No. III/14 - 30 September 2014

PSI photon, neutron and muon user facilities newsletter

Editorial

Hans Braun

Dear colleagues,

When checking the PSI location on Google Earth you find a 700m long narrow stretch of building east of the Aare river. This is the footprint of PSI's X-ray free electron laser, SwissFEL, which takes shape in the forest of Würenlingen.

SwissFEL uses a 5.8GeV linear accelerator as a driver for the FEL lines. The first of these lines, ARAMIS, is built together with the linac. It covers the photon range from 1.8-12.4keV. The linac consists of a low emittance injector and 26 C-band accelerator modules. The key building blocks and the performance of the injector have successfully been tested in PSI's SwissFEL test facility, which operates since 2010 and will be decommissioned this October for re-use of the components in SwissFEL. The C-band linac module is a development of PSI in collaboration with industry. It provides up to 250MeV in 9m with a single RF station.

The ARAMIS FEL is made of 12 variable gap in-vacuum undulators with 15mm period and 4m of length each. They are also a collaborative development of PSI with industry. Beginning of 2014 the first of these undulators was tested with beam in the SwissFEL test facility. Self-Amplified Stimulated Emission (SASE) FEL lasing was established in this configuration, thus providing the first FEL radiation at

New calls for proposals

SLS: PX-beamlines
deadline: October 15, 2014
SLS: non-PX beamlines
deadline: March 15, 2015
more information
<http://www.psi.ch/sls/calls>

SINQ
deadline: November 15, 2014
more information
<http://www.psi.ch/sinq/call-for-proposals>

SμS
deadline: December 2014
more information
<http://www.psi.ch/smus/calls>

An **overview** about all proposal submission deadlines of the PSI facilities can be obtained **here** <http://www.psi.ch/useroffice/proposal-deadlines> **.**

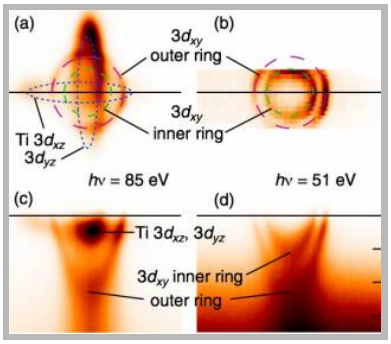
Facility news

PSI and in Switzerland.
The plans for the first two experiment stations, ESA and ESB, and their photon beamlines are finalized and procurement of components has started. Both stations are built in parallel with the FEL. With the SwissFEL building shell near completion and the series production of accelerator and FEL components ramping up an intense installation period is ahead of PSI which will last until late 2016. The first experiments at SwissFEL are expected for 2017. In parallel the planning for a second SwissFEL line, ATHOS, covering the 0.3-1.8keV soft X-ray regime with full polarization control is already underway for the 2017-2020 period.
Thus intense and exciting years are ahead of us!

Hans Braun on behalf of the SwissFEL team at PSI

Research highlights

SLS - Materials Science: Next generation of electronic devices



A revealing mixture: The surface of an oxide insulator can host two distinct types of conducting electrons

N.C. Plumb et al, Physical Review Letters 113, 086801 (2014), DOI: 10.1103/PhysRevLett.113.086801 <http://dx.doi.org/10.1103/PhysRevLett.113.086801>
A collaboration led by scientists at PSI used detailed high-resolution angle-resolved photoemission spectroscopy (ARPES) at the Surface/Interface Spectroscopy (SIS) beamline in order to obtain the clearest view to date of the electronic structure of the metallic surface state on $SrTiO_3$. ARPES is a uniquely powerful technique for prob-

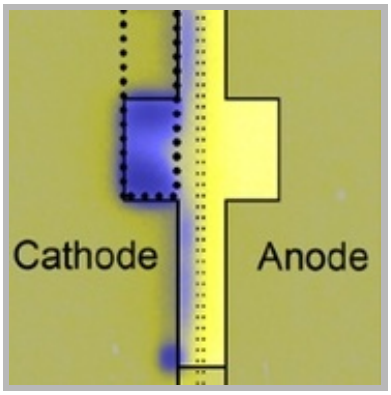
SLS: Special issue of JSR: Diffraction limited storage rings – a window to the science of tomorrow
Using new concepts in magnet design, vacuum technology and an improved understanding of beam dynamics, light sources of unprecedented quality are being and will be built. The users have embraced this challenge and now design instrumentation to exploit this increased performance as well as experiments demanding it. In our common effort to make the invisible secrets of nature visible we have again come one step further. A recently published special issue by guest editors Mikael Eriksson and J. Friso van der Veen [J. Synchrotron Rad. **21**, 837-1216 (2014)] provides a comprehensive review of the field with contributions from leading researchers and groups from around the world, **more information** <http://www.iucr.org/> .

