

## Milestone for Europe's new X-ray laser

European XFEL underground shell construction completed within time and budget



It's an important milestone for Germany's largest science construction site: the underground civil engineering work for the future X-ray laser European XFEL is complete and the underground shell construction almost finished. The full complex will consist of the tunnel system of approximately 5.8 kilometres that runs in depths of 6 to 38 metres from the DESY campus in Hamburg-Bahrenfeld to the neighbouring Schenefeld in Schleswig-Holstein and of several underground halls – at DESY, at the Osdorfer Born site and on the main Schenefeld site. The Schenefeld experimental hall alone has a surface area of 4500 square metres, more or less comparable to the dimensions of a hockey field, and it has a depth of 14 metres, enough space to make a four-storey-

house disappear completely. The next step is the installation of the technical and later on of the scientific infrastructure. Moreover, construction will start for the buildings like the future European XFEL headquarters in Schenefeld.

“With the end of the underground civil engineering work, we successfully completed what probably was the most difficult construction phase,” says Massimo Altarelli, managing director of the European XFEL GmbH. “Now, we will concentrate on the construction of the buildings above ground and on the equipment of the tunnels and halls with scientific instruments and tools.” Already in 2016, there will be first experiments at the new facility. “Europe's new X-ray laser will

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provide unprecedented insights into the nanocosm,” DESY director Helmut Dosch points out. DESY is not only the main shareholder of the European XFEL GmbH but, as the principal, also responsible for the underground civil engineering.

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## DIRECTOR'S CORNER

Dear colleagues,

Some months ago, at the European XFEL project, industrial serial production started for the 800 niobium cavities, the central components of the superconducting 17,5 GeV linear accelerator – a joint DESY and INFN Milano contribution to the project. In 2012, the newly established infrastructure for mechanical production and chemical surface treatment at both manufacturers in Italy and Germany was gradually put into operation and qualified. This process took more time than expected; however, the thorough and systematic procedure, supervised by DESY and INFN experts, has paid off.

The cavity test benches in the AMTF hall at DESY took up operation. Both, the corresponding cryostats and the helium transfer line to the HERA cryogenic plant were provided by the University of Wrocław. The cavity tests and the tests of the superconducting magnets and accelerator modules are carried out by the well-coordinated team of IFJ-PAN Krakow. The test results of so far approximately 30 cavities are extremely satisfactory even in this early stage of production. The achievable accelerator gradient is on average significantly higher than the XFEL specifications of 24MV/m. An increased field emission that

occurred in a few cavities could be eliminated with a relatively small effort by high-pressure rinsing with ultrapure water.

Serial production is also running for all other linear accelerator components; the required parts for the assembly of the accelerator modules are being shipped to CEA Saclay. However, the delivery of the RF couplers, a French contribution to the project provided by LAL Orsay, is still a time-critical bottleneck. We are in close consultation with our French partners and have to jointly make every effort to speed up the processes of coupler production and module assembly, with the aim to guarantee the completion of the European XFEL accelerator by the end of 2015.

Kind regards  
Reinhard Brinkmann

“We are glad that the underground civil engineering work for this international large-scale project, under the leadership of the DESY construction division, could be concluded on schedule and that the costs were largely kept within the budget fixed at the project placing,” said Dosch.

In the past three years, about 3500 construction workers of the building contractors moved more than 500 000 cubic metres of earth and used 150 000 cubic metres of concrete and 28 000 tons of steel for the underground construction. Starting on the DESY campus in Hamburg Bahrenfeld the two kilometre-long accelerator tunnel leads to the Osdorfer Born site. There, the tunnel system branches out into the so-called undulator tunnels where the X-ray light will be produced. Finally, five photon tunnels end in the underground experimental hall in Schenefeld.

From the tunnels, the X-ray flashes will then be conducted to up to 15 experimental stations. The construction of the experimental hall was a special challenge: the ground of the building pit was located far below ground-water level. Therefore, divers were needed to build the concrete sole under water. Only after this, it was possible to pump the water out of the pit. In order to avoid that the ground-water pressure lifts the concrete sole like a ship, it is anchored in the ground with about 560 steel tie bars of up to 22 metres length.

The tunnels, which were already completed last year, were excavated with two 71 and 83 metres long tunnel boring machines weighing more than 500 tons each. Within two years, these machines drilled their way from Schenefeld to Hamburg. To excavate all tunnel segments, it was necessary to lift the tunnel boring machines from the shafts and set

them up again a total of seven times. At four times, the machines could be pulled through a building pit.

