International NR Newsletter

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International Society for Neutron Radiology

(www.isnr.de)

Conference photo of the delegates at Kwa-Maritane

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Some words from the new ISNR president

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It is just two months ago since the experts from the neutron imaging community held their 9th World Conference in the Republic of South Africa. This event can be considered as something like the "General Meeting" of the neutron imaging community, taking place only within a four year period. Unfortunately, we missed this time participants from relevant countries like France, India, South Korea and from South America.

We are still impressed by the hospitality, the nature and the life style of this beautiful country – South Africa. However, we are even more impressed by the organizational talent and the well prepared meeting we were able to celebrate in a very remote place in pure nature and close to wild animals. When we remember all the events during those days in South Africa: the trainings school in the iThembaLABS, the vital conference at the Kwa Maritane Lodge, the visit at the Necsa institute and the many opportunities to discuss relevant topics – one person was in the focus all the time: Frikkie de Beer.

He enabled to hold the meeting for the first time outside the established regions of neutron imaging (USA, Japan, Europe) – and he did very well together with his team. We never expected a meeting like this with many native aspects: drumming as opening ceremony, safari tours in the early morning or after the evening session, very interesting meals and a beautiful climate (not only related to the weather conditions). This was probably the reason why almost all presentations and posters were of high standard and gave exciting reasons for many discussions.

Now, Switzerland takes over to organize the 10th World Conference in the field of neutron imaging. It will be a real challenge to enable a scientific and cultural meeting on the best standards, which will be made available in 4 years from now on. After hot desserts in South Africa, cold mountains might be the right contrast.

Despite all of the preparation of the next meetings of the ISNR society, I understand my position as its elected president in the way to try to bring closer together members and interested persons in neutron imaging in order to promote this inimitable technique in the best way and to attract more users to all facilities which are able to serve on high standard. On the other hand, there are many neutron sources (by trend the most essential component in neutron imaging) which could be used much better if some investments and simple improvements are taken. To enable the best neutron utilization of those facilities, knowledge transfer is needed. This aspect should be in the focus of ISNR, using the ISNR homepage (www.isnr.de).

There are many new options in neutron imaging available now, which were unbelievable at the time when neutron radiography conferences were initiated in 1981. Aside from the digital imaging aspect in neutron imaging we are now able to use phase contrast features, polarized neutron imaging, tomography, time dependent imaging and we come close to the performance of neutron scattering devices in some respect. It will be only a question to time if "neutron imaging" and "neutron scattering" will find their common working place and language – past enmity becomes over. We have to learn a lot from each other. Such approach might take place within the European Spallation Source project (ESS), where we can only win together. Pulsed and time-dependent neutron fields will be a real challenge in order to find out the best features and applications, also for imaging.

I like to invite you for a more intensive interaction inside ISNR in order to establish a powerful and creative community for imaging with neutrons under best possible conditions.

News from the Board

At WCNR-9 two meetings of the old board of members took place. Some of the main topics were related to the update of the logo of ISNR, a discussion on retaining the name "International Society for Neutron Radiology" and work on standardization for the determination of spatial resolution in neutron radiography initiated at the last board meeting at Kobe 2008. While decision making on the first topic was postponed to one of the next meetings, summaries on the latter two are presented in this newsletter.

After the elections on the last day of WCNR-9 the new board of members met for a short inauguration meeting. They express their gratitude to the resigning board members Marton Balasko, Jack Brenizer, John Lindsay, Roberto Rosa and Cheul-Muu Sim for their work and efforts for the ISNR. The board is now composed by the following members:

President	Eberhard Lehmann (Switzerland)
Vice-President	Ray Tsukimura (USA)
Secretary	Thomas Bücherl (Germany)
Board:	
	M. Arif (USA)
	Les G. I. Bennett (Canada)
	Frikkie de Beer (South Africa)
	Chris Franklyn (South Africa)
	Ulf Garbe (Australia)
	Zhiyu Guo (China)
	Anders Kaestner (Switzerland)
	Nikolay Kardjilov (Germany)
	Yoshiaki Kiyanagi (Japan)
	Burkhard Schillinger (Germany)
	Nobuyuki Takenaka (Japan)

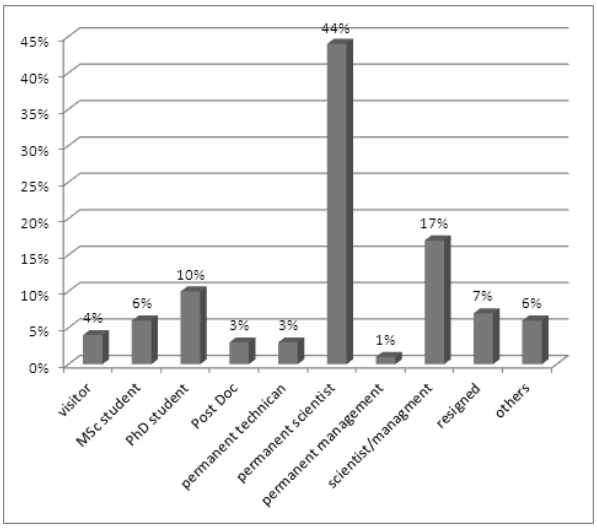
You can read the curriculum vitae of some of the board members in section "Personal" in this newsletter.

Former board members Marton Balasko, Roberto Rosa and Cheul-Muu Sim (from top to bottom)

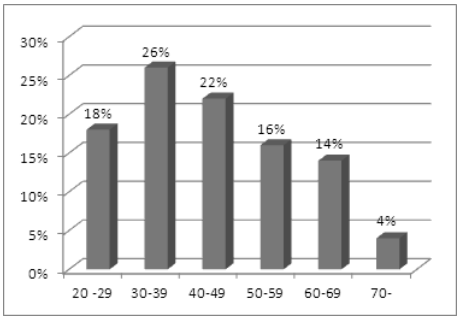
Profile of members

The knowledge on the profile of the members of ISNR is of vital interest for the board to be able to focus their (limited) resources to those activities getting the most benefit for the society. Therefore a survey amongst the participants of WCNR-9 revealed for the first time a summary of the age distribution, the education and position in their institutions and companies, respectively, as well as their professional experiences in the field of neutron radiology. Although not all members of ISNR were present at WCNR-9, the results can be regarded as being representative for the whole society.

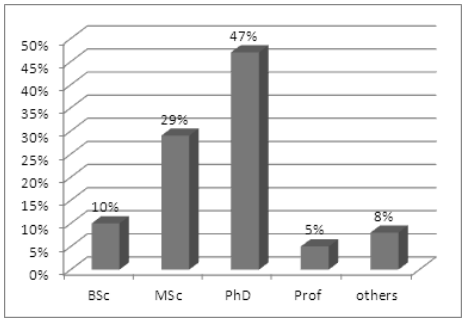
The status of the individual members shows, that nearly half of them have a permanent position as scientists, while additional 17 % scientists are involved in management, too. The lack of participating post docs (only 3 %) and students might be apportioned to restrictions in traveling budgets, wherefore only the "heads" of the facilities or instruments were able to attend the conference. Although, one of the main focuses



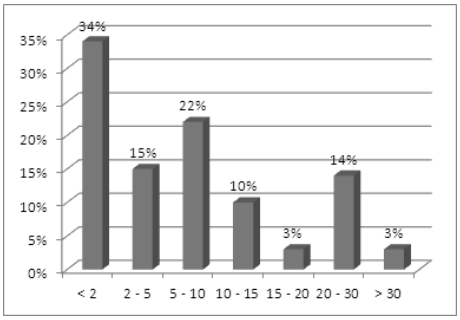
Status of the participants of WCNR-9



Age distribution of the participants of WCNR-9



Education of the participants of WCNR-9



Experience in years of the participants of WCNR-9 in the field of neutron radiology.

for the ISNR - and in special for the board of members - should be the promotion of neutron radiology to attract more MSc and PhD students. This also should include the creation of new post doc positions, where possible. Fortunately, the age distribution with its maximum between 30 and 39 years shows that aging is actually no serious problem for our society, but should be taken into account for future progress of ISNR. Most participants have either a master or a PhD degree (76 %). It is worth to notice, that the group of technicians, which indisputably contribute to the development and successful operation of a facility, are not represented adequately. Also, only 12 % of the members are female. A positive development is the sustainability of knowledge, as many participants are now working for more than 5 years in the field of neutron radiology. Thus, the loss of information due to rapid staff fluctuations is limited, at least among the members of ISNR.

