

lichtblick

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In search for the perfect catalyst

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IMPRINT

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Three questions for... Thomas Frederking



What was the most stimulating event for you in the last few weeks?

Thomas Frederking (Administrative Director): One of the most important events was the inauguration of our new Helmholtz Institute HIPOLE in Jena. The Helmholtz Senate gave the green light for its funding a year ago. The rooms in the new university building are already being moved into, and we have reached the most important milestones in the start-up phase. We're making good progress in all areas, for example with appointing people, closing contracts and equipping the labs. These are all essential prerequisites for doing excellent science in Jena. HZB hoisted the rainbow flag in May during the Diversity Month. Why is diversity so important for us?

Diversity is an integral part of society, and for HZB it is both a requirement and a great opportunity. What we witness every day, as an international research centre, is that different backgrounds of people bring different approaches and ways of thinking with them. The result is we gain solutions that are more creative and new approaches in solving complex scientific challenges. That's what makes it so important for us in management to continue to raise awareness for everyone about this topic, so that we can live up to our own standards. We have made diversity a permanent part of our strategy, and the board of directors expressly supports everything that aims in this direction.

What is on the agenda for you after the summer break?

Autumn is customarily about various committee meetings. But beyond that, things will properly get underway in preparation for the Programme-oriented-Funding (PoF) review next spring. An especially noteworthy event is of course our workshop on corporate culture, on the 4th of September, where we will be delving deep into the topic with all our managers and discuss the further handling of it at HZB.

Interview: Silvia Zerbe



COVER STORY

In search of the perfect catalyst

obert Seidel can't hold back a smile when he thinks about his path to becoming a physicist and his first big disappointment: he had slogged his way through the first four semesters of the degree, through tons of theory and endless mathematical formulas because he knew that, eventually, elementary particle physics would come up in the fifth semester. "That's what I was studying physics for: even as a teenager, I would devour everything there was to read about space, the Big Bang and black holes," he says looking back. And then finally came the long-awaited fifth semester. Except, "We didn't work with telescopes, we didn't work with microscopes; all we did was once again data analysis and some kind of models from higher mathematics," he recalls. "I was devastated!"

It has been more than two decades since then, and that excitement for the subject he couldn't quite feel back then, Robert Seidel now feels every day. In Adlershof he sits in Robert Seidel has a promising method he is using at the electron storage ring: he is analysing liquids – something that was not possible for a long time. His research has now earned him a high-calibre ERC Consolidator Grant.

his office, in his T-shirt and short hair, just a few steps away from the huge electron storage ring that brings his colleagues from all over the world to Berlin. Robert Seidel's physics studies took their decisive turn when he heard a guest lecture: a researcher from BESSY II was reporting on experiments in which they had used electron spectroscopy to analyse liquids. The method was still largely unknown at the time. "I was immediately hooked," says Robert Seidel, who eventually wrote his doctorate on the subject. And now he has just received an ERC Consolidator Grant, a high-calibre research grant. The aim of his project: over the next five years, he and his team of six will be investigating high-tech catalysts that can be used to produce green hydrogen highly efficiently.

This research puts Robert Seidel at the centre of one of the most important topics of the energy transition. "For the energy transition to succeed, there are two pillars that must be very stable: the first is the generation of energy and the second is its storage," he says. His work addresses the second pillar: his research into photocatalysis, which produces hydrogen, addresses on one of the key areas of hope in the field of storage. However, much more than the logistics of the energy supply, he has always been interested in the highly complex processes taking place in the background, on a physical level, invisible to the human eye.

When Robert Seidel talks about his research,

you can't hear his Berlin origins. He was born in East Berlin a few years before reunification. He studied at Humboldt University, did his doctorate at TU Berlin, then went to the University of Southern California for two years as a postdoc and started at HZB upon his return, soon winning an Emmy Noether Fellowship. He now lives just a few kilometres from his parents' house as the crow flies, in a strategically favourable location in the middle of Adlershof, four minutes by bike from HZB. "It's just the most practical option for the night shifts in the experimental hall," he says with a shrug.

The technology he uses for his research is comparatively new. Originally, Robert Seidel explains, photoelectron spectroscopy could only be used to analyse solids and gases. A sample would be placed in a vacuum before having X-rays shone through it. This causes the analysed sample to release electrons – and from their energy and energy distribution, important inferences can be drawn Outwitting physics: Normally, aqueous solutions cannot be analysed with X-ray beams unless a trick is used. A very fine nozzle is used to generate a wafer-thin, fast-flowing liquid jet. Before the solution evaporates in a vacuum, it is flashed with X-ray light.

290 km/h

The liquid jet reaches this high speed when a very small nozzle (~15 μ m) is used.

about the sample itself and about processes taking place within it. This method cannot actually be used for liquids because the sample has to be in a vacuum – "and water starts to boil in a vacuum, so it simply doesn't work." That was until researchers developed a new method, which Robert Seidel now works with, using a liquid jet.

