

**TOP STORIES**



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## From the Director – Making an impression



**Australian Synchrotron users and staff are continuing to compile an impressive list of achievements and awards, including an international award for a new x-ray detector.**

The [Maia detector system on the x-ray fluorescence microscopy beamline](#) here enables researchers to obtain nanoscale information with 1000 times more detail than was previously possible. It was recently judged one of the 100 most significant technological products to enter the world market in the past 12 months. The detector has also received a state-level award for innovation in information and communications technology. The Maia detector was developed jointly by researchers from CSIRO and Brookhaven National Laboratory in New York.

Recent research papers in prestigious scientific journals include a Nature Chemistry paper about synthetic manganese catalysts for solar energy production. This was authored by Rosalie Hocking from Monash University and others including the synchrotron's Chris Glover. Another paper in Nature Photonics reported the first time that the full wavelength (colour) range of synchrotron light has been used to produce images, a development that could enable some sample images to be collected 60 times faster than by current

methods. The Nature Photonics paper was authored by Brian Abbey from the University of Melbourne and others, including AS Head of Science Andrew Peele and me.

We are also working with users and students to spread the synchrotron message further afield.

The [Australian Synchrotron user meeting](#) to be held on 8-9 December will provide plenty of opportunities for synchrotron users to discuss their techniques and achievements and for new users to learn from more-experienced hands.

To help encourage the next generation to take an active interest in synchrotron science, AS education officer Jonathan de Booy is holding a series of laboratory sessions over the next few weeks for high school students.

Another essential element of our future is funding. After attending a recent meeting with state and federal government departments and key science agencies, I'm pleased to say that these discussions are proceeding at a good rate and all parties are working to ensure our ongoing success.

### **Keith Nugent**

Director, Australian Synchrotron



## Up to speed: Michael Tonroe



This month our short interview features Michael Tonroe, the Australian Synchrotron's chief financial officer and company secretary.

### Describe your job in 25 words or less.

Looking after the finance and reporting requirements, safeguarding assets, financial and business controls assisting the Management team and board to make decisions about the future.

### Best thing about your job?

Working with the people at AS – there is a fascinating diversity of disciplines and backgrounds.

### Worst thing about your job?

Can't think of anything

### Biggest challenge facing your team?

Improving the business systems to help the AS run smoothly

### Apart from the Australian Synchrotron, what's the coolest job you've ever had?

Working for a travel company that sold volunteer and teaching holidays all over the world

### Best things about living in Melbourne and why?

It's warmer, gets more sun and less rain than my home town of Manchester in the UK.

### Your favourite overseas destination and why?

Savannah Georgia, USA – most of my family live there and my brother sells the best burgers in the USA.

### A little-known fact about the Australian Synchrotron?

Twenty percent of the electricity consumed by AS is from renewable sources.

### What's the most unusual or interesting question you've been asked in relation to your work at the AS?

Can you power anything using the beam?

## Australian Synchrotron thesis medal 2011

Continuing a tradition set up by the Australian Synchrotron Research Program (ASRP), the Australian Synchrotron regularly seeks submissions for the Australian Synchrotron Thesis Medal. This medal is awarded annually to the PhD student at an Australian or New Zealand University who is judged to have completed the most outstanding thesis of the past two years - and whose work was undertaken at and acknowledges the Australian Synchrotron, or the Australian National Beamline Facility (ANBF), or whose work acknowledges and was undertaken under the auspices of the International Synchrotron Access Program (ISAP) or the ASRP.

The 2011 Australian Synchrotron Thesis Medal was awarded jointly to Dr Kaye Morgan and Dr Corey Putkunz, who completed their PhD studies at Monash University and La Trobe University respectively.

The Medals were presented at the Australian Synchrotron User Meeting on 8-9 December 2011.

[Click here for more information about the PhD research undertaken by Kaye Morgan and Corey Putkunz.](#)

### Previous Thesis Medal winners

The 2010 Australian Synchrotron Thesis Medal was awarded to Martin Duriska from Monash University for his PhD thesis entitled 'Introducing Multiple Functions into Discrete Supramolecules and Coordination Polymers'. The standard of entries was so high in 2010 that two commendations were awarded; these went to: to Lorien Parker (Crystallographic Studies of the Recognition of Anti-cancer Compounds by Glutathione Transferase Pi) and Grant Webster (Applications of Resonance Raman and Fourier Transform Infrared Microspectroscopy in Malaria Research).

[Click here to find out about the 2008 Australian Synchrotron Thesis Medal](#) in biology and life sciences, which was awarded to Dr Fleur Tynan.

