

NEWSLETTER 05 | UNE 2012



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FEATURE

COATING DECODED - MISSION POSSIBLE?



How can the cutting of metal be made cheaper, faster and more environmentally friendly? Jens Birch is determined to find out. Over the course of the next five years, the Swedish scientist will examine

the process of cutting metal in a way no one has ever done it before. New facilities soon available within the Röntgen-Ångström-Cluster in Germany and Sweden will help Birch to investigate the cutting process more thoroughly. Will his mission be possible?

Jens Birch is confident: "The new facilities that we are constructing for DESY will make such a project possible." Birch is heading the project in which a team of Swedish researchers from Linköping University and the Swedish tool manufacturer SECO Tools is collaborating with German scientists using the 'High Energy Materials Science' beamline at the world's most brilliant synchrotron PETRA III.

The high energy X-rays will enable him to decode and uncover what is happening to thin protective coatings on metal cutting tools as they are actually put to work in an industrial cutting process. The coatings are multifunctional and are used both to protect the tools from chemically reacting with the workpiece and to prevent them from overheating by for instance reducing the friction of the tool. "So far, we haven't been able to witness – in real time – what happens to the coatings in the cutting process. We will analyse many different kinds to determine their very characteristics", Birch notes.

"The key to all of this is precision", explains the scientist, "and the communication between the Swedish and Germans involved." The cutting rig, an instrument of industrial scale weighing between 500 and 700 kg and crucial to the experiments, is currently being built in Sweden. It will then have to be transported to Hamburg in order to carry out the experiments. "This has never been done before", says Birch. The Swede is excited, no doubt. Not just because of the sheer scale of the undertaking but because he's hoping to make a difference outside the scientific world. "Currently, the industry uses large amounts of environmentally unfriendly and expensive cooling liquid to deal with the enormous temperatures arising when cutting metal", Birch says. Therefore, to eliminate the cooling, there is a large driving force to develop coatings able to withstand ever higher temperatures. The industry already has a few materials systems in place, but the mechanisms behind how they work are to a large extent unknown. [...] continued on page 5

Editorial

As the holiday season approaches, this June edition of the Röntgen-Ångström-Cluster Newsletter offers plenty for you to read. After briefly introducing the eight research projects funded via the Swedish Research Council in our last newsletter, we'll provide further insights and keep you posted about their progress. For a start, we have talked to Jens Birch of Linköping University. Read more about his ambitious plan to make the cutting of metal greener, cheaper and faster.

As one of only a few competence centers across the world offering together a neutron source and a synchrotron radiation source for scientific research, the Helmholtz Centre for Materials and Energy in Berlin (HZB) plays a significant role within the Röntgen-Ångström-Cluster. Read more about it below.

Massimo Altarelli is one of the driving forces behind the European XFEL project. Here, you can find out, what he is hoping to achieve and what led him to his job in Hamburg. Enjoy the newsletter and have a great summer.

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The editors

News

HELMHOLTZ CENTRE BERLIN IS ACTIVE WITHIN THE RÖNTGEN-ÅNGSTRÖM-CLUSTER FRAMEWORK

The Helmholtz Centre for Materials and Energy (HZB) in Berlin is one of only a few competence centers across the world, offering together a neutron source and a synchrotron radiation source for scientific research: the research reactor BER II, for experiments with neutrons, and the electron storage ring BESSY II, producing an ultra bright photon beam ranging from Terahertz to hard X-rays. The aim is to elaborate on the complementary use of neutrons and photons to gain a more complete picture of matter. For this reason HZB is an important element in the development of the Swedish-Northern German region as a scientific excellence region that is unique and internationally visible in these research fields.

Helmholtz Centre Berlin Facts & Figures

• Employs approximately 1,100 staff, of whom 800 work at Lisa-Meitner-Campus located in Wannsee and 300 at Wilhelm-Conrad-Röntgen Campus in Adlershof.

• It has a total budget of about 110 million Euros.

• Every year, HZB's user service enables some 2,500 external scientists (from 35 countries to date) to access measuring methods, which in some cases are guite unique.

• About 100 doctoral candidates from the neighboring universities are involved in research and training at HZB.

• Outside the Berlin-Brandenburg region, HZB cooperates with more than 400 partners at German and international universities, research institutions and in companies.

The INT at the Helmholtz Centre Berlin

• The INT was founded in October 2010 as a result of the merger of the former HZB Department of Optical Systems and the AZM - Application Centre for Microtechnology.