Thomas Bücherl
based on the presentation given by Frikkie de Beer at WCNR-9

General

Activities in China

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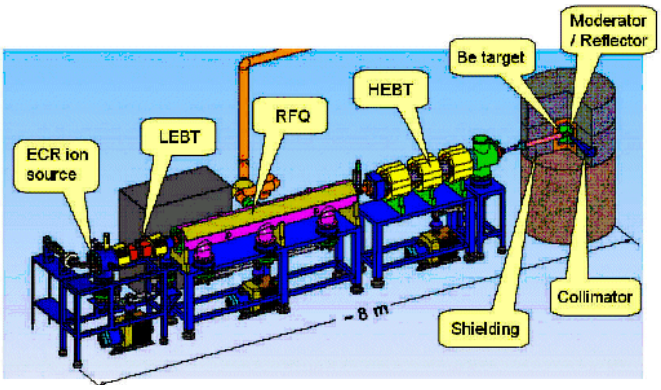
Locations of Chinese institutions carrying out the neutron imaging research

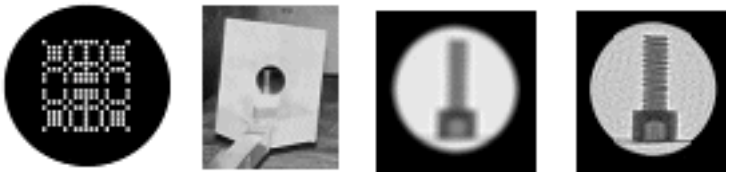
The early neutron imaging activities in China can be traced back to 1970's, when several neutron radiography facilities were installed on research reactors using film at China Institute of Atomic Energy (CIAE), China Academy of Engineering Physics (CAEP) and Tsinghua University. Some papers have been published on WCNR-2 and -3. But in 1990's the nuclear science research was declined in China and all those studies stopped due to lack of financial support. Peking University (PKU) and CAEP have carried out the neutron radiography study with CCD camera since early this century. Recently Tsinghua University and CIAE also involve the study on neutron imaging.

The project of PKUNIFTY has been launched at PKU to construct a neutron imaging facility based on a 2 MeV deuteron RFQ accelerator. The neutrons are generated by deuteron-

beryllium reaction. The expected thermal neutron flux at detector plane is $5 \cdot 10^5$ n/cm^2/s @ L/D = 50. The L/D can be adjusted from 25 to 200, and the maximum field of view is 20 cm x 20 cm. The facility size is about 8 m x 4 m. It is expected that the facility can be commissioned in 2011. The coded source neutron imaging technique has been investigated, which may be helpful to improve the image quality of PKUNIFTY. The thermal and fast neutron radiography has been studied on PKU 4.5 MV Van de Graaff since 2003. A new wavelength-shift fiber fast neutron detector is under developing. The fast neutron tomography was studied under the collaboration with Dr. Thomas Bücherl, TUM.



Layout of thermal neutron source of PKUNIFTY

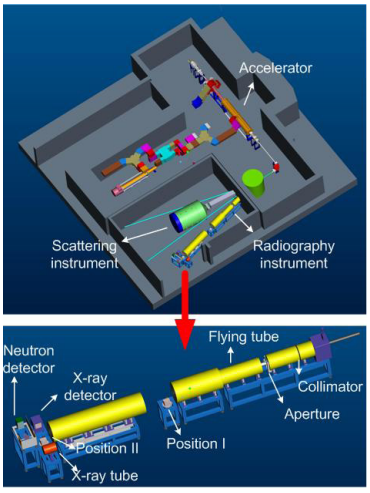


Coded source neutron imaging. From left to right: coded mask, screw sample, raw image, reconstructed image

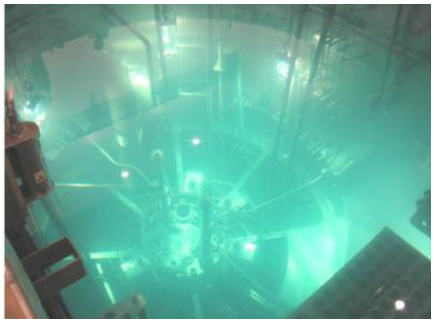
The thermal neutron radiography at CAEP started in 1970s, which was based on a Swimming Pool Research Reactor (SPRR-300). At that time the major imaging techniques were using Gd metal screen and films as well as In or Dy converter for transfer imaging. In the end of 1990's, a digital imaging facility with frame-transfer CCD was developed, and a real-time (~25 f/s) neutron radiography facility with the image intensifier and CCD camera was also set up. In 2004, an integral neutron radiography facility with cooled CCD was established, which was equipped with optical lens and ^{6}LiF converter screen. Now the thermal neutron radiography facility is being upgraded, and the fast and cold neutron radiography facilities are under construction.

Neutron radiograph of a floppy disk taken by CAEP

Since 2009 Tsinghua University has launched the Compact Pulsed Hadron Source (CPHS) Project, which will provide a medium-flux neutron source based on a 13 MeV proton RFQ/DTL accelerator. In the first 3-year phase of the construction, there are two experimental instruments for small-angle scattering and radiography/tomography with cold neutrons. The imaging instrument includes the options to adopt the coded-aperture technique and time-of-flight grating-based phase-contrast imaging. Additionally, we plan to add a modulus for measurements of neutron-induced prompt gamma-ray activation analysis (PGAA) and prompt gamma-ray 3D emission CT (PGA-ECT). Another extension is energy-dependent imaging using TOF techniques, which can be used for the imaging of the microstructure and texture in engineering materials.



Schematic layout of the neutron imaging instrument at the CPHS at Tsinghua University



Building of CARR at CIAE

The 60 MW China Advanced Research Reactor (CARR) at CIAE has reached its first criticality in May, 2010. It is a tank-in-pool type reactor using a D_2O reflector for inverse neutron trap, and the designed optimal undisturbed thermal neutron flux is $8{\cdot}10^{14}$ n/cm2/s. A thermal neutron radiography station will be placed in the reactor experiment hall. The max neutron flux at sample position is $6{\cdot}10^{8}$ n/cm^2/s, and its L/D can be 240 – 2960. A cold neutron radiography station will be installed in the guide hall. The max neutron flux at sample position is $8{\cdot}10^{7}$ n/cm^2/s, and its L/D can be 160 – 1600. The concept designs of the two facilities have been completed.

Activities in Australia

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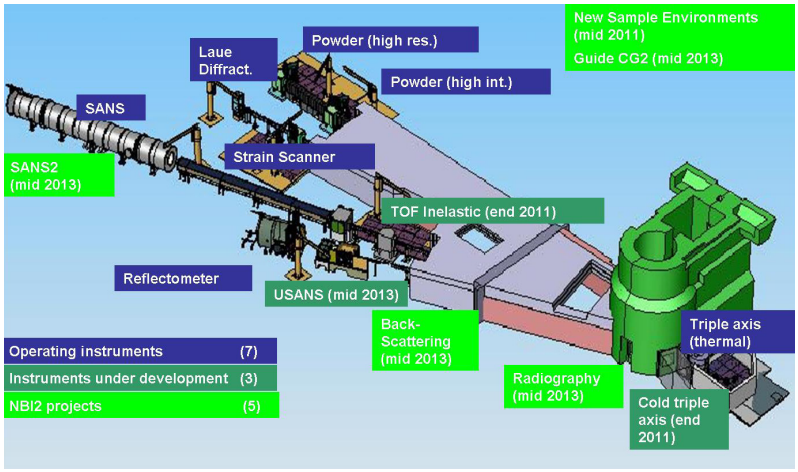
Neutron radiography tomography imaging station DINGO

A new state-of-the-art instrument will be built to support the area of neutron imaging research (neutron radiography/tomography). Neutrons are routinely used in quality control of equipment for defense, industrial, mining, space and aircraft applications, for assessing oil and water flow in sedimentary rock reservoirs (for example the North West Shelf), assessing water damage in aircraft components, the study of hydrogen storage, cracking in steel, and more.

Background

ANSTO's world-class OPAL research reactor and neutron beam instrument facility allows scientists from Australia and around the world to conduct research from which science, medicine and industry will greatly benefit. Over the next three years, the existing suite of seven operating instruments will be expanded to a total of 13 neutron beam instruments and will complimented by a new neutron guide CG2 + new sample environment equipment. The planned expansion of ANSTO's neutron science facilities is driven by the demand of the Australian scientific and industrial user community. These additional instruments will enable Australian scientists to undertake research in areas such as material behavior and biological studies which are at the leading edge of international science.



