MLZ
Heinz Maier-Leibnitz Zentrum

2015 User operation

2014 2013 2012 2011 2010 2009 2008 2007 2006 2005

Newsletter 14

MLZ is a cooperation between:

JÜLICH FORSCHUNGSZENTRUM

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

TUM
Technische Universität München

The Heinz Maier-Leibnitz Zentrum (MLZ):
The Heinz Maier-Leibnitz Zentrum is a leading centre for cutting-edge research with neutrons and positrons. Operating as a user facility, the MLZ offers a unique suite of high-performance neutron scattering instruments. This cooperation involves the Technische Universität München, the Forschungszentrum Jülich and the Helmholtz-Zentrum Geesthacht. The MLZ is funded by the German Federal Ministry of Education and Research, together with the Bavarian State Ministry of Education, Science and the Arts and the partners of the cooperation.

Bavarian State Ministry of
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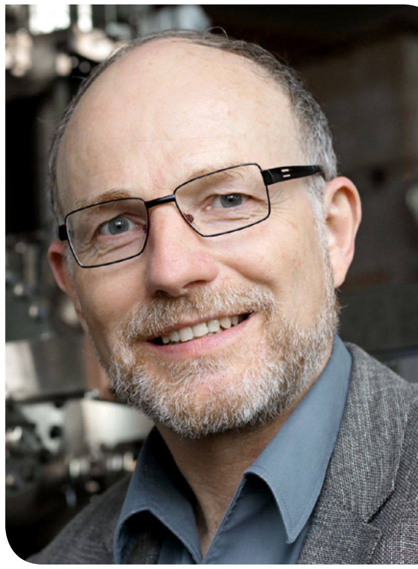
Reaching Maturity!

Editorial by



Prof. Dr. Thomas Brückel
Managing Director JCNS
Scientific Director MLZ

Some four years ago, the MLZ was founded as a collaboration between the Technische Universität München and the Helmholtz-Centres Forschungszentrum Jülich and Helmholtz-Zentrum Geesthacht, including partners from other German universities and the Max-Planck-Gesellschaft. MLZ can be seen as the third model of cooperation between universities and the Helmholtz Association, along with the **K**arlsruhe **I**nstitute of **T**echnology (KIT) and the **J**ülich **A**achen **R**esearch **A**lliance (JARA). Today we can firmly state that MLZ has developed into a real model of success, is going very strong and is reaching maturity! In the world of neutrons, the brand name MLZ is well established and MLZ is recognised as one of the leading centres for research with neutrons worldwide. As such it brings together main players in the field and lays the cornerstone for method competence. This statement is substantiated by the fact that together with European partners, the three members of MLZ have submitted a total of ten instrument proposals to the ESS, of which five are ready to enter the engineering design phase. This success was enabled by a major participation in the design update of ESS with project funding by the German Federal Ministry of Education and Research (BMBF). It underpins the position of MLZ as a key player on an international level and shows that MLZ takes up the challenge to position itself within the changing European and international landscape of research with neutrons.

This does not mean that the homework in Garching is being neglected:

- In the future Neutron Guide Hall East, several instrument components have already been installed:
  - the six anvil press of SAPHiR
  - the detector housing of the chopper spectrometer TOPAS
  - the magnetic shielding of the neutron EDM experiment.
  - Others are being assembled at the respective home institutions and are awaiting the neutronic connection of the Neutron Guide Hall East to the reactor. A decisive step is planned for the end of this year, when the new beam plugs SR-5 and SR-6 will be installed.
- Ground has been prepared for the construction of the new science buildings, which will bring together the instrument scientists currently spread over the Garching campus. This will invigorate scientific exchange. For our users, new laboratories and user offices are foreseen.
- A scientific roadmap for the MLZ is being developed, based on the input obtained from the MLZ user meeting in February this year. The new format of a “workshop user meeting” turned out to be a great success and the many valuable suggestions are now being incorporated into the MLZ roadmap.

Being endowed with such an active and creative user community, MLZ counts on its continued support. We look forward to receiving many excellent projects through the unique funding opportunity of the BMBF Verbundforschung. A call is expected in summer this year. We also hope to see again many excellent proposals for outstanding science at the next upcoming proposal deadline on September 11th, 2015!

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Ten years FRM II: A decade of user service

Fig. 1: The first experiment. At TRISP, K. Habicht (HZB, at that time known as HMI) explains W. Petry (FRM II) the set-up, accompanied by K. Buchner and P. Aynajian (from left to right)

With the start of the second reactor cycle on April 29th, 2005, the routine operation of our neutron source was launched and our user programme made its first steps. As first friendly users we could welcome colleagues from Berlin at the instrument TRISP investigating the phonon life times in superconductors. Ten years of user service, a time to look back and review our achievements but also an opportunity to look forward. What are the challenges in the near future and how to address them? As instrument and method development for neutron research takes quite some time, a look forward to the next ten years, even though with some uncertainties, might be appropriate.

The mission of our facility in view of the instrumentation was twofold. On the one hand we envisaged a broad range of applications and on the other hand we tried to optimise the conditions to build the instruments right from the beginning. As an example, twelve out of the sixteen instruments in the Neutron Guide Hall West dispose of an end-standing guide position. In the Experimental Hall still three out of ten beam ports are used by only one instrument, even though two channels are always available. In addition, one beam nose has been optimised and shaped for one particular instrument. This high degree of optimisation has led to a powerful suite of instruments, 26 are in routine operation, six are under construction, mainly to be installed in the new Guide Hall East.

Quite a lot of effort has been made to improve the reliability of the instruments and especially the sample environment. Here, we strongly focussed on the development of dry systems, i.e. low temperature equipment and magnets free of liquid cryo-cooling. By this, for example, with one push of a button you are able to reach down to about 3 K of your sample temperature. A high degree of specialisation and optimisation means also that a large number of our sample environment equipment has been developed in-house like a rotatable multifunctional load frame.

10 000 user visits

As of today, we can offer a wide range of neutron beams, including cold, thermal, hot, and even fast fission neutrons; a source for ultra cold neutrons is under construction. In addition the world most intense beam of thermalised, monochromatic positrons is available for our users, including five different instruments and measuring stations. The suite of neutron and positron instruments was supplemented in the last years by laboratory methods like TEM or sample preparation available on-site of the MLZ.

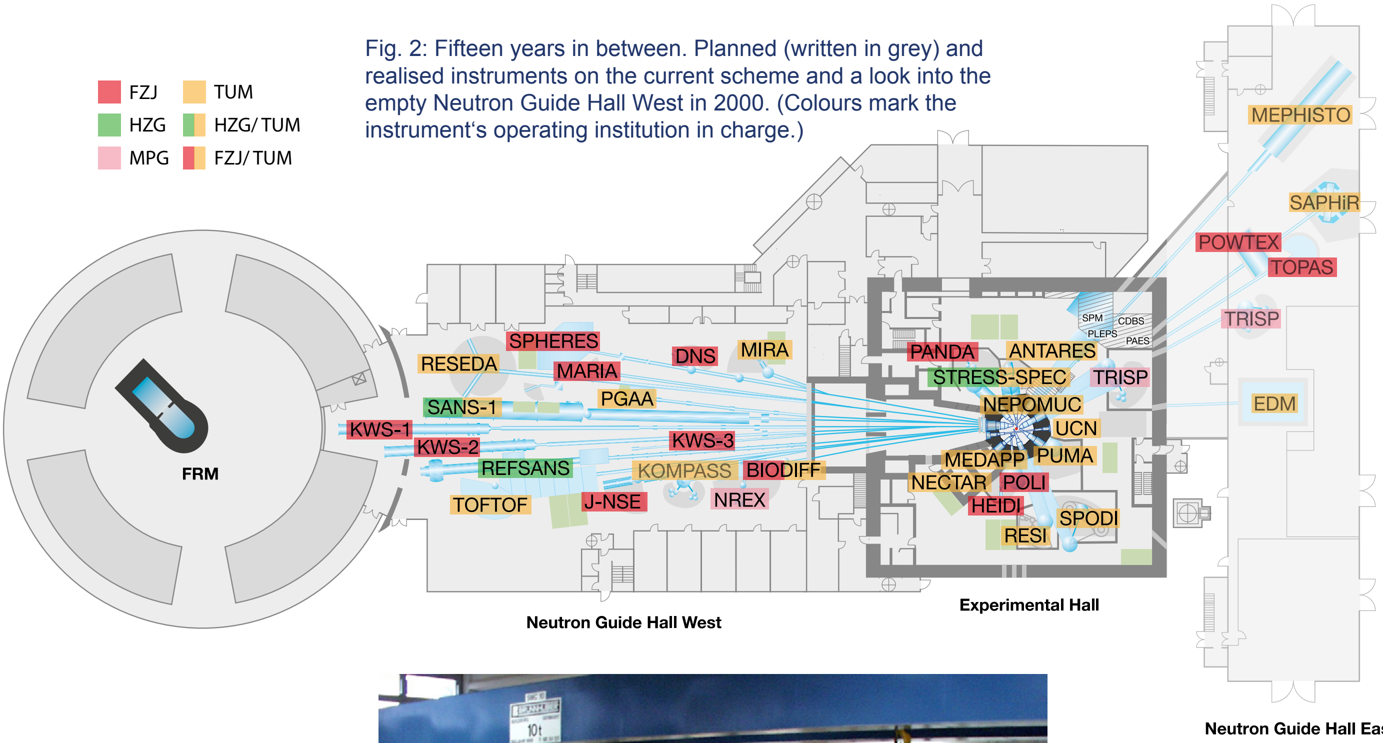


Fig. 2: Fifteen years in between. Planned (written in grey) and realised instruments on the current scheme and a look into the empty Neutron Guide Hall West in 2000. (Colours mark the instrument's operating institution in charge.)

Bringing together university groups, Max-Planck-Institutes, and Helmholtz Centres, we were a large family of different institutions to build up the instrumentation right from the beginning. The increasing support from the Federal Ministry of Education and Research (BMBF) brought us to the cooperation agreement between the TUM and the centres of the Helmholtz Association in Jülich, Geesthacht, and Berlin in December 2010 and further on to the inauguration of the Heinz Maier-Leibnitz Zentrum on February 21st, 2013. By joining all these forces, replenished by the enthusiasm of our scientists, the wide experience of the collaborating groups, and last but not least by the financial support of the Bavarian State Ministry for Education and culture, Research as well as the Arts and the BMBF we are looking forward to a bright and long lasting future of our source.

4873 submitted proposals

But what are the challenges we have to face in the future? To which of the grand challenges of our society neutrons made in Garching can contribute significantly? What are the needs and expectations of our national and international users? A science roadmap should gather these requirements and provide a basis for our future instrument and method development activities. In a two-stage process we collected scientific topics from in-house groups and recently from our external users at the 2015 user meeting in Ismaning. Supported by our Scientific Advisory Board and for the instrumentation in more detail by our Instrument Advisory Board, we will balance this roadmap with our current and future instrumentation projects.

Besides continuous developments at the instruments which are reported in our newsletter, two major infrastructure projects are already under way. Since some years we are transforming the building on the reactor's east side into the new Neutron Guide Hall East. The connecting building was completed last year. To guide neutrons and positrons into the new hall requires significant changes in the Experimental

3016 accepted proposals

7154 experiments

Hall of the reactor building. Beam tube no. 5 has to be rebuilt in order to deliver three thermal neutron beams instead of two. A fourth cold neutron beam (no. 4b) will serve the instrument for particle physics MEPHISTO. Because of this, the entire radiography and tomography station ANTARES hasd to move from beam tube no. 4b to 4a. In addition, the beam plugs of the through going beam tube no. 6 have to be exchanged in order to accommodate the ultra cold neutron source.

The second infrastructure project addresses the significantly growing number of staff and requirement of office and laboratory space on-site. Site preparation could be finalised early this year and we expect the construction work for two new buildings in spring next year. They are a common effort of the Forschungszentrum Jülich (office space and laboratories) and the TUM raising a workshop and office building. It is planned to inaugurate them in the beginning of 2019.

For our instrument and method development we see a growing interest in specialised in-situ experiments, where the sample or component under investigation is exposed to extreme environmental conditions, varying during the measurement. A continuous improvement of the instruments and sample environment up to the construction of entirely new instruments like the time-of-flight diffractometer with multi-anvil press SAPHiR (University of Bayreuth) will face these requirements. Improving our local infrastructure will enable us to develop further our organisational structure at the MLZ. One of our aims is to foster the link of university research with large research infrastructures like the Helmholtz Centres. Different university groups could build up a sort of outstation at the MLZ in order to facilitate the use of rather complex neutron research. The benefit could be manifold, from the link of expert knowledge to occasional user, new impact on methods' and instruments' development up to synergies in education activities and training of neutron techniques.

