International Collaboration on Advanced Neutron Sources

Sunday, October 29, 2023 - Saturday, November 4, 2023

Book of Abstracts

Contents

Detectors for neutron scattering instruments at IBR-2 reactor in FLNP JINR 1

New INS spectrometer at FLNP JINR 1

A new method to find out the optimal neutron moderator size based on neutron scattering instrument parameters 2

Tuning the Nano Structures of Micellar Aggregates 2

Commissioning of an Atmospheric Neutron Irradiation Spectrometer at CSNS 3

eMAP: The new engineering diffractometer at ISIS 3

High-brilliance and high-flux cold neutron source based on high-aspect ratio rectangular parahydrogen moderators. 4

Behavior of proton beam window materials of high power spallation targets 4

TS1 Project with-beam commissioning 5

Outline plans for target stations at the ISIS-II facility 5

Summary of lessons learned from the TS1 project implementation 6

Developments in Target Manufacture Procedures 6

ISIS BEAMLINE HIGH VOLTAGE INTERLOCK SYSTEM 7

MR: the multipurpose reflectometer at Chinese Spallation Neutron Source 7

Status and Future Developments of the ISIS Pulsed Neutron and Muon Source 8

Instrument Upgrade, Installation and Operation at ISIS 8

Performance assessment of the cold-neutron disk-chopper spectrometer at J-PARC . . . 9

Development of Sample Environment at CSNS 10

ISIS Target Station 2 Horn Moderator 10

The progress of neutron optics development for CSNS 11

Development of Spherical Neutron Polarimetry devices at CSNS 11

ESS Bilbao. Current Status and Perspectives 11

The application of the polarized neutron techniques at the China Spallation Neutron Source beamlines . . . 12

An alternative approach to synchronize the triggering of the external sample environment with the neutron data aquisition . . . 13

Development of polarized neutron capability at the CSNS . . . 13

the Multi-Slit Very Small Angle Neutron Scattering Instrument in China Spallation Neutron Source . . . 14

Visualizing the magnetic fields using polarized neutron imaging technique . . . 14

Investigation of Pancake-like Moderator-Reflector Structure for the High Brilliance Neutron Source (HBS) . . . 15

Plasma spraying B4C-ZrO2 to prepare moderator decoupling layer for spallation neutron sources . . . 15

Scientific computing and data management for the users of the European Spallation Source ERIC . . . 16

Medium-pulse length source studies for the European Spallation Source . . . 16

The Muon Science Facility of MLF J-PARC . . . 17

Recent upgrades and current status of cold-neutron disk-chopper spectrometer AMATERAS . . . 17

A proton driver based on a Fixed Field Alternating Gradient Accelerator . . . 18

The ESS helium cooled rotating target. Final design stages, manufacturing process and FAT test. . . . 18

Manufacturing of the ESS Monolith Vessel: Lower and medium Vessel, Neutron port weldings, Connection Ring and head of the vessel . . . 19

The HighNESS Project at the European Spallation Source . . . 19

Simulated and Measured Performance of ISIS TS1 Project Target . . . 20

Initial Target Concepts for ISIS-II . . . 20

Optimisation Procedures for ISIS-II Targets . . . 21

Study of interplay between structure & magnetism in novel AMO2 (A=Alkali metals; M=3d Transition Metals) advanced oxide materials exhibiting unconventional chemical & physical properties. . . . 21

J-PARC Linac and RCS operational status and upgrade plan to 2 MW . . . 22

The TOSCA secondary spectrometer upgrade: design and simulations . . . 23

The SINQ Solid State Target: Lessons learned from a Recent Target Failure and the Experience Gained from an Improved Target Design . . . 23

The China Spallation Neutron Source . . . 24

MARMOT Si crystal analyzer (Keynote) 24

Update from ESS 24

new Tosca+ spectrometer to be built at ISIS (Endeavour project) (Invited) 24

Recent upgrades on AMATARES (Invited) 24

CSPEC (Invited) 24

Status and Future Developments of the ISIS Pulsed Neutron and Muon Source 25

McStas 25 years, project status and future 25

Refining magnetic structures using representational theory and SARAh - learning from simplicity and serendipity (Inivted) 25

Scientific computing and data management for the users of the European Spallation Source ERIC (Invited) 25

Simulating single-crystal inelastic scattering in full phase-space (Invited) 25

TS1 Project with-beam commissioning 25

Outline plans for target stations at the ISIS-II facility (Keynote) 26

TS1 Project with-beam commissioning 26

Summary of lessons learned from the TS1 project implementation (Invited) 26

A new method to find out the optimal neutron moderator size based on neutron scattering instrument parameters 26

Low energy muons update and future developments (Keynote) 26

HRPD with elliptic focusing under commissioning (Invited) 26

POWTEX at POWGEN 26

Diffraction at SNS 27

Target/HIMB and FLAME (Invited) 27

Muon spectrometer design for the first muon facility in China (Invited) 27

J-PARC Linac and RCS operational status and upgrade plan to 2 MW (Invited) 27

Medium-pulse length source studies for the European Spallation Source 27

A proton driver based on a Fixed Field Alternating Gradient Accelerator 27

Multi-physics instrument: Total scattering neutron diffractometer at China Spallation Neutron Source 27

Diffraction at SNS 28

Diffraction at SNS 28

A novel high-intensity ns-pulsed compact accelerator-driven neutron source (Invited) . . 28
xxx 28
xxx 28
SINQ 28
STS project at ORNL 28
Status of Hefei Light Source 29
Polarized SANS and GISANS (Keynote) 29
ESTIA/AMOR (Invited) 29
Slit focusing VSANS under commissioning (Invited) 29
Behavior of proton beam window materials of high power spallation targets (Invited) . . 29
xxx 29
Slit focusing VSANS under commissioning 29
ISIS BEAMLINE HIGH VOLTAGE INTERLOCK SYSTEM 30
Instrument Upgrade, Installation and Operation at ISIS 30
xxx 30
ISIS brightness 30
High-brilliance and high-flux cold neutron source based on high-aspect ratio rectangular parahydrogen moderators. 30
Neutronics evaluation of a potential ISIS-II TS-2 target, reflector and moderator assembly 30
Mesitylene and the short-pulse spallation neutron sources 30
Developments in Target Manufacture Procedures 31
NeXT 2.0, the new Neutron and X-Ray Tomograph at ILL (Keynote) 31
Engineering diffraction at CSNS (Invited) 31
eMAP: The new engineering diffractometer at ISIS 31
Wide-angle polarization analysis at ISIS: past, present, and future (Keynote) 31
Status of the He-3 spin filter station at MLF (Invited) 31
Neutron polarization platform focus on 3He at CSNS (Invited) 31
Wide-Angle Solid State Polarization Analysis for MAGiC (Invited) 32
Boron-based detectors (Keynote) 32
The future and the present of neutron detectors for instruments at CSNS (Invited) 32

Muon tracking detectors (Invited) 32

Status of LANSCE at Los Alamos National Laboratory 32

Update on WASP, wide angle spin echo spectrometer (Keynote) 32

Status overview of J-parc facility 32

Resonance spin-echo options using Wollaston prisms at HFIR 33

ISIS Target Station 2 Horn Moderator 33

xxx 33

The ESS helium cooled rotating target. Final design stages, manufacturing process and FAT test (Invited) 33

The HighNESS Project at the European Spallation Source (Invited) 33

High pressure research at PSI using neutrons and muons (Keynote) 33

Event-mode stroboscopic experiments with sample environments (Invited) 33

Development of Sample Environment at CSNS (Invited) 34

Simulated and Measured Performance of ISIS TS1 Project Target 34

Initial Target Concepts for ISIS-II (Invited) 34

The SINQ Solid State Target: Lessons learned from a Recent Target Failure and the Experience Gained from an Improved Target Design (Keynote) 34

MELODY project of CSNS-II, design & development of the first muon facility in China (Invited) 34

The Muon Science Facility of MLF J-PARC (Invited) 34

xxx 34

Low energy muons update and future developments 35

Target/HIMB and FLAME 35

Muon spectrometer design for the first muon facility in China 35

xxx 35

Detectors for neutron scattering instruments at IBR-2 reactor in FLNP JINR 35

New INS spectrometer at FLNP JINR 35

The progress of neutron chopper development for CSNS 36

Unraveling the Effects of Ta, Re and Mo on Vacancy-mediated Diffusion and Structural Order in γ'-Ni3Al: A Kinetic Monte Carlo Study 36

The operation and maintenance status of neutron chopper system for CSNS 36

How to reduce the vibration of neutron choppers . . . 37

The design and current status of the high-resolution neutron diffractometer at China Spallation Neutron Source . . . 37

The future and the present of neutron detectors for instruments at China Spallation Neutron Source . . . 37

Design of the macromolecular diffractometer at the High Brilliance Neutron Source (HBS) 38

Background sources in Advanced High-Pressure Neutron Scattering Experiments . . . 38

High pressure research at PSI using neutrons and muons . . . 39

The surrogate modelling based optimization of target station for bimodal neutron and photon imaging . . . 39

Development of Nano-sized graphene material for neutron intensity enhancement below cold neutrons . . . 40

An Instrument suite for the HBS . . . 40

Research on neutron/X-ray CT image denoising method based on semantic context aggregation . . . 41

Characterizations of the tantalum cladded tungsten blocks prepared by hot isostatic pressure (HIP) diffusion welding . . . 41

test . . . 42

Muon spectrometer design for the first muon facility in China . . . 42

WASP the wide angle neutron spin echo instrument . . . 43

Physics Design and Commissioning of the Mark-IV TMRS assembly at the Lujan Center 43

Larmor labeling of neutron spin with superconducting magnetic devices . . . 43

Development and application of 3He neutron spin filters at J-PARC MLF . . . 44

The Design of a Scientific Data Management System Based on DOMAS at CSNS-II . . . 44

Polarized SANS and GISANS at the ESS . . . 45

How to Control the Proton Beam on the SINQ Target . . . 45

HOW VARIETY AND SPECILISM STRENGTHENS THE ISIS ELECTRICAL & ELECTRONIC USER SUPPORT GROUP . . . 46

Status of the Second Target Station at the Spallation Neutron Source . . . 47

Neutron facilities and developments of single crystal neutron diffraction at ORNL . . . 47

The Jülich High-Brilliance Neutron Source Project . . . 48

Development of Spherical Neutron Polarimetry devices at CSNS . . . 48

The performance of General Purpose Powder Diffractometer at CSNS . . . 48

TBD 49

TBD 49

TS1 Project with-beam commissioning 49

Tuning the Nano Structures of Micellar Aggregates 49

Commissioning of an Atmospheric Neutron Irradiation Spectrometer at CSNS 49

Study of interplay between structure & magnetism in novel AMO2 (A=Alkali metals; M=3d Transition Metals) advanced oxide materials exhibiting unconventional chemical & physical properties. 49

Detectors for neutron scattering instruments at IBR-2 reactor in FLNP JINR 49

Multi-physics instrument: Total scattering neutron diffractometer at China Spallation Neutron Source 50

Status of the Second Target Station at the Spallation Neutron Source 50

MR: the multipurpose reflectometer at Chinese Spallation Neutron Source 50

ESS Bilbao. Current Status and Perspectives (Keynote) 50

The application of the polarized neutron techniques at the China Spallation Neutron Source beamlines 50

Operating status and recent upgrades of SANS diffractometer at CSNS 50

Development of polarized neutron capability at the CSNS 50

The operation and maintenance status of neutron chopper system for CSNS 51

How to reduce the vibration of neutron choppers 51

The future and the present of neutron detectors for instruments at China Spallation Neutron Source 51

Background sources in Advanced High-Pressure Neutron Scattering Experiments 51

Development of Nano-sized graphene material for neutron intensity enhancement below cold neutrons (Invited) 51

An Instrument suite for the HBS 51

Research on neutron/X-ray CT image denoising method based on semantic context aggregation 51

High pressure research at PSI using neutrons and muons 52

Updated of accelerator in ISIS-II (Invited) 52

Future plan of ESS accelerator: a novel spallation neutron source with medium pulse length protons (Invited) 52

Manufacturing of the ESS Monolith Vessel: Lower and medium Vessel, Neutron port weldings, Connection Ring and head of the vessel (Invited) 52

Characterizations of the tantalum cladded tungsten blocks prepared by hot isostatic pressure (HIP) diffusion welding . . . 52

Physics Design and Commissioning of the Mark-IV TMRS assembly at the Lujan Center 52

The Design of a Scientific Data Management System Based on DOMAS at CSNS-II 53

How Variety and Specilism Strengthens the ISIS Electrical & Electronic User Support Group . . . 53

The Jülich High-Brilliance Neutron Source Project . . . 53

Overview of the CSNS phase-II . . . 53

test email . . . 53

test2 . . . 53

Experimental measurement of neutronic performance at neutron beam line in CSNS . . 54

Thermal and experimental analysis for components of CSNS target station . . . 54

test3 . . . 54

The Operation Status and upgrade of CSNS Target Station (Keynote) . . . 54

TBD (Invited) . . . 54

Status of HEPS . . . 54

Radiation Related Issues and Management at CSNS . . . 55

The Operation of CSNS Cryogenic System . . . 55

Status of TMR at CSNS and progress of CSNS-II (Keynote) . . . 55

Commissioning of an Atmospheric Neutron Irradiation Spectrometer at CSNS . . . 55

Condition monitoring for Chopper Systems . . . 55

Unveiling local magnetic correlations: the development of magnetic pair distribution function at CSNS (Invited) . . . 55

Studies on 3D spiral injection scheme for compact storage rings . . . 55

An alternative approach to synchronize the triggering of the external sample environment with the neutron data aquisition . . . 56

The reactor at Tsinghua University . . . 56

Overview talk of muon facilities . . . 56

Dysurf: A program for simulating four-dimensional dynamical structure factor for inelastic neutron scattering measurement (Invited) . . . 56

Status and upgrade of CSNS accelerator . . . 56

New scheme of the injection system for CSNS-II . . . 56

Ion sources used for neutron production developed at CSNS 56

Development of Dual-harmpnic RF System For CSNS-II 57

High repetition rate short pulse neutron source based on hundred milliampere continuous wave accelerator (Invited) 57

Current status and CSNS-II progress of CSNS remote handling system 57

Status of Shanghai Light Source 57

Wide-angle polarization analysis at ISIS: past, present, and future. 57

NeXT 2.0, the new Neutron and X-Ray Tomograph at ILL Abstract: attached 58

Dysurf: A program for simulating four-dimensional dynamical structure factor for inelastic neutron scattering measurement 58

Unveiling local magnetic correlations: the development of magnetic pair distribution function at CSNS 59

Simulating single-crystal inelastic scattering in full phase-space 59

ISIS muon facility status and technology development (Invited) 59

Construction of post-irradiation sample preparation capabilities in CSNS hot cell and prospects for PIE research 60

Development of Liquid Neutron Reflectometer at China Spallation Neutron Source . . . 60

The utilization of the event-recorded data acquisition with the sample environments in MLF at J-PARC 60

Design and key technology research of moderator and reflector system at CSNS-II 61

Giant cryogenic reversible magnetostriction in rare-earth free MnCo(Ni)Si metamagnetic alloys 61

UB Matrix based on Single Crystal Orientation Program in Neutron Spectrometer 62

The design of high-energy direct-geometry chopper spectrometer at CSNS 62

High repetition rate short pulse neutron source based on hundred milliampere continuous wave accelerator 63

Back-n White Neutron Facility as a Multi-purpose Research Platform 63

Trip to Keyuan Garden and Lingnan Art Museum 63

Status of Hefei Light Source 64

Status of HEPS 64

Status of Shanghai Light Source 64

Refining magnetic structures using representational theory and SARAh - learning from simplicity and serendipity 64

Back-n White Neutron Facility as a Multi-purpose Research Platform 64

Instruments / **4**

Detectors for neutron scattering instruments at IBR-2 reactor in FLNP JINR

Author: Viktor Bodnarchuk[1]

[1] *Joint Institute for Nuclear Research*

Corresponding Author: bodnarch@nf.jinr.ru

One of the priority of FLNP JINR is the development of detectors for thermal and cold neutrons. There are 14 neutron instruments for condensed matter investigation at the pulsed IBR-2 reactor. Every instrument operates in time-of-flight mode and implements certain scattering method. The performance of any instrument mainly defines by characteristics of its detector system consisting of a registering unit and DAQ electronics. At IBR-2 reactor two types of registering units differing by the converter material are used in the detectors. Most part of detectors based on the gaseous He-3 converter, and several detectors based on scintillator ZnS(Ag)/6LiF. Besides this, the infrastructure for the fabrication of detectors based on boron-10 converter is developing now. The DAQ system of the detectors use the electronics solutions developed in FLNP as well as the commercially available electronics. In the report the status and future prospects of the study and implementation of neutron detector technique is considered.

Instrument -Spectrometers / **5**

New INS spectrometer at FLNP JINR

Author: Dorota Chudoba[1]

Co-authors: Alexander Belushkin [1]; Eugeny Goremychkin [1]

[1] *International Intergovernmental Organization Joint Institute for Nuclear Research, Frank Laboratory of Neutron Physics*

Corresponding Author: mardotka@gmail.com

The state of research of the condensed matter dynamics using the inelastic neutron scattering (INS) technique at FLNP was a matter of concern for both the user community and laboratory management, and was the subject of intensive discussions on the further development of this research area at FLNP. As a result of the discussions, it became clear that the current INS spectrometer NERA, which once competed with similar instruments in European neutron centres, has become significantly outdated and no longer meets the requirements of the user community in the Eastern European region. Therefore, it is extremely important to significantly upgrade the suit of INS instruments and support the preservation of the world-leading scientific position of FLNP JINR in the field of INS spectroscopy.

In order to regain competitiveness in the field of neutron spectroscopy, it is necessary to create new INS spectrometers that will use modern neutron optics and new design solutions to obtain high resolution in combination with a good signal-to-background ratio over a wide range of energy transfer that permits using small samples (˜a few mg). The first planned instrument will be a universal spectrometer in inverse geometry - the BJN spectrometer (Bajorek-Janik-Natkaniec). The high luminosity of the IBR-2 source, in combination with modern focusing neutron optics, and a very large surface area (˜3.3 m2) of energy analysers will ensure the maximum possible luminosity of the spectrometer under development. Monte Carlo simulations have been performed using the MacStas software package in order to optimize the geometry of spectrometer and especially the geometry of energy analyser system (cooled beryllium filters + HOPG).

INS is a technique that is ideally suited to study hydrogen-containing materials due to the high cross section of hydrogen. The instrument promises the applicability to a wide manifold of scientific research activities: functional materials, energy storage materials, hydrogen bonds in molecular matter (vibrational analysis), dynamics studies of pharmaceutics and new biologically active compounds or photonic materials of industrial applications.

In summary a broad project overview with conceptual engineering design and development highlights will be presented.

