application to fit the sensor; our technology means that we can customise the sensor to fit the intended application,” explains Kai Schlage, inventor and project manager of the novel sensor technology. In the course of the validation project, a new coating line will be built and the use of the sensors will be tested in an industrial environment, to ensure they can fulfil the requirements of the automotive industry and other areas of application.

The Helmholtz Association is providing almost 900,000 euros to fund the development of the novel type of magnetic sensors to commercial viability over the next two years. DESY and an industrial partner are together providing the same amount of money to support the project.

A mystery from the world of art solved by DESY's X-rays

With the help of the brilliant X-ray radiation from DESY's research light source PETRA III, scientists have solved a decades-old mystery from the world of art: A team led by Dr. Geert Van der Snickt of the University of Antwerp unravelled the nature of mysterious white spots on the famous painting "The Scream" by the Norwegian artist Edvard Munch.

Contrary to popular assumption, the stains are not bird droppings and neither simply white color. Instead, the X-ray examination shows that the patches are made of wax, which probably dripped from a candle in Munch's studio on the painting***. (The mysterious white spots on the “Scream”. Photo: Norwegian National Museum.)***



It is known that Munch painted several of his large drafts outdoors and that he liked to expose his paintings to the forces of nature. However, this particular painting entered the Norwegian National Museum's collection directly from the artist's studio and the white splatters have always been present. All of this resulted in a theory that Munch would have left the “Scream” outside and that birds flying by literally added another layer of meaning to Munch's Masterpiece.

The "Scream" has become an icon of the European art canon. In the late nineteenth century, Edvard Munch made four versions of the “Scream”, a painting that is nowadays considered vital for the later development of Expressionism. Although one of the versions was sold in 2012 for a staggering 119 million dollars, the most renowned version is undoubtedly the painting that is part of the collection of the Norwegian National Museum. This work differs from the others not only in the fact that it is considered as the earliest version, but also because it features a series of enigmatic white splatters on its surface.

Open Day at the Technical University of Košice

The 2016 Open Day of the Technical University of Kosice (TUKE) took place on 7th November and was dedicated to the Slovak Presidency of the Council of the European Union.

It was focused on promotion of the university and its nine faculties and selected institutional workplaces to the elementary and secondary school students as well as to the general public. TUKE introduced its accredited fields of study and ensured direct contact with science and research applications in selected laboratories of excellence interfacing with industry. There was also a visit to the Start-up Centre (Centre of technological innovation).









According to proven traditions, hand in hand with the official program, eye catching accompanying events were also organized in order to enlighten and enrich the visitors so their call was not only a tour around university buildings and laboratories but also a source of wisdom and amusement.
(Photos: TUKE)

First Beam Emission Spectroscopy (BES) summer school in Budapest

The Institute of Nuclear Techniques of the Budapest University of Technology and Economics together with the Wigner Research Centre for Physics organized the first Beam Emission Spectroscopy (BES) summer school in Budapest from 29 August to 02 September 2016. ***(Photo: Wigner RCP)***

Sixteen students from all over Europe participated in the event. They were introduced in details to the BES fusion plasma diagnostic technique, in which the Hungarian research group plays a leading role in Europe. During the visit to the Wigner laboratories

novel developments were presented and the students had a closer look on the technology side of research. The programme combined theory with experimental data analysis practice. Real measured BES data from 4 different experiments were analyzed in detail in small groups with a close supervision of an expert, thus providing environment close to the real research work. Inspired by the success of the event, the institutes plan to organize BES summer school on a bi-annual basis in the future.

In focus

ELI-ALPS – a journey beyond the limits

The Attosecond Light Pulse Source (ALPS) facility of the pan-European Extreme Light Infrastructure (ELI) project is designed to build a laser-based research infrastructure in which light pulses of few optical cycles in the infrared or mid-infrared spectral range are generated and used for basic and applied research. These pulses will be used as a driving source for generation of even shorter extreme ultraviolet pulse with durations that can be as short as a few tens of attosecond.

Four laser sources are being implemented at the ELI-ALPS infrastructure, operating in different regimes of repetition rate, peak power, and spectral range. All four light sources deliver pulses with unique parameters: unparalleled fluxes, extreme broad bandwidths and sub-cycle control of the generated fields. The high repetition rate (HR) system delivers TW peak power, < 5 fs pulses at 100 kHz. The 1 kHz repetition rate single cycle (SYLOS) system provides 20 TW pulses with a pulse duration of <5 fs. The petawatt-class high-field (HF) laser *(in the picture, right)* will operate at 10 Hz repetition rate with 17 fs pulse duration. The described laser systems operate in a bandwidth window of 600 nm - 1400 nm. They are complemented by a mid-infrared (MIR) laser system, which provides tunable (2.5 μm - 3.9 μm) sub-4 cycle laser pulses at 100 kHz repetition rate with 15 W average power.

These exceptional laser sources will generate a set of secondary sources with incomparable characteristics, including light sources ranging from the THz to the X-ray spectral ranges and particle sources. The laser and secondary sources foreseen at ELI-ALPS will push the frontier of attosecond science in three main directions as coincidence measurements, investigations of highly nonlinear processes in the XUV (extreme ultraviolet radiation) and X-ray spectral range, and ultrafast valence-shell and core electron dynamics.

Beyond attoscience, the laser sources of ELI-ALPS would also provide regional and national, basic and applied science projects with experimental opportunities in radiobiology, biophotonics, plasma and particle physics.

Some recent developments of the over 230 million € project concern two of the five main laser systems that are now at full operation at the place of development and construction. The THz secondary source and laboratory are also in place. The detailed technical design of five of the six attosecond sources is already completed and most of the procurement procedures have started.