When explaining this technology, he has a

favourite picture on his laptop: it shows a glass capillary, with a minute opening at its bottom end. "You can imagine this as a nozzle," he says: a liquid is shot out of this opening at high pressure in a stream only ten to twenty micrometres thick - this is the "jet" after which the method is named. This jet is injected into the vacuum, where, just after it exits the nozzle, the X-ray light from BESSY II hits it. "We're basically pre-empting physics," says Robert Seidel - even before the liquid has had a chance to change its state in the vacuum, it will have already been hit by the X-rays in a timespan of mere milliseconds. This background explains why the current project - for which Seidel and his team will receive two million euros in funding over the next five years – is called Water-X: the





X stands, of course, for X-rays. The experiment focuses on nanoparticles in water that become activated by light and act as catalysts. The researchers are investigating four nanoparticle systems: different metal oxides each with different properties. However, the particles all have in common that the reaction processes happen within picoseconds - so fast that no one has yet been able to figure out how the reaction actually takes place. "There are theories about the intermediate steps that occur, but no details are known," says Robert Seidel. He aims to close this gap. The liquid jet method makes it possible to follow, virtually in slow motion, what is happening in the nanoparticles at a molecular level - at the boundary between water and the nanoparticles. The answer to

this question is not only of theoretical significance: it is hoped that the knowledge and events occurring in the catalysts can be used to optimise the production of hydrogen. When Robert Seidel talks about this, he delves deep into the physical details. What the secret of the reaction is, what exactly happens in it at the atomic level – he is driven by these questions, and it is clear that his fascination for the subject has long since won the upper hand. His frustrating introduction to studying physics seems long forgotten. But there is one thing he has retained over the years anyway: his enthusiasm for the stars, which motivated him to study physics in the first place as a teenager, captivates him to this day. That is why he has set up a telescope in his flat in Adlershof. And sometimes, when

"For the energy transition to succeed, two pillars must be very stable: firstly, the generation of energy and secondly, its storage."

Robert Seidel

a comet comes within sight of the earth, Robert Seidel lies in wait at night, scanning for traces of it in the starry sky over Berlin. BY KILIAN KIRCHGESSNER

STARTING THE SECOND TERM OF OFFICE

"The team spirit is strong with us"

We interviewed HZB's Scientific Director, Bernd Rech, about the milestones behind us, about the social relevance of basic research – and about what he has planned for his second term of office.

Director Rech, how long did it take you to decide whether you would apply for a second term?

Bernd Rech: Not long at all. Although, I did feel compelled to talk first with our funding providers about whether there will in fact be political backing for the strategic plans we are pursuing together at the centre. And once as I was convinced there would be, I didn't have to think much longer.

So, you don't feel the urge to return to science?

(Laughs) I always joke that I was downgraded to senior management. And yes, of course, I do miss research a great deal – getting to rack your brains over exciting problems, going to conferences and supervising students every day. But, in return, there is also a lot on the plus side of the director position.

Your previous term was marked by a great number of negative external influences.

Oh yes! First came the Covid pandemic, then Russia's terrible invasion of Ukraine, then the cyberattack on our infrastructure. All of this had a massive impact on our work at the centre. But then, there is also that plus side I mentioned: for example, I was surprised by just how much support everyone gave me right off the bat from when I joined the board. How smooth the cooperation is, how strong the team spirit is with us. That has an extremely inspiring effect. And then, of course, there were a whole series of scientific highlights.

Which highlights are you thinking of?

At the very beginning of the pandemic, we had the honour of carrying out important studies together with virologists here at BESSY II. We were right there in the thick of it, and we were able to contribute our expertise. But I'm also thinking of the world records that were achieved at HZB in the efficiency of perovskite solar cells. And, of course, the incredibly exciting projects in the field of green hydrogen and storage technologies. In short, we successfully helped in finding solutions to many problems. When our scientists receive awards it always makes me extremely happy, and I am proud of everyone at the centre who has played their part in all of this. We see our role in management as

enablers. In fact, all of us are, because success is always a team effort.

Could it be that HZB is turning its focus increasingly onto more current issues? The areas you mentioned before are all highly relevant to society.

I think basic research is highly relevant to society in and of itself, because it gives rise to new technologies. Vista GmhH



But this work is suddenly being looked at a lot more closely.

That's certainly true. We work on problems that we are especially well-positioned to tackle thanks to our research infrastructure. These are problems relating to electrons, charge transport, chemical compounds and interfaces. The typical examples of applications are solar cells, batteries, catalysts, green chemistry, hydrogen technologies, novel green fuels and even quantum technologies. We have been researching in these areas since long before the energy transition was proclaimed – for many decades longer. "In addition to all the AI and bright minds, we need skilled hands, and our hearts have to be in it. Gut instinct has also led to many a discovery." Bernd Rech

How relevant are your discoveries in practice?

Given our aim to translate our basic research as fast as possible into practical applications, we also work sometimes very close to industry, or more precisely together with industry. For example, we are researching and developing entirely new classes of materials for photovoltaics, or even for potential batteries and catalysts. And energy and climate are, of course, major, if not the biggest, issues for humanity at present. We are trying to do our part by bringing many ideas further into reality ourselves, but also by supporting others who need our large-scale facilities for their research. That is exactly what BESSY III is intended for, the planned electron storage ring full of new technical possibilities. I assume this major project will dominate your next term of office.

Oh yes, absolutely. That definitely takes a lot of my time, every single day. I am convinced that BESSY III is indispensable for society. If we want to remain at the forefront, with our clear focus on energy materials research, we need a state-of-the-art synchrotron. Not just for our own researchers, mind you, but also for our strong partners such as the National Metrology Institute (PTB), the Max Planck Society and our international user community. And, incidentally, the latter is becoming more diverse in terms of background, origin, scientific expertise and requirements for a synchrotron. We are planning to have not only complementary synthesis and analysis techniques at BESSY III; we also want to make everything digitally available wherever possible. In addition to all the AI and bright minds, we need skilled hands, and our hearts have to be in it. Gut instinct has also led to many a discovery.

