No. III/15 - 24 September 2015

PSI photon, neutron and muon user facilities newsletter

Editorial

Mike Seidel <http://www.psi.ch/abe/>

Dear colleagues,

scarcity of resources and climate change are important topics today. The energy theme affects also large accelerator driven research facilities. In particular new projects such as ESS or the FCC / CLIC studies at CERN will have large power consumption and must optimize their energy efficiency. Also at PSI the consumption of electrical energy is dominated by the large research facilities and optimization efforts are undertaken.

Through the European project EUCARD-2 we participate in the development of energy efficient technologies for accelerators: **psi.ch/enefficient** <http://www.psi.ch/eneffi-cient> . Developments like low power accelerator magnets or efficient radio frequency (RF) generation are aimed at producing the primary electron or proton beam using grid power efficiently. Accelerator technology is thus an important and obvious part of the efficiency aspect. However, if we take a step back the context of efficiency must be seen even broader. We want to maximize the capability of doing scientific studies for a given effort. In fact the flux of neutrons, muons, X-rays with specific properties on a sample is the parameter that counts. Of-

Next calls for proposals

SLS: PX-beamlines
deadline: October 15, 2015
SLS: non-PX beamlines
deadline: March 15, 2016
more information
<http://www.psi.ch/sls/calls>

SINQ
deadline: November 15, 2015
more information
<http://www.psi.ch/sinq/call-for-proposals>

SμS
deadline: December 2015
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.p-si.ch/useroffice/proposal-dead-lines> **.**

Facility news

ten generation and transport of the desired secondary radiation has even more potential for improvements than accelerator technology. Optimizations of the SINQ spallation target gained a factor 1.4 in neutron flux at the same power input in the recent years. Such efficiency improvements are at the core of the planned upgrades for SINQ or the ongoing studies on high flux muon production. The proposal for an upgraded SLS 2.0 aims at obtaining a much increased brightness of X-rays with similar power consumption as of today. An optimized low emittance magnet lattice in the ring will enable this qualitative jump.

The mentioned projects are high level examples of efficiency improvements in our large facilities. But also pragmatic measures that are discussed or being realized should be mentioned here. PSI has installed a steering committee **Energy and Environment** <http://www.psi.ch/energieleitbild> and two working groups that investigate the improvement potential for the large facilities as well as for the general PSI infrastructure and buildings. The acquisition of more efficient compressors for liquid helium production is being planned. Per year the energy of 1.2 GWh (0.8% of PSI total) could be saved and the measure is financially supported by the public program “ProKilowatt”. In many facilities we use waste heat for heating purposes, and SwissFEL has implemented cooling circuits that run at higher temperature (70°C) to allow efficient heat recovery.

The importance of energy efficiency will increase, not least in the public awareness. We are already active in this field as the examples show. Let me ask all colleagues involved in the technical and the experimental aspects of our facilities to consider the efficiency topic in their areas of responsibility, and to bring in ideas for improvements.

Mike Seidel, Accelerator Operation and Development **ABE** <http://www.psi.ch/abe/> , Department GFA, PSI

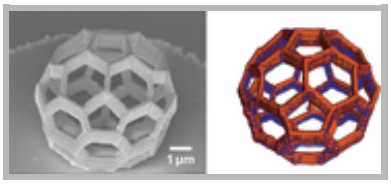
SLS: Nanotomography at cryogenic temperatures

Ptychographic multi-keV X-ray computed tomography (PXCT) has been demonstrated down to an isotropic 3D resolultion of 16 nm in a multi-micron sized test object [1]. This was achieved in a prototype tomography instrument, that was measuring at room temperature and atmospheric pressure. This prototype was and is in regular user operation at the cSAXS beamline at SLS. However, measuring at room temperature was limiting high-resolution PXCT to radiation insensitive samples. The OMNY (tOMography Nano crYo) instrument was successfully commissioned at the cSAXS beamline in June and is now available. A radiation sensitive biological structure was measured at a temperature of 92 K with a 3D resolution of 28 nm. The instrument is additionally equipped with a cryogenic sample transfer system that allows cryogenically fixed specimens to be transferred and measured in OMNY. For further information or in case of interest please **contact** <http://www.psi.ch/sls/csaxs/people> the beam line staff.