Overview of the instrument developments

As is detailed below, the Neutron Beam Expansion Program (NBI2 Program) encompasses design, construction and commissioning of a further three instruments for the OPAL reactor

i) a second small-angle neutron scattering instrument (SANS2)
ii) a backscattering spectrometer
iii) a neutron imaging station
iv) an associated new split cold guide on beam port CG2 and
v) new pressure, temperature and magnetic field sample environments

In addition to the instruments currently under development by ANSTO, funding for the NBI2 was granted by the initiative by the Department for Innovation, Industry, Science and Research on 12 May 2009. The budget for the expansion is AU$37 million and it is scheduled to be completed within four years (1 July 2009 – 30 June 2013).

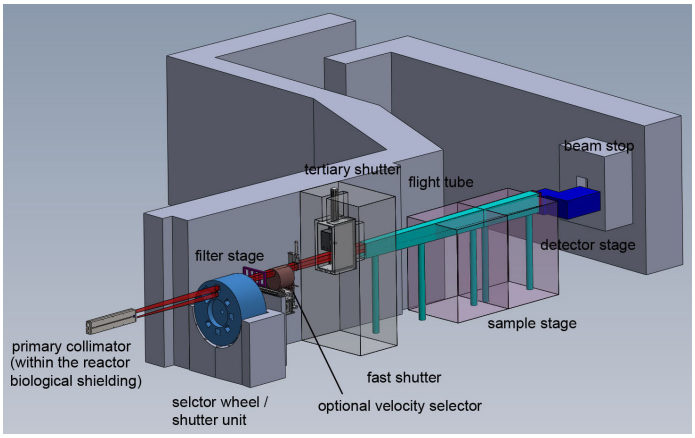
As a part of the expansion program a new neutron radiography tomography imaging station will significantly enhance the research capabilities of the Australian neutron science facilities at ANSTO.

Conceptual Layout of the Radiography / Tomography Instrument

The L/D ratio as a performance indicator depends on the overall length of the instrument, which is restricted by the shielding of other instrument areas and / or operational requirements. In order to gain additional instrument length within the given infrastructure, a fixed collimation system upstream of the main shutter will provide approximately 2 meters of extra instrument length, which leads to better resolution and larger beam size depending on the L/D ratio. The suggested collimator will cover two different apertures. The collimator is made of a steel body with optional borated aluminum at the front of the collimator.

The two upstream collimated beams will pass the main shutter and hit another secondary collimator. This collimator is part of the selector wheel shutter / unit and will accept one beam only. The remaining beam is blocked by the collimator material which should be again a layered structure of borated aluminum and steel to reduce background radiation at the sample position.

With a selectable L/D from 250 and 1000 (high resolution configuration) defined by the in-pile collimator, the most common configurations for high intense and high resolution neutron imaging are covered. In order to realize special configurations the selector wheel will provide inserts with optional apertures.



Instrument configurations for a high resolution measurement

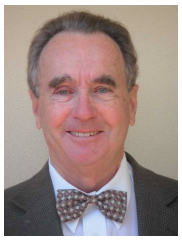
The beam separation, directly in front of the reactor shielding offers enough space between the two beams ensuring overlapping doesn't play a role in this setup. The in-pile collimator will lead to high quality images with lower background radiation, due to the fact that the main source of background radiation is inside the reactor within the reactor shielding. A high resolution option can be realized with a fine pinhole (< 1 mm) placed in the selector wheel. The reduced length between aperture and detector will result in a smaller beam size, which is acceptable due to the fact that samples analyzed with high resolution (10-20 µm) are often smaller. A 200 mm x 200 mm image with 10µm resolution needs at least a 400 megapixel camera.

The instrument will cover a large area of scientific research from engineering applications, biology and environmental science, geology and medical science as well industrial application which are key areas for future technology and industrial developments in Australia.

DINGO Team: *U. Garbe*
T. Randall
C. Li
C. Hughes

The designation "Radiology"

From time to time discussions are starting whether the designation "Radiology" in "International Society for Neutron Radiology" is correctly expressing our intentions or should be replaced by "Imaging" or some other designation. John Barton, one of the main initiators of ISNR, is giving a short summary on his motives for selecting the designation "Radiology".



Dr. John Barton
(Honorary member of ISNR)
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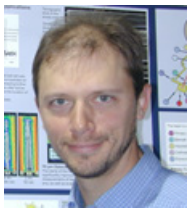
When drafting "the Constitution" I deliberately used the word "Radiology" rather than "Radiography" as it generally carries a broader meaning including all aspects of penetrating radiation science including Imaging, Gauging, Backscatter etc. My experience with the field was that from 1968, soon after arriving in USA from France/UK. I was Chairman of the "Penetrating Radiation Committee of the American Society for Non-Destructive Testing". The committee covered all aspects of X-Ray and Neutron Ray techniques whether quantitative or pictorial. Likewise I was an active member of the American Society for Testing and Materials (ASTM). It were groups within these societies that tried to find consensus and proposed the word Radiology should be used as broader than Radiography including so called real time radiography (radioscopy etc.).
In brief, while there are always different opinions on the usage of words, I think the word "Radiology" includes "Imaging" and many other aspects in the uses of neutrons for inspection and testing.

To my opinion, these arguments still hold nowadays. But as we are a democratic society, what is your personal opinion on the name "International Society for Neutron Radiology"? Is there a need for change? Please mail your comments to **in1@isnr.de**.
Thomas Bücherl

News from the Labs

High resolution neutron imaging of fuel cells



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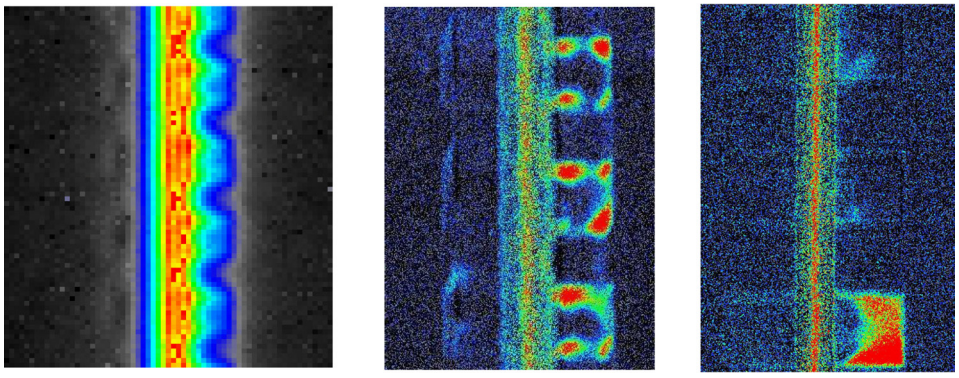
Efficient water management in proton exchange membrane fuel cells (PEMFCs) remains a critical issue for this technology to gain wide adoption for automotive applications. While early neutron imaging studies provided valuable insight into gas flow-field design and the impacts of general operating conditions, further development of PEMFCs rests on understanding the fundamental mechanisms involved in the through-plane water transport - that is from the anode to the cathode. The challenge for neutron imaging is that to address these issues very high spatial resolution is required, as the gas diffusion media (GDM) are of order 250 µm, the catalyst layers are of order 10 µm, and the membrane is of

Effect of Spatial Resolution on Fuel Cell Imaging



Scintillator 250 µm | MCP 25 µm | MCP 13 µm

order 20 µm; thus to resolve the water distribution in the catalyst and membrane requires image spatial resolution significantly less than 10 µm.