The last European XFEL buildings will be completed in 2015. Parallel to this, the tunnels and halls will first be equipped with light, digital radio networks and pipework and later on with the accelerator modules and the undulators that generate the X-ray light. With the European XFEL and the already existing DESY facilities PETRA III and FLASH, the Hamburg area will offer a worldwide unique combination of light sources for the exploration of the nanocosm. *(tim)*

# Setting the course for European particle physics

Research centres play an important role in the strategy update



An future linear accelerator could complement the research at the LHC.

On 30 May, at a special meeting hosted by the European Commission in Brussels, the CERN Council formally adopted the update of the European Strategy for Particle Physics. This strategy sets the course for the future of this research field in Europe, making recommendations for projects and research sectors to be pursued with priority, both in the near-term and the long-term future.

According to the paper, top priority is given to the continued operation of the LHC and its future upgrade for operation at higher luminosities, to ensure the exploitation of its full scientific potential. Other priorities for large-scale physics facilities are the development of a post-LHC accelerator project at CERN with global contribution, the European participation in the linear accelerator ILC and the development of a European neutrino research programme.

Moreover, the European Strategy recommends the continuation of a strong and diversified theory programme, studies in specific areas of particle physics in Europe and other regions with European participation, extension of research and development of innovative detector technologies and close collaboration with neighbouring fields such as astroparticle physics and nuclear physics.

The strategy stresses the importance of global collaboration in the field of particle physics and the coordinating role of CERN. It also emphasises the social benefits and the research field's responsibility: it is important to ensure that central scientific activities such as communication and outreach will become part of all projects, that technology transfer is supported and that young scientists will always get a good training as it is currently offered at research centres like DESY.

The European Strategy is regularly updated on the basis of current scientific results. With the discovery of the Higgs particle in summer 2012, the already planned update for this year had become even more urgent and concrete. The strategy is developed by the CERN Council Strategy Group, appointed by the CERN Council. It consists of representatives of all CERN member states, eight members of the European Committee for Future Accelerators ECFA and of the CERN Scientific Policy Committee (SPC), representatives of observer states and the directors of the largest European research centres. DESY was represented by the Research Director for Particle and Astroparticle Physics Joachim Mnich.

German particle physicists, organised in the Committee for Elementary Particle

Physics KET, also formulated their priorities for particle physics in Germany, thus contributing to the strategy process. KET sees CERN as the international centre of particle physics. Based on the recommendations of KET, these activities should be supported by the very successful collaborative research instrument of the Ministry of Education and Research BMBF. Only this way, universities can substantially participate in the CERN experiments. In this structure, DESY plays an important role as a national laboratory and a coordination centre for particle physics. (baw)

## Seeds for the future sewn at DESY

Two top-class workshops at DESY focussed on future particle physics developments. At the meeting of the European Committee for Future Accelerators ECFA, from 27 to 31 May, more than 300 participants discussed the next generation linear collider. More than 200 members of the CMS collaboration came to DESY from 3 to 7 June to discuss the future of their detector. The detector will need an upgrade to accompany the upgrade of the Large Hadron Collider LHC, and the main topic of the meeting at DESY is the upgrade during phase 2 – after 2022.

## DORIS DAYS

Mid of May, several hundreds of guests from science, politics and business celebrated the outstanding performance of DESY's venerable accelerator DORIS. At the beginning of this year, DORIS retired after nearly 40 years of operation for particle physics, accelerator development and research with synchrotron radiation. DESY Director of Administration Christian Scherf opened the event.

## DORIS DAYS

Der Spiegel (1969)  
Zum Bau von DORIS

schaffter je zuvor. Vielleicht wird es ihnen sogar glücken, in den Speicher-Röhren Spuren eines physikalischen Edelwilds auszumachen, das die Forscher bisher vergebens gejagt haben — die „Quarks“: kleinste Elementarteilchen, deren Existenz wohl theoretisch postuliert, nicht aber nachgewiesen wurde.

The image shows a scanned page from the magazine 'Der Spiegel' (1969) titled 'WISSENSCHAFT' and 'Spuren im Speicher'. It features a portrait of a man, likely a physicist, and a diagram of a particle accelerator structure labeled 'HENNSTRECKE FÜR ATOMKERNEN'. The text discusses the construction of the DORIS accelerator and the search for quarks.

