MLZ
Heinz Maier-Leibnitz Zentrum

MaMaSELF

Newsletter 19

MLZ is a cooperation between:

JÜLICH FORSCHUNGSZENTRUM

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

Technical University of Munich TUM

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 Education, Science and the Arts

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Education of young neutron scientists: A key mission for the MLZ

An editorial by

Winfried Petry

Scientific Director FRM II
Scientific Director MLZ

The changing neutron landscape in Europe is one of the hot topics being discussed at the MLZ. This covers not only the situation of European neutron sources but also the expectations and the expertise of our users.

Looking back in time, I remember a lot of expert groups at universities and research institutes coming to my instrument at the ILL and I profited from their expertise in the early stages of my career. Today at the MLZ, the situation has changed substantially. More and more less experienced users come to Garching to perform neutron experiments. This reflects on the one hand the increasing demand for neutron measurements in a growing number of research disciplines. On the other hand, neutron scattering complements frequently research projects, i.e. neutrons are "only" one method applied to the scientific question. In this context, education of young scientists will be of increasing importance for our near future. The MLZ with the inherent strong link to the Technical University of Munich as well as to other universities is even now a key player in this business. One example is the education of master students in a dedicated programme: The celebration of ten years Erasmus Mundus MaMaSELF programme is one of the topics in this newsletter.

Education at the MLZ even now spans a wide range of activities. Starting from undergraduate courses with hands-on training at our instruments (TUM Physics Department), neutron lectures including our contribution to the international e-learning project (e-neutrons.org) up to neutron schools organised by the MLZ partners in Jülich (JCNS Laboratory Course – Neutron Scattering) and Geesthacht (MATRAC school) also with hands-on training on-site at the MLZ; all steps of the career of a neutron scientist are covered. However, considering the increasing demand that we see we aim for further extension of our activities. The things we have in mind go from a MLZ graduate school for neutron research via providing experts for teaching to data evaluation support for the experiments.

Read more

- about *MaMaSELF* on p. 5-8
- about the *JCNS LabCourse* on p. 14

MaMaSELF is celebrating ten successful years

In September 2007, the first cohort started the ERASMUS Mundus "Master in Material Science Exploring Large scale Facilities" (MaMaSELF) with about 20 students. In the meantime about 300 students from all over the world finished their studies at one of the five participating universities: University of Rennes 1 and University of Montpellier in France, the Technical University (TUM) and the Ludwig-Maximilians University (LMU) in Munich, and the University of Torino in Italy.

Originally, Prof. Werner Paulus started at the University of Rennes with a one-year master programme. He had at that time already a large background of neutron and X-ray diffraction and knew of course other scientists with the same background. But, in those days, knowledge about research with neutrons was in Europe a kind of "fringe subjects": a very small community with only a few students and even less chairs at only some universities and finally poor job options. So Paulus looked for support from his colleagues Winfried Petry (TUM), Wolfgang Schmahl (LMU), and Carlo Lamberti (Torino). Together they designed a master programme with the dedicated goal to form skilled scientists in materials science with an advanced knowledge of the use of large scale facilities such as neutron and synchrotron sources or free electron lasers.

Every year before Christmas, Wolfgang Schmahl shows the Munich students the historical town and the Christmas market in Regensburg with hot wine and a lot of fun.

All participants are carefully selected by all professors: (left to right) W. Paulus, C. Lamberti, C. Papadakis, M. Saß, and W. Petry.

Since 2010, the master programme turned into a two-year master course. ERASMUS Mundus stands for the promotion of the European Union as a Centre of Excellence in the field of higher education. To enhance the visibility and attractiveness of European higher education all around the world, ERASMUS Mundus provided EU funded grants for students from the beginning until today. Non-European students now get €29,000 for the two years, European students from the programme countries €20,000. Of course selected students can participate in the MaMaSELF programme without grant as well.

As a sign of the great success of the programme the number of applicants highly increased, whereas it is astonishing that on the other hand the financial support decreased tremendously. In the first cohort in 2007, 17 from 20 accepted students got a grant; in 2017 there had been only 8 students be granted out of 36 accepted students. The rest has to pay for itself. So, companies are cordially invited to support in the future of some of the best students!

One specific aim of the MaMaSELF programme is to teach the application of "large scale facilities" for the characterisation and development of materials. MaMaSELF's objective is to provide a very multidisciplinary and international approach and train high-level students. These should be able to manage perfectly the scientific and technological aspects of the elaboration, the implementation, the control, and the follow-up of materials. At the end they should fit both into an industrial environment and be able to continue with a PhD.

Karin Kleinstück and Wolfgang Schmahl move together in Munich some of the big stones (room, visa etc.)

Three success stories out of many

Three of the former students of the MaMaSELF master course fulfilled perfectly these hopes: Shuai Guo (2009-2010) from China, Kirill Lomachenko (2010) from Russia, and Avishek Maity (2012-2014) from India.

Shuai Guo belonged to the early students' cohorts who passed the one-year programme. She learned about MaMaSELF from a senior student, Dayin Xu, who was a participant one year before and got the information himself from the French embassy in Shanghai. Shuai Guo says about her participation: "Study wise, it offered me a big variety of curriculums to choose, e.g., physics, chemistry, engineering, finance and marketing, as well European politics. I was highly interested in renewable energy, thus chose organic photovoltaics in Peter Müller-Buschbaum's group at TUM as topic for my PhD study". This was successfully published in a high-ranking journal with an impact factor of 12. The impact on her personal life was profound: "It was one of the most interesting and exciting years of my life. What I did was simply following my heart!" Her advice for other students: "If you have a dream, tell the world what you want, and everyone/ all energy around you will help you to realise it! The world is always bigger than you think; if not, it's your turn to create something new". Shuai Guo now works as a product engineer at Infineon Technology in Munich, where she is a technical interface between different functional groups.

Kirill Lomachenko from Russia participated in the 2010 cohort and has "very warm memories of my time in Munich". After finishing the MaMaSELF programme, he made a joint PhD between the University of Turino (Italy) and the Southern Federal University (Russia). After having completed he worked as a Junior Scientist at the Southern Federal University for one year and moved finally, in February 2017, to Grenoble and is now working as a scientist at the BM23/ ID24 beamlines of the ESRF synchrotron source.

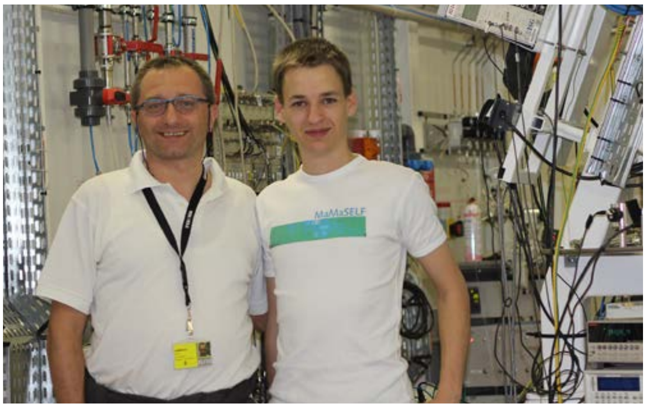
Avishek Maity did his master in physics at the Indian Institute of Technology Madras (IIT Madras), which is one of the active partner institutes of MaMaSELF since the beginning of this Erasmus Mundus programme. He spent his MaMaSELF years (2012-2014) at Université de Montpellier and the Technical University of Munich respectively. "If I express in very short, the most important and exciting part for me was to work as master student in the large scale facilities in direct contact with beamline scientists. MaMaSELF equally provides invaluable cultural enriched experience, it feels like a small world under the same roof" he summarises his experience. Last year, Avishek finished his PhD thesis in strongly correlated material oxides with Werner Paulus at Unitversité de Montpellier and today you meet him here at MLZ as an instrument scientist at PUMA.

Avishek Maity during his master thesis 2014 at Heidi.

Requirements and selection process

Students must have a background in materials science or related disciplines as chemistry, physics, or geo-science. Since all lessons are in English, they have to proof good English competencies. School certificates are not comparable in all countries, so students have to bring at least two recommendation letters. What are the criteria for the selection process? Besides the excellent grades and the very good English language skills there are some more criteria. So, e.g. the recommendation letters are randomly checked and some foreign experience is helpful. There are even more rules: around 50 % of the students should be female; the selection committee attaches importance to a fair and almost equal distribution in regard to the countries of origin of the students. So, a fixed number of places are reserved for students from Asia, Africa and so on. The MaMaSELF webpage shows a very impressive world map of the alumni's countries (37!) and this proves an effect as we know it from other fields of life: where already one sits, others from the same country or institution will follow. But, this is only true if the programme is excellent. This year, more than 1000 students from all over the world applied, 150 of them were selected and 36 finally arrived in September 2017. Organisers empirically know that not all students accept; there are several explanations for it, mostly because of social reasons: no visa, new situation in the family, not enough money… Due to the five partners in the programme, the overall number of participants in a cohort is not really limited.

Graduation ceremony 2017 at the University of Rennes with Wolfgang Schmahl, Karin Kleinstück (middle, right), and Christiane Cloarec (middle, left), the communication and administrative coordinator in Rennes, France.



Kirill Lomachenko (right) with one of the initiators, Carlo Lamberti, at the ESRF in Grenoble.

What are the benefits for students?

The MaMaSELF students study in two different European countries and at least at two different universities. Therefore they receive at least two European master degrees from the five participating European universities. At the end of the first year, students must change country and join a second institution. They have to choose in advance, so that they know before their arrival, in which countries and cultures they will get an insight. Students can start the first year of their studies at any of the five partner universities. The third semester is offered at one of the other four partner universities, while semester 4 is dedicated to the master thesis and can be undertaken at one of the five consortium universities, in industry, at large scale facilities or at any of the partner institutions. An additional option for those who really like to travel is to undergo their master thesis at one of the partner institutions in Japan (Kyoto University, Tokyo Institute of Technology), Switzerland (PSI/ ETH Zurich), India (Indian Institute of Technology Madras), Russia (Southern Federal University), and the USA (Cornell University and the University of Connecticut).

The second academic year will start with a summer school of two weeks at the University of Montpellier in France, where both lectures and practical work will offer an excellent introduction into the use of neutrons and "Large Scale Facilities". The core of the lectures will be given by the scientists responsible for the Master in each of the five universities (Wolfgang Paulus, Philippe Rabiller, Winfried Petry, Wolfgang Schmahl,

The summer school in Rigi (Switzerland) provides a first insight in the Swiss culture: mountains, alp horns and bearded men (one is Wolfgang Schmahl (middle)).Karin Kleinstück (right) is obviously also a musician.

The cohort of 2016 during their stay in Rigi (Switzerland).

and Carlo Lamberti), exhibiting a huge background in this area. Each year, the core lectures will be supported by specific seminars given by other university colleagues and by researchers directly coming from national or European large scale facilities centres.

Science, culture and unforgettable events

All new MaMaSELF students will meet for a Welcome Week in Rennes before starting the lectures at each site of the consortium. This Welcome Week is one of the three main events of the programme where all participants meet; it takes place during the first two weeks of September. This week should help to integrate the new students and form a group. This is very important for the participants because it will provide them with new friends and a lot of support for the future years. It will also propose administrative information (how to open a bank account or to get health insurance) and procedures as well as integration activities as e.g. cultural and sport activities. There will be an opening dinner and the possibility to meet the master students of the second year.