At the NIST neutron imaging facility, an initial improvement in the spatial resolution down to 13 µm (with a field of view of 40 mm in diameter) has enabled several fundamental studies of the water transport in GDM and thick membranes. The evolution of the detector spatial resolution at NIST is show in the figure below, where the through-plane water content of a PEMFC was measured using three different detector technologies. The experiments that have made use of this new detector have focused on the effects of thermal gradients on the water transport in the GDM, exploring the effects of water surface energies and the porosity distribution. As well, an exhaustive study of the in situ water sorption as a function of water activity has been performed, confirming the existence of Shroeders paradox and investigating the effects of membrane compression.
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Neutron Tomography of Hydrogen Storage Bed

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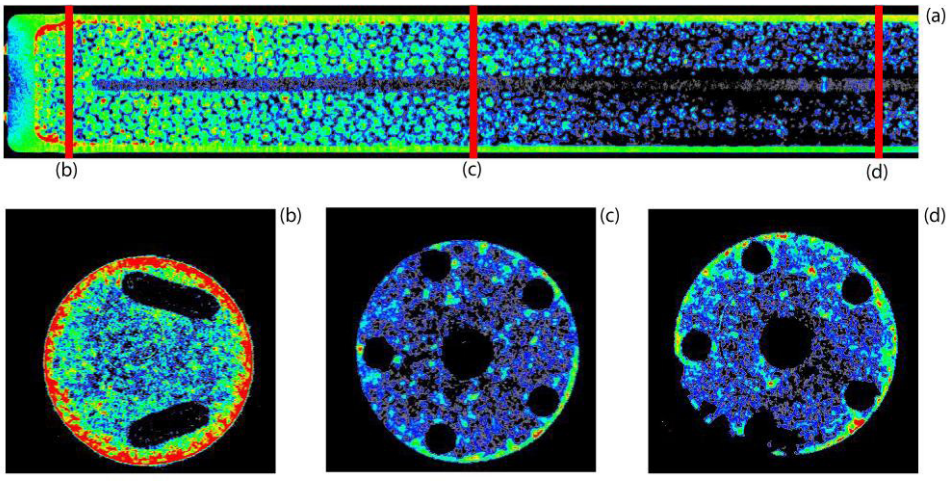
Future hydrogen fuel cell vehicles will require hydrogen storage vessels that efficiently store and quickly release the hydrogen fuel. The hydrogen uptake in most storage materials strongly depends on the thermal environment, thus optimizing the fuel tank will require understanding the coupled heat and mass transport system. While many techniques exist to measure the volume average of the hydrogen uptake, only neutron imaging can measure the full three-dimensional hydrogen distribution within the storage vessel. In order to demonstrate this ability, a prototype hydrogen storage bed has been studied using neutron tomography and radiography.

The prototype metal hydride bed consisted of a ≈90 % porous aluminum foam filled with $LaNi_{4.78}Sn_{0.22}$ powder. The foam provided structural integrity and enhanced the thermal conductivity of the system. A heater rod with four turns ran the length of the bed and was in contact with the aluminum foam to heat the metal hydride during hydrogen desorption. Hydrogen gas was introduced into and removed from the bed via a hollow stainless steel filter tube in the center. One aspect of this study involved acquiring two tomograms of the hydrogen storage bed: the first was after the bed was heated to 100 °C and evacuated to a pressure below 10^{-6} mbar; the second was after the bed was charged with about 12 standard liters of hydrogen. The Figure shows slices through the 3-D image of a hydrogen storage bed after the addition of 12 standard liters of H_2. Red indicates higher con-



(a) Slice along the length of the storage bed, (b)-(d) axial slices from the locations denoted in (a).

centration of hydrogen, black the absence of hydrogen. (a) Slice along the length of the storage bed, (b)-(d) axial slices from the locations denoted in (a). Hydrogen absorption is an exothermic process, and the hydrogen uptake decreases with increasing temperature. This is why hydrogen is seen to preferentially absorb along the outer circumference in (a), and accumulate towards the end of the storage bed. This is a result of the absorption of hydrogen by $LaNi_{4.78}Sn$ being exothermic coupled with reduced hydrogen uptake at higher temperatures. From neutron imaging an accurate picture of the hydrogen distribution in a storage bed can be obtained and compared with models of heat and mass transfer in order to optimize the storage and transport of hydrogen in the bed.

Standardization

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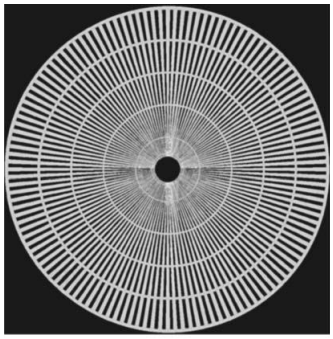
The problem of standardization in neutron imaging has two aspects – standardization of components and facilities and standardization of experimental procedures. The first approach is used for a comparison of facility parameters such as beam quality, spatial and temporal resolution. The standardization of experimental methods (transmission radiography and tomography, phase-contrast and energy-selective imaging) is needed when the methods are provided to external users (e.g. industrial customers) where problems like safety reliability and insurance, life time guarantee and safety inspection are addressed.

The presently available standardization techniques in neutron imaging are historically related to film-based methods where standards for measuring of beam quality and spatial resolution have been developed and optimized for film based detectors. They were initiated and certified in the 90's of last century in USA as ASTM rules and applied in several labs that time.

The development of digital detectors with better signal-to-noise characteristics and faster read-out electronics and the increase of the performance of computation systems in the last 10 years resulted in an almost fully replacement of the analog (film based) detectors by digital (mostly CCD camera based) systems. This development influenced not only the quality of the experiments but changed the concept of neutron imaging. The digital imaging allows for short exposure times, data quantification, tomography applications, developing of new methods like phase contrast grating interferometry and time-of-flight imaging. Time dependent investigations became possible for very short shots using a triggering approach for repetitive processes. As a consequence the neutron imaging beam lines were involved in the user operation of the large scale facilities (research reactors and spallation sources) on the equal level compared to scattering facilities and gained high importance in the neutron research community.

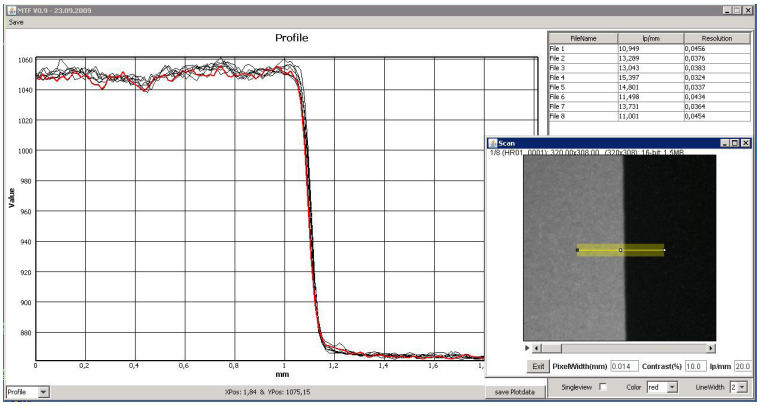


Test pattern (Siemens star) used for qualitative estimation of spatial resolution in neutron imaging experiments [1]

The lack of new standardization procedures for the digital based neutron imaging might be a real drawback in the estimation of the facility performances and in the comparison of results obtained at different beam lines. Sometime industrial customers and external users were confused by obtaining different results for experiments performed under the "same" conditions. This shows that the discussion about the standardization should be started in the neutron imaging community and new standard tools and procedures needs to be developed.

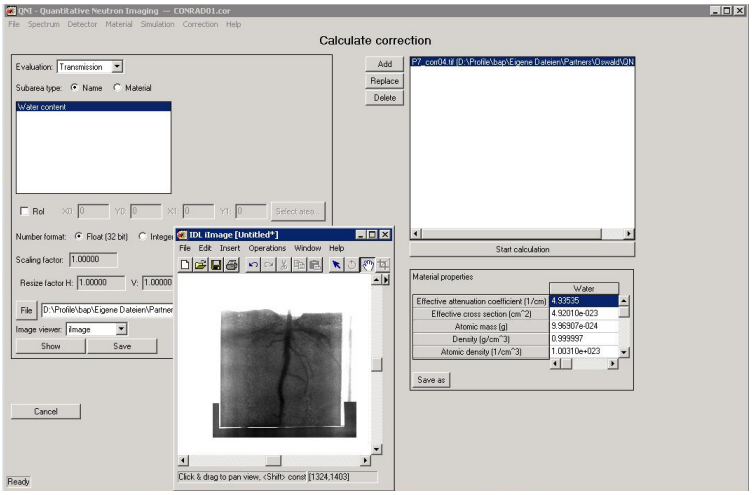
However, the first steps in this direction have been already done. Concerning the measurement of the spatial resolution of digital based detector systems a test pattern (Siemens star) was developed from the imaging group at PSI [1]. This pattern can be used for qualitative estimation of the resolution. A quantitative procedure based on measurement of the edge-spread function and consequent calculation of MTF (modulation transfer function) is under development at HZB in collaboration with PSI,

NIST and TU München. A plug-in for the freeware software ImageJ for the calculation of the MTF from a measurement of an absorbing edge was developed. A test version of the plug-in will be available for download on the ISNR web site begin of 2011.