• The INT collaborates closely with MaxLab, Sweden.

A key point of the collaborations between INT and MaxLab are issues of X-ray optical elements conceptual design for upcoming light source like ultimate storage rings or free electron X-ray lasers (European XFEL) as well as future metrology control and supply of precise optical components for beamlines.
The long term experience gained with the operation of third generation storage rings Max II and BESSY II becomes now invaluable in the design of beamlines for these sources.
Scientists from MaxLab and INT established a close and fruitful cooperation in the development of design tools.



HZB Helmholtz



Research-Reactor BER II, Experimental hall © HZB

PROF. ALEXEI ERKO, DIRECTOR OF THE INSTITUTE NANOMET-RE OPTICS AND TECHNOLOGY AT HELMHOLTZ CENTRE BERLIN



"An intensive dialogue and exchange between scientists of different nationalities is necessary to master the complex challenges of the future. The high quality of technologies and metrology instruments can only be reached on the basis of an interdisciplinary joint research program as well as open communication and exchange, involving partners worldwide. That is why HZB

is active within the Röntgen Ångström-Cluster framework", declares Prof. Alexei Erko, Director at the Institute Nanometre Optics and Technology (INT) of the Helmholtz Centre Berlin. (Photo © HZB)

The HZB Institute for Nanometer Optics and Technology (INT) maintains long-term and close cooperation with various Swedish research Institutes. Recently, the first Swedish German workshop on X-ray optics, held on 13-15 March 2012 in Åhusstrand, Sweden, gave an excellent opportunity to overview the collaborations in the field of X-ray optics. The workshop brought together scientists and engineers from the northern light sources and various research institutes in Sweden and northern Germany. It was the third in a series of five topical workshops within the Röntgen Ångström-Cluster framework, organized by Prof. Ralf Nyholm, Dr. Ulf Johansson (both from the MAX IV Laboratory), Prof. Alexei Erko and Dr. Rolf Follath both from HZB Berlin. Financing came from the Swedish Research Council.

The workshop attracted 30 participants (16 from Germany and 14 from Sweden), of which 21 gave oral presentations. The participants came from Swedish and German Universities and research Centres including representatives from the European X-ray Free Electron Laser Project Team. The workshop covered inter alia the following topics:

- Beamlines and beamline optics
- Modelling software for X-ray optics
- Micro/nano-optics technology
- Optical and at-wavelength metrology.

BESSY II, Hall indoors © HZB

PEOPLE

GETTING THE JOB DONE: MASSIMO ALTARELLI – MANAGING DIRECTOR OF THE EUROPEAN XFEL



Massimo Altarelli's first visit to the Deutsches Elektronen-Synchrotron (DESY) in Hamburg was in 1976. But the Italian physicist keeps lively images of his two-week encounter with what is today one of the world's leading accelerator centres:

"I remember vast green spaces with rabbits running around." Altarelli smiles,

perhaps reflecting upon the unpredictable dynamics of life often leading one along paths never imagined possible. Heading back to the University of Illinois in the USA, where Altarelli worked between 1974 and 1979, he never dreamt that his biggest professional challenge yet would bring him back to DESY. (Photo © European XFEL)

More than 35 years on, Massimo Altarelli heads the European XFEL GmbH, the non-profit limited liability company behind the X-ray free electron laser (European XFEL). Scientists around the world watch with interest as this unique facility evolves. The European XFEL's targeted capability of generating 27 000 flashes per second will make it the only one of its kind worldwide. The facility, which will feature a tunnel with a length of 3.4 kilometres, is currently being built on site at DESY in Hamburg and running into neighbouring Schleswig-Holstein. It will open up areas of research previously inaccessible, such as deciphering molecular compositions of cells, details of viruses and taking three-dimensional images of the nanoworld.

Since Altarelli first set foot on DESY's grounds in 1976, the vast green spaces have been replaced by numerous research buildings and office blocks. Scientists from all over the world buzz across the campus. His new office is just a stone's throw away from the DESY campus. "Building European XFEL is a huge responsibility" he says, adding humbly: "and not the work of one man alone." The independent research organization, European XFEL GmbH, is building up a workforce of about 250 employees. "We are a team of very dedicated people from all over the world," says Altarelli, who is and has always been a driving force, committed with head and heart to the undertaking.

