



No. I/15 - 30 March 2015

PSI photon, neutron and muon user facilities newsletter

Editorial



Markus Janousch

Dear colleagues,

In the world in which we live today electronic devices with embedded computers and smart sensors are becoming ubiquitous. With your smart-phone you can check the energy consumption and production of your home and regulate the illumination

from anywhere. Wired and wireless connections allow the aggregation of data into information and knowledge. Currently, we witness the merging of the physical and digital world - the dream of the "**Internet of Things**" <http://en.wikipedia.org/wiki/Internet_of_Things>".

For accelerator based research this dream has already come true through the hands of the Controls Section. The control systems for the accelerators and experiments at PSI facilities are designed to connect all the different devices and subsystems to allow data exchange, automation, and supervisory control. The core of this is the Experimental Physics and Industrial Control System (**EPICS** <<http://www.aps.anl.gov/epics/>>). It provides the foundation to automated measurements, optimized data collection and, in the end, successful experiments.

EPICS was developed by a collaboration of control groups at large research facilities that has grown over the years into a world-wide community. They succeeded in creating a modular tool-kit that allows one to build distributed

New calls for proposals

SLS: PX-beamlines, attention: new date

deadline: April 15, 2015

SLS: non-PX beamlines
deadline: September 15, 2015

more information

<<http://www.psi.ch/sls/calls>>

SINQ

deadline: May 15, 2015

more information

<<http://www.psi.ch/sinq/call-for-proposals>>

SμS

deadline: June 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.psi.ch/useroffice/proposal-deadlines>> .

control systems for detectors, astronomy projects like telescopes, and accelerators with their experimental facilities. Some of the major advantages in using EPICS are configuration tools that substitute programming, a large base of proven software, and well defined interfaces for extensions at all levels.

At PSI we introduced EPICS with the SLS for both the control of the accelerator and the beamlines as well. But we did not stop there and since it is used for the proton accelerator and the medical accelerator as well as for the control of infrastructure such as our helium liquefaction plant. The notable exception is SINQ. For SwissFEL again EPICS will provide the controls for the accelerator as well as for the experimental stations. All this is made possible by the scalability and modularity of the software and knowledge provided by the collaboration.

In recent years, the emphasis of control system applications has shifted from the controlling and monitoring of devices to data-acquisition and analysis with its handling of high data-rates and volumes. This provides new challenges for the Controls Section that we tackle in cooperation with our colleagues from Scientific Computing. It stresses even more the integrating role that Controls plays among the different groups involved at the facilities: from the detector developers, the electricians, the technicians, accelerator specialists, operators and computing providers to the beamline scientists. Ultimately Controls is here to support the experimentalists in their endeavors.

Markus Janousch, Head of "Controls", Department GFA - Large Research Facilities, PSI

Research highlights

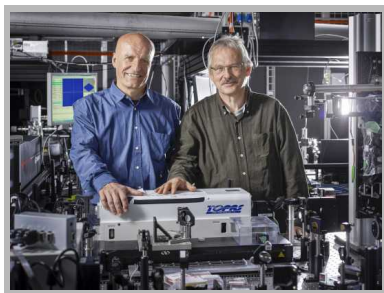
SLS - Materials Science: Prepared for the SwissFEL

Facility news

SLS: HERCULES 2015 - practical training at the SLS

As part of the month long Hercules course, the Paul Scherrer Institut hosted a group of 20 young physicists, chemists and biologists for practical training at the SLS from 15 - 20 March 2015. The course is designed for students, postdoctoral fellows and senior scientists from European universities and laboratories, in the fields of neutron and synchrotron radiation for condensed-matter studies (Biology, Chemistry, Physics, Materials Science, Geosciences, Industrial applications). Emphasis is placed on experimental training in small groups with a maximum of four participants.

