DESY inFORM.

02/2012
Newsletter of the
Research Centre DESY

Better together for 20 years

In Zeuthen, DESY looks back on a long tradition of research

In January, DESY celebrated the 20th anniversary of the signing of the state treaty in Brandenburg which unified DESY. Originating from the Institute of High-Energy Physics IfH of the GDR Academy of Sciences in Zeuthen, today it is an integral part of DESY and fully established in the science landscape of the Berlin/Brandenburg region.
"The DESY site in Zeuthen has become an indispensable part of DESY and its scientific mission over the past 20 years," Helmut Dosch, Chairman of the DESY Board of Directors, stresses out.

Rich in tradition: DESY in Zeuthen.

After the reunification the German Council of Science acknowledged the high scientific level of the Zeuthen institute and recommended its association with DESY. In cooperation with the Zeuthen scientists, DESY developed a concept for the institute's future. On 1 January 1992, the formal unification of labs became valid.

The Institute of High-Energy Physics was already looking back on a long research tradition in particle physics. Even though cooperation with DESY was not possible, between 1968 and 1985 because of political reasons, joint experiments at CERN helped to maintain contacts to West European colleagues and institutes. In 1985, the IfH was allowed to re-establish contacts with DESY, participating in the construction of the H1 detector. For the first time, there were more than a few scientists involved, as there was also a close cooperation among physicists, engineers and workshops of both institutes. As of 1990, Zeuthen scientists also participated in other experiments in Hamburg. In parallel the IfH had also started to become involved in neutrino experiments in the 1980s, e.g. the bubble chamber experiment SKAT, the neutrino calorimeter experiment in Serpuchow near Moscow, and the Baikal experiment to detect cosmic high-energy neutrinos.

After association of the IfH with DESY, activities were developed in Zeuthen in all three DESY research fields. Comprehensive modernisation created a perfect infrastructure. Zeuthen scientists and technicians participated in all four HERA experiments and in the L3 experiment at CERN. Today, they are working at experiments at the Large Hadron Collider LHC. Theoretical particle physics too still is one of the pillars of science in Zeuthen. Mid of the 1990s, it was expanded with computer-based theoretical elementary particle physics. Today, DESY operates large computer and storage systems, independent of locations, for international research groups doing experiments at the LHC, IceCube and CTA, and for the theory groups as well.

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PETRA III sets record runtime

PETRA III concluded the year 2011 with the longest runtime since its commissioning. In December, the electron beam circled the storage ring for 353.5 hours without interruption – this is more than two weeks straight. The world's most brilliant X-ray source thus offered perfect conditions to the users.

HASYLAB Users' Meeting with record participation

This year, the traditional HASYLAB and European XFEL Users' Meeting attracted a record number of visitors. More than 600 participants came to Hamburg at the end of January to discuss research possibilities. Moreover, the interest for DESY light sources has never been as high: in 2011, the number of users clearly exceeded 2500.

DIRECTOR'S CORNER

Dear colleagues,

there are days that will always be remembered. Think of significant dates in world history, like 14 June 1789, 8 May 1945 or 9 November 1989. Or very personal moments you will never forget – your first day at school, the passing of an exam, the birth of a child…

DESY might not have written world history, but it surely wrote history of research. Many DESY colleagues remember the 11th of November 1991. "This is an important day," Paul Söding, long-time director of research and former head of DESY in Zeuthen, said at that date.

On 11 November, the Federal Republic of Germany signed a state treaty in Zeuthen with the states of Brandenburg and Hamburg which became effective on 1 January 1992. Ever since then, DESY has had two locations. "This day," Söding said twenty years ago, "gives the institute a definite place in the research landscape of the Federal Republic of Germany. We are lucky to be one of the first institutions where the science of the west and of the east of Germany grow together…" – And it has been a very successful merging, we may add today.

