

# **NEW ZEALAND SYNCHROTRON GROUP LIMITED**



**ANNUAL REPORT 2016**



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## CHAIRMAN'S REPORT

The New Zealand Synchrotron Group Ltd (NZSG) has now completed its tenth year of operation providing support for New Zealand researchers using the Australian Synchrotron. Throughout this ten year period since its establishment, the New Zealand participants have been treated as equals with unfailing fairness and generosity by our Australian hosts.



Access as of right to the state of the art synchrotron in Melbourne is important to New Zealand's leading scientists dealing with materials of all types. Whilst "services" are a growing source of export income for the New Zealand economy, physical exports of materials, commodities and processed goods remain important. All of these products can be analysed in unprecedented detail using the various workstations on the machine. Synchrotron radiation is also indispensable for example for advanced medical imaging, protein analysis for drug discovery and forensics. The right of access for New Zealand based scientists has been secured through a continuous contribution over ten years of both capital and operational funding set at a level agreed with the Australians which ensures that New Zealand participants are paying their way in Australia under a full cost recovery model. Agreed ongoing access is part of a government to government undertaking now entered into by both countries. The New Zealand participation although modest in relation to the project as a whole, has enabled the scope of the facility to be expanded to the benefit of scientists in both countries, rather than be seen as any sort of burden. Such a facility, arguably the largest single science infrastructure project in Australasia is beyond the current means of New Zealand research bodies, but owing to the unequalled powers of resolution of the imaging it achieves, such a facility is vital for scientists wanting to do groundbreaking work of international quality.

During the year, the company welcomed AUT as a new shareholder. Their researchers are now eligible to apply for merit beamtime on an equal basis to those from the other funding shareholders.

The past year was the last of a three-year interim funding and access regime under which New Zealand contributed 5% of the cost of operating the Synchrotron in return for 5% of the beamtime available to Australian and New Zealand users. The funds were provided jointly by the New Zealand government and eight of the company's shareholders. The 5% access level delivers approximately half the number of beamline shifts that was previously achieved when New Zealand researchers had unrestricted access to the merit pool plus dedicated Foundation Investor time. There has therefore been high demand for the available beamtime over the year and the company's Access Committee has had a difficult task taking the needs of the New Zealand research sector and the merit rankings of the Synchrotron's advisory committees into account when making the decisions on who receives the beamtime.

From July 2016 the ownership of the Synchrotron and responsibility for funding its operation was assumed by the Australian Commonwealth government. The Victorian government, as the majority shareholder, and all the minor shareholders, including NZSG transferred their shares to ANSTO. In return, the Australian government agreed to provide the majority of the operating funding for the next ten years and to preserve the access rights that New Zealand researchers had previously enjoyed. NZSG has completed access agreements with ANSTO under which New Zealand will continue to receive 5% access over the next three years in return for a contribution of A\$1.5 million per year towards the facility's operating costs. Agreements are in place with the New Zealand government and nine of the shareholders to jointly provide those funds.

With the long term future of Synchrotron secured, attention is now being focused on a development programme to maintain the world class standard of the facility and better utilise the light source by adding new beamlines. While it is intended that most of the funds for this development come from the Commonwealth and Victorian governments and the Australian research sector, New Zealand has been asked to contribute. By doing so, New Zealand can ensure preferred access to the new beamlines and potentially influence decisions on the order in which beamlines are constructed. The New Zealand government has already made provision for supplementing funds that the research sector provides. In the past year, NZSG contributed A\$150,000 towards the cost of a new detector for the MX2 beamline.

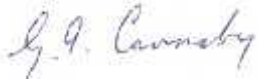
The company had budgeted for an operating surplus for the year of \$40,363 and in addition to use \$78,125 of retained earnings as part of the contribution towards the new MX2 detector (giving a net budgeted loss of \$37,162). While the result from providing secretariat and synchrotron science support activities was ahead of budget, the overall result was heavily influenced by foreign currency considerations, and a net loss of only \$13,042 was achieved. At the beginning of the year, the company held a forward contract for the February 2016 payment to SLSA. The board has written down its value to zero as the payment has now been completed. New vanilla options have been purchased to preserve the value of the funds to be received from the government for the next three years of operating costs and in March 2016, when the exchange rate was particularly favourable, another forward contract was entered into for the February 2017 payment to ANSTO. The net effect of the changes in value of these financial derivatives during the financial year was a cost of \$58,981.

Shareholder equity has increased from \$511,165 to \$585,643. Given the need for future investment for the new beamlines and the uncertainty in currency exchange rate movements, the directors believe it is prudent to maintain this level of cash reserves in the short term and to reassess the situation once the future funding arrangements for the new beamlines are finalised.

The board has been very well supported by the Royal Society of New Zealand who provide secretariat services to NZSG. In particular, I would like to acknowledge the contribution made by Dr Don Smith in assisting the board, administering the New Zealand Synchrotron Support Programme and negotiating the funding and access arrangements. I would also like to acknowledge the contribution from the Chair of the Access Committee, Professor Geoff Jameson and its members Professor Vic Arcus,

Dr Vladimir Golovko and Dr Geoff Waterhouse who have evaluated all requests for access and for funding support for training.

Finally, I would like to especially acknowledge the contribution made by Dr Des Darby who retired from the board in November 2015 and thank my fellow directors, Professors Geoff Jameson, Jim Metson and Ian Shaw and welcome the new director Professor Mike McWilliams.

A handwritten signature in cursive script, appearing to read 'G.A. Carnaby', written in dark ink.

GA Carnaby  
Chair

## **BUSINESS REVIEW**

### **Investment in the Australian Synchrotron and Access Rights**

Through the original investment in the Australian Synchrotron in October 2007, NZSG became a member of the Australian Synchrotron Company (ASCo) and a shareholder in the Australian Synchrotron Holding Company (ASHCo). As part of the restructuring of the Australian Synchrotron operations and funding in 2012, responsibility for operating the Synchrotron was transferred from ASCo to a new entity, the Synchrotron Light Source Australian Pty Ltd (SLSA) on 1 January 2013. SLSA is a subsidiary of the Australian Nuclear Science and Technology Organisation (ANSTO). ASCo was deregistered in June 2013, however NZSG remained a shareholder in ASHCo which leased the facility and equipment to SLSA to operate. The 5 million A\$1 shares in ASHCo held by NZSG were fully paid, however their value was written down to zero as at 30 June 2013 to reflect the cessation of access rights to all foundation investors in the Australian Synchrotron after August 2013. Those shares were transferred at no cost to ANSTO in July 2016 as part of the new ownership arrangement.

Under arrangements set in place three years ago to access rights and provide funding for the operating costs of the facility until June 2016, NZSG's shareholders have collectively contributed A\$652,750 per annum which has been supplemented by funding from the New Zealand government. In total, A\$1.39 million has been provided each year as New Zealand's share of the operating costs and in return New Zealand researchers have been entitled to 5% of the merit beamtime. From July 2016 the annual payments will increase to A\$1.5 million. These funds are channelled through the company which has entered into a Funding and Access Agreement with ANSTO that governs the access arrangements until 30 June 2019. Ag Research, Plant & Food Research and Lincoln University do not have access to merit beamtime as they do not contribute to the sector's funding pool.

Although the Synchrotron is now operated by an entity independent of the original foundation investors, its operations have been governed by an Operating Services Agreement with ASHCo under which a Funders Committee was established to advise the board of SLSA and to have oversight of the Synchrotron's operations, budget and development. The NZSG board has appointed Dr Don Smith to be the company's representative on the Funders Committee. He was also the company's representative at meetings of the shareholders of ASHCo. A new Stakeholders Committee with similar responsibilities is being formed by ANSTO to replace the Funders Committee. Dr Smith is also the contact person for day-to-day matters associated with access arrangements and user liaison with ANSTO.

### **Decisions on Access and Funding Support**

The Funding and Access Agreements with SLSA and now with ANSTO also provide for the company to influence the way in which the 5% overall entitlement to beamtime is allocated to provide the best advantage for New Zealand. This includes

being able to decide on the distribution of beamtime between beamlines and on the ranking of the New Zealand proposals to each beamline. New Zealand researchers from the nine funding institutions are able to apply to the Australian Synchrotron for beamtime. Their applications are assessed on a merit basis by the Synchrotron's beamline panels, however the final selections are made by an Access Committee that was established by the board to make the decisions on applications for beamline access and to select researchers to attend the Cheiron School run each year at the SPRing-8 Synchrotron in Japan. The members of the Committee are:

Professor Geoff Jameson, Massey University (Chair)  
Professor Vic Arcus, University of Waikato  
Dr Vladimir Golovko, University of Canterbury  
Dr Geoff Waterhouse, University of Auckland

The Committee met by teleconference throughout the year as required to make their selections. The table at the end of this section of the Annual Report lists the New Zealand researchers who have gained beamline access to the Australian Synchrotron from July 2015 onwards, and where applicable, the funding support provided to them.

