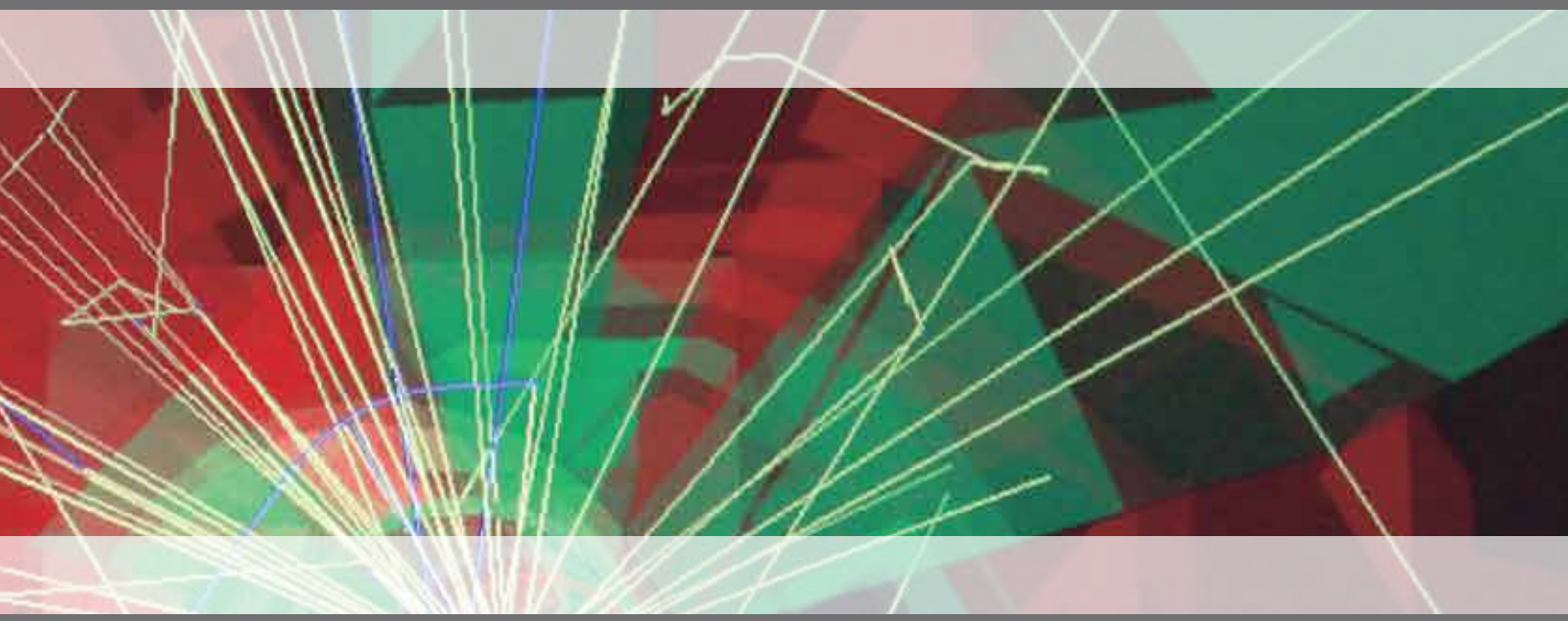
Australian Synchrotron
Annual Report 2011

The Australian Synchrotron vision – to be the catalyst for the best scientific research and innovation in Australasia



Australian Synchrotron

Supported by

Australian Government

State Government Victoria AUSTRALIA

About this Annual Report

The 2011 Australian Synchrotron Annual Report provides an overview of the activities undertaken at the facility over the 2010/2011 period. It is written with a broad readership in mind and we encourage the reader to provide feedback on this report by emailing info@synchrotron.org.au. This report is a public document and is freely available on the Australian Synchrotron website at www.synchrotron.org.au. On this website, the reader can also learn more about the Australian Synchrotron, its capabilities and the benefits it delivers to science, business and the general community.

Contents

About Us

The Australian Synchrotron provides Users with a suite of powerful tools for analysing and visualising materials in ways that cannot be achieved using other technologies. These tools utilise x-ray and infrared radiation generated by the synchrotron to enable advances in science and technology across a range of fields from medicine and mineral exploration to nanotechnology.

Synchrotron light is millions of times brighter than light produced by conventional x-ray machines in laboratories and hospitals. The unique properties of this light mean that experiments carried out at the Australian Synchrotron are highly accurate, extremely precise and faster than research carried out using conventional equipment.

The establishment of the Australian Synchrotron as a national research facility (the only one of its kind in Australia) has helped to drive scientific discovery to a new level, while also contributing to a strong and productive scientific workforce. The Australian Synchrotron also supports education and outreach activities that continue to drive and benefit our own scientific community.

Discoveries made at the Australian Synchrotron are contributing to an improved understanding of our world and lead to exciting new technologies, processes and products, which deliver a range of health, social and economic benefits.

Vision

To be the catalyst for the best scientific research and innovation in Australasia. The key focus of the facility is on providing a thriving scientific research environment that is conducive to creating and nurturing the best scientific outcomes for Users and the staff of the facility.

Mission

To develop a world-class synchrotron facility, maximising the quality, breadth and impact of scientific output.

Core values

Passion, respect, collaboration, innovation and continuous improvement.

National Research Priorities

Australian Synchrotron science and technology contributes to all of Australia's National Research Priorities including:

- An environmentally sustainable Australia
- Promoting and maintaining good health
- Frontier technologies for building and transforming Australian industries
- Safeguarding Australia

Our research capabilities

The research capabilities available at the Australian Synchrotron are useful across many fields, including:

- Advanced materials: ceramics, polymers, biomaterials, semiconductors, magnetic, superconducting and battery materials and opto-electronics
- Agriculture: plant cells, plant tissues, plant cell and root uptake and soil analysis
- Biomedical: new diagnostic, imaging and therapeutic techniques and high-throughput structural biology
- Defence industries: new materials, sensors and heavy metal analysis
- Environmental technologies and services: analysis of soils, fresh and salt water, air and atmospheric samples, pollutants, toxins and contaminants, environmental remediation
- Food technology: analysis of food ingredients and packaging materials, product and process development
- Forensics: broad range of analytical capabilities and development of new techniques
- Manufacturing: metal alloys, catalysts, engineered components, stress analysis, fibres and textiles, adhesives, polymers and plastics, surfaces, interfaces and coatings
- Minerals: mineral exploration and mineral processing
- Nanotechnology and microtechnology: advanced nano and micro-device manufacturing and micro-circuits and sensors
- Oil and gas: exploration, pipeline reactions, fuel processing and fuel cells
- Pharmaceuticals: analysis of proteins, nucleic acids and viruses, cell imaging, quality control monitoring, bio-mimetic materials (artificial skin or organs), identification of drug targets and assessment of drug candidates
- Scientific instruments: detector technologies, measurement techniques, medical implants and delivery systems.

Chairman's Report

In 2011 the Australian Synchrotron has had a year of significant achievements with growth in both scientific outcomes and overall performance.

Throughout the year our scientists and our diverse User base have received recognition for research excellence, exceeding all expectations for this stage of the facility's development. These scientific outcomes are matched by the world-class performance and reliability of the machine together with the dedication and commitment of our staff.

It has been my privilege, and that of my fellow Directors, to support and work collaboratively with the staff and the many organisations and committees that form part of the wider Australian Synchrotron community. We would like to acknowledge the work of our Scientific Advisory Committee, our Machine Advisory Group and the many other scientific panels that work tirelessly and contribute to the highly successful operation of the Australian Synchrotron.

The inaugural meeting of the National Science Colloquium brought its eminent members to the facility where they strongly supported our scientific staff in their research endeavours. Their presence and support encouraged enthusiasm and pride in our scientific program and helped equip Colloquium members to support the Synchrotron throughout the community.

In what has been a stimulating year, we are also very grateful for the ongoing support of both the State and Federal Governments, together with our valued Foundation Investors, in enabling the Australian Synchrotron to remain a world class scientific facility.

During the course of the year there have been a number of significant Board and senior management movements. One of four foundation Directors, Dr Garth Carnaby, stepped down from the Board. On behalf of the Board I would like to pay tribute to the enormous, insightful contribution Garth provided in terms of governance, funding and stakeholder involvement and strategic direction.

After serving as a Board Director for a relatively short period, Professor Keith Nugent resigned from this position to accept the appointment of Director of the Australian Synchrotron. Professor Nugent is responsible for the Australian Synchrotron's scientific leadership and strategic development. The Board is delighted with the appointment of a distinguished and respected scientist, and further acknowledges Professor Nugent's contribution as a Director of the Board. The Board also expressed its appreciation to the University of Melbourne which had made Professor Nugent's appointment possible.

Professor Nugent's priorities have been to ensure the Synchrotron produces great science and to work with the Board, staff, stakeholders, Scientific Advisory Committee and the National Science Colloquium to promote the case for the Australian Synchrotron's future expansion and development.

Professor Nugent's appointment was one of four new senior appointments and followed a re-organisation of senior Australian Synchrotron responsibilities. Dr George Borg, who was Acting Facility Director of the Australian Synchrotron, was appointed to the new role of Chief Operating Officer of the Australian Synchrotron Company and Chief Executive Officer of the Australian Synchrotron Holding Company. Dr Borg is responsible for Australian Synchrotron operational and administrative matters and both Professor Nugent and Dr Borg report to the Board and attend Board meetings. The Board acknowledges the outstanding work of Dr Borg while in the role of Acting Facility Director.

Professor Andrew Peele replaced Professor Ian Gentle as the new Head of Science. Professor Peele has been seconded from La Trobe University for a 12 month period. Since taking on the role, Professor Peele has focused his attention on setting new scientific priorities for the facility, reviewing the science group and creating a new structure to support future growth.

Professor Gentle held the position of Head of Science at the Australian Synchrotron for two years. He joined the synchrotron during its critical development stage and was responsible for establishing the science program and associated policies. Under Professor Gentle's stewardship the beamlines became fully operational leading to a significant increase in the scientific output. He also played a leading role in the preparation of the Science Case 2 document for the future expansion of the facility.

The Board acknowledges Professor Gentle's important achievements and science leadership at the Australian Synchrotron.

Chairman's Report continued

The Australian Synchrotron has also been very pleased with the appointment of a new Chief Financial Officer and Company Secretary, Mr Michael Tonroe and a new Head of External Relations, Dr Shirley Lanning.

The Board expresses its appreciation to all Synchrotron staff for their contribution to the effective operation of the facility; for their own research achievements; the services provided to researchers using the facility; and, for the high standards of compliance and accountability of its operations.

It has been a significant year for the scientific program at the Australian Synchrotron with many of our beamlines operating with full User programs and overall beamline performance exceeding expectations. The publication and impact of our research has increased significantly with several of our research results now being accepted by some of the most prestigious scientific media such as *Nature*.

User satisfaction levels, as measured by our User exit surveys also continue to show a high level of satisfaction which is a testimony of our scientific capabilities and the dedication of our staff. The 2010 User Conference was a major highlight of the year attended by more than 200 Australian and international delegates.

Throughout the year our extensive operations have taken place in a very safe working environment. The investment in the delivery of safety programs, training and inductions has underpinned a strong safety culture which has helped to reduce workplace incidents and injuries. High priority to radiation safety at the facility is, as always, paramount in our operations.

The Australian Synchrotron met all its financial goals for year 2010/11. The surplus for the year was $963,000. The main source of revenue remains the Commonwealth and State Governments, to the amount of approximately $24 million, and from the New Zealand Synchrotron group, $800,000. In addition to our State and Federal operational funding the facility received other grant funding of $1.7m towards its activities during the year.

The Australian Synchrotron's multi-million dollar capital works program moved from the planning and design phase to the construction of new facilities. This included the construction of the new infrastructure buildings as funded by the Education Investment Fund (EIF) and the second phase of the imaging and medical beamline, funded by the National Health and Medical Research Council (NHMRC).

During the course of the year the Australian Synchrotron was honoured to host a number of VIP visitors including the Honourable Louise Asher, the Victorian Minister for Innovation, Services and Small Business; the Honourable Gordon Rich-Phillips, the Victorian Minister for Technology, who attended the facility to launch the MASSIVE (Multi-Modal Australian Sciences Imaging and Visualisation Environment) program; members of the Victorian Legislative Council; Mr Daniel Taylor the New Zealand Consul General/Trade Commissioner and Mr Simon McKeon, the 2011 Australian of the Year and Chair of CSIRO.

The Australian Synchrotron continues to be an active member of SEMIP (South East Melbourne Innovation Precinct). This is a unique partnership involving Government, CSIRO, Monash University, Australian Synchrotron, small technologies cluster and the councils of Greater Dandenong, Kingston, Knox and Monash working in collaboration with industry. The precinct is ideally positioned to be an innovation, business and knowledge hub creating long-term job opportunities. Our involvement has resulted in several successful industry events and participation in a series of workshops.

Elsewhere in the report the Director, Professor Nugent, and the COO, Dr Borg, have provided details of the Australian Synchrotron's many achievements, in particular benefits FIs have gained from their investment and involvement through the outstanding quality and quantity of the scientific work undertaken. It has been a matter of pride that we have welcomed our 3500th User and had significant publications in *Nature* and *Cell*.

With this said, the Australian Synchrotron has reached a crucial stage in its development, after significant achievements in its short history, and is now looking forward to the next phase of its development and expansion.

Mrs Catherine Walter AM

Director's Report

The past year has been one of continuing development for the Australian Synchrotron and one in which we consolidated our reputation as a productive, high-performing science and research facility with an increasingly diverse User base.

The Australian Synchrotron continued to meet the expectations of the domestic and international scientific User community. Focusing on critical research and development areas, such as immunology, biomedicine and nanotechnology, the year saw 197 papers published using Australian Synchrotron data; an outstanding performance by any standards.

Importantly, our work also delivered benefits to business and industry. Our facility contributed to the development of environmentally safe cement, called E Crete™ and its commercialisation by the Australian company, Zeobond Pty Ltd. The facility also supported the creation of stronger and more versatile manufacturing materials for the sheep industry, new super-foods and treatments for cancer and infectious and autoimmune diseases, like diabetes. In summary, over 90 private companies were identified as having benefited from links with the Australian Synchrotron.

The facility again supported the Australian Synchrotron Postgraduate Awards and the Australian Synchrotron Thesis Medal. These and other activities are part of our continued efforts to promote the development of science in Australia and the region. The scientific standing of the facility continued too, through the further development of partnerships with the Australian Collaboration for Accelerator Science and Monash Biological Imaging.

Our contribution to our immediate precinct grew, largely through our active involvement in the South East Metropolitan Innovation Precinct (SEMIP).

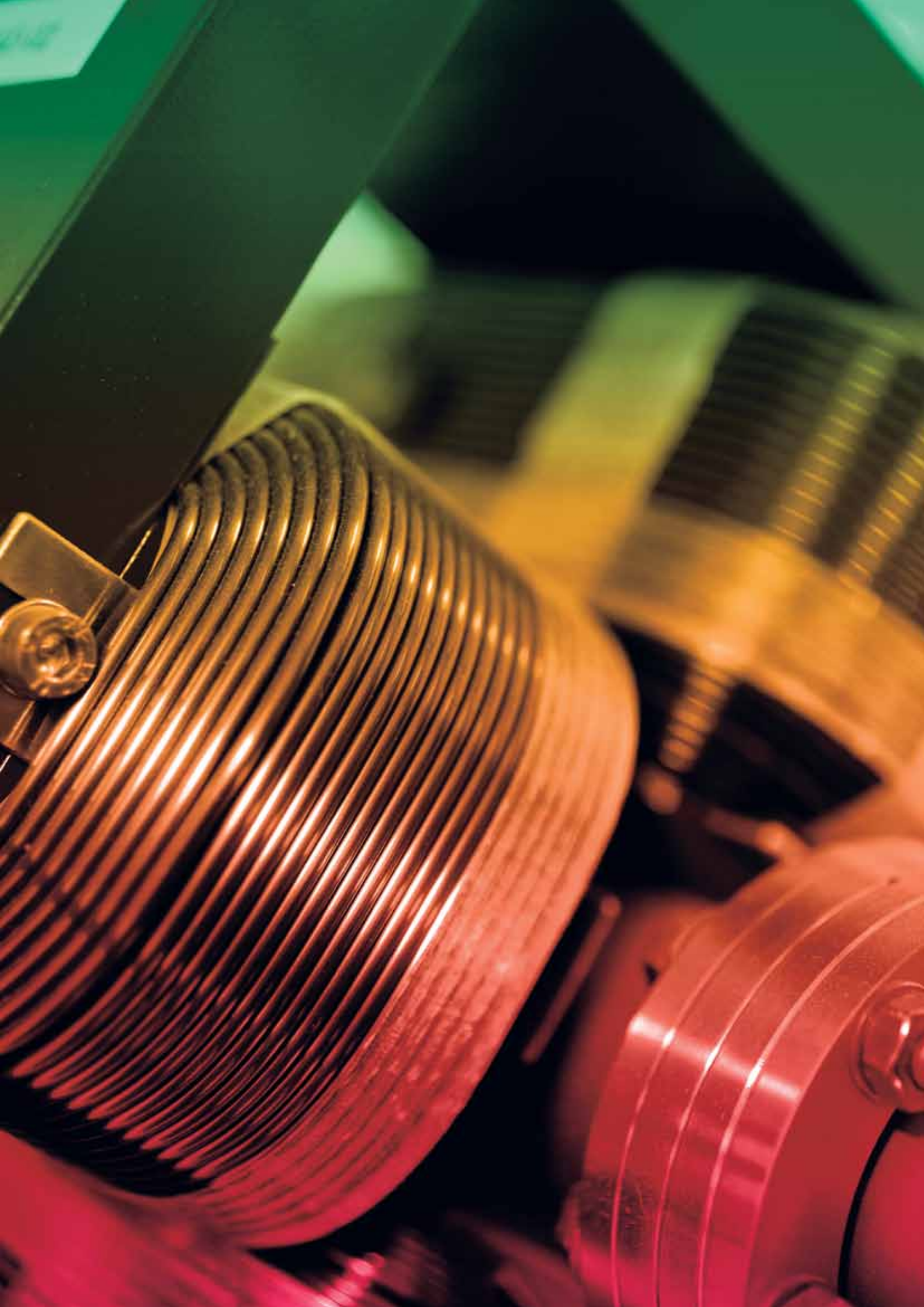
We can also safely say the Australian Synchrotron made significant contributions to the Federal Government's National Research Priorities and to the development of new innovative industries for Victoria.

