FELs OF EUROPE NEWS 3|16

3. ISSUE | www.fels-of-europe.eu

PSI researchers Christoph Hauri, Carlo Vicario and Mostafa Shalaby (from left to right) in the laser laboratory at PSI. The terahertz laser developed at PSI is currently the world's most intensive source of terahertz light. (Photo: Paul Scherrer Institute/Markus Fischer)

High-performing nonlinear visualization of terahertz radiation on a silicon charge coupled device

Researchers from the Paul Scherrer Institute PSI have succeeded in using a commercially available camera technology to visualise terahertz light. In doing so, they are enabling a low-cost alternative to the procedure available to date, whilst simultaneously increasing the comparative image resolution by a factor of 25. The special properties of terahertz light make it potentially advantageous for many applications, from safety technology to medical diagnostics. It is also an important tool for research. At PSI, it will be used for the experiments on the X-ray free-electron laser SwissFEL. The system developed at PSI is one of the most intensive single cycle sources of terahertz light. The researchers are presenting their findings in the scientific journal "Nature Communications". CH

Reference: Mostafa Shalaby, Carlo Vicario, Christoph Hauri, *Nature Communications,* 26 October 2015; DOI: 10.1038/ncomms9439

The international Science@FELs Conference, organized by Elettra – Sincrotrone Trieste, will take place from September 5 to September 7, 2016 in Trieste. This conference is a follow up of the Science@FELs 2014 at the Paul Scherrer Institute and the one in 2012 at DESY and will henceforth be organized regularly as an activity of the Collaboration of European FEL and SPS Facilities (FELs OF EUROPE). This year Laserlab Europe will take part in the organization of the Science@FELs conference with the aim to stimulate more extensive cross-fertilization and collaboration between the two communities, i.e. those working with lab-scale lasers and FELs, respectively.
Science@FELs 2016 will focus on the scientific highlights achieved during the last years in the fast evolving development and operation lasers sources that are enabling experiments to shorter wavelengths, adding element and chemical state specificity by exciting and probing electronic transitions from core levels.

Registration is open! EP

https://www.elettra.eu/Conferences/2016/Science_at_FELs/

Widely tunable two-color pulses for double resonant pump-probe experiments at FERMI

Many crucial aspects of the spectral and temporal characteristics of free-electron lasers can be tailored to specific needs by an accurate control of the lasing process. In particular, the ability to create two FEL pulses of differing wavelengths separated in time by a controlled delay (two-color mode) has enormous potential for femtosecond time-resolved studies. Two-color FELs open up unique opportunities for studying the dynamic response in atomic, molecular and solid state systems by tuning both the pump and the probe wavelengths to selected core electron resonances. The conceptual and experimental development of two-color schemes engenders major research efforts at all FEL facilities worldwide [1], with the ambition of optimizing wavelength and timing control.

Two-color sources are currently constrained by limited wavelength tunability. In a recent experiment, Ferrari *et al.* [2] designed a new configuration of the FERMI source to deliver two time-delayed FEL pulses with different wavelengths, each tunable independently over a broad spectral range. This new two-color seeded source meets the requirements of double-resonant FEL pump / FEL probe studies, providing improved conditions for two-color experiments. The new scheme is based on seeding the electron bunch with two time-delayed optical laser pulses and on splitting the FEL radiator in two independent sub-sections (Fig. 1). The two colors can be tuned over the entire FEL range and their polarization state can be set independently, a feature of special importance for atomic and molecular physics studies.

The performance of the new source scheme was tested in a resonant scattering experiment, probing the femtosecond magnetization dynamics in systems containing two magnetic elements, Fe and Ni. The Ni demagnetization process was analyzed in two compounds, permalloy and Ni-ferrite, comparing the effect of tuning the pump wavelength on/off the Fe 3p-3d core resonance. While no difference was observed in permalloy, releasing the pump energy preferentially at the Fe site had a clear effect in Ni-ferrite. The different behavior can be ascribed to the direct hybridization of delocalized Fe and Ni 3d orbitals in permalloy vs. indirect exchange of more localized 3d orbitals in the ferrite.

