Lightspeed

Australian Synchrotron Update
January/February 2007

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1. BEAMLINE PROGRESS

Soft X-ray Beamline

Surveying has been completed by FMB prior to installing all the elements of the beamline. The first two vacuum sections have been installed into the First Optical Enclosure, the high heat load primary slits and the Mirror 1 vessel. The first mirror has arrived from Germany and is being installed in the mirror tank. These two sections will then be pumped down and baked.

The cable installation from the FMB control system is on course to be completed next week on schedule. After the installation of the mirror the other elements of the beamline will be installed over the coming weeks. With the arrival of the undulator, the beamline is still on course to have beam on sample by the end of March 2007.

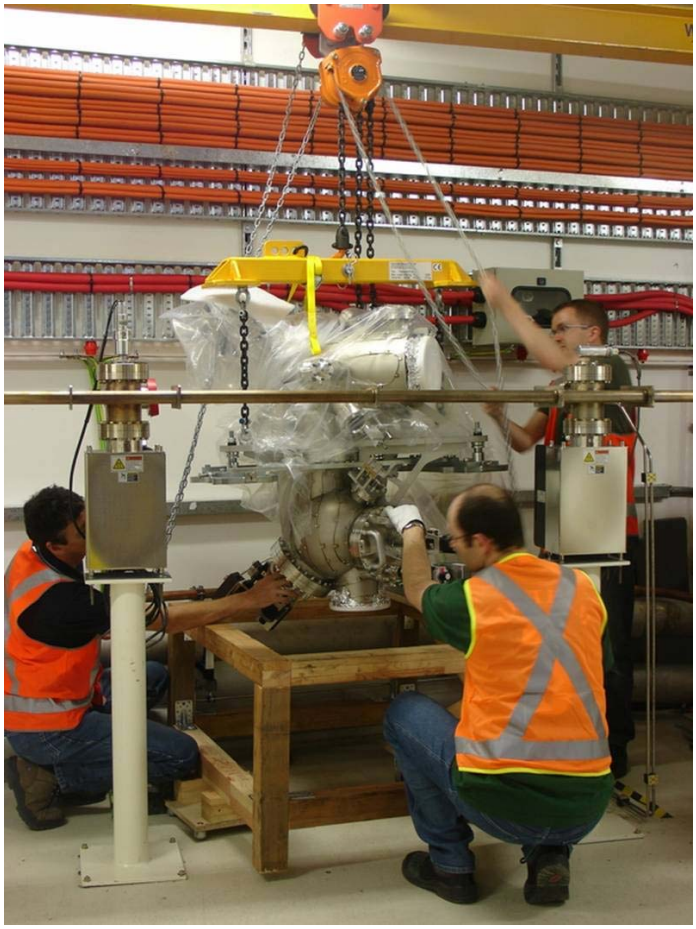
Bruce Cowie inspects the high heat load slits in the Soft Xray Beamline hutch. (Photo: Bruce Cowie)

Bruce Cowie, Soft X-ray Beamline Scientist

Infrared Beamline

"Thanks and well done to everybody involved in the planning and execution of the critical first stage of the Infrared (IR) front end installation. The granite block, M1 mirror mechanism and the M2 optics system (photo) were hoisted into place between the dipole vessel and shield wall without a hitch, and on time, and M1 is now under vacuum. This has been possible as a result of good planning and coordination, and good cooperation between ASP [the project team] and FMB staff [the contractors]."

Mark Tobin, Infrared Beamline Scientist



Installation of IR front end by (from L to R) Derek Aboltins (ASP), Hans Henninger (FMB) and Jonathan McKinlay (ASP). (Photo: Mark Tobin)

SAXS/WAXS Beamline

The progress of the SAXS/WAXS (Small Angle/Wide Angle X-ray Scattering) beamline took a major step forward in January 2007 with the placing of the photon delivery system contract with Oxford Danfysik. The final design review of the photon delivery system is complete and components are now in manufacture. The beamline optics features the latest adaptive optics mirror technology, and a focussing geometry in both the vertical and horizontal planes. Coupled to its 3 metre in-vacuum

undulator (which is currently in manufacture by Neomax in Japan), SAXS/WAXS will be a high performance and versatile beamline.