Questions about the Thesis Medal may be addressed to the Science Administrator via email: [fran.westmore@synchrotron.org.au](mailto:fran.westmore@synchrotron.org.au)



## New x-ray system to turn superheroes green

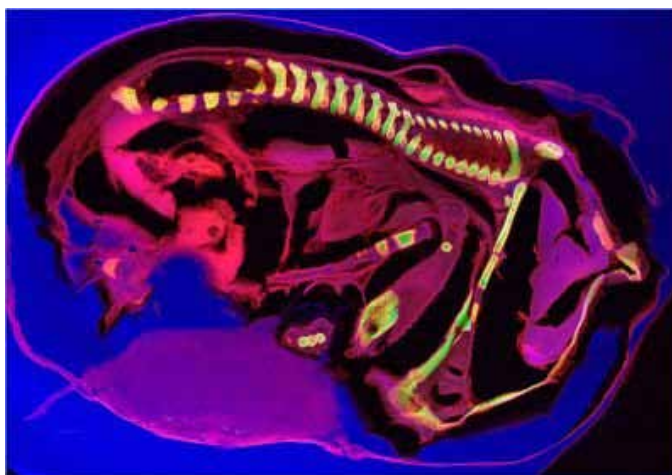
**It's enough to make your average superhero hand back their lycras! A powerful new x-ray vision and detection system is producing 3D pictures of nanoscale details much faster and with one thousand times more detail than was previously possible.**

Recently honoured with a prestigious R&D 100 award as one of the 100 most significant technological products to enter the world market in the past 12 months, the new x-ray detector system can probe the trace-element make-up of an incredibly diverse range of materials.

Developed by CSIRO in Melbourne and Brookhaven National Laboratory in New York, and sponsored by the Australian Synchrotron and an ARC LIEF grant, the Maia detector system is used with one of the Australian Synchrotron's most popular experimental facilities, the x-ray fluorescence microscopy beamline.

This powerful combination of Maia detector and x-ray microprobe capabilities has already been used to study samples as diverse as cancer tumours, cereal grains, meteorite relics of our proto-solar system, super broccoli and paintings by the masters. Important commercial applications include enabling medical researchers to investigate the role of metal ions in diseases such as Parkinson's and Alzheimer's, fine-tuning the nutritional value of superfoods, and providing new knowledge about ore formation processes to assist the minerals industry in its search for new reserves of gold and other metals.

Keith Nugent, Director of the Australian Synchrotron, describes the benefits of high-speed imaging: "The incredible speed of this detector means researchers can



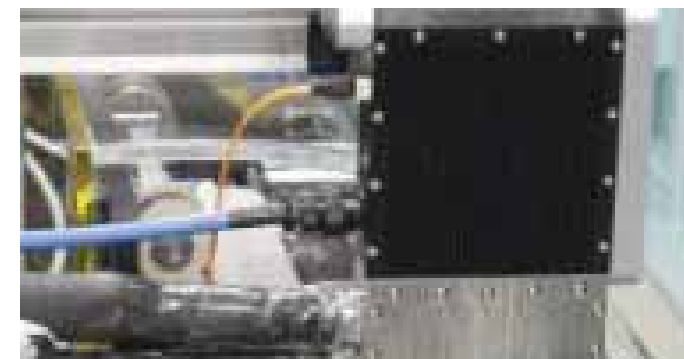
Calcium (green) and zinc (red) distribution in a mouse embryo, as captured by the Maia detector system at the Australian Synchrotron XFM beamline. Image: Euan Smith and Enzo Lombi, CRC CARE, University of South Australia

undertake needle-in-the-haystack investigations, finding small features within larger frameworks. This capability is crucial for finding small particles of gold within a mineral sample, or metal accumulations within brain tissue."

And the Maia detector offers more than just speed. It also has real-time output, enabling scientists to see the results while they are at the beamline. This gives them the power to adjust their investigations 'on the fly'.

"In the past if an unexpected result was encountered, a scientist often didn't find out until they returned to

their laboratory or university. Scientists using the Maia detector can modify their experimental focus in real time, which greatly improves the final result," Keith said.



Looks can be deceiving - the Maia detector system is exciting worldwide attention. The Maia detector system on the XFM beamline at the Australian Synchrotron has been used to study tumours, meteorites, super-foods, paintings and many other diverse materials

## Taking the lead out of solder alloys

**Demand for lead-free solder alloys is increasing as a result of legislation designed to protect manufacturing workers, consumers and the environment from the well-documented hazards of lead.**

Kazuhiro Nogita (shown at right) from the University of Queensland is developing new lead-free soldering alloys for use in a broad range of applications. He recently used powder diffraction (PD) at the Australian Synchrotron to investigate how trace levels of nickel influence the processing and service properties of a popular type of lead-free solder: near-eutectic tin-copper alloys.