### **Use of the Australian Synchrotron by New Zealand Researchers**

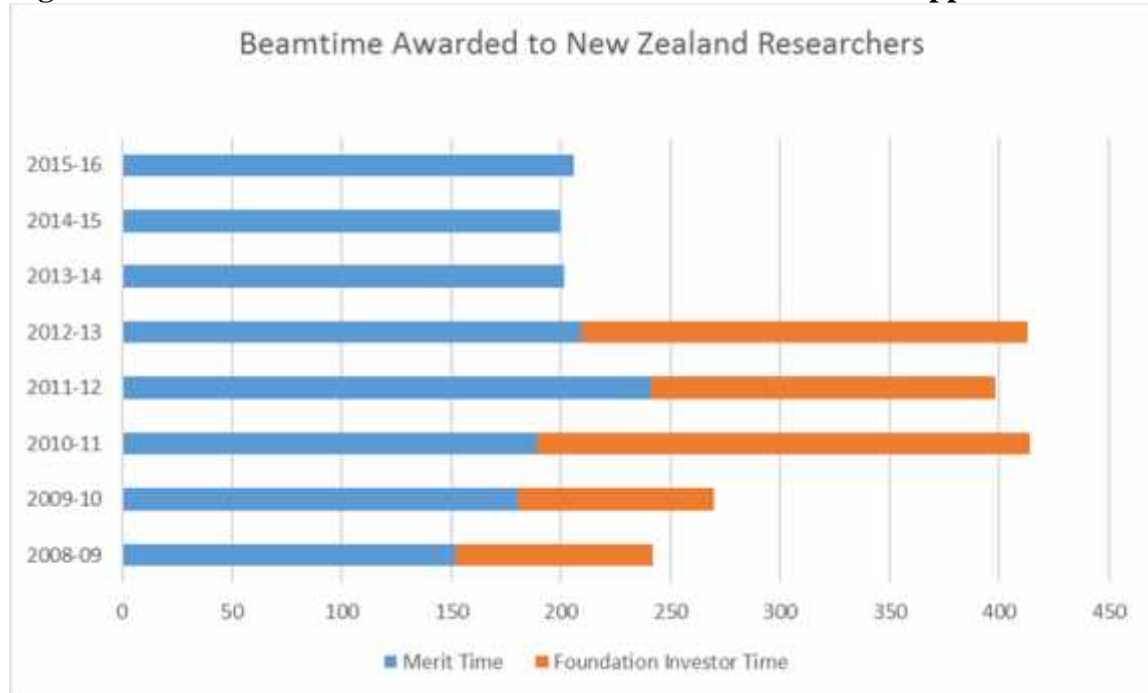
The first of the beamlines was successfully commissioned in mid-2007 and since then all of the originally planned beamlines have become operational. The last of them, the Imaging and Medical Beamline, is not yet fully available, but some merit time has been awarded during the past year. Approximately 80% of the available beamline time is assigned to the "merit access" pool and competitive applications are sought from researchers worldwide, including from New Zealand. The Australian Synchrotron makes calls every four months for merit access to the beamlines. Applications are made directly to the Australian Synchrotron, however as explained above, NZSG oversees the ultimate selection of which New Zealand applicants receive beamtime.

Since late 2008, in recognition of the contribution New Zealand makes to operating costs, the Australian Synchrotron began contributing towards the travel costs for New Zealand researchers who obtained beamtime at the Australian Synchrotron on an equal basis with Australian researchers. These funds are administered through NZSG.

Under the access regime introduced at the Synchrotron in 2013, New Zealand researchers have been entitled to receive 5% of the available beamtime. This is considerably less than was received under the former funding and access regime when through open access to the merit pool of beamtime and guaranteed access to a set amount of Foundation Investor time, New Zealand received approximately 10% of the available time. Figure 1 shows this change in graphical format. New Zealand now receives approximately 200 shifts of beamtime each year. It should however be noted that real access is approximately 50% greater than shown in the graph as a significant number of New Zealand researchers are co-applicants on proposals from Australian colleagues that have been awarded merit beamtime.



**Figure 1: Historical record of beamtime awarded to New Zealand applications**



The research community has had to adjust to the reduced level of access. There is now more demand for beamtime and consequently a higher proportion of proposals for beamtime are unsuccessful. This has been compensated for to some extent by increased collaboration between research groups within New Zealand and also with colleagues in Australia. Of 52 applications made by New Zealand researchers for beamtime during the 2015/16 year, only 31 (or 60%) were successful. The applicants had requested 388 beamline shifts and were awarded 206 shifts (53% of that requested).

**Table 1: Success Rate for NZ Beamtime Applications – 2015/16\***

Beamline	No. Shifts Requested	No. Shifts Awarded		No. Appl'ns. Received	No. Awarded Beamtime	
HRIR <sup>+</sup>	9	12	133%	1	1	100%
IMBL	18	12	67%	3	2	67%
IRM	72	42	58%	8	2	25%
PD	30	0	0%	5	0	0%
SAXS	77	30	39%	20	10	50%
SXR	30	24	80%	2	2	100%
XAS	12	9	75%	2	1	50%
XFM	9	9	100%	1	1	100%
<b>Subtotal</b>	<b>257</b>	<b>138</b>	<b>54%</b>	<b>47</b>	<b>26</b>	<b>55%</b>
MX (CAPs)	131	68	52%	5	5	100%
<b>Overall</b>	<b>388</b>	<b>206</b>	<b>53%</b>	<b>52</b>	<b>31</b>	<b>60%</b>

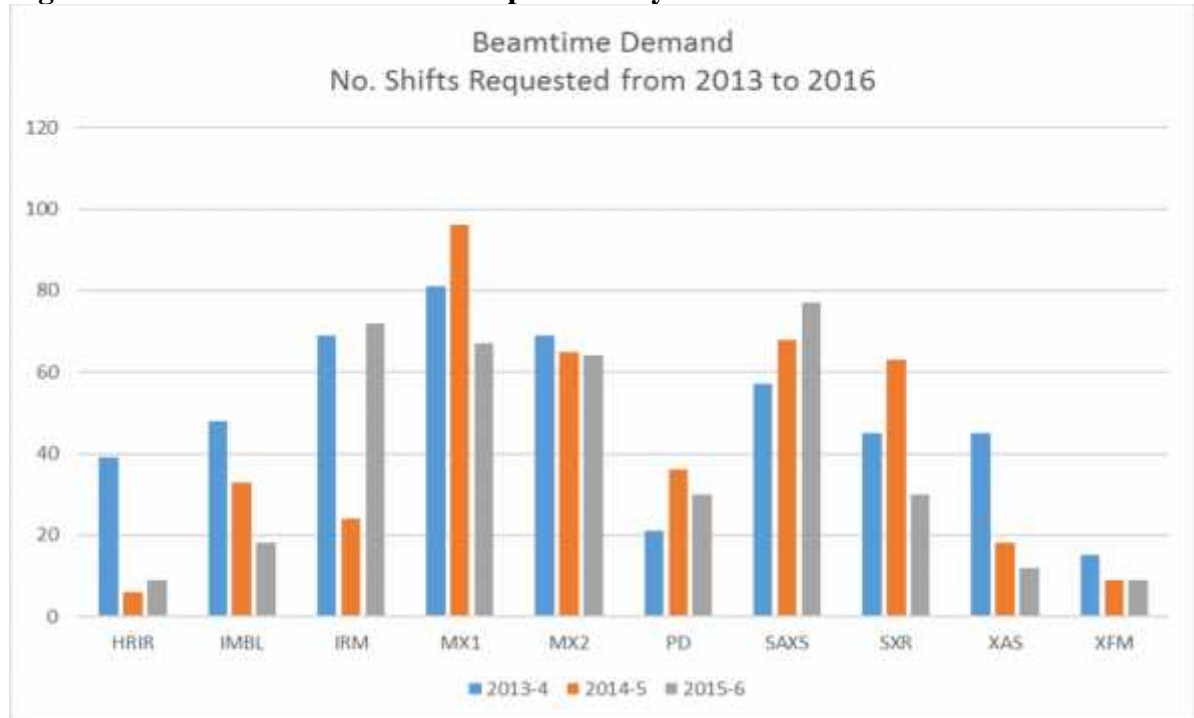
<sup>+</sup>.Shift numbers can be increased to meet minimum requirements of the advisory panels

\* A description of the beamlines and the abbreviations used in given on pages 18-19

