Issue 8 | March 23

Scatter Matters

Supported by NCRIS National Research Infrastructure for Australia An Australian Government Initiative

From the Director's desk

Welcome to 2023 and I trust that the transition to the new year has been smooth and new opportunities are being realised. We ended 2022 with some fantastic highlights including the ANSTO-HZB Neutron School, ANBUG-AINSE Neutron Scattering Symposium (AANSS 2022), the ANSTO Powder Diffraction School and the ANSTO Small-angle Scattering Workshop. It was great for these events to be run as face-to-face events.

Congratulations to the winners of the 2022 ANBUG Awards and a special mention to Kirrily Rule who received the ANBUG Neutron Award and Andrew Nelson who received the ANBUG Technical Award.

We are continuing with a number of upgrade projects and are expecting the new improved Koala Laue Diffraction instrument after taking the first diffraction pattern in early February 2023 to be returned to the user program soon (see Koala 2.0 project article). We are also planning for the 2024 OPAL reactor shutdown in which the Cold Neutron Source will be replaced (see 2024 OPAL Long shutdown article).

The OPAL long shutdown in 2024 will run from 18th March to 5th July 2024. Some ACNS instruments will also be not available for users in July 2024 as we return them to operations and we will also need to undertake performance measurements of the new Cold Neutron Source after the reactor returns to normal operations. As a consequence of the reduced days we will be adjusting our proposal rounds with the 2023-2 round running from 1st August 2023 to 17th March 2024 and the 2024-2 running from 1st August 2024 to 31st January 2025. We realise this may have implications for students and those on fixed-term contracts, hence we urge all primary investigators to plan ahead.

The 2023-2 proposal round is currently open and closes on 15th March 2023 with proposals submitted to the ANSTO Research Portal (ARP).

A reminder that we now offer Scientific Computing as part of the user program. Please consider if this support can assist with your neutron scattering measurement analysis and interpretation.

Jamie Schulz

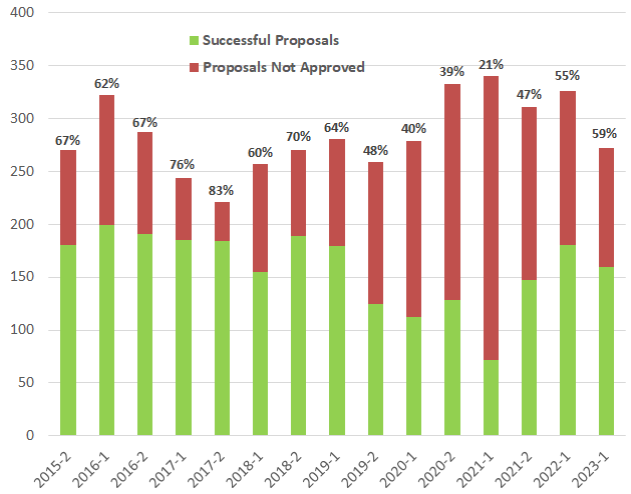
Issue 8 | March 23

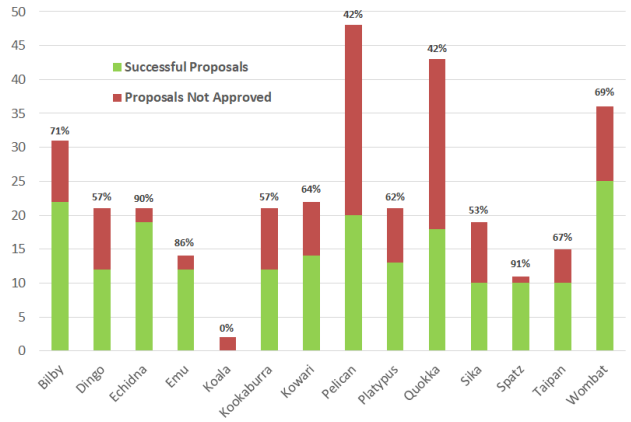
Scatter Matters

Supported by NCRIS National Research Infrastructure for Australia An Australian Government Initiative

Round statistics 2023-1

The Australian Centre for Neutron Scattering & National Deuteration Facility Program Advisory Committee met on the 14th & 15th November 2022 to assess the scientific merit of neutron beam-time and deuteration proposals, for access between February and July 2023. In total 272 neutron beam experiments along with proposals to the National Deuteration Facility were assessed and 160 were recommended for approval. The average proposal success rates for the past 15 rounds and the success for the instruments in the 2023-1 round are given below.



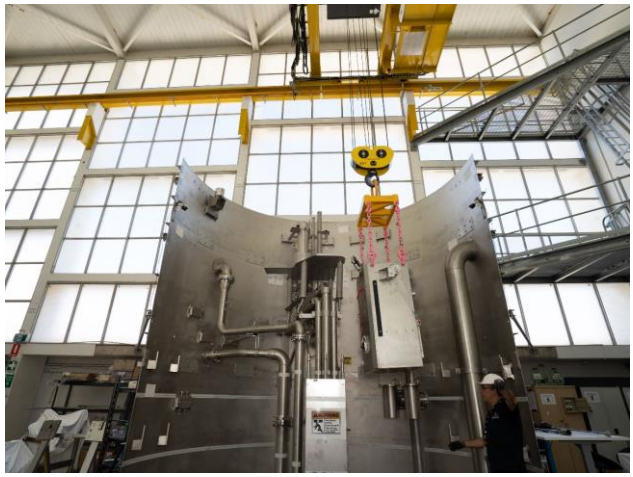


Preparing for the long shutdown

After over 15 years of service, it is time to replace our Cold Neutron Source (CNS). This will have an impact on the number of days the OPAL reactor will operate in 2024. Between 18th March to 5th July 2024 the OPAL reactor will transition to a shutdown state while the replacement is undertaken.

The primary reason to replace the CNS is due to radiation damage of the materials from which the CNS is constructed. We are also expecting a modest increase in performance of the CNS which will benefit the cold neutron instruments.

ANSTO has been planning the replacement of the CNS for over the past 5 years and to enable our team to plan and practice the highly complex and unique activities required for the upgrades and maintenance of OPAL, a life-size mock-up nuclear reactor has been built.