Kazuhiro first began working with tin-copper-nickel alloys in 2003, when he undertook a small consulting job for Nihon Superior Co. Ltd, an international supplier of solder alloys based in Osaka, Japan. Nihon's unique tin-copper-nickel alloy has been used in more than 1.5 billion circuit boards since 1999 and the market continues to grow strongly due to consumer demand for electrical goods and the need to introduce lead-free alternatives into products previously exempt from legislation.

"The move to lead-free products is relatively recent and there is significant research still to be done for the development of products suitable for specific applications," Kazuhiro says. "Near-eutectic tin-copper alloys with trace levels of nickel perform better during production and product service life than nickel-free alloys."

The PD work at the Australian Synchrotron has helped establish how nickel improves the performance of soldered joints containing the Cu<sub>6</sub>Sn<sub>5</sub> intermetallic phase. It has also revealed the limitations of the nickel stabilisation effect in Cu<sub>6</sub>Sn<sub>5</sub>, the thermal expansion of Cu<sub>6</sub>Sn<sub>5</sub> with and without Ni between -100 and 250°C, and the kinetics of the phase transformation of Cu<sub>6</sub>Sn<sub>5</sub>. In 2010, a paper by Kazuhiro and his colleagues was judged the best of some 170 papers submitted to the International Conference on Electronics Packaging.

"The resolution and speed of data collection offered by the powder diffraction beamline at the Australian Synchrotron allowed us to determine the nature and kinetics of phase transformations in the Cu<sub>6</sub>Sn<sub>5</sub> intermetallic."

The Cu<sub>6</sub>Sn<sub>5</sub> intermetallic forms at the interface between solder alloys and copper substrates. In nickel-free alloys, the hexagonal allotrope of the intermetallic phase transforms to monoclinic as the solder joint cools from 186°C; this is accompanied by volumetric change that will result in internal stresses in a constrained joint. The presence of small amounts of nickel stabilises the hexagonal phase and the transformation to monoclinic does not occur at typical industrial cooling rates.

Kazuhiro and his colleagues used powder diffraction under controlled temperature conditions at the Australian Synchrotron to study how these transformations vary with time and temperature. The aim is to identify practical production and operating



## Taking the lead out of solder alloys (cont.)

← conditions that will either promote or restrict the hexagonal/monoclinic phase transformation. Promoting a phase transformation during production may be preferable to the transformation and associated volumetric changes occurring during the product's operating life.

Kazuhiro also measured the lattice parameters of the  $\text{Cu}_6\text{Sn}_5$  phase as a function of temperature. These measurements will be used to determine the coefficient of thermal expansion and assist in modelling the stresses and strains experienced in soldered components under typical operating conditions.

"Being able to do this work in Australia has allowed us to expedite some of our main research priorities," Kazuhiro said. "The PD beamline at the Australian Synchrotron is a leading international facility, and the ability to control temperature and atmospheric conditions has helped us ascertain the fundamental mechanisms behind the behaviour of our materials. We have also done complementary experiments at synchrotron facilities in Japan."

Kazuhiro plans to use the Australian Synchrotron again for his ongoing investigations of the stability of the solder alloys and the intermetallic reaction layers that form between solders and their substrates. He particularly wants to look at how substrates and solder composition influence texture formation, phase stability at low and high temperatures, and stress generation.

Kazuhiro is an associate professor and principal research fellow in the School of Mechanical and Mining Engineering at the University of Queensland and a Queensland Government Smart Futures Fellow.



The battery controller circuit board for electric vehicle 'Deep Green Research EV' in the Global Green Challenge from Darwin to Adelaide in October 2009 was soldered with SN100C, a tin-copper-nickel solder alloy that has been the focus of much of Kazuhiro Nogita's research.



## Faster computers for work and play



ANU's ion implantation facility is being used to produce doped silicon samples for synchrotron analysis.

**Consumer demand for faster and faster computer processing means using smaller and smaller electronic devices to power our computers. A key challenge is to maintain the activity of the 'dopant' atoms that modify the electrical properties of the ultra-pure crystalline silicon used to fabricate these devices.**

The vast majority of the electronic devices that power today's computers are fabricated from ultra-pure crystalline silicon (Si) laced with minute yet controllable quantities of impurities (dopants) to modify the silicon's electrical properties. As devices get smaller, dopant concentration increases – and many

dopant atoms become electrically inactive as a result of their incorporation into dopant clusters.

