FROM THE DIRECTOR: OUR NUMBERS ARE UP

Scientists are accustomed to dealing with some pretty big numbers – and some very small ones too.


Prof. Robert Lamb

Take an electron, for example. It weighs around 9.10938188 x 10-31 kilograms when it's just sitting around. Now take a few more, turn them into a beam 0.06 millimetres wide, and accelerate the beam to say 99.9987% of the speed of light, which is 299,792,458 metres per second. Then persuade your electron beam to turn enough corners to keep it circulating in a synchrotron storage ring 24 hours a day.

That's the amazing feat regularly performed by the Australia Synchrotron's team of engineers, accelerator physicists, operators, technicians and other support staff.

Impressed? I certainly am. Especially when that's combined with a beam availability of 98.3 per cent that puts us in the world's top five synchrotrons in terms of performance.

And it seems our users are impressed too. Since we opened in July 2007, over 500 users have collectively visited us more than 1000 times, and we were only running at 30 per cent capacity. That says a lot for the outstanding quality of our beamlines and the staff behind them – and the speed with which we've transformed ourselves from construction project to high-performance user facility!

Our numbers are truly up!

In this issue:

A TRIBUTE TO HANS FREEMAN

Emeritus Professor Hans Freeman AM, FAA, FRACI, FRSChem passed away in early November 2008. The Australian Synchrotron community would like to pay tribute to his crucial contribution to the development of Australia's synchrotron capabilities.

Hans Freeman

Hans was part of a team that guided Australia's overseas synchrotron programs for nearly two decades, and underpinned the rapid development of the Australian synchrotron user community and the consequent decision to fund the Australian Synchrotron.

Hans was a member of the Australian Academy of Sciences committee that produced a 1989 report recommending the construction of an Australian beamline at an overseas synchrotron light source. In conjunction with the ASTEC 'Small Country - Big Science' report, this report led directly to the establishment of the Australian National Beamline Facility (ANBF) at the Photon Factory in Japan in 1992. The ANBF, which now operates as part of the overseas commitments of the Australian Synchrotron, gave many Australian users their first taste of synchrotron research.

Hans served on the ANBF committee of management from its inception in 1991 until it was absorbed into the Australian Synchrotron Research Program (ASRP) in 1995, and from then on the ASRP Policy and Review Board until the transfer of the ASRP into the Australian Synchrotron in mid-2008. He also represented ASRP on the Consortium for Advanced Radiation Sources (CARS) Board of Governors in the US.

Hans Freeman was a true pioneer and a major contributor to the Australian synchrotron community. He will be sorely missed.

BEAMTIME APPLICATIONS

The call for submissions for 2009 Round 1 beamtime at the Australian Synchrotron closed on 3 November 2008.

Beamtime submissions will open again on 11 February 2009 for beamtime between May and August 2009. Key dates for 2009 beamtime submissions are listed at: http://www.synchrotron.org.au/content.asp?Document_ID=5305.

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

UP TO SPEED

This month our short interview features Cathy Harland, who heads the User Office at the Australian Synchrotron.

Describe your job in 25 words or less.
Anything to do with users - we oversee proposals, user travel, safety inductions and general information about anything to do with doing an experiment here.

Best aspect of your job?
Dealing with users, I come in contact with lots of interesting people. And the great people I work with, such as Lauren, who has kept things running smoothly while I've been on maternity leave.

Worst aspect of your job?
Unexpected last-minute jobs.

Apart from the Australian Synchrotron, what's the coolest job you've ever had?
Maybe not the coolest, but definitely the most unusual, painting names on Christmas decorations at a stall in the mall.

Best things about living in Melbourne and why?
Being back close to family after living in the USA, and Australian food and restaurants!

Your favourite overseas destination and why?
Prague - great culture and pretty good beer too.

A handy hint for users visiting the synchrotron?
Don't leave things to the last minute. Talk to staff if you have questions about what is possible.

Funniest or most surprising question a user has asked you?
When working at the APS in Chicago I was asked by a user where they could buy cheese in a can. Yep, it's a US invention!

A little-known fact about the

SYNCHROTRON OPENS UP

On Sunday 26 October 2008, the Australian Synchrotron opened its doors to an estimated 3000 people keen to peer deep inside the nation's brightest new science facility.