32 535 experiment days

We are grateful for the sustainable support of our funding agencies in Bavaria and Germany – without it, all the future developments would not be possible. The next ten years of user operation ahead will bring us a further challenge by the shutdown of the neutron source in Berlin. Taking the right steps for a future of neutron research in Germany strongly relies on the feedback and interaction with our users. So please get in touch with us on any occasion!

J. Neuhaus (FRM II)

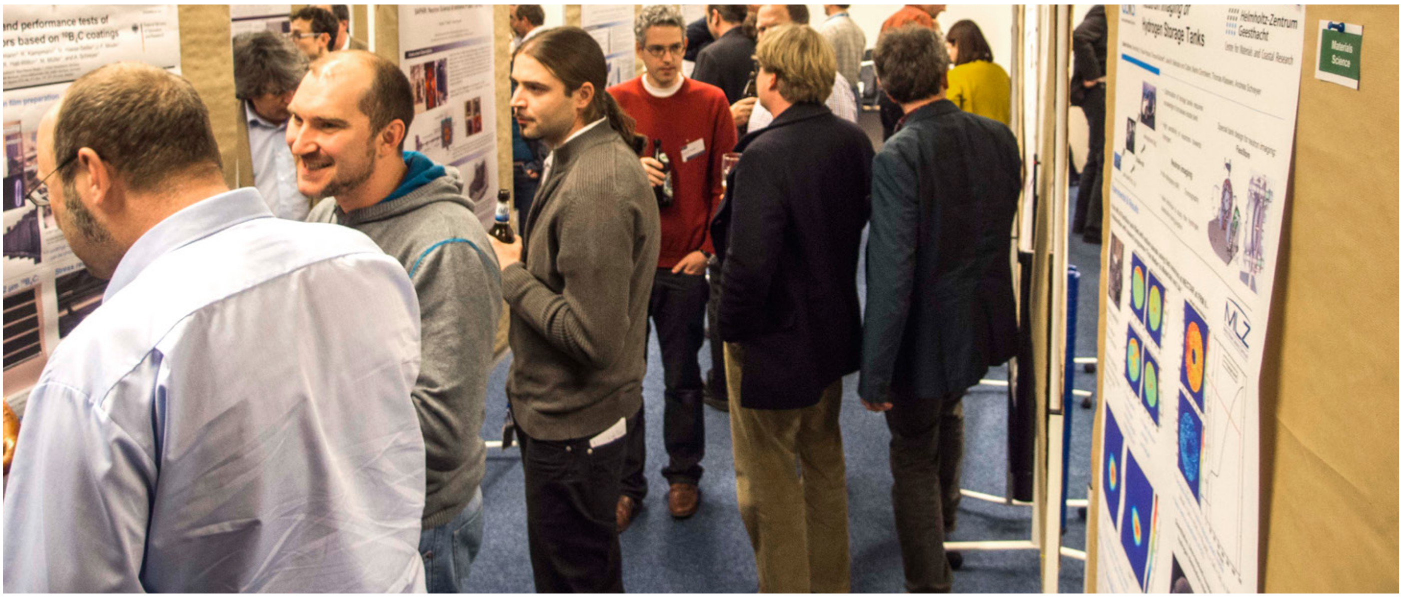


Fig. 3: Poster session at the User Meeting 2015.

DNS reloaded!

Fig. 1: The new look of the diffuse scattering spectrometer DNS.

Since the beginning of its routine user operation in 2008, DNS has become a workhorse instrument for the applications of polarised neutron scattering techniques at MLZ. With its compact design, large double-focus monochromator, and wide-angle polarisation analysis, DNS is optimised as a high intensity instrument for the studies of complex magnetic correlations in highly frustrated spin systems and strongly correlated electron systems.

Timely and well-executed instrument upgrading is an essential step to keep DNS as one of the leading polarised neutron instruments worldwide. Due to the increased neutron flux after the upgrade of the upstream NL6 neutron guide sections to m = 2 supermirror in 2013, the instrument upgrade at DNS was essentially focussed on the improvement of radiation shielding. A new shielding concept was chosen based on extensive Monte-Carlo simulations. In addition, a new lifting-stone system for the changing of the wavelength has been implemented. During the long reactor shutdown period in 2014, the complete monochromator shielding system (see fig. 1) including the new mechanical, pneumatic, and electronic components had been installed and successfully passed for radiation protection.

In addition, a new **n**eutron **v**elocity **s**elector (NVS) has been installed and successfully commissioned in the last reactor cycle in 2014 (see fig. 2). The new NVS will act mainly as a high-order filter to suppress the high-order contamination of the monochromatised beam. It will also offer the possibility to expand the present wavelength range to the thermal neutron regime by the selection of second-order incident neutrons. With the average neutron transmission at about 75% in the cold-neutron regime offered by the new NVS, additional gain in the polarised neutron flux at the sample position has also been achieved.

A major milestone for DNS toward a user-friendly instrument has been achieved by the complete switching to the new generation instrument control software TANGO and NICOS in the second reactor cycle of 2015.

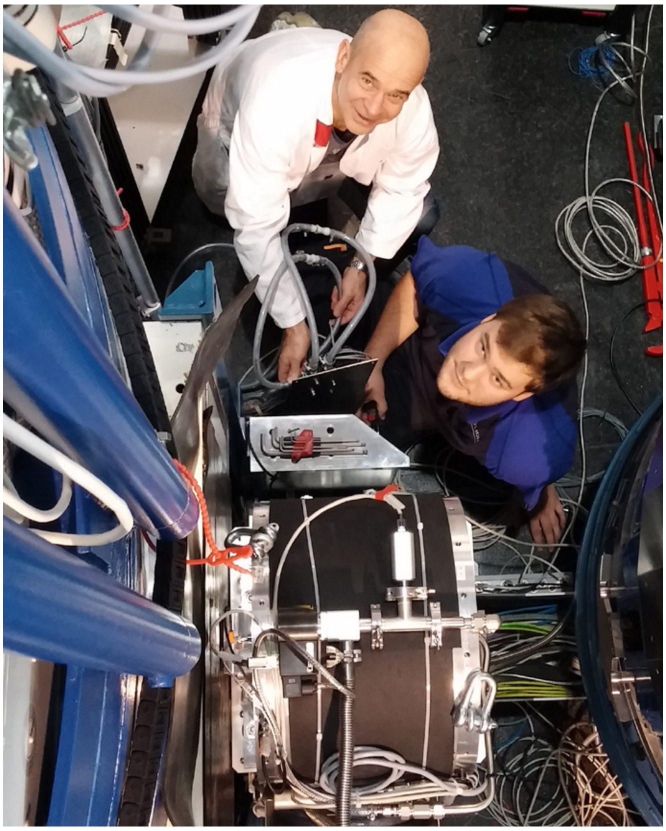
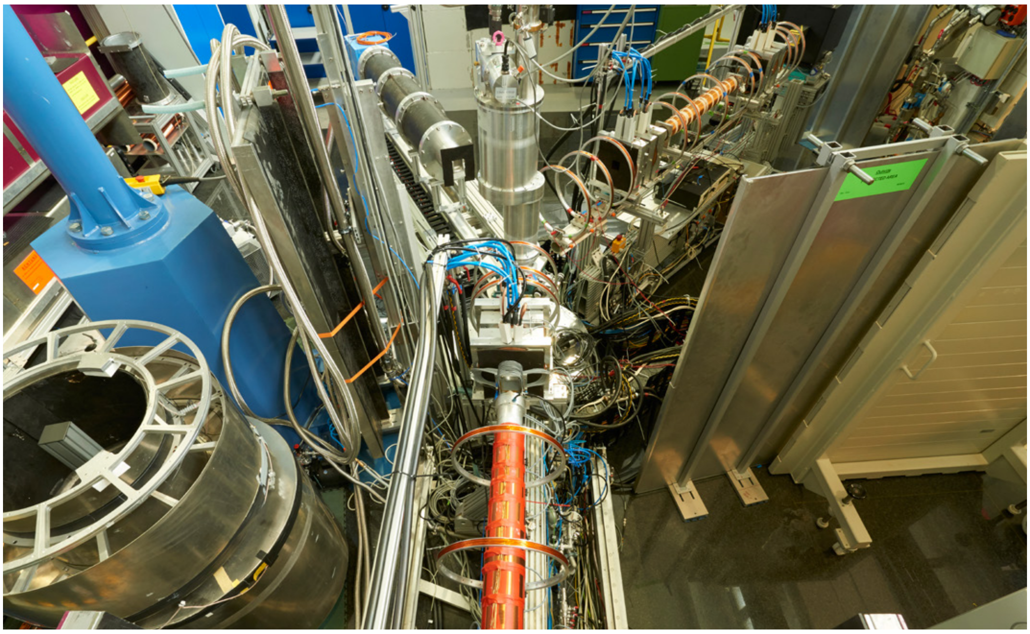


Fig. 2: Installation of the neutron velocity selector (NVS).

The huge potential of this instrument can finally be realised once the time-of-flight inelastic neutron scattering option is fully implemented. With the combination of large-array position sensitive detectors covering 1.9 sr of solid angle and a high-frequency disc chopper system, both under development, DNS is expected to become a high count-rate cold time-of-flight spectrometer with medium resolution in the near future.

Y.Su, K. Nemkovskiy (JCNS)

New longitudinal NRSE setup at RESEDA



At RESEDA, water cooled static field coils in Helmholtz geometry are used, giving a maximum field at the spin flipper of B_{max} = 135 mT, employing 100 A current in the coils. Compensation coils are used for a sharper field rise in beam direction. Field subtraction coils in the shape of classic NSE coils on both arms can be used to substract field integral, yielding in principal infinitesimal small spin echo times. The guide fields avoiding depolarisation of the beam due to magnetic stray fields consist of several 20'' coils with up to 60 windings of copper wire.

Today's highest energy resolution in the field of neutron scattering is achieved by **n**eutron **s**pin **e**cho (NSE) instruments. Besides classical NSE [1] instruments, the **n**eutron **r**esonance **s**pin **e**cho (NRSE) [2] is well established, avoiding large solenoids and costs of classical NSE. Furthermore, NRSE allows the so called MIEZE (**M**odulation of **I**nt**e**nsity with **Z**ero **E**ffort) [3] technique which gives access to depolarising conditions at the sample position, i.e. ferromagnetic samples and strong magnetic fields at the sample position. However, standard transversal NRSE (static field perpendicular to neutron beam) precludes high spin echo times and beam correction is not easy.

The new developed **l**ongitudinal NRSE (LNRSE) [4] method combines the advantages of classical NSE and NRSE. As the field geometry is the same as in classical NSE, all well-known NSE correction elements (pythagoras coils, fresnel coils) can be used in LNRSE. Furthermore, due to the special geometry the corrections needed are smaller by one magnitude than in NSE. Together with new radio frequency flipper coils that are currently under development, much higher effective field integrals (520 mTm at 4 MHz) and therefore a higher resolution can be reached. A further simplification compared to TNRSE (transversal NRSE) is the use of a small guide field in beam direction opposed to the former delicate double μ-metal shielding.

A second spectrometer arm is dedicated for SANS (**S**mall **A**ngle **N**eutron **S**cattering) and MIEZE measurements, using the 2D Cascade detector. In the MIEZE setup the analyser is placed in front of the sample, encoding the information in the intensity of the neutron beam instead of the polarisation as in LNRSE. This allows for the use of strong magnetic fields at the sample position and depolarising samples, but limits the available q-range.

In first tests already a resolution of 100 ns was reached corresponding to 130 mTm. The large dynamic range already allowed to study critical dynamics at continous phase transitions in Fe and UGe_2 using the new LNRSE method as well as dynamics of skyrmions, flux line lattices in vanadium and the reentrant spin glass FeCr using the (longitudinal) MIEZE method.

C. Franz, T. Schröder (FRM II)

Read more:

[1] F. Mezei, Z. Physik 255, 146 (1972).

[2] R. Gähler and R. Golub, Z. Physik B 65, 269 (1987).

[3] R. Gähler et al., Physica B: Condensed Matter 180, 899 (1992).

[4] W. Häussler et al., Chemical physics 292, 501 (2003).

STRESS-SPEC revamped

Fig. 1: New MWPC detector in its custom made housing including electronics.

During reactor cycle 37, the materials science and engineering diffractometer STRESS-SPEC had undergone a major upgrade with the installation and successful commissioning of a new 2d detector and the addition of a fully automated beam defining slit system.

