EuroFEL NEWS

06|11

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3rd Annual Meeting at HZB in Berlin

With a three-day meeting in March, the EU project IRUVX-PP – the "Preparatory Phase" of EuroFEL, one of the ESFRI Roadmap projects – was brought to an end. The event was hosted by Helmholtz-Zentrum Berlin, one of the project partners.

117 participants registered for the meeting in Berlin Adlershof. They made a very positive résumé: during the three years of the project, new networks have been created between the partners on different levels, not only including scientific and technical innovations but also other important areas such as user access and optimal use of the facilities, coordinated training and exchange of personnel, and improved internal and external communication.

The perfectly organised meeting started on a sunny Monday with status reports of the national FEL projects. A lively panel discussion on the future „European collaboration of FEL and SPS facilities" rounded off the first day. The discussion made evident that centrally coordinated collaborations in FEL science and technology need to be strengthened. On Tuesday, the work package leaders summarised their project results and presented highlights from three years of project work. In the afternoon, working groups elaborated proposals for further activities after the end of IRUVX-PP. One of the working groups held a separate satellite meeting on "Timing and Synchronisation" with presentations of the latest developments, results and experiences. The last meeting day focused on recent highlights from FEL science and technology developments themed "EuroFEL provides access to cutting-edge technology".

"IRUVX-PP developed the scope and the structure of a sustainable European FEL consortium. I hope that the results we obtained convince the decision makers", said coordinator Josef Feldhaus.

Dear readers,

the IRUVX-PP project is finished, the final reports are nearly completed. IRUVX-PP has prepared the basis for EuroFEL, a European distributed research infrastructure of FELs and other advanced, accelerator based short-pulse photon sources.
It will still take some time to reach a final agreement and to formally establish the consortium, therefore it is crucial to maintain the momentum gained during the preparatory phase and to continue our collaboration at a reasonable level even without external funding. This has been recognised by the partners and a memorandum of understanding is currently under discussion to cover this intermediate phase. We hope to include also the European XFEL which is currently under construction and very much interested to participate in the EuroFEL activities.

Sincerely,

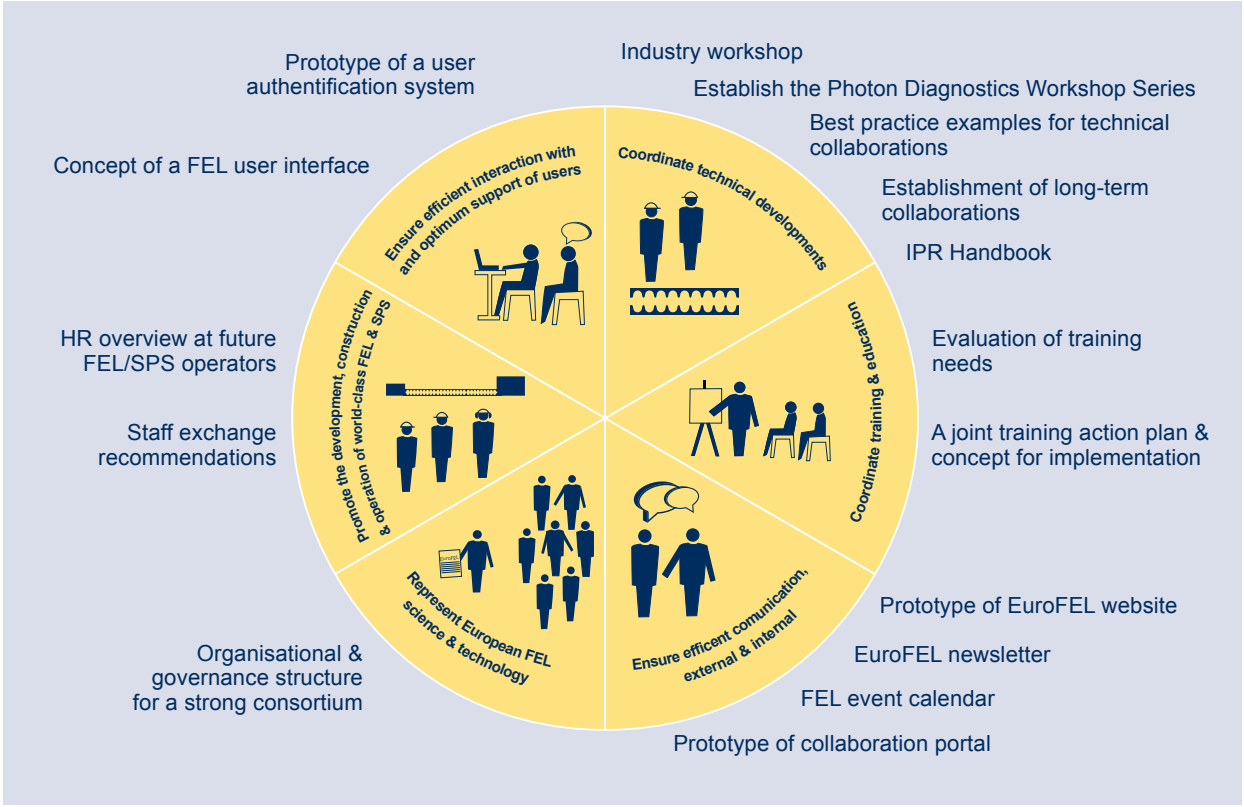
Josef Feldhaus, Ute Krell
& Matthias Kreuzeder,
IRUVX-PP Coordinator Team