[1] **M. Holler et al, Scientific**

Research highlights

SLS - Materials Science: Advances in fabrication techniques to create mesoscopic 3D structures



Element-Specific X-Ray Phase Tomography of 3D Structures at the Nanoscale

C. Donnelly et al. Physical Review Letters 114, 115501 (2015), DOI: 10.1103/PhysRevLett.114.115501 <http://dx.doi.org/10.1103/PhysRevLett.114.115501>

Recent advances in fabrication techniques to create mesoscopic 3D structures have led to significant developments in a variety of fields including biology, photonics, and magnetism. Further progress in these areas benefits from their full quantitative and structural characterization. We present resonant ptychographic tomography, combining quantitative hard x-ray phase imaging and resonant elastic scattering to achieve ab initio element-specific 3D characterization of a cobalt-coated artificial buckyball polymer scaffold at the nanoscale. By performing ptychographic x-ray tomography at and far from the Co K edge, we are able to locate and quantify the Co layer in our sample to a 3D spatial resolution of 25 nm. With a quantitative determination of the electron density we can determine that the Co layer is oxidized, which is confirmed with microfluorescence experiments.

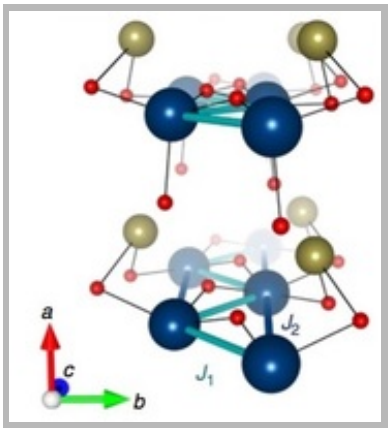
Read the full story <http://www.psi.ch/media/nanometres-in-3d>

SINQ - Magnetism: Towards the understanding of stripes

Reports 4, 3857 (2014)
<http://dx.-doi.org/10.1038/srep03857>

SINQ: High-fields on TASP and more general magnets

Thanks to the efforts of engineers and scientists in LDM, the high-field upgrade of TASP was successfully completed this year. Pre-upgrade sample magnetic fields were limited mainly by forces between the magnet and ferrous components of the sample table. During the Winter shutdown all ferrous parts were replaced by new non-magnetic components and force tests confirm that the magnetic field limits are now extended from 12 T to 14.9 T for vertical fields, and from 5.5 T to 6.8 T for horizontal fields; or simply the maximum fields of the MA15 vertical field and MA7 horizontal field magnets at SINQ, respectively. The newly available extended field ranges open up unexplored areas of scientific inquiry at TASP, and we look forward to servicing new community experiments in the upcoming proposal round.



<http://www.psi.ch/num/2015#pnc>

Spin-stripe phase in a frustrated zigzag spin-1/2 chain

M. Pregelj et al, Nature Communications 6, 7255 (2015), DOI: 10.1038/ncomms8255 <http://dx.doi.org/10.1038/ncomms8255>

Motifs of periodic modulations are encountered in a variety of natural systems, where at least two rival states are present. In strongly correlated electron systems, such behaviour has typically been associated with competition between short- and long-range interactions, for example, between exchange and dipole-dipole interactions in the case of ferromagnetic thin films. Here we show that spin-stripe textures may develop also in antiferromagnets, where long-range dipole-dipole magnetic interactions are absent. A comprehensive analysis of magnetic susceptibility, high-field magnetization, specific heat and neutron diffraction measurements unveils β-$TeVO_4$ as a nearly perfect realization of a frustrated (zigzag) ferromagnetic spin-1/2 chain. Notably, a narrow spin-stripe phase develops at elevated magnetic fields due to weak frustrated short-range interchain exchange interactions, possibly assisted by the symmetry-allowed electric polarization. This concept provides an alternative route for the stripe formation in strongly correlated electron systems and may help understanding of other widespread, yet still elusive, stripe-related phenomena.