Visitors participated in self-guided tours and learned about what a synchrotron is and how synchrotron light is harnessed for a wide range of scientific and medical applications. Specialist tours provided additional insights into the accelerator science, engineering, personnel safety systems and computer expertise that underpins the facility's operations.

The local Clayton Rotary club provided a sausage sizzle, but it wasn't just the sausages that got grilled. Scientists, engineers and other synchrotron staff willingly faced a barrage of questions from visitors of all ages and backgrounds.

"For me, the highlight of the open day was the enthusiasm of the public," synchrotron external relations manager Steve Gower told *Lightspeed*. "It was great to be able to satisfy their curiosity about the synchrotron – and to give our staff an opportunity to present their work to the public."

Comments from visitors ranged from "scientifically inspiring", "amazing potential for our future knowledge" and "excellent use of taxes" to "dream job 2da max" and "I want one!".

http://www.synchrotron.org.au/content.asp?Document_ID=5491

Australian Synchrotron?
The men's toilets at the synchrotron were measured, but not used, for a hand-washing scene in the Nicolas Cage movie that was partly filmed at the Australian Synchrotron in April 2008.

EVENTS DIARY

EVENTS IN AUSTRALIA

Second Australian Tomography Workshop (Aus Tomo II)

13-14 November 2008
Monash University, Melbourne

With the aim of fostering links and collaborations, this meeting is open to all aspects of tomography, including x-rays, electrons and theoretical / computational aspects. The first day will look at tomography generally and the second day will focus on existing plans and future proposals for tomography at the Australian Synchrotron. Workshop participants will be able to tour the Australian Synchrotron.

More:
http://xrsi.cmit.csiro.au/TomoWkshop

A-O Week of the Australian Synchrotron

1-5 December 2008
Australia plays host to researchers from the Asia-Oceania region at The A-O Week of the Australian Synchrotron from 1 to 5 December. The week features a series of important events beginning with a meeting of the Science Advisory Committee (SAC) planned for 1 December. This is followed by the Australian Synchrotron Users Meeting on 2-3 December and the third Asia-Oceania Forum for Synchrotron Radiation Research (AOFSRR) on 4-5 December. Satellite activities include the Next Generation Science Workshop on 4 December

Discount available for student registrations

IN SCIENCE, A LOT CAN HAPPEN IN JUST ONE NIGHT

Prof. Michael Cortie from the University of Technology Sydney has been fascinated by gold-copper-aluminium based shape memory alloys for 15 years, but it wasn't until he came to the powder diffraction beamline at the Australian Synchrotron that he discovered the true nature of the alloy's structure and transformations.

Over the last 15 years, Michael's research in this area has taken him around the world, to jewellery trade shows, to scientific conferences, to industry and more. The work has been the basis of a PhD project, honours projects, research grants, collaboration and favours from friends and colleagues. When the opportunity came to use the Australian Synchrotron to do more diffraction, he was certainly keen, but not really expecting to find much more than he already knew.

Then in one 12-hour nocturnal marathon session at the synchrotron, Michael and his team finally found the answers he had been seeking for over a decade – answers that will have great practical relevance if the alloy ever reaches routine commercial production. With this new knowledge, the team can now take their alloy in new and exciting directions.

http://www.synchrotron.org.au/content.asp?Document_ID=5487

EXPERIMENTING WITH SAXS

With the world market for gold nano-particles in biomedical, pharmaceutical and cosmetic applications already worth over $200 million, it's not surprising that gold nano-rods – tiny elongated crystals of gold with very attractive optical properties that could open up a whole range of new applications – are the subject of intense international research interest.

Dr Catherine Kealley and colleagues from the University of Technology Sydney visited the Australian Synchrotron recently to study the formation and growth of gold nano-rods using in-situ synchrotron SAXS (small angle x-ray scattering). Cat's aim is to solve some of the mysteries that still surround the synthesis of nano-rods, paving the way for their use in specific applications.