The preliminary design of the hutches is complete and is currently at the Request for Tender stage. Detailed design work on experimental tables, data acquisition and beamline controls infrastructure is currently in progress.

Nigel Kirby, SAXS/WAXS Beamline Scientist

X-ray Absorption Spectroscopy

The XAS beamline wiggler has been installed into the storage ring, and successfully operated at minimum gap (14 mm). Installation is progressing for the beamline optics, with about 1/2 of the large vacuum vessels installed. Endstation integration to the EPICS control system is under way, with current assistance from Kurt Goetz from the Beamline Controls Group at the Advanced Photon Source in Chicago.

Chris Glover, XAS Beamline Scientist

Imaging and Therapy Beamline

The contract has been placed for the three Stage 1 enclosures in the experimental hall, with construction to be completed by October 2007. The main design and radiation shielding specifications of the 150 metre beamline (Stage 2) have been completed. Work is now concentrating on completing the instrumentation specification and design for all the enclosures, both inside the experimental hall and in the satellite building at 150 m.

Daniel Häusermann, Imaging and Therapy Beamline

Powder Diffraction Beamline

Since the beginning of January 2007 Oxford Danfysik (OD) has been on-site installing the Powder Diffraction beamline optics. The mirrors and double crystal monochromator (DCM) will be grouted into position in early February.

Cosylab technicians Rok Gajsek and Matjaz Kobal commence controlling the white-beam slits of the Powder Diffraction beamline for the first time (Photo: Kia Wallwork)

The photo shows the hutches and two of the team from Cosylab who have written the beamline control software on behalf of OD. On 30 January they controlled the beamline in situ for the first time!

Installation of the high-accuracy powder diffractometer, from Rotary Precision Instruments, will also begin in the first week of February.

Kia Wallwork, Powder Diffraction Beamline Scientist

Microspectroscopy Beamline

“We have had Kurt Goetze, a beamlines controls expert with more than 12 years experience at the Advanced Photon Source (APS), visiting us for two weeks in January to assist with integration of our complex beamlines controls systems. The visit by Kurt continues building the collaboration between the APS and the Australian Synchrotron particularly in the area of beamline instrumentation and controls.

The contract for the photon delivery system for the Microspectroscopy Beamline is being finalised with a UK company. The beamline is on schedule to be completed in 2008."

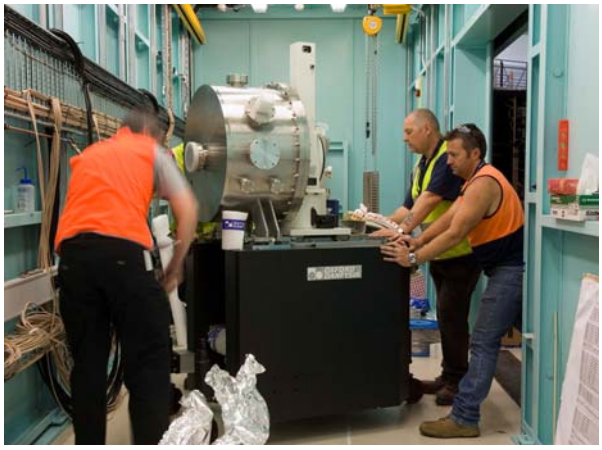
David Paterson, Microspectroscopy Beamline Scientist

Protein Crystallography Beamlines

Protein Crystallography (PX) Beamline

Radiation shielding verification was undertaken on 9 January, after hours, with the beam from a bending magnet being taken by the front end through the shield wall and into the PX First Optical Enclosure hutch for the first time.

Components for the beamline photon delivery system have all arrived and are now installed in the hutch, aligned and being evacuated. The control system is almost completely wired up, and software testing started at the end of January.