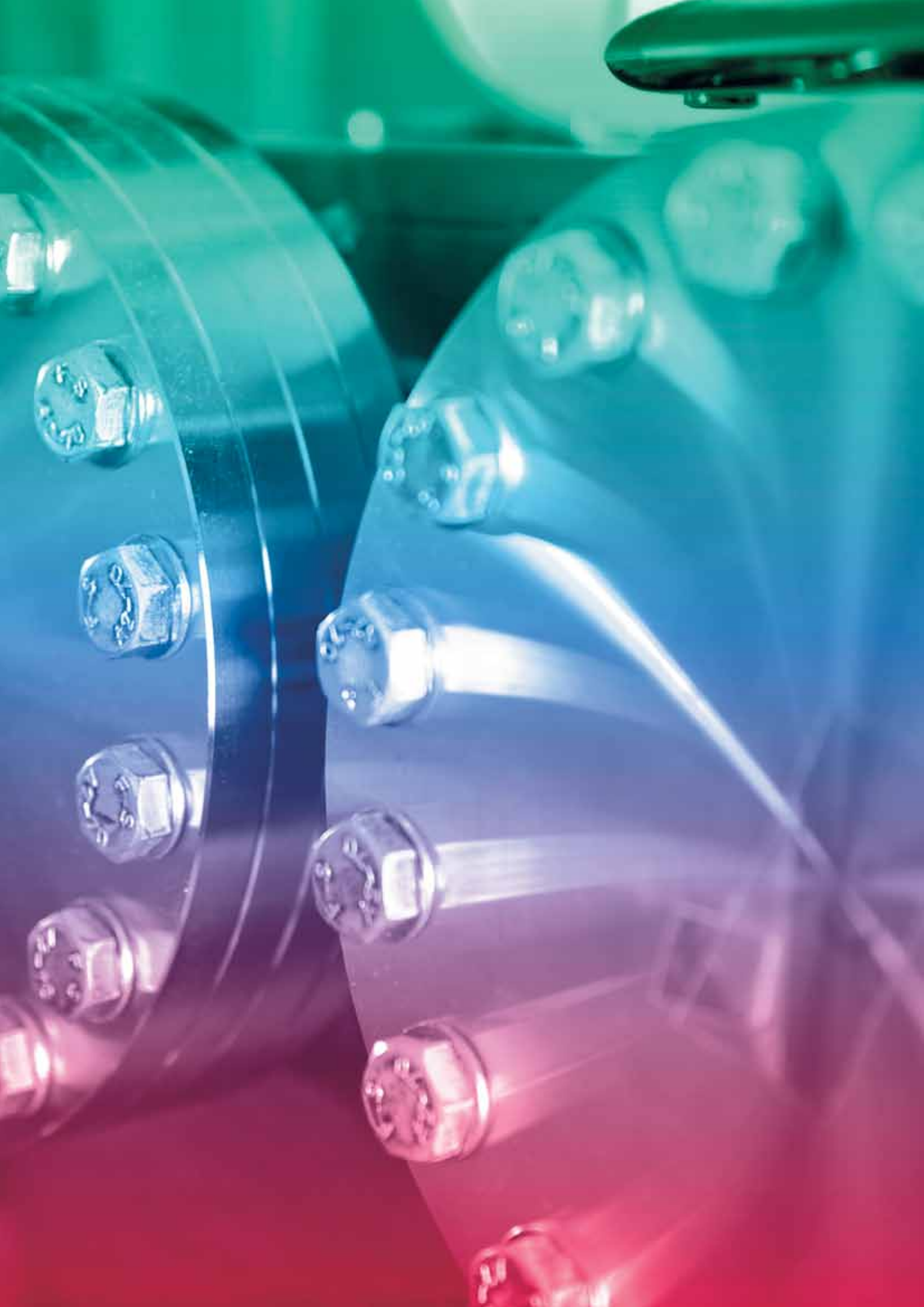
In addition, a number of important senior appointments were made within the Australian Synchrotron, particularly in respect to its management team, which I believe will benefit the future growth of the facility and its role in producing world class scientific outcomes.

As we now move into the next phase of the Australian Synchrotron's development, I would like to thank our Foundation Investors for their continued support and advocacy.

I would also like to thank our staff and the User community for their enthusiasm and passion. We cannot underestimate the importance of Users through the User Advisory Committee and the many other committees and activities to which they willingly and freely contribute. Professor Ian Gentle and Dr George Borg should also be thanked for their exceptional dedication and commitment while in their roles as Head of Science and as Acting Facility Director.

Professor Keith Nugent





Chief Operating Officer's Report

Since taking up my new appointment as Chief Operating Officer for the Australian Synchrotron Company and Chief Executive Officer of the Australian Synchrotron Holding Company, I have been particularly impressed by the calibre of our people and their commitment to ensuring the Australian Synchrotron remains the world-class research facility that it is today.

While the Australian Synchrotron has had a number of significant scientific achievements over the past 12 months I am equally proud of the expertise and dedication of our operations and wider support staff who have worked diligently to provide the environment which has enabled these high-quality outcomes.

Despite the many challenges, the Australian Synchrotron was able to meet all its financial commitments and return a surplus for the year. This surplus funding has enabled us to re-invest in our capabilities, including a financial contribution to the procurement of our Uninterruptable Power Supply (UPS) and commencement of our post-doctoral program.

In line with the facility's commitment to quality, compliance and performance, the Australian Synchrotron continued to adopt and implement best practice management, risk and safety standards under its ISO 9001:2008 accreditation standard. Providing a safe work environment to all our staff, Users and Contractors remains a high priority in all our operations, together with our commitment to radiation safety at the facility. This investment in the delivery of safety programs, training and inductions has underpinned our strong performance in reducing workplace incidents and injuries.

Considerable progress has been achieved over the past 12 months in our extensive building construction program. Supported by infrastructure grants totalling approximately $53m from the Federal Government's Education Investment Fund, the National Health and Medical Research Council (NHMRC) and the Victorian State Government (Department of Business and Innovation) the facility has continued to significantly expand its infrastructure capabilities, ultimately with the aim of improving its services to staff and Users.

Expansion of our infrastructure capabilities has included the construction of a National Centre for Synchrotron Science, a Technical Services Building, a User Accommodation Building, Office Extension Building and Extension Switch Room. It is these and other initiatives which will undoubtedly contribute to positioning the Australian Synchrotron as a leading research and science facility long into future.

A number of other exciting capital expenditure projects were also undertaken during the year, including the upgrade of the imaging and medical beamline (IMBL).

I am pleased to report that all our building programs are ahead of schedule and on budget. All buildings, including the National Centre for Synchrotron Science, which is earmarked to be a hub for future scientific events, including seminars and exhibitions will be completed by June 2012.

Machine performance continues to rank amongst the world's best, with beam availability above 98% for the year. Our international Machine Advisory Group met during the year and praised the high quality of the machine performance, and the excellent results coming from our student program and the Australian Collaboration for Accelerator Science (ACAS). Significant progress has been made towards a move to the top-up mode of operation of the machine. This will improve beam stability and integrated photon flux, resulting in better and quicker experiments. Top-up is expected to be fully implemented by mid-2012. Factory testing of our site Uninterruptible Power Supply was successfully completed and is expected to be installed and commissioned in late 2011. This is expected to remove brown-outs from our incoming power feed, which are the major cause of unscheduled beam losses.

A number of capital improvement projects have also been completed under our Essential Operating Upgrades framework, including vibration improvements on the micro-crystallography beamline, improved biological and chemical control of our cooling water system, integration of a high temperature sample furnace on the powder diffraction beamline, development of our computing systems for data acquisition and an upgrade of our site security system. All of these improvements have assisted in the efficient and effective operations of the facility.

As custodian of the Australian Synchrotron's significant asset base I am also pleased to report that a number of initiatives were undertaken throughout the year to improve the monitoring and maintenance of the organisation's vast asset holdings.

None of these achievements would have been possible without the support of the many people and functions who have ensured that we run in an efficient and safe manner. I take opportunity to thank all staff for their tireless effort throughout the year.

Dr George Borg

Chief Operating Officer – Australian Synchrotron Company
Chief Executive Officer – Australian Synchrotron Holding Company

Australian Synchrotron Highlights

- Focusing on critical research and development areas, such as immunology, biomedicine and nanotechnology, the year saw more than 197 papers published using Australian Synchrotron data.
- The median impact factor (IF) of all journals in which Australian Synchrotron publications appeared was 4.4 (2010, ISI Journal Citation Reports); a result comparable to the performance of Australia's best research groups.
- It was a year that saw no less than five Australian Synchrotron scientists achieve a personal career highlight by having their research published in some of world's most highly regarded scientific journals including: *Nature Photonics*, *Nature Chemistry* and *Nature Magazine*.
- Through its active involvement with industry, the Australian Synchrotron identified it had contact via User linkages with over 90 different companies, both domestic and international. 30 of these companies were involved in linkage grants that mention the use and value of the Australian Synchrotron.
- The quality and breadth of the Australian Synchrotron's scientific output during the year also meant its performance was on par with other synchrotrons at equivalent stages of their development.
- During what was a busy year for the facility over 3000 researchers used the Australian Synchrotron's science and research capabilities.
- The Australian Synchrotron actively participated in initiatives and programs aimed at facilitating interaction between science and business. This activity saw the Australian Synchrotron work with groups such as the Australian Nanotechnology Alliance (ANA), Plastics and Chemical Industries Association (PACIA), AusBiotech, BioMelbourne Network, Australian Industrial Research Group and Business Victoria's, South East Melbourne Innovation Precinct (SEMIP).
- Importantly, the scientific work generated by the Australian Synchrotron also made a positive contribution to Australia's National Research Priorities including: creating an environmentally sustainable Australia; promoting and maintaining good health; developing frontier technologies for building and transforming Australian industries; and safeguarding Australia.
- To improve the scientific outputs of the facility, the Australian Synchrotron upgraded its imaging, data analysis and visualisation capabilities by installing two advanced technologies: the Maia Detector System and MASSIVE (Multimodal Australian ScienceS Imaging and Visualisation Environment). Both technologies position the facility at the forefront of developmental and experimental science.
- Research infrastructure grants totalling $53 million from state and federal government continued to improve the Australian Synchrotron's infrastructure and research capabilities. Ongoing construction of new facilities, such as the National Centre for Synchrotron Science, a new User Accommodation Building and Technical Support Laboratory will actively support increases in User numbers, User satisfaction and scientific outputs.
- As part of its industry engagement program, the Australian Synchrotron managed the South East Melbourne Innovation Precinct Innovation Showcase and co-managed with CSIRO the highly successful 'Green Chemicals Futures' and 'Hungry for Innovation' workshops.
- The Australian Synchrotron's work also saw it support a growing number of commercial clients exploring anti-infective drugs, electronic and bio-analytical measurement instruments, bio-fuel products, pharmaceutical and nutraceutical products and bio-pharmaceuticals

Our Supporters

The Australian Synchrotron was established as part of a strategic partnership instituted by the Victorian Government and involving the support of the Australian Government. This strategic partnership and generous support has been enhanced by investments from the New Zealand Government and research institutes, universities and state governments from across Australia and New Zealand.

As Foundation Investors each has played an essential role in the establishment of the Australian Synchrotron through the funding of the beamlines program, with each contributing a minimum of $5 million to its start-up.

All Foundation Investors continue to play an active role as primary advisers to the Board with regard to governance of the facility.

Supported by

Australian Government

State Government Victoria AUSTRALIA

Foundation Investors

AAMRI

ANSTO

CSIRO

Monash University

University of Melbourne

New Zealand Synchrotron Group Limited

New Zealand Government (Funding Partner)

University of Auckland

Massey University

University of Waikato

Victoria University of Wellington

Lincoln University

University of Canterbury

University of Otago

New Zealand Institute for Plant & Food Research Ltd

AgResearch

GNS Science Limited

IRL (Industrial Research Limited)

AUSyn14 Consortium

NSW Government

University of Western Sydney

University of New England

Southern Cross University

Charles Darwin University NT

Charles Sturt University

University of Technology Sydney

University of Canberra

University of NSW

University of Newcastle

University of Wollongong

University of Sydney

University of Tasmania

Macquarie University

Queensland Consortium

QLD Government

Griffith University

James Cook University

Queensland University of Technology

University of Queensland

South Australian and La Trobe Consortium

Government of South Australia

Flinders University

University of Adelaide

La Trobe University

University of South Australia

Western Australian Consortium

Government of Western Australia

University of Western Australia

Curtin University

Our User Community

The User Office

In any given year, the User Office is the first point of contact for current and prospective users, and central to the experience associated with working at the Australian Synchrotron and producing research outcomes.

In addition to ensuring that more than 600 proposals a year are properly reviewed, ranked and awarded beamtime, the User Office looks after the practical needs of the hundreds of Users who come to the Australian Synchrotron annually.

The User Office oversees the review of all merit-based proposals to use the facility, beamtime scheduling and the flow of information and advice to the User community. Post-beamtime, the User Office also manages the collation of publications containing scientific work resulting from the Australian Synchrotron beamlines.

As part of its additional responsibilities, the User Office runs the International Synchrotron Access Program, which funds Australian research groups travelling overseas to other synchrotron facilities.

The main achievement for this year was the successful management of more than 3500 safe User visits to the Australian Synchrotron. Our ongoing User exit survey also reported that for this period, the average user felt their experience with the User Office was either "good" or "excellent".

Looking forward, the group will continue improving its processes to meet the demand of expanding User numbers, and their growing wish to use web-based systems.

The User Office Team

Dr Cathy Harland, Group Leader, User Support

Ms Amanda Louch, User Office Administrator

Mr Scott Kendall, User Office Administrator

Ms Amanda Kirby, Publications and User Office Admin Support

User access

The allocation of User access to the beamlines is based on the following schedule:

Merit based

(approximately 50 percent)

Merit beamtime is allocated through a competitive, peer review process. There were three open 'calls for proposals' in 2010-2011 relating to three beamtime periods. Typically the call for proposals is open for one month, and closes two months ahead of the scheduling period.

Foundation Investor

(approximately 30 percent)

Foundation Investor proposals are not subject to peer review and are allocated beamtime by the Foundation Investor Consortia subject to satisfactory safety and technical feasibility criteria. This arrangement remains in place for six years from the time of the first beamline becoming operational in September 2007.

Facility and commercial access

(approximately 20 percent)

This includes access for scientists working at the Australian Synchrotron to further their own research projects. A commercial program is also in operation and achieved significant revenue over 2010-2011.

User support

Users of the Australian Synchrotron are fully supported to ensure that they are able to make efficient use of their visit to the facility. Prior to visiting the facility the User Office manages interactions with Users, assisting with the proposal process, accommodation booking and travel support. The Australian Synchrotron User experience while on site includes:

- Comprehensive safety and beamline induction training on arrival
- Extensive, hands-on support from our beamline scientists during business hours on all week days
- Direct support and assistance from our beamline scientists with any trouble-shooting outside of business hours
- Support from our machine operators with common faults when beamline scientists are not available
- On-call support from beamline staff for any significant technical issues

The Australian Synchrotron also provides extensive facilities to support our Users in preparation and analysis of their samples, including laboratory space and equipment and post-experimental support and analysis to assist in the preparation of scientific papers.

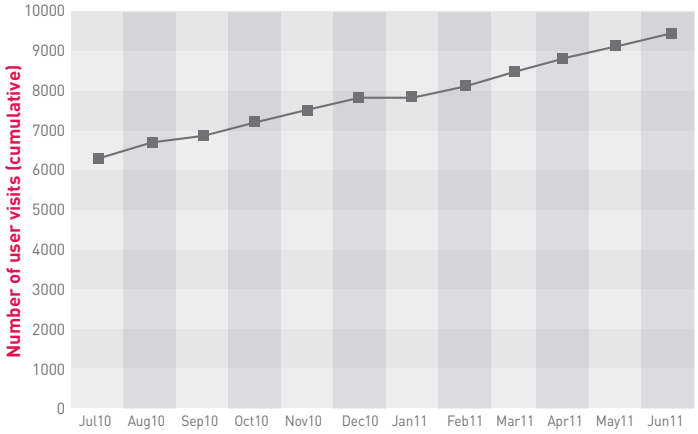
Monash University PhD student, Julie Cao, on the Infrared Microspectroscopy Beamline

Monash University Associate Professor, Merrill J Rowley and colleague Allyson M Croxford, on the Infrared Microspectroscopy Beamline

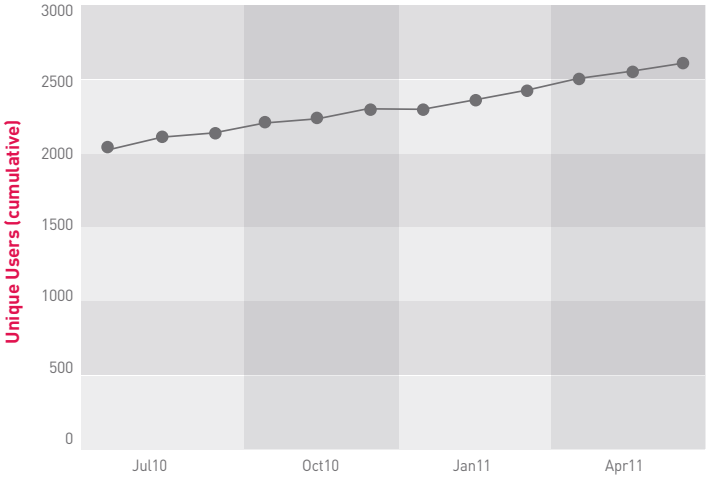
Our User Community

The Australian Synchrotron User community is significantly diverse and continues to grow. It includes a mix of government, academic and industrial scientists from Australia and countries around the world including New Zealand, Malaysia, Singapore, Turkey, Korea, India, Thailand, Canada, Denmark, Finland and many more. A number of our Users are also students and early career researchers, indicating the critical role the Australian Synchrotron plays in the development of our national and international synchrotron science community.

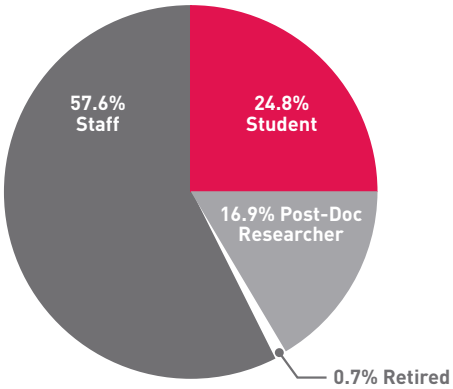
User Visits - July 2010 to June 2011



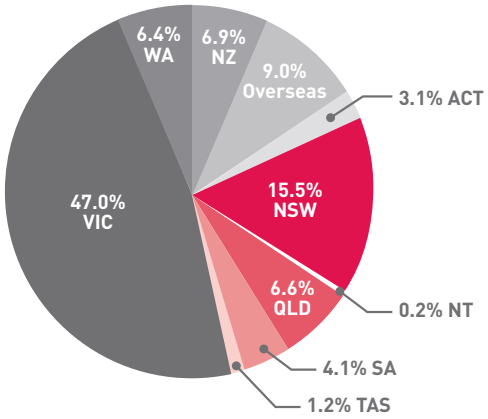
Unique Users - July 2010 to June 2011



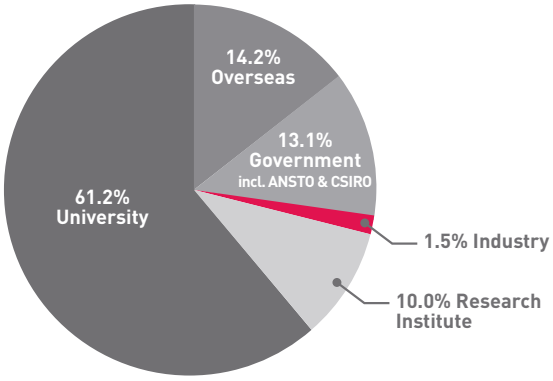
AS User Career Level



AS User Location



AS User Affiliation



Scientific Overview

Over the last year the development of science at the Australian Synchrotron has been buoyed by the excellence of our scientific staff and the great science produced by our Users.

For a facility that is still in its early years, the Australian Synchrotron is punching well above its scientific weight. While measures such as numbers of papers – 197 in the 2010 calendar year up from 63 in 2009 – are impressive, it is the breadth and quality of the research produced that makes the facility such an important part of the Australasian science community.

These papers support our National Research Priorities and cover a diverse range of topics from cancer management and immunology to environmental sustainability, advanced electronics, nanotechnology and manufacturing. Our Users and scientific staff also had papers accepted by some of the most prestigious and influential scientific media in the world, including *Nature*, *Immunity*, *Cell*, *Science* and others.