Beamline scientist Nigel Kirby (second from left) discusses SAXS techniques with L to R: Jonathan Edgar, Catherine Kealley and Michael Cortie from the University of Technology Sydney (photo: Amanda Kirby)

"Our visit was incredibly useful," Cat told *Lightspeed*. "We already had some

More details available at http://www.asnevents.com.au/synchrotron08/

11th International Symposium on Radiation Physics (ISRP-11)

21-25 September 2009
The University of Melbourne, Australia

ISRP-11 is organised by the International Radiation Physics Society (IRPS) and is supported by DEST, the Australian Synchrotron and the Victorian Government. The meeting is devoted to current trends in radiation physics research.
More:
http://mcmconferences.com/isrp11

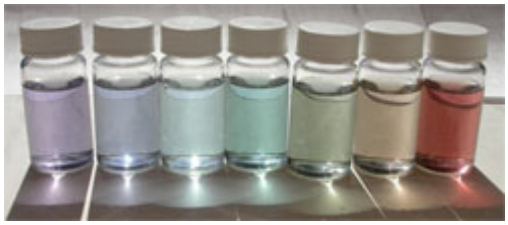
10th International Conference on Synchrotron Radiation and Instrumentation 2009 (SRI2009)

Melbourne Convention & Exhibition Centre
28 September – 2 October 2009

The world's largest and most important forum for synchrotron radiation science and technology communities, SRI is expected to attract 800 international and Australian delegates in 2009. The conference promotes international exchange and collaboration among scientists and engineers involved in developing new concepts, techniques and instruments related to the production and utilisation of synchrotron radiation. More details are available at http://www.sri09.org/

promising data from laboratory SAXS, but could not achieve the time resolution or the low-q angle that the synchrotron gave us. When you're watching nano-rods grow in-situ, the ability to collect information about the system every five seconds or so is crucial.

"Nigel Kirby is an energiser bunny! His energy, enthusiasm and drive are contagious and everyone worked around the clock to make sure we collected some great data.



Almost all the colours of the rainbow: gold nanorods in solution, with aspect ratios increasing from left to right (photo: Jonathan Edgar, University of Technology Sydney)

"There are so many questions surrounding the nucleation and growth of gold nano-rods, but the high-quality data we collected at the synchrotron has gone a long way in helping our understanding of the system.

"Being able to do this work by travelling interstate rather than overseas means we can come more often, for longer – when Nigel and the rest of us have caught up on some sleep."

ONE IN A THOUSAND

PhD student Audrey Beaussart's visit to the synchrotron on 1 October 2008 was the 1000th visit that users have made to our facility.

Audrey and her colleagues from the University of South Australia used the synchrotron's infrared spectroscopy beamline in October 2008 as part of their ongoing investigation into how adsorbed polymers affect material surfaces. The aim is to be able to correlate the structure and shape that polymer molecules adopt at a solid-liquid interface with the polymer's ability to alter surface properties.

Audrey Beaussart from the University of South Australia receives a commemorative certificate from George Borg, the Australian Synchrotron's head of technical services

Audrey's PhD focuses on how adsorbed polymers affect surface wettability. She chose this PhD topic because its combination of fundamental research with industrial applications appealed to her engineering background.

The infrared beamline at the Australian Synchrotron has also allowed her to explore how adsorbed polymers might function as lubricants. Studying lubrication with water-soluble polymers is relevant for many systems, including biolubrication (e.g. in human joints and tears).

Her initial work has focused on two particular lubricant systems: Langmuir-Blodgett (LB) films and adsorbed PLL-PEG (poly-L-lysine-polyethylene glycol) graft co-polymers. LB films are model lubricants that are representative of the lubricant layers formed by fatty acid additives in engineering lubricants. PLL-PEG is a novel polymer system that is a good mimic for the biolubricants present in synovial fluid.

Audrey used the infrared beamline to obtain in-situ FTIR (Fourier transform infrared) spectra of the two lubricant layers in contact between two surfaces.

EVENTS OUTSIDE AUSTRALIA

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

BioCARS Workshop on Time-resolved Macromolecular Crystallography

20-22 Nov 2008, APS, Chicago, US

This workshop will provide hands-on training in designing and conducting time-resolved experiments and in Laue data processing and analysis. Participants will also learn about recent upgrades to BioCARS insertion device beamline 14-ID X-ray and laser facilities.

More: http://cars.uchicago.edu/biocars

Further information:
Vukica Srajer v-srajer@uchicago.edu
or Jane Andrew
andrew@cars.uchicago.edu

High Pressure Molecular Biophysics Conference (HPMB2008)

10-12 December 2008
SOLEIL, Saint Aubin, France

Jointly organised by SOLEIL, Centre de Biophysique Moléculaire (CBM, Orléans) and Institut de Biologie Structurale (IBS, Grenoble), this multidisciplinary conference will highlight:

- interests and prospects of combining high-pressure perturbation and various biophysical tools, including high resolution structural methods (NMR and macromolecular crystallography)
- scientific results in the field
- recent instrumental advances
- interplay between experiments and simulations.

