NEW ZEALAND
SYNCHROTRON GROUP

ANNUAL REPORT 2024

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CHAIRMAN'S REPORT

The past year was the eighteenth in which the New Zealand Synchrotron Group Ltd (NZSG) provided support for New Zealand researchers using the Australian Synchrotron and was my first as its Chairman. I am delighted to be able to support this important programme and partnership with Australia in delivering access to one of the region's most impressive pieces of research infrastructure to the New Zealand research community.

I would first like to acknowledge the outstanding service to the NZSG from Dr Garth Carnaby who retired from the Board in November 2023. Dr Carnaby became involved in 2006 and was a relentless champion for the initiative as Chair from the company's inception until his retirement. He was also a Board member of the Australian Synchrotron entities that governed and operated the facility for some years prior to its acquisition by the ANSTO (Australian Nuclear Science and Technology Organisation). His contribution has been enormous and appreciated by all.

The past year has been more eventful than might have been expected. Severe flooding in Melbourne in February resulted in the synchrotron being shut down for a short period. Despite that interruption, a full programme of research was undertaken by New Zealand researchers during the year, with the highlight being the commencement of operations on the fourth new beamline, BioSAXS, earlier this year.

Demand from the New Zealand research community for beamtime on the original beamlines continues to increase and was 60% higher than last year. Interest in the capabilities of the four new beamlines was also strong, and New Zealand's entitlement to all beamlines was fully utilised. It was also pleasing to see the number of publications arising by New Zealand authors has begun to increase again after the downturn during and after the COVID-19 period.

Another consequence of COVID-19 was the lost opportunity to provide ongoing training and experience in synchrotron science to students and early career researchers. Once travel recommenced and student numbers began to increase, the company instituted a programme of funding support for these researchers to gain experience at the synchrotron. Travel grants were also made available to students presenting at the Annual User Meeting in November 2023. The Asia Oceania Forum for Synchrotron Radiation Research, of which NZSG is a member, also resumed its annual Synchrotron Radiation School and NZSG sent students to the School in Thailand in June 2023 and the 2024 School at the Australian Synchrotron in August.

COVID-19 also affected the timetable for the construction of the new beamlines and there have been a few further minor delays with the last four new beamlines. Nevertheless, construction is well advanced with the next new beamline (Macromolecular Crystallography 3 – MX3) expected to commence user operations in June 2025 and the first Advanced Diffraction and Scattering beamline (ADS1) in July 2025. New Zealand is a major contributor of funding for the new beamline programme with NZSG providing A$12 million towards the programme, all of which has now been paid.

The past year was the last year of the operation of the Capability Build Fund which was funded on a 75:25 basis by MBIE and NZSG. Through this $400K programme 21 groups received seed funding to undertake small research projects leading to use of the new beamlines and 4 travel awards were made to enable researchers to travel to other synchrotrons to learn techniques becoming available on the new beamlines. Although only four of the new beamlines are currently in operation, it was very pleasing that 12 of the 25 teams funded have already used the new beamlines including 36 researchers travelling to Melbourne to do so.

The company generated an operating surplus of $35K for the year which was significantly ahead of the budgeted loss of $72K. The major reasons for this were $57K of unbudgeted revenue received from organisations that are not parties to the synchrotron access funding arrangement, and $47K less expenditure on purchasing commercial beamtime and additional merit beamtime than budgeted. Income from interest was also greater than anticipated with the higher interest rates during the year.

The company's cash position at the end of the year was $800K and shareholder equity rose from $809K to $844K. Directors have considered the level of reserves that would be sufficient to cover any sudden crisis and took the view that the reserves were above the level demanded by prudent governance. Accordingly, a decision was made to waive 50% of the charge to institutions under the funding contract for the 2024/25 year, and to maintain a greater than usual level of expenditure to strengthen future synchrotron science support activities, such as student attendance at workshops and training schools.

As indicated in previous reports, changes in the exchange rate are one of the most significant uncertainties the company faces. This has previously been managed by taking a series of forward contracts to lock in and provide certainty around future exchange rates. As there are only two more annual payments to be made to ANSTO under the current contract, a change in strategy was made for the coming year and NZ$800K from the funds received from MBIE have already been used to purchase the Australian currency required for the 2025 payment. There are also two vanilla options to provide protection against a substantial fall in the exchange rate for the final payments of the current funding and access agreement in 2025 and 2026.

As the end of the current funding and access arrangement is only two years away, a major focus for the Board is securing support from the research community and from the government for its continuation. A separate consultation document will be distributed to stakeholders in preparation for discussions with the sector and negotiations with ANSTO and MBIE early next year.

The Board has been very well supported by the Royal Society Te Apārangi who provide secretariat services to NZSG. In particular, I would like to acknowledge the contribution make by Dr Don Smith in assisting the board, administering the New Zealand Synchrotron Support Programme and looking after our interests in Australia and on the Asia Oceania Forum for Synchrotron Radiation Research.

I would also like to acknowledge the contribution from the Chair of the Access Committee, Emeritus Professor Geoff Jameson and its members, Associate Professor Vladimir Golovko and Professor Geoff Waterhouse who have evaluated all requests for access. Finally, I would like to thank my fellow directors, Professor Catherine Day, Emeritus Professor Geoff Jameson and Professor Jim Metson.

Professor Metson is retiring from the Board in November 2024. He has been a member of the Board since 2007 and has also been Chair of the Australian Synchrotron's Science Advisory Committee. I would like to acknowledge the exceptional contribution he has made to the company and to the advancement of synchrotron science in New Zealand. New directors to replace Dr Carnaby and Professor Metson are expected to be appointed shortly.

BR Cowan
Chair

BUSINESS REVIEW JULY 2023-JUNE 2024

Growing an innovation-based economy requires access to the highest quality research facilities. Synchrotrons facilitate many technological innovation and advances, and New Zealand researchers have made significant discoveries in partnership with the Australian Synchrotron.

The research community in Aotearoa New Zealand benefits from preferred access to the Australian Synchrotron. These benefits arise due to the significant capital investment in the facilities over the last 18 years by our government, and active participation by our research community. Four new beamlines came into operation this year, enhancing the range of synchrotron research tools available to our scientists.

Although COVID pandemic impacts on the research community continue to be felt, synchrotron-based research is recovering well, and New Zealand researchers use of the facility continues to grow. A wide range of new research outputs have stemmed from use of the synchrotron, with 12% more papers published this year than the previous year.

The research undertaken represents advances in diverse fields such as climate science, materials science, medical research and geoscience. Examples of projects include investigating the feasibility of maple syrup production in New Zealand, new collagen-based tissue scaffolds to aid wound healing and reconstructive surgery, more efficient energy solutions for electronics, and how past climate signatures in ancient stalagmites from Niuē and the Cook Islands could help predict future climate change in the South Pacific region.

New beamlines expand opportunities for New Zealand research

During the past year the first four of the new beamlines were operational, giving a total of 14 beamlines now available for researchers (Table 1). The usage of these new beamlines has altered the pattern of demand on some of the original beamlines. For example, some small-angle x-ray scattering work previously undertaken on the SAXS/WAXS beamline was assigned to the new biological small-angle x-ray scattering BioSAXS beamline. The BioSAXS provides new opportunities for biologists as it is specifically designed for structural biology and has specialised facilities for protein work.

The addition of the new beamlines creates opportunities to support research that previously might not have been awarded beamtime, due to full capacity. While most applications this year have come from existing users, it was pleasing to see new groups using both the original and new beamlines. However, a lack of awareness of the new capabilities on offer means some sectors of the wider New Zealand research community may not yet be taking advantage of the opportunities offered. Consequently, NZSG has the opportunity to promote the Australian Synchrotron and its new potential to the wider research community in the year ahead.

Table: 1: Original and new beamlines in operation at the Australian Synchrotron, with their actual or planned operational dates. New beamlines remaining to be commissioned as part of the BRIGHT programme are in blue text. Detailed descriptions and potential applications can be found in *The Australian Synchrotron* section.

Beamline	Operational date
Macromolecular crystallography 1 (MX1)	Jan 2008
Infrared spectroscopy and microscopy (IRM) & FTIR spectrometer (THz)[1]	Early 2008
Powder diffraction (PD)	Feb-May 2008
Soft x-ray absorption spectroscopy (SXR)	Late 2008

[1] The infrared spectroscopy (IR) beamline features two end stations: an FTIR spectrometer (THz) and an infrared microscope (IRM). Effectively this provides a total of 14 beamlines.

Beamline	Operational date
X-ray absorption spectroscopy (XAS)	Jan 2009
Small-and wide-angle x-ray scattering (SAXS/WAXS)	Early 2009
Macromolecular crystallography 2 (MX2)	Mid 2009
X-ray fluorescence microspectroscopy (XFM)	Early 2009
Imaging and medical (IM)	2013
Micro-computed tomography (MCT)	2022
Medium energy x-ray absorption spectroscopy (MEX1)	Nov 2022
Medium energy x-ray absorption spectroscopy (MEX2)	Apr 2023
Biological small-angle x-ray scattering (BioSAXS)	Mar 2024
High performance macromolecular crystallography (MX3)	Jun 2025
Advanced diffraction and scattering (ADS1)	Jul 2025
X-ray fluorescence nanoprobe (NANO)	Early 2026
Advanced diffraction and scattering (ADS2)	Jun 2026

Australian Synchrotron staff continue to be collaborative and supportive of NZSG and New Zealand researchers in general. They were particularly helpful when new arrangements were introduced for the allocation of merit time and preferred access on the new beamlines.

Under the current agreement with ANSTO, NZSG researchers effectively have three types of access to the Synchrotron:

1. **Merit access to the original beamlines**. New Zealand researchers have rights to a specific number of shifts annually.[2] There is no restriction on which beamlines the shifts are used. This arrangement effectively puts our researchers in a priority position, as these shifts must be allocated by ANSTO before Australian researchers' shifts.
2. **Preferred access to the new beamlines**. Access is guaranteed to NZSG because of New Zealand's capital investment. Guaranteed access persists for five years after each new beamline comes into operation. The first of these rights expire in 2028 and the remainder will expire around 2031, five years after the last of the new beamlines begins operation.
3. **Merit access to the new beamlines**. Proposals by Australian and New Zealand researchers compete for time, which is allocated based solely on research quality.

Guaranteed merit access to the original beamlines and preferred access to the new beamlines demonstrates the value of the New Zealand government and research community investment in the Australian Synchrotron. With a sound science partnership between our two countries, Aotearoa New Zealand has access to all the benefits of this world class facility.

How proposals for access to the Australian Synchrotron are assessed

Proposals for access are assessed by ANSTO and NZSG in different ways depending on the type of access and whether original or new beamlines are requested.

Approximately 80% of the available time on the original beamlines is assigned to the merit access pool. Every four months, the Australian Synchrotron calls for competitive proposals from researchers worldwide, including from New Zealand. Although researchers apply directly to the Australian Synchrotron, NZSG oversees the final selection of New Zealand applications.

The agreement with ANSTO enables NZSG to decide how our merit access to the original beamlines is allocated to gain the best advantage for the New Zealand research community. This includes distributing time among beamlines and ranking of the New Zealand proposals. The Board established the NZSG Access Committee to assess proposals for merit access. The

[2] Shifts are units of time that the researcher can use to access the synchrotron, with three 8-hour shifts per day.

committee hold Zoom meetings throughout the year to agree their selections. For the past year the committee members were:

- Emeritus Professor Geoff Jameson, Massey University (Chair)
- Associate Professor Vladimir Golovko, University of Canterbury
- Professor Geoff Waterhouse, University of Auckland

For the first five years after each new beamline begins operating, New Zealand receives guaranteed (preferred access) beamtime in recognition of our contribution to the cost of the new beamlines. The NZSG Access Committee also evaluates proposals for this access.

The ANSTO Program Advisory Committees assess proposals for merit access to the new beamlines. Although the NZSG Access Committee does not evaluate them, a proposal can be considered for preferred access in parallel with ANSTO's evaluation. This provides scope to maximise the number of successful New Zealand proposals.

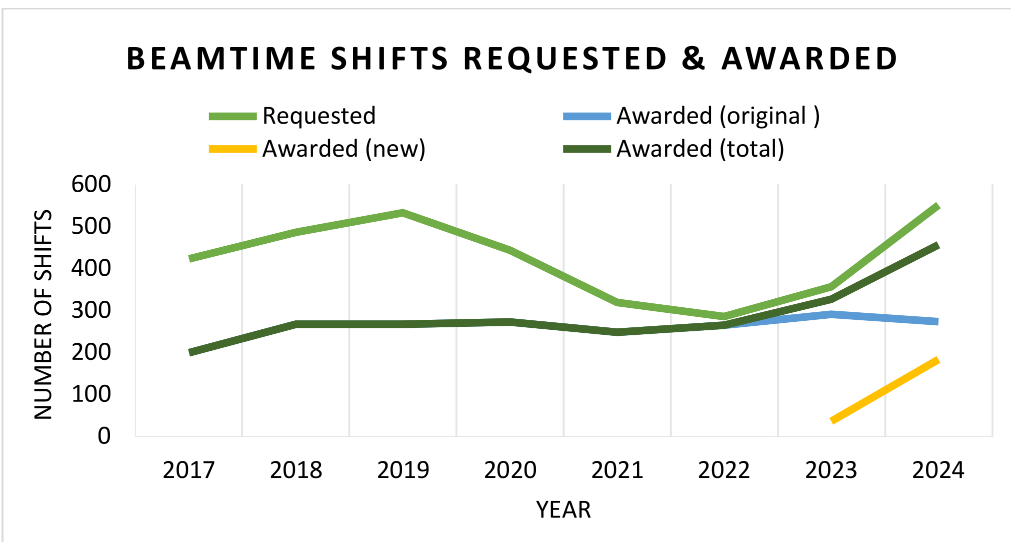
Use of the Australian Synchrotron by New Zealand researchers

Demand for, and use of, the Australian Synchrotron by New Zealand researchers has continued to grow. In the last year alone, the number of proposals submitted by our researchers increased by 60%.

New Zealand researchers are entitled to 267 shifts of merit access on the original beamlines annually, approximately 6.6% of the available time. Prior to COVID the number of shifts requested substantially exceeded the entitlement. During and immediately after COVID, research activity declined. That, and restrictions on travel, resulted in fewer applications for beamtime, which allowed most of the requests to be fulfilled.