Last year, the cyberattack on HZB caused many systems to fail – and the consequences are still being felt today. How can something like that be prevented from happening again?

Other systemically important institutions in Germany were attacked along with us; it was a planned criminal attack. It presents us with a difficult balancing act: of course we want to be less vulnerable – but at the same time we have an open scientific system. How do we strike the right balance? We are currently seeking a lot of external advice and are looking at the issue of cybersecurity primarily in a strategic context. We are becoming more digital overall – from administration to specific digital tools – and we are planning many new projects in the field of artificial intelligence in particular.

You have big plans for this, especially in connection with BESSY III.

Exactly. BESSY III should be a material discovery machine. And it needs a digital twin so that we can optimally integrate artificial intelligence into materials research. We are implementing this concept with the support of the Helmholtz Association and many strategic partners – and this new type of research infrastructure naturally poses entirely new challenges in terms of cybersecurity.



"I am convinced that BESSY III is indispensable for society." Bernd Rech

At the last staff meeting, you mentioned that the working atmosphere was a major priority. What do you feel is missing?

For years now, we have been in one crisis mode or another. We've had Covid, the cyberattack and many other issues, and all kinds of task forces have been meeting continually. So, I feel it is important that we now find time and take a step back. Then we can

look at how we want to define the way we all work together: What do we stand for? What is our management culture? What is the right balance between working from home and working on-site? How do we continue to develop our campuses? We have set a lot of things in motion, and it is very important to me that we all continue this process together.

Your new term of office is just about to begin. When it's up in five years, what kind of institution will HZB be?

I have no doubt that, five years from now, we will still all be passionately researching our chosen topics. And that we will be proudly looking back on a whole series of scientific breakthroughs. As to what they will be, I'm like a kid at Christmas: can't wait to find out! And I hope that, in five years' time, we will be harvesting the first fruits for our BESSY II+ upgrade project and that we will have taken another big step forward in our preparations for BESSY III. But, actually, in five years, we will still be in the middle of a chapter.

Why is that?

Because we are all working towards our plan for 2035: to build a superb integrated research campus with a brand new synchrotron at its heart. I grew up near the mountains and I like to compare our situation now to that moment while hiking, when you just come out above the tree line. You see the summit towering over you, but you also appreciate just how high you have climbed. And you say to yourself: "I can keep going. I will make it!" Over the next five years, I want to make great progress on our journey with the team at HZB.

Interview: Kilian Kirchgessner



Chilean President Gabriel Boric visits HZB

Accompanied by the Chilean Minister of Science and four other ministers, the President of Chile Gabriel Boric visited HZB on 11 June 2024. The 50-strong delegation included members of parliament, representatives of national authorities, businesspeople and researchers. During the visit, Bernd Rech and the Executive Vice President of the Chilean "Society for the Promotion of Production", signed a Memorandum of Understanding. Both organisations intend to cooperate on research into renewable energies and the development of sustainable technologies. Chile wants to deepen its relations in Europe through the official visits to Germany and Sweden as well as participation at the Summit on Peace in Ukraine organised in Switzerland. *(fk)* OFFICIAL OPENING IN JUNE 2024

Fast, Faster, HIPOLE Jena

With the Helmholtz Institute for Polymers in Energy Applications HIPOLE Jena, the HZB and the Friedrich-Schiller-Universität Jena are joining forces in the field of energy storage and energy conversion.



HPOLE

Ulrich S. Schubert is the founding director of HIPOLE Jena, which focuses on sustainable polymer materieals for the energy transition.

rainy day in late May. It's a tenminute walk from Jena-Paradies station to the Landgrafen Campus of the University of Jena. Ten minutes, enough to get soaked to the skin in a Jena downpour. Better to take the bus, which drops you almost at the doorstep of the new "Center for Energy and Environmental Chemistry Jena" (CEEC) buildings. The bright facade with its copper-colored steel window surrounds and the similarly coppercolored cap on the roof of the building catch your eye at first glance. This is no ordinary, austere laboratory building, but an architectural highlight.

Now housing a scientific highlight: HIPOLE Jena, the "Helmholtz Institute for Polymers in Energy Applications" of Helmholtz-Zentrum Berlin. The HZB founded it together with the University of Jena in June 2023. Barely a year later, its nearly 20 employees have moved into their labs at CEEC – specifically, the CEEC Jena Application Center – and can start work immediately. This was made possible because Thuringia went ahead: When it became clear that a Helmholtz Institute was to be established in Jena, those responsible in the state did everything they could to have the necessary infrastructure ready in time. They succeeded. "We are extremely fast here," comments Prof. Ulrich S. Schubert, the founding director of HIPOLE Jena, on this rapid start. Things are also moving quickly in terms of hiring staff, as Maria Haupt, the administrative coordinator at HIPOLE, says: "17 hires in seven months. It's a proud feeling to see the team grow like this."

At the end of May, almost everyone on the



two floors HIPOLE Jena occupies is carrying moving boxes. Although research has already been conducted in neighboring university labs in recent months, the goal is now to research new materials for the energy transition in their own rooms. The work at HIPOLE Jena focuses on innovative, sustainable polymer materials. They aim to revolutionize energy production and storage.