The double crystal monochromator being moved into position on the Protein Crystallography beamline. (Photo: Focal FX)

In December the commissioning end station system was installed and commissioned. Dr Jinhu Song from the Stanford synchrotron, SSRL, visited for two weeks to help with the integration of the user interface and interfacing of the SAM robot to the beamline.

The beamline Personnel Safety System is being beta tested ready for ‘cold commissioning’ and the commencement of ‘hot commissioning’ later in February.

Ruth Plathe has joined the PX team as a Beamlines Associate and is learning about beamlines and crystallography at a rapid rate. Ruth will be authoring the beamline user documentation and has already started this important task.

PX Microcrystal Beamline
In late December, the contract for the second protein crystallography beamline was awarded to Oxford Danfysik, UK.

The radiation enclosures layout has been finished and is currently out for tender. The beamline utilities design is progressing well with the interfaces between the two beamlines being the most challenging part of the design process.

Julian Adams, Protein Crystallography Beamline Scientist

Liquid nitrogen system for beamlines

The contract for the liquid nitrogen distribution system has been awarded to DeMaCo, Netherlands.

2. SYNCHROTRON COMMUNITY NEWS

Australian Synchrotron operator

ANSTO/Worley Parsons Joint Venture (AWP) and the Victorian Government have signed an Interim Services Deed to 30 June 2007 that enables AWP to work alongside the Australian Synchrotron team to prepare for transition to independent operation as a national facility.

Handy Hint for Grant Applications

If you or your colleagues are preparing grant applications, and plan to use the Australian Synchrotron, you may want to include an estimate of travel and accommodation costs. The following estimates (in 2007 dollars rounded to the nearest $10) include:

- return air fares (where appropriate) from major airport (Qantas Flexisaver);
- return airport transfers from Melbourne airport to the facility;
- four nights' accommodation.

This does not include return transfers from the host institution to the airport of departure nor experimental station consumable costs. Beamline consumables are covered by the facility as a part of laboratory operating costs.

State of Origin	Budget per person
ACT	$990
NSW	$990
NT	$2070
QLD	$1260
SA	$1030
TAS	$990
Vic	$400
WA	$1980

AINSE President appointment

Congratulations to Brian O'Connor from Curtin University, Western Australia, who has recently been appointed as President of the Australian Institute of Nuclear Science and Engineering (AINSE). Brian follows in the footsteps of another well-known synchrotron supporter, Prof. John White from ANU.

Victorian Premier's Award for Medical Research—for young researchers

The Victorian Premier's Award for Medical Research is awarded annually to recognise the exceptional contributions made by young health and medical researchers. The $16,000 prize will be awarded to a Victorian PhD student or recent PhD graduate who has made an exceptional contribution to any field of health, basic, applied or clinical research and health-related technologies. Prizes of $8,000 will be awarded to highly commended applicants. More at: http://www.business.vic.gov.au/premiersaward

3. FORTHCOMING EVENTS

AUSTRALIAN EVENTS

Lorne Cancer Conference 2007

8–10 February 2007, Erskine on the Beach, Lorne, Vic including AAMRI-sponsored symposium on imaging with synchrotron radiation on Friday 9 February, 2pm
http://www.lornecancer.org

Symposium: Synchrotrons, nanotechnology and soft materials—Towards a wholly synthetic muscle

Professor Anthony J Ryan OBE, The ICI Professor of Physical Chemistry and Director of The Polymer Centre, The University of Sheffield, UK.
12.30 pm Wednesday 7th February 2007
Theatre S1, Building 25, Monash University, Clayton, Vic.

Abstract: The common theme in my research is phase transitions in polymers. Most recently we have used the knowledge of the thermodynamics and kinetics of phase behaviour in polymer blends and block copolymers to develop new processing methods based on self-assembly. This has led to the development of the new field of Soft Nanotechnology where synthetic and natural macromolecules are harnessed in a way that makes use of their intrinsic flexibility and susceptibility to Brownian motion to generate work from changes on molecular conformation.

Developments in polymers responsive to their environment have lead to research into molecular machines, specifically the fabrication of molecular valves and motors.

