THE AUSTRALIAN SYNCHROTRON

General Information

The Australian Synchrotron is a world-class research facility that uses accelerator technology to produce powerful beams of X-ray and infrared radiation. The facility harnesses that light so that researchers can study the structure, composition and behaviour of materials, on scales ranging from the atomic to the macroscopic. The Australian Synchrotron supports high-quality research outcomes, with applications in sectors from medicine and nanotechnology to manufacturing and mineral exploration. Our highly advanced techniques and passionate staff contribute directly and demonstrably to scientific advances and industrial innovations with benefits for all Australians.

Vision - The Australian Synchrotron's vision is to be the catalyst for the best research and innovation in Australia and New Zealand. The focus for the facility is to provide a thriving environment that is conducive to creating, inspiring and nurturing the best outcomes, enabled by scientific excellence, for users and staff of the facility.

Mission - The Australian Synchrotron's mission is to enable science for the benefit of the community, by providing world class synchrotron expertise and facilities.

Core values - The facility is driven by the core values of passion, respect, innovation, collaboration, and excellence.

User Operations: Commenced 2007

3 GeV, 200 mA Top-Up operation:

For FY2014:

5016 hrs of stored beam

Operations Budget: AU$ 25.3M

4347 visiting users

May 2014 saw our 20,000th user visit.

1252 proposals submitted, 985 approved (78.7%)

User affiliation: 13% International, 60% Universities, 12% National research institutes, 15% Medical research institutes.

Beamlines:

IMBL	– Imaging and Medical
IRM	– Infrared Microspectroscopy
MX1 and MX2	– Macromolecular- and Micro Crystallography
PD	– Powder Diffraction
SAXS/WAXS	– Small- and Wide-Angle X-ray Scattering
SXRs	– Soft X-ray Spectroscopy
SXRi	- Soft X-ray Imaging
THz/Far-IR	– Terahertz/Far-Infrared
XAS	– X-ray Absorption Spectroscopy
XFM	– X-ray Fluorescence Microspectroscopy

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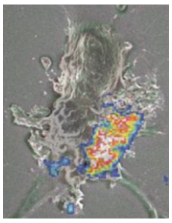
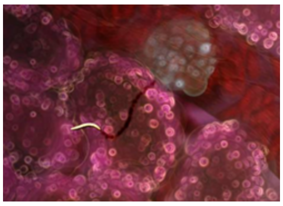
Current Activities

The Australian Synchrotron's sophisticated scientific techniques provide benefits for diverse scientific and industrial fields and purposes, including:

Biomedicine: Offering new, world-class diagnostic, imaging and therapeutic techniques and investigation of biomimetic materials (such as artificial skin and organs), as well as conducting cell imaging, and high-throughput structural biology capabilities.

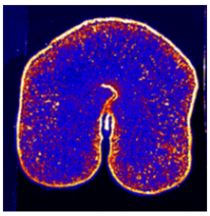




Defence: Enabling study of the atomic structure of materials, sensors and specialty alloys.

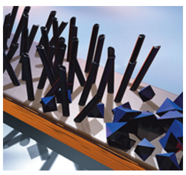
Environmental technologies and services: Supporting environmental remediation and analysis of soil samples, the quality and composition of fresh and salt water, air and atmospheric samples, pollutants, toxins and contaminants.

Food technology: Analysing the composition of ingredients, assessing the effectiveness of food processing and determining the nutritional impact of foods.

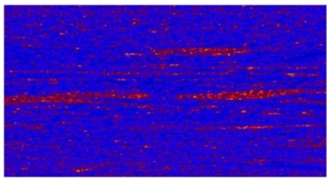


Forensics: Refining or developing new forensic processes, techniques and applications.

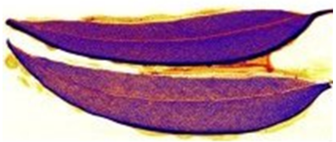
Advanced Materials: Alternative energy and carbon capture, hydrogen generation and storage, batteries and electronic devices, new materials with industrial applications.



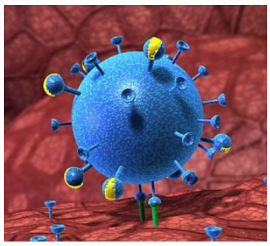
Manufacturing: Investigating the structure and characterisation of alloys, catalysts, fibres, textiles, adhesives, polymers, plastics, surfaces, interfaces and coatings and analysis of stresses and texture in engineered components.



Mining and Minerals: Supporting all aspects of mineral exploration and processing. Development of fuel systems and fuel cell innovations.



Life Sciences and pharmaceuticals: Understanding disease, fighting bacteria and viruses, and supporting agriculture. Analysing proteins, nucleic acids, bacteria and viruses that are fundamental to healthy biological function or disease; quality control monitoring, identification and assessment of the effectiveness of drug targets.



Scientific instruments: Developing detector technologies, new analytical techniques, medical implants and drug delivery systems.

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Future Perspective

Current demand for the facility greatly outstrips supply, with over-subscription rates ranging between 100 - 300%. The facility is also increasingly focussed on direct commercial partnerships, and well positioned to engage with South-East Asia, with strong growth anticipated in the pharmaceutical, agricultural and minerals sectors of the region.

After extensive forecasting with research communities and international experts, a detailed science case for the development of the Australian Synchrotron includes a 7-year phased upgrade, including installation of 10 new 'beamlines'.

Following are details of seven, of the anticipated ten, next generation beamlines planned for the Australian Synchrotron. These seven beamlines are in advanced stages of planning due to their particularly high demand in the research community.

High-Coherence Nanoprobe (HCN)
A device to produce super high resolution images, on the order of 30 nm or better. The design is a unique combination of two techniques. One involves scanning samples with a highly focussed X-ray beam, and the other where entire samples are illuminated by the beam, taking advantage of synchrotron beam's unique coherence.

High-Performance Macromolecular Crystallography (MX3)
MX3 will complement the Australian Synchrotron's existing macromolecular (MX1) and microcrystalline (MX2) crystallography facilities, with extremely high throughput screening of protein structures.

Medium Energy X-ray Adsorption Spectroscopy (MEX)
A complementary beamline to our high energy wiggler-based X-ray Absorption Spectroscopy (XAS) beamline, MEX will source X-rays from a bending magnet to enable the study complex samples with lighter elements Si, P, S, Cl, K and Ca.

Advanced Diffraction & Scattering (ADS)
ADS has been designed for analysis of engineering materials, alloys, ceramics and other bulk materials and optimised for industrial samples using high energy X-rays.

Micro-Computed Tomography (MCT)
Micro-CT measurements give three-dimensional (3D) images of the internal structure of samples. Scientists who are familiar with laboratory-based micro-CT are now turning to synchrotron micro-CT to enable research that requires high throughput, higher resolution images, the ability to use phase-contrast, techniques that give chemical information and high-speed data collection. This provides 3D observations of processes occurring in real time.

Micro Materials Characterisation (MMC)
Will offer the ability to simultaneously measure diffraction and fluorescence, with sub-micron resolution. The proposed MMC beamline will use a broad energy beam to collect structural information that is spatially resolved on the smallest possible length scale and may be produced from deep within a sample.

Small Angle Scattering for Structural Biology (BioSAXS)
Will have the greatest impact in the study of the structure of the larger biological molecules involved in the critical functions of human cells, such as proteins and the nucleic acids that compose the genetic material within cells. This technique will strongly complement protein crystallography or NMR spectroscopy, but will not rely on large quantities or crystallised forms of purified biomolecules such as proteins. The BioSAXS beamline will complement the capabilities of the existing SAXS/WAXS beamline.