Read the full story <http://www.psi.ch/num/2015#pnc>

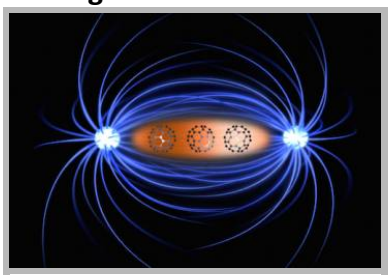
SμS - Magnetism: new magnets for technical applications?

SμS:Performance of new SμS spectrometer

The commissioning of the new μSR spectrometer in the PiM3.2 area has successfully been performed in the first beam cycle of 2015. By making use of muons and positrons detectors made of plastic scintillators and read out by Geiger-mode Avalanche Photodiodes, the time resolution of the complete instrument could be improved to about 160 ps compared to 800 ps in the old GPS. Accordingly, frequencies of up to 1.8 GHz have been measured on a quartz crystal. In addition, the width of the prompt peak has been drastically reduced which now allows to obtain good data already about 1 ns after muon implantation. The new compact design with detectors left and right from the sample increased the solid angle for transverse field experiments by 50%. First user experiments already profited from the enhanced overall performance of this new instrument.

SwissFEL: Umbrella MoU Signed by 14 Parties

Beating the Stoner criterion using molecular interfaces



<http://www.psi.ch/num/2015#mamari>

courtesy: Univ. Leeds, iStockPhoto

F. Al Ma'Mari et al, Nature 524, 69 (2015), DOI: 10.1038/nature14621 <http://dx.doi.org/10.1038/nature14621>
Only three elements are ferromagnetic at room temperature: the transition metals iron, cobalt and nickel. The Stoner criterion explains why iron is ferromagnetic but manganese, for example, is not, even though both elements have an unfilled 3d shell and are adjacent in the periodic table: according to this criterion, the product of the density of states and the exchange integral must be greater than unity for spontaneous spin ordering to emerge. Here we demonstrate that it is possible to alter the electronic states of non-ferromagnetic materials, such as diamagnetic copper and paramagnetic manganese, to overcome the Stoner criterion and make them ferromagnetic at room temperature. This effect is achieved via interfaces between metallic thin films and C_{60} molecular layers. The emergent ferromagnetic state exists over several layers of the metal before being quenched at large sample thicknesses by the material's bulk properties. Although the induced magnetization is easily measurable by magnetometry, low-energy muon spin spectroscopy provides insight into its distribution by studying the depolarization process of low-energy muons implanted in the sample. This technique indicates localized spin-ordered states at, and close to, the metal–molecule interface. Density functional theory simulations suggest a mechanism based on magnetic hardening of the metal atoms, owing to electron transfer. This mechanism might allow for the exploitation of molecular coupling to design magnetic metamaterials using abundant, non-toxic components such as organic semiconductors. Charge transfer at molecular interfaces may thus be used

Umbrella is the pan-European federated identity system for the users of the large-scale European photon and neutron facilities. This IT platform offers for the first time an EU-wide, unique and persistent ID for a wide, multidisciplinary user community. It was initiated by the IRUVX-PP project and further developed with the support of several EU projects such as PaNdata and CRISP. On the 31st of March 2015, the Memorandum of Understanding of the Umbrella Collaboration was signed by 14 parties: ALBA, DESY, Diamond Light Source Ltd, Elettra, EMBL Heidelberg, ESRF, European XFEL, HZB, ILL, Instruct Academic Services Ltd, KIT, PSI, STFC and SOLEIL. **Read more** <http://www.psi.ch/swissfel/highlights> .

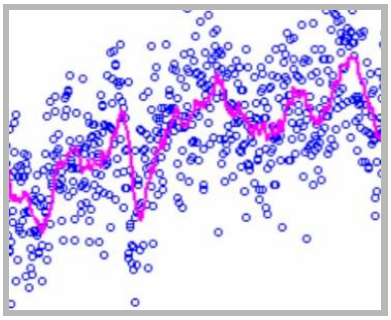
Upcoming events

Workshop on Neutron Imaging and Tomography
<http://www.sfn.asso.fr/jdn/site-jdn-23/imaging-workshop/>
October 5-6, 2015, Evian Les Bains, France

to control spin polarization or magnetization, with consequences for the design of devices for electronic, power or computing applications.