**DORIS.**  
A particle accelerator that's almost history.



## WHAT'S ON AT DESY

### June

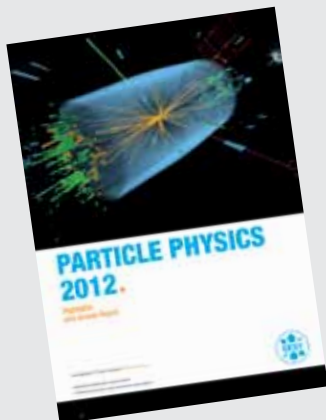
- 3-7** Workshop (<http://cmsup2013.desy.de>)  
CMS Upgrade Week  
DESY, Hamburg
- 8** Lange Nacht der Wissenschaften  
16:00-24:00 h  
Campus Berlin-Adlershof, am Teleskop
- 10** DESY staff assembly  
Hamburg (auditorium), Zeuthen (video cast)  
(seminar room 3), 10:00 h
- 10-11** Helmholtz Open Access Workshop  
Open Access to Publications and Data in the Research Field  
„Structure of Matter“ of the Helmholtz Association  
DESY, Hamburg, Bldg. 28c, seminar room
- 11-12** PITZ Collaboration Meeting  
DESY, Zeuthen
- 12** Science Café DESY (<http://sciencecafe.desy.de>)  
Hautnah – Zell- und Bakterienhaut im Forschungsfokus  
Oliver Seeck, DESY, Hamburg, DESY Bistro, 17:00 h
- 12** Public lecture (<http://fortbildung.desy.de>)  
Vom Urknall bis zum Kältetod – Die Geschichte des Universums  
Karsten Büßer, DESY, Hamburg, auditorium, 19:00 h
- 15** Event series Music & Science  
„Einsteins Universe“, B. Foster & J. Liebeck, 17:30 h  
Concert, J. Liebeck (violin) und J. Drake (piano), 20:00 h  
Laeiszhalle, small hall
- 18** Lecture series „Gesund Bleiben“  
Reisebegegnungen mit Gifttieren  
DESY, Hamburg, bldg. 1c, seminar room 4a, 16:00 h  
Professor Dietrich Mebs, Uni Frankfurt
- 18** Tuesday seminar  
HERA Forum: Results for the Summer Conferences  
DESY, Hamburg, auditorium, 16:45 h
- 18-21** VERITAS Collaboration Meeting  
DESY, Zeuthen

### July

- 2** Technical seminar  
Schwarze Löcher im Universum - Schwarze Löcher im Labor?  
DESY, Zeuthen, seminar room 3, 10:00 h  
B. Schöneich, DESY
- 10** Seminar Series  
Status of FAIR  
DESY, Hamburg, bldg. 28c, seminar room, 14:00 h  
Oliver Kester (GSI)

## Highlights Reports 2012

The annual reports of the DESY accelerators and particle physics research fields are now available. On about 150 pages, the Particle Physics Highlights Report summarises the most important events and research results of DESY particle physics from the past year. This includes the discovery of a Higgs particle at the Large Hadron Collider, which was achieved with important contributions from DESY scientists, and also the very successful OLYMPUS experiment, which was the final experiment of the DESY accelerator DORIS after about four decades of operation.



In the accelerator field, the construction progress of the X-ray laser European XFEL is one of the most important events of the past year. Moreover, numerous accomplishments were achieved at the existing DESY facilities. For user operation, DESY's free-electron laser FLASH for the first time generated very short wavelengths in the so-called water window and produced an X-ray beam by means of the so-called seeding with the worldwide shortest wavelength of 38 nanometres for this technique. Apart from the construction of the European XFEL, also existing DESY facilities were extended: the construction of the second FLASH tunnel is well under way, and so is the planning for the new experimental halls at the PETRA III storage ring; last year, its large experimental hall was named after the German X-ray pioneer Max von Laue.

Both Highlights reports can be downloaded from the DESY website, together with the annual report from the DESY photon science department which was published earlier this year. All three reports are written in English.

[http://www.desy.de/about\\_desy/annual\\_reports/](http://www.desy.de/about_desy/annual_reports/)



# Test beam booked out

## Researchers from all over the world as guests at the DESY ring

The list reads like a Who's Who of particle physics: ATLAS, ALICE, CALICE, CMS, Compass, JLAB, LCTPC, LHCb, mu3e: groups from all over the world applied for beam time at the DESY II test beam. Prototypes of only one square millimetre and others weighing several hundreds of kilograms; components which will become the heart of a detector and others designed for the outer layers of future detectors. All these will be put to the acid test at DESY's oldest accelerator.

