NEWSLETTER

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Around the members

- "Horia Hulubei" Institute of Physics and Nuclear Engineering (ELI-NP), Romania
- DESY, Germany
- Sofia University, Bulgaria
- CERN, Switzerland

In focus:

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Successful laser power tests at ELI-Nuclear Physics

"Intermediate power tests were performed, reaching 3 PW of the high power laser system (HPLS)", Professor Nicolae Victor Zamfir, Project Director of the Extreme Light Infrastructure – Nuclear Physics (ELI-NP), stated, adding: "The entire laser system has been installed and components were tested. This follows the testing of the whole assembly."

The ELI-NP, a major European project valued at almost 310 MEuro without VAT, is co-financed by the European Commission and the Romanian Government from Structural Funds (SOP IEC) via the European Regional Development Fund. Its implementation began in 2013 on the Măgurele Physics campus (near Bucharest) and is expected to be completed and to start operation in 2020, under an "open access" scheme.

ELI-NP represents the Romanian research pillar of the pan-European distributed infrastructure ELI (http://www.eli-np.ro/about-eli.php), part of the ESFRI Roadmap, and is based on two main pieces of research equipment: a laser system composed of two 10PW beams and a gamma beam system that will produce highly collimated, high intensity gamma radiation with tunable energy up to 19 MeV. Due to the unique combination of these exquisite instruments, ELI-NP has the potential to be in the fore-front of science worldwide.

A research centre of a European stature, ELI-NP is expected to bring significant advances in basic sciences, such as laser, nuclear physics and astrophysics as well as important breakthroughs in applications of major societal interest in material and life sciences, and in management of nuclear materials.

The new ELI-NP facility in Magurele, Romania (Photo: ELI-NP)

European XFEL accelerator reaches its design energy of 17.5 GeV

The European XFEL has for the first time accelerated electrons to a level higher than that of any other X-ray free-electron laser in the world so far. In July, the superconducting linear accelerator brought electrons to its originally specified 17.5 GeV. Since its initial commissioning in 2017 to 14.9 GeV, the accelerator has been further ramped up gradually in terms of energy. Staff and operators of the DESY accelerator division powered up the last part of the 96-module accelerator and managed to accelerate electrons beyond the previous benchmark. "This is a tremendous success for the superconducting technology that has been pioneered by DESY and its international partners over the last three decades.", says Winfried Decking, head of XFEL accelerator operation.

A few months earlier, in March 2018, the European XFEL successfully started operation of its third light source. It will provide light for the MID (Materials Imaging and Dynamics) and HED (High Energy Density science) instruments scheduled to start user operation in 2019. All three light sources that successfully run in parallel will eventually provide X-rays for at least six instruments. At any one time, three of these six instruments can simultaneously receive X-ray beam for experiments.

DESY leads the international consortium of 16 renowned accelerator institutes and universities that constructed the largest superconducting linear accelerator of the world. More information

Screenshot of the European XFEL accelerator control display showing the electron energy at 17.5 GeV (Picture: DESY accelerator team).

Sofia University is leading a project for development of a Centre of Competence

The European Regional Development Fund and the Bulgarian government have awarded cca. 24 million BGN to the Clean&Circle project („Clean technologies for sustainable environment – waters, waste, energy for circular economy“) for creation and development of a Centre of Competence.

The project aim is to build an effective infrastructure and research capacity to develop innovations in the circular economy focusing on water, energy and waste management. It will be implemented by a Consortium led by Sofia University and involving three research institutes of the Bulgarian Academy of Sciences, three universities and a foundation.

The Centre's R&D and innovations programme involves development of approaches and technologies for recovery of natural resources in the course of the disposal of waste and wastewater - recovery of phosphorus and other chemical elements, of bio-products, and obtaining of valuable products (microbiological and augmentation preparations) from wastes.

New construction materials will be developed from construction waste and residues from waste disposal technologies. Green zeolites, valuable material for water and air purification and concentration and extraction of new valuable chemical elements present in water as a pollutant will be generated from waste ashes from heat plants and incinerators. Adsorbents and catalysts, mesopores and nanocomposites, useful for effective water treatment, will be produced from agricultural waste. The valuable for agriculture - compost and bio-fertilizers enriched with macro- and microelements will be obtained.