Read the full story <http://www.psi.ch/num/2015#mamari>

Enabling fs resolution pump-probe experiments at SwissFEL



<http://dx.doi.org/10.1117/12.2179016>

Laser arrival measurement tools for SwissFEL

Marta Divall Csatari et al., Advances in X-Ray Free-Electron Lasers Instrumentation III, 95121T (2015), DOI: 110.1117/2.2179016 <http://dx.doi.org/10.1117/12.2179016>

To probe ultrafast processes at SwissFEL it is crucial that the pump laser, used at the end stations, arrives in time with the generated X-ray pulses. For fs resolution pump probe experiments a path-length change of few-hundred nanometers already affects the measurement quality. The length of SwissFEL and the total propagation path of the pump laser light to the experiment is in the scale of several hundred meters, which makes this task challenging. The Timing and Synchronization and the SwissFEL laser group are working on developing tools to measure and correct the timing over the machine complex. In their latest publication they report on the Laser Arrival Monitor (LAM) concept for the SwissFEL gun laser, which produces the electron at the start of the linear accelerator. This device is based on high bandwidth electro-optical modulators adapted from telecommunication. They also report on the first results using a spectrally resolved cross-correlator, which enabled to measure time of arrival with fs resolution and to correct long term timing

JCNS Workshop 2015: Neutron Scattering on Nano-Structured Soft Matter: Synthetic- and Bio-Materials <http://www.fz-juelich.de/jcns/JCNS-Workshop2015>

October 5-8, 2015, Tutzing, Germany

JDN 23: Les journées de la Diffusion Neutronique 23 <http://www.sfn.asso.fr/?id=183>

October 5-8, 2015, Evian Les Bains, France

MASR 2015: Medical Applications of Synchrotron Radiation <http://www.esrf.fr/masr2015>

October 5-9, 2015, Grenoble, France

2nd International Conference on Rheology and Modeling of Materials <http://www.ic-rmm2.eu>

October 5-9, 2015, Lillafured, Hungary

8th International Conference on Electromagnetic Processing of Materials <http://epm2015.sciencesconf.org/>

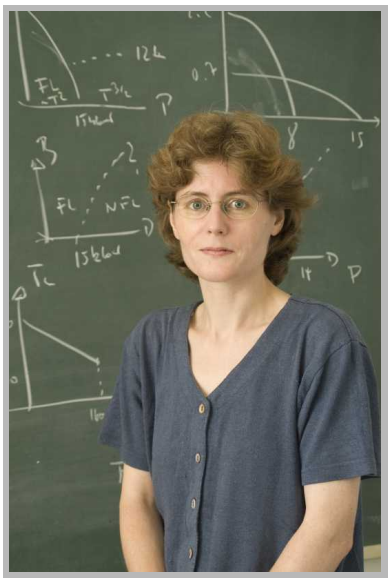
October 12-16, 2015, Cannes, France

NMI3-II: General Assembly 2015 <http://nmi3.eu/news-and-media/calendar.html>

drifts of a Terrawatt class Ti: sapphire laser system from the ps level to below 10 fs over 10 hours. The measurements will also help to identify the major sources of drift for passive stabilization. These results are important to enable fs resolution pump-probe experiments at SwissFEL.

Users Association

JUSAP - The Joint Users Association



<http://www.psi.ch/userofice/users-association>

Sarah Dunsiger

The website "**Methods at the PSI User Facilities** <http://www.psi.ch/science/methods-and-scopes-of-the-large-research-facilities> " acts as a useful tool to help users find the most appropriate SLS, SINQ or SμS beamline for their research. In a wider context, The initiative "**Coordinated Access to Lightsources to Promote Standards and Optimization** <http://www.calipso.wayforlight.eu> " (CALIPSO) involves the development of a web based "wayforlight" European light sources single entry point. It is intended to present to a potential user all European synchrotrons and free electron laser facilities in a coordinated manner.

