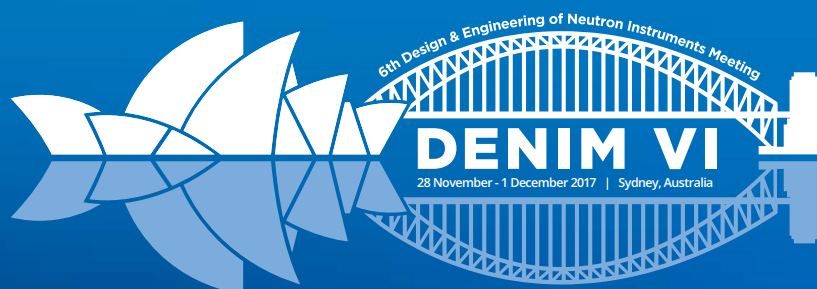


6th Design and Engineering of Neutron Instruments Meeting

2017



Program and Abstract Booklet



LOCAL ORGANISING COMMITTEE



Scott Olsen
ANSTO
Kelly Cubbin
ANSTO

Stewart Pullen
ANSTO
Kirril Rule
ANSTO

INTERNATIONAL ORGANISING COMMITTEE



David Anderson
SNS
Jerome Beaucour
ILL
Elbio Calzada
FRM II
Sylvain Désert
LLB
Lars Drescher
HZB

Nancy Hadad
NIST
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BNC
Kevin Jones
ISIS
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PSI
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ANSTO
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FZJ
Donald Pierce
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Delft
Guido Vehres
Jülich
Yanyan Wu
CSNS



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PROGRAM

DAY 1

Tuesday, November 28

2:00PM - 5:00PM

OPTIONAL

Self-funded Sydney Harbour Bridge Climb
(Pre-Paid)

5:30PM - 7:00PM

**Welcome Drinks –
Penny Lane Bar & Cafe**



7:00PM - 8:00PM

OPTIONAL

Dinner - Self-funded
(Location to be confirmed)



Optional Sydney Harbour Bridge climb.

DAY 2

Wednesday, November 29

8:00AM - 8:30AM	Registration	
8:30AM - 8:45AM	Acknowledgement of Country: <i>UTS speaker</i>	
	Conference Introduction: <i>DENIM 2017 Chair</i>	
8:45AM - 9:00AM	Welcome: <i>Head of Australian Centre for Neutron Scattering</i>	
9:00AM - 9:30AM	PLENARY 1 How 50 years with HIFAR shaped the Australian Centre for Neutron Scattering <i>Dr. Margaret ELCOMBE — ANSTO</i>	
9:30AM - 10:10AM	PLENARY 2 The next 50 years of Neutron Scattering - a brave attempt at extrapolating current trends way beyond their reasonable validity <i>Prof. Ken ANDERSEN — European Spallation Source</i>	
10:10AM - 10:40AM	Morning Tea	
10:40AM - 11:50AM	SESSION A - PROJECT MANAGEMENT Systems Engineering Analysis of the Science Productivity Program for Instrument Improvement Projects <i>Lacy JONES — ORNL Neutron Sciences Directorate</i> Recent enhancements and performance gains from upgrades to ANSTO's thermal neutron instrument TAIPAN and the triple-axis and Be-filter spectrometers <i>Dr. Kirrily RULE — ANSTO</i> Project execution by ZEA-1 and lessons learned of implementing the project phases at HEiDi and other neutron scattering instruments <i>Dr. Romuald HANSLIK — Forschungszentrum Juelich GmbH</i>	
11:50AM - 12:20PM	Poster Slam	
12:20PM - 1:20PM	Lunch	
1:20PM - 2:40PM	SESSION B - DETECTOR SYSTEMS Additive manufacturing of a wavelength shifting fibres (WLSF) based detector element: IMAT diffraction detector array <i>Dr. Francesco ZUDDAS — STFC - ISIS</i> Challenge 1 m² neutron detector <i>Mr. Joerg BURMESTER — Helmholtz-Zentrum Geesthacht</i> Mechanical design of 10B based technology neutron detectors <i>Mr. Isaac LOPEZ HIGUERA — European Spallation Source ERIC</i> Detector bank upgrade of the Necsa neutron powder diffractometer <i>Dr. Deon MARAIS — The South African Nuclear Energy Corporation (Necsa) SOC Limited</i>	
2:40PM - 3:10PM	Afternoon Tea	
3:10PM - 4:30PM	SESSION C - BEAM SHAPING, SLITS AND CONDITIONING METHODS "Bilby" collimator vessel, design considerations & solutions <i>Mr. Jason CHRISTOFORIDIS — ANSTO</i> Additive Manufacturing Of Collimators From Neutron Absorbing Material <i>David ANDERSON — Oak Ridge National Laboratory</i> Current State of Japanese Engineering Diffractometer, RESA-1 <i>Dr. Hiroshi SUZUKI — Japan Atomic Energy Agency</i> Beam-stop Changer Device <i>Mr. Sylvain DESERT — LLB</i>	
4:30PM - 6:30PM	Poster Session, Sponsors, DENIM Challenge	

DAY 3

Thursday, November 30

8:30AM - 10:10AM

SESSION D - INSTRUMENT AND MOTION CONTROL

Air cushion: Pads and floors experiences

Mr. Peter KELLER — Paul Scherrer Institut

Design of Factory Acceptance Testing of slit assemblies for Neutron Reflectometry

Dr. Frank DARMANN — ANSTO

Design and Manufacturing Characteristics That Effect Accuracy and Repeatability of Worm and Wormwheel Rotation Stages

Mr. Toby OSTE — ANSTO

Motion Control Future at the STFC ISIS Facility

Mr. Stephen COX — STFC ISIS

ISIS Mechatronics challenges and success undertaken in the last year

Mr. Nick WEBB — ISIS

ANSTO OPAL Reactor CNS Replacement

Mr. ELTOBAJI, Andrew — ANSTO

10:30AM - 10:50AM

Morning Tea



10:50AM - 12:30PM

BREAKOUT SESSIONS

Three Breakout Topics :

1. Instrument Build, Commissioning and Operation
2. Automation, Measurement and Monitoring
3. Beam conditioning, Metrology and Shielding

12:30PM - 1:30PM

Travel: to ANSTO

1:30PM - 2:30PM

Lunch by the ANSTO pool



2:30PM - 4:30PM

ANSTO Tour

4:30PM - 5.30PM

Travel: Return to City



ANSTO's OPAL multi-purpose reactor.