Demand for beamtime has now returned to pre-COVID levels and there is strong competition for time on the beamlines. The demand for shifts has always regularly exceeded what is awarded, even under COVID (Figure 1). It is expected that demand will continue to grow as the final new beamlines come into operation by 2031, particularly as new types of experiments will be possible, attracting a wider pool of researchers.

Figure 1: Beamtime demand. Shifts requested and awarded on the original beamlines in the last eight years, and on the new beamlines over the last two years.



During the past year, 58% of proposals for merit time on the original beamlines were successful, and they were awarded 49% of the beamtime requested (Table 2). On average, applications requested 10 shifts (80 hours) of time. The XAS beamline had the most requests, with 120 shifts (960 hours). Applications to use the IM, MX1 & 2 and IR THz end station were 100% successful, with more time allocated to the IR THz than requested.

Table 2: Success rates of proposals by New Zealand researchers for use of the original beamlines 2023/2024.

Beamline[3]	Shifts requested	Shifts awarded	% success	Proposals received	Awarded beamtime	% success
Imaging and medical (IM)	9	6	67%	2	2	100%
Infrared microscope (IRM)[4]	39	12	31%	3	1	33%
Powder diffraction (PD)	51	18	35%	7	3	43%
Small- and wide angle x-ray scattering (SAXS/WAXS)	21	6	29%	3	2	67%
Soft x-ray absorption spectroscopy (SXR)	69	45	65%	5	3	60%
FTIR spectrometer (THz)	21	24	114%	3	3	100%
X-ray absorption spectroscopy (XAS)	120	30	25%	13	4	31%
X-ray fluorescence microspectroscopy (XFM)	72	36	50%	7	4	57%
Subtotal	**402**	**177**	**44%**	**43**	**22**	**51%**
Macromolecular crystallography MX (CAPs)[5]	149	95.7	64%	7	7	100%
Total	**551**	**272.7**	**49%**	**50**	**29**	**58%**

Demand for time on the new beamlines was also strong. During the past year all proposals received beamtime and New Zealand's full entitlement to preferred access time was allocated (Table 3). More shifts was allocated than requested for the MEX1 and MEX2 beamlines so that there was sufficient time to undertake the proposed experiments.

The full benefit of investing in the new beamlines has yet to be realised, as only half of the new beamlines are operational. Nevertheless, the impact on the total amount of beamtime requested and used is significant (Figure 1). Nearly 25% of all requests are for the new beamlines (Tables 2 & 3).

Table 3: Success rates of proposals by New Zealand researchers for use of the new beamlines 2023/2024.

Beamline	Shifts requested	Shifts awarded	% success	Proposals received	Awarded beamtime	% success
Biological small-angle x-ray scattering (BioSAXS)	51	51	100%	10	10	100%
Micro-computed tomography (MCT)	54	51	94%	6	6	100%
Medium energy x-ray absorption spectroscopy (MEX1)	27	33	122%	5	5	100%
Medium energy x-ray absorption spectroscopy (MEX2)	45	48	107%	7	7	100%
Total	**177**	**183**	**103%**	**28**	**28**	**100%**

[3] Descriptions of the beamlines and their applications are provided in the *Australian Synchrotron* section.
[4] The infrared spectroscopy (IR) beamline features two end stations: an FTIR spectrometer (THz) and an infrared microscope (IRM). They are reported separately here.
[5] As the MX1 and MX2 beamlines offer similar functionality, researchers apply for a pool of access to both beamlines, MX (CAPs), which is then allocated by NZSG.

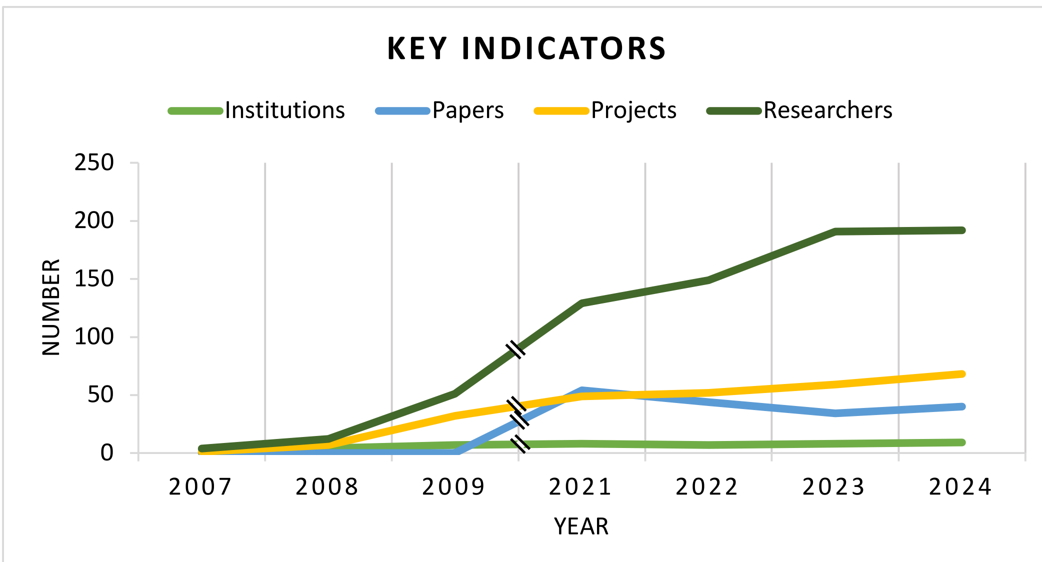
Research highlights

The 50+ synchrotrons around the world are routinely used for ground-breaking science. Important science questions could not be answered without them. The use of synchrotrons is set to grow in response to the demand for alternative technologies to protect our planet's increasing scarce resources and degraded environment.

Of all synchrotrons globally, the Australian Synchrotron has the second highest publication rate, and New Zealand researchers are strong contributors to the scientific output of the facility. Papers by New Zealand researchers constituted 6.8% of the total arising from use of the Synchrotron, while our researchers' experiments made up 6.6% of the facility's usage.

In the past year New Zealand researchers published 38 peer-reviewed papers based on experiments on the Australian Synchrotron (Annex 1; Figure 2). This is a 12% increase on the previous year when 34 papers were published, indicating that research output is recovering from the downturn seen during the COVID and post-COVID period.

Figure 2: Key indicators for Aotearoa New Zealand research community use of the Australia Synchrotron since inception in 2007-2009 and 2021-2024 (July to June). ⑊ indicates data not shown for 2010-2020.



Fifty-seven New Zealand project teams accessed the Australian Synchrotron this year. Most of the projects were collaborative, with up to four national institutions taking part in some projects (Annex 2). The number of projects and researchers all show a steady increase over the longer-term even when COVID is considered (Figure 2).

The research undertaken on the facility also often involves international collaborators. Seven world-class institutions from outside New Zealand worked on projects led by New Zealand researchers in the past year.

Many proposals included students and early-career researchers, which gave them opportunities to gain experience at the Australian Synchrotron. The NZSG is keen to see the synchrotron used extensively for training the next generation of researchers.

The proposals funded this year again covered a very broad range of science topics. The following are just a small selection that illustrate the breadth of research undertaken by New Zealand scientists at the Australian Synchrotron during the year.

How do crustaceans detect sound?

Dr Lucille Chapuis, A/Prof Craig Radford, Emily Leedham and Jimmy Rapson (University of Auckland)

The world's oceans are increasingly being harmed by human development, but many of these impacts are unseen. We know very little about how marine animals respond to perturbations such as noise pollution, particularly invertebrates. Researchers from the University of Auckland have used the new MCT to study how marine animals sense their ever-changing environment.

Detection of sound plays a critical role in the life history of many animals. Recent studies have revealed that marine invertebrates can detect sound, yet the mechanisms behind this function remain unclear. This project aimed to explore how crustaceans, like shrimps and crabs, use their statocyst organ to sense sound.

Using the MCT beamline and its high frame rate *pco.edge* camera detector, the research team captured the first images of movement of the statocyst of the snapping shrimp *Alpheus richardsoni* when exposed to sound particle motion. This pilot study proved the capacity of the MCT to successfully acquire motion triggered by sound in an invertebrate. The initial tests also allowed the team to optimise parameters such as exposure time, x-ray energy and contrast levels.

The research advances our understanding of marine invertebrate sensory systems, which is fundamental to assessing the impact of noise pollution on these creatures. The findings could influence environmental regulations, enhance public awareness about marine conservation efforts, and inform on how noise pollution might affect the productivity of crustacean aquaculture systems if it changes the behaviour of the animals.

Collagen-based surgical scaffolds for healing and skin reconstruction

Emeritus Prof Richard Haverkamp, Karla Wolmarans, Andrea Matinong and Olivia Buwalda (Massey University)

Engineered tissue scaffolds are often needed to aid wound healing and skin reconstruction. Scaffolds can act as a guide to cell adhesion and growth to form functional and structural skin tissue. Full-thickness skin loss requires 75 million surgical procedures annually in the United States alone, which drives the demand for novel dermal scaffold materials. One of the major challenges is the limited selection of materials available for such surgical applications.

Surgical scaffolds can be made from collagen-based matrices, a variety of other natural polymers (e.g., chitosan, cellulose, fibrin), or synthetic polymers. Collagen matrix scaffolds are produced from decellularised tissue, either allografts or heterografts, or are reconstructed from collagen in suspension or solution. The integration of the collagen scaffold into the body is slow and complex. Acellular matrices that have been meshed could allow cells to populate matrixes more rapidly, promoting better integration compared with solid sheets.

The team used the new MCT beamline to investigate the structure of collagen matrices from a commercial acellular dermal matrix, from arterial collagen matrices under development, and from tendon matrices – all heterograft materials. This remarkable research contributed to development of a new technology for artery heterografts developed from New Zealand animal sources, which is in the process of being patent protected.

Establishing a maple syrup industry in New Zealand: How critical are freeze/thaw cycles?

Prof Daniel Holland, Prof Matthew Watson, Matt Rennie, Dr James Robinson and A/Prof Justin Morgenroth (University of Canterbury), Prof Mike Clearwater (Waikato University) and Abby van den Berg (University of Vermont)

Maple syrup is a high value commodity that is geographically restricted to regions of long, cold winters (i.e., north-eastern North America). However, there is evidence to suggest that sugar maples can produce sap in milder climates, such as New Zealand.

Sugar maple trees exude high volumes of sugar rich sap in spring, which is processed into maple syrup. The causes underlying maple sap exudation are poorly understood, although it is thought that repeated freeze thaw cycles create high stem pressures and hence sap flow.

The researchers used the high-speed imaging capability of the IM beamline to observe changes in gas filled vessels within the xylem of maple saplings throughout a freeze-thaw event. Analysing changes in these vessel embolisms helps to clarify the mechanisms of sap exudation, and the specific role freeze-thaw cycles play in the development of stem pressure.

The results to date support the idea that repeated freeze thaw cycles create the pressure needed for maple sap to flow. This information will help inform on the viability of establishing a maple syrup industry in the New Zealand climate.

Right: University of Canterbury student Matt Rennie working with the IM beamline at the Australian Synchrotron.

Understanding subtle chemical reactions that contribute to the resilience of wool fibre

Dr Duane Harland, Dr Marina Richena, Dr Santanu Deb-Choudhury, Dr Jeff Plowman and Kim Parker (AgResearch)

Mammalian α-keratin hard structures such as horns, hooves, hair, and sensory whiskers have promise as engineered bio-based materials. Mimicking the naturally ordered chemistry of α-keratin materials is one approach to developing these materials. Sulphur’s complex chemistry plays a significant role in the functionality of enzymes and proteins and is crucial for the mechanical performance of such materials.

The team used both new MEX beamlines to investigate the subtle chemical reactions that occur within single wool fibres as moisture content changes. The functional performance of these structures is linked to how the network of disulfide bonds within and between proteins degrades over a lifetime of environmental changes and stresses.

The resulting research helps us understand how the complex chemistry of sulphur contributes to making wool, a sulphur-rich fibre, incredibly resilient. Just one step of many, the research will help pave the way for innovative applications in bio-based materials, with the promise of flow-on economic benefits for the country.

Using spintronics to find solutions for energy efficient electronics

Dr Samuel Yick, A/Prof Tilo Soehnel, Marco Vas, Dr and Joseph Vella (University of Auckland), Qinfen Gu (ANSTO) and A/Prof Clemens Ulrich (University of New South Wales)

Among other goals, the New Zealand Energy Strategy and Australia's Long-Term Emissions Reduction Plan seek to reduce the energy usage of electronics. New technologies that make this possible have significant economic potential for both New Zealand and Australia.

This partnership of New Zealand and Australian researchers is working in the emerging field of spintronics, which takes advantage of the magnetic and electronic attributes of electrons. Skyrmions are protected spin structures that can be driven by external stimuli. These unique spin lattices can provide a platform for low energy electronics.

The researchers used the PD beamline to investigate a low-temperature structural anomaly in the skyrmion hosting material Cu2OSeO3 upon co-doping (introducing more than one metal impurity – doping – onto a semiconductor). Although in-depth analysis is to be finalised, preliminary results indicate a systematic change to the lattice distortion corresponding to the dopant levels. This Marsden-funded research also saw students gaining further competency and expertise in running the PD instrument.

Right: University of Auckland student Marco Vas using the PD beamline at the Australian Synchrotron

Using South Pacific cave formations to help understand past climate and predict future changes

Dr Daniel Sinclair, Gavin Holden and Susan Al-Fahid (Te Herenga Waka-Victoria University of Wellington) and A/Prof Silvia Frisia and Dr Andrea Borsato (University of Newcastle)

Cave stalagmites and stalactites (speleothems) represent an important archive of climate history. Their layered structures capture their growth mechanism and geochemical signatures of the water that formed them. In a similar way to ice cores, under the right circumstances, parameters such as trace elements can be related to environmental processes to detect changes in regional hydrology over thousands of years. As a result, they are known as "the ice cores of the tropics".

The researchers were particularly interested in how rainfall responded to rapid climate changes in the tropical Pacific region. Existing records from Pacific island speleothems hinted that the region experienced major disruptions in rainfall over time. However, correctly interpreting speleothem trace-element records can be tricky as they can be influenced by both growth mechanisms and the speleothem's crystal fabric, which cause variation within the growth layers.