A good reason to celebrate twenty years of our common history and to take a look at the "DESY family album". In the past twenty years, the institute at the Zeuthen Lake has become an integral part of DESY. Its scientific programme successfully rests on three pillars: astroparticle physics, particle physics and accelerator physics – ten years of PITZ comprising the close cooperation between Hamburg and Zeuthen is another highlight to celebrate. DESY in Zeuthen participates in leading experiments, it is firmly established in the scientific landscape of the region, and it cooperates with the Humboldt Universität zu Berlin, Technische Universität Berlin and Universität Potsdam, and still builds bridges to Eastern Europe.

Just like the big sister in Hamburg, DESY in Brandenburg is a place of encounter. People from the former east and west work together in science and workshops; here, colleagues who have been employed at the institute for more than 40 years meet the best apprentice in Brandenburg and pupils from Berlin attending the school-lab. Among the visitors are tourists who follow the tracks of Fontane, people living in Brandenburg and scientists from all over the world. Thanks to the commitment of my predecessor Ulrich Gensch, we are able to further develop the institute as a place of communication. This summer, we will inaugurate our „Lakeside House", a conference location in an old villa. We are looking forward to the coming twenty years, to further interesting encounters and, of course, to visits of colleagues from Hamburg.

yours,
Christian Stegmann

At the beginning of the new millennium, the photo injector test facility PITZ became the first accelerator in Brandenburg. PITZ roots Zeuthen firmly in DESY's core programme: accelerator physics and development. At its 10th anniversary in January 2012, PITZ presents significant results (see info box).

In the future, astroparticle physics in Zeuthen will play an increasingly important role. Scientists use several celestial messengers to solve the mysteries of the cosmos. At IceCube, the largest neutrino telescope worldwide, DESY is the main European partner. In the past years, gamma telescopes such as MAGIC, Veritas and H.E.S.S. have discovered numerous high-energy particle sources. This success story is to be continued with the Cherenkov Telescope Array CTA, also with a strong DESY participation. *(ub)*

PITZ, the research accelerator in Brandenburg.

INFO

10 years Photo injector test facility in Zeuthen (PITZ)

The photo injector test facility in Zeuthen, PITZ, is used to develop and optimise electron sources of free-electron lasers such as FLASH and the future European XFEL. Both facilities need electron beams of extremely high quality. In the past 10 years, scientists have been able to achieve a series of successes and in 2011 present world's leading electron beam properties:

1999: Building permit for PITZ
2002: Commissioning of the facility
since 2004: FLASH operated with electron sources optimised at PITZ
2007: important parameters for the future XFEL source achieved
2009: requirements for the European XFEL topped
2011: stable run with world's leading beam quality
Future:
> characterisation of the start-up source for the European XFEL
> testing of new photocathode laser systems and beam diagnostic elements
> development work on the production of ultra-short electron pulses
> beam-powered plasma accelerator experiments within the ARD accelerator research and development programme of the Helmholtz Association

Pioneering research architecture

Spirit of cooperation at CFEL

At the Hamburg Center for Free-Electron Laser Science (CFEL), not only is the futuristic building architecturally noteworthy; also the cooperation between DESY, the Max Planck Society and the University of Hamburg has a pioneering architecture. The three partners are closely interconnected to jointly tackle key research with CFEL for the benefit of society.

The round architecture supports the concept of open communication at CFEL.

Moving into the new CFEL building is scheduled for May. However, more than 140 CFEL colleagues are already working on the DESY campus in Hamburg Bahrenfeld. One of them is Max Planck scientist Sebastian Loth who is establishing an independent research group for ultrafast and high-resolution scanning tunnelling microscopy. With this, Loth is building upon his work at the IBM computer company, where he and his colleagues created the world's smallest magnetic data storage with only twelve iron atoms.

At first sight, this has not much to do with free-electron lasers. However, the environment at CFEL was ideal for his work, Loth emphasises. There are several groups who work at taking photographs of atomic details at a high time resolution. "This is also my goal, although I am approaching the problem from another point of view." Whereas experiments using light or electron beams already allow recording fastest processes, the required spatial resolution to see single atoms is still not available. "With the scanning tunnelling microscope I can get the spatial resolution but not the time resolution. Many approaches are similar or may even be combined. This way, we can learn from each other."