A theme which has emerged is the reward for science that comes from local engineering and scientific developments being driven and enabled by community needs.

Accordingly, structural biology programs have benefited from development on our crystallography and small and wide angle x-ray scattering beamlines. The introduction of 'user changeable energy' and 'micro collimation' continues the implementation of high throughput methods and rapid analysis of crystallographic samples. In addition, our small and wide angle x-ray scattering beamline is now considered to be world class due to its data analysis and automation capabilities. The resulting high-profile publications speak for themselves.

Another wonderful example is the deployment of the R&D100 Award-winning CSIRO and Brookhaven Laboratories-built Maia x-ray fluorescence detector on the facility's x-ray fluorescence beamline. This resulted in some spectacular scientific results, including visualisation of hidden work by painter, Arthur Streeton. Maia's ability to perform three-dimensional imaging and spectroscopy on biological samples will also improve the world-class standing of this beamline.

Showcasing recent developments and User science was the very successful User meeting held in November 2010. With over 200 delegates and presentations by Australian and international plenary speakers, the 2010 Australian Synchrotron Thesis Medal winner and over 60 other speakers, the meeting highlighted the critical role Users play in making this facility one of the world's best.

Students and early career researchers are integral to the research community. The Australian Synchrotron continued to provide strong support for students through scholarship top-ups, training and workshops, and direct supervision; the Accelerator Science group in particular has been active in the supervision of students.

To assist in maintaining our high level of performance, several important programs of work were undertaken during the year. Our desire to expand the capabilities of the facility by increasing the number of beamlines and services available to Users has been progressed by the development of the science case and by undertaking conceptual design studies for a suite of new beamlines. Reflecting the outstanding levels of performance of the machine, the facility will also move to top-up operations in 2012, which will provide Users with a more stable beam.

In addition to the Maia detector system, introduction of computing technologies like the TARDIS data management solution and the MASSIVE high-performance cluster mean that the facility's ability to capture, manage, share, analyse and visualise data are world-class.

During the year the organisation also pushed ahead with the upgrade of the imaging and medical beamline. The beamline will, in 2012, deliver an unprecedented wide field-of-view for synchrotron-based x-ray imaging and therapy providing research into areas such as cancer treatment and diagnostics. It is encouraging to also see scientists coalescing over projects that will take advantage of its ground-breaking capabilities.

During what has been a productive year, I would like to thank the Scientific Advisory Committee (SAC) for their advice and the National Science Colloquium (NSC) for their efforts in supporting the Australian Synchrotron. The acceptance of positions on the NSC by Professor Peter Doherty and Australia's Chief Scientist, Professor Ian Chubb, for example, are symbolic of the wider scientific community's active support of this facility.

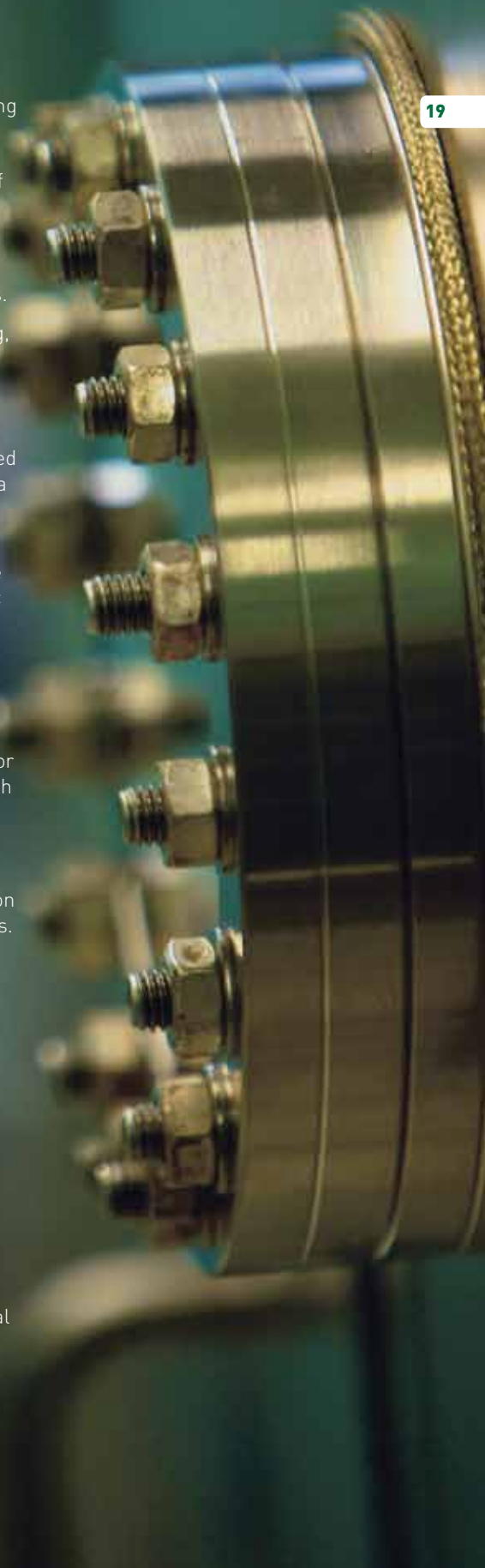
In closing I would also like to pay a debt of gratitude to the former Head of Science, Professor Ian Gentle, for his significant contribution to the Australian Synchrotron and the development of synchrotron science in Australia and abroad.

Professor Andrew Peele
Head of Science

Overview of Beamlines

- High Throughput Macromolecular Crystallography (MX1): dedicated to determining the structure of protein crystals and the initial assessment of more complex crystals, this beamline also provides rapid and detailed crystal structure information in addition to supporting the rapid determination of large numbers of protein structures.
- Micro Crystallography (MX2): uses multiple wavelengths of light to evaluate high-resolution crystal structures and allows characterisation of structures that were previously difficult to determine, particularly for small, weakly diffracting crystals.
- Imaging and Medical Beamline (IMBL): will provide high-resolution x-ray imaging, tomosynthesis and computed tomography of biomedical samples and materials, as well as enable micro-beam radiation therapy research. When upgraded in early 2012 the IMBL will allow even greater resolution in phase contrast imaging and associated applications than is possible using conventional methods, and by mid-2012 it will deliver an unprecedented wide field-of-view for synchrotron-based x-ray imaging and therapy. It is one of few beamlines in the world configured for a wide range of bio-clinical and materials research applications, which will enable research into areas such as cancer and diagnostics.
- Small and Wide Angle x-ray Scattering (SAXS/WAXS): provides information on the structure and dynamics of complex samples and allows the collection of dynamic process data that cannot be collected by any other means.
- X-ray Fluorescence Microscopy (XFM): provides very high-definition maps of elemental distributions, particularly the transition metals, across a diverse range of samples and sample environments with sub-micronmetre resolution. XFM can be tuned to probe and analyse a single element providing valuable additional information about the oxidation state or chemical bonds. The ultrafast Maia detector system enables 3D fluorescence tomography and chemical speciation mapping with real time output.
- X-ray Absorption Spectroscopy (XAS): provides structure or chemical information about a sample including data about chemical bond lengths, local atomic geometry, nearest neighbour atoms, disorder and oxidation state. This information can be obtained for crystalline as well as amorphous, liquid and gaseous systems.
- Powder Diffraction (PD): supports a range of experiments on multi-component samples that provide data on their structure, strain, phase, texture and composition. The beamline allows rapid data collection with high-resolution and can produce two-dimensional maps of data. This is the optimal technique for investigating atomic structures in materials that do not form as a single crystal.
- Far infrared, high-resolution spectroscopy and infrared microspectrosopy (IR): the Australian Synchrotron has two infrared beamlines that operate independently of one another. Synchrotron infrared facilities are relatively new and provide significantly higher resolution than conventional infrared sources. The technique allows for high spatial resolution chemical images and high-resolution characterisation of gas samples.

  Far infrared, high-resolution spectroscopy is widely used in research, analytical and industrial laboratories. In contrast, the infrared microspectroscopy beamline extends the scope of this popular technique, and can locate and analyse individual components in samples with dimensions of only a few microns, producing high spatial resolution chemical images.



The Global Synchrotron Science Community

As a world-class science and research facility and the only piece of scientific infrastructure of its kind in Australia, the Australian Synchrotron continues to play an active role in international synchrotron affairs and the growth of synchrotron science worldwide.

In the past year its contribution to synchrotron science has been significant.

Apart from catering to the scientific needs of over three and half thousand Users, its involvement in international work programs and pursuit of scientific collaboration has ensured its place as an influential and valued member of the broader international synchrotron science community.

In its efforts to support learning and development within the Australian User community, the Australian Synchrotron again invested a significant amount of time and effort in its International Synchrotron Access Program (ISAP). The initiative is aimed at building User expertise by providing direct access to synchrotron facilities around the world.

During the year, the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS) also provided an additional source of funding for Australian scientists whose research benefited from access to overseas facilities.

To further support the work of Australian scientists, the Australian Synchrotron also provided its scientists continued access to the maturing x-ray absorption spectroscopy (XAS) beamline in Japan.

The Australian Synchrotron strongly believes that these and other initiatives will continue to support the development, growth and expertise of Australian scientists.

Scientific Highlights

- The Australian Synchrotron has generated 197 scientific papers over the course of the 2010/11 year in areas as diverse as immunology, biomedicine, mineral processing, environmental sustainability, food security, accelerator physics and instrumental development.
- Of these 197 scientific papers, approximately 68% have appeared in journals with an A*/A ranking under the Excellence for Research in Australia assessment scheme, including leading international science journals such as Nature. This is comparable to the performance of Australia's best research groups.
- A further 57 papers were generated from work done at the ANBF (Australian National Beamline Facility) in Japan or at other overseas facilities where access for Australian researchers was managed by the Australian Synchrotron.
- Australian and overseas researchers are using the Australian Synchrotron to help them develop potential new treatments for combating drug resistance in the AIDS virus, improve the efficiency of mineral processing operations for nickel, bauxite, titanium and iron ores; investigate environmentally-friendly bioleaching for extracting copper from low-grade ores, develop better magnesium-air batteries for use in small-scale medical devices and large-scale electric vehicles and reveal how a key defence protein called perforin punches holes in cancer cells and cells hijacked by viruses.
- Activity undertaken by commercial clients is also contributing to development of anti-infective drugs, electronic and bio-analytical measurement instruments, bio-fuel products, pharmaceutical and nutraceutical products, and biopharmaceuticals.
- The Australian Synchrotron's infrared (IR), x-ray fluorescence microscopy (XFM) and small and wide angle x-ray scattering (SAXS/WAXS) beamlines are considered world-leading.

Macromolecular and Micro-Crystallography Beamlines

Australia's diverse and very productive crystallography community uses the synchrotron's two crystallography beamlines to assist their research in many different areas. These areas include potential drug candidates for disease-related microbiological and human proteins, the molecular basis of immune recognition, and bacterial pathology. Over the last 12 months, specific targets have included perforin – a key protein in the immune system that allows T-cells to kill cancerous or virus-infected cells, and a malarial protein that could be targeted to starve the parasite to death.

A team of seven scientists manages the crystallography beamlines, looks after Users and implements ongoing improvements to beamline capabilities, precision, stability, reliability, performance and data quality. Team members have expertise in areas such as protein and small molecule crystallography and conduct research in their own right, usually in collaboration with Users.

As well as university researchers and researchers from government agencies, the crystallography beamlines attract commercially-funded Users who pay to access the beamlines on a confidential basis.

Key achievements

Users can now rapidly screen crystallisation trays at the synchrotron to identify crystals suitable for data collection on the macromolecular and micro-crystallography beamline. When combined with the automated crystallisation facilities offered by the CSIRO's Collaborative Crystallisation Centre, tray screening has the potential to significantly increase throughput and reduce the time from lead to target in structure-based drug discovery programs.

New beamline calibration procedures ensure beamline stability and data quality and further enhance the User experience on the MX beamlines. Auto-processing software developed in-house provides invaluable real-time feedback on data quality and is being extended to encompass automated structure solution.

The beam steering system pioneered on the micro-crystallography beamline (MX2) has been rolled out to macromolecular beamline (MX1). Combined with earlier monochromator improvements, the beam steering system has allowed the introduction of full User-changeable x-ray energy capabilities on MX1, and Users can now use multiple wavelength techniques to solve protein structures.

Major research outcomes from the crystallography beamlines over the past year include the structure of perforin (an important protein in the body's immune system), and the discovery by Australian and New Zealand researchers of a protein that is common to human poxviruses and other much simpler viruses that infect bacteria – and could lead to the development of new antiviral drugs. Monash University made further advances in its studies of T-cells (a major part of the immune system), including how they recognise foreign lipid molecules and the molecular mechanism of T-cell maturation in the immune system.

About the beamlines

Macromolecular crystallography is the study of the structure of large biomolecules such as proteins and nucleic acids (DNA and RNA) using x-ray crystallography. Proteins are essential to life and carry out almost all reactions inside living cells. X-ray diffraction is the most widely used method for protein structure determination, providing essential information for a wide range of applications, including drug development, food technology, agriculture, manufacturing and chemical processing.

Determining the structure of proteins provides valuable information on how these "molecular machines" work, how they evolved and how to design drugs to modify their actions. This information can be used to design specific drugs that target proteins involved in diseases such as cancer, HIV, tuberculosis and malaria.

The Australian Synchrotron has two crystallography beamlines. The macromolecular crystallography (MX1) beamline is a high-throughput beamline for users with large numbers of samples. The micro-crystallography (MX2) beamline also caters for difficult crystals that are small or weakly diffracting. Remote access is available on both beamlines by prior arrangement.

Beamline team

Dr Tom Caradoc-Davies, Principal Scientist

Dr Nathan Cowieson, Scientist

Dr Christine Gee, Scientist

Dr Santosh Panjikar, Scientist,

Dr Alan Riboldi-Tunnicliffe, Scientist

Dr Rachel Williamson, Scientist

Dr David Aragao, Post-doctoral Fellow

Dr Rachel Williamson, Scientist - Macromolecular and Micro-Crystallography Beamline

Dr James Pearson, Scientist – Imaging and Medical Beamline

Imaging and Medical Beamline

The imaging and medical beamline (IMBL) is being upgraded and extended, with completion expected in late-2012. At its furthest extent, the upgraded beamline will boast the world's widest synchrotron x-ray beam: 500 mm by 40 mm.

The beamline will allow greater resolution in phase-contrast imaging and associated applications such as tomosynthesis and computed tomography – with an unprecedented field of view. It will be one of the few beamlines in the world configured for a wide range of bioclinical and materials research applications that will enable research into areas such as cancer, diagnostics and treatment.

While the beamline is being upgraded, staff have been designing novel detector and optics instrumentation and developing collaborations to support forthcoming clinical programs.

Achievements

In April 2011, beamline team members, our Head of Science and the chair of the IMBL Clinical Advisory Panel participated in the inaugural Australia – Europe Bilateral Workshop on Research Infrastructure. Hosted by the Belgian Academy of Science, the Brussels workshop was partly funded by DIISR and the Australian Synchrotron. The IMBL team organised the Medical Applications of Synchrotron Radiation program and a second workshop, also supported by DIISR, will take place in Melbourne in late 2011.

A beamline forum has been set up for IMBL users. They can obtain information on the beamline and contribute postings: http://imblforum.synchrotron.org.au/

The future

A new monochromator will be installed in January 2012. The optical components were designed in-house to build expertise in preparation for future beamlines. This ultra-stable device will deliver beam up to 136 metres from the source. Other monochromators are being designed and evaluated.

The main biomedical support facilities in the satellite building include animal holding rooms and surgeries, laboratories and a clinical suite for handling patients.

Four detectors have been added to meet user requirements for resolution, field of view and readout time. These include a prototype for the modular high-resolution detector system, which will adapt to x-ray beam sizes from 100 to 500mm.

The coming year will see the design and installation of instrumentation for preclinical and clinical imaging and radiotherapy programs. In radiotherapy, a new micro-beam collimator designed in collaboration with the European Synchrotron Radiation Facility and a high-speed positioning system will be commissioned. In imaging, the main tasks are constructing the 100-metre transfer line to deliver the x-ray beam to the satellite building and developing detector systems that marry beam size with high-resolution.

About the beamline

IMBL operations were suspended in September 2010 to enable construction of near-beam surgery and preparation (NBSP) facilities in the main synchrotron building, animal holding and preparation facilities in the satellite building (SAT) and the addition of a second and third floor to the SAT building to house offices and support laboratories for biomedical and clinical research.

Beamline commissioning recommenced in May 2011 in parallel with work on NBSP infrastructure and the satellite building. The NBSP was completed in June 2011 and the SAT in August 2011.

When finished, the beamline will provide unrivalled capabilities for phase-contrast imaging, tomosynthesis and computed tomography of biomedical samples and materials, and for micro-beam radiation therapy research. The extended beamline's 500mm by 40 mm x-ray beam in the satellite building will provide high-resolution imaging of cells, tissues and tumours, and enable cell tracking using markers. The beamline's cardiovascular, lung and bone imaging capabilities will allow preclinical research program outcomes to be translated into clinical research with patients.

Beamline team

Dr Daniel Häusermann, Principal Scientist

Dr Chris Hall, Scientist

Dr Anton Maksimenko, Scientist

Dr James Pearson*, Scientist

Dr Karen Siu*, Scientist

Dr Alberto Astolfo, Post-doctoral Fellow

** Joint positions with the Monash Biomedical Imaging (MBI) research platform*

Small and Wide Angle x-ray Scattering Beamline

The small and wide angle x-ray scattering (SAXS/WAXS) beamline is widely acknowledged as a world-class beamline that is operated, maintained and developed by an expert team.

The beamline supports experiments on solid and liquid systems as well as surfaces. Almost half the research groups that use this beamline are studying protein structures in solution to understand biological processes at the molecular level, often leading to medical advances. A further 20 per cent study soft matter, for example developing new methods for controlled release of pharmaceutical drugs in the body. Many Users study synthetic materials such as polymers, minerals, films, and membranes, and natural materials such as fibres, timber and leather.

Recent developments on the beamline now mean that many liquid samples can be run in a highly automated way. With the beamline's speed and excellent signal-to-noise ratio, in-situ size exclusion chromatography analysis of proteins has become routine, allowing detailed analysis of complex and challenging samples not previously accessible.

The longer-term benefits of research on the beamline include an improved understanding of how diseases work at the molecular level, leading to better methods for diagnosing and treating diseases and more effective drug delivery systems with fewer side effects. Other benefits include improved mineral processing, better control of manufacturing processes, and new materials with better properties.

Key achievements

The beamline and engineering team has built a new loading system that takes up to 192 protein samples at a time and runs them automatically. Together with other developments in instrument performance, this is enabling a paradigm shift in experiment design and capabilities, and allows Users to focus on their science rather than laboriously running samples manually. The system has potential uses in other areas such as chemistry research.

The beamline has made further progress in supporting high thoughput analysis: Users have run up to 4000 samples per day. Some Users are combining the power of robotic sample preparation with the high speed of the SAXS/WAXS beamline to pioneer new approaches in high-throughput combinatorial studies, driving the efficiency and pace of research to a whole new level. This approach has been particularly productive for research into mesoporous materials, for applications such as drug delivery systems and protein crystallisation.

The beamline continues to be heavily utilised for in-situ experiments which take advantage of the high speed and sensitivity of the beamline, and its flexibility to incorporate a diverse range of sample environments. Applications have included determining temperature-dependent phase behaviour, determining phase diagrams, reaction kinetics, aggregation and fibril formation of proteins and peptides, polymer processing, gas absorption media, membranes, thin films, and optically or thermally activated materials.