Target and Moderator / 8

A new method to find out the optimal neutron moderator size based on neutron scattering instrument parameters

Authors: Alexander Ioffe[1]; Petr Konik[2]

[1] *Research Center Juelich*

[2] *JCNS*

Corresponding Author: p.konik@fz-juelich.de

In the last decade, low-dimensional neutron moderators made from almost pure para-hydrogen (pH2) have been introduced [1]. Thanks to large difference in pH2 scattering cross-section between thermal and cold neutrons, moderators in the form of tubes or disks provide significant brightness improvements over traditional cold sources. According to a study by the ESS [2], potential gains of up to 2-3 times in the useful neutron flux are possible when the moderator height is reduced from 12 cm to 3 cm, especially for high-resolution instruments that use well-collimated beams. However, the small size of the moderators in some cases makes it difficult to fully illuminate the sample, leading to non-uniform beam profiles at the sample. Therefore, larger neutron moderators with reduced brightness are preferred for some instruments.
To determine the optimal moderator size, we have developed a new approach that takes into account instrument parameters such as sample size and angular resolution. It is based on phase space considerations and extensive Monte Carlo simulations have been conducted to validate it. This method is particularly useful for designing new neutron instruments and neutron sources.

1. K. Batkov et al 2013 NIM A729 500-505.
2. L. Zanini et al 2018 J. Phys.: Conf. Ser. 1021 012066.

Instruments: SANS / 9

Tuning the Nano Structures of Micellar Aggregates

Author: Peixun Li[1]

[1] *ISIS neutron and Muon source*

Corresponding Author: peixun.li@stfc.ac.uk

Cationics are widely used for various applications, e.g., fabric softening, antimicrobial action, oilfield applications and pesticides, all of which involve the strong interaction of the cationic group with an oppositely charged surface. Their role would be considerably widened if the nonionic ethoxylate grouping could be reliably and accurately attached to the cationic group as it can for anionic surfactants. The incorporation of nonionic hydrophilic groups with anionic groups is particularly effective in that the nonionic groups improve solubilization, lower the Krafft point, and mitigate the effects of higher valence ions on aggregation or precipitation. Part of this pattern of behavior seems to be that such surfactants show a tendency to form complex layers at the air water interface, e.g., multilayers, as formed by the alkyl ethoxy sulfonates.

We have synthesized a novel category of cationic surfactant, which incorporated a substantial fraction of nonionic ethylene oxide groups in a configuration where two ethylene oxide groups of nearly equal length and a single group are attached to the quaternary nitrogen. The new method of making the ethoxylated cationics makes it possible to combine relatively precise amounts of EO as a pair of chains of close to equal length with a final single EO to create the cationic charge and hence to tune the amphiphilicity reasonably accurately. Its self-assembly has been investigated by small angle neutron and small angle X-ray. The results indicate that the Nano structure of surfactant aggregates can be tuned by simply using a mixture of cationic and non-ionic surfactant ‘homologue’.

Instruments: HiCANS/Neutron Irridiation spectrometer / 10

Commissioning of an Atmospheric Neutron Irradiation Spectrometer at CSNS

Author: 全芝于全芝 [1]

[1] *CSNS*

Corresponding Author: yuqz@ihep.ac.cn

The Atmospheric Neutron Irradiation Spectrometer (ANIS) is a new beamline at the China Spallation Neutron Source (CSNS), which is mainly dedicated to accelerated testing of modern microelectronics. It features an atmospheric-like neutron spectrum, with both collimated beam spots and flood beam spots. The total length of ANIS is 40 m, equipped with neutron shutter, flight tube, neutron expander, flux controller, collimators, clearing magnet, neutron filters, and also beamline shielding. A control room, an operation room and a storage room are arranged at the back end of ANIS. Design, assembly, check-out testing, and initial commissioning tests were successfully completed in 2022. ANIS is now in an advanced stage of scientific commissioning, for the measurement of the of the neutron spectrum, flux and profiles in the different configurations. The neutron beam characters were measured with fission ionization chamber (FIC), position-sensitive gas electron multiplier (GEM), activation foils and single crystal diamond detectors. In this work, we present the measured beam specifications and the beam evaluation of ANIS, which are promising for an imminent start of the ANIS user programme. The early operation and user experiments are also presented.

Instuments: Diffraction / 11

eMAP: The new engineering diffractometer at ISIS

Author: Tung Lik Lee[1]

Co-authors: Saurabh Kabra [1]; Joe Kelleher [1]; Winfried Kockelmann [1]; Robert Bewley [1]

[1] *ISIS Neutron and Muon Source*

Corresponding Author: tung-lik.lee@stfc.ac.uk

ISIS neutron and muon source is now seeking its next phase of new instruments and significant upgrades to existing instruments: a portfolio of projects that has been called the Endeavour Programme. Endeavour will increase both capacity and capability of the facility to address 21st century challenges and enable research in areas such as advanced materials and manufacturing, clean energy technologies, and biosciences and healthcare. Starting in the 2023/24 financial year, the Endeavour Programme will construct 4 new experimental instruments and 5 significant upgrades to existing instruments, over a 10-year period.

Here we report on the modelling and design of the new proposed engineering diffractometer, eMAP, at ISIS. eMAP is a new instrument providing greater depth penetration capability to enable measurements on full-size engineering components, and represents a step change in our ability to study real world engineering components. The flux and resolution characteristics of eMAP will allow:

3D residual stress mapping; high spatial resolution; large, thick, heavy and complex shaped components; near-to-surface measurements; process measurement (e.g. in-situ welding); in-situ loading and special environments; long-term tests (e.g. creep).

eMAP is designed with a performance complementary to the diffraction capabilities offered by the existing ISIS engineering instruments. ENGIN-X, the current "workhorse" instrument is oversubscribed, especially for industrial partnership access. eMAP will bring extra capacity and new capabilities for stress measurement of full size engineering components, enabling engineering manufacturers and emerging technology SMEs to design the next generation of complex machines with improved performance, durability and capability.

Target and Moderator / **12**

High-brilliance and high-flux cold neutron source based on high-aspect ratio rectangular parahydrogen moderators.

Authors: Alexander Ioffe[1]; Peter Konik[2]; Konstantin Batkov[3]

[1] *Research Center Juelich*

[2] *Jülich Centre for Neutron Science (JCNS) at Heinz Maier-Leibnitz Zentrum (MLZ), Forschungszentrum Jülich GmbH*

[3] *MAX IV Laboratory, Lund University*

Corresponding Author: a.ioffe@fz-juelich.de

Recent studies [1, 2] have revealed the remarkable potential of optimized low-dimensional liquid para-H2 moderators in enhancing cold neutron brightness compared to voluminous moderators. In this research, we introduce a novel analytic approach to calculate the brightness of such moderators. Our findings demonstrate that as the brightness gain is the near-the-surface effect, the high-aspect ratio rectangular cold para-H2 moderators offer even higher cold neutron brightness then the moderator optimized for ESS [3]. We demonstrate that solely the "geometrical" low dimensionality of moderators is not sufficient for achieving substantial brightness gains and that the "physical" low-dimensionality on the scale of the mean free path of thermal neutrons is required. The obtained results are in excellent agreement with MCNP calculations.

To address the trade-off between brightness gain and neutron beam intensity in low-dimensional liquid para-H2 moderators, we propose the chessboard-like and the staircase-like assemblies of moderators with a well-developed total surface. This configuration ensures wide, intense neutron beams while preserving the high brightness of the narrow moderator.

The stacked staircase moderator geometry offers a solution to partially overcome the limitations posed by the inhomogeneous thermal neutron flux distribution around the reactor core or spallation source target. By implementing this geometry, it becomes possible to achieve brightness gains ranging from 2.5 to 3.5 times when compared to single flat para-H2 moderators of the same width.

Target and Moderator / **13**

Behavior of proton beam window materials of high power spallation targets

Author: Yong Dai[1]

[1] *Paul Scherrer Institut*

Corresponding Author: yong.dai@psi.ch

A proton beam window is an important component in a spallation target. It guarantees the safe operation of the target, since its failure may cause severe contamination of the proton beamline and lead prolonged shutdown of the neutron source. A proton beam window is the component exposed to the highest proton beam current or intensity in the target. The high proton beam current density in a MW-class targets leads to a high radiation damage rate (dpa rate) and high heat deposition in the beam window material. Therefore, high radiation damage resistance and good thermomechanical properties are the basic requirements for beam window materials. If the beam window is water cooled, water corrosion resistance also needs to be considered. Whereas the structure of a beam window is greatly affected by thermal stress, the lifetime of the window is mainly limited by the level of radiation. In this presentation, the behavior of existing high power spallation target beam window materials such as Al-alloys AlMg3 and Al6061-T6, Inconel718, and stainless steel 316L after irradiation will be described. The pros and cons of their applications will be discussed.

Target and Moderator / 14

TS1 Project with-beam commissioning

Author: Stephen Gallimore[1]

[1] *UKRI - STFC*

Corresponding Author: stephen.gallimore@stfc.ac.uk

On 4th November 2022, neutrons were produced on ISIS' target station 1 (TS1) for the first time since a long shutdown began on 21st June 2021 to enable the planned work for the TS1 project [1]. Since that date in November scientists, engineers and technicians been working hard to return TS1 to a fully operational state and enable the delivery of science again.
Relatively quickly after receiving beam, it was noted that the temperature of the front target plate was elevated compared to predictions and compared to the other plate temperatures [2]. While investigating this potential issue, the decision was taken to limit beam power on target to ¼ of the maximum (by reducing the repetition rate). In the meantime, work continued on commissioning the cryogenic moderator systems.
Several challenges were also encountered during the commissioning of the cryogenic moderator systems, from issues with helium compressors, to moderator leaks.
This paper will discuss these challenges, the approach employed to diagnose them and actions taken to rectify them.

References:
[1] ISIS TS1 Project summary –S. Gallimore et al 2018 J. Phys.: Conf. Ser. 1021 012053 DOI 10.1088/1742-6596/1021/1/012053
[2] Simulated and Measured Performance of ISIS TS1 Project Target –D.Wilcox ICANSXXIV 2023

Target and Moderator / 15

Outline plans for target stations at the ISIS-II facility

Author: Stephen Gallimore[1]

[1] *UKRI - STFC*

Corresponding Author: stephen.gallimore@stfc.ac.uk

The ISIS Neutron and Muon Source is based at the Rutherford Appleton Laboratory in the UK and is owned and operated by the Science and Technology Facilities Council, one of the councils that forms UK Research and Innovation (UKRI). Since production of first neutrons in 1984, ISIS has continued

to develop its capabilities while growing and supporting the neutron scattering and muon science communities. ISIS-II is the proposal for a next-generation neutron source as the successor for ISIS. Although ISIS will continue to operate for many years to come, plans will be developed over the next decade in order to be ready for construction of the new facility, which is expected to be operational in the 2040s and will support cutting-edge science into the latter part of the century. [1]
In order to maximise capacity and breadth of science, the intention is for ISIS-II to be constructed and operational with two neutron production target stations (one at high and one at low repetition rate) from day one. The feasibility of an additional stand-alone muon target station is also under investigation, as is how best to provide irradiation facilities to support the growing programme in that area.
This paper will provide details of what such a facility might look like, where it might be located and why the two target station strategy is favoured.

References:
[1] Roger Eccleston ' s ISIS facility overview at ICANS XXIV

Target and Moderator / 16

Summary of lessons learned from the TS1 project implementation

Author: Stephen Gallimore[1]

[1] *UKRI - STFC*

Corresponding Author: stephen.gallimore@stfc.ac.uk

Conceived back in 2012, the TS1 project [1] is a long-running sustainability project that set out to reinvigorate the internals of target station 1, including but not limited to the neutron target, reflector and moderators (TRaM), as well as the supporting services required to keep the TRaM components operating.
In over a decade that the project has been running, a great many things have changed, both internally to ISIS and the wider external situation. As with all long-term, large-scale projects unexpected events can happen and unforeseen outcomes can occur. With other facilities around the world looking to upgrade their infrastructure or add additional capability, it was thought that reflecting on some of the lessons learned from the TS1 project might be of wider use or interest to the community.
In this paper I aim to summarise some of the key lessons and pass on how I might do things differently in the future, if faced with similar choices again.

References:
[1] ISIS TS1 Project summary –S. Gallimore et al 2018 J. Phys.: Conf. Ser. 1021 012053 DOI 10.1088/1742-6596/1021/1/012053

Target and Moderator / 20

Developments in Target Manufacture Procedures

Author: Grace FenemoreNone

Corresponding Author: grace.fenemore@stfc.ac.uk

ISIS is a synchrotron that utilises more than 30 different specialised instruments over 2 target stations to gain an insight into the properties of materials on the atomic scale. (ISIS, 2019). It was established in the 1980 ' s and has undergone a series of expansion projects to get to where it is today, the most recent being a £90M investment to bring in 4 new instruments and upgrading an existing 5 in the facility.

ISIS is one of the few facilities in the world that manufactures both of its targets almost entirely in house. A recent addition of an ISIS Target Manufacture workshop has meant that the Target group has expanded its production capabilities and has the capacity to put more focus towards refining and perfecting the manufacture and build of each target. This facility also allows for a more reactive style of work. Designs can be changed and improved quickly with the manufacture of development pieces, resulting in these changes being proven and implemented on the very next target build.

Details on the recent developments made in the ISIS target manufacture and build will be presented. This will be covering how 5-axis machining capabilities have meant that all main components are now made in house, how Electrical Discharge Machining (EDM) technologies have allowed for complex and advanced profile manufacturing to be carried out, and how the 2 electron beam welders enable all plate and target assembly to be completed in the workshop under controlled conditions. The ISIS target manufacture group have also recently commissioned their own Hot Isostatic Press (HIP) facility with the aim of doing all their own bonding work in the near future.

Furthermore, through years of experimenting and developing the process a huge importance has now been placed on the preparation and cleaning procedures for the tungsten and tantalum. Rigorous cleaning procedures are in place before anything is sent for HIP as this has been found to be one of the biggest effecting factors as to whether a complete bond is achieved or not. From start to finish components are polished, cleaned and kept under vacuum to reduce the chances of them picking up contaminants. Without these processes in place it would be very difficult to create successful HIP bonds or weld joins on both targets, and the proportion of work that fails after ultrasonic Non Destructive Testing (NDT) would be much higher. This will also be expanded on further during the presentation of work.

With credit to Jeremy Moor, Leslie Jones, and Daniel Cross for their work and involvement with the ISIS Target Group.

Safety and Operation / 21

ISIS BEAMLINE HIGH VOLTAGE INTERLOCK SYSTEM

Author: Maxwell Williams[1]

[1] *STFC*

Corresponding Author: max.williams@stfc.ac.uk

The project aim was to design a beamline high voltage interlock system to carry out the protection of personnel from being harmed by electrical hazards under all operating modes.
Experiments that require the use of high voltage power supplies are becoming increasingly common which has been the driving force for the requirement of this safety system. The experiments typically are conducted on PCBs with exposed live conductors. Previously, these experiments were performed solely under administrative controls which is one of the least effective methods of control. With elimination and substitution not practicable, due to high voltages being required, that left engineering control the viable solution.

This talk will discuss the design and development of the system and the benefits this has provided to the ISIS user community and staff.

Instruments: SANS / 22

MR: the multipurpose reflectometer at Chinese Spallation Neutron Source

Author: 涛朱 [1]

[1] 中科院物理研究所

Corresponding Author: tzhu@iphy.ac.cn

Neutron reflectometry is a technique to probe the surface and interface structures of thin films, including magnetic thin films, semiconductor films, polymer films, and so on, due to the high penetration depth of neutrons. As one of three instruments in the phase I of CSNS, the multi-purpose reflectometer (MR) has been opened for user since 2018. Currently, the neutron flux of MR at sample position is about 1.18⊠108 n/cm2/s when the beam power reaches 100 kW. Now the polarized neutron reflectometry (PNR) measurement is also available. For the setup of PNR, high-quality FeSi/Si supermirror has been used. Then we can obtain the polarized neutron reflectivity, R++ and R−, where the spin polarizations are the same for the incoming and reflected neutrons. Now both polarized and un-polarized reflectivity measurements continue to provide a great opportunity to investigate the structure inside the thin film, in particular, the depth profile of chemical and magnetic distribution [1-3].

References

[1] H. Li et al., Sci. Adv. 8, eabm8550 (2022).
[2] Q.H. Zhang et al., Phys. Rev. Lett. 128, 167202 (2022).
[3] Q. Jin et al., Phys. Rev. Lett. 128, 017202 (2022).

Plenary:Monday Plenary / 23

Status and Future Developments of the ISIS Pulsed Neutron and Muon Source

Author: Roger EcclestonN[one]

Corresponding Author: roger.eccleston@stfc.ac.uk

Status and Future Developments of the ISIS Pulsed Neutron and Muon Source.

Roger S ECCLESTON

ISIS Pulsed Neutron and Muon Source,
STFC, UKRI, Rutherford Appleton Laboratory,
Harwell, Oxfordshire, OX11 0QX, UK

The ISIS Pulsed Neutron and Muon Source has been operating for nearly 39 years. Through continuous development and significant upgrades, including the addition of a second target station, ISIS continues to provide world-leading capability to a thriving international user base and deliver world-leading productivity.

Throughout 2021 and 2023 the synchrotron and high power target station (Target Station 1) underwent a significant refurbishment to improve performance and serviceability. This extensive project is now complete and both target stations are operational.

The next wave of development of the instrument suite, the Endeavour Programme, which involves five significant instrument upgrades and the construction of four new instruments, is now underway. A feasibility study for a MW class source to replace ISIS, ISIS-II, is in progress, which includes a detailed analysis of technical options and the scientific specification.

I will report on the status and performance of the ISIS Source. I will also provide an overview of plans for the future development of ISIS, including the Endeavor Programme and ISIS-II.

E-mail of the corresponding author: roger.eccleston@stfc.ac.uk

Safety and Operation / 24

Instrument Upgrade, Installation and Operation at ISIS

Author: John Crawford[1]

[1] *ISIS STFC*

Corresponding Author: john.crawford@stfc.ac.uk

Instrument Upgrade & Installation and Operation at ISIS

This talk will focus on my experiences as an Operations Manager at ISIS and how I also manage the delivery of Instrument Projects at ISIS. It will include the challenges faced as a technician carrying out the work, and as a Operations and Installation manager looking after Operating Instruments and Instrument Installations at the same time.
The talk will be spilt into three topics;

• Planning and preparation
• Managing Installation and Operation
• The Aftermath –Learning for the future

Planning and Preparation will focus on the planning phase and the role Instrument Operations has in working with designers, scientists and engineers in preparing a project for installation. Using examples from my experiences as a technician on OSIRIS Beryllium Filter and Instrument ZOOM and as an Installation Manager on Sandals/Alfred, my talk will demonstrate this essential part of the process.
I will discuss the benefits of Pre-building, Installation planning and lessons learned when this go wrong.
Managing Installation and Operation will focus on the importance of relationships, communications and the links between the Instrument Project and Instrument Operation. The talk will discuss how we carry out managing the day to day activities of an installation and providing technical support for Operating Instruments simultaneously. I will also give examples how we manage safety on Instrument Installations and Operations and give examples of when things go wrong and how we got over these challenges on projects like Instrument ZOOM build, Reflectometer Instrument Alignment Projects and Instrument INTER Secondary Upgrade.
The Aftermath –Learning for the future will focus on how we implement continual improvement, review our performance and measure our success' s. Examples will be given such us Reflectometer guide alignment and CHIPIR Intermediate Shutter.