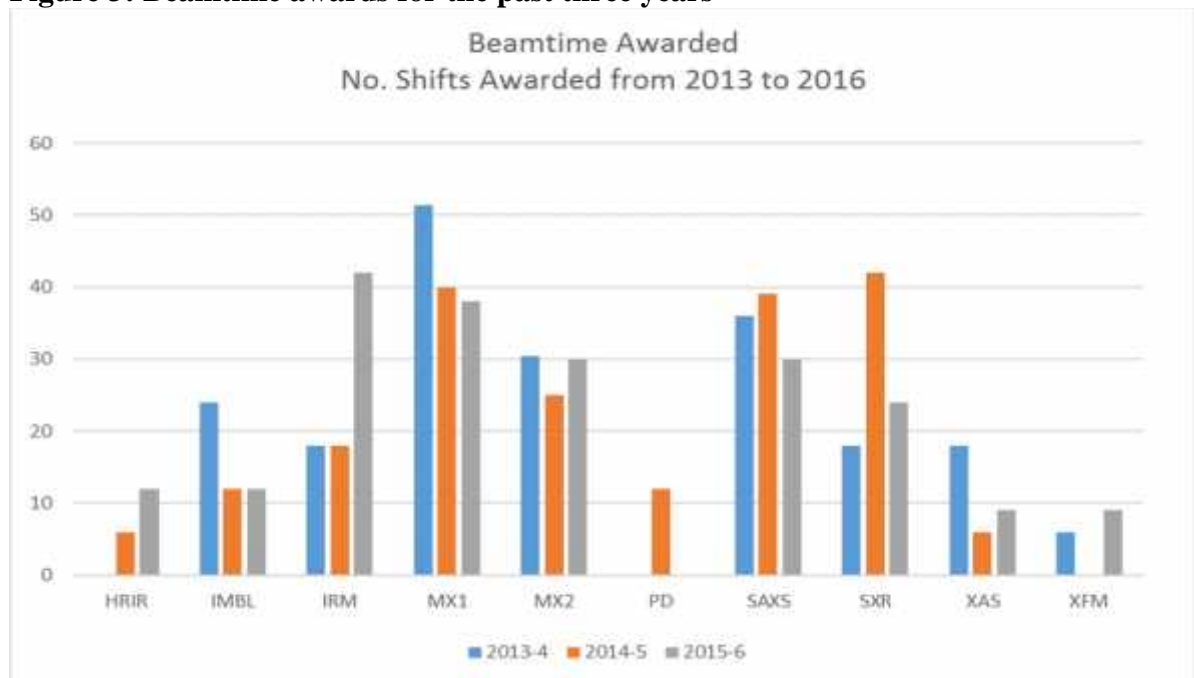
The following two graphs demonstrate the relatively stable demand for beamtime over the past three years. The greatest demand is for time on the crystallography (MX) and the small/wide angle x-ray scattering (SAXS) beamlines. Others, particularly the

infra-red (IRM) and soft x-ray absorption spectroscopy (SXR) have also been in demand. One of the proposed new beamlines is a biological small angle scattering (BIOSAXS) beamline. The company will push for the early construction of this beamline as it will take some of the pressure off the MX and SAXS beamlines.

**Figure 2: Beamtime demand for the past three years**



**Figure 3: Beamtime awards for the past three years**



## Science Achievements

A full list of the researchers who received merit beamtime over the past year is given on pages 9 to 15. These projects cover a very broad range of science topics. Many have involved the training of young researchers. Five examples that illustrate the wide applicability of synchrotron science to New Zealand's research needs and the benefit of having access to the Australian Synchrotron are given on page 9.

## Support for Synchrotron Scientists

Until 30 June 2009, the company operated the New Zealand Synchrotron Support Programme (NZSSP) with funds originating from the Tertiary Education Commission. With the cessation of that funding, the formal NZSSP has scaled down, but in a large part has been replaced by travel funding available from the Australian Synchrotron which most groups which are access are entitled. NZSG administers these funds. During the year, the company used funds to purchase two additional periods of beamtime for groups whose proposals had not been selected but were very close to selection, and also to offer groups that had obtained merit beamtime the opportunity to take an extra person to Melbourne to help expand the pool of synchrotron scientists; 13 groups took up the offer.

In recent years, in addition to funding a number of them to travel to Melbourne to use the Australian Synchrotron, through the associate membership of the Asia Oceania Forum for Synchrotron Radiation Research (AOFSRR), three places are made available each year for young researchers to attend the Cheiron School at the SPring-8 Synchrotron in Japan. Two of the students receive full funding for travel and accommodation from the School. The remaining place was for a self-funded participant, who received a \$3,000 travel grant from NZSG.

The table below provides details of the students who were selected to attend the School in September 2015.

Name	Institution	Details	Comment
Yifei Fan	University of Canterbury	PhD student	Funded by Cheiron School
Jeremy Keown	University of Auckland	Postdoc	Funded by Cheiron School
Heather Jameson	Massey University	PhD student	Funded by NZSG

The SPring-8 Synchrotron has decided not continue running the Cheiron School, so the AOFSRR is working with other synchrotron operators in the region to establish a similar training opportunity for new researchers.



D K W Smith  
Executive Officer  
Secretariat

## Examples of Recent New Zealand Use of the Australian Synchrotron

*There is intense therapeutic interest in the development of drugs which release nitric oxide, as they could provide new treatments for multiple diseases including cancer, stroke and hypertension, as well as aid in tissue repair following trauma injury. Dr Greg Giles and colleagues from the University of Otago have developed the novel drug tDodSNO that uses light to control the rate of nitric oxide release. This is a breakthrough in drug design, as it enables them to use photoactivation to determine both the total amount of nitric oxide released from the drug, and the time over which nitric oxide is present in the target tissue. They have used the infrared microscope beamline at the Australian Synchrotron to characterise the effects of nitric oxide release from tDodSNO on cancer cells. Using live cell imaging, they mapped damage locations across the cell and quantified the changes occurring to lipid, protein and DNA species under nitric oxide exposure.*

*Dr Patricia Durance and a team from GNS Science and Monash University have been investigating mineralogical links between New Zealand and eastern Australia to determine whether it is possible that New Zealand orogenic mineralisation associated with the Greenland Group once belonged to the world-famous Bendigo Zone. The x-ray fluorescence beamline at the Australian Synchrotron was used to quantify the gold content, trace element chemical associations, internal mineralogical textures and inter-mineral associations between a variety of phases associated with crystallographically controlled gold in the Reefton goldfield, Greenland Group, New Zealand and the Fosterville gold deposit, Bendigo Zone, Victoria.*

*Researchers from the University of Canterbury, Massey University and the University of Waikato have combined to use the micro- and macrocrystallography beamlines at the Australian Synchrotron to study enzyme structure and function, and using structure to guide their understanding of enzyme evolution. Enzymes are phenomenal catalysts, in some cases increasing chemical reaction rates by up to 17 orders of magnitude. There is currently vociferous debate regarding the precise mechanism by which enzymes achieve transition-state stabilisation. Many of the group's studies have focused on small molecule protein interactions. They have probed ligand and inhibitor binding in target proteins associated with significant infectious disease such as from *Mycobacterium tuberculosis*, *Neisseria meningitidis* and *Pseudomonas aeruginosa*.*

*The city of Auckland is built within the confines of the active Auckland Volcanic Field, which last erupted approximately 500 years ago. Due to the risk posed by eruptions in densely populated areas, effective evacuation plans need to be informed by precise estimates of time lapse between precursory seismic activity and eruption. Magma ascent rates, and hence length of warning period before an eruption are determined by measuring compositional gradients within crystals in rocks from the Auckland Volcanic Field. Professor Shane Cronin from The University of Auckland with colleagues from that institution and from Victoria University of Wellington has used the Infrared Microscope beamline to study water diffusion rates in magma crystals from Pupuke, Rangitoto and Mangere volcanoes. Use of the Synchrotron has been essential for this project due to the very low water concentrations in the minerals being investigated, requiring a high signal to noise ratio, and to provide an independent dataset for assessing the internal consistency of the data collected from other analytical techniques.*

## New Zealand Research Groups Awarded Beamtime (July 2015 – June 2016)

The following New Zealand research groups were awarded merit time at the Australian Synchrotron between July 2015 and June 2016.

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
<b>Dr Chris Squire</b> Prof Ted Baker Dr Ghader Bashiri Dr David Goldstone Dr Richard Kingston Dr Shaun Lott	Auckland Auckland Auckland Auckland Auckland	2015-2	Micro Crystallography (MX2) “Auckland University Structural Biology Collaborative Access Proposal 2014-2015”	Merit Access 1 day 2-3 July	\$0
Yang Xun <b>Dr Duncan McGillivray</b>	Austr. Synch. Auckland	2015-2	Small/Wide Angle X-ray Scattering (SAXS) “Casein’s inhibitory impacts on thermal- induced aggregation of model proteins”	AS Merit Time 1 day 3-4 July	\$938
<b>Professor Emily Parker</b> Emma Livingstone Logan Heyes	Canterbury Canterbury Canterbury	2015-2	Macromolecular Crystallography (MX1) “Enzymes and Allostery”	Rapid Access Merit Time 1 day 8-9 July	\$2,161
<b>Dr Geoff Waterhouse</b> Wan-Ting Chen Andrew Chan Aubrey Dosado Dana Goodacre Rosaana Roy	Auckland Auckland Auckland Auckland Auckland	2015-2	Soft X-ray Spectroscopy (SXR) “Local electronic structure of the rarest binary copper oxide, Paramelaconite (Cu <sub>4</sub> O <sub>3</sub> ), and its related silver-copper oxides (Ag <sub>2</sub> Cu <sub>2</sub> O <sub>3</sub> and Ag <sub>2</sub> Cu <sub>2</sub> O <sub>4</sub> )	Merit Access 5 days 14-19 July	\$2,327
<b>Dr Bridget Ingham</b> Dr Sujay Prabakar Dr Ilva Rupenthal	Callaghan Innov. LASRA Auckland	2015-2	Small/Wide Angle X-ray Scattering (SAXS) “In-situ monitoring of the interactions of functionalized ZnO quantum dots with collagen hydrogels”	Merit Access 1 day 4-5 August	\$2,633
<b>Dr Gillian Norris</b> Dr Bridget Ingham Rafea Naffa Dr Meekyung Ahn	Massey Callaghan Innov. Massey LASRA	2015-2	Small/Wide Angle X-ray Scattering (SAXS) “Fibril architecture in fresh raw and pickled animal skins”	Merit Access 1 day 7-8 August	\$1,884
<b>Dr Chris Squire</b> Prof Ted Baker Dr Ghader Bashiri Dr David Goldstone Dr Richard Kingston Dr Shaun Lott	Auckland Auckland Auckland Auckland Auckland	2015-2	Macromolecular Crystallography (MX1) “Auckland University Structural Biology Collaborative Access Proposal 2014-2015”	Merit Access 2 days 10-11 June 7-8 August	\$889
<b>Prof Emily Parker</b> Prof Geoff Jameson Prof Vic Arcus Dr Andrew Sutherland- Smith	Canterbury Massey Waikato Massey	2015-2	Micro Crystallography (MX2) “Enzymes, Allostery and Evolution”	Merit Access 1 day 7-8 August	Incl in above