Deadlines 2018

The final deadline for all students who want to participate in the next master course is **May 15th, 2018**. Students who need to get a scholarship by the Erasmus Mundus programme should make sure that they apply in time: Non-European students until **January 30th**, the European ones until **March 10th, 2018**.

www.mamaself.eu

Besides the already mentioned Welcome Week and the Summer School there is the annual status meeting in Rigi Kulm, Switzerland. On the top of the mountain surrounded by lakes, students of the second year are presenting the preliminary results of their master thesis in front of the consortium members and international scientists. Additionally scientific topics will be presented by experts from research centres.

A collective adventure

Of course this is a great opportunity for all MaMaSELF participants, for many of them it is also a great adventure. A lot will return to their countries and serve as an anchor for interesting international research and future common projects, others will stay in Europe. All will find new friends, some even for the rest of their career or life. Wolfgang Schmahl (LMU) mentioned this in his talk for the 10th anniversary celebration in Rennes (September 2017): over the years four students met their spouses and so the MaMaSELF coordinators could proudly present two international couples.

Shuai Guo ended her talk at the 10th Birthday party of MaMaSELF in Rennes: “Last but not the least, to all MaMaSELF students: let us be thankful and not forget all the heroes and heroines, who spent tremendous efforts to make this international master programme run so successfully! Thank you very much for your wonderful work!“

C. Kortenbruck (FRM II), K. Kleinstück (MaMaSELF)

Like a Phoenix: The new J-NSE

The empty carrier structure after removal of the normal conducting main coils.

The very first appearance of the "beast" in the news was in Newsletter number 1 published in December 2008 ("A New Beast in the Guide Hall: J-NSE"): the neutron spin echo instrument which had been in operation for ten years at the Jülich DIDO reactor before being transferred to and rebuilt at the FRM II at Garching. After another decade of operation here, it transformed again.

This time it was not a relocation of the instrument, but rather a cardiac transplantation. The main precession coils, so far water cooled copper coils bearing a maximum of 440 Amps at 360 Volts, were removed in March 2017. They have been replaced by superconducting segmented main coils providing a much more homogeneous magnetic field and improving the performance of the J-NSE significantly. A large team of physicists, engineers and technicians from Jülich and Garching made an effort to keep the time on the operating table short.

During the summer cycle, the J-NSE instrument recovered from anesthesia and found its way back to life, feeling neutrons on the detector again. That cycle was therefore dominated by adjustments and tuning of the auxiliary coils and correction coils. The concept of improving the resolution by an optimised field shape and thus being able to correct for higher magnetic field integrals with the available correction coils, worked out and allowed to increase the Fourier time range at our standard wavelength of 8 Å from 40 ns to 100 ns. The new set-up will pay off especially for the time range up to 200 ns, which is now accessible with a wavelength of 10 Å instead of 15 Å with a much higher intensity.

The cycle finished with first test experiments successfully, and from next cycle on, the "beast" can digest user experiments again, with a much better performance than before. Some time for adjustment will be used for further optimisation of the many new parameters available now, which is particularly important at longer wavelength for very high resolution.

Stay tuned for further progress of the superconducting J-NSE!

O. Holderer, S. Pasini (JCNS)

The new superconducting main precession coils in their cryostats in place at the J-NSE.

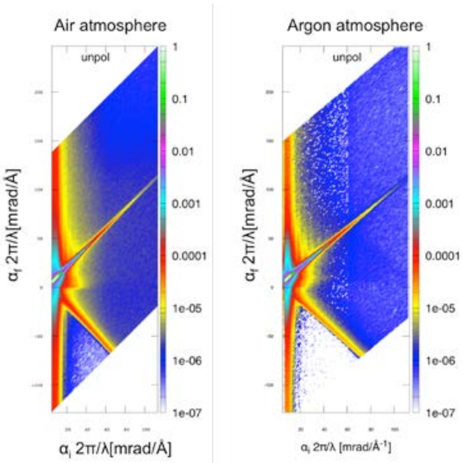
MARIA: Now with argon atmosphere in the detector arm

MARIA is the high flux reflectometer of the JCNS with vertical sample geometry running for quite a long time now in user operation and serving the community very well. However, from the beginning it was foreseen to run the detector arm not in atmosphere, as the air scattering of the neutrons is increasing the background of each measurement and blurring the off-specular scattering. But the development of the in-situ pumped ^{3}He neutron spin filter running in the detector arm slowed the design of a new detector arm down.

One of the key aspects during the design was to change as less as possible of the ^{3}He neutron spin filter set-up and keep it running like it is. Therefore, the option to use vacuum inside the detector arm had to be cancelled because the relative pressure on the thin glass walls of the large ^{3}He-cell would be doubled to 2 atm. The next idea was to use a He atmosphere inside the detector arm, but first tests showed that the temperature of the furnace that is needed for the in situ pumped ^{3}He neutron spin filter dropped quite rapidly.

Avoiding the construction of a new furnace inside the entire ^{3}He set-up, we decided to go for an argon atmosphere inside the new detector arm. Positive here is that it is quite easy to achieve argon tightness, but unluckily it can be activated and has a worse thermal conductivity than air. The latter could cause problems as the furnace and the lasers are heating up the detector arm, and at the same time the detector must run at temperatures below 50°C and some of the optical components to pump the ^{3}He-cell even lower. But good news: First tests where the old detector arm was put under an argon atmosphere, while running all devices inside, revealed that a simple water-air cooler with 700 W cooling power is enough to prevent a heating up of the detector housing. So the detector arm had to be argon tight, definitely tight for neutrons from the surrounding, and to reduce in addition the influence of electromagnetic noise onto the ^{3}He set-up, we decided to make it safe even in terms of electromagnetic compatibility (EMC). To ensure the latter, the entire box was checked at the HZG and was found to be EMC-safe for frequencies up to 2 MHz.

The amount of argon inside the detector arm is controlled via the oxygen level. To control a certain oxygen level (e.g. 1%), a minimum and maximum oxygen threshold is defined (0.9% and 1,1%) together with a minimum and maximum difference pressure of the detector arm (e.g. 0.5 mbar and 1,6 mbar). To keep the oxygen level between the thresholds, argon is pumped into the detector arm and cycled between the minimum and maximum levels until the minimum oxygen level is reached (~1 hour). Then the system is going into a standby until the maximum oxygen level is reached (~11 hours) and the argon pumping starts again. In other words, the oxygen level is only increased by 0.2% in roughly half a day and the system is quite tight.



The figure shows a comparison between a measurement with the old detector arm under normal atmosphere and the new detector arm under argon atmosphere. The left map was measured with 60 s per detector image and the right one with 15 s per detector image up to 65 mrad/ Å in α_i and beyond that point with 60 s per detector image. Comparing the colour scale in the latter region, a three times lower background can be identified. So the signal to noise ratio was increased by a factor of 3 due to the argon atmosphere. In the lower region (<65 mrad/ Å), the factor is above 1 order, but keeping the shorter counting time in mind, it corresponds again to a factor of 3.

The advantage of the new detector box under argon atmosphere is demonstrated by the vanished blue triangle in the lower left part of the left map (air atmosphere). The corresponding region on the detector is fully blocked by the beam stop and can only be illuminated due to diffuse air scattering of the reflected neutron beam inside the detector box. Now with the new detector box under argon atmosphere, this region is mostly white demonstrating a much lower background.

S. Mattauch (JCNS)

Switchable wavelength resolution at the SANS diffractometer KWS-2

KWS-2 is primarily a dedicated high intensity SANS diffractometer, which in the instrument concept is provided by a specially designed neutron guide system and a velocity selector that enables a relaxed resolution, Δλ/λ = 20% [1]. Following demands from the user community regarding improvements in resolution, the instrument was equipped with a double-disc chopper with a variable opening slit window and time-of-flight (TOF) data acquisition option [2]. The chopper used in concert with the velocity selector enables the tuning at will of the wavelength resolution within a broad range, from the standard configuration (only selector) down to 2%. The instrument gained tremendously in performance for applications which require wavelength resolutions Δλ/λ ≤ 5% at wavelengths for which no dedicated velocity selectors exist. However, for wavelength resolutions in the range 10% ≤ Δλ/λ ≤ 20% used in typical SANS experiments, dedicated velocity selectors present clear intensity advantage over the set-up involving the chopper.

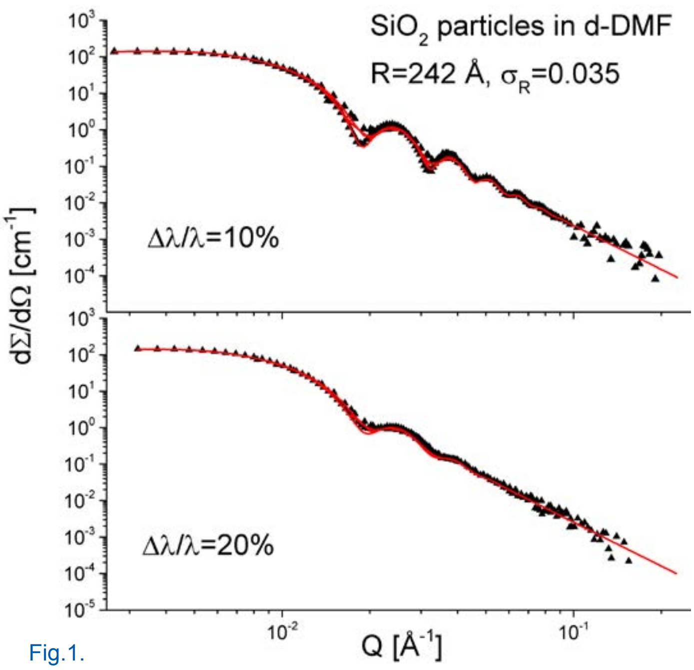


Fig.1.

Detailed McStas simulations have shown that by tilting a selector designed for a resolution of Δλ/λ = 10% over an angle of -10° with respect to the beam axis, a gain in intensity based on the resolution relaxation up to Δλ/λ = 20% can be obtained. The results have been confirmed by gold foil activation and by measurements on the silver behenate (AgBeh) peak structure and the size standards SiO_2 particles with very small polydispersity in size (see fig. 1), which were carried out with different neutron wavelengths λ and in different positioning configurations of two selectors, one delivering a standard Δλ/λ = 20% (selector 1) and another one -Δλ/λ = 10% (selector 2).