Poster / **25**

Performance assessment of the cold-neutron disk-chopper spectrometer at J-PARC

Authors: Masami Nirei[1]; Maiko Kofu[1]; Masahide Harada[1]; Kenji Nakajima[1]; Seiko Ohira-Kawamura[1]; Naoki Murai[1]; Yasuhiro Inamura[1]

[1] *J-PARC Center, Japan Atomic Energy Agency*

Corresponding Author: masami.nirei@j-parc.jp

AMATERAS[1] is the disk-chopper type neutron spectrometer for measuring inelastic and quasielastic neutron scattering in the energy range from cold to sub-thermal neutron regions with high efficiency and fine resolution. In 2021, AMATERAS extended the neutron guide to focus neutrons and increase intensity at the sample position. In the opportunity, we evaluated neutron flux at the sample position by measuring gold foil and vanadium plate. The white and monochromatic beams (E_i = 10.5 meV, λ = 2.8 Å) have been measured. The neutron fluxes obtained by measuring gold foil and vanadium plate are consistent with high accuracy in the white and monochromatic beams. Based on a comparison of simulation using McStas [2] with the experimental results, the effectiveness of the gain of flux due to extending the guide will be discussed. In the presentation, the energy resolution of AMATERAS investigated with various chopper conditions will also be shown.

[1] K. Nakajima, S. Ohira-Kawamura, T. Kikuchi, M. Nakamura, R. Kajimoto, Y. Inamura, N. Takahashi, K. Aizawa, K. Suzuya, K. Shibata, T. Nakatani, K. Soyama, R. Maruyama, H. Tanaka, W. Kambara,

T. Iwahashi, Y. Itoh, T. Osakabe, S. Wakimoto, K. Kakurai, F. Maekawa, M. Harada, K. Oikawa, R. E. Lechner, F. Mezei, M. Arai, J. Phys. Soc. Jpn. 80 (2011) SB028.
[2] K. Lefmann, K. Nielsen, Neutron News 10 (1999) 20–23.

Instruments / **26**

Development of Sample Environment at CSNS

Author: Haitao Hu[1]

Co-authors: Bao Yuan [1]; Bo Bai [1]; Wanju Luo [1]; Hui Cheng [1]; Fan Ye [1]; Yuan Sun [1]; Mengjia Dou [1]; Chenyang Wang [1]; Xin Tong [1]

[1] *Institute of High Energy Physics, Chinese Academy of Sciences*

Corresponding Author: huht@ihep.ac.cn

As one of the important auxiliary devices for neutron scattering instruments, sample environment provides various experimental conditions to enhance the research capabilities of the instruments. The sample environment at the Chinese Spallation Neutron Source (CSNS) has been providing in-situ experimental services since the commissioning of the instrument in 2018. It has evolved from initially serving as a cryostat to now supporting a wide range of sample environments, including low temperature, high temperature, high pressure, and magnetic field, catering to different user needs. The development has enabled the transition from single-sample environment experiments to multiple-sample environment experiments, showcasing the progress from 0 to 1 and from 1 to many in terms of experimental applications. This article primarily introduces the operation and usage of the sample environment at CSNS. It also highlights recent developments and optimizations in sample environment. Additionally, some experimental applications conducted in collaboration with users are also presented.

Target and Moderator / **27**

ISIS Target Station 2 Horn Moderator

Author: Henry Russell[None]

Corresponding Author: henry.russell@stfc.ac.uk

Target Station 2 at the ISIS Neutron source utilises a series of moderators to slow and condition neutrons for experimental applications, the media used within the moderators vary and include: liquid hydrogen, solid methane and water. Continual monitoring of moderator parameters ensure the safe and efficient operation of the entire TRaM system (Target, Reflector & moderator).

During the 2022/02 ISIS user cycle, the Target Operations Group (TOG) became aware an increase in moisture levels detected by the Residual Gas Analyser within the TRaM Void Vessel, this was reinforced by an indicated decrease in header tank levels for the Light Water Cooling Circuit (LWCS) - the water cooling system which serves, amongst other components, the Horn Pre-moderator.

Following the completion of the user cycle, the TRaM was withdrawn from its operational position into the Remote Handling Cell (RHC) to enable the TOG to investigate the source of the LWCS leak. Remote manipulator arms were used to disassemble TRaM components to allow for flying lead camera access, and the system was pressurised to assist in identifying the origin of the leak.
The team quickly established the cause to be a return pipe from the Horn water moderator, situated within the West half of the beryllium reflector.

With guidance from Leslie Jones and Dan Coates of the Target Design Group, the TOG further disassembled the TRaM assembly, and removed the defective component. A replacement Horn Moderator assembly was pressure tested and prepared for installation, as this component had never before been

changed, a bespoke remote lifting equipment was produced and trialed using the full scale TRaM mock-up. The new component was then installed and tested, further details of the processes used will be discussed.

Instruments / **29**

The progress of neutron optics development for CSNS

Author: PING WANG[1]

[1] 高能所

Corresponding Author: wangping@ihep.ac.cn

Over the past decade, China spallation neutron source has made significant progress in neutron optics development, mainly reflected in areas such as neutron choppers, neutron guides, and radial neutron collimators. In the realm of neutron choppers, key technologies have been overcome, leading to the successful development and mass production of T0 choppers, bandwidth choppers, and Fermi choppers. Concerning neutron guides, the preparation of a supermirror with m=3 has been accomplished, and precision assembly of the shell and on-site installation collimation techniques have been mastered. As for neutron collimators, in collaboration with enterprises, fine radial collimators have been successfully developed.

Instruments / **30**

Development of Spherical Neutron Polarimetry devices at CSNS

Authors: Bo Bai[1]; Haibin Chen[2]; Tianhao Wang[1]; Xin Tong[3]; Yuchen Dong[1]

[1] *China Spallation Neutron Source*

[2] *Dongguan University of Technology*

[3] *Institute of High Energy Physics*

Corresponding Author: dongyc@ihep.ac.cn

Spherical Neutron Polarimetry (SNP) is a powerful technique which can measure the variation of polarization directions between incident and scattered neutron. Using this technique, the directional and phase information of the magnetic structure factor can be determined. This technique has been achieved by Meissner effect or high permeability alloys to produce zero-field environment.

We are developing a set of SNP devices at CSNS using combined method to produce zero-field environment, which intends to achieve high performance and low cost of operation. In this presentation, we present an overview on the process of the development, including the design and performance of a superconducting neutron spin flipper and the study on zero-field chamber. The spin flipper has achieved a flipping efficiency of 99% at 4Å with a miniaturized size. We will introduce the study on the shape of zero-filed chamber and show the rotatable design for triple-axis spectrometer.

Target and Moderator / **31**

ESS Bilbao. Current Status and Perspectives

Authors: MARIO PEREZ LOPEZ[1]; FELIX JIMENEZ VILLACORTA[2]; FERNANDO SORDO BALBIN[2]; IBON BUSTINDUY [2]

[1] *ESS Bilbao / ELENA Association*

[2] *ESS BILBAO*

Corresponding Author: mperez@essbilbao.org

ESS Bilbao is a public consortium of the Spanish and Basque Governments. It brings knowledge and added value in particle accelerators, nuclear and neutron and scattering science and technologies by leveraging its in-kind contribution to the European Spallation Neutron Source (ESS), in Lund (Sweden). ESS is currently under construction and when operating will represent the most powerful neutron facility worldwide.
ESS Bilbao is delivering key in-kind components to the facility, including the MEBT, the RF Systems for the cold Linac, several Target Systems and the instrument MIRACLES. We will briefly introduce the status and development of such in-kind contributions.
Additionally, ESS Bilbao is developing, in collaboration with other partners within Europe under the umbrella of the European Low Energy accelerator-based Neutron facilities Association (ELENA –www.ELENA-neutron.eu), a cost-effective alternative to the classical research reactors and spallation neutron sources. These sources developed based on lower power accelerators that do not utilize spallation are so called High Current Accelerator-driven Neutron Sources (HiCANS) and offer new challenges in their optimization for particular applications to serve dedicated communities on the regional or national level including science as well as industry.
The current HiCANS projects are aimed at rejuvenating the European neutron ecosystem after the shut-down of major older research-reactor based national neutron sources. To cite the recent LENS –BrightnESS - ENSA position paper "Neutron Science in Europe": "Though ESS will provide enhanced capabilities, these can only be fully exploited if the supporting ecosystem has sufficient strength, depth and diversity." … "The only route for entirely new facilities with significant capacity are High Current Accelerator-driven Neutron Sources …"
This contribution will also describe one of such envisaged infrastructures, ARGITU [1], a unique and versatile local compact accelerator-driven neutron source being developed by ESS Bilbao in collaboration with local BERCS (Basque Excellence Research Centers). This infrastructure will undoubtedly place the Basque country at the forefront of research in neutrons within Europe and will serve as a magnet for attracting talent, thus fostering its neutron R&D ecosystem.

[1] M. Pérez, F. Sordo, I. Bustinduy, J. L. Muñoz & F. J. Villacorta, News, 31:2-4, 19-25, (2020)

E-mail of the corresponding author: mperez@essbilbao.org

Instruments / **32**

The application of the polarized neutron techniques at the China Spallation Neutron Source beamlines

Author: 田龙 None

Corresponding Author: tianlong@ihep.ac.cn

Polarized neutrons play an indispensable role in neutron scattering research, and have been incorporated into various neutron diffractometers and spectrometers. Recognizing the importance of polarized neutrons, the China Spallation Neutron Source (CSNS) has dedicated resources for developing its own capabilities for polarized neutron techniques to meets the requirements of its beamlines. Based on the established the neutron technology development beamline BL-20 at CSNS, the characterization of neutron spin filter cells manufactured at CSNS, the calibration of self-developed polarized neutron instruments and performance of the polarized neutron technique applied to beamlines have been accomplished. In addition, the on-site test of the replacement of in-situ 3He neutron spin filter (NSF) as the polarization analyzer of the Multi-Purpose Reflectometer has approved that, the self-developed 3He NSF is qualified for the regular measurements with magnetic thin films, whose cell parameters can be optimized depending on the wavelength range. The designs for the polarization

analyzed small-angle neutron scattering (PASANS) were also carried out for the Very Small Angle Neutron Scattering instrument at CSNS. Different setups combined with magnet (weak field with2 mT, or strong with 2 T along vertical direction) - Cryostat (1.8 K) sample environments and PASANS ability have been optimized to cover the experimental requirements related to organics or magnetic nanoparticles. This work demonstrates the capability of CSNS to develop time-of-flight polarized neutron techniques in-house.

Instruments / 33

An alternative approach to synchronize the triggering of the external sample environment with the neutron data aquisition

Author: Hanqiu Jiang[1]

Co-authors: Yubin Ke [1]; Haibiao Zheng [1]

[1] *China Spallation Neutron Source*

Corresponding Author: jianghq@ihep.ac.cn

Materials that undergo controllable structural and property changes upon external stimuli are known as stimuli-responsive or "smart" materials. Understanding the transitional pathway and the out-of-equilibrium state of their micro-structures are crucial for the establishment of a dynamic structure-property relationship. With increasing neutron flux, time-resolved small angle neutron scattering experiment allows for capturing of the transient structures down to seconds. Higher time resolution can be achieved through repeated measurements. However, it is cumbersome to synchronize additional stimulating sources into an operational TOF instrument, especially when precise timing repeatability is required.
Traditionally, data acquisition is hardware synchronized with the external sample environ-ment or vice versa [1, 2], which requires modification or replacement hardware and software components. Instead, we propose an alternative approach that is able to decouple the trig-gering of the external device from the data acquisition process. A mini mechanical shutter made of neutron absorption material is integrated in the sample environment equipment control system and mounted in front of the sample holder. As part of the external device, the status of the mini shutter (sample's exposure to neutron) can be easily synchronized with the initiation of the external stimulation, while the data acquisition process can be initiated at any time earlier. From the acquired time-of-flight neutron data, the sudden increase in neutron counts serves as the indication of the initiation of the external stimulation, making the allocation of the initiation point of the transition process straightforward. The initiation time accuracy of the SANS experiment is thus optimized to the response time of the mechanical shutter (˜ms). The successful implementation of this new experimental platform will provide a feasible means to study the physical and chemical processes involving rapid microstructure transitions in the field of soft matter.

References

[1] D.S. Li, Y.T. Lee, Y.Y. Xi, I. Pelivanov, M. O'Donnell, L.D. Pozzo, A small-angle scattering environment for in situ ultrasound studies, Soft Matter, 14 (2018) 5283-5293.
[2] S. Schmolzer, D. Grabner, M. Gradzielski, T. Narayanan, Millisecond-range time-resolved small-angle x-ray scattering studies of micellar transformations, Phys Rev Lett, 88 (2002) 258301.

Instruments / 34

Development of polarized neutron capability at the CSNS

Author: Tianhao Wang[1]

Co-authors: Junpei Zhang ; Long Tian ; Salman Ahmed ; Xin Tong

[1] 中科院高能物理研究所

Corresponding Author: wangtianhao@ihep.ac.cn

Polarized neutron capability has been continuously developed at the China Spallation Neutron Sources. With the initial instrumentation developed and calibrated at the test beamline (BL-20) at the CSNS, the ongoing development now focus on implementing polarized neutron devices on the existing and upcoming CSNS beamlines. Preliminary experiments have already been performed at the Multi-purpose reflectometer beamline (CSNS) at the CSNS. New setups are also planned for the V-SANS instrument and high-resolution diffractometer.

In this presentation, we demonstrate in detail the status of the polarized neutron techniques, as well as the future development plans. Published and preliminary results of the development shall be presented, and roadmaps for the upcoming CSNS phase-II development will also be briefly discussed.

Instruments / 35

the Multi-Slit Very Small Angle Neutron Scattering Instrument in China Spallation Neutron Source

Author: 贺程 [1]

Co-authors: 太森左 [1]; 松文肖 [1]; 泽华韩 [2]; 芳卫王 [2]; 长利马 [1]; 雄林 [1]

[1] 中国科学院高能物理研究所

[2] 散裂中子源科学中心

Corresponding Author: cchhustc@163.com

A Multi-Slit Very Small Angle Neutron Scattering (MS-VSANS) has just been accepted at beam line 14# in China Spallation Neutron Source (CSNS). MS-VSANS aims to achieve the best signal-to-noise ratio. It has three modes, i.e., SANS, VSANS and polarized neutron, respectively. With three 1*1 m2 He3 detectors at 1 m, 4m and 12 m, and one 21*21 cm2 high resolution detector at 12.75 m sample-to-detector distances (SDD), it can cover the overall scattering vector range (q) from 0.00028 to 1.4 Å-1. It is the first VSANS based on a spallation source in the world, and is a powerful tool for multi-scale structure calibrations in chemistry, biology, material science and condensed matter physics. Here, a detailed review is given on the development, principles and application of the MS-VSANS.

Instruments / 36

Visualizing the magnetic fields using polarized neutron imaging technique

Authors: Ahmed Salman[1]; Long Tian[1]; Tianhao Wang[1]; Xin Tong[1]

[1] *Spallation Neutron Source Science Center, Dongguan 523803, China*

Corresponding Author: asalman@ihep.ac.cn

In this work, we present a demonstration of performing polarized neutron imaging (PNI) at the beamline BL20 at Chinese Spallation Neutron Source (CSNS). Utilizing the V-cavity supermirror as the polarizer, the in-house developed in-situ polarized 3He neutron spin filter (NSF) system as the analyzer, and an energy resolved neutron imaging detector, an aluminum cylindrical solenoid as a sample to generate a known magnetic field. Two dimensional polarized neutron images were produced from this PNI experiment. The observed oscillating behavior in the polarization wavelength dependence at specific areas of the sample is a proof of the precession of the neutron polarization vector around the magnetic field inside and beside the sample.

The results of this work show the possibility of applying the PNI at CSNS for visualizing the magnetic field distributions within and around the magnetic materials and electric devices.

Poster / **37**

Investigation of Pancake-like Moderator-Reflector Structure for the High Brilliance Neutron Source (HBS)

Author: Junyang Chen[1]

Co-authors: Jörg Voigt [1]; Egor Vezhlev [2]; Paul Zakalek [3]; Ulrich Rücker [3]; Jingjing Li [3]; Thomas Gutberlet [3]; Thomas Brückel [3]

[1] *Forschungszentrum Jülich GmbH*

[2] *2Jülich Centre for Neutron Science (JCNS-4) at Heinz Maier-Leibnitz Zentrum (MLZ)*

[3] *Jülich Centre for Neutron Science (JCNS-2/PGI-4), Forschungszentrum Jülich GmbH*

Corresponding Author: ju.chen@fz-juelich.de

The High Brilliance Neutron Source (HBS) project is developing a high-current accelerator-driven neutron source (HiCANS) to maintain a healthy neutron landscape in Europe. Despite the lower primary neutron yield of the nuclear reactions compared to reactor or spallation neutron sources, HiCANS achieve a competitive neutron brightness by a compact moderator and reflector design, which makes a large fraction of the primary neutron spectrum available for applications. The spectral and temporal, i.e. frequency and pulse length, characteristics of the neutron pulse are tailored to the instruments hosted at a target station.

Based on the ' pancake ' and ' butterfly ' moderator geometries developed for the European Spallation Source (ESS), we investigate a pancake-like structure by means of Monte Carlo simulations involving multi-parameter optimization routines. By increasing the interface area, we try to improve the coupling between thermal and cryogenic moderator. The extraction surfaces of the applied pancake-like geometry achieve a cold neutron flux of 85%-87% of a cylindrical para H2 moderator (length= 10 cm, diameter = 2.4 cm) with ideal coupling. The flux through the thermal extraction surfaces reaches 70%-79% in comparison to an ideal case with just a single extraction channel looking at the thermal flux maximum in the center of the thermal moderator. The optimized structure with up to twelve extraction channels looks therefore very promising for target stations that serve a large number of thermal and cold instruments. At this workshop, we will present the results of our study of this moderator-reflector assembly.

Poster / **38**

Plasma spraying B4C-ZrO2 to prepare moderator decoupling layer for spallation neutron sources

Authors: YU CHAOJUN[one]; UNKNOWN 王松林 [1]; UNKNOWN 张锐强 [1]; UNKNOWN YIN WenN[one]; UNKNOWN LIANG TianjiaoN[one]

[1] 高能所

Corresponding Author: yucj@ihep.ac.cn

Cadmium and boron carbide(B4C) are two very excellent neutron decoupling materials, due to the problem of irradiation swelling(increases helium gas), B4C has not been used as a decoupling material in high-power spallation neutron sources in the world, and cadmium or cadmium composite materials are still the mainstream neutron decoupling materials that have been applied practically. But in fact, B4C as a neutron decoupling material can get a higher decoupling energy value. In

order to actually use B4C as a neutron decoupling material in the high-power spallation neutron source, J-PARC researchers reported a cadmium-B4C-cadmium composite structure, cadmium is a pre-decoupler can reduce the helium production of the B4C. In this paper, another potential decoupling layer preparation method to reduce B4C swelling is provided, and the decoupling layer is prepared by plasma spraying of B4C-zirconia, and the pores are added by the spraying process to accommodate the generated helium and avoid material damage.