The two-color XUV source developed at FERMI covers the 3p resonances of Mn, Fe, Co and Ni, making a wide class of relevant magnetic materials accessible to resonant FEL pump / resonant FEL probe experiments. It can find original applications in many other fields of condensed matter, atomic and molecular physics. In general, it enables the excitation of a particular energy and polarization selected core resonance on a well-defined atomic site in a complex system and makes it possible to study its dynamic response with a second FEL pulse tuned to probe another atomic site and/or electronic subshell. This new source offers unprecedented opportunities for probing complex relaxation processes, such as Auger cascades, sequential multiple ionizations and charge transfer dynamics. MS

References

[1] E. Allaria *et al.,* Nat. Commun. 4, 2476 (2013); T. Hara *et al.,* Nat. Commun. 4, 2919 (2013); A. A. Lutman *et al.,* Phys. Rev. Lett. 113, 254801 (2014); A. Marinelli *et al.,* Nat. Commun. 6, 6369 (2015).

[2] E. Ferrari *et al.,* Nat. Commun. (2016).

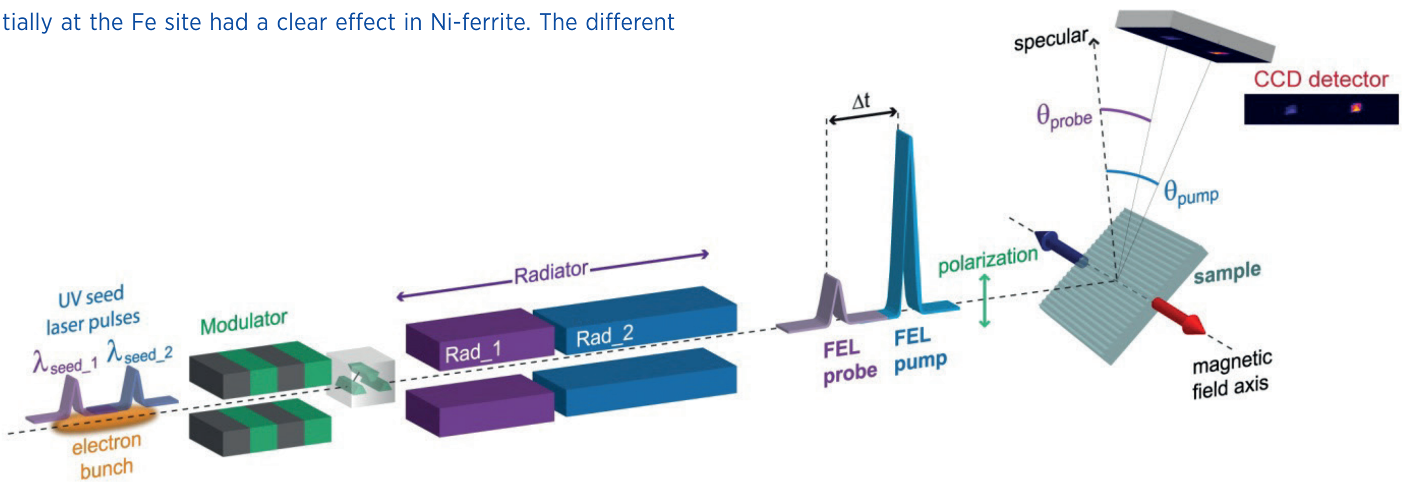


Figure 1. Sketch of the double-resonant FEL-pump / FEL-probe experiment. Two time-delayed UV pulses of different wavelengths interact with the electron bunch in the Modulator. The twin-seeded bunch goes through the Radiator, which is split in two independently set subsections. Two time delayed FEL pulses are produced, whose wavelengths are tuned by selecting the UV seeds and the radiator settings. The first pulse, tuned to the Fe 3p→3d resonance, pumps the Fe-Ni sample, while the second, tuned to the Ni 3p→3d core excitation, probes the Ni ultrafast demagnetization in a resonant magnetic scattering experiment.

Mimicking water splitting with a bare manganese oxide cluster

The oxygen evolving complex (OEC) acts as a biocatalyst in photosynthesis, splitting water with the help of absorbed sunlight. This process takes place on the surface of calcium-manganese oxide clusters in the center of the OEC. The OEC enzyme has received ample attention not only because of its crucial role in photosynthesis in biological systems, but also for its potential relevance for artificial water splitting in the quest for renewable energy sources. In the FELIX laboratory, a team of researchers from Germany, the USA and the Netherlands have studied the isolated manganese oxide cluster, which mimics the working of the OEC, and probe its interaction with individual water molecules through IR spectroscopy with the free electron laser FELIX. This simplified system allows for the elucidation of molecular processes involved in water evolution.

