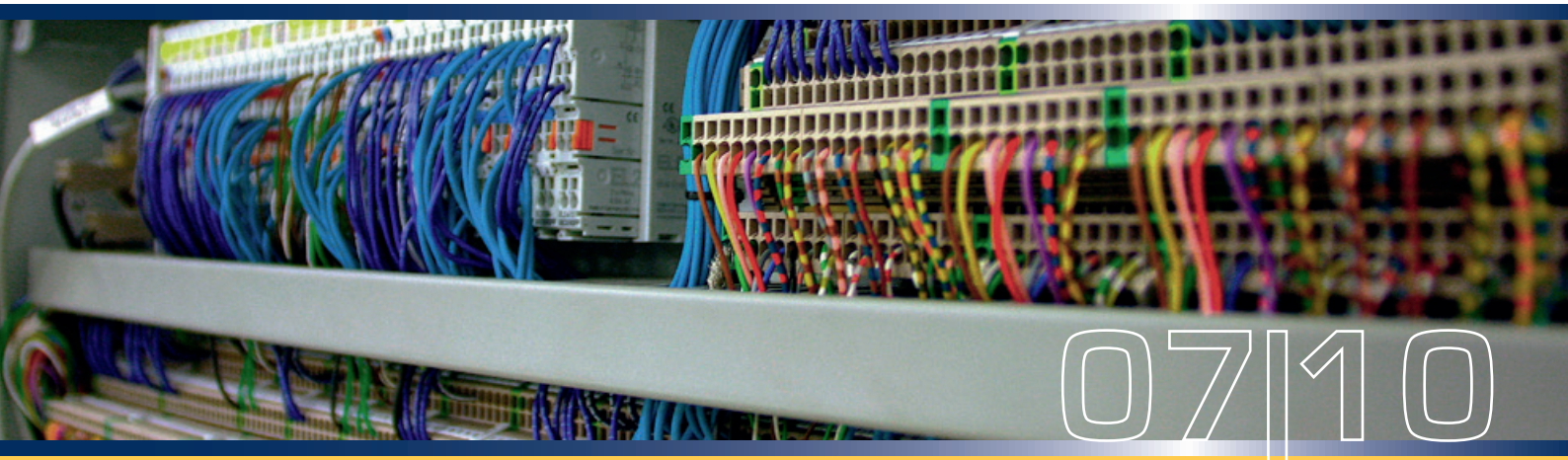
News

2nd Issue, 07|2010

EuroFEL
FREE ELECTRON LASERS OF EUROPE



A word from the Project Management

The 2nd Annual Meeting of the IRUVX-PP project at Döllnsee near Berlin on 2-4 March was an important milestone for EuroFEL. The record attendance demonstrated the large interest of the community and industry, and most importantly, the directors of the participating research centres, DESY, Elettra, HZB, INFN, MAX-lab, PSI and STFC, fully endorsed the mission and core activities of the future FEL consortium that had been worked out by IRUVX-PP. They also agreed that the new ERIC (European Research Infrastructure Consortium) of the EU should be used as the legal form. This will not only enhance the visibility and recognition as a pan-European research infrastructure, but also the structuring effect in this area on the European level.

Because establishing an ERIC takes time, it was agreed to apply for extending the preparatory phase by a year. We will use some of the remaining funds to implement the basic management structure foreseen for EuroFEL and get started with technical and training activities in spring 2011.

We believe it is crucial for the consortium and, in particular, for the new facilities that have a realistic chance to be funded in the next few years, to maintain the spirit and momentum of the current collaboration. The new facilities urgently need the high visibility of EuroFEL on the ESFRI roadmap as well as the close collaboration with the other partners. And for EuroFEL this is the only way to build the critical mass and the trust for a sustainable long-term partnership.

Josef Feldhaus, Ute Krell and Matthias Kreuzeder

CONTENT

UPCOMING FEL EVENTS

32nd International Free Electron Laser Conference FEL 2010
August 23 – 27, in Malmö, Sweden

FEL 2010 will focus on the scientific, technological and some user aspects of Free Electron Lasers and will also include tutorials on important FEL subjects. The conference is organised by MAX-lab (Lund University) and the Stockholm Uppsala FEL Centre.