One task is to develop polymer-based

batteries that are lightweight and flexible and have the potential to fundamentally change the way we store energy. In addition, the researchers are working on perovskite solar cells with polymer additives. These highly efficient solar cells are made of inexpensive materials and can be applied to a wide variety of surfaces.

Sustainable chemistry is another central research area at HIPOLE Jena. Polymer



Yan Lu in the lab: Developing new, efficient batteries is an important goal for HIPOLE.

materials offer good opportunities for this because they are easy to process and can be specifically functionalised. By using high-throughput methods and artificial intelligence, Schubert and his team hope to achieve rapid progress and significantly accelerate the development of such materials. When talking about the new building where HIPOLE Jena has settled, Schubert's eyes light up: "The design of the new building was a battle with the architects," he says. "We had to find a good balance between aesthetics and functionality." The result is impressive: "The bright atrium, which promotes communication, and excellent laboratories will make good work possible here," says Schubert. The academic and entrepreneurial environment

of HIPOLE Jena on the Landgrafen Campus is also intended to promote interdisciplinary collaboration and the rapid transfer of knowledge.

But the key to success is likely to be a truly vibrant networking between research disciplines: Polymer chemistry, materials science, and artificial intelligence are ultimately supposed to enable nothing less than new technologies for energy storage, hydrogen production, and photovoltaics. "The proximity to the university and a close connection to the HZB provide good conditions for this," Schubert is confident.

HZB scientist Prof. Yan Lu also wants to contribute to the success. The polymer expert has been appointed to the University of Jena. "The expertise of the University of Jena and the HZB complement each other perfectly."

Bernd Rech Scientific Director at HZB "HIPOLE Jena offers the unique opportunity to conduct polymer sciences at the highest level and thus truly contribute to the energy transition," says the deputy HIPOLE director. Prof. Bernd Rech, Scientific Director at HZB, also has high hopes for the new Helmholtz Institute: "The expertise in polymer chemistry and technology applications at the University of Jena ideally complements our experience in photovoltaics, battery research, and methods for investigating chemical processes, such as at BESSY."

On Monday, 3 June 2024, laboratory work at HIPOLE Jena really began. Almost exactly eleven months after its founding. And 14 days before the official opening.

BY HANNES SCHLENDER

CONGRATULATIONS



SEBASTIAN KECKERT

was honoured with the Young Scientist Award for Accelerator Physics of the German Physical Society (DPG) during the spring conference in Berlin. The prize is endowed with 5000 euros and recognises the physicist's outstanding achievements in the development of new superconducting thin-film material systems for cavities.



ARTEM MUSIIENKO

has been honoured for his new method for characterising semiconductors. At the annual conference of the Marie Curie Alumni Association (MCAA) in Milan, Italy, he was presented with the Best Innovator Award worth 1500 euros. Musiienko has been doing research at HZB with a postdoctoral fellowship from the Marie Sklodowska Curie Actions since 2023.



ROBERT SEIDEL

has been awarded a Consolidator Grant from the European Research Council (ERC). Over the next five years, he will receive funding totalling two million euros for his WATER-X research project. Seidel wants to investigate nanoparticles in aqueous solutions using X-ray methods at BESSY II (see cover story).



KAZUKI MORITA

has been awarded a Humboldt Research Fellowship for Postdocs and will spend a guest stay at HZB with Antonio Abate. Morita conducts research at the Institute of Physical Chemistry at the University of Pennsylvania, USA.



NEW WTR-CHAIRWOMAN

Esther Dudzik has been elected as the new Chairwoman of the Scientific and Technical Council (WTR). This internal body advises the management board on strategic issues.

CREATE ENCOUNTERS

Science meets Art

Art and science have always inspired each other. What research develops inspires art – and vice versa. We show two successful examples.



JULIA SCHMELZER

works in Dresden and is a masterclass student of Dresden University of Fine Arts. She received the Robert-Sterl Award in 2023. The installation and video artist also works as a curator, and has created many exhibitions and international formats, particularly in digital form.

MODERN HEROES DRESSED IN STARS

177 eye tumour shields from HZB are assembled to depict a constellation of Orion in the distant future. The installation of artist Julia Schmelzer was exhibited at Dresden's renowned Oktogon Art Gallery.

I n the fight against cancer, they are the unsung heroes: little brass shields that are used for eye tumour therapy in Wannsee. While the proton beam destroys the tumour, the shield protects the healthy rest of the eye. The contours of these shields tell individual illness stories, where each disc is sculpted precisely to the size of the tumour. Normally, once the treatment is over, these silent heroes are retired. But not so when they decorate a prestigious exhibition wall like a chart of the stars.

Julia Schmelzer is a graduate of Dresden University of Fine Arts, having attended the masterclass of Carsten Nicolai. Her thesis was exhibited at the Oktogon from January to April 2024. This venue, nicknamed the lemon press, is located in the historical part of Dresden, just a few steps away from the Frauenkirche. HZB lent the shields to Schmelzer for the duration of the exhibition.

The artist loves to work with real objects which she can give new life. The wall installation of eye tumour shields depicts the star Betelgeuse from the constellation of Orion. Although, not as it is today, but rather as it will be in one galactic year's time,



Heroes in action:

When the proton beams destroy the tumour, the disc protects the healthy eye tissue. Each disc is precisely sculpted to the size of the tumour.

roughly 2.25 million years from now. A timespan that is beyond earthly or human perception. She is fascinated by the idea that humans were already reading the stars thousands of years ago. "The light from the stars can have already travelled lightyears to get to us. We are looking into the past. Yet, using simulation techniques, people can also see into the future by model the future masses and formations of stars," she explains. "We still try to comprehend the timescale of the stars, even though it can't be fully grasped by human understanding."