The model cluster is found to deprotonate several water molecules, which is an important prerequisite for a water oxidation reaction. We found that the bare cluster, which does not resemble the cluster in the OEC, transforms into a structure that is very similar to that in the OEC upon the adsorption of water molecules. Therefore, the capacity for water deprotonation is an inherent property of the cluster and its shape in the biological system is independent of its complex protein surrounding.

This study is a first step in bio-inspired research to mimic the processes that biology offers us. Eventually, closer mimicking of the photosynthesis process in the laboratory may come within experimental reach, providing abundant and energy efficient catalysts for (solar) hydrogen production.

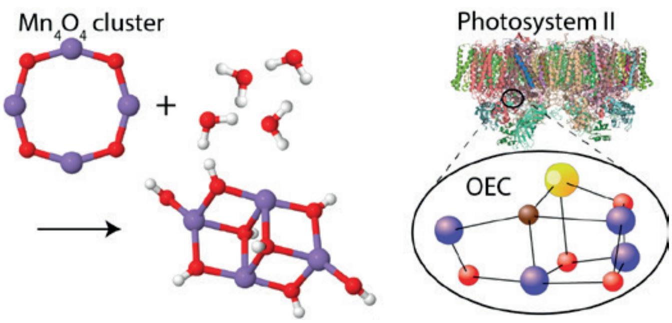
The IR wavelength range and laser intensities offered at the FELIX Laboratory at Radboud University are crucial to investigate the complex molecular level structure of the manganese oxide clusters in the presence of water molecules in full detail. JB

Reference:

'The Interaction of Water with Free $Mn_4O_4^+$ Clusters: Deprotonation and Adsorption-Induced structural Transformations'
Sandra M. Lang,* Thorsten M. Bernhardt, Denis M. Kiawi, Joost M. Bakker,* Robert N. Barnett, and Uzi Landman*
Angew. Chemie Int. Ed. 2015, 54 (50), 15113–15117 doi: 10.1002/anie.201506294

Further information:

Dr. Joost Bakker, FELIX Laboratory, Radboud University, Nijmegen, The Netherlands, j.bakker@science.ru.nl or felix@science.ru.nl



Kick-off TELBE

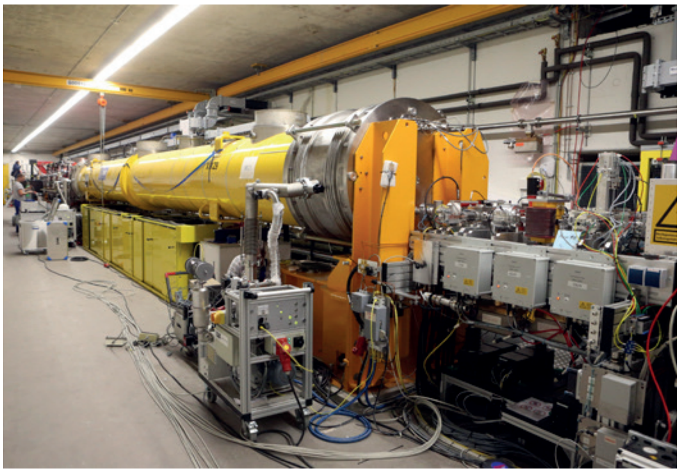
More than 40 participants from 11 different research institutes and universities from across Europe met for the 2-day Kick-off meeting for the new TELBE THz user facility at the ELBE Center for High-Power Radiation Sources at the HZDR. The TELBE facility starts with 2 weeks of "friendly user" operation per beamtime period in the 2nd semester of 2016. It complements the available IR and THz spectrum at the center with the lower end of the THz spectrum between 0.1 and 3 THz. In difference to the FELBE FEL facility its provides not only high average power but also high THz fields at user determined repetition rates and with a unique timing to external lasers in the few 10 femtosecond regime [1]. Future users from areas as diverse as accelerator R&D, material sciences and life sciences were invited to present their experimental ideas and experimental requirements. Each of the respective sessions was ended with a round-table discussion on the short-, medium- and long term ideas and requirements of the respective user communities. MG