The beamline has now switched to an entirely new User interface and control software called "scatterBrain". Written by Stephen Mudie, scatterBrain provides a substantially more intuitive and modern interface, powerful and flexible data acquisition capabilities, and the ability to continue to expand its capabilities into the future. The beamline is continuing to innovate, and maintains the skills needed to constantly develop its capabilities and to respond directly to the needs of Users.

About the beamline

The SAXS/WAXS beamline provides information on the structure of materials on scales ranging from atomic to molecular to particle scale: from 1 angstrom up to 400 nanometres. Many types of materials have structure on the nano scale, including liquid emulsions, colloids, particles, proteins and surfaces.

SAXS provides useful structural information on a wide range of solids, powders, gels, liquids and solutions, including biological materials, polymers, coatings, biosensors, and mineral ores and products.

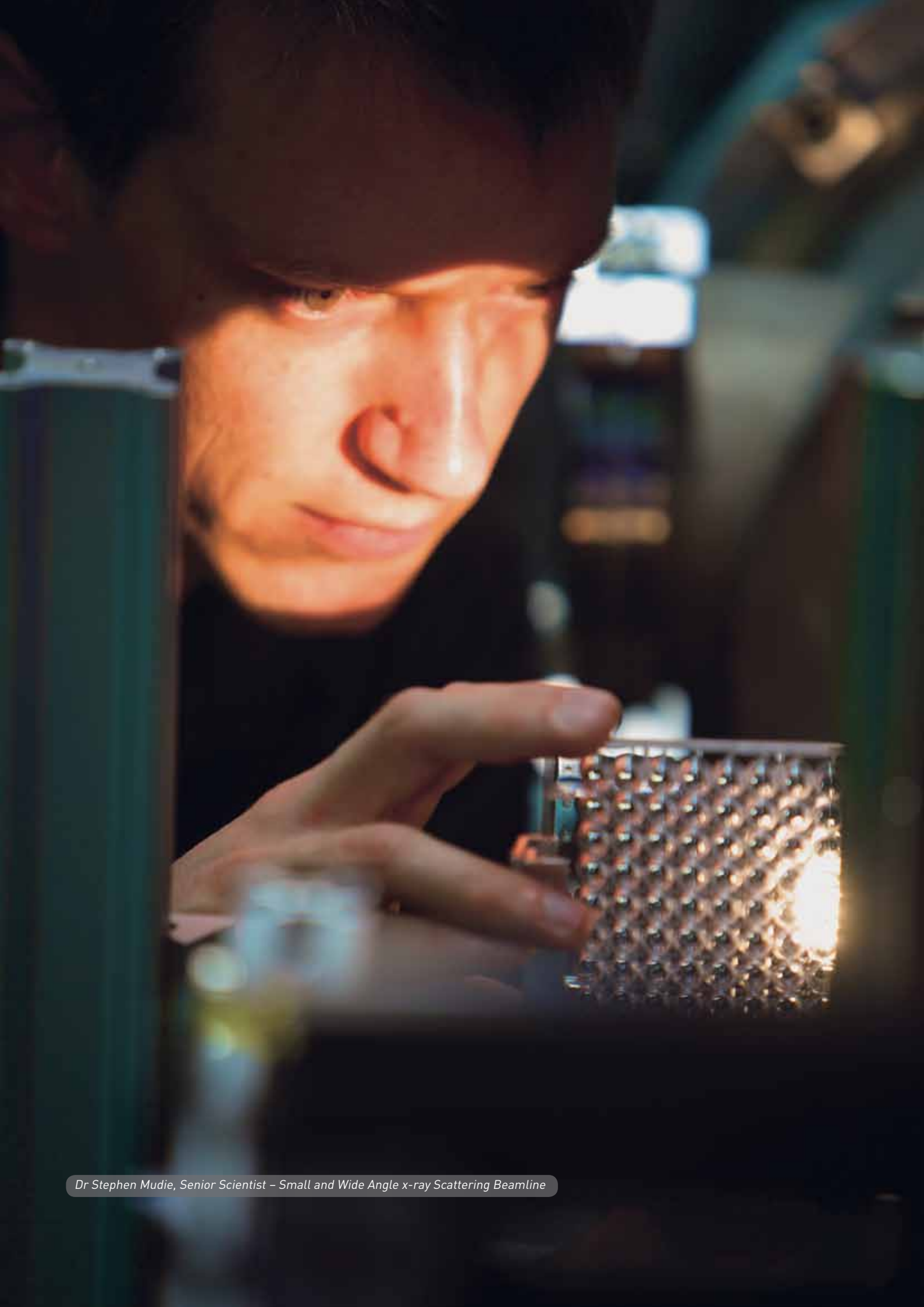
The beamline also offers simultaneous WAXS, which is useful for structures ranging down to the atomic level. The beamline's WAXS capabilities are used for projects such as phase analysis in minerals, molecular packing in polymers, and small-scale structures in surfactants, and in many cases the SAXS and WAXS measurements are taken simultaneously to study dynamics at differing scales.

Beamline team

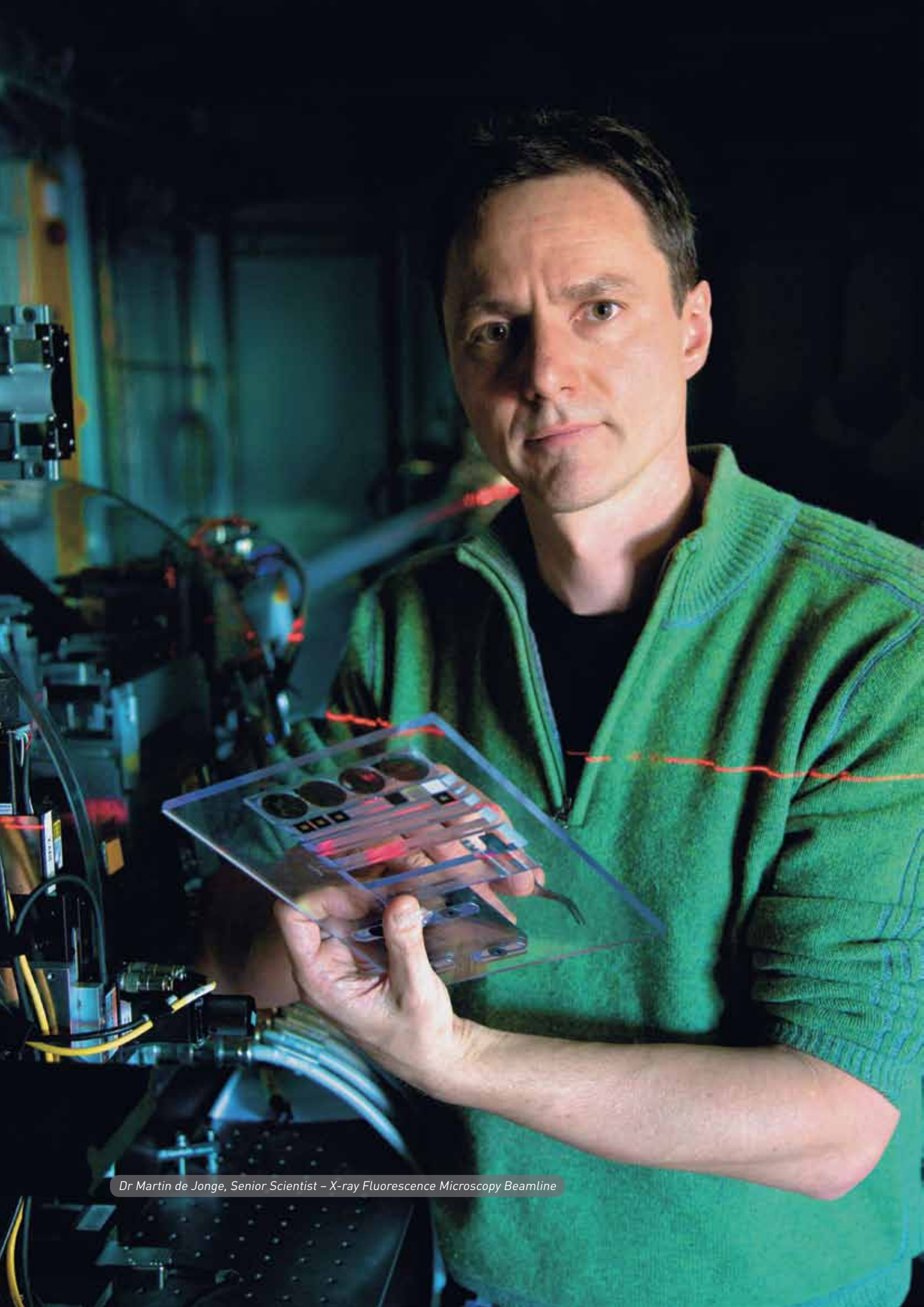
Dr Nigel Kirby, Principal Scientist

Dr Stephen Mudie, Senior Scientist

Dr Adrian Hawley, Scientific Support Officer



Dr Stephen Mudie, Senior Scientist – Small and Wide Angle x-ray Scattering Beamline



Dr Martin de Jonge, Senior Scientist – X-ray Fluorescence Microscopy Beamline

X-ray Fluorescence Microscopy Beamline

The breadth of research conducted at the x-ray fluorescence microscopy beamline (XFM) is reflected in diverse samples that include a single human hair, rice, gold-bearing ore, and tumour tissue. Users come from many different areas, including medicine, biology, agriculture, geology, mining, environmental studies, forensics and the art world. Their objectives range from understanding biological mechanisms causing Alzheimer's and Parkinson's disease, for example, to improving mineral deposit assessment.

Meeting the huge User demand is a major challenge for XFM team members, who are working hard to improve beamline usability, efficiency, throughput, and capability.

Many beamline staff are key advisors to user groups, and work on design and requirements for proposed new beamlines that would provide additional capabilities or enhance existing ones, such as increasing nanoprobe and microprobe capacity.

Key achievements

The beamline's scientific output increased substantially in the last year with several important publications demonstrating the powerful insights that XFM can provide.

Our biggest technical achievement was the successful deployment and integration of the Maia detector system into routine operation at XFM. The Maia system received an R&D100 award as one of the 100 most significant technological products to enter the world market in the past 12 months. Its impact on the beamline's science output is demonstrated by the tremendous breadth and versatility of user research now being performed. The Maia detector was developed jointly by researchers from CSIRO and Brookhaven National Laboratory in New York.

Fast 3D fluorescence tomography and 2D chemical imaging are routine methods at the beamline. These methods are in infancy at other facilities, and the beamline leads the world in these capabilities due to a unique combination of the Maia detector and local expertise.

Over the last year, XFM users have achieved many significant science outcomes. Of particular note are cultural heritage and forensic high-definition studies of significant national and international artwork, and the fast x-ray fluorescence micro-tomography of hydrated biological samples made possible by the beamline's ultrafast scanning and detection capabilities.

In other developments, a new user cabin and sample preparation cabin now offer a more comfortable working environment for users and staff at the beamline. Fast sample stages being constructed in-house will enable scans at speeds that take full advantage of the beamline's Maia detector and microprobe capabilities.

Improvements to user interfaces and beamline operating modes have made the beamline one of the world's most efficient and easy to use. For example, one group of users was able to automate a complicated series of sample measurements that then ran for 72 hours without interruption.

Beamline staff hosted a visit from international beamline colleagues from the Soleil synchrotron in Paris, who conducted experiments and learnt how the Australian Synchrotron's XFM beamline operates. The two facilities are presently negotiating a Memorandum of Understanding to foster the sharing of beamline design information.

In the coming year, workshops for XFM Users will address data analysis and good sample preparation. A workshop on how to analyse the huge and rich data sets produced by the Maia detector will be held around the time of the Australian Synchrotron User meeting in December 2011.

About the beamline

The beamline provides valuable elemental, structural and chemical information from a very diverse range of samples with micrometre and sub-micrometre resolution. X-ray fluorescence microscopy (XFM) produces highly-detailed elemental images by sequentially probing small areas and combining this information to make up the full picture.

X-ray fluorescence can simultaneously identify the presence and determine the concentration of many elements, particularly the first-row transition metals including iron, copper and zinc. The technique is useful across biology, geology and mining, environmental studies, cultural heritage and forensics where knowledge of metal distributions is required.

Beamline team

Dr David Paterson, Principal Scientist

Dr Martin de Jonge, Senior Scientist

Dr Daryl Howard, Scientist

X-ray Absorption Spectroscopy Beamline

The x-ray absorption spectroscopy (XAS) beamline is a versatile instrument attracting roughly equal numbers of researchers from materials, biological, medical, chemical, earth and environmental sciences. Around the world, XAS beamlines are in high demand for a broad range of applications. Researchers have used XAS at the Australian Synchrotron to examine many different samples, often in specialised sample environments.

The breadth of XAS research has included metal uptake in hyper-accumulating plants, the structure of nanoparticles in sunscreens, new detectors for medical imaging, the environment of semiconductor dopant atoms, nutrients in cereal crops, and studies of ancient Egyptian artefacts with a blue-green glaze called faience.

The beamline User program ran at full capacity in 2010/11, with major growth in environmental science. The University of NSW studied the formation of iron-based minerals in river systems, their impact on aquatic environments, and how impurities such as chromium and uranium bond with these iron-based minerals. The University of South Australia investigated methods of reducing heavy metal contamination in biosolids from municipal wastewater treatment plants. Australian Nuclear Science and Technology Organisation examined how radioactive technetium interacts with various materials to assist the development of more efficient radioactive waste storage, and looked at how uranium bonds to bauxite refinery residues.

The beamline is popular for drug design studies. One group investigated arsenic-, chromium- and selenium-based compounds for their potential as anti-cancer drugs. Careful study is required to understand the mechanisms that influence both the beneficial anti-cancer effect of these drugs and their acute toxicity.

The power and versatility of XAS has attracted some of the most challenging experiments conducted at the Australian Synchrotron, including geology experiments at extremely high pressures and studies of highly toxic and radioactive samples. The dedicated XAS beamline team successfully implemented these experiments and trained Users to conduct the experiments safely.

Key achievements

A major scientific highlight for XAS in 2011 comes from a Monash University study of water-oxidising catalysts, published in the prestigious journal Nature Chemistry. The eventual aim is to produce hydrogen from sunlight, providing a cheap and renewable alternative to fossil fuels.

The 100-element germanium detector on the XAS beamline was operational for its first full year, making the beamline one of only four in the world with this enhanced capacity. Users have noted that the beamline is producing high-quality fluorescence data, and measurements can be done in around half the time that would be required on the beamline's counterpart in Japan, the Australian National Beamline Facility (ANBF).

Preliminary studies of several enhanced beamline capabilities produced outstanding results. For example, using rapid energy scanning to study the initial precipitation of the mineral ferrihydrite from solution revealed the transformation of octahedral Fe(III) to tetrahedral Fe(III) during Fe(III) hydrolysis. Tests of rapid ('on-the-fly') scanning with the 100 element detector showed that scan times could be reduced by 90 percent.

About the beamline

XAS techniques provide chemical and structural information on atoms from calcium to uranium, for a wide range of solid and liquid systems. XAS experiments require an intense, tuneable photon source only available at synchrotrons.

The x-ray absorption near-edge structure (XANES) region of an XAS spectrum yields chemical information such as local coordination geometry and oxidation state. The extended x-ray absorption fine structure (EXAFS) region provides structural information such as bond length, coordination number and disorder.

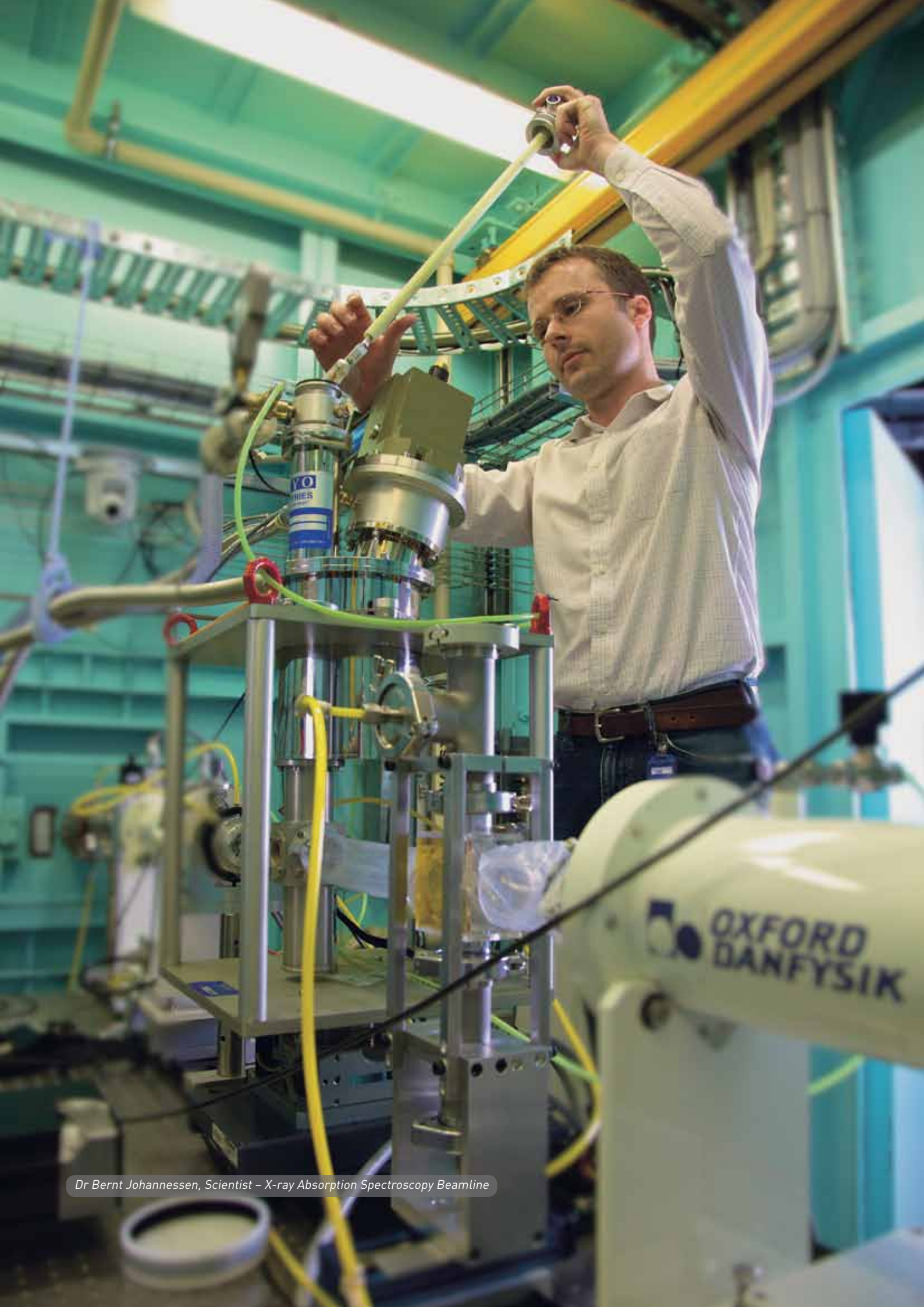
Widely used by both specialists and non-specialists, XAS is a mature technology that enables the advancement of new areas of science. The technique can complement protein crystallography studies, and the two are frequently used in combination to determine challenging structures.

