Bragg Peaks > for neutron users
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OPAL news

The OPAL Reactor and its cold neutron source continued to perform very well during the period July to September 2010, with an overall reliability of 85% with respect to the published schedule. Our 4 thermal-neutron diffractometers used 82% of this beam time for user experiments, while the two cold-neutron instruments used 63%.

Bragg Institute news

We have also approved the scope, budget and estimated schedule for the fifth and final major component of the five key elements in the $37M Neutron Beam Expansion Project announced in the Australian Government's May 12th 2009 Budget Statement: the CG2 split cold-neutron guide. One of the two guides (CG2-A, 40 x 100 mm^2) will feed the new BILBY time-of-flight small-angle neutron scattering instrument, while the second (CG2-B, 40 x 250 mm^2) could feed a second neutron reflectometer, along with a variety of other possible cold-neutron instruments.

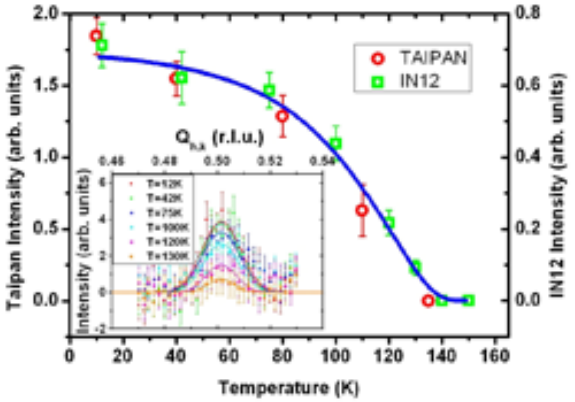
On October 15, the Bragg Institute received the ARPANSA licence to operate TAIPAN, our thermal-neutron three-axis spectrometer. Invitations for scheduling have gone out to all preapproved primary investigators, and we hope to complete as many of these experiments within the current round. This effectively represents the successful end of the initial instrument build at OPAL, which included the reactor, cold source, guides, buildings and the initial suite of instruments.

Around the instruments

Taipan *(thermal triple-axis spectrometer)*

TAIPAN, which uses thermal neutrons, is ideally suited to the study of collective motions of atoms in solids (such as phonons and magnons), and in studying the physics of phase transitions and processes where thermal energy are involved. These include strong magnets, superconductors and strange metallic states.

Recently, for example, the triple-axis spectrometers TAIPAN (ANSTO) and IN12 (Institute Laue Langevin, Grenoble) were employed to fully resolve the atomic scale antiferromagnetic structure within a mono-stoichiometric $FePt_3$ thin film consisting of alternating chemically ordered antiferromagnetic and chemically disordered ferromagnetic layers. The onset of a half-order magnetic peak along the (½ ½ 0) direction confirmed the direction of AFM order below the Néel temperature, see Figure below.

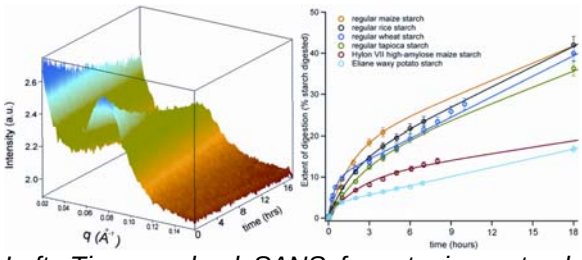


Integrated antiferromagnetic Bragg peak intensities as a function of temperature. The squares represent the data recorded at IN12, which are shown in the inset (symbols = data and lines = Gaussian fits). The circles have been recorded with TAIPAN in similar geometry to IN12 (profiles not shown).

Reference: T. Saerbeck, F. Klose, D. Lott, G.J. Mankey, Z. Lu, P.R. LeClair, W. Schmidt, A.P.J. Stampfl, S. Danilkin, M. Yethiraj, and A. Schreyer, *Phys. Rev. B* **82**, 134409 (2010)

Where lower energy excitations such as the novel ground states of one-dimensional materials are of interest, SIKA, which uses cold neutrons, will be better suited. Naturally materials have a combination of low energy and thermal excitations and the two machines can be chosen based on the requirements of the particular experiment.