More: http://www.synchrotron-soleil.fr/portal/page/portal/Soleil/ToutesActualites/Workshops/2008/HPMB2008 or email: conf-hpmb2008@synchrotron-soleil.fr

The synchrotron experiments will provide information on how polymers behave at an interface when a load is applied, i.e. when the polymer is squeezed between two opposing surfaces.

"While we might have been able to do this work elsewhere, the remarkable brightness of the Australian Synchrotron has enabled us to acquire high-quality spectra," Audrey told *Lightspeed*.

"The Australian Synchrotron staff were very professional and friendly, especially the support staff on the beamline."

THE NEXT GENERATION OF SYNCHROTRON PHDS

The Australian Synchrotron encourages its staff to undertake further studies related to their work and several staff have completed their PhDs here. Now we can also claim an international PhD student of our own.

Physicist Evelyne Meier, a Swiss-French national, is the Australian Synchrotron's first official PhD student. Her work is part of a major international collaboration called the FERMI@Elettra (Free Electron laser Radiation for Multidisciplinary Investigations at Elettra) project. This project 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.

Evelyne is helping to develop a feedback system that will help stabilise the electron beam that drives the FERMI free-electron laser. Her research centres on theoretical studies and computer simulations of beam dynamics with the Australian Synchrotron's linear accelerator (linac) operating as a FEL driver.

Evelyne's PhD is jointly supervised by 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. Her project also involves collaboration with the Linac Coherent Light Source at the SLAC National Accelerator Laboratory(formerly the Stanford Linear Accelerator Center), which will be the world's first x-ray free electron laser when it becomes operational in 2009.

PhD student Evelyne Meier (second from right) with (L to R): Edwina Cornish (Monash Deputy Vice Chancellor & Vice President Research), Greg LeBlanc and Sandra Biedron

Synchrotron Environmental Science IV

11-13 December 2008
San Francisco, California, USA

The SESIV meeting will consider emerging frontiers in environmental science and the role synchrotron science can play in solving our global environmental problems. Environmental science researchers new to synchrotron radiation are encouraged to attend.

Early registration deadline: 14 November 2008

More: http://esd.lbl.gov/sesIV08/index.html

XAFS 14 Conference

26-31 July 2009
University of Camerino, Italy

The International Conference on X-ray Absorption Fine Structure (XAFS) is a triennial event. XAFS 14 will cover a wide range of topics, including EXAFS, NEXAFS, XANES, DAFS, SEXAFS, EELFS, XMCD and Auger spectroscopies, microspectroscopy and spectro-microscopy, resonant photoemission, resonant and non-resonant inelastic x-ray scattering, time-resolved XAFS and diffraction. Specific symposiums are planned on hot topics such as ultra-fast time-resolved spectroscopy, slicing schemes and free electron lasers in the x-ray and UV/XUV domains.

Early registration and student discounts available. Early registration deadline is 15 May 2009.

More: http://www.xafs14.it/

X-RAY SCIENCE, GORDON RESEARCH CONFERENCE MEETING

2-7 August 2009
Colby College, Waterville, Maine, USA

Topics currently under consideration for this meeting include:

- science frontiers using new x-ray sources
- x-ray scattering /spectroscopy under extreme conditions
- use of coherent x-rays for imaging and studies of dynamics
- x-rays in biology, life, energy and

ANOTHER HIGH-PERFORMANCE MACHINE

The Victorian Government will contribute $1.45 million towards a $2.9 million high performance computer facility at the Australian Synchrotron.

Announcing the investment in early October 2008, Victorian Minister for Innovation Gavin Jennings said he was delighted to be building on the state's investment in the Australian Synchrotron and the life sciences supercomputer to further boost Victoria's and Australia's capacity for groundbreaking research and development.

The high performance computer facility will be used by all Australian Synchrotron beamlines, but will be particularly useful for the imaging and medical therapy beamline and for protein crystallography applications.