Beamline team

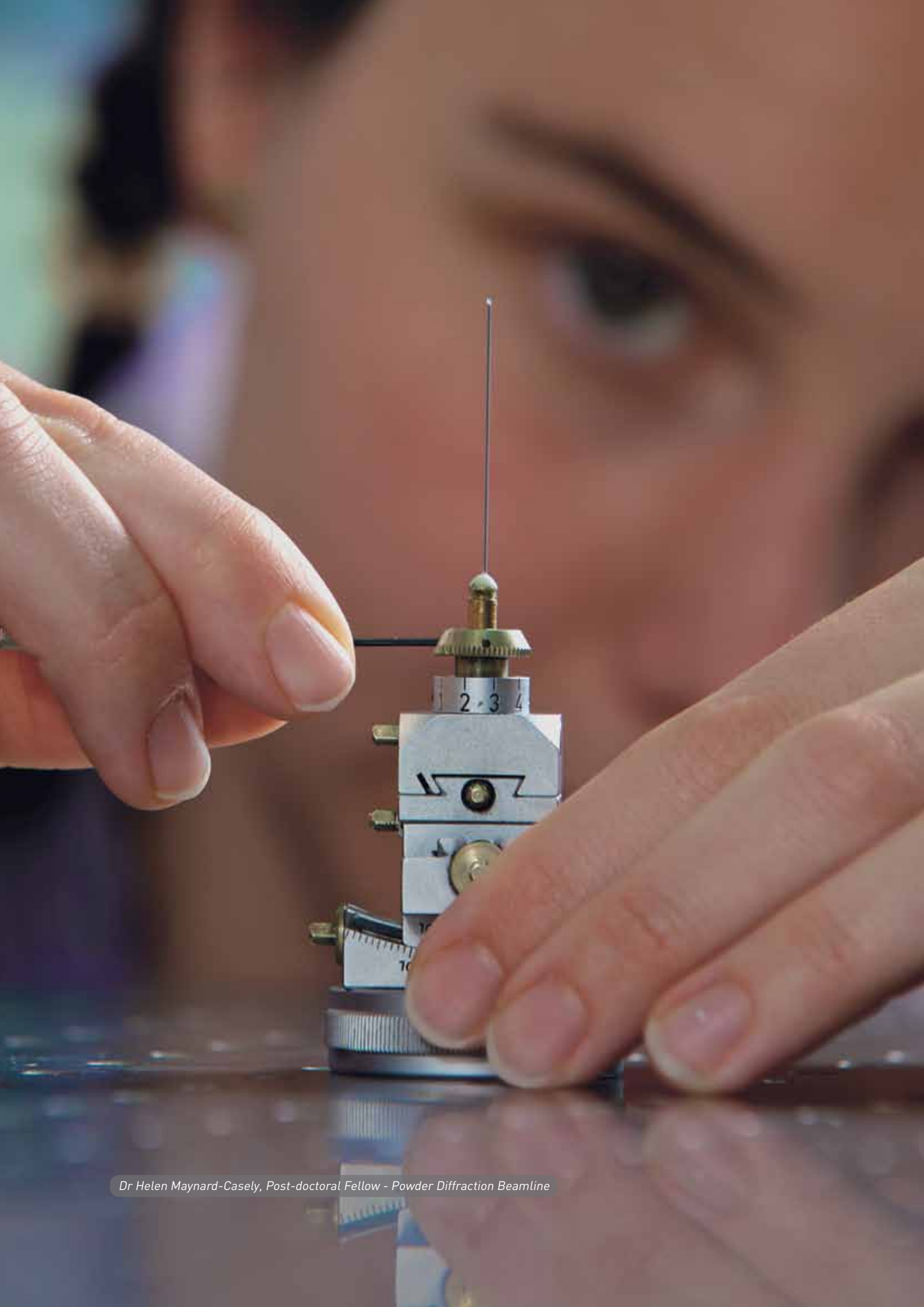
Dr Chris Glover, Principal Scientist

Dr Bernt Johannessen, Scientist

Glyn Devlin, Scientific Support Officer



Dr Bernt Johannessen, Scientist – X-ray Absorption Spectroscopy Beamline



Dr Helen Maynard-Casely, Post-doctoral Fellow - Powder Diffraction Beamline

Powder Diffraction Beamline

The powder diffraction beamline (PD) at the Australian Synchrotron contributes to an extensive range of research areas, with particular relevance to fundamental and practical insights into the design and development of functional materials. The diverse applications of these materials include energy storage systems, electronics components, magnetic materials and nuclear waste storage.

Synchrotron powder diffraction studies are essential for the full characterisation of materials that provide practical functionality and technological enhancement. The technique enables researchers to examine a material's crystal structure at the 'atomic building block' level – and relate this to the material's functional properties. For example, an improved understanding of the structure of solid hydrogen storage materials is assisting the development of higher performance materials.

The value of powder diffraction for examining real-world problems is stimulating continued growth in user numbers and sparking interest from research areas beyond chemistry and crystallography, such as engineering and processing science. To support this widening range of research areas, the beamline team is expanding the beamline's capabilities with additional ancillary and detector hardware.

Key achievements

The Australian Synchrotron powder diffraction beamline has an enviable publication record, with 21 papers published in A/A* ERA ranked journals between 1 July 2010 and 30 June 2011.

A specially constructed flow cell on the beamline enabled University of Wollongong researchers to look at hydrogen release from a potentially valuable new class of hydrogen storage materials: boron-nitrogen-hydrogen compounds. Using hydrogen as a fuel will require safe and efficient methods for storage, transportation and controlled release of large quantities of hydrogen.

A Monash University research group used synchrotron Powder Diffraction to find out how heat influences the properties of a cost-effective new generation of strong permanent magnets for potential use in electronic devices such as computers, microphones, electric motors and cars. The aim is to identify manufacturing conditions that will enhance the material's magnetic properties.

University of Sydney researchers are seeking to address carbon pollution by examining how mixed metal oxides absorb carbon dioxide. They used the high-temperature furnace on the beamline to assist the development of ceramics that are stable at the high temperatures and high carbon dioxide pressures found in some industrial applications.

Users who want high-throughput data acquisition are benefiting from a new multi-sample-well cassette that can hold up to 40 samples. This makes it possible to acquire data from around 1000 samples per day. A new automatically-aligning capillary-sample spinner allows faster, more accurate positioning of samples.

Another recent addition is a Mar165 charge-coupled device (CCD), two-dimensional detector that allows acquisition of rapid, moderate-resolution diffraction. This detector is ideal for use in combination with in-situ sample cells where the range of accessible diffraction angles is small.

About the beamline

Powder diffraction provides information on the crystal structure of polycrystalline natural and synthetic materials that can be related to the properties of those materials. It permits the study of bulk materials and provides a robust alternative for structural characterisation when single crystals are not available, as is often the case in nature and the laboratory.

Applications include in-situ studies of reaction mechanisms, investigations of crystal chemistry, phase identification and determination of how crystal structure affects physical, chemical or magnetic properties. The technique is used for studying a wide variety of samples and problems, including pharmaceuticals, radioactive waste materials, battery components such as electrolytes and electrodes, mineral ores and mineral processing conditions.

Compared to conventional laboratory-based powder diffraction, synchrotron powder diffraction offers superior, more accurate data, excellent signal-to-noise outcomes and faster time-frames, and can be used to examine significantly smaller samples. A further advantage is that synchrotron x-rays can be tuned to particular wavelengths to suit sample composition and experimental requirements.

Beamline team

Dr Kia Wallwork, Principal Scientist

Dr Justin Kimpton, Scientist

Dr Qinfen Gu, Scientist

Infrared Beamlines

The synchrotron provides a highly-focused, very stable source of infrared (IR) light that enables users to probe samples with much greater sensitivity than is possible in their own research, analytical or industrial laboratories. The facility's two infrared beamlines are supported by a team with skills in many areas, including biological imaging, sample preparation and data analysis.

Infrared microspectroscopy beamline

The IR microspectroscopy beamline has experienced further growth in beamtime applications from Users working with cultural heritage materials and objects, and researchers studying live biological samples.

Biological studies include Monash University investigations of cartilage degeneration in rheumatoid arthritis, focusing on the role of antibodies and their relation to collagen.

Monash Immunology and Stem Cell Laboratory used the beamline's live cell capabilities to study the differentiation process in stem cells. There is potential to develop infrared spectroscopy methods for screening cells for use in stem cell therapy.

Swinburne University researchers are studying the composition of insect wings, which have self-cleaning and water-repelling properties. Understanding their micro-scale chemical composition and nano-scale structure could assist the development of novel surfaces for future use in medical devices.

Far-IR and high-resolution beamline

The far-IR and high-resolution beamline is used to study a diverse range of materials, including gases of atmospheric importance and astrophysical interests. The beamline has also been used to study proteins and novel rechargeable battery materials at cryogenic temperatures.

The gas-phase research program is a concerted collaborative effort by La Trobe University, Monash University and the Australian Synchrotron. Research currently focuses on fluoro-, hydrofluoro- and hydrochlorofluoro-carbons, synthesised hydrocarbons and some short-lived gas molecules.

The University of Queensland is measuring and characterising biomedical samples such as lysozyme fibrils, alanine-rich peptides, and higher-order protein structures made from β-lactoglobulin and polyomavirus proteins.

Murdoch University has used far-IR to characterise novel olivine-type electrode materials for aqueous rechargeable batteries and zinc electrodes.

Key achievements

The implementation of the low temperature gas phase capability on the far-IR high-resolution beamline is a major achievement. Spectral congestion is significantly reduced by studying gases cooled to liquid nitrogen temperature and even as low as 4.8 K using liquid helium.

Far-IR / high-resolution beamline scientists and accelerator physicists have made further progress towards generating terahertz coherent synchrotron radiation for specialised experiments. They have recorded what may be the first high-resolution spectrum of a molecule with this radiation.

The IR microspectroscopy beamline can now accommodate an expanded range of high and low temperature studies.

Both IR beamline teams have been collaborating with their counterparts at the SOLEIL synchrotron in Paris, using FAST funding from the Department of Innovation, Industry, Science and Research.

As part of developing enhanced spatial resolution capabilities at the IR microspectroscopy beamline, IR beamline scientists recently conducted experiments at SRC Wisconsin and the CLIO Free Electron Laser in Paris.

About the beamlines

The Australian Synchrotron has two infrared beamlines that extend the use of popular infrared microspectroscopy techniques as well as enabling some highly specialised far-infrared and high-resolution infrared studies.

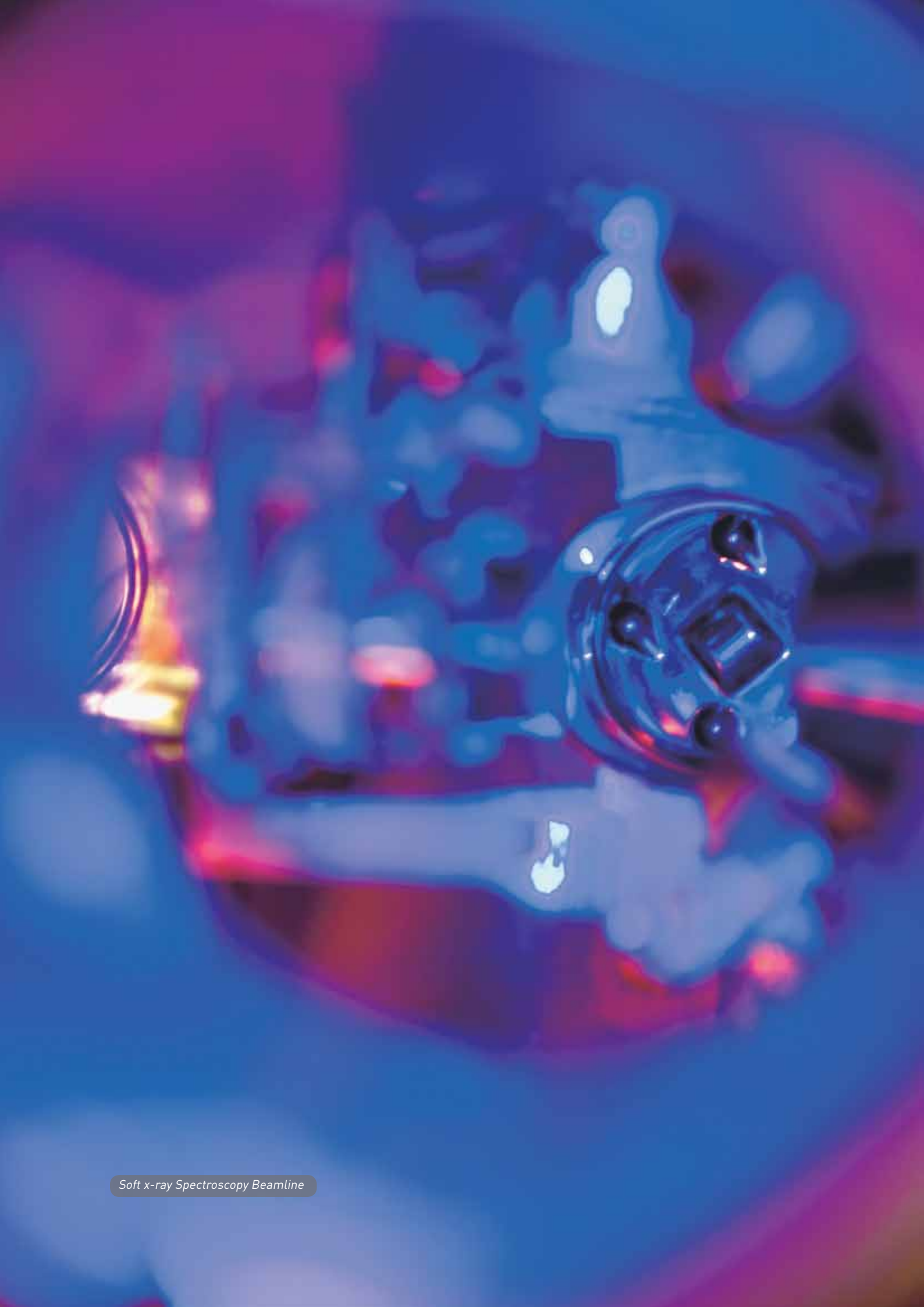
The IR microspectroscopy beamline can locate and analyse individual components in samples only a few micrometres across, producing high spatial resolution chemical images. A temperature-controlled stage allows samples to be studied from -196°C (liquid nitrogen temperature) to 600°C. Samples can be examined as polished solids, thin sections, dispersed particles, surface deposits and various other forms.

The far-infrared and high-resolution beamline offers high brightness, high spectral resolution and the possibility of cryogenic temperatures for characterising gas phase samples, solids and thin films on surfaces. Users can study molecules in the gas phase and extract spectral parameters at a resolution not feasible without a synchrotron source.

Beamline team

Dr Mark Tobin, Principal Scientist
Dr Ljiljana Puskar, Scientist
Dr Dominique (Dom) Appadoo, Senior Scientist
Dr Danielle Martin, Scientific Support Officer
Ms Ruth Plathe, Scientific Support Officer

Dr Mark Tobin, Principal Scientist and Scientific Support Officer, Dr Danielle Martin – Infrared Beamline



Soft x-ray Spectroscopy Beamline

Soft x-ray Spectroscopy Beamline

The soft x-ray spectroscopy beamline is a versatile instrument that can handle sample types and preparation methods difficult to accommodate elsewhere. While many users are looking at bulk materials in powdered form, the beamline's flexible experimental setup also enables a very wide range of surface treatments for sample cleaning and preparation to be done in-situ.

A special preparation chamber prevents sample surfaces reacting with any atmospheric components, enabling users to study surfaces that would otherwise be highly reactive. The chamber has extensive facilities for introducing thermal evaporation sources, leak valves for dosing gases, and the ability to measure low energy electron diffraction (LEED) patterns from single crystals. A new ultra-high vacuum (UHV) four-point probe allows users to measure surface conductivity for suitable samples.

The flexibility of the beamline's hemispherical electron energy analyser and electron flood gun mean that many highly electrically insulating samples can still be measured despite the ultra-high vacuum nature of the instrument. Samples that might have been discarded at other beamlines are often surprisingly easy to record at the Australian Synchrotron's soft x-ray beamline.

Key achievements

The grating exchange mechanism in the beamline monochromator was repaired and recommissioned during the New Year shutdown to enable the beamline to run with the 250 l/mm grating as well as the 1200 l/mm grating. Since this work was completed, the monochromator and beamline have again been operating at theoretically calculated limits and the gratings can readily be swapped. The 250 l/mm grating operates from 100 to 950 eV, where it provides approximately 10 times the x-ray flux for only a modest decrease in photon energy resolution.

Diamond surfaces continue to be a hot topic with several groups. For example, La Trobe University researchers used the beamline to demonstrate that single crystal diamond surfaces could be doped with fluorine atoms by using the decomposition of fluorinated buckminsterfullerene molecules (buckyballs). Diamond is normally a very good electrical insulator, but it can potentially be doped in the same way as silicon to create integrated circuits, the basis of the current computer chip industry. Circuits formed on diamonds could be stacked closer together and run at much faster speeds than those using the current silicon wafers.

Over the next year, beamline capabilities will be upgraded with the installation of an instrument currently housed in the Advanced Photon Source at Argonne Laboratory in Chicago, USA. This instrument was designed by the ARC Centre of Excellence for Coherent X-ray Science (CXS) in Melbourne. It combines two methods for observing material on the nanometre scale: coherent diffraction imaging (CDI) and scanning transmission x-ray microscopy (STXM).

Still in its infancy, CDI has the potential to perform lens-less imaging at the resolution defined by the wavelength of the x-rays used; on the soft x-ray beamline this will mean spatial resolution between 1 and 10 nm. STXM uses a very similar experimental setup and allows imaging in the range of 20 to 50 nm. The instrument will arrive in mid-2012 and a new branchline is being constructed to supply it with soft x-rays. Once the new instrument is installed, the soft x-ray beam will swap between this and the current high-resolution photo-emission instrument.

About the beamline

This beamline can provide information on bond lengths, coordination numbers, coordination geometry and oxidation state for atoms with atomic numbers below 20 (hydrogen to calcium) for a wide range of solid and liquid samples.

It is mainly used for near-edge x-ray absorption fine structure (NEXAFS) studies. NEXAFS can only be done at synchrotrons because it requires the ability to scan through a range of x-ray energies. The beamline also offers soft x-ray photoelectron spectroscopy (SXPS), which gives higher photon resolution and sensitivity than conventional laboratory XPS.

Beamline team

Dr Bruce Cowie, Principal Scientist

Dr Lars Thomsen, Scientist

Dr Anton Tadich, Scientist

Accelerator Science

The Australian Synchrotron is a particle accelerator facility known as a light source. It consists of a high energy electron accelerator and an array of high-tech equipment used to generate synchrotron light – electromagnetic radiation ranging from infrared to x-rays which are used for diverse research experiments.

Running a synchrotron light source requires high-level expertise in the science of accelerating and storing beams of electrons. At the Australian Synchrotron, this expertise is provided by Greg LeBlanc and his team, who keep the Australian Synchrotron accelerators running and optimised, and undertake accelerator research.

The team has a strong commitment to education and training. The program provides opportunities for students and early career researchers through Post-doctoral, PhD, MSc, BSc and high school programs. Regular accelerator schools are held in Australia by internationally renowned lecturers to attract students into the field of accelerator physics.

Key achievements

The brightness and stability of synchrotron light depends on the electron beam that emits the light. As electron bunches circulate inside the vacuum chamber, 'wake-fields' are generated like the wake from a passing boat. Wake-fields from a leading bunch can perturb trailing electron bunches, degrading the quality of the synchrotron light produced. The accelerator science team is developing a feedback system that enhances beam stability by damping inter-bunch motion at frequencies between 1 and 250 megahertz (MHz), and a separate global feedback system that will stabilise the average bunch motion at frequencies between 0 and 150 Hz.

In December 2010, team members coordinated a workshop on accelerator feedback systems with the support of the Australian Collaboration for Accelerator Science (ACAS). The workshop brought together experts in this field from around Australia.