ANSTO has created a short clip which features Andrew Eltobaji (former ACNS staff & now with the ANSTO maintenance & engineering group) who speaks from the OPAL reactor mock-up facility. He outlines what the cold neutron source does and how

ANSTO plans on replacing it. https://vimeo.com/799367433

To keep up-to-date with the OPAL shutdown, do subscribe to the mailing list below,

https://www.ansto.gov.au/form/opal-shutdown-2024-enquiry-form

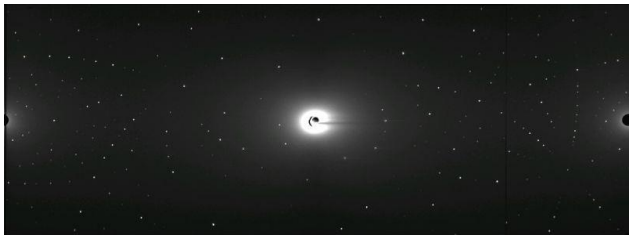
News from the Instruments

Operations

The operations team at ACNS includes the technical group, laboratory group and sample environment group.

ACNS lab staff are available to assist with access to the laboratories and advise on chemical safety in support of your neutron proposals, and can be reached at acns_laboratories@ansto.gov.au

Update on Koala 2.0



The Koala 2 project is now in the final commissioning phase and the first diffraction pattern has been collected.

We spoke with Frank Darmann, the Project Manager to reflect on this challenging project and provide some insights into the construction of our newest neutron beam instrument.

Q. The new Koala is an important project for ACNS. Probably this is the first neutron beam instrument fully designed and developed in-house. Which part of the project you found most challenging?

The biggest challenge has been to manage and coordinate in an efficient way all the separate resources coming from different parts of the organisation. Just to add complexity, the Koala 2 project was conducted across two sets of four-month long Covid Lockdowns. To maintain the project schedule, we organised an effective way to work from home and make meaningful progress on the design. During the first lock-down it was all about design, choosing components, and design drafting. We have been fortunate that the structural manufacturer, a local engineering company, was operating during lockdown. For the second lockdown, we created a safety working "bubble" to progress the building of the motion and safety control cabinet. Our mechatronic design engineer, Toby Oste, was able to build a safety PLC prototype system at home with all the Koala 2 safety field devices and this allowed him to complete programming and drawing of the instrument safety system and motion control electrical circuit, ready for the drafts person convert in AutoCAD Electrical.

Technically, the implementation of the large bore spindle (to enable an open drum) that can still provide reliable data scanning at 600 rpm was an engineering challenge.

Q. Which features of Koala 2 are you particularly excited to introduce to the scientific user community?

The structure was machined and assembled in Australia using a local engineering company. All the

main body work, steel work, doors, and mounting plate. The sample stage has been designed by Eno Imamovic with close review and feedback from Jthe team. For Koala 2.0 we designed a larger diameter drum, to accommodate larger sample environments. However, I believe the best upgrade is the 24-bit, dual channel pre-amp features of the data acquisition system. It will be an immediate benefit to Laue diffraction science and represents the single greatest improvement in Koala 2. Having the two channels available in each read cycle will allow the scientists to discriminate between saturated data spots and optimise the data in a single read cycle. In the previous instrument, the discrimination required two read cycles.

Q. Which is the biggest advantage you see in the short and long terms by developing instruments in house with respect to buy a turnkey system from overseas?

Simply importing and "bolting down" overseas made equipment does not respect the brilliance that we have here at ANSTO nor the skills of the Australian work force. Also, it offered, finally the opportunity to standardise Koala to all other neutron beam instruments, reducing costs, in terms of available spares, and improving maintainability. I am confident that such instrument, built in house, with local knowledge, will greatly increase reliability, providing a better user experience. This without going in the details of the enormous knowledge and expertise gained by the team in terms of electrical, electronic and mechanical design and construction.

Q. Many people have been involved in the development and construction of Koala 2. From the professional point of view what do you think are the major achievements for ANSTO staff, contractors and for the team?

I counted that overall, in one way or another, 17 people contributed to the success of this project. 90% of the project budget remained in Australia contributing to the local economy. Toby Oste programmed the motion control system and the instrument safety system and provided invaluable engineering design input. Jason Christoforidis led the engineering design efforts. There are so many innovative solutions in this project, the team solved issues and improved the original design at every step. For example, the sample rotation stage; the accuracy and tolerances required were achieved through clever design and realisation, the ability to achieve this, is now a local knowledge.

Q. Which are the newly built-in safety features of Koala 2.0 you can brag about?

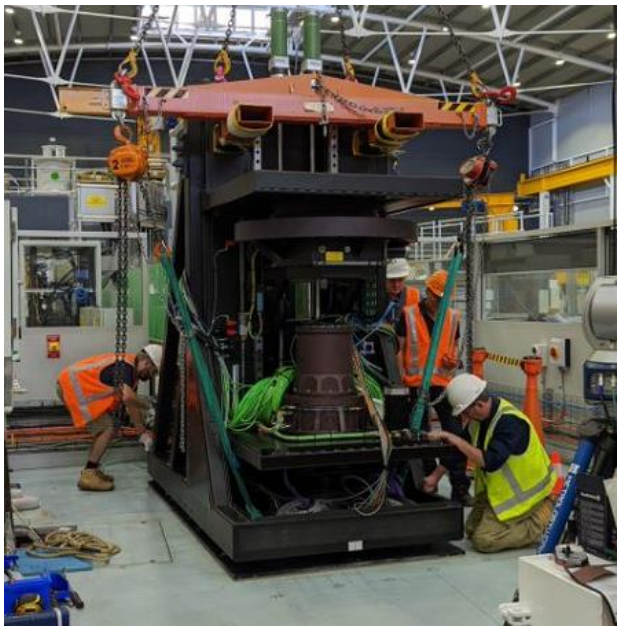
As you know safety is paramount at ANSTO and we took the challenge to build a seriously safe system from the beginning, according to the highest standards. There are three features that are really a shining example: The Instrument Safety System, Koala 2 has its own safety PLC programmed by Toby Oste. Koala 2 has two levels of ballistics shielding on the drum, including a drum shroud and the instrument doors. The sample table and the drum table each have three levels of support to prevent them dropping under gravity including sufficient motor static detent torque, electromagnetic brake, and pneumatic release carriage brakes. Each system on its own has a safety factor. This is what we call defence in depth, multiple layers of safety engineered in the system.

Q. Looking back at the completed project, getting ready for user service, what would you do differently? Which is the major lesson learned?