DAY 4

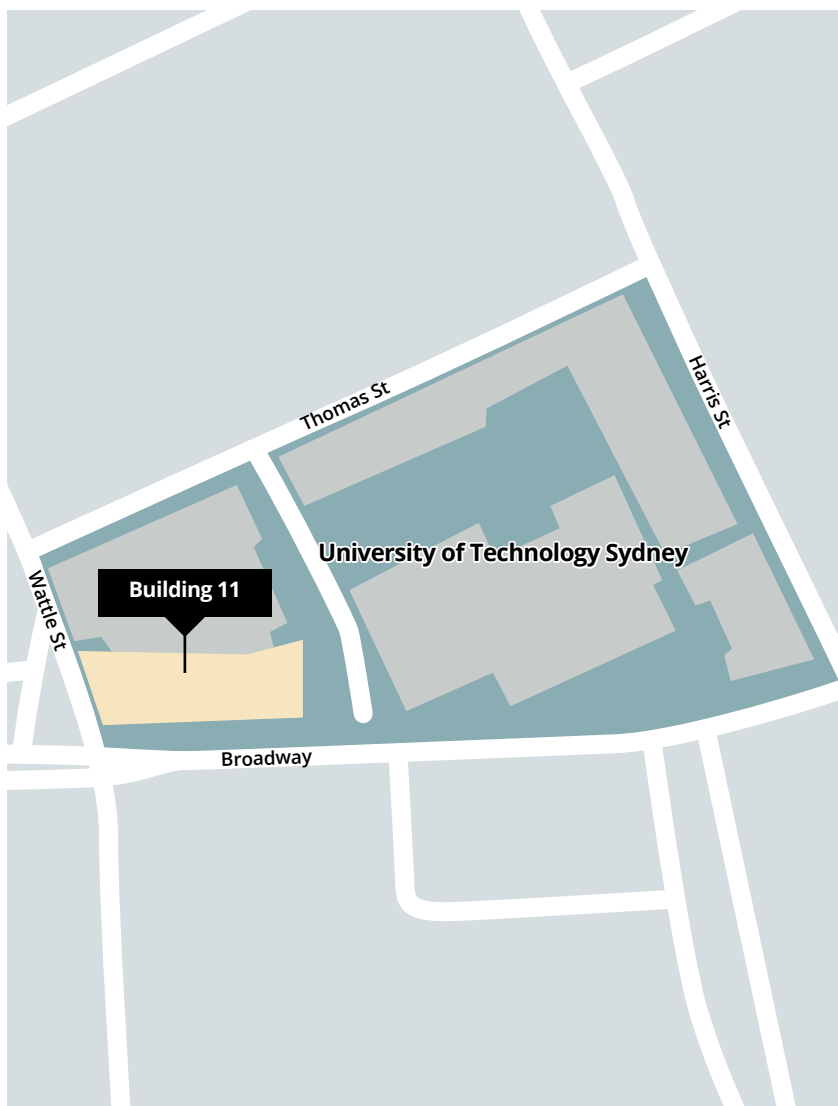
Friday, December 1

8:30AM - 9:00AM	BREAKOUT DISCUSSION Summary (10min/group)	
9:00AM - 10:20AM	SESSION E - CHOPPERS AND SOURCES Mechanical Design of ANDES: a multi-purpose neutron diffractometer for the RA10 <i>Mr. Agustín COLEFF — Mechanical division - Centro Atómico Bariloche - CNEA</i> Spallation Neutron Source Second Target Station Conceptual Design <i>Mr. Van GRAVES — Oak Ridge National Laboratory</i> Fan chopper for chopper spectrometers at long pulse neutron sources <i>Mr. Peter HARBOTT — Forschungszentrum Jülich GmbH - JCNS</i> The status of CSNS neutron choppers development <i>Mr. Ping WANG — Institute of high energy physics, Chinese academy of sciences</i>	
10:20AM - 10:50AM	Morning Tea	
10:50AM - 11:20AM	PLENARY 3 Event Horizon, an exploration of the future of neutron scattering facilities <i>Mr. Iain SUTTON — ESS</i>	
11:20AM - 12:40PM	SESSION F - GUIDES AND SHIELDING Identifying and Resolving Shielding Issues <i>Mr. Will HALCROW — STFC - ISIS</i> In-Kind Instrument Projects – Gathering Experience by building an R&D guide-section <i>Mr. Sven SCHUETZ — PSI</i> Redesign of Monochromator Shielding of Cold Neutron Triple-Axis Spectrometer at HANARO <i>Mrs. Ji-Myung RYU — Korea atomic energy research institute</i> Manufacturability of Neutron Beam Monochromator Drum Shielding <i>Justin JONES — Merrick & Company</i>	
12:40PM - 1:40PM	Lunch	
1:40PM - 2:40PM	SESSION G - OPERATIONS AND MAINTENANCE Development of an argon box for stable beam collimation on MARIA instrument at the JCNS <i>Mr. BINGÖL, Kendal and Mr. DAEMEN, Jos — JCNS / Forschungszentrum Jülich</i> Status of Neutron Scattering Facilities at HANARO <i>Dr. BAEK SEOK SEONG — KAERI</i> Remote handling implementation at ESS <i>Mr. Erik NILSSON — European spallation source ESS ERIC</i>	
2:40PM - 3:00PM	WRAP UP DENIM 2017 and discussion on DENIM 2018	
3:00PM - 3:30PM	Travel: to Sydney Opera House	
3:30PM - 5:00PM	Sydney Opera House Tour	
5:00PM - 7:00PM	Free Time	
7:00PM - 10:30PM	CONFERENCE DINNER Nick's Bar & Grill	

VENUE

The DENIM conference will be held at the state of the art UTS Campus (University of Technology, Sydney) Faculty of Engineering and IT.

MAP



ADDRESS

University of
Technology Sydney
Building 11
Room CB11.00.40
83-117 Broadway
Ultimo NSW 2000

10km

from Sydney International Airport

550m

from Central railway station

2km

from the heart of Sydney CBD

1.4km

from Darling Harbour

1km

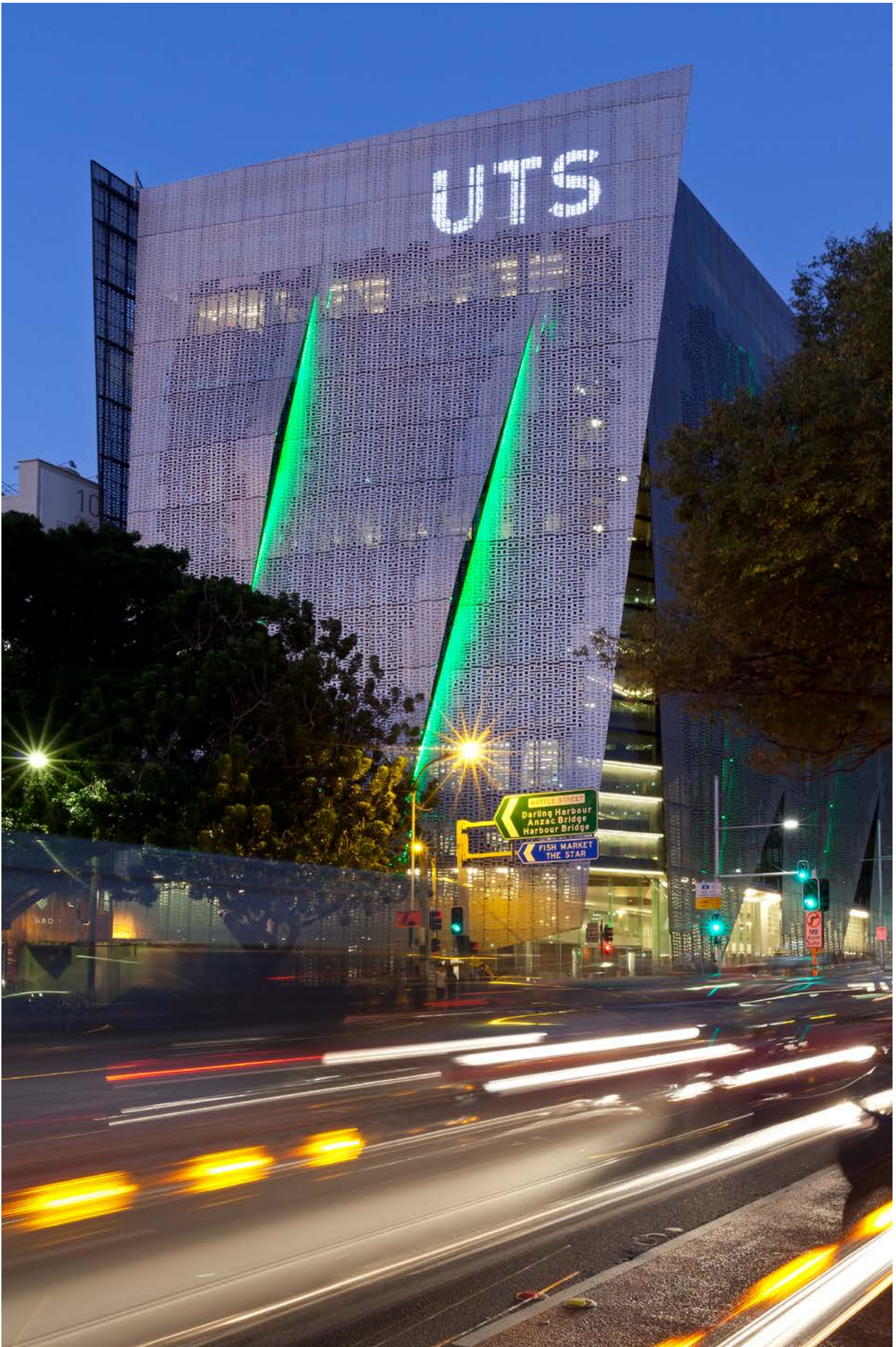
from Chinatown

WI-FI at UTS

Wi-Fi will be available for all delegates while on campus. You will be provided your own unique log in and password once you have registered on your first day.

Some company laptops have blocks on them from joining other networks and servers. It is recommended that any delegates that wish to join the UTS wi-fi check with their IT department that they can do this on their laptop prior to arriving.





GETTING THERE

Sydney's public transport is cashless for all trains, buses, light rail or ferries. If you wish to use this service you will require an [OPAL transport card](#), which requires the user to **Tap On** and **Tap Off**.

You can either obtain a multi-use ticket which can be topped up with additional money or a single one way ticket

You can obtain an OPAL card at the Domestic and International airports, railway stations or at any of [these locations](#).

Cost of the ticket will depend on the distance travelled prices can be [found here](#).

****Please note there is surcharge to get on and off at the airport stations***

Other Transport Options

Taxi – Please note an estimated fare from the airport to the venue is between \$22 - \$32 and would take approximately 30 minutes in normal traffic (10km).

Uber is available in Sydney.





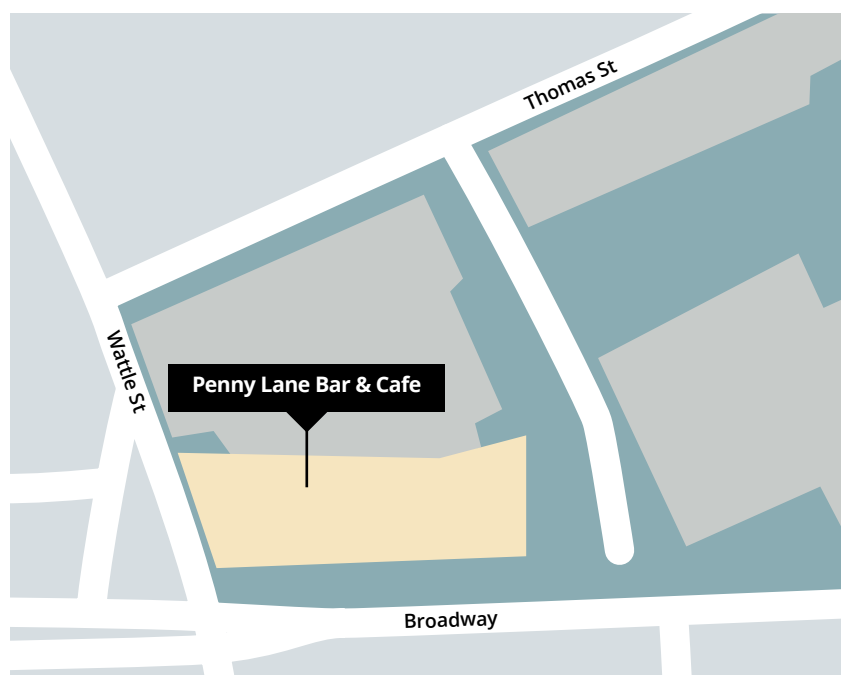
An OPAL transport card is required to use Sydney's public trains, buses, light rail and ferries.



Welcome drinks

Please join us at the Penny Lane Bar & Cafe for a Welcome Drinks Reception from 5:30pm on Tuesday 28th November 2017. Here you can meet friends and colleagues who will also be attending the DENIM conference.

After this, you are all welcome to join the local organising committee for an optional self-funded dinner in a nearby establishment (to be determined).