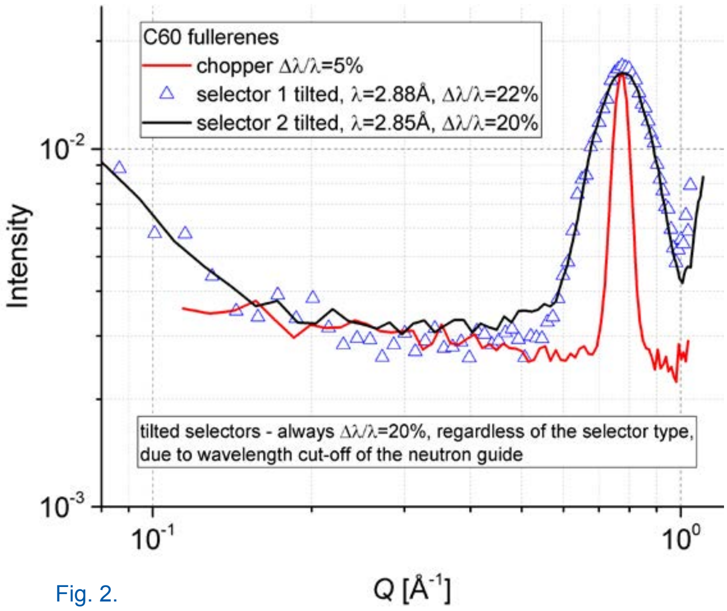


Fig. 2.

The tilting set-up of the KWS-2 selector was designed and installed in 2016 following a collaborative work between the JCNS and the FRM II Neutron Optics Group. Since summer 2017, the use of a velocity selector (ASTRIUM GmbH) that provides either a Δλ/λ = 10% or Δλ/λ = 20%, depending on its parallel or inclined positioning with respect to the beam axis is the main monochromatisation method currently used at KWS-2. The set-up also enables both the possibility of achieving lower wavelengths, down to λ = 2.8 Å (see fig. 2), hence a higher Q_{max} = 1 $Å^{-1}$, with significant intensity, and to continue to maintain a very high flux offer for experiments that require intensity at a cost of resolution by using monochromatic beams with Δλ/λ ≅ 20%.

A. Radulescu (JCNS)

Read more

[1] A. Radulescu et al., Nucl. Instr. Meth. A 2012.

[2] A. Radulescu et al., J. Appl. Cryst. 2015.

New option of thermal neutron imaging at NECTAR

Apart from the regularly used fission neutron spectrum with a mean energy of 1.9 MeV for neutron imaging applications, an ongoing instrument upgrade will make also a thermal neutron spectrum routinely available for external user programme. This upgrade adds a pure thermal neutron spectrum with a mean energy of 28 meV to the energy ranges available for neutron imaging at MLZ instruments (thermal and fission spectra at NECTAR, cold spectrum at ANTARES).

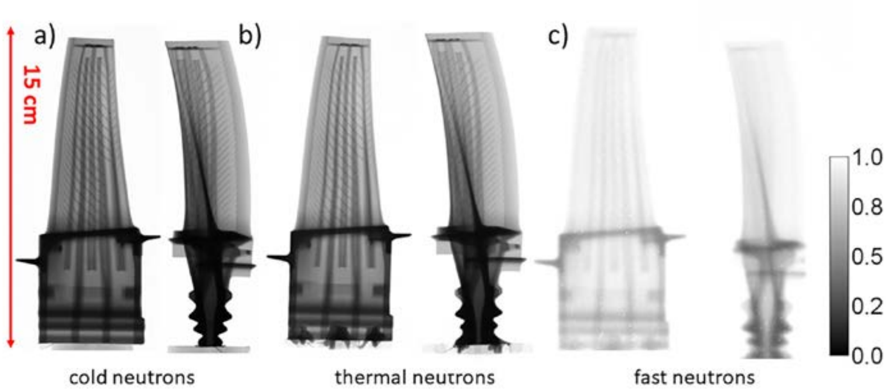


Fig. 1: Comparison of neutron radiographies of a turbine blade with different neutron energy ranges.

The possibility of switching between fission and thermal spectra will significantly broaden the variety of applications at NECTAR. The penetration depth of fission neutrons is much higher compared to cold or thermal neutrons, and thus gives more insight in large objects and samples containing strongly attenuating elements. In contrast, thermal neutrons provide a much better spatial resolution while still showing higher penetration depth than the cold neutrons available at ANTARES. Thus, NECTAR is a well-suited instrument for investigation of inner structures of large, i.e. archaeological or paleontological objects. Because of the high sensitivity to light elements, many applications are related to hydrogen or ammonia storage systems and observation of water distribution in e.g. large wooden samples.

Moreover, it will be possible to perform non-destructive inspection by neutron 2D and 3D imaging using fission and thermal neutron spectra without moving a sample. This world-wide unique possibility to combine the two different neutron energy ranges at a single instrument will allow to benefit from the combination of the high penetration power and more selective contrast for hydrogen provided by fission neutrons, while thermal neutrons will serve to reach higher spatial resolution for structure materials surrounding the hydrogen containing materials.

First measurements with a temporary set-up using thermal neutrons achieved a spatial resolution of about 200 µm. Fig. 1 presents the comparison of neutron radiographies of a turbine blade performed with a) cold, b) thermal and c) fast neutron spectra. Fig. 2 illustrates the 3D visualisation of the reconstructed tomographies of the blade. Presented images reveal the capabilities and limitations of the neutron imaging using different energy ranges. The best spatial resolution was achieved with cold neutrons, but due to low transmission, a reconstruction of the thickest parts of the object was not possible. In contrast, the transmission of fast neutrons was very high but the resolution very poor. Thermal neutrons provided the best results, allowing for reconstructing the whole object, while still providing very good spatial resolution.

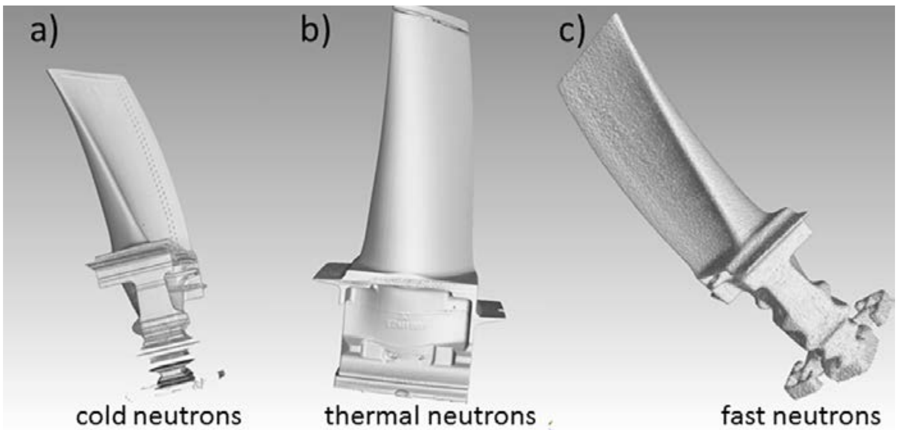


Fig. 2: 3D reconstruction from the tomographies corresponding to the radiographies shown in fig. 1.

S. Zimnik, M. Makowska, M. Schulz, (FRM II);
M. Mühlbauer, S. Zimnik (KIT);
T. Bücherl (TUM RCM)

The thermal neutron beam option is funded by BMBF in the frame of research project 05K16VK3.

MLZ@ICNS

Twelve metres long - that was the impressive booth of the MLZ at the *International Conference on Neutron Scattering* this year. Between July 9th and 13th, 758 participants from 36 countries gathered at Daejeon, Korea. Besides visiting our booth presenting *Neutrons for Science in Germany*, they listened to and discussed about a total of 682 talks and posters. Furthermore the guided tour of the HANARO reactor as well as the conference dinner with a breathtaking Nanta performance offered time for socialising.

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During the closing ceremony, the Springer Nature Best Poster award was announced.

Happy winners:
T. Weber (left),
T. Cronert (centre).

Among the winners was Tobias Weber of FRM II with his poster about *Takin: A Visual Experiment Planning Software for Neutron Triple-Axis Spectrometers*. The poster of a colleague from Forschungszentrum Jülich enthralled the referees as well: Tobias Cronert won for *Low Dimensional Thermal and Cold Finger Moderator for the High Brilliance Neutron Source Jülich*.

I. Lommatzsch (FRM II)

Lively discussions at the MLZ conference on *Neutrons for Health*

About 70 scientists from all areas of health, bio-research, and medicine participated in the international MLZ conference *Neutrons for Health* in Bad Reichenhall from June 27th-30th, 2017.

The experts from all over the world presented impressive work in the fields of radioisotopes, nuclear medicine, protein dynamics, neutron capture therapy, drug delivery systems, and material science in medicine. The talks and posters emphasized the use of neutron scattering, spectroscopy, and irradiation as analytical tools for the characterisation and understanding of biological systems as well as development and applications in medical treatments.

With a warm welcome by MLZ Director Thomas Brückel the meeting started. Highlights were the presentation on "Neutrons against Cancer" by Wolfgang Sauerwein of the University Hospital Essen, the talk on production and distribution of radio isotopes in cancer treatment and diagnostics by Oliver Buck of ITM AG, Garching, and a highly enjoyable and entertaining talk combining health and food and neutron scattering by Elliot Gilbert of ANSTO.

The conference led to a multitude of inspiring and fruitful discussions with a strong outlook towards the perspectives neutron methods and applications can provide to tackle important problems and questions in health and medicine.

T. Gutberlet (JCNS)

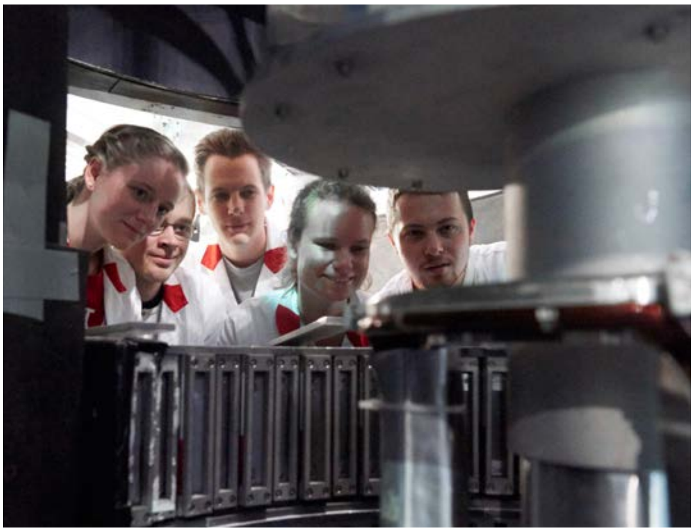
21st JCNS Laboratory Course Neutron Scattering

The 21st Laboratory Course Neutron Scattering of the Jülich Centre for Neutron Science (JCNS) took place Sept. 4th-15th. As in the previous years, this annual lab-course was held at two locations, Forschungszentrum Jülich for the lecture part and at the MLZ in Garching for the experiments.

The labcourse is open to students world-wide of physics, chemistry, and other natural sciences. Participation is free of charge and travel expenses are subsidised. The course is part of the curriculum of RWTH Aachen University. Students can earn European Credit Transfer System (ECTS) points by taking an optional examination. The course is financed by Forschungszentrum Jülich with support from the EU project SINE2020 and the European Network of Excellence SoftComp.

The first week of the neutron scattering course is dedicated to lectures and exercises on theory and instrumentation. In addition, selected topics of condensed-matter research are addressed.

In the second week, eleven instruments are made available for students' training, including the neutron spin-echo spectrometer J-NSE, the backscattering spectrometer SPHERES, the time-of-flight spectrometer TOFTOF, and the small-angle scattering instrument KWS 1. These world-class instruments are provided by JCNS, TUM, University Göttingen, RWTH Aachen, and Karlsruhe Institute of Technology.