To strengthen confidence in the interpretation of the records, the XFM mapping feature was used to study the relationship between trace elements and the crystal fabric at high resolution. The researchers looked back to the most recent glacial period 10-100,000 years ago, a time of several rapid global-scale climate perturbations. The team analysed a range of speleothems from Niue and the Cook Islands to characterise a particularly pronounced series of rapid warming and cooling events that took place 35-45,000 years ago.

The team found a close relationship between the colour and crystal structure of the cave formations and their chemical composition. This breakthrough suggests a new way to reconstruct ancient climate changes in the region. The findings, which were presented at a major European scientific conference, could also help improve our understanding of how the South Pacific climate might respond to future changes.

Additional support for New Zealand researchers

In addition to access rights, students and other researchers benefit from a range of other NZSG-coordinated initiatives, which enable them to gain valuable experience of synchrotron science. This support includes seed funding and travel assistance.

Since late 2008, in recognition of the New Zealand investment in the facility's operating costs, the Australian Synchrotron has been contributing to our researchers' travel costs to use the facility. As well as overseeing New Zealand researcher access to the Synchrotron, NZSG administers this travel funding, to which all groups awarded merit access are entitled. Each team awarded beamtime receives funding for travel and accommodation at the Australian Synchrotron Guesthouse.

Capability Build Fund supports synchrotron science

Growing the next generation of researchers is always critical. To prepare for the future, the NZSG created a *Capability Build Fund.* To deliver the fund, the NZSG secured $300,000 from MBIE through an extension to the existing SIFF contract and contributed $147,450 from company reserves.

The goal of the fund, which has now closed, was to enable upskilling of our researchers and extend the range and quality of New Zealand science. New Zealand has preferred access rights to all eight new beamlines and NZSG encourages the use of this allocation. The Capability Build Fund offered researchers access to the new techniques and opportunities on the new beamlines as well as travel funding, either to ANSTO or to equivalent beamlines at synchrotrons globally.

After a delay caused by COVID, the fund was launched in February 2021 and eight projects received seed funding. A second project round in February 2022 saw a further 10 projects selected, with a further three in 2023 (Table 4). In total, 21 recipients were granted funding for access to the new beamlines, with a total value of $178,200 (Table 4).

Eleven of the early recipients of seed funding grants have already used the new beamlines.

Table 4: Recipients of Capability Build Fund grants for small projects 2021/2022-2023/2024.

Grant Applicant (Institution)	**Project (beamline)**	**Award**	**Status**
CBF21/1 Fellner (Otago)	Characterisation of newly discovered biofilm-related virulence factors of *Staphylococcus aureus* (BioSAXS)	$30k	Used
CBF21/2 Hicks (Waikato)	Structural rearrangement and interaction of the transcriptional regulator CysB with DNA (BioSAXS)	$18k	Used
CBF21/3 Johnston et al. (Canterbury)	Understanding the interplay of complex formation, substrate binding and allostery (BioSAXS)	$15k	Used
CBF21/4 Kelton (Waikato)	Structural characterisation of unique natural antibody variants (BioSAXS)	$25k	Used
CBF21/5 Morris (Canterbury)	1. Host-pathogen interactions 2. Ligan interactions of immune receptor TREM2 3. Insights into p16 amyloid formation (BioSAXS)	$15k	Used
CBF21/6 Holland (Canterbury)	Understanding maple sap exudation using micro computed tomography (MCT)	$30k	Used

Grant Applicant (Institution)	Project (beamline)	Award	Status
CBF21/7 Schipper (VUW), Kennedy (Canterbury)	Micro computed tomography image processing capability (MCT)	$25k	Used
CBF21/8 Golovko et al. (Canterbury)	Studies of novel catalysts for H_2 production and utilisation and NZ rock samples from potential H_2 storage reservoirs (MEX1 & MEX2)	$25k	Used
CBF22/1 Fellner (Otago)	Three projects to develop capability for the MX3 beamline (MX3)	$20k	MX3 not yet available
CBF22/2 Hartinger (Auckland)	Cancer cell mitochondria targeted with iphenyl-phosphonium-functionalised organo-metallic anticancer agents: A synchrotron investigation (NANO)	$20k	NANO not yet available
CBF22/3 Richena (AgResearch)	Distribution of mechanically disrupted disulfide bonds in tensile stressed wool fibres observed using medium energy X-ray absorption spectroscopy (MEX2)	$22k	Used
CBF22/4 Verbeek (Auckland)	Characterising the degree of crystallinity and orientation of recycled thermoplastic blends in the fibre-matrix interphase by in-situ tensile tests on the ADS-1/MCT beamlines (ADS1/MCT)	$20k	ADS1 not available
CBF22/5 Allison et al. (Canterbury)	1. Integral membrane protein of *Campylobacter jejuni* N-linked glycosylation pathway 2. Membrane-associated pore-forming proteins associated with type VII secretion systems 3. TRAPS (TRipartite ATP-independent Periplasmic (TRAP) transporters (MX3)	$20k	Not available
CBF22/6 Giles (Otago)	Organoselenium drugs to selectively target triple negative breast cancer (NANO)	$18.2k	NANO not yet available
CBF22/7 Alloo and Pavlov (Canterbury)	Development of experimental and theoretical protocols for DF tomography using a SBXI technique and testing a new phase-retrieval technique (MCT)	$10k	Used
CBF22/8 Procter and Calvelo-Pereira (Massey)	Linking carbon stabilisation with pore structure in paleosols (MCT)	$18k	Used
CBF22/9 Johnston et al. (Canterbury)	Looking inside the active site using tiny crystals: Molecular level insights into the enzyme catalysis and novel regulation mechanisms (MX3)	$20k	MX3 not yet available
CBF22/10 Allen (Canterbury)	X-ray absorption spectroscopy on MEX 1&2 and chemical mapping on the x-ray fluorescence NANO to investigate the phosphonic scid and sulfur modification of β-Ga_2O_3 surfaces (MEX, NANO)	$10k	MEX used as NANO unavailable
CBF23/1 Mace (Otago)	Establishing routine crystallographic fragment screening for MX3 Use (MX3)	$20k	MX3 not yet available
CBF23/2 Arcus and Hicks (Waikato)	Structural mechanisms of DNA binding and chromatin organisation of Lsr2 from *Mycobacterium* tuberculosis (MX3)	$20k	MX3 not yet available
CBF23/3 Marshall (Canterbury)	Unveiling the structure of heterogeneous catalysts using advanced diffraction and scattering methods (ADS)	$20k	ADS not yet available

Grant Applicant (Institution)	Project (beamline)	Award	Status
Total value		**$178.2k**	

The travel funding component of the Fund was launched in April 2022 and four grants were awarded this year. This funding enabled researchers to use facilities in the United States, Sweden, Japan and France (Table 5).

Table 5: Recipients of Capability Build Fund travel awards 2023/2024.

Applicant (Institution)	Beamline	Host synchrotron	Award
Fellner (Otago)	MX3	Stanford Synchrotron Radiation Lightsource, Stanford University, USA (SSRL)	$7.5k
Haverkamp (Waikato)	MEX	Swedish National Synchrotron Laboratory, Lund University, Sweden (MAX IV)	$7.5k
Pavlov (Canterbury)	MCT	European Synchrotron Radiation Facility, Grenoble, France (ESRF)	$7.5k
Alloo (Canterbury)	MCT	Super Proton ring-8 GeV synchrotron, Riken, Harima Science Park City, Japan (SPring-8) & ESRF	$3.75k
Total value			**$26.25k**

The scientific value of the Capability Build Fund will only be fully realised once the remaining four new beamlines are commissioned.

Additional support for students

The New Zealand Synchrotron Group provides support for students to attend the annual User Meeting held at the Australian Synchrotron, and the annual Synchrotron Radiation School run by the Asia Oceania Forum for Synchrotron Radiation Research (AOFSRR), of which NZSG is a member. Both events give the recipients opportunities to further enhance their knowledge of synchrotron science and meet a wide range of researchers from throughout the region.

Travel funding enabled four students to attend the most recent User Meeting, held in November 2023. Two students, Samantha Alloo (University of Canterbury) and Jie Wu (University of Auckland) were also selected to attend the AOF Synchrotron Radiation School at the Synchrotron Light Research Institute in Thailand in June 2023. Science and engineering graduate students and early career researchers from the entire Asia-Oceania region attend the school. The school offers a programme of seminars on the application of synchrotron science, together with practical sessions on how specific beamlines can be applied to a wide range of research.

Conclusion

This year has been another satisfying period for the NZSG and for New Zealand synchrotron science. The Australian Synchrotron is one of the best in the world. New Zealand’s partnership contributes to the capability of our science community to deliver world-class research, now and in the future.

Access to the Australian Synchrotron provides significant benefits to New Zealand researchers. The facility is the only one of its kind in Oceania and is the largest stand-alone scientific infrastructure in the southern hemisphere. With a sound science partnership between our two countries, Aotearoa New Zealand has access to all the benefits of this world class facility. The NZSG looks forward to the completion of the new beamlines and the additional science achievements that they will enable.

Despite many major achievements, we are yet to reap the full rewards of synchrotron science, and enabling access by more researchers will lead to long-term benefits for the research community, and Aotearoa New Zealand.

D K W Smith

Executive Officer

Secretariat

Annex 1: Publications by New Zealand researchers

New Zealand researchers published 38 peer-reviewed papers in the last year based on experiments on the Australian Synchrotron.

1. Sharma, S.K., Ahangari, H.T., Johannessen, B. J., Golovko, V.B. and Marshall, A.T. Au Cluster-derived Electrocatalysts for CO_2 Reduction. *Electrocatalysis* **14**, 611–623 (2023).
   DOI: 10.1007/s12678-023-00821-2
2. Scott, J.I., Adams, R.L., Martinez-Gazoni, R.F., Carroll, L.R., Downard, A.J., Veal, T.D., Reeves, R.J. and Allen, M.W. Looking Outside the Square: The Growth, Structure, and Resilient Two-Dimensional Surface Electron Gas of Square SnO_2 Nanotubes. *Small*, **19**: 2300520 (2023).
   DOI: 10.1002/smll.202300520
3. Huang, E. Y.-W., Kwai, B. X. C., Bhusal, R. P., Bashiri, G. and Leung, I. K. H. *Mycobacterium tuberculosis* Rv1916 is an AcetylCoABinding Protein, *ChemBioChem* **24**, e202300162 (2023)
   DOI: 10.1002/cbic.202300162
4. Sharma, S.K., Johannessen, B. J., Golovko, V.B. and Marshall, A.T. Electrochemical CO_2 Reduction on Au Cluster-based Electrodes: Investigating the Role of Nafion Ionomer. *J. Electrochem. Soc.* **170,** 076509 (2023)
   DOI: 10.1149/1945-7111/ace12e
5. Devkota, S.R., Aryal, P., Pokhrel, R., Wanting, J., Perry, A., Panjikar, S., Payne, R.J., Wilce, M.C.J., Bhusal, R.P. and Stone, M.J. Engineering broad-spectrum inhibitors of inflammatory chemokines from subclass A3 tick evasins. Nat Commun **14**, 4204 (2023).
   DOI: 10.1038/s41467-023-39879-3
6. Barnett, M.J., Pinheiro, J., Keown, J.R., Biboy, J., Gray, J., Lucinescu, I-W., Vollmer, W., Hirt, R.P., Simoes-Barbosa, A. and Goldstone, D.C. NlpC/P60 peptidoglycan hydrolases of *Trichomonas vaginalis* have complementary activities that empower the protozoan to control host-protective lactobacilli. *PLoS Pathogens*, **19**, e1011563 (2023)
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   10.1038/s41557-023-01277-z
8. Chan, J.R., Casey-Stevens, C.A., Le Ster, M., Shaib, A., Tadich, A., Cowie, B.C.C., Trodahl, H.J., Brown, S.A., Granville, S., Ruck, B.J., Garden, A.L. and Natali, F. Epitaxial growth of gadolinium and samarium thin films and their subsequent facile nitridation at ambient temperatures. *Applied Surface Science* **632**, 157550 (2023)
   DOI: 10.1016/j.apsusc.2023.157550
9. Pu, Y., Moseley, D., He, Z., Pitike, K.C., Manley, M.E., Yan, J., Cooper, V.R., Mitchell, V., Peterson, V.K., Johannessen, B., Hermann, R.P. and Cao, P. (Mg,Mn,Fe,Co,Ni)O: A rocksalt high-entropy oxide containing divalent Mn and Fe. *Science Advances* ***9,*** eadi8809 (2023)
   DOI: eadi8809
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    DOI: 10.3390/ijms241813738
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    DOI: 10.1016/j.str.2023.07.007
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Annex 2: Beamtime awarded

Fifty-seven New Zealand research projects were awarded time at the Australian Synchrotron between July 2023 and June 2024. The value includes travel and sample shipping funding. The list of researchers includes the applicants (principal investigators), associates, postdoctoral fellows and students.