DAY 1

Tuesday,
November 28

TIME

5:30pm - 7:00pm

LOCATION

Penny Lane Bar & Cafe
11/81-117 Broadway,
Ultimo NSW 2007



DENIM challenge

As with every DENIM conference we have constructed a DENIM challenge which will be held after the poster session on Wed 29th November. You will be allocated into teams on Wednesday morning - so please let us know ahead of time if you will not be able to participate in the challenge.

This is a challenge that will sound simple at first but require every ounce of engineering expertise and creativity you have – similar to designing and building neutron instrumentation! All will be revealed on the day!

DAY 2

Wednesday,
November 29

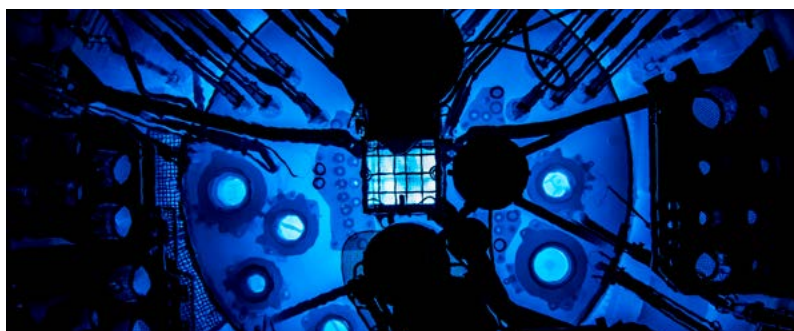
TIME

5:20pm - 6:30pm

ANSTO tour

After the morning talks and breakout sessions on Thursday 30th November, there will be a bus to take those who registered to ANSTO for a tour of the OPAL reactor and neutron scattering facilities.

Our tour will begin with a BBQ by the ANSTO pool followed by visits to the neutron guide hall and the new ANSTO Nuclear Medicine facility with a special tour of the cold-source replacement mock-up.



DAY 3

Thursday,
November 30

TIME

2:30pm - 4:30pm

LOCATION

ANSTO,
New Illawarra Road,
Lucas Heights NSW

IMPORTANT

Please ensure that
you bring your
passport with you to
be allowed on-site!



Echidna



Wombat



Koala



Joey



Kowari



Pelican



Quokka



Bilby



Platypus



Kookaburra



Emu



Dingo



Sika



Taipan

ANSTO's Australian
Centre for Neutron
Scattering (ACNS)
currently has a suite
of 14 instruments.

Sydney Opera House tour

At the conclusion of the official program on Friday 1st December, we will travel together by bus from the UTS campus to the iconic Sydney Opera House for a behind-the-scenes tour of this architectural masterpiece.

At the conclusion of the tour, you will have free time from 5:00pm to 7:00pm within which you can make your way to our conference dinner location.



DAY 4

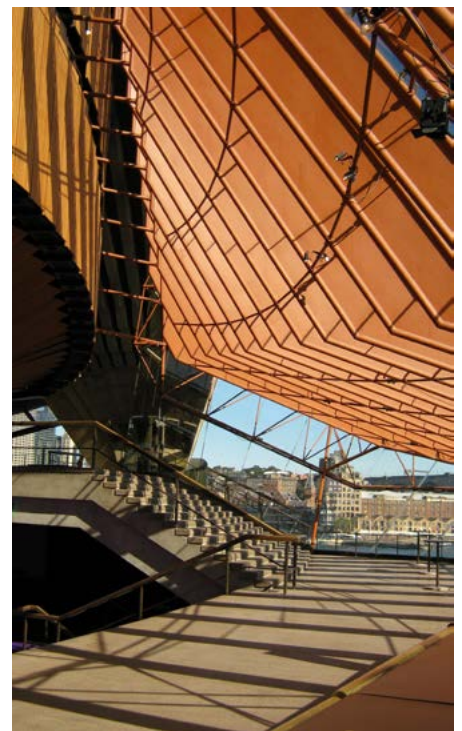
Friday,
December 1

TIME

3:30pm - 5:00pm

LOCATION

Sydney Opera House



Conference dinner

After the tour of the Sydney Opera House there are a number of ways in which you could reach our conference dinner location of Nick's Bar & Grill which is located at 32-34 The Promenade, Sydney NSW 2000:



WALKING
30 mins



TAXI
15 mins



TRAIN
18 mins



FERRY
30 mins

DAY 4

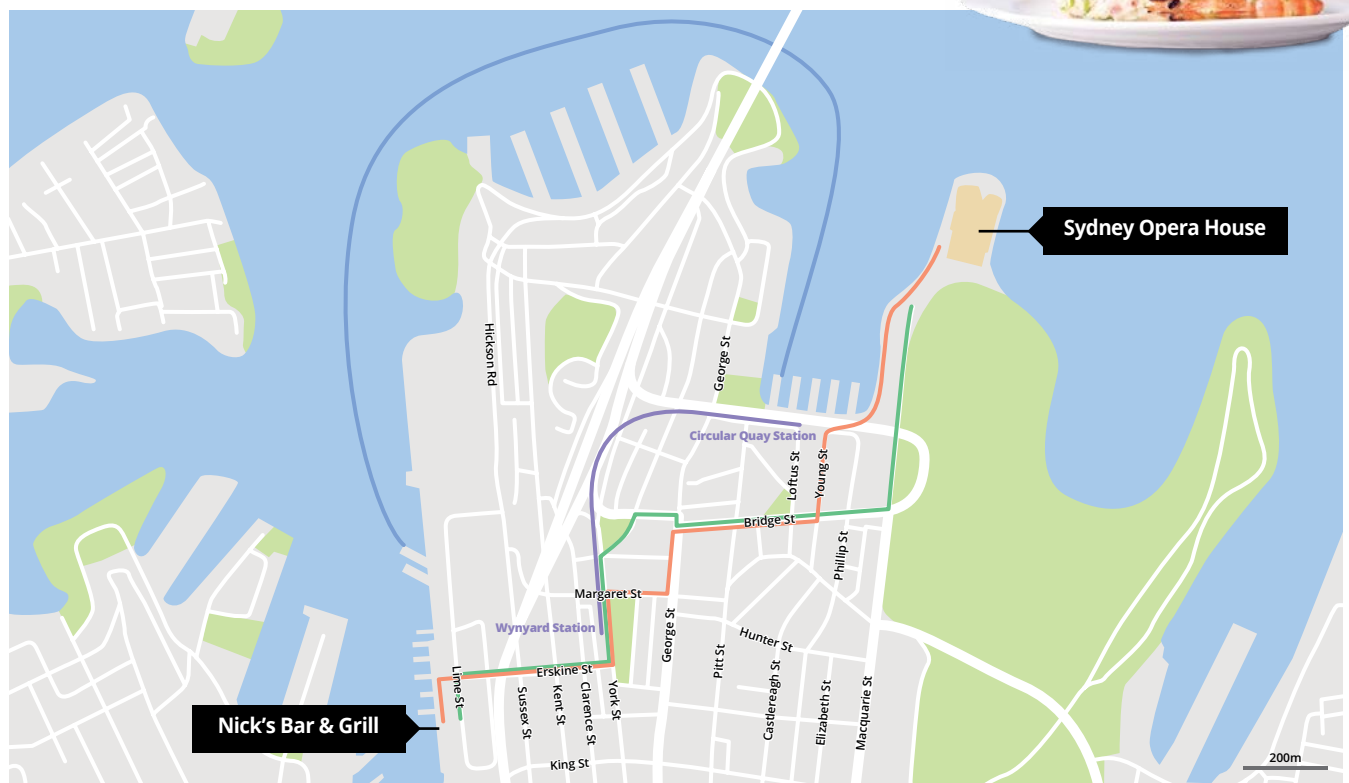
Friday,
December 1

TIME

7:00pm - 10:30pm

LOCATION

Nick's Bar & Grill,
32-34 The Promenade
Sydney 2000



Plenary talks

How 50 years with HIFAR shaped the Australian Centre for Neutron Scattering

Dr. ELCOMBE, Margaret (ANSTO)

This talk will be based on my experience with Triple Axis Spectrometers over 50 years. The good and not so good features have had a profound influence on the changes made to the early instruments and the design of new instruments which have occurred over the years. In the early days Australians were very good at adapting existing equipment, writing ingenious computer algorithms and initiating the development of new materials. Later we took on designs, materials and new technologies from overseas and incorporated into them more rigorous radiation and safety standards to avoid many of the early pitfalls. What we learnt from this upgrade affected how and what we took forward into the design of both the reactor and the suite of neutron beam instruments which is the Australian Centre of Neutron Scattering today.

The next 50 years of neutron scattering – a brave attempt at extrapolating current trends way beyond their reasonable validity

Prof. ANDERSEN, Ken (European Spallation Source)

Neutron scattering is in a period of upheaval, representing both opportunities and pitfalls. New facilities are being designed and built, while many ageing research reactors are threatened with closure. The result will be a more dynamic ecosystem of neutron facilities, ranging from high-end facilities such as the as-yet unfinished European Spallation Source and the development of its eventual successor, to the population of an intermediate niche of modern research reactors and accelerator-based sources, as well as truly compact neutron sources within the budgetary scope of a university group. Instrument concepts and technologies have matured greatly over the last ten years, based on the acceptance of the need to make the most of the inherently limited neutron source brightnesses achievable. Even without assuming new game-changing technologies, many trends can be identified which will lead to order-of-magnitude improvements in performance. There are also a number of scientific trends from which we can reasonably extrapolate instrument design drivers: being able to design materials based on microscopic understanding of their properties, exploring new regimes of extreme conditions such as pressure or magnetic field, understanding the function of biologically active molecules, tying together structure and behaviour over multiple length and time scales. Neutron instrumentation will need to adapt to address these problems, which are all needed for addressing the current and, presumably, future societal grand challenges.