Quokka *(SANS)*

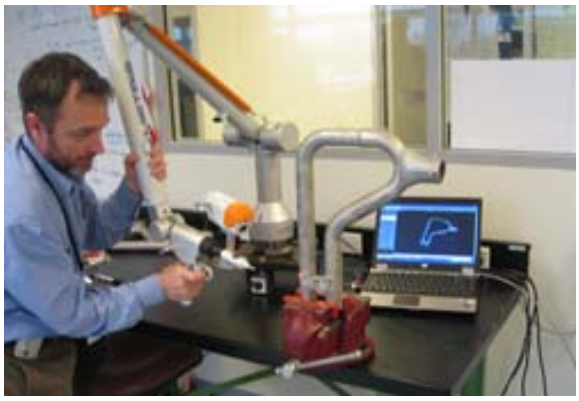


Left: Time-resolved SANS from tapioca starch as a function of digestion time: Right: Time-resolved extent of digestion for granular starches investigated.

During October we experienced some difficulties with the performance of the 2-dimensional area detector on our QUOKKA small-angle neutron scattering instrument. We have now installed the spare 1m^2 detector in place of the original detector and QUOKKA is now back in full user service.

Also, the first paper from QUOKKA has been accepted for publication in *Biomacromolecules*. The full title and reference is: J. Blazek and E. P. Gilbert, "The Effect of Enzymatic Hydrolysis on Native Starch Granule Structure".

Kowari *(strain scanner)*



Philip Bendeich (ANSTO – Institute of Materials Engineering) using KOWARI's new coordinate measuring arm.

Previously, positioning even simple samples for residual stress measurements on KOWARI could take a few hours, whilst complex components could take half a day or more. This procedure had to repeated for each measured stress direction (usually a minimum of three directions are needed). Thus a significant portion of user beam time was devoted to positioning the sample.

Enter Strain Scanning Simulation Software (SSCANSS)! This software was developed at the Open University, UK, to simplify positioning and enable many of the steps to be undertaken off-line. The component to be analysed has a number of fixed points glued to it which are then measured using our laser scanner and touch probe. A 3-dimensional model of the sample surface and all fixed points is rendered as you scan. This model is then used off-line to define the positions where the user wishes to record strain measurements, and the instrument movements are calculated.

Once prepared to run the experiment on KOWARI, the researcher places the sample on the instrument table and records the position of the fixed points. The software then orients the model and measurement points on the instrument table and writes scripts to move the component, saving hours of beam time.

SSCANSS was used for the first time measuring conventional and temperbead weld repairs recently, it is estimated that the software saved 2 days of positioning over a 4 day experiment.

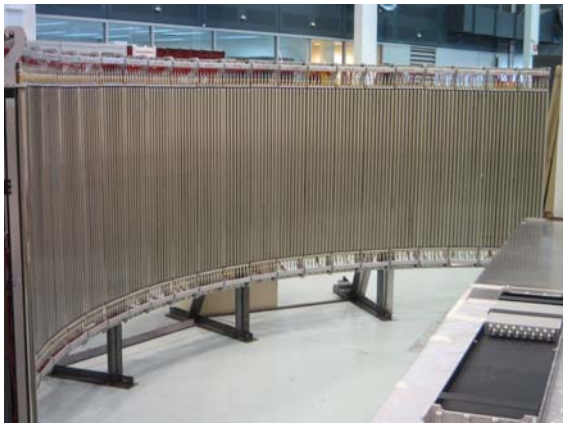
Koala *(Laue Diffractometer)*

A view down the length of the Cobra nitrogen flow system directed into the detector drum on KOALA.

A new Oxford Cryosystems Cobra Plus has been delivered and been successfully used for the first time. Cobra is available for single-crystal diffraction on KOALA, and uses nitrogen gas, from a nitrogen gas generator, to produce a constant cold stream of nitrogen, down to 80 K.

Key specifications include a temperature range of 80 – 400 K (with a possible increase to 500 K pending future tests on the detector drum), nitrogen flow rate of 5 or 10 Lmin^{-1} and temperature stability of 0.1 K.

Pelican *(Time-of-Flight Spectrometer)*



The Pelican detector array being tested in the Neutron Guide Hall.

We continue to await the arrival of the main component of Pelican, its large aluminium vacuum vessel, which is currently undergoing leak testing. In addition, Pelican's complete 5 m^2 detector array has now been assembled and a full test of the 200 ^{3}He detectors and data acquisition electronic system is in progress.

Also, the three high-performance Fermi choppers have successfully passed factory acceptance test and are on their way to ANSTO from SKF Magnetic Bearings, in Canada.