The facility's engineering, technical and accelerator science teams are working together on a major project: the introduction of 'top-up' operation, in which the number of electrons in the storage ring is kept constant through regular topping up. An international workshop on top-up was hosted at The University of Melbourne in 2009 to gain expertise on the best path to top-up. Top-up mode will produce more stable light (photon) beams for user experiments and is expected to be implemented in 2012.

The brightness of synchrotron light depends on the size and alignment of the electron beam: the smaller and more parallel the beam is the better. One measure of this is called 'emittance'. Research at the Australian Synchrotron has resulted in the smallest recorded vertical emittance achieved in a storage ring. This research is also critical to the development of the next generation of high energy particle colliders such as the Large Hadron Collider at CERN, the European Organization for Nuclear Research.

Following the team's 2010 success in precisely measuring the kinetic energy of electrons in the storage ring to one part in a million, the measurement was repeated at the Stanford Synchrotron Radiation Laboratory (SSRL) in collaboration with the SPEAR3 storage ring accelerator group.

The team has developed a 'low-alpha' operating mode to enhance the output of far-infrared radiation. Not previously available to scientists here, this region of infrared radiation will enhance the facility's infrared beamline capabilities.

A research fellowship awarded to Mark Boland by the Japanese Society for the Promotion of Science will enable work to be conducted at KEK in Tsukuba, Japan, on new optics for visible light diagnostics at the Australian Synchrotron. This work will continue to strengthen the international collaborations the Australian Synchrotron has with the worldwide particle accelerator community.

About the synchrotron light source

The first major component of the Australian Synchrotron light source is a linear accelerator that accelerates electrons to 99.9 percent of the speed of light with a kinetic energy of 100 million electron volts (MeV).

Next, the electrons are injected into a booster ring to increase their energy to 3 billion electron volts (3 GeV or Giga electron volts).

The final stage is the storage ring, where the electrons are kept at 3 GeV and made to travel inside an evacuated stainless steel tube that traverses a circle 216 metres in circumference. The electron beam, which consists of around 300 electron bunches spaced 60 centimetres apart, circulates under high vacuum for many hours, producing synchrotron light for use in experiments.

Accelerator science team

Mr Greg LeBlanc, Head of Accelerator Science and Operations

Dr Mark Boland, Principal Accelerator Physicist

Dr Rohan Dowd, Senior Accelerator Physicist

Dr Eugene Tan, Accelerator Physicist

Dr David Zhu, Accelerator Physicist

Dr Else van Garderen, Instrumentation Scientist

Ms Evelyne Meier, Post-doctoral Fellow

Machine Operations

The Australian Synchrotron's Machine Operations Group took responsibility, as they do each year, for the operation of the machine, with this demand requiring operators to work 24 hours a day, seven days a week on rotating shifts.

The Group's core focus remained the maintenance of the beam, including its quality and availability. This involved the twice daily injection of electrons into the storage ring using the electron gun, linear accelerator and booster ring, the management of safe and secure operations (across the facility) and the continual optimisation of beam quality. As part of this process, the Group continued to monitor and fine-tune systems used to keep stray radiation to an absolute minimum.

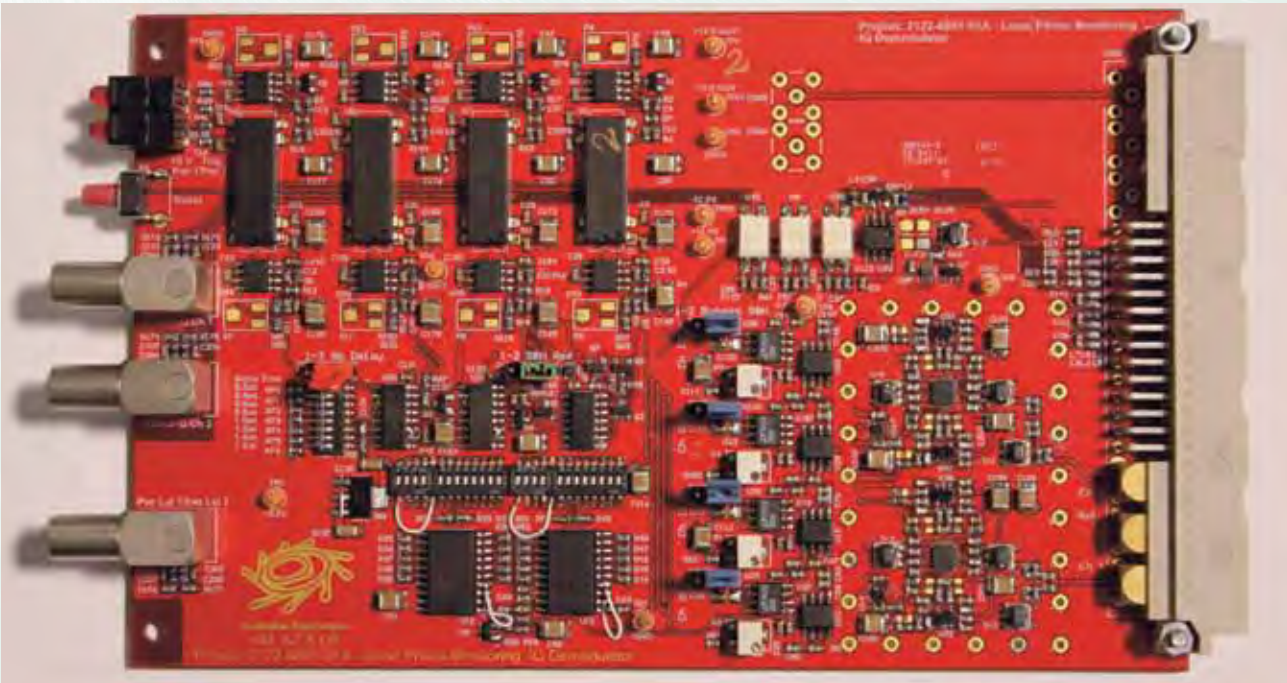
In addition to these and other activities, Operations held responsibility for fault recovery that follows the loss of beam at the facility. This required the rapid identification of faults, the escalation of recovery processes to the technical and engineering staff, and the reinjection of electrons into the storage ring. By constantly monitoring the many operations of the machine, the Operations Group were also able to limit the machine's downtime by identifying faults before they occurred.

The Operations Group also took on additional responsibilities. The 2010-2011 period saw the Group provide after-hours and weekend support to Users for the first time. After receiving training from beamline staff, Operators were able to diagnose and solve common problems experienced by Users during off-peak and in some cases peak-periods. This activity resulted in a 40% growth in Operator support over the year.

Activity undertaken by the Operations Group to maintain the machine's world-class performance, including its work with technicians, engineers and scientists, resulted in positive reviews from both domestic Users and the international scientific community.

Achievements for the year included meeting KPIs for beam availability, specifically mean down time (MDT) and mean time between failures (MTBF), implementing a post mortem system for viewing the orbit of the stored beam electrons during beam dumps, extensive testing of six upgraded storage ring magnet power converters, replacement of the storage ring input/output computers (IOCs), replacement of the booster beam position monitor system and the precise measurement of the energy and stored beam.

The Operations Group's future focus will be the continued improvement of the machine's stability and overall performance and the move to 'Top up' operation (where the stored beam current is constant at all times). The planned expansion of the number of beamlines at the facility will also present a new and exciting challenge for the Group, because of the need to maintain the quality of the beam, as new beamlines are constructed and come online.



Scientific Computing

Users of the Australian Synchrotron produced terabytes (1TB = 1,000GB) of scientific data during beamtime operations over the 2010/11 period. Analyzing this data and ensuring that it benefited the broader scientific and industrial community was and continues to be an ongoing challenge for the Scientific Computing Group (SCG).

To better meet this challenge, a suite of projects (involving external organisations, institutes, as well as some of Australia's major universities) were created to provide the Australian Synchrotron User with additional data management services.

The Virtual Beam Line (or VBL), evolved as the result of a collaboration between the Australian Synchrotron and Victorian eResearch Strategic Initiative (VeRSI). This unique project, which started in 2007 now allows the User to access data, monitor an experiment in progress, and even control data collection remotely. As testament to the success of this project 200 researchers have already performed experiments remotely using the Macromolecular and Micro Crystallography beamlines.

The Australian Synchrotron MASSIVE supercomputer

In addition to the VBL, a joint initiative between the Australian Synchrotron and the Australian Nuclear Science and Technology Organisation (ANSTO), funded by the Australian National Data Service (ANDS), will soon offer Australian Synchrotron Users access to the TARDIS software solution. This solution, which was given the go-ahead during the year, organises large amounts of metadata and provides a nationally focused library catalogue of data that can be shared.

A third project managed by the SCG called MASSIVE (Multi-modal Australian ScienceS Imaging and Visualisation Environment), was the most recent project to go live, and is a collaborative venture between the Australian Synchrotron, CSIRO and Monash University. It centres on two co-managed super-computers, which are optimised to process large experimental data sets for molecular structure refinement, advanced imaging and 3D visualisation. MASSIVE was launched at the Australian Synchrotron in March 2011.

These and other programs were the primary focus of the SCG for the period and will continue to benefit Users across the facility.

Looking forward, the main challenge for the SCG will be in ensuring each project meets the sometimes divergent interests of each organisation. Externally funded collaborations are an important value-added activity for the Australian Synchrotron, both from the perspective of the enhanced capabilities they deliver, and also the additional expertise they make available to the User community.

As part of its future growth, the SCG will look to other projects that will benefit the facility and the services it delivers.

Major Projects and Technical Services

What characterised the 2010/2011 financial year for the Major Projects and Technical Services Group, was the inevitable transition of two of its major building projects, from the planning and design phase to construction.

Supported by the Federal Government's Education Investment Fund (EIF) and the Victorian Government's National Health and Medical Research Council (NHMRC), the Major Projects and Technical Services Group's major responsibility for the period involved managing the construction of a number of key building projects across the facility, including the National Centre for Synchrotron Science, which will, once complete, be a scientific centrepiece for the facility.

Alexis Kouts (right), Acting Head of Major Projects and Technical Services and Project Manager, Richard Feltscheer

Under the NHMRC scheme, the Major Projects and Technical Services group also took on responsibility for the upgrade of the facility's flagship beamline, the Imaging and Medical Beamline (IMBL) and outreach and support facilities.

During the period, work by the Group involved the creation of detailed construction plans and the appointment of two principal building contractors (Kane Constructions and Abigroup Contractors) to carry out the construction works. This work included having detailed design plans and architectural drawings approved by planning authorities at a state and local level including the Department of Planning and Community Development (DPCD) Monash Council and Monash University.

In December 2010, with the planning, design and initial consultation phase over and the appointment of construction group Kane complete, the Major Projects and Technical Services Group moved to the construction stage. As a Group, Major Projects and Technical Services also achieved a number of other significant milestones for the year.

It worked closely with the Australian Synchrotron's Quality Group and associated government auditing and compliance agencies to ensure standards across projects were world-class. In an endorsement of its success, the Major Projects and Technical Services Group had its future construction business plan approved in June 2011 by the Australian Government and administrators of the Education Investment Fund (EIF).

Other achievements often overlooked by employees and Users, involved the important work carried out by the Major Projects and Technical Services Group to ensure the facility ran smoothly. Activities included: general building and grounds maintenance, upgrading the air-conditioning controls system and management of onsite security.

For the Quality Group, which holds responsibility for the introduction and management of quality management systems across the organisation (and which is part of the larger Major Projects and Technical Services Group), the past year was defined by a number of important initiatives.

Quality continued with its introduction of the ISO 9001:2008 standard and its audit program. Maintaining certification to the ISO standard meant close attention was again paid through the year to document and records management, business process development, equipment inspection, and testing and risk management.

A major achievement for the group came in June 2011 when the Australian arm of audit and risk and business improvement specialists, SAI Global, gave the facility a positive report card for its work.

In the year ahead, the Major Projects and Technical Services Group will face a number of challenges involving the 'fit-out' of all newly constructed buildings (under the EIF and NHMRC schemes), the relocation of staff to new sites across the facility and the construction of a bridge between the satellite IMBL building and the Monash Biomedical Imaging building, designed to facilitate the sharing of data and other scientific information.

In contrast, Quality will focus its attention on a number of initiatives, such as the introduction of new quality measures to support the facility's ISO 9001:2008 accreditation standards, further development of the Australian Synchrotron's document management system, record controls, business process improvement and risk management processes.

Engineering

With responsibility for taking care of the single largest piece of scientific infrastructure in Australia, the Engineering Group played an important role in the facility's operation and its delivery of world-class scientific outcomes.

During the 2010-2011 period, the Group again worked with the facility's beamline scientists, accelerator team and physicists to deliver and manage a series of major projects. It also upgraded existing equipment and carried out necessary maintenance work essential to the facility's 24 hour operation.

Over the year, the Group managed as many as 450 separate pieces of work, with these varying in size from smaller jobs to large-scale projects with values of up to and over one million dollars.

Key achievements for the year included procuring an Uninterruptible Power Supply (UPS) for the machine and initiating the upgrade of a large number of magnet power supplies essential to the facility's operation.

While the Group focused on improving the reliability of the facility's equipment, and maintenance work, other activities carried out by the Group turned to improving the capabilities of the beamlines and the machine. This work, for example, saw the installation of a number of state-of-the-art research technologies including Maia, a high-throughput x-ray fluorescence detector.

Brad Mountford (right), Group Leader – Mechanical Engineering and Mick Kusel, Principal Mechanical Engineer

Information, Communications and Technology

In an important change to the structure of the organisation, the Engineering Group also took over functional and operational responsibility for the facility's information, communications and technology (ICT) and computing needs. What was formally the Computing Group was itself split into two sections: the ICT Group and the Scientific Computing Group.

The ICT Group, which now sits under Engineering, is responsible for taking care of the Australian Synchrotron's ongoing information technology needs including all aspects of networking, voice and desktop services and peripherals.

During the year, the ICT Group managed the many hundreds of IT systems located thoughout the facility, such as its high-speed networks, which allow data and information to be transferred to each and every laboratory across Australia and even to other parts of the world.

In order to cater to the growing IT demands of Users and scientific staff, the ICT Group also upgraded the facility's data management capabilities. Part of this work saw it assist the Scientific Computing Group with the acquisition and installation of a new super-computer called MASSIVE. MASSIVE will now provide Users and the facility with world's best data capture, data management and 3D sample visualisation capabilities.

In the coming year a key challenge for the Engineering Group will be the facility's move to 'top-up' operations, which are aimed at improving the stability and quality of the beam. Another significant challenge will be the design and installation of new beamlines under the facility's proposed beamline expansion program. Preliminary design work has already begun in this area.

In the coming year, the ICT Group will turn its attention to the establishment of a high-speed fibre optic connection between CSIRO's Clayton location and the Australian Synchrotron to support more efficient access and data delivery; the introduction of new IT infrastructure to support new buildings and the imaging and medical beamline (IMBL) upgrade; and the adoption of new technologies and possible architectural platforms to host new corporate systems across the facility.

Work Health and Safety

In keeping with its functional role across the facility, the Work, Health and Safety Group worked to promote the critical importance of health and safety.

For the 120 Australian Synchrotron employees and contractors, suppliers and community groups that work in or visit the facility, the Group introduced new training systems, standards and new processes to minimise risk across the organisation.

This work included, amongst other things, the identification and implementation of new radiation technologies and the certification, by the Office of Gene Technology Regulator, of the facility's own Physical Containment level 2 (PC2) laboratory. Its work also saw it create a new training video for Users that explains the facility's 'search and secure' procedure.

In an endorsement of the team's activity, no notices or directives were given by government or any statutory body, pursuant to the relevant sections of the Victorian OHS Act 2004, Accident Compensation Act 1985, the Dangerous Goods Act 1985 and Radiation Act 2005.

Under its environmental management responsibilities, the team also introduced an Environmental Sustainability Policy and compiled and lodged its annual WaterMAP (Water Management Action Plan) and National Greenhouse and Energy Reporting Report with the appropriate statutory authorities.

In the coming year, the Group will focus on improving its work, health and safety record even further, while delivering new services to management, workers, contractors and Users as they move from one central location to four new buildings across the facility. It will also work towards adopting new environmental management standards under ISO 14001:2004.

Changes to legislation will also mean the group must comply with new amendments to existing WHS, radiation safety, dangerous goods, scheduled substances, public health and workers' compensation laws.

Other initiatives requiring the expertise of the Group will include the facility's management of water use and in particular the facility's dam/basin water solution and storm water harvesting system.

Sergio Constantin, Senior Radiation Safety Officer

External Relations

The External Relations Group plays a critical and strategic role in supporting the work and future development of the Australian Synchrotron through its activities in corporate communications, stakeholder relations, industry engagement, and education and outreach. In late-December 2010, the team was strengthened by the appointment of Dr Shirley Lanning as Head of External Relations. Working closely with the Science Group, Dr Lanning will lead the ER team in supporting the organization's next phase of development.

Jonathan de Booy (left), Education and Outreach Officer and Perrie Gillet from Wanganui Park Secondary College

Over the past year, the group has streamlined its operations and assisted the facility in achieving some significant outcomes.

Highlights included the Australian Synchrotron's 2010 User Meeting, which hosted over 230 attendees and provided an excellent forum for the nation's scientists to showcase their research, and the facility's 2010 Open Day, yet again a successful event attracting over 3000 visitors.

The MASSIVE (multi-modal Australian Sciences Imaging and Visualisation Environment) launch, organised in conjunction with Monash's e-Research Centre, was another significant event, raising the profile of the Australian Synchrotron with stakeholders including the Minister for Technology, the Hon Gordon Rich-Phillips.

In the area of communications, a proactive approach to media relations, together with the media training of the senior management group and principal scientists, led to over 80 positive to neutral mentions of the Australian Synchrotron in print, radio and TV Media. Coverage appeared in *The Age*, *The Australian*, ABC Radio, and Channel 10 and Channel 7 News.

The facility's website, publications and photographic capabilities were also enhanced. Major publications included the 2010 annual report, the inaugural 2007-2009 Research Highlights Report, and bi-monthly e-newsletter, Lightspeed, whose readership increased to over 4000.

Stakeholder relations activity focused on development of a strategy and materials to support engagement with government and foundation investors. Visits were also hosted for the Hon Louise Asher (Victorian Minister for Innovation, Services and Small Business), the Victorian Legislative Council, Mr Simon McKeon (Australian of the Year and Chair of CSIRO), among others.

The year also saw developments in the education and outreach program. Building on the success of the previous year, 57 VCE Unit 4 Physics laboratory sessions were held. A total of 4000 visits to the facility were hosted, including 1956 school tours.

As a young facility, the focus of industry engagement activities has necessarily been on the creation of awareness of the AS amongst industry and the development of solid relationships with industry groups, as well as individual companies. This activity has been significantly enhanced by the facility's involvement in the South East Melbourne Innovation Project (SEMIP), of which the ER Group's Business Development Manager, Kerry Hayes, is now Chair. This resulted in a number of successful industry events, including the SEMIP Inaugural Innovation showcase, which targeted 250 individuals and businesses interested in developing relations with publicly-funded research organisations across the South East region, and participation in the SEMIP Workshop series.

The AS also hosted a number of events for industry organizations including SEMIP, the Plastics and Chemical Industries of Australia (PACIA) and the Australian Nanotechnology Alliance.

A number of companies used the facility on a commercial basis, whilst a survey revealed that 90 companies accessed the facility through collaborations or other routes.

The next financial year will see the introduction of a new external relations strategy aligned to the organization's business objectives. Future challenges will include finding more effective ways in which to communicate with stakeholders, in particular, government and foundation investors.