Participants in the coffee break after the Accelerator R&D and Magnetism session on day 1 of the meeting

Reference

[1] B. Green et. al., *High-Field High-Repetition-Rate Sources for the Coherent THz Control of Matter,* Scientific Reports 6 (2016), 22256

European XFEL enters final phase of construction



The installation of components at the European XFEL is entering its most intense phase as the X-ray laser counts down to user operation. The 3.4 km long facility is expected to begin commissioning at the end of 2016, with the first user experiments starting in 2017. Many critical milestones are being reached on the road to the facility's opening.

In 2015, progress with the accelerator installation ramped up. The DESY-led Accelerator Consortium achieved a major milestone in December with the first electrons accelerated in the injector section of the facility. By the end of January 2016, over 60 of the required 100 modules were in place in the accelerator tunnel. Meanwhile, crews installed infrastructure such as the focusing magnets, beamline pipes, transfer lines for liquid helium, and many other components.

Also making rapid progress are the undulators. In December, the European XFEL undulator group began installation of the 35 undulator segments needed for the first two instruments that will go online in 2017, and by late January all major components were in place. The undulator group expects to have all three of the European XFEL's starting undulators in place and operational by the end of 2016.

The other technical and scientific groups are also hard at work installing infrastructure. Crews are installing the physical beamlines through which the X-ray flashes will travel to the facility's underground experiment hall in Schenefeld, where the six starting scientific instruments will be located. To direct these beams while preserving their unique laser-like properties, European XFEL and collaborators are constructing some of the most precise mirrors in the world. In the experiment hall, crews are building the hutches for the six starting instruments. Soon, the assembly of the first two scientific instruments, FXE and SPB/SFX, will begin.

Groups are busy implementing data analysis, control systems, and IT infrastructure across the facility's length. Developments are ongoing on the facility's in-house control and analysis software framework, Karabo, and new devices are being integrated continually. The systems being installed in the tunnels and experiment hall will ensure that the facility's components work to be able to produce and record massive amounts of femtosecond-timescale data.

In June 2016, European XFEL staff members will settle into their offices in the new headquarters building above the experiment hall. The headquarters building also includes laboratories where users can prepare their samples before analysis at the scientific instruments, as well as clean rooms for detector development, laser laboratories, and many other specialized technical workspaces.

On the final week in January 2016, the joint European XFEL and DESY Photon Science Users' Meeting attracted over 1000 scientists from 29 different countries, many eagerly anticipating the first experiments next year. At the meeting, they were informed that the first call for user experiment proposals is scheduled to be released towards the end of 2016. JP

Update on CLARA

Phase 1 of the CLARA FEL Test Facility at Daresbury Laboratory in the UK has commenced installation. When the test facility is complete it will be able to test new ideas and concepts which can then be applied to FEL user facilities, existing or planned. The particular aspects of the FEL output that we are focussing on are the generation of ultrashort pulses, increasing shot to shot stability and achieving extreme synchronisation levels. In addition CLARA will be an ideal test bed for proving new accelerator technologies. As such Phase 1 of the project includes the installation of an in-house designed high repetition rate (400Hz) normal conducting RF photoinjector. Also included is a 2m long S-band linac and so the maximum beam energy for this phase will be about 50 MeV. Commissioning with beam will commence in May 2016 whilst procurement continues on the other hardware required to complete CLARA. JC

The photo shows the first modules of CLARA installed alongside VELA at Daresbury.

European XFEL and DESY Photon Science Users' Meeting with record participation: Registrations pass 1000-mark for the first time

On 27–29 January, over 1000 scientists from around the world came to Hamburg for the European XFEL and DESY Photon Science Users' Meeting. This joint annual event in the last week of January has become more and more attractive in the last years, with the upcoming start of user operation at the European XFEL next year and the first scheduled user experiments on the new FLASH2 beamlines and also on the first PETRA Extension beamlines this year.

In Wednesday's sessions, European XFEL presented its installation progress and the current status of the six scientific instruments and the optical lasers as well as various aspects of the beginning of user operation in 2017.