Innovative approaches and technologies for efficient use of energy in water cycles will be developed. Special innovations will be implemented and tested in energy production technologies from the biomass of excess active sludge, biomass from algal technologies in water treatment plants, and biomass of plant and food waste.

All these innovative approaches and future technologies are the steps towards the introduction of resource and energy efficiency in the water and solid waste sectors, towards the restoration of biological and technical resources, and sustainable development of the economy, environment and society.

They will lead to an increase in the competitiveness of the Bulgarian economy. A large part of the technologies envisaged are technologically advanced TRL-3, TRL-4.

Each created technology will be accompanied by a business plan and the most effective and efficient channels for its economic and technological dissemination and realization will be selected. These will be achieved with the support of the Technology Transfer Office of Sofia University, also involved in the project.

Research, technology, training and business innovations will serve as a powerful driver for introduction of the key elements of the circular economy linked to resource and energy efficiency in the "water" and "waste" sectors. The distance between the scientific achievements, real technologies and business will be shortened and gradually eliminated. The ultimate goal of the sought-after scientific and technological innovations is to turn any waste into a substantial raw material or energy with its maximum value, i.e. in each new element the technological, economic, environmental and social potential will be sought and evaluated.

The implementation of the above-mentioned innovation chain of the circular economy will involve students - bachelors and masters, PhDs, postgraduates, young researchers. They will be trained according to the dual system of "learning by doing" and "qualification in the course of the scientific and technological innovations", which in turn will ensure the sustainability of the CoC and will enable the financial investment to start playing off.

The CoC will be constructed, equipped and fully operational in the end of 2023.

The Cliean&Circle project team at its kick-off meeting

Particle detectors meet canvas

At CERN, the Medipix collaborations have been developing pixel detector readout chips since the 1990s, enabling high-resolution, high-contrast, noise-free images – making them unique for imaging applications. Medipix2, Medipix3, Timepix and Timepix3 are state-of-the-art particle imaging and detection readout chips. Now they are being used to bring about a revolutionary improvement in the field of art authentication and restoration. A new start-up company based in Prague, InsightArt s.r.o., has adopted the technology to perform spectral X-ray scans of paintings.

Bringing together scientists and art restorers, InsightArt uses these chips to perform highly detailed X-ray scans of artworks. Unlike more conventional X-ray systems used in art authentication, the InsightArt scanner produces "colour" X-rays where colours represent different materials, i.e. pigments, in a painting. Differences in materials are detected by measuring the wavelength of X-ray photons. Furthermore, by using a system with robotic arms, analysis can be expanded to sculptures and other antique objects.

It can take between ten minutes and two hours to scan a piece of art, depending on its type and size. The read-out chips work like cameras, recording images based on the number of photons that hit the pixels when the shutter is open. The result is an X-ray image with unprecedented contrast and information on X-ray wavelengths, permitting researchers to estimate the materials used to create the piece. This helps for instance to determine whether any modifications have been performed on it over time, and even whether or not it is an authentic piece. More information

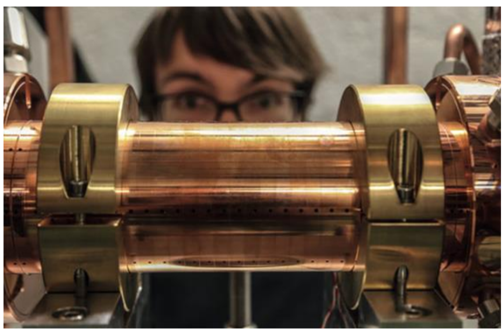
Slotting a painting into the X-ray scanner, which will analyse it at a high resolution. (Image: InsightArt s.r.o.)

CLIC technology lights the way to compact accelerators

The CompactLight project is a new European project that aims to use advanced linear-accelerator (linac) technology, developed at CERN and elsewhere, to develop a new generation of compact X-ray free-electron lasers (XFELs). XFELs work by accelerating electrons at almost the speed of light before sending them through "undulators", which are an array of magnets producing alternating magnetic fields. These fields deflect the electrons back and forth to produce high-intensity X-ray beams of unprecedented brilliance and quality. These X-ray beams provide novel ways to probe matter and allow researchers to make "movies" of ultrafast biological processes. By using a technology known as "X-band", linacs can accelerate electrons with higher accelerating-gradients, resulting in shorter accelerating cavities and hence a more compact machine. X-band technology is the result of years of intense research and development at SLAC in the US, KEK in Japan and at CERN in the context of the Compact Linear Collider (CLIC) project.