Software / 39

Scientific computing and data management for the users of the European Spallation Source ERIC

Author: Thomas Rod[1]

[1] *European Spallation Source ERIC*

Corresponding Author: thomas.holmrod@ess.eu

The importance of scientific computing and data management for harnessing the full potential of the European Spallation Source (ESS) was recognized early on in the ESS's design phase. The ESS Data Management and Software Centre (DMSC) was therefore already established at the foundation of ESS and charged with providing the scientific computing tools and services that users need from proposal to publication; supporting them with generating high impact science. Hence, the DMSC is responsible for providing solutions for the full data pipeline associated with an experiment at the ESS, beginning with the user portal and data acquisition, over data reduction, to data analysis, modelling and data management, and instrument simulations.

In this presentation, the strategy for providing a common data pipeline that suits the whole suite of instruments under construction at ESS is discussed. Specific solutions for different steps in the data pipeline will be presented. Moreover, challenges and opportunities associated with developing software at a non-operational facility, the emergence of artificial intelligence, and Findable, Accessible, Interoperable, and Resuable (FAIR) data will be discussed.

Accelerator / 40

Medium-pulse length source studies for the European Spallation Source

Authors: Arai Masatoshi[1]; Christopher Prior[2]; Mamad Eshraqi[3]; Mats Lindroos[1]; Bryan Jones[1]; Ciprian Plostinar[1]; Colin Carlile[1]; Ekelöf Tord[4]; Hakan Danared[1]; Luca Zanini[1]; Maja Olvegård[4]; Miyamoto Ryoichi[1]; Natalia Milas[1]; Pascale Deen[1]; Schweika Werner[1]; Shinji Machida[5]; Ulf Oden[1]; Valentina Santoro[6]

[1] *European Spallation Source ERIC*

[2] *STFC*

[3] *E*

[4] *Uppsala University*

[5] *STFC UKRI*

[6] *University of Lund*

Corresponding Author: ciprian.plostinar@ess.eu

A compression of the 5 MW ESS proton pulse from the present 2.86 milliseconds to a medium pulse length of a few tens of microseconds which is better matched to the moderator time-constant of thermal and cold neutrons would considerably boost the performance for many instruments at ESS. A pulse of a few tens of microseconds can most likely be handled by the ESS target with some minor modifications to the tungsten block shape while a short pulse of a microsecond could not be managed. Generating such a proton pulse with preserved integrated beam power per pulse requires a storage ring to be added to the ESS accelerator. Such a ring has been studied within the ESSnuSB neutrino super-beam study. Historically, the extraction of a medium pulse from a storage ring for high-power beams have been considered impossible as traditional slow extraction schemes require a septum in the ring which quickly would be destroyed at high-beam powers. However, there are new ideas for how to generate such a medium-pulse length without intercepting extraction devices based on advances in longitudinal and transverse beam manipulations techniques. We will in this talk give an overview of the proposed scheme but also discuss the pros and cons for the accelerator, the target, moderators and instruments of a medium pulse length compared with traditional short pulse sources.

Instruments / **41**

The Muon Science Facility of MLF J-PARC

Author: Naritoshi Kawamura[1]

[1] *KEK/J-PARC*

Corresponding Author: nari.kawamura@kek.jp

The muon experiment facility called the Muon Science Establishment (MUSE) is the user facility at J-PARC MLF as well as the neutron facility.
The muon production target, which is 2 cm thick graphite consuming about 5% of 3 GeV proton beam and located 30 m upstream from the neutron mercury target, produces high-intensity muon beams to be utilized in versatile muon science studies. Four secondary muon beamlines are extended from the muon target and deliver the muon beam to the experimental apparatus. Each beamline has unique features and provides an intense muon beam with suitable properties, i.e., energy, polarity, etc., for an intended study like material science, elemental analysis, fundamental physics study, etc. In the presentation, we present the current status of MUSE, which is still partially under construction or commissioning.

Instruments / **42**

Recent upgrades and current status of cold-neutron disk-chopper spectrometer AMATERAS

Author: Seiko Ohira-Kawamura[1]

Co-authors: Maiko Kofu [1]; Naoki Murai [1]; Yasuhiro Inamura [1]; Masami Nirei [1]; Pharit Piyawongwatthana [1]; Daisuke Wakai [2]; Kenji Nakajima [3]

[1] *J-PARC Center*

[2] *NAT Corporation, J-PARC Center*

[3] *Materials Sciences Research Center JAEA, J-PARC Center*

Corresponding Author: seiko.kawamura@j-parc.jp

AMATERAS, cold-neutron disk-chopper spectrometer at the Materials and Life Science Experimental Facility in J-PARC, has been in operation since 2009 [1]. Due to its high flexibility of the neutron intensity and the energy resolution, AMATERAS has been used for experiments in various research fields such as magnetism, functional materials and so on. Recent issues of AMATERAS are the high competition rate in the user program, inefficiency of beamtime due to frequent changing of sample environment and resultant working loads of the staff. In order to improve such situation, we have

been upgrading the instrument these past few years. Associated with refurbishment of the cryopump on the vacuum scattering chamber in 2019, we introduced a gate valve on it and automated the pumping system of the vacuum scattering chamber. Furthermore, we extended a short guide mirror downstream of the monochromating chopper by replacing a B_4C collimator with it. While we gained the neutron flux, it yields a new background at a low-Q region. In this talk, details of the upgrades and current status of AMATERAS will be presented.

[1] K. Nakajima, S. Ohira-Kawamura, T. Kikuchi, M. Nakamura, R. Kajimoto, Y. Inamura, N. Takahashi, K.Aizawa, K.Suzuya, K.Shibata, T.Nakatani, K.Soyama, R.Maruyama, H.Tanaka, W.Kambara, T. Iwahashi, Y. Itoh, T. Osakabe, S. Wakimoto, K. Kakurai, F. Maekawa, M. Harada, K. Oikawa, R. E. Lechner, F. Mezei, M. Arai, J. Phys. Soc. Jpn. 80 (2011) SB028.

Accelerator / 43

A proton driver based on a Fixed Field Alternating Gradient Accelerator

Author: Shinji Machida[1]

[1] *STFC*

Corresponding Author: shinji.machida@stfc.ac.uk

As an upgrade of ISIS facility, the next generation spallation neutron source is under consideration. One of option as a proton drive is based on a Fixed Field Alternating Gradient Accelerator (FFA). We are planning the construction of a prototype FFA which accelerates from 3 MeV to 12 MeV to prove the merits of this option. Although the energy range is much lower than the final goal, the space charge tune shift will be the similar level and we will study the effects of the high intensity beams. We are going to talk about the design and status.

Target and Moderator / 44

The ESS helium cooled rotating target. Final design stages, manufacturing process and FAT test.

Authors: Sjögreen Kristoffer[1]; Fernando Sordo Balbín[2]; Fernandez Luis Angel[3]; Oden Ulf[4]

[1] *ESS*

[2] *Consorcio ESS Bilbao*

[3] *ess bilbao*

[4] *ESS*

Corresponding Author: fsordo@essbilbao.org

The European Spallation Source (ESS) is an ambitious European project with a budget higher to 1800 Me. The aim of the project is to design, build and operate the brightest spallation neutron source in the world. The ESS will use a proton beam with final power deposited on the target of 5 MW, which will impact on a tungsten Target cooled by helium gas.

The Target will be designed with a set of tungsten blocks placed inside of a wheel of ~ 2.6 meter of diameter. Protons will impact at high speed on the wheel in a radial direction. Inside the wheel, helium flows at high velocity, cooling the tungsten blocks dissipating the heat produced by the nuclear reactions. The wheel rotates at a speed of 0.2-0.5 Hz, so the proton beam impacts on a different region of the wheel at a repetition rate of 14 Hz, distributing the heat over the whole perimeter of the wheel.

The helium is introduced in the Target wheel by means of a coaxial pipe: the Target Shaft. This Shaft is also responsible to align the wheel and transfer the rotation. The Target Shaft is supported by the drive unit and connected to the cooling system by means of the rotatory seal.

The aim of this contribution is to summarize the progress on the final design stages, manufacturing and FAT testing of the different components of the target system.

Target and Moderator / **45**

Manufacturing of the ESS Monolith Vessel: Lower and medium Vessel, Neutron port weldings, Connection Ring and head of the vessel

Authors: Andersson Anders[1]; Arrillaga Iker[2]; Fernando Sordo Balbín[3]; Ghatnekar Sara[4]; MARIO PEREZ LOPEZ[5]; Osoro jon[6]

[1] *ESS*

[2] *Cadinox*

[3] *Consorcio ESS Bilbao*

[4] *Ess*

[5] *ESS Bilbao / ELENA Association*

[6] *A.V.S.*

Corresponding Author: fsordo@essbilbao.org

The European Spallation Source (ESS) is an ambitious European project with a budget higher to 1800 Me. The aim of the project is to design, build and operate the brightest spallation neutron source in the world. The ESS will use a proton beam with final power deposited on the target of 5 MW, which will impact on a tungsten Target cooled by helium gas.

The spallation reactions produced take place in the Target Station, where the accelerated protons impact the Target Wheel which rotates synchronized with the proton pulses. Large amount of radiative isotopes will generate as a product of these reactions. The amount of activated material generated by this process is comparable to a 5 MW fission reactor hence, enclosure barriers are needed to avoid damage to the public and workers. In order to confine the activated material, the target systems are enclosed in a vacuum or inactive helium atmosphere confined by a pressure vessel: the monolith vessel (MV). On 2015 ESS-bilbao was selected as in kind partner for the component.

The aim of this contribution is to summarize the progress on the manufacturing process of the different sub components during the last years, including the on site welding operations to close the confinement barrier.

Target and Moderator / **46**

The HighNESS Project at the European Spallation Source

Author: Valentina Santoro[1]

[1] *ESS*

Corresponding Author: valentina.santoro@ess.eu

The European Spallation Source (ESS), presently under construction, in Lund, Sweden, is a multidisciplinary international laboratory that will operate the world's most powerful pulsed neutron source. By the year 2027, a suite of 15 instruments will be served by a high-brightness moderator

system positioned above the spallation target. However, the existing ESS infrastructure, encompassing the proton linac, target station, and instrument halls, possesses the capability to incorporate a second neutron source positioned beneath the spallation target.
Backed by 3MEuro Research and Innovation Action within the EU Horizon 2020 program, a design study (HighNESS) has operated over the past three years. The study's primary objective was to design a secondary neutron source beneath the spallation target. Distinguished from the first source situated above the target and optimized for high cold and thermal brightness, this new source will deliver heightened intensity (the total number of neutrons from the moderator). Additionally, there will be a shift towards longer wavelengths within the Cold (4-10 Å), Very Cold (10-100 Å) (VCN), and Ultra Cold ($>$ 500 Å) (UCN) neutron spectral ranges.
The high-intensity neutron beams offered by the project will open up new possibilities in neutron scattering, particularly in imaging and Small Angle Neutron Scattering (SANS), as well as enable pioneering experiments in fundamental physics, such as the search for neutron to antineutron oscillations.
As the HighNESS initiative approaches its culmination, I will present several key aspects, including the final design of the second cold neutron source, different options for Ultra-Cold Neutrons (UCNs) and Very Cold Neutrons (VCNs) sources, the proposed neutrons scattering instrument concepts, and the neutron-to-antineutron oscillations experiment at the ESS.

Target and Moderator / 47

Simulated and Measured Performance of ISIS TS1 Project Target

Authors: Dan Wilcox[1]; David Findlay[1]; Molly Probert[1]; Stephen Gallimore[1]; Stephen Jago[1]

[1] *UKRI - STFC*

Corresponding Author: dan.wilcox@stfc.ac.uk

As part of the ISIS TS1 Project [1], a new design of spallation target has been installed and operated at ISIS TS1. Detailed Finite Element Analysis (FEA) simulations were used to guide the design process and predict target performance. Since the TS1 Project target began operation in November 2022, operating data has been collected and used to validate the target simulation approach.
As reported elsewhere at this conference [2], the front target plate temperature was elevated compared to predictions. Because the installed target was now too radioactive to permit hands-on inspection, FEA simulations became a vital tool to understand the possible causes and safety implications of this anomalous behaviour.
The elevated temperature appears to be confined to the front target plate only, indicating a highly localised effect. The other nine target plate temperatures agreed closely with FEA simulations of both steady-state and transient behaviour. This gives confidence in the overall simulation approach, while also ruling out several proposed causes of the elevated front plate temperature.
Recent reports [3] [4] have shown a significant reduction in the thermal conductivity of tungsten after irradiation. The installation of a new, fully instrumented TS1 Target offered an opportunity to observe this effect in-situ on a working spallation target. Detailed records were kept of plate temperatures over time, and compared to FEA simulations which included irradiation-degraded material properties.

References
[1] ISIS TS1 Project summary –S. Gallimore et al 2018 J. Phys.: Conf. Ser. 1021 012053 DOI 10.1088/1742-6596/1021/1/012053
[2] TS1 Project with-beam commissioning –S. Gallimore ICANSXXIV 2023
[3] Thermal diffusivity of tungsten irradiated with protons up to 5.8 dpa –J. Habainy et al., Journal of Nuclear Materials, 2018
[4] Thermal diffusivity degradation and point defect density in self-ion implanted tungsten –A. Reza et al., Acta Materialia, 2020

Target and Moderator / 48

Initial Target Concepts for ISIS-II

Authors: Dan Wilcox[1]; Daniel Wells Calvo[1]; Lina Quintieri[1]; Stephen Gallimore[2]

[1] *UKRI-STFC*

[2] *UKRI - STFC*

Corresponding Author: dan.wilcox@stfc.ac.uk

Conceptual design studies are now underway for ISIS-II [1], the successor to the UK's pulsed neutron and muon source. Appropriate target technologies must be selected for each of the two proposed neutron target stations, to achieve a balance between neutronic performance and engineering reliability.

An essential choice early in the design process is between a stationary solid target or a rotating wheel; therefore it is necessary to understand the limits of achievable beam power on a stationary solid target. Safe operating limits must be defined for direct beam on target, as well as residual decay heat in a Loss of Coolant Accident (LOCA) scenario. Decay heat rather than direct beam has been found to be the limiting factor in some recent facility designs.

This talk will present the current status of preliminary designs for an ISIS-II target concept which enables the highest possible beam power on a static solid target. Detailed optimisation procedures will be presented elsewhere at this conference [2]. Strategies to mitigate the severity of a LOCA scenario were considered from the conceptual design phase. Alternative designs for rotating target wheels will also be presented. The selection of candidate core and cladding materials for ISIS-II targets in still in the early stages. A broad overview will be given of the current status of irradiated material studies, knowledge gaps and plans to address these.

References

[1] Outline plans for target stations at the ISIS-II facility –S. Gallimore ICANSXXIV 2023

[2] Optimisation Procedures for ISIS-II Targets –D. Wells-Calvo ICANSXXIV 2023

Target and Moderator / 49

Optimisation Procedures for ISIS-II Targets

Authors: Dan Wilcox[1]; Daniel Wells Calvo[1]; Lina Quintieri[1]; Stephen Gallimore[2]

[1] *UKRI-STFC*

[2] *UKRI - STFC*

ISIS-II, the successor to the UK's pulsed neutron and muon source, will require two newly-designed spallation targets [1]. This work is still at the conceptual design stage, with a range of possible target designs still under consideration [2]. To evaluate these concepts, it is necessary to produce a range of well-optimised target designs in sufficient detail to understand all the issues involved. Trade-offs must often be made between the competing requirements of neutronic performance and engineering reliability.

This poster will present details of the optimisation procedures applied to various aspects of the target design, including selecting the number of target plates and designing the outer pressure vessel. These processes were automated as much as possible, allowing a large number of design concepts to be evaluated in detail.

References

[1] Outline plans for target stations at the ISIS-II facility –S. Gallimore ICANSXXIV 2023

[2] Initial Target Concepts for ISIS-II –D. Wilcox ICANSXXIV 2023

Instruments / 50

Study of interplay between structure & magnetism in novel AMO2 (A=Alkali metals; M=3d Transition Metals) advanced oxide materials exhibiting unconventional chemical & physical properties.

Author: Naveed Zafar Ali[1]

[1] *National Centre for Physics Islamabad Pakistan*

Corresponding Author: nzafar@ncp.edu.pk

ABSTRACT
Probing the interplay between crystal structure and magnetism in new multinary oxides through the Rietveld refinement of high resolution synchrotron and neutron powder diffraction data has becoming increasingly critical for the advancement of science and technology in condense matter science. The seminar will highlight the brief summary of the (X+n) results collected at reputed European synchrotron and neutron diffraction facilities. Operando monitoring and deciphering the real-time (in-situ) chemical or structural changes and of magnetic phase transitions in series of new multinary oxides of 3d transition metals series will be presented. Focus will be to illustrate as how by changing the lattice dimensionality influence dramatically the thermodynamic properties by concerted study of the specific heat, magnetic susceptibility, magnetic phase transitions and allied spin fluctuations particularly at low temperature. Finally in order to construct a model for the spin interactions in these alkali oxometallates, the resulting magnetic properties will be justifiably analysed by employing various theoretical models.

BIO
Dr. Ali earned his Ph.D. (Dr.rer.nat.) degree from Max Planck Institute (MPI-FKF) for solid state research (MPI-FKF), Stuttgart Germany, where he also continued as a Postdoctoral fellow with fellowship from Max Planck Society. He is also the recipient of DAAD (German Academic Exchange Service) fellowship sponsoring his research stay at Federal Institute for Material Research Testing (BAM) Berlin, Germany. Besides he did sabbatical short academic stays at reputed Labs worldwide namely Brigham Young University, Provo UTAH, USA, ACNS, ANSTO Australia and large scale Synchrotron Light sources Worldwide specifically ESRF-Grenoble, France, Paul-Scherrer Institute PSI-Switzerland, & at Dan-Max Lab, MAX IV Lund Sweden. Currently He is working as Principal Scientist at National Centre for Physics (NCP), Quaid-I-Azam University campus, Islamabad Pakistan for the last ten years.

Accelerator / 51

J-PARC Linac and RCS operational status and upgrade plan to 2 MW

Author: Kazami Yamamoto[1]

[1] *Japan Atomic Energy Agency*

Corresponding Author: kazami@post.j-parc.jp

The 3-GeV rapid cycling synchrotron at the Japan Pro-ton Accelerator Research Complex was designed to pro-vide 1-MW proton beams to the following facilities. Thanks to the improvement works of the accelerator sys-tem, we successfully accelerate 1-MW beam with quite small beam loss. Currently, the beam power of RCS is limited by the lack of anode current in the RF cavity system rather than the beam loss. Recently we developed a new acceleration cavity that can accelerate a beam with less anode current. This new cavity enables us not only to reduce requirement of the anode power supply but also to accelerate more than 1-MW beam. We have started to consider the way to achieve beyond 1-MW beam acceler-ation. So far, it is expected that up to 1.5-MW beam can be

accelerated after replacement of the RF cavity. We have also continued study to achieve more than 2 MW beam in J-PARC RCS.