Thursday morning was dedicated to current activities and future plans at FLASH and a science session with recent highlights from soft X-ray free electron lasers.

Friday morning was reserved for the traditional synchrotron radiation users' meeting with a general overview presentation by the Photon Science director, several science highlight presentations from PETRA III and brief reports from the chairs of the Users Committee and the European Synchrotron User Organisation.

On Friday afternoon, a joint poster session and a vendor exhibition were organised featuring over 350 posters and 61 companies distributed over three buildings.

The main programme was complemented by a number of satellite workshops which were organised by European XFEL and DESY scientific groups and mainly held on Thursday afternoon, covering specific user communities and scientific instruments as well as sample environments for biological studies and X-ray diagnostic devices developed for the European XFEL and other light source facilities.

Once more, European XFEL provided bursaries for 34 young scientists who came from 11 countries across the globe, including Russia, Slovakia, Poland, and Italy. SM/JF

Figure: The beginning of the Users' Meeting, with European XFEL Managing Director Prof. Massimo Altarelli in waiting position for his opening talk.

MAX IV – on the way to inauguration

On 21 June 2016 the MAX IV facility is being inaugurated. On the brightest day of the year, the brightest hour and the brightest light source.

In December 2015 darkness was manifested by the closing down of the old MAX-lab facility on the Lund University Campus. With that 30 years of very successful synchrotron radiation came to an end.

The MAX IV facility has been in its commissioning mode since 2015. The linear accelerator is now operating routinely up to 3 GeV and specifications for injection into the storage rings. The 3 GeV ring started commissioning in August 2015 and is now tuned towards full performance. At time being > 100 mA can be stored and beam injected in top-up mode during commissioning operation. The machine is thus ready for light into beamlines, and the first two undulators have been installed during a short shut-down in February 2016. The BioMAX and NanoMAX undulators are in-vacuum devices with 2 m length, 18 mm period and a minimum gap of 4.2 mm. (photo)

Meanwhile the FemtoMAX beamline taking short pulses (100 fs) at 3 GeV directly from linac is close to completion. Two 5 m long in-vacuum undulators with a period of 15 mm are installed and will provide light up 20 keV. First light on samples is expected in the near future.

After many years of extremely successful accelerator design and operation Professor Mikael Eriksson is now stepping down from the role as Machine Director at MAX IV. Since 15 February 2016 Pedro Fernandes Tavares has taken over as Machine Director. SW

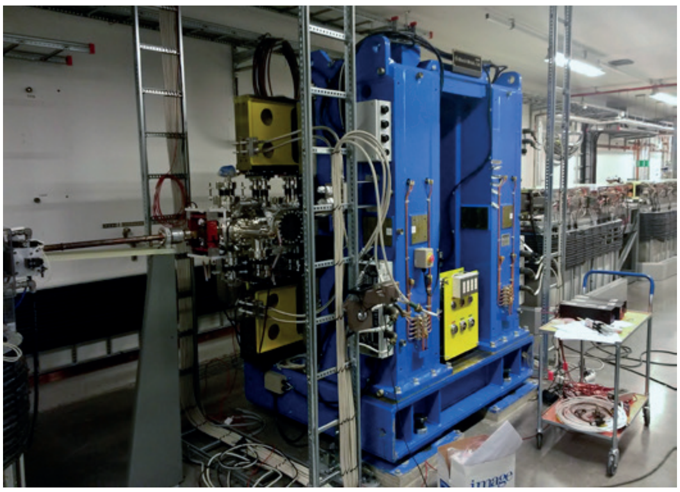


Photo: The in-vacuum undulator for the BioMAX beamline being installed at MAX IV in Lund. (Photo: S. Werin)

FELIX Laboratory officially opened

FELIX / Victor Claessen

October 2015 was an eventful month for the FELIX Laboratory: it was officially opened by the Dutch State Secretary for Education, Culture and Science Sander Dekker, an inspiring user meeting was organised and the first lasing of the FELICE laser was achieved.