IN THIS ISSUE

EuroFEL
FREE ELECTRON LASERS OF EUROPE

EuroFEL is part of the ESFRI Roadmap since 2006. The preparatory phase of EuroFEL (IRUVX-PP) prepared the establishment of the EuroFEL Consortium to link FEL & SPS facilities in Europe closer together. IRUVX-PP has been funded by the European Commission under FP7 from April 2008 to March 2011.

3 years of IRUVX-PP



The core activities of the future EuroFEL consortium and the most important results of its preparatory phase project IRUVX-PP

After three years of hard work, the IRUVX-PP project, the preparatory phase of EuroFEL funded by the EC under FP7, finished in time on 31st March 2011. IRUVX-PP was an unusual and challenging project for all participants: firstly, because it dealt largely with non-technical aspects such as legal and organisational structure and governance, the development and exchange of personnel, communication within the consortium and with outside partners, handling of intellectual property and issues related to user access. Secondly, EuroFEL was the first “distributed research infrastructure” among the physical and analytical facilities on the ESFRI Roadmap 2006. At that time it was not much more than a vague idea of a few individuals and there was no prototype example.

The objective of IRUVX-PP was basically to turn this idea into reality. Accordingly, the project started with a careful analysis of why a strong EuroFEL consortium would indeed much better exploit the full potential of Free Electron Laser light sources for science and innovation and where the bottlenecks are to realise and operate such a distributed research infrastructure in Europe.

It determined the core activities of the consortium and how they would benefit the user community and the individual facilities. In addition, it worked out in great detail how this could be organised, and produced a number of important results for the future collaboration, such as a regular EuroFEL Newsletter, a prototype website and essential components of a common user portal. It also proposed a governance structure for the consortium based on the ERIC framework provided by the EC.

The core activities and the most important project results are shown in the figure above. The work would not have been possible without the positive experience of the preceding EUROFEL Design Study project under FP6.