Instruments / **52**

The TOSCA secondary spectrometer upgrade: design and simulations

Author: Adrien Perrichon[1]

Co-authors: Claudio Bovo [1]; Stewart F. Parker [1]; Davide Raspino [1]; Jim Nightingale [1]; Jeff Armstrong [1]; Victoria Garcia Sakai [1]

[1] *UKRI, STFC, ISIS Neutron and Muon Source*

Corresponding Author: adrien.perrichon@stfc.ac.uk

TOSCA is a high-resolution, broad band, indirect geometry chemical spectrometer operated at the ISIS Neutron and Muon Source, UK. As a neutron analogue to optical spectroscopy, it is optimised for the study of molecular vibrations in fields such as catalysis, hydrogen storage materials, hydrogen bonded systems, or biological and organic compounds. We present the detailed design and performance of the proposed upgrade of the TOSCA secondary spectrometer. The entire secondary spectrometer will be replaced and new sets of large, curved pyrolytic graphite analysers, beryllium filters and position sensitive detectors will be installed. The design, dimensions and placement of each component has been optimised with neutron ray-tracing simulations. A gain factor in detected intensity of a least 10 is expected over the current instrument, independent of the neutron energy. This results from the increased solid angle coverage, increased transmission through the filter, and increased neutron detection efficiency. The predicted spectral resolution remains close to 1% of the energy transfer at high energy transfer. Furthermore, the performance of the beryllium filter in eliminating high energy neutrons has been improved by a factor 10, which should improve the signal-to-noise ratio and thus the sensitivity and detection limit of the instrument. This upgrade will ensure that TOSCA remains highly competitive in years to come.

Target and Moderator / **53**

The SINQ Solid State Target: Lessons learned from a Recent Target Failure and the Experience Gained from an Improved Target Design

Author: Bertrand Blau[1]

Co-authors: Sven Jollet [1]; Pavel Trtik [1]; Joerg Welte [1]

[1] *PSI*

Corresponding Author: bertrand.blau@psi.ch

The continuous wave spallation source, SINQ, has been in operation for 28 years. The proton beam power was gradually increased over the past decades, up to nearly 1.0 MW. The D2O-cooled Pb/Zr-based 'cannelloni'-type solid state targets have proven to be very reliable, and underwent several design improvements over time in order to maximize the neutron yield. The strategy to use solid state targets, which are periodically replaced every two years, appeared to be highly successful, yielding in a 96% annual availability of the facility averaged over the past 20 years.

However, in 2016 an unexpected failure of target #11 occurred, forcing us to replace it thereafter. The premature end of the target was caused by extensive damage of many target rods and large amounts of molten lead blocking the cooling paths between the rods, as revealed by PIE. It should

be emphasized that during the incident, all inventory was contained safely inside the target, the primary cooling loop and its filters. No radioactivity was released from SINQ.

Thereafter, the design of the SINQ target was significantly altered. In addition, the capabilities to accurately monitor the proton beam position on the target and the temperatures within the target were enhanced. The newly designed target has been in operation successfully since 2018.

We also introduced some sample rods with different Pb filling in the most thermally stressed area of the target and exposed them to the proton beam for two years. Afterwards, we performed tomography of the highly radioactive rods. The tomographic dataset reveals a strong re-distribution of the lead filling inside the irradiated Zircaloy tube.

This presentation will give an overview of the improved target design since the last target failure, including an elaborate temperature survey system in the hottest target region. We also present some results of the tomography of the re-distributed lead in one of the sample rods coming from this region.

Plenary:Monday Plenary / 54

The China Spallation Neutron Source

Instrument -Spectrometers / 55

MARMOT Si crystal analyzer (Keynote)

Tuesday Plenary / 56

Update from ESS

Corresponding Author: pascale.deen@ess.eu

Instrument -Spectrometers / 57

new Tosca+ spectrometer to be built at ISIS (Endeavour project) (Invited)

Corresponding Author: adrien.perrichon@stfc.ac.uk

Instrument -Spectrometers / 58

Recent upgrades on AMATARES (Invited)

Instruments / 59

CSPEC (Invited)

Corresponding Author: pascale.deen@ess.eu

Plenary:Monday Plenary / 60

Status and Future Developments of the ISIS Pulsed Neutron and Muon Source

Corresponding Author: roger.eccleston@stfc.ac.uk

Software / 61

McStas 25 years, project status and future

Corresponding Author: peter.willendrup@ess.eu

Software / 62

Refining magnetic structures using representational theory and SARAh - learning from simplicity and serendipity (Inivted)

Software / 63

Scientific computing and data management for the users of the European Spallation Source ERIC (Invited)

Corresponding Author: thomas.holmrod@ess.eu

Software / 64

Simulating single-crystal inelastic scattering in full phase-space (Invited)

Target and Moderator / 65

TS1 Project with-beam commissioning

Corresponding Author: stephen.gallimore@stfc.ac.uk

Target and Moderator / 66

Outline plans for target stations at the ISIS-II facility (Keynote)

Corresponding Author: stephen.gallimore@stfc.ac.uk

67

TS1 Project with-beam commissioning

Corresponding Author: stephen.gallimore@stfc.ac.uk

Target and Moderator / 68

Summary of lessons learned from the TS1 project implementation (Invited)

Corresponding Author: stephen.gallimore@stfc.ac.uk

Target and Moderator / 69

A new method to find out the optimal neutron moderator size based on neutron scattering instrument parameters

Corresponding Author: p.kkonni@gmail.com

Instruments: Moun/white Neutron instrumentation / 70

Low energy muons update and future developments (Keynote)

Corresponding Author: kanda@post.kek.jp

Instuments: Diffraction / 71

HRPD with elliptic focusing under commissioning (Invited)

Instruments: Neutron and muon sample environment/Moun technology / 72

POWTEX at POWGEN

Instruments: Neutron and muon sample environment/Moun technology / 73

Diffraction at SNS

Corresponding Author: wuy1@ornl.gov

Instruments: Moun/white Neutron instrumentation / 74

Target/HIMB and FLAME (Invited)

Corresponding Author: thomas.prokscha@psi.ch

Instruments: Moun/white Neutron instrumentation / 75

Muon spectrometer design for the first muon facility in China (Invited)

Corresponding Author: panzw14@mail.ustc.edu.cn

Accelerator / 76

J-PARC Linac and RCS operational status and upgrade plan to 2 MW (Invited)

Corresponding Author: kazami@post.j-parc.jp

Accelerator / 77

Medium-pulse length source studies for the European Spallation Source

Accelerator / 78

A proton driver based on a Fixed Field Alternating Gradient Accelerator

Corresponding Author: shinji.machida@stfc.ac.uk

Instuments: Diffraction / 79

Multi-physics instrument: Total scattering neutron diffractometer at China Spallation Neutron Source

Instruments: Neutron and muon sample environment/Moun technology / 80

Diffraction at SNS

Corresponding Author: wuy1@ornl.gov

Instruments: Neutron and muon sample environment/Moun technology / 81

Diffraction at SNS

Corresponding Author: wuy1@ornl.gov

Accelerator / 82

A novel high-intensity ns-pulsed compact accelerator-driven neutron source (Invited)

Accelerator / 83

xxx

Corresponding Author: kazami@post.j-parc.jp

Accelerator / 84

xxx

Corresponding Author: kazami@post.j-parc.jp

Tuesday Plenary / 85

SINQ

Corresponding Author: michel.kenzelmann@psi.ch

Tuesday Plenary / 86

STS project at ORNL

Plenary / 87

Status of Hefei Light Source

Instruments: SANS/Reflectometry / 88

Polarized SANS and GISANS (Keynote)

Corresponding Author: annika.stellhorn@ess.eu

Instruments: SANS/Reflectometry / 89

ESTIA/AMOR (Invited)

Corresponding Author: artur.glavic@psi.ch

Instruments: SANS/Reflectometry / 90

Slit focusing VSANS under commissioning (Invited)

Target and Moderator / 91

Behavior of proton beam window materials of high power spallation targets (Invited)

Corresponding Author: yong.dai@psi.ch

Instruments: SANS/Reflectometry / 92

xxx

Instruments: SANS/Reflectometry / 93

Slit focusing VSANS under commissioning

Safety and Operation / 94

ISIS BEAMLINE HIGH VOLTAGE INTERLOCK SYSTEM

Corresponding Author: max.williams@stfc.ac.uk

Safety and Operation / 95

Instrument Upgrade, Installation and Operation at ISIS

Corresponding Author: john.crawford@stfc.ac.uk

Safety and Operation / 96

xxx

Corresponding Author: john.crawford@stfc.ac.uk

Target and Moderator / 97

ISIS brightness

Corresponding Author: goran.skoro@stfc.ac.uk

Target and Moderator / 98

High-brilliance and high-flux cold neutron source based on high-aspect ratio rectangular parahydrogen moderators.

Corresponding Author: a.ioffe@fz-juelich.de

Target and Moderator / 99

Neutronics evaluation of a potential ISIS-II TS-2 target, reflector and moderator assembly

Corresponding Author: goran.skoro@stfc.ac.uk

Target and Moderator / 100

Mesitylene and the short-pulse spallation neutron sources

Corresponding Author: goran.skoro@stfc.ac.uk

Target and Moderator / 101

Developments in Target Manufacture Procedures

Corresponding Author: grace.fenemore@stfc.ac.uk

Instruments / 102

NeXT 2.0, the new Neutron and X-Ray Tomograph at ILL (Keynote)

Instruments / 103

Engineering diffraction at CSNS (Invited)

Instruments: Neutron and muon sample environment/Moun technology / 104

eMAP: The new engineering diffractometer at ISIS

Corresponding Author: tung-lik.lee@stfc.ac.uk

Instruments: Neutron polarisation/neutron optics / 105

Wide-angle polarization analysis at ISIS: past, present, and future (Keynote)

Instruments: Neutron polarisation/neutron optics / 106

Status of the He-3 spin filter station at MLF (Invited)

Corresponding Author: takayuki.oku@j-parc.jp

Instruments: Neutron polarisation/neutron optics / 107

Neutron polarization platform focus on 3He at CSNS (Invited)

Instruments: Neutron polarisation/neutron optics / 108

Wide-Angle Solid State Polarization Analysis for MAGiC (Invited)

Corresponding Author: christine.klauser@psi.ch

Instruments / 109

Boron-based detectors (Keynote)

Corresponding Author: irina.stefanescu@ess.eu

Instruments / 110

The future and the present of neutron detectors for instruments at CSNS (Invited)

Instruments / 111

Muon tracking detectors (Invited)

Tuesday Plenary / 112

Status of LANSCE at Los Alamos National Laboratory

Eric N. Brown LANSCE

Instruments / 113

Update on WASP, wide angle spin echo spectrometer (Keynote)

Tuesday Plenary / 114

Status overview of J-parc facility

Corresponding Author: toshiya.otomo@j-parc.jp

Instruments / 115

Resonance spin-echo options using Wollaston prisms at HFIR

Target and Moderator / 116

ISIS Target Station 2 Horn Moderator

Corresponding Author: henry.russell@stfc.ac.uk

Instruments / 117

xxx

Target and Moderator / 118

The ESS helium cooled rotating target. Final design stages, manufacturing process and FAT test (Invited)

Corresponding Author: fsordo@essbilbao.org

Target and Moderator / 119

The HighNESS Project at the European Spallation Source (Invited)

Corresponding Author: valentina.santoro@hep.lu.se

Instruments: Neutron and muon sample environment/Moun technology / 120

High pressure research at PSI using neutrons and muons (Keynote)

Corresponding Author: gediminas.simutis@psi.ch

Instruments: Neutron and muon sample environment/Moun technology / 121

Event-mode stroboscopic experiments with sample environments (Invited)

Corresponding Author: yasuhiro.inamura@j-parc.jp

Instruments: Neutron and muon sample environment/Moun technology / 122

Development of Sample Environment at CSNS (Invited)

Target and Moderator / 123

Simulated and Measured Performance of ISIS TS1 Project Target

Corresponding Author: dan.wilcox@stfc.ac.uk

Target and Moderator / 124

Initial Target Concepts for ISIS-II (Invited)

Corresponding Author: dan.wilcox@stfc.ac.uk

Target and Moderator / 125

The SINQ Solid State Target: Lessons learned from a Recent Target Failure and the Experience Gained from an Improved Target Design (Keynote)

Corresponding Author: bertrand.blau@psi.ch

Instruments / 126

MELODY project of CSNS-II, design & development of the first muon facility in China (Invited)

Instruments / 127

The Muon Science Facility of MLF J-PARC (Invited)

Corresponding Author: nari.kawamura@kek.jp

Instruments / 128

xxx

Safety Operation / 129

Low energy muons update and future developments

Corresponding Author: kanda@post.kek.jp

Safety Operation / 130

Target/HIMB and FLAME

Corresponding Author: thomas.prokscha@psi.ch

Safety Operation / 131

Muon spectrometer design for the first muon facility in China

Corresponding Author: panzw14@mail.ustc.edu.cn

Instruments / 132

xxx

Instruments / 133

Detectors for neutron scattering instruments at IBR-2 reactor in FLNP JINR

Corresponding Author: bodnarch@nf.jinr.ru

Instrument -Spectrometers / 134

New INS spectrometer at FLNP JINR

Corresponding Author: mardotka@gmail.com

Instruments: Neutron polarisation/neutron optics / 135

The progress of neutron chopper development for CSNS

Poster / 136

Unraveling the Effects of Ta, Re and Mo on Vacancy-mediated Diffusion and Structural Order in γ'-Ni3Al: A Kinetic Monte Carlo Study

Authors: Peng Hu[1]; Wenyue Zhao[2]; Yakang Li[1]; Fazhi Qi[1]; Shengkai Gong[2]

[1] *Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China; Spallation Neutron Source Science Center, Dongguan 523803, China*

[2] *Research Institute for Frontier Science, Beihang University, Beijing 100191, China*

Corresponding Author: hup@ihep.ac.cn

Diffusion controls almost microscopic processes such as element partition, microstructure evolution, structural order, and dislocation climb, which is closely related to the creep strength of Ni-based superalloys. In this study, the effects of Re, Mo and Ta on vacancy-mediated diffusion and structural order of γ'-Ni3Al have been systematically evaluated via incorporating first-principles and kinetic Monte Carlo (KMC) simulation. From a thermodynamics perspective, each alloying element increases the barriers of basic diffusion processes of Ni and Al. It is noted that they do not change the preferences diffusion direction of Ni and Al. Specifically, the effects of alloying elements on increasing the inter-sublattice diffusion barriers of Ni and Al follow the sequence of Ta ≈ Re > Mo. For the other basic diffusion processes of Ni and Al, the sequence is Ta > Mo > Re. From a kinetic perspective, KMC simulations indicate that the sequence for reductions in the effects of alloying elements on vacancy diffusion coefficients is Ta > Re > Mo. Each alloying element increases the equilibrium order degree of the γ'-Ni3Al system at high temperatures. It originates from the stable occupations of these alloying elements at Al sublattice sites. Such occupations result in elevated diffusion barriers for Ni migrating to the Al sublattice sites and the decreased equilibrium concentration of NiAl antisite. Further analysis suggests that the structural disorder primarily originates from the limited Ni diffusion processes within inter-sublattice. In contrast, more Al diffusion processes within inter-sublattice contributes less to structural disorder due to their high correlation factor.

Instruments / 137

The operation and maintenance status of neutron chopper system for CSNS

Author: UNKNOWN 蔡伟亮 [1]

[1] 高能所

Corresponding Author: caiwl@ihep.ac.cn

Since the Chinese Spallation Neutron Source (CSNS) began operation in 2018, 35 neutron choppers have been installed and are currently being used in the neutron instruments. The cumulative operating time of the neutron choppers has exceeded 300,000 hours, with overall stable performance but some incidents of malfunction. This report will share relevant maintenance experience. In the next 6 years, the construction and operation of neutron choppers in CSNS will continue to be parallel, with more than 30 new choppers to be put into operation in the CSNS-II project.

Instruments / 138

How to reduce the vibration of neutron choppers

Authors: 清张 [1]; UNKNOWN WANG Ping[1]; UNKNOWN 蔡伟亮 [1]

[1] 高能所

Corresponding Author: qingzhang@ihep.ac.cn

Mechanical vibration poses a substantial risk to the chopper's longevity. By effectively controlling vibrations, maintenance intervals can be increased, and the service life of the chopper can be extended. This report analyzes the causes of chopper vibration, explores methods to mitigate it, and proposes measures to reduce vibrations from multiple perspectives. These measures have been successfully implemented in the design and operation of the CSNS chopper, yielding positive results.

Instruments / 139

The design and current status of the high-resolution neutron diffractometer at China Spallation Neutron Source

Author: Ping MiaoN[one]

Corresponding Author: miaoping@ihep.ac.cn

A new neutron diffractometer is under construction at China Spallation Neutron Source, which aims to reaching a world-leading resolution of Δd/d ≤ 0.05% and bearing a moderate flexiblity of varying resoultion and brightness. Fully elliptical geometry in both vertical and horizontal directions is impletmented in neutron guides and high-frequency T0 chopper is adopted to increase the flux gain of short wavelength neutrons, which could impove the statistics at long-Q range, so that high Q-resolution pair distribution function analysis could potentially be realized. The diffratometer is designed to have large solid- angle coverage of 3He PSD detectors, spanning from 5 degree to 177 degree in the horizonal plane and from -28 degree to 28 degree in the vertical plane. Its flexibility allows versatile diffraction measurements, encompassing long-time data collection of the high- resolution powder diffraction patterns, quick measurement of small powder samples, as well as single-crsytal diffraction measurement.

Instruments / 140

The future and the present of neutron detectors for instruments at China Spallation Neutron Source

Author: 志嘉孙 [1]

[1] 散裂中子源科学中心

Corresponding Author: sunzj@ihep.ac.cn

Neutron science and technology plays an irreplaceable role in national defense and industry. China spallation neutron source (CSNS) is a major science and technology platform for multidisciplinary applications. As one of the most expensive core equipment of neutron instruments, the neutron detector plays a very important role in the construction and operation of neutron instruments at CSNS. Based on the requirements of the instruments, many common key technologies of neutron detectors have been studied and the detector system of large-scale engineering application has been preliminarily established. A professional and young team has been cultivated to be engaged in developing the advanced neutron detectors. The team has completed the construction of neutron detectors

for General Purpose Powder Diffractometer (GPPD), Small Angle Neutron Scattering (SANS), Multi-functional Reflectometer (MR), Multi-Physics Instrument(MPI), Energy-Resolved Neutron Imaging instrument(ERNI), High Energy Direct-Geometry Inelastic Neutron Scattering Spectrometer(HD), Very Small Angle Neutron Scattering Instrument(VSANS) and Engineering Material Diffractometer (EMD). We have successfully developed a large area of scintillator detector (Fig.1 (a)), a large area of 3He tube array detector (Fig.1 (b)), an energy resolved neutron imaging detector (Fig.1 (c)) and a ceramic GEM neutron detector (Fig.1 (d)). These detectors are under the final commissioning for operation. At the present, CSNS II will be constructed in this summer. Many kinds of detectors will be further developed to realize better performances including larger area, higher spatial resolution, higher detection efficiency and higher integration.