Screen shot of the ImageJ plug-in used for a calculation of MTF function from measurements of absorbing edge at different lens setups. The plug-in can be used for focusing of optical components as well.

For a quantification of water content in porous materials a correction software tool named QNI [2] was developed at PSI which corrects the contribution of scattered neutrons. The software has been used successfully for water quantification in soil samples (University of Potsdam, ETH Zurich, PSI and HZB) as well as for quantification of water dynamics in fuel cell components.



Screen shot of the QNI software used for correction of the contribution of scattered neutrons in samples containing water (e.g. soil sample).neutron imaging experiments [1].

Concerning the evaluation and standardization of facility parameters an initiative from IAEA is started in order to classify the existing imaging facilities at the research reactors word wide. E. Lehmann from PSI was involved in this procedure to provide his expert opinion. His suggestion for a preliminary questionnaire is given below.

Necsa in South Africa is willing to contribute very actively to the field of standardization in neutron imaging where the PhD student Mabuti Jacob Radebe will work on this subject under the supervision of Frikkie de Beer. The neutron imaging community appreciates this initiative and will support the work of Mr. Radebe by providing expert help and access to the existing beam lines.

	A	B	C	D
1	**Comparison of Facilities for Neutron Imaging**			
2				
3	***1. General Information***			
4				
5	Country			
6	Place, Region			
7	Insitution			
8	Type of neutron source			
9	Source power [MW]			
10	Source intensity [n/s]			
11				
12	***2. Beam qualification***			
13				
14	beam line alignment			
15	neutron spectrum (qualitative)			
16	neutron spectrum (mean energy)			
17	maximal beam intensity at sample position			
18	polarisation			
19				
20	***3. Beam line layout***	*can be a multidimensional matrix*		
21				
22	aperture (s)			
23	aperture - detector distance			
24	resulting L/D			
25	effective beam size			
26	corresponding intensity			
27				
28	***4. Detectors for neutron imaging***			
29				
30	specifications in detail			
31				
32	*can be made as selection tool*			
33				
34				
35	***5. Advanced neutron imaging features***			
36				
37	tomography			
38	time sequences			
39	grating interferometry			
40	energy selection			
41	polarizers			
42				
43				
44	***6. involved manpower***			
45				
46	scientists			
47	students			
48	engineers			
49	technicians			

Suggested questionnaire by E. Lehmann for classification of neutron imaging facilities.

In order to make the discussion about the standardization in neutron imaging more efficient dedicated workshops and meeting should be organized by the community in the near future.

Standardization and certification of procedures are important for the acceptance and professional application of digital neutron imaging methods. Due to the limited manpower capacity spent until now for this aspect of our work this process is just in its initial phase. Several proposals and approaches are already available now (as shown above), but its practical test and the formal acceptance by the community is still pending. All ISNR members are invited for comments and improvements, including tests at their facilities.

References

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[2] R. Hassanein, F. de Beer, N. Kardjilov, and E. Lehmann, "Scattering correction algorithm for neutron radiography and tomography tested at facilities with different beam characteristics," Physica B 385-86, 1194-1196 (2006).

Review of past events

WCNR-9 - BIG 5 ON NEUTRON RADIOGRAPHY

Mr Frikkie de Beer
Pres ISNR (2006 - 2010)
Necsa
South Africa
frikkie.debeer@necsa.co.za

The technical activities of the ISNR during the time 1st – 8th October in South Africa evolved around hosting a School: "Imaging with radiation" (1st & 2nd October) at iThembaLABS (Gauteng) in Johannesburg as well as the WCNR-9 (3rd -8th October) held in the African Bush and at Kwa-Maritane Bush Lodge within the Pilansberg National Nature reserve in the North West province. It was a great pleasure to be the host for 50 trainees for the School and 90 delegates to the WCNR-9 activities of whom several delegates were experienced the African continent and/or South Africa for the first time in good weather and bright sunlight – what a memorable time it was where the African spirit could be experienced in song and dance and entertainment while serious discussions during the 4 and a half day around neutron radiography and related scientific activities took place in a comfortable and relaxed atmosphere.

To those who did not have the opportunity to be at Kwa-Maritane (e.g. participants from Algeria, France, India, South Korea or South America) – you have missed a lifetime memorable experience and to those who could attend – please come back, despite the many hours of flight and enjoy again the friendliness of the African people and South Africa, our wonderful country once more.

A view of the venue hall at Kwa-Maritane during the oral sessions of WCNR-9.

The theme of the African leg in the series of world conferences on neutron radiography "The Big-5 on Neutron radiography" is synonymous to the most sought animals to be known and to be seen in the wild, known better as the BIG-5 e.g. lion, leopard, elephant, buffalo and rhinoceros. Without those animals the African bush , the animal kingdom will cease to exists – so for the basic and key components of the neutron radiography technique without which no radiograph can be obtained (e.g. neutron sources, - beams, - methods, - applications and – detectors) the technique ceases to produce results. All the 64 oral and 30 poster presentations were categorized into those 5 themes within the scientific program which consisted out of 14 sessions spread over the 4 days and presented by delegates from 19 countries.

Prof. Petro Terblanche (General Manager of R&D division Necsa)

On Monday, 4th October 2010, the WCNR-9 was officially opened by Prof. Petro Terblanche, General Manager of the R&D division of Necsa. Mr. Frikkie de Beer, president of the ISNR and chairman of the local organization committee WCNR-9 welcomed all the participants and wished a fruitful conference.

Mr. Frikkie de Beer (President ISNR)

From the beginning of the conference and continued throughout, all the presentations of the participants were of high standard and quality. Within the comfortable air cooled hall of the conference center all participants engaged deeply into the science and technology of all aspects of neutron radiography and related sciences. A couple of new upcoming reactor based facilities were presented (Morocco and Australia), while emphasis was given on the neutron imaging facilities at new spallation sources (ESS and JPARC).

The importance of cold neutron beams and their scientific analytical value in neutron imaging were enhanced by a number of 9 oral/poster presentations in total – especially in polarized neutron studies of magnets. Applications of neutron imaging presented ranged from paleontology, archeology, aircraft structures, porous media, fuel cell technology to high resolution imaging to name a few.

Detectors for neutron imaging, which through the years the major drawback of the technology to limit the spatial resolution to 100 micro-meters, came under the spotlight with a few new presentations in the range of fast neutron imaging. A presentation about new re-usable shielding materials, being developed at FRM-II drew the attention because of its high performance - minimizing weight due to its high neutron and gamma shielding

capabilities. Several key note speakers started a series of sessions on key topics related to neutron imaging.

Two software application IT packages, Octopus and Volume Graphics were presented due to the high utilization of the software in the neutron imaging fraternity. As main key note speaker, Prof. H. Kobayashi proudly presented, also as honorable member of the ISNR, a summary of his lifelong contribution to the science of neutron imaging. Aspects, technology and applications of the whole range of neutron energies (cold, thermal and fast) were presented while advanced topics such as phase contrast imaging and mono-energetic neutron beams completed the scope of oral and poster activities.

Delegates to WCNR listen carefully

A couple of new countries were represented for the first time at a world conference – they are Morocco, China and New Zealand while South Africa with 18 scientists, as host country, has the most participants attending.

All the delegates to the conference could nominate and vote for the new ISNR board that was announced at the end of the conference. Eberhard Lehmann was elected as President of the Society for the term 2010 – 2014 and to be the host of the WCNR-10 in Switzerland in 2014. The elected members of the new board are being mentioned elsewhere in this newsletter.

The scientific program closed with a scientific visit to the nuclear facilities of Necsa on Friday, 8th October. Delegates had the opportunity to visit the gallery of the SAFARI-1 nuclear research reactor, obtaining information about the reactor as well as on the more commercial activities (medical isotope production and SAFARI-1 role in the global nuclear medicine industry). The South African neutron Radiography facility (SANRAD) on the beam port floor was the key attraction in the short tour – the plans for the new SANRAD facility at SAFARI-1 will be described in the next NR newsletter. The PLABS laboratory, a neutron acceleration facility consisting out of 2 x RFQ accelerators for fast neutron science, formed part of the tour and a visit to the laboratories for X-ray imaging completed the tour to Necsa and the end of the program of the WCNR-9.