The detector was developed in-house by the Detector Group (K. Zeitelhack and I. Defendi) with the design based on a concept of a **M**ulti **W**ire **P**roportional **C**ounter (MWPC) developed within the "MILAND" Joint Research Activity of the NMI3 consortium within the framework program 6 of the EC. It has an active area of 250 x 250 mm^2 and is filled with a gas mixture of 4 bar ^3He + 2 bar CF_4 resulting in a detection efficiency of almost 70% for thermal neutrons. Prior to the installation at STRESS-SPEC, the detector was thoroughly tested in the detector lab and position resolution and linearity of the detector was investigated using a collimated beam of 4.73 Å neutrons at the TREFF testing beamline at MLZ. The results of those experiments showed that a very high position resolution of $\Delta x,y < 1.3$ mm (FWHM) in both directions could be reached.

The new detector was finally transferred to STRESS-SPEC and figure 1 shows the detector in its new detector housing, which was built in cooperation with the technical services of the Helmholtz-Zentrum Geesthacht and the workshop of the Physics Department. Figure 1 also shows the ancillary electronics and data acquisition system which could be fully integrated into the instrument control software using the QMesyDaq interface developed by the Instrument Control Group (J. Krüger and E. Faulhaber).

The first commissioning experiments at STRESS-SPEC clearly showed the massive resolution gains compared to the previous Mirrortron delay line detector. Figure 2 shows images of the transmitted neutrons through a BN-mask which was mounted directly in front of the corresponding detectors. While features like the 1 mm vertical and horizontal stripes in the centre of the mask are blurred using the old detector, they can be easily discerned using the new MWPC. Full analysis of the images confirms the results of the position resolution measurements previously done on

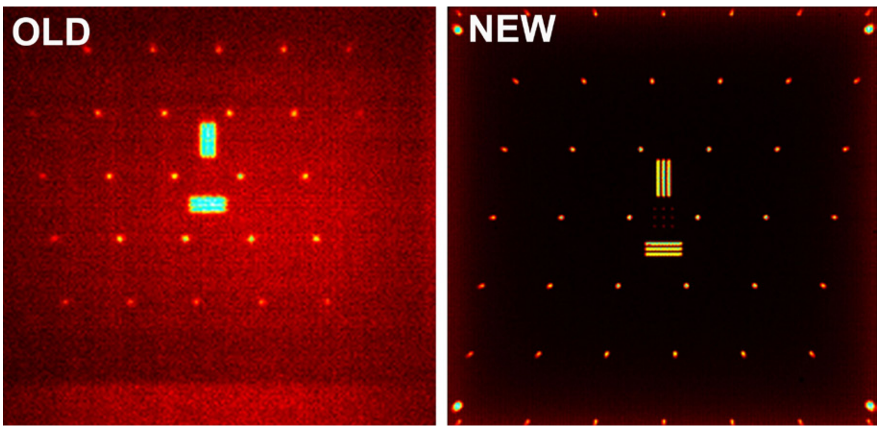


Fig. 2: BN mask as seen with the old delay line detector (left) and the new MWPC detector (right) showing the markedly improved resolution.

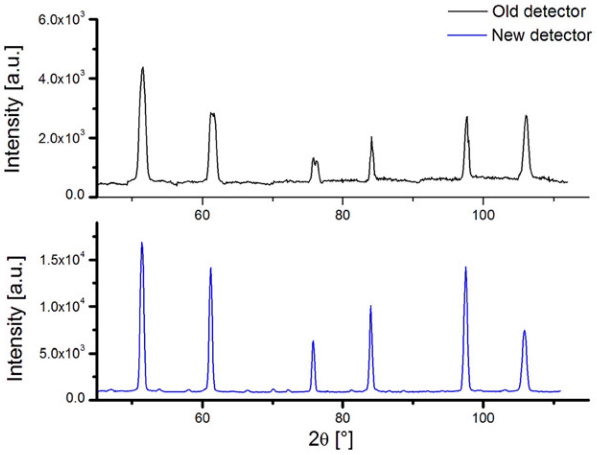


Fig. 3: Diffraction patterns of Si standard powder measured using the old detector (top) and the new MWPC detector (bottom).

TREFF. In addition, the detection efficiency is around 40% higher than with the old system. Combining this with much narrower peak profiles (see fig. 3) results in an efficiency increase in case of residual strain measurements of almost a factor of 2 (note: for a rough comparison in residual strain measurements a figure of merit FOM˜ I/FWHM^2 can be utilised [1]). In addition, figure 3 shows a comparison of powder diffraction patterns of Si measured with both detector systems, highlighting besides the narrower peak profiles a significantly improved and almost flat background of the new MWPC. This together with the increased detection efficiency is beneficial for full pattern diffraction studies and the texture analysis program of the instrument. After commissioning, the detector saw a full cycle of user operation without any major problems and in the upcoming cycles it is foreseen to further develop the detector by facilitating its event mode data acquisition capabilities.

Besides the new detector, a slit system defining the incoming, monochromatic beam just before the sample was installed (fig. 4). The new primary slits are fully motorised and allow defining gauge dimensions continuously from 0.1 × 0.1 mm^2 up to 7 × 17 mm^2. With the new system it is also possible to adjust the position of the slits with respect to the beam axis and sample centre. For instance, in case of a collision with the sample the slit can be repositioned without realignment due to the use of a precision safety clutch.

The new additions, detector and slit system, will make measurements at STRESS-SPEC faster, more precise as well as enable fully automated measurements even in cases where the gauge dimensions need to be adjusted during the course of an experiment.

W. Gan (HZG),
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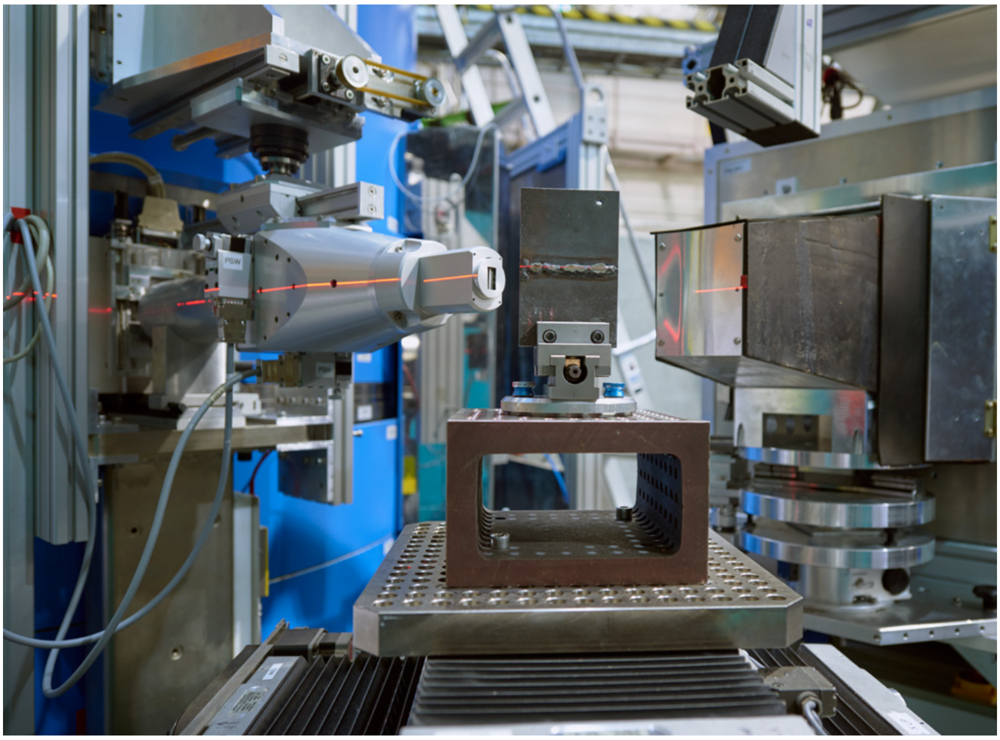


Fig. 4: New gauge volume defining slit and its new mounting fixture.

Read more:

[1] M.R. Daymond et al., Appl. Phys., A74, suppl., 112–114 (2002) .

In-situ FTIR spectroscopy at the SANS diffractometer KWS-2

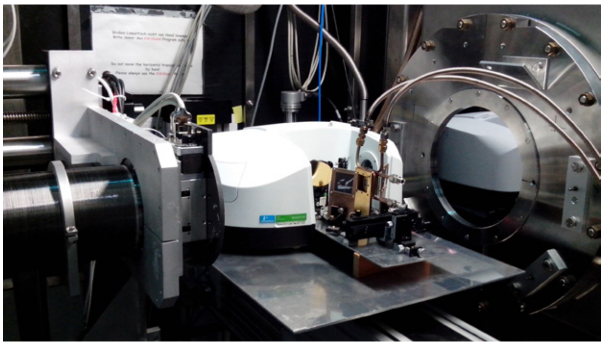


Fig. 1: Experimental set-up for simultaneous FTIR/SANS measurements.

Small **a**ngle **n**eutron **s**cattering (SANS) aims for mesoscopic scale and uses the ability to vary the neutron scattering contrasts between different constituents of a multi-component system over a broad range by specific synthesis procedures or H/D substitution without modifying the physical chemistry of the samples. It is thus a well-established characterisation method for structural investigation of soft matter and biological systems. To carry out successful SANS experiments and to achieve an unambiguous interpretation of data, it is necessary in some cases to know the sample condition throughout the entire experiment on one hand, and to appeal to complementary techniques on the other hand. The combination of SANS with in-situ FTIR spectroscopy, a technique that provides information about the concentration and conformational state of each chemical species in a measuring object, would produce a fruitful methodology for accurate characterization and monitoring of complex systems.

A simultaneous FTIR/ SANS measurement approach consisting of a portable FTIR spectrometer and an optical system of own production was recently tested and brought into operation at the SANS diffractometer KWS-2 [1]. Two mirrors of this optical system set just before and after the sample cell are Al coated quartz plates and enable to irradiate the measuring object with the incident neutron beam and the IR beam from the FTIR spectrometer coaxially at the same time (fig. 1). The transmitted IR beam is deflected into the IR detector, while the scattered neutron beam is transmitted to the SANS detector.

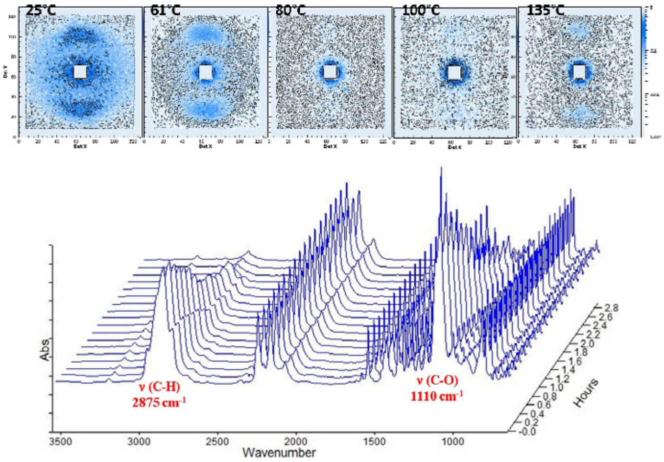


Fig. 2: Temperature dependence of SANS image (top) and FTIR spectra (bottom).

The performance of this simultaneous measurement system was confirmed by investigating the structure changes induced by heating in a cocrystal of deuterated syndiotactic polystyrene (d-sPS) containing triethylene glycol dimethyl ether (TETGDME) as guest in its crystalline region. Fig. 2 reproduces the changes in SANS 2D image and IR spectrum of a uniaxially drawn d-sPS/ TEGDME cocrystal film. Two intense first-order reflections appear in the meridian direction due to the periodic structure of crystalline lamellae as the result of the significant contrast of scattering length density between the crystalline region containing protonated guest molecules and the amorphous region. The two lamellar reflections become weaker with increasing temperature, up to their almost annihilation at around 80°C. A further increase in temperature brought about the reappearance and gradual intensity increase of the two reflections. On the contrary, the IR bands due to TEGDME significantly decreased in intensity, whereas the IR bands due to d-sPS remained almost unchanged. Since the distribution of TEGDME within the d-sPS matrix is a main cause for the contrast between amorphous and crystalline regions, the IR spectral changes suggest that the SANS profile changes can be chiefly ascribed to the changes in distribution of TEGDME. This leads to the conclusion that the guest TEGDME molecules migrated into the amorphous region and further evaporated from the film surface on the heating process.