Event Horizon, an exploration of the future of neutron scattering research facilities

Mr. SUTTON, Iain (ESS)

The future is the ultimate unknown and unknowable territory. And this is as true with respect to our research facilities as it is to the science which they enable. An increasing forecasters warn that the years ahead are likely to be ones of great challenges and change when a conjuncture or environmental imperatives and enabling technologies drives deep and fundamental social changes. Despite such uncertainties, and perhaps even because of them, it is increasingly important to envision where these years may take us, and so, perhaps collectively influence its trajectory. Projecting forward through the next 25 years, this talk will present a holistic vision of a future of research facilities design, deployment and use. The role of traditional change drivers, 'science pull' and 'technology push', on development will be explored within the broader context of ongoing technological, environmental and social megatrends. This work will draw from the insights of contemporary interdisciplinary thinkers, the DENIM engineering community and Comic novels.

Oral presentations

Systems Engineering Analysis of the Science Productivity Program for Instrument Improvement Projects

JONES, Lacy (ORNL Neutron Sciences Directorate)

The large-scale investment program Science Productivity is a vehicle by which to prioritize, stage, plan and implement requests for directorate funding and resource allocations as Instrument Improvement Projects (IIP) to maintain and improve neutron instrumentation at the neutron facilities at Oak Ridge National Laboratory (ORNL), Spallation Neutron Source (SNS) and High Flux Isotope Reactor (HFIR). The program management approach will be discussed based on the author's role as the Deputy Program Manager, and the program analyzed from a systems engineering perspective as part of the author's recent capstone project for an Industrial and Systems Engineering Master's degree at the University of Tennessee. A recommended systems process mapping and guidance document will be summarized for sustainable optimization and integration of the projects into the culture and framework of the work flow of the facilities.

Recent enhancements and performance gains from upgrades to ANSTO's thermal neutron instrument TAIPAN and the triple-axis and Be-filter Spectrometers

Dr. RULE, Kirrily (ANSTO)

TAIPAN is the thermal-neutron spectrometer located at the reactor face of Australia's OPAL reactor (ANSTO). TAIPAN hosts two interchangeable secondary instruments; the triple-axis spectrometer (TAS) and the beryllium-filter spectrometer. The TAS option has been operating since 2010 whilst the Be-filter only began operating in 2015. TAIPAN is renowned for its versatility and high neutron flux which has allowed the TAS to measure a broad range of samples including single crystals, powders, thin films, and co-aligned multi-crystal arrays. While the TAS option is used mostly to study structural and magnetic excitations in materials, the Be-filter option is used to measure vibrational density of states from powder samples. TAIPAN has recently undergone some upgrades to improve the accessible momentum and energy range of both the TAS and the Be-filter spectrometers.

Four key features have been modified to improve performance: the accessible momentum transfer has been increased by re-designing the enclosure; a sapphire-filter translation-stage mechanism has been installed to allow epithermal neutrons to pass to the monochromators; a new Cu-200 double-focussing monochromator has been installed to allow monochromatic scattering of neutrons up to 180 meV; and finally a new tertiary shutter and snout have been designed to improve the signal-to-noise ratio and reduced background outside the instrument enclosure. Extensive testing and alignment of all new motion stages were undertaken with reproducibility within ± 0.05 degrees or ± 0.25 mm obtained for both the monochromator rotation angle & sapphire-filter alignment.

Project execution by ZEA-1 and lessons learned of implementing the project phases at HEiDi and other neutron scattering instruments

Dr. HANSLIK, Romuald (Forschungszentrum Juelich GmbH)

The Central Institute of Engineering, Electronics and Analysis ZEA-1 of Forschungszentrum Jülich has been contributing significantly to the development of neutron scattering instruments for the Heinz Maier-Leibnitz Zentrum (MLZ/FRM II reactor) in Garching. These instruments are operated by Jülich Centre for Neutron Science (JCNS). This talk will present the institute ZEA-1 and project execution by ZEA-1 with all project phases from project acceptance through design phase to manufacturing. The lessons learned during implementing the project phases in a new project HEiDi -Heißes Einkristall Diffraktometer (single-crystal diffractometer) and other neutron scattering instruments will be also presented.

Single-crystal diffractometer HEiDi is placed at the beam tube SR9b in the experimental hall of FRM II. It has been developed in close collaboration between RWTH Aachen (Institut für Kristallographie) and TU München (FRM II) to cover a broad range of experiments for the structural analysis of single crystals. ZEA-1 has developed and manufactured a secondary plug for the biological shielding of HEiDi with integrated exchange mechanics for the realization of three different filter positions.

Additive manufacturing of a wavelength shifting fibres (WLSF) based detector element: IMAT diffraction detector array

Dr. ZUDDAS, Francesco (STFC - ISIS)

IMAT (Imaging and Materials Science & Engineering) is a neutron imaging and diffraction instrument for materials science, materials processing and engineering. It is located at the Science and Technology Facilities Council's ISIS Neutron and Muon Source. The special features of the instrument will be energy-selective neutron imaging and the combination of neutron imaging and neutron diffraction.

The instrument is being built in several stages. The first stage is almost complete with two imaging cameras available: a gated CCD camera and a time-of-flight capable high resolution pixel detector. Currently IMAT has a new diffraction detector array in the prototype stage. The angular coverage of the detectors is 53° vertical and 30° horizontal and the theoretical detecting surface lies on a 2000 mm spherical radius.

The aim of this design is to reduce the time-of-flight approximation, usually introduced when using arrays of flat detectors, by creating curved detector elements. In order to follow the curvature, every single 64-pixels submodule has been 3D printed. We have developed a WLSF scintillator detector with a 0.1 m² detecting area per module. Each module has 64 × 8 pixels and a 2 mm × 100 mm pixel size. A ZnS/6LiF scintillator combined with a fibre encoding scheme is used to record the neutron events.

Challenge 1 m² neutron detector

Mr. BURMESTER, Joerg (Helmholtz-Zentrum Geesthacht)

Due to the price of ³He gas, developments of detectors based on ¹⁰B₄C have taken place. At the HZG some test-detectors have been developed for prove of concept. The aim is to develop and build detectors with an active area of 1 m² and a spatial resolution of 2 mm². The big challenge lies in the mechanical setup of these detectors because of their size. On one hand the setup should be as lean as possible and on the other hand it should also be stable to withstand the different forces caused by the tension of the wires and the applied high voltage. Especially the high voltage causes a bending of the ¹⁰B₄C-planes and the wires. In my talk I would like to show how we faced this problem and build up the HZG-“sandwich“- detector.

Mechanical design of ¹⁰B based technology neutron detectors

Mr. LOPEZ HIGUERA, Isaac (European Spallation Source ERIC)

The design and construction of the European Spallation Source ERIC (ESS) is taking place in Lund, Sweden. Fifteen instrument proposals have been selected and all of these require a new generation of detectors in order to meet the unprecedented neutron instantaneous flux.

Due to the shortage of ³He gas and its counting rate capability limitations, the detectors of about half of these fifteen instruments will require to be based on a new technology. One of the best alternatives found for neutron detectors is ¹⁰B. The technology for these is being developed within the Detector Group. The fact that the neutron conversion occurs in a solid layer and that layers must be carefully arranged to meet detection requirements, require novel engineering solutions. In this presentation, we will show the mechanical engineering effort currently underway to implement the ¹⁰B technology neutron detectors, design and construction of prototypes this far, together with the progress and results on these detector demonstrators. The presentation will focus on the MultiBlade and MultiGrid technologies.

The MultiBlade is a Boron-10-based detector conceived to face the challenge of counting rate capability in the neutron reflectometry. The MultiBlade technology will be installed at the ESS reflectometer instruments: ESTIA and FREIA. The MultiGrid, introduced at the ILL, and jointly developed between ILL and ESS, is aimed to enable the large detector area, while eliminating the limitations related to the ^3He , required by the upcoming instruments CSPEC and T-REX, the cold and the thermal spectrometers being built at ESS.

Detector bank upgrade of the Necsca neutron powder diffractometer

Dr. MARAIS, Deon (The South African Nuclear Energy Corporation (Necsca) SOC Limited)

The current detector system of Necsca's Powder Instrument for Transition in Structure Investigations (PITSI) neutron diffractometer consists of 15 vertically stacked 609.6 mm x 25.4 mm Reuter-Stokes He3 gas-filled position sensitive tube detectors. This assembly results in a pseudo area detector with an active area of $\sim 610 \times 380 \text{ mm}^2$. At a sample-to-detector distance of 1.6 m, the detector spans a 2θ angle of a mere 21° , requiring the detector to be step-scanned to 6 positions in order to cover a range of $10^\circ < 2\theta < 120^\circ$. This significantly influences measurement time.

A project is currently under way to increase the active area of the detector by adding an additional 33 tubes. The resulting detector assembly will consist of three banks each containing 16 tubes, separated by a dead-space of 18.5° at 1.6 m. This configuration requires a step-scan of only 2 positions to cover the complete 2θ range, effectively increasing the instrument acquisition speed by a factor greater than 3. The sample to detector distance can be varied from 1.6 m to 1.2 m providing the ability to reduce the measurement time even more with a trade-off in angular resolution.

The current USB-communication based electronics (from Instrumentation Associates) will also be replaced by an Ethernet based Mesytec system to increase stability and reduce the amount of cabling needed.

"Bilby" collimator vessel, design considerations solutions

Mr. CHRISTOFORIDIS, Jason (ANSTO)

My presentation will focus on the 'Bilby' ToF SANS - Collimation System and will detail the following design constraints that heavily influenced it's design: • Narrow instrument footprint – the need to fit the Bilby Instrument between an existing SANS instrument (QUOKKA) and a future beam line CG2B. • Concrete shielding underneath the collimator • U shaped shielding over the collimator • The inclusion of a 5 position aperture selector at the beam entry side of each of the collimation guide translating section within the collimation vessel • Future requirement for possible maintenance access walkway above the Bilby collimation beam line.