Pelican's Fermi choppers during testing in Canada.

Gas and Vapour Sorption Systems

We have recently ordered a Gas Handling and Vapour Systems from Hiden Isochema in the UK, as part of the NBI-2 Project.

The Gas Sorption System.

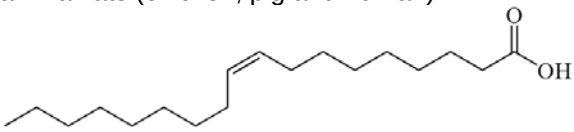
The Gas Handling System will have 5 different gas lines and is capable of mixing gases to 200 bar within a fully automated gas manifold system, that can be temperature stabilised to 50 °C. It will deliver gases as a stream or by measured volumes.

The Gas Vapour System will also have 5 different gas lines and can automatically deliver either saturated gas-vapour mixtures up to 10 bar or a humidified stream up to 1 bar.

Delivery of these systems is expected in November 2011.

National Deuteration Facility *(Chemical Deuteration)*

The Chemical Deuteration team within the National Deuteration Facility has succeeded in synthesising gram-quantities of deuterated oleic acid, a major component in common vegetable oils such as olive, peanut and sesame oils, and the most abundant fatty acid present in many animal fats (chicken, pig and human).



Oleic acid ((9Z)-Octadec-9-enoic acid).

This work also has great relevance to work on biological cell membranes, which contain oleic acid as a segment in phospholipid tails. This synthesis progress will now enable a whole class of new reflectometry and small-angle neutron scattering experiments using oleic acid.

Announcements

The 2011-2 Proposal Round for beam time between September 2011 – March 2011 and access to all 7 initial neutron-beam instruments (powder diffraction, SANS, reflectometry, strain scanning, single-crystal diffraction, triple-axis) and the National Deuteration Facility (bio- and chemical deuteration) is now open.

The Program Advisory Committee will meet to assess 2011-1 proposals in February 2011.

Sample-Environment Workshop 2012

At the International Workshop on Sample Environments for Neutron Scattering, held in Munich (Germany), it was decided that the next meeting in the series will be hosted by ANSTO in Sydney. The 2012 meeting will be the first held outside Europe or North America. The meeting covers the apparatus and infrastructure for achieving high and low temperatures, magnetic and electric fields and high pressures or stresses, amongst other things, for samples in neutron beams. Congratulations go to Scott Olsen and Paolo Imperia who presented our successful bid to host the next meeting.

Tall Poppy recognised in Canberra

One of our users, Dr. Darren Goossens, has been recognised with the award of an ACT Young Tall Poppy Science Award 2010, as the *Winner of the ANU Medal for the ACT Young Tall Poppy Scientist of the Year*. Darren is one of the inaugural AINSE Research Fellows, based at the Australian National University, and is an alumnus of the Institute, having worked with us as a postdoctoral fellow between 2001 and 2003. Darren continues to be a major user of the neutron scattering facilities at the OPAL Reactor.

Faces

Newcomers:

Elvis Shoko joins the Bragg Institute to work on the Energy Project after completing his PhD in condensed matter physics at the University of Queensland. Elvis will model data from neutron scattering experiments to develop a fundamental picture of the microscopic processes reflected in the neutron scattering data.

After 30 years working in Europe, Gary McIntyre, a leading neutron-diffraction expert, has returned to Australia as Leader for Hard Condensed Matter at the Bragg Institute. Gary joins us most recently from the Institut Laue Langevin in Grenoble, France. Gary is replacing Don Kearley who will continue with the Institute in a part-time research role focussing primarily on modelling in support of the neutron scattering program, and in quasielastic neutron scattering.

Departures:

Left: Mohana Yethiraj and; Right: Bill Hamilton

In late August, Bill Hamilton and Mohana Yethiraj returned to the USA after fours years at the Bragg Institute. Bill, an instrument scientist on QUOKKA, developed a reputation of performing difficult small-angle scattering and reflectometry experiments on QUOKKA and PLATYPUS. Mohana, an instrument scientist on the TAIPAN Thermal 3-axis Spectrometer published its first scientific results, *Observation of Soft Phonon Modes in Superionic Copper Selenide*. Mohana also spurred Bragg Institute interest in superconducting flux-line lattices using a new 11-T horizontal-field magnet on QUOKKA. Both were keen members of the Bragg Institute Cake Club.

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