Schmelzer has long pondered the implications of opposites – past and future, humans and technologies, life and death. "Shields used in eye tumour therapy exemplify modern treatment. But on stellar timescales, they are mere historical artefacts, testimony of our state of knowledge on this day," says Julia Schmelzer. And there is another opposite they convey: "The brass shields are made by precision computer manufacturing, but sitting in the treatment chair is a person going through an exis-

tential situation."

The shields furthermore symbolise the "presence of an absence". Schmelzer emphasises the fact that the shapes of the tumours are cut out as negative shapes in the shields. The result is an irregularly shaped hole, while the tumour itself is not visible. "Cancer is written in our human genes; we have to accept that, even domesticate it, in a way. Despite medical advancements, cancer still remains a part of human existence."

Scientific artefacts inspire the artist in her other projects as well. She is currently composing music from sleep records kept at Charité, converting restless nights into melodies.

BY SILVIA ZERBE

THE NEURON ACCELERATOR WILL SOON BE ATTRACTING PEOPLE AT BESSY

In front of the entrance to the BESSY building, an art installation will be built by mid-2025. The "Neuron Accelerator" will create a space for interaction and the flow of ideas.

F or publicly funded enterprises, "Art in Architecture" is a mandatory part of constructing a new building, serving to promote contemporary art. However, the current competition shows that it is much more than an obligation, but rather an excellent opportunity for new

creative projects and exchange with artists.

HZB has three construction projects in the planning (EMIL, BERLinPro and the Testing Hall), which will be complemented by a large-scale

art project in the forecourt of BESSY II. The experts organised a competition for this with the project consultants of the firm Phase 1. The artwork had to relate to research at HZB and improve the quality of time spent in this space.

"We had 62 concepts submitted in total. From these, the jury selected ten designs in the first session," reports architect Heike Kampherm of HZB Planning and Construction. First prize went to Berlin artist Peter Sandhaus for his "Neuron Accelerator". The design is a curvy, ring-shaped sculpture, where people can sit and stand in an area of eight by eight metres. The sculpture of white, matt-finished concrete will be placed a little off to the side in front of BESSY II. "The jury of prominent art experts came surprisingly fast to a unani-

PETER SANDHAUS

The former architect PETER SANDHAUS works as a conceptual artist in Berlin. His visual art ranges from concrete paintings to digitally programmed drawings and murals. His greatest passion, however, is art in public spaces. He has been awarded numerous prizes and commissions and has realised a number of large-scale works in public spaces. says Kampherm, "and the winning design also impressed the representatives of HZB." The artist Peter Sandhaus argues

mous decision,"

the importance of art in public spaces in this information

age. His works are made to create spaces where people can have real-world experiences. "As an artist, I also want to bring about happy coincidences, where people get new ideas as if by accident, and so to create "social sculptures" as Joseph Beuys put it in the 1970s," Peter Sandhaus explains. The "Neuron Accelerator" will create a space for informal encounters, for spontaneous discussions and for the exchange of ideas. Its ring shape quasi brings BESSY II's circular accelerator outside and also embodies the



community of researchers.

Currently the sculpture is still only a 3D model on the artist's computer. However, he is already working on the details for the foundation and its realisation: for example, the cast into which the special concrete will be poured will be made from a special moulding sand by 3D printing. The background

62

draft ideas were received. The jury was immediately impressed by Peter Sandhaus' design. arrangements are also being made at HZB so that the artwork can be realised as soon as possible. "It ought to be ready by mid-2025," Heike Kampherm is happy to report.

BY ANTONIA RÖTGER

Space for encounters:

The neuron accelerator is to be built in front of BESSY II by mid-2025.

About a year ago, HZB fell victim to a cyberattack. One year later and most of the IT services have been restored, networks rebuilt and new security measures put in place. Are we now better protected against new attacks? And what have we learned from it all?

o find out, we interviewed the Clearing Board, which has been prioritising the requirements for IT since February 2024. On the Clearing Board are:



Ants Finke

Head of IT and representative of the Administration Experts Group



Roel van de Krol

Representative of the Science Experts Group and Scientific Lab Infrastructures



Andreas Jankowiak

Representative of the Large Facility Research Experts Group.

ONE YEAR AFTER THE CYBERATTACK

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"It was about two to three weeks after the attack when we realised that, there was no way we could simply fire up the old infrastructure again."

Immediately after the cyberattack, HZB shut down all of its IT systems. At what point did you realise that the attack would still be keeping us busy 12 months later?

Finke: It was about two to three weeks after the attack when I realised that, as bit by bit we received the updates from the forensic team about what paths the malware took to spread and what systems were affected. At that point, we knew there was no way we could simply fire up the old infrastructure again.

Jankowiak: We set up a task force at the end of June already, to restore the experiment IT infrastructure for BESSY II. And by mid-July, it was already clear to us that we couldn't resume experimenting with the existing IT environment. It had grown organically over many years and it no longer met today's standards, and many systems had been compromised by the attack. And to rebuild everything from scratch – and start operating with the new capabilities that brings – twelve months is just too short.

Van de Krol: The situation in the labs was very different. In the beginning, I would never have imagined how long it would keep us busy.

HZB responded immediately by calling in forensic specialists. What did they discover? Do they know what the hackers' motives were?