EuroFEL will integrate the national activities in Europe to deliver a unique, distributed European research infrastructure of Free Electron Laser light sources. EuroFEL is part of the ESFRI Roadmap 2008. The preparatory phase of EuroFEL (IRUVX-PP) is funded by the European Commission under FP7.

IRUVX-PP meets industry

As part of the WP6 “Collaboration with industry”, the IRUVX-PP consortium organised a workshop “IRUVX-PP meets industry” on 1 March 2010 in Döllnsee near Berlin in connection with the 2nd IRUVX-PP Annual Meeting. There were 85 participants from industry, scientists and engineers from the partner institutes and 20 industrial exhibitors. The objective of the workshop was to open a dialogue with industry and focus on key industries for the setting up of new FEL facilities. Therefore the aim was to provide information to industry about required specification for realisation of advanced components and systems, required R&D collaboration with industry, outline of industry’s involvement and opportunities and give examples of collaboration with industry and technology transfer from both an institute perspective and from an industry perspective.

Common technical needs for construction of FELs have initially been identified in the areas of photon and e-beam diagnostics, X-ray optics, laser systems, synchronisation and control systems. Other areas, such as advanced undulator concepts, detector development, cryogenic modules and superconducting RF technology, will be addressed in future workshops.

Very positive feedback has been received from both, the industry and engineers with the main feedback from industry indicating that networking with individual facilities is difficult and there is a distinct advantage in linking with EuroFEL with experts being present from all over Europe. Please find more information under: *www.iruvx.eu/industrymeeting2010* *VS*

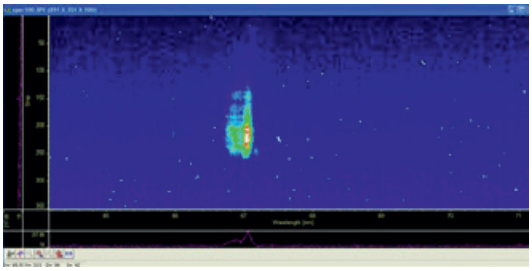
New experiments need new diagnostics

FELs are opening a fascinating new world of opportunities for photon science. They are providing light pulses of a coherence, brightness and shortness that even a few years ago scientists weren’t able to dream of. But with the new opportunities also new challenges are arising: How to handle and diagnose a light pulse that is a thousand times shorter and a billion times brighter than ever before? Industrial suppliers for today’s synchrotron sources are not able to provide beam line transport systems with the required thermal resistance and spatial accuracy to exploit FELs; they don’t even have the metrology to measure them. New materials, new techniques and new ideas are necessary.

End of June, about 85 scientists from 33 current and future FEL labs and industrial participants met at DESY in Hamburg for the first “EuroFEL Workshop on Photon Beamlines and Diagnostics” which was organised by the workpackages 3 & 7 of the IRUVX-PP project. The aim was to discuss new ideas which arise in the different laboratories, and to start joining the efforts for developing diagnostic systems and metrology. Perspectives of entirely new R&D efforts were presented, for example multilayer mirrors that are able to compress or expand the FEL beam or which can be used for soft X-ray polarimetry techniques. Wave front sensing, another intensively discussed topic, is one of the most promising approaches to optimise FEL beam transport systems and might be used for active or adaptive optics. “It was great to see the participants in intense discussions and making plans for joint projects,” says DESY’s Kai Tiedtke. “The people have amazing new ideas and approaches for the challenges of the FELs.” After three days of presentations and discussion, the participants returned to their labs with the clear wish that this dedicated FEL workshop should mark the start of a series. *TZ*

Recent seeding results at SPARC

The SPARC [1] test facility provides a new and exciting opportunity to study Free Electron Laser (FEL) dynamics in exotic configurations. The undulator is based on six variable gap modules which may be tuned combining the higher order resonances to realise Free Electron Laser cascades or harmonic cascades [2].



