DESY inFORM.

11|12
Newsletter of the
Research Centre DESY

Thank you DORIS!

Photon science community bids farewell to its workhorse

DORIS continues to run till the end of the year for a particle physics experiment.

Physicists are said to be no friends of great gestures, and so, after more than 30 years, the end of DORIS' X-rays came at the touch of a button. On Monday, 22 October, at 8:00, the positron beam, which the night shift in the HASYLAB experimental hall had just used for final measurements, was sent to the particle grave, the "beam dump". Thus ended the very successful era of research with synchrotron radiation at the DORIS storage ring, which had first made a name as a trailblazing pioneer facility and later as a reliable "workhorse".

But as the ingenious multiple usage of accelerators is a tradition at DESY, the lights at DORIS are not definitively switched off: the run time until the end of the year will be dedicated to the OLYMPUS experiment, which follows up on the particle physics history of the storage ring, studying the scattering processes between electrons and protons. In addition, the DORIS user community continues to publish exciting results (see page 3), prolonging the successful track record of around 600 publications in the past year. Therefore, no nostalgic mood came up in the DESY auditorium at the ceremony to celebrate the switch-off of DORIS as a synchrotron radiation source. Instead, DESY director Edgar Weckert looked ahead at the bright prospects of PETRA III, which became possible only thanks to DORIS. "Early on already, measurements using synchrotron radiation played an important role at DORIS. A dedicated and creative team decisively drove this young research field forward

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DIRECTOR'S CORNER

Dear colleagues,

A few days ago, user operation with synchrotron radiation ended at the DORIS storage ring. After decades of reliable operation, this accelerator is now seeing the end of its era as a radiation source. But the era DORIS is not yet over: the last two months of the year are dedicated to the operation of the OLYMPUS experiment. Machine and experiment have been well prepared for this run, creating excellent conditions for successful data acquisition. Nevertheless, a bit of finger crossing cannot hurt to ensure that, in this relatively short last phase of operation of the facility, everything goes as planned. To a certain extent, DORIS thus returns once again to its earlier destiny as a machine for particle physics, before settling permanently into a well-earned retirement on New Year's Eve 2012.

Our other accelerator projects have no prospect of retirement, however. The major project European XFEL, where DESY is leading the construction of the accelerator complex, is in full swing. It will enter into a decisive phase next year with the start of series production of the superconducting accelerator modules. At the same time, the extensive expansion projects at FLASH and PETRA III are being carried out, and together with the University of Hamburg we are involved in exciting experiments on plasma acceleration with the construction of LAOLA@REGAE. Furthermore, there are infrastructure tasks for CFEL and other future research institutions. The groups of the M division, as well as other groups and departments at DESY, are driven close to their limit by these numerous parallel activities. We won't be able to get around setting priorities in one situation or another, i.e. we will have to deal with some tasks one after the other instead of at the same time. I am sure that with good communication, effective collaboration and, where necessary, clear decisions with sound judgment, we will successfully master these challenges.

Kind regards,
Reinhard Brinkmann

Run 6856 was the last the last one. On 22 October at 8 a.m., DORIS stopped operation as a synchrotron radiation source.

– and laid the foundation for DESY to become an internationally renowned institution for research with intense X-ray light," Weckert said. Many of today's standard methods in photon science were developed at DORIS and enabled ground-breaking advances in the analysis of the structure of materials and biomolecules.

The DOuble-RIng Store DORIS started up in 1974 as a machine for particle physics and made important contributions to the quark model, which was being established at that time. Just before measurements began in Hamburg, two accelerators in the USA uncovered the charm quark – a spectacular discovery that became known as the "November Revolution" in the history of physics. By demonstrating "excited charmonium states", DORIS was instrumental in proving the existence of heavy quarks. In 1981, DORIS was converted into DORIS II, and the particle physicists specialised in the analysis of so-called B mesons, i.e. particles containing a b quark. The rise of research with synchrotron radiation, which inevitably arises when charged particles fly around a curve, happened in parallel. The use of this "waste product" developed into a promising new research direction. Consequently, the expansion of DORIS into DORIS III, then one of the brightest X-ray sources in Europe, started in 1990. Even if its luminosity is now eclipsed by modern radiation sources such as PETRA III and the free-electron lasers, the success story of DORIS will still reach far into the future. *(uw)*

Success story with a future

DORIS will continue to deliver excellent research results in a wide range of fields

Calcium pump with a turbo switch

The vital calcium pump in our body's cells has a turbo switch, as a Danish-British research team discovered in studies at DORIS III and the European Synchrotron Radiation Facility ESRF. The on-off switch of the pump thus has a previously unknown third position, in which the pump changes into the turbo gear. Calcium plays a central role in many processes of life, such as cell division, the day-night cycle and the communication of cells.