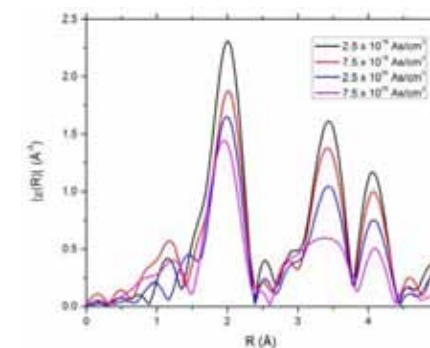
Mark Ridgway (pictured above) from the Australian National University, Stefan Decoster from the Katholieke University Leuven in Belgium and Leandro Araujo from the University Federal Rio Grande do Sol in Brasil are using x-ray absorption spectroscopy (XAS) in collaboration with the Australian Synchrotron's Chris Glover to deduce the atomic-scale structure of dopant clusters and identify the device fabrication conditions that minimise their formation and concentration.

Mark and his colleagues use state-of-the-art semiconductor processing technologies at the ANU's Australian National Fabrication Facility to produce samples suitable for XAS analysis. This involves ion implantation of arsenic (As) and antimony (Sb) dopants into silicon-on-insulator wafers (Si/SiO<sub>2</sub>/Si) used for high-speed metal-oxide-semiconductor (MOS) transistor fabrication. After implantation and thermal annealing, layers of As- or Sb-doped silicon just 2 μm thick are separated from the wafer by selectively dissolving the intermediate SiO<sub>2</sub> layer with corrosive hydrofluoric acid. If the etching procedure is successful and the researcher retains all of his/her fingers, 10 of these very fragile layers are then stacked together to create a sample for XAS analysis. This process yields a much improved XAS signal-to-noise ratio that enables the local atomic-scale surroundings of the dilute dopant to be investigated on the XAS beamline at the Australian Synchrotron.

"With its intense wiggler source and pixel-array detector technology, the XAS beamline at the Australian Synchrotron is ideally suited for ultra-dilute XAS fluorescence measurements," Mark says. "It's one of only a handful of beamlines in the world up to this challenge."

The results (shown below as Fourier-

transformed XAS spectra) indicate that an increase in arsenic dopant concentration increases disorder in the surrounding silicon lattice and therefore decreases the amplitude. To complement their ongoing XAS investigations, the researchers are also conducting sheet resistance measurements to probe the electrically-active dopant fraction, ion scattering measurements to probe the dopant lattice location and double-crystal x-ray diffraction measurements to probe lattice strain. Mark and his colleagues "seek to achieve fundamental insight to yield results of not only scientific significance but also of technological importance". For Lightspeed readers this should hopefully mean faster computers for work and play.



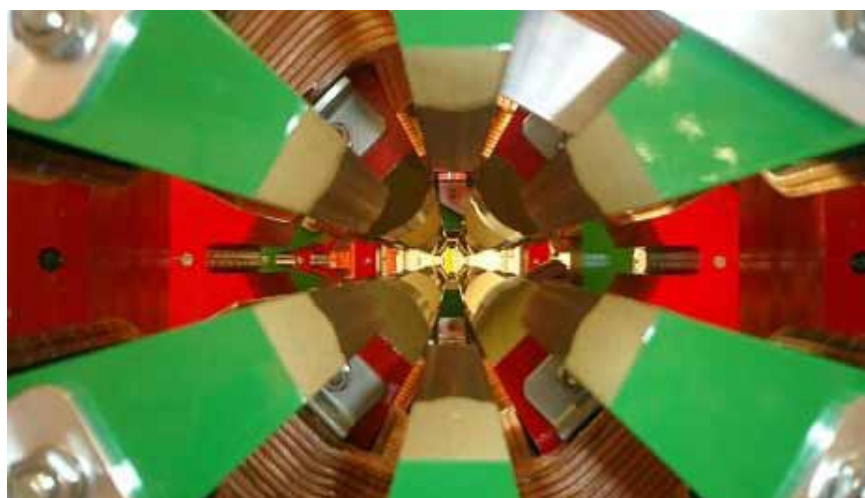
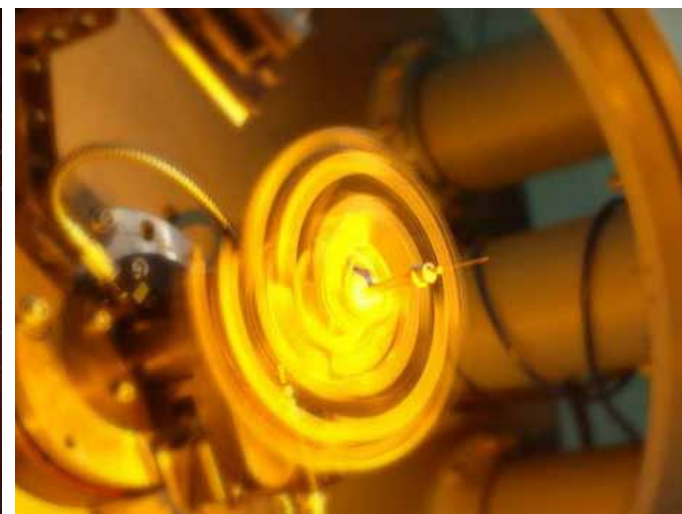
Proof-of-concept: the Fourier-transformed XAS spectra (arsenic K-edge of As-doped Si) as a function of arsenic dopant concentration. Image: Mark Ridgway

## Photo entries June – July 2011

Thank you to everyone who entered the June-July 2011 photo competition, submitting photos ranging from sunrise over the synchrotron, rainbows inside and outside the synchrotron and beamlines in action to a 'film noir' vision of the new user accommodation block.