A number of 70 papers were submitted for peer review and for publication as special edition of the proceedings of the WCNR-9 in the international journal of Nuclear Instruments and Methods-A.

SCHOOL "IMAGING WITH RADIATION": 1st – 2nd October 2010

The aim of the school, being presented prior to the WCNR-9, was to expose South African- and visiting young scientists, lecturers and post graduate students in South Africa and Africa to the basic principles of radiography, provide training and capacity building, to assist with the creation of an expert knowledge base for the South African R&D community and to promote the use of the technology in general. The success, in hosting the school, were measured in the consistent attendance of 50 participants on both 2 days and feedback on the valuable knowledge gained by several South African researchers from all the invited international lecturers who presented over the 2 day period.

Jelle Vlassenbroeck from InCT during his lecture at the School

On day-1 of the school, the basic knowledge and the principles around X-ray- and neutron radiography were presented by Nikolay Kardjilov, Jelle Vlassenbroeck, Burkhard Schillinger, Eberhard Lehmann and Anders Kaestner.

Day-2 was dedicated to the special software normally being utilized by many neutron- and X-ray facilities, Octopus, for reconstruction of projections into virtual volumes and VGStudio for the visualization in 3D data of the sample. Jelle Vlassenbroeck from InCT (Ghent, Belgium) and Daniela Handl from Volume Graphics (Heidelberg, Germany), respectively, presented these topics

and many practical handling and utilization problems were addressed and solved.

An excursion to the "World of Beer" within Johannesburg city center and a traditional Braai were on the menu as social events which were thoroughly enjoyed.

International delegates enjoy a drink during the tour to the "World of beer"

Social program of WCNR-9

No conference can be a success without the particular social program which complements the scientific one. In the case of the WCNR-9, the social program reflected the true African nature and offered a showcase of the African culture and activities.

The welcome cocktail on Sunday evening with the traditional hand washing and face painting ceremony started the event in the right mood. Frikkie de Beer, Chairman of the LOC of WCNR-9, welcomed the delegates back to Africa with remark: "Welcome Home" as it is believed that mankind originated from Africa. Soft violin and cello background music (Joalet and Elisna de Beer) created an atmosphere together with colorful lights and open fires under the Southern sky for old friends to meet again in a true African environment and setting.

John Rogers's (UK) turn for face painting while the Canadians, Les Bennet and Bill Lewis and their wife's watch.

The program of WCNR-9 started with a drumming session during the opening ceremony event on Monday morning where all participants joined in into the rhythm and beat of the African drum and Zulu culture. The evening social programs entailed a star gazing event with the Southern sky under discussion through several game rangers from Kwa-Maritane showing the Southern Cross and other important sky features.

The highlight of the evening social program was a late afternoon/evening game drive which ended in a Boma where the dinner (Braaivleis, sosaties, boerewors, pap, etc.) was being prepared and the delegates entertained by a group of African tribal dancers while some delegates took the change to join in the dance and festivities. A Marimba band entertained the delegates until deep into the night and it was a pity to say goodbye to the friendly African entertainers.

Delegates participating in the drumming session

The gala dinner was a highlight in itself as the conference venue was completely changed in to a dining hall, carefully decorated. A brass band with an African lady entertained the delegates during the evening with song and music. The highlight of the evening was the first official announcement of elected honorable members of the ISNR (Barton, Berger and Kobayashi) and the personal presentation of a cer-

Marimba band entertain delegates at Boma braai

Delegates enjoying the evening at the Boma braai

Frikkie de Beer presented a certificate to the Honorable member Prof. Kobayashi (Japan)

M. Arif received the certificate on behalf of Honorable member Harold Berger (USA)

John Rogers (UK) received the certificate on behalf of Honorable member John Barton (USA)

tificate to Prof. Kobayashi – the only one who could attend the conference. The honorable membership was bestowed upon these gentlemen for their life long contribution in the science and technology of neutron radiography.

A visit to Africa and being on a game drive completes the full picture. The delegates could, on a couple of days experience an early morning or late evening game drive, called safari, within the Pilansberg nature reserve and could be able to spot, and in some cases meet, during the course of the conference, 3 of the "big-5", Lion, Elephant and rhinoceros as well as many smaller antelopes and predators within their natural habitat.

A successful accompanied persons program was also launched and organized by Chevaune de Beer. It entailed a visit to Palace of the Lost City in the Sun City complex, a typical South African town Rustenburg as well as the crocodile- and butterfly world. Thank you for your assistance.

A word of thanks to the sponsors: Both events were sponsored by Necsa, the IAEA, Volume Graphics, the National Research fund (NRF) and South African Institute of Non-destructive Testing (SAINT).

The LOC would like to thank all delegates who participated in the WCNR-9 events and contributed to its success - we all to meet again in Canada for the ITNMR-7 in 2012.

For me personally, to be in a position to organize the event was a once in a life time experience and an honor to be the chairman and host to the WCNR-9 successfully. It was an honor to work together as President with colleagues within the board of the ISNR who made it an easy task for me to chair. Together we could make good progress in the organization and structure of the ISNR (introduction of honorable membership, utilization of the ISNR website, publishing of the NR newsletter on a frequent basis, etc.). A word of special thanks to Thomas Bücherl (Secretary) and Eberhard Lehmann (former vice President).

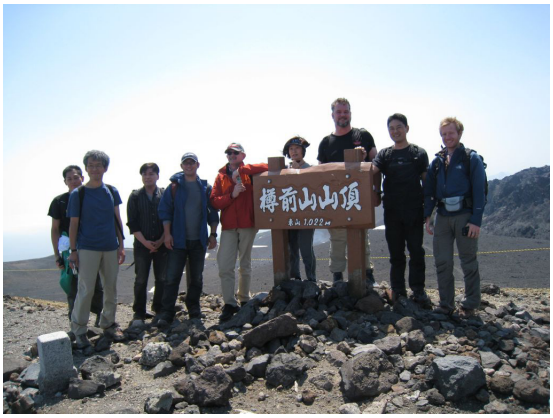
My wish is that all the participants could take something back from Africa to remember and to cherish and left South Africa with the idea to visit "HOME" again in the future.

Frikkie de Beer
Past President (2006 – 2010): ISNR
Chairman: LOC of WCNR-9

NEUWAVE-3

The Workshop for Energy depended Neutron Imaging studies was held in Sapporo, Japan, during June 6th and 9th, 2010.

Scientists from 6 major countries, specialized in neutron imaging, met in Sapporo, Japan, between June 6th and 9th 2010, to discuss the progress and future development in the very promising field of neutron energy selective imaging. This aspect in neutron research gained more relevance in the past years with the inauguration of new neutron sources, which are spallation based and provide pulsed neutron beam lines. A suitable energy selection can be obtained by the time-of-flight measurement techniques. The neutron imaging aspect at these sources was one of the main issues of the NEUWAVE-3 meeting. For the moment, there are facilities started running in USA (SNS), Japan (J-PARC) and UK (ISIS-TS2) which are top in their performance in respect to pulse peak power with the potential of further improvement and upgrade. Europe has decided about its spallation neutron source project ESS, allocated to be installed in Lund (Sweden).



Traditionally, the Workshop was started with a hiking tour (walking discussion) – this time onto the top of the volcano

Among the potential users of these sources the neutron imaging community plays still a minor role. However, there are indications for important new options in neutron research when imaging capabilities will be introduced and used properly. A direct link to neutron scattering techniques and its information becomes clearly visible. So, phase bases techniques, as well as the use of polarized neutrons become more and more important for both neutron scattering and imaging due to complementary information about the physical system (sample). The development of new detector systems enriches the field of neutron scattering in a same manner.

This approach was one major aspect during NEUWAVE-3, which was triggered by the decision at ISIS to build the IMAT facility at target station 2 and to prepare the beam port 22 at J-PARC for a dedicated neutron imaging installation. In USA, there is the VENUS project in its preparative phase and looks for funding after its approval by the scientific council at SNS in 2009.

The "beer on top" was celebrated by some of the participants after the two hours walk

The series of NEUWAVE meetings was initialized at the Technische Universität München two years ago in order to invite prominent representatives of the neutron imaging community dealing with advanced methods at their facilities to exchange their knowledge and experience in a relaxed manner and open-minded atmosphere. Therefore, the days of topical presentations were surpassed by an introductory walk to a mountain on the Sunday in advance to the scientific event. This physical activity has enabled to familiarize between all participants in an easy manner.