His working group is a good example of the closely intertwined CFEL cooperation: budgeting is provided by the Max Planck Society, infrastructure – for example the offices – by the University of Hamburg. For Loth's group, DESY is currently building a low vibration laboratory for the ultrafast scanning tunnelling microscope. It will not only be the first one of its kind on the DESY campus, but "it will be a unique microscope worldwide," Loth, who came to CFEL five months ago, points out. "It will be especially constructed for excitation experiments using the pump-probe method." In these experiments, the sample – in this case single atoms – are excited at first (pump), and then this state is investigated with precise clocking (probe). This too is a technique belonging to the standard repertoire of a free-electron laser.

For CFEL research coordinator Ralf Köhn, this teamwork is exemplary for this new cooperation. Similar as with Loth's group, the contributions of the three partners are also jointly organised with other groups. For instance, the Max Planck Society and the University of Hamburg share the funding of an atomic dynamics imaging group. DESY's contribution is the development of the required accelerator technology and the REGAE accelerator itself. "Only this way we can get the best people," Köhn says.

Mutual learning is also encouraged by the fact that the groups are accommodated in a mixed way, thus not being isolated, Loth emphasises. This contributes to the fruitful climate at CFEL. „When in the United States, where I worked for the past three and a half years, someone has a new idea, the first reaction of research colleagues usually is: 'fascinating! Let's try it out.' I found the same spirit here at CFEL." Loth also went to see several other institutes, even well-known ones. "Here at CFEL, there was more buzz in the air than elsewhere, and I immediately got excited," the 32-year old stated. "Then I realised: here is the best place to create something new; here, I want to participate!" *(tim)*

INFO

On 25 April at the Science Café DESY, Sebastian Loth will present his work at the world's smallest data storage (17 h, DESY Bistro, Hamburg, in German, no entry fee).
http://sciencecafe.desy.de

Retrospect

For nearly twenty years, at the former Institute for High Energy Physics IfH – today's location of DESY in Zeuthen – research focused on bubble chamber experiments. This picture shows Zeuthen laboratory assistants measuring bubble chamber photographs (1974).

February

1 Public Lecture
Von Hankels Ablage zum DESY – Die Geschichte eines Forschungsstandortes bei Berlin
Michael Walter, DESY, Zeuthen, seminar room 3, 19 h

2 String theorie seminar
BPS black holes and BPS bounds in N=2 D=4 gauged supergravity
Stefan Vandoren (Utrecht),
DESY, Hamburg, bldg. 2a, seminar room 2, 14.15 h

3 CFEL science seminar
IR/UV spectroscopy in the gas phase: from isolated peptides to proton wires
Markus Gerhards (University Kaiserslautern, TU),
DESY, Hamburg, bldg. 28c, seminar room, 10 h

13 PIER event (www.pier.de)
WISPy Lecture Day
DESY, Hamburg, auditorium, 9-17 h

21 **employees assembly**
DESY, Hamburg, auditorium, 9.30 h

22 Science Café DESY (http://sciencecafe.desy.de)
Schneeflocken – Ein mathematisches Winter-Wunder
Waldemar Tausendfreund, DESY Bistro, 17 h

23 BRIDFAS Lecture
Laura Ashley: the woman who changed the way we thought about houses and clothes in the 1970's
Anne Sebba, DESY, Hamburg, auditorium, 20 h

March

5-9 Terascale-Workshop (www.terascale.de/intro2012)
Introductory School „Terascale Physics"
DESY, Hamburg

21 CFEL Colloquium
Watching chemistry in the molecular frame
Henrik Stapelfeldt (Universität Aarhus)
DESY, Hamburg, auditorium, 15 h

22 BRIDFAS Lecture
The History of Windsor Castle and its Royal Occupants
Oliver Everett, DESY, Hamburg, auditorium, 20 h

28 Science Café DESY (http://sciencecafe.desy.de)
Keplers Traum – Von der Alchemie zur Naturwissenschaft
Ilja Bohnet, DESY Bistro, 17 h

All current events: www.desy.de/events

Speed check at the south pole

IceCube is searching for superluminal neutrinos

Are neutrinos faster than light? The neutrino telescope IceCube in Antarctica offers the chance to check the surprising observation of the Italian OPERA experiment. OPERA registered neutrinos coming from CERN, 730 kilometres away, 60 nanoseconds earlier than they should have arrived with speed of light in vacuum. Since then, scientists all over the world try to understand this observation.