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
<b>Dr Darren Svirskis</b> Ben Boyd Dedeepya Uppalapati Dr Bridget Ingham Prof Jadranka Travis-Sejdic Saiful Mohammad Nizam Azmi	Auckland Monash U. Auckland Callaghan Innov. Auckland Auckland	2015-2	Small/Wide Angle X-ray Scattering (SAXS) “Kinetics of formation and phase switching of porous conducting polymer prepared through host liquid crystal template for drug delivery applications”	Merit Access 2 days 8-10 August	\$1,688
Stewart Midgely <b>Dr Nanette Schleich</b> Dr Andrew Stevenson	Monash Univ <b>Otago</b> CSIRO	2015-2	Imaging and Medical Beamline (IMBL) “Characterisation of the Imaging and Medical Beamline for Dual Energy X-ray Analysis using Synchrotron Computed Tomography at 30–100 keV”	Monash Univ Merit Access 2 days 11-13 August	\$730
<b>Dr Peter Mace</b> Prof Kurt Krause Dr Sigurd Wilbanks Dr Joel Tyndall Prof Catherine Day Prof Greg Cook	Otago Otago Otago Otago Otago Otago	2015-2	Micro Crystallography (MX2) “University of Otago Structural Biology Group”	Merit Access 1 day 14-15 August	\$3,045
Assoc Prof Marcel Nold <b>Dr Daryl Schwenke</b> Dr Claudia Nold Dr James Pearson Dr Ina Rudloff Nikesh Sharitian Dr Megan Wallace Assoc Prof Philip Berger Steven Shian Chin Cho Dr Kirstin Elgass	Monash Uni Otago MIMR Aust Synch MIMR MIMR MIMR Monash Univ. Monash Univ. MIMR	2015-2	Imaging and Medical Beamline (IMBL) “Seeking the First Treatment for Neonatal Pulmonary Arterial Hypertension: Studies at the Imaging and Medical Beamline (Submission 2)”	Monash Univ. Merit Access 3 days 19-22 August	\$981
<b>Assoc Prof Martin Allen</b> Dr James Partridge Prof Alison Downard Prof Roger Reeves Adam Hyndman Alexandra McNeill Rodrigo Gazoni	Canterbury RMIT Canterbury Canterbury Canterbury Canterbury	2015-3	Soft X-ray Spectroscopy (SXR) “Modification of the surface electron accumulation layers on metal oxide semiconductors”	Merit Access 3 days 18-21 September	\$1,963
<b>Dr Tilo Soehnel</b> Assoc Prof Clemens Ulrich Prof Kevin Smith Paul Graham Daniel Jeremy Wilson Hyung Been Kang Furitsu Suzuki	Auckland UNSW Auckland UNSW Auckland Auckland Auckland	2015-3	THz/Far-infrared (FIR) “Pressure dependent IR spectroscopy studies of the phase transitions in high temperature modification of doped copper antimony oxides”	UNSW Merit Access 5 days 22-27 September	\$2,078

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
<b>Dr Chris Squire</b> Dr David Goldstone Assoc Prof Peter Metcalf Professor Ted Baker Dr Shaun Lott Assoc Prof Alok Mitra Dr Richard Kingston Prof Juliet Gerrard Dr Ghader Bashiri	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2015-3	Macromolecular Crystallography (MX1) “Auckland Structural Biology CAP”	Merit Access 1 day 1-2 October NZSG Access 1 day 7-8 October	\$2,968
<b>Dr Peter Mace</b> Dr Joel Tyndall Dr Sigurd Wilbanks Prof Greg Cook Prof Catherine Day Prof Kurt Krause	Otago Otago Otago Otago Otago Otago	2015-3	Macromolecular Crystallography (MX1) “University of Otago Structural Biology Group”	Merit Access 1 day 2-3 October	\$0
<b>Prof Emily Parker</b> Dr Gillian Norris Dr Andrew Sutherland-Smith Prof Geoff Jameson Prof Vic Arcus Heng Zhang Jainika Hermawan Oliver Sterritt	Canterbury Massey Massey  Massey Waikato Waikato Massey Canterbury	2015-3	Micro Crystallography (MX2) “Protein Structure and Function: Waikato, Canterbury and Massey Universities”	Merit Access 1 day 10-11 October	\$3,289
<b>Dr Mark Waterland</b> Haidee Dykstra	Massey Massey	2015-3	THz/Far-infrared (FIR) “Investigating self-assembly of edge-functionalised graphene nanoribbons”	Merit Access 4 days 22-26 October	\$2,362
<b>Prof Richard Haverkamp</b> Hannah Wells Katie Sizeland Catherine Clark	Massey Massey Massey Massey	2015-3	Small/Wide Angle X-ray Scattering (SAXS) “Collagen Fibril Mechanics”	Merit Access 1 day 5-6 November	\$2,783
<b>Dr Peter Mace</b> Dr Joel Tyndall Dr Sigurd Wilbanks Prof Greg Cook Prof Catherine Day Prof Kurt Krause Matthias Fellner Jodi Pillbrow	Otago Otago Otago Otago Otago Otago Otago Otago	2015-3	Micro Crystallography (MX2) “University of Otago Structural Biology Group”	Merit Access 1 day 5-6 November	\$2,543
<b>Dr David Goldstone</b> Dr Richard Kingston Dr Jeremy Keown Martin Rennie	Auckland Auckland Auckland Auckland	2015-3	Small/Wide Angle X-ray Scattering (SAXS) “Investigation of antiviral proteins Structural Biology at University of Auckland”	Paid Access 1 day 17-18 November	\$2,688
<b>Prof Emily Parker</b> Dr Grant Pearce Dr Renwick Dobson Serena Watkins Dr Sarah Kessans	Canterbury Canterbury Canterbury Canterbury Canterbury	2015-3	Small/Wide Angle X-ray Scattering (SAXS) “University of Canterbury SAXS collaborative programme	Merit Access 1 day 18-19 November	\$3,159

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
<b>Dr Chris Squire</b> Dr David Goldstone Assoc Prof Peter Metcalf Professor Ted Baker Dr Shaun Lott Assoc Prof Alok Mitra Dr Richard Kingston Prof Juliet Gerrard Dr Ghader Bashiri	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2015-3	Micro Crystallography (MX2) “Auckland Structural Biology CAP”	Merit Access 1 day 20 November	Incl in above
<b>Dr Johan Verbeek</b> Dr Jim Bier Dr Mark Lay Jussi Uitto Matthew Smith	Waikato Waikato Waikato Waikato Waikato	2015-3	Infrared Microscope (IRM) “Chain structure in nano-particle reinforced protein-based thermoplastics”	Merit Access 3 days 1-4 December	\$3,546
<b>Dr Bridget Ingham</b>  Prof David Williams Dr Monika Ko   Student Dr Mobbassar Hassan Sk	Callaghan Innov. Auckland Auckland and Quest Integrity VUW Qatar University	2015-3	Small/Wide Angle X-ray Scattering (SAXS) “In situ GISAXS study of electrochemically-induced corrosion of mild steel in CO <sub>2</sub> -saturated solutions	Merit Access 2 days 2-4 December	\$3,651
<b>Prof Emily Parker</b> Dr Gillian Norris Dr Andrew Sutherland-Smith Prof Geoff Jameson Prof Vic Arcus Oliver Sterritt A Sharrock	Canterbury Massey Massey  Massey Waikato Canterbury	2015-3	Macromolecular Crystallography (MX1) “Protein Structure and Function: Waikato, Canterbury and Massey Universities”	Merit Access 1 day 4-5 December	\$2,605
<b>Dr Marco Brenna</b> Dr Ian Schipper Dr Ian Smith Prof Shane Cronin	Auckland VUW Auckland Auckland	2015-3	Infrared Microscope (IRM) “Using hydrogen diffusion in crystals from the Auckland Volcanic Field to estimate magma ascent rates”	Expert User Access 4 days 10-13 December	\$3,373
<b>Dr Patricia Durance</b> Dr Steven Micklethwaite Dr Jerome Leveneur Dr Andrew Tompkins Dr Simon Jowitt Dr Bill Trompetter	GNS Science Monash Univ. GNS Science Monash Univ. Monash Univ. GNS Science	2016-1	X-ray Fluorescence Microscopy (XFM) “New Zealand gold and the great Australian link”	Merit Access 3 days 9-12 February	\$1,801
<b>Prof Geoff Jameson</b> Dr Chris Glover Assoc Prof Yoav Livney Dr Ashling Ellis Prof Harjinder Singh	Massey Austr. Sych Massey/Technion Massey Massey	2016-1	X-ray Absorption Spectroscopy (XAS) “Milking iron for all its worth: speciation of iron in casein micelles re-assembled with controlled Fe:Ca stoichiometry”	Merit Access 3 days <b>Rescheduled to 12-15 July</b>	\$1,967