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
1.	**Prof Emily Parker** Prof Geoff Jameson Dr Ron Ronimus Dr Andrew Sutherland-Smith Assoc Prof Wayne Patrick Dr David Comoletti Prof Vic Arcus Dr Joanna Hicks Chelsea Vickers Thomas Bird Vince Carbone Adele Williamson Alexandra Perry	VUW Massey AgResearch Massey VUW VUW Waikato Waikato VUW VUW AgResearch Waikato Waikato	MX2 / 2023-2 *Protein Structure and Function: AgResearch NZ, Ferrier Institute and Waikato, Victoria and Massey Universities*	Merit: 5 shifts 2-3 Jul and 29-30 Jul	$8,059
2.	**Prof Aaron Marshall** Dr Shailendra Sharma Prof Valdimir Golovko Prof Gregory Metha Dr Chang Wu	Canterbury Canterbury Canterbury Adelaide Canterbury	XAS / 2023-2 *Electrochemical behaviour of atomically precise clusters*	Merit: 9 shifts 6-9 Jul	$2,975
3.	**A/Prof Chris Squire** Dr Ghader Bashiri Dr Richard Kingston Assoc Prof Shaun Lott Dr David Goldstone	Auckland	MX2 / 2023-2 *Auckland Structural Biology 2023 CAP Program*	Merit: 6 shifts 8-9 July and 12-13 Aug	$5,551
4.	**Dr Fryderyk Lyzwa** Dr Daniel Steil Jeffrey Low Prof Dr Vasily Moshnyaga James Ferguson	Auckland Goettingen Auckland Goettingen Auckland	THz / 2023-2 *THz spectroscopy study of the charge, spin and structural orders in transition metal-oxide thin films and heterostructures*	Merit: 12 shifts 11-15 Jul	$2,423
5.	**Dr Matthias Fellner** Prof Kurt Krause Prof Brian Monk Dr Peter Mace Dr Adam Middleton Prof Catherine Day Helen Opel-Reading Dr Ashley Campbell Caleb Trimble Adrian Smith-Beech	Otago	MX2 / 2023-2 *University of Otago Structural Biology Group*	Merit: 5 shifts 12-13 Jul and 19-20 Aug	$8,892

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
	Prof Emily Parker Prof Geoff Jameson Dr Ron Ronimus Dr Andrew Sutherland-Smith Assoc Prof Wayne Patrick Dr David Comoletti Prof Vic Arcus Dr Joanna Hicks Chelsea Vickers Thomas Bird Vince Carbone Adele Williamson Alexandra Perry	VUW Massey AgResearch Massey VUW VUW Waikato Waikato VUW VUW AgResearch Waikato Waikato	MX1 / 2023-2 *Protein Structure and Function: AgResearch NZ, Ferrier Institute and Waikato, Victoria and Massey Universities*	Merit: 3 shifts 12-13 Jul	With # 1
6.	**Prof Jadranka Travis-Sejdic** Dr Xin Sun Dr Eddie Chan Yuhka Uda Jingwen Yang	Auckland	SAXS/WAXS / 2023-2 *Investigation of crystalline domains in transient organic electronics based on oligomers and polymers of 3-hexyl thiophene*	Paid: 3 shifts 13-14 Jul	$5,189
7.	**A/Prof Chris Squire** Dr Ghader Bashiri Dr Richard Kingston A/Prof Shaun Lott Dr David Goldstone	Auckland	MX1 / 2023-2 *Auckland Structural Biology 2023 CAP Program*	Merit 3 shifts 19-20 Jul	With # 3
8.	Prof Richard Haverkamp Olivia Buwalda Andrea Matinong Dr Max Plouviez Prof Benoit Guiysse	Massey	SAXS/WAXS / 2023-2 *Collagen Rehydration*	Paid: 3 shifts 3-4 Aug	$5,257
9.	**Prof Daniel Holland** Prof Matthew Watson Matt Rennie Dr James Robinson Abby van den Berg Prof Mike Clearwater A/Prof Justin Morgenroth	Canterbury Canterbury Canterbury Canterbury Vermont Waikato Canterbury	IM / 2023-2 *Visualizing the microscopic changes in water status within a tree stem in response to induced freeze-thaw cycles: An in-situ experiment on maple saplings*	Merit: 15 shifts 11-17 Aug	$3,169
10.	**Dr Shailendra Sharma** A/Prof Aaron Marshall Dr Chang Wu Alexander Heenan	Canterbury	XAS / 2023-3 *Identifying the Role of Nafion Binders for Electroche,mical CO2 Reduction using CuO Derived Catalysts*	Merit 9 shifts 28 Sep- 1 Oct	$3,695
11.	**Prof Emily Parker** Prof Geoff Jameson Dr Ron Ronimus Dr Andrew Sutherland-Smith A/Prof Wayne Patrick Dr David Comoletti Prof Vic Arcus Dr Joanna Hicks Chelsea Vickers	VUW Massey AgResearch Massey VUW VUW Waikato Waikato VUW	MX2 / 2023-3 *Protein Structure and Function: AgResearch NZ, Ferrier Institute and Waikato, Victoria and Massey Universities*	Merit: 5 shifts 4-5 Oct and 15-16 Nov	$4,127

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
12.	**A/Prof Chris Squire** Dr Ghader Bashiri Dr Richard Kingston A/Prof Shaun Lott Dr David Goldstone	Auckland	MX2 / 2023-3 *Auckland Structural Biology 2023 CAP Program*	Merit 6 shifts 5-6 Oct and 2-3 Dec	$7,784
13.	**Prof Jonathan Procter** Shannen Mills Anke Zernack Stuart Mead	Massey	MCT / 2023-3 *Exploring new minerals created in volcanic debris avalanche emplacement*	Merit: 9 shifts 6-9 Oct	$4,100
14.	**Prof Geoff Waterhouse** Dr Jun-Xi Wu Dr Yongfang Zhou Dr Shanghai Wei	Auckland	SXR / 2023-3 *Effect of Particle Size on the Local Electronic Structure of Layered Double Hydroxide Nanosheets for Photocatalytic Ammonia Synthesis*	Merit: 15 shifts 10-15 Oct	$2,990
15.	**Dr Matthias Fellner** Prof Kurt Krause Prof Brian Monk Dr Peter Mace Dr Adam Middleton Prof Catherine Day	Otago	MX2 / 2023-3 *University of Otago Structural Biology Group*	Merit: 5 shifts 10-11 Oct and 24-25 Nov	$4,438
16.	**Dr Fryderyk Lyzwa** Prof Joseph MacLennan Dr Daniel Steil Alex Barnes Jeffrey Low Stanley Tan Hazel Hogan-Murphy	Auckland Colorado Goettingen Auckland Auckland Auckland Auckland	THz / 2023-3 *THz and Infrared spectroscopy study of ferroelectric nematic liquid crystals*	Merit: 12 shifts 17-21 Oct	$2,932
17.	**Dr Daniel Sinclair** A/Prof Silvia Frisia Dr Andrea Borsato Gavin Holden Susan Al-Fahid	VUW Newcastle Newcastle VUW VUW	XFM / 2023-3 *Hydrological Response of the Southern Tropical Pacific to Rapid Glacial Climate Fluctuations*	Merit: 9 shifts 26-29 Oct	$3,000
	A/Prof Chris Squire Dr Ghader Bashiri Dr Richard Kingston A/Prof Shaun Lott Dr David Goldstone	Auckland	MX1 / 2023-3 *Auckland Structural Biology 2023 CAP Program*	Merit: 3 shifts 31 Oct-1 Nov	With # 13
18.	**Prof Richard Haverkamp** Dr Max Plouviez Prof Benoit Guiyesse Karla Wolmarans	Massey	MEX1 / 2023-3 *Metal complexation by phosphate in algae*	Merit: 9 shifts 16-19 Nov	$3,590
19.	**A/Prof Gabor Kereszturi** Maia Kidd Shannen Mills Prof Jonathan Procter Emmy Scott Dr Ben Kennedy	Massey Massey Massey Massey Massey Canterbury	MCT / 2023-3 *Linking high-resolution 3D micro-structures with mechanical properties in volcanic rocks*	Preferred: 6 shifts 17-19 Nov	$4,160

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
20.	**Dr Grant Pearce** Dr Jodie Johnston Prof Ren Dobson Dr Tim Allison Dr Christoph Goebl Dr Ali Nazmi Dr Vaneesa Morris Dr Fiona Given Irene Antony	Canterbury	BioSAXS / 2023-3 *University of Canterbury SAXS Proposal* BioSAXS was unavailable – 3 shifts of SAXS/WAXS time provided instead 21-22 Nov	Merit: 6 shifts 21-23 Nov	$2,757
21.	**Dr Ingrid Ukstins** Mila Huebsch Dr Joali Paredes-Mariño David Adams	Auckland	MCT / 2023-3 *Quantifying outgassing and decompression mechanisms causing extreme explosivity in the Hunga volcanic eruption*	Merit: 12 shifts 22-26 Nov	$3,459
22.	**Dr Joanna Hicks** Prof Geoff Jameson Prof Vic Arcus Prof Emily Parker Dr Gerd Mittelstaedt Dr Elena Harjes Tracy Hale Dr Stefan Harjes Dong Luo Jack McGarvie Florian de Pol Bruce Chilton Hamish Dunham	Waikato Massey Waikato VUW VUW Massey Massey Massey Massey Waikato VUW Massey ESR	SAXS/WAXS / 2023-3 *Protein complexes and conformational change*	Merit: 6 shifts 22-24 Nov	$5,744
23.	**A/Prof Tilo Soehnel** Dr Samuel Yick Marco Vas Dr Mohammed Abdelbassit Qinfen Gu Lanyi Chi	Auckland Auckland Auckland Auckland ANSTO Auckland	PD / 2023-3 *High-resolution crystal structure determination of complex transition metal oxide and novel cluster systems*	Rapid Access Merit: 2 hr 23 Nov	$0
24.	**Prof Martin Allen**	Canterbury	MEX2 / 2023-3 *Use of X-ray Absorption Spectroscopy to investigate the effectiveness of sulfur treatments in controlling the surface electronic properties of SnO_2, ZnO and beta-Ga_2O_3*	Preferred: 9 shifts 23-26 Nov	$3,100
	Dr Matthias Fellner Prof Kurt Krause Prof Brian Monk Dr Peter Mace Dr Adam Middleton Prof Catherine Day	Otago	MX1 / 2023-3 *University of Otago Structural Biology Group*	Merit: 3 shifts 24-25 Nov	With # 16

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
	Prof Emily Parker Prof Geoff Jameson Dr Ron Ronimus Dr Andrew Sutherland-Smith A/Prof Wayne Patrick Dr David Comoletti Prof Vic Arcus Dr Joanna Hicks Chelsea Vickers	VUW Massey AgResearch Massey VUW VUW Waikato Waikato VUW	MX1 / 2023-3 *Protein Structure and Function: AgResearch NZ, Ferrier Institute and Waikato, Victoria and Massey Universities*	Merit: 3 shifts 6-7 Dec	With # 12
25.	**Prof Richard Haverkamp** Prof Benoit Guieysse Karla Wolmarans Dr Maxence Plouviez	Massey	MEX2 / 2024-1 *The role of phosphate accumulation in algae in metal accumulation*	Preferred: 6 shifts 8-10 Feb	$0
26.	**Dr Matthias Fellner** Prof Kurt Krause Joel Tyndall Prof Catherine Day Dr Nathan Kenny A/Prof Peter Mace Dr Adam Middleton Prof Brian Monk Dr Daniel Pletzer Dr George Randall Adrian Smith-Beech	Otago	MX2 / 2024-1 *University of Otago Structural Biology Group*	Merit: 5 shifts 13-14 Feb and 13-14 Apr	$6,986
27.	**Prof Emily Parker** Prof Geoff Jameson Dr David Comoletti Dr Vince Carbone Dr Andrew Sutherland-Smith A/Prof Wayne Patrick Adele Williamson Prof Vic Arcus Dr Joanna Hicks Dr Chelsea Vickers	VUW Massey VUW AgResearch Massey VUW Waikato Waikato Waikato VUW	MX2 / 2024-1 *Protein Structure and Function: AgResearch NZ, Ferrier Research Institute and Waikato, Victoria and Massey Universities*	Merit: 5 shifts 16-17 Feb and 18-19 Apr	$12,786
28.	**A/Prof Chris Squire** Dr Ghader Bashiri Dr Richard Kingston A/Prof Shaun Lott Dr David Goldstone	Auckland	MX1 / 2024-1 *Auckland Structural Biology 2024 CAP Program*	Merit: 3 shifts 21-22 Feb	$6,536
29.	**A/Prof Franck Natali** A/Prof Ben Ruck Dr Jay Chan Dr Caitlin Casey-Stevens Kiersten Kneisel Dr Anna Garden	VUW VUW VUW Otago VUW Otago	SXR / 2024-1 Spectroscopic understanding of the facile dissociation of molecular nitrogen at room temperature on crystalline lanthanide surfaces	Merit: 15 shifts 28 Feb-4 Mar	$4,668
30.	**Dr Fryderyk Lyzwa** Hazel Hogan-Murphy Stanley Tang Alex Barnes	Auckland	THz / 2024-1 *Cryogenic THz Reflectivity Measurements of Transition Metal(-Oxide) Thin Films*	Merit: 9 shifts 29 Feb-3 Mar	$1,890

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
31.	**Dr Christopher Larsen** Prof James Wright Connal Finlay Conor Doran Yongjiang Chen	Auckland	XAS / 2023-3 *Probing the Origin of Solvent Polarity-Dependent Catalytic Activity in New Pd(PYA) Hydrogenation Catalysts Using Pd K-Edge XANES and EXAFS* **Rescheduled from 2023-3**	Merit: 6 shifts 5-7 Mar	$2,845
32.	**Dr Samuel Yick** Prof Tilo Soehnel Marco Vas A/Prof Clemens Ulrich Dr Qinfen Gu Joseph Vella	Auckland Auckland Auckland NSW ANSTO Auckland	PD / 2024-1 *Investigating the low-temperature structural anomaly in the skyrmion hosting material Cu_2OSeO_3 upon Co doping*	Merit: 6 shifts 5-7 Mar	$2,839
33.	**Dr William Kelton** Dr Adele Williamson	Waikato	BioSAXS / 2024-1 *Human antibody dynamics and the temperature-dependent structural behaviour of extremophile DNA-repair enzymes* **Rescheduled to 2024-2**	Merit: 3 shifts 6-7 Mar	$0
34.	**Dr Lucille Chapuis** A/Prof Craig Radford Emily Leedham Jimmy Rapson	Auckland	MCT / 2024-1 *Revealing hearing in crustaceans: sound-induced motion in 4D*	Merit: 9 shifts 8-11 Mar	$4,100
35.	**Dr Jodie Johnston** Prof Ren Dobson Dr Michael Currie Dr Ngoc Ang Thu Ho Michelle Klein Dr Grant Pearce Dr Ali Reza Nazmi Dr Tim Allison Dr Fiona Given	Canterbury	BioSAXS / 2024-1 *University of Canterbury: Protein Chemistry Collective Projects BioSAXS* **Rescheduled to 2024-2**	Merit: 6 shifts 8-10 Mar	$996
36.	**A/Prof Vladimir Golovko** Prof Aaron Marshall Dr Shailendra Sharma Michelangelo Santos Connor Timms Alex Heenan	Canterbury	MEX2 / 2024-1 *Stability of metal-ligand bonds in metal clusters upon catalyst fabrication, activation, and testing*	Merit: 9 shifts 8-11 Mar	$4,471
	Dr Matthias Fellner Prof Kurt Krause Joel Tyndall Prof Catherine Day Dr Nathan Kenny A/Prof Peter Mace Dr Adam Middleton Prof Brian Monk Dr Daniel Pletzer	Otago	MX1 / 2024-1 *University of Otago Structural Biology Group*	Merit: 3 shifts 9-10 Mar	With #30