The second meeting (NEUWAVE-2) was held in 2009 near to ISIS in Abingdon (UK) and focused more onto the pulsed beam option for neutron imaging than before. It was clarified that the study of textures, strain and phase effects might bridge between neutron scattering and imaging in a best possible way by the future installations at pulsed sources.

During NEUWAVE-3, hosted by the Hokkaido University, Sapporo, Japan, a broad range of topics was discussed within the 30 oral presentations during the three days of scientific interaction. First of all, the experiences about the options in the energy selective mode were reported in respect to the visualization of stress-strain performance, crystalline grain size distribution and Bragg edge contrast enhancement. Secondly, the approach towards new detection system for time-dependent studies keeping the spatial resolution high was discussed and some new concepts were described with first obtained results. Here, the Japanese contribution was the most important one, which is based on the usage of the test beam line NOBORU (BL10) at the J-PARC facility. The third topic was the beam line layout and a comparison was made between the proposed projects at the above mentioned facilities.

From the application point of view and not less important was the discussion of running new features in neutron imaging: usage of polarized neutrons for the study of magnetic phenomena and phase contrast phenomena for enhancing the contrast near edges within non-visible structures. These contributions indicated that both the scientific and the applied usage of the future beam lines at the new sources have to be taken into account adequately.

The meeting in Sapporo took profit from the excellent preparation by the team around Prof. Y. Kyjanagy (Sapporo University), the exited interaction between the participants and the challenge for new scientific options with the methods in energy selective neutron imaging. It was started with a similar mountain walk than near Munich two years before, but now onto the top of the volcano Mt. Tarumae. The visit of the accelerator installation at the Hokkaido University for neutron research convinced the participants about the competence of the Japanese scientists dealing with specific preparative studies for the J-PARC facilities.

The workshop presentations will be made available on the home page of the Hokkaido University in the next few weeks.

All participants agreed to continue this kind of meetings in a tight sequence of one year in order to keep valid the access to the new neutron sources in the most pragmatic and best possible scientific way. It was decided to hand over the responsibility for NEUWAVE-4 to USA, probably to be held in Tennessee next to the SNS facility.

Eberhard Lehmann

A hard discussion was about the beam direction of the new imaging facility at JPARC among the Japanese participants...

… whereas other participants enjoyed better meals and drinks

News on persons

Awards

Dr. Daniel Hussey has been awarded the President's Early Career Award for Scientists and Engineers (PECASE). This award recognizes and honors outstanding scientists and engineers at the outset of their independent research careers. This is the highest federal award given to a young scientist in the United States. Dr. Hussey received this award in part due to his research work in neutron imaging. Dr. Hussey received his award from President Obama in a White House ceremony on December 13, 2010.

Dan Hussey during the welcome cocktail at WCNR-9

Information on the board members

Eberhard Lehmann (Switzerland)

Eberhard Helmar Lehmann, born 1952 in Leipzig, made his first scientific steps at the university of his home town by his Diploma degree in Physics about molecular dynamic simulations of proteins. He moved in 1974 to the nuclear research center in Rossendorf near Dresden where he dealt with the physics and technology of fast breeder reactors. His PhD work was about cross-section data of structural materials in the fast energy range, which were obtained at dedicated critical facilities he designed and utilized. A move to Switzerland in 1991 was intended to broaden his knowledge in reactor physics at the 10 MW research reactor, where he already started with trials in neutron radiography. The shutdown of that facility but the installation of a new spallation neutron source (SINQ) gave the unique opportunity to initiate neutron imaging on a state-of-the-art level. Presently, he is the head of the "Neutron Imaging & Activation Group" at PSI (CH), where 2 imaging facilities are operational successfully and some irradiation facilities too. He was chairing several conferences and workshops and participated in European collaborations as the Swiss representative. In October 2010, Eberhard H. Lehmann was elected as President of the "International Society for Neutron Radiology" for the period 2010 - 2014. He and his team are prepared to host WCNR-10 in Switzerland.

Thomas Bücherl (Germany)

In 1993 Thomas Bücherl received his Ph.D. degree in physics from the Technische Universität München (TUM) working on energy selective neutron radiography and tomography. He then crossed faculty lines and started working at the Institute for Radiochemistry at TUM on the field of non-destructive characterization of radioactive waste packages. For the instrumentation of FRM II he designed and installed the fission neutron radiography and tomography facility NECTAR which he is operating. In 2002 he was elected by the members of the International Society for Neutron Radiology as secretary being reelected in 2006 and 2010. He is the editor of the International NR Newsletter, being the successor of such famous persons like Herold Berger, John Barton and Shigenori Fujine.

M. Arif (USA)
Muhammad Arif received a Ph.D. degree in physics from the University of Missouri-Columbia in 1986 specializing in single crystal neutron interferometry and optics. He joined the National Institute of Standards and Technology (NIST) as a US National Research Council post doctoral fellow in 1988 and currently is a senior supervisory physicist in the Physical Measurement Laboratory. Dr. Arif is the leader of the neutron physics program at NIST that includes a broad range of basic and applied research areas ranging from the study of fundamental symmetries to alternative energy. His main research interests are in fundamental physics, neutron interferometry, and neutron imaging. He introduced the technique of neutron imaging for hydrogen fuel cell research. This technique has greatly accelerated the process of rapid development and commercialization of fuel cells. Dr. Arif is the recipient of several prestigious United States federal awards for his distinguished service, and other research and development awards for excellence in scientific research.

Les G. I. Bennett (Canada)
Les Bennett is a Professor of Nuclear Engineering in the Department of Chemistry and Chemical Engineering at the Royal Military College of Canada, located at Kingston, Ontario, Canada. He is also an Adjunct Professor in the Department of Physics, Queen's University at Kingston. He graduated in Chemical Engineering (Nuclear Option) from RMC, and then obtained a M.A.Sc. degree in Radiochemistry and Ph.D. in Nuclear Engineering from the University of Toronto. His research interests center around a SLOWPOKE-2 research reactor where a neutron beam tube was installed and a neutron radioscopy system developed over the years with a succession of researchers directed by him. Before the reactor was available (1985), he worked with Californium-252 in two transportable devices developing neutron radiography applications. The experience indicated that a permanent system could be installed on the reactor that would give a more useful neutron beam almost with the intensity of larger reactors. The improvement of imaging systems from film to CCD cameras allowed for application to inspecting aircraft components and further research into their problems, which is still ongoing. Furthermore, neutron tomography is now being developed with other applications in archaeology in mind.

Frikkie de Beer (South Africa)
Frikkie obtain his BSc(ed) and B(ED) degrees at University of Johannesburg. Started 22 years ago at Pelindaba, South Africa, as junior experimental officer in an NDT environment to evaluate high radioactive fuel pins from the Koeberg power reactor. 10% of time was dedicated to neutron radiography on the fuel pins until the program was stopped in 1993. Started as technician on the neutron radiography facility and become scientist in 2000 to develop a NRAD facility for South Africa at the SAFARI-1 nuclear research reactor. Obtain, in collaboration with PSI which supported Necsa to host a tomography facility, in January 2003 the first neutron tomogram in the Southern Hemisphere - which Frikkie was awarded the best performance award at Necsa. He became Senior- and later Chief Scientist on neutron radiography and in 2007 become the head of the radiography/tomography section in the radiation science department and R&D division of Necsa. Through collaboration with several international and national counterparts, the SANRAD facility

has proven its existence and a bid to host the WCNR-9 in 2010 in South Africa was successful. He became the President of the ISNR for the term 2006 - 2010 and hosted successfully the WCNR-9 as chairman of the LOC. His vision is to establish the first National Center for Radiography and Tomography imaging at Necsa in the forthcoming years for scientists, students and researchers to utilize the neutron-, X-ray- and gamma ray imaging facilities for R&D activities.

Ulf Garbe (Australia)
2008 – present:
Scientific Staff at ANSTO the Bragg Institute. Project leader for the new neutron radiography tomography imaging station DINGO. Strain and texture experiments at the OPAL reactor at ANSTO.
2005 – 2008:
Scientific Staff at the GKSS Outstation Munich FRM-II. Instrument scientist for the materials science diffractometer STRESS-SPEC
2001 – 2004:
Scientific Staff at the HASYLAB at DESY in Hamburg; PhD-student and local contact at the high energy beam line BW5. He prepared PhD in physics and physical technology at TU-Clausthal with Prof. Bunge. The topic was texture development in two-phases streaming solid / liquid mixtures. After Prof. Bunge died in 2003 the PhD was finished at University of Goettingen Centre of Geoscience with Prof. Kuhs
2000 – 2001:
Scientific Staff at the Arbeitsgemeinschaft Texturen e.V. in Clausthal Zellerfeld. Responsible for the x-ray texture goniometer. Diploma in local resolved texture analysis with x-rays at University of Goettingen Centre of Geoscience with Prof. Kuhs.