Some of the critical technical research and development could be extended under IRUVX-PP and did not only intensify the contacts in the technical areas but also served as a model for testing and refining different ways of doing such collaborative work in the future. It is now up to the decision makers to come to a formal agreement on the scope and the framework of the EuroFEL consortium. *JF*


IRUVX-PP Kick-Off Meeting, 9 – 11 April 2008,
DESY, Hamburg, Germany




1st IRUVX-PP Annual Meeting,
9 – 13 March 2009, Trieste, Italy



2nd IRUVX-PP Annual Meeting,
2 – 4 March 2010, Döllnsee, Germany


Various SC-Meetings,
2008 – 2011


Various R&D collaboration
meetings and workshops, 2008 – 2011


Representatives of the labs participating in
the IRUVX-PP project, 25 – 26 November
2010, PSI, Villigen, Switzerland

3rd IRUVX-PP Annual Meeting, 21–23 March 2011,
Helmholtz Zentrum Berlin, Germany


EuroFEL Workshop on Photocathodes for RF guns at INFN of Lecce, Italy

The first two days in March 2011 saw the "Workshop on Photocathodes for RF guns" take place at the Physics Department of the University of Salento in Lecce, Italy. This was the second of the EuroFEL Workshopseries following the successful meeting on "Photon Beamlines and Diagnostics" held at DESY Hamburg in June 2010.

The Lecce workshop was supported by Work Package 3 of the IRUVX-PP project and was managed by a team from the National Institute of Nuclear Physics (INFN, Frascati, Italy) as part of the WP3 Expert Group 1 programme. Over 40 specialists working in the field took part in the workshop. They came from a number of international research institutes including, in particular, representatives from the United States: L. Cultrera (Cornell University), D. Dowell (SLAC), F. Hannon (Jefferson Laboratory) and X. J. Wang (BNL).
The WP3 policy of opening its activities to participants from outside the IRUVX-PP member organizations results in presentations and exchanges at the most advanced and topical level. Despite its short duration, the range of topics covered was very wide:

- Photoemission theory (derivation of quantum efficiency and thermal emittance, cathode engineering);
- Photocathode growth and preparation (metal and semiconducting thinfilms and metal bulk surface treatments);
- Photoelectron characterisation (quantum efficiency, thermal emittance and dark current);
- Photocathode lifetime (observations of contamination, the influence of RF conditioning, UV laser interaction with residual gas, etc.);
- Practical experience with photocathodes;
- Cathode cleaning techniques (laser cleaning, annealing, ozone gas treatment, etc.);
- Advanced photoelectron sources (carbon nanotubes, Spindt field emitters, ultracold electron sources);
- New photocathode materials (high quantum efficiency, suitable for infrared or green laser light, suitable for superconducting guns).

Details of the programme and copies of the presentations are available onthe workshop's website at *http://photocathodes2011.eurofel.eu* It proved to be a very effective forum for discussions and for the exchange of ideas in photocathode R&D and the organisers* were pleased to have delivered such a successful and well-attended event. It is proposed to continue the EuroFEL Workshop Series in the next phase of the EuroFEL programme. *GH, SS*

* Workshop chairs were Antonella Lorusso (INFN), Giuseppe Penco (Elettra) and Siegfried Schreiber (DESY)

The first flashes of light at FERMI@Elettra

The night between December 13 and 14 2010 was very gratifying for the Sincrotrone Trieste team. The new Free Electron Laser (FEL) source FERMI@Elettra seeded at 260 nanometers with an external laser produced the first coherent emission from the FEL-1 undulator chain tuned at wavelengths of 65 nanometers (fourth harmonic of the seed laser) and 43 nanometers (sixth harmonic).

The tracks from the laser's light flashes were captured on a detector screen and greeted with applause by the physicists and technicians who have been constantly following Fermi's development ever since the planning stage.

"The results we have achieved – commented Carlo Rizzuto, president of Sincrotrone Trieste – are the fruits of intensive teamwork we have been engaged in since 2006, lately working night and day, and we are greatly thrilled to have reached this goal. Now our work goes on, continuing to improve performance, and launch FERMI's experimental programme, which is open to the entire international scientific and industrial community". *BP*

Experimental hall at FERMI, February 2011.
The FERMI crew has started to install the first beamline.

PolFEL on course

Polish Ministry of Science and Higher Education has published the Polish Roadmap of Research Infrastructures, a list of large scientific infrastructure projects which are provided for preferential benefit from the future domestic and European grants. The list includes a separate part dedicated to the development of light sources dedicated to interdisciplinary research. In particular the Ministry decided to promote

- EuroFEL/PolFEL – Polish contribution in the international cooperation dedicated to the Free Electron Laser Physics European
- XFEL – Poland, Polish branch of European Consortium constructing X-ray FEL in Hamburg.