"The discovery not only improves our understanding of a fundamental mechanism in the biology of all higher organisms, but could one day allow for better treatment of certain diseases in which the calcium balance is disturbed," says Henning Tidow from Aarhus University. The group of Tidow and Lisbeth Poulsen from the University of Copenhagen studied the switching complex of the pump among others at the EMBL measuring station at DORIS III.

Waves in the superconductor

At low temperatures, ceramic superconductors develop an unexpected wavelike distortion. This was discovered at DORIS III in studies of high-temperature superconductors from the YBCO group (yttrium, barium, copper and oxygen). The distortions, known as charge density waves, and superconductivity represent two competing configurations of the material, as the scientists led by Johan Chang from the Swiss Federal Institute of Technology in Lausanne observed with the help of a strong magnet.

"Using the magnetic field, we were able to beautifully show the competing behaviour of charge density waves and superconductivity," explains DESY scientist Martin von Zimmermann, a member of the research team. "At high field strengths, the charge density wave is large and superconductivity small, and vice versa at small fields." The results could one day contribute to the construction of better, tailor-made superconductors for specific applications.

Peter Zotter, Markus Furger and Suzanne Visser (from left) exchange a probe wheel at the DORIS beamline. Every wheel contains 96 probes of particulates which are being X-rayed for 30 seconds each. After 30 seconds, the wheel rotates automatically.

Bad air from London

Even after the end of synchrotron radiation operation, DORIS III will still produce countless scientific insights. It will be months before the most recent studies are evaluated. Among the last users of DESY's venerable X-ray source is the team of Mark Furger from the Swiss Paul Scherrer Institute. The researchers had brought particulates from the London air, which had been collected among others during the Olympics and was tested at DORIS for certain chemical elements. "We have detected, for example, barium and antimony, which typically originates from brakes," says doctoral student Suzanne Visser.

Each sample contains only a few micrograms of material, and individual elements are present only in nanogram concentrations. Such trace concentrations can be measured best with synchrotron radiation, ordinary laboratory X-ray sources not being sensitive enough. Detecting heavy elements such as barium requires the high excitation energies of DORIS.

The samples could be examined wet-chemically, but would be destroyed in the process. Additionally, the group took samples every two hours over several weeks, and thus has far too many of them for wet-chemical analysis. "As the particulates were collected separately according to particle sizes, the process resulted in about 3000 samples per month," says Furger, who was a regular guest scientist at DORIS and who, for the future, will be relying on the extensions at PETRA III.

The analysis is complicated, but will provide a unique look at the time profile of the air pollution. The group around Furger is looking forward to seeing whether the opening fireworks of the Olympic Games can also be detected in the samples. The data will flow into the major project ClearfLo (Clean Air for London; www.clearflo.ac.uk), an investigation of the London air quality involving eleven British institutions and a number of international partners. *(tim)*

For even more security

When the DESY Technical Emergency Service sets out for action, it is impossible to overlook. Since late September, the team of trained rescue workers has a new, bright red 3.5-tonne truck with flashing blue lights, which they have designed according to their wishes and needs. The Technical Emergency Service is in charge of any emergency on the DESY site and carries out first measures. If necessary, reinforcement is requested from external forces.

“We can access our new vehicle from three sides, put on the breathing gear directly while standing, the tools are sorted according to the emergency situations, and we have many state-of-the-art instruments on board,” says Hans-Joachim May, head of the SAVE department (for Service Centre Facility Security, Fire Prevention, Emergency Service). At DESY, there are fire alarms about 100 times a year, with potentially complicated access routes and situations – this is where the experts come in. The emergency phone number is also on the license plate of the new vehicle: 2500.

WHAT’S ON AT DESY

November

7-8 Meeting (http://mac.desy.de)
Machine Advisory Committee MAC
DESY, Hamburg

7-9 Meeting (http://prc.desy.de)
Physics Research Committee PRC
DESY, Zeuthen

12 ALPS Seminar
Shining light on modifications of gravity
Clare Burrage
DESY, Hamburg, bldg. 1b, seminar room 3, 14 h

15 Event (www.mintforum.de)
1. Hamburger MINT-Tag
DESY participation with student lab, physics show and Science Café DESY

28 Science Café DESY (http://sciencecafe.desy.de)
Warum findet mein Smartphone ohne Einstein seinen Weg nicht?
Jürgen Reuter, Hamburg, DESY Bistro, 17 h