Students sneak a peek of the inner workings of the neutron time-of-flight spectrometer with polarisation analysis, DNS.

How well do you know MLZ? Although the instrument these students are admiring is not visible, the picture contains a clue to its identity – who can guess?

This year, 54 students were selected from 119 applicants. The most represented major subject of the students was Physics (28) followed by Chemistry (13), Geosciences (7), Materials Sciences (5), and Engineering (1). 22 foreign students came from a total of 13 countries. The participation of female students was 41%.

In the first week, 14 lectures were presented accompanied by exercises in small groups. This concept is strongly preferred by the students in favour of an all-lecture programme. In the second week, the performance of the neutron source was flawless, so that experiments could be carried out all five days. The feedback of the students was positive, especially indicating that the level of the course was well-adapted to the audience.

The programme was completed by a serene welcome party in Jülich, a sightseeing tour to Aachen, and an exuberant farewell party in Garching.

The next JCNS laboratory course will take place Sept. 3th–14th, 2018 following the same concept having the first (lecture) week in Jülich and the second (experimental) in Garching. You are cordially invited to submit applications. In January 2018, more details will be posted at www.neutronlab.de.

R. Zorn (Forschungszentrum Jülich)

JCNS-Workshop 2017 on *Trends and Perspectives in Neutron Scattering*

The JCNS-Workshop 2017: *Trends and Perspectives in Neutron Scattering: Probing Structure and Dynamics at Interfaces and Surfaces* was held at the Evangelische Akademie Tutzing at Lake Starnberg south of Munich on Oct. 10th-13th. 67 attendees from Europe, USA, Russia, Canada, and Australia joined the workshop. 44 invited and contributed talks were given and eight posters were presented.

This year, the workshop covered a wide range of topics related to interfaces and surfaces at different types of materials. Sessions were devoted to magnetic interfaces and nanoparticles, buried interfaces, soft and biological surfaces as well as interfacial and surface dynamics. Recent approaches to adapt neutron reflectometry, SANS, imaging, neutron spin echo spectroscopy, and neutron depth profiling to get deep insights were presented. Neutron techniques are capable to visualize buried interfaces and interactions and probing interfacial kinetics and dynamics. The focus is on in-operando studies of interfaces. Current and future requirements for novel experimental opportunities presented here are seen as a valuable input for the planning of future instrumentation at the different neutron facilities.

An excursion to the antenna dishes of the Ground Station Raisting about 30 km west of Tutzing and the workshop dinner offered time for further discussion and deepened the scientific exchange. Financial support by Oxford Instruments is gratefully acknowledged.

R. Bruchhaus, T. Gutberlet (JCNS)

Communicating science – *PARI* workshop

The speed-networking at the beginning of the workshop gave the chance to get to know each other briefly.

The idea of this workshop on *Public Awareness of Research Infrastructures* (PARI) was born at MLZ and aims to be a hands-on forum for communication officers and public relations staff to share their experiences and expertise.

As in 2015, the PARI workshop was jointly organised by the same and proofed team: the MLZ and European Southern Observatory (ESO) under the umbrellas of the European Association of European-level Research Infrastructure Facilities (ERF-AISBL) and the EIROforum at the premises of the ESO in Garching. 110 participants met from May 29th-30th to exchange, discuss about, and find solutions on public engagement and communication at large scale research infrastructures. Three guided tours of the research neutron source FRM II, the ESO and the construction site of the ESO Supernova were offered and happily received. In 2015, 70 participants followed the invitation, so this rise of almost 60% means a great success of the first workshop. In an online questionnaire, Garching was highly positively valued as a workshop location (4,5 stars out of 5).

After the workshop, 30 participants met to found a new working group called RICE (Research Infrastructures Communications and Engagement) within the ERF-ASIBL. The aim is to share best practices and organise joint workshops (as PARI) or exhibitions (for example 2018 at the European city of science in Toulouse, France).

C. Kortenbruck, A. Voit (FRM II)

Neutron imaging school *AUNIRA* at Garching

In collaboration with the International Atomic Energy Agency (IAEA), the MLZ hosted the third neutron imaging workshop *AUNIRA* (Advanced Use of Neutron Imaging for Research and Applications) from Aug. 28th-Sept. 1st. Attended by young researchers from wherever a new reactor with imaging facilities is being built, or existing reactors are refurbished with modern electronic imaging systems, the current level of research in building and applying neutron imaging facilities was presented.

Aaron Craft of Idaho National Lab (USA) explaining the project with MLZ.

The days were covered by theoretical lectures and practical exercises. Subjects included design of the beam geometry, appropriate high-efficiency shielding, new detectors, and imaging techniques like neutron grating interferometry and dark field imaging. Each topic was presented by a specialist who explained fundamental as well as practical design aspects, and reported about his own experiences and research. Aaron Craft e.g. reported about first trials to install an electronic imaging system (instead of image plates) for the examination of spent nuclear fuel in an environment with special shielding requirements in collaboration with the MLZ.

In the afternoon, practical exercises at the neutron imaging facilities ANTARES and NECTAR were on the agenda: not only the effects of different beam collimation and different neutron energies were tried out, but also image processing and 3D data treatment as well as the gamma scanner of the Radiochemistry Munich, where gamma scans with a Cobalt-60 source were performed as contrast to neutron imaging.

The participants left with new friendships and collaborations established during a poster session and an evening at a beer garden, and to apply new ideas at their home facilities.

B. Schillinger (FRM II)

Workshop on analysis of difficult structures using Jana2006 software

Diffraction data are known to contain unique information about the atomic arrangement and atom vibration, size and shape of scattering domains, and microstrains etc. Deep evaluation and analysis of diffraction data is the key for the successful extraction of relevant structure parameters, which is usually performed by Rietveld refinement technique. Among several programs capable to perform the multiparametric modelling of diffraction data using Rietveld method, the Jana2006 software possesses unique capabilities, e.g. simulation of aperiodic/ modulated structures, modelling of magnetic structures using magnetic space group formalism, refinement of anharmonic displacement parameters.

A two-day workshop on Jana2006 software for Rietveld refinement of powder or single crystal diffraction data was organised by the Structure Research Group on Oct., 26th-27th at MLZ. Jana2006 is a development project from Institute of Physics, Czech Academy of Sciences. This is already a second time that MLZ hosts the Jana2006 workshop. The authors and experts of Jana2006 (V. Petricek, M. Dusek, M.S. Henriques) guided both new and well-established users through the rich functionality of the software, where the hands-on tutorial was combined with the scientific lectures on different aspects (modulated order, magnetic structure determination, twinning etc). About 25 participants from MLZ, TUM/ LMU, Karlsruhe Institute of Technology, and University of Augsburg took part.

A. Senyshyn (FRM II)

In the beginning was the Egg

Fully booked guided tours, crowded info booths, and great interest in the special exhibition on the Atomic Egg – the Open House Day at the research neutron source as well as a photo exhibition were a great success.

The special exhibition with a miniature Atomic Egg on the occasion of its 60th birthday attracted many visitors.

The first visitors of the FRM II who wanted to register for the tour, got up very early for a Saturday. They wanted to register at 9 o'clock; four hours later all the tours were booked for the whole day. 543 lucky people could see the reactor pool, walk through the Experimental and the Neutron Guide Halls. 120 people had already booked early via online registration, the remaining 423 had to line up in the Physics Department directly on Saturday, October 21st and hope for their luck.

Even those who could no longer get a room were able to enjoy the many other attractions and get information. For example at the booth of radiation protection, one was able to prove his abilities as a reactor driver and virtually control a neutron source. At the information booth of the Heinz Maier-Leibnitz Zentrum, scientists showed the use of their scientific instruments with the help of Lego-models. The neutron-toss ball game was always crowded, especially by younger visitors, who won a T-shirt after they hit four "atoms" successfully.

Also the lectures of Anton Kastenmüller, Astrid Schneidewind, Michael Hofmann, Michael Lerche, Christoph Hugenschmidt, and Steffen Schuster at the Physics Department attracted visitors, as did the films in another lecture room.

On the occasion of the 60th birthday of the Atomic Egg, a special exhibition with a walk-through miniature atomic egg was held in the entrance building of the FRM II, where visitors could listen to recordings in the interior of the egg, watch films and pictures about the history of the first German research reactor, and look at some original expositions such as fuel element models. Norbert Waasmaier, formerly having worked at the Atomic Egg, and the former administrative director Klaus Seebach answered the questions of the very interested visitors and let them live the history of the Atomic Egg.

The booth of the Heinz Maier-Leibnitz Zentrum at the open day was always surrounded by people.

The FRM II presented photos from the Berlin photographer Bernhard Ludewig on the occasion of "60 years of neutrons from Garching", from August until October in the underground station of the Garching city and in November/ December in the Munich museum "Reich der Kristalle" (Kingdom of Crystals), the public part of the Mineralogical State Collection.

A. Voit, C. Kortenbruck (FRM II)

See more

photos of the Atomic Egg at p. 26!

Discoveries and advances en route to electron-positron pair plasmas

The large mass imbalance between ions and electrons (a factor of at least 1836) produces a separation of the two species' length and time scales that is a cornerstone of traditional plasma physics. To consider the novel behaviour of a "pair plasma", comprising particles with opposite charge but equal mass, is to revisit much of plasma physics from the ground up. To date, on the order of 1000 papers have explored this topic via a variety of analytical and computational treatments, but the experimental side of the investigation is still in its nascence. Laboratory studies of magnetically confined electron/ positron plasmas will enable the first tests of many simulation and theory predictions – e.g., the stabilisation of anomalous transport mechanisms [1] – with implications for our understanding not only of pair plasmas and astrophysical phenomena in which they play a role but also of traditional electron/ ion plasmas such as those used for fusion.

Working toward this goal, the APEX (A Positron Electron eXperiment [2]) collaboration is not only bringing together techniques and technologies from a variety of fields but also further developing them. The figure shows an overview of how the different "pieces of the puzzle", being developed at the Max Planck Institute for Plasma Physics (where it is supported by an ERC Advanced Grant) and at other research centres and universities in Germany and abroad, will ultimately come together at MLZ. The arrows at the bottom indicate how recent and upcoming highlights (several described in the following summaries) fit into that picture.