SINQ: New single-crystal diffractometer ZEBRA
In the International Year of Crystallography 2014, construction of a new single-crystal diffractometer **ZEBRA** <http://www.psi.ch/lns-dif-

ing and visualizing electrons' energy and momentum states, which determine a material's most fundamental electronic properties.

Read the full story <http://www.psi.ch/sls/scientific-highlights>

SINQ - Energy Research: Supercooled water inside fuel cells



Dual Spectrum Neutron Radiography: Identification of Phase Transitions between Frozen and Liquid Water

J. Biesdorf et al, Physical Review Letters 112, 248301 (2014), DOI: 10.1103/PhysRevLett.112.248301 <http://dx.doi.org/10.1103/PhysRevLett.112.248301>

In this study, a new approach to distinguish liquid water and ice based on dual spectrum neutron radiography is presented. The distinction is based on arising differences between the cross section of water and ice in the cold energy range. As a significant portion of the energy spectrum of the ICON beam line at Paul Scherrer Institut is in the thermal energy range, no differences can be observed with the entire beam. Introducing a polycrystalline neutron filter (beryllium) inside the beam, neutrons above its cutoff energy are filtered out and the cold energy region is emphasized. Finally, a contrast of about 1.6% is obtained with our imaging setup between liquid water and ice. Based on this measurement concept, the temporal evolution of the aggregate state of water can be investigated without any prior knowledge of its thickness. Using this technique, we could unambiguously prove the production of supercooled water inside fuel cells with a direct measurement method.

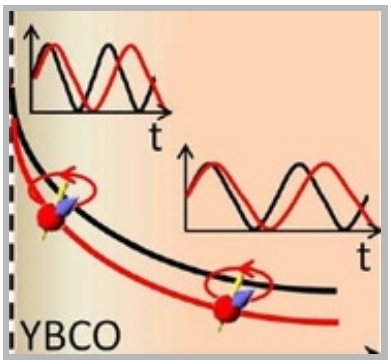
Read the full story <http://www.psi.ch/num/2014#biesdorf>

fraction/HomeEN/2014-ZEBRA.pdf> has started at SINQ. The new instrument will be optimized for experiments on small single-crystal samples of novel materials and for studies of magnetic order under multi-extreme conditions in temperature, magnetic field and pressure. The new diffractometer will have a variety of detector and analyzer options and will be completed by the end of 2016. The project is funded by the Swiss National Science Foundation via its SNF R'equip program and supported by the **Swiss Society for Crystallography (SGK/SSCr)** <http://www.sgk-sscr.ch> , the **University of Fribourg** <http://www.chem.unifr.ch/kf/> , among many other organizations.

SμS: First publication using HAL-9500

This year, the new high field and low temperature μSR spectrometer HAL-9500 has been opened for user operation. Now the first publication using its high field capabilities (up to 9.5 T) **has been published** <http://www.psi.ch/num/2014#guguchia_prb> . Here, Z. Guguchia et al.

SμS - Light promotes superconductivity



Controlling the near-surface superfluid density in under doped $YBa_2Cu_3O_{6+x}$ by photo-illumination

E. Stilp et al, Scientific Reports 4, 6250 (2014), DOI: 10.1038/srep06250 <http://dx.doi.org/10.1038/srep06250>

The interaction with light weakens the superconducting ground state in classical superconductors. The situation in cuprate superconductors is more complicated: illumination increases the charge carrier density, a photo-induced effect that persists below room temperature. Furthermore, systematic investigations in underdoped $YBa_2Cu_3O_{6+x}$ (YBCO) have shown an enhanced critical temperature T_c. Until now, studies of photo-persistent conductivity (PPC) have been limited to investigations of structural and transport properties, as well as the onset of superconductivity. Here we show how changes in the magnetic screening profile of YBCO in the Meissner state due to PPC can be determined on a nanometer scale utilizing low-energy muons. The data obtained reveal a strongly increased superfluid density within the first few tens of nanometers from the sample surface. Our findings suggest a non-trivial modification of the near-surface band structure and give direct evidence that the superfluid density of YBCO can be controlled by light illumination.