<b>Researchers</b>	<b>Institution</b>	<b>Cycle</b>	<b>Beamline</b>	<b>Access</b>	<b>Travel Funding</b>
<b>Dr Greg Giles</b> Dr Najwa Ejje Samantha McNeill Eve Hewitt	Otago  Otago Otago	2016-1	Infrared Microscope (IRM) “Infrared Analysis of the Cellular Damage Response to Nitric Oxide”	Merit Access 5 days 23-28 February	\$3,086
<b>Dr Peter Mace</b> Dr Joel Tyndall Dr Sigurd Wilbanks Prof Greg Cook Prof Catherine Day Prof Kurt Krause	Otago Otago Otago Otago Otago Otago	2016-1	Macromolecular Crystallography (MX1) “University of Otago Structural Biology Group”	Merit Access 1 day 24-25 February	\$4,904
<b>Dr Chris Squire</b> Dr David Goldstone Assoc Prof Peter Metcalf Professor Ted Baker Dr Shaun Lott Assoc Prof Alok Mitra Dr Richard Kingston Prof Juliet Gerrard Dr Ghader Bashiri Melissa Webby Othman Rechiche Marko Zutic	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2016-1	Macromolecular Crystallography (MX1) “Auckland Structural Biology CAP”	Merit Access 2 days 25-26 February 29-30 April	\$5,385
<b>Prof Emily Parker</b> Dr Gillian Norris Dr Andrew Sutherland-Smith Prof Geoff Jameson Prof Vic Arcus Heng Zhang Oliver Sterritt	Canterbury Massey Massey  Massey Waikato Waikato Canterbury	2016-1	Micro Crystallography (MX2) “Protein Structure and Function: Waikato, Canterbury and Massey Universities”	Merit Access 1 day 26-27 February	\$4,780
<b>Prof James White</b> Dr Ian Schipper Arran Murch Dr Rebecca Carey	Otago VUW Otago Tasmania Univ	2016-1	Imaging and Medical Beamline (IMBL) “Digging into a big explosive submarine eruption to understand seafloor volcanism”	Merit Access 2 days 4-6 March	\$2,843
<b>Dr Chris Squire</b> Dr David Goldstone Assoc Prof Peter Metcalf Professor Ted Baker Dr Shaun Lott Assoc Prof Alok Mitra Dr Richard Kingston Prof Juliet Gerrard Dr Ghader Bashiri Dr Paul Young	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2016-1	Micro Crystallography (MX2) “Auckland Structural Biology CAP”	Merit Access 1 day 31 Mar-1 Apr	Incl in above
<b>Dr Peter Mace</b> Dr Joel Tyndall Dr Sigurd Wilbanks Prof Greg Cook Prof Catherine Day Prof Kurt Krause	Otago Otago Otago Otago Otago Otago	2016-1	Micro Crystallography (MX2) “University of Otago Structural Biology Group”	Merit Access 1 day 6-7 April	Incl. in above

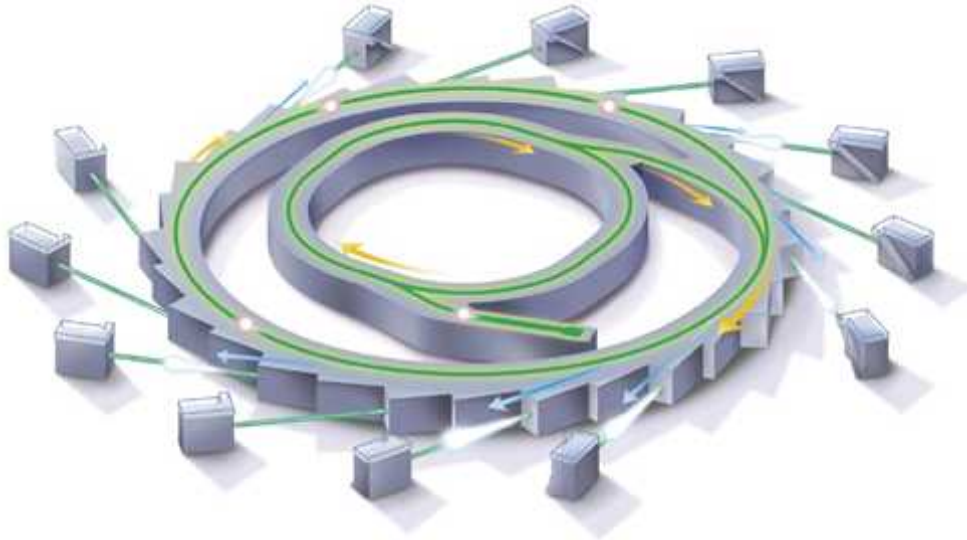
Researchers	Institution	Cycle	Beamline	Access	Travel Funding
<b>Dr Duncan McGillivray</b> Amy Xu Dr Timothy Ryan Prof Laurence Melton Da Chen Praveen Vaddakedath	Auckland  Auckland Austr. Synch. Auckland Auckland Auckland	2016-1	Small/Wide Angle X-ray Scattering (SAXS) “Tied together: the structure of covalently-linked protein-polysaccharide conjugates”	Merit Access 1 day 23-24 April	\$3,320
<b>Dr Grant Pearce</b> Dr Renwick Dobson Prof Emily Parker	Canterbury Canterbury Canterbury	2016-1	Small/Wide Angle X-ray Scattering (SAXS) “University of Canterbury SAXS Collaborative Program”	Merit Access 1 day 26-27 April	\$3,281
<b>Prof Emily Parker</b> Dr Gillian Norris Dr Andrew Sutherland-Smith Prof Geoff Jameson Prof Vic Arcus Bishwa Subedi Gert-Jan Moggre	Canterbury Massey Massey  Massey Waikato Massey Canterbury	2016-1	Macromolecular Crystallography (MX1) “Protein Structure and Function: Waikato, Canterbury and Massey Universities”	Merit Access 1 day 28-29 April	Incl. in above
<b>Dr Mark Waterland</b> Haidee Dykstra	Massey Massey	2015-3	THz/Far-infrared (FIR) “Investigating self-assembly of edge-functionalised graphene nanoribbons”	Merit Access 4 days <b>Rescheduled to 5-7 May</b>	\$2,772
<b>Emily Parker</b> Dr Gillian Norris Dr Andrew Sutherland-Smith Prof Geoff Jameson Prof Vic Arcus	Canterbury Massey Massey  Massey Waikato	2016-2	Micro Crystallography (MX2) “Protein Structure and Function: Waikato, Canterbury and Massey Universities”	Merit Access 1 day 9-10 June	Not claimed yet
<b>Prof Richard Haverkamp</b> Dr Katie Sizeland Dr Nigel Kirby Susyn Kelly Lyll McDonald Hannah Wells	Massey  Austr Synch Austr. Synch Massey Massey Massey	2016-2	Small/Wide Angle X-ray Scattering (SAXS) “How Elastic is Collagen”	Merit Access 1 day 11-12 June	\$3,013
<b>Dr Marco Brenna</b> Prof Shane Cronin Dr Ian Schipper Dr Ian Smith Dr Michael Rowe Elaine Smid	Auckland Auckland VUW Auckland Auckland Auckland	2016-2	Infrared Microscope (IRM) “Using water diffusion in olivine crystals from the Auckland Volcanic Field to estimate magma ascent rates”	Merit Access 3 days 14-17 June	\$2,238
<b>Dr Geoff Waterhouse</b> Pei Huan Hsieh Andrew Chan Wan-Ting Chen Ramon Quitales	Auckland Auckland Auckland Auckland Auckland	2016-2	Soft X-ray Spectroscopy (SXR) “Local electronic structure of ultrathin layered double hydroxide photocatalysts from synchrotron XPS and NEXAFS measurements”	Merit Access 5 days 14-19 June	\$2,209