The Free Electron Lasers for Infrared eXperiments (FELIX) Laboratory at Radboud University in Nijmegen (The Netherlands) exploits a suite of unique intense pulsed (far)infrared and THz free electron lasers. The four lasers FELIX-1, FELIX-2, FELICE and FLARE each produce their own range of wavelengths. Together, they provide a tuning range between 3 and 1500 μm to experiments in the infrared and terahertz spectrum.
The grand opening festivities on October 30 consisted of an open house in the FELIX Laboratory, several short lectures, speeches by Sander Dekker and Gerard Meijer - the president of the executive board of Radboud University - and an official opening act.
Prior to the opening, a user meeting with more than 80 participants including 50 external guests was organised, allowing interested users to get to know more about the facility, meet each other, discuss projects, challenges, opportunities and present needs and wishes.

Timely for opening and user meeting, the first lasing of the FELICE laser was achieved in October 2015, bringing the entire suite of FELs to full operation. The FELICE laser beam line, which is tunable in the region of 5–100 μm, allows intra-cavity user experiments in a dedicated molecular beam cluster setup and an FTICR mass spectrometer, in particular suited for 'action' spectroscopy of clusters and (complex) molecules and ions in the gas phase. IK/BR

RU/Joeri Borst

FERMI facility status

Last January three important installations were fulfilled in FERMI. Two new accelerating structures were installed in the injector while the two existing ones were moved to the high energy part of the LINAC; in this way up to 100 MeV additional energy gain in the LINAC is expected. Furthermore, the radiator of the first stage of FEL-2 has received its third undulator section, an EPU as the already installed ones; this should guarantee more intense FEL emission from the first stage, relaxing the power requirements on the seed laser. Together with the new regenerative amplifier for the FEL-2 seed laser, that will produce shorter pulses and larger tunability at UV wavelengths, this should provide an improvement of the FEL-2 operation for users, in terms of stability and uptime. A dedicated machine run to commission these new installation is scheduled between February and March.
Also the two new beamlines, TIMER and TeraFERMI are under commissioning. TIMER is available for users since the fifth call for proposals. At the end of January deadline, 72 proposals were submitted for experiments on the four experimental stations that are now available on FERMI. MSv

Installation progress of the SwissFEL

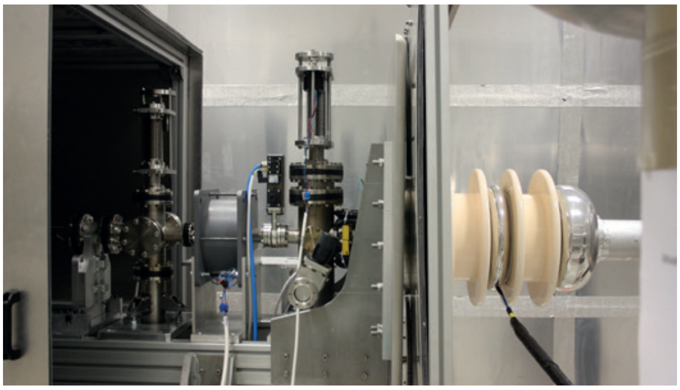
The installation of the linear accelerator (LINAC) progresses very well. At the beginning of February, the last girder of the so-called "LINAC 1" was installed in the SwissFEL tunnel. The entire C-band accelerator consists of LINAC 1, LINAC 2, and LINAC 3, and a total amount of 104 accelerating structures. Meanwhile, 38 accelerating structures are installed in the SwissFEL tunnel. The assembly work on the remaining LINAC modules will take place until end of September 2016. By then it is planned to finish the installation of all LINAC modules in the SwissFEL tunnel.
Furthermore, on the 25th of January, the first "completed" undulator has been transported to its final position in the SwissFEL tunnel. The 1064 permanent magnets of this undulator where shimmed to the sub-micrometer level and the magnetic profile has been carefully measured for the full gap range. Twelve of such undulators will be installed by October 2016! MvD

LINAC1 within the SwissFEL tunnel

Figures: Undulator being transported to final destination in SwissFEL tunnel.

Turkish Accelerator and Radiation Laboratory in Ankara (TARLA)

The Turkish Accelerator and Radiation Laboratory in Ankara (TARLA) facility is under construction at Institute of Accelerator Technologies of Ankara University. The TARLA machine which is based on superconducting technology is designed to accelerate the electron beam up to 40 MeV in quasi-cw mode at maximum current of 1.5 mA with a bunch duration of 0.4-5 ps and adjustable repetition rates between a few Hz and 13 MHz. The machine will operate as a multi-experiment facility for different electron-based secondary radiation sources. Current founded scope of TARLA consists of operating one FEL line in the range of 3-20 microns and a Bremsstrahlung radiation production setup up to 30 MeV. Four FEL experimental stations will be available for users in the field of material research, infrared spectroscopy, bio-micro spectroscopy and ultra fast photon research.