"In practical terms, the new computer facility will mean that researchers won't waste time analysing bad data as they will be able to see the results almost as soon as they collect the data," says Richard Farnsworth, head of controls and IT at the Australian Synchrotron.

The high performance computer facility will be jointly funded by the Victorian Government, Monash University, CSIRO and the Australian Synchrotron.

Link to website media release:

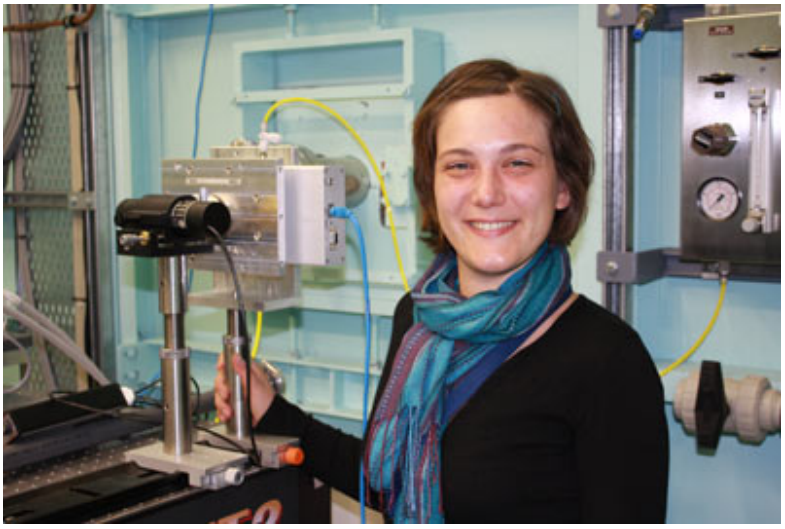
http://www.synchrotron.org.au/content.asp?Document_ID=5468

BEAMLINE FOCUS

X-ray Absorption Spectroscopy Beamline

Several major issues with the XAS beamline have recently been resolved, paving the way for improved user operations. The motor actuators in both mirror systems have been replaced, the support systems for the double crystal monochromator (DCM) have been modified to limit susceptibility to ambient vibrations, and a new set of Si(111) crystals has been fitted to the DCM. Australian Synchrotron staff are now developing a functional feedback system to improve the usability of the beamline control system.

For first cycle of 2009 user operations, transmission experiments at variable temperatures will be offered using the closed-cycle helium cryostat or user-supplied sample environments. The 10-element germanium detector, which is on loan from the ANBF, is undergoing repairs in the USA. A 100-element germanium detector is due to be delivered in April 2009.



Lisa Giachini

environment science

- dynamics by pump and probe technique
- inelastic x-ray scattering
- new techniques / optics, detectors and others.

The Conference Chairman is Jun'ichiro Mizuki (mizuki@spring8.or.jp), Deputy Director General, Quantum Beam Science Directorate, Japan Atomic Energy Agency (JAEA).
The Vice Chair is Brian Stephenson (stephenson@anl.gov), ANL.

RAPID ACCESS ON TRIAL

Applications are invited for the final section of the rapid access trial on the high-throughput protein crystallography beamline at the Australian Synchrotron on 11-12 December 2008.

The main aim of the new system, which was successfully trialled for the first time on 8-9 October, is to provide rapid beamline access for experienced users with high profile, highly competitive projects. Assessment criteria for Mode 1 Rapid Access will include, for example, publishing prospects, intellectual property considerations, and evidence of strong competition by other groups. Proposals must be lodged at least three weeks in advance of the shift being sought, and will be considered on a first-come first-served basis.

The rapid access system also aims to provide more immediate access for users who have already had proposals accepted for that round but want to investigate additional crystals. Mode 2 Rapid Access time will only become available if Mode 1 proposals have not filled all the rapid access timeslots.

http://www.synchrotron.org.au/content.asp?Document_ID=5448

The XAS beamline welcomed Dr Lisa Giachini as scientific support officer in September 2008. Lisa comes from Italy and France with a strong background in XAFS (extended x-ray absorption fine structure). Her specialties are biological applications of XAFS and XAFS data analysis. The XAS beamline at the Australian Synchrotron will be particularly good for bio-type XAFS (with the cryostat and 100 element detector), and prospective new bio-XAFS users are encouraged to contact Lisa.