28 Public Lecture
Mit Sand zu neuen Entdeckungen – Moderne Teilchendetektoren
Ingrid-Maria Gregor, DESY, Hamburg, auditorium, 19 h

29 **Staff assembly**
DESY, Hamburg, auditorium, 9:30 h

Dezember

3-5 Workshop (www.terascale.de/alliance2012)
6th Annual Workshop of the Helmholtz Alliance “Physics at the Terascale”
DESY, Hamburg

4 Lecture Series “Gesund bleiben”
Elektrounfälle: Medizinische Aspekte
Prof. Dr. med. Stefan Oppermann, HAW Hamburg,
DESY, Hamburg, bldg. 7, seminar room 7a, 16 h

5 Science Café DESY (http://sciencecafe.desy.de)
Where’s my Warp Drive? – The Science of Star Trek
Tim Wiegels, Hamburg, DESY Bistro, 17 h

5 **Reading from the cime novel “Teilchenbeschleunigung”**
Ann-Monika Pleitgen and Ilja Bohnet
DESY, Hamburg, auditorium, 19 h

7 Event Series “Musik & Naturwissenschaft”
Was Hasen und Sonnenblumen gemeinsam haben – der goldene Schnitt und andere (A)Symmetrien
Arnulf Quadt (Uni Göttingen),
DESY, Hamburg, auditorium, 17:30 h
Goldner String Quartett
DESY, Hamburg, auditorium, 19:30 h

19 DESY’s Christmas Show
Die Physikanten
DESY, Hamburg, auditorium, 19 h

All current events: www.desy.de/events

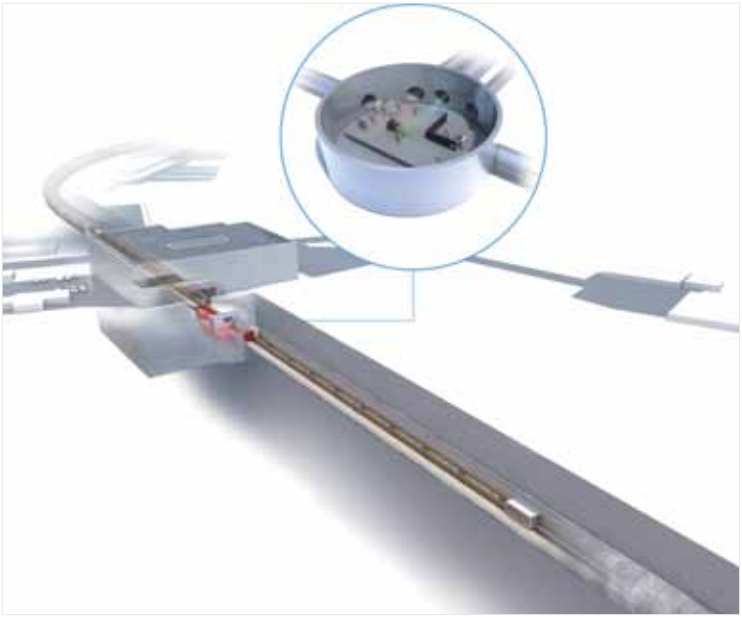
From proton magnet to photon magnet

Preliminary tests for ALPS II show promising results

The ALPS experiment has cleared an important hurdle on the way to its next expansion stage. Since September, a HERA magnet with straightened beam pipe has been operating on a test stand at minus 269 degrees Celsius – and it shows that it does not mind the straightening.

ALPS (Any Light Particle Search) first became known as a "light-through-the-wall" experiment. Using a converted spare magnet from the HERA proton ring, scientists had searched for very light particles, which could exist in throngs according to some extensions of the Standard Model (see DESY inForm 05/2010). These axions or similar particles should form from the conversion of photons – particles of light – in a strong magnetic field and then transform back into photons. The researchers tested this with ALPS I and published the world's most accurate measurements on the issue in 2010.

Although the scientists could not find any of these lightweight particles with the first stage of ALPS, they gained a lot of experience for the proposed larger version of the experiment. ALPS II is to use not just one HERA magnet, but twenty of these giants; ten in which an axion-like particle can form from photons, and ten in which this particle has the opportunity to convert back into a photon. In between, a wall that is impenetrable for photons, but not for axions. "The probability that we can detect an axion-like particle is proportional to the fourth power of the strength and length of the magnetic field, and increases with the number of photons in the system," explains Dieter Trines from the ALPS team. Several superconducting HERA magnets placed one behind the other are therefore ideal to beat even the sensitivity of previous indirect detection limits for the existence of axion-like particles. The problem: HERA is round, but light flies straight. For as many of the ALPS magnets as possible to be installed in a row without losing the light on the walls of the beam pipe, the "clear line of sight" of the magnets must be as large as possible. This requires that the beam pipes of all planned magnets, which once served as HERA spare parts, be straightened.