Characterisation and optimisation of a world-class positron beam

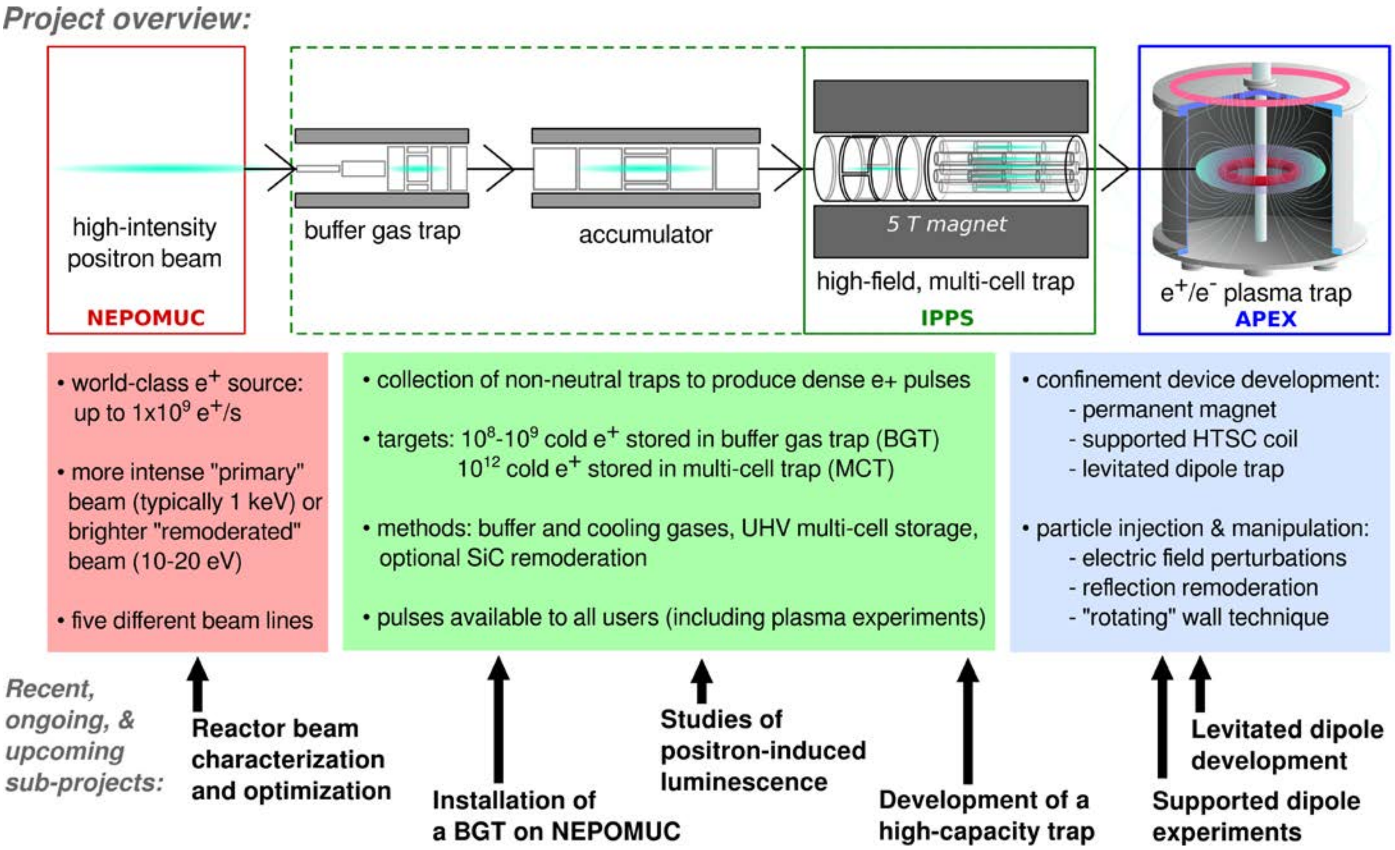
One of the first priorities has been to gather data about properties of the NEPOMC (NEutron-induced POsitron source MUniCh) upgrade [3] beam: positron flux, parallel and perpendicular energy spreads, and spatial profile, as well how these vary depending on beam energy and where along the beam line they are measured. This information is essential for determining which settings of the NEPOMUC beam will be best suited for making the pair plasma – i.e., for achieving the volumetric particle densities needed to generate the collective effects that define a plasma [4]). The first experiment campaign characterised several beam energies and found that non-adiabatic guiding plays a role in the transportation of the highest-energy beams [5]. Subsequently, primary beams from NEPOMUC have been measured at low energies (5-60 eV) for the first time; this then enabled injection of a record number of positrons into the supported dipole trap (described below). Altogether, four different versions of the NEPOMUC beam have been successfully drift-injected into the trap, and a fifth was successfully injected after in situ remoderation. The measured beam parameters are now routinely used in simulations, producing excellent agreement with experimental results.

Levitated dipole development

A levitated dipole trap is an elegant way to produce closed magnetic field lines that can simultaneously confine both positively and negatively charged particles. A superconducting current ring is suspended in the middle of the vacuum chamber, with the downward gravitational force balanced by attraction to a current-carrying coil on top of the vacuum chamber (blue box in the figure). Compared to existing levitated dipole experiments in the U.S.A. and Japan, the APEX device will be smaller and lighter and have less heat load; therefore, a new solution to a complex optimisation problem was required [6]. Coils are being wound at NIFS (National Institute for Fusion Science) in Japan in December 2017, and initial tests of a prototype levitation feedback system and of cold head cooling methods have already been done.

Supported dipole experiments

In conjunction with the design of the levitated dipole trap, a number of key questions have been investigated in a supported dipole trap [7] (described previously in MLZ News 14). These include how to efficiently transport charged particles into the trap (since confining magnetic fields also necessarily prevent particles from entering) and how sensitive confinement times are to asymmetric perturbations to the system. Drift injection using crossed electric and magnetic fields has been shown to be a robust and reproducible means of moving particles from the beam line, across the separatrix (the magnetic surface at the boundary of



Positrons from the NEPOMUC beam will be accumulated into ever denser bunches in a series of non-neutral plasma traps, then injected along with electrons (not shown) into the confining dipole magnetic field of a levitated, current-carrying superconducting coil.

the confinement volume), and into the confinement region of the dipole; lossless injection of the beam has been demonstrated for a large region of the parameter space. Once in the trap, positrons can be moved deeper into the confinement region by means of potentials applied strategically to the outer wall of the trap. Finally, after the injection potentials are switched off, it was demonstrated that positrons persist in the trap for hundreds of thousands of toroidal orbits around the magnet.

Upcoming projects with linear traps

So far, APEX experiments have used only steady-state positron beams (without intermediate bunching or accumulation). Two new efforts will provide tailorable positron pulses not only for APEX's pair plasma experiments, but also for other NEPOMUC users. A buffer gas trap (BGT) is a tried-and-true technique for turning a low-density, steady-state beam into high-density, low-temperature pulses; at MLZ, it will be combined with a reactor-based positron beam for the first time. Funded by a partnership with the University of California, San Diego, existing traps are being reconfigured and upgraded, after which they will be installed on NEPOMUC. Meanwhile, the DFG-funded Intense Positron Pulse Source (IPPS) – a high-capacity, high-field, multi-cell trap that will be able to confine record numbers of positrons (10^{12}) – is being developed with the University of Greifswald. Ultimately, the completed trap is envisaged to be part of the infrastructure installed for positron experiments in MLZ's new Neutron Guide Hall East.

The APEX collaboration

Read more

[1] P. Helander. Physical Review Letters., 2014, 113, 135003.

[2] T. Sunn Pedersen et al. New J. of Physics, 2012, 14, 035010.

[3] C. Hugenschmidt et al. New J. of Physics, 2012, 14, 055027.

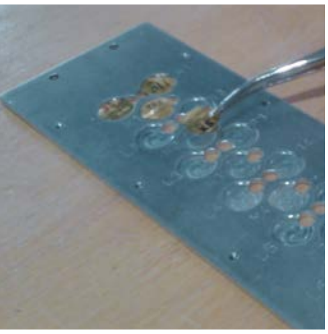
[4] E. V. Stenson et al, J. of Plasma Physics 83 (2017), 10.1017/S0022377817000022.

[5] J. Stanja et al. Nuclear Instr. and Methods in Phys. Res. Sec. A. 2016, 827, 52 – 62.

[6] H. Saitoh et al, Technical Report IPP 17/52, MPI for Plasma Physics, 2016.

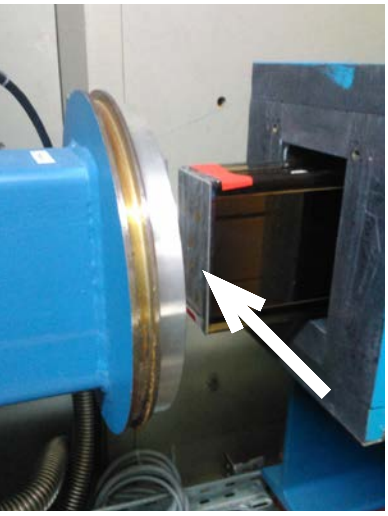
[7] H. Saitoh et al. New J. Phys. 17, p. 103038 (2015).

Catching neutrons with gold



Placing the gold foils into the holder with a cross section of 3 × 17 cm.

Sixty 20 µm thin disks of pure old were the key players in the cold neutron guide general review carried out this August. 15 years after installation of the first neutron guides and after 43 reactor cycles with about 2500 days of operation, the Neutron Optics Group performed flux measurements using gold activation analysis at all cold neutron guides in the Neutron Guide Hall West. Of course regular renewal and upgrading of some of the guides took place over time and some of the neutron guides had been replaced. Nevertheless the general review provides useful data for several tasks.



One of the 12 different measurement positions. The arrow points to the gold foils mounted on the end of the guide.

First of all comparing to previous reference, flux data may reveal changes in the performance of the neutron guide due to degradation often not being detected by the instruments themselves. Second the measured neutron flux values serve as experimental standard for Monte Carlo simulations. Future changes and upgrades of the guide system and depending instruments delivered with cold neutrons strongly rely on such simulations to benchmark expected benefits.

For each neutron guide up to ten gold foils with a typical mass of 36 mg each were arranged on holders in order to test the flux homogeneity of the beam cross section. Precisely mounted on the ends of the guides, the foils were exposed to the neutron beam. The measurement positions at the individual guides were chosen to be just in front of the first instrument components like velocity selectors, choppers, or crystal monochromators in order to get the unaltered neutron guide transport performance. Depending on the expected neutron flux, exposure times of 120 sec or 300 sec were needed to achieve an activity appropriate for the subsequent handling and gamma spectroscopic evaluation.

After exposure, the activities of the foils were measured with the gamma spectrometer of the instrument PGAA. A subset of five arbitrarily selected foils was also measured independently at the gamma spectrometer of the FRM II Radiation Protection Department. The obtained activities differed less than 1% of the absolute value. The activities of the gold foils, together with their mass and exposure time then yielded the thermal equivalent neutron flux at the measurement position. The table summarises the main results obtained.

Two striking exceptions from the general behaviour present NL2-b and NL4-a. Here, the observed thermal equivalent neutron flux values were noticeable smaller than expected. These findings now lead to further investigation of all segments of these neutron guides to disentangle the cause of the reduced performance. For all other guides, it can be seen that the measured thermal equivalent neutron flux corresponds fairly well with the value obtained from McStas simulations. Also a comparison to precedent measurements revealed no major changes, indicating that these neutron guides behave well as expected.