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
37.	**Dr Shailendra Sharma** Prof Aaron Marshall Dr Chang Wu Dr Vedran Jovic Alexander Heenan	Canterbury Canterbury Canterbury GNS Science Canterbury	XAS / 2024-1 *Unravelling the Structure of M-doped RuO_2 (M = Mn, Ni, Fe and Ir) Under Oxygen Evolution Reaction*	Merit: 6 shifts 13-15 Mar	$2,483
	Prof Emily Parker Prof Geoff Jameson Dr David Comoletti Dr Vince Carbone Dr Andrew Sutherland-Smith A/Prof Wayne Patrick Adele Williamson Prof Vic Arcus Dr Joanna Hicks Dr Chelsea Vickers	VUW Massey VUW AgResearch Massey VUW Waikato Waikato Waikato VUW	MX1 / 2024-1 *Protein Structure and Function: AgResearch, Ferrier Research Institute and Waikato, Victoria and Massey Universities*	Merit: 3 shifts 14-15 Mar	With #31
38.	**A/Prof Michael Rowe** Prof Kathy Campbell Dr Andrew Langendam Ema Nersezova Barbara Lyon	Auckland Auckland ANSTO Auckland Auckland	XFM /2024-1 *Evidence of trace metal biogenicity in hot springs: preparing for a Mars sample return mission II*	Merit: 12 shifts 14-18 Mar	$1,842
	A/Prof Chris Squire Dr Ghader Bashiri Dr Richard Kingston A/Prof Shaun Lott Dr David Goldstone Ben Krinkel Evie Mansfield	Auckland	MX2 / 2024-1 *Auckland Structural Biology 2024 CAP Program*	Merit: 5 shifts 16-17 Mar and 14-15 Apr	With #32
39.	**Prof Richard Haverkamp**	Massey	MEX1 / 2024-1 *Rare earth accumulation by microalgae*	Preferred: 6 shifts 22-24 Mar	$2,870
40.	**Dr Joanna Hicks** Prof Geoff Jameson Prof Vic Arcus Prof Emily Parker Dr Gerd Mittelstaedt Florian de Pol Dong Luo	Waikato Massey Waikato VUW VUW VUW Massey	BioSAXS / 2024-1 *Protein complexes and conformational change* **Rescheduled to 2024-2**	Merit: 6 shifts 22-24 Mar	N/A
41.	**Dr Ghader Bashiri** Dr Richard Kingston A/Prof Shaun Lott Dr Jamie Taka Daniel Body Dr Stephanie Dawes George Randall Ishana Ratti	Auckland	BioSAXS / 2024-1 Solution *investigation of proteins with biomedical significance*	Merit: 6 shifts 5-7 Apr	$0
42.	**Prof Tilo Soehnel** Mark Appletree Marco Vas Lanyi Chi	Auckland	MEX1 / 2024-1 *Exploring the effect of Mechanical Milling on Rare Earth-Alkaline Earth Doped Manganites*	Preferred: 3 shifts 9-10 Apr	$4,407

#	Researchers	Institutions	Beamline / Cycle ***Project***	Access	Value
43.	**Dr Matthias Fellner** Dr Ashish Sethi Dr George Randall Adrian Smith-Beech	Otago ANSTO Otago Otago	BioSAXS / 2024-1 University of Otago Structural Biology Group BioSAXS **Rescheduled from 2023-3**	Preferred: 6 shifts 10-12 Apr	$3,348
44.	**Dr Samuel Yick** Prof Tilo Soehnel Prof Peng Cao Dr Krystina Lamb Dr Shanghai Wei Ryan Silk Mohammed Abdelbassit Branwen Hastings	Auckland Auckland Auckland ANSTO Auckland Auckland Auckland Auckland	MEX2 / 2024-1 *Investigating the effects of doping in the Mg-ion battery cathode material - $Mo_6S_{(x-8)}Se_{(x)}$ $_{(x\,=\,0\,-\,8)}$ and $Mo_4Ru_2Se_8$*	Merit: 6 shifts 11-13 Apr	$4,407
45.	**Dr Courtney Ennis** A/Prof Samaranda Marinescu Yashna Khakre Jake Gilchrist	Otago Southern California Otago	THz / 2023-3 *Far Infrared Investigation of the Stacking Configurations of 2D Dithiolene-based Metal−Organic Frameworks for Hydrogen Evolution*	Paid: 3 shifts 12-13 Apr	$1,492
46.	**Dr Duane Harland** Dr Marina Richena Dr Jeffrey Plowman Dr Simon James Dr Santanu Deb-Choudhury Kim Parker	AgResearch AgResearch AgResearch ANSTO AgResearch AgResearch	MEX2 / 2024-1 *Feasibility of mapping changes in sulfur-based protein cross-links in materials using medium energy X-ray absorption microspectroscopy (sulfur k-edge)*	Merit: 9 shifts 18-21 Apr	$2,819
47.	**Prof Richard Haverkamp** Karla Wolmarans Andrea Matinong Olivia Buwalda	Massey	MCT / 2024-1 *Collagen surgical scaffold structures*	Preferred: 6 shifts 19-21 Apr	$1,358
48.	**Prof Aaron Marshall** Prof Daniel Holland Prof Christina Roth Prof Geoff Waterhouse Dr Shailendra Sharma Campbell Tiffin	Canterbury Canterbury Bayreuth Auckland Canterbury Canterbury	IM / 2024-1 *Imaging hydrogen and oxygen bubbles within porous transport layers to optimise the structure of low-cost AEM water electrolysers*	Merit: 6 shifts 27-29 Apr	$2,898
49.	**Dr Jun-Xi Wu** Prof Geoff Waterhouse Dr Ziyun Wang Dr Yongfang Zhou Dr Shanghai Wei Dr Kai Sun	Auckland	MEX1 / 2024-2 *Surface reconstruction of layered double hydroxide catalysts during the oxygen evolution reaction in alkaline media*	Merit: 9 shifts 31 May- 3 Jun	$2,340
50.	**Dr Mohammed Abdelbassit** Prof Tilo Soehnel Dr Samuel Yick Marco Vas Lanyi Chit	Auckland	MEX1 / 2024-2 *XANES studies on the coordination geometries and oxidation states of novel transition metal oxide clusters*	Merit: 6 shifts 4-6 Jun	$2,094

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
51.	**Dr Marina Richena** Dr Simon James Dr Duane Harland Dr Santanu Deb-Choudhury Kim Parker Dr Jeffrey Plowman Georgia Rutter	AgResearch ANSTO AgResearch AgResearch AgResearch AgResearch Otago	MEX2 / 2024-2 *NZ - preferred access MEX2*	Preferred: 6 shifts 5-7 Jun	$931
52.	**Prof Tilo Soehnel** Dr Samuel Yick	Auckland	MEX2 / 2024-2 *XANES studies of ruthenium in novel transition metal oxide clusters*	Preferred: 3 shifts 7-8 June	$2,099
53.	**Dr Anke Zernack** Prof Jonathan Procter Shannen Mills Joseph Fleming Kavashan Ranatunga Prof Colin Walker Prof Jason Ingham A/Prof Steve Matthews Dr Enrique del Ray	Massey Massey Massey Massey Auckland VUW Auckland Auckland Auckland	MCT / 2024-2 *Exploring the 3D microtextural characteristics of rhyolite pumice clasts and powders from the Taupō Volcanic Zone, New Zealand*	Merit: 3 shifts Preferred: 6 shifts 13-16 Jun	$5,309
54.	**Dr Ingrid Ukstins** Mila Huebsch Dr Annaleise Klein Dr Joali Pareses-Mariño David Adams Annahlise Hall	Auckland Auckland ANSTO Auckland Auckland Auckland	IRM /2024-2 *Quantifying eruption pressure conditions from tephra glass volatile contents of the 2021-2022 eruption of Hunga Volcano, Tonga*	Merit: 12 shifts 13-17 Jun	$4,362
55.	**Dr Matthias Fellner** Prof Kurt Krause Joel Tyndall Prof Catherine Day Dr Nathan Kenny A/Prof Peter Mace Dr Adam Middleton Prof Brian Monk Dr Daniel Pletzer Helen Opel-Reading Dr Ashley Campbell Dr George Randall Haziq Anwar	Otago	MX2 / 2024-2 *University of Otago Structural Biology Group*	Merit: 5 shifts 20-21 Jun and 2-3 Aug	$8,142
56.	**Prof Emily Parker** Prof Geoff Jameson Dr David Comoletti Dr Vince Carbone Dr Andrew Sutherland-Smith A/Prof Wayne Patrick Adele Williamson Prof Vic Arcus Dr Joanna Hicks Dr Chelsea Vickers	VUW Massey VUW AgResearch Massey VUW Waikato Waikato Waikato VUW	MX2 / 2024-2 *Protein Structure and Function: AgResearch NZ, Ferrier Research Institute and Waikato, Victoria and Massey Universities*	Merit: 5 shifts 21-22 Jun and 18-19 Aug	$7,595

#	Researchers	Institutions	Beamline / Cycle *Project*	Access	Value
57.	**A/Prof Chris Squire** Dr Ghader Bashiri Dr Richard Kingston A/Prof Shaun Lott Dr David Goldstone	Auckland	MX2 / 2024-2 *Auckland Structural Biology 2024 CAP Program*	Merit: 5 shifts 26-27 Jun and 10-11 Aug	$4,054

New Zealand researchers collaborated on four Australian-led projects using the MX beamlines. All New Zealand researchers were from Canterbury University.

Researchers	Beamline / Cycle *Project*	Access
Prof Paul Kruger Nathan Harvey-Reid Sydney Koia Chris Fitchett Brooke Matthews	MX1 and MX2 / 2024-full year *Hybrid Ultramicroporous Materials, Metal Organic Frameworks and Magnetic Coordination Cages*	Merit: MX1 1 shift, MX2 1 shift various dates
Dr Tim Allison Viet Anh Hoang Dr Ngoc Anh Thu Ho	MX / 2024 full year *Exposing the intricate interactions of membrane-associated bacterial machinery*	Merit: MX2 5 shifts various dates
Dr Jodie Johnson Dr Fiona Given Dr Ngoc Anh Thu Ho Michelle Klein	MX1 and MX2 / 2024-full year *Understanding Enzymes: Inhibition, Drug Discovery, Promiscuity, Allostery and Engineering Biocatalyts*	Merit: MX1 1 shift, MX2 5 shifts various dates
A/Prof Ren Dobson Dr Heather Shearer David Wood Mackenzie Aitken Ashleigh Johns Irene Antony Dr Michael Currie Michael Newton-Vesty Jovarn Sullivan Guyan Abeysekera	MX2 / 2024-full year *Membrane transporters, Transcription factors, Fungal effector proteins, enzymes, and phage proteins.*	Merit: MX2 9 shifts various dates

PREPARING FOR THE FUTURE

Both the synchrotron access arrangements with Australia, and the New Zealand government funding subsidy are due for reconsideration within the next two years. The research sector is facing significant challenges, and the current financial climate makes participation in synchrotron science increasingly difficult for some members of the research community, particularly small organisations. Securing future funding and access arrangements will be managed in tandem by NZSG over the coming year to ensure the best outcomes for the New Zealand research community.

The current funding and access arrangements cease on 30 June 2026. Until that time, directors expect that the company will be able to function normally and deliver the usual range of support offered to the research sector.

The company is beginning to plan for renewal of the access arrangement with ANSTO. By 2026, all the new beamlines will be in operation. Although there will be some carry-over of guaranteed access rights to the new beamlines, continued merit access to both the original and new beamlines will be dependent on a new access agreement.

The Board is conscious of changes in the research sector in the eight years since the current agreement was first proposed. One aspect of the current arrangement that is disappointing is that most of the CRIs and other research establishments are not included. There has been little use of the paid access facility that NZSG coordinates for the country, yet there is interest from individual researchers in organisations outside the company. The NZSG now has an opportunity to promote synchrotron science and the Australian Synchrotron to the wider research community.

Any new arrangement will need to consider changes or initiatives arising from the current reviews of the science and university systems. Enabling access to, and investment in, key research infrastructure will undoubtedly be considered in this process. The NZSG made a submission to the Strategic Science Advisory Group (SSAG) during the early consultation period. Some revision of the funding model to lower the institutional burden will be needed to ensure ongoing and equitable access.

The most significant risk faced by synchrotron science in New Zealand is the impact that the current financial status of the tertiary sector could have on the institutions' future ability to participate in the access programme. The financial challenges faced by some universities already creates uncertainty around their participation in the current programme. Although the eight NZSG shareholders must meet their contractual obligations, some regular users of the Australian Synchrotron are affected by the cost-cutting measures of their universities. While no institutions have prevented researchers from applying for beamtime, in some cases departmental budget constraints have resulted in reduced demand.

The NZSG is committed to a smooth transition from the current access and funding arrangements to enable synchrotron science to continue to be applied for the benefit of the research community and the whole country.

THE AUSTRALIAN SYNCHROTRON

A synchrotron is a cyclic particle accelerator that generates an extremely intense beam of electromagnetic radiation that can be used for scientific experiments. The light is channelled down several ‘beamlines’, each optimised for a specific technique, which are grouped into three broad categories: diffraction (and scattering), spectroscopy and imaging.

How synchrotrons work

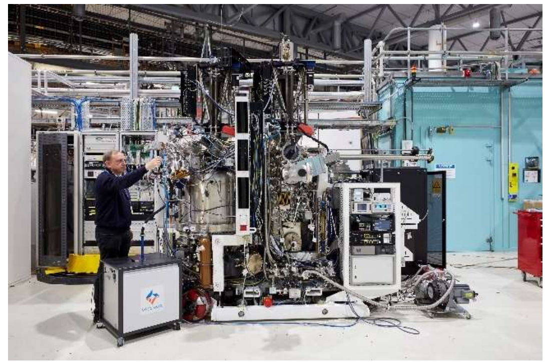
Above: Electrons are produced an electron gun (1) and accelerated in the linear accelerator (LinAc), (2). The electrons then progress into the smaller ‘booster’ ring (3), where they are further accelerated to their final velocity (99.99% of the speed of light, a kinetic energy of 3.0 GeV). At this point they are ‘injected’ into the larger storage ring (4), where they circulate for a period of hours to days. The electron beam is steered and focused by magnetic fields. At each point where the beam is deflected, electromagnetic radiation is produced tangential to the beam path. ‘Insertion devices’, undulators and wigglers, are periodic magnet structures that increase the radiation flux by up to five orders of magnitude. The radiation produced can be used in many different types of techniques and applications. The light is channelled from the ring down several ‘beamlines’ (5), each of which is optimised for a particular technique and controlled via experimental ‘hutches’ with end stations (6).

