



No. IV/12 - 21 December 2012

PSI photon, neutron and muon user facilities newsletter

Editorial



Oliver Bunk

Dear colleagues,

What do the Large Hadron Collider (LHC) at CERN, the Square Kilometre Array (SKA) telescope, the Internet and certain synchrotron-radiation beamlines have in common? The answer to this question is data rates

and volumes beyond imagination! To give you some examples: CERN reduces its data rate by event filtering currently to 25 Petabytes (10^{15}) per year. This is comparable to the global Internet IP traffic per month. If you think, 'This is interesting, but not my business', then please consider the following numbers for the PILATUS detector, developed at PSI: Each large-area detector, as found at many synchrotron-radiation beamlines around the world, can produce 2 Petabytes of data per year. The next-generation EIGER detector will easily enter the Exabyte (10^{18}) data production rate per year regime and brings us into the good company of the above-mentioned SKA telescope.

This 'data deluge' is not an inevitable fate without escape. The driving forces are clear scientific questions. These developments create both opportunities and challenges. At our facility, we take considerable effort to enable high data rates to be achieved and to provide online feedback. The more we succeed in rendering such experiments seemingly easy, the more it may come as a surprise how resource-intensive and tedious further data

New calls for proposals

SLS: PX-beamlines

deadline: February 15, 2013

SLS: non-PX beamlines

deadline: March 15, 2013

more information

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

SINQ

deadline: May 15, 2013

more information

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

SLS/SINQ: joint X+N powder diffraction

deadline: February 17, 2013

more information

<<http://www.psi.ch/useroffice/x-plus-n>>

SμS

deadline: June 2013

more information

<http://lmu.web.psi.ch/facilities/next_call.html>

An **overview** about all proposal submission deadlines of the PSI facilities can be

analysis can be. There are no easy solutions available. For example, powerful analysis centres with skilled staff could be a bonus for any kind of experiment, but in times of constant or decreasing budgets we are facing questions such as, 'Shall we close beamlines A and B in order to provide better support for users of beamline C?', or vice versa, 'Shall we limit the performance of beamline C in order to preserve resources for other beamlines?'. I think that this points towards another common element of research at LHC, SKA and SLS: Close collaboration between facility and users promises much higher scientific output than a pure service-provider approach. Let us use the opportunities available and face the challenges which confront us by deepening close collaboration between the different facilities and their scientific communities. I wish you and your families a Merry Christmas, a restful vacation period and a Happy New Year 2013!

Oliver Bunk, Head of the Laboratory for Macromolecules and Bioimaging - LSB, SYN Department, PSI

Research highlights

SLS - Life Science: The evolutionary origins of our pretty smile



Development of teeth and jaws in the earliest jawed vertebrates

M. Rücklin et al, Nature Advance Online Publication 17 October 2012; DOI: 10.1038/nature11555

Until recently, it was not clear whether the earliest vertebrates (animals with a backbone) which had jawbones already possessed teeth or not. Now, an international research team has shown that the jaws of the prehistoric fish *Compagopiscis* already had teeth. This demonstrates

obtained **here** <<http://www.psi.ch/useroffice/proposal-deadlines>> .

Upcoming events

5th MaNEP Winter School - Understanding electronic and magnetic correlations

<<http://www.manep.ch/en/events/saasfee13>>
January 13-18, 2013, Saas-Fee, Switzerland

7th International Symposium Hydrogen and Energy

<<http://www.empa.ch/h2e-symposium>>
January 21-25, 2013, Stoos, Switzerland

European XFEL Users' Meeting 2013

<<http://www.xfel.eu/2013-users-meeting/>>
January 23-25, 2013, Hamburg, Germany

44th IFF Spring School: Quantum Information Processing <http://www.fz-juelich.de/pgi/EN/Leistungen/SchoolsAndCourses/SpringSchool/_node.html>

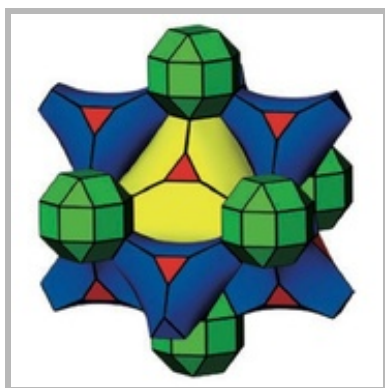
February 25 - March 8, 2013, Jülich, Germany

33rd Berlin School on Neutron Scattering

that teeth appeared at the same evolutionary time as jaws – or at least shortly afterwards. The leaders of this project were scientists from the University of Bristol, England, who carried out their decisive experiments at the SLS at the Paul Scherrer Institute, Switzerland, where they were able to actually look inside *Compagopiscis* fossils. The results of this research have just been published in the latest edition of the journal *Nature*.