With a planned improvement of the optical system throughput, this complementarity becomes available on demand at KWS-2 SANS diffractometer.

F. Kaneko (Osaka University),
M.M. Schiavone, T.E. Schrader, A.Radulescu (JCNS)

Read more:

[1] F. Kaneko et al., Chem. Lett. 44, 497-499 (2015).

New sample environment at NREX: Arbitrary atmosphere generator

Fig. 1: Left: sample cell with windows made from aluminium for neutrons and Kapton (amber-coloured foil) for X-rays.
Right: Control unit with gas washing bottles and thermostat in a standard 19' rack.

Investigating structure, dynamics and interactions of biological membranes is an ongoing hot scientific topic. As in most cases, scientists keep the system under investigation as simple as possible. Thus, for mimicking biological cell walls, model membranes, made from lipid bilayers adsorbed on a planar substrate, are used commonly. But, since the origin of live was the ocean, cell membranes are hydrated. To push these systems into their natural environment one either can investigate this system in solution, with neutrons and hard X-rays (above 10 keV) or, as the hydration is determined by the osmotic pressure, in water saturated atmosphere, which is accessible with conventional X-rays sources as well. To make use of the unique in-situ X-ray and neutron reflectometry option at NREX, and to investigate the hydration process in detail an arbitrary atmosphere generator, together with an appropriate sample cell, was developed.

The first major step, a stable controllable humidity (ranging from 5 to 100% r.h. within 1% accuracy) in nitrogen atmosphere, was achieved in the framework of a Bachelor Thesis. The system showed its performance in a user experiment in the end of 2014. The working principle is based on a controlled mixture of dry and saturated gas streams as depicted in the scheme. Here dry and pressurised N_2 is supplied by evaporated liquid nitrogen from a cryogenic storage Dewar and, water-saturated, by washing the dry N_2 in gas washing bottles. The principle enables SLD-contrast experiments by mixing H_2O/D_2O into the saturated stream. Typical time constants for adjusting the desired relative humidity are in the minute range and will be improved significantly by a redesigned sample cell with reduced dead volume. In addition the available temperature range inside the new chamber will be adjustable between 10–60°C by an external water bath thermostat.

Beside humidity the system is foreseen to provide arbitrary- (i.e. ethanol-, toluene-, acetone-) atmospheres with restrictions to

- those where commercially sensors are available (to probe the solvent content), and
- non corrosive ones.

Thus disjoining pressure effects on thin soft films can be investigated routinely with neutron and X-ray reflectivity at NREX.

L. Michalitza (FH München),
T. Keller, O. Soltwedel (MPI FKF)

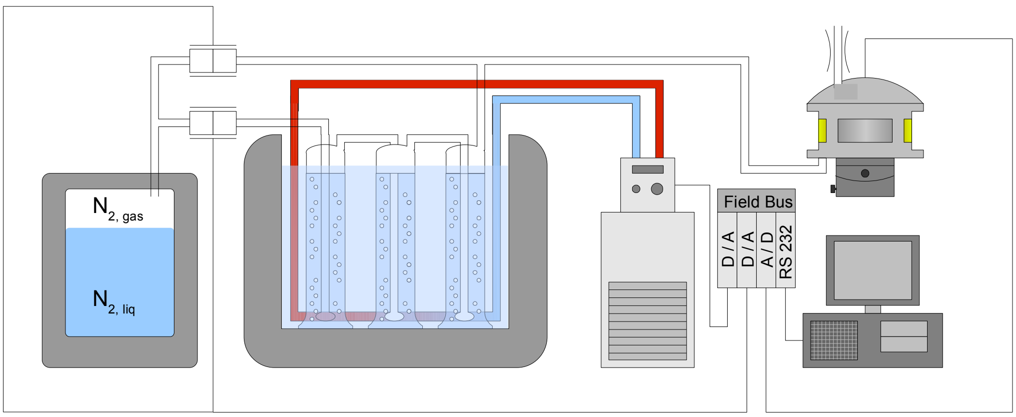


Fig. 2: Liquid Nitrogen serves as gas reservoir. Arbitrary atmospheres are generated by a sensor controlled flux regulation of pure and saturated N_2. The chamber temperature is adjustable via the water bath. To keep environmental conditions at the sample position stable a computer communicates to all components via a filed bus.

Neutron grating interferometry at ANTARES

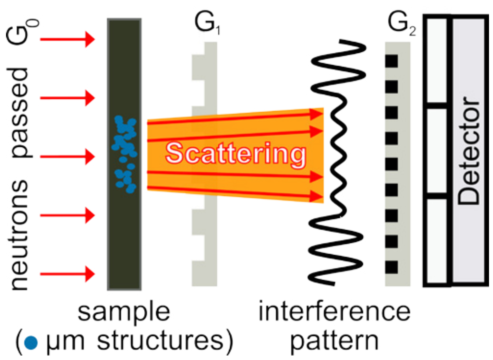


Fig. 1: Sketch of the nGI setup.
The neutron beam that passed G_0 (periodicity p_0 = 1.6 mm) is phase modulated at G_1 (p_1 = 7.98 µm) resulting in an intensity modulation at G_2 (p_2 = 4 µm).
Scattering within the sample degrades the interference fringes.

At the ANTARES beamline samples can be non-destructively imaged using neutron radiation. A wide range of applications exists for neutron imaging, e.g. in material science, archeology, battery and fuel cell research. Currently the spatial resolution is limited to a few 10 µms. Hence, no information about microstructures within the sample can be obtained. With the recent implementation of a **n**eutron **g**rating **i**nterferometer (nGI) at ANTARES this resolution limit can be overcome, allowing to identify µm inhomogeneity in the sample and to determine their orientation.

nGI is an advanced imaging method which is based on two neutron absorption and one neutron phase gratings implemented into an imaging beamline (fig. 1). The first two gratings G_0 and G_1 generate a neutron interference pattern at the detector position. This intensity modulation can be measured, although its pitch is below the detector resolution. To achieve this, a second absorption grating G_2 which has the same periodicity as the interference streaks is placed in front of the detector. If one of the gratings is now moved perpendicular to the beam this leads to a sinusoidal oscillation in each detector pixel. By taking serveral images at different grating positions, the local amplitude, offset, and phase of the interference pattern can be calculated.

If a sample is introduced to the interferometer, scattering within the object degrades the amplitude of the interference pattern. This degradation has its maximum effect if the scattering structures are in the µm range. The reduction of the interference amplitude in each detector pixel is visualised in the neutron **d**ark-**f**ield **i**mage (DFI) which consequentially marks the locations of micrometer inhomogeneity.

However, the DFI is insensitive to scattering components parallel to the grating lines. That is why the unique feature of the ANTARES nGI setup is the capability to rotate all three gratings simultaneously around the beam axis. In this way, directional dark-field imaging is possible in which DFIs are taken at different rotation angles to locally quantify anisotropies in the scattering structure and to determine the direction of µm textures.

To demonstrate this, we chose a test sample consisting of a small Gadolinium absorption micro-grating, a brass rod and a woven fiber glass mat. In fig. 2, the angular average DFI and the local scattering anisotropy of the sample are shown. Additionally, the local anisotropy direction of the grating was extracted.

In conclusion, nGI broadens the application range of ANTARES and is a major step to bridge the gap between scattering and imaging techniques as now the distribution and orientation of structures having a µm length scale can be investigated. Possible applications range from the observation of domain nucleation in magnetic or superconducting systems to material testing for small pores or the investigation of corrosions processes. We will be happy to discuss ideas for new applications with potential users.

T. Reimann (FRM II)

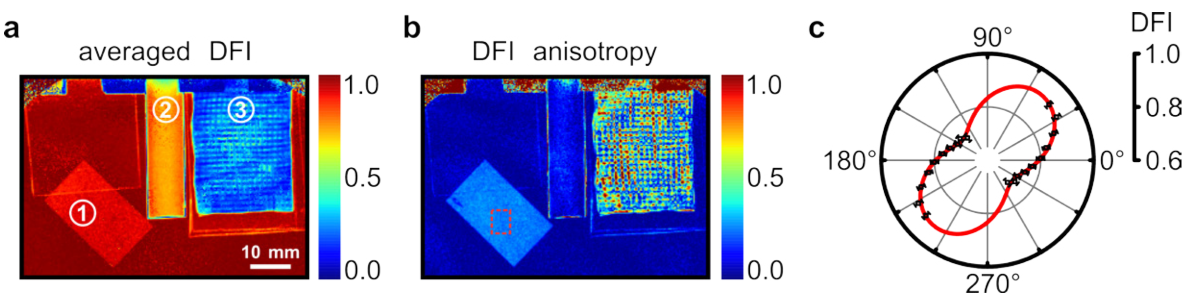


Fig. 2: Results of a test object (1 - Gd grating, 2 - brass rod, 3 - fiberglass mat).
a: Directionally averaged DFI.
b: Anisotropy of the DFI.
c: DFI vs. grating rotation for the area marked in b. The angles of maximum and minimum DFI correspond to an orientation of the Gd test grating parallel or perpendicular to the setup gratings.

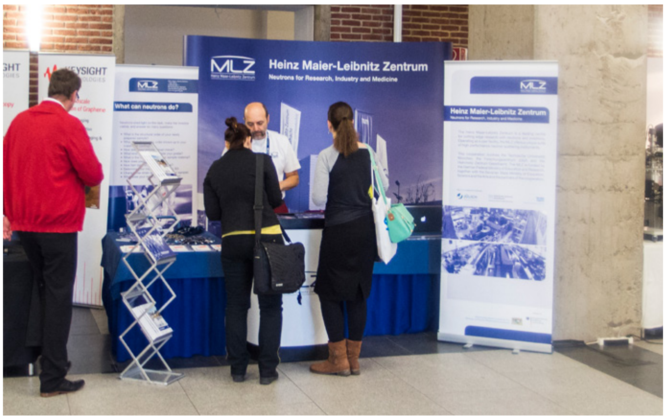
DPG Spring Meeting of the Condensed Matter Section

Berlin: March 15^{th}-20^{th}, 2015

The German capital is always worth a visit! In March 2015 even more because the 79. DPG Spring Meeting of the Condensed Matter Section was held there. A total of 6055 participants accepted the invitation and bustled about at the Technische Universität Berlin. Most of them - about 81% - came from Germany, more than 600 from European countries, and also from the USA, Japan, China, Australia, Russia, Canada, South Korea, Taiwan, and Israel. They listened to 3471 talks and looked at 1658 posters - a lot of work for those few days!

In between times, the exhibition of literature and equipment asked for a visit - and that was where the MLZ booth awaited new and old users. The User Office informed about neutrons' and positrons' applications, possibilities to get beam time at Garching, and how to apply for financial support. Like always, it was a pleasure for us to meet and chat with you!

I. Lommatzsch (FRM II)



Workshop on 'Public Awareness of Research Infrastructures'

Garching: June 18^{th}-19^{th}, 2015

A group after the tour of the FRM II.

On June 18^{th}-19^{th}, the workshop *Public Awareness of Research Infrastructures* was held at the European Southern Observatory in Garching, co-organised by ESO, the European Association of National Research Facilities (ERF-AISBL) and the MLZ. This was the 8^{th} of a series of workshops and seminars organised by the ERF-AISBL.

The workshop brought together around 90 people, counting with press officers and heads of several research facilities, social researchers from Europe and the United States, as well as project managers and funding agencies. The aim was to present expectations, experiences and give examples of their work on public relations. This was a very good opportunity for participants to learn from each other and hold many fruitful discussions.

Keynote speakers from ESO, CERN, the Science & Technology Facilities Council (STFC) and the Helmholtz-Zentrum Berlin (HZB) delivered inspiring presentations about their outreach activities, challenges related to bringing science to a political level, as well as on the importance of engaging stakeholders about the impact of our science.

While a number of participants already carry out well established collaborations, events like this one make it possible to finally meet in person and have more time to discuss future steps and how to go further together.

I. Crespo (NMI3)

www.frm2.tum.de/erf-workshop

FaNGaS: a fast neutron analogue to PGAA material characterisation in PGAA-Actinide project

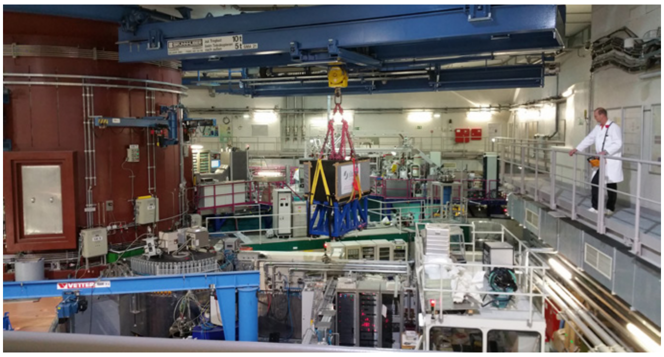


Fig. 1: Transport of the 4 ton FaNGaS instrument to its position at the MEDAPP facility on Nov. 18th, 2014.