Human Resources

As the function responsible for providing a development-focussed employment framework for the Australian Synchrotron workforce, and filling multiple roles across the organisation, the Human Resources (HR) Group played a key role in shaping the facility's structure and culture.

While the strategic focus of HR did not change, including its need to attract and retain a skilled workforce and build a culture of collaboration and efficiency, the more mature and dynamic nature of the organisation presented a new set of challenges.

HR managed retention rates of over 90%, a 14 % headcount increase and the selection, recruitment and induction of 22 new employees across a broad spectrum of roles including science, engineering, technical, and trade, administration and management fields.

Left to right: Anne Ridgway, Head of Human Resources, Catriona Starr, Senior Human Resources Advisor and Genny Lobo, Human Resources Advisor

Six talented scientists were also selected from countries around the world. As part of this exercise, HR managed employer-sponsored immigration and related new employee relocation and accommodation needs; a process important to securing the expertise of scientists who are in themselves critical to the development of the facility.

In an enabling capacity, HR also facilitated the organisation's strategy development process, assisting firstly with the setup of leadership and employee workshops to define a new set of strategic objectives, and then with the development of an operational strategy for the facility, aligned with the development planning and review process and Australian Synchrotron employment agreements, 2008 and 2010.

Importantly HR, coordinated the leadership-initiated Organisational Development Program facilitated by SACS Consulting and Insight SRC, who were commissioned in mid - 2010 by the Australian Synchrotron's Board to conduct an organisational climate survey and leadership 360 degree feedback process. This activity resulted in employee-led projects, approved by leadership, to provide further clarity of purpose and collaboration across the facility.

As part of a broader consultative change-management exercise, the year also saw HR partner with the Operations Division. In this role, the Group recruited for and assisted in the set up of a new structure within the facility's Controls Engineering team. The first round of 2010 Post-doctoral Fellowships recruitment was also completed and the second round of recruitment is well under way for 2011.

In extended efforts to train and retain a highly skilled workforce, HR also introduced a number of initiatives, such as the Environmental Group, Mentoring Program and the Diversity and Inclusion Group.

HR also managed employee reward and remuneration benefits which resulted in the establishment of salary packaging benefits. In addition, its work saw it coordinate the 'on-site' employment of short-term contractors and students' work experience programs, whilst maintaining head count limits to deliver short and long-term productivity goals.

Challenges for the Group are diverse, but will focus in most cases around the future expansion of the facility's amenities and buildings, skill shortages in areas such as engineering and science and the need to constantly address diversity and gender balances across the organisation.

Finance Report

The Australian Synchrotron continued to deliver strong scientific benefits to Foundation Investors and the wider scientific and commercial community during the 2010-2011 financial year.

The surplus for the year was $962,973. The result on total revenue of $26,375,347 was earned after incurring expenditure of $25,412,374.

The main source of revenue was from the funding agreement between the Commonwealth and State Governments of $23,944,232 and the New Zealand Synchrotron Group of $799,788. Other revenue included grant funding towards International Synchrotron User Access by Australian scientists and the Australian National Data Services Meta Data project.

Operating expenditure during the year was made up of $14,454,253 for salaries and employee benefits and $6,338,709 to operate and maintain the facility at a world-class standard, including $2,139,108 for building and technical expenditure, $2,162,395 for utilities and $2,037,206 on essential operating upgrades and spare parts. An additional $2,241,200 was committed to support local and international User access, scientific development, external relations activity and business development. $2,378,212 was spent on administering the facility including staff travel, information technology, occupational health and safety, general administration and Board costs.

Under Australian Synchrotron's capital works program, the year saw the Australian Synchrotron move from the planning and design phase to construction of new scientific facilities, including the National Centre for Synchrotron Science and User Accommodation Building. The first building (Extension to the Switch Room) was completed in May 2011. In addition, the satellite building for the medical and imaging beamline (IMBL) facility was completed in June 2011.

A high performance computer known as MASSIVE was also introduced to improve the ability of the facility to process and store high volumes of data. It will also assist researchers because of its visualisation capabilities. This project is funded by Monash University, CSIRO, the Australian Synchrotron, the Victorian Partnership of Advanced Computing (VPAC), the State Government of Victoria and the National Computational Infrastructure (NCI).

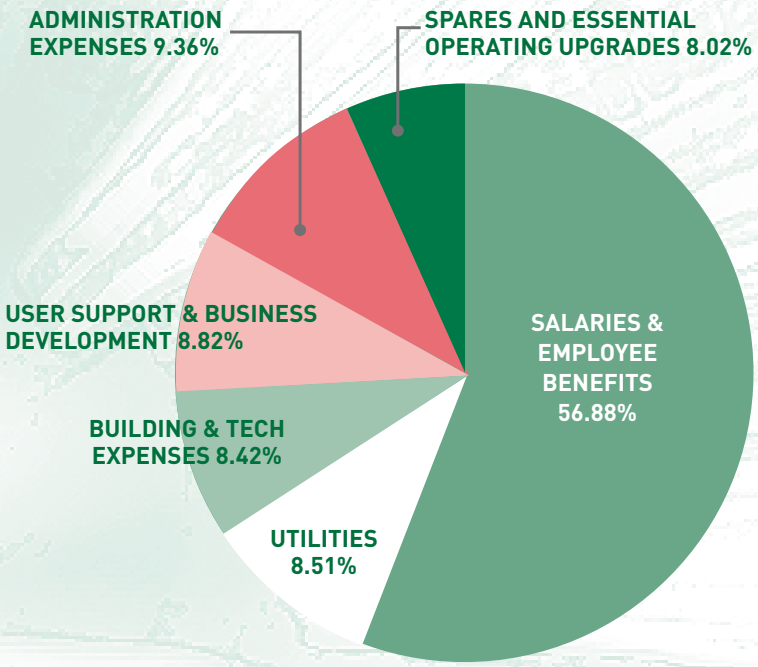
The remaining key infrastructure projects funded under the Commonwealth Government's Education Investment Fund (EIF) have anticipated completion dates as follows:

- National Centre for Synchrotron Science (Jun 2012)
- User Accommodation Building (Feb 2012)
- Office Extension Building (Aug 2011)
- Technical Support Laboratories Building (Sep 2011)
- Extension to Switch Room (complete May 2011)

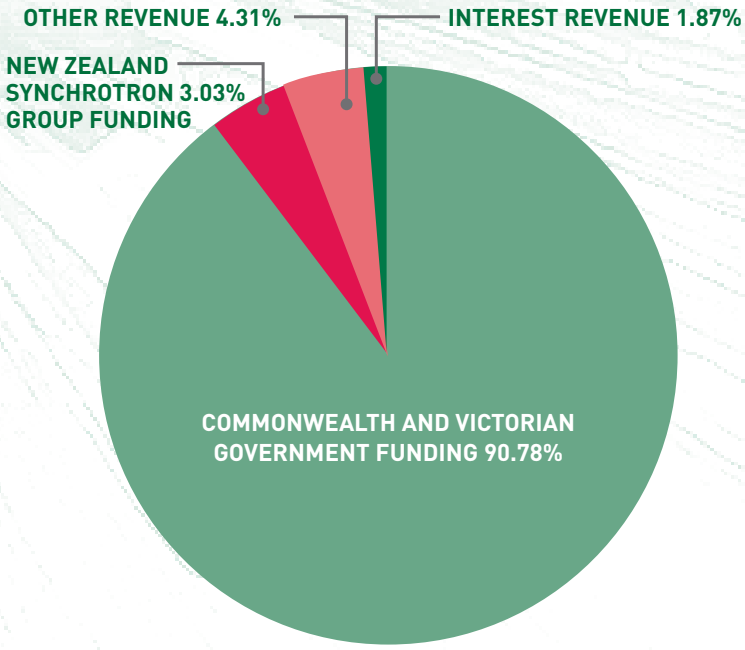
Further financial information is available in the 2011 annual financial reports for Australian Synchrotron Company (ASCo) and Australian Synchrotron Holding Proprietary Company (ASHCo).

Michael Tonroe, Chief Financial Officer and Company Secretary

Finance Report



EXPENDITURE

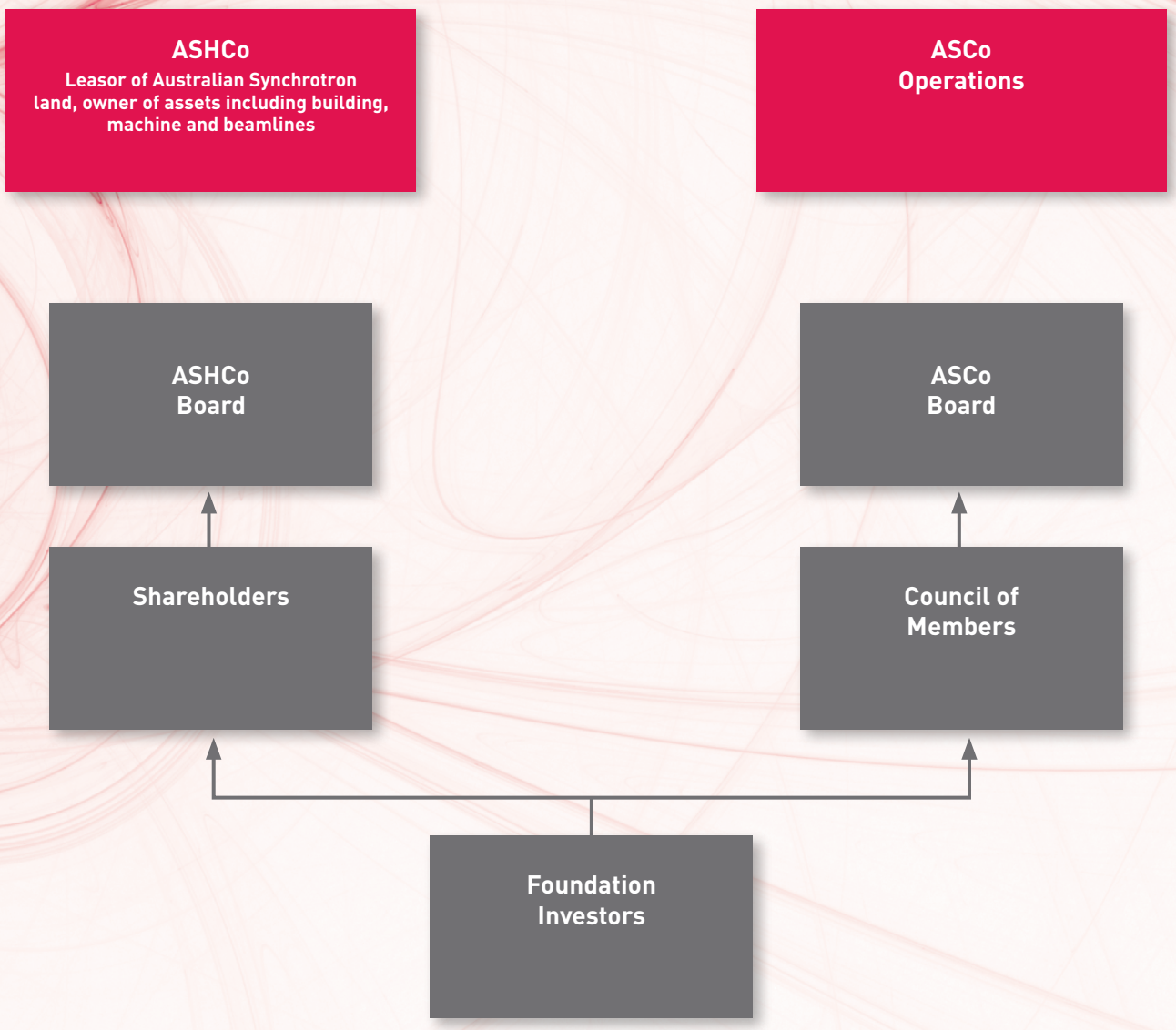


INCOME

Senior Management Group

Left to right: Mr Michael Tonroe, Chief Financial Officer & Company Secretary; Professor Keith Nugent, Director; Dr George Borg, Chief Operating Officer; Dr Dean Morris, Head of Operations; Professor Andrew Peele, Head of Science

Governance Structure



Advisory Committees and Councils

The Australian Synchrotron is managed under a dual entity structure, comprising two companies:

- Australian Synchrotron Holding Company (ASHCo) is the ownership entity and owns all Australian Synchrotron assets
- Australian Synchrotron Company Limited (ASCo) is the management entity and has the exclusive right to operate, manage and develop the Australian Synchrotron assets under a lease with ASHCo

Foundation Investors in the Australian Synchrotron have interests in both companies in consideration of their capital investment, namely shares in ASHCo proportional to their level of capital investment (being a minimum of $5 million) and membership of ASCo.

Composition of the Australian Synchrotron Board of Directors

The Boards of Directors for ASHCo and ASCo, as at 30 June 2011, are listed below.

Further details of the Directors and activities of the Companies are contained in the Financial Reports 30 June 2011 for ASHCo and ASCo associated with this document.

ASHCo

Mrs Catherine Walter AM

Dr Rod Hill

Dr Sean Gallagher

Prof Linda Kristjanson

ASCo

Mrs Catherine Walter AM

Dr Rod Hill

Dr Sean Gallagher

Prof Linda Kristjanson

Prof Peter Colman

Prof Max Lu

Advisory Committees and Councils

The Council of Members

The Council of Members is a representative committee of Foundation Investors. Its role is to advise the Board of ASCo on issues related to scientific policy, committee appointments and terms of reference and overall facility development.

Affiliation of Council of Members

Foundation Investor	Representative
Victorian Government	Dr Amanda Caples
Monash University	Mr David Pitt
AAMRI (Association of Australian Medical Research Institutes)	Prof Julie Campbell
ANSTO (Australian Nuclear Science and Technology Organisation)	Mr Peter Arambatzis
CSIRO (Commonwealth Scientific and Industrial Research Organisation)	Ms Jan Bingley
Western Australian Consortium	Mr Anthony Tate
New Zealand Synchrotron Group	Dr Don Smith
University of Melbourne	Dr Frances Skrezenek
South Australian and La Trobe University Consortium	Prof Richard Russell AM
Queensland Consortium	Prof Max Lu
AUSyn14 Consortium	Dr Chris Ling

Foundation Investor Liaison Group

The Foundation Investor Liaison Group meets regularly to coordinate foundation investor access to the synchrotron. Its members are the conduit for communication with the Foundation Investors and relevant researchers at member organisations.

Foundation Investor	Representative
Victorian Government	Ms Sue Heistein
ANSTO (Australian Nuclear Science and Technology Organisation)	Dr Richard Garrett
CSIRO (Commonwealth Scientific and Industrial Research Organisation)	Dr Jose Varghese
University of Melbourne	Dr Frances Skrezenek
Monash University	Dr Karen Siu
AUSyn14 Consortium	Dr Chris Ling
Queensland Consortium	Prof Jenny Martin
Western Australian Consortium	Prof Charles Bond
South Australian and La Trobe University Consortium	Dr Peter Kappen
	Dr Hugh Harris
New Zealand Synchrotron Group	Dr Don Smith
AAMRI (Association of Australian Medical Research Institutes)	Assoc Prof Mike Lawrence

Advisory Committees and Councils

as at 30 June 2011

National Science Colloquium

Membership:

- Sir Gustav Nossal AC (Chair)
- Prof Warwick Anderson AM, Chief Executive Officer, National Health and Medical Research Council
- Prof Robin Batterham, President, Australian Academy of Technological Sciences and Engineering
- Prof Lyn Beazley, Chief Scientist, Western Australia
- Mr Tim Besley AC, former Chair, CRC for Greenhouse Gas Technologies
- Prof Ian Chubb AC, Chief Scientist for Australia
- Prof Suzanne Cory AC, President, Australian Academy of Science
- Prof Peter Doherty AC, Laureate Professor, Department of Microbiology and Immunology, University of Melbourne
- The Hon Barry Jones AO, former Science Minister
- Dr Peter Laver AM, Director, Australian Centre for Innovation
- Prof Julio Licinio, Director, John Curtin School of Medical Research
- Prof James Metson, Head of the Department of Chemistry, University of Auckland
- Prof Brian O'Connor, Emeritus Professor of Applied Physics, Curtin University of Technology
- Prof Margaret Sheil, Chief Executive Officer, Australian Research Council
- Prof David Siddle, former Deputy Vice Chancellor Research, University of Queensland

Scientific Advisory Committee

Australia/New Zealand members

- Prof Ted Baker, Professor of Biological Sciences, The University of Auckland, NZ (Chair)
- Prof Mitchell Guss, Professor of Molecular and Microbial Biosciences, The University of Sydney
- Prof Brendan Kennedy, Professor of Solid State Chemistry, The University of Sydney
- Dr Mark Ridgway, Senior Fellow, The Australian National University

International members

- Prof Hongjie Xu, Director of Shanghai Synchrotron Radiation Facility, China
- Prof Soichi Wakatsuki, Director, Photon Factory Synchrotron Radiation Facility, Tsukuba, Japan
- Prof Janet Smith, University of Michigan Medical School, Life Sciences Institute, USA
- Prof Michael Hart, Emeritus Professor of Physics, The University of Manchester, UK
- Assoc Prof Lisa Miller, National Synchrotron Light Source, Brookhaven National Laboratory, USA
- Dr Harald Reichert, Director of Research, European Synchrotron Radiation Facility, France
- Prof Chi-Chang Kao, Associate Laboratory Director, Stanford University

Advisory Committees and Councils

as at 30 June 2011

Program Advisory Committees

Macromolecular and Micro-Crystallography PAC

- Prof Charlie Bond, University of Western Australia (Chair)
- Dr Michael Lawrence, The Walter and Eliza Hall Institute
- Dr Helen Blanchard, Griffith University
- Assoc Prof Matthew Wilce, Monash University
- Dr Daniela Stock, Victor Chang Cardiac Research Institute
- Dr Renwick Dobson, University of Melbourne
- Dr David Turner, Monash University
- Dr Michael Gardiner, University of Tasmania

Powder Diffraction PAC

- Dr Michael James, ANSTO (Chair)
- Assoc Prof Stuart Batten, Monash University
- Assoc Prof Evan Gray, Griffith University
- Dr Darren Goossens, Australian National University
- Prof Richard Haverkamp, Massey University
- Ms Nicola Scarlett, CSIRO

Infrared PAC

- Assoc Prof Bill van Bronswijk, Curtin University of Technology (Chair)
- Dr Phil Heraud, Monash University
- Dr Elizabeth Carter, University of Sydney
- Dr Llew Rintoul, Queensland University of Technology
- Prof Graham Bowmaker, University of Auckland
- Dr Evan Robertson, La Trobe University

Advisory Committees and Councils

as at 30 June 2011

Soft x-ray PAC

- Dr James Downes, Macquarie University (Chair)
- Dr Craig Klauber, CSIRO
- Dr Michael Gladys, University of Newcastle
- Dr Ben Ruck, MacDiarmid Institute
- Dr Chris Pakes, La Trobe University

Small and Wide Angle x-ray Scattering PAC

- Dr Kevin Jack, University of Queensland (Chair)
- Prof John White, Australian National University
- Prof Craig Buckley, Curtin University
- Assoc Prof Matthew Wilce, Monash University
- Dr Terry Mulhern, University of Melbourne
- Dr Tracey Hanley, ANSTO

X-Ray Fluorescence Microscopy PAC

- Dr Chris Ryan, CSIRO
- Dr Rob Hough, CSIRO
- Dr Cassandra Schefe, Dept of Primary Industries
- Prof Peter Lay, University of Sydney
- Prof Greg Anderson, Queensland Institute of Medical Research