The thermionic triode DC electron gun at cw mode and maximum 300 kV energy is operating since 2014 and the cryoplant of facility is installed and will be commissioned until May 2016. The injector part of accelerator is planned to be commissioned by the end of 2016. Two superconducting accelerating modules will be delivered by the end of 2016 and in the first quarter of 2017. A 20 MeV section of the accelerator is planned to be operated in 2017 and the second part will be operated in 2018. First lasing is planned to be achieved in 2019 and provided to the users in same year. However, laser users will start to use experimental stations with conventional sources in 2017.
The user and scientific advisory meetings are organized every year periodically since 2013. The first application of the facility is proposed to be fixed target experiment such as radiation damage and hardness experiment. On the other hand the first FEL application is proposed to be pump-probe experiments. AA

EUCALL Kick Off and First Milestones

In October 2015, the European Cluster of Advanced Laser Light Sources (EUCALL) project officially started and EUCALL's Kick-Off meeting took place during 29-30 October at the Centre for Free Electron Laser Science at DESY in Hamburg.

The purpose of the EUCALL project is to generate collaboration and synergy between large scale sources of laser-driven and accelerator driven X-ray radiation. The project is coordinated by the European X-ray Free Electron Laser (XFEL), the other partners are DESY, the Extreme Light Infrastructure (ELI) with its three facilities in Czech Republic, Hungary, and Romania, ESRF in Grenoble, Helmholtz Zentrum Dresden-Rossendorf, Lund University, Paul Scherrer Institute, and Elettra Sincrotrone Trieste. The networks Laserlab-Europe and FELs of Europe are also involved, while representatives from the user communities of FELs and Optical Lasers are members of EUCALL's steering committee. EUCALL is the first comprehensive effort to bring together the two scientific communities who have been using X-ray light in parallel to each other, and from different scientific and technological backgrounds.

Under EUCALL, the facilities work together on common methodologies and research opportunities, potentially sparking new scientific investigations, as well as new applications and private-sector innovation, and develop tools to sustain this interaction in the future. There are Work Packages (WPs) for EUCALL's management, dissemination strategies and for development of Synergy of Advanced Light Sources, as well as four technical WPs. These are devoted to the development of new software for simulation and processing of advanced radiation experiments, as well as for new hardware for standardised sample delivery and beam diagnostics for ultra-fast laser experiments. The project has received funding of 7M€ from the EU's Horizon 2020 research and innovation program and runs until September 2018.

"EUCALL is a great opportunity to create and shape a broad, sustainable collaboration between laser based and accelerator based light source infrastructures" says Josef Feldhaus, DESY's representative on EUCALL's steering committee. "This will substantially contribute to improved performance and output of these large investments to the benefit of science and innovation. Our facilities are based on highly specialised, complex systems, therefore we are eager to collaborate in the further development and integration of techniques: we contribute our knowhow, benefit from partners' knowhow and find optimised solutions. We exploit synergies, we avoid duplication of effort, and we standardise soft- and hardware components. This facilitates access for users who need to use different facilities for their research, and optimises the efficient use of the facilities."

Since the Kick Off, EUCALL's first two technical Milestones have been completed. These achievements were made by the High Repetition Rate Sample Delivery (HIREP) Work Package. With HIREP's milestones, the first steps towards an integrated concept for decentralized sample characterization and fast sample positioning at EUCALL's facilities have successfully been made. It shows that scientists from EUCALL's network are successfully cooperating just four months into the three year project period.

www.eucall.eu GA

SC meeting Dresden

The 22nd meeting of the steering committee (SC) of FELs OF EUROPE was held on 28 and 29 September 2015 in Rossendorf, Dresden, Germany, hosted and organized by the Helmholtz Zentrum Dresden/Rossendorf (HZDR). The meeting was chaired by Rafael Abela, Chair of the SC, and started with a short welcome and introduction to HZDR and its different facilities by Prof. Roland Sauerbrey, Scientific Director of HZDR.