FRM II offers not only high-intensity thermal and cold neutron beams to the users but also the unique fission (also referred as fast) neutron beam SR-10 with a mean energy of 1.9 MeV. Until 2014, this beam was used for medical applications and patient treatments at MEDAPP, fast neutron tomography experiments at NECTAR, and irradiation of electronic devices by fast neutrons to simulate e.g. the working conditions in space.

The new idea of using the fast neutron beam for nuclear waste characterisation together with setting up a new and up-to-date database of fast neutron inelastic scattering data – e.g. for simulations of Generation IV reactors – was brought by M. Rossbach, our Jülich colleague, who is well acquainted with the standard PGAA technique. By PGAA, thermal or cold neutrons are captured in the target material and prompt gamma rays are released and detected by a **h**igh-**p**urity **ge**rmanium **de**tector (HPGe). This way, using the (n, γ) reaction, almost complete elemental composition of materials can be revealed fast and non-destructively.

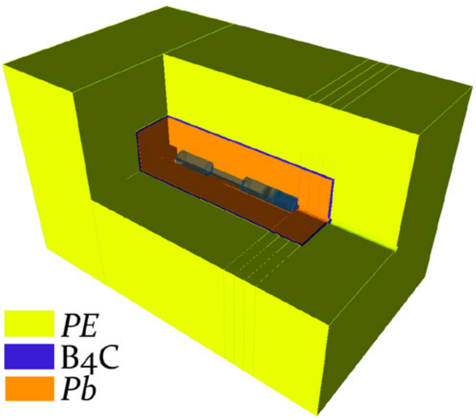


Fig. 2: Complex shielding of the FaNGaS detector consists of boron rubber sheets, Polyethylene blocks, a boron carbide layer, and lead blocks to thermalise and capture scattered fast neutrons before reaching the sensitive HPGe detector.

For fast neutrons, the (n, γ) reaction is very improbable. However, inelastic neutron scattering, written as (n, n'γ), has higher cross-section and a lower-energy neutron is released together with gamma-rays. Thus, the HPGe detector can be used for the characterisation of the material in the fast neutron beam as well. Exactly this idea is used since years in field work, when characterising nuclear waste, drill holes, concrete and other materials using neutron generators coupled with HPGe detector shielded well against fast neutrons.

The project behind FaNGaS called "PGAA-Actinides" is supported by the German Ministry for Education and Research (BMBF) under grant 02S9052A and concentrates mostly on creating a new precise database for actinides and other elements appearing in nuclear waste material. It was started in August 2012 and will be finished in December 2015. The use of reactor fission neutrons has some great advantages: the beam intensity is about hundred times higher than that of the best neutron generators. The source of fast neutrons is about 5.5 m away from the sample position still offering about 10^8 fast n/s of well-defined energy, so the signal to background ratio is incomparably better than in close geometry typical for neutron generators.

The FaNGaS instrument (**Fa**st **N**eutron **Ga**mma **S**pectrometer) was designed and constructed at the IEK-6 (Forschungszentrum Jülich GmbH) in cooperation of M. Rossbach group and the MLZ groups PGAA and MEDAPP. It was transported to its place of operation at beam guide SR-10 in the MEDAPP bunker on the Nov. 18th, 2014 (fig. 1).

Since fission neutrons behave differently than cold neutrons, the shielding of the HPGe detector was much trickier than at standard PGAA where roughly speaking stack of ^{6}Li or B followed by thick lead shielding makes the job. Fast neutrons hitting the HPGe detector are destroying its performance quickly, so it must be assured that only a small fraction of scattered neutrons reaches the germanium crystal. For that purpose, the HPGe (n-type, 50%) is covered by large shielding (fig. 2) containing from outside bo-

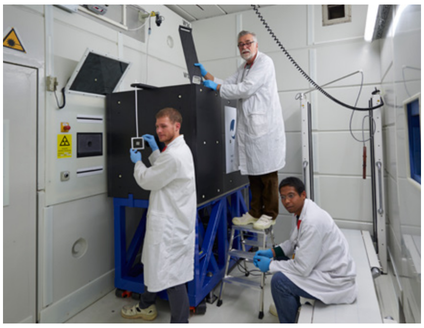


Fig. 3: Irradiation position for the sample in the fast neutron beam (left) and a decay-counting position for the activation analysis (up) 17 cm in front of the HPGe detector.

ron rubber for catching thermalised neutrons, polyethylene sheets to thermalise fast neutrons, boroncarbide layer to capture those thermalised neutrons again and finally a thick lead layer to attenuate 478-keV gamma-rays from boron neutron capture. A stack of polyethylene and lithiated glass is introduced into the collimator between the sample and the HPGe detector to reduce the scattered fast neutrons from the irradiated sample from this direction as well. Not only the irradiation position at the distance of 67 cm was installed, but also a position for counting decay gamma radiation much closer to the detector (17 cm) where the detector efficiency is much higher while keeping measuring background at its minimum (fig. 3).

Another tricky part was designing the collimation of the fast neutrons before they reach the sample. The design actually follows similar pattern as the complex shielding of the HPGe detector (fig. 4). The first part of the collimator allows the fast neutrons from almost the whole convertor plate to reach the sample in front of the detector, while the second part collimates the beam to a diameter of about 5 cm. A lead plug with the thickness of 5 cm at its end reduces the intensity of the unavoidable gamma-rays coming out together with the fast neutrons.

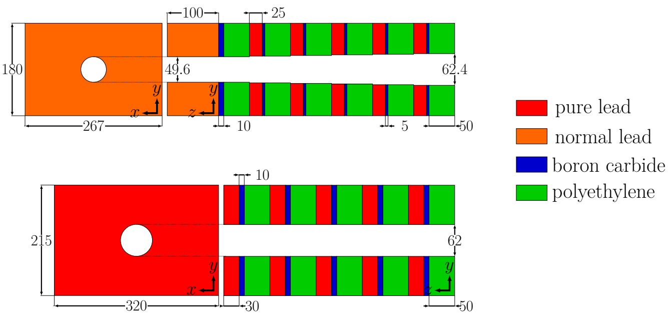


Fig. 4: Two collimator systems to shape the fast-neutron beam to a diameter of 5 cm.

Until now, there were three campaigns performed with FaNGaS at MEDAPP. The first one was spent mostly by fine-tuning of the new instrument, reducing the background and calibrating the HPGe detector. The collimated fission-neutron flux was measured by activation of different metal foils. The next two were dedicated to irradiate different metallic foils for comparison with the only available catalog of (n, n'γ) reactions by A.M. Demidov (1978). Then actinides like ^{238}U but also Pb, Cd, Ti, W, Fe etc. were irradiated and the decay spectra were acquired after the irradiation in the decay-counting position.

The acquired spectra are rather complicated (fig. 5), the background signal has to be analysed in detail and subtracted. So the thorough analysis and evaluation is still going on.

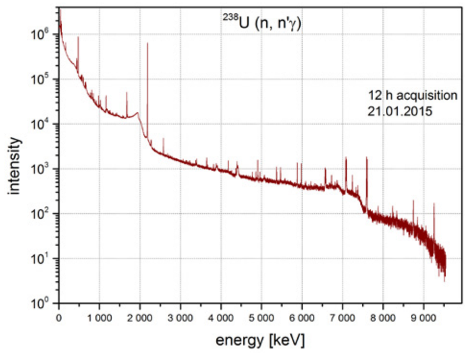


Fig. 5 The (n, n'γ) spectrum of the ^{238}U target.

The FaNGaS instrument just has been installed and tested as a removable option at the MEDAPP facility. There are many improvements foreseen according to the experience collected during the first half year of the operation. Once the FaNGaS method has been established at FRM II, and the analysis would continue routinely, other nuclear reactions like (n, p), (n, α) are being explored by decay measurements as well. In the best case a new precise catalogue similar to that of Demidov will be compiled which could be used as the primary database in the field work with neutron generators and for simulation calculations in reactor physics as well.

P. Kudejova (FRM II)

Elementary particle physics at low energies: Searching for new physics with neutrons

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Bastian Märkisch studied physics at the Heidelberg University and the University of Edinburgh. He received his doctorate in 2006 in Heidelberg. This was followed by several long research visits to the Institut Laue-Langevin, Grenoble, and a position as scientist there. Since 2010 he is PI within the Priority Programme SPP 1491 of the DFG. He is spokesperson of the PERC collaboration and started his group at TUM in April 2015.

The **S**tandard **M**odel (SM) of particle physics very successfully describes all phenomena which involve three of the four fundamental forces. Nonetheless, there are many reasons to believe that this theory is incomplete and that it needs to be extended. Often searches for physics beyond the SM are performed at very high energies, for example at colliders. Experiments at low energies but with very high precision can provide complimentary access to these questions, especially if the mass of new particles is beyond the reach of direct production at colliders.

Precision experiments with cold and ultra cold neutrons indeed address and test a wide range of physics questions and models. These include e.g. quantum mechanics, physics in the early universe (matter-antimatter asymmetry and element formation), the structure and nature of the weak interaction, searches for new interactions and particles, extra spatial dimensions, and much more.

At the MLZ, a number of experiments in this field are currently being set up:

- The nEDM experiment will search for an Electric-Dipole-Moment of the neutron, a question closely related to the understanding of the matter-antimatter asymmetry in the universe.
- The PENeLOPE experiment will determine the lifetime of the neutron, which has an impact on the element formation in the early universe and searches for new physics.
- The **P**roton **E**lectron **R**adiation **C**hannel facility (PERC) will enable precise measurements on spectra and correlations in neutron beta decay in search for new physics beyond the SM.

Neutron beta decay is an excellent system to study the charged weak interaction experimentally. The neutron decays into a proton, an electron and an anti-electron-neutrino. The maximum kinetic energy of the released electron is 782 keV. Comparing this with the mass of the W boson $m_W = 80$ GeV/c^2 of the weak interaction clearly shows that this is a low energy process. Being the simplest semi-leptonic decay, neutron decay is precisely described by theory and unencumbered by nuclear structure effects. In fact, only three parameters, the ratio of axial-vector and vector coupling constants $\lambda = g_A/g_V$, the matrix element V_{ud} of the Cabibbo-Kobayashi-Maskawa (CKM) quark mixing matrix, and the Fermi coupling constant G_F, are required to completely describe the decay within the SM. G_F is known with very high precision from muon decay, leaving only two free parameters to be determined by neutron decay experiments. Alternative theories to the SM change the prediction for the experimental observables in neutron decay. Precision measurements are used to investigate the structure of the weak interaction and to derive the CKM matrix element V_{ud}.

Observables in neutron beta decay are about a dozen so called correlation coefficients, spectra and – most well known – the neutron lifetime. The most prominent

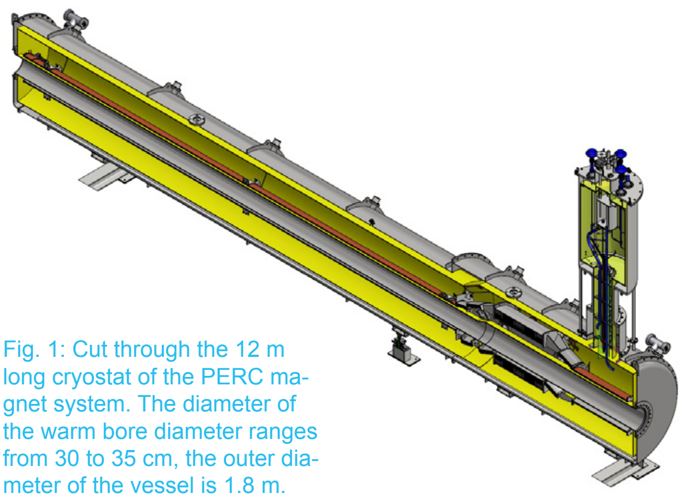

Fig. 1: Cut through the 12 m long cryostat of the PERC magnet system. The diameter of the warm bore diameter ranges from 30 to 35 cm, the outer diameter of the vessel is 1.8 m.