Finke: The forensics analysed how deep the attack penetrated our IT infrastructure and what damage it did. These were very important insights, for knowing how to rebuild the systems. The trigger of the attack was a so-called spoofing email with a link to a faked website. In general, we know that this was no spontaneous attack; rather it was very well prepared. I can only speculate about the hackers' motives. My impression is: they just wanted to destroy and sabotage the research at HZB.

Are research centres popular targets for attack?

Finke: Research centres and universities have a relatively open user base. That puts them generally at higher risk than companies. But I don't see them being especially popular targets. The attacks are based on the geopolitical situation, and are targeted at the common good as a whole: things like energy providers, hospitals or public administrations – all of these have been recently attacked. For those who are interested, there is a website, "konbriefing.com", which provides an overview of known cyberattacks.

What advice would you give to other Helmholtz centres to be better prepared for attacks?

Finke: All Helmholtz centres are already much better prepared to ward off attacks now. For example, they have introduced or are in the process of introducing multi-factor authentication. That greatly lowers the risk of misuse of user IDs – including those with extensive IT privileges. New security measures are generally not very popular with IT



"The Clearing Board supports in-house dialogue, prioritises requirements and helps to reconcile interests." Andreas Jankowiak

users, because they can be an inconvenience and can take up more of your time. But I would recommend you don't let that stop you from putting them in. Otherwise, sooner or later, it would come back to bite you.. Jankowiak: You should also have good contingency plans for events like these. We learned a lot in the days and weeks after the attack, like that you have to have lists of emails and phone numbers available outside your IT department and that you should have instructions for emergency operations in those first few days.

Have we come further than where we were a year ago?

Finke: We are much better prepared. We have an emergency email system with file services

in place, so that we can rapidly inform the employees, and have established many security measures.

Can you give us three specific improvements that have been put in place?

Finke: For one, we have completely restructured and separated the networks. A second important measure is endpoint monitoring, meaning the installation of Carbon Black software, which records and reports suspicious activity on PCs. And a third, as already mentioned, is multifactor authentication.

Immediately after the cyberattack, the board of directors assembled a crisis team. Since February, you have also been on the Clearing Board. What are the tasks? Jankowiak: The crisis team was formed directly after the attack as an immediate response to solve the first problems and to ensure proper communication.

The Clearing Board was put together at the request of the board of directors and the scientific departments. They needed a body that could work effectively as a small team. The most important measure was to set up three expert groups who would represent lab-based science, research at BESSY II and administration. These would present in condensed form the needs of the various user groups to the Clearing Board and would develop concepts in close cooperation with the main IT department. This body thus closes an important gap: it supports in-house dialogue, prioritises requirements and helps to reconcile interests.

How often does the Clearing Board meet?

Jankowiak: We have met 13 times since February: weekly at first and now not quite so often.

That's quite a lot of time, especially seeing as you all have full agendas. Why is it so important?

Jankowiak: Because our work and the success of the centre depend on it, and because we all have a great interest in establishing a refashioned, secure and functional IT environment. There's even one positive thing to come out of this crisis, we have noticed, which is that mutual understanding in the centre is growing, and that cooperation with the IT department is increasing. That is moving us forward.

Finke: I would like to mention another advantage, which is that the expert groups are taking the often vague requirements of employees and developing concrete use cases from them. So, we will be able to work much better from this point forward.

What is on the Clearing Board's agenda, currently?

Van de Krol: As one example, we are working to make sure proton therapy gets back up and running under more stable and secure conditions.

Jankowiak: At BESSY II, the restructuring of the network is largely completed. It has to be reconciled in the long term with our user community's requirements for modern research facilities. Keywords are remote access and data storage. The requirements for FAIR data are constantly growing; we need to tackle that.

Ultimately, in the Clearing Board, it's about striking a balance between security on one hand and efficiency on the other. Working out compromises will keep us busy for some time to come.

Finke: But you also have to remember: we are not back in normal operation, yet. We are still busy gradually making the IT services available again. At the same time, we have to

replace equipment that has reached the end of its service life, and establish new networks. So, at the moment, we are torn between lots of things: on the one hand we have to get services running again; on the other hand there are longer-term requirements that are also very important.

IT emergency operations are expected to continue until the end of 2024. Why is it taking so long?

Finke: We will have completed the most important projects for the restoration by the end of 2024. But that doesn't mean we will automatically return to normal operations. It's more like we will have to enter a phase in which we will prepare for normal operations. This will include, for example, introducing "We will have completed the most important projects for the restoration by the end of 2024." Ants Finke and expanding a testing and monitoring system across the board. Also, normal operations don't mean returning to the same state of affairs as before the attack. In hindsight, that was a high-risk operation.

Has there been a change in the security consciousness and conduct of employees?

Finke: It was a big scare for everyone when it first happened. Currently, I have noticed that many are returning to their routine, and that alertness is going back down. But the PC is often the most important tool, and everyone should take care of theirs individually. Tidying the inbox, doing the updates, reading the notices on the Intranet and taking them seriously – that's all part of it.



What training measures are planned for employees to increase IT security?

Finke: It is not easy to keep up your vigilance all the time. We will set up a training portal within the Helmholtz Association, and there will be IT security instruction given over the Intranet, similar to what we are familiar with for work safety or privacy. We will also go back to holding events for sensitisation.

The flood of emails is forever rising, and it's insane how fast we're expected to respond to them all. What can each individual do, especially in the face of increasingly convincing phishing emails?