This year the training sessions was performed at the cutting-edge experimental facilities of the SLS, with the cSAXS, microXAS, MS, PXIII, SIM, SIS, PHOENIX and TOMCAT beamlines involved. It also gave the participants the opportunity to become acquainted with the staff scientists of the SLS and, as a highlight before departing, with a guided tour of our Synchrotron ma-



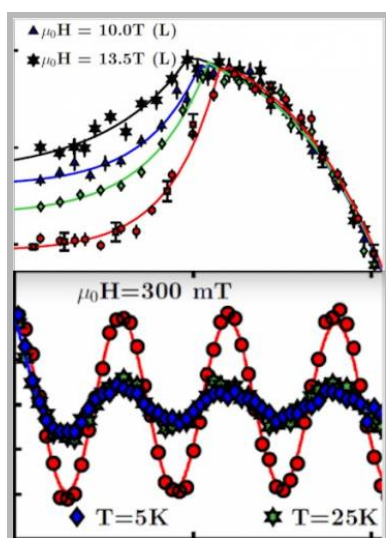
Prospective studies for SwissFEL experiments done at the SLS FEMTO station

L. Rettig et al, Physical Review Letters 114, 067402 (2015), DOI: PhysRevLett.114.067402 <<http://dx.doi.org/10.1103/PhysRevLett.114.067402>>

For many years, PSI researchers have been testing experimental methods that will provide insights into novel materials for electronic devices. Using a special trick to make the Swiss Light Source (SLS) at PSI generate light with similar properties to that of PSI's x-ray laser SwissFEL, the researchers were able to demonstrate that the experiments planned for SwissFEL are possible and they are now building an experimental station at SwissFEL.

Read the full story <<http://www.psi.ch/media/prepared-for-the-swissfel>>

SINQ and S μ S - The competition between superconductivity and magnetism



Competing superconducting and magnetic order parameters and field-induced magnetism in electron-doped $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$

J. Larsen et al, Physical Review B 91, 024504 (2015), editor's choice, DOI: 10.1103/PhysRevB.91.024504 <<http://dx.doi.org/10.1103/PhysRevB.91.024504>>

chine ring to obtain an insight into the inner workings of such a facility. Visits to the SinQ, S μ S and Proton Therapy completed an introduction to the PSI user facilities. **More information** <<http://hercules-school.eu/>> .

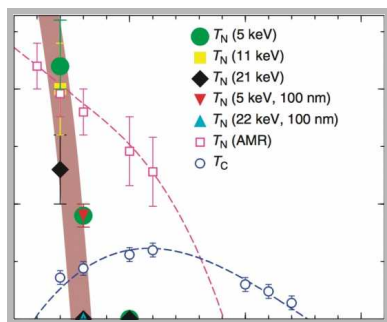
SINQ: Two new humidity chambers under development

Neutrons are an ideal probe for the effects of water transport processes in many materials such as membranes for fuel cells/batteries, building materials (e.g. concrete, wood) or in food science due to their very high sensitivity for hydrogen. Therefore, two humidity chambers are under development at SINQ: one for small-angle neutron scattering and another one for neutron imaging. The SANS-chamber is optimized for a relative moisture between 20%rh and 95%rh, temperatures between 20°C and 100°C, and ambient pressure. The one for neutron imaging has been designed for temperatures in the range -10°C to 90°C and relative moisture contents between ca. 5%rh and 90%rh. It will allow for a field of

We have studied the magnetic and superconducting properties of $\text{Ba}(\text{Fe}_{0.95}\text{Co}_{0.05})_2\text{As}_2$ as a function of temperature and external magnetic field using neutron scattering and muon spin rotation. Below the superconducting transition temperature the magnetic and superconducting order parameters coexist and compete. A magnetic field can significantly enhance the magnetic scattering in the superconducting state, roughly doubling the Bragg intensity at 13.5T. We perform a microscopic modeling of the data by use of a five-band Hamiltonian relevant to iron pnictides. In the superconducting state, vortices can slow down and freeze spin fluctuations locally. When such regions couple they result in a long-range ordered antiferromagnetic phase producing the enhanced magnetic elastic scattering in agreement with experiments.

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

SμS - Superconductivity: a higher degree of symmetry



The phase diagram of electron-doped $\text{La}_{2-x}\text{Ce}_x\text{CuO}_{4-\delta}$

H. Saadaoui et al, Nature Communications 6, 6041 (2015), DOI:

10.1038/ncomms7041

<<http://dx.doi.org/10.1038/ncomms7041>>

Superconductivity is a striking example of a quantum phenomenon in which electrons move coherently over macroscopic distances without scattering. The high-temperature superconducting oxides (cuprates) are the most studied class of superconductors, composed of two-dimensional CuO_2 planes separated by other layers that control the electron concentration in the planes. A key unresolved issue in cuprates is the relationship between superconductivity and magnetism. Here we report a

view with an edge length of up to 15cm. The two humidity chambers will be available for the SINQ user program later on.