The Italian was working as Chief Executive Officer and Scientific Director of the Elettra Synchrotron Light Source located in Trieste, Italy, employed by the International Centre for Theoretical Physics when, as Altarelli recalls, "people started talking about the opportunity of a free electron laser".



The European XFEL facility in Hamburg and Schenefeld © European XFEL



Generation of x-ray laser flashes in an undulator. © European XFEL

The Italian was hooked. In 2005 he was appointed Head of the European Project Team and granted a leave of absence from his engagements in Trieste.

At the time, there were no guarantees that the project would happen. Still, once appointed and committed to the endeavor, Altarelli packed his bag and his family and moved to Hamburg. In 2009, the European XFEL GmbH was finally founded. At present, Denmark, France, Germany, Greece, Hungary, Italy, Poland, Russia, Slovakia, Spain, Sweden, and Switzerland participate in the construction and operation of the European XFEL, while Germany and Russia hold most shares.

Taking decisions, sticking with them and committing himself to a set target is something that Altarelli has been doing from a young age onwards. At 15 or 16 he decided he should study physics. "I was much better at maths", he recalls, "but studying physics, just like my older brother, seemed like the right thing to do". And so he did and he never looked back at other options. It was one of his professors at the University of Rome who convinced him to get into synchrotron radiation. Altarelli followed his professor's call and stayed on that route.

His path eventually led him via the USA to the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, where he worked as a Research Director. In 1999, aged 51, his appointment at the International Centre for Theoretical Physics in Trieste, brought him back to his homeland Italy. Little did he know then that six years on he would yet again move countries. When the offer came, he didn't think twice.

Massimo Altarelli will have reached retirement age when his contract runs out. Does he think about what happens next? The European XFEL seems too big to leave room for other thoughts: "I think about it always. We're aiming to be number one, the best x-ray free electron laser facility in the world," says Altarelli, fully aware of the enormous scope of the undertaking. If the European XFEL finishes on time and on budget, Massimo Altarelli will consider his job done. Undoubtedly, his next challenge will wait around the corner. In this section, we introduce members of the Röntgen-Ångström-Cluster Steering Committee at random order.



LUTZ KIPP:

Good networking of the Physics-scene ensures success

In Physics, theory and practice should go hand in hand. That is the opinion of Lutz Kipp who is Professor and Faculty Director at the Institute of Experimental and Applied Physics at the Christian-Albrechts-University Kiel. To combine the two – theory and practice – links or networks between different institutions need to be in place, says Kipp. Lutz Kipp is the initiator of one such network, involving the University of Kiel and DESY in Hamburg. Kipp's project started in July 2010 and will be running for three years. As part of the project, scientists from the University of Kiel carry out research, using DESY's large scale facilities, such as PETRA III and FLASH. One idea behind the project is to determine the manufacturing process of magnetic sensors in real time in order to significantly strengthen their effectiveness. To support this, the Federal Ministry of Education and Research has generated an amount of about 1.3 Million Euro.

The joint research facility of the University and DESY, the Ruprecht-Haensel-Laboratory, according to Kipp, is "an excellent platform, to bundle the instrumental and methodological developments, to provide international cooperation partners with the latest technology and knowledge, and through joint appointments to improve the teaching quality in the field of nanosciences and surface research".

As a member of the Steering Committee of the Röntgen-Ångström-Cluster, Lutz Kipp is also engaged in joint German-Swedish projects. In his various roles, he's hoping to promote the expansion of European research with neutrons. Not only to strengthen research activities in future-oriented fields but to make the most efficient use of the research infrastructure available through the close cooperation between Sweden and Germany. Science no longer takes place in an academic ivory tower but must be measured by reality. However, science must not blunder into the atmosphere of commercial companies or economy-related institutions, thinks Kipp. For this reason, he warns against the rising influence of business-related organizations and foundations. Above all, there is "the basic right to freedom of science, research and teaching", demands Kipp.



Sealing the contract between DESY and the University of Kiel (Nov. 2011): from left Prof. Edgar Weckert, Prof. Helmut Dosch, Christian Scherf (Commercial Director of DESY), Frank Eisoldt (Chancellor Christian-Albrecht University), Prof. Gerhard Fouquet and Prof. Lutz Kipp. © DESY

ALEKSANDAR MATIC:

Putting an emphasis on the next generation

To involve the future generation of researchers in the work of the Röntgen-Angström-Cluster is one of Aleksandar Matic's priorities as a member of the Steering Committee. A start was made by a workshop on Soft Matter in Björkliden in March this year, jointly organized by Chalmers Graduate School for Soft Matter, and with PhD-students from both Sweden and Germany. "It's important to educate the new users of the facilities we're creating", states Matic who is Professor of Applied Physics at Chalmers University of Technology.