Looking back, I wish we would have tackled the build of the laser system as well in house, with Australian components and expertise. This is the only major outsourced part. I would have also consulted much earlier with a civil engineer. We completed all the

work while closely collaborating with the ANSTO mechanical engineering team. However, there was a surprise in the method of mounting of the Koala 2 diffractometer just three months before installation which required a mounting plate to be designed. Again, ANSTO staff came to the rescue and through the design skills of Jason Christoforidis, the engineering design expertise of Toby Oste, and the Faro mapping skills of Jeremy Shalala, a mounting plate was designed in a short time and built within the budget available. Thanks to Tai Nguyen, David Witchard, and James Totman, the mounting plate was grouted in place within the time frame required to stay on track. Plans are everything and nothing. In the end, it is the engagement and professionalism of the people on the project that make it a success.

Thank you, Frank and team, for this amazing project and success!

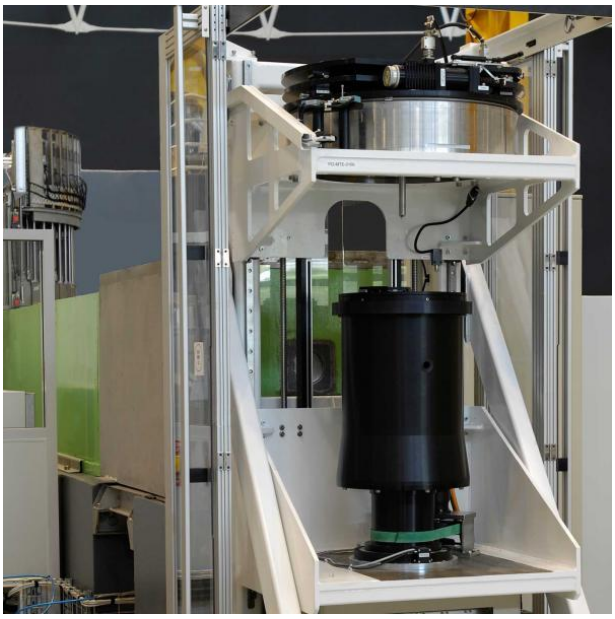


Paolo Imperia

Diffraction

The diffraction instruments at ACNS are Echidna (high-resolution powder diffraction), Wombat (high-intensity diffraction) and Koala (Laue diffraction). The group also includes the Scientific Computing staff and runs the Physical Properties Measurement System (PPMS). They can all be reached at acnsdiffraction@ansto.gov.au

Koala 1.0 decommissioned



After 15 years in the user service program, the Koala single-crystal neutron Laue diffractometer was decommissioned in November 2022 and will be replaced with next generation instrument. Since 2007, more than 350 experiments by researchers from 22 countries have resulted in 83 journal publications. Some of the articles were published in journals such as Nature and Nature Chemistry and widely covered by science news media due to the very high impact of the results.

Issue 8 | March 23

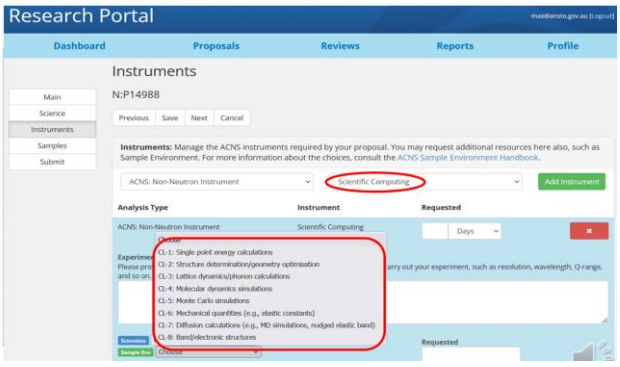
Scatter Matters

Supported by NCRIS National Research Infrastructure for Australia An Australian Government Initiative

Visiting Professorship

Max Avdeev has been awarded a visiting Professorship at the Technical University of Munich (TUM) in Germany under the "TUM Global Visiting Professor" program. TUM Global Visiting Professors are expected to enrich the vibrant research culture at TUM by virtue of innovative approaches and to explore new, cutting-edge research fields. Max will undertake the visiting professorship in March 2023.

Provision of Scientific Computing Support service for ACNS 2023-2 round



The service includes calculations and simulations to complement Neutron Experiments undertaken at the ACNS. Researchers can request the service via the ANSTO Research Portal as a part of the proposal submission. We will support the two highest-ranked projects for up to six months based on their scientific merit and feasibility.

ACNS' Scientific Computing Scientist will provide the computational work in collaboration with the Experimental Scientist. The service includes project planning, software configuration, production of simulations, data analysis, visualisation and interpretation.

The service includes the following methods: Single point energy calculations, structure determination/geometry optimisation, lattice dynamics/phonon calculations, molecular dynamics and Monte Carlo simulations.

Pablo Galaviz

Engineering & Imaging

The engineering and imaging instruments at ACNS are Dingo (imaging) and Kowari (strain scanning). The group can be contacted at acnsimagingandengineering@ansto.gov.au

Visiting research fellow

Joseph Bevitt has been appointed as a Visiting Research Fellow at the Powerhouse Museum in Sydney. The Powerhouse Research Fellowship Program provides a supportive environment to undertake research related to the museum's collection, education, conservation and museum

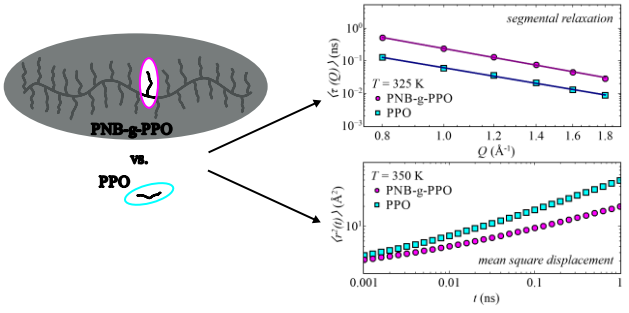
practice. The fellowships enable researchers to access Powerhouse resources to support their research for a short period of time.

The visit will initiate and develop collaborative research and facilitate interaction with, and training of, Powerhouse staff. Joseph will work on incomplete projects that weren't used in the highly successful "The Invisible Revealed" exhibition and develop pathways for their completion, and publication pathways for those projects where conclusions were drawn on objects. Further papers will be prepared that focus on the research outcomes of individual objects, or groups of objects, and/or focus on the technical innovation of the applied non-destructive nuclear methods toward cultural heritage studies.

Inelastic

The inelastic instruments at ACNS are Taipan (triple-axis spectrometer), Emu (high-resolution back-scattering spectrometer), Pelican (time-of-flight spectrometer) and Sika (cold triple-axis spectrometer). The team also operate Joey (Laue camera) and can be contacted at acnsinelastic@ansto.gov.au

Science Highlight – Changing Dynamics due to Grafting Process.