SPARC FEL operating above saturation in a cascaded configuration. Spectrum of the third harmonic of the radiator.

A seeding system has been implemented within the past EUROFEL Design Study framework. In collaboration with CEA (France) a system of chambers for the generation of high harmonics in gas was realised and installed to drive the FEL. This system now provides the possibility to seed the FEL amplifier and the various cascades with the odd harmonics generated in gas (Ar) and with the second harmonic of the Ti:Sa drive laser. The first seeding experiment started this year.

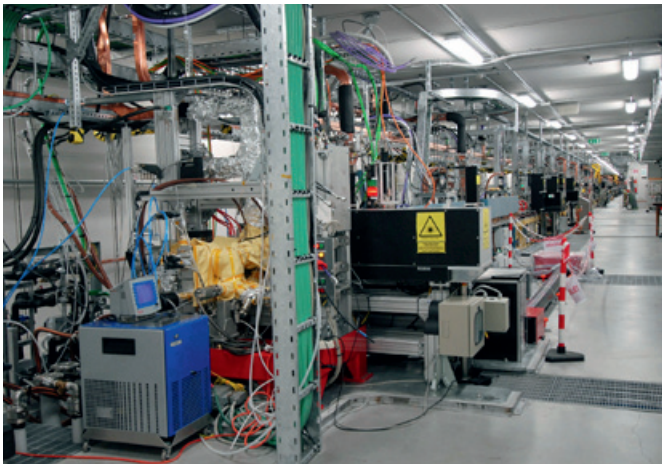
For the first time, an FEL cascade has been seeded with radiation generated in gas, and recently the FEL has been operated in a cascaded configuration operating above saturation. This layout, based on a mechanism which is efficient in the generation of higher order harmonics, allowed to observe a coherent signal at the 6th harmonic of the seed at 67nm, with a beam energy of 176 MeV only. The spectrum of the signal is shown in the picture. *LG*

[1] L. Giannessi et al. Nuclear Instruments and Methods in Physics Research A 593 (2008) 132–136

[2] L. Giannessi, P. Musumeci New Journal of Physics 8 (2006) 294

FERMI@Elettra

FERMI@Elettra (FERMI), a fourth-generation synchrotron light source user facility under construction at Sincrotrone Trieste S.C.p.A just outside of Trieste, Italy will provide ultra-bright, ultra-short laser-like pulses to a broad user programme. Wavelengths will be continuously tunable over the range of 100 nm to 4 nm and harmonics of the fundamental will reach even shorter wavelengths. The undulators (APPLE-II type) will allow complete control of polarisation from planar in both planes to both left- and right-handed circular and all variations in between. By using seeded operation the output of optical properties should be coherent both transversely and longitudinally.



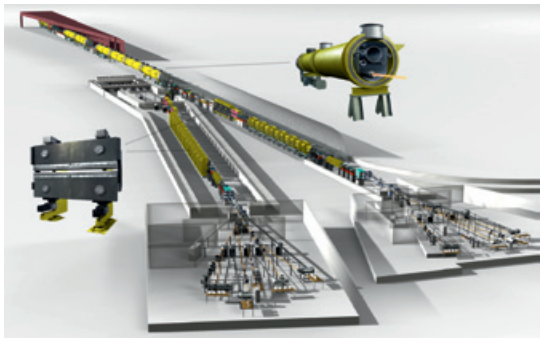
The accelerator systems installed in the linac hall (picture: Filippo Cianciosi)

Installation and commissioning are presently occurring simultaneously. All new required buildings and infrastructure are being finalised and transfer lines through the undulator region are presently being installed. Commissioning of the 1.5 GeV linac is underway and electron beam performance is as expected.