High-energy atomic nuclei from the cosmos continuously rain down on Earth's atmosphere, producing cascades of secondary particles. Plenty of neutrinos are produced in these so-called air showers. With IceCube, it is possible to test if the neutrinos travel faster than the rest of the air shower. An above-ground detector array called IceTop records the time of arrival of the air shower. The underground detector network of IceCube, melted into the eternal ice, scouts for the neutrinos. From the comparison of the arrival time, it is basically possible to calculate whether the elusive elementary particles have broken the upper speed limit.

However, according to the team of physicists led by Christian Spiering, head of the DESY astrophysics group in Zeuthen, it isn't all that simple. Should all neutrinos be as fast as recorded by OPERA, IceCube would have no chance to measure the tiny margin the elementary particles would gain on the average 15-kilometre way through the atmosphere.

Detectors of the IceTop air shower array

However, there are reasons to assume that the speed ofpossible faster-than-light neutrinos might depend on their energy. Whereas at OPERA neutrinos with 17 Giga electron volts were measured, the energies of air shower neutrinos are 10 to 1000 times higher. If the speed depended on the neutrinos' energy, their breaking the speed limit would be much higher, thus possibly making it measurable for IceCube. Within a year, the neutrino hunters hope to find indications of the existence or non-existence of superluminal neutrinos. *(tim)*

Rich in music

HASPA supports Kinderwelt@DESY

Music is a big thing at Kinderwelt@DESY in Hamburg – even before last year, when the kindergarten won the first German Kita music award. The Hamburger Sparkasse (HASPA) bank provided a substantial injection of funds to promote early musical education in the kindergarten. From HASPA lottery savings, 2,500 euros went to the kindergarten for the acquisition of music instruments. In January, HASPA representative Rüdiger Lendzian handed out the cheque to kita leader Christina Daniluk. The first purchase of Kinderwelt will be professional portable hi-fi equipment.

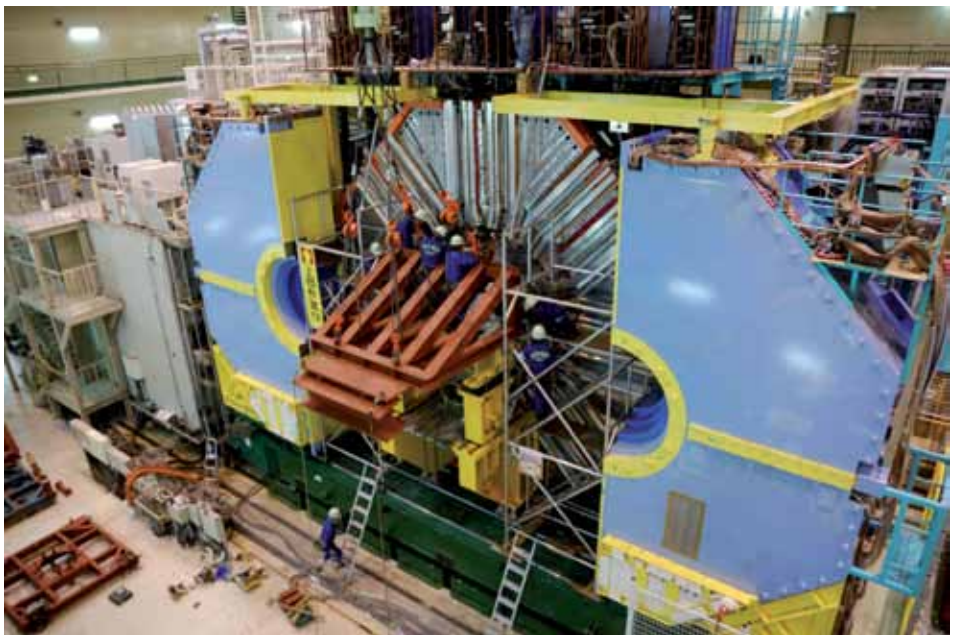
For its performance of "Peter and the Wolf", the kindergarten was one of eight winners from all over Germany of the KITA music award, presented for the first time last year. At Kinderwelt@DESY, „drawing on their rich music life, the children also immerse playfully into the world of classical music," was the reason for the award. "Their fascinating presentation of 'Peter and the Wolf' is an excellent example of how to make masterpieces of music enjoyable even for the little ones. The complete kindergarten location turned into a theatre, this was better than just playing on a stage." *(tim)*