P. Link (FRM II)

(n/cm²/s)	NL1	NL2-a-o	NL2-a-u	NL2-b	NL3-a	NL3-b	NL4-a	NL5-S	NL5-N	NL6-S
Φ_c (McStas)	$1.5 \cdot 10^{10}$	$1.16 \cdot 10^{10}$	$1.21 \cdot 10^{10}$	$1.45 \cdot 10^{10}$	$8.3 \cdot 10^{9}$	$7.2 \cdot 10^{9}$	$6.8 \cdot 10^{9}$	$1.2 \cdot 10^{10}$	$1.5 \cdot 10^{10}$	$1.3 \cdot 10^{10}$
Φ_c (2017)	$1.5 \cdot 10^{10}$	$1.03 \cdot 10^{10}$	$1.02 \cdot 10^{10}$	$0.97 \cdot 10^{10}$	$8.9 \cdot 10^{9}$	$7.5 \cdot 10^{9}$	$3.9 \cdot 10^{9}$	$1.0 \cdot 10^{10}$	$1.5 \cdot 10^{10}$	$1.6 \cdot 10^{10}$

Measured thermal equivalent neutron flux of the FRM II cold neutron guides (NL1-6) compared to Monte-Carlo simulation results using McStas.

Dear friends,

in summer 2017, the 11th German committee for Research with Neutrons (KFN) was elected by the user community. A huge amount of the eligible neutron users submitted their votes in time – making the KFN a strong representation of the German user community. Many thanks to all of you and to the members of the 10th KFN for their great efforts to strengthen the German user community!

During the period of the 10th KFN 2014-2017, the upcoming imminent changes in the neutron landscape had already been visible:

- Germany committed its contribution to the ESS construction budget, and the construction of the facility is well underway now. German partners are involved in building seven of the 15 instruments of the initial suite.
- We had to learn about the decision to close BER II at HZB at the end of 2019.
- The development of a new generation of accelerator driven neutron sources designed to be operated by universities was initiated by JCNS.
- The KFN actively participated in the efforts of the European Neutron Scattering Association (ENSA) to make the transnational access to neutron facilities sustainable and to enhance the efficient use of neutrons.

The 11th KFN will pursue these developments, but it needs also to consider additional trends: the challenges of the digital techniques including data mining, data management, and scientific computing, changing demands on the scientists, progress within several complementary methods beyond synchrotron scattering and thus bringing neutron scattering experiments in wider research fields. Therefore, not only contributions are requested to ensure the funding of neutron sources; we are definitely asked to expedite a strategy how the scientific use of neutrons will develop within the German and European environment in the next decade.

But first, the users are invited for the experiments in the first half of 2018. Looking forward to successful experiments and interesting interpretation of the results, I wish you a Merry Christmas and a peaceful year 2018!

Astrid Schneidewind

Chair of the 11th KFN
(Komitee Forschung mit Neutronen)

astrid.schneidewind@fz-juelich.de

Komitee Forschung mit Neutronen

Newly arrived

Alexandre Bertin

I am a postdoc from TU Dresden, and responsible for the BAMBUS project which aims to develop a multianalyser option at the cold three axes spectrometer PANDA of JCNS.

I obtained my PhD from CEA Grenoble (France), where I studied some geometrically frustrated magnets of the pyrochlore and spinel families by means of neutron scattering and muon sprectroscopy.

My main scientific interest is frustrated magnetism.

alexandre.bertin@frm2.tum.de

Anke Görg

I am the new information manager of the SINE2020 (Science and Innovation with Neutrons in Europe in 2020) project. I am the successor of Inês Crespo and also based at the MLZ in Garching, Germany.

For the last two years, I have worked in strategic marketing, another four years as a project manager specialised in marketing and (live-) communications, I was in charge of international clients from various sectors of industry such as automotive, logistics, pharmaceutical, real estate, and maintenance.

Now finally it's science and especially my favorite: PHYSICS!

anke.goerg@frm2.tum.de

Michael Heere

I am responsible in the ERWIN project (Energy Research WIth Neutrons) for building a powder diffractometer and thus for the upgrade of the thermal neutron single crystal diffractometer RESI.

My PhD was based within the Marie Curie network "ECOSTORE" in Norway. Before, I had been an officer in the German Armed Forces and worked as an engineer at VW.

Energy materials, for applications like hydrogen storage/ batteries/ concentrated solar power are my motivation and will be my main focus here.

michael.heere@kit.edu

Newly arrived

Olaf Soltwedel

As a former scientist at the reflectometer NREX, I arrived at the REsonance Spin Echo for Diverse Application (RESEDA, a high-resolution resonance spin-echo spectrometer) after crossing the Neutron Guide Hall West at MLZ from the north east to the south west back in September 2017.

At NREX, I spent the last five years supporting users in the field of soft matter und strengthen its scientific profile – which is now expanded for both instruments with a focus on RESEDA. Additionally I have the great opportunity to upgrade this sophisticated spectrometer with the newest and most suitable equipment as stated in the project “Longitudinale Resonante Neutronen Spin-Echo Spektroskopie mit Extremer Energie-Auflösung” financed by the Federal Ministry of Education and Research (BMBF-Projekt 05K16WO6).

olaf.soltwedel@frm2.tum.de

Samantha Zimnik

I am involved in the upgrade of the fission neutron facility NECTAR for using thermal neutrons for neutron imaging. The idea is to combine the higher spatial resolution of thermal neutrons with the high penetration power and selective contrast for hydrogen of fission neutrons, that are currently used for imaging at a single instrument.

Before I went to the KIT, I obtained my PhD at the positron facility NEPOMUC at the MLZ where I studied metal surfaces with highest toplayer sensitivity.

My scientific interest at NECTAR is focussed on Li-ion batteries, especially on the distribution of the electrolyte in the cell.

samantha.zimnik@frm2.tum.de

Stefano Pasini

I am one of the instrument scientists at the neutron spin echo spectrometer J-NSE.

I studied and obtained my PhD at the University of Bologna. After being a post doc at the TU Dortmund, I joined the JCNS-1 group at Jülich. There I worked on the design of the neutron spin echo for the ESS as well as the new superconducting coils of the J-NSE. Last summer, I moved to MLZ to follow the installation of the new coils.

My main scientific interests span from the dynamics of polymeric systems to the physical principles at the base of neutron instrumentation.

s.pasini@fz-juelich.de

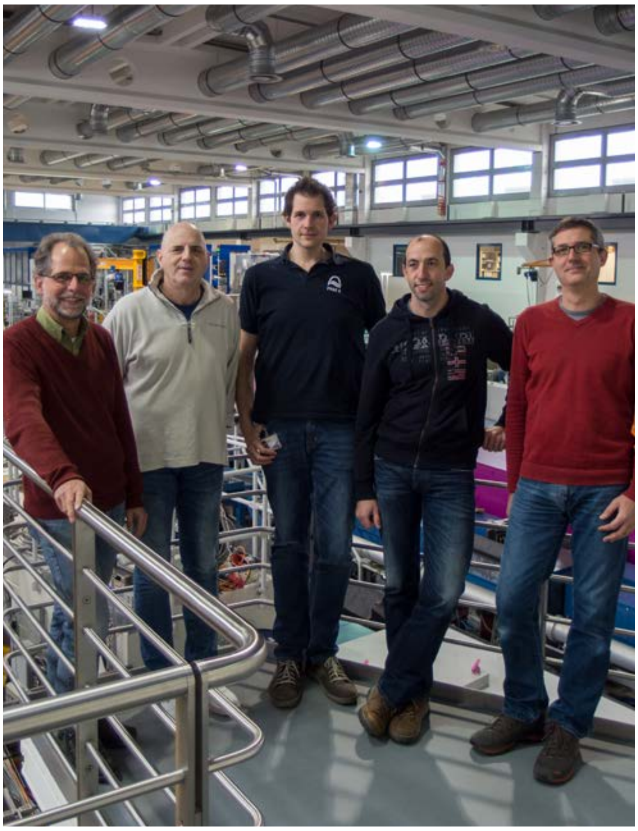
The Detector Group

When a new neutron scattering instrument together with its specific technological highlights is presented, the detector system is rarely mentioned, although no instrument would work without a detector. In fact, the use of a highly performing state-of-the-art neutron detector is a key prerequisite for the efficient exploitation of any neutron scattering instrument. Existing instruments can often be opened to new experimental possibilities through upgrades of the detector system to permit, for example, higher rates or improved angular resolution. Detector systems for neutron scattering applications are rarely available commercially, but instead require a fusion of available components with in-house research and development.

This is where the Detector Group at the MLZ comes into play. As part of its daily business it provides maintenance and service to the instruments in the fields of detectors and corresponding readout and data acquisition electronics to guarantee full performance of the systems at any time. But even more, the group develops and builds complex state-of the-art detectors including the required electronics. As an example the large-area and high-rate detector built of a linear array of individual ^{3}He filled position-sensitive proportional counters installed at the small angle scattering instruments SANS-1 or the new high-resolution 2D position sensitive Multi-Wire Proportional Chamber (MWPC) with high rate capability installed at the materials engineering diffractometer STRESS-SPEC were built in-house at MLZ.

Working in the cleanroom facility.

The group's latest large scale project is the construction of a 130° curved MWPC for the new diffractometer instrument ERWIN. A 30° prototype detector, based on a concept developed at Brookhaven National Laboratories (BNL), has been built in collaboration with the Institute Laue-Langevin (ILL) and the Paul-Scherrer-Institut (PSI) and is presently under investigation. The key ingredient, the MWPC segments, were completely designed at MLZ and built in the Detector Group's cleanroom facility.

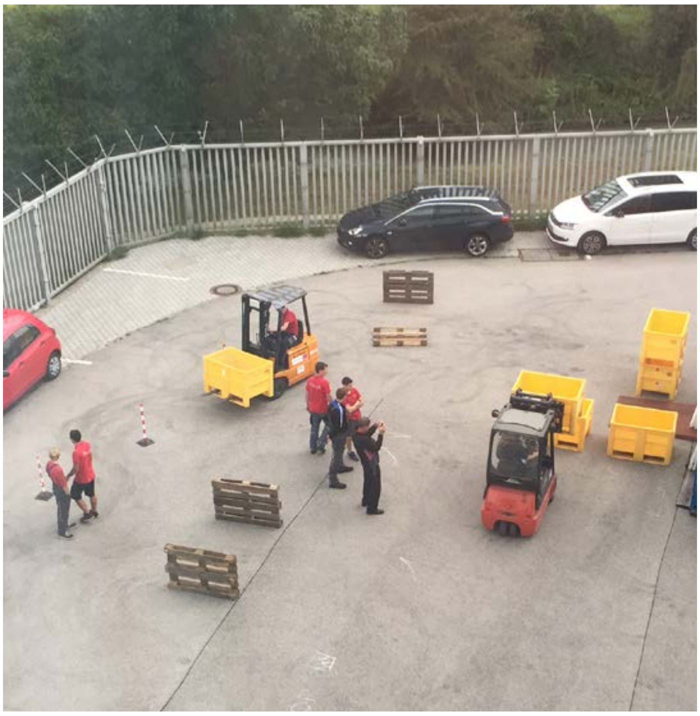


Head K. Zeitelhack with his team: M. Panradl, S. Strobl, P. Wind, and I. Defendi. Missing: A. Howard and R. Wildgruber.

Since ^{3}He based detectors are the group's key competence, the sudden supply shortage of ^{3}He occurring some years ago strongly motivated the group to investigate the development of alternative detection technologies. In the framework of the NMI3 Joint Research Activity and its follower programme SINE2020, as well as within the International Collaboration for the Development of Neutron Detectors (ICND), the group is an active participant in the design of neutron detectors using solid Boron-Carbide layers as converter material.