Both of these projects are coordinated by The Andrzej Soltan Institute for Nuclear Studies (IPJ). The other light-source-related projects are:

- Solaris – construction of the synchrotron radiation source at the Jagiellonian University in Kraków
- Polish contribution to ESRF upgrade

Taking the advantage from the granted privilege, IPJ and associated institutions are going to apply for grants supporting the research and development works on photocathodes, electron beam dynamics and light generation simulations, x-ray and EUV optics, beam control and synchronization methods.

Polish 2010 and 2011 contribution to XFEL has been summarized in the letter of Karl Witte, the Managing Director of the European XFEL GmbH. Out of 21,6 M€ committed by Polish Government, more than three quarters are already paid in cash or allocated as in-kind contribution. The in-kind contribution agreements that have been concluded with IPJ provide:

- the production of Cryogenic components for Accelerator Module Test Facility carried out by the Wrocław University for Technology and the Wrocław Technology Park,
- tests of equipment to be carried out by the Henryk Niewodniczanski Institute of Nuclear Physics, Polish Academy of Sciences, Kraków and
- the supply of Higher-Order-Mode couplers and Beam Line Absorbers, carried out by IPJ Świerk itself. *MP*

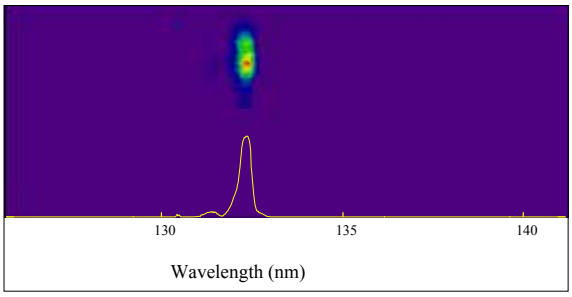
FLASH news

The current user period at FLASH is ending in September 2011 when the facility is shut down for three months in order to start the construction of the new tunnel for a second FEL. Almost 80 proposals have been submitted for experiments in 2012. The proposals will be evaluated by an international Project Review Panel in October. The construction work for the upgrade project FLASH II has started in May. Currently the site is prepared including the relocation of cables and the removal of a building which are in the way. The actual construction of the new tunnel with service buildings and the new experimental hall will start in September and take about one year. The planning of the electron and photon beam lines are currently being completed and possible contributions are discussed with HZB and PSI. The second FEL branch will make use of variable-gap undulators in order to cover a wide wavelength range down to ~4 nm with fixed electron beam energy. This will significantly increase the available beamtime for users and also make it more efficient. *JF*

FEL seeded with nonlinear harmonics generated in gas (Ar)

In the framework of the DS4 EUROFEL collaboration, a research work plan aiming at the investigation of seeded and cascaded FEL configurations was implemented.

The main goal was to study the amplification and the harmonic generation process of an input seed signal obtained as higher order harmonics generated in gases. The main component of the seed laser system is a regenerative amplifier seeded by the same oscillator driving the photocathode amplifier. The laser is focused to an in vacuum cell, where a valve synchronized to the 10 Hz timing system of SPARC injects Argon. The radiation is then injected in the FEL amplifier at the third and fifth harmonics of the Ti:Sa.
With the third harmonic the FEL has been operated as a frequency multiplier in a modulator radiator configuration to generate radiation at 133 nm. A sample spectrum at the wavelength of 133 nm is shown below. *LG*



Spectrum of the SPARC FEL seeded with third harmonic of TI:Sa generated in gas after harmonic conversion from 266nm to 133nm