Poster / 141

Design of the macromolecular diffractometer at the High Brilliance Neutron Source (HBS)

Authors: Zhanwen Ma[1]; Klaus Lieutenant[2]; Jorg Voit[2]; Tobias Schrader[2]; Thomas Gutberlet[2]; Thomas Bruckel[2]

[1] *PSI*

[2] *Jülich Centre for Neutron Science*

Corresponding Author: zhanwen.ma@psi.ch

As a novel approach to neutron research facilities, High-Current Accelerator-driven Neutron Sources (HiCANS) are currently being developed for use as future national neutron sources. One of these facilities is the High Brilliance neutron Source (HBS), designed at the Jülich Center of Neutron Science (JCNS) in Germany. HBS uses a pulsed proton beam of 70 MeV energy and 100 kW time-averaged power at each of the three target stations. A reference instrument suite of 24 instruments has been planned for HBS. Due to its time structure, low background, and flexible, high-brilliance moderator setups, the instruments at HBS are expected to be highly competitive with existing state-of-the-art scattering instruments. In this work, we will present a concept for a macromolecular diffractometer for HBS. SELENE neutron guides will be used in this instrument, and the neutron optics have been optimized using VITESS Monte Carlo simulations. With the optimized neutron optics, we can achieve a low background and a very bright, tunable neutron beam spot at the sample, with a cross-section as small as 1 mm2. This promises a viable instrument for the life science community. Virtual neutron scattering experiments have been performed to explore the instrument's capabilities to study samples with large unit cells.

Instruments / 142

Background sources in Advanced High-Pressure Neutron Scattering Experiments

Authors: Zhanwen Ma[1]; Daniel Mazzone[2]; Jakob Lass[2]; Gediminas Simutis[2]; Sascha Thürsam[2]; Marek Bartkowiak[2]; Stanislav Nikitin[2]; Tom Fennell[2]; Ekaterina Pomjakushina[2]; Mads Bertelsen[3]; Peter Willendrup[4]; Uwe Filges[2]; Christine Klauser[2]

[1] *PSI*

[2] *Paul Scherrer Institute*

[3] *European Spallation Source*

[4] *European Spallation Source;5. Technical University of Denmark*

Corresponding Author: zhanwen.ma@psi.ch

For condensed matter physics neutron scattering experiments at high pressures are an ideal combination of microscopic probe and tuning parameter to investigate magnetic properties and phenomena. However, they require a high neutron flux and a robust signal-to-noise ratio, especially for small samples. This work focusses on the background noise within high-pressure neutron scattering experiments. It provides a comprehensive assessment for specific pressure cells and neutron scattering instruments through a combination of simulations and benchmark experiments with the aim to device more generally applicable background analysis and reduction strategy. We employed McStas 3.2 package with the Union component framework to simulate different origins of background contributions and their contribution in high-pressure experimental settings. The experimental benchmark was performed at CAMEA, SINQ, where we used a Ho2Ti2O7 powder sample enclosed within a CuBe clamp cell inside orange cryostat. Our analysis concludes with technical solutions to improve the signal-to-noise ratio in state-of-the-art neutron experiments.

Instruments / 143

High pressure research at PSI using neutrons and muons

Author: Gediminas Simutis[1]

[1] *Paul Scherrer Institute*

Corresponding Author: gediminas.simutis@psi.ch

High pressure is an important pathway to access and understand the properties of materials as well as their various phases in the fields ranging from mineral physics inside the earth to cooperative many-body quantum phases emerging in crystals.

At PSI we combine the high-pressures with accelerator-based scattering and resonance methods in order to explore, understand and control theses phases. In my talk I will introduce the high-pressure equipment that is available at PSI and discuss how it is coupled to the user programs in the muon and neutron sources. I will then present our recent developments in both hydrostatic and anisotropic pressure techniques that enabled us to expand the accessible parameter phases. Finally, recent scientific studies enabled by the high pressures will be highlighted.

Poster / 144

The surrogate modelling based optimization of target station for bimodal neutron and photon imaging

Authors: Yigang Yang[1]; Yuxuan Lai[1]

[1] *Tsinghua University*

Corresponding Author: lyx20@mails.tsinghua.edu.cn

The one-source-one-detector bimodal imaging system shows incredible promise in in-situ industrial applications, such as residual core material detection for turbine blade, lithium ore concentration analysis and study of water transport in concrete. The target station design will dramatically affect the spectrum and flux for both neutrons and photons, which in turn influence the material identification capability of the system. However, traditional parameter sweep method for designing target station largely relies on expert's experience and can't fully explore the parameter space due to system's high complexity. In this study, the surrogate modelling based optimization method with the aid of Dakota software is developed for the optimized target station design. With this method, Multidisciplinary systems, such as Monte Carlo simulation, computational fluid dynamics and structural analysis are incorporated simultaneously within the evolutionary optimization process to find global opima. And appropriate surrogate models for these systems are generated to largely reduce computational cost. A bimodal neutron/photon target station based on an 18 MeV/8 kW electron accelerator is optimized to demonstrate the effectiveness of the method.

Target and Moderator / 145

Development of Nano-sized graphene material for neutron intensity enhancement below cold neutrons

Author: Makoto Teshigawara[1]

Co-authors: Yujiro Ikeda [2]; Kazuo Muramatsu [3]; Koichi Sutani [3]; Masafumi Fukuzumi [4]; Yohei Noda [5]; Satoshi Koizumi [5]; Koichi Saruta [1]; Yoshie Otake [2]

[1] *Japan Atomic Energy Agency*

[2] *RIKEN*

[3] *INCUBATION ALLIANCE INC.*

[4] *Hyogo Prefectural Institute of Technology*

[5] *Ibaraki University*

Corresponding Authors: teshi@post.j-parc.jp, muramatsu@incu-alliance.co.jp

Slow neutrons, such as cold neutrons, are really important non-destructive probes not only for basic physics but also for the structural genomics advancements. Neutron-based science is also known as high-neutron-intensity-dependent science. A new unique method focusing on nanosized particle aggregation has been proposed to increase neutron intensity below cold neutron energy region. The method is based on intensity enhancement by multiple coherent scatterings with nanosized particle aggregation. The aggregation of nanosized particles matches the wavelength of below cold neutrons, causing a similar effect to coherent scattering, so-called Bragg scattering, leading to neutron intensity enhancement by several orders of magnitude. Nanodiamonds and magnesium hydride have recently been studied numerically and experimentally. The major challenge with nanodiamonds in practical applications is the molding method. Another carbon structure, graphene is focused on to find a solution to this problem.
In this paper, we report the potential of nanosized graphene as a reflector material below cold neutrons, together with recent experimental results.

Instruments / 146

An Instrument suite for the HBS

Author: Jörg Voigt[1]

Co-author: Klaus Lieutenant [2]

[1] *Forschungszentrum Jülich*

[2] *Jülich Centre for Neutron Science, Forschungszentrum Jülich GmbH*

Corresponding Author: j.voigt@fz-juelich.de

High Current Accelerator driven Neutron Sources (HiCANS) are considered as the next generation medium flux neutron facility taking over the role of today ' s national neutron sources. The High Brilliance Source HBS will provide dedicated target stations delivering ~ 100 kW proton beam power, where the instruments around the target station define the pulse and spectral properties of the neutrons source. Recently, we have finished the technical design report for the HBS comprising of four volumes, covering "Accelerator" , "Target" , "Instrumentation" and "Infrastructure" [1]. We will present the instrumentation suite that has been explored in the Volume "Instrumentation" by a large group of instrument developers from JCNS and other facilities. They show, that the HBS can

host a competitive instrument suite, which is able to cover the future requirements of the neutron community.

References
[1] T. Brückel, T. Gutberlet, Ser. Ed., Technical Design Report HBS (2023)

Instruments / 147

Research on neutron/X-ray CT image denoising method based on semantic context aggregation

Authors: 健芳李 [1]; UNKNOWN 王声翔 N[one]; 亚康李 [1]; 法制齐 [1]

[1] 高能所

Corresponding Author: lijf@ihep.ac.cn

Improving the quality of neutron/X-ray CT images is a critical challenge for the energy-resolved neutron imaging spectrometer (ERNI) with dual-modality imaging system at China Spallation Neutron Source (CSNS). Noise and artifact removal is the core process to enhance image quality. However, most existing denoising methods for neutron/X-ray CT cannot handle various noise and artifact types simultaneously. To address this, we focus on the post-processing of neutron/X-ray CT images and employ multiple ways to preserve the details in original image. In particular, we initially investigate the creation of a learning framework based on a transformer-based macro-architecture for semantic representation of image structures in low-quality CT images. Subsequently, we explore the aggregation of contextual information for semantic representations using spatial attention mechanisms and channel attention mechanisms to model contextual relationships. Finally, we conduct experiments on neutron and X-ray CT image datasets, separately evaluating the denoising of low-dose X-ray CT images and the sparse-view reconstruction of CT images. In both application scenarios, we achieve promising results. This approach will help improve the accuracy and completeness of imaging structural details and generate clear neutron/X-ray CT images with different noise and artifacts removed. The implementation of this project will overcome the limitations of existing methods in adaptability, reliability and robustness. We will provide new perspectives, algorithms and models for the neutron/X-ray CT imaging field, thereby supporting key applications such as large scientific facility CT, medical CT, and industrial CT.

Target and Moderator / 148

Characterizations of the tantalum cladded tungsten blocks prepared by hot isostatic pressure (HIP) diffusion welding

Author: Shaohong 魏少红 [1]

Co-authors: Ruiqiang Zhang ; Wen Yin ; Tianjiao Liang

[1] *Institute of high energy physics,CAS*

Corresponding Author: weish@ihep.ac.cn

The solid spallation neutron source target is used in the condition of high temperature, high radiation and continuous cooling water erosion. In order to obtain a high neutron yield, the target material is generally selected from the metal material with a relatively high atomic number. Tungsten is one of the suitable choices as the spallation neutron sources solid target material due to its high efficiency of neutron, excellent heat removal ability and high melting point. Many spallation neutrons sources, tungsten is selected as the target material such as KENS, LANSCE, ISIS and ESS. However, tungsten has poor corrosion resistance performance especially subjected to the irradiation and corrosion environment. It is an effective method to solve the poor corrosion performance of tungsten by coating the tungsten surface with corrosion-resistant metals such as tantalum, niobium, titanium or zircaloy.

Tantalum (Ta) coated tungsten (W) blocks were prepared by hot isostatic pressure (HIP) diffusion welding in the temperature range from 1250 ℃ to 1550 ℃. The mechanical tensile properties displayed that the bonding strength of the W-Ta interface reached the maximum value of 139.9 MPa at 1450 ℃. The value of nanoindentation hardness values of the W-Ta interface are between the values of W and Ta substrates indicating the diffusion layer. W-Ta diffusion layers were formed during the HIP, and the thickness of diffusion layers increased with the increase of the HIP temperature. TEM results show that the diffusion layer consists of W-Ta solid solution, and crystal plane distances of the diffusion layers were slightly enlarged due to the W-Ta solid solution.

Instruments / 149

test

Author: 俊英沈 [1]

[1] 高能所

Corresponding Author: shenjy@ihep.ac.cn

test

Instruments / 150

Muon spectrometer design for the first muon facility in China

Author: Ziwen Pan[1]

Co-authors: Qiang Li [2]; Tianyi Yang [1]; Hao Liang [1]; Hui Cheng [2]; Haitao Hu [2]; Yongji Yu [2]; Yang Li [2]; Yu Bao [2]; Xiaojie Ni [1]; Bangjiao Ye [1]

[1] *University of Science and Technology of China*

[2] *China Spallation Neutron Source*

Corresponding Author: panzw14@mail.ustc.edu.cn

Muon spin spectroscopy, known as a collection of muon spin rotation, relaxation and resonance (μSR) techniques, uses highly polarized muons to study the microscopic magnetic structure and dynamics of condensed matter. The interaction between muon spins and the local field inside materials forms the physical basis of μSR techniques. Such information is extracted by the detection of positrons decaying from muons inside a sample and asymmetrically emitted at the solid angle of 4 π steradians. Currently, there are five international muon facilities providing continuous or pulsed muon beams for material characterization. In addition to the existing facilities, the first Chinese muon source, the Muon station for sciEnce technoLOgy and inDustrY (MELODY), is planned to be constructed at Phase II of the China Spallation Neutron Source (CSNS). It aims to provide intense and pulsed muon beams to conduct μSR applications in multiple disciplines, including condensed matter physics, material science, chemistry, and energy science. The group from the University of Science and Technology of China (abbreviated as the USTC group) participated in the collaboration with the CSNS accelerator group for the construction of the muon source. The USTC group dominated the R&D of the first-generation photomultiplier tube (PMT)-based μSR spectrometer and the design of the second-generation silicon photomultiplier (SiPM)-based spectrometer. The PMT-based spectrometer is a 128-channel prototype to demonstrate and develop key detector and electronics technologies for the planned MELODY. After several iterative designs and updates of detectors and electronics, the spectrometer prototype achieved a 7-ns dead time, which is shorter than that of the ISIS spectrometer and can record more positrons in each pulse. Based on the technologies developed from the first-generation spectrometer, the second-generation spectrometer will use SiPMs to accommodate over 2500 detector units to make full use of muons in MELODY. The development of

μSR spectrometers will greatly boost the construction of MELODY and provide high-quality data to users to interpret material properties.

Instruments / 151

WASP the wide angle neutron spin echo instrument

Authors: Bela Farago[1]; Peter Falus[2]; Peter Fouquet[1]

[1] *ILL*

[2] *Intitut Laue Langevin*

Corresponding Author: falus@ill.fr

Neutron Spin Echo (NSE) instruments are the highest energy resolution neutron spectroscopy instruments. WASP the Wide Angle Spin echo is the youngest member of this family. WASP's magnetic configuration is unique, it is the single functioning instrument of its kind. After four cycles of user operation the first results were published. It will be shown on practical examples how the very wide angle coverage and high intensity of this flagship instrument opens new science areas for exploration. Since the instruments capabilities are a mixture of the capabilities of Back Scattering Time of Flight and Neutron Spin Echo instruments, the science cases are also varied. We
Hopefully these examples will inspire you to attend the HIRES workshop at ILL to explore how Neutron Spin Echo can be used in synergy with other measurement techniques.

Target and Moderator / 152

Physics Design and Commissioning of the Mark-IV TMRS assembly at the Lujan Center

Authors: Josef Svoboda[1]; Michael Mocko[1]

[1] *LANL*

Corresponding Author: svoboda@lanl.gov

During the 2022 maintenance outage, installation was completed for the new generation of the spallation target-moderator-reflector-shield (TMRS), known as Mark-IV, at the Manuel Lujan Jr. Neutron Scattering Center (Lujan Center) within the Los Alamos Neutron Science Center (LANSCE). This paper deals with a physics design comparison between the previous and current targets, commission work, and the accurate determination of the target position using Laser Tracker Survey. At the end of 2022, we conducted a beam spot experiment with an active high-speed gated camera imager, which closely matched the predictions from our MCNP beam spot simulations.

Instruments / 153

Larmor labeling of neutron spin with superconducting magnetic devices

Author: Fankang Li[1]

[1] *Oak Ridge National Laboratory*

Corresponding Author: frankli@ornl.gov

Conventional neutron scattering techniques encounter limitations when measuring scattering events characterized by small momentum or energy transfers due to the inherent trade-off between resolution and useable flux. To address this challenge, we explore the innovative utilization of neutron spin Larmor precession. By harnessing this phenomenon, it becomes possible to encode neutron momentum or energy changes as substantial shifts in the total Larmor phase, thereby circumventing the resolution-useable flux trade-off. This approach holds the potential to enhance the resolution of established techniques such as small angle neutron scattering, neutron diffraction, and inelastic neutron scattering. A pivotal element for effectively encoding neutron beams within the momentum-energy phase space is the magnetic Wollaston prism (MWP). In this conference, we introduce the advancement of superconducting MWPs and showcase their application in Larmor labeling of neutron spin. Through compelling demonstrations across various neutron scattering methodologies, we illustrate the transformative impact of this technique, opening new avenues for high-resolution investigations in neutron research.

Instruments / 154

Development and application of 3He neutron spin filters at J-PARC MLF

Author: Takayuki Oku[1]

[1] *J-PARC Center, JAEA*

Corresponding Author: takayuki.oku@j-parc.jp

We have been developing a 3He neutron spin filter (NSF) for the efficient utilization of pulsed neutrons, since the 3He NSF is effective for neutrons in the wide energy range. The 3He NSF is effective especially for neutrons with energy higher than several-tens-meV. It also can cover a large solid angle and polarize neutrons without deflecting them from their original trajectory, it is suitable for the analyzer for SANS and reflectometer instruments. In addition, the 3He NSF will be a key device in the application of recently developed magnetic field imaging technique by using polarized pulsed neutrons, since it can polarize a thick neutron beam without deteriorating projection image of the transmitted neutrons. In order to apply the 3He NSF to experiments at a pulsed neutron experimental facility such as the J-PARC, it is important to make the system stable and easy to setup and operate, because the system is located inside thick and bulky radiation shields for high energy gamma ray and neutrons. In this talk, we will report the development and application status of the NSF at at J-PARC MLF.

155

The Design of a Scientific Data Management System Based on DOMAS at CSNS-II

Authors: Li Wang[1]; Peng Hu[2]

Co-authors: 亚康李 [1]; UNKNOWN TANG Ming [1]; 皓胡 [1]; 浩帆王 [1]; 蓉杜 [1]; 法制齐 [1]; UNKNOWN ZHANG Junrong [1]

[1] 高能所

[2] *IHEP*

Corresponding Authors: wangli320@ihep.ac.cn, hupeng@ihep.ac.cn

At the second stage of China Spallation Neutron Source (CSNS-II), 17 new neutron instruments will be constructed, which will produce 2 PB of raw experimental data annually. However, the existing data management system (DMS) based on ICAT has several limitations like poor scalability of

metadata database, imperfect data status management and inflexible API. To ensure the accuracy, usability, scalability and efficiency of CSNS-II experimental data, a new scientific data management system is therefore designed based on DOMAS framework developed by Computing Center of IHEP. The data acquisition, transmission, storage and service systems are re-designed and tailored specifically for CSNS-II. Upon its completion, new DMS will overcome the existing challenges and offer functions such as online display, search functionality and rapid download capabilities for metadata, raw data and analyzed data; flexible and user-friendly authorization; and data lifecycle management. Ultimately, new DMS will improve the efficiency of experimental data analysis, pushing CSNS-II to reach international advanced standard and further retrieving sci-tech self-reliance and self-strengthening at high level of China. The development and deployment of new DMS begin at the end of 2023.

Instruments / **156**

Polarized SANS and GISANS at the ESS

Author: Annika Stellhorn[1]

Co-authors: Mikhail Feygenson [2]; Wai-Tung Lee [1]; Sebastian Jaksch [3]; Emmanuel Kentzinger [4]; Elizabeth Blackburn [5]; Andrew Jackson [1]

[1] *European Spallation Source ERIC, SE-22100 Lund, Sweden*

[2] *European Spallation Source ERIC, SE-22100 Lund, Sweden, and Forschungszentrum Jülich GmbH, Jülich Centre for Neutron Science (JCNS-1), 52428 Juelich, Germany*

[3] *1European Spallation Source ERIC, SE-22100 Lund, Sweden.*

[4] *Forschungszentrum Jülich GmbH, Jülich Centre for Neutron Science (JCNS-2) and Peter Grünberg Institut (PGI-4), JARA-FIT, 52428 Juelich, Germany*

[5] *Division of Synchrotron Radiation Research, Lund University, SE-22100 Lund, Sweden*

Corresponding Author: annika.stellhorn@ess.eu

Small-Angle Neutron-Scattering (SANS) with polarization analysis is a powerful technique to investigate magnetic order in hard condensed matter systems on the nanometer and mesoscopic length scales, and to suppress hydrogen incoherent scattering in soft matter materials. The high neutron flux expected at the European Spallation Source (ESS), coupled with novel instrumentation that will be supported by a wide variety of sample environments, will be combined with neutron polarization analysis on many instruments [1], enabling exciting new science projects.