My presentation will conclude with various ideas that these constraints generated along with the following benefits that the final "Vee" collimation base design provided: • a reduced collimation vacuum volume for a reduced pump down time. • an accessible place to locate the vacuum electrical feed throughs and associated cabling. • a functional space to allow development and implementation of our ROTATIONAL aperture selectors.

Additive Manufacturing Of Collimators From Neutron Absorbing Material

ANDERSON, David (Oak Ridge National Laboratory)

A recent collaboration combining Oak Ridge National Laboratory (ORNL) resources in the fields of Neutron Scattering Science, Engineering, and Additive Manufacturing has resulted in a breakthrough capability to 3D print collimators from neutron absorbing material. The technology will enable production of components incorporating complex geometric features previously impractical or impossible to manufacture. Furthermore, this new additive manufacturing technique provides a new opportunity for scientists and engineers to iteratively optimize collimation, which previously could not be leveraged due to limitations in manufacturing. Neutron Scattering Science at ORNL will now have the capability to produce bespoke collimation for instruments and sample environments, and the possibility to provide experiment specific collimation. Additionally, Neutron Scattering Instrument components other than collimators will be produced by this technique.

Current State of Japanese Engineering Diffractometer, RESA-1

Dr. SUZUKI, Hiroshi (Japan Atomic Energy Agency)

RESA-1 is an angular-dispersive neutron engineering diffractometer installed in the JRR-3 guide hall of the Japan Atomic Energy Agency. This is a large-scaled engineering diffractometer, which can measure the residual stress inside materials at centimeter-order depth non-destructively. The gauge volume is normally defined using the radial collimator and incident cadmium-slit. Optionally, the vertical convergent slit, which can limit the gauge height at a measurement position, can be installed in the incident neutron beam path alternatively to provide a large sample space. RESA-1 has a cryogenic load frame with the load capacity of 10 kN. The in-situ deformation behaviour can be evaluated by neutron diffraction at 5 K in minimum temperature. Furthermore, the quarter type Eulerian cradle enables us to measure crystallographic texture of metals. Unfortunately, JRR-3 has been suspended since 2011 due to the Great East Japan Earthquake Disaster. Nevertheless, we are making efforts to upgrade the RESA-1 continuously for future restart. New type Z-stage was lately developed to realize a long travel distance in vertical within a range of 300 mm. Furthermore, we have developed lately high intensity monochromator system, an automatic controlled double focusing Si bent perfect crystal monochromator with multiple Si(400) wafers stacked. Recently we have some fatal problems in not only RESA-1 but also any other instruments in JRR-3 during long term stop, aging degradation of electrical equipment. It is urgent for us to solve these issues since JRR-3 restarts.

Beam-stop Changer Device

Mr. DESERT, Sylvain (LLB)

The new SANS instrument, PA20, recently built at LLB is a 40 m long instrument offering the possibility to tailor the incoming beam on sample along rectangular shapes from square to horizontal or vertical slit for the GISANS option. Beam tailoring is achieved by using various sets of diaphragms, each composed of 4 individual blinds. In order to optimize the use of such beam shapes, the beam-stop located in front of the detector inside a vacuum vessel has to be adapted. The beam-stop changer device developed at LLB will be presented. It offers selecting among 8 beam-stop shapes, still fulfilling the requirements of working in a vacuum tank, being reliable, not creating heat and with a structure not interacting with the neutron beam.

Air cushion: Pads and floors experiences

Mr. KELLER, Peter (Paul Scherrer Institut)

Often, spectrometers and other components have to be moved on a horizontal plane without any restrictions and by a very low effort. In such cases air cushion pads are very popular. Our used solution of air cushions and floors will be explained. The bellow sealing pads ("Hoover-type") and solid pads ("metal air cushion pads") will be described in case of applications and the collected experiences. The floor specifications and our developments will be showed. Additional floor changings and the way how we repaired them will be illustrated. Finally our present developments in this area will be explained.

Design of Factory Acceptance Testing of slit assemblies for Neutron Reflectometry

Dr. DARMANN, Frank (ANSTO)

Reliable, accurate and repeatable neutron beam slit systems are required for reflectometry experiments. The design of the factory acceptance tests (FAT) and methods of encoding and verification are essential to the operational excellence of slit systems. While simple in concept, the reliable operation of neutron beam slits can be the cause of several issues including lost position and drift over time during use. The independent confirmation of operational requirements at the FAT can be employed to check performance against the specification, to confirm that the encoding technique employed is fit for purpose, and to assess reliability and endurance. In this talk several aspects of slit assembly design and specification will be explored and options for FAT endurance, repeatability and accuracy testing will be discussed for neutron beam slit assemblies.

Design and Manufacturing Characteristics That Effect Accuracy and Repeatability of Worm and Wormwheel Rotation Stages

Mr. OSTE, Toby (ACNS ANSTO)

The need to rotate Samples or Monochromators in Neutron Instruments is often achieved by the use of Rotary Stages that contain a worm and wormwheel mechanism. The accuracy and/or repeatability with which the Sample or Monochromators can be rotated are often critical to achieve the performance required by the Instrument. This presentation explores some of the Design and Manufacturing characteristics that impact on accuracy and repeatability performance. Although some quantitative analysis is considered, qualitative appraisal of some characteristics that are difficult to calculate will also be examined.

Factors such as the use, resolution and location of the resolver or encoder, the impact of torsional loading on the stage, choice of the worm and wormwheel gear ratio, consideration of gear mesh backlash control and gear stiffness, bearing and bearing support structure stiffness, Encoder/Resolver coupling torsional stiffness, gear mesh quality and the effect of eccentricity between the Wormwheel bearing centre and the centre of its gear form will all be discussed.

Motion Control Future at the STFC ISIS Facility

Mr. COX, Stephen (STFC ISIS)

This presentation will give an overview of the future direction for motion control at the STFC ISIS facility. The current Galil controller based standard control system has been used for over 10 years and was installed on most of the 34 ISIS instruments. It has been reliable but we are now finding limitations to what can be achieved with the system. This system also has custom parts and is difficult to procure. STFC ISIS started a project in 2016 to specify a 2nd generation of the standard system. The project team have collected requirements from the ISIS instrument scientists that are based on their future experiment applications. The specification has been listed for competitive tender and was due to finish in October 2017. This tender focused on selecting the control technology rather than trying to rigidly define cabling and connector standards. The presentation will look at the areas that the project team have investigated, some of the details of the specification and what we want to achieve. The outcome of the tender and selected hardware should also be decided before DENIM and so this can also be discussed.

ISIS Mechatronics challenges and success undertaken in the last year

Mr. WEBB, Nick (ISIS)

This presentation covers the particular mechatronics successes and challenges undertaken at ISIS. The recent work completed on our Phase II beamlines including the installation challenges of integrating a motion safety system into our new IMAT beamline. How we have built our multi skilled mechatronics team up over the last year and how the team interacts smoothly with our operations and computing teams. What the future holds for mechatronics at ISIS.

ANSTO OPAL Reactor CNS Replacement

Mr. ELTOBAJI, Andrew (ANSTO)

ANSTO is planning to replace the Cold Neutron Source (CNS) at the end of its design life. The project has a number of challenges due to the activity of the components. Working to ALARA principles and to minimise the reactor shutdown duration, a number of specialised tools and processes are being developed.

The topics that will be discussed in this presentation include the components to be replaced, computer modelling, tooling, mock-up, safety equipment, planning and training. In addition, some lessons have already been learnt and these lessons can be incorporated into future CNS designs.

Mechanical Design of ANDES: a multi-purpose neutron diffractometer for the RA10

Mr. COLEFF, Agustín (Mechanical division - Centro Atómico Bariloche-CNEA)

The Argentinean Atomic Energy Commission (CNEA) is building a multi-purpose research reactor in Centro Atómico Ezeiza, Argentina, with commissioning planned for mid 2020. The RA-10 will be an open-pool facility for radioisotope production, materials irradiation and neutron techniques applications. Associated to this last goal there is a separate project to build the Argentinean Neutron Beams Laboratory (LAHN), also executed by CNEA and funded by the National Government. The first stage of LAHN project includes two instruments of particular application in (nuclear) materials research and development. One of them is ANDES (Advanced Neutron Diffractometer for Engineering and Science), a multi-purpose neutron diffractometer for materials science and engineering applications, able to perform a variety of analysis, both on intact objects and on small samples. The techniques available include strain scanning, texture measurement, and high intensity powder diffraction on a variety of environments. The development of this instrument is supported in 4 main areas: shielding design, mechanical engineering design, neutron optics and automation and control.

In this work we present the advances in the mechanical design of the main components of the instrument. In particular we focus in the management procedures used to determine the optimum solution for each component.

Spallation Neutron Source Second Target Station Conceptual Design

Mr. GRAVES, Van (Oak Ridge National Laboratory)

The Spallation Neutron Source is planning a facility upgrade which is split into two elements: an accelerator power upgrade and a second target station. The proton power upgrade will double the amount of power which can be delivered by the accelerator complex from 1.4 MW to 2.8 MW, of which ~2 MW will be directed to the first target station and ~700 kW to the second. The Second Target Station will support twenty-two beam lines designed for peak neutron brightness which will be produced by optimized moderators, a rotating tungsten target, and a small proton footprint on the target. Some of the beam lines will approach 100 meters in length, and these long beam lines extend from the target facility via grade-level trenches with removable shield covers. Conceptual designs for several potential instruments have also been developed. The facility and some instrument designs will be discussed along with the project status.