A full suite of microstructural analysis is used to confirm the dynamic experiments and computer modelling is also used. My main contribution to the field has been the development and application of the techniques of time-resolved structural tools to polymers.

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Presented by: Monash Centre for Synchrotron Science, Monash Institute for Nanosciences, Materials and Manufacture and Monash University Department of Materials Engineering.

Introductory Synchrotron Workshop (half-day), La Trobe University

Monday 19 February, 2–5 pm, Institute for Advanced Studies, La Trobe University, Bundoora, Victoria
'Introductory Workshop on Synchrotron Radiation Research' with Introduction by Prof. Roger Parish, Acting Vice-Chancellor. The workshop will introduce synchrotron-based techniques and provide an opportunity to collaborate in synchrotron radiation research.
More at:
http://www.latrobe.edu.au/physics/xray/downloads/ltuprogram.pdf
Free but bookings essential to Robyn Mulroney
Tel. 03 9479 2622 Email: r.mulroney@latrobe.edu.au

12th International COMS Conference 2007

2–6 September 2007, Melbourne, Vic
Conference on the Commercialisation of Micro and Nano Systems, bringing together world leaders within the field and showcases Australia's dynamic nanotechnology community, facilities and partnering opportunities.
Email: mancefcoms2007aust@iird.vic.gov.au

INTERNATIONAL USERS CONFERENCES

For additional information and listings, see:
http://www.lightsources.org/cms/?pid=1000068

2007 National Synchrotron Radiation Instrumentation (SRI) Conference

25–27 April 2007, Baton Rouge, Louisiana, USA
http://www.camd.lsu.edu/SRI/sri07home.htm

ICMAT 2007

International Conference on Materials for Advanced Technologies
1–6 July 2007, Singapore
Receipt of Abstracts: 31 January 2007
http://www.mrs.org.sg/conference/icmat2007/
http://www.mrs.org.sg/conference/icmat2007
Prof Herbert Moser, Director of the Singapore Synchrotron Light Source (SSLS) and ICMAT 2007 Symposium 'N' Chair, has written a personal message encouraging Australian users to attend ICMAT 2007.

ICMAT is a bi-annual International Conference on Materials for Advanced Technologies which started in 2001 and has drawn more than 2500 registered participants in 2005. Traditionally, it includes public and plenary talks by Nobel Laureates and is structured in a number of individual symposia—there will be 18 in 2007. This is a major event in materials science which reaches a worldwide audience.

SSLS is organising the Symposium N on "Synchrotron Radiation for Making and Measuring Materials" which offers a forum for virtually any synchrotron-related work. It offers an excellent opportunity for Australian synchrotron users to attend, well-timed with the opening of the Australian Synchrotron facility.

VUV 15TH International Conference on Vacuum Ultraviolet Radiation Physics

July 29 – August 3, 2007, Konzerthaus Berlin, Germany
http://www.bessy.de/VUVXV

World Biomaterials Congress—2008

28 May–1 June **2008**, Amsterdam, The Netherlands
http://www.wbc2008.com/

4. SCIENCE HIGHLIGHTS FROM AROUND THE WORLD

News and recently published research assisted by synchrotron science

Watertight water theory

How water behaves in contact with hydrophobic (water-repellent) surfaces, where water droplets bead rather than soak in, has been a long-standing scientific puzzle, with many environmental, medical and industrial implications.

According to a controversial theory, water should pull away from a hydrophobic surface—but does it leave a thin layer of less tightly packed water molecules at the interface (known as 'depleted' water)? Such interfaces are crucial in biological systems, and knowledge about them can give insights into protein folding and stability.

Researchers, including scientists from the University of South Australia, used synchrotron measurement techniques to reveal a depletion layer, about one molecule thick (from 0.1 to 0.5 nanometres). Using near-perfect hydrophobic surfaces and synchrotron x-ray measurement techniques, the researchers found the theoretical prediction to be correct. Findings of two studies were reported in *PNAS*, 20 November 2006 and in the journal *Physical Review Letters*, 31 December 2006.