October 14-16, 2015, Copenhagen, Denmark

LiQ2015: Current frontiers on liquid-liquid interfaces <http://www.ill.eu/liq2015> October 21-23, 2015, Grenoble, France

5th Annual Niels Bohr International Academy Workshop on ESS Science: Condensed Matter Theory and Advanced Software <https://indico.nbi.ku.dk/conferenceDisplay.py?ovw=True&confId=815> November 9-13, 2015, Copenhagen, Denmark

Jülich Soft Matter Days 2015 <http://www.fz-juelich.de/ics/ics-2/EN/Leistungen/ConferencesAndWorkshops/JSMD/_node.html> November 10-13, 2015, Bad Honnef, Germany

In Situ Serial Crystallography Workshop <http://indico.psi.ch/conferenceDisplay.py?confId=3677> November 17-19, 2015, PSI Villigen, Switzerland

Inelastic neutron scattering school <http://www.ansto.gov.au/Events/Neutronschool/index.htm> November 22-27, 2015, ANSTO near Sidney, Australia

A dedicated section for ESUO on the wayforlight portal may possibly be implemented. The development of such an interface on the wayforlight website would serve the synchrotron and FEL users community by for example, giving direct access for the European users community to ESUO news, to their national users organizations and to their national delegates.
The preparation of a possible CALIPSO+ proposal is in progress. In this context, ESUO, together with other participants, has been invited to take part to the first meeting of the writing core group, meeting scheduled by the end of September 2015 in Helmholtz-Zentrum Dresden-Rossendorf (HZDR,Germany). Members of the wider synchrotron user community are invited to offer input by contacting ESUO chair Prof. Dr. Ulli Pietsch (**pietsch@physik.uni-siegen.de**).

The next meeting of the JUSAP committee will take place in mid-October 2015. Issues, concerns or suggestions from the PSI user community are highly encouraged. Please contact the JUSAP committee chair (**dunsiger@triumf.ca**) or committee members.

Yours sincerely,

Sarah Dunsiger (JUSAP committee chair)

2015 MRS Fall Meeting and Exhibit <http://www.mrs.org/fall2015/>
November 29 - December 4, 2015, Boston, MA, USA

Fan du LLB <http://www-llb.cea.fr/fanLLB/>
December 7-10, 2015, Gif-sur-Yvette, France

RESONANCE workshop: Multicolor FEL pulses and coherent control on the attosecond time scale opening new science perspectives <http://www.elettra.eu/Conferences/2015/RESONANCE/>
December 10-11, 2015, Trieste, Italy

ECM-30: European Crystallographic Meeting <http://ecm30.ecanews.org/>
August 28 - September 1, 2016, Basel, Switzerland

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

Current Openings

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

Announcements

Jonas Okkels Birk receives SGN Young Scientist Prize

Dr. Jonas Okkels Birk of the Laboratory for Neutron Scattering and Imaging **LNS** <http://www.psi.ch/lns> , wins the Young Scientist Prize of the Swiss Neutron Scattering Society **SGN/SSDN** <http://www.psi.ch/sgn> . The award recognizes his outstanding PhD work on neutron instrumentation and especially on the new CAMEA spectrometer for SINQ and ESS. The SGN Young Scientist Prize is awarded annually to a young scientist in recognition of a notable scientific achievement and is sponsored by **Swiss-Neutronics** <http://www.swissneutronics.ch> .

30th Meeting of the European Crystallographic Association

ECM-30 will be a four-day vibrant and intensive scientific meeting held between August 28 and September 1, 2016 in Basel, Switzerland and will provide many learning opportunities in every current aspect of crystallography.
In addition, there will be a Young Crystallographers meeting, workshops and user meetings, lunch meetings, and a social program, which will allow scientists from all over Europe and the world to meet, connect and exchange. Besides the satellite meetings, a visit to the free electron laser SwissFEL is planned. Please find more information on the **conference website** <http://ecm30.ecanews.org/> .

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>
Contact: PSI User Office, Phone: +41-56-310-4666, Email: **useroffice@psi.ch**