X-ray Absorption Spectroscopy PAC

- Dr Stephen Best, University of Melbourne (Chair)
- Dr Peter Kappen, La Trobe University
- Prof Richard Haverkamp, Massey University
- Dr Hugh Harris, University of Adelaide
- Dr Victor Streltsov, CSIRO

Advisory Committees and Councils

as at 30 June 2011

International Proposal Advisory Committee

- Dr Chris Ryan, CSIRO (Chair)
- Prof Paul Dastoor, University of Newcastle
- Prof Lyndon Edwards, ANSTO
- Dr Karen Siu, Monash University
- Prof Arie van Riessen, Curtin University
- Prof Ian Gentle, University of Queensland

User Advisory Committee

- Dr Richard Garrett, ANSTO (Chair)
- Dr Peter Kappen, La Trobe University
- Assoc Prof Matthew Wilce, Monash University
- Dr Sarah Harmer, The University of South Australia
- Ms Deborah Lau, CSIRO (Deputy Chair)
- Dr Andrew Stevenson, CSIRO
- Dr Siegbert Schmid, The University of Sydney
- Dr Bridget Ingham, Industrial Research Ltd, New Zealand
  (PAC Chairs ex-officio)

Machine Advisory Group

- Dr Jeff Corbett, Stanford linear Accelerator Centre, United States
- Dr Erhard Huttel, Forchungszentrum Karlsruhe, Germany
- Dr Chin-Cheng Kuo, Synchrotron Radiation Research Centre
- Dr Tsumoru Shintake, RIKEN, Japan

Employee Directory

Prof KEITH NUGENT	Director (AS)	Senior Management Group
Dr GEORGE BORG	Chief Operating Officer ASCO/ASHCO	Senior Management Group
Dr DEAN MORRIS	Head of Operations	Senior Management Group
Mr MICHAEL TONROE	Chief Financial Officer & Company Secretary	Senior Management Group
Prof ANDREW PEELE	Head of Science	Senior Management Group - On Secondment
Ms TIFFANY MORRIS	Executive Assistant	Corporate
Ms FRAN WESTMORE	Science Administrator	Science
Dr DAVID COOKSON	Head of Beamline Science & Operations	Science
Ms LAUREN BAIRD	Database Officer	Science
Dr KIA WALLWORK	Principal Beamline Development and Operations Adviser	Science
Dr CATHY HARLAND	Group Leader - User Support	User office
Ms AMANDA LOUCH	User Office Administrator	User office
Mr SCOTT KENDALL	User Office Administrator	User office
Dr THOMAS CARADOC-DAVIES	Principal Scientist - MX	Science
Dr NATHAN COWIESON	Senior Scientist - MX	Science
Dr ALAN RIBOLDI-TUNNICLIFFE	Scientist - MX	Science
Dr CHRISTINE GEE	Scientist - MX	Science
Dr RACHEL WILLIAMSON	Scientist - MX	Science
Dr SANTOSH PANJIKAR	Scientist - MX	Science
Dr DANIEL HAUSERMANN	Principal Scientist - IMBL	Science
Dr ANTON MAKSIMENKO	Scientist - IMBL	Science
Dr CHRISTOPHER HALL	Scientist - IMBL	Science
Dr KAREN SIU	Scientist - IMBL	Scientist - seconded
Dr JAMES PEARSON	Scientist - IMBL	Scientist - seconded
Dr JUSTIN KIMPTON	Scientist - PD	Science
Dr QINFEN GU	Scientist - PD	Science
Dr BRUCE COWIE	Principal Scientist - SXR	Science
Dr LARS THOMSEN	Scientist - SXR	Science
Dr ANTON TADICH	Scientist - SXR	Science
Dr MARK TOBIN	Principal Scientist - IR	Science
Dr DOMINIQUE APPADOO	Senior Scientist - IR	Science
Dr LJILJANA PUSKAR	Scientist - IR	Science
Dr DANIELLE MARTIN	Scientific Support Officer - IR	Science
Ms RUTH PLATHE	Scientific Support Officer - IR	Science
Dr NIGEL KIRBY	Principal Scientist - SAXS/WAXS	Science
Dr STEPHEN MUDIE	Senior Scientist - SAXS/WAXS	Science
Dr ADRIAN HAWLEY	Scientific Support Officer - SAXS/WAXS	Science
Dr DAVID PATERSON	Principal Scientist - XFM / XAS	Science
Dr MARTIN de JONGE	Senior Scientist - XFM	Science
Dr DARYL HOWARD	Scientist - XFM	Science
Dr CHRISTOPHER GLOVER	Senior Scientist - XAS	Science
Dr BERNT JOHANNESSEN	Scientist - XAS	Science
Dr GLYN DEVLIN	Scientific Support Officer - XAS	Science

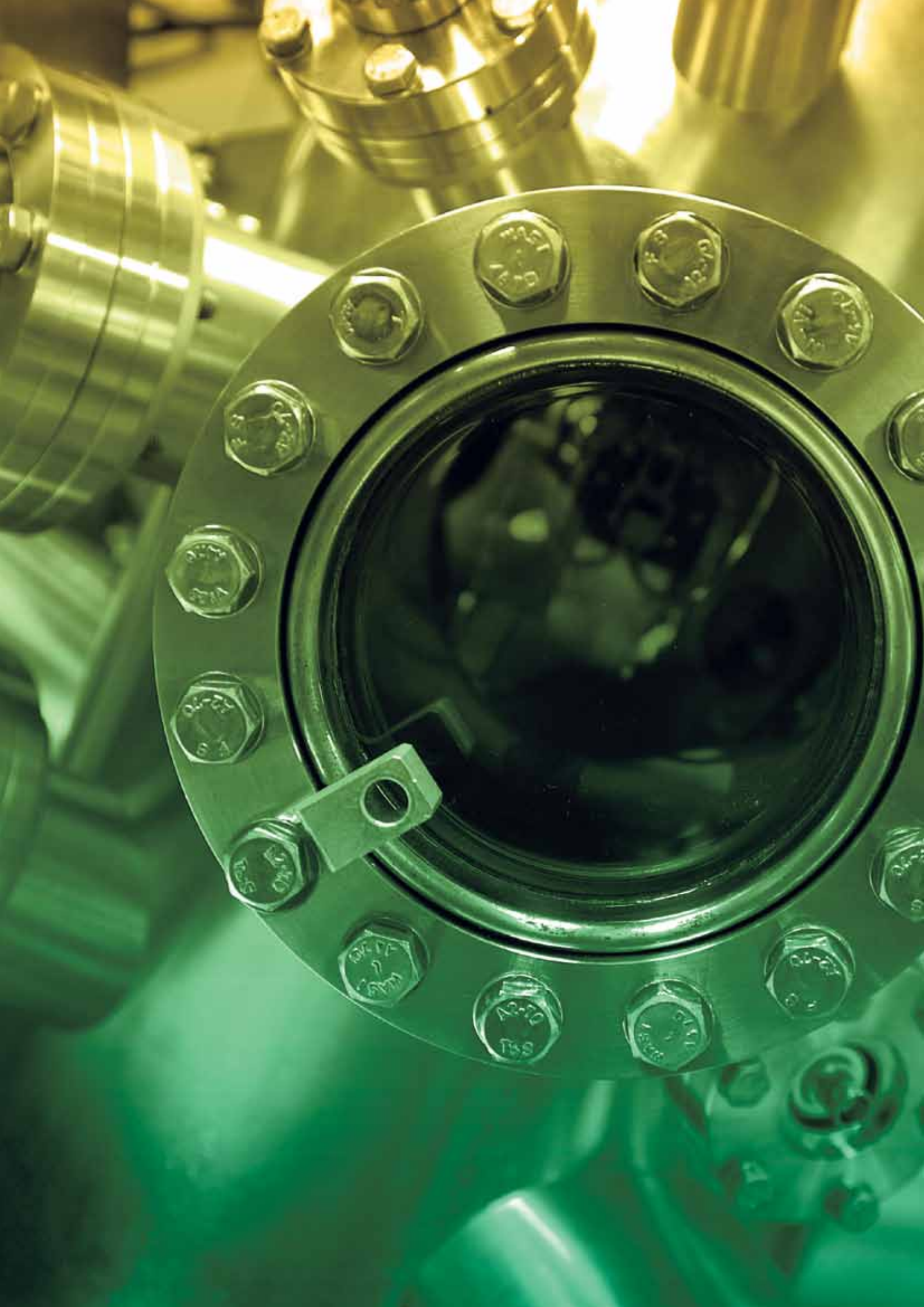
Employee Directory

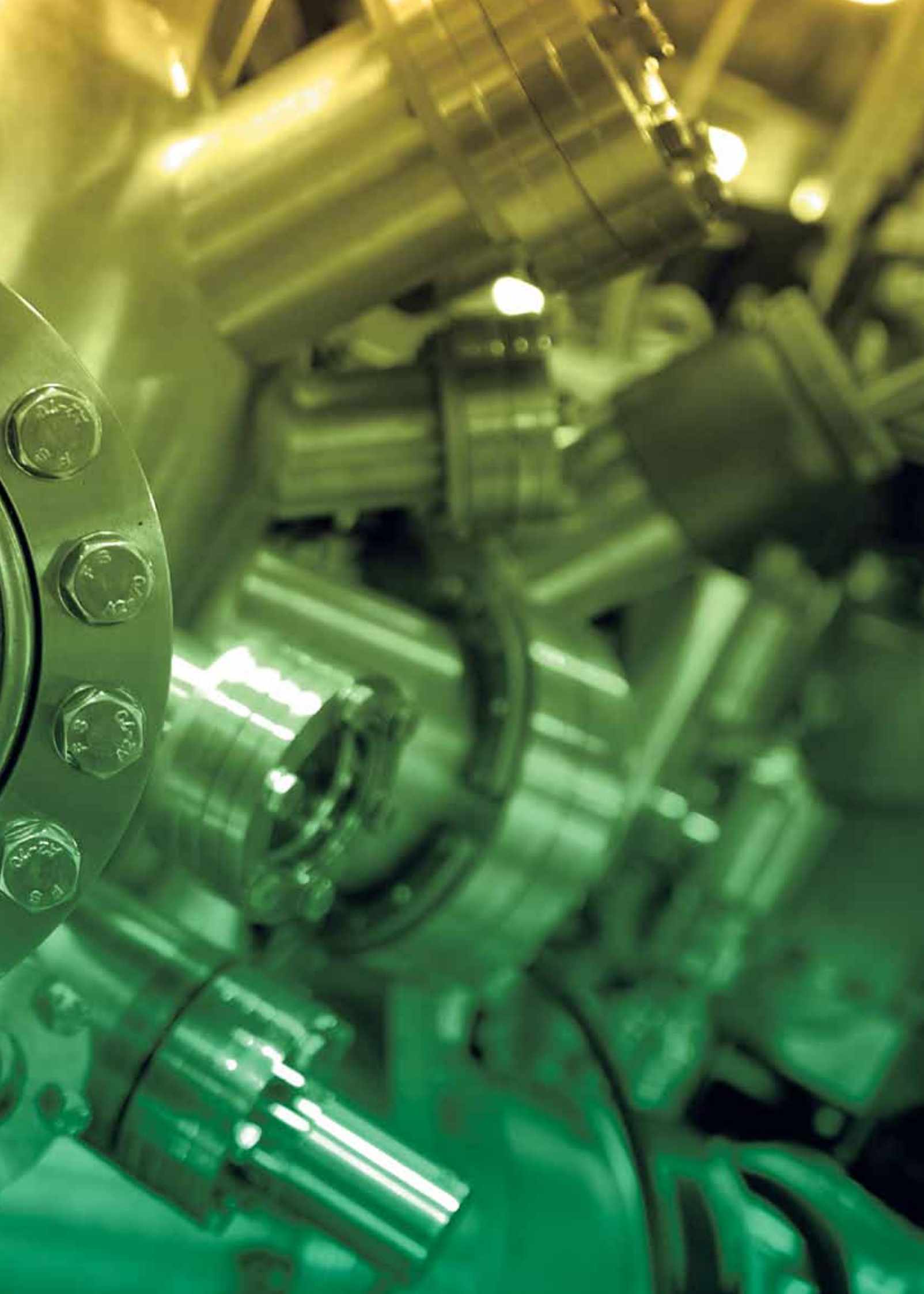
Mr ALBERTO ASTOLFO	Post Doc Fellow - IMBL	Post Doctoral Fellow
Ms EVELYNE MEIER	Post Doc Fellow - Accelerator Science	Post Doctoral Fellow
Dr DAVID ARAGAO	Post Doc Fellow - MX	Post Doctoral Fellow
Dr HELEN MAYNARD-CASELY	Post Doc Fellow - PD	Post Doctoral Fellow
Dr MATTHEW DIMMOCK	Post Doc Fellow - XAS	Post Doctoral Fellow
Dr HAYDYN MERTENS	Post Doc Fellow - SAXS/WAXS	Post Doctoral Fellow
Mr GREGORY LE BLANC	Head of Accelerator Science and Operations	Accelerator Physicist
Dr MARK BOLAND	Principal Accelerator Physicist	Accelerator Physicist
Dr ROHAN DOWD	Senior Accelerator Physicist	Accelerator Physicist
Dr YAW-REN (EUGENE) TAN	Acclerator Physicist	Accelerator Physicist
Dr DAJUN (DAVID) ZHU	Accelerator Physicist	Accelerator Physicist
Dr ELSA VAN GARDEREN	Instrumentation Scientist	Accelerator Physicist
Dr DONALD McGILVERY	Group Leader - Accelerator Operators	Accelerator Operations
Mr CAMERON RODDA	Senior Accelerator Operator	Accelerator Operations
Mr JOEL TREWHELLA	Senior Accelerator Operator	Accelerator Operations
Mr ROBERT CLARKEN	Senior Accelerator Operator	Accelerator Operations
Mr RODNEY KING	Accelerator Operator	Accelerator Operations
Mr PETER JONES	Accelerator Operator	Accelerator Operations
Dr STEPHEN MARTIN	Accelerator Operator	Accelerator Operations
Ms LOUISE HEARDER	Accelerator Operator	Accelerator Operations
Mr MARK ATKINSON	Accelerator Operator	Accelerator Operations
Mr SIMON CUNNINGHAM	Accelerator Operator	Accelerator Operations
Mr DAVID TOKELL	Head of Engineeing	Engineering
Mr BRADLEY MOUNTFORD	Group Leader - Mechanical Engineering	Engineering
Mr MICHAEL KUSEL	Principal Mechanical Engineer	Engineering
Mr JONATHAN McKINLAY	Principal Beamline / Alignment Engineer	Engineering
Mr JIM DIVITCOS	Senior Mechanical CAD Designer	Engineering
Mr ADAM WALSH	Senior Mechanical Engineer	Engineering
Mr HENGZI (DAVID) WANG	Senior Mechanical Engineer	Engineering
Mr STEPHEN GRIFFITHS	Group Leader - Electrical & Electronics Engineering	Engineering
Mr KARL-LUDWIG ZINGRE	Principal RF Engineer	Engineering
Mr ADAM MICHALCZYK	Senior Electronics Engineer	Engineering
Mr WESLEY HOFFMAN	Senior Electrical Draftsman	Engineering
Mr SEAN MURPHY	Electrial Engineer	Engineering
Mr LUIGI CORVETTI	Group Leader- Controls Engineering	Engineering
Mr ANDREW STARRITT	Principal Controls Engineer	Engineering
Mr BRYCE KARNAGHAN	Principal Controls Engineer	Engineering
Dr MARK CLIFT	Senior Controls Engineer	Engineering
Mrs VESNA SAMARDZIC-BOBAN	Senior Controls Engineer	Engineering
Mr ANDREW RHYDER	Senior Controls Engineer	Engineering
Dr TERRY CORNALL	Senior Controls Engineer	Engineering
Mr FREDRICK LE GUEN	Senior PLC Controls Engineer	Engineering
Mr PAUL MARTIN	Senior Controls & Instrumentaiton Engineer	Engineering

Employee Directory

Mr EMMANUEL VETTOOR	Controls Engineer	Engineering
Mr TIMOTHY BUTLER	Senior IT Officer	IT
Mr NICHOLAS HOBBS	Senior IT Officer	IT
Mr PAUL LEONARD	Group Leader - Mechanical Technicians	Engineering
Mr JASON WIRTHENSOHN	Senior Mechanical Technician	Engineering
Mr ROBERT GRUBB	Senior Mechanical Technician	Engineering
Mr TRENT SMITH	Mechanical Technician	Engineering
Mr ALAN EASDON	Mechanical Technician	Engineering
Mr CRAIG HODGSON	Mechanical Technician	Engineering
Mr ROBERT ROSTAN	Mechanical Technician	Engineering
Mr CRAIG MILLEN	Group Leader - Electrical Technicians	Engineering
Mr NOEL BASTEN	Senior Electrical Technician	Engineering
Mr BRIAN JENSEN	Senior Electrical Technician	Engineering
Mr MARK COLCLOUGH	Senior Electrical Technician	Engineering
Mr JAIME ARIAS	Electrical Technician	Engineering
Dr SHIRLEY LANNING	Head of External Relations	External Relations
Ms KERRY HAYES	Business Development Manager	External Relations
Mr NICHOLAS GREEN	Senior Communications Officer - Media and Publications	External Relations
Ms NANCY MILLS	Senior Communications Officer - Science Writing	External Relations
Ms MELISSA MOYLE	Communications Officer - Marketing & Events	External Relations
Mr JONATHAN De BOOY	Outreach Officer	External Relations
Ms LEANNE WALLACE	External Relations Administrator	External Relations
Ms SAMANTHA CHAN	Receptionist	External Relations
Ms SUZANNE THURSKY	Financial Controller	Finance
Ms LARISSA KETELAARS	Finance Administration & Compliance Officer	Finance
Ms QI (SHARON) WANG	Senior Finance Officer	Finance
Ms REBECCA KOFFEL	Senior Contracts Officer	Finance
Ms MARIE CLARK	Purchasing Officer	Finance
Ms PIKU KAUR	Accounts Office	Finance
Mr WORRELL LOUDEN	Stores Manager	Stores
Ms ANNE RIDGWAY	Head of Human Resources	Human Resources
Ms CATRIONA STARR	Senior Human Resources Advisor	Human Resources
Ms GENEVIEVE LOBO	Human Resources Advisor	Human Resources
Mr. ALEXIS KOUTS	Acting Head of Technical Services & Major Projects	Major Projects & Technical Services
Mr JONATHAN PRIEST	Senior Project Support Engineer	Major Projects & Technical Services
Mr MAURIZIO MESSINA	Facilities Manager	Facilities
Mr GORDON SPRATT	Maintenance Technician	Facilities
Dr KATHLEEN MUSCAT	Quality Manager	Quality
Ms SNEZANA VUKOVIC	Document & Configuration Control Officer	Quality
Mr THEAN (HOCK) CH'NG	Head of Safety	Safety
Mr SERGIO COSTANTIN	Senior Radation Safety Officer	Safety
Mr PIERS DAVENPORT	Safety Officer	Safety
Ms LAURA BOUCHER	Lab Technician	Safety


90
80
70





Australian Synchrotron
800 Blackburn Road
Clayton, Victoria, Australia 3168
t. +61 3 8540 4100
f. +61 3 8540 4200
www.synchrotron.org.au

Cover Image: The image used on the cover of this report is based on artwork created by Melbourne-based digital artist, Chris Henshke. Chris is currently undertaking a second artistic residency at the Australian Synchrotron.

Australian Synchrotron Company Limited
ACN 126 531 271

Australian Synchrotron Holding Company Pty Limited
ACN 126 506 205