Van de Krol: You've touched upon an important point there. The pressure on employees has increased over the years, whether it's in science or administration. And then you have "People are actually okay with the idea of IT security, but they already have so much else on their plate." Roel van de Krol the relatively strenuous IT security measures added on top. Many just want their computers to work, and not to create more work. People are actually okay with the idea of IT security, but they already have so much else on their plate.

Finke: That would be a very concerning trend, indeed. Because every employee has a responsibility that nobody else can take off their shoulders.

Jankowiak: If the pressure in the working world continues to increase in general, we'll be left with no choice but to slow down.

The last 12 months were extremely challenging for many. How did you cope with the constant stress, personally? Finke:The situation never lets you rest com-

pletely. I made a conscious effort to take time

out, to relax and spend time with the family. Jankowiak: I am deliberately trying to compartmentalise, for example, by not reading work emails on the weekends. If you want to stay in your job for any number of years, you also have a responsibility to yourself. You can't wait for it to get better by itself, because the constant stress will always be there.

Interview: Silvia Zerbe and Ina Helms.



FIGURES ...

ON CYBERCRIME IN GERMANY

134,400

cases of cyber-criminality were recorded by the police in **Germany** in 2023 (source: Federal Criminal Police Office).

148 billion

euros is the **total economic damage** directly caused by cyberattacks in Germany in 2023 (source: digital association Bitkom).

56

percent of people in Germany estimate that they are at low or no risk at all of being affected by criminality on the Internet in future (source: Federal Office for Information Security).

Over 800

companies and institutions in Germany reported ransomware attacks, where the unreported number is estimated to be much higher (source: Federal Criminal Police Office).

24

percent: Every fourth person in Germany has at least once been the **victim of cyber-criminality**. (Source: Federal Office for Information Security)

622,000

US dollars was the **average ransom sum paid**, which went up sharply in 2023 (source: Federal Criminal Police Office)

Neutron research on HZB instruments continues

t the end of 2019, after decades of successful research, BER II was shut down. Many years before this, Roland Steitz and colleagues had already started putting out feelers for where the valuable instruments could continue to be used. "The project's been keeping us extremely busy since 2016," says Roland Steitz. They have since found new homes for 23 out of the total of 24 instruments.

"We often even had several interested takers for an instrument," Roland Steitz recounts. The German Federal Ministry of Education and Research had stipulated clear priorities for how they could be passed on. Establishments in Germany would get first dibs, after which the rest of Europe would have its chance. Only if no takers were found in these regions could the neutron sources then be offered to establishments outside the European Union.

The project team is delighted with their

What a success: of the 24 instruments from the Berlin neutron source BER II, 23 have found new homes.

success, having put in a lot of work behind every single neutron instrument to be sent out.

The Legal and contracts department is working to make sure all requirements are fulfilled for the donation contracts and transporting. Radiation Protection is accompanying the dismantling of the instruments and radiologically evaluating each individual component under official supervision. Only then can permission be granted for their transport. The practical realisation of the instruments' transfer – from dismantling to shipping – is being coordinated by the Experiments department for subsequent use under the leadership of Daniel Clemens. The establishments receiving the instruments are sharing part of the costs for dismantling and covering the full costs for transport and reassembly.

Neutron instruments in use worldwide

20 instruments have already been delivered to their new destinations. One has even been in full user operation since 2020. This is the instrument formerly known as BioRef, which now goes by the name of Spatz in the service of ANSTO in Australia. "We are still cooperating very closely. Every two years, we host a neutron school event together with ANSTO. HZB experts give lectures and, of course, combine this with measuring time." Components from the instrument Conrad, used to create 3D neutron tomographs, are also back in operation: at the Institut Laue-Langevin in France, HZB imaging expert Nikolay Kardjilov is collaborating with local partners on upgrading the NEXT instrument for research on energy materials.

There are also shielding, casemattes, sample environments and neutron conductors being handed over to interested takers. All of this is emptying out the halls of BER II, which is an important prerequisite for the dismantling of the facility. However, the primary motive is to give newly established neutron scattering centres, as well as established sources, the chance to expand their services. After all, it only makes sense for the valuable BER II instruments, some of which have unique capabilities, to continue to be used for research at other sources. A part of the measuring time on these is in fact reserved for researchers from German establishments.

The high field magnet with the instrument EXED is currently being prepared for shipping to Oak Ridge National Laboratory in the USA. The time-of-flight spectrometer NEAT will soon be rebuilt in Budapest. Only one piece of equipment is still looking for a new home: the neutron auto radiography instrument for nondestructive analysis of paintings. One establishment did already express interest, but backed out again. Steitz is confident that this instrument will also find a place soon. "Ultimately, all instruments will continue to be used, which is very much what we want."