This is what the setup of ALPS II in the HERA tunnel could look like.

The ALPS team tested the straightening first on an old exhibition magnet, then on the ALPS I magnet itself. The scientists distorted the inner part of the magnet, the so-called cold mass, using pressure screws at the ends and in the centre, and braced it on the outer vacuum tank. For this, they developed special supports that transmit a force of several tonnes, but at the same time conduct little heat to the cold mass of the magnet. In addition, the supports must be movable to compensate for the contraction of the cold mass during the cool-down of the magnet. Measurements showed that, out of the 55 millimetres of diameter of the beam pipe, no less than 50 millimetres offered a clear line of sight. In a curved magnet, this so-called aperture amounts to only 35 millimetres. "Without the inventive work of Gerhard Meyer who developed the forming method and the pressure screws together with the fantastic support from a number of groups, we would not have succeeded," says Dieter Trines.

But then came the anxious question: how much worse would the magnet react to cold temperatures and high currents because of the bending? The surprising answer: both in the thermal properties and the maximum current, the magnet even showed a slight improvement compared to the values when he was still crooked.

Just in time for the presentation of the technical design report for ALPS II to the Physics Review Committee (PRC), which will meet at DESY in Zeuthen in early November, a major technical hurdle for ALPS II has thus been taken. With the progress made at the same time in the optical design and the development of a new superconducting photon detector up their sleeve, the ALPS scientists hope that the committee will recommend the experiment, especially as it costs little and promises great insights. They have devised a three-stage plan for the commissioning. In the final expansion stage, ALPS II could be installed from around 2017 in the HERA tunnel, on a length of 200 metres around the North hall, and maybe see particles that would open up a new vista for our understanding of dark matter in the universe and for physics beyond the Standard Model of particle physics. *(tz)*

INFO

http://alps.desy.de

Students search for particle tracks

DESY starts the "School course in particle physics" with five schools

DESY offers Hamburg students unique insights into science: along with five Hamburg schools, the "Teilchenwelt" network and the Science & Technology Initiative, the research centre initiated a "Student Course Particle Physics", which is to be offered regularly across schools.

The three-day course is designed for students from Class 9 and intended to convey the fascination of particle physics to the 15- to 19-year-olds in a concrete and practical way. This includes the construction of so-called cloud chambers, which make the tracks of charged particles visible, at the DESY school lab physik.begreifen. "This will allow interested students to experience science first-hand," DESY director Helmut Dosch said at the contract signing ceremony at the school lab on 30 October. The students of the participating secondary schools Süderelbe and Grootmoor, Matthias-Claudius-Gymnasium, Sankt-Ansgar-Schule and Stadtteilschule Barmbek can now use the opportunity regularly. Especially since you can nowhere be as unrestrainedly curious and live out your spirit of research as in the natural sciences, as Hamburg School Senator Ties Rabe pointed out at the launch of the cooperation. *(tz)*

Helmut Dosch and Ties Rabe inspect the freshly built cloud chambers.

Start for PIER Phd students

PIER Helmholtz Graduate School awards first scholarships

The first round of scholarship awards within the new PIER Helmholtz Graduate School is completed. Seven outstanding candidates can look forward to a three-year funding of their doctorate. Hong-Guang Duan, Nele Müller, Özgür Mehmet Sahin, Matthias Schlaffer and Clemens Wieck were awarded a Joachim Herz grant, Alena Wiegandt and Cornelius Gati are supported by a Helmholtz grant. The scholarship holders will conduct their Ph.D. in one of four PIER research fields.

A total of 36 young scientists from Germany and abroad had applied for the PIER scholarships. The best 16 of them were invited to present themselves in public lectures in front of a ten-member committee of top-class scientists and to confront the questions of the committee.

"The applications for the first round were brilliant – the choice was very difficult for the reviewers. With these scholarships, the PIER Helmholtz Graduate School can help to make Hamburg a magnet for the world's best young scientific talents," says Stefanie Tepaß, coordinator of the PIER Helmholtz Graduate School.