Rüdiger Lendzian from HASPA hands out a cheque of more than 2500 euros to Christina Danikuk from Kinderwelt@DESY

DESY science in Japan

German scientists build pixel vertex detector for Belle II

Last November, the laying of the foundation stone for the SuperKEKB project took place in Japan. This so-called Super B Factory is supposed to solve one of the major mysteries of particle physics: where has all the antimatter gone which must have existed in the same quantities as matter after the Big Bang and is missing in today's universe? As of 2015, Super KEKB is to produce the so-called B mesons with electron and positron collisions at so far unprecedented rates. The B mesons play a key role in the investigation of what caused the disappearance of antimatter. Their relatively long lifetime and decay properties, which were in fact first discovered in 1987 at the DORIS experiment ARGUS, make them an ideal candidate for these and other measurements.



Belle II will achieve 40 times the collision rate of the predecessor experiment Belle (photo). Photograph: Isamu Nakamura

Since November, DESY is also a member of the collaboration that builds the Belle II detector that will verify these B decays. At the first stone laying ceremony, DESY scientists and other German science representatives signed a cooperation agreement with KEK.

DESY scientists will particularly participate in building the Belle II pixel vertex detector using the DEPFET technology developed for the ILC. The vertex detector will tightly enclose the Super KEKB beam pipe to precisely measure the electron-positron collision point and the B meson decay point. For this purpose, it will generate 50 000 images per second with a resolution of 8 million pixels. The construction of the small detector will be a challenge for the German research groups: because the energy of the particles is much smaller than at the LHC, it is important that the detector is built as light as possible. Therefore, both of its highly sensitive silicon layers have a thickness of only 75 thousands of a millimetre and the whole pixel detector is smaller than a can of soda. Nevertheless it must be integrated into the complete detector and remain mechanically and thermally stable – a major challenge to which DESY will contribute all its experience in this field. One example is the planned construction of a novel CO_2 cooling system to keep the detector at an optimal operating temperature.

In autumn 2015, the detector is planned to be installed in Belle II. Until that time, a large number of tests are necessary, among others to be carried out already this year and next year at the DESY test beam. *(tz)*

Synchrotron Innovation Award

The Innovation Award on Synchrotron Radiation 2011went to a team of scientists from DESY, the Physikalisch-Technische Bundesanstalt (PTB), and the Russian Joffe Institute. All six were awarded for their contributions to the development and operation of gas monitor detectors (GMD) at free-electron lasers. Apart from the DESY staff members Ulf Jastrow, Andrey Sorokin and Kai Tiedtke, the prize winners are Udo Kroth and Mathias Richter from PTB in Berlin, and Sergey Bobashev from the Joffe Institute in Saint Petersburg.

More than ten years ago, at the former Tesla Test Facility (TTF), the laureates developed their detector system to determine the absolute photon pulse energy. Today, advanced GMD's do not only control the pulse energy of the X-ray flashes at the TTF successor FLASH. Meanwhile, this technology is used at all free-electron lasers in the soft and hard X-ray radiation range, the Society of Friends of Helmholtz-Zentrum Berlin commented the distinction. The Europe-wide award is presented every year for outstanding technological or experimental developments which broaden the application field of synchrotron radiation.

Kick-off for EU project CoPoRI

Within a new EU project, DESY participates in the strategy development and communication for European research infrastructures. The CoPoRI (Communication and Policy development for Research Infrastructures in Europe) project is coordinated by the Deutsche Zentrum für Luft- und Raumfahrt (DLR) and the Federal Ministry of Education and Research, with DESY as a project partner. The kick-off meeting took place in Bonn at the end of January. CoPoRI is funded for two and a half years by the European Commission.