K. Zeitelhack (FRM II)

A driving license of a special kind



An open air training course, pallets, containers, a motivated group of learners: on September 6th and 7th, Uwe Stiegel, master craftsmen and licensed forklift instructor examined trainees and employees of the FRM II for the “other” driving license, involving no cars, but agile, powerful and indispensable machines: industrial trucks.

The permission for operating a forklift is not connected to the common car driving license, but requires a proper official test consisting of a theoretical and practical instruction as well as a regular driving experience. Ludwig Kitzinger, trainee in mechatronics at the FRM II, took part in this year´s forklift training day and sums up the necessary prerequisites for operating industrial trucks: “A minimum age of 18 years, physical and mental aptitude, the certificate of the passed tests, a written transport order of the company, and an annual refresher training.”

However, operating a forklift should not be underestimated. Moving high loads fast, efficiently and precisely requires skill, experience, a good eye and an excellent overview of machinery, cargo and space - presented in the most sensational way by the famous “forklift driver Klaus”. The fictitious character known to almost every German engineering student shows in a very black-humorous short-film the worst case scenarios being possible when operating a forklift without any care. Sadly this video has a serious background. Every year more than 30.000 accidents involving industrial trucks happen in Germany.

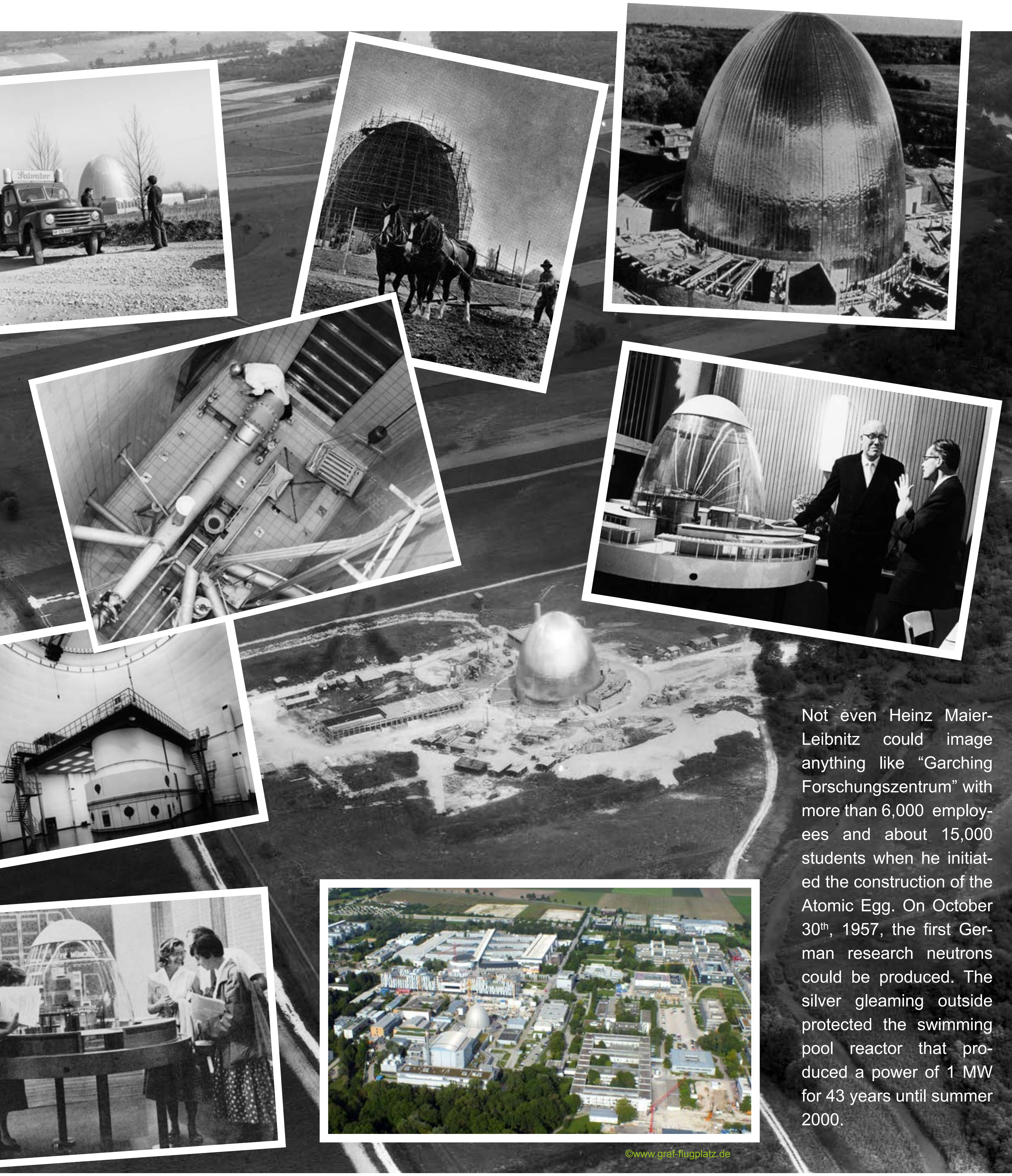
“Operating a forklift always ensures a certain amount of excitement and thrill“, tells Korbinian Wambach, colleague of Ludwig Kitzinger and experienced driver. The mechanics and technicians of the FRM II particularly use forklifts to move scientific devices and technological equipment up to a weight of three tons. “For example when unloading a new CNC machine from the truck, you don´t get a second chance.” Forklift drivers bear high responsibility and thereby handle high costs. Thus both Korbinian Wambach and Ludwig Kitzinger respond consistently to the question about the sense of the forklift license. “The test definitely makes sense. We’re happy about the good instructions we get and the regular briefings. And luckily we never had to experience any severe accident with a forklift – to which the instructions are certainly not unconnected.”

Ludwig Kitzinger shows a good eye during the practical test.

“Besides, driving a forklift and moving heavy loads is pretty fun and a welcome change of the daily routine”, Ludwig Kitzinger adds with a smile. He recently passed his license and gladly remembers his instruction-day: “We spent a fun time!”

T. Kiechle (FRM II)

Celebrating the Atomic Egg's 60. birthday



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Not even Heinz Maier-Leibnitz could image anything like "Garching Forschungszentrum" with more than 6,000 employees and about 15,000 students when he initiated the construction of the Atomic Egg. On October 30th, 1957, the first German research neutrons could be produced. The silver gleaming outside protected the swimming pool reactor that produced a power of 1 MW for 43 years until summer 2000.

MLZ proposal round 2017-II

The second MLZ proposal round in 2017 will be reminded as the proposal round with the largest number of submitted proposals in the MLZ history. The 459 proposals submitted to the 27 MLZ instruments represent 28% more than the number of proposals submitted during last proposal round and 14% more than those submitted to the previous MLZ record. The total number of requested days is as high as 2.658, again a new record at MLZ.

The proposal submission deadline was on September 12th, 2017, and the MLZ Review Panel took place on October 17th-18th, 2017. The MLZ Review Panel assessed the submitted proposals according to their scientific merit and prepared their recommendations for the MLZ Directors. The MLZ Directors approved the recommendation of the MLZ review panel after the penalisation for missing experimental reports was applied, where few scientifically sound proposals moved down in the ranking without allocation of beam time.

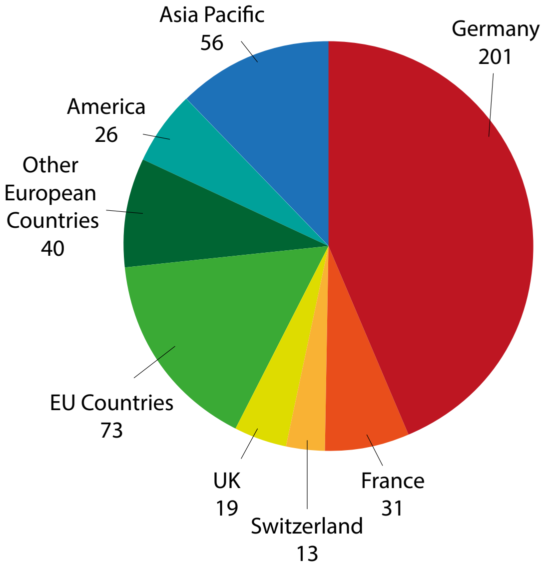


Fig. 1: Country of origin of the submitted proposals.

Following the procedure established recently at MLZ, 34 proposals not accepted for beam time for instrument overload were included in a waiting list. A waiting list proposal will be invited for an experiment when additional beam time will become available and all the accepted proposals have been measured. The waiting list is valid until new proposals will be accepted at the next proposal round.

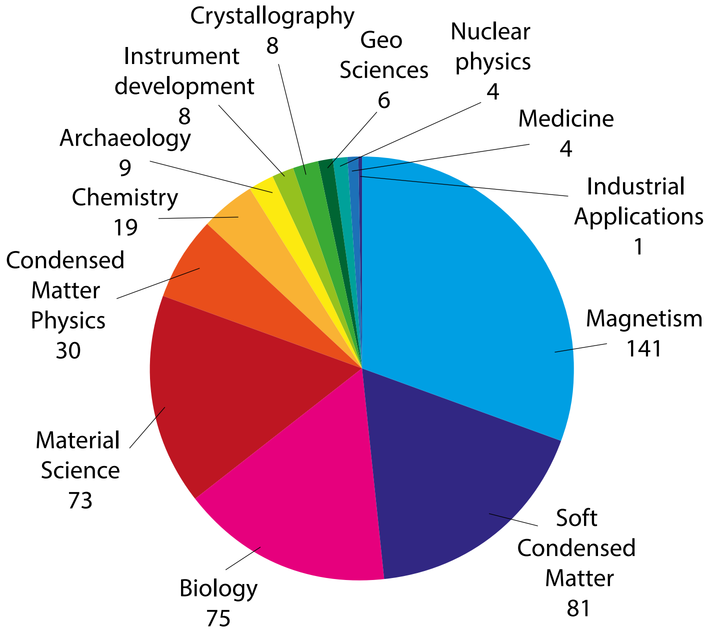


Fig. 2: Scientific fields of the submitted proposals.

The most requested instrument in terms of number of submitted proposals was by far the small-angle scattering diffractometer KWS-2 with 59 submitted proposals, while the 14 proposals submitted to BIODIFF requested the largest number of beam time, i.e. 196 days. The average overbooking factor on all MLZ instruments is as high as 2.3, with 4 instruments (BIODIFF, KWS-2, RESEDA and SANS-1) above 4.

About 44% of the submitted proposals come from a German institution and the whole European user community has submitted about 82% of the proposals. It is also interesting to mention that the remaining proposals have been submitted by American (6%) and Asian/Pacific (12%) scientists, respectively.

More than 30% of the submitted proposals regard magnetic investigations, representing the scientific field largely demanded; moreover, about 50% of the submitted proposals are equally focussed on Soft Matter, Biology and Material Science.

The MLZ Review Panel is constantly evolving to ensure the necessary expertise and enthusiasm. Out of the total number of 65 members, 13 were replaced in five different panels. We warmly thank those members who have already served the MLZ Review Panel and welcome the new ones.

F. Carsughi (JCNS)

The new MLZ User Committee

The MLZ users have now a joint voice!