The integration of data analysis with instrument work is crucial for a successful scientific study. The variety of sample environments and the broad scientific scope of time-of-flight SANS instruments with large position sensitive detectors at the ESS complicate the data workflow for polarized SANS experiments considerably. Comprehensive and user-friendly procedures for the collection, reduction, and analysis of polarized SANS data have to be established for ESS instruments. Firstly, I will present the status of polarized SANS development on ESS instruments, including design, the data reduction protocols for polarized SANS and its future implementation in the data reduction software Scipp [2], together with plans for the data analysis using the SasView software [3]. Secondly, I will demonstrate how those procedures are applied to two example systems exhibiting complex magnetic spin textures: (i) a magnetoelectric single crystal leading to magnetic chiral structures as a function of applied electric and magnetic fields and temperature, studied by polarized SANS, and (ii) magnetic chiralities in a superconductor/ferromagnet thin film structure with temperature dependent chiral domain walls [4, 5], studied by polarized GISANS.

[1] W. T. Lee et al., Report on ESS Polarisation Workshop, ESS-3549713 (2020).
[2] https://scipp.github.io/ess/
[3] www.sasview.org
[4] A. Stellhorn et al., New Journal of Physics 22, 093001 (2020).
[5] A. Stellhorn, Ph.D. thesis, RWTH Aachen University (2021).

Poster / 157

How to Control the Proton Beam on the SINQ Target

Authors: Joerg Welte[1]; Bertrand BlauN[one]; Patrick SimonN[one]; Sven JolletN[one]

[1] *Paul Scherrer Institut*

Corresponding Author: joerg.welte@psi.ch

In 2019, we have introduced a new system that improves the safe application of the proton beam onto the SINQ target. The basic idea is that we detect the beam position directly in the target with a two-dimensional network of temperature sensors. The temperature measurement is done with type-K thermocouples directly in our Zircaloy target rods. This system is called TBPS (Target Beam Positioning System) and is installed in every new target since then. The TBPS helps to protect our target from overheating and is therefore relevant for a fast beam shut-off.
The system was used for the first time in target #14 and is, with a minor improvement, currently running successfully in target #15.
The poster will present technical details about the temperature sensors themselves, their locations and how they were installed. In addition, the algorithms are explained which are used to create the Gaussian three-dimensional temperature distribution plots as well as the way how they are visualized on the beam control monitors in real time. The analysis and visualization are done by a program in LabVIEW that creates a 3D temperature map (X, Y, T) from the temperature values of the TBPS grid. This gives the proton beam operators very useful information about the position and the width of the beam inside the target.
Additionally, the temperatures are compared with the calculated values from CFD-simulations. The calculations give a good agreement.

Safety and Operation / 158

HOW VARIETY AND SPECILISM STRENGTHENS THE ISIS ELECTRICAL & ELECTRONIC USER SUPPORT GROUP

Author: Jamie Nutter[1]

[1] *STFC*

Corresponding Author: jamie.nutter@stfc.ac.uk

J.Nutter(a), S.Payne(a), J.Chandler(a), M.Schastny(a), M.Williams(a), T.Allinson(a), G.Burgess(a), K.Allum(a) S.Cooper(a), E.Baker(a), T.Jenkins(a)

(a) ISIS Neutron and Muon Source, OX110QX, Oxfordshire, United Kingdom

This talk provides an overview of the ' ISIS Electrical & Electronic User Support Group ' (EEUSG). The Group, commonly referred to as the Electronics Group, provides essential electrical and electronics work for the ISIS Operations Division.
The Group provides critical support for a wide variety of systems across the ISIS facility including Personnel Protection Systems (PPS), Temperature control systems, Motion control systems, data acquisition, Bespoke software design, Additive Manufacturing, and rapid prototyping.
This talk highlights how encouraging staff members to learn and deploy a variety of skills enables the group to deliver complex multiskilled technical solutions.

The talk will highlight:
• An overview of the ISIS Electrical & Electronic User Support Group
• The group ' s areas of responsibility
• An evaluation of multiskilling & specialising
• Examples of technical solutions

Plenary / **159**

Status of the Second Target Station at the Spallation Neutron Source

Author: Igor Remec[1]

[1] *Oak Ridge National Laboratory*

Corresponding Author: remeci@ornl.gov

The Oak Ridge National Laboratory (ORNL) currently operates the High Flux Isotope Reactor (HFIR) and the Spallation Neutron Source (SNS), two of the world's most advanced neutron scattering research facilities. The long-planned fourth-generation neutron source, the Second Target Station (STS), obtained the United States Department of Energy Critical Decision 1 approval in November 2020 and subsequently started preliminary design. The goal of the STS project is to construct an additional target station optimized for cold neutrons which will be able to accommodate 18 to 20 neutron scattering instruments. In 2021 a committee of 22 national and international experts selected the eight instruments to be built within the scope of the STS project: PIONEER, a single-crystal diffractometer; QIKR, a kinetics reflectometer; CHESS, a cold neutron spectrometer; CENTAUR, a SANS/WANS instrument; BWAVES, a broadband spectrometer; CUPI2D, a neutron imaging instrument; EXPANSE, a wide-angle neutron spin echo instrument; and VERDI, a polarized diffractometer. The first three of those instruments are expected to deliver early science at around 2034. The STS will operate as pulsed neutron source with 700 kW of proton beam power delivered in short, less than 1 μs long pulses, with 15 Hz repetition rate. The STS will receive one out-of-four pulses from the existing linear accelerator, which is currently undergoing an upgrade that will double the capability of the accelerator to a proton beam power of 2.8 MW. The core of the STS will be a rotating water-cooled tungsten target which will feed neutrons into two coupled cryogenic moderators filled with liquid hydrogen, surrounded with water pre-moderators and a beryllium reflector. The STS will be designed to provide exceptionally bright beams of cold neutrons and will be equipped with new-generation instruments optimized for the exploration of small samples of complex materials. It will complement the capabilities of the SNS First Target Station for high-resolution measurements and the strength of HFIR in producing intense continuous neutron beams. The high neutron beam brightness will be obtained by specifically optimizing the moderators for operation with pure parahydrogen, tight coupling of target and moderators, and small size neutron beams. The cylindrical moderator, which will serve 12 beamlines, will have four rectangular extraction ports with the viewed areas of 30 mm × 30 mm size, while the novel one-dimensional "tube" moderator will have three circular viewed areas with 30 mm diameter and will serve six beamlines. This presentation will describe the status of the STS design.

Instruments / **160**

Neutron facilities and developments of single crystal neutron diffraction at ORNL

Authors: Bryan Chakoumakos[1]; Yan Wu[1]; Clarina Dela Cruz[1]; Jon Taylor[2]; Matt Tucker[1]

[1] *Oak Ridge National Laboratory*

[2] *Oak Ridge National laboratory*

Corresponding Author: wuy1@ornl.gov

There are two neutron facilities at Oak Ridge national laboratory(ORNL): High Flux Isotope Reactor(HFIR) with the world's highest continuous neutron brightness and Spallation Neutron Source(SNS) with the world's highest peak neutron brightness. Supported by the powerful neutron sources of SNS and HFIR, the diffraction instruments at ORNL have developed world leading capabilities on high resolution nuclear structure analysis, magnetic structure and spin density determinations, contrast variation (particularly D2O/H2O) for nuclear structural studies, lack of radiation damage when using crystals of biological molecules such as proteins, and the fidelity to measure nuclear and magnetic diffuse scattering with elastic discrimination. Leading by the new trends in neutron diffraction

studies, more features are continually implemented at each instrument with the developments of neutron technologies and beamlines constructions. This talk includes a facility update on the two neutron sources and a review on the single crystal neutron diffraction suite at ORNL.

Instruments / 161

The Jülich High-Brilliance Neutron Source Project

Authors: Alexander Schwab[1]; Eric Mauerhofer[1]; Holger Podlech[2]; Jingjing Li[1]; Jörg Voigt[1]; Paul Zakalek[1]; Iwan Pechenizky[1]; Johanes Baggemann[1]; Junyang Chen[1]; Klaus Lieutenant[1]; Norberto Schmidt[1]; Olaf Felden[3]; Oliver Meuserl[2]; Qi Ding[1]; Ralf Gebel[4]; Romuald Hanslik[5]; Thomas Brückel[1]; Thomas Gutberlet[1]; Ulrich Rücker[1]; Yannick Beßler[5]

[1] *Jülich Centre for Neutron Science, Forschungszentrum Jülich GmbH*

[2] *Institut für Angewandte Physik, Goethe-Universität Frankfurt*

[3] *Nuclear Phsyics Institute, Forschungszentrum Jülich GmbH*

[4] *Nuclear Phsyics Institute, Forschungszentrum Jülich GmbH, GSI Helmholtzzentrum für Schwerionenforschung GmbH,*

[5] *Central Institute for Engineering and Technology, Forschungszentrum Jülich GmbH*

Corresponding Author: p.zakalek@fz-juelich.de

Accelerator driven neutron sources provide a cost-efficient and attractive alternative to classical neutron sources like fission reactors. With the advent of high current proton accelerator systems, a novel class of such neutron facilities can be established termed High-Current Accelerator-driven Neutron Sources (HiCANS). Such sources can counteract the increasing shutdown of existing fission-based neutron sources and a decline in available neutron beam days in Europe.

The High Brilliance neutron Source project (HBS) at the Forschungszentrum Jülich develops such a HiCANS facility. It utilizes a 70 MeV and 100 mA pulsed proton linear accelerator providing tailored proton pulses with frequencies of 24 Hz and 96 Hz, respectively, to three optimized target stations. Due to the low energy nuclear reactions releasing neutrons from a high-power tantalum target, the target stations are compact in comparison to spallation neutron sources. It allows for an efficient neutron production, moderation and extraction and thus achieving competitive neutron instrument performances.

A detailed technical design report describing all relevant components ranging from accelerator, target, moderators up to the instruments was published recently. It describes a potential national neutron facility with up to 24 instruments for all kinds of applications.

We will present the current status of the High-Brilliance neutron Source (HBS) HiCANS project. In particular we will emphasize the experimental validation of our design and simulations for all components, including their interplay at the JULIC neutron platform.

Instruments: Neutron polarisation/neutron optics / 162

Development of Spherical Neutron Polarimetry devices at CSNS

Instuments: Diffraction / 163

The performance of General Purpose Powder Diffractometer at CSNS

Software / 164

TBD

Software / 165

TBD

Target and Moderator / 166

TS1 Project with-beam commissioning

Corresponding Author: stephen.gallimore@stfc.ac.uk

Instruments: SANS / 167

Tuning the Nano Structures of Micellar Aggregates

Corresponding Author: peixun.li@stfc.ac.uk

Instruments / 168

Commissioning of an Atmospheric Neutron Irradiation Spectrometer at CSNS

Corresponding Author: qzhyu@aphy.iphy.ac.cn

Instuments: Diffraction / 169

Study of interplay between structure & magnetism in novel AMO2 (A=Alkali metals; M=3d Transition Metals) advanced oxide materials exhibiting unconventional chemical & physical properties.

Corresponding Author: nzafar@ncp.edu.pk

Instruments / 170

Detectors for neutron scattering instruments at IBR-2 reactor in FLNP JINR

Corresponding Author: bodnarch@nf.jinr.ru

Target and Moderator / 171

Multi-physics instrument: Total scattering neutron diffractometer at China Spallation Neutron Source

Corresponding Author: wenyin@aphy.iphy.ac.cn

Target and Moderator / 172

Status of the Second Target Station at the Spallation Neutron Source

Corresponding Author: remeci@ornl.gov

Instruments: SANS/Reflectometry / 173

MR: the multipurpose reflectometer at Chinese Spallation Neutron Source

Instruments: HiCANS/Neutron Irridiation spectrometer / 174

ESS Bilbao. Current Status and Perspectives (Keynote)

Corresponding Author: mperez@essbilbao.org

Instruments: Neutron polarisation/neutron optics / 175

The application of the polarized neutron techniques at the China Spallation Neutron Source beamlines

Instruments: SANS / 176

Operating status and recent upgrades of SANS diffractometer at CSNS

Instruments: Neutron polarisation/neutron optics / 177

Development of polarized neutron capability at the CSNS

Corresponding Author: wangtianhao@ihep.ac.cn

Instruments: Neutron polarisation/neutron optics / 178

The operation and maintenance status of neutron chopper system for CSNS

Instruments: Neutron polarisation/neutron optics / 179

How to reduce the vibration of neutron choppers

HiCANS/Instruments: Neutron and Muon detectors / 180

The future and the present of neutron detectors for instruments at China Spallation Neutron Source

Instruments: Neutron polarisation/neutron optics / 181

Background sources in Advanced High-Pressure Neutron Scattering Experiments

Corresponding Author: zhanwen.ma@psi.ch

Target and Moderator / 182

Development of Nano-sized graphene material for neutron intensity enhancement below cold neutrons (Invited)

Corresponding Author: teshi@post.j-parc.jp

Instruments: HiCANS/Neutron Irridiation spectrometer / 183

An Instrument suite for the HBS

Corresponding Author: j.voigt@fz-juelich.de

Instruments / 184

Research on neutron/X-ray CT image denoising method based on semantic context aggregation

Corresponding Author: lijf@ihep.ac.cn

Instruments / 185

High pressure research at PSI using neutrons and muons

Accelerator / 186

Updated of accelerator in ISIS-II (Invited)

Corresponding Author: stephen.gallimore@stfc.ac.uk

Accelerator / 187

Future plan of ESS accelerator: a novel spallation neutron source with medium pulse length protons (Invited)

Target and Moderator / 188

Manufacturing of the ESS Monolith Vessel: Lower and medium Vessel, Neutron port weldings, Connection Ring and head of the vessel (Invited)

Corresponding Author: fsordo@essbilbao.org

Target and Moderator / 189

Characterizations of the tantalum cladded tungsten blocks prepared by hot isostatic pressure (HIP) diffusion welding

Corresponding Author: weish@ihep.ac.cn

Target and Moderator / 190

Physics Design and Commissioning of the Mark-IV TMRS assembly at the Lujan Center

Corresponding Author: svoboda@lanl.gov

Software / 191

The Design of a Scientific Data Management System Based on DOMAS at CSNS-II

Corresponding Author: wangli320@ihep.ac.cn

Safety Operation / 192

How Variety and Specilism Strengthens the ISIS Electrical & Electronic User Support Group

Corresponding Author: jamie.nutter@stfc.ac.uk

Instruments: HiCANS/Neutron Irridiation spectrometer / 193

The Jülich High-Brilliance Neutron Source Project

Corresponding Author: p.zakalek@fz-juelich.de

Plenary / 194

Overview of the CSNS phase-II

195

test email

Author: 俊英沈 [1]

[1] 高能所

Corresponding Author: shenjy@ihep.ac.cn

test email

Instruments: Moun instrumentation / 196

test2

Author: Li Wang[1]

[1] 高能所

Corresponding Author: wangli320@ihep.ac.cn

1111111111111111

Target and Moderator / 197

Experimental measurement of neutronic performance at neutron beam line in CSNS

Target and Moderator / 198

Thermal and experimental analysis for components of CSNS target station

Accelerator / 199

test3

Author: Junying Shen[1]

[1] *CSNS & IHEP*

Corresponding Author: shenjy@ihep.ac.cn

aaa

Target and Moderator / 200

The Operation Status and upgrade of CSNS Target Station (Keynote)

Software / 201

TBD (Invited)

Plenary / 202

Status of HEPS

Corresponding Author: dongyh@ihep.ac.cn

Safety and Operation / 203

Radiation Related Issues and Management at CSNS

Safety Operation / 204

The Operation of CSNS Cryogenic System

Target and Moderator / 205

Status of TMR at CSNS and progress of CSNS-II (Keynote)

Instruments: HiCANS/Neutron Irridiation spectrometer / 206

Commissioning of an Atmospheric Neutron Irradiation Spectrometer at CSNS

Safety and Operation / 207

Condition monitoring for Chopper Systems

Software / 208

Unveiling local magnetic correlations: the development of magnetic pair distribution function at CSNS (Invited)

Accelerator / 209

Studies on 3D spiral injection scheme for compact storage rings

Corresponding Author: rehman@ihep.ac.cn

Instruments: SANS / 210

An alternative approach to synchronize the triggering of the external sample environment with the neutron data aquisition

Plenary / 211

The reactor at Tsinghua University

Tuesday Plenary / 212

Overview talk of muon facilities

Corresponding Author: thomas.prokscha@psi.ch

Software / 213

Dysurf: A program for simulating four-dimensional dynamical structure factor for inelastic neutron scattering measurement (Invited)

Accelerator / 214

Status and upgrade of CSNS accelerator

Accelerator / 215

New scheme of the injection system for CSNS-II

Accelerator / 216

Ion sources used for neutron production developed at CSNS

Accelerator / 217

Development of Dual-harmpnic RF System For CSNS-II

Accelerator / 218

High repetition rate short pulse neutron source based on hundred milliampere continuous wave accelerator (Invited)

Target and Moderator / 219

Current status and CSNS-II progress of CSNS remote handling system

Plenary / 220

Status of Shanghai Light Source

Instruments: Neutron polarisation/neutron optics / 221

Wide-angle polarization analysis at ISIS: past, present, and future.

Authors: D. RaspinoNone; G. J. Nilsen[1]; I. SilverwoodNone; J. R. StewartNone; K. S. NemkovskiNone; M. DevonportNone; P. ManuelNone; P. J. GalsworthyNone; R. I. BewleyNone; V. Garcia-SakaiNone

[1] *STFC UKRI*

Polarization analysis increases the information that can be gained from neutron scattering experiments by enabling separation of the sample cross section and magnetisation components. This capability has previously been combined with a wide variety of neutron techniques to study phenomena ranging from the magnetisation distribution in magnetic heterostructures to complex magnetic structures in bulk magnets to coherent and incoherent dynamics in liquids. On the other hand, implementing polarization analysis can be both technically challenging and costly, particularly on instruments with broad wavelength bands and/or large solid-angle detectors. In this talk, I will discuss our approach to overcoming these challenges in the context three of three instrumentation projects at ISIS: In 2019, uniaxial polarization analysis was installed on the LET cold neutron time-of-flight spectrometer. To take full advantage of the large detector solid-angle of the instrument, 3He was chosen to analyze the polarization of the scattered beam. The polarized option on LET is now in routine operation, and has been used for quasi-elastic scattering studies of liquids, energy materials, and biological and soft matter.