SUBSEQUENT USE AROUND THE WORLD

- 1 V5 (SPAN) Wide-Angle Spin Echo (Grenoble/France, partial)
- 2 E1 Thermal 3-Axis Spectrometer (near Warsaw/Poland)
- 3 V18 Bio-Reflectometer (Sydney/Australia)
- 4 V19 (PONTO) Radiography Station (Villigen/Switzerland, partial)
- 5 V1 Membrane Diffractometer (Dresden/Germany)
- 6 E11 (FALCON) Laue Diffractometer (Villigen/Switzerland)

- E4 2-Axis Diffractometer (near Warsaw/Poland)
- 8 E5 4-Circle Diffractometer (near Warsaw/Poland)
- 9 E6 Focusing Powder Diffractometer (near Warsaw/Poland)
- 10 V7 (CONRAD) Tomo-/Radiography
 - Station (Grenoble/France)
- V12 USANS (Vienna/ Austria)
 E2 Flat-Cone Diffractometer
- (near Warsaw/Poland)
- 13 E3 Residual Stress Diffractometer (near Warsaw/Poland)

- 4 E9 (FIREPOD) Fine Resolution Powder Diffractometer (Munich/Germany)
- 15 V2 (FLEXX) 3-Axis Spectrometer & NRSE (Munich/Germany)
- 16 V14 Neutron Optics Test Station (Budapest/Hungary)
- 17 V4 Small Angle Scattering Instrument (Buenos Aires/Argentina)
- 18 V6 Polarised Neutron Reflectometer (Buenos Aires/Argentina)

- 9 V16 (VSANS) ToF Small-Angle Scattering instrument (Pennsylvania/USA)
- 20 V17 Detector Test Station (Delft/Netherlands)
- 21 V3 (NEAT) Time-of-Flight Spectrometer (Budapest/Hungary) (in progress)
- 22 V15 (EXED)/HFM Diffractometer for Extreme Environments & High Field Magnet (Tennessee/USA) (in progress)
- 23 V20 ESS-Test Station (Lund/Sweden) (in progress)



A DUO FOR BESSY II

Stronger into the future: new joint leadership for BESSY



In the summer of 2024, the board of directors established a new management duo for BESSY II light source. Together and on an equal footing,

Antje Vollmer as Facility Spokeswoman and Andreas Jankowiak as Technical Director will manage the further development and operation of BESSY II. They have each been dedicated to this goal at Helmholtz-Zentrum Berlin for many years, and they let us in on what is especially important to them in their new role. »My aim, in close contact with Andreas Jankowiak and the scientific departments, is to offer the scientific community the best possible research environment to drive progress in innovative infrastructure and solve fundamental and applied scientific problems together with researchers from all over the world. Multi-modal experimentation with integrated beamline and laboratory infrastructure as well as large-scale research, as a catalyst for global collaboration, play a central role for me in the continuing development of BESSY II.«

Antje Vollmer

Facility Spokeswoman

»BESSY II has exciting times ahead. The consequences of the cyberattack are still being felt and the demands on experimental IT and cybersecurity are increasing. What my part in this will be, together with Antje Vollmer and all HZB departments involved in the technical operation and further development of BESSY II, is to ensure that BESSY II optimally supports HZB's research and remains highly attractive for our national and international users and partners. Together, we have the opportunity to build the bridge from BESSY II to BESSY III with BESSY II+ so that, in the coming years, we will continue to operate a highly efficient, reliable and sought-after synchrotron radiation source where people will do exciting, outstanding and relevant research.«

Andreas Jankowiak Technical Director

PICTURE RIDDLE

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Girls'Day at HZB: 80 girls got a taste of scientific careers in April 2024. Can you find the 7 mistakes? Here's what you can win: 1 x HZB umbrella, 1 x Romme card game*, 1 x Skat card game* (*special edition with scientists) Closing date: 31.08.2024



Please mark all the mistakes clearly in the image and send us an email to lichtblick@helmholtzberlin.de. Alternatively, you can send your solution by internal mail or post to: Helmholtz-Zentrum Berlin, keyword: lichtblick competition, Communications Department, Hahn-Meitner-Platz 1, 14109 Berlin. We will notify the winners by email. With your entry you agree that your name will be published in the next issue. The legal recourse is excluded.



THE WINNERS OF THE LAST ISSUE – THE DRAW HAS DECIDED: First place: Anna Ziegler Second place: Deniz Wong Third place: Kaustuv Datta

RECIPE FROM BRASIL

Ingredients for 8 persons 500 g of tapioca pearls* 1.5 cup of sugar 1.3 L of (coconut) milk* 250 g of grated coconut Optional for topping: condensed milk and extra grated coconut

* Tapioca pearls are made from the cassava root, a starchy tuber. Many Asian supermarkets stock them.



Cuscuz de Tapioka

Tapioka-Couscous by Mayara da Silva Santos

Add the tapioca pearls with the sugar in an oven dish (glass or ceramic). Heat up the (coconut) milk and add it, while hot, to the tapioca mixture. Stir it and let it set until creamy. Add the grated coconut and mix it. Let it set in the fridge. Serve it with condensed milk and extra grated coconut on top.

This recipe works well with either coconut milk or cow's milk.

Bom apetite!



Mayara da Silva Santos

Department Highly Sensitive X-ray Spectroscopy Mayara studied chemistry in Brazil, where she was born. In 2020, in the midst of the pandemic, she started her doctoral thesis at HZB in the department Highly Sensitive X-ray Spectroscopy. There, she studies the behaviour of positively charged metal oxide molecules. In the summer of 2024, she has been invited as a PhD student to attend the Nobel Prize Laureate Meeting in Lindau, and is looking forward to a promenade with Nobel Prize Laureate Donna Strickland.



Notes of HZB

Homesickness?



Location: at the beamline 15.2. of BESSY II, of course!

Greetings from the dentist

<image><image><text>

Location: unknown

Vive la Révolution!



Found in a coffee-free office in Adlershof

With a lock and a clear message



Location: experimental hall of BESSY II

What funny notes at HZB catch your eye? Please send them to: lichtblick@helmholtz-berlin.de