Within this project, pan-European workshops will be held, for example on socioeconomic influences of research infrastructures; the project also plans to increase visibility of the European Strategy Forum on Research Infrastructures (ESFRI). DESY is leading a work package to strengthen the exchange of information between existing and planned ESFRI projects. This also includes collecting and making available online best-practice examples and different solution possibilities for the draft and implementation of new research infrastructures, and possibly the establishment of a "club of ESFRI projects."

The first exchange of experience workshop will be held at DESY in June.

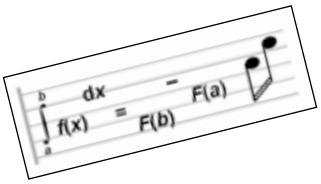
Joint performance of Brian Foster (centre) and Jack Liebeck (front).

The sound of mathematics

Musical Performances at DESY are “In Tune” with Scientists’ Research

By Manuel Gnida

The very thought of a mathematical theorem may elicit mixed emotions. We may think of it as a useful tool to solve everyday problems. Or we might admire its abstract form and simple beauty. Yet again, we may feel painfully reminded of our math classes in school. But who, do you ask, would think of setting a mathematical theorem to music? It therefore was as a surprise when the DESY choir performed the “Cantata of the Fundamental Theorem of Calculus” by Friedrich Wille at its concert last fall, praising the mathematical concepts of integration and differentiation. “We are truly dealing with a central seed of all higher mathematics, and the physics after Newton would have not been possible without it,” explains Axel Schaffran, DESY choir director and music arranger. Without a doubt, research at DESY would not be possible without this theorem. However, the cantata does not intend to teach math. In fact, it is a humorous approach to bridging the abstract world of science and the world of the non-expert.



Likewise, the composer Edward Cowie is building musical bridges with his work. In Oxford, UK, he teamed up with particle physicist Brian Foster and violinist Jack Liebeck to produce the “Particle Partitas”, a series of works for violin that are inspired by particle physics. “In terms of the way subatomic particles are observable in their collisions, in their traces, in their impacts, music can do the same thing,” Cowie explains. “You can make music that has a device into which it is forced to impact – fragments fly off it and they have behaviors, which can parallel.” The music of the “Particle Partitas” will be combined with brief lectures by Foster on the history of particle physics. Foster, a Humboldt Professor at DESY and Hamburg University, will also play the violin alongside Liebeck. Do not miss the German premier performance at DESY on June 22, 2012 (Auditorium, 4 p.m.).

HELMHOLTZ ASSOCIATION

Accelerators – a key technology

Increasingly, particle accelerators are used in medicine, life sciences and materials research. Thus, the development and construction of innovative accelerator components has evolved into a comprehensive task, now strongly supported by the Helmholtz Association: Six Helmholtz centres, two Helmholtz institutes, eleven universities, two Max Planck Institutes and the Max Born Institute closely cooperate in the portfolio theme „Accelerator Research and Development“ (ARD). For the period between 2011 and 2014, the project is funded with 16.7 million euros. Subsequently, the accelerator initiative is to be consolidated within the framework of programme-oriented funding.

In the Helmholtz Association, the centres DESY, GSI, KIT, FZJ, HZB and HZDR have made breakthroughs with particle accelerators in both nuclear and particle physics, and contributed to photon research and the further development of accelerator technologies. „Over the past years, accelerator technologies have developed into a key technology. We therefore bundle the competences and further develop the networking between the German research institutions,“ said Jürgen Mlynek, President of the Helmholtz Association. With ARD, a platform is created serving as a link for German research institutes and as a starting point for international cooperation.

www.helmholtz.de/hermann

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Publisher
DESY-PR
Notkestraße 85
D-22607 Hamburg

Contact
email: inform@desy.de
telephone +49/40/8998-3613
www.desy.de/inform
(online version + newsletter subscription)

Editors
Gerrit Hörentrup
Till Mundzek (editor-in-chief)
Barbara Warmbein
Ute Wilhelmsen
Thomas Zoufal

Production
Britta Liebaug (layout)
Veronika Werschner (translation)
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