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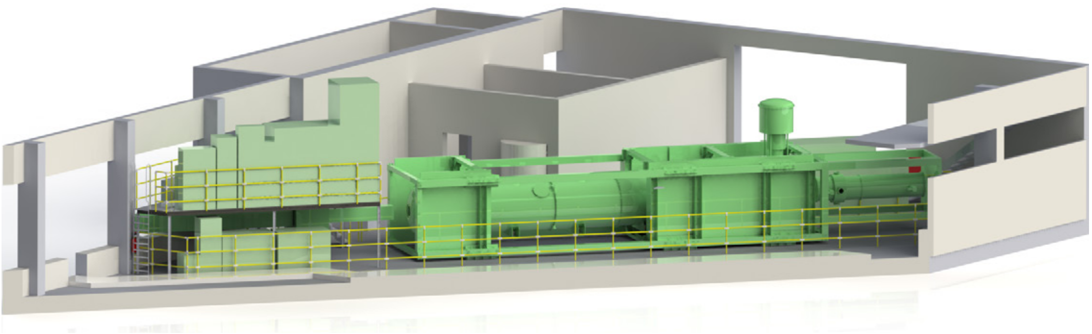


Fig. 2: PERC installed at the new beam site MEPHISTO. The site is located at the northern side of in the new Neutron Guide Hall East. The beam preparation by the velocity selector, polariser, adiabatic fast passage spin flipper and chopper is partly hidden by the infrastructure platform in the left part of the picture.

correlation coefficient in beta decay is the beta-asymmetry parameter A which describes the correlation of the electron momentum distribution and the neutron spin. The equivalent process in the beta decay of ^{60}Co led to the experimental discovery of parity violation in the weak interaction by Wu, Ambler et al. For more information see reviews [1].

The experimental focus of the new TUM group "Elementary Particle Physics at Low Energies" at the Physics Department are measurements of correlation coefficients in neutron beta decay. Our existing spectrometer PERKEO III was built by Heidelberg University and is currently installed at the Institute Laue-Langevin, Grenoble. Measurements are performed by a collaboration between Heidelberg, TU Wien, ILL, and TUM. A description of the measurement principle of PERKEO III can be found in [2].

The new facility PERC is currently under construction at the MLZ. It is designed to measure several of the correlation coefficients with a precision up to 10^{-4}, an improvement by one order of magnitude compared to its predecessors, see [3,4].

PERC's main component is a 12 m long superconducting magnet system, which is depicted in fig. 1. The left part consists of an 8 m long solenoid with a field of B_0 = 1.5 T. It contains the active volume in a non-depolarising neutron guide. This guide needs to be non-depolarising on the 10^{-4} level in order to sufficiently preserve the neutron polarisation. This scheme offers the maximum phase space density of neutrons available in a cold beam and allows using a much longer section of the n-beam, while retaining a small detector size and a good signal to background ratio. In the rear, where decay products, electrons and protons, are separated from the neutron beam, the magnetic field can be as high as B_1 = 6 T.

PERC will act as a source of protons and electrons from neutron beta decay. These particles will then be analysed by exchangeable specialised detector systems to measure different observables. The detector systems will be provided by the users. Concepts under investigation or development by different groups range from rather simple plastic scintillation detectors, to magnetic spectrometers, Wien filters, or the novel RxB spectrometer.

The technical design details of the PERC magnet are currently being finalised and it will be delivered to and installed at the new beam site MEPHISTO in the Neutron Guide Hall East in summer/ autumn 2016. Being located at the rim of a new building, the beam site has only few neighbouring instruments, which reduces background for measurements and provides easy access on ground level to allow installation of the magnet itself, and the sizeable secondary detector systems, see fig. 2.

PERC is one of the flagship experiments of the Priority Programme SPP 1491 of the Deutsche Forschungsgemeinschaft. Collaboration partners come from Universität Heidelberg, TU Wien, SMI Wien, Universität Mainz, ILL, TUM, and FRM II.

B.Märkisch (TUM)

Read more:

[1] D. Dubbers and M. G. Schmidt, Rev. Mod. Phys. 83, 11111171 (2011); and H. Abele, Prog. Part. Nucl. Phys., 60, 1-81 (2008).

[2] B. Märkisch et al., Nucl. Instr. Meth. A 611, 216-218 (2009).

[3] D. Dubbers et al., Nucl. Instr. Meth. A 596, 238-247 (2008).

[4] T. Soldner, FRM News No 5.

Positron trapping experiments for future plasma physics studies

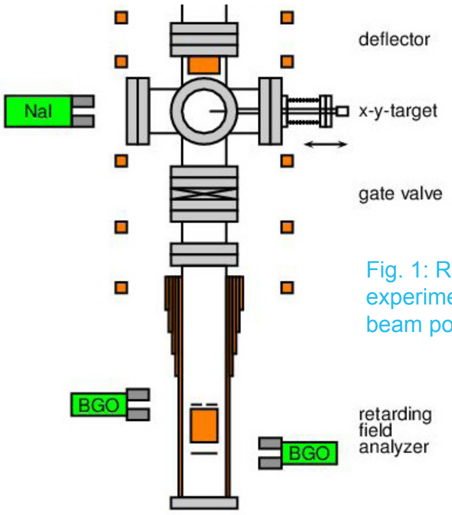
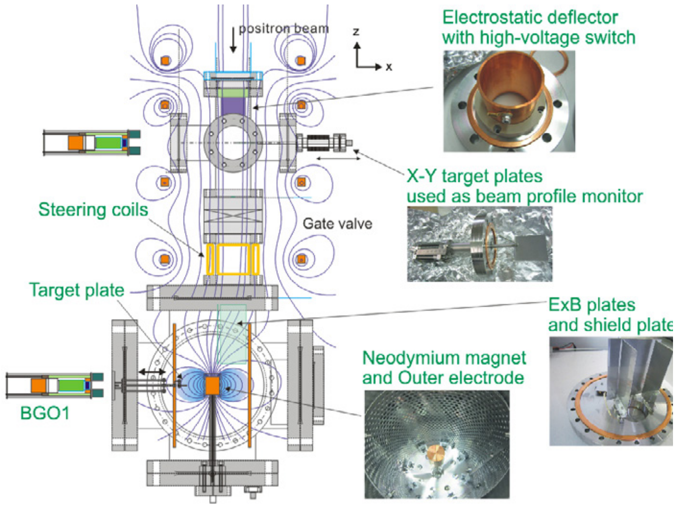


Fig. 1: RFA (left) and dipole (right) experiments operated at the open beam port of NEPOMUC.



Experimental studies with positrons are making rapid progress fostered by recent advances in technologies for positron production. The APEX/PAX team, a collaboration between positron and plasma physicists, attempts to create a novel object for fundamental physics research: A positron-electron plasma. Such plasma is predicted to exhibit completely different properties from those of conventional ion-electron plasmas as a result of the equal-masses of the particle species. Although intensive theoretical and numerical studies have been conducted on this topic, such as unique stability and wave propagation properties, there are very few experiments on pair-plasmas so far. In particular, confined positron-electron plasmas, suitable for plasma physics experiments, have never been created on Earth.

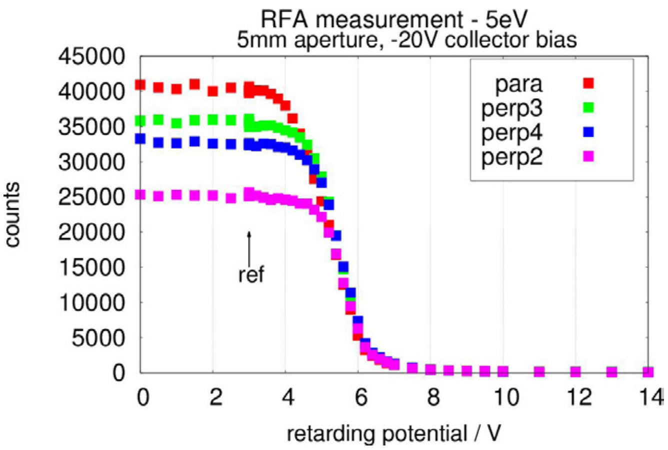


Fig. 2: Typical RFA data: Variation of the annihilation signal versus the retarding potential for the 5 eV remoderated positron beam. The four different symbols indicate four different magnetic field gradients. The shift of the edge gives a measure for the total energy and the perpendicular temperature. To monitor the beam stability, reference measurements were taken periodically.

We plan to confine a plasma of positrons and electrons using novel toroidal magnetic traps operated at the bright positron source NEPOMUC. Development of schemes for efficient high-rate positron injection and stable confinement of non-neutral plasmas are key technologies in our project. For these purposes, understanding the positron beam properties and demonstration of positron injection into closed field lines are important first mile-stones. On this basis, first experiments have been carried out at the open beam port of NEPOMUC using a **r**etarding **f**ield **a**nalyzer (RFA) and a prototype dipole field device with a supported permanent magnet.

A scheme of the experimental set-up is shown in fig. 1. Topmost, a six-way-chamber houses a set of x-y-targets which in combination with a NaI scintillation detector can be used to determine the beam profile in close proximity to the experimental location. On the downstream side this chamber can be connected to either one of the following set-ups:

- A RFA, consisting of an aperture, a retarding electrode and collector, is located within field coils which are capable of creating various magnetic field gradients. In this configuration, the energy components both parallel and perpendicular to the magnetic guiding field can be determined via the annihilation signal produced on the collector.
- A strong permanent neodymium magnet is used to create a prototype dipole field trap. At the beam entrance port a set of oppositely biased plates is used to transport the positrons into the strong

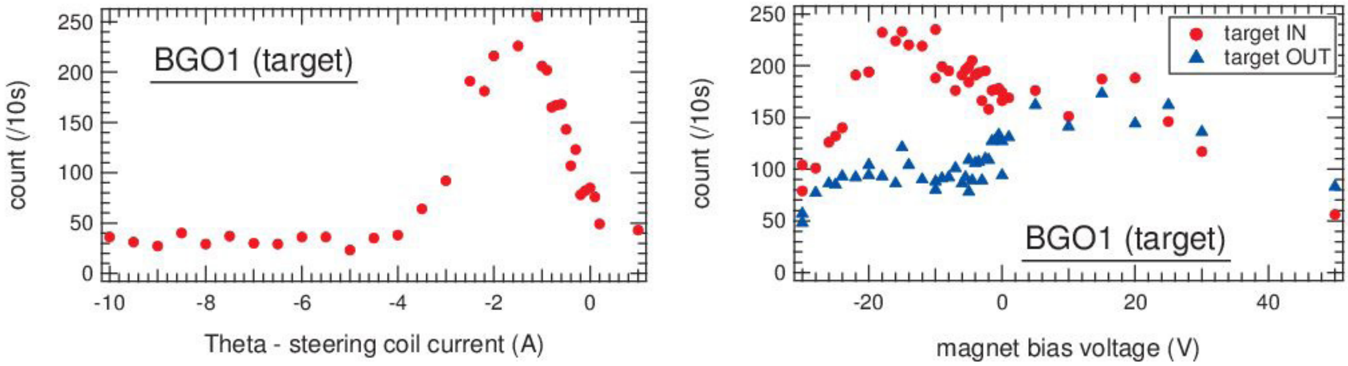


Fig. 3: Variation of the steering coil current (left) and the bias applied to the magnet (right) in order to maximise the counts detected on a target inserted into the strong field region. For the magnet bias scan the annihilation signal from the same region but with the target retracted from the strong field region is shown. This shows both, the successful transport of positrons into the strong field region and their toroidal transport.

field region via the ExB drift. Two BGO scintillation detectors are used to identify the annihilation position. This device permits studies of drift injection and trapping of positrons in this field configuration.

For the plasma physics experiments various incoming beam energies are of interest. According to simulations, low-energy positrons at a few eV have higher trapping efficiency in the dipole trap. High-energy positrons, however, could be used to create low-energy positrons from an in-situ remoderator (tungsten crystal) in the dipole trap. Thus, the NEPOMUC remoderated positron beam was characterized at energies of 5, 12 and 20 eV, as well as the primary beam at 1 keV energy. Typical annihilation signals versus retarding potential in the presence of various magnetic field gradients are shown in fig. 2. Analysis of the resulting curves gives a measure of the total energy and the perpendicular temperature.

In the dipole experiment, the drift injection was optimised by maximising the annihilation counts on a target inserted into the strong field region opposite to the injection point, see fig. 1. The optimal bias applied to the drift plates was found to be in remarkable agreement to orbit calculations. Additionally, the injection position, determined by two pairs of steering coils, and the bias voltage applied to the magnet and an outer electrode were found to play key roles, as shown in fig. 3. As a result, positrons were successfully transported into the dipole field and observed to drift 180° toroidally. In order to test for confinement, pulses of positrons were injected into the magnetic trap and the time between the injection and the initiation of the annihilation signal counting was varied. It was found that the positrons remain in the trap for a few tens of microseconds, see fig. 4.