Inelastic neutron scattering is the only spectroscopic technique that can simultaneously probe both time/energy and length scales. This study on bottlebrush polymers used three spectrometers to span three decades in time, a dynamic range difficult to achieve with almost any other technique. With multiple different timescales covered continuously, it was then possible to determine all the different contributions to the dynamics.

The study on these polymers, which are an interesting class of architecture with substantially different dynamical behaviour compared to linear polymers, was a collaboration between scientist from Louisiana State University, ANSTO and J-PARC. The team collected data on the spectrometer Emu (High-resolution backscattering spectrometer ANSTO), Pelican (Time-of-flight spectrometer, ANSTO), and BL02 DNA (Biomolecular dynamics spectrometer, J-PARC) - combining these three instruments resulted in a merged time range of t~1 ps to t~1 ns.

Bottlebrush polymers consist of linear side chains densely grafted onto a linear backbone, variation of which can change properties like the dynamical behaviour. Comparing the linear side chains before and after the grafting process reveals changes in the segmental dynamics, inherent with the tethering of one chain end. In this study, the relatively stiff polymer, poly(norbornene), was used as the backbone, whereas the more flexible poly(propylene oxide) serves as side chains. Due to the differences in glass transition temperatures, it is possible to study the segmental dynamics of the side chains while the backbone is outside the accessible time window. The grafting process causes a slowdown of the segmental relaxation time over the entire length scales investigated, leading to broader distributed relaxation times. This relates to a more heterogenous dynamics of the bottlebrush polymer, which is also reflected by the non-gaussian parameter, α_2 (t), and the time dependent mean square displacement, ⟨r^2 (t)⟩. This together shows that all segments within the side chains are affected. To clarify if they are affected to the same degree,

further studies will be conducted with selectively labeled side chains to investigate the influences close to and away from the grafting point.

Read the full article here https://onlinelibrary.wiley.com/doi/full/10.1002/marc.202200902

Alice Klapproth, Richard Mole and Nicola D'Sousa

Reflectivity

The reflectivity instruments at ACNS are Platypus, Spatz and the X-ray reflectometer. The group also includes the ^{3}He polarisation staff, and they can all be reached at acnsreflectivity@ansto.gov.au.

Spatz: Spreading its Wings

Spatz has recently achieved its first publications using neutrons from the OPAL Reactor. A publication by Robertson et al., in SoftwareX (https://doi.org/10.1016/j.softx.2022.101225) describes refellips, a new software package for analysing ellipsometry data and uses data collected on Spatz to demonstrate the software's capabilities for simultaneously fitting neutron reflectometry, X-ray reflectometry, and ellipsometry data. The next paper published in Journal of Applied Crystallography (https://doi.org/10.1107/S160057672201086X) is the hot commissioning paper for the instrument demonstrating Spatz' capabilities and performance at its new nest. Congratulations to all the authors for achieving this milestone.

A new development for reflectometry at ACNS is that we have commissioned and conducted the first user experiments using the high temperature furnace on Spatz (pictured). The vertical sample geometry of Spatz allows for some sample environment that cannot be used on Platypus to be used on a reflectometer and this is the first such case. We can now measure samples for reflectivity that require temperatures to 1000 °C. For users interested in using the high temperature furnace for their future reflectometry experiments please talk to your friendly instrument scientists before putting in a proposal.

Anton LeBrun

Small Angle Scattering

The small-angle-scattering instruments at ACNS are Quokka, Bilby, Kookaburra (ultra-small angle) and the X-ray small-angle camera. The team can be reached at acnssmallangle@ansto.gov.au

The Xenocs Xeuss 3.0 (Gi)SAXS/WAXS/USAXS Instrument

A Xeuss3.0 SAXS instrument (Xenocs Grenoble) has been installed in the ACNS Guide Hall replacing the

NanoSTAR II SAXS instrument (Bruker Karlsruhe) which has been in routine operation since 2006.

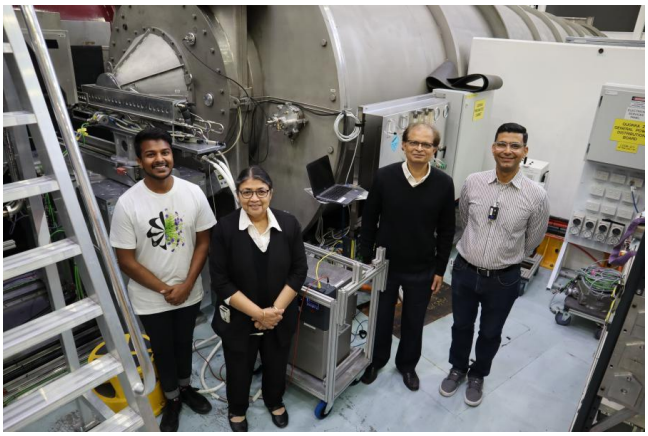
The Xeuss3.0 SAXS instrument is equipped with a variety of sample environments and special hardware configurations, including controlled sample temperature, and measurements under shear or tension.

The instrument incorporates the latest developments in X-ray beam technology and a large range of instrument configurations is possible. There are two X-ray wavelengths available – Cu and Mo sealed micro-focus sources – with two adjustable pinholes for standard pinhole geometry. An automated Bonse-Hart geometry USAXS module is available to provide sequential USAXS/SAXS data on the same sample. The large sample chamber accommodates numerous sample environments plus a WAXS detector (Dectris Eiger2 R 500k). In-vacuo and lab-atmosphere environment for the sample chamber is possible. The SAXS detector (Dectris Eiger2 R 1M) is mounted on a 3-axis translation stage in-vacuo with sample-to-detector distance in the range ~45 - 1800 mm. No beamstop is required. An extensive suite of software enables control of all system functions (XICC: Xenocs Instrument Control Centre), and for online data display and analysis (XSACT: X-ray Scattering Analysis and Calculation Tool).

The system was funded in FY2021/2022 by a RIIP Grant. The primary purpose for the co-location of the SAXS instrument at ACNS is to support research programs on the SANS/USANS instruments, and in some cases, experiments on other neutron scattering/imaging instruments. Access to the Xeuss3.0 SAXS instrument is possible through the ACNS Research Proposal System.

Robert Knott

Science Highlight - In the push and pull of crowds, disordered proteins dance precariously



A collaboration of scientists from RMIT, ANSTO and the CSIRO has published pioneering research in Science Advances that brings new insights into intrinsically disordered proteins and protein regions (IDPs)/ (IDRs) and how they behave under various physiological processes.