Read the full story <<http://www.psi.ch/media/current-news>>

SINQ - Porous materials for hydrogen storage



On Demand: The Singular rht Net, an Ideal Blueprint for the Construction of a Metal–Organic Framework (MOF) Platform

J.F. Eubank et al, *Angew. Chemie Int. Edition* 51, 10099 (2012)

The exceptional nature of the rht-MOF platform, based on a singular edge-transitive net (the only net for the combination of 3- and 24-connected nodes), makes it an ideal target in crystal chemistry. The high level of control indicates an unparalleled blueprint for isorecticular functional materials (without concern for interpenetration) for targeted applications.

Read the full story <<http://www.psi.ch/num/2012#eubank>>

SμS - Quantum magnetism: A story of competition and frustration

Kapellasite: A Kagome Quantum Spin Liquid with Competing Interactions

B. Fåk et al, *Physical Review Letters* 109, 037208 (2012)

<http://www.helmholtz-berlin.de/events/neutron-school/index_de.html>

February 28 - March 8, 2013, Berlin, Germany

ISIS practical neutron training course

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

March 5-14, 2013, Didcot, United Kingdom

CRISP 2nd annual meeting

<<http://www.crisp-fp7.eu/news-events/2013/>>

March 18-20, 2013, PSI Villigen, Switzerland

12th PSI Summer School on Condensed Matter Physics

<<http://www.psi.ch/summer-school>>

August 17-25, 2013, Zuoz, Switzerland

3rd Joint User Meeting at

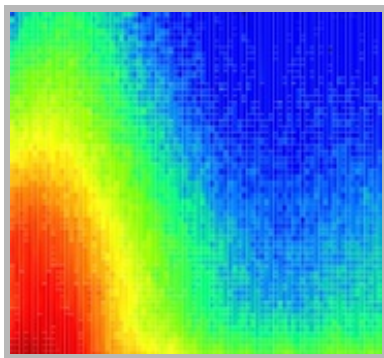
PSI: JUM@P 2013 <<http://indico.psi.ch/event/jump13>>

September 18-20, 2013, PSI Villigen, Switzerland

Facility news

SLS: Near-Ambient Pressure Photoemission, NAPP

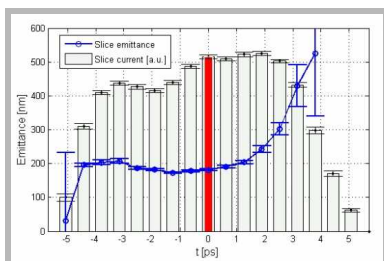
X-ray photoelectron spectroscopy (XPS) performed at



Magnetic susceptibility, NMR, muon spin relaxation, and inelastic neutron scattering measurements show that kapellasite, $\text{Cu}_3\text{Zn}(\text{OH})_6\text{Cl}_2$, a geometrically frustrated spin-1/2 kagome antiferromagnet

polymorphic with herbertsmithite, is a gapless spin liquid showing unusual dynamic short-range correlations of noncoplanar cuboc2 type which persist down to 20 mK. The Hamiltonian is determined from a fit of a high-temperature series expansion to bulk susceptibility data and possesses competing exchange interactions. The magnetic specific heat calculated from these exchange couplings is in good agreement with experiment. The temperature dependence of the magnetic structure factor and the muon relaxation rate are calculated in a Schwinger-boson approach and compared to experimental results.

Read the full story <<http://www.psi.ch/num/2012#fak>>



Record low emittance at the SwissFEL Injector Test Facility

The SwissFEL injector test facility at PSI is the principal test bed and demon-

stration plant for the SwissFEL project.

Significant progress has been achieved in the past few months, during which the injector settings were systematically optimized for maximum brightness of the electron beam (low emittance at high beam current). The result of this optimization is a stable working point for uncompressed electron bunches, which ensures beam transport with minimal emittance dilution. Once the influence of the accelerator itself on the beam emittance is

pressures up to 20 mbar (here referred to as near-ambient pressure photoemission, NAPP) is an emerging tool that allows the probing of the chemistry of surfaces that are relevant to catalysis and the environment under nearly realistic reactant and pressure conditions. The SLS-NAPP instrument has been set up as a mobile end-station prepared for different beamlines e.g. the Phoenix beamline. For environmental surface chemistry, the long-term focus is to establish a molecular-level description of the climate and the impact of atmospheric particles on air pollution. In the field of catalysis, the ultimate aim is to measure industrially relevant catalyst structures under catalytic conditions that have realistic flow dynamics.