Fan chopper for chopper spectrometers at long pulse neutron sources

Mr. HARBOTT, Peter (Forschungszentrum Jülich GmbH - JCNS)

The unique conditions of the long pulses generated at the European Spallation Source (ESS) allow for multi-chromatic operation of spectrometers. The full wavelength spectrum of a single ESS pulse is subdivided into a number of sub-pulses of different wavelengths by the chopper system. However, the chopper system must not only assign a unique wavelength to the sub-pulse but also adapt the time frame to the respective energy of the pulse. A newly developed so called fan chopper is able to selectively suppress sub-pulses as they are generated by the pulse chopper of the instrument. The design consists of 10 separate blades spinning synchronized to the source frequency of 14 Hz on a common axis like clock hands. Like in a clock the blades are mounted on hollow shafts. Each of them is connected to an individual drive. This setup allows to adjust an angular phase shift between the blades during operation generating an adjustable "slit-pattern". A first prototype has been built and a feasibility study has been performed at ISIS on the cold neutron chopper spectrometer LET. The mechanical design, the control and drive system and our findings during the measurements at LET are presented.

The status of CSNS neutron choppers development

Mr. WANG, Ping (Institute of high energy physics, Chinese academy of sciences)

China Spallation Neutron Source (CSNS) is one of the major national scientific projects under construction in China. Totally Two T0 choppers and seven disk choppers are needed in CSNS first three neutron instruments, all these choppers were self-designed and fabricated in China, and they were installed on the neutron beam lines in year 2017. For the neutron choppers control system, several choppers for one neutron instrument are controlled in one control cabinet, which reduces the cost and spaces. The commissioning of these chopper's control was completed in June of

year 2017. The mechanical vibration monitoring and analysis system of neutron chopper is also constructed and the initial mechanical vibration results were acquired, which can be used to evaluate the health of neutron choppers and to guide the improvement for next generation neutron chopper' mechanical design. Now all choppers are ready for the first neutron beam in September of year 2017.

Identifying and Resolving Shielding Issues

Mr. HALCROW, Will (STFC - ISIS)

In the latest instrument build programme at ISIS (TS2 Phase 2), two of the new neutron instruments suffered with significant radiation shielding problems. These problems slowed their commissioning, delayed their delivery and added cost to the projects. This presentation will give an overview of the radiation problems that were faced, and the challenges found whilst trying to characterize them. It will explain the root causes for the various problems seen. It will highlight the complexities that come when trying to increase the radiation shielding at the end of an instrument project and will show how an experienced neutron facility can be caught out by radiation shielding problems.

In-Kind Instrument Projects – Gathering Experience by building an RD guide-section

Mr. SCHUETZ, Sven (PSI)

ESTIA will be one of the first instruments at ESS. Based on its elliptical Selene neutron guide concept, the Instrument will project a 0.06 x 1 mm slit over a distance of 24m to the sample position (<https://www.psi.ch/ins/estia>). To achieve this extraordinary efficiency two Selene Guides will be aligned with 180 kinematic mounts. The mounts will spread over a length of 7.2m and will be aligned within micron accuracy to each other. Furthermore those kinematic mounts will be placed in vacuum and high radiation environment. To gain confidence over the system, a guide prototype is currently being built and tested. I will present the interferometry-metrology concept and its motion mechanics which will allow for a measurement range over 7.2m. Furthermore we will discuss the technical implementation of the system, such as lessons learned in this R&D project.

Redesign of Monochromator Shielding of Cold Neutron Triple-Axis Spectrometer at HANARO

Mrs. RYU, Ji-myung (Korea atomic energy research institute)

A Cold Neutron Triple-Axis Spectrometer (Cold-TAS) was initially installed in the guide hall of HANARO's cold neutron research facility in 2012. Owing to frequent mechanical troubles, simplification of the sample table and the analyzer took place in 2013. And the instrument was licensed for normal operation in 2014. Soon after, however, HANARO was shut down because of the reinforcement activity of the outer walls of the reactor building to enhance the seismic stability. Taking this opportunity, we decided to redesign and reconstruct the monochromator shielding of the Cold-TAS because serious deformations were found in it in 2015. The entire shielding structure was redesigned to stack horizontally to support the larger weight with little deformation. During the redesign process, we evaluated the shielding performance for radiation using MCNP. Shielding blocks were filled with mixed concrete with lead balls and boron powder. The concrete had different densities depending on their strategic location in the shielding structure. To fasten the bottom shielding block with bolts, stainless steel plates with tapped holes were installed on the concrete floor. After the installation of the redesigned shielding, we polished the surface of the dance floor to ensure smooth operation of the sample and the analyzer tables. All of the above activities were finished by the end of 2016. Now the instrument control system is under stress testing because it has not been used for a long time. Once the reactor resumes operation, we will measure the performance of the redesigned shielding.

Manufacturability of Neutron Beam Monochromator Drum Shielding

JONES, Justin (Merrick & Company)

To obtain the precision required for custom instruments used in neutron facilities, it is necessary to consider materials and components and their effect on tolerances throughout the entire design, manufacturing, and installation process. Designing for manufacturability includes considering and minimizing the number of components in an assembly; the stack-up of tolerances; the effects of temperature, welding, and machining; and the orientation of moving components. Merrick in one of its past projects completed a study and redesign for fabrication of three

new neutron beam monochromator drum shields. This project reflects the manufacturability issues that must be considered. This component was encountering problems during manufacturing, and Merrick completed a detailed study to identify ways to consolidate, eliminate and simplify parts in order to lower the assembly stack-up tolerances and streamline assembly operations. This presentation will describe the issues considered in the redesign of the neutron beam monochromator drum shields and the related considerations for achieving manufacturability of similar precision components.

Development of an argon box for stable beam collimation on MARIA instrument at the JCNS

Mr. BINGÖL, Kendal and Mr. DAEMEN, Jos (JCNS / Forschungszentrum Jülich)

The neutron reflectometer MARIA with polarization analysis is dedicated for the investigation of thin interfaces like magnetic layered structures down to the monolayer scale and/or lateral structures. To maximize the signal to noise ratio the background scattering has to be kept as low as possible. Therefore the flight path of the neutrons before and after the sample should be not in air but in vacuum or in an atmosphere like Ar or He. Because Ar is not cheap the goal is to run as long as possible with the filling a permissible box. Therefore after the initial Ar filling the Oxygen level is logged. As long it is below a certain threshold (e.g. 4.2%) no action is done. Above the threshold the box is filled with Ar by cycling with a slight overpressure. The detector box with a volume of about 2 m³ is fixed on a movable detector arm and is equipped with a complete set of feedthrough for the motors, encoders, pressure driven linear stages, water cooling system, detector and the ³He-filter in situ pumped SEOP filter. Oxygen sensors are also installed to allow a safe working place.

We present the technical details of the design and construction and will explain why we have chosen the Ar atmosphere on MARIA, why and how we combined the three requirements for being black for background neutrons, to be EMC-compatible and Ar tight at the same time.

Status of Neutron Scattering Facilities at HANARO

Dr. SEONG, Baek Seok (KAERI)

HANARO (30MW) is a powerful neutron source with a liquid hydrogen cold source. Currently, a total of 12 neutron beam facilities for basic science and industrial applications, such as a powder diffractometer, a residual stress instrument, two neutron image facilities, three SANS, and so on, are under operation. Recently, two inelastic scattering facilities (Th- TAS, CTAS) for dynamically studying materials and a polarized reflectometer are under commissioning. In the future, we plan to develop a thermal neutron guide system with several industrial dedicated neutron beam instruments at HANARO. In this presentation, I would like to present the status and perspective of the neutron scattering facilities at HANARO, and some activities on the operations, maintenance, and upgrades of neutron beam facilities.

Remote handling implementation at ESS

Mr. NILSSON, Erik (European spallation source ESS ERIC)

- Highly active and dangerous environment – Check
- Aggressive accelerator ramp-up – Check
- Ambitious operating schedule – Check
- Tight implementation schedule – Check
- Little or no budget for own development – Check
- 17 build partners with individual methods, best practices, experiences and traditions – Check

This is the story of how we decided to implement and deploy the remote handling strategy and guideline at the ESS. The talk describes how we took what was available and modified it to our needs as well as how we decided to implement it among our partners. The talk will discuss the future for remote handling at ESS and how we will check for compliance.

Poster presentations

Readout of the MWPC detector at the neutron reflectometer MARIA based on TANGO and the GPX TDC ASIC

Mr. KLEINES, Harald (Forschungszentrum Juelich)

For the readout of multi wire proportional chambers (MWPC), Forschungszentrum Jülich has developed a CompactPCI module based on the GPX TDC ASIC from acam messelectronic gmbh. Originally designed for X-Ray spectroscopy at the plasma physics tokamak TEXTOR, recently it has been integrated into the DAQ electronics of the neutron reflectometer MARIA. For the integration into the MARIA instrument control system a TANGO server has been developed. Design of the electronics as well as the software architecture is presented and performance issues are discussed on the base of measurements.

OPAL - Thermal Neutron Guides TNG1 and TNG3 Replacement

VERONIKA, Kristian (ANSTO)

During the 2019 major shutdown, ANSTO has set up a project to remove existing Thermal Neutron Guide (TG1-3) in-pile assembly and replace it with a new in-pile assembly containing an additional TG-2 A/B in-pile guides.

The purpose of this presentation is to provide following:

- Brief description of ANSTO neutron guide configuration;
- Improvements made to enable easier future guide installation /removal
- Provide overall project progress in preparation for the replacement.

How to set up a complex sample by lasers

Mr. NGUYEN, Tai (ANSTO); Mr. NEW, Mark (ANSTO)

With the major rise in commercial infrastructure works in recent years, the workload demands on the Kowari Residual Stress Instrument on industrial engineering components has also increased significantly. And while the increase in demand represents good news for the industry, the changes have also brought with it many new challenges. These challenges have demanded innovation from scientists and users to formulate solutions to set up complex shapes and sizes of samples in a manner that is quick, simple but also accurate.

Scientists and technical support teams working on the Kowari Instrument have invested a significant amount of time investigating, designing and testing new solutions. Through this work, our team has come up with the answer of utilising four laser pointers every 90 degrees on the sample in order to establish all angles of the sample on the sample stage. This method allows scientists to see and gauge exactly whether the ideal angles and positions of the sample can be accessed by a neutron beam. Our team implemented this method for the first time recently, and this poster will show the design and setup of all lasers, explain how they work, and discuss plans for future improvement.