IDPs carry out a range of important biological tasks and play a key role in several biological functions, including, various metabolisms, cellular signalling, infections, illnesses, tissue repairs, as well as drug delivery. These proteins are distinctive in that, unlike other functional proteins, they do not have a stable three-dimensional structure; rather, the same protein can rearrange it in multiple pathways and may adapt to engage in different interactions with different consequences

Although multiple techniques were used in the research, it was deuteration at the National Deuteration Facility and Ultra-small and Small Angle Neutron Scattering (USANS and SANS) at the Australian Centre for Neutron Scattering (ACNS) that were crucial in identifying the IDP and its metamorphosis in the soup of molecules that typically crowd the cellular environment.

The Rec1-resilin a segment of resilin was produced by a team of researchers at CSIRO. The deuterated protein was biosynthesised at NDF, ANSTO by RMIT and ANSTO teams before being used for SANS and USANS experiments at ACNS, ANSTO. Experimentally identifying the shapes of the ensembles of IDPs and their metamorphosis under various crowding circumstances reveals the links between their sequences and functions.

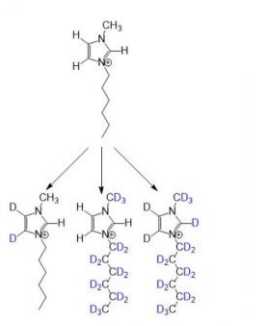
Read the full article here https://dx.doi.org/10.1126/sciadv.abq2202

National Deuteration Facility (NDF) News

The National Deuteration Facility has expertise in both biodeuteration and chemical deuteration techniques, enabling access to a wide range of deuterated molecules. The diversity of molecules available can be found in our extensive NDF Product List, which provides examples of the types of molecules and labelling possible. Although NDF is a separate ANSTO research infrastructure platform to ACNS, we share many of our users – so are using this corner of the ACNS newsletter to get in touch with you all!

NDF News and Science Highlights

Find NDF Science News and Highlights here on the ANSTO website. Recent stories showcase the utilisation of deuterated ionic liquids for various studies, along with biosynthesis of the deuterated protein 'Rec1-resilin' for SANS and USANS experiments at ACNS (also see SAS Science highlight above).



NDF Access Modes and Proposal Types

There are three modes of access available to NDF capabilities – Merit, User Pays/Collaboration and Commercial.

Further information on NDF access modes can be found here.

Reminder for the open ACNS & NDF 2023-2 Round closing 15th March 2023 – if you wish to request deuterated molecules from NDF for use with ACNS experiments, the combined NDF and ACNS Proposal Type 'Deuteration/Neutron' needs to be submitted.

For any NDF related questions (e.g. regarding access, molecule options), please contact the NDF team at ndf-enquiries@ansto.gov.au.

ANBUG update

The ANBUG community currently holds 377 members, with 477 Twitter followers of ANBUGneutron. They all receive ANBUG newsletter and ACNS Scatter Matters regularly.

The ANBUG EC committee have regular meeting to manage website and communications, survey and response as well as organize town hall meeting to update neutron facility information and seminar/workshop to support users' research. In 2022, the ANBUG EC has been very active to support Australian neutron beam users from Australia, New Zealand and other countries, to minimise the impact of the backlog caused by the COVID lockdown by working together with the ACNS Director. We have conducted a survey for the blind grant and

application review, responded to the ANSTO consulting on the New Terms and Conditions for users. Our EC working group organized the town Hall meeting on polarized neutron scattering; a crash course in neutron reflectometry and polarized reflectometry.

AANSS 2022

Karyn Wilde of the National Deuteration Facility chaired the symposium and organising committee for the AINSE-ANBUG Neutron Scattering Symposium (AANSS) 2022, held in person 9-11 November 2022 at ANSTO's Lucas Heights campus. AANSS is the biennial symposium of the Australian and New Zealand neutron scattering community and aims to bring together the users (both local and international) of Australia's neutron research infrastructure with other global experts and users of neutron instrumentation.

Prof Andrew Peele (ANSTO Group Executive, Nuclear Science and Technology) presented the opening address followed by ACNS and NDF research infrastructure facility updates for the first session.

The symposium covered multiple topics areas - Earth, Environment and Cultural Heritage; Manufacturing, Engineering and Industry; Chemistry and Crystallography; Biological Systems and Soft Matter; Deuteration for Neutrons; Magnetism and Condensed Matter; Neutron Instruments and Techniques, and Advanced Materials. For the first in person event since before the COVID-19 pandemic, AANSS2022 was well attended attracting over 85 attendees from Australia and overseas with:

- 31 contributed talks (presented by students, ECRs and experienced researchers),
- 7 Keynote/Invited speakers &
- 2 International Plenary speakers
- ~40 Posters

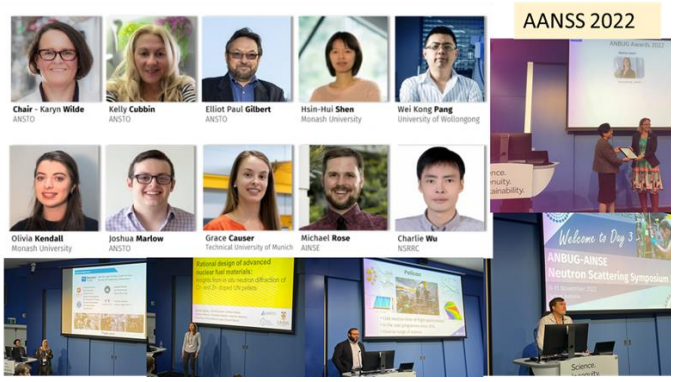
The poster and networking session on the 1st evening, the event dinner on the 2nd evening and lunch breaks provided great opportunity for many interesting science conversations between delegates. A student-ECR Q&A session with a panel of researchers at different career stages was also successfully held.

Highlights included virtual Plenary speaker presentations from international speakers Marianna Yanez Arteta (Associate Director - Advanced Drug Delivery, Pharmaceutical Sciences, AstraZeneca, Sweden) and Valeska Ting (Prof of Smart Nanomaterials, University of Bristol, UK), who spoke on highly topical subjects: "Lipid Nanoparticles for mRNA delivery: Using Neutron Scattering for Successful Redesign" (collaborations between industry, academia, neutron and deuteration research infrastructure) and "Insights into hydrogen storage in porous materials from neutron scattering" respectively.