SINQ: Extraordinary high request for beam time

At the recent proposal round in November 2012, SINQ received more proposals than ever before: 183 proposals for the diffractive instruments and another 56 for the two imaging beamlines were submitted by the user community. Together

kept at a minimum, subtle effects of the laser generating the electrons at the cathode (via the photo-electric effect) become accessible to beam optics measurements. In this way it was possible, for instance, to demonstrate the effect of the laser photon energy (or wavelength) on the beam emittance. During these studies extremely small emittances were measured, in particular for low bunch charges, where the adverse effects of Coulomb repulsion (space charge) are also smallest. But even at the nominal SwissFEL working point of 200 pC charge and with the standard laser wavelength of 260 nm, which ensures high electron yield, record low emittances well below the SwissFEL requirements have been achieved. At these conditions, global (projected) emittances below 0.35 mm mrad are now obtained routinely, with best values around 0.30 mm mrad. The more relevant slice emittance, i.e. the emittance measured for individual slices along the bunch length, which represents a key beam parameter for free-electron lasers, is typically below 0.20 mm mrad, with a record value of 0.18 mm mrad (see image). These promising results were obtained with still uncompressed electron bunches. To reach the high peak currents necessary to drive a free-electron laser, longitudinal bunch compression is essential. The study of compressed electron bunches at the SwissFEL injector test facility is planned for 2013, when a linearizing harmonic cavity will be installed. The new cavity will allow for a more uniform compression of the bunch in the magnetic chicane (the so-called bunch compressor).

with the first deadline in 2012, this makes a total of almost 400 new proposals, which means that the request for SINQ beam time is at the same enormous level as in 2011. The evaluation procedure has been started and users will be informed in February about the results.

S μ S: New evaluation process for beam time proposals

Beginning with the upcoming call, the μ SR proposals will be solely evaluated on the basis of the written application for beam time. Accordingly, there will be no oral presentations of proposals at an S μ S users' meeting. Instead, the users of the S μ S are invited to participate in the Joint Users' Meetings at PSI **JUM@P** <<http://indico.psi.ch/event/jump13>> bringing together the three user communities of SLS, SINQ and S μ S (see announcement below). The evaluation committee members will still meet in person at PSI to judge the submitted proposals.

SwissFEL: Workshops on Sample Mounting and Pump Laser

The two workshops on Pump Laser and Sample Mounting held in November 2012 were a great success. The talks given by experts from different facilities gave an inspiring view of the existing and planned instrumentation for Pump Laser and Sample Mounting at different FEL and XFEL facilities. We are grateful for the excellent contributions which were made.

Current Openings

Job opportunities at PSI

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

Announcements

SwissFEL approved by the Swiss Parliament

An important political and financial milestone for the realization of the new SwissFEL facility was reached on the 13th of December 2012 when the Swiss Parliament approved the federal budget for research and education for the years 2013-2016, in which SwissFEL is explicitly included. After the issuance of legal building permission, construction of the SwissFEL project will begin early in 2013.

2013 PSI Summer School on Condensed Matter Physics

The 2013 edition of the PSI Summer School on condensed matter physics is being dedicated to some of the main topics addressed at large-scale user facilities, such as neutron and muon sources or synchrotron photon sources: Materials - structure and magnetism. International experts and PSI staff

members will introduce and deepen your knowledge not only about these scientific topics but also about the main methods applied to understanding the phenomena which are presently at the forefront of modern solid-state physics and chemistry. The school will be organised from **August 17-23, 2013** at the Lyceum Alpinum in Zuoz, Switzerland. Following the school, practical training is being offered at PSI to allow a limited number of participants to obtain hands-on experience with state-of-the-art instrumentation using photons, neutrons, and muons. More information can be obtained from the **school's webpage** <<http://www.psi.ch/summerschool>> .

Joint User Meeting JUM@P 2013 at PSI

The date for the 3rd edition of the **JUM@P user meeting** <<http://indico.psi.ch/event/jump13>> series at PSI has now been fixed for **September 18-20, 2013**. Please reserve these dates in your diaries now. The aim of the PSI Joint User Meetings is to bring together the three user communities for SLS, SINQ and μ S and to generate new synergies among these scientists driven by common scientific, rather than technical, interests. JUM@P '13 will be a users-for-users meeting. Organizers of the meeting are PSI and its Users Association **JUSAP** <<http://www.psi.ch/useroffice/users-association>> . The meeting will consist, on the first day, of a plenary session with keynote and invited lectures, as well as information about PSI and its user facilities. The second day is being reserved for **topical parallel workshops** <<http://indico.psi.ch/internalPage.py?pagelId=4&confId=2034>> of a half- or one-day duration. Poster sessions and the award of the third PSI thesis medal will complete the programme. The 2013 annual meeting of the European Synchrotron User Organisation **ESUO** <<http://www.esuo.org>> will be organized as a JUM@P satellite event.

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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