The winner of the June-July 2011 photo competition at the Australian Synchrotron is Sean Murphy (electrical engineer at the synchrotron) for his photo of the synchrotron from a vantage point overlooking the HDR cable gantry.

Qinfen Gu (powder diffraction scientist at the AS) and Mark Tobin (head of the AS infrared beamline team) were awarded equal second place with their photos of the new sample spinner on the PD beamline (Qinfen) and AS mechanical technician Alan Easdon using ultrasonic drilling to create a specialised piece of equipment for the IR microspectroscopy beamline (Mark).



Clockwise from top left 1. Looking along the HDR cable gantry, by Sean Murphy

2. Sample spinner on the powder diffraction beamline, by Qinfen Gu

3. Ultrasonic drilling, by Mark Tobin

4. Fourth place was awarded to Rohan Dowd (senior accelerator physicist at the AS) for an electron's view of the storage ring magnets.



## Innovation ideas for industry

### SEMIP Innovation Showcase

The inaugural SEMIP Innovation Showcase in Melbourne in June 2011 addressed popular topics such as constrained resources and other factors that affect efficiency and productivity, climate change, collaboration and open innovation, and advances in biotechnology, manufacturing and business systems management.

At the Showcase, business operators from small and medium-sized enterprises discussed innovation and other hot topics with industry leaders, researchers working on new technologies and government representatives who can assist the innovation process.

The event was officially opened by Councillor Ron Brownlees from the City of Kingston.

“The challenge for us all today is to bring together all the knowledge that these great companies have with world-class research to ensure that our region becomes an innovation and knowledge capital of the south-east Asia-Pacific region,” Ron told participants.

“The sharing of that knowledge and that information is so valuable to your growth. To survive and remain competitive, we must become more innovative.”



Shown above at the SEMIP Showcase (L-R): Virginia Trioli (ABC), Jürgen Schneider (Siemens Australia), David Cookson (AS), Suzanne Ferguson (City of Kingston), George Borg (AS)

The Showcase attracted delegates and speakers from organisations around the region including CSIRO, Monash University, Invetech, MiniFAB, Small Technologies Cluster and Grey Innovation. The event was well-received by industry participants.

Ray Keefe from Successful Endeavours, a technology implementation company focusing on electronics and software, said he found the forum valuable in discussing

issues pertinent to what was happening in society and in the world today.

“If you’re not involved in forums in which you’re discussing issues and talking about possibilities then you don’t have the awareness required to change your mind-set and your business behaviour in a positive way,” Ray said.

Michael Vainer from VR TEK Global, a company working with CSIRO and Deakin University on a new tyre recycling

technology, said “the SEMIP event was a ray of hope for innovative manufacturing in Australia”.

Jürgen Schneider, Regional General Manager for Siemens Ltd in Victoria and South Australia, is heavily involved in business development across the industry, energy and healthcare sectors.

“In today’s competitive market, businesses should always look at how they can innovate to grow and improve



Innovation ideas for industry (cont.)



SEMIP panel members with panel chair Virginia Trioli (L-R): Steve Tighe (Chasing Sunrises), Dave Sag (Carbon Planet), Virginia Trioli (ABC), Jürgen Schneider (Siemens Australia), Kane Thornton (Clean Energy Council)



Event MC Toby Travanner (The Learning Company) with event organiser Suzanne Hart (Suzanne Hart Events)

their organisation. The Innovation Showcase provided an ideal and affordable way to do so," Jürgen said. He has recently agreed to act as deputy chair for the SEMIP steering committee.

Peter Lewis leads the global sales and marketing effort for the cutting edge design services offered by Hydrix, one of Australia's leading software and electronic design consultancies.

"The SEMIP Innovation Showcase provided a great opportunity to not only share our

approach to advanced product design and manufacturing, but also to hear from our industry colleagues about their own innovative processes," Peter said. "I think everybody learnt something new and it certainly gave us some good ideas towards continually improving our value-add for our clients."

Chris Quint, Business Development Manager for Arrayware, which focuses on FPGA development, said he attended events such as the SEMIP Innovation

Showcase primarily for the networking opportunities.