The immediate goal is to complete all installation and commissioning through the first of two FEL lines. The schedule is to seed the FEL process late in November of 2010 and to provide first light to the initial user experiment before the end of 2010. 2011 will be used as a transition year with continued installation of the second FEL line and user experimental stations, commissioning of both the FEL I and FEL II lines, and user operation periods. Full user operation is scheduled to begin in October 2011 and light will be available from either FEL I or FEL II at that time, depending upon the specific user demands and capabilities of the two FEL lines. SM

FLASH upgrades

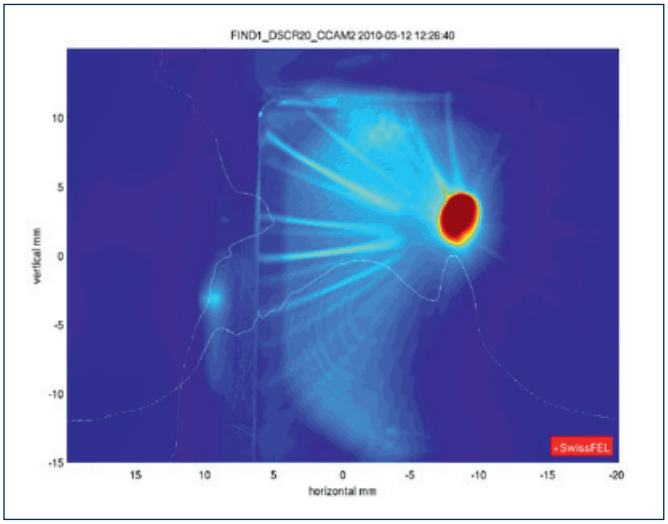
After a five-month upgrade the FLASH facility at DESY will shortly resume user operation with significantly extended features. The minimum wavelength recently achieved in the commissioning phase is 4.45 nm, very near the carbon K-edge; before the energy upgrade it was 6.5 nm. At the same time, record pulse energies up to 0.3 mJ were reached thanks to the new third-harmonic RF cavities installed in the injector. These cavities allow controlling the longitudinal electron beam parameters and producing radiation pulses with variable duration between tens and hundreds of femtoseconds. The pulse energy scales with the pulse duration.



Long electron bunches are essential for the new sFLASH project. Four additional undulators have been installed in the FLASH tunnel in order to further develop direct seeding with high laser harmonics. First seeding experiments at 38 nm wavelength are planned in the next months. While the new installations are still under commissioning, the next major upgrade, called FLASH II, is already being prepared. It includes a seeded FEL in a new tunnel and a new experimental building with space for six experimental stations. The electron beam can be switched between the two FELs allowing quasi-simultaneous operation of two experiments at different wavelengths. FLASH II has just been approved by the funding bodies. It will be ready for user experiments in 2014. JF

First beam at the SwissFEL Injector Test Facility

The technical development of the SwissFEL project has reached another milestone: in the SwissFEL injector test facility, the first electron beam from the gun has been extracted and accelerated to 5 MeV on 12 March 2010.



First results at the SwissFEL injector

Between March and May 2010, the first characterisation of the electron source started. Measurements show that the assembly can deliver a high quality beam very close to the simulated values. The normalised projected emittance after the RF electron gun ranges from 0.45 mm mrad at 60pC to 0.7 mm mrad at 220pC. The phase and amplitude stabilities have been measured for the RF amplifier supplying the RF electron gun. With 20fs (0.02 degree S-band) rms phase jitter and 0.02% rms amplitude jitter, the SwissFEL specifications have been demonstrated. The RF electron gun is presently being connected to the rest of the facility. The official inauguration of the SwissFEL injector will take place on 24 August 2010. Please find more information on the new SwissFEL web site: www.swissfel.ch MvD

New SwissFEL publication:
Coherent Science at the SwissFEL X-ray Laser.
Special issue on X-ray beams with high coherence.
Read the full story here:
Patterson et al, New Journal of Physics 12, 035012 (2010)

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Images: page 1 Heuer/DESY; page 2 Annika Nyberg/MAXlab, Marta Mayer/DESY; page 3 SPARC/INFN, Filippo Cianciosi/ELETTRA, ; page 4 DESY, SwissFEL/PSI

Partners of IRUVX-PP – the preparatory phase of EuroFEL