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
<b>Dr Chris Squire</b> Dr David Goldstone Assoc Prof Peter Metcalf Professor Ted Baker Dr Shaun Lott Assoc Prof Alok Mitra Dr Richard Kingston Prof Juliet Gerrard Dr Ghader Bashiri	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2016-2	Macromolecular Crystallography (MX1) “Auckland Structural Biology CAP”	Merit Access 2 days 16-17 June 17-18 August	Not claimed yet
<b>Dr Bridget Ingham</b> Dr Sujay Prabakar Dr Geoff Holmes Dr David Clarke Ethan Zhang	Callaghan Innov. LASRA LASRA Callaghan Innov. LASRA	2016-2	Small/Wide Angle X-ray Scattering (SAXS) “Optimizing industrial tanning processes by studying structural differences in leather during the processing of skin”	Merit Access 1 day 29-30 June	\$1,551
<b>Dr Renwick Dobson</b> Dr Suzuki Hinori Arvind Ravichandran Alex Law Dr Michael Griffin	Canterbury Canterbury Canterbury Canterbury Melbourne U.	2014-3 to 2015-2	Macromolecular Crystallography (MX1) “University of Melbourne, Bio21 Institute, and Affiliated Researchers Collaborative Access Programme Group”	Merit Access 1.5 shifts (1 day) Various dates	N/A
<b>Dr Renwick Dobson</b> Dr Sarah Kessans Rachel North Chris Horne Dr Michael Griffin	Canterbury Canterbury Canterbury Canterbury Melbourne U.	2014-3 to 2015-2	Micro Crystallography (MX2) “University of Melbourne, Bio21 Institute, and Affiliated Researchers Collaborative Access Programme Group”	Merit Access 0.75 shifts (0.5 day) Various dates	N/A
<b>Dr Grant Pearce</b> Dr Renwick Dobson Dr Michael Griffin	Canterbury Canterbury Melbourne U.	2014-3 to 2015-2	Macromolecular Crystallography (MX1) “University of Melbourne, Bio21 Institute, and Affiliated Researchers Collaborative Access Programme Group”	Merit Access 1.5 shifts (1 day) Various dates	N/A
<b>Dr Grant Pearce</b> Dr Renwick Dobson Dr Michael Griffin	Canterbury Canterbury Melbourne U.	2014-3 to 2015-2	Micro Crystallography (MX2) “University of Melbourne, Bio21 Institute, and Affiliated Researchers Collaborative Access Programme Group”	Merit Access 0.75 shifts (0.5 day) Various dates	N/A
<b>Prof Paul Kruger</b> Dr David Turner A/P Michael Gardiner Chris Fitchett David Young Shane Verma Rob Stanisland	Canterbury Monash U. Univ of Tasmania Canterbury  Canterbury Canterbury	2014-3 to 2015-2	Macromolecular Crystallography (MX1) “Chemical Crystallography of Functional Molecules, Complexes and Materials”	Merit Access 3.0 shifts (1 day) Various dates	N/A

<b>Researchers</b>	<b>Institution</b>	<b>Cycle</b>	<b>Beamline</b>	<b>Access</b>	<b>Travel Funding</b>
<b>Prof Paul Kruger</b> Dr David Turner A/P Michael Gardiner Chris Fitchett David Young Shane Verma Rob Stanisland	Canterbury Monash U. Univ of Tasmania Canterbury  Canterbury Canterbury	2014-3 to 2013- 2	Micro Crystallography (MX2) “Chemical Crystallography of Functional Molecules, Complexes and Materials’	Merit Access 1.0 shift (0.3 day) Various dates	N/A

## Australian Synchrotron

A synchrotron is a large research facility that generates an extremely intense beam of electromagnetic radiation ('light') that can be used for scientific experiments. The radiation is produced by taking a stream of electrons travelling at close to the speed of light, and deflecting them with magnetic fields. The light covers the electromagnetic spectrum from the infrared to the hard x-ray region.



Electrons are generated in the linear accelerator (linac), and progress into the smaller 'booster' ring, where they are further accelerated up 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, 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 serve to increase the radiation flux by up to five orders of magnitude. The radiation produced can be used in many different experiments and techniques. The light is channelled from the ring down a number of 'beam lines', each of which is optimised for a particular experimental technique.

The status of the various beam lines at the Australian Synchrotron can be summarised as follows:

- ) Protein crystallography (MX1) was the first beam line to become operational and began accepting general users in January 2008. This technique uses x-ray diffraction to determine the structure of proteins, used in drug design and understanding biochemical interactions.
- ) Infrared spectroscopy and microscopy (IR) also came online in early 2008. The beam line features two endstations: an FTIR spectrometer and an infrared microscope.
- ) Powder diffraction (PD) began taking general users in February 2008 and was fully operational by May 2008. This beam line is a general purpose diffraction beam line with several sample environments for observing changes in materials structure as a function of temperature, pressure, time, etc.

- ) The soft x-ray absorption spectroscopy (SXR) beamline was available for general users from the September-December 2008 cycle. It operates at low x-ray energies and is most useful for surface studies.
- ) Final commissioning of the X-ray absorption spectroscopy (XAS) beam line was completed at the end of 2008 and 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 (SAXS), combined with wide-angle x-ray scattering (WAXS) is a useful technique for determining large scale (1-100 nm), short-range order in materials. This beam line came online at the beginning of 2009.
- ) The commissioning of the second protein crystallography and small-molecule crystallography beamline (MX2) was completed in mid 2009. It complements the existing protein crystallography beam line and is able to measure micron-sized crystals and other weakly-scattering or hard to crystallise systems.
- ) The microspectroscopy beam line (XFM) construction 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 medical imaging and therapy beam line is has only recently become available and is still coming into full use. It was redesigned from its original concept. The redesign involved a 150 m long enclosure being built which extends well outside the synchrotron building.



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

With the completion of the initial suite of nine beamlines, thoughts turned to the possibility of adding new beamlines to expand the facilities capabilities. The Australian Synchrotron consulted with the research communities in Australia and New Zealand and a Science Case to add a further 10 beamlines and make other upgrades to the facility was published in July 2010. Consideration of this Case was set aside while arrangements were made to secure operating funding from the Australian Commonwealth and the Victorian State Governments and the other Foundation Investors. In 2013 an updated development plan, called “Bright”, describing 7 new beamlines was published. New Zealand has been offered the opportunity to contribute to the development, thereby securing long-term access for New Zealand researchers to the enhanced facility.

The ownership of the Synchrotron and responsibility for its operation changed with effect from 1 July 2016. The structure and process described in the previous year's Annual Report was largely followed. The Victorian government and the minor shareholders agreed to transfer their shares to ANSTO who now own the Synchrotron on behalf of the Commonwealth government. The Commonwealth government also committed to provide 10 years operating funding for the facility and to provide future increases in the operating funding to meet higher costs associated with the operation of the new beamlines.

The Commonwealth has offered New Zealand the opportunity to continue participating in the Synchrotron. A government to government arrangement has been signed that establishes the right for New Zealand researchers to have access to the Australian Synchrotron. The directors believe the formal country-to-country agreement will give shareholders greater influence than the previous minority shareholding position, and therefore the confidence to continue participating in the sector-wide partnership with the government to fund ongoing access to the facility.

NZSG has negotiated a funding and access agreement with ANSTO that maintains the 5% access level for the next three years in return for an annual contribution of A\$1.5 million towards the facility's operating costs. The New Zealand government is providing half the cost of access, the remainder comes from the research sector.

# CORPORATE GOVERNANCE

## Board Composition

The company operates with a board comprising of 5 directors, including an independent chairman. Interim directors were appointed initially. These were replaced by a permanent board following elections which were held in April 2007.

The Directors during the period up to 30 June 2016 were:

Dr Garth Carnaby, Chair

Dr Desmond Darby, formerly at GNS Science (retired November 2015)

Professor Geoffrey Jameson, Massey University

Professor Michael McWilliams, formerly at GNS Science (appointed June 2016)

Professor James Metson, The University of Auckland

Professor Ian Shaw, University of Canterbury

## Indemnities and Insurance

The board has taken Directors and Officers Liability Insurance with Lumley General Insurance Limited. Coverage of up to \$5 million has been obtained.

## Attendance at Board Meetings

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

Director	No. meetings held during the year	No. meetings attended	Fees paid
Dr Garth Carnaby	6	6	\$9,000
Dr Desmond Darby	3	2	-
Professor Geoffrey Jameson	6	5	-
Professor Michael McWilliams	1	1	-
Professor James Metson	6	6	-
Professor Ian Shaw	6	6	-

## Donations

The company did not make any donations during the period from establishment up to 30 June 2016.

## Interests Register

During the course of undertaking its normal business activities in supporting 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 that particular matter.



The following significant entries relating to the directors were recorded in the Interests Register during the year.

<b>Director</b>	<b>Organisation/Entity</b>	<b>Nature of Interest</b>
<b>Dr GA Carnaby</b>		
Shares Held	GA Carnaby & Associates Ltd	Controlling majority
Beneficiary of Trusts	Carnaby Trust	Trustee and discretionary beneficiary
Offices Held	National Provident Fund	Annuity/Defined benefit
	Canterbury Development Corporation	Chair
	Canterbury Economic Development Trustee Ltd	Chair
	NZ Food Innovation (South Island) Ltd	Chair
	Lincoln University	Chair, Research & Commercialisation Committee
	Dodd-Walls Centre of Research Excellence	Chair
	BioResource Processing Alliance	Chair
	Seed Research Centre, Lincoln Univ.	Chair
	NZ Food Innovation Network	Director
<b>Dr D Darby</b>		
Shares Held	Vector Ltd	Minority shareholder
	Sound Direction Ltd	Majority shareholder
Offices Held	Sound Direction Ltd	Director
	GNS Science	Senior manager
	NZ Association of Scientists	Council member
<b>Prof GB Jameson</b>		
Shares Held	Tower Ltd	Minority shareholder
Beneficiary of Trusts	Estate of MEB Jameson	Discretionary beneficiary
Offices Held	Massey University	Employee
Other Interests	Te Manawa Museums Trust Board	Board member
<b>Prof JB Metson</b>		
Shares Held	Vector Energy	Minority shareholder
	Pacific Lithium	Minority shareholder
Offices Held	University of Auckland	Deputy Vice-Chancellor
	MBIE	Research
	Brain Research New Zealand	Chief Science Adviser
	Maurice Wilkins Centre for Molecular Biodiscovery	Board Member
	Medical Technologies Centre of Research Excellence	Board Member
	Te P naha Matatini	Board Member
	Dodd Walls Centre	Board Member

<b>Director</b>	<b>Organisation/Entity</b>	<b>Nature of Interest</b>
	High Value Nutrition National Science Challenge	Board Member
	A Better Start National Science Challenge	Board Member
Other Interests	Auckland UniServices Ltd	Director
	Australian Synchrotron	Science Advisory Committee member
<b>Prof IC Shaw</b>		
Offices Held	University of Canterbury	Employee
Other Interests	Sandoz GmbH, Austria	Consultant
	New Zealand Pharmaceuticals	Consultant

**New Zealand Synchrotron Group  
Limited  
Financial statements  
for the year ended 30 June 2016**



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Directors

G A Carnaby  
G B Jameson  
M O McWilliams  
J B Metson  
I C Shaw

Registered Office

11 Turnbull Street  
Thorndon  
Wellington

Nature of business

The purpose of the company is to provide a minimum amount of 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 access of New Zealand researchers to the Australian Synchrotron.