"Previous experiments have been interpreted sometimes in favour of a depletion layer, sometimes against, and sometimes as indicating intimate solid–water contact in places and 'nanobubbles' in others," said researcher Steve Granick, a professor of materials science and engineering, chemistry and physics at the University of Illinois.

"Part of our study was to help understand why there was so much disagreement in the scientific literature," said Granick.

Scientists from the University of South Australia, the Max Planck Institute for Metals Research in Germany, and the European synchrotron in France (ESRF) carried out synchrotron experiments on silicon wafers covered by a water-repulsive layer at the surface. The wafers were then immersed in water by a special cell.

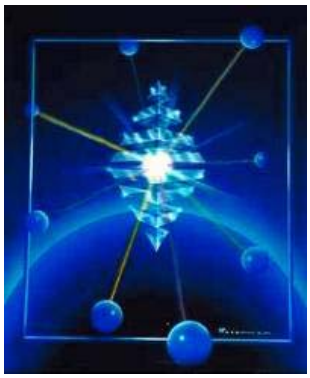
“This was the first time that high energy synchrotron x-rays have been used as a tool to measure such properties, the researchers said. “Some teams have used neutrons, but they didn’t have enough resolution. After all, the gap is extremely small and difficult to track.”

"These studies will increase our knowledge of how water behaves in different environments. The structure of water in the environment is still somewhat of a mystery to us, despite the fact that our world is surrounded by water".

Source: Reported on 22 November 2006 at: http://www.nanotechwire.com/news.asp?nid=4062 and 17 January 2007 at http://nanotechwire.com/news.asp?nid=4225.

Prussian Blue for molecular data storage

Prussian Blue, a pigment used in paints, could form the basis of new high efficiency data storage devices.



Scientists have created a compound from the pigment Prussian Blue that can act as a magnetic medium where each bit of binary data is stored on a molecule. Prussian Blue is not magnetic at the outset, but it can become magnetised by the effect of light and return to its initial state by heating.

Researchers at the Institute of Molecular Chemistry and Materials of Orsay (CNRS/University of Paris XI) and the Laboratory of Inorganic Chemistry and Molecular Materials (CNRS/University of Paris VI) showed that this change of state is due to the collective modification of the position of the atoms, induced by light. Their work was presented in the journal *Angewandte Chemie* online 9 January 2007.

By replacing some of the atoms of iron with cobalt, they managed to transform the pigment into a compound that can act as a magnetic switch. Illuminated by a red light at low temperature (–150°C), the compound shifts from a non-magnetic state to a magnetic state in a way that is stable over time. If it is heated, it returns to the non-magnetic state. The change of state is due to the transfer of an electron from the cobalt to the iron (and vice-versa), by absorption of light or thermal energy.

Using the Italian synchrotron, Elettra in Trieste, the scientists observed that when the electron goes from the iron atom to the cobalt atom due to the red light, the 3-D links between the atoms become linear. This structural modification is responsible for the existence of the magnetic state and its stability over time.

The new compound can perfectly reproduce the storage function of traditional components, say the researchers, who believe the material could be widely used in future miniaturised information storage devices.

Sources: Laboratory of Inorganic Chemistry and Molecular Materials (CNRS/University of Paris VI); More at: http://www.lightsources.org/cms/?pid=1001878
this story reported 18 January, http://www.scienceagogo.com/news/20070017200215data_trunc_sys.shtml

MORE INFORMATION

A list of Australian Synchrotron Project personnel can be found at http://www.synchrotron.vic.gov.au/content.asp?Document_ID=129.
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[Please note that the facility is in commissioning phase and is not open to visitors]

HOW TO SUBSCRIBE OR UNSUBSCRIBE

TO SUBSCRIBE

http://www.synchrotron.vic.gov.au/content.asp?Document_ID=196&FirstName=&Email=&x=16&y=9

TO UNSUBSCRIBE

Send an email with UNSUBSCRIBE Synchrotron in the Subject line to contact.us@synchrotron.vic.gov.au