As an alternative injection scheme, the creation of low-energy positrons from a high-energy positron beam impinging on a reflection remoderator within the dipole trap is studied. Within the last beamtime, steering of the beam onto the target has been demonstrated. The reemission of the low-energy positrons and their transport into the strong field region however requires further investigation.

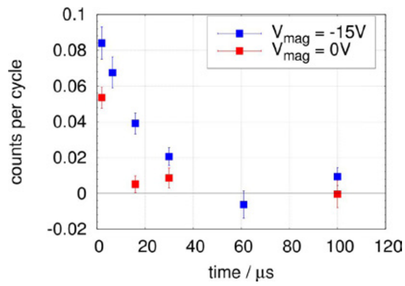


Fig. 4: Variation of the time between the injection and the start of the annihilation signal record for the magnet negatively biased (blue) and grounded (red). Positrons persist in the dipole field for a few tens of microseconds.

The first results obtained at the open beam port of NEPOMUC clearly show the validity of the drift injection scheme toward the creation of pair-plasmas. Basic parameters of positron beams needed for the optimization of injection were also obtained. These results represent significant steps towards the creation of a positron-electron plasma. Based on these results, we plan to construct and operate a superconducting levitated dipole device at NEPOMUC for the simultaneous confinement of positrons and electrons.

J. Stanja, H. Saitoh, E. V. Stenson, U. Hergenhahn,
T. Sunn Pedersen (MPI für Plasmaphysik)
M.R. Stoneking (Lawrence University, Wisconsin)
C. Piochacz, C. Hugenschmidt (TUM)

Bringing together broad interests

Franz Michael Wagner retired a few months ago after 35 years work at the neutron sources FRM and FRM II at Garching. We talked with him about his life, his work, and how he brought together physics and music as well as physics and medicine.

Mr. Wagner, your main interests are physics and music. How did this come about?

I always wanted "to understand whatever binds the world's innermost core together" and this is only possible in my opinion by physics. No other discipline is so fundamental, and it does not allow any seduction since rationality and logics never abandon you.

This is quite a humanistic approach for a physicist?

I attended a high school focused on languages at Berchtesgaden where I grew up. I started studying physics at the LMU in 1968 and sometimes struggled with the disregard of natural sciences at school. But when it came to my doctoral studies at the former Mößbauer Institute, I realised that at least good English was a matter of course, and so my former education paid for itself.
During a scientific exchange with the Soviet Academy of Sciences – I worked several times in Russia – I got acquainted to my wife whom I married in 1979. Due to the political situation, she got the permission to leave the Soviet Union only in 1982.
During that time, I got also the chance to attend courses in the faculty of medicine in order to finally go to the field of medical physics which always had great attraction for me. The study of medicine strongly deepened my respect for creation and humanity.

So, how was your further career?

Due to several reasons I was not able to finish my doctorate studies. After a short interlude in industry in 1980, L. Koester gave me the chance to participate in his fast neutron therapy project at FRM II which is continued at FRM II until today.

Your first working day at the FRM was August 1st, 1980. What was your task in detail?

I had multiple tasks: One was the cooperation with biologists from various institutes who collected data about fast reactor neutrons. In this context, also a project on **B**oron **n**eutron **c**apture **t**herapy (BNCT) was conducted, and I was a member of the European concerted action on BNCT. Another task was mixed-field dosimetry which was realised in cooperation with the former GSF at Neuherberg, supported by the Bavarian Umweltministerium, and also with a neutron therapy group at Obninsk, Russia, with support of Volkswagen-Stiftung.
After the Chernobyl accident, the authorities constantly increased requirements in radiation protection so that I had to dedicate more and more time to such tasks from where, in fact, came the money for my (permanent) position. In the last years of the old FRM, I became radiation protection officer, and I was the first one of FRM II. In this position I was also involved in the planning and public relations work for FRM II. This interrupted most of my scientific work until 2007 when neutron therapy could be restarted at FRM II. Since then, the MEDAPP facility had many users not only from the clinics of TUM, Innsbruck University, and others, but also biologists as well as medical, electronic and nuclear researchers used the fast neutron beam. So I had the opportunity for research, and the pleasure to supervise many very talented students of whom several are now working in hospitals. I am especially grateful to the directors of FRM II, the late K. Schreckenbach, to W. Petry, and to A. Kastenmüller who attained the CE-sign of the MEDAPP-facility.

F.M. Wagner, briefing his new colleagues: C. Genreith (below left), S. Söllradl (below right).

Your second passion is music. How did that come up?

My father was an orchestra conductor and pianist, and so I grew up with music, played the double bass in orchestras, and sang in choirs. I played the organ and got first experience in conducting our vocal ensemble in the church. Although my interest in physics was predominant, I never abandoned this field and attained a degree as a choir conductor in 1993. I became director of many choirs in the Munich region, and I was elected chief conductor in several choir associations. In 2006, with encouragement of my wife and TUM President W. Herrmann, I founded "Campus-Chor Garching" (CCG) which since then performed many concerts and sang at many festive occasions at the TUM. I am very grateful for this opportunity and so are the singers coming from many faculties and from about 20 nations.

During the last years, only few patients were treated at the FRM II. What are the reasons?

In the 1980s, there was a great hope that neutron therapy will solve the problem of "radio-resistant" tumours. Since then, however, the radiation treatments with photons made enormous technical progress. Methods like tomotherapy and intensity modulated radiotherapy are nowadays able to target on the cancer very sharply. As well as the biological advantage of fast neutrons persists, such a non-standard method requires more resources. Nowadays, only palliative cases of superficial tumours like chest wall metastases of mammary carcinoma and recurrent melanoma are to be treated at FRM II. In addition, the 24/7 running mode of FRM II with longer breaks cannot be used so effectively by clinicians as the facilities in the hospitals. During the last year, after a longer technically caused break in medical treatment, we worked mainly on dosimetry, but we made a lot of industrial irradiations. Especially the radiation hardness of electronic devices to hadrons can be very well tested with fast reactor neutrons. The main applications concerned electronics of air crafts, of nuclear facilities, electronics used in intense radiation fields, and fundamental questions of radiation effects as they may occur, e. g., during a manned Mars mission. So we were quite busy anyway.

How will the things continue with MEDAPP?

In future two colleagues will be responsible for the SR-10: S. Söllradl mainly for neutron computed radiography and tomography (NECTAR) and my direct successor C. Genreith for the technics at MEDAPP and for the new instrument FaNGaS (see p. 16); clinical physics is supervised by the MRI. My young colleagues will take care for the techniques of beam tube SR-10, and of the support of scientists and industrial users.

We wish you the best for the future and good luck for your next concert!

The next concert will be a lighthouse project at the occasion of the 1100-year anniversary of the city of Garching: We perform as main choir together with additional choirs, orchestra, and actors Carl Orff's "Carmina Burana"!

F.M. Wagner was interviewed by C. Kortenbruck (FRM II)

Some thoughts about...
Neutron instrumentation at German sources and beyond

Tobias Unruh
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The deadline for the next round of the BMBF call for German-Swedish research projects in "materials research and structural biology with neutrons and synchrotron radiation" in the frame of the Röntgen-Angström-Cluster is just gone and the planning for the next round of collaborative research is in full swing. For this purpose, a very constructive strategy meeting was held by the BMBF in Bonn on May 21st, 2015. In this meeting, the KFN highlighted the research with neutrons as a national key competence for solving scientific and technological challenges of our society. In this context, the essential role of collaborative research for the German neutron community was pointed out and was illustrated by some selected impressive ongoing collaborative research projects. We are looking forward to the forthcoming call of the BMBF followed by many innovative proposals of the user community!

Unfortunately, HZB will not support new collaborative research projects for research with neutrons. But we are looking forward to proposals for MLZ and ILL as well as a considerable number of proposals for ESS instrumentation some of which in close cooperation with MLZ or ILL. I would like to thank the many colleagues who sent a short abstract of their intended projects for the next collaborative research round to the KFN. This helped us to formulate some recommendations for the upcoming call.

In the context of support for collaborative research projects but especially also in view of the operation and the ongoing important investments, the effective budget reduction of FRM II is regarded by the user community as a severe threat for the full operational availability of MLZ which is essential for fulfilling the societal mission of research with neutrons mentioned above. The MLZ is in the phase to reach highest standard and output. In this time, a putative small amount of money with respect to the total operation budget could severely reduce the productivity of MLZ. Thus, a common effort of the MLZ members and the funding bodies is demanded from the user community to avert momentous damage for research with neutrons in Germany.

It is the intense engagement of the whole German user community from universities, national institutes, and large scale facilities in building new instrumentation especially at MLZ over the last decades that made possible the enormous success of German contributions to the instrumentation at ESS. In a highly competitive, transparent and professional selection process five (out of the first twelve) instruments with leading contributions of German institutions were chosen to enter the construction phase. This number might be extended when the selection of the next four instruments will be announced. Now it is important that the selected projects are efficiently supported such that the design update and the construction of the instruments can be initiated and the instruments will be ready to use the very first neutrons at ESS hopefully still in 2019. In this context the discussion about the operation costs of the instruments at ESS needs to be solved in due time. The institutions which were selected on the basis of the scientific excellence of their proposed instruments should be enabled to build the instruments independent on their capability to provide the corresponding operation costs. Only in this way it will be possible to guarantee the highest quality standard for the instrumentation at ESS.

Newly Arrived

Sebastian Busch

As a scientist, I joined the teams at both REFSANS and SANS-1 and will also support users at the latter. I know the MLZ - I had finished my PhD at TOFTOF dealing with dynamics before I went to the University of Oxford working on structure determination.
I am really interested in novel materials, especially in large scale structures and surface effects (a topic REFSANS and SANS-1 are very well suited for) and it would be great to combine structure and dynamics by studying kinetic effects!

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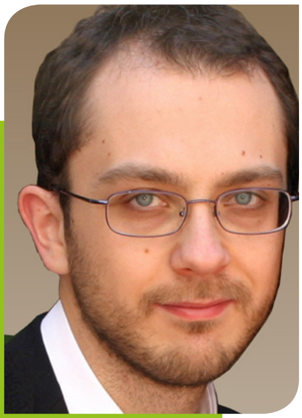
Gaetano Mangiapia



I am a postdoc at KWS-1, investigating microemulsions in the presence of block copolymers used as additives for increasing the surfactant efficiency.
I also plan to study the effects of some commercial drugs on phospholipid-based membranes. My previous scientific work was related to the study of supramolecular systems with potential applications as therapeutic and/or diagnostic devices. I am interested in soft matter, chemical thermodynamics, matter transport, and, obviously, neutron scattering!

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I am the instrument scientist for MEDAPP. I will prepare it for medical patient treatments, perform irradiations for science and industry, and work with the FaNGaS spectrometer (see pp. 16). I obtained my PhD at FZ Jülich and RWTH Aachen, where I worked on partial capture cross section measurements for actinides. I designed and manufactured appropriate samples, performed simulation studies and conducted experiments both at FRM II and BRR.
My main scientific interests lie in the application of fission neutrons and nuclear reaction studies.

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Christoph Genreith

I am one of the instrument scientists on KWS-1. I will mostly perform SANS experiments on soft matter systems.
I obtained my PhD at Uppsala University and the ILL. There I was mainly characterising polymer gels for biomaterial purposes. I was also involved in the development of implant surface drug delivery. After that I held a postdoc position at the LMU working on functionalised surfaces and liposomes. My research interests are primarily structure of soft materials. I am interested in biological systems, complex fluids, as well as surface interactions.