The first day of the SC meeting was dedicated to the discussion on ways to strengthen the collaboration and increase its visibility at the European and international level. As part of this (the late and greatly missed) Prof. Wolfgang Sandner, in his function as new chair of the association, was invited to give an introduction to the ERF-AISBL Association of European Research Infrastructure Facilities and to discuss the opportunities and possible involvement of FELs of Europe. In line with the formulated aim to establish collaborations with the neighboring communities, Rafael Abela reported on a meeting in Munich with representatives of the Laserlab-Europe and ELI consortia. As a first concrete action, Laserlab-Europe will participate with the organization of one special session in the FELs of Europe conference "Science@FELs" which will take place in September 2016 in Trieste, Italy.

The focus of day two was on future plans and projects including a discussion of applications in response to Horizon 2020 calls "INFRAIA-01-2016-2017: Integrating Activities for Advanced Communities" and "INFRAIA-2-2017: Integrating Activities for Starting Communities". Moreover, the participation of FELs of Europe in the EUCALL project – a cluster project with the idea to build up a bigger community around ESFRI projects and the foster the implementation of ESFRI projects has been reminded of.

Participants were also informed about updates, news and activities of the facilities, collaboration activities as website, newsletter, the preparation of the Whitebook and the planning and organization for the third Science@FELs conference Trieste in 2016.

MH/BR

CURRENT AND UPCOMING CALLS FOR PROPOSALS

for Experiments at FLASH for the beamtime period January – June 2017
Deadline: 1 April 2016
http://photon-science.desy.de/users_area/calls__deadlines/index_eng.html

for Experiments at FELBE for the beamtime period August 2016 – January 2017
Deadline: 15 April 2016
https://www.hzdr.de/db/Cms?pNid=1732

for Experiments at FELIX for the beamtime period October 2016 – March 2017
Deadline: 15 July 2016
http://www.ru.nl/felix/facility-0/application/

UPCOMING EVENTS

Erice Workshop "Trends in Free Electron Laser Physics":
17–23 May 2016, Erice, Sicily, Italy
https://agenda.infn.it/conferenceDisplay.py?ovw=True&confId=10613

INTERNATIONAL SCHOOL OF SOLID STATE PHYSICS – 68th Course: The Free Electron Laser for Ultrafast Imaging at the Nanoscale
5–10 June 2016, Erice, Sicily, Italy
http://noxss.fisica.unimi.it/

Ultrafast X-ray Summer School (UXSS)
June 12–16, 2016, SLAC National Accelerator Laboratory, Menlo Park, California, USA
https://ultrafast.stanford.edu/uxss-2016

Science @ FELS 2016
5–7 September 2016, Trieste, Italy
http://www.elettra.eu/Conferences/2016/Science_at_FELs/

IMPRINT

Publisher: FELs OF EUROPE, chaired by Dr. Rafael Abela, Paul Scherrer Institut | 5232 Villigen PSI | Switzerland
Editors: Britta Redlich, Mirjam van Daalen
Contact: info@fels-of-europe.eu | www.fels-of-europe.eu | phone +41 56 310 32 71
Articles: Avni Aksoy (AA), Graham Appleby (GA), Joost Bakker (JB), Marie-Emmanuelle Couprie (MEC), Jim Clarke (JC), Mirjam van Daalen (MvD), Bernd Ebeling (BE), Josef Feldhaus (JF), Michael Gensch (MG), Christoph Hauri (CH), Manfred Helm (MH), Iris Kruijen (IK), Claudio Masciovecchio (CM), Sergei Molodtsov (SM), Joseph Piergrossi (JP), Emiliano Principi (EP), Britta Redlich (BR), Maurizio Sacchi (MS), Barbara Schramm (BS), Michele Svandrlik (MSv) and Sverker Werin (SW).

FELs OF EUROPE is an initiative of the ESFRI projects EuroFEL and European XFEL. It is a collaboration of all free electron laser (FEL) facilities in Europe, with the goal to meet the technological and scientific challenges of these novel and rapidly developing technologies and to provide a worldwide unique, pan-European research infrastructure that enables exploiting the full scientific potential of these unique accelerator based short-pulse light sources. More info at: www.fels-of-europe.eu

FELs OF EUROPE