SwissFEL development of new measurement methods

An important milestone for the realization of the new SwissFEL facility was reached on the 24th of August 2010, when the core of the new facility, the 250 MeV injector, was set into operation at the Paul Scherrer Institute. This part will be used to develop and test new schemes in accelerator physics as well as diagnostics and undulators. The SwissFEL facility should start user operation in 2017. Meanwhile the SwissFEL Photonics Group is developing novel measurement methods for use with the X-ray Free Electron Laser. These include: a demonstration of ultrafast initiation of chemical reactions using high-energy pulses of terahertz radiation – for future THz pump/XFEL probe experiments, and exploiting cross-correlations in x-ray scattering measurements with the aim to determine the 3 D structure molecules in solution. Regarding the second project, in a first pilot phase, we considered the simplified 2D case and with immobilized particles to overcome the acquisition time limit.

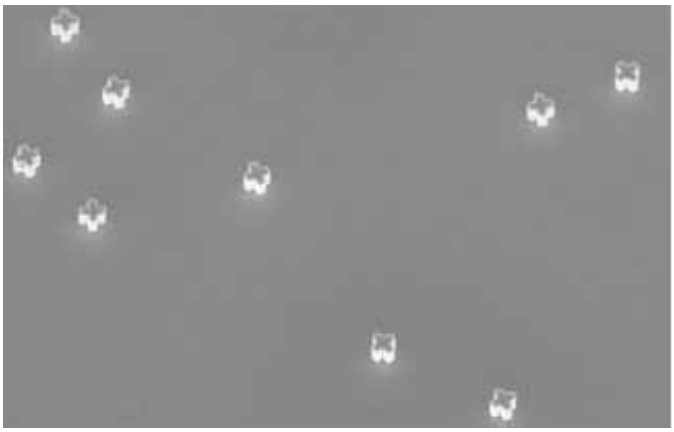


Figure 1: SEM image of a gold nanostructure ("nanoparticles") sample used for X-ray cross-correlation pilot experiments in 2D.

A large number of simple, identical gold nanostructures of size 200-500 nm, called nanoparticles in the following, were grown in random orientation on Si_3N_4 membranes in an LMN laboratory at PSI (see Fig. 1). To simulate a 2D-liquid, X-ray diffraction images were acquired at the cSAXS beamline of SLS by scanning the membrane, in order to illuminate a different random configuration of nanoparticles for each image (see Fig. 2). We are now in the stage of reconstructing the nanoparticle's 2D shape by a suitable phasing algorithm. *MD*

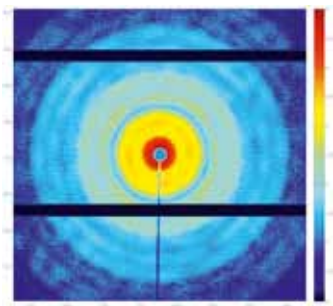
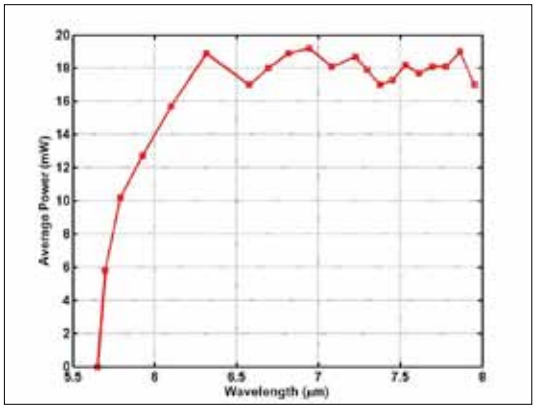


Figure 2: Example of one of the 3750 multi-particle diffraction images acquired with the sample shown in Fig. 1. The displayed intensity corresponds to the number of photons counted in each pixel during the acquisition time of 1 s, and is color coded in log10-scale according to the bar on the right of the plot

ALICE update

The first demonstration of continuous wavelength tuning of the ALICE IR-FEL was achieved in early March 2011: by increasing the gap of the magnetic undulator the FEL wavelength was continuously tuned from 8.0μm to 5.7μm with lasing sustained at all times. The results demonstrate that the undulator arrays maintain their precise relative alignment as they are moved, proving the engineering design of the supporting structures. It is expected that eventually the FEL wavelength will be tuneable over the full range 5 – 12μm. Among other recent successes, the ALICE THz output has now been successfully transmitted to a Tissue Culture Laboratory which has clearance to undertake experiments on living cells.