SμS: New spectrometer

Recently a completely new spectrometer has been installed in the PiM3.2 area to replace the existing **GPS** <<http://www.psi.ch/smus/pim3>> instrument. The new spectrometer is based on scintillating detectors read out directly by Avalanche Photo-Diodes (APDs). It therefore features an improved time resolution and a significantly increased solid angle covered by the positron detectors. In addition, higher magnetic fields will be available for the experiments. First promising tests with beam have already been performed at the end of December last year and final commissioning of this new SμS facility with overall improved performance is foreseen for beginning of June.

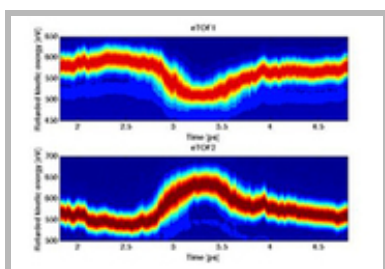
!SwissFEL: Successful start of the series production of the C-band accelerating structures for SwissFEL

A total of 104 C-band accel-

sharp phase boundary of static three-dimensional magnetic order in the electron-doped superconductor $\text{La}_{2-x}\text{Ce}_x\text{CuO}_{4-\delta}$, where small changes in doping or depth from the surface switch the material from superconducting to magnetic. Using low-energy spin-polarized muons, we find that static magnetism disappears close to where superconductivity begins and well below the doping level at which dramatic changes in the transport properties are reported. These results indicate a higher degree of symmetry between the electron and hole-doped cuprates than previously thought.

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

SwissFEL



The pulse arrival and length monitor PALM successfully tested at SACLA

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 a 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. The device was successfully tested at SACLA, recording the arrival time accuracy to a sub-10 fs level and making successful measurements of the pulse length. The device will be made into a permanent diagnostic device, further improved and upgraded, and installed at SwissFEL.

erating structures will be needed for SwissFEL. Each of these structures is about 2 m long and consists out of 113 copper cells that are manufactured with micrometer precision using ultra-precision diamond machining, which results in mirror-like surfaces. The main components are the couplers at the input and the output of the structure, and the copper disks. For both, couplers and disks, the series production was successfully launched at the end of 2014. Since then the Dutch company VDL and TEL Mechatronics in Trübbach, Switzerland, delivered already many sets of couplers and accelerating disks, respectively. **More information** <<http://www.psi.ch/swissfel/highlights>> .

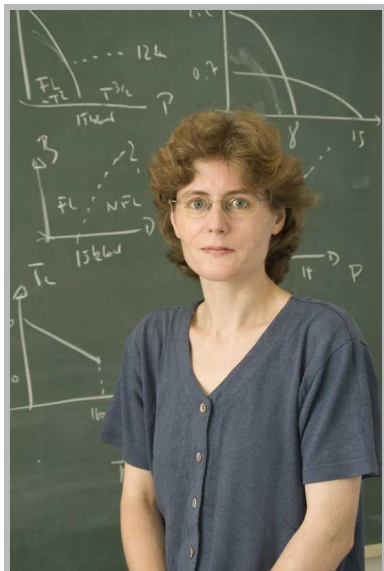
Upcoming events

Structural Systems Biology - From Molecules to Organisms <<https://indico.desy.de/conferenceDisplay.py?ovw=True&confId=11462>>

April 13-17, 2015, Hamburg, Germany

Users Association

JUSAP - The Joint Users Association



Sarah Dunsiger

Developments in instrumentation like new detector systems in recent years have led to so called "data deluges". These potentially Terabyte sized datasets pose challenges for the on-line analysis during experiments, as well as subsequently.

The Paul Scherrer Institute would like to address this

issue and is pleased to announce a new project "Data analysis infrastructure for the multi-disciplinary users of PSI large scale facilities" to start in April 2015. It aims to provide the necessary support for storing data for up to 12 months and by offering computing facilities which may be used both on site and remotely from the home institutions. This service would ultimately be extended to all PSI large scale facilities, including SLS, SINQ, μ SR and the upcoming SwissFEL.

Building up the necessary IT infrastructure, processes for data transfer, book keeping and access rights and especially providing software environments for more and more scientific communities will be a long term process. The initial phase will focus on further developing and providing software for three types of beamlines at the SLS which currently create the largest data volumes: TOMCAT (hard X-ray imaging), PX (macromolecular crystallography) and cSAXS (spatially and time-resolved small-angle scattering and high resolution imaging).