"At events like this we have made valuable contacts with organisations who engage us to help them design and develop their high speed programmable hardware," Chris said. "It's also a great way to keep in touch with what is happening in areas like research, new product developments and initiatives like open innovation."

Kerry Hayes, Chair of the SEMIP Innovation Showcase and Business

Development Manager at the Australian Synchrotron, said the showcase had helped SMEs identify business opportunities, as well as providing access to government representatives and the leaders of major research facilities.

"It has been very gratifying to see such a positive response to our first flagship event," Kerry said. "We look forward to presenting the SEMIP Innovation Showcase again in 2012."



## Innovation ideas for industry (cont.)

← Showcase tips and themes from the SEMIP 2011 Innovation Showcase:

- Determine what business you're in, what the drivers are for your organisation and what solutions you can provide for the market place (Jürgen Schneider, Siemens Australia)
- Look out for the signals – change doesn't come out of nowhere (Dave Sag, Carbon Planet)
- Decide, focus, invest, and then make it happen (Fred Davis, Invetech)
- If the product is simple it's unlikely to be made in Australia due to higher costs. Technology that is complicated is suitable for Australia with its advantage being its agility and responsiveness (Fred Davis, Invetech)
- Challenges for Australia include having internationally competitive levels of investment for a project and access to the right talent (Jefferson Harcourt, Grey Innovation)
- Australian SMES can enjoy the numerous benefits of open innovation such as accessing new revenue streams and markets and accessing ideas and talent, however you need to develop the right approach and

culture in your company and be easy to work with (Sarah Pearson, ANU)

- SMEs in manufacturing must utilise digital technology like the automotive and aviation industries have done (Errol Harvey, MiniFAB).
- Many opportunities exist in Melbourne's south east for collaboration, whether it's external partnerships or access to a critical mass of valuable, publicly-funded resources
- Australia is excellent in the field of research but commercialisation and financial support remain areas of challenge
- In addition to SEMIP, organisations that can offer support for innovation projects include:

Enterprise Connect  
[www.enterpriseconnect.gov.au](http://www.enterpriseconnect.gov.au)

Victorian Centre for Advanced Materials Manufacturing  
[www.vcamm.com.au](http://www.vcamm.com.au)

Cooperative Research Centres  
[www.crc.gov.au](http://www.crc.gov.au)

### More about SEMIP

SEMIP is the South East Melbourne Innovation Precinct, an initiative that involves the Australian Synchrotron, the Victorian State Government, CSIRO, Monash University, Small Technologies Cluster and the Councils of Greater Dandenong, Kingston, Knox and Monash working in collaboration with industry.

Subscribe to the SEMIP newsletter:  
[www.business.vic.gov.au/BUSVIC/NEWSLETTER/PC\\_63964.html](http://www.business.vic.gov.au/BUSVIC/NEWSLETTER/PC_63964.html)

Email general enquiries to [inquiries@semip.org.au](mailto:inquiries@semip.org.au) or visit [www.semip.org.au](http://www.semip.org.au) to see how SEMIP can assist your business.

Key SEMIP contacts are Paula Brennan, Suzanne Ferguson and Kerry Hayes.

### Contacts

#### Paula Brennan

Economic Development Coordinator,  
City of Greater Dandenong  
[Paula.brennan@cgd.vic.gov.au](mailto:Paula.brennan@cgd.vic.gov.au)  
03 9238 1573

#### Suzanne Ferguson

Manager Economic Development,  
City of Kingston  
[Suzanne.ferguson@kingston.vic.gov.au](mailto:Suzanne.ferguson@kingston.vic.gov.au)  
03 9581 4712

#### Kerry Hayes

Business Development Manager,  
Australian Synchrotron  
[Kerry.hayes@synchrotron.org.au](mailto:Kerry.hayes@synchrotron.org.au)  
03 8540 4232



## Synchrotrons in the news August 2011

### Drug 'dance' revealed

Researchers in the US and Belgium used a synchrotron to produce 3D images of a molecular 'dance' involving an important hormone receptor that is a common target for drugs used to combat asthma and blood pressure problems. This provides new information about the process of signalling across cell membranes, which is a key part of the body's response to drug treatments.

<http://www.nature.com/nature/journal/vnfv/ncurrent/full/nature10361.html>

<http://www.vib.be/en/news/Pages/Common-drugs-initiate-a-molecular-pas-de-quatre-at-the-surface-of-the-cell-membrane.aspx>

### Next-generation memory and sensing devices

US scientists have found a new way that electric and magnetic properties can be coupled in a material. Called 'multiferroics' – magnetic materials with north and south poles that can be reversed with an electric field, these materials are rare in nature.