A programme to study the effects of THz radiation is expected to generate significant results of great interest to medics.



ALICE also acts as the injector for EMMA, a proof-of-principle electron model non-scaling FFAG (Fixed Field Alternating Gradient) accelerator. Systematic studies of the interaction of the RF field with the electron beam during the last week in March 2011 indicated that the injected beam energy had increased by a few MeV confirming acceleration had been achieved.

This new approach is set to change the way such particle accelerators are designed in the future. A range of potential applications include charged particle cancer therapy, accelerator driven reactors and particle physics (e.g. neutrino factories). *GB-W*

The PAL-XFEL in Korea

The Pohang Accelerator Laboratory (PAL), Pohang University of Science and Technology (POSTECH), Korea currently has two main missions: (1) Major Upgrade of Pohang Light Source (3rd generation) and (2) PAL-XFEL (PAL X-ray Free Electron Laser) Project.

The major upgrade project has been launched in 2009 and will be completed by the end of this year. The aim of this major upgrade project includes (i) energy increase to 3.0 GeV, current increase to 400 mA, (iii) emittance reduction to 5.8 nm.rad, (iv) insertion device beamlines to 20, (v) top-up mode operation, (v) adoption of superconducting RF facility, and (vi) photon flux increase of 2 order.

Aerial view of the new PAL-XFEL facility

The PAL-XFEL project has just been launched in January of this year. The PAL-XFEL will be completed its construction in 2014 and start the commissioning in 2015. The electron beam energy is chosen 10 GeV to get photon flux of over 1.0×10^{12} photons/pulse at a wavelength (λ) of 0.1 nm and to have a capability to provide higher energy photon up to 20 keV (λ = 0.06 nm). The 590-m long electron linac using S-band normal conducting structures is designed to generate a 3 kA peak current beam with 0.5 mm-mrad emittance at 120 Hz. The total length of the facility is 1 km including a 250-m long undulator hall. A soft X-ray FEL line branched out at the 4-GeV point of the main linac is designed to have a full polarization capability by using Elliptical undulator.

Self-seed scheme for narrow-band spectrum and enhanced SASE scheme for attosecond X-ray pulse generation are also included in the design as long term development goals. The undulator is a variable-gap out-vacuum undulator with the minimum gap of 6.8 mm. *MR*

Contact
Pohang Accelerator Laboratory (PAL)
San 31, Hyoja-dong, Nam-gu
Pohang 790-784, Republic of Korea
http://paleng.postech.ac.kr/

SDUV FEL reaches saturation with HGHG

The Shanghai Deep UV Free Electron Laser (SDUV-FEL) facility in Shanghai Institute of Applied Physics (SINAP), Chinese Academy of Sciences is a dedicated test-bed of seeded FEL schemes. The facility is comprised of a photo-injector followed by a s-band linac that can provide an electron bunch of about 100pC bunch charge at 150MeV with normalized emittance of 3-4mm.mrad, a double-modulator layout that can carry out researches on different seeding principles and a long radiator undulator section.

Following the early experiments on HGHG (High Gain Harmonic Generation) and EEHG (Echo-Enabled Harmonic Generation) bun-ching studies in summer, SDUV reached saturation at HGHG mode in December 17, 2010. The wavelength is around 349nm, the third harmonic of the laser seed of 1047nm. The measurements show the typical HGHG spectrum and gain curve. More experiments are underway to compare the HGHG and EEHG FELs. *DW*

Contact
Shanghai Institute of Applied Physics,
Chinese Academy of Sciences
Shanghai 201800, China
http://www.sinap.ac.cn/

Handbook on IPRs

The active engagement of public research organisations in managing Intellectual Property (IP) and Knowledge and Technology Transfer (KTT) is essential for generating socio-economic benefits for European member states. Increasingly, Intellectual Property Rights (IPR) are recognised as a central part of most commercial transactions, whether acquisition of a company and associated assets, investment in start-up or spin-out companies, or structuring a joint venture or collaborative arrangement.