Historically, the most prominent application of polarized neutrons has been the study of magnetic materials. This includes the separation of weak magnetic components from the remainder of the scattering using the so-called XYZ method. To provide these capabilities at ISIS, we are developing a polarized option for the WISH diffractomer based on a transmission-based super-mirror polarizer and wide-angle analyzer. A prototype for the latter has been built and tested on the Larmor and IMAT instruments. Looking further into the future, we aim to capitalise on the potential demonstrated by early experiments on LET by building a high-resolution and high-count-rate polarized indirect spectrometer called SHERPA. Like WISH, this will use supermirror devices for both polarization and analysis. SHERPA will provide a greater than order-of-magnitude performance increase versus LET at high resolution, and promises to extend the polarized quasi-elastic scattering to a much wider range of materials, including battery materials, catalysts, and biological systems.

Instruments: Neutron and muon sample environment/Moun technology / **222**

NeXT 2.0, the new Neutron and X-Ray Tomograph at ILL Abstract: attached

Authors: A. Fedrigo[1]; Alessandro Tengattini N[one]; E. Ruiz-Martinez[1]; L. Helfen[1]; N. Kardjilov[1]

[1] *ILL*

NeXT-Grenoble is the Neutron and x-ray tomograph born in 2015 from a collaboration between the Institut Laue-Langevin (ILL) and University Grenoble Alpes (UGA). This instrument has undergone a major upgrade to further expand the portfolio of contrast options. This is the result of a collaboration between the initial partners (UGA and ILL) plus the Helmholtz-Zentrum Berlin (HZB), also via the newly founded international mixed research unit NI-Matters. This upgrade also adds MoTo, a Monochromatic Tomograph designed with grating interferometry and polarized neutron imaging in mind.
The upgrade has improved the highest attainable spatio-temporal resolutions by increasing the maximum flux (expanding the accessible collimation ratios L/D) as well as by upgrading the range of detectors. The simultaneous x-ray imaging has also been improved to explore a broader range of geometrical configurations. An improved sample stack helps automate and expands the possibilities (in size/weight) of in-situ apparatus that can be easily installed on the instrument, as well as adding a laminography option.
A number of new contrast options have also been added: a velocity selector as well as a double crystal monochromator provide versatile energy selection. A grating interferometer allows the characterization of heterogeneities on the scale of 0.1 μm to 10 μm and above through dark-field imaging, while differential phase contrast can be employed to differentiate even modest variations in the refractive index. The new instrument also has a native integration of neutron polarization equipment in order to perform vectorial tomographies of magnetic fields.
This presentation will provide an overview of the science made at NeXT in the last years, detail the upgrade of NeXT and of MoTo and highlight new scientific venues that will be explored thanks to these new options.

Software / **224**

Dysurf: A program for simulating four-dimensional dynamical structure factor for inelastic neutron scattering measurement

Authors: Bing Wei[1]; Changpeng Lin[2]; Jiawang Hong[1]; Liu Junyan[1]; Qi Ren[1]; Yongheng Li[1]

[1] *Beijing Institute of Technology*

[2] *École Polytechnique Fédérale de Lausanne*

Inelastic neutron scattering is a powerful technology to measure the lattice dynamics of materials, which is essential to understand the thermal transport properties and other phonon-related properties. The realization of obtaining a sufficient amount of effective data within a limited time is a major demand facing the development of the current inelastic scattering technology. Here, we develop a Fortran program that can be applied to simulate the four-dimensional dynamical structure factors (Dysurf) for inelastic neutron scattering experiments. With the underlying theoretical formalisms, the detailed implementation of the program is described. Based on the second-order force constants from the first-principles method, the Dysurf code is able to effectively calculate the four-dimensional dynamical structure factors, which can be used to design and optimize the inelastic neutron scattering measurement to save the valuable beamtime, before the measurement. It can also help the users to find the improper procedure and adjust the plan during the measurement, or analyze the neutron data to reveal the underlying physical mechanism after the measurement. Four main applications of this code with the corresponding examples will be introduced here, including the two-, there- and four-dimensional dynamical structure factors, thermal diffuse scattering and slice function at the specific point in the Brillouin zone.

Software / 225

Unveiling local magnetic correlations: the development of magnetic pair distribution function at CSNS

Author: Long Yang[1]

[1] *Tongji University*

The magnetic pair distribution function (mPDF) analysis of neutron total scattering data has recently emerged as a powerful method for investigating the local magnetic correlations in materials. Similar to the atomic pair distribution function (PDF) method, the mPDF utilizes the Fourier transform of the magnetic neutron scattering cross section to obtain information about magnetic structures at the sub-nanometer length scale in real space. Without the long-range symmetry constraints, the mPDF method is promising for revealing short-range magnetic correlations, such as those in strongly correlated electron systems or geometrically frustrated magnets. Here, we introduce the development of the mPDF method at the MPI beamline of the China Spallation Neutron Source. This method will significantly enhance the neutron scattering technique for the study of magnetic materials.

Software / 226

Simulating single-crystal inelastic scattering in full phase-space

Author: Xiaoxiao CaiN[one]

To simulate inelastic neutron scattering in a single crystal, the algorithm needs to sample a high dimensional distribution. The numerical difficulties are twofold. To start with, the memory footprint of such distribution is typically challenging for mainstream computers to handle. Secondly, the energy and momentum resolutions of the sampled results may not optimised, if the distribution is not calculated with a suitable set of parameters.

In this talk, a toolchain to produce and sample the high dimensional scattering distribution is introduced. A self-adaptive integration method is used to calculate the cross section. In addition, a rejection sampling method [Cai, et. al, J. Comput, 2019] is implemented in a machine learning model. There are no tunable physical parameters in the overall process. This toolchain will also be discussed for the application of high-throughput computation.

Instruments: Neutron and muon sample environment/Moun technology / 227

ISIS muon facility status and technology development (Invited)

Corresponding Author: rhea.stewart@stfc.ac.uk

Safety and Operation / 228

Construction of post-irradiation sample preparation capabilities in CSNS hot cell and prospects for PIE research

Corresponding Author: zhaocg@ihep.ac.cn

Poster / 229

Development of Liquid Neutron Reflectometer at China Spallation Neutron Source

Author: Guang Wang[1]

[1] 高能所

Corresponding Author: wangguang@ihep.ac.cn

Interfaces are scientifically crucial as they allow symmetry breaking, leading to many novel and interesting phenomena, this is not just the case for metal magnetic systems, for example biological interfaces are crucial for life and consist of stacked layers of proteins and the surfaces of catalysts are also critical to how they function. Reflectivity is unique in its ability to probe these buried interfaces and surfaces. Compared to those techniques either lack chemical sensitivity to the sample composition or require invasive labelling, neutron reflectivity (NR) is extremely powerful to derive composition and structure information. A complementary reflectometer (the multi-purpose reflectometer (MR) with a vertical sample geometry has commissioned) with a horizontal sample geometry that will cover the largest and fastest growing scientific areas, including soft condensed matter and life sciences, has been scheduled in the phaseⅡproject of China Spallation Neutron Source.

The core scientific areas potential to be addressed include, but not limited to:
• Self-assembly systems of surfactants, polymers and proteins at solid-liquid and liquid-liquid interfaces;
• Polymer science in thin films, e.g., inter-layer movement, annealing/drying/exchange/wetting processes;
• Interfacial kinetics in e.g., plastics, polymer blends, drug delivery and implant materials, chemical and biological sensors;
• Advanced materials that undergo structural changes in response to external stimuli (chemical, mechanical, electrical or magnetic) for various applications;
• Atmospheric science that involves aerosol formation and change at air-water interface as a response to climate change;
• Surface chemistry involves changes in structure or chemical composition, e.g., catalysis, oxidation, corrosion or other surface reactions, receptor-ligand binding, drug-target interactions, surface functionalization etc.;
• Bioscience regarding almost everything that can attach to or penetrate into cell membranes.
Keywords: china spallation neutron source; liquid neutron reflectometer; scientific areas

230

The utilization of the event-recorded data acquisition with the sample environments in MLF at J-PARC

Author: Yasuhiro Inamura[1]

[1] *Japan Atomic Energy Agency*

Corresponding Author: yasuhiro.inamura@j-parc.jp

J-PARC MLF, which has the spallation neutron source, has adopted the event recording method as the standard data acquisition (DAQ) mode. This method has realized that all signals which are detections of neutrons at detectors installed in the instruments are recorded as events with a timestamp.
A typical event recorded data produced from DAQ system at MLF consists of 2 types of events. One is the detected neutron events including the detection position with the time-of-flight information, which is used to distinguish the energy, another is the kicker events of the neutron spallation with an actual time. By using these 2 types of timestamps, it is easy not only to do the variety unit conversion of measured data with the flexible binning but also to slice data in the time region required to be analyzed and visualized.
This useful feature is utilized on various measurement methods, for example, the multi-Ei method used in the inelastic scattering measurement.
In order to obtain the conditions of the sample environments devices and the instrument optical components like a beam narrower and chopper, MLF had developed and utilized the other DAQ board, named TrigNET, to input a common electric signal.
The event produced by this TrigNET consists of the electric signal status and the timestamp which has same type of timestamps as neutron detection event. By treating neutron events and signal status events on same timeline, it is possible to extract only those data that satisfy a required device conditions as a filtering function.
This 'event filtering' method can achieve the observation of the transient phenomena produced by the external field applying to the sample with higher time resolution. For example, if the sample environment equipment can be arranged so that the electric field, magnetic field, and temperature applied to the sample can be extracted in the form of electrical signals, it will be possible to extract only the neutron scattering data under the external field conditions that need to be observed.
This method has already been generalized in some instruments in MLF and is being utilized in actual experiments. Especially, this method is useful for the stroboscopic measurement, which improves statistical accuracy by repeatedly measuring the response inside the sample to external field change in a short term, for example the periodic electric field, the rapid heating and cooling, applying the ultraviolet light and so on.

Target and Moderator / 231

Design and key technology research of moderator and reflector system at CSNS-II

Poster / 232

Giant cryogenic reversible magnetostriction in rare-earth free MnCo(Ni)Si metamagnetic alloys

Authors: 晓文郝 [1]; 清勇任 [1]; 良左 [2]; 波杨 [2]; 欣童 [1]; 晓明黄 [1]

Co-author: 🄵李 [3]

[1] 散裂中子源科学中心

[2] 东北大学

[3] 中科院金属所

Corresponding Author: haoxw@ihep.ac.cn

Magnetostrictive materials, which exhibit the a mechanical strain when subject to a magnetic field, have attracted tremendous investigative interest because of their potential in constructing multi-functional devices. However, limited magnetostriction coefficient, expensive raw-materials cost, narrow working temperature range around room temperature and intrinsic irreversibility of the traditional magnetostrictive materials and ferromagnetic shape memory alloys severely restrict the usage of these materials under extreme environments. In this work, we report a giant cryogenic magnetostriction up to 10600 ppm in [100]Orth oriented MnCoNiSi alloys, exhibiting reversibility, inexpensive price, cyclic stability over a broad operation-temperature and composition range. Such a giant magnetostriction implies that the [100]Orth oriented has an enhanced magnetostrictive coefficient of × 2.25 compared with [111]Orth oriented MnCoSi alloy. In situ neutron powder diffraction measurements provide evidence that the magnetic structures have been changed after doping with Ni, generating an enhanced magnetostriction and cryogenic magnetostrictive response. Our work would inspire the study of the giant magnetostrictive effect with excellent cyclic service performance in a wide range of metamagnetic transformation materials.

Poster / 233

UB Matrix based on Single Crystal Orientation Program in Neutron Spectrometer

Author: 坚吕 [1]

[1] *CSNS*

Corresponding Author: lvjian@ihep.ac.cn

In neutron spectroscopy measurements, the orientation of single crystal samples has always been a fundamental yet still a relevant concern. Orientation refers to determining the initial orientation of a single crystal sample and calculating the sample's deviation angles, providing convenience for rotating the sample and processing data in subsequent steps. Sample positioning before conducting experiments is highly necessary because it can reduce unnecessary data processing issues, such as background subtraction and handling, while incorrect positioning could potentially lead to misleading data analysis. Furthermore, when studying certain excitations, such as phonons and magnons, their excitation directions, namely dispersion relations, must be precisely defined along specific crystallographic directions. Based on these requirements, we have referenced and developed a single crystal orientation programs using the UB matrix. By inputting lattice parameters and a predefined set of crystallographic vectors, it can assist in determining the degree of deviation of the crystal, providing information for the subsequent experimental rotations and data processing, such as with software tools like MSlice and Horace.

Poster / 234

The design of high-energy direct-geometry chopper spectrometer at CSNS

Authors: 伟罗 [1]; 俊英沈 [1]; 历斯李 [1]; 欣童 [1]; 清勇任 [1]; 雨冯 [1]

[1] *Institute of High Energy Physics*

Corresponding Author: lils@ihep.ac.cn

The High energy Direct geometry spectrometer (HD) is a direct geometry time-of-flight chopper spectrometer[1]. It will be the first inelastic neutron scattering instrument at the China Spallation Neutron Source. Currently, the spectrometer construction has been completed and under commissioning. when it opens to the user, it will fulfill the increasing beam-time demand from the user from all over the world.

With its high neutron flux and a 160◦ angular coverage of 3 m long positionsensitive 3He detectors, the spectrometer will mainly be used to probe inelastic signals of novel spin and lattice dynamics in condensed matters and functional materials. The HD spectrometer is equipped with three switchable Fermi slit packages providing monochromation for both thermal and epithermal neutrons from 10 meV to 1500 meV, as well as a high-resolution repetition-rate multiplication (RRM) mode using curved slits. A special feature as a strict single incident energy mode can be provided using the combination of specially designed disk choppers and Fermi choppers. The design of the HD spectrometer will be presented in the poster.

[1] Wei Luo, et al. Nuclear Inst. and Methods in Physics Research, A 1046 (2023) 167676.

235

High repetition rate short pulse neutron source based on hundred milliampere continuous wave accelerator

Authors: Xiaodong Zhang[1]; Liang Sheng[1]; Zhongming Wang[1]; Xiao Liu[1]; Xiufeng Weng[1]; Xinjian Tan[1]; Bo Tang[1]; Ge Ma[1]; Jingtao Xia[1]; Hongqiao Yin[1]

[1] *National Key Laboratory of Intense Pulsed Radiation Simulation and Effect (Northwest Institute of Nuclear Technology)*

Corresponding Author: zhangxd16899@163.com

Neutron technology and related neutron detection technology have become a very important technical means in the research of basic disciplines such as science, life science and astrophysics. They are widely used in many important fields, such as industry, agriculture and medicine. Since there are no free neutrons in nature, in order to explore the world effectively with neutrons, it is necessary to develop a neutron-generating device. In order to solve the problem of accurate calibration of the energy spectrum response of the neutron measurement system, the high repetition rate short pulse neutron source based on 100 mA proton accelerator will be built, which has the characteristics of high number of single pulse neutron, narrow pulse width, high repetition rate and wide energy range covering 0.1 ˜ 20 MeV range. The time-of-flight method can be used to calibrate the neutron response sensitivity of the whole energy range in one experiment, so the neutron calibration efficiency can be greatly improved. This report will introduce the technical route of the neutron source, the calculation results of the key equipment, the configuration of the device and the application prospect. The main technical indexes of the neutron source include: the maximum proton energy is 30 MeV, the number of particles in the micro-pulse beam is more than 1 × 1010/ pulse, the length of the micro-pulse beam is 1ns, the repetition frequency is 40 kHz, and the neutron yield is more than 1 × 1013 n/s. The technical parameter of the neutron source is very characteristic and has reached the international advanced level. It will provide a useful reference for us to develop an advanced neutron source based on a new technology.

Instruments: Moun/white Neutron instrumentation / 236

Back-n White Neutron Facility as a Multi-purpose Research Platform

237

Trip to Keyuan Garden and Lingnan Art Museum

Plenary / 238

Status of Hefei Light Source

Plenary / 239

Status of HEPS

Plenary / 240

Status of Shanghai Light Source

243

Refining magnetic structures using representational theory and SARAh - learning from simplicity and serendipity

Author: Andrew Wills[1]

[1] *University College London*

As we approach the centenary of Neel's models of antiferromagnetism and ferrimagnetism, it is remarkable to note that magnetism and magnetic orderings remain frontiers of research rather than turn-the-handle studies. Quantum mechanics, the framework originally used to dismiss these initial models is now seen to allow possibilities that are still being discovered. For over 60 years, the need to describe and analyse magnetic structures has involved a range of group theoretical techniques, with formalisms based on the Shubnikov groups and representation theory becoming the most common. Underlying the modern application of these is a framework of phase transitions that was proposed by authors such as Landau, Dzyaloshinski, and Dimmock.

SARAh was originally developed in 1999 [1] as to perform the calculations of representation theory and as a meta-programme (a front end) to allow the analysis of magnetic diffraction data with GSAS and FullProf directly in terms of the mixing (weighting) coefficients of the magnetic basis functions. This talk will explain some of the theoretical background behind the new software [2], web-SARAh and SARAh webRefine FP, which brings together representation theory, Shubnikov groups, order parameters groups and Landau theory, and integrates the analysis with FullProf. It will also introduce SERENDIPITY, a protocol to determine exchange interactions compatible with a given magnetic structure. The example application of SERENDIPITY to the analysis of powder inelastic neutron scattering data collected from the frustrated magnet claringbullite will be briefly explained [3].

[1] A.S. Wills, A new protocol for the determination of magnetic structures using Simulated Annealing and Representational Analysis- SARAh, Physica B: Condensed Matter 276, 680 (2000).
[2] A.S. Wills http://fermat.chem.ucl.ac.uk/spaces/willsgroup/web-software/sarah-web-representational-analysis/
[3] M. Georgopoulou, B. Fåk, D. Boldrin, J. R. Stewart, C. Ritter, E. Suard, J. Ollivier, and A. S. Wills Phys. Rev. B 107, 024416 (2023).

Instruments: Moun/white Neutron instrumentation / 244

Back-n White Neutron Facility as a Multi-purpose Research Platform

Author: Ruirui Fan[1]

[1] *CSNS*

The Back-n white neutron source at CSNS (China Spallation Neutron Source) has been in operation since 2018, and provides a beam time of about 5000 hours per year. As a multidisciplinary research platform, Back-n has its main focus on nuclear data measurements but also covers the applications in neutron irradiation effects, detector calibrations, and elemental analysis and imaging using neutron resonances. With its unique beamline using the back-streaming neutrons from a proton beam of higher than 100 kW in beam power impinging on a thick spallation target in tungsten, Back-n owns the highest neutron flux for a given flight path among white neutron sources. The other excellent properties include a wide neutron energy spectrum covering from 0.4 eV to 300 MeV and a good time resolution of a few per mille in most of the energy range. Currently available detector systems or spectrometers for nuclear data measurements are FIXM for fission cross-section measurements, C6D6 detectors and GTAF-II for neutron capture measurements, LPDA for light-particle emission measurements, NTOX for total cross-section measurements, and user-owned HPGe detectors for in-beam gamma spectrum measurements. Back-n has been providing beam times for irradiation effect studies, especially chip tests of the single-event-effects. It is also the unique facility in China to provide wide-energy range neutrons for detector calibration. A number of different methods to exploit neutron resonances for elemental analysis and imaging are also under development. In addition, Back-n is in the international collaboration on the experimental study on the time reversal violation with neutrons. This presentation will cover the above topics.