Zhiyu Guo (China)
Zhiyu Guo graduated from Peking University in 1968 specializing in nuclear physics, then worked in a factory for ten years during the Cultural Revolution in China. He received a Master of Science degree from Peking University in 1981 specializing in accelerator beam pulsing, and then joined the Institute of Heavy Ion Physics, Peking University. He currently is a professor of university as well as the Vice-president of the Chinese Particle Accelerator Society and the honorary council member of the Chinese Nuclear Society. His main research interests are in accelerator physics and technology, accelerator mass spectrometry (AMS) and neutron imaging (NI). As a principle investigator he performed several important projects to set up the first ^{14}C AMS facility in China which contributed a lot to the national Xia-Shang-Zhou Chronology Project, to build up the first technological cavity of intense proton beam RFQ accelerator in China for the Chinese ADS project, to develop the design method of high current RFQ and the diagnostic instrument of high current beam emmittance. Since 2003 he devoted to NI studies including the construction of thermal neutron radiography facility based on a 2 MeV intense deuteron beam RFQ accelerator, the methodology of non-destructive test with NI, and the development of NI technology such as coded source NI, fast neutron detection etc. He is the recipient of several scientific awards from the Ministry of Education, Ministry of Nuclear Industry and Beijing City etc., and he is also the recipient of Special Government Allowance granted by the State Council of China.

Anders Kaestner (Switzerland)
Dr. Anders Kaestner is currently a beamline scientist at the ICON beamline at Paul Scherrer Institut, Switzerland. He was born in Sweden 1971 and grew up on the Swedish west coast. He studied Computer systems engineering at Halmstad University and received his M.Sc. degree in 1997. In 2002 he received his PhD degree in Signal Processing at Chalmers University of Technology, Gothenburg. The topic was microwave tomography of fibrous materials such as wood. The following four years he spent in the Soil physics group at ETH Zuerich working with three dimensional image analysis and computed tomography algorithms mainly for data from synchrotron and neutron imaging beamlines. In 2006 he joined Varian Medical Systems (Baden, Switzerland) as an algorithm specialist for CT algorithms. Since 2008, he is working in his current position as beamline scientist.

Upcoming Conferences

UCANS-II
The Second Meeting of the Union for Compact Accelerator-driven Neutron Sources
July 5-8, 2011, Bloomington, Indiana, USA, www.indiana.edu/~lens/UCANS/

Fully 3D
11th International Meeting on Fully Three-Dimensional Image Reconstruction in Radiology and Nuclear Medicine
July 11 - 15, 2011, Potsdam, Germany, www.fully3d.org/2011/index.html

ICNS
5th European Conference on Neutron Scattering
July 17 - 21, 2011, Prag, Czech Republic, ecns2011.org/joomla_15/

NEUWAVE-4
October 9 - 12, 2011, Oak Ridge, USA

IWORID-13
13th International Workshop on Radiation Imaging Detectors
2011, Switzerland, http://indico.psi.ch/event/iworid2011

18th-WCNDT
18th World Conference for Non-Destructive Testing
April 16 - 20, 2012, Durban, Republic of South Africa, www.saint.org.za/saint_007.htm

ITMNR-7
7th International Topical Meeting on Neutron Radiography
June 17 – 21, 2012, Confederation Place Hotel, Kingston, Ontario, Canada
www.itmnr-7.com

WCNR-10
10th World Conference on Neutron Radiography
2014, Switzerland

Preview on ITMNR-7

Seventh International Topical Meeting on Neutron Radiography

Applications and Imaging for Neutron Radiology and Tomography

June 17 – 21, 2012
Confederation Place Hotel, Kingston, Ontario, Canada

Les Bennett
Royal Military College of Canada
Canada
bennett_l@rmc.ca

Introduction

From June 17th to June 21st of 2012, the Seventh International Topical Meeting on Neutron Radiography will be held at the Confederation Hotel in Kingston, Ontario, Canada. This meeting is intended to bring together both developers and users of neutron radiography and tomography from around the world. Specialists involved in facility design, establishment, operation and use of the neutron beam and neutron imaging should attend as well as those that have current or potential applications in their own fields. Participants may come from academic, industrial, military and government areas. The intent of the meeting is for the providers and users to share experiences and goals in order for their future needs and applications to be met.

Preliminary details of this seventh Topical Meeting were presented at the ninth World Conference on Neutron Radiography, South Africa, in October, 2010. Both the World Conferences and Topical Meetings are held under the auspices of the International Society for Neutron Radiology (ISNR) on a four year cycle.

Format

To allow participants to attend every presentation, allowing for maximum knowledge gain, the format of this meeting will be serial oral and poster presentations. Frequent discussion periods and technical tours will allow for interaction among attendees. Technical tours for participants are currently being arranged and will be posted later. The language of this meeting will be English.

Location

The meeting will be held at the Confederation Place Hotel in Kingston, Ontario, Canada. Kingston is located in the South Eastern part of Ontario, where Lake Ontario meets the St. Lawrence River. Sitting almost half way between Montreal and Toronto, Kingston was the first national capital, named so in 1841 by Governor Lord Sydenham. Kingston remained an important military installation long after the national capital was changed to the city of Ottawa.

Additional Information on Kingston and on the Royal Military College can be found at www.cityofkingston.ca and www.rmc.ca, respectively.

Transportation

Kingston, Ontario (YGK) is accessible by air only from Toronto (YGK), but is almost equidistant in under three hours by land transportation from Toronto, Ottawa (YOW), Montreal (YUL) and Syracuse, USA (SYR), all of which have international airports. Further details will be provided in later Announcements.
As Kingston is a small city with a vibrant downtown, most activities can be reached by walking.

Registration

Registration of all attendees must be completed by no later than April 6th, 2012 using the website, launched December 6, 2010 at **www.itmnr-7.com**. Details of the Meeting fees and payment methods will be announced later.

Accommodations

The Meeting will be held at the Confederation Place Hotel in Kingston, Ontario, located in the heart of the city, within easy walking distance of many fine restaurants in the downtown district of this historic city. A block of 80 rooms will be reserved for attendees at the Meeting hotel at special room rates, with overflow at adjacent hotels.

Call for Abstracts

Abstracts will be required before the Meeting and will be reviewed. Both oral papers and posters will be presented, depending on numbers and author preference. Full details will be provided in upcoming Announcements.

Proceedings

Reviewed papers/posters will be published in Nuclear Instruments and Methods - A (NIM-A) after the Meeting.

Tentative Program

Sunday June 17th
- Afternoon – Executive Meeting
- Early evening – Registration
- Evening – Reception

Monday June 18th
- Registration
- Opening Ceremony
- Plenary session
- Oral & poster sessions

Tuesday June 19th
- Morning – Oral & poster sessions
- Afternoon – Thousand Islands Boat Cruise
- Evening – Meeting Dinner

Wednesday June 20th
- Oral & poster sessions

Thursday June 21st
- Morning – Oral & poster sessions
- Noon – Closing Luncheon

Social Program

A reception will be held the night of Sunday June 17th after the registration. A boat cruise touring the Thousand Islands in the St. Lawrence River will occur on the afternoon of Tuesday June 19th followed by a gala dinner at the Confederation Place Hotel. Monday and Wednesday evenings will be free for small groups to meet over dinner in one of the many venues in downtown Kingston.

Optional Pre- and Post-Conference Tours

A day-long pre-conference bus tour on Saturday, June 16th, 2012 of nearby scenic Prince Edward County is planned. A post-conference stay from Thursday night, June 21st for three nights at a wilderness lodge in Algonquin Park is being considered. Details will be provided in later Announcements.

Timelines

Website opening & 1st Announcement	December 6, 2010
Submission of Abstracts	December 16, 2011
Notification of Acceptance	January 20, 2012
Conference Registration and Payment of Fees	April 6, 2012
Hotel Registration	April 6, 2012
Confirmation of Conference Registration	May 11, 2012 or upon receipt of payment
Submission of Manuscripts	June 1, 2012
Topical Meeting	June 17-21, 2012

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