Read the full story <http://www.psi.ch/num/2014#stilp>

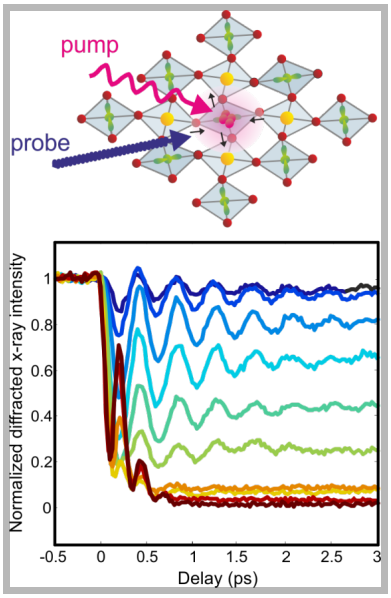
SwissFEL

demonstrate that $EuTiO_3$ exhibits a hidden high temperature phase of dynamic weak magnetism which can be promoted by the external magnetic field.

SwissFEL: (PALM) based on the THz-streak camera concept

The accurate, non-destructive measurements of FEL pulse length and arrival time relative to an experimental laser are necessary for operators and users alike. The FEL operators can get a better understanding of their machine and the optics of an FEL by looking the pulse length changes of the photons coming to the user stations, and the users can use the arrival time and pulse length information to better understand their data. PSI has created the pulse arrival and length monitor (PALM) based on the THz-streak camera concept for measurement at X-ray FELs, meant to be used at the upcoming SwissFEL facility.

Upcoming events



A time-dependent order parameter for ultrafast photoinduced phase transitions

P. Beaud et al, Nature Materials 13, 923 (2014), DOI: 10.1038/nmat4046

<http://www.nature.com/nmat/journal/vaop/ncurrent/full/nmat4046.html>

The exploration of the interaction of structural and electronic degrees of freedom in strongly correlated electron systems on the femtosecond time scale is an emerging area of research. One goal of these studies is to advance our understanding of the underlying correlations, another to find ways to control the exciting properties of these materials on an ultrafast time scale. So far a general model is lacking that provides a quantitiative description of the correlations between the structural and electronic degrees of freedom. Here we investigate a perovskite-type manganite, a prototypical example of a strongly correlated electron system which exhibits properties such as colossal magnetoresistance and insulator-to-metal transitions that are intrinsically related to symmetry changes of the atomic lattice and to intriguing ordering patterns of the spins, orbitals and charges. The application of an ultrashort optical pulse melts the electronic order and launches a structural phase transition.

Read the full story <http://www.psi.ch/swissfel/highlights>

Users Association

WCNR10: 10th World Conference on Radiography <http://www.psi.ch/wcnr10>
October 5-10, 2014, Grindelwald, Switzerland

3rd JCNS Workshop on neutron instrumentation: From spallation to continuous neutron sources: a positive feedback on neutron instrumentation <http://www.fz-juelich.de/jcns/JCNS-Workshop2014>
October 20-23, 2014, Tutzing near Munich, Germany

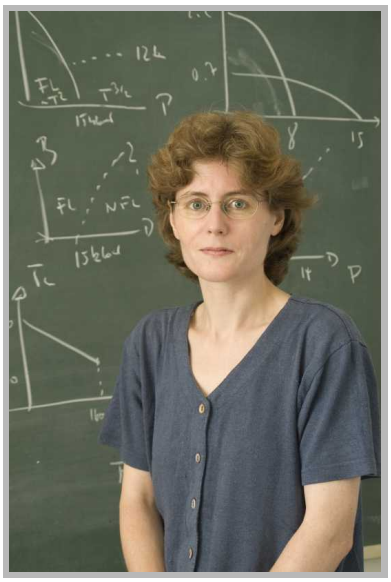
Horace software package workshop <http://horace.isis.rl.ac.uk/Horace_Workshop>
October 22-23, 2014, ISIS, Rutherford Appleton Laboratory, UK

12th International Conference on X-Ray Microscopy <http://www.xrm2014.com>
October 26-31, 2014, Melbourne, Australia

Solution scattering from biological macromolecules. EMBO Practical Course <http://events.embo.org/14-sas/index.html>
October 27 - November 3, 2014, Hamburg, Germany

Neutron Scattering in Magnetic Fields Above 15 Tesla <http://www.helmholtz-

JUSAP - The Joint Users Association



A meeting of the board members of the Joint Users' Association of PSI - **JUSAP**

Sarah Dunsiger

<http://www.psi.ch/useroffice/users-association> will take place on 8th October 2014. This is an opportunity to raise issues of relevance to the User community. On behalf of the committee members, I would like to invite PSI facility users to submit any comments, suggestions or concerns they would like to be discussed at the upcoming meeting. Such issues could be related for example to specific equipment, spectrometers, beam scheduling, manpower, as well as the conditions for proprietary use or the user program me in general.