Australian Synchrotron beamlines and their applications

The Australian Synchrotron has 14 beamlines, 10 of which have been operating for some time and four that commenced operations in the past two years. A further four are under construction and will be available for users progressively from 2025.

Original beamlines

- **Macromolecular crystallography (MX1)** was the first operational beamline and began accepting general users in January 2008. This technique uses x-ray diffraction to determine the structure of proteins and is used in drug design and understanding biochemical interactions.
- **Infrared spectroscopy and microscopy (IR)** also came online in early 2008. The beamline features two end stations: an FTIR spectrometer (THz) and an infrared microscope (IRM). The beamline is ideally suited to the analysis of microscopic samples, such as small particles and thin layers within complex matrices, or thin coatings on surfaces.
- **Powder diffraction (PD)** began taking general users in February 2008 and was fully operational by May 2008. This beamline is a general purpose diffraction beamline with several sample environments for observing changes in materials structure as a function of temperature, pressure, time, or other environmental conditions.



- The **soft x-ray absorption spectroscopy (SXR)** beamline was available for general users from late 2008. It operates at low x-ray energies and is most useful for surface studies. Left: the soft x-ray spectroscopy (SXR)beamline.
- The **x-ray absorption spectroscopy (XAS)** beamline became available to general users from January 2009. This technique is useful for probing elemental valence states and determining the local structure around an atomic species of interest.
- **Small-angle x-ray scattering**, combined with **wide-angle x-ray scattering (SAXS/WAXS)** is a useful technique for determining large scale (1-100 nm), short-range order in materials. This beamline came online at the beginning of 2009.
- The commissioning of the second **macromolecular crystallography (MX2)** beamline was completed in mid-2009. It complements the original MX1 crystallography beamline and can measure micron-sized crystals and other weakly-scattering or hard to crystallise systems.
- The **x-ray fluorescence microspectroscopy (XFM)** beamline was also completed in early 2009. This beamline combines the high spatial resolution of a microscope with the information that can be gleaned through x-ray fluorescence spectroscopy.
- The **imaging and medical (IM)** beamline was available from 2013. It was redesigned from its original concept to include a 150 m long enclosure which extends well outside the Synchrotron building. It has the world's widest x-ray beam and can provide dynamic 3D x-ray imaging at very high resolution. In addition to its medical applications, it has been used by geoscientists for tomography studies.

New operational beamlines

- The new **micro-computed tomography (MCT)** beamline commenced user operations in September 2022. Micro-computed tomography opens a window on the micron-scale 3D structure of a wide range of samples relevant to many areas, including life sciences, materials engineering, anthropology, palaeontology and geology. The beamline delivers high-throughput and dynamic micro-CT down to submicron resolution. A key feature is the speed of data collection, for both applications where many samples are imaged, and experiments where a single specimen is imaged many times to observe dynamic responses to temperature, pressure, strain or other changing environmental conditions.
- The two new **medium energy x-ray absorption spectroscopy (MEX1 and MEX2)** beamlines commenced operation in November 2022 and April 2023 respectively. Two independently operated end-stations provide medium energy absorption spectroscopy optimised for cutting-edge applications in biological, agricultural and environmental science. They cover an energy range not previously available to Australian and New Zealand researchers, allowing x-ray absorption spectroscopy measurements of very important elements such as sulphur, phosphorus, silicon and chlorine. Applications include environmental studies of inorganic, organophosphate and organochlorine pollutants, water pollution, plant growth, micro-nutrient transport and soil salinity, as well as studies of biomineralisation.
- The new **biological small angle x-ray scattering (BioSAXS)** beamline commenced user operations in March 2024. It was specifically designed for structural biology and has equal or better specifications than the current SAXS/WAXS beamline, combined with specialised

facilities for protein work, giving scientists and industry unprecedented access to the most sophisticated tools available.

Applications of the BioSAXS include better resolution in the study of the structure of larger biomedical molecules involved in the critical functions of human cells, such as proteins and the nucleic acids that comprise the genetic material, and the study of interactions between biological molecules and new drugs.

New beamlines under construction

Prior to COVID, all the new beamlines were on track to be completed on time. However, shutdowns in Melbourne from early 2020 resulted in the periodic closure of the Australian Synchrotron. Similar shutdowns in Europe where important components were being manufactured also caused delays.

During that period there were restrictions on people entering Australia which has affected equipment installation and more recently the cancellation of a contract to source an insertion device from Russia and securing an alternative has further complicated construction plans.

The net effect is that the first four beamlines were about 9 months behind the original completion date and the remaining four beamlines will be 12-18 months late.

High performance macromolecular crystallography (MX3)

Expected availability: Jun 2025

This ultra-high flux micro-focus macromolecular crystallography beamline is intended for small and/or poorly diffracting samples. The most important targets for the design of novel drugs include difficult large assemblies, which rarely produce crystals of sufficient size for analysis using traditional macro or micro-molecular crystallography beamlines. The MX3 beamline will enable the study of sub-5μm crystals, providing a state-of-the-art high-throughput facility for researchers to study very small, weakly diffracting crystals of protein fragments and solution studies of protein fragments.

Applications include in-membrane proteins and receptors; virology; and materials science. The beamline will take advantage of the latest developments in high-throughput crystallography, including robot handling of 96-well crystallisation plates.

Advanced diffraction and scattering (ADS1 and AD2)

Expected availability: ADS1 Jul 2025 & ADS2 Jun 2026

The ADS beamline will also have two independent end-stations providing capabilities previously unavailable in Australasia with two high energy beamlines for polychromatic and monochromatic x-ray diffraction and imaging. Applications include studies of mineral formation and recovery under extreme conditions of temperature and pressure; non-destructive detection of cracking, fractures, textures, strains and deformations in large, manufactured objects across the energy, automotive, transport, defence and aerospace sectors; maintenance and component failure studies of engineering infrastructure; and studies of corrosion and cracking in aluminium alloys used in aircraft and marine platforms

X-ray fluorescence nanoprobe (NANO)

Expected availability: Feb 2026

The multimodal nanoprobe beamline will be optimised for fluorescence detection, allowing the mapping of metals inside samples with extremely high resolution and sensitivity. It will have three operating modes: high resolution mapping (80 nm), high-flux mapping (160 nm resolution) and spectroscopy (160 nm resolution).

The nanoprobe is useful for a range of applications in physics, chemistry, biology, nutrition and health, geosciences, engineering, environmental research, soil science, agriculture, cultural heritage, and materials science.

Above: the Australian Synchrotron facility

History of the Australia/New Zealand Synchrotron partnership

The Australian Synchrotron has become an essential tool for many researchers and has deepened a strong and mutually beneficial partnership with Australian scientists. Moreover, New Zealand's partnership with the Australian more broadly enhances science infrastructure in the Australasia region.

In 2006 the Victorian State government invited New Zealand to contribute to construction of beamlines at the newly built synchrotron facility in Melbourne. This contribution was jointly funded by a consortium of Universities and CRIs and a substantial capital grant from the New Zealand government (a 50:50 split), who could see the benefits of synchrotron science. The consortium formed NZSG to hold shares in the synchrotron on their behalf, represent them in governance matters, manage access to the facility, and promote synchrotron science to researchers.[6]

The New Zealand Synchrotron Group was one of ten foundation investors, each of whom has contributed A$5 million towards the initial suite of beamlines. This investment secured preferred (as-of-right) access for each foundation investor, spread over all the beamlines, in addition to unrestricted access to the merit beamtime pool. The preferred access arrangements for foundation investors ceased in August 2013.

To keep pace with the rest of the world, a beamline expansion programme, BRIGHT, was initiated. Contributing institutions, including New Zealand via NZSG, have exclusive access to these new beamlines for five years. Again, this demonstrates the benefit of the partnership to New Zealand. New Zealand invested in these beamlines knowing the full benefit would accrue after 2026. The new beamlines add significant capacity and new capability to the Australian Synchrotron.

New Zealand agreed to make an annual payment of A$1.5 million (plus CPI adjustment) towards the cost of access and contribute A$12 million towards the cost of the new beamlines. Access and capital costs are equally shared by the New Zealand research sector and the government. The government's A$6 million contribution was paid to ANSTO during the 2017/18 financial year. The sector's share was paid in five instalments, the last of which was made in 2022/23.

Due to New Zealand's contribution to funding of the new beamlines and the ongoing operations of the Synchrotron, an increase in the amount of merit beamtime was secured for New Zealand researchers. Access to the original ten beamlines increased from 201 shifts to 267 shifts per year.

In addition, proportionate rights to the merit and preferred access shifts to the new beamlines were secured. The agreement expires in June 2026. The agreement also guaranteed that the new

[6] In addition to the government of the State of Victoria, consortia representing Australian research groups also became shareholders.

BioSAXS beamline, which has capability of particular interest to New Zealand researchers, would be one of the first beamlines to be added to the facility.

The New Zealand research community has been a significant partner in the Australian Synchrotron since its inception in 2007. The Synchrotron is overseen by a Stakeholders Committee that monitors operations, budget and development and provides advice to ANSTO. New Zealand, as the largest single contributor towards the cost of the new beamlines and a significant user group, is a key stakeholder.

The NZSG board appointed its Executive Officer, Dr Don Smith, as the company's representative on the Stakeholders Committee. Dr Smith is also the contact person for day-to-day matters associated with access arrangements and user liaison with ANSTO.

The ANSTO and NZSG agreed to reduce the annual contribution towards the Synchrotron's operating costs for three years from 2020/21 to assist with cash flow during the COVID pandemic. Now that the payments towards the new beamlines have ceased, the annual operating cost payment has been increased for the final three years of the funding and access agreement so that the full amount will be paid.

By virtue of their participation in the joint funding arrangement with the government, researchers and students from the Universities of Auckland, Canterbury, Otago and Waikato, Auckland University of Technology, Massey University, Victoria University of Wellington and AgResearch are eligible to apply for subsidised merit beamtime on the Australian Synchrotron. Researchers from other organisations can apply for commercial access with assistance from NZSG. The New Zealand Synchrotron Group would like more of our researchers have access to this remarkable asset.

CORPORATE GOVERNANCE

Board composition

The company operates with a board comprising up to five directors, including an independent Chair. The inaugural Chair, Dr Garth Carnaby retired in November 2023 and was replaced by Professor Brett Cowan. The board vacancy created by Dr Carnaby's retirement has not yet been filled.

The Directors during the period 1 July 2023 to 30 June 2024 were:

- Dr Garth Carnaby, Chair (retired on 24 Nov 2023)
- Professor Brett Cowan, Auckland University of Technology (Chair from 24 Nov 2023)
- Professor Catherine Day, University of Otago
- Emeritus Professor Geoffrey Jameson, Massey University
- Professor James Metson, The University of Auckland

Indemnities and insurance

The board has taken Directors and Officers Liability Insurance of up to $6 million with New Zealand Insurance.

Attendance at Board meetings

The following table shows the attendance at meetings of the board for each director and the fees paid.

Director	Meetings held during the year	Meetings attended	Fees paid
Dr Garth Carnaby	4	4	$3,600
Professor Brett Cowan	7	7	$5,250
Professor Catherine Day	7	7	-
Emeritus Professor Geoffrey Jameson	7	7	-
Professor James Metson	7	7	-

Donations

The company did not make any donations during the period from establishment up to 30 June 2024.

Interests register

During the course of its normal business activities to support the development of synchrotron science, the company provides assistance towards the travel costs for research staff from its shareholders. The practice at meetings of the board is for directors from organisations who are receiving financial support to declare an interest and to refrain from voting on relevant matters. The following significant entries relating to the directors were recorded in the Interests Register during the year.

Director	Organisation/Entity	Nature of Interest
Dr GA Carnaby		
Shares held	GA Carnaby & Associates Ltd	Controlling majority
Beneficiary of Trusts	Carnaby Trust	Trustee and discretionary beneficiary
	National Provident Fund	Annuity/Defined benefit
Offices Held	Dodd-Walls Centre of Research Excellence	Chair
	BioResource Processing Alliance	Chair
	Wool Industry Research Ltd	Chair

Director	Organisation/Entity	Nature of Interest
Professor BR Cowan		
Offices held	Auckland University of Technology	Pro Vice-Chancellor and Dean
	ESR	GM and Chief Scientist
	Cowan Consulting Ltd	Director and shareholder
	Jatby Investments Ltd	Director and shareholder
	Matai Medical Research Institute	Trustee
	Atanga Trust	Trustee
Other	Financial Markets Authority	Daughter (Jenika Phipps) has a lead role in sustainability reporting
Professor CL Day		
Offices held	University of Otgao	Employee
	Maurice Wilkins CoRE	Member - AI
Shares held	Fairholm Farming Ltd	Minority shareholder
Emeritus Prof GB Jameson		
Shares held	Tower Ltd	Minority shareholder
Offices held	Massey University	Emeritus Professor
	Asian Crystallographic Association	Vice-President
Other interests	Te Manawa Museums Trust Board	Board member
	Science Centre Trust, Palmerston North	Secretary
	Riddett Institute	Member - PI
	MacDiarmid Institute	Member - AI
	Maurice Wilkins Centre	Member - AI
Prof JB Metson		
Shares held	Vector Energy	Minority shareholder
Offices held	University of Auckland	Strategic Advisor Newmarket Campus
	Dodd Walls Centre	Board Member
	Ngā Pae o te Maramatanga	Board Member
	Te Titoki Mataroa	Board Member
	Riddet Institute	Board Member
	Research and Education Advanced Network New Zealand (REANNZ)	Director
	Rotary Science & Technology Forum Trust	Member

NEW ZEALAND
SYNCHROTRON GROUP

New Zealand Synchrotron Group Limited

Financial Statements

for the year ended 30 June 2024

Contents

Directors

B R Cowan (Chair)
C L Day
G B Jameson
J B Metson

Registered Office

11 Turnbull Street
Thorndon
Wellington

Nature of business

The purpose of the company is to provide research access in the Australian Synchrotron for researchers from New Zealand. The company also promotes synchrotron science, assists in the capability of New Zealand researchers in synchrotron science and manages the travel funding for New Zealand researchers using the Australian Synchrotron.