The construction works of the ELI-ALPS building, which started in April 2014, using unique techniques, are about to finish by the end of 2016. Activities in the purpose-designed and built building complex will start with the installation of the MIR and HR laser systems in the spring of 2017. Simultaneously, the assembly of the high harmonic beamlines, THz laboratory, and nanoplasmonic experiments will begin as well. The first XUV bursts of light with attosecond duration are expected to be generated by the end of 2017. First users will arrive in 2018 and full operation is expected in 2019.

ELI-ALPS provides research opportunities in a wide range of disciplines and will enable high-quality cutting-edge research, ultrafast physical processes, biological, medical and materials sciences and energy research: from solar cells to artificial photosynthesis. ***(Illustrations credit: ELI-ALPS)***

The interview

David Bereczkei,

Project Management Coordinator at ELI-ALPS, Hungary

What are the main achievements and challenges since the beginning of the ALPS project?

One of the main achievements of ELI-ALPS is the human capital. The recruitment of scientific staff started only 3 years ago and so far we have 132 researchers and research engineers who produced more than 60 papers published in peer-reviewed journals, 29 out of them - in the first 10 months of 2016! Over the last three years, almost 200 presentations have been delivered at scientific conferences.

From implementation point of view, beyond the scientific publications, the far major achievement is the complete conceptual design of the research infrastructure, completed technical design of most of the research equipment, and the so far more than 100 public procurement procedures for research technology at a total value exceeding 50M€.

Among the challenges we shall mention the specification and design of the systems, initially with very limited research and engineering staff, the extremely lengthy procurement procedures, which are even more difficult due to the financial model applied (structural funds of the EU). All these are topped with the fact that ELI-ALPS is implemented by a non-profit enterprise established for this purpose, but without the background of any larger organization, hence the usual difficulties of a rapidly expanding organization also have to be dealt with. Finally, the difficulties of finding, and recently, keeping the already employed skilled, or even unskilled but talented researchers and engineers, cannot be underestimated.

What kind of staff would you need to enable ELI-ALPS to successfully perform its functions and where do you look for them?

Beneficiary of the ELI-ALPS project is the ELI-HU Non-Profit Ltd, which was established in 2010. Originally starting with only three employees, now it has more than 220 co-workers, with all kind of experience: legal financial, HR, PR, engineers, project management, and most importantly – from the view of the mission of the project – the Scientific and Research Technology Directorates. Currently, the company employs over 130 researchers, scientific engineers and technicians, from 16 nations. Recruiting started well before the construction works, so our researchers were also involved in the technical design of the lasers and secondary sources. ELI-HU has concluded over 20 Memoranda of Understanding and Letters of Intent with outstanding universities and research infrastructures, making it possible for the future staff of ELI-ALPS to gain experience before starting their experiments with the state-of-the-art equipment of the ALPS facility.

What are the perspectives of the ELI project?

ELI Delivery Consortium International Association (ELI-DC AISBL) is the body coordinating the three ELI research centres (ELI-ALPS, ELI Beamlines and ELI Nuclear Physics) in their implementation phase and in the transition period before 2018, as the user operation phase of ELI since then will be under the unified governance of a European Research Infrastructure Consortium, ELI ERIC. Steps have already been taken to form the future ERIC: the current members agreed on the future statutes, the host seat, formulated the technical and scientific description of ELI. All these documents are required to submit the so-called Step 1 application to the European Commission. After a thorough evaluation and assessment of the Step 2 application, the college of the Commissioners will approve the ERIC and this decision will be published in the Official Journal of the European Union.

ERIC is a legal framework governed by the EC Regulation 723/2009. It benefits from VAT and excise duties exemptions on its purchases in all EU Member States and it may adopt its own procurement rules under certain limits and conditions. Operation of the ELI ERIC will therefore be financed mainly by the contribution of its members.

Due to the uniqueness of ELI, there is an on-going and growing up interest about the possibility of joining the Consortium. (According to the Regulation, ERIC is open to EU member-states and international organizations). I encourage all readers of this newsletter to examine this possibility, thus giving their national research communities an opportunity to become part of the ELI success story in the next years.

First “Academia Meets Industry” forum at IEEE NSS/MIC in Strasbourg

HEPTech organized for the first time an academia-industry matching forum in the framework of the IEEE Nuclear Science Symposium (NSS) and Medical Imaging Conference (MIC), and 23rd International Symposium on Room-Temperature Semiconductor Detectors (RTSD) that took place from 29 October to 6 November 2016, at Palais de la Musique et des Congres, in Strasbourg, France.

The HEPTech forum was held on 1st November and attracted more than 60 attendants. In line with the topics that dominated the whole conference, its first two sessions explored new developments in the imaging systems, including PET imaging, and innovative solutions relating mainly to HEP and medical applications. Green particle physics was the focus of the third session. It discussed the so called “green accelerator experiment” in terms of the environmental stability.

The large attendance and motivation of the participants proved that this prestigious world conference would be the right place to further reveal the potential of our AIMEs.

The HEPTech forum was part of the overall industrial programme of the conference whose chair was Jean-Marie Le Goff of CERN, Chairman of HEPTech. The industrial programme comprised also an exhibition and integrated technical seminars. 83 companies presented products and services related to the nuclear science, medical imaging, and room-temperature semiconductor detectors.

The IEEE NSS/MIC takes place every year and has proved itself as one of the most prestigious world forums in its specific scientific domains. This year it attracted the interest of 1850 participants from the United States, Europe (Italy, France, Germany, and UK) and Asia (Japan, China and South Korea) and created a unique environment for scientific exchange and cooperation with industry.

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