Company Registration number

1865516

Independent auditor

Office of the Auditor General with assistance from  
PricewaterhouseCoopers

New Zealand Synchrotron Group Limited  
Board Report  
for the year ended 30 June 2016

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 2016.

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 18 for issue on 23 September 2016.

For and on behalf of the Board



.....  
Garth Carnaby  
Chair

23 September 2016

.....  
Date



.....  
Mike McWilliams  
Director

23 September 2016

.....  
Date



## ***Independent Auditor's Report***

to the readers of the New Zealand Synchrotron Group Limited's Financial Statements for the year ended 30 June 2016

The Auditor-General is the auditor of the New Zealand Synchrotron Group Limited (the Company). The Auditor-General has appointed me, Chris Ussher, using the staff and resources of PricewaterhouseCoopers, to carry out the audit of the financial statements of the Company on her behalf.

### ***Opinion on the financial statements***

We have audited the financial statements of the Company on pages 7 to 18, that comprise the statement of financial position as at 30 June 2016, 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.

In our opinion:

- the financial statements of the Company:
  - present fairly, in all material respects:
    - its financial position as at 30 June 2016; and
    - its financial performance and cash flows for the year then ended; and
  - comply with generally accepted accounting practice in New Zealand and have been prepared in accordance with Public Benefit Entities Standards Reduced Disclosure Regime.

Our audit was completed on 23 September 2016. This is the date at which our opinion is expressed.

The basis of our opinion is explained below. In addition, we outline the responsibilities of the Board of Directors and our responsibilities, and explain our independence.

### ***Basis of opinion***

We carried out our audit in accordance with the Auditor-General's Auditing Standards, which incorporate the International Standards on Auditing (New Zealand). Those standards require that we comply with ethical requirements and plan and carry out our audit to obtain reasonable assurance about whether the financial are free from material misstatement.

Material misstatements are differences or omissions of amounts and disclosures that, in our judgement, are likely to influence readers' overall understanding of the financial statements. If we had found material misstatements that were not corrected, we would have referred to them in our opinion.

An audit involves carrying out procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on our judgement, including our assessment of risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, we consider internal control relevant to the preparation of the Company's financial statements 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.





An audit also involves evaluating:

- the appropriateness of accounting policies used and whether they have been consistently applied;
- the reasonableness of the significant accounting estimates and judgements made by the Board of Directors;
- the adequacy of the disclosures in the financial statements; and
- the overall presentation of the financial statements.

We did not examine every transaction, nor do we guarantee complete accuracy of the financial statements.

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

***Responsibilities of the Board of Directors***

The Board of Directors is responsible for the preparation and fair presentation of financial statements for the company that comply with generally accepted accounting practice in New Zealand.

The Board of Director's responsibilities arise from the Crown Entities Act 2004.

The Board of Directors is also responsible for such internal control as it determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error. The Board of Directors is also responsible for the publication of the financial statements, whether in printed or electronic form.

***Responsibilities of the Auditor***

We are responsible for expressing an independent opinion on the financial statements and reporting that opinion to you based on our audit. Our responsibility arises from the Public Audit Act 2001.

***Independence***

When carrying out the audit, we followed the independence requirements of the Auditor-General, which incorporate the independence requirements of the External Reporting Board.

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

A handwritten signature in black ink that reads 'Chris Ussher'.

Chris Ussher  
On behalf of the Auditor-General  
Wellington, New Zealand

A handwritten signature in black ink that reads 'PricewaterhouseCoopers'.

PricewaterhouseCoopers

New Zealand Synchrotron Group Limited  
Statement of comprehensive revenue and expenses  
for the year ended 30 June 2016

	Note	2016 <i>Unaudited budget</i> \$	2016  Actual \$	2015  Actual \$
<b>Revenue from non exchange transactions</b>				
Revenue for Australian Operations	3	1,662,948	1,705,507	1,663,373
<b>Revenue from exchange transactions</b>				
Revenue for NZ Operations	4	109,878	114,878	109,878
Other revenue	4	133,270	107,972	160,858
<b>Total Revenue</b>		<u>1,906,096</u>	<u>1,928,357</u>	<u>1,934,109</u>
<b>Expenses</b>				
Australian Synchrotron Group costs		1,447,917	1,480,891	1,513,804
Other operating expenses	6	417,818	460,508	183,790
<b>Operating expenditure</b>		<u>1,865,734</u>	<u>1,941,399</u>	<u>1,697,594</u>
<b>Total surplus/(deficit) for the year</b>		<u>40,361</u>	<u>(13,042)</u>	<u>236,515</u>
Other comprehensive income		-	-	-
<b>Total comprehensive revenue and expense</b>		<u><u>40,361</u></u>	<u><u>(13,042)</u></u>	<u><u>236,515</u></u>

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 18

New Zealand Synchrotron Group Limited  
Statement of changes in net assets  
for the year ended 30 June 2016

	Notes	Share capital \$	Retained earnings \$	Total equity \$
Balance as at 30 June 2014		2,824,036	(2,549,992)	<b>274,044</b>
Net surplus		-	236,515	<b>236,515</b>
Other comprehensive income		-	-	-
Total comprehensive revenue and expenses		-	236,515	<b>236,515</b>
<b>Balance as at 30 June 2015</b>		<b>2,824,036</b>	<b>(2,313,477)</b>	<b>510,559</b>
Net deficit		-	(13,042)	<b>(13,042)</b>
Other comprehensive income		-	-	-
Total comprehensive revenue and expenses		-	(13,042)	<b>(13,042)</b>
Contributions from owners	15	88,126	-	<b>88,126</b>
<b>Balance as at 30 June 2016</b>		<b>2,912,162</b>	<b>(2,326,519)</b>	<b>585,643</b>

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 18

**New Zealand Synchrotron Group Limited**  
**Statement of financial position**  
as at 30 June 2016

<b>ASSETS</b>	<b>Note</b>	<b>2016</b>	<b>2015</b>
		<b>\$</b>	<b>\$</b>
<i>Current assets</i>			
Cash and cash equivalents	7	367,751	452,149
Trade and other receivables	8	50,664	6,575
Derivative financial instruments	9	194,555	69,496
<b>Total current assets</b>		<b>612,970</b>	<b>528,220</b>
		<hr/>	<hr/>
<b>TOTAL ASSETS</b>		<b>612,970</b>	<b>528,220</b>
 <b>LIABILITIES</b>			
<i>Current liabilities</i>			
Trade and other payables	11	27,327	17,661
<b>Total current liabilities</b>		<b>27,327</b>	<b>17,661</b>
		<hr/>	<hr/>
<b>TOTAL LIABILITIES</b>		<b>27,327</b>	<b>17,661</b>
		<hr/>	<hr/>
<b>Net assets</b>		<b>\$ 585,643</b>	<b>\$ 510,559</b>
 <b>EQUITY</b>			
Share capital	15	2,912,162	2,824,036
Retained earnings		(2,326,519)	(2,313,477)
<b>TOTAL EQUITY</b>		<b>\$ 585,643</b>	<b>\$ 510,559</b>
		<hr/>	<hr/>

For and on behalf of the Board



.....  
Garth Carnaby  
Chair

23 September 2016  
Date: .....



.....  
Mike McWilliams  
Director

23 September 2016  
Date: .....

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 18

**New Zealand Synchrotron Group Limited**  
**Statement of cash flows**  
**for the year ended 30 June 2016**

	Notes	2016 \$	2015 \$
<b><i>Cash flows from operating activities</i></b>			
<u>Receipts</u>			
Receipts from non exchange transactions		1,705,507	1,663,373
Receipts from exchange transactions		156,803	195,034
Interest	4	21,460	27,529
<b>Net cash flows from operating activities</b>		<b>1,883,770</b>	<b>1,885,936</b>
<u>Payments</u>			
Australian Synchrotron Group Costs		(1,466,820)	(1,524,722)
Less: Cash applied to Derivative Asset		(153,524)	-
Other expenses		(435,950)	(183,790)
<b>Total cash applied</b>		<b>(2,056,294)</b>	<b>(1,708,512)</b>
<b>Net cashflows from operating activities</b>	17	<b>(172,524)</b>	<b>177,424</b>
<b><i>Cash flows from financing activities</i></b>			
<u>Receipts</u>			
Contributions from shareholders		88,126	-
<b>Net cash flows from financing activities</b>		<b>88,126</b>	<b>-</b>
Net (decrease)/increase in cash and cash equivalents		(84,398)	177,424
Cash and cash equivalents at 1 July	7	452,149	274,725
<b>Cash and cash equivalents at 30 June</b>	7	<b>367,751</b>	<b>452,149</b>

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 18

**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 a minimum amount of research access in 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 access of New Zealand researchers to 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 five 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 2019.