Company Registration number

1865516

Independent auditor

Grant Thornton New Zealand Audit Limited
on behalf of the Auditor-General

The Board has pleasure in presenting the annual report of the New Zealand Synchrotron Group Limited ("NZSG") incorporating the financial statements and the auditors' report, for the year ended 30 June 2024.

The Company has taken advantage of the reporting concessions available to it under sections 211(3) of the Companies Act 1993.

The Board of NZSG has authorised these financial statements presented on pages 7 to 20 for issue on 18 October 2024.

For and on behalf of the Board

....	....
B R Cowan	J B Metson
Chair	Director
18-Oct-2024	18-Oct-2024

Grant Thornton

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INDEPENDENT AUDITOR'S REPORT

TO THE SHAREHOLDERS OF NEW ZEALAND SYNCHROTRON GROUP LIMITED FOR THE YEAR ENDED 30 JUNE 2024

The Auditor-General is the auditor of New Zealand Synchrotron Group Limited (the Company). The Auditor-General has appointed me, Brent Kennerley, using the staff and resources of Grant Thornton New Zealand Audit Limited, to carry out the audit of the financial statements of the Company on his behalf.

Opinion

We have audited the financial statements of the Company on pages 7 to 20, that comprise the statement of financial position as at 30 June 2024, the statement of comprehensive revenue and expenses, statement of changes in net assets and statement of cash flows for the year ended on that date and the notes to the financial statements that include accounting policies and other explanatory information; and

In our opinion:

- the financial statements of the Company on pages 7 to 20:
    - present fairly, in all material respects:
        - its financial position as at 30 June 2024; and
        - its financial performance and cash flows for the year then ended; and
    - comply with generally accepted accounting practice in New Zealand in accordance with Public Benefit Entity International Public Sector Accounting Standards Reduced Disclosure Regime ('PBE IPSAS RDR'); and

Our audit was completed on 18 October 2024. This is the date at which our opinion is expressed.

The basis for our opinion is explained below. In addition, we outline the responsibilities of the Board of Directors and our responsibilities relating to the financial statements, we comment on other information, and we explain our independence.

Basis for our opinion

We carried out our audit in accordance with the Auditor-General's Auditing Standards, which incorporate the Professional and Ethical Standards and the International Standards on Auditing (New Zealand) issued by the New Zealand Auditing and Assurance Standards Board. Our responsibilities under those standards are further described in the Responsibilities of the auditor section of our report.

We have fulfilled our responsibilities in accordance with the Auditor-General's Auditing Standards.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Responsibilities of the Board of Directors for the financial statements

The Board of Directors is responsible on behalf of the Company for preparing financial statements that are fairly presented and that comply with generally accepted accounting practice in New Zealand. The Board of Directors is responsible for such internal control as it determines is necessary to enable it to prepare financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board of Directors is responsible on behalf of the Company for assessing the Company's ability to continue as a going concern. The Board of Directors is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting, unless the Board of Directors intends to liquidate the Company or to cease operations or has no realistic alternative but to do so.

The Board of Directors' responsibilities arise from the Crown Entities Act 2004 and the Education Act 1989.

Responsibilities of the auditor for the audit of the financial statements

Our objectives are to obtain reasonable assurance about whether the financial statements, as a whole, are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion.

Reasonable assurance is a high level of assurance but is not a guarantee that an audit carried out in accordance with the Auditor-General's Auditing Standards will always detect a material misstatement when it exists. Misstatements are differences or omissions of amounts or disclosures and can arise from fraud or error. Misstatements are considered material if, individually or in the aggregate, they could reasonably be expected to influence the decisions of readers taken on the basis of these financial statements.

Our audit procedures with respect to the budget information reported in the financial statements were limited to verifying its consistency with the Group's approved budgeting schedules.

We did not evaluate the security and controls over the electronic publication of the financial statements.

As part of an audit in accordance with the Auditor-General's Auditing Standards, we exercise professional judgement and maintain professional scepticism throughout the audit. Also:

- We identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- We obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control.
- We evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Board of Directors.
- We evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- We conclude on the appropriateness of the use of the going concern basis of accounting by the Board of Directors and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Company's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Company to cease to continue as a going concern.
- We evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- We obtain sufficient appropriate audit evidence regarding the financial statements of the entities or business activities within the group to express an opinion on the consolidated financial statements. We are responsible for the direction, supervision and performance of the group audit. We remain solely responsible for our audit opinion.

We communicate with the Board of Directors regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Our responsibilities arise from the Public Audit Act 2001.

Other information

The Board of Directors are responsible for the other information. The other information comprises the information included on page 4, but does not include the financial statements and our auditor's report thereon.

Our opinion on the financial statements does not cover the other information and we do not express any form of audit opinion or assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information. In doing so, we consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated. If, based on our work, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

We wish to draw attention to the fact that the entity's funding agreement with its Shareholders and the Government is due to expire in 2026. While we have reviewed the 2025/26 financial year budget for any potential indicators of going concern issues, no material uncertainty has been identified for the current audit period. Accordingly, the use of the going concern assumption is appropriate for the year ended 30 June 2024. However, we note that the entity's ability to continue as a going concern beyond 2026 will depend on the renewal or replacement of these funding agreements. Our opinion is not modified in respect of this matter.

Independence

We are independent of the Company in accordance with the independence requirements of the Auditor-General's Auditing Standards, which incorporate the independence requirements of Professional and Ethical Standard 1 (Revised): *Code of Ethics for Assurance Practitioners* issued by the New Zealand Auditing and Assurance Standards Board.

Other than the audit, we have no relationship with or interests in the Company.

Brent Kennerley
Grant Thornton New Zealand Audit Limited
On behalf of the Auditor-General
Wellington, New Zealand

	Note	*2024 (Unaudited) Budget*	2024 Actual	2023 Actual
		$	$	$
Revenue from non exchange transactions				
Revenue for Australian Operations	3	*2,581,819*	2,593,044	2,790,930
Revenue from exchange transactions				
Revenue for NZ Operations	4	*60,000*	60,000	93,500
Other revenue	4	*186,000*	249,547	245,179
Total Revenue		*2,827,819*	2,902,591	3,129,609
Expenses				
Australian Synchrotron Group costs	5, 18	*2,554,895*	2,378,704	2,640,515
(Gain) / Loss on fair value of derivatives		*0*	1,636	39,495
Other operating expenses	6	*344,850*	486,970	402,114
Operating expenditure		*2,899,745*	2,867,310	3,082,124
Total surplus/(deficit) for the year		(71,926)	35,281	47,485
Other comprehensive income		-	-	-
Total comprehensive revenue and expense		***(71,926)***	**35,281**	**47,485**

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 20.

	Notes	Share capital $	Accumulated losses $	Total equity $
Balance as at 30 June 2022		2,912,162	(2,150,629)	**761,533**
Net surplus		-	47,485	47,485
Other comprehensive income		-	-	-
Total comprehensive revenue and expenses		-	47,485	47,485
Balance as at 30 June 2023		**2,912,162**	**(2,103,144)**	**809,018**
Net surplus		-	35,281	**35,281**
Other comprehensive income		-	-	-
Total comprehensive revenue and expenses		-	35,281	**35,281**
Balance as at 30 June 2024		**2,912,162**	**(2,067,863)**	**844,299**

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These financial statements should be read in conjunction with the accompanying notes on pages 11 - 20.

ASSETS	Note	2024	2023
		$	$
Current assets			
Cash & cash equivalents	7	797,751	222,580
Investments	7	-	471,503
Trade and other receivables from exchange transactions	8	83,829	153,680
Prepayments	8	-	2,400
Derivative financial instruments	9	5,992	18,501
Total current assets		**887,572**	**868,664**
TOTAL ASSETS		**887,572**	**868,664**
LIABILITIES			
Current liabilities			
Trade and other payables	11	43,273	48,773
Derivative financial instruments		-	10,873
Total current liabilities		**43,273**	**59,646**
TOTAL LIABILITIES		**43,273**	**59,646**
Net assets		**$ 844,299**	**$ 809,018**
EQUITY			
Share capital	15	2,912,162	2,912,162
Accumulated losses		(2,067,863)	(2,103,144)
TOTAL EQUITY		**$ 844,299**	**$ 809,018**

For and on behalf of the Board

B R Cowan
Chair

18-Oct-2024

J B Metson
Director

18-Oct-2024

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These financial statements should be read in conjunction with the accompanying notes on pages 11 - 20.

	Notes	2024 $	2023 $
Cash flows from operating activities			
Receipts			
Receipts from non exchange transactions		2,593,044	2,790,930
Receipts from exchange transactions		305,741	196,126
Interest	4	73,657	68,069
Total cash received		**2,972,442**	**3,055,125**
Payments			
Australian Synchrotron Group Costs		(2,378,704)	(2,640,515)
Less: Cash applied to Derivative Asset		0	-
Other expenses		(490,070)	(509,606)
Total cash applied		**(2,868,774)**	**(3,150,121)**
Net cashflows from operating activities	17	***103,668***	***(94,996)***
Cash flows from investing activities			
Receipts			
Sale of investments		471,503	(50,202)
Total cash received		**471,503**	**(50,202)**
Net cash flows from investing activities		***471,503***	***(50,202)***
Net (decrease)/increase in cash and cash equivalents		*575,171*	*(145,198)*
Cash and cash equivalents at 1 July	7	222,580	367,778
Cash and cash equivalents at 30 June	7	**797,751**	**222,580**

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 20.

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Note 1. General information

New Zealand Synchrotron Group Limited ("the Company" or "NZSG") was incorporated on 13 September 2006. The Company is a Public Sector Public Benefit Entity. The purpose of the Company is to provide research access to the Australian Synchrotron for researchers from New Zealand. In addition, the Company also promotes synchrotron science, assists the development of capability of New Zealand researchers in synchrotron science and manages the travel funding for New Zealand researchers using the Australian Synchrotron. It has twelve shareholders who are all either New Zealand universities, Crown Research Institutes or Crown Entities. The company is managed by a four person board elected by the shareholders, including an independent Chair. The Chair receives remuneration; the other directors do not. The Royal Society of New Zealand has been contracted to provide secretariat services to the Board.

The Company's revenue consists of fees paid by both shareholders and the Ministry of Business Innovation and Employment ("MBIE") to provide support services and funds provided by the Australian Synchrotron for travel funding grants. Its registered office is 11 Turnbull Street, Thorndon, Wellington.

The financial statements are prepared on a going concern basis. The Company has entered into agreements for future access to the Australian Synchrotron up until 30 June 2026.

The Board has authorised the financial statements on 18 October 2024.

Note 2. Significant accounting policies

(a) Basis of preparation

The financial statements of the Company have been prepared in accordance with Generally Accepted Accounting Practice in New Zealand (NZ GAAP). They comply with Public Benefit Entity Standards Reduced Disclosure Regime (PBE Standards RDR) and authoritative notices that are applicable to entities that apply PBE Standards.

The Company is eligible and has elected to report in accordance with Tier 2 PBE Standards RDR on the basis that the Company has no public accountability and is not large as defined in XRB A1. The Directors have elected to report in accordance with Tier 2 PBE Accounting Standards and in doing so have taken advantage of all applicable Reduced Disclosure Regime ("RDR") disclosure concessions.

The significant accounting policies adopted in the preparation of the financial statements are set out below. These policies have been consistently applied to all the periods presented, unless otherwise stated.

Statutory base

New Zealand Synchrotron Group Limited ("NZSG" or the "Company") is a company registered under the Companies Act 1993.

The financial statements have been prepared in accordance with the Financial Reporting Act 2013.

Basis of measurement

These financial statements have been prepared under the historical cost convention, as modified by the revaluation of financial instruments at fair value through surplus or deficit.

(b) Changes in accounting policy

There have been no changes in accounting policy.

(c) Foreign currency translation

Functional and presentational currency

The financial statements are presented in New Zealand dollars, which is the Company's functional and presentation currency.

Foreign currency transactions are translated into the functional currency using the exchange rates prevailing at the dates of the transactions. Foreign exchange gains and losses resulting from the settlement of such transactions and from the translation at year end exchange rates of monetary assets and liabilities denominated in foreign currencies are recognised in the statement of comprehensive revenue and expenses.

(d) Revenue recognition

Revenue from exchange transactions

Revenue from exchange transactions comprises the fair value for the sale of goods and services, excluding Goods and Services Tax, rebates and discounts. Revenue is recognised when services are rendered.

Interest income

Interest income is recognised on a time proportion basis using the effective interest method. When a receivable is impaired, NZSG reduces the carrying amount to its recoverable amount, being the estimated future cash flow discounted at the original effective interest rate of the instrument, and continues unwinding the discount as interest income. Interest income on impaired loans is recognised using the rate of interest used to discount the future cash flows for the purpose of measuring the impairment loss.

Other funding

Other funding includes grants from shareholders, contributions from Australian Synchrotron and other kinds of funding that meet the definition of exchange transactions. Other funding is recognised as revenue when it becomes receivable in the accounting period in which the services or activities related to the funding are rendered or completed. This is by reference to completion of the specific transaction assessed on the basis of the actual service provided or the activity completed as a proportion of the total service to be provided or activity to be completed.

Revenue from non-exchange transactions

Revenue from non-exchange transactions comprises the fair value received from a third party without directly giving approximately equal value in exchange.

Government grants

Contract income from the Ministry of Business, Innovation and Employment is a primary source of income for the Company. Government grants and non-government grants are recognised as revenue when they become receivable unless there is an obligation to return the funds if conditions of the grant are not met. If there is such an obligation, the grants are initially recorded as grants received in advance and recognised as revenue when conditions of the grant are satisfied.

(e) Income Tax

From 1 July 2009 the NZSG has been granted a Tax Exemption under Section CW49 of the Income Tax Act 2007. As a consequence NZSG will have no ongoing liability for Income Tax.

(f) Goods and Services Tax (GST)

The statement of comprehensive revenue and expenses has been prepared so that all components are stated exclusive of GST. All items in the statement of financial position are stated net of GST, with the exception of receivables and payables, which include GST invoiced.

(g) Cash and cash equivalents

Cash and cash equivalents includes cash on hand, deposits held at call with financial institutions, and other short term highly liquid investments with original maturities of three months or less, that are readily convertible to known amounts of cash, and which are subject to an insignificant risk of changes in value.

(h) Financial Assets and Financial Liabilities

(h.1) Financial Assets

Initial recognition and measurement

Financial assets and financial liabilities are recognised when the Company becomes a party to the contractual provision of the financial instrument.