Development of accelerator-driven compact neutron source for non-destructive inspection of infrastructure constructs

Dr. KOBAYASHI, Tomohiro (RIKEN)

A compact neutron source by using a particle accelerator is a promising tool for practical material analysis, infrastructural diagnostics, nuclear detection, and medical treatment. We have been operating the neutron source RANS (RIKEN Accelerator-driven compact Neutron Source) with 7 MV proton LINAC and a beryllium target for 5 years and learned a lot about experiment, maintenance and safety management. In recent years, imaging with fast neutrons, engineering diffraction for texture evolution estimation and austenite volume fraction, prompt-gamma neutron analysis (PGA) are the major activities. The weights of the accelerator section and the target station of RANS are 5 tons and 25 tons, respectively.

For outdoor use of neutrons source for such as non-destructive inspection of old constructs, it is required to develop a system smaller and lighter. We have started R&D of a mobile neutron source "RANS2" with a newly designed proton RFQ. We chose lithium for the target and the energy of proton was set at 2.49 MV. Total neutron yield per proton current of 100 uA is estimated to be 1011 neutrons / sec. The present status of the project is as follows. The design and the fabrication of the ECR proton ion source and the RFQ LINAC were completed including vacuum and cooling tests. Ion generation and acceleration is in preparation. Design of the lithium target including cooling system, neutron reflector and shielding is underway by performing numerical simulation. The total system will be completed in 2018.

Progress Status of New T0 Chopper System at J-PARC MLF

Mr. KAMBARA, Wataru (J-PARC)

Materials and Life Science Experimental Facility (MLF) at J-PARC is a pulsed neutron facility. The accelerators have delivered a proton beam at 25 pps to a mercury neutron producing target. MLF has over 20 instruments and over 50 neutron choppers. Neutron Choppers are important devices that remove unwanted energy components from the pulsed neutron beam. We have been improving durability and performance by developing a newly designed T0 chopper. We reported the status of our new T0 chopper in the last DENIM.

After that, we have been testing the prototype T0 chopper. We succeeded in the 100Hz rotation test of that. We are currently improving vibration, cooling and synchronization of that chopper. In the presentation we will show the current status of new T0 chopper, and share our experienced.

Neutron Chopper Vibration Analysis

Mr. WILLIAMS, Sebastian (ANSTO)

The backscattering instrument managed by ANSTO called Emu was built with two neutron choppers. These choppers condition the neutron beam and typically spin at 2400rpm and 1200rpm respectively. They were supplied with an integrated vibration monitoring system. From late 2016, this system would occasionally trip, decreasing the availability of the instrument. This issue, coupled with the delicate nature of the equipment, created the need to better understand the sources of vibration.

Through research, testing and consultation with the manufacturer and third-party vendors, the integrated vibration monitoring system was found to be effective at protecting the choppers. However, by design, it lacked the ability to perform the detailed analysis required to determine the sources of vibration, without impacting the instrument's operation. As a result, a second independent vibration monitoring system was installed on one of the choppers, allowing detailed analysis. The frequency spectrum revealed that most of the vibration experienced by the chopper was at 400Hz. Defects on bearings create vibration at known frequencies, proportional to the running speed of the chopper. These damage frequencies can be calculated based on the geometry of the bearing. The 400Hz signal matches the 4th harmonic of the ball bearing damage frequency. The spectrum was observed while the chopper was slowing down and the spectral spike decreased in frequency. This was further evidence that this 400hz spike was due to bearing damage. It was through this independent system that in-depth analysis could be completed and that the bearing damage could be identified.

Sample Environment Equipment for use on Neutron Instruments

LEE, Stan (Australian Nuclear Science Technology Organisation)

In order to complete and complement the neutron instruments, Australian Centre for Neutron Scattering procures and commissions a continuously evolving suite of sample environment equipment, able to determine and manipulate the physical conditions under which a neutron scattering experiment is performed. The sample environment equipment, therefore, plays a crucial role in the success of an experiment; the very role of sample environment has shifted from purely technical infrastructure to an invaluable component of the experimental procedure. The range of equipment available spans from cryostats and cryofurnaces, superconductive magnets, high temperature, high pressure, gas and vapour delivery systems to more specialised equipment tailored to specific necessities.

In designing a neutron instrument, consideration is given to ensuring the different sample environment equipment can be repeatedly and efficiently mounted, installed and operated within the confines of the instrument's sample stage and surrounding floor space. Current development projects include the design, construction and commissioning of a new superconducting split-coil magnet, a fast cooling closed cycle cryostat and a closed cycle dilution refrigerator of the latest generation. Also in the pipeline are thermalised sample tumblers for SANS and USANS.

Upgrade of the Necsa neutron radiography instrument

Dr. MARAIS, Deon (The South African Nuclear Energy Corporation (Necsa) SOC Limited)

Neutron radiography has been conducted at the SAFARI-1 research reactor since the early 1970's. Digital neutron radiography commenced in 1996 and a 3D tomography capability was installed in 2003. Major deficiencies regarding corrosion of water cooling pipes of the internal collimator as well as shielding and control infrastructure were identified to be addressed in the design of new state-of-the-art neutron radiography instrument.

A bismuth filter that limited the utilisation of the beam port is being replaced by a multiple filter exchange unit allowing for radiography using either fast or thermal neutrons or the gamma-ray component of the beam. Due to the optimization of the neutron optics, the field of view on the detector plane was improved from 5x5 cm² to 35x35 cm². The highest neutron flux anticipated will increase from 1x10⁷ to 1x10⁹ n.cm⁻².sec⁻¹. Shielding design was improved to allow < 1 µSv/hour dose rate on contact at the outside wall. To minimise stray neutron scattering towards the detector, the size of the experimental chamber is increased from 2x2x2 m³ to 8x5x2 m³ and is lined with a 200 mm thick layer of B-PE. To improve towards the full utilisation of available beam-time, comprehensive experiment control, data analysis and user-office management systems will be implemented.

Variable collimation snout for Quokka (Small angle instrument)

Mr. PERRY, Merv (ANSTO)

In 2007 ACNS (formally known as The Bragg Institute) commissioned its first small angle instrument known as Quokka. Quokka has a fixed collimation tank of 20meters and a sample area gap of 960 mm to allow for a variety of sample environment equipment from superconducting magnets to simple 20 position sample changers. The challenge was to keep the distance from the sample environment equipment to the fixed collimator section to a minimum to minimise air scattering. Originally this was done by placing fixed lengths of evacuated aluminium tubing onto the fixed collimator. Unfortunately this system was time consuming and did not always optimise the gap between the sample environment and fixed collimator. In 2016 to 2017 the ACNS Scientific Operations group and Quokka's instrument scientist successfully developed and built a variable collimation snout utilising motor driven linear slides and welded bellows. This new system is totally non-magnetic as a result of the titanium welded bellows and has infinite adjustment over a range of 800mm. This allows for the recently installed polarisation system on Quokka to be utilised with all available sample environment equipment. Changing the length of the snout went from hours to just a few minutes with a repeatability greater than 0.1mm over the entire length.

Design Stage Divergent Neutron Beams

Mr. BELL, Matt (ANSTO)

Higher background on detectors compared to anticipated design levels? Persistent hot spots on detectors? Increased radiation levels? These are common aspects of a new instrument, and even an old instrument. The divergent beam exiting from a guide, or reflecting from a chopper, can create unwanted background, or damage neighbouring equipment. For instance, persistent hot spots and higher background counts on the detector of the backscattering spectrometer, EMU, had been present since hot commissioning. While the scientists and technical support team worked on step-wise tests to localise some of the causes, the extreme worst-case beam divergence was also investigated within the CAD model. This additional CAD analysis showed that a neutron beam exiting a guide with the highest possible beam divergence could actually bypass the in-operation beam stop and reflect off an analyser array back onto the detectors. This was just one of a few issues creating a higher background for the instrument. From our experience, during the instrument commissioning stage and subsequent years after, instrument and technical

support teams spend a lot of time adding and improving shielding, to reduce background neutrons and gammas. This tedious and time consuming process may be reduced if future design projects allow for specific, divergent neutron beams, milestone design review steps. Divergent beams and their shielding are very easily overlooked in the design phase of instrument projects. We will outline a mechanism allowing to avoid such problems, through consideration throughout the design process.

Safety Interlock System and User Interfaces

Mr. FEDERICI, David (Electrical controls Technician, ANSTO)

Safety Interlock System and User Interfaces My poster will be on the safety interlock system (SIS) employed at the ACNS, focusing on the interfaces including the touch screens we use to operate the safety system for an instrument. The touch screen interface design satisfies the needs of various users: 1. Instrument users require very clear and basic instructions to operate the instrument. A user is brought on sight for only a couple of days and shown by the instrument scientist how to operate the instrument only once. So the touch screens need to be straight forward and fairly intuitive to make this possible.

1. Instrument scientists employ the touch screen to operate the instrument and analyse faults when the safety system has a safety trip for example due to an emergency stop button being pressed or a safety malfunction occurring. The instrument scientist is the first point of call in any operational error and they decide who needs to be called. For example if there is a master reset required the instrument scientist will call a source officer.

2. The technical staff that employ the touch screen for trouble shooting the safety system in case there is an error that the instrument scientist can't recover from. The event log on the touch screen is a convenient central location that technical staff can sight and make a rapid determination of triage requirements.