The third member of the XAS team, Bernt Johanessen, is currently at the ANBF in Japan and will relocate to the Australian Synchrotron in April 2009.

Chris Glover, Principal Scientist, X-ray Absorption Spectroscopy

Powder Diffraction Beamline

With the arrival of Dr Justin Kimpton in the role of Scientist, the powder diffraction beamline team is complete. Justin joins us from the University of Melbourne, where he was a member of the Optics group working on the precision measurement of x-ray energy in highly-ionised medium-Z systems using high-resolution x-ray curved-crystal spectrometry for the critical testing of QED. He received his PhD from Swinburne University of Technology in 2003 after completing a thesis entitled 'Conductivity and microstructural characterisation of doped zirconia-ceria and lanthanum gallate electrolytes for the intermediate-temperature, solid oxide fuel cell'. He has also worked for CSIRO Materials Science and Technology, where he managed an x-ray laboratory and conducted materials analyses in the analytical spectroscopy laboratories. Justin is looking forward to applying his industrial and x-ray characterisation experience to new challenges at the synchrotron.

Justin Kimpton

Kia Wallwork, Principal Scientist, Powder Diffraction

A TRAVELLER'S TALE

The following entries were taken from the travel diary of a senior Australian Synchrotron manager, who has requested that he remain anonymous. Next time you encounter problems when you travel on synchrotron-related business, remind yourself that it could be worse – and share the details with us.

Scratch the diary bit. Let's call it a saga. Enjoy (at my expense)...

CAREERS AT THE AUSTRALIAN SYNCHROTRON

The Australian Synchrotron offers a unique working environment for a wide range of specialists.
More information on job postings: http://www.synchrotron.org.au/content.asp?Document_ID=14.

NEW SURVEY TO BOOST USER SATISFACTION

A new online survey has been developed to help users provide feedback to the Australian Synchrotron.

All users are required to complete the new survey, even if they have already provided feedback. Future beamtime allocations may be contingent on completion of the survey.

The online survey takes around 15 minutes to complete, and is available via the User Information section on the Australian Synchrotron website.

Survey:
http://www.synchrotron.org.au/content.asp?Document_ID=5450

READER FEEDBACK

Lightspeed welcomes your comments and suggestions. Please send these to: info@synchrotron.org.au with 'Lightspeed comments' in the subject line.

Damn saga this travel. Started out from Melbourne poorly and has gotten worse. No booking on the system for Melb-Syd for 9am. Checking found it at 6pm instead of 9am. Turned out it wasn't mine but some poor bloke with a similar surname. By this time I had already boarded etc. They chase the plane down the tarmac to give me a handful of boarding passes now that they have located me on the system. Flight to Sydney uneventful. Decide to book luggage in early so I can travel around Sydney with just carry-on luggage. Arrive at Cathay check-in to be told there is a typhoon in Hong Kong and they are rerouting flights. Half an hour later they realise I am on a later flight and process me. Can't take baggage, however, so I store commercially. Talk goes well. Everyone impressed with Sync and wowed by brilliant delivery. Check baggage in and confirm seating. Refused entry to Qantas Club lounge because I am travelling with a Cathay boarding pass. Lesson. Don't let the Cathay staff throw the Qantas duplicates in the bin. Go to board and my pass is rejected. Five minutes on frantic computer tapping and I get to board. I have a bulkhead window seat. Finally the gods are smiling. Good flight. Watched the Forbidden City (Jet Li and Jackie Chan Kung Fu movie). Land to discover flight to Taiwan cancelled. Go to Cathay Lounge to sort out flight. Am told I will be put on the next Cathay flight an hour 20 later. Am refused entry to Cathay lounge. You can only smile and shake your head. Am asked if I have baggage to which I say yes. Am informed that there is no baggage in the system associated with me. I produce the baggage ticket. Frantic keyboard tapping. Am told it never left Sydney. More frantic keyboard tapping. Am told there is no record of lost baggage in Sydney and so maybe it is in Hong Kong. Empathy felt and am granted entry to First Class lounge. Contacted in lounge and told next two flights are full. Dragon Air might be a possibility and they are checking that.

And all that is in less than 24 hours. I'm not even close to my final destination, the NSRRC in Taiwan.

MORE INFORMATION

A list of Australian Synchrotron personnel can be found here: http://www.synchrotron.org.au/content.asp?Document_ID=129.

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