The DESY test beam offers a wide range of possibilities to the users. Under the fire of electrons and positrons of one to six Giga electron volts, the users may test properties like response behaviour and accuracy of their detector types – this is decisive for the future function in the experiment. The beam for the three measuring stations is not decoupled directly from the accelerator. It is generated by introducing a hair-thin wire into the DESY II beam. This creates photons which, through another target,



Ingrid-Maria Gregor at the pixel telescope of the DESY test beam.

“We are booked out,” said Ingrid-Maria Gregor, one of the four test beam coordinators. When it was clear, due to the shutdown phase of all CERN accelerators, that the DESY test beam would be one of a few worldwide and the only one available in Europe, a call to register for beam time was started last year. “After the first planning, we were actually overbooked,” said Gregor. However, she and her colleagues managed to find a place for all applicants, even though the year of operation at DESY already ends in September, because of the beginning of major construction work for the PETRA extensions and necessary work at other accelerators.

are converted into electron-positron pairs. A magnet behind the target gives the test beam user the possibility to select the energy of the electrons individually. Moreover, this does not disturb the filling of PETRA III and, therefore, the photon science user run. In the test beam, there is a pixel telescope – currently even two, one is a loan from the ATLAS experiment – and a superconducting magnet PCMAG, both available to the experimenters. Even today, the accelerator that operates since 1964 is a coveted facility for technology development – continuation guaranteed.(gh)



### CTA prototype taken in operation

Berlin may not be the ideal location for the whole Cherenkov Telescope Array CTA – it needs dark, cloudless nights with a low amount of scattered light – but Berlin-Adlershof is perfect as a location for the prototype of the medium-sized telescopes. On 22 May, the 60-tons colossus was inaugurated with 200 guests. After the symbolic press of the button by Brandenburg's research minister Sabine Kunst (center) and (from left) Karl Eugen Hutmacher from the Federal Ministry of Research, DESY project manager Stefan Schlenstedt, Christian Stegmann, CTA spokesman Manel Martinez and Helmut Dosch, the telescope simulated an observation night and the observation of a gamma ray burst in quick succession.

## Goodbye, auf Wiedersehen and До свидання Christian Spiering is retiring

Everything has its end. This is also true for the active scientific career of Christian Spiering – at least officially. On 21 May, he was bid farewell on his retirement with a scientific colloquium in Zeuthen. However, Spiering is convinced that „neutrino search never ends!“

Since 1973, Christian Spiering has been a research associate in Zeuthen, first at the Institute for High Energy Physics IfH; after the German reunification, as from 1992, at DESY. In Zeuthen, he played a decisive role in the successful integration of the former IfH into DESY.

End of the 1980s, Christian Spiering moved from experimental particle physics at accelerators to neutrino astrophysics. His work with Russian scientists at the Baikal Sea coined him; afterwards, he engaged himself in the AMANDA and later in the IceCube experiment. Since 1988, Spiering was head of the astroparticle group in Zeuthen. Apart from his work as an internationally renowned scientist and his leading tasks in numerous



councils, e.g. the European ApPEC Roadmap Committee which elaborated a European roadmap for astroparticle physics, or the Committee for Astroparticle Physics in Germany, a key concern for Christian Spiering was the communication of research themes to the general public. You can find a recent example of his talent in an interview published in the coming issue of the “GEO Kompakt” magazine. (ub)

### Golden badge of honour for Herwig Schopper

The former DESY director Herwig Schopper received the golden DESY badge of honour at the DORIS DAYS. Schopper was honoured for his great merits for DESY. From 1973 to 1980, he was chairman of the DESY board of directors. This was the time of the early DORIS years, the far-sighted decisions to the DORIS II upgrade, the construction and commissioning of PETRA and the successful discovery of the gluon.

### DFG extends LHC Graduate School

The German Research Foundation (DFG) continues to finance the Graduate School Mass, Spectrum, Symmetry: Particle Physics in the Era of the Large Hadron Collider. It will be funded with 3.3 million euros for another four and a half years. Already since 2009, scientists from the Humboldt-Universität zu Berlin, Technische Universität Dresden and from DESY in Zeuthen collaborate in this group and use their research potential in theoretical and experimental particle and astroparticle physics to train outstanding PhD students. Among others, financial support will go to 16 PhD positions, further training of doctoral students in key qualifications, and will support invited guest scientists. The connecting link of all institutes is the participation in the ATLAS experiment at the Large Hadron Collider (LHC) at CERN in Geneva.