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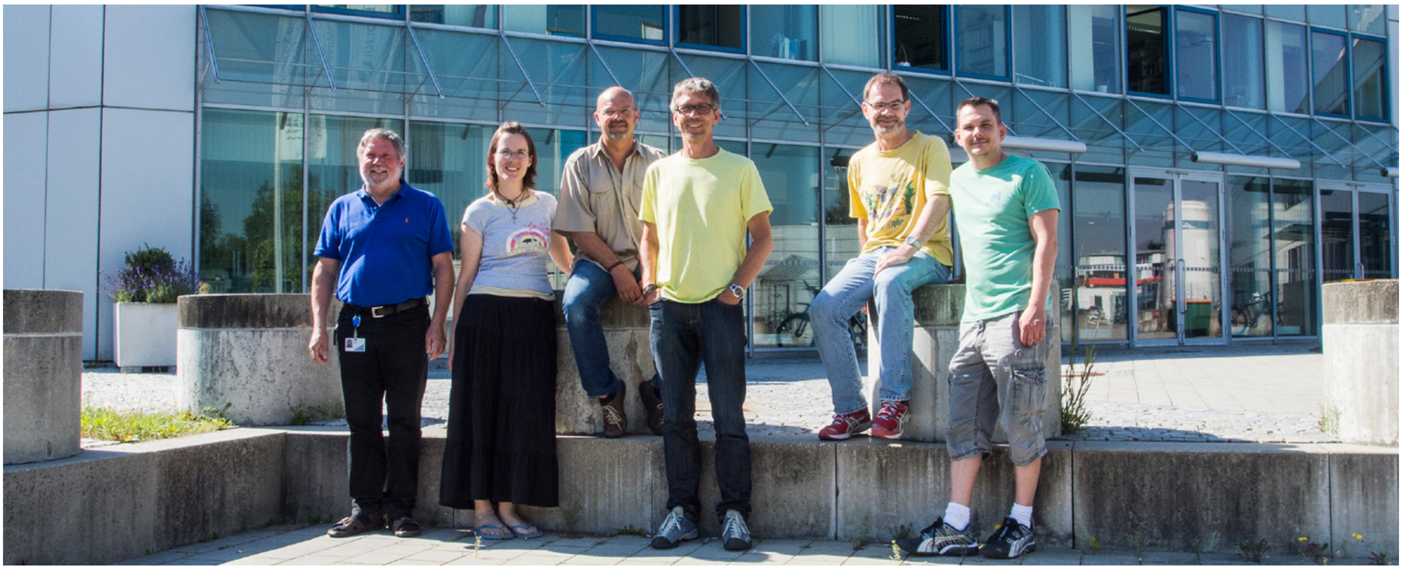
Ida Berts

Enterprising helpers in the background: The Sample Environment Group



Most of the FRM II Sample Environment Group getting some sun in front of the entrance building: H. Weiß, M. Resag, P. Biber, J. Peters (head of the group), H. Kolb, J. Wenzlaff.

When submitting a proposal in order to get beam time at the MLZ, one part of the online form you have to complete is dedicated to the desired sample environment. Why? Because the majority of neutron scattering experiments is not performed at ambient conditions. Most phenomena become evident either at low or high temperatures, in electric or magnetic fields, high pressure or stress and even the simultanous application of these environmental conditions. Therefore, you can select from lists with available devices like cryostats, high temperature furnaces, pressure cells, and magnets and have to give necessary information about the temperature range and stability as well as on pressure range and magnetic field.

To cover the requirements of new scientific fields or to go beyond existing limit means continous adaption and improvement of existing experimental techniques and devices as well as the development of novel equipment. This is the field of the Sample Environment Group, dealing daily with the equipment's maintenance and set-up, and always there to give a helping hand (including an on-call-duty).

The continuous improvement of the interplay of instrument and sample environment control is another field of activity in collaboration with the Instrument Control group. For the efficient use of the existing equipment it should be flexible enough to be used on every instrument within MLZ. The centre wide strategy is to use TACO/SE-boxes to hook-up the equipment to the neutron scattering instruments. So all equipment originating either from FRM II or JCNS will be interchangeable as "plug and play".

But this is not enough!

> *"In the framework of the NMI3 Joint Research Activity we are strongly involved in different fields of sample environment development e.g. soft matter applications like humidity cells or extreme environments like high pressure"*,

explained Jürgen Peters, head of the FRM II Sample Environment Group, and Harald Schneider, head of the JCNS part.

The latter has been in charge of the JCNS instrument suite – but for the longest time, because after about eight years at Garching, he will head for the ESS at Lund in August. Not only we but also many users will miss him, his know-how, and his lusty nature when conducting their next experiment. We wish him all the best!

H. Schneider (JCNS) conducting the specification test of a 5 T cryomagnet.

I. Lommatzsch (FRM II)

The Egg gets a crack on the head!

Having a close look before starting the work at the Atomic Egg's lid.

Building up a working platform.

Working....

Enjoying the view: recognising the famous Allianz Arena when peering towards Munich.

View to the oppsite site - nearly seeing the airport.

News from the User Office

U6 at 10-minute intervals

Good news for those who always forget something at the hotel:

The underground line U6 to and from "Garching-Forschungszentrum" now goes every ten minutes during the day from Monday to Friday.

Scan the code for the next departure from "Garching-Forschungszentrum".

Rapid Access at BIODIFF

The large unit cell diffractometer BIODIFF is the latest member in the group of instruments offering Rapid Access. Like KWS-2, PGAA, and SPODI, it offers three beam days of a cycle within this programme; a maximum of twelve hours per accepted proposal.

Scan the code for all information about the Rapid Access Programme.

Applying for a visit

Please note that due to internal processes, we have to ask our users to apply online for their visit at the MLZ three weeks in advance at the latest. Otherwise we are not able to guarantee your access to the halls.

Just log in at the User Office System and use the module "Arrival_Departure".

Canteens: Extended opening hours

To get hungry at the MLZ is sometimes a big problem... But there is hope!

The Garching canteen ("Mensa") extended its kitchen opening until 16:00 from Monday to Thursday.

Scan the code for a list of all canteens' opening hours.

German radiation passport

Our Radiation Protection Department asks participants in experiments here at Garching working at German institutions to take care of a radiation passport well in advance.

In case you have to apply for one, this will take some time - even more if your institution doesn't have a radiation protection officer. Please start the process as early as possible in order to avoid any problems when starting the experiment at our instruments.

Don’t forget to submit your proposal!

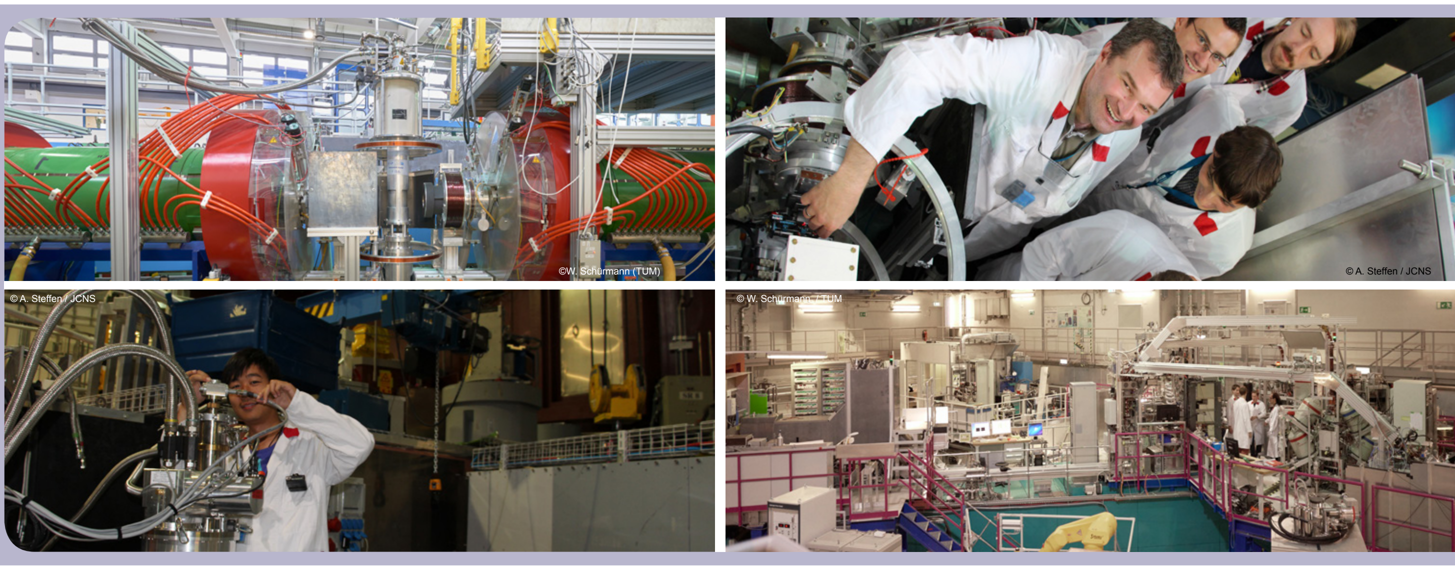
Next Proposal Deadline: September 11th, 2015

Read the Call for Proposals

- at mlz-garching.de/user-office
- or scan the qr-code!

Submit your proposal at

- fzj.frm2.tum.de
- user.frm2.tum.de



Rapid Access

Find all information

- at mlz-garching.de/englisch/user-office/getting-beam-time.html
- or scan the qr-code!

Submit your proposal at

- fzj.frm2.tum.de
- user.frm2.tum.de

Upcoming

August 30-September 04
ECNS 2015: VI. European Conference on Neutron Scattering
(Zaragoza, Spain)
ecns2015.unizar.es
Visit our booth there!

September 07-18
19th JCNS Laboratory Course – Neutron Scattering 2015
(Jülich and Garching, Germany)
neutronlab.de

September 13-17
DyProSo 2015: 35th Symposium on Dynamical Properties of Solids
(Freising, Germany)
mlz-garching.de

September 21-25
MATRAC 1 Summer School:
Application of Neutrons and Synchrotron Radiation in Engineering Materials Science
(Ammersbek, Germany)
hzg.de/matrac

October 05-08
JCNS Workshop 2015:
Neutron Scattering on Nano-Structured Soft Matter: Synthetic- and Bio-Materials
(Tutzing, Germany)
fz-juelich.de/jcns/JCNS-Workshop2015
+ Satelite Workshop:
October 08-09
Soft Matter & Neutrons GO Energy
(Feldafing, Germany)

Reactor Cycles 2015

No.	Start	Stop
38a	14.07.2015	07.08.2015
38b	08.09.2015	12.10.2015

Please note:
From October 12th, a break of some months is planned. Keep an eye on our webpage to find the latest news about the future cycles!

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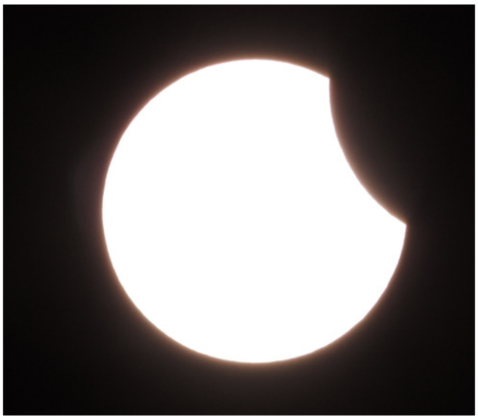
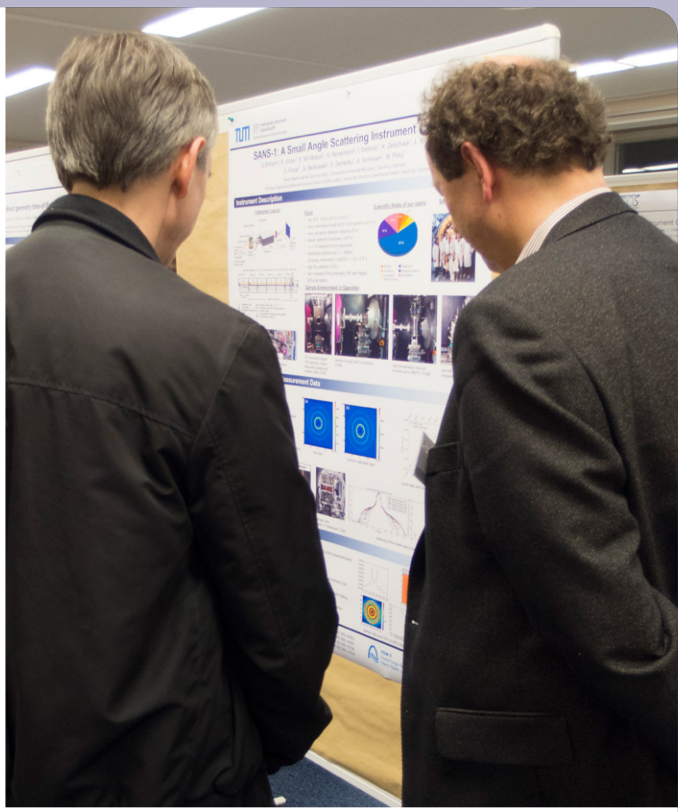







An eclipse of the sun and a horde of physicists.... More words needed?

Photos of the eclipse by B. Schillinger (FRM II)



Impresssions from the User Meeting 2015.