Mechanical testing of the RAMPA Type B Inserts when used in Pb99.94Cu Lead shielding

Mr. PULLEN, Stewart (ANSTO)

As part of the transfer of the BioRef instrument from Helmholtz Zentrum Berlin (HZB) to ANSTO, Sydney, a number of lead shielding components will need to be lifted in and out of their positions. These lifts utilise RAMPA Type B inserts embedded in the lead shielding via a self-tapping process with a pilot hole. These inserts have been used extensively at other facilities and there is data on the use of RAMPA Type A inserts in PbSb4 see Ofner (2015). Data on load limits for inserts when used in Pb99.94Cu lead alloy are not readily available. In order to fulfill the requirements of the Lifting Equipment Approval process at ANSTO a safe load limit needs to be determined prior to utilisation at ANSTO.

The process to determine that safe load limit made use of a number of mechanical analytical tools including Pull-out testing, fatigue testing, and creep testing; along with tensile testing and XRF Spectroscopy for material characterisation. The results of this testing and the resulting safe load limit applied to these lift points will be presented.

Update of the transfer of the BioRef (SPATZ) Reflectometer from HZB to ANSTO

Mr. PULLEN, Stewart (ANSTO)

This poster will outline the progress to date on the transfer of the BioRef (SPATZ) reflectometer from the Helmholtz-Zentrum Berlin to ANSTO. It will also outline work to be done to complete the transfer by September 2018.

The Powersupply system of the Neutron Spin-Echo Spectrometer at the FRM-II

Mr. VEHRER, Guido (Forschungszentrum Jülich GmbH)

A Neutron Spin-Echo Spectrometer (NSE) measures small velocity changes at a sample of the neutrons encoded by the neutrons spin clock while the neutron spin precesses in large magnetic fields following Bloch's equation. In order to reach this ambitious goal, a high precision of the magnetic field integral before and after the sample, which directly relates to the resolution of the instrument, is required. As the power supply system operating various coils of the J-NSE in Garching had reached end of its life cycle and the manufacturer limited the support for the system FZJ decided to replace that system. Due to the demanded technical requirements (accuracy, stability and reliability) of the whole system in conjunction with limited space and budget an investigation for a new supplier was started. Nether the less the new systems connectivity should also fit into the Jülich-München standard to be implemented into the Tango / Nicos instrument software. Within the talk we will explain procedures we developed to compare documented characteristics of the power supplies with measurements made in our labs with respect of operating an neutron scattering instrument.

The Upgrade of the Neutron Spin-Echo Spectrometer at the FRM-II (Poster)

Mr. KOZIELEWSKI, Tadeusz (Jülich Centre for Neutron Science, Forschungszentrum Jülich GmbH, Jülich, Germany)

A Neutron Spin-Echo Spectrometer (NSE) measures small velocity changes at a sample of the neutrons encoded by the neutrons spin clock while the neutron spin precesses in large magnetic fields following Bloch's equation. In order to reach this ambitious goal, a high precision of the magnetic field integral before and after the sample, which directly relates to the resolution of the instrument, is required. FZJ has decided to upgrade the water-cooled copper coils of the J-NSE installed at the research reactor FRM II in Munich with two optimized and stray-field compensated superconducting magnetic precession coils with minimal intrinsic field integral inhomogeneity. The new design will reduce the necessary corrector strength, which limits the resolution, by a factor of about 2.5 compared to previous cylindrical coil designs and provide field integrals up to 1.5 Tm. We present the layout and properties of these coils and major technical improvements. The subsequent design modifications of other components and the new power supply system should also improve the reliability of the upgraded J-NSE.

Commissioning of a shearing machine for soft matter samples

Mr. VEHRER, Guido (Forschungszentrum Jülich GmbH)

Shear rheology is a widely used technique in both research and industry for different kinds of materials, covering various applications. Nevertheless, hardly any practical system is available which is suitable to study low temperature behavior in situ using small angle neutron scattering experiments.

Our approach bases on vertical sandwich shear geometry, which allows examining rubber- like or soft matter samples. The system is designed to reach high shearing rates while keeping the movement precision around 1mm. To obtain a maximum shearing force up to 300N a massive design was chosen. A temperature range between -100 and +100 degree celsius was realized using a nitrogen gas flow based temperature control system. In this talk we will show the development from the first design stage to the deployable machine and illustrate the problems we faced within the implementation of the system.

Maintaining and calibrating your equipment - what methodologies and systems exist?

Mr. OLSEN, Scott (ANSTO)

On 3 July 2017 ANSTO went live with a major new system known as SAP Ae (Ansto Enterprise). This one stop shop covers all aspects of asset management planning, including procurement, maintenance, calibration, asset renewal, customer relationships and even HR. This system has been primarily designed for the commercial side of ANSTO (Nuclear Medicines, Silicon Irradiation and Minerals divisions). Issues, challenges and opportunities of using such a major piece of software for the ACNS' neutron scattering instruments will be discussed.

ESS Instrument Controls

Mr. BRODRICK, David (European Spallation Source ERIC)

The European Spallation Source ERIC (ESS) are actively developing fifteen neutron instruments, the first of which will be ready for routine user operation by 2023. Although the instruments are being developed by many partner institutions, a common controls framework will be used for all instruments in the ESS instrument suite. This presentation will provide a brief overview of the controls architecture to be used for the ESS instruments and describe activities which are currently underway to integrate the various instrument component technologies and to prototype and develop the instrument controls framework.

Target development of the accelerator driven High Brilliance neutron Source (HBS)

Mr. DOEGE, Paul-emmanuel (JCNS-2, Forschungszentrum Jülich GmbH, D-52425 Jülich, Germany)

Neutron supply for research is nowadays predominately based on spallation or fission. The High Brilliance neutron Source (HBS), currently under development at Forschungszentrum Jülich, will use protons or deuterons from an accelerator in the 10 MeV to 50 MeV range, shot on a low Z-material in order to produce neutrons. The HBS is optimized to be highly cost efficient and scalable. Medium flux devices, which are affordable for universities or companies will be available, as well as high flux facilities, comparable to today's research reactors.

The heart of the system is the target assembly, where nuclear reactions between ions and target nuclei take place to produce neutrons and where the major fraction of the projectiles kinetic energy is converted to heat. The neutron yield is strongly correlated to the beam power, making the thermomechanical properties of the target material a limiting factor. The ion range, which is a function of the ion's initial energy, is limiting the allowable thickness of target materials with low diffusion coefficients like beryllium, due to ion implantation causing severe degradation by blistering. For an efficient high power target with an acceptable lifetime, smart choice of design parameters is therefore crucial. Simulations show the feasibility of a 10 kW peak power target producing 10¹³ n/s at 4 % duty cycle, for a system on university scale. Latest target design considerations and techniques for effective heat dissipation will be presented, which allow the maximization of the neutron yield.

Leveraging existing IT condition monitoring systems to keep track of the health of networked industrial devices and their processes

Mr. BARTLETT, Daniel (ANSTO)

Nagios, a free and open source computer-software application that monitors systems, networks and infrastructure^[1], was configured to monitor the health of common industrial devices. The ACNS has 14 neutron beam instruments which employ various industrial electronic components such as: Galil controllers, Rockwell programmable logic controllers, Pilz safety systems and many others. Monitoring the health of these devices and the services they run is vital in providing a reliable scientific research facility. Simple software plugins were written in Python to interface these devices to an existing nagios instance that was initially set up to monitor the IT infrastructure. If any of these systems become degraded, technical staff are notified by email so that rapid repairs or rectifications can be made. Global mechanical services like compressed air, chilled water and neutron guide vacuum levels, critical to all the instruments, are also monitored and technical staff notified when problems arise.

The results have been impressive, where technical staff were alerted of a problem before the scientific users were even aware. The aim of the system is to never use neutrons to discover the failure of a piece of equipment, or put another way, never have the users scientific experiment or its data the method of fault detection. Currently the technical teams are notified by email but future expansion of the system is planned to include sms notification to the rostered on call technical support person.

[1] Wikipedia- <https://en.wikipedia.org/wiki/Nagios>

Present Status of University-owned Neutron Beam Instruments at JRR-3

Dr. KAWANA, Daichi (Neutron Science Laboratory, Institute for Solid State Physics, the University of Tokyo)

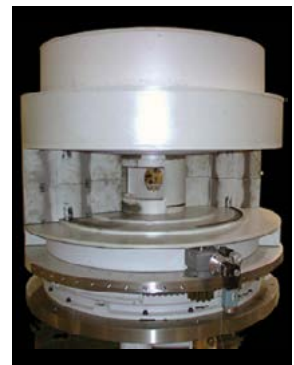
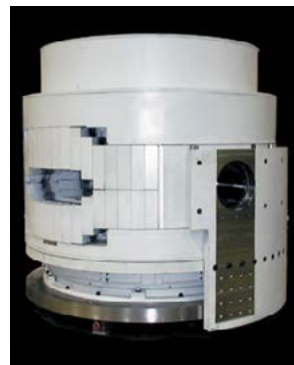
ISSP owns 14 neutron-beam instruments in the Japan Research Reactor No. 3 (JRR-3), which has been built and owned by Japan Atomic Energy Agency (JAEA), and operates a general user-program for neutron scattering research for half a century. Unfortunately, the operation of JRR-3 has been suspended since the Great East-Japan Earthquake disaster on Mar. 11, 2011. To restore the JRR-3 operation, many tasks of safety management must be met the government regulation. We have been proceeding mainly two following tasks in a recent few years. One is cleaning up and rearrangement of a radiation-controlled laboratory in JRR-3. Users-owned items were returned to the owners, and less-frequently-used accessories were moved to outside of the laboratory. All the items continuously-preserved in JRR-3 have been registered in a database with the owner, installation location, period and specific character are recorded. The other is an organization of an inter-facility safety-and-health control team. In order to transfer information from the facility owner, JAEA, to the instrument staff members, we organized "University-owned instruments Safety-management Team (UST)" which is comprised of one professor and technical staff members. Under the leadership of JAEA, the UST have cooperatively proceeded comprehensive safety activities such as check of electric equipment and item management. For our instruments, commissioning has been carried out together with the responsible instrument staff members, toward the upcoming restoration of the reactor operation.

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