The MLZ Directors have established the MLZ User Committee (UC) by approving its Terms of Reference. The main task of the MLZ UC is to organise a discussion forum to collect opinions, comments, and suggestions from the users, and propose new strategic ideas and procedures to improve the user access and work at MLZ with the ultimate goal to improve the MLZ user satisfaction.

The MLZ UC consists of five members, each member is appointed for a three years term and can be elected for not more than two mandates. Each MLZ user who performed at least three experiments in the last three years before the election can be a MLZ UC member. Among the elected members the MLZ UC Chairperson and deputy Chairperson will be appointed by the members.

All the users who fulfil the eligibility condition are contacted and those users who intend to candidate shall inform the MLZ User Office. When the list of candidates is ready, the election process starts. Only users who performed at least one experiment in the last five years have voting rights. The voting procedure is organized by email by the MLZ User Office, and each user can cast up to five preferences. The five candidates with the largest number of preferences will be appointed as MLZ UC members.

The MLZ UC Chairperson will represent the MLZ user community at official meetings, and the MLZ UC members are kindly invited to attend conferences of MLZ interest, such as, for example, the German Neutron Scattering Conference, to meet the MLZ user community.

The MLZ UC shall meet at least once a year, and, in order to make the life of the MLZ UC members easier, the meetings can be either in person or in videoconference. In exceptional cases, extraordinary meetings can be considered. In special cases, the MLZ UC Chairperson may also invite to the meetings any person who may provide relevant contribution to the discussion.

Detailed information on the activity of the MLZ UC will be available on the MLZ web portal, where minutes of the MLZ UC meetings will be available as well as other important information on its activity.

The MLZ users are welcome to provide the MLZ UC members with their comments either through the MLZ experimental reports, or by direct contact with one or more members.

At the time of the publication, the election procedure with eleven candidates is in progress and the voting deadline is fixed on November 30th, 2017. The MLZ UC will enter into force on January 1st, 2018. The results will be published soon on the MLZ web portal.

The establishment of the MLZ UC is a step forward towards the improvement of the MLZ user management, and please consider to contribute to this important process either by providing useful comments or also considering to candidate yourself to the MLZ in the future.

F. Carsughi (JCNS)

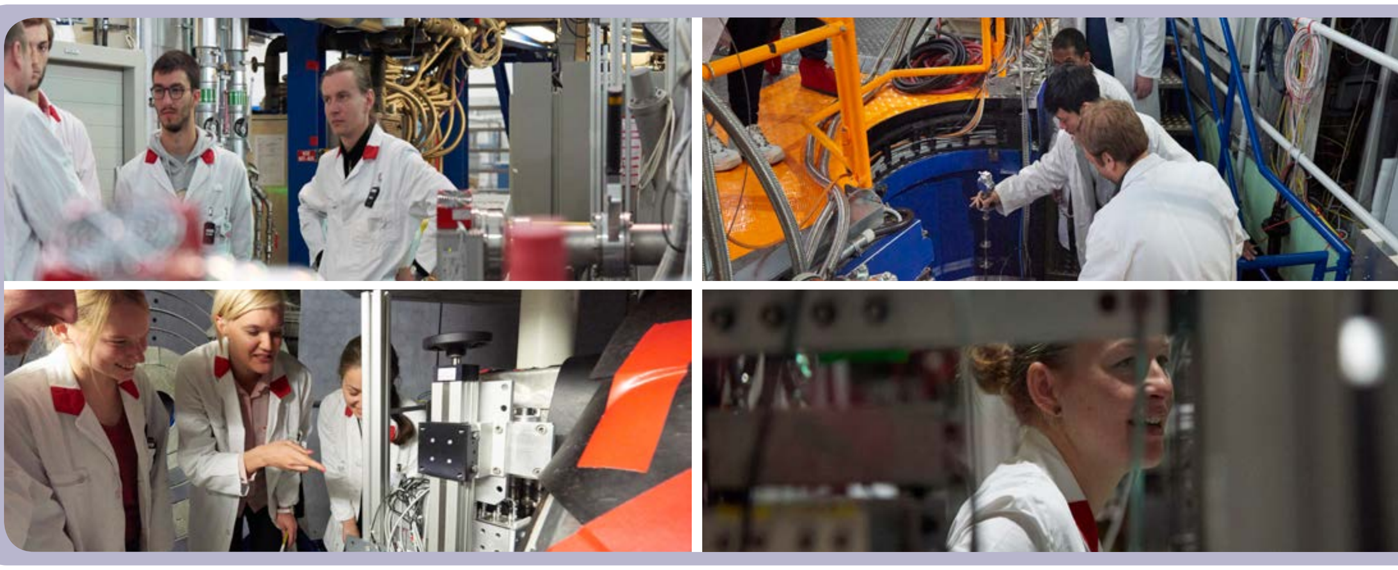
Save the Date!

SNI 2018 • Garching • September 17th-19th, 2018

Next Proposal Deadline: February 23rd, 2018

Find all information at

- mlz-garching.de/englisch/user-office/getting-beam-time.html



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Submit your proposal at

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

Next Rapid Access Deadline: January 12th, 2018

Upcoming

IFF Springschool: Physics of Life
Feb. 26th - March 03rd, Jülich (Germany)
www.iff-springschool.de

DPG Spring Meeting of the Condensed Matter Section (SKM)
March 11th - 16th, Berlin (Germany)
berlin18.dpg-tagungen.de
Visit our booth there!

MLZ Conference 2018: Neutrons for Culture and Arts
June 19th - 22nd, Lenggries (Germany)
https://indico.frm2.tum.de/event/56/

SAVE THE DATE!

22nd JCNS Laboratory Course - Neutron Scattering 2018
Sept. 03th - 15th, Jülich + Garching (Germany)
www.neutronlab.de

SNI 2018
Sept. 17th - 19th, Garching (Germany)

The JCNS-Workshop 2018 will be dedicated to soft matter
Oct. 9th - 12th October, Tutzing (Germany)

Reactor Cycles 2018

No.	Start	Stop
44	23.01.2018	23.03.2018
45	24.04.2018	22.06.2018
46	31.07.2018	28.09.2018

Season's greetings from the MLZ User Office!

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Editors
Rainer Bruchhaus
Flavio Carsughi
Christine Kortenbruck
Ina Lommatzsch
Jürgen Neuhaus
Andrea Voit

Layout and typesetting
Ramona Bucher
Ina Lommatzsch

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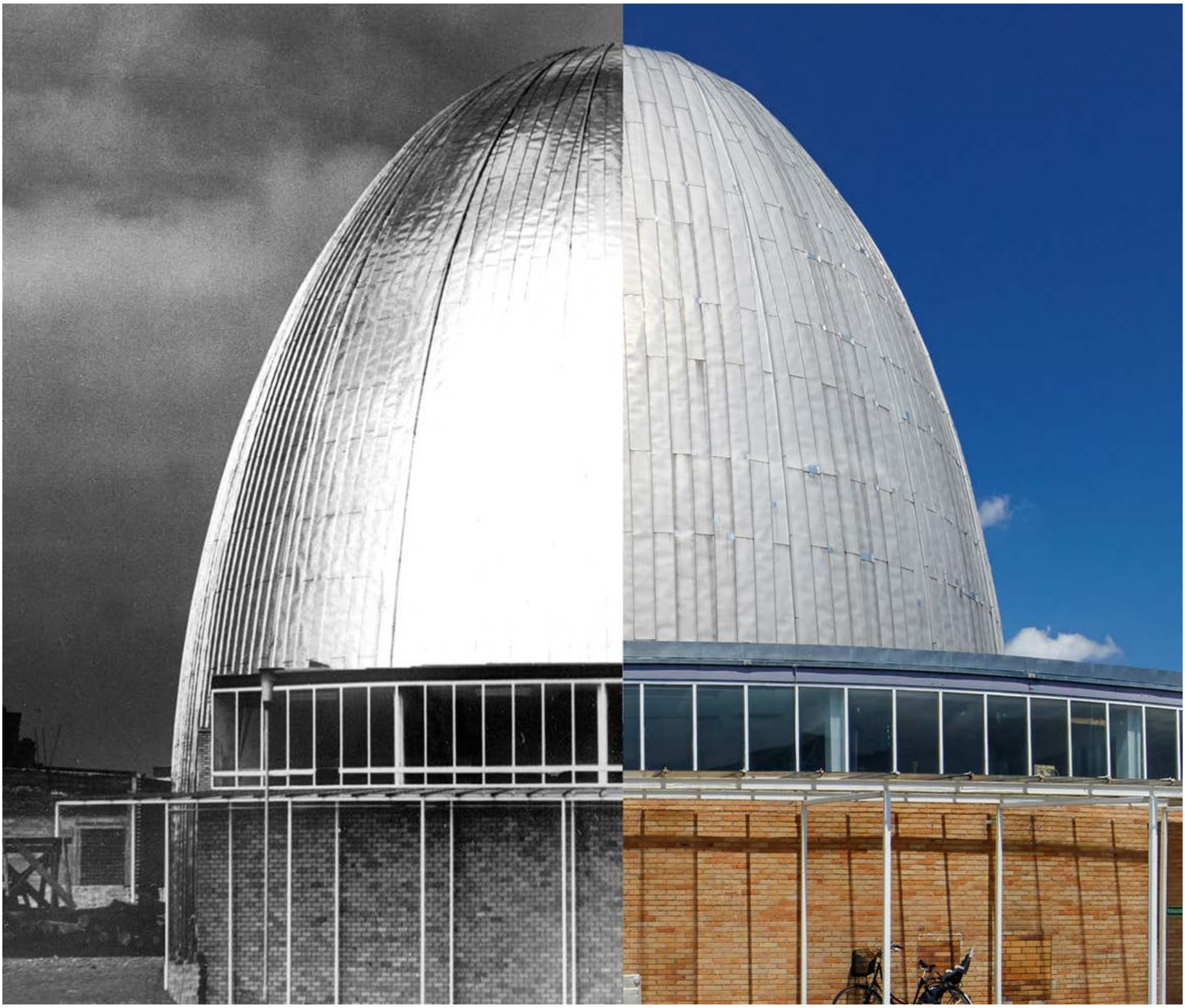
We thank K. Kleinstück of MaMaSELF for providing so many photos of this programme!

Contact

Forschungs-Neutronenquelle
Heinz Maier-Leibnitz (FRM II)
User Office
Lichtenbergstraße 1
85747 Garching, Germany
Phone: +49.(0)89.289.10794
10703
11751
Fax: +49.(0)89.289.10799
e-mail: useroffice@mlz-garching.de
www.mlz-garching.de



The Atomic Egg then and now -
it lost its gleaming, but it is still a beautiful example of architecture and therefore a listed building.


BIOLOGIE
MEDIZIN
ATOM-EI
NEUTRONENLEITER
PHYSIK
MAIER-LEIBNITZ
FORSCHUNG
60
NEUTRONEN
WISSENSCHAFT
INSTRUMENT
LABOR
FRM II
Sonderausstellung
7. November bis 3. Dezember 2017
Museum Reich der Kristalle
RADIOGRAFIE
KRISTALLOGRAFIE
MATERIALWISSENSCHAFTEN
ARCHÄOLOGIE
GARCHING