As one of the visionaries behind the European Spallation Source, the ESS Scandinavia as it was called at the time, Matic demonstrates the ability to think big and to think well ahead into the future. "It is important that we think carefully about this facility and what we can and want to gain from it", says Matic who was one of the authors of the Swedish proposal for the facility in Lund, "we need to approach it in unprecedented ways. This facility will run until at least 2060. We musn't forget that." For Matic, the Röntgen-Ångström-Cluster provides an excellent vehicle to do just that: gather valuable input from the scientific communities beyond Sweden's borders. "We have to exploit these unique possibilities, jointly, the Swedes together with the Germans ", stresses Matic. He's excited about the scientific collaboration across national borders that has resulted from workshops in the recent past. "I have made new contacts in Germany and am hoping to build on them in the future", says Matic.

In the meantime, he is set to make use of the facilities at DESY for the first time in his career. "I did some research in Germany during my PhD but I haven't worked there since", admits the 44-year-old. His team recently got a proposal accepted at PETRA III to examine ionic liquids. In his research, too, Matic is forward thinking. One of his current projects is to improve the life expectancy of lithium batteries to get hybrid vehicles on their way.



Announcement



SCIENCE LINK – CONFERENCE IN SEPTEMBER

Science link is organising a conference on September 27th in Krakow. The aim of this event is to discuss research structures and cooperation in the Baltic Sea region. Some of the topics are: structures and funding sources for cooperation between research infrastructures, universities

and commercial users; analysis of regional needs and clusters; first findings and results of Science Link.

The project Science Link is a network between large-scale research infrastructures of photon and neutron sources and users aimed at fostering innovation and entrepreneurship in the Baltic Sea Region. Apart from the large-scale facilities, the network also includes institutes, universities and regional organisations that serve as service and promotion units. Science Link runs within the Baltic Sea Region programme and is part financed by the European Regional Development Fund. The project runs from 2012-2014 and engages 17 partners from eight countries. For more info on the conference, please contact:

Katariina Röbbelen-Voigt, katariina.roebbelen-voigt@desy.de (programme) and Tom Förster, tom.foerster@desy.de (organisation).

SECOND SWEDISH-GERMAN WORKSHOP

The second Swedish-German Workshop within the Röntgen-Ångström-Cluster is taking place at Stockholm University, Arrhenius laboratory, between 28-29 August, 2012. The workshop focuses on special topics in Materials Science with the aim of establishing collaborative projects for 2013.

Please check www.rontgen-angstrom.eu for updates on this.

MORE NEWS ONLINE - DON'T MISS OUT

In due course, we will announce the recipients of the funding awarded by the German authorities for projects to be carried out in the context of the Röntgen-Angström-Cluster. Please check our website at www.rontgen-angstrom.eu

IMPRINT

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Jens Birchs aim is to get at the heart of the coatings, to reveal the atomic processes leading to the desired multifunctionality, and in this way be able to make intelligent designs of new, even better, coatings. Accordingly, in another part of the project, syntheses of new coatings using industrial processes will be studied in real time using the very same high energy X-rays as in the cutting experiments.

diation Source BESSY II in Adlershof ©HZB

"Revolutionise" is the word Birch uses, "after this five-year research project, we are likely to know exactly how to make cooling liquids obsolete during the process of metal cutting".

Editors' note: With this project, Jens Birch has been chosen as one of the eight recipients of the funding awarded in December 2011 by the Swedish Research Council in the context of the Röntgen-Ångström-Cluster. The actual experiments will commence next year.

The OTHER News

Originally, people in Scandinavia, especially in Sweden, celebrated "Midsommar" (midsummer night) on June 23rd, one day before the day of John the Baptist. However, in order to better accommodate the demands of the working week and the festive activities, a bill was introduced in 1953: Since then, Midsommar is held on the Friday closest to June 21st, summer solstice, the longest day and brightest night of the year. In previous times, people also celebrated that the crop had been brought out or that the hay had been harvested and one could take some days off before threshing began.



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