### Announcement of grants for doctoral studies from the Joachim Herz Foundation

Outstanding university graduates can apply for one of the grants from the Joachim Herz Foundation at the PIER Helmholtz Graduate School. Until 30 June, interested students who want to do their doctoral thesis in one of the PIER research fields - particle and astroparticle physics, nano science, photon science and infection and structural biology - may hand in their application.

The PIER Helmholtz Graduate School is a subdivision of PIER, the close partnership of DESY and the University of Hamburg. This year, the Joachim Herz Foundation funds attractive three-year scholarships for six particularly talented doctoral students of the PIER Helmholtz Graduate School.

Apart from the monthly basic allowance of 1,800 €, the scholarships also include comprehensive funds for basic equipment and grants for research stays abroad, organisation of workshops and attendance at international conferences.

Applications can be submitted by university students with outstanding performance in their studies and examination, interest in the PIER research fields, commitment that exceeds the professional studies and identification with the values and principles of the Joachim Herz Foundation. Outstanding doctoral students in the first year of their doctoral studies are welcome as well.

For detailed information and application, see: <http://graduateschool.pier-campus.de/>

## Federal government funds new large-scale projects

Six Helmholtz Association centres are involved in planning the three large-scale research projects that were rated as particularly urgent by the German Federal Ministry of Education and Research (BMBF) upon recommendation by the German Council of Science and Humanities. After their acceptance into the “Roadmap for Research Infrastructures” and the corresponding financial commitment, the realisation of the projects is within grasp. The selected projects in detail: The Cherenkov Telescope Array measures cosmic gamma radiation of the highest energy levels and it will be composed of three different telescope types. DESY has taken responsibility for building one of these three telescope types.

In the EU-Openscreen co-operation project, numerous European research institutions intend to jointly identify hundreds of thousands of biologically active substances and collect these in a central database. The substances may serve as starting points for new medication development. Helmholtz Association centres in the project are the Max Delbrück Center for Molecular Medicine and the Helmholtz Centre for Infection Research. IAGOS will use commercial aircraft to collect atmospheric data from the height of the air corridors. The new system thus allows for more detailed climate forecasts and it can identify the effects of air pollution. Helmholtz partners are the Forschungszentrum Jülich, the Karlsruhe Institute of Technology and the German Aerospace Center.

[www.helmholtz.de/hermann](http://www.helmholtz.de/hermann)



Sent off by real samurai: team „Wat mutt dat mutt“. From left: Carsten Niebuhr, Joe Pournovin, Karsten Gadow and Eckhard Elsen

## Hiking like an electron

### Three DESY scientists tackle a charity trailwalk in Japan

It's no secret that scientists have a tendency to totally immerse themselves in their work. Sometimes they also immerse themselves into an adventure – like DESY scientists Eckhard Elsen, Karsten Gadow and Carsten Niebuhr. The three of them tackled a walk for charity in May, a so-called Oxfam Trailwalk through Hakone National Park in Japan. This hike would lead the three (alongside another 178 teams) over 100 kilometres in an arc around Mount Fuji and was not allowed to last longer than 48 hours. This particular trailwalk had the added „feature“ of an elevation of 5000 metres (going up) and 4000 metres (going down) through not particularly well-trodden terrain.

“This walk was a bit like particle acceleration at DESY,” says Eckhard Elsen. “Like a good particle bunch we kept our goal in sight, there were a few sections of excellent acceleration (downhill) and bad phase adaption (uphill). We needed a strong final focus to reach our target, and like at any collider our beta function was particularly steep right before the end. The final 20 kilometres included two impressive elevations.” The team, carrying the pragmatic northern German

title “Wat mutt dat mutt” (“whatever must be, must be”) was completed by Englishman Joe Pournovin who lives in Japan and is a semi-professional trailwalker for charity. The men – all wearing TEAM t-shirts from the ECFA Linear Collider workshop that took place in Hamburg at the end of May - had to hike through the night in order to stay in the 48-hour time limit. There were eight check points along the way for food and general support, and the team had hoped for dramatic vistas of Mount Fuji, “but Fuji-san is a shy mountain,” says Carsten Niebuhr, “it likes to shroud itself in clouds.”

The hike followed old Samurai paths from Odawara city to Yamanaka Lake, and the team „Wat mutt dat mutt“ reached the finish in about 30 hours. Despite the pouring rain on day 2, they came in at rank 39. A total of 527 trailwalkers finished the challenge. Completely soaked, the German-English team welcomed the warm waters of a nearby Japanese onsen in order to wake the next morning to a beautiful sunny view of Fuji-san. (baw)

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