The ANBUG also ran the first supporting program to promote Women in Neutron scattering in this AANSS conference.

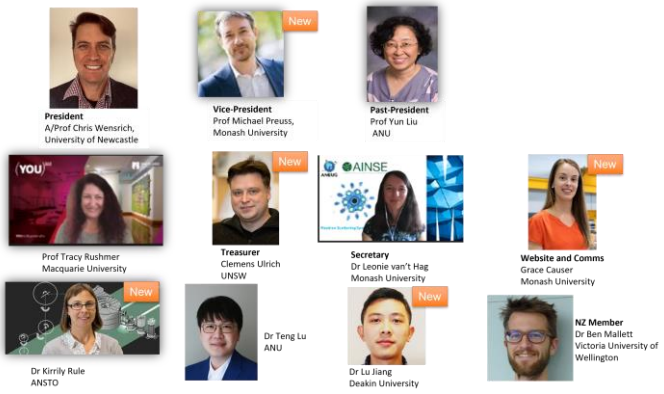
Thanks to Karyn and the AANSS 2022 committee for their work in organising this gathering for the

neutron community. Thanks also to AANSS sponsors – ANSTO, AINSE, Swiss Neutronics, AVS and Merck.



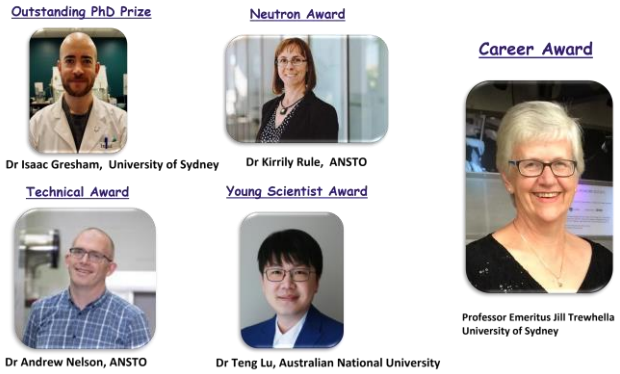
2023-2024 ANBUG executive committee

In parallel with this conference, ANBUG also run the AGM meeting and ANBUG Award session.



The New President of the ANBUG for 2023-2024 will be A/Prof Chris Wensrich (university of Newcastle), and new vice president Prof Michael Preuss (Monash University). They are joined by new members of the committee Dr Grace Causer, Dr Kirrily Rule, Prof Clemens Ulrich and Dr Lu Jiang. Continuing committee members are Prof Yun Liu, Prof Tracy Rushmer, Dr Leonie van't Hag. Dr Teng Lu and Dr Ben Mallet.

ANBUG awards



Congratulations to all the ANBUG award winners who were:

Dr Isaac Gresham – Outstanding PhD prize

Dr Kirrily Rule – Neutron Award

Dr Andrew Nelson – Technical Award

Dr Teng Lu – Young Scientist Award

And the ANBUG Career Award was given to Professor Jill Trewhella.

Achievements

Grant successes

ACNS scientists, partnering with our user community, have been successful on several grants since the last Newsletter. These include:

DP230100462 lead by Dr Teng Lu (ANU) with David Cortie (ACNS) titled "Locally structured polar-photofunctional materials for energy conversion". This project aims to develop new polar-photofunctional materials that will significantly improve opto-electro-mechanical coupling and energy conversion, facilitating uses in renewable energy harvesting and smart optomechanical devices.

DP230100558 lead Prof Chris Ling (USyd) with Max Avdeev (ACNS) titled "Rare earth-free high-performance magnets". This project aims to discover new magnetic materials that are competitive for advanced technology applications, free of the rare earth metals that currently dominate the high-performance end of the market.

DP230102221 lead by Professor Xiaolin Wang (UWol) with Kirrily Rule (ACNS) titled "Giant magnetic-thermoelectricity in topological materials". This project aims to explore magnetic field-induced exotic thermoelectricity in emerging topological materials and develop novel magnetic-field-mediated heat-to-electricity generators and coolers. The significance and outcomes of this project will be the discovery of new magnetic topological materials with thermoelectric conversion efficiency superior to traditional thermoelectric materials and unlocking the physics of the exotic magnetic-field-correlated thermoelectric phenomena. The outcomes of this project will offer new avenues for novel applications of quantum topological materials and establish a solid foundation for the next generation of thermoelectric devices for various applications.

Awards

Our ANSTO Neutron and Deuteration impact awards are the chance for you our users to tell us about your science outcomes! This year awards were given to:

Olivia Kendall from Monash University who outlined her research using Kowari on applying laser cladding to the repair of tram rails

Madeline Mcrae from University of Sydney who described how NDF molecules had assisted her research on the search for new antibiotics

Joshua Stroh from University of British Columbia who used Kowari to investigate aluminium alloys for the automotive industry.

Thanks to all that entered, look out for the winning entries appearing on the ANSTO website!

Event Reports

ANSTO Powder Diffraction Workshop 2022

Thirty postgraduate students from around Australia and New Zealand were introduced in person to the rarefied delights of powder diffraction Rietveld data analysis in November. The school, which has been held annually since 2011, is run by an elite team of powder diffraction instrument scientists from the

Australian Synchrotron and ACNS, supplemented by local guest experts. It is aimed at students who have little to no experience with powder diffraction data, and who have, or are likely to have, data from ANSTO instruments. By the end of the three-day school, the students were able to apply straightforward structural models to their data, and know where to look in order to further develop their skills.

This year saw a welcome return to an in-person school at the refurbished Nandin centre after several years of online schools. The costs associated with bringing the students to ANSTO were covered by generous sponsorship from AINSE, the Australian Synchrotron, and ACNS.

The next school will be held at the Australian Synchrotron in the second half of this year. Keep an eye on the ACNS mailing list for news about dates and application procedures.

ANSTO – HZB Neutron School 2022

The second ANSTO – HZB Neutron School was held in October 2022 at the ACNS with lecturers and tutors from HZB and ANSTO. Twenty-three students came from Australia, New Zealand, Germany and further afield. The aim of the school was to provide a broad overview of the capabilities of neutron scattering covering theory, applications, and instrumentation in a mixture of lectures, workshops, and practicals. One highlight was the student poster presentation where students and staff got discuss student projects and ideas for future proposals. Congratulations to the poster prize winners Ashley Carey (Flinders University) and David Matzdorff (Technical University of Berlin). Thank you to all involved with organising and putting on the school and thank you to the students for being such eager learners.