The following week, on 13th October 2014, there will be an organizational meeting for JUM@P 2015. The aim of the Joint Users' Meetings at PSI has been to bring together the three user communities of SLS, SINQ and SμS and to generate new synergies among the scientists driven by common scientific rather than technical interests. JUM@P is a "users for users" meeting organised every two years jointly by PSI and its Users Asscociation. We would like to solicit input from the user community over topics of current interest for focus sessions or more general suggestions for the best format of the workshop.

Please contact us via the address given on the **JUSAP homepage** <http://www.psi.ch/useroffice/users-association> . In-

berlin.de/events/hfm-workshop/index_de.html>
October 29-30, 2014, Berlin, Germany

Fourth Niels Bohr International Academy Meeting on ESS Science<https://indico.nbi.ku.dk/conferenceDisplay.py?confId=712>
November 10-14, 2014, Copenhagen, Denmark

12th International Workshop on Synchrotron Radiation in Nanomaterials Research <http://xrdlab-nrc-eg.org/registration.htm>
November 15-18, 2014, El-Gouna, Hurghada, Egypt

EMBL Hamburg 40th Anniversary Symposium and Celebrations <http://www.embl-hamburg.de/training/events/2014/HH-40th-Anniversary/index.html>
November 27-29, 2014, Hamburg, Germany

6th joint BER II and BESSY II User Meeting
<https://www.helmholtz-berlin.de/user/usermeetings/user-meeting-2014/index_en.html>
December 3-5, 2014, Berlin, Germany

Neutron School 'Fan du LLB'
<http://www-llb.cea.fr/fanLLB/in-

dividual board members for SμS, SINQ or SLS may also be contacted directly. I look forward to hearing from you.

Sarah Dunsiger (JUSAP chair)

dex.php>

December 8-11, 2014, Saclay, France

more events <http://www.psi.ch/useroffice/conference-calendar>

Current Openings

Job opportunities at PSI <http://www.psi.ch/en/pa/offenestellen/>

Announcements

FEL 2014 and Science@FELs 2014, two international conferences organised by the Paul Scherrer Institute

On 25-29 of August the international FEL conference FEL 2014 was held in Basel. FEL 2014 focused on the scientific, technological as well as on some user aspects of free electron lasers. For more information see **FEL14** <http://www.fel2014.ch/> .The second conference organized by PSI was the Science@FELs 2014 conference, which took place from 15-17 September 2014 at PSI. The latter conference focussed on the scientific highlights achieved during the last years in the fast evolving development and operation of free electron lasers. For more information see **Science@FELs 2014** <https://indico.psi.ch/conferenceDisplay.py?confId=2910> . Both conferences were a great success. The level of the presentations was very high and we are grateful for the numerous excellent contributions.

Soon to start: World Congress on Neutron Radiography 2014

The Neutron Imaging group of the NUM department organizes the 10th World Conference on Neutron Radiography in Grindelwald, Switzerland from October 5-10, 2014. WCNR14 will attract scientists active in the field of neutron imaging either as designers and/or operators of facilities or as users of such installations. During the conference the latest methodical developments, instrumentation layout and improvements and new applications will be presented and discussed. More information can be obtained from the **conference website.** <http://www.psi.ch/wcnr10>

Proprietary research

A certain fraction of the beamtime at PSI research facilities is reserved for proprietary use. This is handled by the **PSI Technology Transfer** <http://www.psi.ch/industry/technology-transfer> . The following **directory** <http://www.psi.ch/industry/expertise> lists services on offer by these facilities. For the SLS beam lines industrial use is facilitated by the SLS Technology Transfer AG. If you are not an expert in a particular technique or you are unsure which technique is best suited for your application(s), please contact us via the email address published on the **SLS TT homepage** <http://www.psi.ch/sls-techno-trans-ag/sls-techno-trans-ag> .

Imprint

PSI Facility News addresses the users of the PSI large facilities and appears quarterly in English. Any feedback is highly welcome! **More information.** <http://www.psi.ch/imprint>
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