[http://www.bnl.gov/bnlweb/pubaf/pr/PR\\_display.asp?prID=1313](http://www.bnl.gov/bnlweb/pubaf/pr/PR_display.asp?prID=1313)

<http://prl.aps.org/abstract/PRL/v107/i5/e057201>

### What electrons do in high-temperature superconductors

Theoretical physicists are excited! Calculations based on a new theory about how electrons behave in high-temperature superconductors agree well with synchrotron data. Although high-temperature superconductors are already in use, their unusual properties have so far evaded explanation.

<http://news.ucsc.edu/2011/07/high-temperature-superconductors.html>

<http://prl.aps.org/abstract/PRL/v107/i5/e056403>

<http://prl.aps.org/abstract/PRL/v107/i5/e056404>

### Do we have a new ancestor?

Paleoanthropologists from the University of the Witwatersrand in Johannesburg have used the European Synchrotron Research Facility (ESRF) to investigate fossil remains that may provide evidence of the first species enough like us to be called human.

<http://ngm.nationalgeographic.com/2011/08/malapa-fossils/fischman-text>

## Beamtime applications August 2011

Beamtime submissions for round 2012/1 (January-May 2012) open on 31 August 2011.

Users who applied for beamtime in round 2011/3 (September-December 2011) will be notified from mid-August.

Key dates for beamtime submissions are listed on the synchrotron website at:

<http://www.synchrotron.org.au/index.php/features/applying-for-beamtime/proposal-deadlines>

If you would like to discuss your ideas for future beamline proposals with the beamline scientists at the Australian Synchrotron, please allow plenty of time.

For more information about applying for beamtime at the Australian Synchrotron, contact the User Office: [user.office@synchrotron.org.au](mailto:user.office@synchrotron.org.au)

## Construction update

### Watch those spaces!

Three of the new buildings being constructed around the Australian Synchrotron are now in use: the technical support laboratories building, the office extension pod and the switchroom extension. External construction of the user accommodation building is complete, and the building is being fitted with furniture in readiness for users.

The biggest construction project, the National Centre for Synchrotron Science building, is nearing completion, with installation of windows and Rodeca panelling on all exterior walls. Inside the building, auditorium seating and lighting are in place, and interior walls and office fittings are quickly taking shape.

Commenced in late 2010, these projects are an initiative of the Australian Government being financed from the Education Investment Fund.

[Click here to download a map](#) (pdf, 140kb) with information about new parking arrangements for visitors to the synchrotron.

### National Centre for Synchrotron Science (NCSS)

- Two-storey building with a 400-seat auditorium, seminar rooms, exhibition space, User Office, staff offices, cafeteria and underground parking.
- Building construction is ahead of schedule. Installation of the translucent Rodeca panelling facade is almost complete and most of the exterior windows have been fitted. Kitchen equipment has

been installed and joinery items are being fitted out throughout the building. Auditorium lighting comprises an impressive array of 120 circular fluorescent luminaries.

- The NCSS building has a five-star rating under the Green Star system, which is a comprehensive, national, voluntary environmental rating system that evaluates the environmental design and construction of buildings. To achieve this rating, the building includes features such as 20 kilolitre water tanks for recycling water, high-efficiency heating and cooling systems, and 100 photo-voltaic panels on the roof to offset the power needed for the facade lighting, which is a key feature of the building's exterior. [Click here to read more about the NCSS building and its green credentials.](#)
- Several elements of the NCSS building, such as landscaping, fittings, and audiovisual equipment, are being managed separately from the main construction works.
- Investigations into the operation of the cafeteria are continuing.
- Following several feasibility studies in late 2011, a detailed landscaping design is being developed from the landscaping masterplan to address aspects such as tree types and locations, irrigation pipes, concreted areas, parking, benches and seating. The design calls for many new trees to be planted, particularly around parking areas and the user accommodation building. A vegetable garden will be established near the existing barbecue area.

The entrance roadway and lighting for the main synchrotron building will be redesigned. The landscaping work is expected to be put out for tender in March 2012.

- See overleaf for photos of construction work on NCSS building.

### User accommodation building

- Two-storey building with 50 self-contained rooms, communal kitchens, lounges, laundry and reception. The ground floor includes disabled facilities.
- Construction is complete. Following successful assessment of the prototype bedroom, all bedrooms are being fitted out with furniture. The kitchen, laundry and lounge areas are also being equipped with furniture, fittings and equipment.
- "The user accommodation building is so nice, particularly the lounge area, that synchrotron staff are already joking about occupying the building themselves," says Alexis Kouts from the Synchrotron's Major Projects and Technical Services Group.
- "Provided the new furniture is delivered on schedule, we hope to begin making the accommodation available to users in April 2012."
- Processes are being developed for carrying out the necessary cleaning, scheduling, security, repair and maintenance tasks.