The scholarships were presented on 31 October during the Jentschke Lecture by the chairwoman of the Joachim Herz Stiftung, Petra Herz, and the representative of the Helmholtz Association, Ilja Bohnet. *(tz)*

INFO

www.pier-campus.de

NEWS

Ph.D. prizes

Katarzyna Anna Rejzner and Arik Willner were awarded this year's Ph.D. prizes of the Association of the Friends and Sponsors of DESY (VFFD). Rejzner received the prize for her thesis "Batalin-Vilkovisky Formalism in Locally Covariant Field Theory", Wilner for his thesis "A High Repetition Rate XUV Seeding source for FLASH II". The awards were presented as part of the Jentschke lecture on 31 October.

Building Bridges

As a follow-up event of the successful conference "Solar Energy for Science/Building Bridges", the conference "Energy, Water and Climate Change – Building Bridges between Europe and Middle East/North Africa" (EWACC 2012) will take place on Cyprus in early December. From 10 to 12 December, scientists, politicians and business representatives will discuss how sustainable development in the Mediterranean can be strengthened. DESY organises the conference together with the Cyprus Institute. The event will be preceded by a three-day forum for young scientists from the MENA region (Middle East/North Africa).

http://ewacc2012.cyi.ac.cy

Award for top trainees

Dominik Wüstemann of DESY in Zeuthen is one of the best training graduates in 2012 in Brandenburg. On 17 October, the Chamber of Industry and Commerce (IHK) Cottbus rewarded Wüstemann, who completed his degree as an industrial mechanic in the Zeuthen training workshop, and other top graduates from Brandenburg for their outstanding achievements. An essential element on the way to this success was the dedicated supervision by training master Jürgen Grote.

Jürgen Grote and Dominik Wüstemann

CSI DESY

“Teilchenbeschleunigung” brings guns into the tunnel

Physicists like to say that science policy can be just as exciting as a thriller. No one really believes them – except those who know the book “Teilchenbeschleunigung” (“Particle Acceleration”), written by Ilja Bohnet and Ann-Monika Pleitgen and published by Argument-Verlag. Here, science policy actually turns into a thriller, complete with murders, briefcases chained to wrists and, what’s really exciting, DESY as the crime scene.

The world’s first DESY novel, written by former DESY employee Ilya Bohnet (who now works at the Helmholtz office) and his mother, Ann-Monika Pleitgen, is the third in a series about the physicist Nikola Rührmann, who is supposed to start working at DESY as a EU referee – but only after she has completed a special mission issued by the directorate itself, revolving around mysterious professors, ghostly particles, Higgs bosons and planned X-ray lasers. Depending on the judgment of a professor about the existence of ghost particles supposedly measured in a DESY accelerator, the accelerator in question will either go on taking data or be turned off as planned to make room for the next big project.

With a grin, Ilja Bohnet says that even if DESY is mentioned on the book cover, there is not necessarily DESY inside. Some of the book’s settings actually exist, but neither is there an ADONIS detector at DORIS, nor do research directors issue special orders or science policy decisions depend on the judgment of one individual. But that doesn’t matter – what is important in “Teilchenbeschleunigung” is the unusual world of research, the bizarre and cerebral that, in the end, hearkens back to human motives. And when else do stilettos, guns and accelerator tunnels come together on one page?

By the way, DESY accelerator director Reinhard Brinkmann read the thriller before publication. He neither found fault with the image of research nor with the directors – he just complained about what he saw as an unrealistic representation of a jazz bassist …

“Teilchenbeschleunigung” by Bohnet/Pleitgen was published in German in 2012 as “Ariadne Krimi 1191” by Argument-Verlag (11 Euro, ISBN 978-3-86754-191-6). *(baw)*

HELMHOLTZ ASSOCIATION

Successful Technology Transfer

In 2011, the centres of the Helmholtz Association continued to successfully transfer their research results to society at large, politics and industry. Key indicators with regard to industry and applications are the three fundamental transfer channels, which are cooperation projects with enterprises, industrial property rights and corresponding licence agreements as well as spin-offs.

Over the course of the past few years, the number of on-going cooperation projects with the industry has increased. In particular, the number of strategic partnerships with companies has considerably increased. The revenue from cooperation activities with the industry, such as licences and options, has likewise increased over the course of the past five years. In 2011, these earnings rose above the level of the previous year, with approximately 16 million Euro from licence agreements and approximately 160 million Euro from cooperation activities.

For many years now, the number of industrial property rights resulting from on-going research has remained relatively constant. With about 400 new patent applications and some 350 granted patents, the 2011 key performance indicators are roughly at the same level as in previous years. By contrast, the number of licence agreements has greatly increased, rising from approximately 1,100 agreements in 2010 to approximately 1,400.

www.helmholtz.de/hermann

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