Crystallography for the next generation: the legacy of IYCr <<http://www.iy-cr2014.org/legacy/conference>>
April 22-24, 2015, Rabat, Morocco

Dielectrics 2015 <<http://dielectrics2015.iopconfs.org/home>>
April 22-24, 2015, Teddington, UK

EMBO workshop: Small angle neutron and X-ray scattering from proteins in solution <<http://events.embo.org/15-saxs/>>

May 18-22, 2015, Grenoble, France

Superconductivity - Unconventional Superconductivity: Materials and Mechanisms <<https://www.grc.org/programs.aspx?id=13854>>

May 24-29, 2015, Hongkong, China

MaMaSELF Status Meeting 2015 <<http://indico.psi.ch/event/mamaself15>>

May 26-29, 2015, Rigi Kulm, Switzerland

The Zurich School of Crystallography: bring your own crystals

<<http://www.chem.uzh.ch/linden/zsc/>>

June 7-20, 2015, Zurich, Switzerland

This project strongly depends on input from the user community to focus on the most important demands. The JUSAP committee would therefore like to invite interested users to submit their suggestions to the project management, **Stephan Egli** and **Derek Feichtinger** or to JUSAP.

Yours sincerely,

Sarah Dunsiger (JUSAP committee chair)

Summer School on Methods and Applications of Neutron Spectroscopy

<<http://www.ncnr.nist.gov/summerschool/ss15/index.html>>

June 8-12, 2015, NIST,
Gaithersburg, MD, USA

ISIS Neutron training course

<<http://www.isis.stfc.ac.uk/learning/neutron-training-course/isis-neutron-training-course9135.html>>

June 16-25, 2015, Abingdon,
UK

PSI Summer School on Condensed Matter Research

2015 <<http://www.psi.ch/summerschool>>

August 15-21, 2015, Zuo2,
Switzerland

M2S 2015: 11th International Conference on Materials and Mechanisms of Superconductivity

<<http://www.m2s-2015.ch>>

August 23-28, 2015, Geneva,
Switzerland

ECNS2015: VI European Conference on Neutron Scattering <<http://www.ecns2015.eu>>

August 30 - September 4,
2015, Zaragoza, Spain

SAS2015: 16th International conference on Small-Angle Scattering <<http://www.->

cac.us.edu.pl>

September 13-18, 2015,
Berlin, Germany

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

Current Openings

Job opportunities at PSI

<<http://www.psi.ch/en/pa/offenstellen/>>

Announcements

PSI Summer School 2015

The 2015 (14th) PSI summer school on condensed matter research will again be organized at the Lyceum Alpinum in Zuoz/CH from **August 15-21, 2015**. The PSI summer schools aim to train young researchers in the methods being used at large scale facilities such as neutron and muon sources or synchrotron photon sources. International experts and PSI staff members will introduce and deepen your knowledge not only on those methods but also on the phenomena, which are presently at the forefront of modern solid state research.

Following the school a practical training is offered at PSI (August 22-23). It will allow a limited number of participants to get hands-on experience with state-of-the-art instrumentation using photons, neutrons, and muons. The online application will open early 2015. Please visit the **school's homepage** <<http://indico.psi.ch/conferenceDisplay.py?confId=3407>> for more information.

ECM-30, Basel 2016

The 30th European Crystallographic Meeting, **ECM-30**, will take place at the congress center in Basel, August 28 to September 1, 2016. Besides the scientific program on topics at the forefront of crystallography and materials science, various satellite meetings and an excursion to the SwissFEL site will be organized. The Swiss Crystallographic Society as the local organizer looks forward to welcoming you next year to Basel, a very international city in the triangle between Switzerland, France and Germany, **more information** <<http://ecm30.ecanews.org/>> .

X+N powder diffraction - session 2015

Since 2008 once a year it is possible to submit proposals that apply for beam time at both the SLS Materials Science beam line **MS-Powder** <<http://www.psi.ch/sls/ms/>> and the SINQ powder diffractometers **HRPT** <<http://www.psi.ch/sinq/hrpt/>> and **DMC** <<http://www.psi.ch/sinq/dmc/>> . Recently, the evaluation of the 2015 proposals was finished and the users have been informed about the results of the proposal review committee's decision already. Although this is a niche initiative for a limited number of scientific cases a total of 80 proposals has already been submitted over the last years with a success rate of 50%. 112 days of beam time at SINQ and 151 shifts at SLS have already been allocated. The next call will be launched in January 2016, **more information** <<http://www.psi.ch/useroffice/x-plus-n>> .

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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