ANSTO Small Angle Scattering Workshop 2022

The Australian Centre for Neutron Scattering (ACNS) and Australian Synchrotron (AS) jointly organised ANSTO's Small Angle Scattering workshop, which took place from November 15-17, 2022. This was the third workshop in the series, following the success of the previous two virtual workshops. The hybrid format of this year's workshop allowed for both in-person and online participation. Of the 75 applications received from all over Australia and New Zealand, 20 participants were selected to attend the in-person event, where they had the opportunity to engage in hands-on practical exercises. The workshop also featured lectures from eminent speakers across a broad range of research fields, which were made available to those who were not selected for in-person attendance. The workshop attracted over 130 registrations in total.

The aim of the workshop was to provide a comprehensive overview of the theoretical and practical aspects of small-angle scattering, including scattering theory, data collection, processing, analysis, and modelling, as well as applying for beam time and the application of small-angle scattering to specialised areas of research.

With a female-to-male ratio of over 50% in both the in-person participants and organising committee, the workshop brought together mostly honours and PhD students, as well as early-career researchers who have used or plan to use ANSTO's small-angle scattering instruments for their research.

In-person participants had the unique opportunity to operate Bilby (SANS), Kookaburra (USANS), and learn about face-to-face data collection and treatment for both ACNS and AS's SAS instruments (covering SANS, USANS, and SAXS), gaining hands-on experience and interacting with like-minded colleagues.

In a survey conducted after the workshop, participants gave the event an overall rating of 4.48 out of 5, indicating a high level of satisfaction with the quality and effectiveness of the workshop. Overall, the ANSTO's Small Angle Scattering workshop was an engaging and educational event that provided a valuable learning experience for participants.

Jitendra Mata

45th Condensed Matter and Materials meeting (Wagga Wagga)

The 45th Australian and New Zealand Institutes of Physics Condensed Matter and Materials Conference (colloquially called "Wagga2023") was held at the Charles Sturt University, Wagga Wagga, NSW, from 7th to 10th February, 2023. The organising committee consisting of Associate Professors Kirrily Rule and Trevor Finlayson (Co-chairs), Professor Chris Ling (University of Sydney), Dr. Danica Solina and Emeritus Professor Michael Cortie (University of technology, Sydney) and Ms Tenille Ibbotson (FLEET, Monash University), received many abstracts for both oral and poster presentations, and a well-balanced programme was prepared. In addition, the conference was supported with sponsorship from a number of Australian organisations, including ANSTO.

The scientific programme comprised 10 invited presentations, 28 oral presentations and 34 poster presentations divided between two poster sessions each of two hours duration. But prior to each poster session, a brief "poster slam" provided an

"Wagga2023" Group Photograph

opportunity for poster presenters to attract delegates' attention to the science being advanced on their poster. Amongst these 72 presentations, there were 20 which included neutron data, most of which had been collected on the instruments at OPAL, notably, Taipan, Platypus, Echidna, Sika and Pelican.

The organising committee considered all aspects of diversity, inclusion and sustainability in this year's program and a number of new initiatives were implemented. First, the dates of Wagga2023 were shifted to the second week in February so as to avoid coinciding with the first week of school in NSW, VIC, SA, and ACT. This would allow delegates who were also parents to attend the precious first week of school activities and still be able to attend the Wagga2023 meeting. Next, child-care bursaries were offered thanks to the generous sponsorship from FLEET and at least one was used to allow a delegate to bring his wife and 3-year-old child to Wagga. A strong focus of many Wagga conferences is often placed in the presentations of students and ECRs and this year 17 of the 28 oral presentations were presented by students and ECRs. In addition, seven of the eight oral sessions were chaired by students and ECRs – in an effort to give these valuable members of our community the opportunity to try out their skills at chairing in a supportive environment. We also ensured that every judging panel for both orals and posters consisted of at least one ECR, at least one retired person and at least one woman.

Four awards for the student oral presentations and two for each of the poster sessions were presented at the conclusion of the conference. The respective winners (in no particular ranking order) were as follows: Jackson Allen (University of Wollongong), Oliver Bellwood (University of Queensland), Nico Hackner (University of Otago) and Thi Hai Yen (Emily) Vu (Monash University) (for student oral presentations); Alex Brown (University of Sydney) and Ellen Liu (University of Newcastle) (for Wednesday posters); and Jack Engdahl (University of New South Wales) and Yerzhan Ashim (University of New South Wales) (for Thursday posters).

As has been a tradition for this particular conference, a special Tribute to the late Dr Tim Bastow (a long-serving CSIRO scientist, who had been a strong supporter of the Wagga Conferences) was delivered by Dr Andrew Smith (Monash University).

On the social side, "Wagga" delegates were invited to sample the CSU wines at the CSU Cellar on the Tuesday evening. The Wednesday evening featured the Conference Dinner with an excellent after-dinner presentation entitled "A Misguided Youth" by Dr Garry McIntyre, in which Garry offered advice to the many younger condensed matter physicists in attendance. The annual Wagga Trivia night was held on the Thursday with six teams competing for the coveted Lindsay Davis Cup with eight rounds of questions and two on-going rounds concerned with famous world structures and nursery rhymes. The Cup was easily won by team #NewyPhysics.

The other perpetual trophy associated with this conference, namely The Jacko, was awarded to Oliver Bellwood (University of Queensland) for his oral presentation entitled "Triplons in quasi-1D antiferromagnets" for which he most cleverly illustrated the confinement of magnetic triplon excitations with specific moves on a chess board.

Kirrily Rule and Trevor Finlayson (University of Melbourne)

Issue 8 | March 23

Scatter Matters

Supported by NCRIS National Research Infrastructure for Australia An Australian Government Initiative

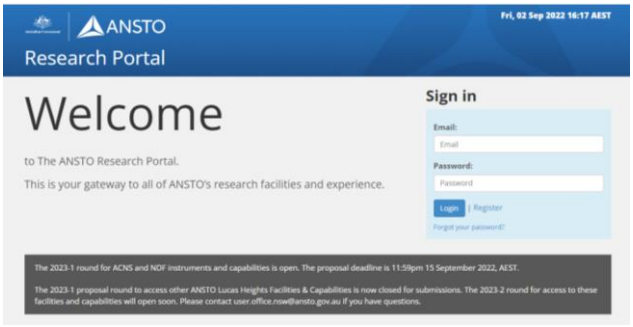
Upcoming Events

IUCr2023 congress and workshops

The crystallographic world will be descending on Melbourne this year – many of our neutron science community will be joining them. The 26th Congress of the International Union of Crystallography will be held at the Melbourne conference centre 22-29 August 2023. Though oral abstracts are now closed, poster abstracts are still being accepted. Early bird registration for the congress closes 31st March – see www.icur2023.org for more details.