Compared with existing XFELs, the proposed facility can have a lower electron-beam energy (due to the enhanced undulator performance), so can be more compact (with both lower energy and a higher accelerating-gradient) and have lower electrical power demand.

The 3-year CompactLight project, funded by the EC's Horizon 2020 programme, brings together a consortium of 21 leading European institutions, including Elettra, CERN, PSI, KIT and INFN, in addition to seven universities and two industry partners. More information



A CLIC X-band prototype built by PSI using Swiss FEL technology. (Image credit: M Volpi)

IN FOCUS

An outstanding example of a successful technology transfer at DESY

The MicroTCA Technology Lab opened at DESY as an outstanding example of technology transfer from the field of fundamental research to broader practical applications. The facility is a Helmholtz Innovation Lab and is working on a versatile, precise and extremely reliable communications technology that can be used not only in particle accelerators but also, for example, in industrial automation settings. “The MicroTCA Technology Lab at DESY shows how much science and industry can learn and profit from each other,” says DESY’s Chief Technology Officer Arik Willner.

Top demands call for top precision and this is available through the electronics standard MicroTCA.4, which DESY has been instrumental in developing and which is based on the well-established telecommunications standard Micro Telecommunications Computing Architecture. It was adapted for controlling the X-ray free electron laser European XFEL, for example, because operating such a major research facility makes very high demands, necessitating an extension of the standard in terms of safety, remote control and redundant operations. Today, the open electronics standard MicroTCA.4 not only ensures the safe operation of the particle accelerator used by European XFEL but also allows usage in other research institutions and by numerous industrial companies, both in Germany and around the world.

MicroTCA Technology Lab was set up at DESY in order to give the business world access to the development of further applications and was ceremoniously opened in the presence of DESY’s Board of Directors, the developers and partners from industry and commerce. The team at MicroTCA Technology Labs has already been working successfully with a number of renowned companies in the electronics industry for several years. Its industrial partners are CAENels, N.A.T., Schroff (PENTAIR), Powerbridge, Rohde & Schwarz, BEVATECH and elspec.

“The on-going development of the deliberately open standard is being driven forward both by industrial partners and by other research institutions, with everyone standing to benefit equally,” explains Willner. “We are particularly pleased that so many industrial companies are now coming to our Technology Lab, which is one of the seven Helmholtz Innovation Labs in Germany. Contract developments, carrying out measurements, offering advice on the design of new systems, training courses, test runs and quality checks, as well as an open exchange of ideas at an annual workshop – all these services and elements of TechLab can benefit industrial companies.”

Helmholtz Innovation Labs are places where scientific expertise is brought together with the needs of industry and its customers. They give rise to long-term “enabling spaces”, in which ideas are tried out. Their aim is to involve corporate partners in joint development projects in the long term. This commercialisation concept, as a “Think and Do Tank”, distinguishes Helmholtz Innovation Labs from pure research labs.

More information at https://techlab.desy.de

The electronics standard MicroTCA.4, which DESY has been instrumental in developing, allows for versatile, precise and extremely reliable applications, not only in accelerator technology. (Credit: DESY, Heiner Müller-Elsner)

HEPTech upcoming events

- HEPTech Internal Workshop, 11th October 2018, at CERN, with VideoConference

- AIME: Machine Learning and Visual Analytics in the Clouds Workshop, 29-30 October 2018, Budapest, Hungary

- Best practice Workshop between HEPTech and Accelerate partners on how industry can access beamlines, 14th November 2018, at DESY, Hamburg, Germany

- "Advanced Imaging Techniques for Industry", an industry event organized by Accelerate and HEPTech, 15th November 2018, at DESY, Hamburg, Germany

- Steering Committee, 21st November 2018, at CERN, with VideoConference

- Board Meeting, 7th December 2018, at CERN, with VideoConference