Financial assets are classified, at initial recognition, as financial assets at fair value through surplus or deficit, receivables, held-to-maturity investments, available-for-sale financial assets, and derivatives. All financial assets are recognised initially at fair value.

Purchases or sales of financial assets that require delivery of assets within a time frame established by regulation or convention in the marketplace (regular way trades) are recognised on the trade date, i.e. the date that the Company commits to purchase or sell the asset.

The Company's financial assets include: cash and short term deposits, trade and other receivables, held to maturity investments and derivative financial instruments.

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(h.1) Financial Assets - *continued*

Subsequent measurement

For the purpose of subsequent measurement financial assets for NZSG are classified in three categories:
-Financial assets at fair value through surplus or deficit
-Trade Receivables
-Held-to-maturity investments

(h.1.1) Financial assets at fair value through surplus or deficit
Financial assets at fair value through surplus or deficit include financial assets held for trading and financial assets designated upon initial recognition at fair value through surplus or deficit. Financial assets are classified as held for trading if they are acquired for the purpose of selling or repurchasing in the near term. Derivatives, including separated embedded derivatives, are also classified as held for trading.
Financial assets at fair value through surplus or deficit are carried in the statement of financial position at fair value with net changes in fair value presented as other expenses (negative net changes in fair value) or other revenue (positive net changes in fair value) in the statement of financial performance.

(h.1.2) Trade receivables
This category of financial assets is the most relevant to the Company. Trade receivables are non-derivative financial assets with fixed payments. After initial measurement, such financial assets are subsequently measured at amortised cost using the effective interest rate method, less impairment. Amortised cost is calculated by taking into account any discount or premium on acquisition and fees or costs that are an integral part of the effective interest rate.
The recoverability of trade receivables is reviewed on an ongoing basis. Debts which are known to be uncollectible are written off. A provision for doubtful receivables is established when there is objective evidence that NZSG will not be

(h.1.3) Held-to-maturity investments
Financial assets with fixed or determinable payments and fixed maturities are classified as held to maturity when the Company has the positive intention and ability to hold them to maturity. After initial measurement, held-to-maturity investments are measured at amortised cost using the effective interest rate method, less impairment.
Amortised cost is calculated by taking into account any discount or premium on acquisition and fees or costs that are an integral part of the effective interest rate. The effective interest rate amortisation is included as finance income in the statement of financial performance.

Derecognition
The Company derecognises a financial asset or, where applicable, a part of a financial asset when the rights to receive cash flows from the asset have expired or are waived, or the Company has transferred its rights to receive cash flows from the asset or has assumed an obligation to pay the received cash flows in full without material delay to a third party; and either;
- the Company has transferred substantially all the risks and rewards of the asset; or
- the Company has neither transferred nor retained substantially all the risks and rewards of the asset but has transferred control of the asset.

(h.2) Financial Liabilities

The Companies financial liabilities include trade and other creditors. These amounts represent liabilities for goods and services provided to NZSG prior to the end of financial year which are unpaid. All financial liabilities are initially recognised at fair value and subsequently measured at amortised cost using the effective interest method. The amounts are unsecured and are usually paid within 30 days of recognition.

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(h.3) Derivative financial instruments

Derivative financial instruments are initially recognised at fair value on the date on which a derivative contract is entered into and are subsequently remeasured at fair value. Derivatives are carried as financial assets when their fair value is positive and as financial liabilities when their fair value is negative.

Gains and losses arising from changes in the fair value of the derivative financial instruments are presented though the statement of financial performance. Any gains or losses arising from changes in the fair value of derivatives are taken directly to surplus or deficit. The fair value of derivative financial instruments are determined by using valuation techniques. Valuation techniques used include the use of comparable recent arm's length transactions, reference to other instruments that are substantially the same, option pricing models and other valuation techniques commonly used by market participants making the maximum use of market inputs and relying as little as possible on entity-specific inputs.

Financial assets at fair value through surplus or deficit are subject to review for impairment at each reporting date. Derivatives are then impaired when there is any objective evidence that the derivatives are impaired. Impairment losses are incurred if there is objective evidence of impairment as a result of one or more events that occurred after the initial recognition of the derivatives and that loss event has an impact on the estimated future cashflows of those derivatives that can be reliably estimated.

(i) Sponsorship and donations expense

Through the ordinary course of its activities the Company provides sponsorships and makes donations to advance its stated objectives. The Company recognises a liability for this expenditure when the recipient meets any eligibility criteria attached to a sponsorship or donation agreement.

(j) Statement of Cash Flows

The following are the definitions of the terms used in the Statement of Cash Flows:

i) Cash is considered to be cash on hand, cash in transit, bank accounts and deposits with a maturity of no more than 3 months from the date of acquisition;

ii) Investing activities are those relating to acquisition, holding and disposal of investments not falling within the definition of Cash;

iii) Financing activities are those activities which result in changes in the size and composition of the capital structure of the Company. This includes equity, debt not falling within the definition of Cash.

All other activities are classified as operating activities.

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Note 3. Revenue for Australian operations

	2024 $	2023 $
Revenue from non-exchange transactions		
Ministry of Business Innovation and Employment	1,063,176	1,052,052
Shareholders - contribution to Aust. Synchrotron beamlines	-	1,302,179
Shareholders - contribution to Aust. Synch. Operating Costs	1,472,636	436,699
Other	57,232	-
	2,593,044	2,790,930

The Company receives support from the Government and shareholders for Australian Synchrotron costs.

Note 4. Revenue for New Zealand operations

	2024 $	2023 $
Revenue from non-exchange transactions		
Ministry of Business Innovation and Employment	-	-
Revenue from exchange transactions		
Grants from shareholders for operating costs of NZSG	60,000	93,500
Other Revenue		
Contribution from the Australian Synchrotron towards travel costs	175,890	165,939
Foreign exchange gains / (losses)	-	11,171
Interest	73,657	68,069
	249,547	245,179
	309,547	338,679

Note 5. Australian Synchrotron Group costs

Under the agreement with Australian Nuclear Science and Technology Organisation (ANSTO), and as detailed in note 10(a), the Company is required to make an annual contribution to the ongoing operating costs of the Australian Synchrotron.

	2024	2023
Contribution to Australian Synchrotron for operating costs	2,378,704	1,330,400
Contribution to Australian Synchrotron for new beamlines	-	1,310,115
	2,378,704	2,640,515

Note 6. Other operating costs

(a) Remuneration of auditor

During the year the following fees were paid or payable for services provided by the Auditor General appointed auditor - Grant Thornton New Zealand Audit Limited.	2024 $	2023 $
Statutory audit services	8,450	8,450

(b) Foreign exchange (gains) / losses

During the year the following exchange (gains) / losses were made on transactions between New Zealand and Australia.	2024 $	2023 $
Foreign exchange (gains) / losses	19,711	-

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(c) Support for Synchrotron Science

During the year the following fees were paid or payable for services provided.

	2024	2023
	$	$
Travel costs reimbursed to shareholders	188,474	163,203
Paid Access to Australian Synchrotron	110,273	3,103
Capability Build expense	-	86,250
User Meetings	27,841	11,006
Asia Oceania Forum for Synchrotron Radiation Research Membership	6,618	9,924
	333,206	273,486

(d) Secretariat and other operating costs

During the year the following fees were paid or payable for services provided.

	2024	2023
	$	$
Secretariat services from the Royal Society of New Zealand and Board costs	120,660	115,554
Insurance	4,400	4,400
Other	543	224
	125,603	120,178
Total other operating costs	**486,970**	**402,114**

Note 7. Cash & cash equivalents and Investments

	2024	2023
	$	$
Cash	392,015	102,377
Foreign currency - AUD	405,736	120,203
Cash & cash equivalents	797,751	222,580

	2024	2023
	$	$
Term Deposits > 3 months (NZD)	-	200,000
Term Deposits > 3 months (AUD)	-	271,503
Investments	-	471,503

All the bank balances and investments are held with the Bank of New Zealand.

Note 8. Other current assets

(a) Trade and other receivables from exchange transactions

	2023	2023
	$	$
Trade receivables	77,783	133,491
Other receivables	0	6,923
Goods and Services Tax receivable	6,046	13,266
Total trade and other receivables	83,829	153,680

(b) Prepayments

	2024	2023
	$	$
Prepayments	0	2,400
Total Prepayments	0	2,400

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Note 9.	**Derivative financial instruments**	**2024**	**2023**
		$	**$**
	Western Union Forward cover	5,992	7,628
	Derivative financial instruments	**5,992**	**7,628**

The following derivatives have been entered into with Western Union.

(a) *Forward foreign exchange contracts*

At 30 June 2023	**Notional**	**Deal rate**	**Fair Value**
Forward exchange contract (Maturity: February 2024)	$833,333	0.9000	(10,873)

At 30 June 2024	**Notional**	**Deal rate**	**Fair Value**
Nil			

(b) *Forward foreign exchange options*

At 30 June 2023	**Notional**	**Strike Price**	**Fair Value**
Forward foreign exchange option (Maturity: February 2024)	$735,294	1.02	$233
Forward foreign exchange option (Maturity: February 2025)	$882,353	0.85	$6,769
Forward foreign exchange option (Maturity: February 2026)	$882,353	0.85	$11,499

At 30 June 2024	**Notional**	**Strike Price**	**Fair Value**
Forward foreign exchange option (Maturity: February 2025)	$882,353	0.85	$933
Forward foreign exchange option (Maturity: February 2026)	$882,353	0.85	$5,059

Note 10. Commitments

(a) Agreement with Australian Nuclear Science and Technology Organisation (ANSTO)

Agreements have been signed on the 14th August 2017, between NZSG and ANSTO whereby NZSG undertakes to provide AUD $12.0m over six years towards the cost of new beamlines and AUD $1.5m per year for nine years (with an inflation adjustment) in return for 6.639% of the access. As part of the Funders' Agreement entered into with 10 of the shareholders and the SIFF Contract with MBIE, these funds will be received directly from the Participants or MBIE when required to fulfil these obligations.

New Zealand shareholders who are party to the Funders' Agreement are irrevocably committed to contribute a total of AUD $12.308m (GST exclusive).

(b) Agreement with Ministry of Business, Innovation and Employment (MBIE)

The company has entered into an agreement with MBIE for Crown Funding totalling AUD $6m plus NZD $10,552,364 over the period 1 July 2017 to 30 June 2026.

Note 11. Trade and other payables

Trade and other payables	2024 $	2023 $
Creditors	1,000	-
Accruals	42,273	48,773
Income in Advance	-	-
Total trade and other payables	43,273	48,773

The amount owed to related parties was nil as at 30 June 2024. (2023: nil).

Note 12. Contingent assets and contingent liabilities

There were no significant contingent assets or contingent liabilities at 30 June 2024 (2023: nil).

Note 13. Related parties

Related parties comprise the shareholders identified in Note 15 and Board members identified in the Directory. There have been a number of related party transactions during the year ended 30 June 2024.

Directors

Transactions with board members include payment of fees. During the year ended 30 June 2024, a total of $9,000 was paid to the Chair (2023: $9,000). As at 30 June 2024, there were no outstanding balances with board members (2023: $0).

Shareholders

Transactions with shareholders during the year ended 30 June 2024 include grants, as per Note 4, amounting to $60,000 (2023: $86,250). Also, as per Note 10, under the agreement with ANSTO the Shareholders who are party to the Funders Agreement are required to contribute a total of AUD $12.308m (GST exclusive) over the nine years of the agreement to 2026. In the year ended 30 June 2024, a total of AUD $1.37m (2023: AUD $1.76m) was contributed by Shareholders who are party to the Funders Agreement and, as at 30 June 2024, there was no outstanding balance with shareholders (2023: nil).

Note 14. Events occurring after balance date

There were no significant events occuring after balance date that affect the financial statements (2023: nil).

Note 15. Share capital

Shareholding at cost	2024	2023
	$	$
The University of Auckland	509,217	509,217
The University of Waikato	190,357	190,357
Massey University	428,317	428,317
Victoria University of Wellington	237,966	237,966
University of Canterbury	285,546	285,546
Lincoln University	28,557	28,557
University of Otago Holdings Ltd	285,546	285,546
AgResearch Ltd	285,546	285,546
Institute of Geological and Nuclear Sciences Ltd	190,357	190,357
The New Zealand Institute for Plant and Food Research Ltd	190,357	190,357
Callaghan Innovation	192,270	192,270
Auckland University of Technology	88,126	88,126
	2,912,162	2,912,162

The shares held at 30 June are:	2024	2023
	# of shares held	# of shares held
The University of Auckland	436,319	436,319
The University of Waikato	163,104	163,104
Massey University	367,001	367,001
Victoria University of Wellington	203,897	203,897
University of Canterbury	244,668	244,668
Lincoln University	24,467	24,467
University of Otago Holdings Ltd	244,668	244,668
AgResearch Ltd	244,668	244,668
Institute of Geological and Nuclear Sciences Ltd	163,104	163,104
The New Zealand Institute for Plant and Food Research Ltd	163,104	163,104
Callaghan Innovation	163,104	163,104
Auckland University of Technology	163,104	163,104
	2,581,208	2,581,208

The amount recognised in the balance sheet as paid in capital is the New Zealand dollar equivalent at the date of issue.

Note 16. Financial instruments

Classification of financial assets by category	Fair value through Profit or Loss	Loans and Receivables
2024	$	$
Cash and cash equivalents	-	797,751
Investments	-	-
Trade & other receivables	-	83,829
Prepayments	-	-
Derivative financial instrument	5,992	-
Total	**5,992**	**881,580**
2023		$
Cash and cash equivalents	-	222,580
Investments	-	471,503
Trade & other receivables	-	153,680
Prepayments	-	2,400
Derivative financial instrument	18,501	-
Total	**18,501**	**850,163**

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Classification of financial liabilities by category

Measured at amortised cost

	2024 $	2023 $
Trade & other payables	43,273	48,773
Derivative financial instrument	0	10,873
Total	**43,273**	**59,646**

Note 17. Reconciliation of profit with cash flows from operating activities

	2024 $	2023 $
Net (Deficit)/Surplus for the year	35,281	47,485
Movement in working capital		
Trade and other receivables	69,851	(74,484)
Derivative financial instruments	1,636	39,495
Trade and other payables	(5,500)	(107,292)
Prepayments	2,400	(200)
Net Cash outflow from operating activities	**103,668**	**(94,996)**

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