The 'Handbook for IPR' was prepared by WP6 – 'Collaboration with Industry' – to provide a set of principles aimed at helping EuroFEL members adopt a common IP and KTT policy and to support the implementation of transnational KTT between EuroFEL partners and Industry. The IPR cover patents, registered designs, trademarks, domain names, copyright, design right, trade secrets, know-how and all similar rights in inventions, computer programmes, semi-conductor topographies and confidential information. KTT refers to a bi-directional process by which knowledge, including technology, know-how, expertise and skills, is transferred from one party to another leading to innovative, profitable or economic and social improvement. The EuroFEL Handbook for IPR covers four main principles:

1. The collaboration agreement specifying the relationship between EuroFEL members concerning confidentiality, background and foreground IP, joint ownership, transfer of foreground IP, access rights, dissemination, publication and dispute resolution.

2. An internal policy constituting the basic principles which the future EuroFEL consortium should implement to effectively manage the IP resulting from their own or from collaborative research and development activities.

3. A complementary KTT policy focusing more specifically on the active transfer and exploitation of such IP.

4. The principles for collaborative and contract research relating to all types of activities conducted or funded jointly by a public research organisation and the private sector. Example Non-disclosure Agreement, Joint Invention Agreement, Licensing Agreement and model Contract/Collaboration Agreement are given in the annexes. These principles are applicable across all future research infrastructure consortiums and are in line with The Commission of the European Communities effort and policy guidelines to improve and harmonise the way public research organisations manage their IP. *VS*

UPCOMING EVENTS

10th Summer School on Condensed Matter Research
13 – 22 August 2011, Institut Montana Zugerberg, Zug & Paul Scherrer Institut, Villigen, Switzerland
http://indico.psi.ch/conferenceDisplay.py?confId=258

33rd International Free Electron Laser Conference
22 – 26 August 2011, Shanghai, China
FEL 2011 will focus on the scientific, technological and some user aspects of FELs and will also contain tutorials on important FEL subjects. The conference is organised by SINAP.
http://www.sinap.ac.cn/fel2011

JUM@P'11: Second Joint Users' Meeting @ PSI
15 – 16 September 2011, Paul Scherrer Institut, Villigen, Switzerland
http://indico.psi.ch/conferenceDisplay.py?confId=42

New Science Opportunities at FLASH
12 – 14 October 2011, DESY, Hamburg
The workshop will cover news from FLASH II, such as expected parameters, beamlines, seeding, and a long term perspective for the entire FLASH facility.
https://indico.desy.de/conferenceDisplay.py?confId=4425

Science at FELs
SRI 2012 Satellite Conference
15 – 18 July 2012, DESY / XFEL, Hamburg
The 'Science at FELs' satellite conference to the 11th International Conference on Synchrotron Radiation Instrumentation in Lyon, France, will present science highlights achieved in the first seven years of operation of short-wavelength FELs.
science-at-FELs-2012.desy.de

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Contact: info@eurofel.eu | www.eurofel.eu | phone +49 40 8998 4130

Contributors: Graham Bushnell-Wye, Mirjam van Daalen, Josef Feldhaus (V.i.S.d.P.), Luca Giannessi, Graeme Hirst, Monika Illenseer, Bibi Palatini, Marek Pawlowski, Moonhor Ree, Siegfried Schreiber, Vlad Skarda, Dong Wang

Images: page 1 A. Nyberg/ MAX-lab; page 2/3 DESY, Fini Jastrow/DESY, Elettra, A. Nyberg/ MAX-lab, PSI; page 4/5 INFN of Lecce, Filippo Cianciosi/Elettra; page 6/7 PSI, STFC, PAL, SINAP

Partners of IRUVX-PP – the preparatory phase of EuroFEL