[Click here to go to user accommodation building photo page.](#) →

## Construction update (cont.)

### ← Modular office extension (office extension pod)

The modular extension 'pod' connected to the main synchrotron building is complete. It has been fitted out with workstations and office furniture and is now occupied by staff from several groups, including Major Projects. The building provides a simple but functional open office area with plenty of natural light. Spare desks are available for visitors to use.

[Click here to go to office extension 'pod' building photo page.](#)

### Technical support laboratories building

This building is occupied and fully operational with four laboratories, an open plan office, meeting rooms, mechanical workshop and stockroom. The large spaces within this building have enabled the engineering group to be consolidated into one area, supported by tools and equipment located downstairs.

[Click here to go to technical support laboratories building photo page.](#)

### Switchroom extension

Extension to the existing low voltage switch room, which had reached capacity. The uninterrupted power supply (UPS) system is now operational. A cooling system is being installed for days of extreme heat. Thanks to three brand-new 'uninterruptable power supply' (UPS) systems, the AS storage ring can continue operating for up to 15 seconds without any power, enabling synchrotron operators and users to continue working through any short-term power supply disruption.

[Click here to go to switchroom extension building photo page.](#)

We will post regular updates on our website to keep you informed of progress.



(1 July 2011): using dirt stockpiled from the excavation to fill in the trench around the NCSS building.



## Construction update (cont.)



[28 July 2011]: filling in the spaces.



[11 August 2011]: NCSS building viewed from the first floor of the technical support laboratories building.



[12 August 2011]: the auditorium space inside the NCSS building.



[12 August 2011]: the north wall of the NCSS building.



## Accelerator scientist inspired by video games



The uncanny ability of state-of-the-art video games to mimic human behaviour has inspired the development of a new tool to boost the quality of the electron beams used in high-tech research experiments in Australia and Italy.

The new tool uses the same artificial intelligence methods that enable video game 'agents' to learn from their interactions with the human players who control them. This involves the use of artificial neural networks, whose structure evolves over time.

The new method was developed by Swiss-French national Evelyne Meier as part of her PhD studies under the joint supervision of Sandra Biedron from FERMI@Elettra in Italy, Greg LeBlanc, head of accelerator science at the Australian Synchrotron, and Michael Morgan from the School of Physics at Monash University. It was reported in 2011 in a scientific journal called Nuclear Instruments and Methods in Physics Research A.

The Australian Synchrotron's first official PhD student, Evelyne recently received her PhD and accepted a postdoc position with the synchrotron's accelerator science team.

Evelyne's PhD work was part of a major international collaboration involving the Elettra synchrotron in Italy and the Linac Coherent Light Source at the SLAC National Accelerator Laboratory in the US. This collaboration focuses on the development of the next generation of synchrotron light sources, which will use free-electron laser (FEL) sources to produce synchrotron light of even greater brilliance than current (third-generation) sources like the Australian Synchrotron.

During her studies, Evelyne produced or co-authored several international journal publications and conference presentations, including the 'video games' paper. Another paper reported the development of a promising new approach to stabilising electron beams that combines feedback control with neural network feed-forward techniques. The ultimate aim is a precise and robust control system that will stabilise electron beam energy and energy spread for the FERMI@Elettra free electron laser at the Elettra Sincrotrone Trieste.



## Spreading the word to new users

In July 2011, 220 researchers and students from around Australia and New Zealand took advantage of a great opportunity to learn more about using synchrotron and neutron techniques to help achieve their research goals. The occasion was a joint Australian Synchrotron-ANSTO symposium at the University of New South Wales. The Synchrotron and Neutron New Users Symposium 2011 presented potential new users, particularly younger scientists, with information about how to use the specialised x-ray, infrared and neutron techniques now available at the synchrotron and at ANSTO's OPAL research reactor – and how to gain access.

The free event included presentations by staff from ANSTO's Bragg Institute, the Australian Synchrotron, CSIRO and university users of the facilities. Presenters gave examples of synchrotron and neutron applications in fields such as biomedical, materials, environmental and physical sciences. Participants included undergraduate students, postgraduates and PhD candidates. The Australian Institute of Nuclear Science and Engineering provided travel support for 36 participants.

The symposium was sponsored by ANSTO, the Australian Synchrotron, AINSE, University of New South Wales, Monash University Biomedical Imaging, CSIRO, University of Sydney, University of Melbourne and La Trobe University.



A recent symposium for potential new users of synchrotron and neutron techniques attracted 220 participants.



## Events diary

Synchrotron-related events  
in Australia and overseas.

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## Space for your event

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## Careers at the Australian Synchrotron

The Australian Synchrotron offers a unique  
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specialists. For information on job postings, go to:  
<http://www.synchrotron.org.au/index.php/about-us/working-at-the-synchrotron/employment-opportunities>

## Staff list

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