In addition to the congress there are a number of preceding workshops, check out https://iucr2023.org/workshops/ for more information on these.

Applying for Instrument time



2023-2 Proposal Round

Applications for the 2023-2 round are open, with the deadline of 11.59 pm, AEDT, Tuesday 15th March 2023

Proposals are welcome on all of our neutron beam instruments, and for scientific computing as well – proposals received before 15th March relate to access commencing August 2023 for a period of 7 months. For submission advice, see the website or contact the ANSTO NSW User Office team on:

T: +61 (0) 2 9717 9111

E: user.office.nsw@ansto.gov.au

Powder Diffraction Mail-in Round

Applications for mail-in powder diffraction measurements on Echidna are continuously open and should be submitted through the legacy portal.

Issue 8 | March 23

Scatter Matters

Supported by NCRIS National Research Infrastructure for Australia An Australian Government Initiative

Meet the new team members

Please join us in welcoming the new members of the Australian Centre for Neutron Scattering team.

Myms Atanacio

Operational Support Officer

Hi ACNS! I am Myms currently on secondment from ANSTO Nuclear Medicine to NST Admin. I missed saying hello in the last Scatter Matters, but am very grateful to have had my secondment extended till Jan 2024. Thank you to all who have welcomed me into the wonderful world of Neutron Scattering – I learn something new every day!

Here to support you all for any administration needs you have.

Natalia Gonzalez Cadiente

Visitor from ISIS neutron source

I am a graduate mechatronics design engineer at STFC and will be joining ACNS for a 3-month placement as part of a collaboration between STFC and ANSTO. My university background is in mechanical engineering and robotics, and I will be joining the Electrical Engineering and Control Systems Group under Frank Darmann.

Bronte Eady

Electrical Apprentice

Bronte has recently joined ACNS as a part of her rotation around ANSTO as a fourth year electrical apprentice. She is currently working with the electrical team helping with the Dingo SIS and motion control.

Zhijun (Helen) Qiu

Industry Instrument Scientist

Helen has joined ACNS since last year to enhance our industry engagement strategy. Her focus is on establishing new links between industry, academia and ANSTO to support their access to our neutron imaging (DINGO) and strain scanner (KOWARI) beamlines. Helen has engineering background with a PhD in direct energy deposition - wire arc additive manufacturing (WAAM) of Ni-based superalloys from University of Wollongong. Her current research covers the study of high/middle entropy alloys, structural materials for nuclear reactor, materials for hydrogen storage and transmission, Australian mining and Incremental Learning.

Issue 8 | March 23

Scatter Matters

Supported by NCRIS National Research Infrastructure for Australia An Australian Government Initiative

Houman Alipooramirabad

Industry Instrument Scientist

Houman has joined ACNS to help develop new links to advanced manufacturing industry with particular focus on access to neutrons on the strain scanner (Kowari) and imaging (Dingo) beamlines. Houman's research background covers the defect criticality assessment of blending hydrogen with natural gas in low-strength steel pipelines, metallurgical characterization, Finite Element simulation of residual stress in casting and welding components and application of neutron diffraction in measurement of residual stresses in engineering components (in-situ and ex-situ neutron diffraction). If you want to chat about neutron strain scanning & imaging, his door is always open.

Indri Badria Adilina

AONSA Young Research Fellow

Indri is a researcher at the Research Center for Chemistry, National Research and Innovation Agency - Indonesia and one of the winners of the AONSA Young Research Fellowship 2021. Her research focus at ACNS is the understanding of nanoparticle-protein interaction on modified geothermal silica using small-angle neutron scattering.

Ferensa Oemry

Visiting scientist

Ferensa recently joined ACNS to work on density functional theory (DFT) calculations for experimental studies from the Beryllium Filter secondary spectrometer on Taipan. Ferensa's research background is DFT-based computational chemistry with main aims to simulate and make data interpretation of x-ray absorption fine spectroscopy and inelastic neutron spectroscopy measurements. His research focuses mainly on catalysts and their catalytic reactions mechanism for various applications.

Xiaoqi Pang

Visiting Scientist from Tohoku University

I am a PhD student majoring in Physics in Tohoku University. I have joined ACNS from Dec. 2022 for the purpose of learning neutron techniques and performing my experiment. It is a wonderful 3 months in ANSTO.

Australian Government | ANSTO Science. Ingenuity. Sustainability.

NCRIS National Research Infrastructure for Australia An Australian Government Initiative

Supported by

Scatter Matters

Christophe Didier

Postdoctoral Researcher

Contracted by ANSTO until June to complete previous work and form new partnerships with industry and academia in the study of energy storage materials. My background is in solid-state physics and chemistry, I have a long experience running in situ measurements on batteries during cycling, using diffraction, small-angle scattering or tomography.

Stephen Collier

System Administrator

I worked as a Developer and System Analyst in the Film Industry for 25 years. My wife passing away 10 years ago, causing me to refocus. I have for the last 8 years worked for a telco (Vocus) as a Sys Admin driving their automation and new processes. I enjoy cycling and skiing for recreation.

The lighter side of neutrons

Following on from last newsletter's cryptic crossword, **Josh Marlow** returns with a small-angle scattering themed logic puzzle for long nights on the beam:

"It seems there's been a mix-up with scheduling on the small-angle instruments. With the following clues, can you help piece together when each experiment starts this week, what each user is studying, and of course, which instrument they are using? A grid has been provided to help you solve the puzzle!"

Clues:

1. Charlie starts two days before Abraham.
2. The Polymer experiment starts after Delilah's experiment but before the Kookaburra experiment.
3. Betty's experiment on concrete did not begin on Wednesday, though the Quokka experiment did.
4. Charlie did not use Bilby, nor did they study lipids.

		Sample				Start Date				User			
		Lipids	Polymer	Emulsions	Concrete	Monday	Tuesday	Wednesday	Thursday	Abraham	Betty	Charlie	Delilah
Instrument	Xeuss												
	Quokka												
	Bilby												
	Kookaburra												
User	Abraham												
	Betty												
	Charlie												
	Delilah												
Start Date	Monday												
	Tuesday												
	Wednesday												
	Thursday												

User	Sample	Instrument	Start Date
Abraham			
Betty			
Charlie			
Delilah			