The financial statements have been approved for issue by the Board on 23 September 2016.

**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 has 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 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.

**(e) 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.

**(f) Government grants, sponsorships and donations**

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.

**(g) 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.

**(h) 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.

**(i) 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.

**(j) Trade receivables**

Trade receivables are recognised initially at fair value and subsequently measured at amortised cost, less provision for doubtful debts.

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 able to collect all amounts due according to the original terms of receivables. The amount of the provision is the difference between the asset's carrying amount and the present value of estimated future cash flows, discounted at the effective interest rate. The amount of the provision is recognised in the statement of comprehensive revenue and expenses.

**(k) Derivative financial instruments**

Derivatives are categorised as financial assets and liabilities held for trading. Derivatives are initially recognised at fair value on the date a derivative contract is entered into and are subsequently re-measured at their fair value. Gains and losses arising from changes in the fair value of the derivative financial instruments are presented in the statement of comprehensive income and expenses within gain/(loss) on fair value of derivatives. 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.

**(l) Investments and other financial assets**

NZSG classifies its investments in the following categories: loans and receivables. The classification depends on the purpose for which the investments were acquired. Management determines the classification of its investments at the initial recognition and re-evaluates this designation at every reporting date.

Loans and receivables are non derivative financial assets with fixed or determinable payments that are not quoted in an active market. They arise when NZSG provides money, goods or services directly to a debtor with no intention of selling the receivable. They are included in current assets, except for those with maturities greater than 12 months after the balance sheet date which are classified as non current assets. 'Trade and other receivables' and 'cash and cash equivalents' are classified as loans and receivables in the statement of financial position.

Loans and receivables are subsequently carried at amortised cost using the effective interest method.

**(m) Trade and other payables**

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

**(n) 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.



**(o) 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 investment in ASHC and 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.

<b>Note 3. Revenue for Australian operations</b>	<b>2016</b>	<b>2015</b>
	\$	\$
<i>Revenue from non-exchange transactions</i>		
Ministry of Business Innovation and Employment	983,000	983,000
Shareholders	722,507	680,373
<i>Revenue from exchange transactions</i>		
	-	-
	<u>1,705,507</u>	<u>1,663,373</u>

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

<b>Note 4. Revenue for New Zealand operations</b>	<b>2016</b>	<b>2015</b>
	\$	\$
<i>(a) Revenue from non-exchange transactions</i>		
	-	-
<i>Revenue from exchange transactions</i>		
Grants from shareholders for operating costs of NZSG	114,878	109,878
<i>(b) Other Revenue</i>		
Contribution from the Australian Synchrotron towards travel costs	90,420	74,274
(Loss)/Gain on fair value of Derivative instrument	(3,908)	59,055
Interest	21,460	27,529
	<u>107,972</u>	<u>160,858</u>
	<u>222,850</u>	<u>270,736</u>

**Note 5. Australian Synchrotron Group costs**

As detailed in note 10(a) the Company makes an annual contribution to the ongoing operating costs of the Australian Synchrotron.

**Note 6. Included in 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 - PricewaterhouseCoopers.	<b>2016</b>	<b>2015</b>
	\$	\$
Statutory audit services	<u>7,750</u>	<u>7,750</u>

**(b) Foreign exchange (gains) / losses**

During the year the following exchange (gains) / losses were made on transactions between New Zealand and Australia.

	<b>2016</b>	<b>2015</b>
	\$	\$
Foreign exchange (gains) / losses	<u>4,431</u>	<u>(9,582)</u>

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**(c) Support for Synchrotron Science**

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

	<b>2016</b>	<b>2015</b>
	<b>\$</b>	<b>\$</b>
Travel costs reimbursed to related parties	109,345	73,379
Payments for access to Australian Synchrotron	48,948	-
Grant to Australian Synchrotron for new detector.	167,224	-
User Meetings	4,528	-
Asia Oceania Forum for Synchrotron		
Radiation Research Membership	14,314	8,147
	<u>344,358</u>	<u>81,526</u>

**(d) Secretariat and other operating costs**

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

	<b>2016</b>	<b>2015</b>
	<b>\$</b>	<b>\$</b>
Secretariat services from the Royal Society and Board costs	100,637	100,718
Insurance	2,950	2,950
Other	382	428
	<u>103,969</u>	<u>104,096</u>
<b>Total other operating costs</b>	<b><u>460,508</u></b>	<b><u>183,790</u></b>

**Note 7. Cash and cash equivalents**

	<b>2016</b>	<b>2015</b>
	<b>\$</b>	<b>\$</b>
Cash	327,954	316,430
Foreign currency - AUD	39,797	135,719
	<u>367,751</u>	<u>452,149</u>

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

**Note 8. Trade and other receivables**

	<b>2016</b>	<b>2015</b>
	<b>\$</b>	<b>\$</b>
Trade receivables	49,189	5,100
Prepayments	1,475	1,475
<b>Total trade and other receivables</b>	<b><u>50,664</u></b>	<b><u>6,575</u></b>

**Note 9. Derivative financial instruments**

	<b>2016</b>	<b>2015</b>
	\$	\$
Western Union Forward cover	194,555	69,496
<b>Derivative financial instruments</b>	<b>194,555</b>	<b>69,496</b>

The following derivatives have been entered into with Western Union.

(a) *Forward foreign exchange contracts*

The notional principal amounts of the outstanding forward exchange contracts at 30 June 2016 were \$792,812 (2015: \$725,389). At 30 June 2016, the fair value amounted to \$6,607 (2015: \$69,494).

(b) *Options*

At 30 June 2016	Notional	Strike Price	Fair Value
Forward foreign exchange option (Maturity: February 2017)	\$852,273	0.88	\$65,678
Forward foreign exchange option (Maturity: February 2018)	\$852,273	0.88	\$62,325
Forward foreign exchange option (Maturity: February 2019)	\$852,273	0.88	\$59,945

At 30 June 2015	Notional	Strike Price	Fair Value
Forward foreign exchange option (Maturity: February 2016)	\$759,012	0.86	\$ -

**Note 10. Commitments**

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

Agreements have been signed on the 17th June 2016, between NZSG and ANSTO Ltd whereby NZSG undertakes to provide AUD4.5m over three years in return for 5% of the access. As part of the Funders' Agreement entered into with 9 of the shareholders, these funds will be received directly from the Participants or MBIE on their behalf when required to fulfil these obligations.

New Zealand shareholders who are party to the Funders' Agreement are irrevocably committed to contribute a total of AUD2,250,000 (GST exclusive) evenly over a 3 year period.

(b) *Agreement with MBIE*

The company has entered into a 3 year agreement with the Ministry of Business, Innovation and Employment for Crown Funding totalling NZ\$2.820m over the period 1 July 2016 to 30 June 2019.

**Note 11. Trade and other payables**

	<b>2016</b>	<b>2015</b>
	\$	\$
Creditors	3,888	-
Accruals	23,439	13,256
Goods and Services Tax payable	-	4,405
<b>Total trade and other payables</b>	<b>27,327</b>	<b>17,661</b>

The amount owed to related parties was nil as at 30 June 2016. (2015: \$15,729).

**Note 12. Contingent liabilities**

There were no significant contingent liabilities at 30 June 2016. (2015: nil)

**Note 13. Related parties**

Related parties comprise of the shareholders identified in Note 15. There have been a number of related party transactions during the year ended 30 June 2016.

These transactions include grants from shareholders as per Note 4 and for operating and travel costs reimbursed as per note 6.

**Note 14. Events occurring after balance date**

Shares held by the Company in the Australian Synchrotron Holding Co Pty have been transferred to ANSTO at nil value. This transaction occurred in July 2016.

**Note 15. Share capital**

Shareholding at cost	2016	2015
	\$	\$
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
Otago University 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	-
	<u>2,912,162</u>	<u>2,824,036</u>

The shares held at 30 June are:

	2016	2015
	# 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
Otago University 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	-
	<u>2,581,208</u>	<u>2,418,104</u>

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

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**Note 16. Financial instruments**

Classification of financial assets by category	Fair value through Profit or Loss	Loans and Receivables
<b>2016</b>	<b>\$</b>	<b>\$</b>
Cash and cash equivalents	-	367,751
Trade & other receivables	-	49,189
Derivative financial instrument	194,555	-
<b>Total</b>	<b>194,555</b>	<b>416,940</b>
<b>2015</b>		<b>\$</b>
Cash and cash equivalents	-	452,149
Trade & other receivables	-	5,100
Derivative financial instrument	69,496	-
<b>Total</b>	<b>69,496</b>	<b>457,249</b>

**Classification of financial liabilities by category**

**Measured at amortised cost**

	2016	2015
	<b>\$</b>	<b>\$</b>
Trade & other payables	27,327	13,256
<b>Total</b>	<b>27,327</b>	<b>13,256</b>

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

	2016	2015
	<b>\$</b>	<b>\$</b>
Net (Deficit)/Surplus for the year	(13,042)	236,515

**Movement in working capital**

Trade and other receivables	(44,089)	10,276
Derivative financial instruments	(125,059)	(59,055)
Trade and other payables	9,666	(10,312)
<b>Net Cash outflow from operating activities</b>	<b>(172,524)</b>	<b>177,424</b>